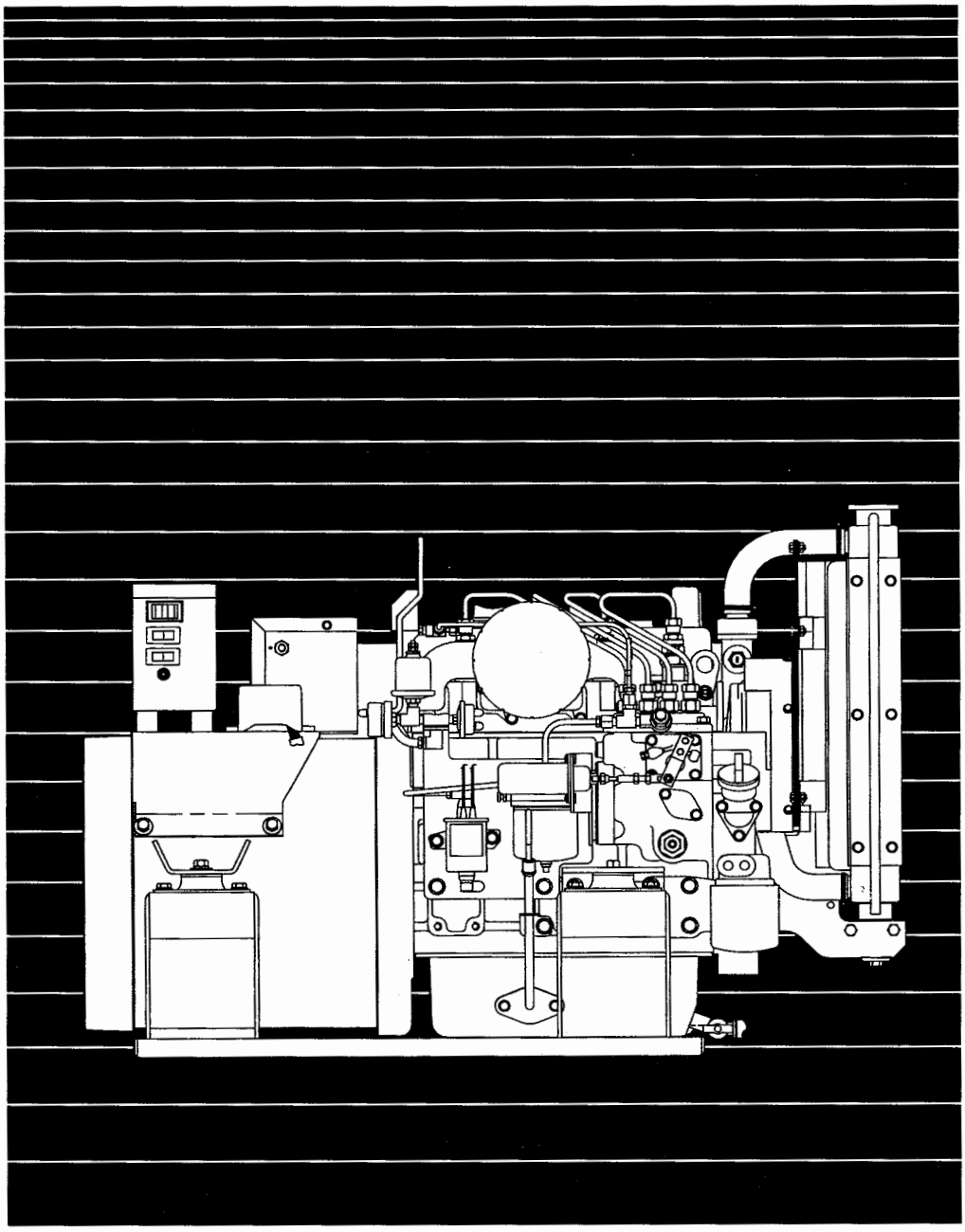
Onan

RV GenSet

Service Manual

DKG



Printed in U.S.A.

981-0511
2-94

Table of Contents

SECTION	TITLE	PAGE
	SAFETY PRECAUTIONS	ii, iii
1	**INTRODUCTION**	1-1
	Assistance	1-1
	Test Equipment	1-1
	Safety Considerations	1-1
	Set Removal	1-2
2	**ENGINE CONTROLS**	2-1
	General	2-1
	Start Control at Set	2-1
	Control Troubleshooting	2-6
3	**ENGINE CONTROL SERVICE**	3-1
	General	3-1
	[A] Battery Check (BT1)	3-1
	[B] Battery Cable Check	3-1
	[C] Battery Charging Check	3-1
	[D] Start Solenoid Check (K11)	3-1
	[E] Heater (Glow Plug) Relay Check (K13)	3-2
	[F] Fuel Solenoid Check (K14)	3-2
	[G] Start/Stop Switch Check (S11)	3-2
	[H] Power Relay Check (A11-K12)	
4	**GENERATOR/VOLTAGE REGULATOR**	4-1
	General Description	4-1
	Generator Operation	4-3
	Electronic Voltage Regulator	4-3
	Generator Service	4-4
5	**GENERATOR/REGULATOR TROUBLESHOOTING**	5-1
	General	5-1
	Troubleshooting Procedures	5-1
6	**GENERATOR/REGULATOR TESTS**	6-1
	General	6-1
	[A] Testing AC Residual Voltage	6-1
	[B] Flashing the Field	6-1
	[C] Voltage Regulator Test	6-1
	[D] Voltage Regulator Replacement	6-2
	[E] Testing Rotating Rectifiers	6-2
	[F] Testing Exciter Stator	6-3
	[G] Testing Exciter Rotor	6-3
	[H] Testing Generator Stator	6-5
	[I] Testing Generator Rotor	6-5
	[J] Wiring Harness Check	6-6
	[K] Voltage Adjustment	6-6
	[L] Reconnection	6-7
7	**WIRING DIAGRAMS**	7-1

Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠DANGER ***This symbol warns of immediate hazards which will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠CAUTION ***This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.***

FUEL AND FUMES ARE FLAMMABLE

Fire, explosion, and personal injury can result from improper practices.

- Do not smoke or allow an open flame or spark producing equipment near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible, non-conductive line.

GASOLINE AND LPG FUEL MAY BE ACCIDENTALLY IGNITED BY ELECTRICAL SPARKS, presenting the hazard of fire or explosion, which can result in severe personal injury or death. When installing the generator set:

- Keep electrical and fuel lines as far apart as possible. Do not allow contact unless both lines are sheathed.

EXHAUST GASES ARE DEADLY

- Never sleep in the vehicle with the generator set running unless the vehicle is equipped with an operating carbon monoxide detector.
- Provide an adequate exhaust system to properly expel discharged gases. Do not use engine cooling air to heat a compartment.
- Be sure the unit is well ventilated.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before starting work on the generator set, disconnect batteries. This will prevent accidental starting and electrical arcs. Disconnect the Negative (-) battery cable first to reduce the risk of arcing.
- Keep your hands away from moving parts.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry while working on generator sets. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect the negative (-) cable at the starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

GENERAL SAFETY PRECAUTIONS

- Wear safety glasses and protective clothing when servicing batteries. DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.
- Have a fire extinguisher rated ABC nearby. Maintain extinguisher properly and become familiar with its use.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

RGA-IN1

1. Introduction

ABOUT THIS MANUAL

This manual contains troubleshooting and repair data for these components of the DKG generator set:

- Generator
- Control

See the Engine Service Manual (981-0501) for engine information.

Study this manual carefully. Heed all warnings and cautions. Proper use and maintenance can result in longer set life, better performance and safer operation.

This manual contains basic wiring diagrams and schematics for troubleshooting. Technicians should use the wiring diagram and schematic shipped with each unit. Update these diagrams and schematics when the set is modified.

PC board information is limited; in the field, it is more efficient to replace the boards than to attempt repair.

ASSISTANCE

When contacting an Onan® distributor, supply the complete model number and serial number shown on the Onan nameplate on the side of the generator control box.

TEST EQUIPMENT

- Multimeter/digital VOM
- AC voltmeter
- DC voltmeter
- Frequency meter
- Jumper leads
- Load test panel
- Megger or insulation resistance meter
- Wheatstone bridge or digital ohmmeter

⚠WARNING ***Incorrect service or replacement of parts can result in severe personal injury, death, and /or equipment damage. Service personnel must be qualified to perform electrical and mechanical service.***

SAFETY CONSIDERATIONS

Generator sets present safety hazards that the technician must know about. Read the precautions on the inside cover of this manual. Familiarize yourself with the hazards shown in Table 1-1. When the hazards are known, approach the job with a safety-conscious attitude. Being safety-conscious is the best way to avoid injury. **Reduce the chance of an accident with the following safeguards.**

Safeguards To Avoid Hazards

- **Use Protective Clothing.** Protect your body by wearing protective clothing such as:
  - Safety shoes
  - Gloves
  - Safety glasses
  - Hard hats

  Leave rings and jewelry off. Do not wear loose clothing that might get caught on equipment.

- **Reduce Workshop Hazards.**
  - Keep guards and shields in place on machinery
  - Maintain equipment in good working order
  - Store flammable liquids in approved containers away from open flame, spark, pilot light, cigarette, or other ignition source
  - Keep the workshop clean and well-lighted
  - Provide adequate ventilation
  - Keep a fire extinguisher and safety equipment nearby
  - Be prepared to respond to an emergency

- **Develop Safe Work Habits.**

  Unsafe actions are the source of most accidents with tools and machines. Be familiar with the equipment and know how to use it safely. Use the right tool for the job, and check its condition before starting. Observe the warnings and cautions in this manual and take special precautions when working around electrical

equipment. Do not work alone if possible and do not take unnecessary risks.

- **Be prepared if an accident occurs.**

Agencies such as the Red Cross and local police and fire departments offer courses in first aid, CPR, and fire control. Take advantage of this information to be ready to respond to an accident. Learn to be safety conscious and make safe practices a part of your work routine. Do not work when tired or after consuming any alcohol or drug that makes the operation of equipment unsafe.

TABLE 1-1
HAZARDS AND THEIR SOURCES

- **Fire and explosions**
  - Leaking fuel
  - Hydrogen gas from charging battery
  - Oily rags improperly stored
  - Flammable liquids improperly stored
  - Any fire, flame, spark, pilot light, arc-producing equipment or other ignition sources
- **Burns**
  - Hot exhaust pipes
  - Hot engine and generator surfaces
  - Hot engine oil
  - Electrical short in DC wiring system
  - Hot engine coolant
- **Poisonous gases**
  - Carbon monoxide from faulty exhaust pipes, joints or hangers
  - Operating generator set where exhaust gases can accumulate
- **Electrical shock (AC)**
  - Improper genset load connections
  - Faulty RV wiring
  - Faulty electrical appliance
  - Faulty genset wiring
  - Working in damp conditions
  - Jewelry touching electrical components
- **Rotating Machinery**
  - Flywheel fan guard not in place
  - Jewelry or loose clothing catching in moving parts
- **Slippery Surfaces**
  - Leaking or spilled oil
- **Heavy Objects**
  - Removing generator set from RV
  - Removing heavy components

SET REMOVAL

Some service procedures require removing the generator set from the vehicle. Because of the wide variety of installations, it is not possible to specify exact removal procedures for each genset. If a satisfactory method for removing a particular set cannot be determined, contact the vehicle manufacturer or the set installer for their recommendations.

