Carrier
TRANSICOLD

Diesel Driven Generator Set

Models
69GL15-114
69GL15-134

OPERATION AND SERVICE

T-251-04

Carrier
TRANSICOLD

OPERATION AND SERVICE MANUAL

DIESEL DRIVEN GENERATOR SET

MODELS
69GL15-114
69GL15-134

UNITED TECHNOLOGIES CARRIER TRANSICOLD

Carrier Transicold Division, Carrier Corporation, P.O. Box 4805, Syracuse, N.Y. 13221

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION 1

DESCRIPTION

1.1 INTRODUCTION

WARNING

Beware of moving V-Belts and belt driven components.

This manual contains Operating Data, Electrical Information, and Service Instructions for the diesel generator sets shown in Table 1-1. (See Figure 1-1 for location of serial/model number plate.)

Separately bound manuals covering the Deutz F3L912W diesel engine for the diesel-driven generator sets are also supplied, see chart below.

MANUAL/ FORM NO.	EQUIPMENT COVERED	TYPE OF MANUAL/FORM
291-1842	F3L912W	Workshop
62-02383	F3L912W	Engine Parts List

The undermounted diesel-driven generator sets provide a constant electrical power supply for an all-electric refrigeration unit.

Located inside the frame are the diesel engine, A-C generator (main alternator), control and monitoring cabinet, starting battery, battery charging alternator, and other necessary accessory components for proper unit operation.

For power, the Deutz F3L912W vertical in-line, three cylinder diesel engine is used. The engine is equipped with glow plugs (used as a starting aid) and "spin-on" lube and fuel oil filters for easier filter changes. All references to engines are viewed from the blower end.

Electrical power is generated by a Lima 15 KW, brushless, single bearing A-C generator. The generator is coupled directly to the engine flywheel. The generator provides a constant 460/230 vac, 3 phase, 60 hertz electrical supply.

The engine air cooling blower and alternator are belt-driven from the engine crankshaft sheave.

The air cooling blower fan belt is automatically tensioned by the idler pully and protected by the fan belt switch.

Table 1-1. Model Chart

Model Number	Integral Fuel Tank 50 U.S. Gallons	Integral Fuel Tank 65 U.S. Gallons	65 Amp Alternator	Dual Voltage	Engine (Deutz) F3L912W	Fuel Warmer
69GL15-114	X	–	X	A	X	–
69GL15-114-1	X	–	X	X	X	X
69GL15-114-2	–	–	X	X	X	X
69GL15-134	X	–	X	X	X	X
69GL15-134-1	–	X	X	X	X	X
69GL15-134-2	–	X	X	–	X	X
69GL15-134-4	–	X	X	–	X	X

A – Provision for dual voltage.

1.2 SAFETY DEVICES (Refer to Table 1-2.)

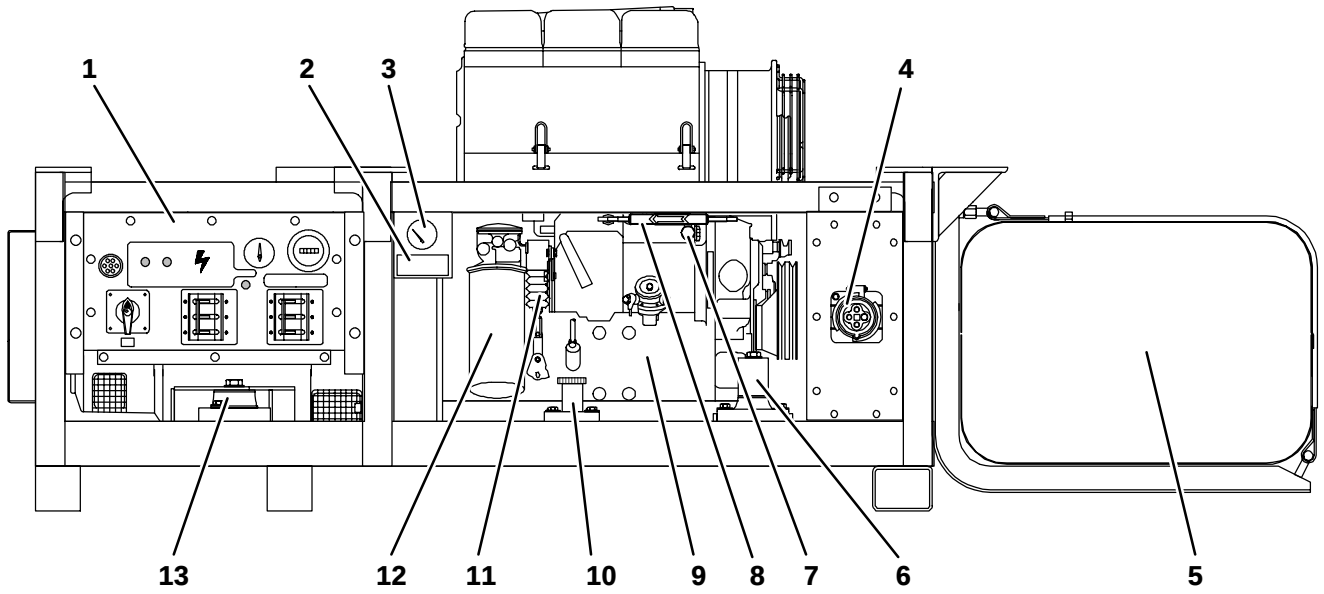
System components are protected from damage caused by unsafe operating conditions by automatically shutting down the diesel engine when such conditions occur. This is accomplished by the safety devices *FBS*, *LOP* or *OTS*. These safety devices monitor system operating conditions and open a set of electrical contacts when an unsafe condition occurs. Opening one or more of these safety switch contacts will de-energize the fuel solenoid.

De-energizing fuel solenoid releases the stop-run lever to the *STOP* position, shutting off the fuel supply to the engine; thus stopping the engine.

The A-C generator and the glow plug circuit are protected by circuit breakers (listed below) but will not shut down the engine if an overload occurs.

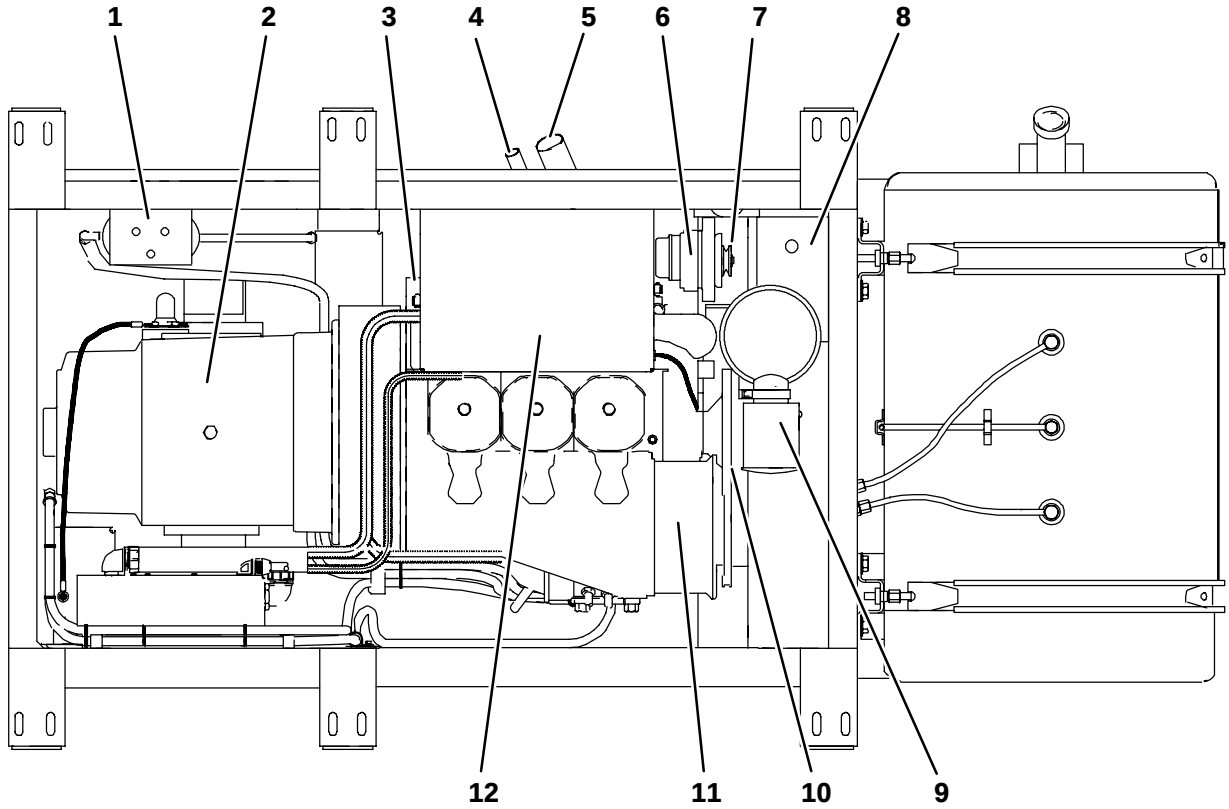
Table 1-2. Safety Devices

Unsafe Condition	Safety Switch	Switch Setting
a. Engine		
1. Broken fan belt	1. Fan belt switch (FBS)	1. Trips when belt breaks
2. Excessive current draw by FS, FH, S, SS or TT	2. Circuit breaker (CB-2) – Automatic reset	2. Trips at 20 amps
3. Low engine lubricating oil pressure	3. Oil pressure switch (LOP) – Automatic reset	3. Opens below 26 psig (1.83 kg/cm@)
4. High oil temperature	4. Oil temperature switch (OTS) – Automatic reset	4. Closes at 266 _F (130_C)
b. Glow Plugs		
1. Excessive current draw on glow plug circuit	1. Circuit breaker (CB-3) – Automatic reset	1. Trips at 50 amps
c. Generator		
1. Excessive current draw by generator	1. Circuit breaker (CB-1) – Manual reset	1. Trips at 26 amps (460 vac)
2. Excessive current draw by generator	2. Circuit breaker (CB-4) – Manual reset	2. Trips at 48 amps (230 vac)



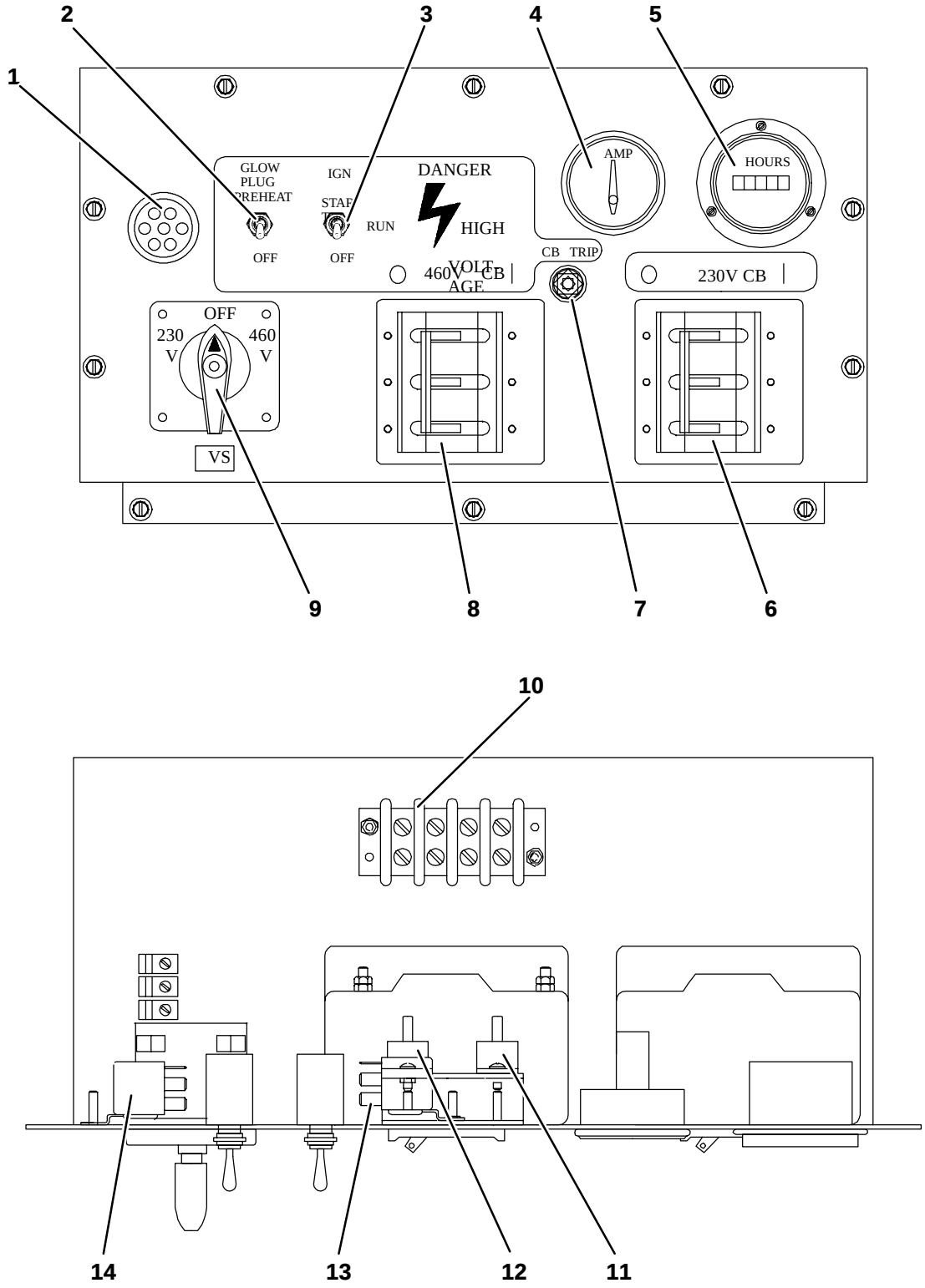
1. Control Box and Panel
2. Serial/Model Number Plate
3. Oil Pressure Gauge
4. Power Receptacle
5. Fuel Tank
6. Engine Shockmount
7. Fuel Bleed Valve
8. Fuel Warmer
9. Engine
10. Lube Oil Dipstick/Fill Cap
11. Fuel Solenoid
12. Engine Oil Filter
13. Generator Shockmount

Figure 1-1. Generator Set – Control Box Side



1. Fuel Filters
2. A-C Generator
3. Starter Motor (Location)
4. Engine Oil Breather
5. Muffler Exhaust Pipe
6. Alternator
7. Alternator Belt
8. Battery
9. Air Cleaner
10. Fan Belt
11. Blower Fan
12. Muffler (Location)

Figure 1-2. Generator Set – Top View



1. Glow Plug Indicator (GPI)
2. Glow Plug Switch (GPS)
3. Ignition Switch (IGN)
4. Ammeter (A)
5. Total Time Meter (TT)
6. Circuit Breaker – 230 vac (CB4)
7. Circuit Breaker Trip Light
8. Circuit Breaker – 460 vac (CB1)
9. Voltage Selector
10. Terminal Block (TB)
11. Circuit Breaker (CB3)
12. Circuit Breaker (CB2)
13. Run Relay (RR)
14. Heat Relay (HR)

Figure 1-3. Control Box and Panel

1.3 UNIT SPECIFICATIONS

a. Fuel Tanks

Standard:

50 Gallon (Integral) Steel

65 Gallon (Integral) Steel

Optional:

75 Gallon (Remote) Aluminum or Steel

110 Gallon (Remote) Steel

b. Weights

Battery:

52 lb (23.6 kg)

Generator (A-C):

285 lb (129 kg)

Engine (Dry) – without Accessories:

595.25 lb (270 kg) Approx.