⚠WARNING ***Generator sets are heavy and they can cause severe personal injury or death if dropped during removal. Use adequate lifting devices to provide sufficient support for the set. Keep hands and feet clear while lifting the generator set.***

Disconnecting Generator Set Systems

Some installations require partial removal of the set to gain access to the battery cable, fuel line, and other connections. Read this entire section before starting set removal. The following steps are a general guideline.

⚠WARNING ***Leakage of fuel in or around the generator set compartment presents the hazard of fire or explosion that can cause severe personal injury or death. Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the compartment thoroughly: park vehicles outdoors in a well ventilated area.***

1. Disconnect the generator set negative (-) battery cable at the battery terminal.

2. Disconnect the generator set positive (+) battery cable from the wire harness.

3. Disconnect the remote control plug wire from the generator set (if applicable).

4. Disconnect the generator load wires. Tag for identification when reconnecting.

5. Disconnect the exhaust system and support brackets or hangers, to allow set removal.

6. Disconnect the fuel line at the genset housing. Securely plug the end of the fuel line to prevent fuel leakage.

7. Verify that the set is adequately supported before loosening any mounting bolts or support members.

⚠WARNING ***Leakage of fuel presents the hazard of fire or explosion that can cause severe personal injury or death. Make certain all fuel line openings are plugged. Before disconnecting the fuel line, be certain there are no ignition sources such as flame, spark, pilot light, cigarette, etc., near the generator set. Keep an ABC type fire extinguisher nearby.***

When reinstalling the set, be sure all mounting hardware, and electrical, exhaust, and fuel system components are connected exactly as they were before removal. See the appropriate installation manual during reinstallation for important safety precautions.

Check for oil and fuel leaks. Check the exhaust system audibly and visually with the generator set running. Repair leaks immediately. Replace worn, damaged, or corroded exhaust and fuel line components before leaks occur.

2. Engine Controls

GENERAL

This section describes the generator set preheat/start/run control system. The set may be started either at the onboard DC control box or by using a remotely mounted start control.

START CONTROL AT SET

The set is started with a Start/Stop/Preheat switch on the front panel of the DC control box. Component references are found on wiring/schematic diagrams in the Wiring Diagrams section of this manual.

The DC control box does not contain meters and is designed for remote mounting within limits of the wire harness (approximately 32 inches [813 mm]). An optional remote control panel with meters is available in a kit from Onan.

Switches

Start-Stop/Preheat Switch S11: Starts and stops the unit locally. Preheat function occurs when the switch is held in the Stop position. The unit may also be operated from a remote switch wired to receptacle J3 on the rear panel.

Circuit Breakers

DC Control Breaker CB11: A 15 ampere DC breaker providing protection to the control box wiring and remote wiring from short circuits or overload. Also serves as an emergency stop switch.

Fault Breaker CB12: A manual reset breaker that shuts down the engine for low oil pressure and high coolant temperatures.

Control Components

The following describes the basic engine control components and how they function.

A11 Engine Monitor Circuit Board: A circuit board that monitors the engine control system functions. This includes starting, stopping, and fault system operation. Terminals are included for making remote connections. See Figure 2-1.

Two relays soldered into the engine monitor board are not serviceable. They function as follows:

- Power relay K12 connects and maintains battery B+ to the control meters and fuel solenoid during operation.
- Starter protection relay K15 is AC operated. When the Start switch is pressed B+ is conneted to K11 start solenoid through the K15 NC contacts until the generator output reaches about 90 volts AC. At this voltage K15 activates and disconnects the starter circuit.

K11 Start Solenoid: Located over the engine monitor circuit board (above K13 glow plug heater solenoid). It connects battery B+ to the start solenoid, K13 heater solenoid, fuel solenoid and meters during cranking.

K13 Glow Plug Heater Solenoid: Located directly above the monitor circuit board. Connects B+ to the engine glow plugs during cranking. It is energized by K11 start solenoid.

K14 Fuel Solenoid: It opens the fuel control valve when the start/stop switch is placed in the Start position.

K15 Field Flashing Relay: The normally-open (NO) contacts in this relay flash the field (F1-F2 exciter stator winding) to restore residual magnetism. They are activated (closed) when the generator set is cranking, and disabled (open) after the genset begins to run.

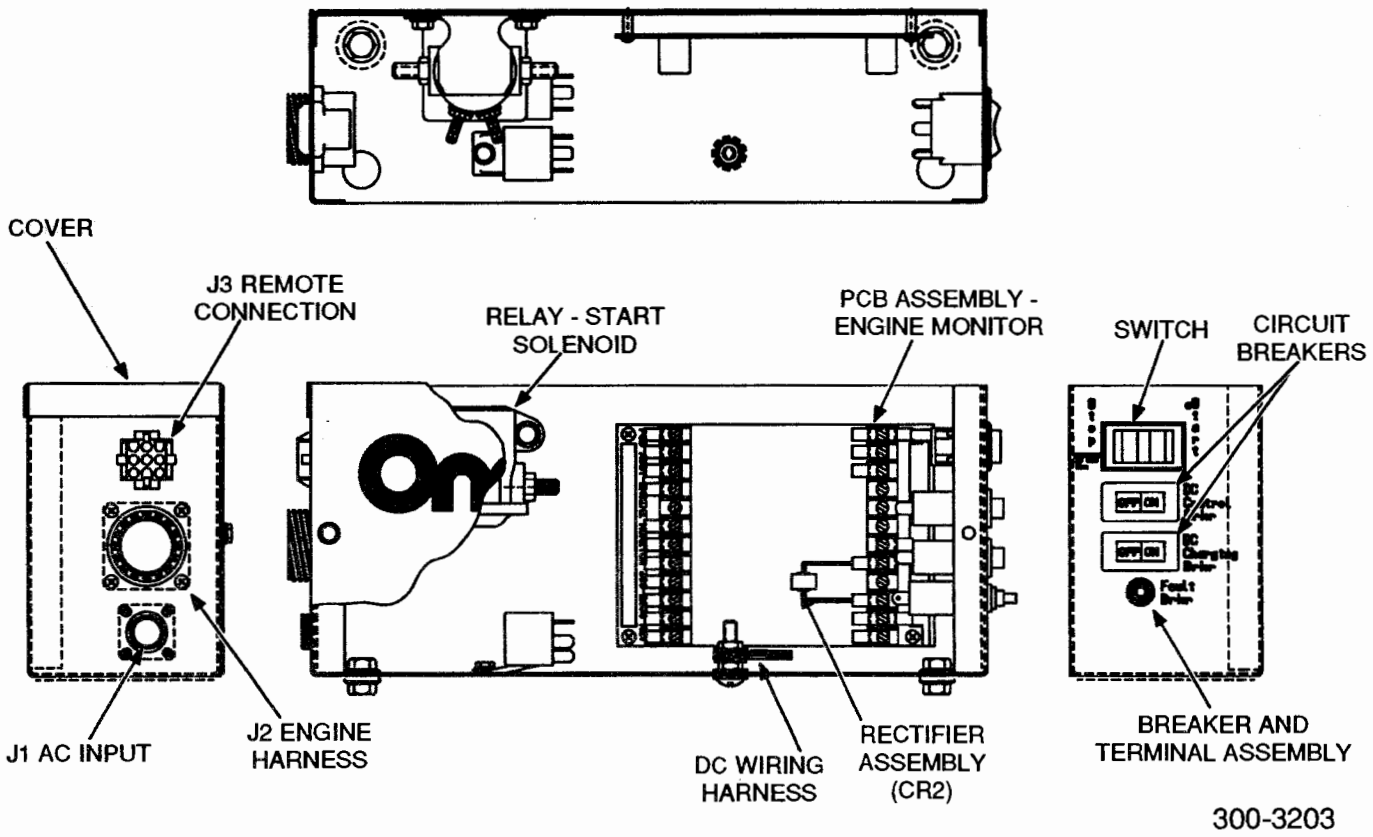


FIGURE 2-1. DKG GENERATOR SET DC CONTROL BOX

Engine Monitors

The following briefly describes the engine sensors (switches) and optional gauge senders. The sensors protect the engine from unfavorable operating conditions; the senders are used with the operational remote panel. These sealed units are not repairable. Do not use a substitute part if replacement is necessary, since they are close-tolerance parts made for a specific application.

The safety sensors (switches) close the fault circuit to ground if abnormal operating conditions exist, tripping the fault breaker CB12 to stop the engine. See Figure 2-2 and schematic 2-3.

Oil Pressure Monitors

Refer to Figure 2-2 for the location of the oil pressure monitors.

Oil Pressure Sender E1: The sender resistance changes with oil pressure and results in a reading on the (optional) oil pressure meter. The meter range is 0 to 100 psi (0 to 700 kPa). The at-rest resistance reading should be about 240 ohms, tolerance range 227 to 257 ohms.

Low Oil Pressure Switch S1: This switch closes if oil pressure drops to 9 psi (62 kPa), activating the fault breaker and stopping the engine.

Control Power Latch S6: This oil pressure switch closes at 5 psi (34 kPa) and provides a latch function for the control circuits. When closed, the switch supplies a ground path for relay K12 on the engine monitor board.

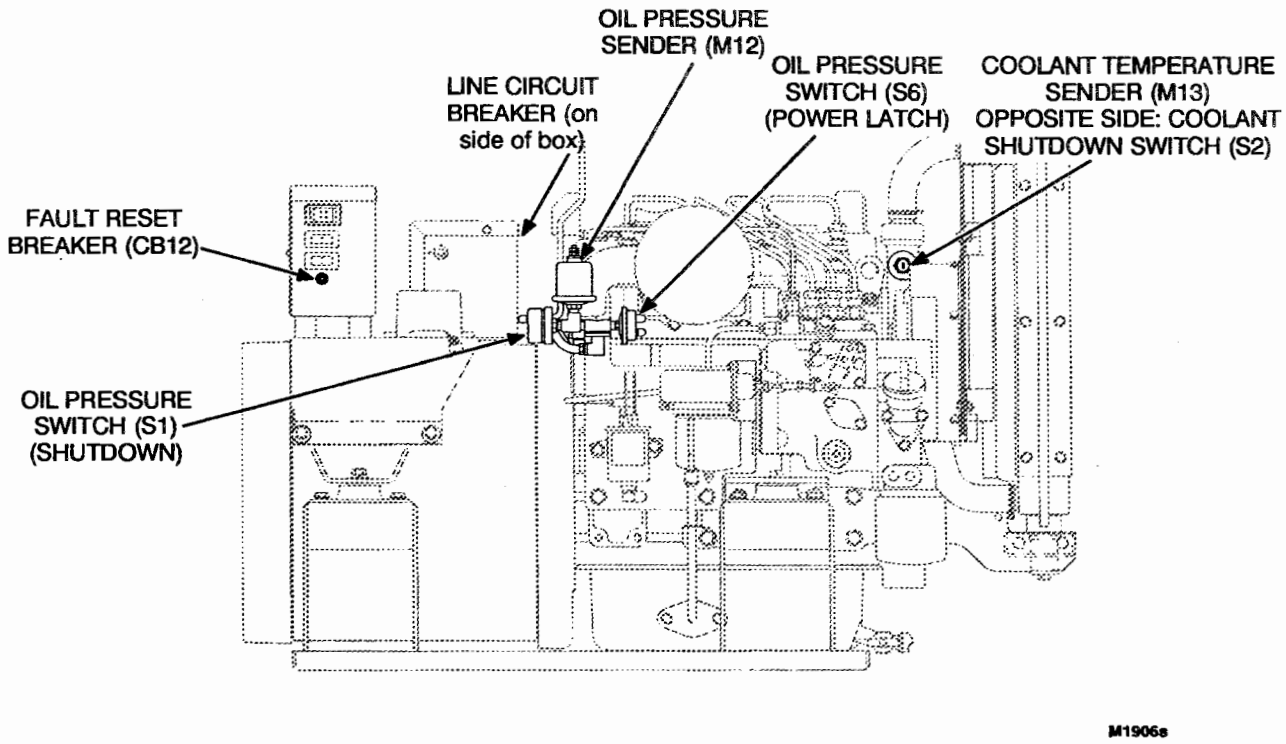


FIGURE 2-2. DKG FAULT SENSOR LOCATION

Engine Temperature Monitors

Refer to Figure 2-2 for the location of the engine temperature sensors.

Coolant Temperature Sender E2: The resistance of the sender unit changes with the engine coolant temperature and causes a reading on the coolant temperature meter (optional). The resistance of the sender at 200° F (93° C) should be 64.3 ohms ± 10%. The meter range is 100° to 250° F (40° to 121° C).

High Coolant Temperature Switch S2: This switch closes if the coolant temperature rises to 250° F (121° C), activating the fault breaker CB12 and stopping the engine.

Control Operation

To understand control operation, refer to the following text and the schematic diagram (Figure 2-3).

Starting Sequence: When start/stop switch S11 is held in the *Stop* position, battery B+ is connected to the coil of heater relay K13. The relay contacts close and connect B+ to heaters HR1 - HR3.

Immediately after preheat time interval, S11 is held in the *Start* position. This connects B+ to K14 fuel solenoid relay and through A11-K15 NC (normally closed) contacts to K11 start solenoid relay. These relays actuate K1 fuel solenoid, B1 solenoid/starter motor and heaters HR1-HR4 (via K13 NC contacts).

A11-K12 power relay is actuated after a short delay, when the control power latch switch S6 closes. S6 is closed when oil pressure rises to 5 psi (34 kPa), assuring engine lubrication before the set reaches full operating speed. NO contacts on A11-K12 close, supplying B+ to the other components on the engine monitor board.

Start-Disconnect Sequence: As the generator gains speed and output voltage, A11-K15 starter protection relay energizes at about 90 VAC. A11-K15 NC contact opens and de-energizes start solenoid relay K11. K11 then disconnects B+ from the starter solenoid (to stop the cranking motor) and from the glow plug heaters. If the generator fails to develop voltage, the engine will attempt to start but will stop as soon as the Start switch is released.

The two K15 NO (normally open) contacts close and function as follows:

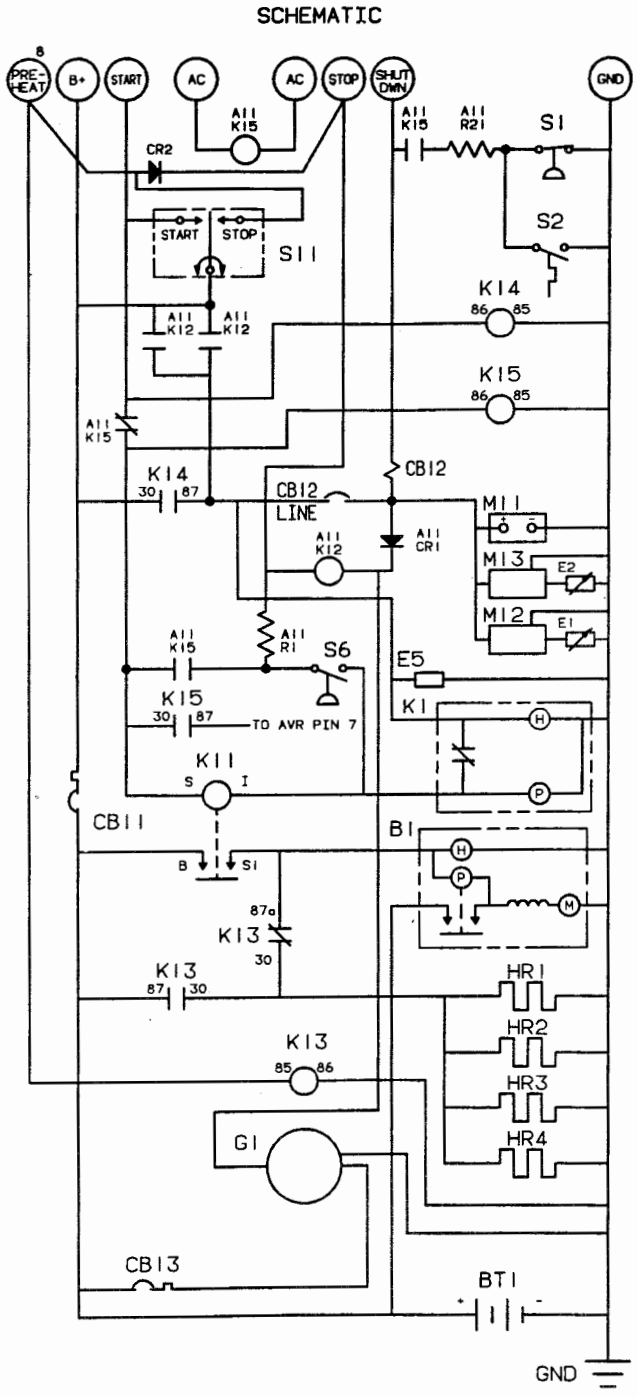
- Closes circuit for S1 and S2 (low oil pressure and high coolant temperature switches respectively)
- Provides another ground path for K12 coil (through K11 coil) similar to S6.

Battery Charge Circuit: Alternator G1, powered by a belt from the engine, supplies B+ voltage to recharge the generator set starting battery through circuit breaker CB13.

Stopping Sequence: Placing S11 in the Stop position puts B+ (through diode CR2) on the ground side of the A11-K12 power relay. This causes K12 to de-energize and disconnect B+ from CB12 and K1 fuel solenoid. De-energizing K1 shuts off the fuel flow to stop the engine.

Fault Shutdown: Fault breaker CB12 opens to stop the engine anytime a fault sensor closes the circuit to ground. The fault sensors as shown in Figure 2-2 are:

- S1 low oil pressure
- S2 high coolant temperature



ENGINE PARTS

B1	Starter and solenoid
BT1	Battery (12V)
E1	Sender (oil pressure)
E2	Sender (coolant temperature)
HR1-4	Heater - glow plug
E5	Fuel pump - electric
K1	Fuel solenoid
S1	Switch - low oil pressure
S2	Switch - high coolant temperature
S6	Switch - control power latch
G1	Alternator

CONTROL BOX PARTS

A11	PCB assy - engine monitor
CB11, 13	Circuit breaker (control)
CB12	Circuit breaker (fault)
K11	Relay - start solenoid (starter) (12 V)
A11-K12	Relay - power
K13	Relay - heater
K14	Relay - fuel solenoid
A11 - K15	Relay - starter protection
K15	Relay - field flashing
A11 - R1	Resistor (K12)
A11 - R2	Resistor (LOP timing)
S11	Switch - start/stop
J3 - J4	Connector - remote

FIGURE 2-3. ELECTRIC START CONTROL SCHEMATIC DIAGRAM (from 612-6599)

Remote Control Operation (Optional): The generator set may be operated from a remote switch connected to the control receptacle J3. Installation instructions are furnished with the kit available from Onan. See Figure 2-4.

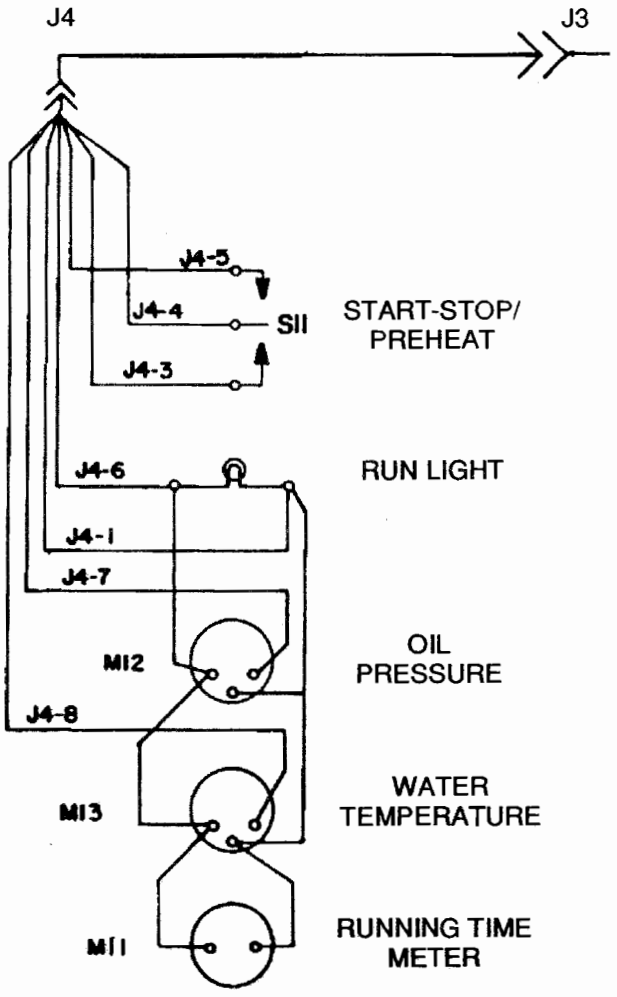


FIGURE 2-4. REMOTE CONTROL WIRING DIAGRAM

Control Troubleshooting

The information in this section is divided into three flow charts. Determine the problem and then refer to the appropriate flow chart (A, B, or C) for the troubleshooting procedures.