Fuel Tank (50 gallon) – Dry:

100 lb (45 kg)

Fuel Tank (65 gallon) – Dry:

130 lb (59 kg)

Fuel Tank (75 gallon) – Dry:

190 lb (86 kg)

Fuel Tank (110 gallon) – Dry:

225 lb (102 kg)

Unit (Genset):

1975 lb (898 kg)

1.4 ENGINE DATA

a. Bore/Stroke

3.94 in. (100mm) /4.72 in. (120 mm)

b. Compression Ratio

19 : 1

c. Cooling System

V-belt driven fan

d. Cylinders (Number)

Three

e. Displacement

172.45 cubic inches (2826 cubic cm)

f. Firing Order

1-2-3

g. Fuel

Winter: Diesel No. 1

Summer: Diesel No. 2

h. Glow Plug Amperage

10 amps per plug at 12 vdc

i. Horsepower

33.5 hp @ 1800 rpm

j. Lubrication System

Oil Pressure:

40 to 60 psig (3.8 to 5.2 kg/cm@)

Oil Pressure Safety Switch Setting Opens:

26 psig (1.83 kg/cm@)

Oil Temperature Safety Switch Setting Opens:

266 _F (130 _C)

Capacity:

Engine – 21.13 U.S. quarts (20 liters)

Optional:

Fill-Max Filter – 10 U.S. quarts (9.46 liters)

Time between Oil Changes:

First 400 Hours, thereafter every 1000 Hours (maximum)

Oil Level Indicator:

Dipstick in oil pan

Lube Oil Specification:

Use a heavy duty lubricating oil conforming to American Petroleum Institute (API) Service Classification CD (DS)

Lube Oil Viscosity:

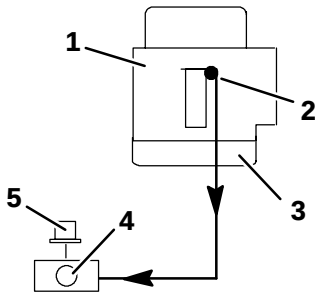
Outdoor Temperature

Fahrenheit	Centigrade	SAE
Below 32_	0_C	10W or 10W30
32_ to 77_F	0_ to 25_C	20
Over 77_F	Over +25_C	30 or 15W40

1.5 ENGINE SCREW THREADS

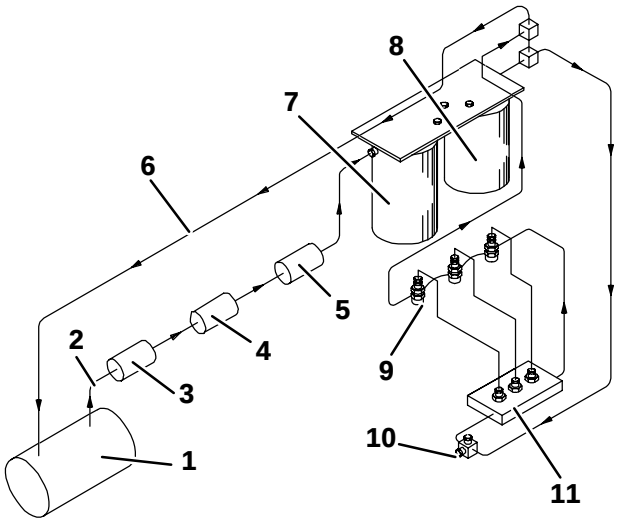
All threads used on the engines are metric except the oil drain plug which is American Standard Pipe Thread (NPT).

1.6 LUBE OIL AND FUEL FLOW DIAGRAMS



1. Engine Block
2. Engine Block Oil Connection
3. Oil Pan
4. Oil Pressure Gauge
5. Oil Pressure Switch

Figure 1-4. Lube Oil Flow Diagram



1. Fuel Tank
2. Fuel Supply Line
3. Fuel Warmer (Optional)
4. Fuel Strainer (Optional)
5. Mechanical Fuel Pump
6. Fuel Return Line
7. Primary Filter
8. Secondary Filter
9. Injector Nozzles
10. Fuel Bleed Valve
11. Injection Pump

Figure 1-5. Fuel System Diagram

1.7 ENGINE AIR SYSTEM

The air cleaner is put on the engine to prolong its life and performance by preventing dirt and grit from getting into the engine causing excessive wear on all operating parts. However, the operator is of necessity charged with the responsibility of giving the air cleaner equipment regular and constant attention in accordance with the instructions.

Clean air is supplied to the engine through the air cleaner (see Figure 1-2). The air is necessary for complete combustion and scavenging of the exhaust gases. As the engine piston goes through the intake stroke, the piston draws clean fresh air down into the cylinder for the compression and power strokes. As the engine goes through its exhaust stroke, the upward movement of the piston forces the hot exhaust gases out of the cylinders through the exhaust valves and the exhaust manifold. If the air filter is allowed to become dirty, the operation of the engine would be impaired.

1.8 OPERATING CONTROLS AND INSTRUMENTS

1.8.1 Introduction

Components required for monitoring and controlling the unit are located in the control box and control panel (see Figure 1-3).

1.8.2 Control Panel and Related Components (see Figure 1-3)

a. Gauges

1. Ammeter Gauge

The ammeter indicates the rate of discharge or charge of the battery charging system composed of the battery and battery charging alternator.

2. Oil Pressure Gauge

The gauge is located next to the control box (see Figure 1-1). Its purpose is to observe normal operating engine pressure. Normal oil pressure is 40 to 60 psig (3.8 to 5.2 kg/cm@).

3. Total Time Meter

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 section 4.1.)

b. Indicators

1. Circuit Breaker Trip Light

This indicator light (red) may be checked (unit not running) by placing the circuit breaker (CB-1) in the off position and at the same time moving the ignition switch to the run position. When the circuit breakers (CB-1 for 460 vac or CB-4 for 230 vac) is in the off position, a set of contacts close to complete a circuit to the light.

If the unit is running and the circuit breaker trips, the light will illuminate to signal the operator of a malfunction with the generator.

2. Glow Plug Indicator

This coil is used as a visual aid to assist the operator in determining when the glow plugs are fully energized. While holding the glow plug switch in the UP (preheat) position peer through the small holes on the face of the indicator. When the coil inside illuminates to a bright orange this indicates that the combustion chamber is at the pre-heat stage for ignition.

c. Switches

1. Glow Plug Switch

The glow plug switch (momentary contact type), when held in the UP position (pre-heat), permits battery current (approximately 10 amps per plug at 12 vdc) to flow to the glow plugs in the engine to pre-heat the combustion chambers. The glow plugs are located under the fuel injectors. When starting engine, it is necessary to continue to hold the glow plug switch in the UP position until the engine has developed sufficient oil pressure to close the oil pressure safety switch.

2. Ignition Switch

The ignition switch (momentary contact type in the start position), when held in the START (ignition) position energizes the starter motor solenoid which in turn allows the starter motor to crank.

3. Voltage Selector Switch (Optional)

This switch is used to select either 230 or 460 vac output. When making a selection the unit must be OFF.

1.8.3 Protective Devices

a. Circuit Breakers

1. A-C Generator Circuit Breaker (CB-1)

This device is located on the control box panel. It protects the A-C generator (main alternator) from excessive current (amperage) draw. When the circuit breaker trips, the generator power output to the refrigeration unit ceases. The diesel engine will continue to run (with normal engine operation), but a voltmeter will indicate no output . The circuit breaker trips at 26 amps (460 vac) and must be manually reset.

2. Circuit Breaker (CB-2)

The circuit breaker is located in the control box. This device prevents excessive current draw by the components FS, FH, HR, S, SS and TT. The circuit breaker opens at 20 amps and will automatically reset.

3. Circuit Breaker (CB-3)

The circuit breaker is located next to CB-2 in the control box. This device prevents excessive current draw by the glow plug and fuel pump circuitry. The circuit breaker opens at 50 amps and will reset automatically.

4. Circuit Breaker (CB-4) (Optional)

This device is located next to CB-1 on the control box panel. It protects the A-C generator (main alternator) from excessive current (amperage) draw. When the circuit breaker trips, the generator power output to the refrigeration unit ceases. The diesel engine will continue to run (with normal engine operation), but a voltmeter will indicate no output . The circuit breaker trips at 48 amps (230 vac) and must be manually reset.

b. Switches

1. Fan Belt Switch (FBS)

This switch is activated by the fan belt breaking and releasing the spring tension on the idler pully, which in turn swings around to hit the fan belt switch. When this happens a set of internal contacts open to de-energize the fuel solenoid (FS); thus stopping the engine.

2. Low Oil Pressure Switch (LOP)

This switch, set to open below 26 psig (1.83 kg/cm@) will automatically stop the engine upon loss of oil pressure. This switch is located behind the oil pressure gauge (see Figure 1-1). When the switch opens, the fuel solenoid (FS) de-energizes; thus stopping the engine.

3. Oil Temperature Switch (OTS)

This switch, set to close above 266 _F (130 _C) will automatically stop the engine when a high oil temperature is reached. The switch is located at the top of the engine block oil connection (see Figure 1-4). When the switch closes, the safety relay (S) coil is energized and the normally closed (N.C.) safety relay contacts open to de-energize the fuel solenoid (FS); thus stopping the engine.

1.9 MAIN ALTERNATOR (A-C GENERATOR)

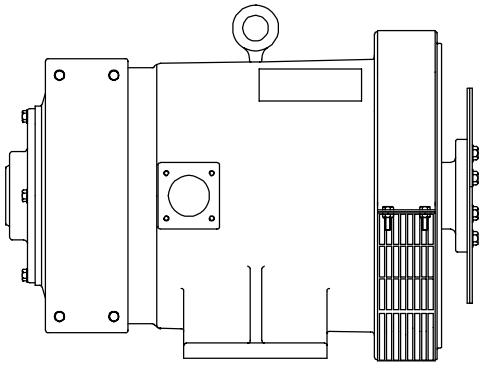


Figure 1-6. Main Alternator (A-C Generator)

1.9.1 Principle of Operation

The MAC (Lima) brushless A-C generator is a self-regulated, rotating field synchronous unit with the rotor having a salient pole construction with amortisseur windings. The generator stator and exciter stator are combined in a common housing. The generator field, exciter rotor and rotating rectifier assembly are mounted on a common shaft. The output of the exciter rotor is applied to the generator field winding through a rotating, full-wave bridge, silicone rectifier unit.

The exciter pole pieces contain residual magnetism, setting up lines of force across the air gap to the exciter armature. When the exciter armature begins to rotate a voltage is induced and current flow is initiated in the exciter armature AC windings. This voltage is fed to the rotating rectifier assembly, rectified and fed to the alternator field coils. This DC voltage is sufficient to magnetize the laminated alternator field which will set up lines of force across the air gap to the alternator stator. As the generator rotor rotates a voltage will be induced and current will flow in the alternator stator windings and to the output circuit.

All connections between the exciter stator windings and the generator stator windings are internally connected within the stator housing. Only the output power leads of the generator unit are brought out to the generator terminal box.

1.9.2 A-C Generator (Main Alternator) Circuit Diagram

Figure 1-7 shows the internal schematic diagram of the generator, exciter and rectifier unit. The generator is a three phase unit and the exciter stator and exciter rotor also have three phase windings. A portion of the exciter stator windings is connected across a tap on the generator stator winding. This exciter shunt winding provides the generator field excitation power required for the generator no load voltage. Another portion of the exciter stator windings is connected in series with the output of the generator and provides a compounding excitation characteristic.

The rotor is, in effect, the secondary of a rotating current transformer induction frequency converter. The exciter rotor output voltage is applied to the generator field windings by a three phase full wave rotating silicone rectifier unit. The response time of the excitation system is very fast since the exciter stator carries an alternating current corresponding to the load current which appears immediately on the exciter primary. An increase in load current will cause an immediate increase in the exciter secondary output voltage which is rectified and applied to the generator field windings. The inherent compounding characteristics of the excitation system provide excellent voltage regulation even under heavy overload conditions.

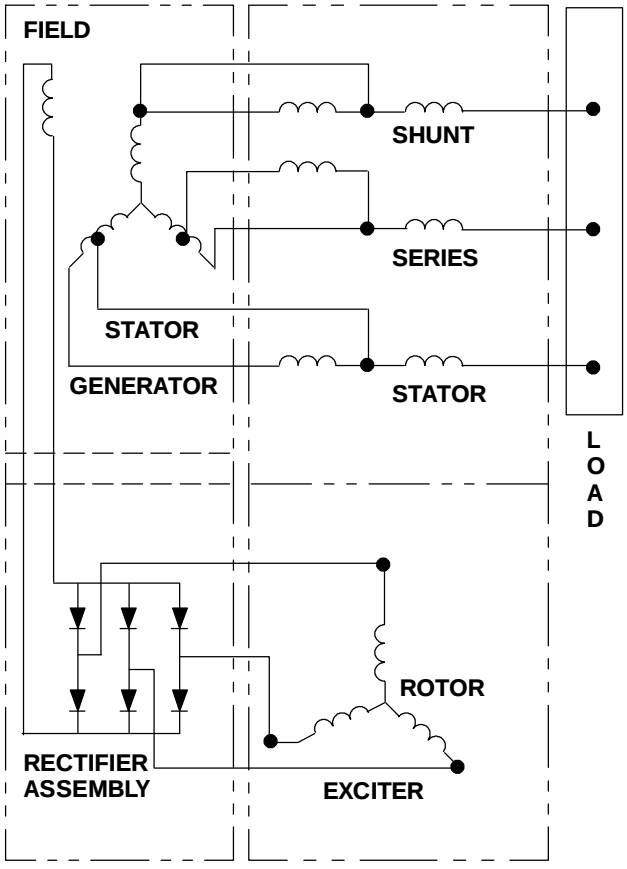


Figure 1-7. A-C Generator Circuit Diagram

1.10 BATTERY CHARGING ALTERNATOR SYSTEM

1.10.1 Introduction

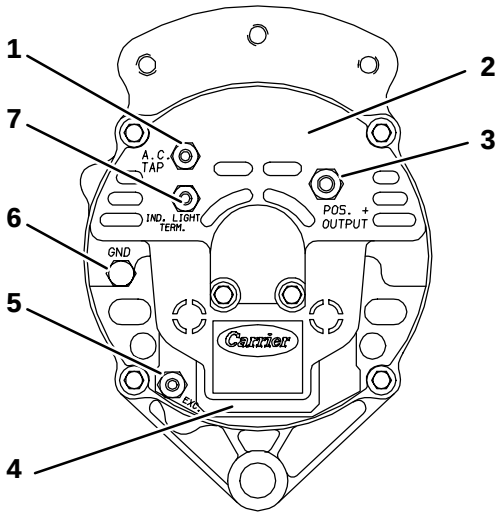
Table 1-3. Alternator and Manual

Prestolite Alternator No.	Prestolite Manual No.	Amps
8EM2012NA	25-197	65

It is recommended that the applicable manual (see chart above) be obtained from *Prestolite Electric, 7585 Empire Drive, P.O. Box 6210, Florence, Kentucky, 41042, U.S.A.*, for complete overhaul and service information of the alternator, and regulator, if required.