A. Engine does not crank.
B. Engine cranks but does not start.
C. Engine starts but stops after running several seconds.

Before starting a troubleshooting procedure, make a few simple checks that may expose the problem and cut down on troubleshooting time.

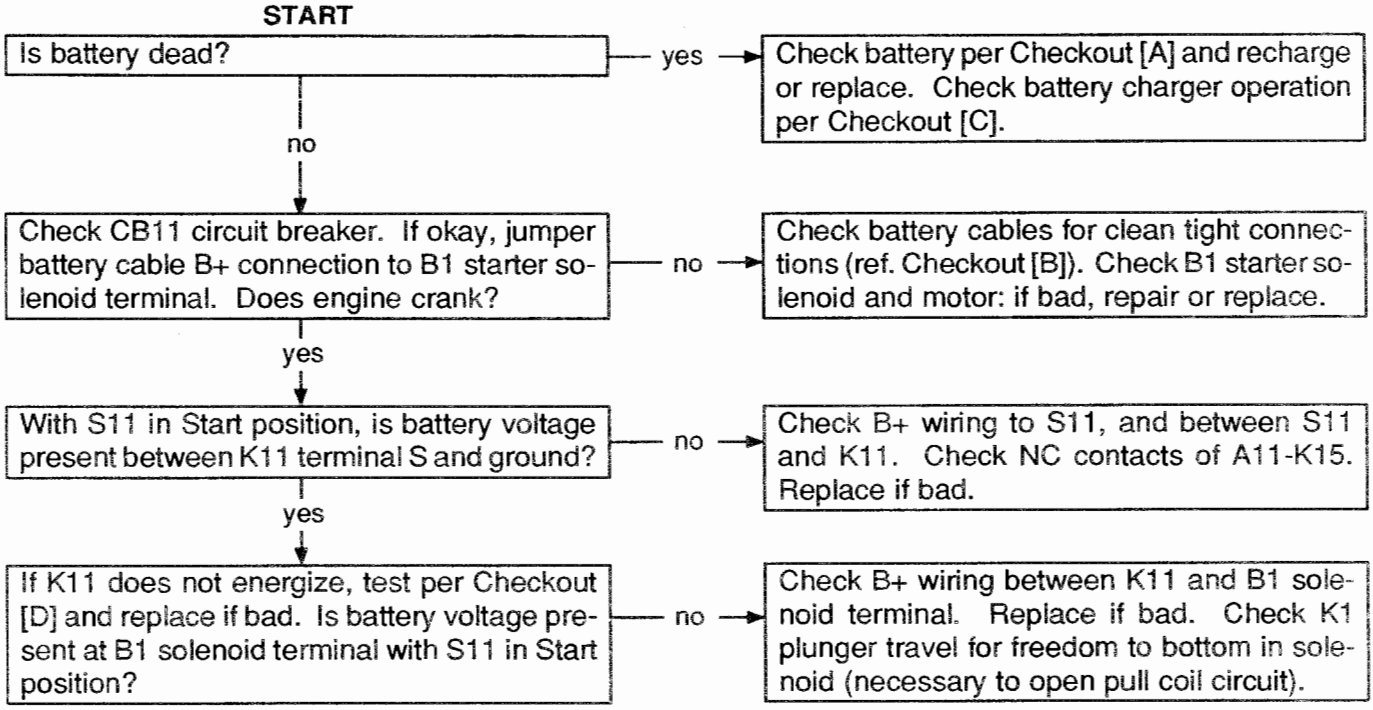
- Check all modifications, repairs, and replacements performed since last satisfactory operation of set. A loose wire connection overlooked when installing a replacement part could cause problems. An incorrect connection, an opened switch or circuit breaker, or a loose plug-in are all potential problems that can be eliminated by a visual check.

- Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.

To troubleshoot a problem, start at the upper-left corner of chart and answer all questions either YES or NO. Follow the chart until the problem is found, performing referenced adjustments or test procedures. Refer to Figures 2-1 through 2-4 for locating control components, leads, terminals and other check points.

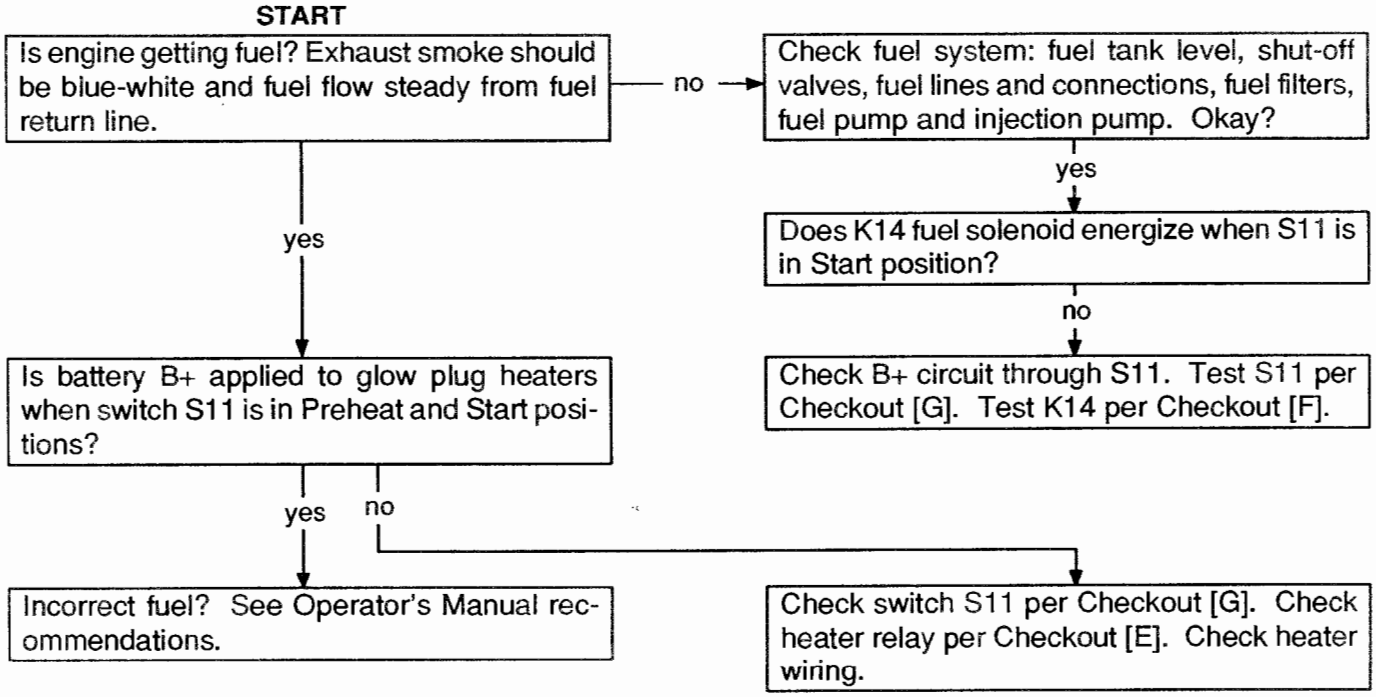
FLOW CHART A. ENGINE DOES NOT CRANK

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***



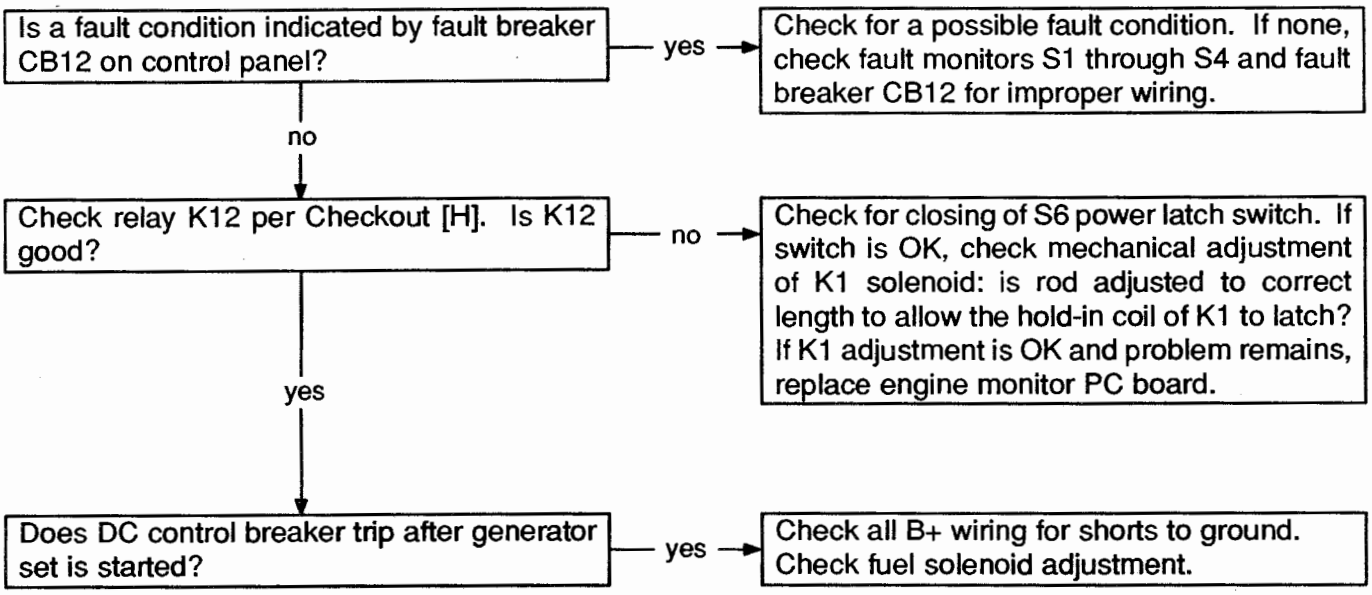
FLOW CHART B. ENGINE CRANKS BUT DOES NOT START

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***



FLOW CHART C. ENGINE STARTS BUT STOPS AFTER RUNNING SEVERAL SECONDS

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***



3. Engine Control Service

GENERAL

The following checks are referred to in the Control Troubleshooting flow charts. They isolate circuit problems caused by faulty engine control components. Disconnect leads before testing components.

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

[A]

BATTERY CHECK (BT1)

Check the battery charge condition with a hydrometer. Electrolyte specific gravity should be about 1.260 for a fully charged battery at 80°F (27°C). If not, add distilled water to keep electrolyte at proper level, then recharge the battery. If the battery will not recharge, replace it.

If the battery loses excess water, the charge rate may be too high. If the battery charge is not maintained, the charge rate may be too low. See procedure [C].

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not permit any flame, spark, cigarette, or other ignition source near the battery.***

[B]

BATTERY CABLE CHECK

With the starter motor running, check these voltage drops:

1. From the battery negative post (not the cable clamp) to the cylinder block
2. From the battery positive post to the battery terminal stud on the solenoid

Normally these should be less than 0.3 volts. If extra-long battery cables are used, slightly higher voltage drops may result. Thoroughly clean all connections in any part of the circuit showing excessive voltage drop.

[C]

BATTERY CHARGING CHECK

With the engine running, check the DC voltmeter (control option). The 12-volt system should read 13.5 to 15 volts.

The power source is a belt-driven alternator. The charge rate/voltage is determined by a voltage regulator located inside the control box.

Improper output may be caused by a loose drive belt, poor terminal connections, broken wires, bad regulator or alternator. Checkout procedures for the regulator and alternator are found in Section 5 of the engine service manual. The charge circuit is protected by circuit breaker CB13.

If the output voltage is high (over 15 volts), check for loose or corroded voltage regulator leads. If this does not correct the problem, the regulator is probably shorted and should be replaced.

[D]

START SOLENOID CHECK (K11)

1. Apply battery positive (B+) to the terminal marked S.
2. Connect a ground wire to the solenoid terminal marked I. The solenoid should activate.
3. If the contacts are good, battery voltage should be read between terminal 1 and ground. The voltage drop measured across the contacts should never exceed one volt in circuit application.

[E]

HEATER (GLOW PLUG) RELAY CHECK (K13)

1. Connect the relay coil voltage across the relay coil terminals. The relay should activate if coil is okay.

2. Connect a voltage source to one side of relay contacts.

3. Connect a voltmeter to other side of relay contact and voltage source. If voltage appears when relay energizes, the contact is good. The voltage reading appears in reverse order when checking normally closed (NC) contacts.

[F]

FUEL SOLENOID CHECK (K14)

If there is fuel to the injection pump, but no fuel at the injection nozzle, the fuel solenoid may be defective.

To check solenoid operation, watch for solenoid actuation when B+ is applied (start switch in start or run position). If there is no actuation when B+ is applied, the fuel solenoid must be replaced. When B+ is removed, the solenoid must de-activate.

[G]

START/STOP SWITCH CHECK (S11)

1. Remove battery B+ cable.

2. Place ohmmeter leads across switch.

3. Open and close switch while observing the ohmmeter. A normally open (NO) switch should indicate infinite resistance when open and continuity when closed. A normally closed (NC) switch should indicate continuity when closed and infinite resistance when open.

4. Replace switch if defective.

[H]

POWER RELAY CHECK (A11-K12)

Make certain that the genset starting battery is good before beginning this check.

1. Unplug CB12-2A from the circuit breaker. Note the markings on the wire to select the correct one.

2. Locate S6 (oil pressure switch) on the genset (see Figure 2-2). Find the grounded side of S6, using a continuity tester.

3. Use a jumper to ground the non-grounded side of S6.

4. Use a second jumper from the B+ terminal on the control board to apply B+ to the SW B+ (switched B+) terminal. Fuel pump E5 should start and run.

5. Remove the B+ jumper. If the fuel pump continues to run, K12 is good. If the fuel pump stops, K12 has failed and the A11 control board should be replaced.

6. Push the genset STOP button.

7. Remove the jumpers and reconnect CB12-2A.

4. Generator/Voltage Regulator

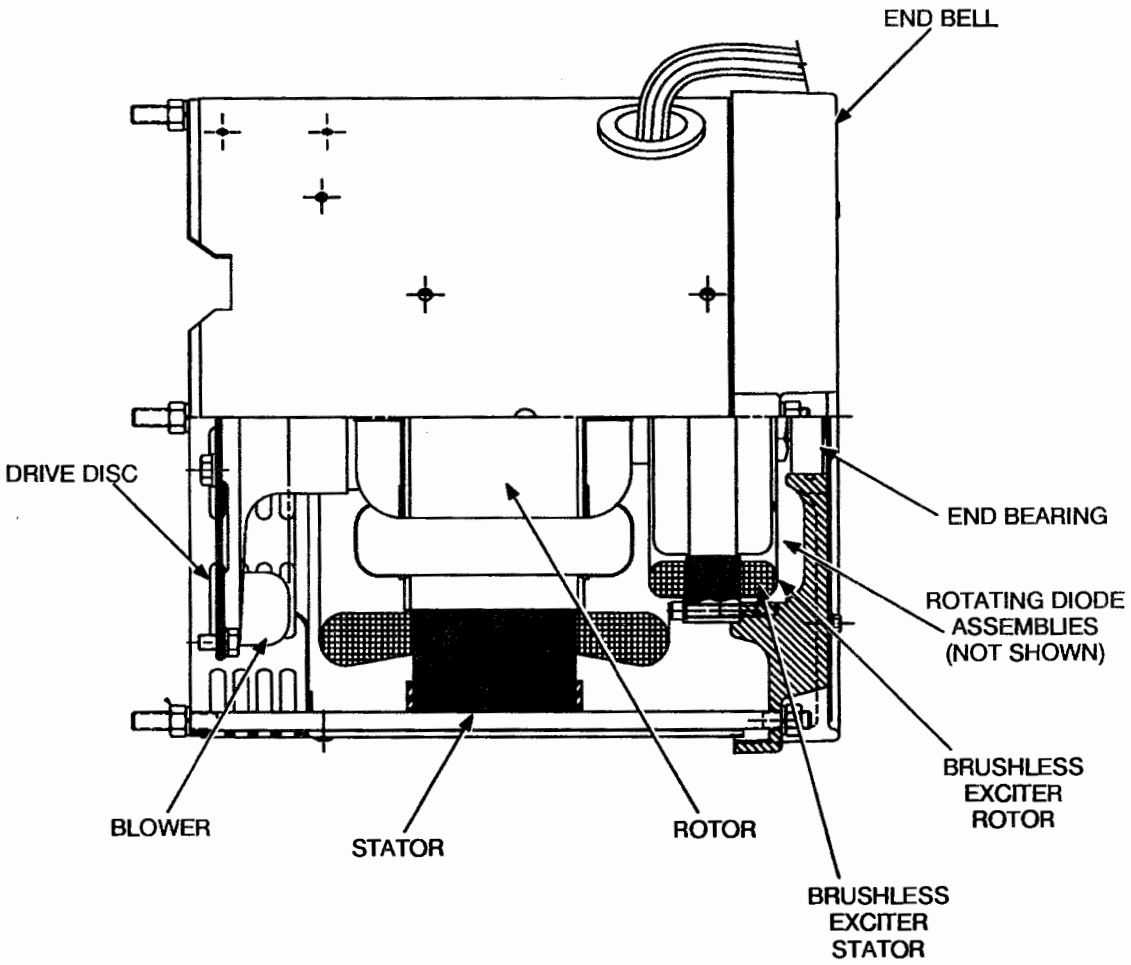
GENERAL DESCRIPTION

The YD generator (Figure 4-1) is a four-pole, revolving field, brushless exciter design with drip-proof construction.

The generator rotor is directly coupled to the engine flywheel with a rigid drive disc. Engine speed determines generator output voltage and frequency. A centrifugal blower on the drive disc circulates generator cooling air which is drawn in through the end bell and discharged through an outlet in the blower end.

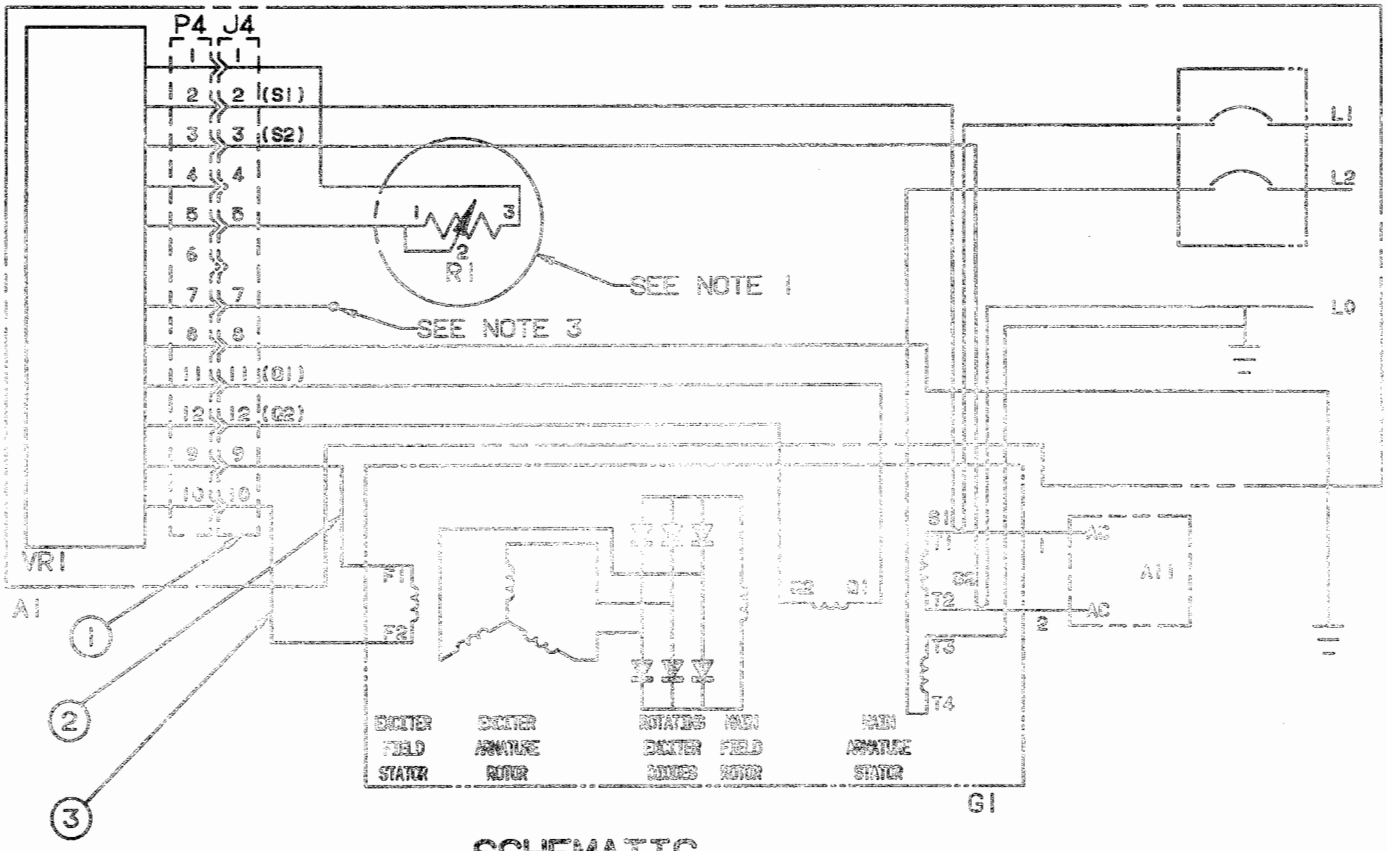
A ball bearing in the end bell supports the outer end of the rotor shaft. The end bell is attached with four studs that thread into the generator adapter casting. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating diode assemblies mount on the generator rotor shaft. Leads F1 (+) and F2 (-) from the exciter stator winding are connected to the output terminals of the voltage regulator.