The mechanical construction of the alternator differs from the d-c generator in that the field rotates and the (armature) generating windings are stationary. The field current necessary to control the output of the alternator is supplied from the solid-state regulator. This integral voltage regulator, which incorporates an IC, all silicone semiconductor and thick-film construction, controls the current feed to the field via the brushes and rotor slip rings.

Two completely sealed ball bearings support the rotor in the front and rear housing.



1. A-C Tap
2. Back Cover
3. Positive Output(B+)
4. Integral Regulator
5. Excite
6. Ground
7. 12vdc Test Lamp Terminal (D+)

Figure 1-8. Alternator and Regulator

CAUTION

Observe proper polarity when installing battery, negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the rectifier diodes in alternator.

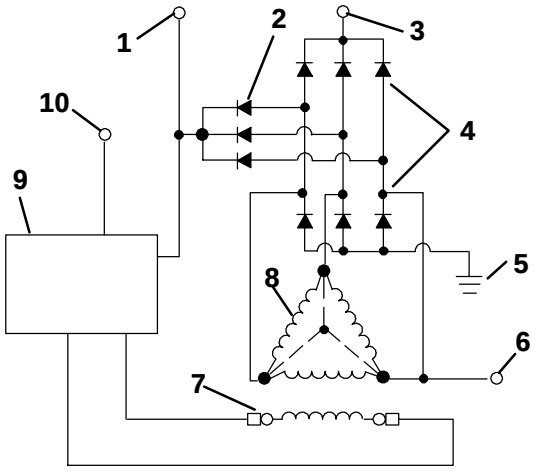
1.10.2 Alternator Operation

The alternator converts mechanical and magnetic energy to alternating current (A-C) and voltage, by the rotation of an electromagnetic field (rotor) inside a three phase stator assembly. The alternating current and voltage is changed to direct current and voltage, by passing A-C energy through a three phase, full-wave rectifier system. Six silicon rectifier diodes are used. (See Figure 1-9)

1.10.3 Integral Voltage Regulator Operation (12 volts d-c)

The regulator is an all-electronic, transistorized device. No mechanical contacts or relays are used to perform the voltage regulation of the alternator system. The electronic circuitry should never require adjustment and the solid state active elements used have proved reliable enough to warrant a sealed unit. The system is temperature compensated to permit the ideal charging rate at all temperatures.

The regulator is an electronic switching device. It senses the system voltage level and switches the voltage applied to the field in order to maintain proper system voltage.



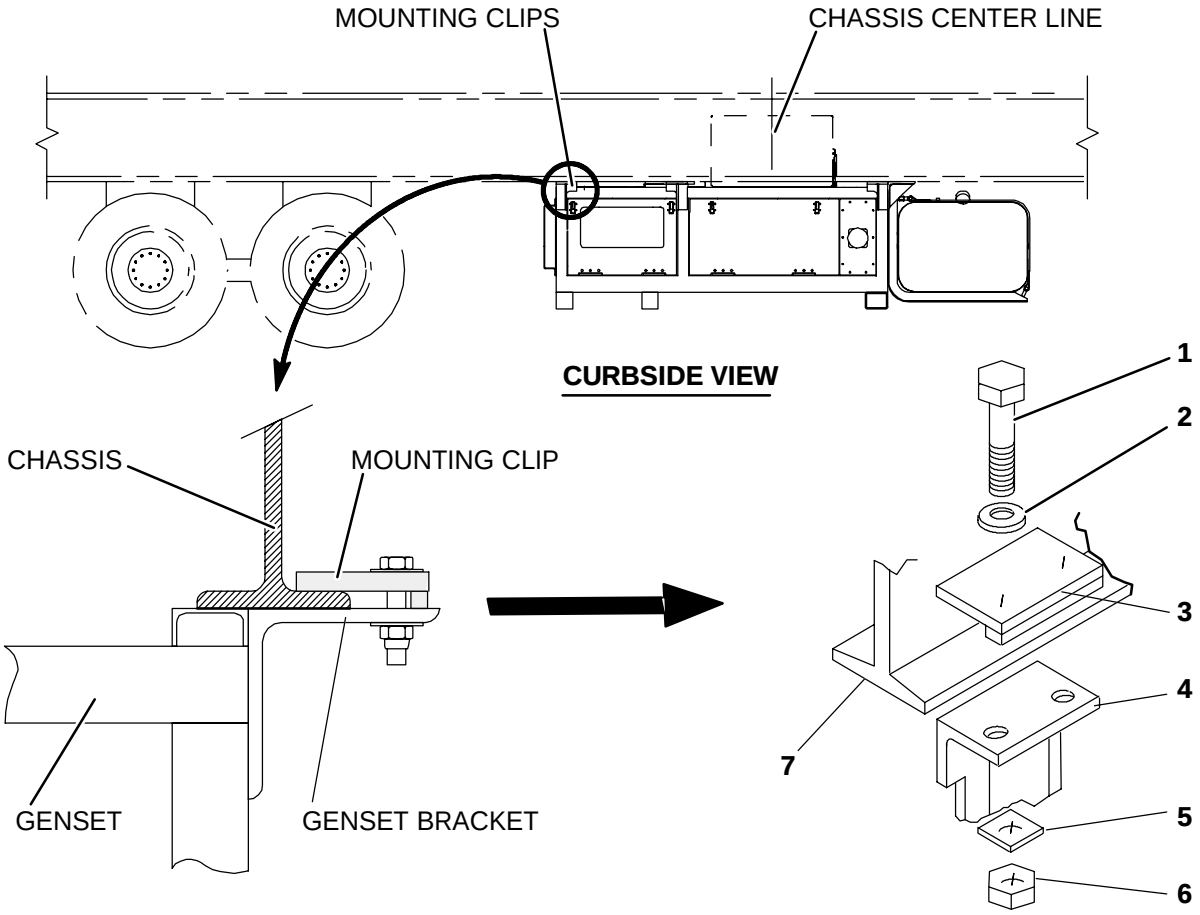
1. 12vdc Test Lamp Terminal (D+)
2. Diode Trio
3. Positive Output(B+)
4. Rectifier
5. Ground
6. A-C Tap
7. Rotor (Field)
8. Stator
9. Integral Regulator
10. Excite

Figure 1-9. Alternator Schematic Diagram

SECTION 2

OPERATION

2.1 GENERATOR SET INSTALLATION AND REMOVAL



1. Bolt (1/2-13 x 2-1/2 lg Grade 8)
2. Flat Washer
3. Mounting Clip
4. Genset Mounting Bracket
5. Rectangular Washer
6. Locknut
7. Chassis I-beam

Figure 2-1. Generator Set Mounting

The Genset centered under the trailer chassis is easily removed with a fork lift truck (Fork lift pockets are provided) capable of handling 2000 pounds.

NOTES

1. When installing genset, torque mounting bolts to 85-90 ft-lbs (11.75-12.44 mkg).
2. It is not recommended using original locknuts for second installation.

a. Installation:

1. Place forks into fork lift pockets of generator set. Attach safety chain between unit and fork truck.

2. Follow Figure 2-1 for installation of genset. Upon completion, remove safety chain before removing forks of fork lift truck from unit.

b. Removal:

1. Disconnect power cable to unit (if connected).

2. Disconnect fuel lines (if fuel tank is remote).

3. With fork lift in position and safety chain attached remove hardware (see Figure 2-1) and then remove genset.

2.2 PRE-TRIP INSPECTION

a. Before Starting Generator Set

1. Check engine lubrication and fuel oil filter cases, oil lines, and connections for leaks.
(Tighten connections and/or replace gaskets.)

2. Check engine lubrication oil level.
(Refer to section 1.4.j.)

3. Check V-belts for fraying or cracks. (Refer to section 4.4.)

4. Check engine blower fan for cleanliness.

5. Check air cleaner for cleanliness and clean if necessary. (Refer to section 4.3.5.)

6. Drain water from primary fuel filter and fuel tank sump.

7. Fill fuel tank with diesel fuel.
(Refer to section 1.4.g.)

8. Check glow plug amperage.
(Refer to section 1.4.h.)

9. Check battery terminals for cleanliness and securement. (Clean and coat with a mineral type grease.)

10. Check for loose electrical connections.

11. Tighten all hardware. (Brackets, ect.)

12. Connect power cable to refrigeration unit. Start genset as detailed in section 2.3 and then turn refrigeration unit ON to check operation.
(Refer to section b.)

b. After Starting Generator Set

1. Refer to section 2.3 for starting and stopping instructions.

2. Checking with a voltmeter. Generator output should be 460 volts a-c (¦ 10% no load).
(1825 rpm, no load) (1800 rpm, with load).

3. Check total time meter operation.
(Run engine 10 minutes.)

4. Listen for abnormal bearing noise.
(Main alternator.)

5. Check fuel lines, lube oil lines and filters for leaks.

6. Check exhaust system for leaks.

2.3 STARTING AND STOPPING INSTRUCTIONS

a. Starting Instructions

NOTE

On new or not yet broken-in engines there is a possibility of oil seepage out the muffler exhaust pipe. The following is recommended:

1. Avoid prolonged high idle/no load periods when engine is not broken-in.

2. Apply full load to engine as soon as possible during initial run-in.

3. Check valve clearance when engine is cold. (Refer to engine workshop manual, see section 1.1)

WARNING

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

NOTE

When starting the engine, it is necessary to continue to hold the glow plug switch in the UP position until the engine develops sufficient oil pressure to close the oil pressure safety switch, energizing and completing all circuits for unit operation.

4. Hold glow plug switch in the UP position for 30 seconds. (See Figure 1-3.)

NOTE

Below 0_F, hold glow plug switch for two minutes, release switch for 30 seconds and again hold glow plug switch for two minutes. If engine does not start after 10 seconds cranking, wait for 30 seconds before repeating starting procedure.

5. With glow plug switch held in the *PREHEAT* position, push the ignition switch to the *START* position.

6. After engine has started, continue to hold the glow plug switch in the *UP* position until the oil pressure safety switch closes (when engine develops sufficient oil pressure). The glow plug switch will automatically be in the *OFF* position when released.

7. Complete pre-trip inspection.
(Refer to section 2.2.b.)

b. Stopping Instructions

1. Push ignition switch to the *OFF* position.

2.4 CONTROL CIRCUIT OPERATION

WARNING

Beware of moving V-Belts and belt driven components.

CAUTION

The generator set circuit breaker must be in the ON position in order to supply power to the refrigeration unit.

When the glow plug switch is held in the pre-heat position, current flows to the glow plugs. The glow plugs (starting aids) provide a source of heat to pre-heat the combustion chamber during start-up.

In order to start engine, hold the glow plug switch in the *PREHEAT* position for the recommended time as detailed in section 2.3.a. and then hold the ignition (Start-Run-Off) switch in the *START* position. With ignition switch in the *START* position, starter solenoid is energized closing starter motor contactor contacts (SS), which energizes starter motor. The starter motor turns over the engine resulting in pumping 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, oil pressure safety switch contacts close to maintain a circuit to the fuel solenoid (FS). The glow plug switch is then released and the ignition switch is released to the *RUN* position. Releasing glow plug switch de-energizes the glow plugs.

Total time meter is energized simultaneously with the fuel solenoid.

With the engine running, the alternator provides 12-volt d-c power to operate the control system and charge the battery.

SECTION 3

TROUBLESHOOTING

3.1 DIESEL ENGINE

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.1.1 Engine Will Not Start		
a. Starter motor will not crank or low cranking speed.	Battery insufficiently charged	Charge
	Battery terminal post or battery defective	Check
	Bad electrical connections at starter	Correct
	Starter motor malfunctions	3.1.3
	Starter motor solenoid defective	Engine Manual
	Open starting circuit	3.1.4
	Incorrect grade of lubricating oil	1.4.j
b. Starter motor cranks but engine fails to start	No fuel in tank	1.3/1.4.g
	Air in fuel system	4.2
	Water in fuel system	Drain Sump
	Plugged fuel filters	Replace
	Faulty fuel control operation	4.3.3
	Safety relay	Check
	Glow plug(s) defective	4.3.6
	Plugged fuel lines to injector(s)	Engine Manual
	Mechanical lift fuel pump malfunction	Engine Manual
c. Starter cranks, engages but dies after a few seconds	Engine lube oil too heavy	1.4.j
	Voltage drop in starter cable(s)	Check
3.1.2 Engine Starts Then Stops		
a. Engine stops after several rotations	No fuel in tank	1.3/1.4.g
	Faulty fuel control operation	4.3.3
	Fuel filter(s) restricted	Replace
	Air cleaner or hose restricted	4.3.5
	Safety device open	1.2
	Open wiring circuit to fuel solenoid	Check
	Fuel solenoid linkage disconnected	4.3.3
	Fuel supply restricted	1.4.g/4.2
	Mechanical lift fuel pump malfunction	Engine Manual
	Oil pressure switch defective	Replace
	Leak in fuel system	Check
	Injector nozzle(s) defective	Engine Manual
	Injection pump defective	Engine Manual

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.1.3 Starter Motor Malfunction		
a. Starter motor will not crank or turns slowly	Battery insufficiently charged	Charge
	Battery cable connections loose or oxidized	Check
	Battery cables defective	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	1.4.j
b. Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Engine Manual
c. Starter motor does not disengage after switch has been released	Ignition switch defective	Replace
	Starter motor solenoid defective	Engine Manual
d. Pinion does not disengage after engine is running	Defective starter	Engine Manual
3.1.4 Malfunction In the Engine Starting Circuit		
a. No power to starter motor solenoid	Battery defective	Correct
	Loose electrical connections	Tighten
b. Fuel solenoid does not energize or does not remain energized	Battery defective	Correct
	Loose electrical connections	Tighten
	Oil pressure switch defective	1.2
	Safety relay defective	Replace
	Fuel solenoid defective	4.3.3
	Ignition switch defective	Replace
3.1.5 Miscellaneous Engine Troubleshooting		
a. Loss of power	Restriction in air cleaner	4.3.5
	Air in fuel system	4.2
	Air vent restricted	Clean
	Restricted fuel lines	1.4.g/4.2
	Defective fuel injection pump	Engine Manual
	Defective injector(s) or incorrect type	Engine Manual
	Incorrect fuel injection pump timing	Engine Manual
	Incorrect valve timing	Engine Manual
	Poor compression	Engine Manual

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.1.5 Miscellaneous Engine Troubleshooting (continued)		
b. Vibration	Engine shockmounts defective	Replace
	Poor compression	Engine Manual
	Fuel solenoid or linkage	4.3.3
c. Overheating	Restriction in air cleaner	4.3.5
	Exhaust pipe restriction	Remove
	Loose V-belt	4.4
	Restriction in air blower inlet	Engine Manual
	Recirculation of cooling air	Engine Manual
d. Excessive crankcase pressure	Plugged crankcase breather line	4.3.7
3.2 ALTERNATOR (AUTOMOTIVE TYPE)		
Battery Undercharged	Defective cables, dirty battery posts or corroded terminals	Clean
	Loose or broken belt	4.4.2
	Worn or broken brushes	4.8.5
	Defective alternator system	Check
	Defective wire harness	Replace
	Broken brush	4.8.5
	Defective alternator	Replace
Battery Overcharged – excessive use of water. Voltmeter indicates greater than 14.5 volts (connected across battery with no load) with engine running.	Defective alternator system	Check
Battery charges with engine running (no load),but discharges under load conditions.	Slipping belt	4.4
	Alternator defective	4.8.7

3.3 A-C BRUSHLESS GENERATOR (MAIN ALTERNATOR)

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
No voltage	Loss of residual magnetism in exciter field	4.5.1.g
	Circuit breaker tripped	Check
	Open in stator windings	4.5.2
	Open or short in rotating rectifiers	4.5.1.c
	Short circuited	4.5.2
	Open in alternator field	4.5.2
	Shorted exciter armature	4.5.2
Low voltage	Low engine speed	4.3.4
	Excessive load	Check
	High resistance connections – connections warm or hot	Tighten
	Shorted field	4.5.2
Fluctuating voltage (May be indicated by flickering lights)	Fluctuating speed	4.3.4
	Irregular speed of engine	Engine Manual
	Loose terminal or load connections	Tighten
	Defective bearing causing uneven air gap	4.5.1.b
High voltage	Excessive engine speed	4.3.4
Overheating	Generator overloaded	Check
	Clogged ventilating screens	Clean
	High temperature surrounding generator	4.3.1
	Insufficient circulation	4.3.1
	Unbalanced load	Balance
	Dry bearing	4.5.1.b
Mechanical Noise	Defective bearing	4.5.1.b
	Rotor scrubbing on stator	4.5.1.b
	Loose laminations	4.5.2
	Loose or misaligned coupling	4.5.2
Generator frame produces shock when touched	Static charge	Check ground to frame
	Grounded armature of field coil	4.5.2

SECTION 4

SERVICE

This section covers service for the generator set and some engine servicing only. Refer to the Deutz engine workshop manual for other engine servicing (refer to section 1.1.).

WARNING

Beware of moving V-Belts and belt driven components.

4.1 MAINTENANCE SCHEDULE

Unit ON/OFF		Operation	Reference Section
4.1.1 Daily Maintenance			
	X	1. Pre-Trip Inspection – before starting	2.2.a
X		2. Pre-Trip Inspection – after starting	2.2.b
X		3. Check total time meter	Run 10 min.
4.1.2 First 400 Hour Maintenance			
	X	1. Pre-Trip Inspection – before starting	2.2.a
X	X	2. Change lube oil and filter	4.3.2
X		3. Pre-Trip Inspection – after starting	2.2.b
X		4. Check total time meter	Run 10 min.
4.1.3 Every 1000 Hour Maintenance (Normal Operating Conditions)			
X	X	1. Complete 400 Hour Maintenance	4.1.2
	X	2. Tighten engine and generator mounting bolts	4.7
	X	3. Tighten all electrical connections in control box and unit	Tighten
	X	4. Clean air cleaner filter, check hose and connections	4.3.5
	X	5. Check V-belt tension	4.4.2
	X	6. Check battery charging alternator amperage output	4.8
	X	7. Clean mechanical fuel lift pump filter (If equipped)	Engine Manual
	X	8. Change engine lube oil	1.4.j
	X	9. Change primary and secondary fuel filters	None
4.1.4 Every 3000 to 6000 Hour Maintenance			
X	X	1. Complete a 400 and 1000 Hour Maintenance	4.1.2 & 4.1.3
	X	2. Clean crankcase breather	4.3.7
	X	3. Check starter condition	Engine Manual
X	X	4. Check engine compression	Engine Manual
	X	5. Check and adjust injector nozzles	Engine Manual
	X	6. Replace V-Belts	4.4
	X	7. Change Fill-Max oil filter (Optional Item)	None

4.2 PRIMING THE FUEL SYSTEM

The unit is equipped with a mechanical fuel lift pump, it is mounted on the engine next to the injection pump.

Since the unit employs a closed fuel circuit, it is recommended to use the following steps:

1. Turn bleed valve (Grey, Hex Head) counter-clockwise until fully opened (see Figure 1-1 or Figure 1-5).

2. Start engine. (Refer to section 2.3.)

3. When engine is running properly, turn bleed valve clockwise until fully closed.

4.3 ENGINE SERVICE AND COMPONENTS

4.3.1 Cooling System

The blower fan and grille, must be clean for adequate cooling. The blower fan belt is adjusted automatically to provide maximum air flow. (Refer to section 4.4.)

4.3.2 Lube Oil Filters

The engine oil filter is located next to the fuel solenoid as shown in Figure 1-1.

After warming up the engine, stop engine, remove drain plug from oil reservoir and drain engine lube oil. Lightly oil gasket on filter before installing.

Replace filters and add lube oil. (Refer to section 1.4.j.) Warm up engine and check for leaks.

4.3.3 Servicing the Fuel Solenoid and Linkage

NOTE

Periodically grease (P/N 07-00245-00) Fuel Solenoid plunger.

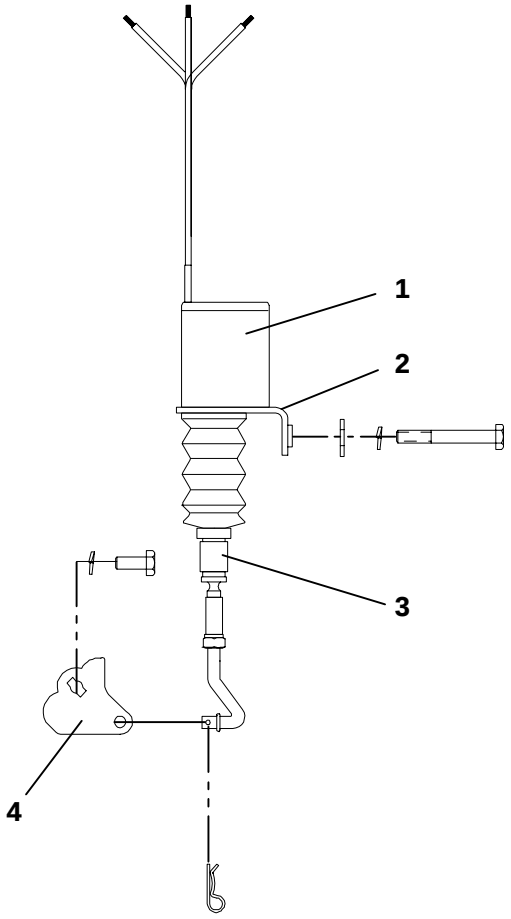
a. Remove run stop lever assembly (item 4, Figure 4-1).

b. Remove support rod (not shown) from mounting bracket, item 2.

b. Disconnect wiring to solenoid. Remove mounting hardware from solenoid and then remove solenoid.

c. Install new solenoid and mounting hardware, connect wiring. Make sure that the half-moon notch in the run stop lever assembly is facing up. Place ignition (Start-Run-Off) switch in the START position to energize solenoid. Check to ensure that the solenoid plunger bottoms out at the end of its stroke at the same time the fuel lever assembly hits against its stop.

d. De-energize solenoid. If the engine does not shut off when the fuel solenoid is de-energized, loosen jam nut and turn for adjustment. Retighten jam nut.



1. Plunger and arm assembly
2. Mounting bracket
3. Body and coil assembly
4. Run stop lever

Figure 4-1. Fuel Solenoid Assembly

4.3.4 Adjusting Engine Speed

The engine speed operates at 1825 rpm (no load), 1800 rpm (with load).

Two methods to check engine speeds are:

a. With the engine stopped, place a mark (white paint for example) on the crankshaft sheave. Start engine and verify engine speed by using a Strobette-model 964 (Strobetachometer), Carrier Transicold Part Number 07-00206.

b. With the engine stopped, the second method of checking engine speed is by using a frequency (hertz) meter. Attach one lead to CB-1, terminal 1, electrical schematics, and the other to chassis ground. Start engine and 60.5 hertz will be 1800 rpm and 61.3 hertz will be 1825 rpm (no load).

4.3.5 Engine Air Cleaner

a. Inspection

The oil bath air cleaner should be inspected constantly for leaks. A damaged air cleaner or hose can seriously affect the performance and life of the engine. The following simple service steps are easily made while the engine is being serviced in the field.

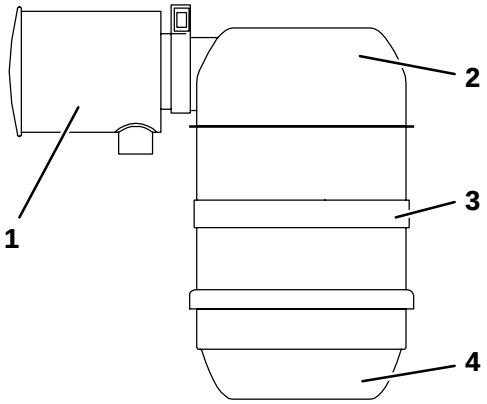
The simple service steps are as follows:

1. Check all connections for mechanical tightness. Be sure cleaner outlet pipe is not fractured.

2. If cleaner has been dented or damaged, check all connections immediately.

3. In case of leakage and if adjustment does not correct the trouble, replace necessary parts or gaskets. *Swelled or distorted gaskets must always be renewed.*

b. Service Intervals and Service Procedure (Oil Bath)



1. Pre-Cleaner
2. Air Cleaner
3. Air Cleaner Clamp
4. Oil Cup

Figure 4-2. Air Filter

1. Oil Cups

When to Service:

Remove the oil cup at regular intervals. Initially inspect daily or as often as conditions require. 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 to carry 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.

How to Service:

Stop the engine and remove the oil cup from the air cleaner. Dump the oil from the oil cup. Clean the cup of sludge.

Reassemble and fill the oil cup to the *indicated level* with SAE #10 oil for temperatures below freezing or SAE #30 for temperatures above freezing. It is generally a recommended practice to use the same oil as required in the engine crankcase.

CAUTION

Do not underfill or overfill the cup. Overfilling of cup means loss of capacity and underfilling means lack of efficiency.

2. Body Assembly

When to Service:

The lower portion of the fixed element should be inspected each time the oil cup is inspected or serviced. If there is any sign of contaminant buildup or plugging, the body assembly should be removed and back flushed. At least one a year or at regular engine service periods remove the entire air cleaner and perform the following:

D Remove oil cup. Check and clean center tube. *DO NOT USE GASOLINE.*

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

4.3.6 Servicing Glow Plugs

The glow plugs are parallel connected and when energized, draw 10 amps at 12 vdc. When servicing, the glow plug is to be fitted into the cylinder head to prevent damage to the glow plug.

Torque value for the glow plugs is 28.9 to 36.2 ft-lb (4.0 to 5.0 mkg).

Checking for a Defective Glow Plug:

a. One method is to remove the injector and then energize the glow plug. The glowing tip may then be observed.

b. Another method is to place an ammeter (or clip-on ammeter) in series with each glow plug and energize the plugs. Each plug (if good) should show amperage draw.

4.3.7 Engine Crankcase Breather

The engine uses an open type breather with the breather line attached to the engine crankcase.

4.4 SERVICING AND ADJUSTING V-BELT

WARNING

Beware of moving V-belts and belt driven components.

NOTE

Frayed, cracked or worn V-belts must be replaced.

4.4.1 Engine V-belt

The V-belt is driven by a sheave on the engine drive shaft and its function is to drive the blower fan, to cool the engine by circulating air through the air cowling and out through the air outlet frame. Adjustment is achieved automatically by the idler pulley.

a. Replacing the V-Belt

1. Push spring loaded idler pulley inwards by hand. Remove belt.

2. Use hand force only to push idler pulley. Replace belt. Belt is tensioned automatically by idler pulley.

4.4.2 Alternator V-Belt

The alternator V-Belt is driven by a sheave on the generator drive shaft. Adjustment is achieved by pivoting the position of the alternator.

a. Replacing the V-Belt

1. Loosen the alternator pivot bolt and capscrew on adjustment arm.

2. Replace belt. Use hand force only on alternator to tighten belt. *Do not use pry bar or excessive force as it may cause bearing failure in the alternator.* When belt is tight, tighten the alternator bolts.

3. Check belt tension, correct specifications are 40-45 lbs. on the Burroughs gauge Carrier Transicold P/N 07-00203.

4.5 SERVICING THE GENERATOR (MAIN ALTERNATOR)

4.5.1 Preventive Maintenance and Operating Precautions

Costly repairs and down time can usually be prevented by operating electrical equipment under conditions which are compatible with those at which the equipment was designed to operate. Follow the instructions outlined below to insure maximum efficiency of the electrical equipment.

a. Cooling

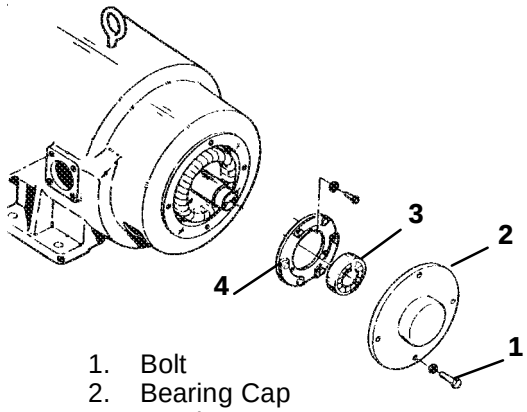
Keep all cooling parts clean and make certain sufficient room is left on all sides for a plentiful supply of fresh coolant air flow. *DO NOT EXCEED TEMPERATURE RISE AS SHOWN FOR 80_C (176_F) ABOVE A 40_C (104_F) AMBIENT.* This ensures that the insulation NEMA Class "F" will not be damaged. *DO NOT EXCEED RATED LOAD* except as specified for the equipment. *OPERATE GENERATOR AT RATED SPEED*. Failure to operate generators at rated load or speed will cause overheating and possible damage to windings due to over voltage or current.

b. Bearing Replacement

Factory lubricated shielded bearings will normally provide several years of trouble free service when operated under normal conditions. Excessive bearing load and adverse environment conditions will greatly shorten bearing life. Should bearing failure occur, bearings can be replaced. *ALWAYS REPLACE WITH THE SAME TYPE BEARING AS INSTALLED AT THE FACTORY. CHECK PARTS LIST FOR PART NUMBER*. Include generator serial number when ordering bearings.