Figure 4-2 shows the generator output and control/meter leads for the voltage options. Voltage reconnection diagrams appear in Section 6. Generator/Regulator Tests, and in Section 7, Wiring Diagrams.



539-1316

FIGURE 4-1. YD SERIES GENERATOR



SCHEMATIC

110/220V, 115/230V & 120/240V AS SHOWN
SEE RECONNECTION CHART FOR OTHER VOLTAGES

NOTE:

1. SEE VOLTAGE REGULATOR CONNECTION CHART FOR CONNECTION. JUMPER FROM 4 TO 5 IS STANDARD.
3. FROM J2-15 FOR FIELD FLASHING.

PART	DESCRIPTION
1	WIRE HARNESS
2	LEAD (F1)
3	LEAD (F2)
G1	GENERATOR
R1	POTENTIOMETER ASSY.
VR1	VOLTAGE REGULATOR – CAPPED AVR
A11	ENGINE MONITOR PC BOARD

FIGURE 4-2. GENERATOR SCHEMATIC

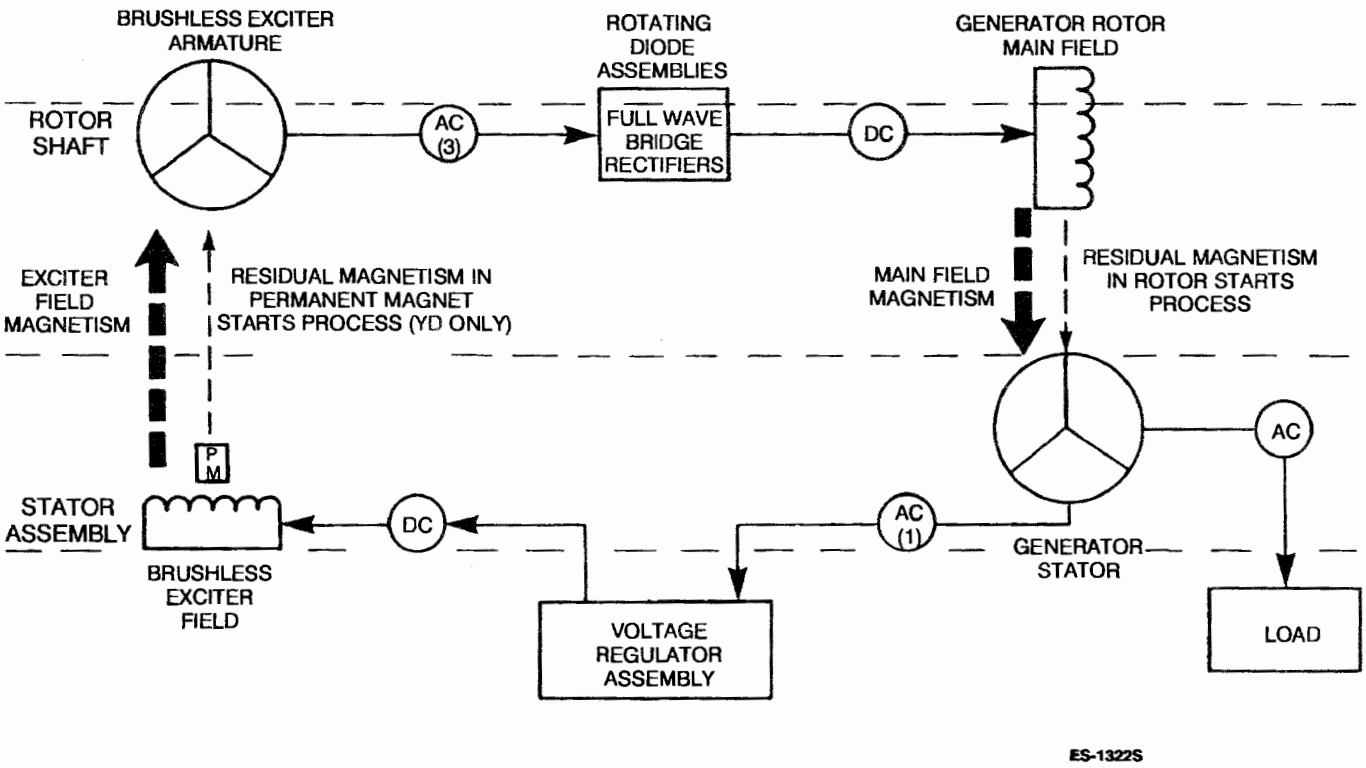


FIGURE 4-3. EXCITATION BLOCK DIAGRAM

GENERATOR OPERATION

Power generation involves the components shown in Figure 4-3. These components are italicized in the following text. A *permanent magnet* embedded in an *exciter stator* field pole begins the voltage build-up process as the generator set starts. Single-phase AC voltage, taken from a *main stator* winding, is connected to the *voltage regulator* as a reference for regulating the generator output voltage. The regulator DC output is coupled to the *exciter stator.*

The *exciter rotor* produces three-phase AC voltage that is converted to DC by the full wave *rotating rectifier assemblies.* The DC voltage excites the *rotor main field* winding to produce *main stator* AC for the load.

ELECTRONIC VOLTAGE REGULATOR

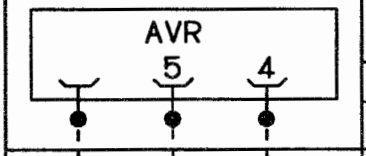
The voltage regulator controls the output of the generator so that a constant voltage is maintained under varying load conditions.

Only the basic functions of the regulator are described (Figure 4-4). Voltage from one of the generator stator windings is supplied to the voltage regulator. The voltage regulator in turn supplies an excitation voltage (F1/F2) that is directly proportionate to the output voltage (L1/L0) it senses. Any changes in the generator output voltage produce a corresponding change in the excitation voltage provided by the regulator. Voltage from quadrature windings Q1/Q2 supply power to the voltage regulator itself.

On the DKG, the voltage regulator assembly includes a potentiometer connected between pins 1 and 5 (see wiring diagram). This enables a slight degree of output voltage adjustment. However, the generator may be set for various fixed output voltages by connecting jumpers or resistors as shown in Figure 4-4.

The voltage regulator assembly contains no user-serviceable parts. If the assembly fails, it must be replaced.

VOLTAGE REGULATOR CONNECTION CHART



FOR AVR 305-0833				
DESCRIPTION				
METHOD	VOLTAGE	PHASE	HERTZ	TYPE
JUMPER	138/240Y 277/480Y	3 3	60	FIXED
JUMPER	120/208Y 240/416Y 120/240 Δ 120/240	3 3 3 1	60	FIXED
1150 Ω FIXED RESISTOR	133/230Y 266/460Y	3 3	60	FIXED
10 KΩ POTENTIOMETER	139/240 TO APPROX 20% 110/192	3 OR 1	60	ADJUST
10 KΩ POTENTIOMETER	120/240	1	60	ADJUST

305-0833

FIGURE 4-4. ELECTRONIC REGULATOR WIRING CHART

GENERATOR SERVICE

The following sections describe the disassembly and reassembly procedures for the generator.

⚠WARNING ***Generator components are heavy and can cause severe personal injury if dropped during service. Be careful, use appropriate lifting techniques, keep hands and feet clear during service, and use the recommended service procedures.***

Disassembly

1. Disconnect the negative (-) battery cable from the battery to prevent accidental starting of the generator set while servicing.

   ⚠WARNING ***Accidental starting of the set can cause severe personal injury or death. disconnect the battery cables, negative (-) lead first, when repairs are made to the engine, controls or generator.***

2. Remove the cover from the control box and disconnect all stator leads. If the control has load circuit breakers, disconnect leads at breaker. If the lead markings do not clearly identify reconnection, mark the leads with tape.

3. Remove end bell cover and remove field leads F1 and F2.

4. Remove the load wires and flexible conduit from the control box.

5. Unplug the wiring harness extending from the voltage regulator assembly to the generator. (The voltage regulator assembly is the black aluminum box mounted on the saddle in front of the AC control box.) Unscrew the two bolts holding the voltage regulator to the set. Remove the regulator and set it aside.

6. Remove the capscrews securing the control box mounting saddle to the stator. The control box and saddle are removed as an assembly.

7. Pull the stator leads through the opening in the bottom of the control box and saddle as they are lifted free from the stator. Do not disconnect any engine DC control wires in the control box.

8. Set the control box and saddle on top of the engine.

9. Remove the end bell stud nuts and slide off the end bell and exciter stator. It may be necessary to pry or jar the assembly loose from the main stator assembly.

10. Use a hoist and safe lifting device (stator handling tongs, nylon lifting strap or chain and lift hooks) to support the stator assembly. A support must be placed under the engine before removing the stator from the vibration mounts.

11. Remove the stator assembly, being careful not to touch or drag it on the rotor. Place the stator on its side in the horizontal position.

12. Using a hoist and sling to support the rotor, carefully remove the capscrews that attach the drive disc to the engine flywheel (Figure 4-5).