Do the following to remove bearing:

1. Remove bearing cap. (See Figure 4-3.)



1. Bolt
2. Bearing Cap
3. Bearing
4. Rotating Diode Bridge

Figure 4-3. Rectifier Removal

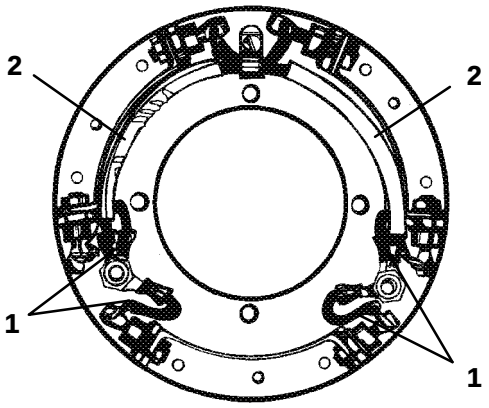
2. Remove bearing with the use of a bearing or wheel puller.

3. Install new bearing. Ball bearings on Lima generators are pre-lubricated and require no further lubrication for the life of the bearing.

4. Replace end cap.

c. Rotating Diode Bridge (Rectifier Assembly) Replacement

The rotating diode bridge can be removed and replaced. Overcurrent, overvoltage, overspeed, or reverse currents can cause damage to the assembly or any of the component parts. The rotating diode bridge may be removed through the bearing cap on the rear of the generator. (See Figure 4-4 and Figure 4-3.)



1. Exciter Rotor Lead
2. Alternator Rotor Lead

Figure 4-4. A-C Generator (Rectifier Assembly)

1. Remove the bearing cap by removing the four bolts shown in Figure 4-3 and both the bearing and rectifier assembly will be visible.

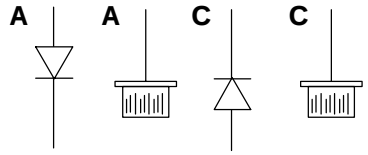
2. Use a bearing puller to remove the bearing from main shaft being careful to locate the puller on the inner race of the bearing to avoid bearing damage. Once the bearing is free, it is then necessary to disconnect the alternator and exciter rotor leads as shown in Figure 4-4.

3. Remove the three hold-down cap screws which secure the rectifier assembly to its adapter. Once this procedure is complete the rectifier assembly is free for removal.

Follow the testing procedures outlined in section 4.5.1.d.

After the rectifier assembly has been repaired or replaced, reverse the procedure as stated above, being careful that all lead connections are tight and that set screws are locked with Loctite. (Loctite Corporation)

d. Testing Diodes With An Ohmmeter



RED LETTERING BLACK LETTERING

	"R" After Number
Forward Polarity Diode	Reverse Polarity Diode
A (+) = Anode	C (–) = Cathode

Figure 4-5. Diode Testing

1. Remove the diode from the circuit. Do not press body out of heat sink. Disconnect the lead. Do not use excessive heat in unsoldering the lead.

2. A good diode should have a low resistance when the + of an ohm meter is connected to the anode and the – to the cathode, and a high resistance when the polarity of the ohmmeter is reversed. (See Figure 4-5)

If both resistances are high or both are low, then the diode is defective and should be replaced.

e. Rotor Damage

The damper bars of the generator prevent excessive hunting when AC generators are operated in parallel. Damper bars, because they must have a low electrical resistance and are subjected to extreme centrifugal forces, must be mechanically secure and permanent. Consequently, they are welded to end plates completely covering the field.

All rotors are static and dynamically balanced to a high degree on precision machines to assure minimum vibration. They will, therefore, remain dynamically stable at speed well beyond the synchronous speed of the generator. The rotors on generators are, however, subjected to extreme centrifugal forces which can increase beyond safe operating limits at overspeed. Therefore, the prime mover should be adequately governed to prevent overspeed.

Damage to the rotor can also occur due to overheating which can be caused by the air flow being restricted from dust or other foreign objects collecting in the air passage.

If a rotor becomes defective, it should be returned to the factory with full nameplate data, because the rotor coils are enclosed in welded squirrel case winding. To repair a rotor the special tooling and technique of the factory is necessary and essential. Should a failure occur, Carrier Transicold should be notified immediately and steps will be taken to get the generator back into service with the least expense; and more important, to determine the cause of the failure and take steps to prevent a recurrence.

f. Generator Windings (Drying)

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 low insulation leakage.

Generators that have been in transit or storage for long periods may be subjected to extreme temperature and moisture changes. This can cause excessive condensation, and the generator windings should be thoroughly dried out before bringing the generator up to full nameplate voltage. If this precaution is not taken, serious damage to the generator can result. The following steps should be taken to effectively dry the generator windings:

1. (a) Place generator in drying oven or hot room.

(b) Dry with warm air blower directed through windings.

2. (a) If the generator has been operated and then put into storage for any period of time, a P.D. George #11127 type air-dry fungus resistant varnish should be applied.

Experience has shown that it is necessary to take these precautions in locations such as seaboard installations and other highly humid areas. Some installations will be

in atmospheres that are much more corrosive than others. A little precaution along the lines outlined here could eliminate an unnecessary repair job.

Each generator was subjected to a standard NEMA insulation test, which means 1000 volts plus twice the highest voltage for which the generator is rated was impressed between the winding and frame. All machines are insulated with a high safety factor for the class of insulation used. The latest and newest in insulation and baking techniques are used.

The finest insulation job can be very quickly broken down by carelessly applying high voltage to windings in a moisture saturated condition. Mishandling in this respect can easily cause a breakdown, making it necessary to return the generator to the factory for repair, and consequent expense and loss of time.

g. Restoring Residual Magnetism

NOTE

When trying to restore residual magnetism, be sure to wear leather gloves and use an insulated 12 gauge (or higher) jumper wire. Cut-off a few strands from both ends of the jumper wire to help ensure fusing does not take place.

The direct current (DC) necessary to magnetize the alternator field is obtained from the exciter. Initially, upon starting the generator, current flow and voltage are induced into the exciter armature by the magnetic lines of force set up by the residual magnetism of the exciter field poles.

Residual magnetism of the exciter field poles may be lost or weakened by a strong neutralizing magnetic field from any source, or if the generator is not operated for a long period of time.

Should the generator fail to build up voltage after being disassembled for any reason, a momentary short-circuit of any two generator leads (L1, L2 and L3) while generator is running should be sufficient to correct this condition. If not, an alternate method may be used. Apply either an alternating current or a direct current voltage of approximately 20 volts to any two generator leads (L1, L2 and L3) while generator is running. Do not make a positive connection but rather touch the leads together until the generator voltage begins to rise and then remove. It is suggested that a 30 ampere fuse be inserted in the circuit to prevent any damage in case the build-up voltage is not removed quickly enough.

Reflash field if generator output voltage does not build up.

4.5.2 Installation and Removal

a. Removing the Generator

1. Remove ground wire from frame of generator set.

2. Remove generator leads from power junction box, then remove four 1/4-20 x 1/2 thread cutting screws securing box to generator.

3. Remove screen from coupling end of generator.

4. Remove twelve M10 x 1.5 x 25mm lg socket head bolts and washers securing the generator flange to the engine flywheel housing. Turn bolts counter-clockwise with offset wrench to start, then use flexible shaft and socket assembly for removal of bolts.

5. Remove eight M10 x 1.5 x 25mm lg socket head bolts and washers that secure generator to engine flywheel.

6. Remove mounting frame hardware (four – 5/8-11 x 2-1/2 lg hex head bolts and washers), then remove generator.

b. Installing the Generator

The generator is a single bearing type which means the shaft end of the rotor floats. Before installing generator, rotate shaft and check if bearing rotates.

1. Remove screen covering from shaft end of generator and brush anti-seize lubricant (lube-plate) on the face of flywheel.

2. Move generator (with hoist) into position and line up with the holes on housing and flywheel. Turn crankshaft (with large wrench) to align flywheel with generator, if necessary.

3. Start the M10 bolts (by hand) through the disc plate and into the flywheel. Once alignment is made torque bolts (eight) to a value of 20 ft-lb (2.77 mkg).

4. Secure two of the housing bolts (M10) to draw the mating flanges together.

5. Secure remaining bolts and washers. The M10 bolts (twelve) are to be torqued to a value of 20 ft-lb (2.77 mkg).

6. Install screen cover, mounting bolts, power junction box, generator leads and ground wiring. Torque generator mounting frame bolts (5/8-11) to a value of 97 ft-lb (13.41 mkg).

NOTE

Install new gaskets (one between generator and junction box and the other between box and cover) when installing junction box.

4.6 MAINTENANCE OF PAINTED SURFACES

The unit is protected by a special paint system against the corrosive atmosphere in which it normally operates. However, should the paint system be damaged, the base metal can corrode. In order to protect the unit from the highly corrosive sea atmosphere or if the protective paint system is scratched or damaged:

a. Clean area to bare metal using a wire brush, emery paper or equivalent cleaning method.

b. Immediately following cleaning, spray or brush on a zinc rich primer.

c. After the primer has dried, spray or brush on finish coat of paint to match original unit color.

4.7 REPLACING SHOCKMOUNTS

4.7.1 Replacement Criteria

When the neoprene shockmount has been cut, split, abraded or has flared due to wear from bolts and normal deterioration.

4.7.2 Shockmount Replacement

a. Engine (See Figure 4-6)

1. Place a two ton jack (minimum) under the center of the engine to support its' weight.

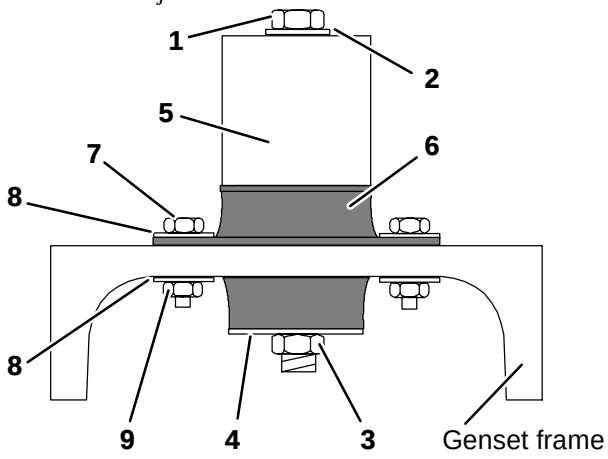
2. Remove all hardware as shown in Figure 4-6, items 1, 2, 3, 4, 7, 8 & 9.

3. Raise the engine just enough to remove the shockmounts (item 6).

4. Install new shockmounts.

5. Lower jack enough to assemble hardware as shown and torque to a value of 97 ft-lb (13.41 mkg).

6. Remove jack.



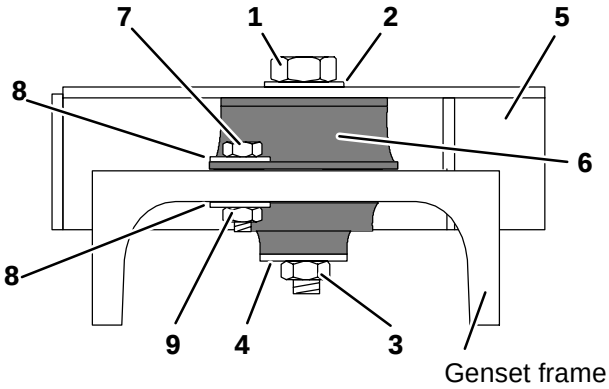
1. Screw (1/2-13 x 5.50 lg)
2. Flat Washer (1/2)
3. Locknut (1/2-13)
4. Flat Washer (.125 Thick)
5. Engine Shockmount Frame
6. Shockmount
7. Screw (3/8-16 x 1-1/4 lg)
8. Flat Washer (3/8)
9. Locknut (3/8-16)

Figure 4-6. Engine Shockmounts

NOTE

For torque values refer to section 4.9.

b. Generator (See Figure 4-7)



1. Screw (5/8-18 x 4.00 lg)
2. Flat Washer (5/8)
3. Locknut (5/8-18)
4. Flat Washer (.250 Thick)
5. Generator Shockmount Frame
6. Shockmount
7. Screw (3/8-16 x 1-1/4 lg)
8. Flat Washer (3/8)
9. Locknut (3/8-16)

Figure 4-7. Generator Shockmounts

NOTE

For torque values refer to section 4.9.

1. Place a two ton jack (minimum) under the center of the generator to support its' weight.

2. Remove all hardware as shown in figure Figure 4-7, items 1, 2, 3, 4, 7, 8 & 9.

3. Raise the generator just enough to remove the shockmounts (item 6).

4. Install new shockmounts.

5. Lower jack enough to assemble hardware as shown and torque to a value of 97 ft-lb (13.41 mkg).

6. Remove jack.

4.8 SERVICING THE ALTERNATOR

4.8.1 Preliminary Checks and Tests

NOTE

Before starting the actual electrical test procedure, the charging system, battery and wiring should be checked to eliminate possible problem areas. Figure 1-8 identifies the terminals on the rear of the alternator.

a. Check the condition and adjustment of belts.

1. Check belt adjustment (refer to section 4.4).

2. Replace any worn or glazed belts.

b. Check to see that all terminals, connectors and plugs are clean and tight.

1. Loose or corroded connections cause high resistance and this could cause overcharging, undercharging or damage to the charging system.

2. Badly corroded battery cables could prevent the battery from reaching a fully charged condition.

c. Check battery condition and charge if necessary. A low or discharged battery may cause false or misleading readings when conducting in-unit tests.

4.8.2 Test Tools

A list of the following tools is provided to perform tests on the alternator and its components.

1. Volt-ohm meter
2. Single-pole, single throw switch
3. 12 vdc lamp
4. Insulated 12 gauge stranded wire
5. Alligator clamp terminals

4.8.3 Problem Area Determination

CONDITIONS: Engine running for all tests (unless otherwise specified).

a. Battery Undercharged

1. Perform open diode-trio test. (Refer to section 4.8.4, Test No. 1)

2. Perform regulator tests. (Refer to section 4.8.4). If regulator is O.K., the cause is probably an open field circuit, and alternator must be removed for repair.

3. Further investigation requires alternator removal and repair (diodes).

b. Battery Overcharged

1. Perform alternator output test. (Refer to section 4.8.4, Test No. 3)

2. Regulator shorted. Replace regulator.

4.8.4 In-Unit Alternator/Regulator Tests

Test No. 1 – Open Diode-Trio Test

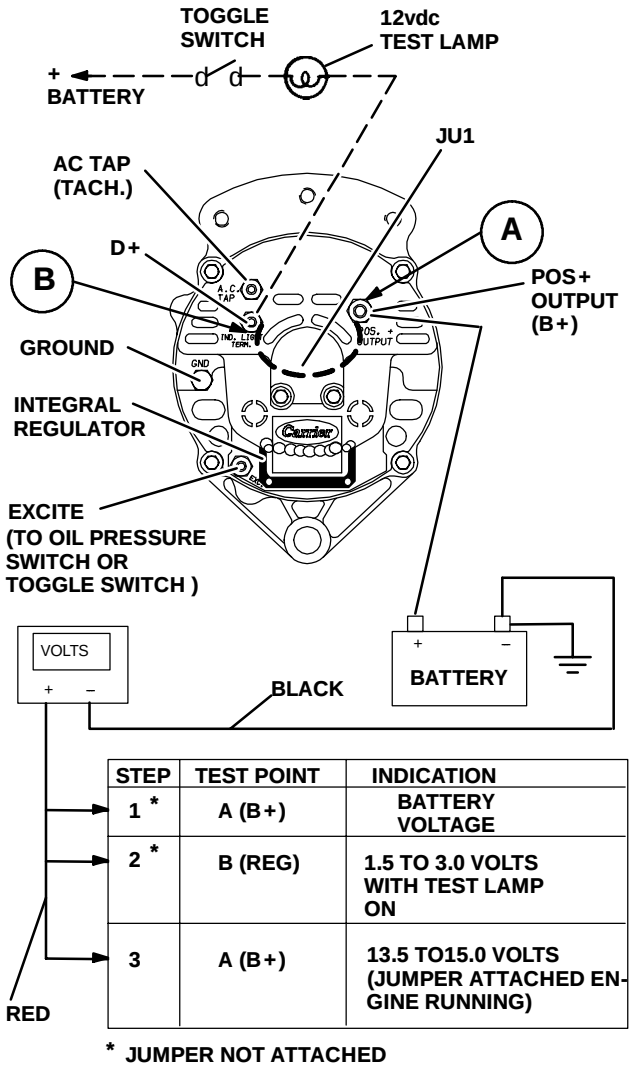


Figure 4-8. Open Diode-Trio Test

CONDITIONS: Start-run-stop switch (SRS) in RUN position and engine stopped (after proper hook-up is made and test leads connected). No electrical loads.

a. With jumper not attached. Check for battery voltage at terminal A and for 1.5 to 3.0 volts at terminal B, see Figure 4-8.

b. Add jumper JU1 between terminals A and B. Start engine and run with no load. If the test lamp now goes off, and charging voltage is present at terminal A (more than battery voltage), the diode-trio is open. Alternator should be removed for repair. If the voltmeter indication is not in this range, remove the jumper and proceed to the regulator test (test no. 2).

Test No. 2 – Open Regulator Test

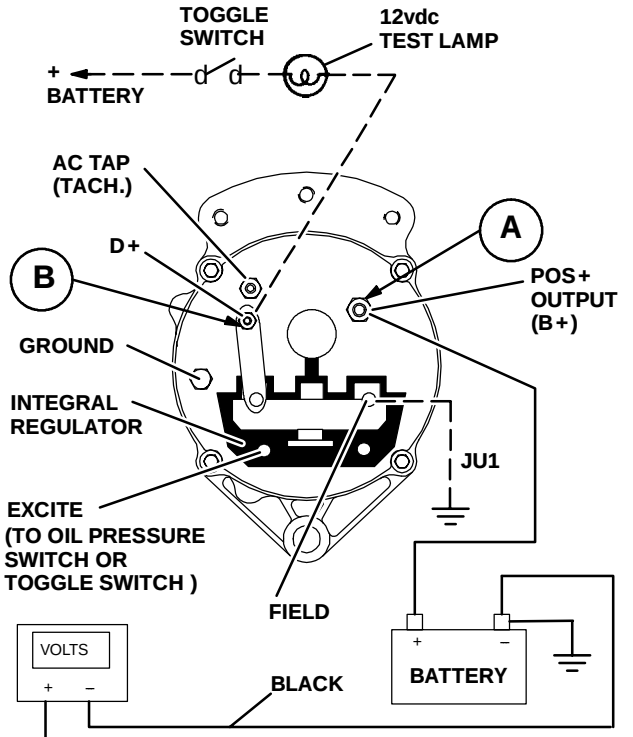
CONDITIONS: Engine stopped (start-run-stop switch in the RUN position) and voltmeter set-up as shown in Figure 4-9.

NOTE

Before performing test, removal of back cover is required. To remove, disconnect wires from terminals extending through back cover. Remove back cover (two screws) and reconnect all wires.

a. With jumper not attached, check for battery voltage at terminals A and B. Test lamp will be off.

b. Add jumper JU1 between field and ground (see Figure 4-9). If 1.5 to 3.0 volts is present at terminal B and the test lamp is on, the regulator is open. Alternator should be removed for repair.



STEP	TEST POINT	INDICATION
1 *	A (B+)	BATTERY VOLTAGE
2 *	B (REG)	BATTERY VOLTAGE WITH TEST LAMP OFF
3	B (D+)	JUMPER ATTACHED. 1.5 TO 3.0 VOLTS. TEST LAMP ON

* JUMPER NOT ATTACHED

Figure 4-9. Open Regulator Test

Test No. 3. Alternator Output Test

CONDITIONS: Engine running (after voltmeter is connected as shown in Figure 4-10).

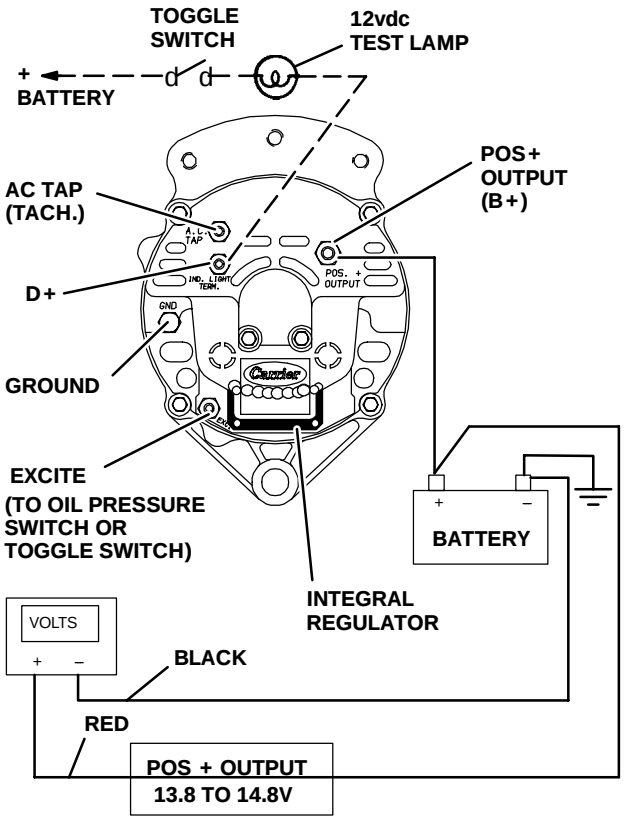


Figure 4-10. Alternator Output Test

a. Start unit and run engine with load. With the unit operating (placing a load on charging circuit) check for nominal system output voltage of between 13.8-14.8 volts for a properly operating charging system. (Voltages may vary a few tenths of a volt, higher or lower, due to ambient temperature variations.)

b. If the alternator output voltage does not fall within the proper range, the alternator should be removed for further inspection and tests. (See Table 1-3 and refer to Prestolite manual.)

4.8.5 Alternator Brush Test Procedure

NOTE

Before performing test, removal of back cover is required. To remove, disconnect wires from terminals extending through back cover. Remove two screws securing back cover to rear housing and remove cover.

a. Removing Brush Set

1. Remove two locknuts securing brush holder and remove brush assembly.

2. Check brush assembly for cracked, chipped or oil soaked brushes. Remaining brush length should be at least 3/16 inch (4.76 mm) long.

3. Check slip rings for carbon build-up.

4. Test brush assembly for continuity and insulation per section 4.8.5.b.

b. Brush Continuity Check

Using a 12 vdc test lamp or ohmmeter, test brush assembly for continuity and insulation as shown (see Figure 4-11). Replace brush assembly if necessary.

CONTINUITY CHECK

Continuity	A to B	OK
Continuity	C to D	OK
No Circuit	A to C	OK
No Circuit	A to D	OK
No Circuit	B to C	OK
No Circuit	B to D	OK

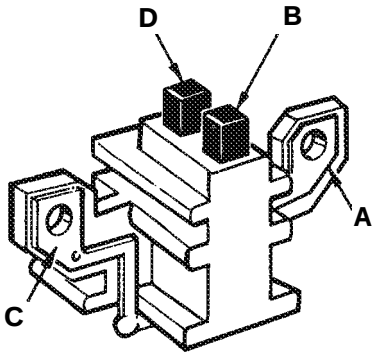


Figure 4-11. Alternator Brush Assembly

4.8.6 Slip Ring Servicing

Clean brush contacting surfaces with fine crocus cloth. Wipe dust and residue away.

If surfaces are worn beyond this restoration, replace entire rotor assembly.

4.8.7 Alternator Installation

a. Make sure negative battery terminal is disconnected.

b. Install alternator to mounting bracket with the alternator pivot bolt and adjustment arm bolt loosely in position.

c. Place V-belt on alternator sheave.

d. Check the center alignment of the generator driving pulley and alternator pulley, to ensure proper drive. Pulley misalignment will create excessive belt wear and limit alternator bearing life. The center line of the alternator sheave, and the driving sheave must be in line.

e. Pivot alternator to place tension on belt. For correct belt tension see section 4.4.2.a.3. Tighten pivot and adjustment bolts.

f. Connect wiring to alternator.

g. Connect battery cable. Start unit and check for output per section 4.8.4, Test No.3.

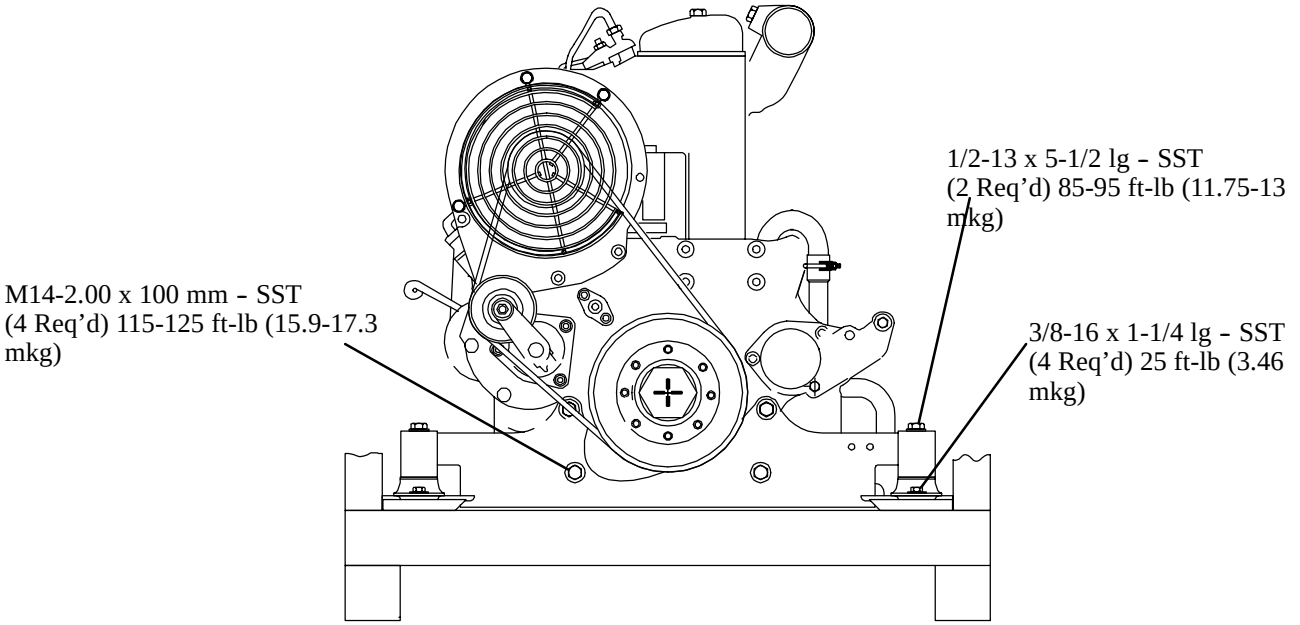
4.9 UNIDRIVE TORQUE REQUIREMENTS

Extensive damage may occur if the proper hardware and procedures are not followed. Periodic inspection of hardware and bolt torque is recommended to ensure the integrity of the unidrive.

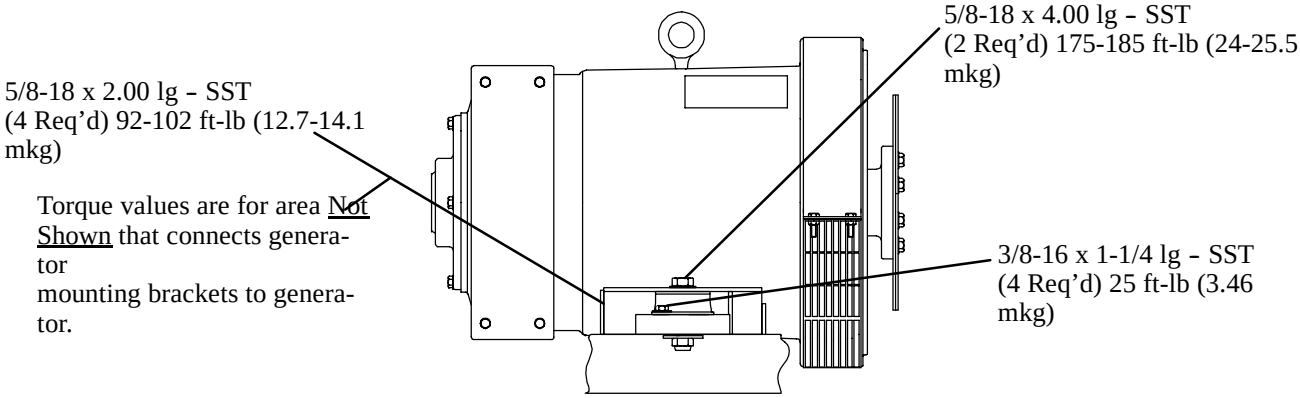
The figures below show the torque value, size and grade of the hardware to be used when assembling the unidrive assembly.

NOTE

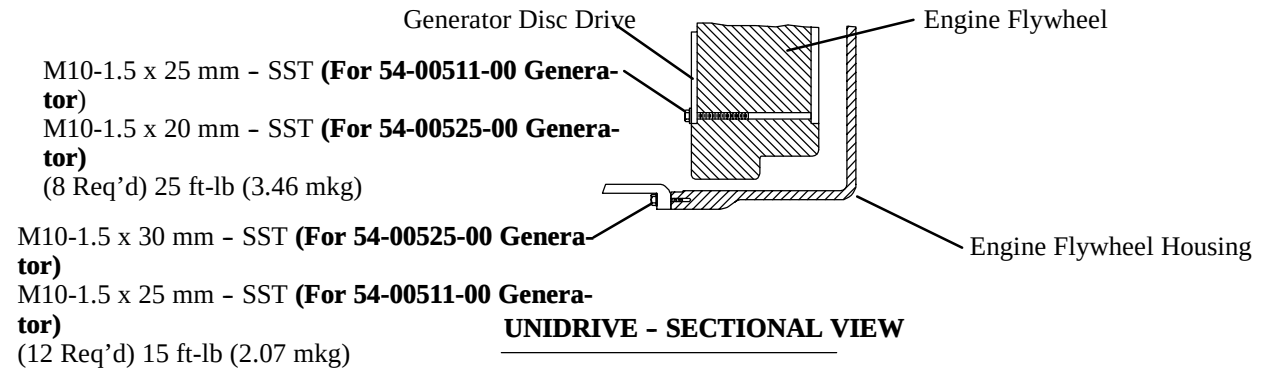
SST is an abbreviation for; Stainless Steel – 300 Series



ENGINE MOUNT – FRONT VIEW



GENERATOR MOUNT – LEFT SIDE VIEW



UNIDRIVE – SECTIONAL VIEW

Figure 4-12. Unidrive Torque Requirements

SECTION 5

SCHEMATICS

5.1 INTRODUCTION

This section contains Electrical Wiring Schematics and Diagrams covering the Model listed in Table 1-1. 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.