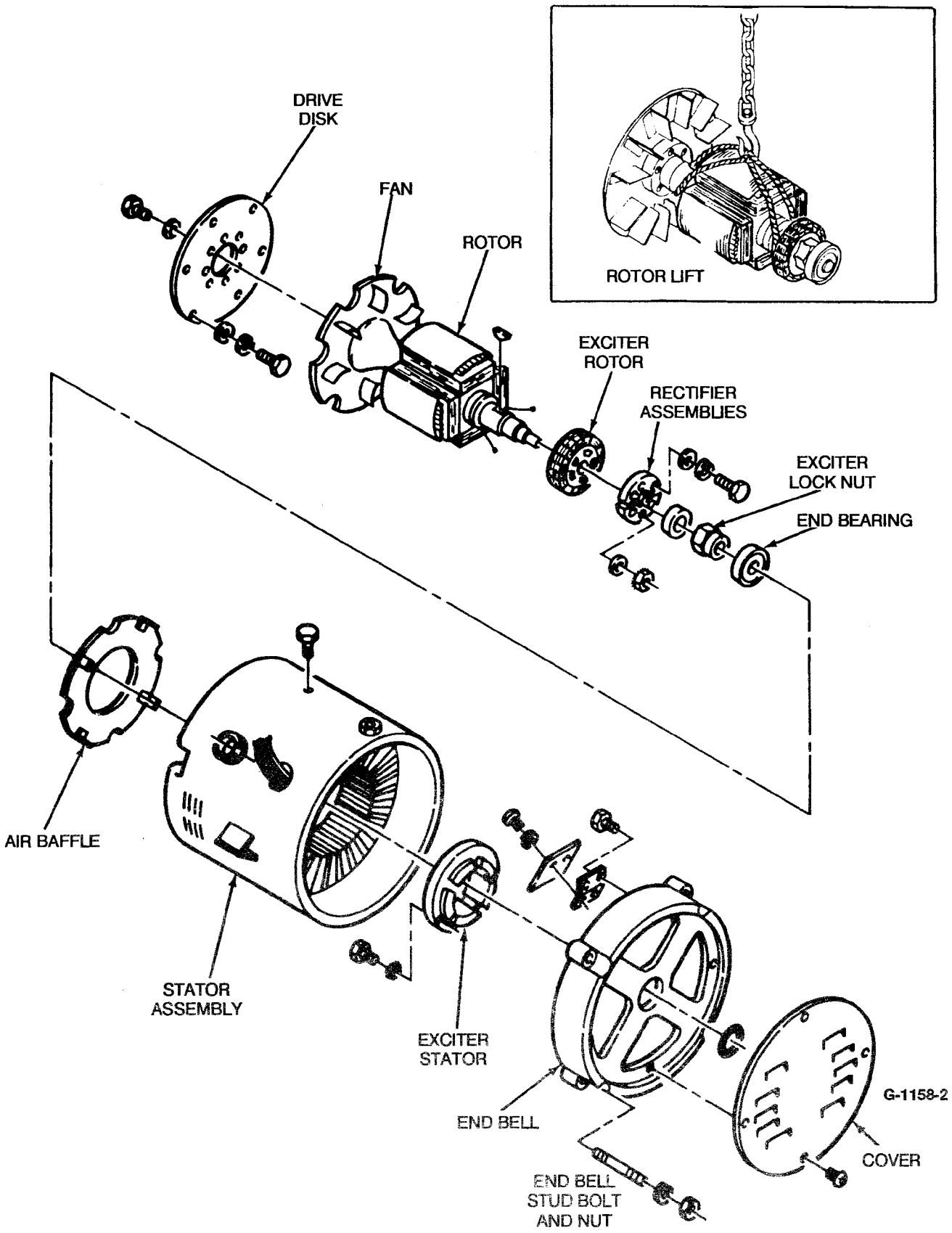
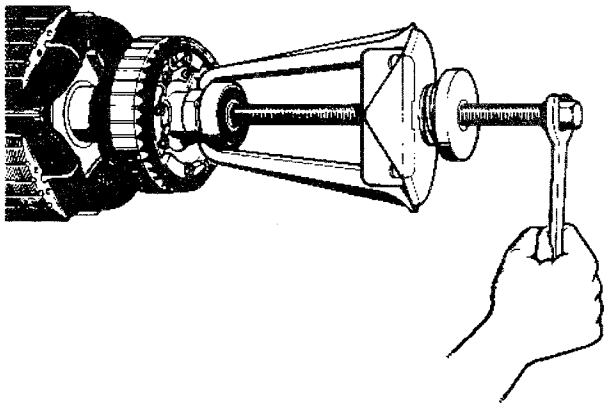


FIGURE 4-5. GENERATOR ASSEMBLY G-1158-2s

13. Remove the rotor assembly and place it on a wood block in the horizontal position. **The drive disc and fan should not be resting on anything, or distortion may occur.**

14. Remove the bolts that hold the drive disc and fan to the rotor shaft. Remove the bolts holding the drive disc to the fan.

15. Use a gear puller to remove the end bearing from the rotor shaft (Figure 4-6).



ES1495

FIGURE 4-6. END BEARING REMOVAL

⚠CAUTION ***The end bearing will be damaged if pulled on the outer race. If the bearing must be removed, replace it; this bearing should not be reused.***

16. Clamp the rotor in a fixed position and remove the exciter rotor lock nut.

17. Remove the generator field leads from the exciter rotor and slide the exciter off the rotor shaft.

Reassembly

1. Slide the exciter rotor over the generator shaft and woodruff key. Install the exciter lock nut and apply the torque values shown in Figure 4-7.

2. Connect the generator field leads to F1+ and F2- terminals on the exciter assembly. Torque them to the values shown in Figure 4-7.

3. Press the new end bearing onto the rotor shaft.

4. Assemble the rotor fan and drive disc to the engine flywheel. Use a hoist and sling to support the rotor. Be sure the drive disc is assembled with the chamfer on the flywheel side. Apply the torque values shown in Figure 4-7.

5. Install the air baffle.

6. Using a hoist and safe lifting device, carefully move the stator assembly into position over the rotor. The leads should be in the top position. Apply a thin film of Molykote grease to mating surfaces of end bearing and hole in the end bell.

7. Install the end bell stud bolts through the stator and into the generator adapter.

8. Install end bell assembly on the stator with the generator lead opening at top position.

9. Torque end bell stud nuts to 20 ft-lbs (27 N•m).

10. Using a lead hammer, tap the end bell at the horizontal and vertical to relieve stress. Torque end bell stud nuts.

11. Feed stator and control leads through opening in control box and saddle and secure saddle to the generator.

12. Connect all applicable control leads (F1, F2, battery charging, etc.) and verify that all connections are secure.

13. Reconnect the AC voltage regulator plug. Attach the regulator to the generator set using two bolts, in the same position it originally had.

14. Install the end bell cover.

15. Connect the stator wires to the load wires.

16. Connect the negative (-) battery cable and test generator operation.

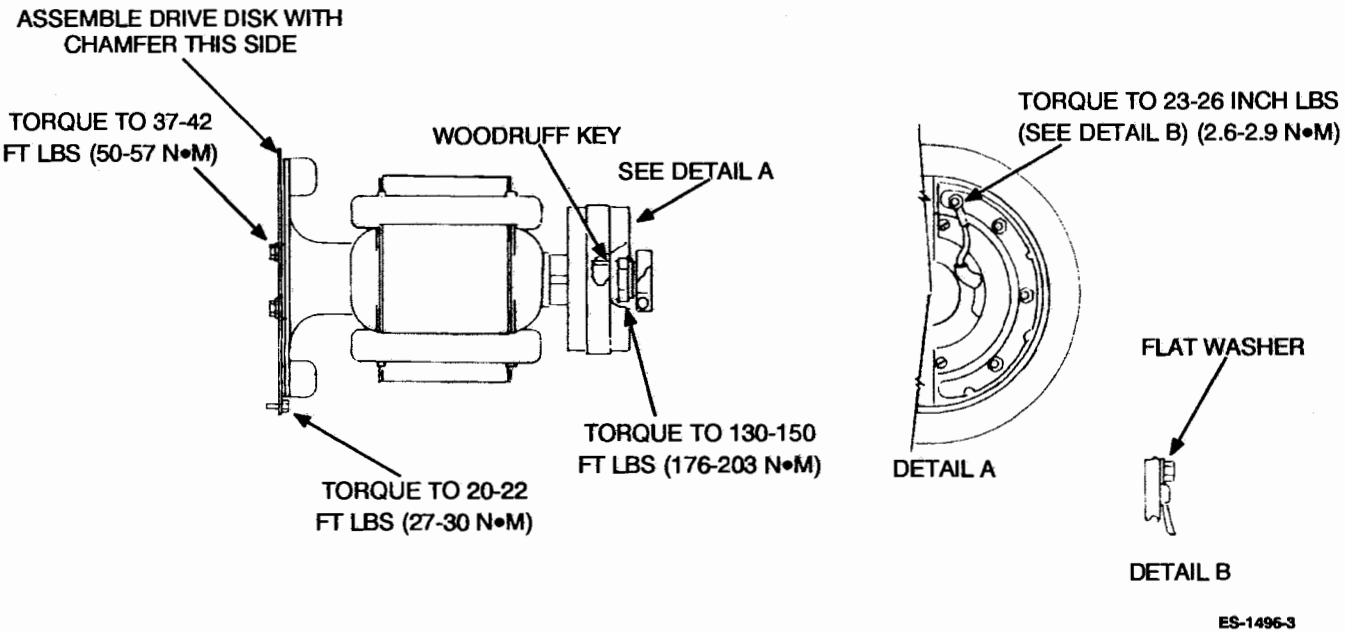


FIGURE 4-7. ROTOR ASSEMBLY AND TORQUE VALUES

5. Generator/Regulator Troubleshooting

GENERAL

This section contains troubleshooting information for the DKG generator and voltage regulator. Make the following visual checks before starting:

- Check any modification or repair that was done since the last satisfactory operation of the set. Verify that it was done properly.
- Check to see that generator leads are connected correctly. Also check the circuit board connectors. A loose, contaminated, or misplaced wire connection can be detected by close inspection.
- Check for an open circuit breaker. If the breaker is open, check for an overloaded circuit and correct load problems before resetting the breaker.

TROUBLESHOOTING PROCEDURES

Determine the type of problem, then refer to the corresponding flow chart (A, B, C, D, or E) for troubleshooting procedures.