WARNING

Electrical power is generated by a Lima 15 KW, A-C generator.The generator provides a constant 460 or 230 vac, 3 phase, 60 hertz electrical supply.

WARNING

Beware of moving V-belts and belt driven components.

WARNING

Before servicing unit, make sure the unit circuit breaker (CB-1 or CB-4) and the start-stop switch are in the OFF position. Also disconnect power plug and cable.

Make sure the power plug(s) are clean and dry before connecting to any power receptacle.

WARNING

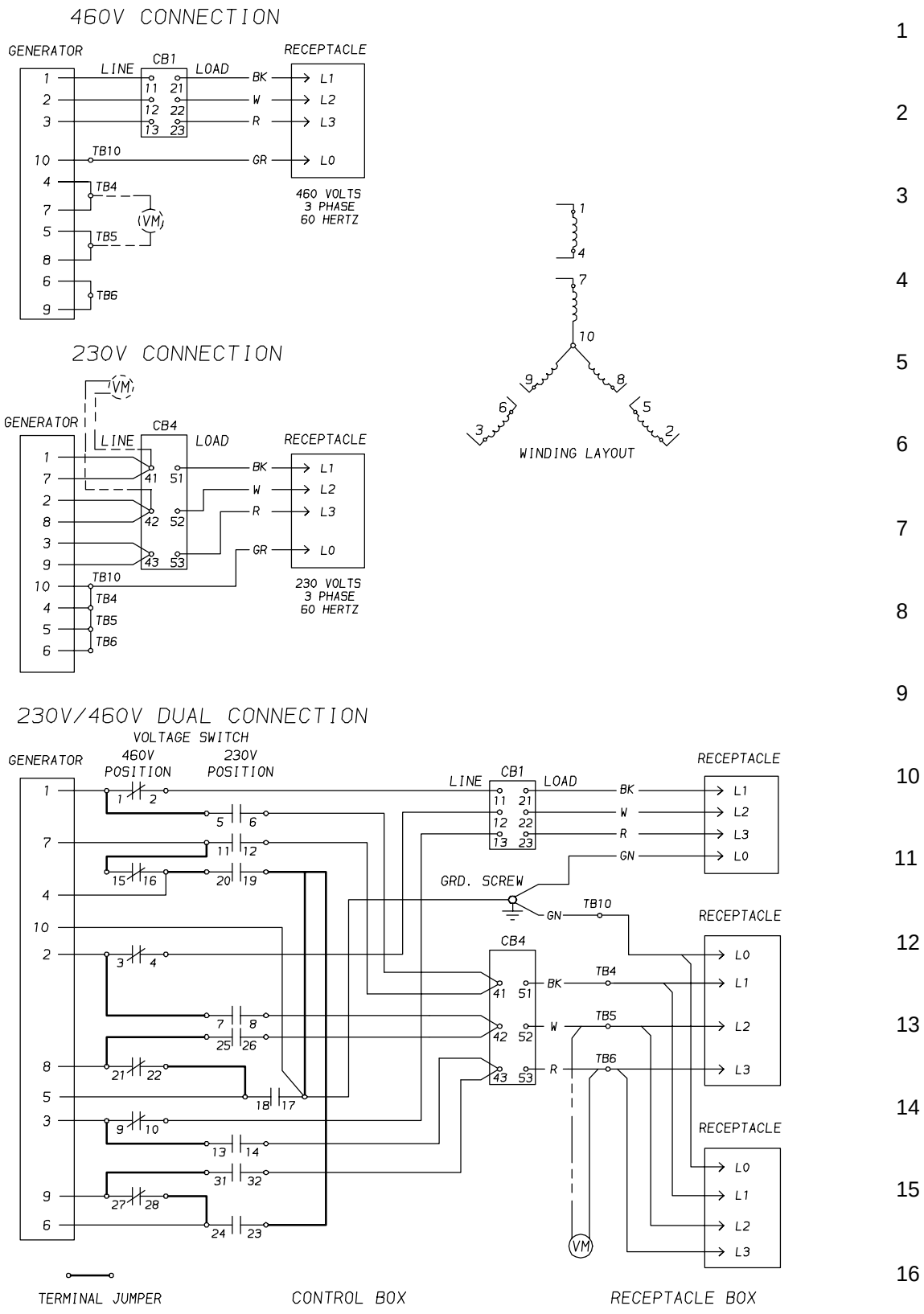
High voltage (dielectric) testing must not be performed to the machine without first observing NEMA rules. The insulation of this generator winding may be safely checked by using a megger. A high megger reading indicates low insulation leakage.

CAUTION

The generator set circuit breaker must be in the ON position in order to supply power to the refrigeration unit.

ZONE	SYMBOL	DESCRIPTION
	- - - - - -	MECHANICAL LINKAGE
	⏚	ENGINE GROUND
	⏚	CHASSIS GROUND
	— — —	OPTIONAL COMPONENT
K5,Y13	A	AMMETER
P5,FF2	ALT	ALTERNATOR
N3,GG3	BAT	BATTERY
D1,D6,H10	BK	BLACK
L8,N9,O9,L12,W6,Y6,Y11,Z11	CB	CIRCUIT BREAKERS
P7,N12,R12,V10,W10,Z12	D	DIODE
Q10,FF5	FBS	FAN BELT SWITCH
R7,GG5	FH	FUEL HEATER
R10,EE6	FS	FUEL SOLENOID
BB4	GEN	GENERATOR
P13,DD5	GP	GLOW PLUG
N13,T11	GPI	GLOW PLUG INDICATOR
M12,U11	GPS	GLOW PLUG SWITCH
D2,D7,H11	GR	GREEN
Q7,P12,W13	HR	HEATER RELAY
M7,W11	IGN	IGNITION SWITCH
Q9	L1	CB TRIP LIGHT
CC6,N10	LOP	LOW OIL PRESSURE SWITCH
K5,R11	N	NEGATIVE (−)
CC5,N10	OTS	OIL TEMPERATURE SWITCH
K5,R11	P	POSITIVE (+)
D2,D7,H11	R	RED
O10,N8,U13	S	SAFETY, RELAY
DD3,R4	SM	STARTER MOTOR
DD2,M4,N7	SS	STARTER SOLENOID
CC10,X3	TB	TERMINAL BLOCK
R11,Z13	TT	TOTAL TIME METER
B5,BB9,C3,H16	VM	VOLTMETER (OPTIONAL)
FF3,P6	VR	VOLTAGE REGULATOR
M9,U10	VS	VOLTAGE SWITCH
D2,D7,H10	W	WHITE

Figure 5-1. Electrical Wiring Schematic & Diagram – Models 69GL15-114,-114-1 & -114-2
Drawing Number 69GL15-1094-RA
(Sheet 1 of 4)



1 thru 10 are wires from A-C generator

Figure 5-1. Electrical Wiring Schematic & Diagram – Models 69GL15-114,-114-1 & -114-2
Drawing Number 69GL15-1094-RA
(Sheet 2 of 4)

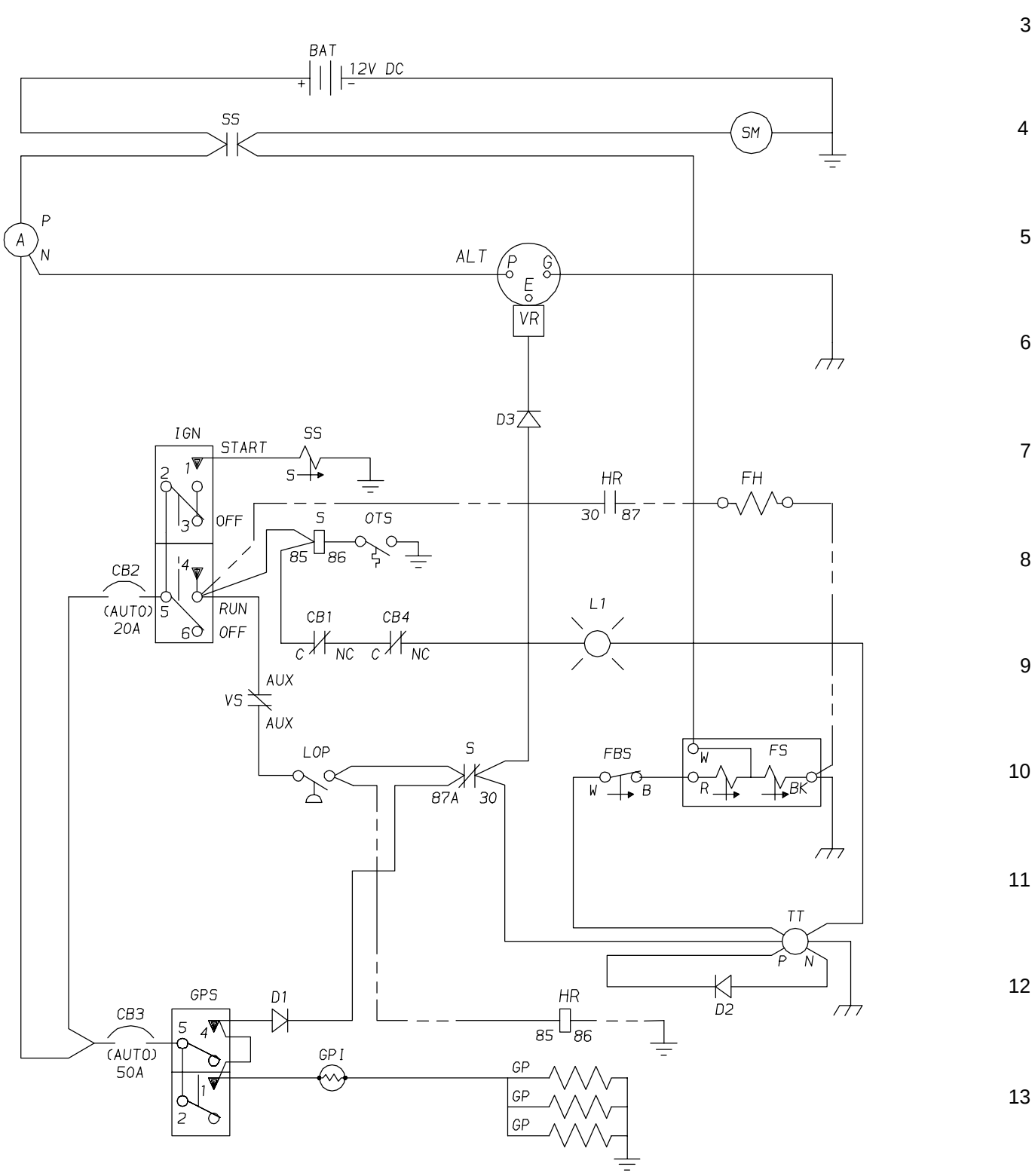


Figure 5-1. Electrical Wiring Schematic & Diagram – Models 69GL15-114,-114-1 & -114-2
Drawing Number 69GL15-1094-RA
(Sheet 3 of 4)

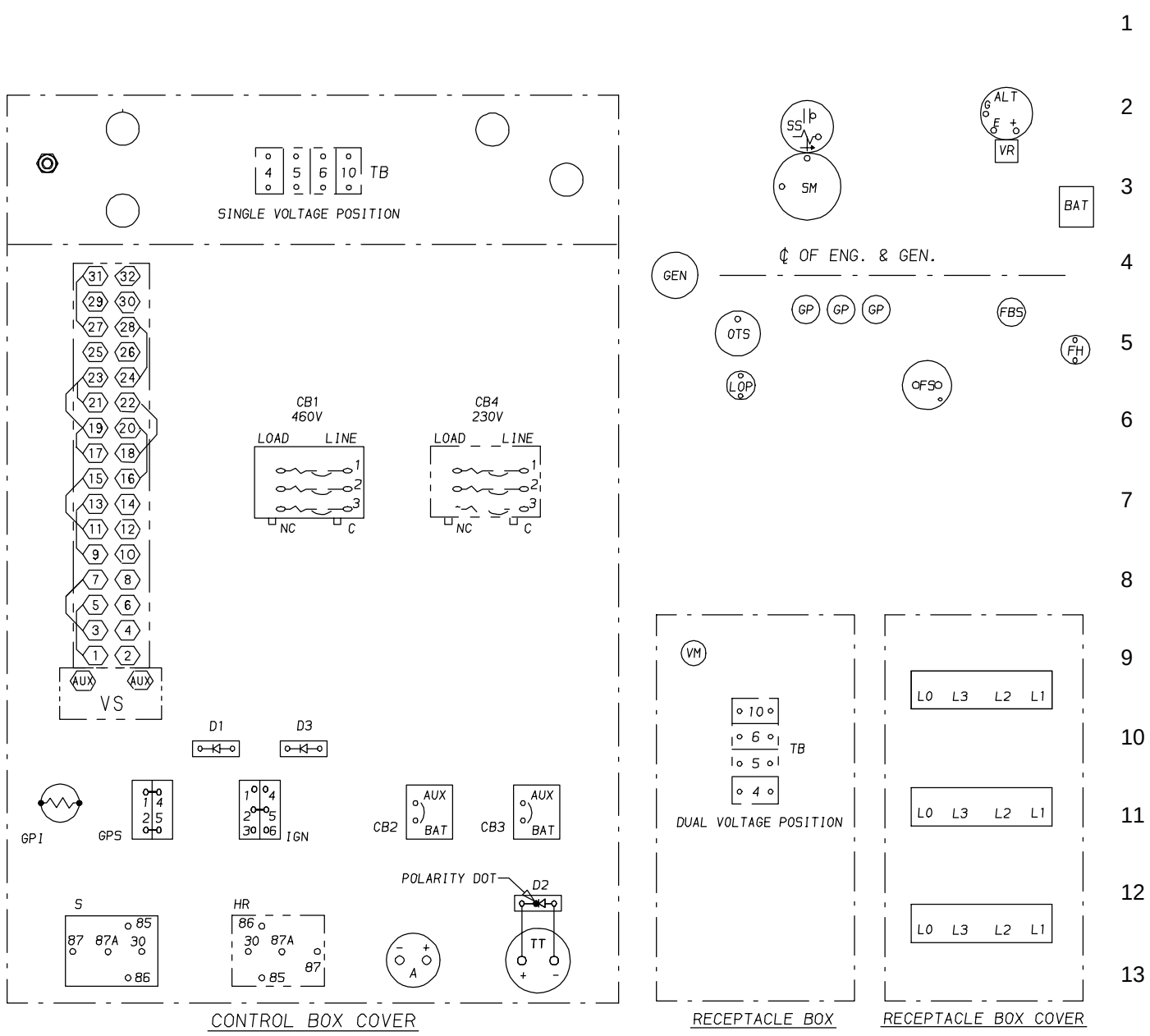


Figure 5-1. Electrical Wiring Schematic & Diagram – Models 69GL15-114,-114-1 & -114-2
Drawing Number 69GL15-1094-RA
(Sheet 4 of 4)

ZONE	SYMBOL		LEGEND
	-------		MECHANICAL LINKAGE
	⏚		ENGINE GROUND
	⏚		CHASSIS GROUND
	— — — —		OPTIONAL COMPONENT
K5,Y13	A	–	AMMETER
P5,FF2	ALT	–	ALTERNATOR
N3,GG3	BAT	–	BATTERY
D1,D6,H10	BK	–	BLACK
L8, N9,09,L12,W6,Y6	CB	–	CIRCUIT BREAKER
P7,N12,R12,V10,W10	D	–	DIODE
Q10,FF5	FBS	–	FAN BELT SWITCH
R7,GG5	FH	–	FUEL HEATER
R10,EE6	FS	–	FUEL SOLENOID
BB4	GEN	–	GENERATOR
P13,DD5	GP	–	GLOW PLUG
N13,T11	GPI	–	GLOW PLUG INDICATOR
M12,U11	GPS	–	GLOW PLUG SWITCH
D2,D7	GR	–	GREEN
Q7,P12	HR	–	HEATER RELAY
M7,W11	IGN	–	IGNITION SWITCH
Q9	L1	–	CB TRIP LIGHT
CC6,N10	LOP	–	LOW OIL PRESS. SW
CC5,N8	OTS	–	OIL TEMP. SWITCH
K5,R11	N	–	NEGATIVE (–)
K5,R11	P	–	POSITIVE (+)
D2,D7,H11	R	–	RED
DD3,R4	SM	–	STARTER MOTOR
DD2,M4,N7	SS	–	STARTER SOLENOID
CC10,X3	TB	–	TERMINAL BLOCK
R11,Z13	TT	–	TOTAL TIME METER
010,N8,U13	S	–	SAFETY, RELAY
B5,B9,C3,H16	VM	–	VOLTMETER
FF3,P6	VR	–	VOLTAGE REGULATOR
M9,U10	VS	–	VOLTAGE SWITCH
D2,D7,H10	W	–	WHITE

Figure 5-2. Electrical Wiring Schematic & Diagram – Model 69GL15-134, -134-1, -134-2, -134-4
Drawing Number 69GL15-2324 Rev B
(Sheet 1 of 4)

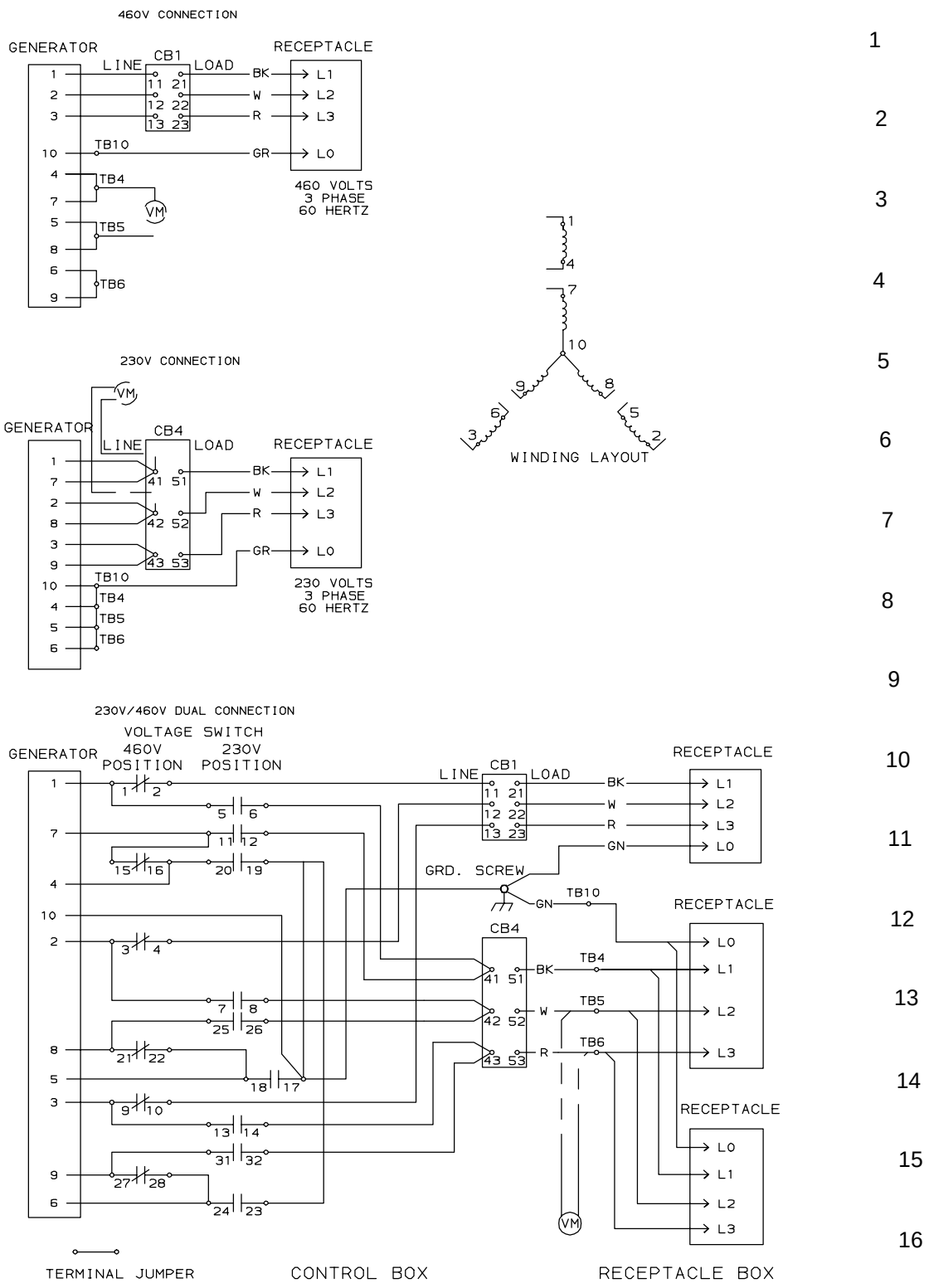


Figure 5-2. Electrical Wiring Schematic & Diagram – Model 69GL15-134, -134-1, -134-2, -134-4
Drawing Number 69GL15-2324 Rev B
(Sheet 2 of 4)

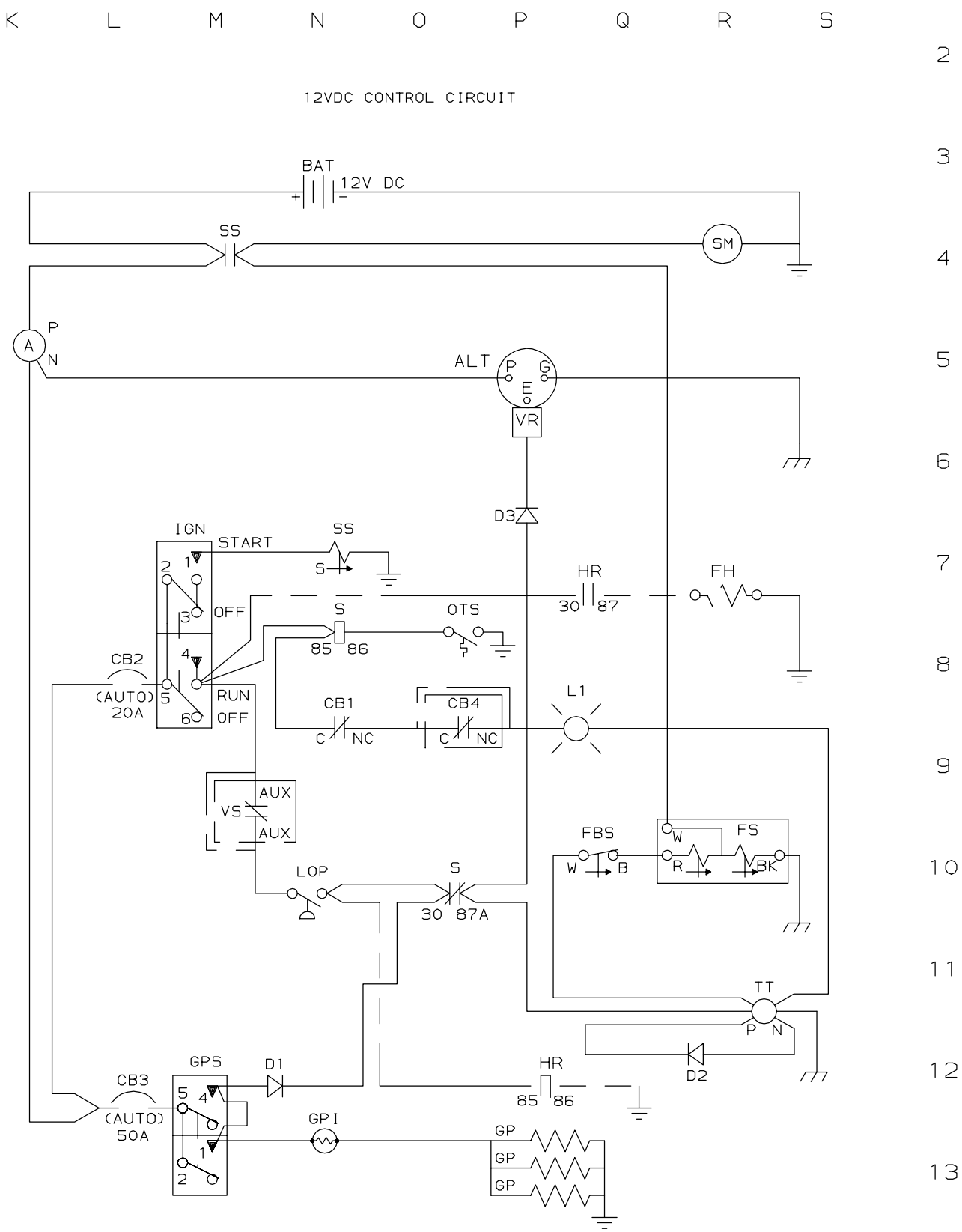


Figure 5-2. Electrical Wiring Schematic & Diagram – Model 69GL15-134, -134-1, -134-2, -134-4
Drawing Number 69GL15-2324 Rev B
(Sheet 3 of 4)

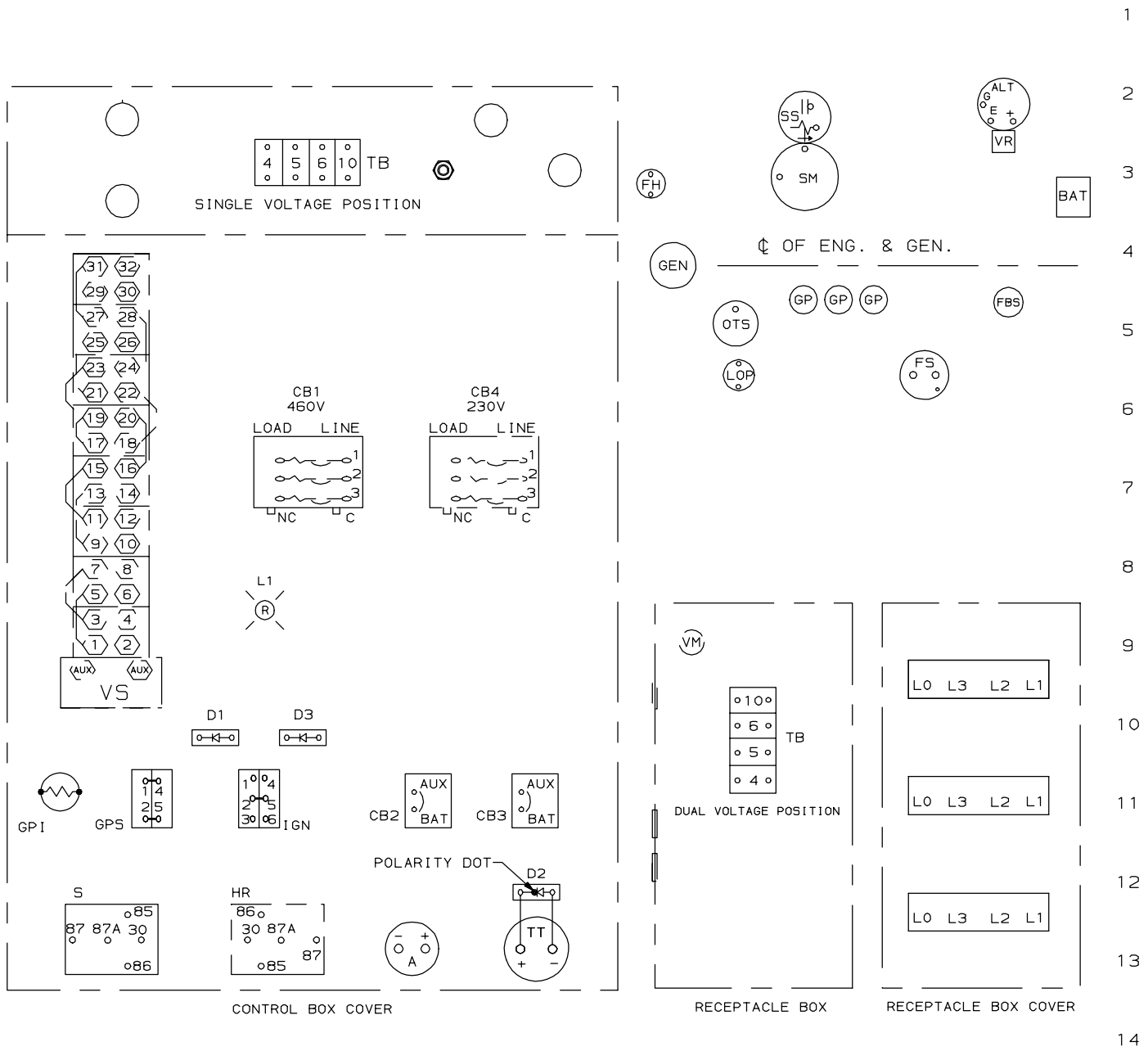


Figure 5-2. Electrical Wiring Schematic & Diagram – Model 69GL15-134, -134-1, -134-2, -134-4
Drawing Number 69GL15-2324 Rev B
(Sheet 4 of 4)