A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM

B. UNSTABLE OUTPUT VOLTAGE, ENGINE SPEED STABLE

C. OUTPUT VOLTAGE TOO HIGH OR TOO LOW

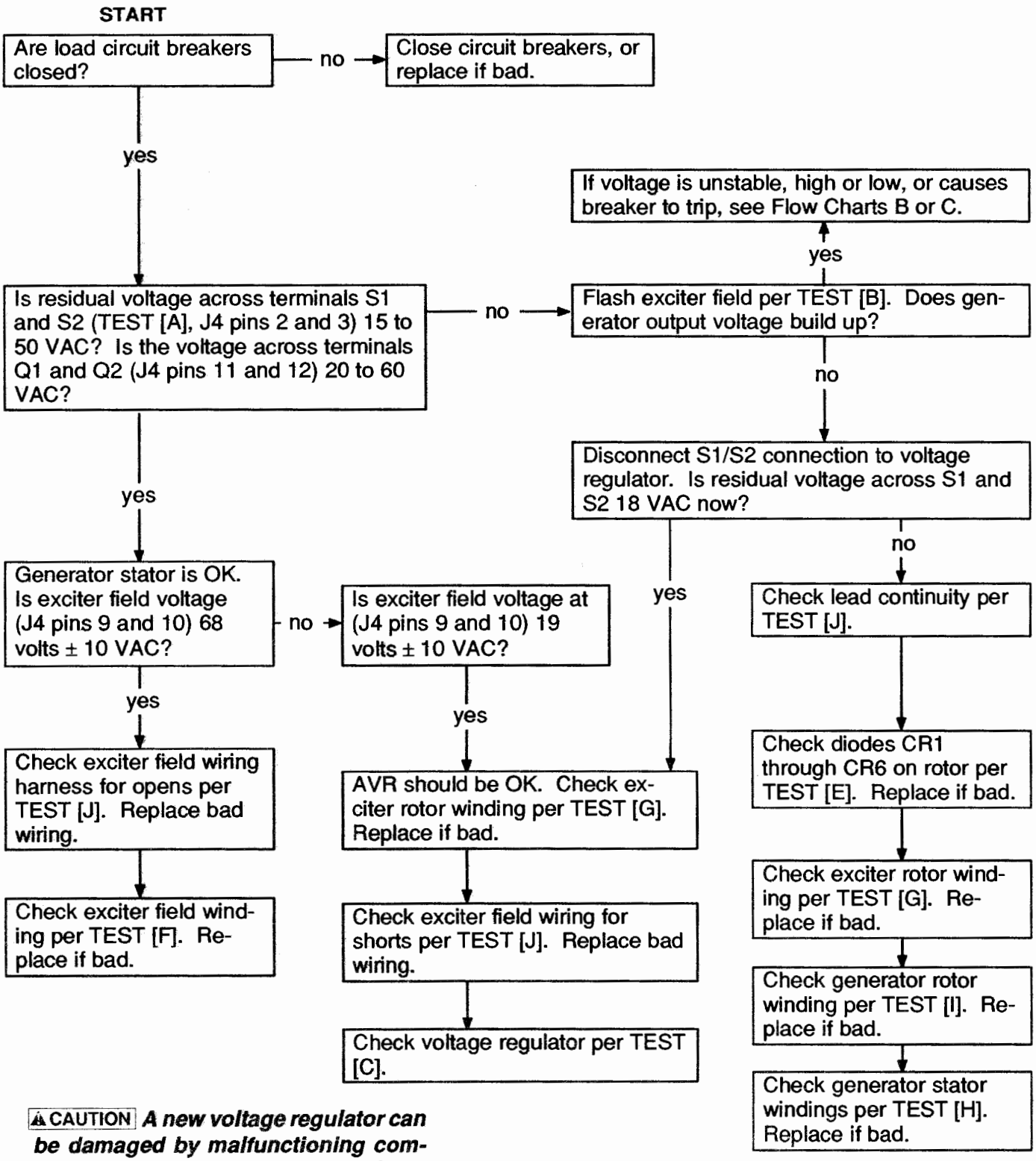
D. UNBALANCED OUTPUT VOLTAGE

To troubleshoot a problem, start at the upper left corner of the chart that corresponds to the problem, and answer all questions either YES or NO. Follow the chart until the problem is found. Perform the referenced test or adjustment procedures in the Generator/Regulator Tests section.

Components referenced in the flow charts, tests and adjustment procedures are found in the schematics and wiring diagrams in Section 7 of this manual.

FLOW CHART A. NO AC OUTPUT VOLTAGE AT RATED ENGINE RPM

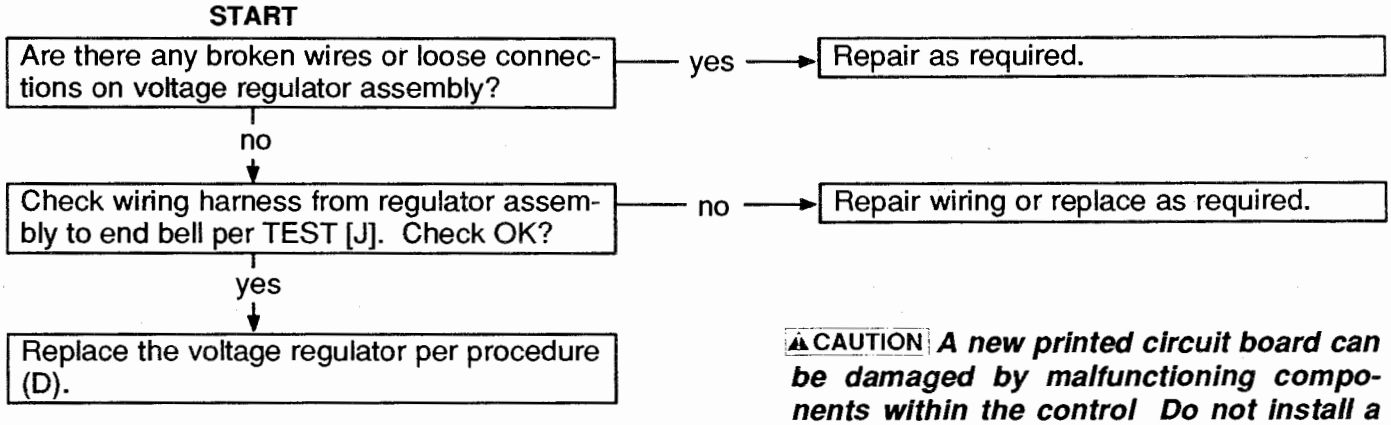
⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***



⚠CAUTION ***A new voltage regulator can be damaged by malfunctioning components. Do not install a new voltage regulator until all other problems have been located and corrected.***

FLOW CHART B. UNSTABLE VOLTAGE, ENGINE SPEED STABLE

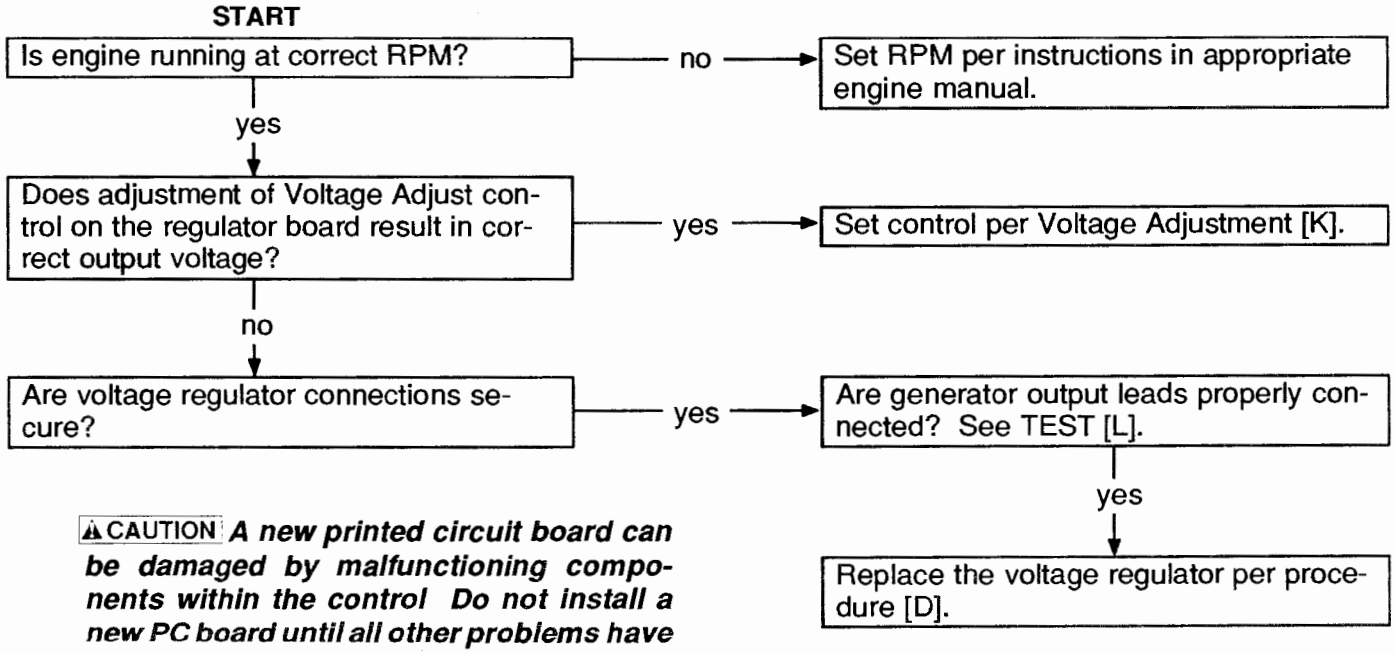
⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***



⚠CAUTION ***A new printed circuit board can be damaged by malfunctioning components within the control Do not install a new PC board until all other problems have been located and corrected.***

FLOW CHART C. OUTPUT VOLTAGE TOO HIGH OR TOO LOW

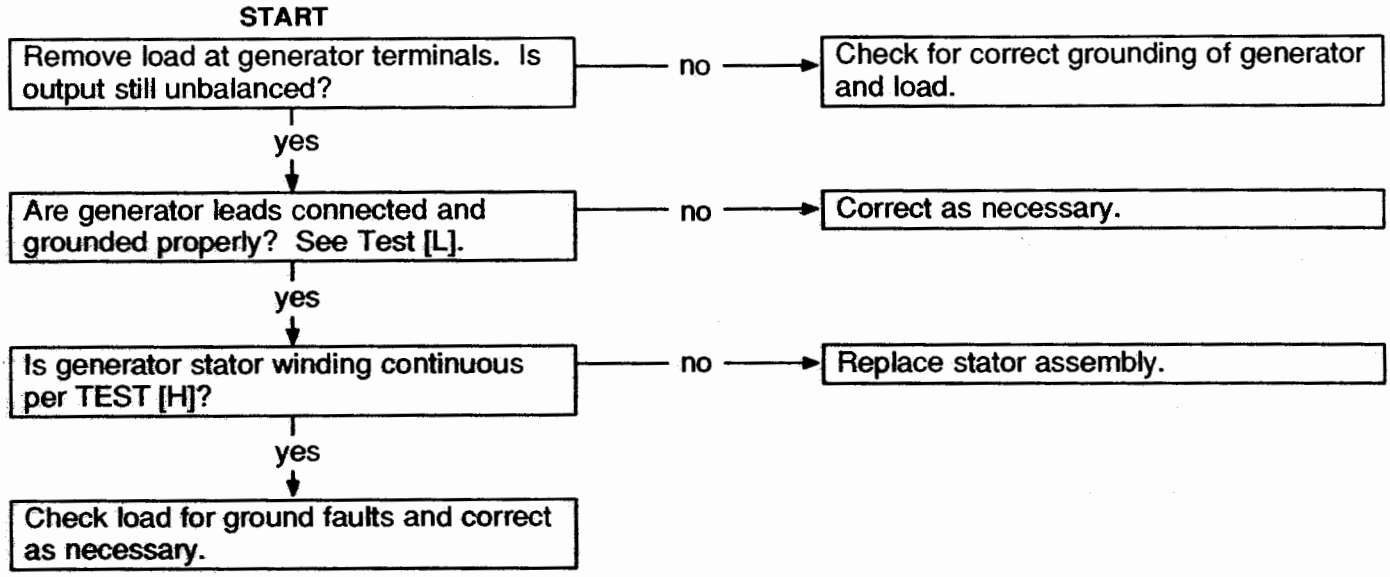
⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***



⚠CAUTION ***A new printed circuit board can be damaged by malfunctioning components within the control Do not install a new PC board until all other problems have been located and corrected.***

FLOW CHART D. UNBALANCED GENERATOR OUTPUT VOLTAGE

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***



6. Generator/Regulator Tests

GENERAL

The following tests and adjustments can be performed without disassembly of the generator. These procedures should be used for testing the generator components and the regulator in conjunction with the Troubleshooting Flow Charts in the Generator/Regulator Troubleshooting section.

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

[A]

TESTING AC RESIDUAL VOLTAGE

Test for residual AC voltage if there is no AC power output from the generator. Check between generator leads S1 and S2. Residual voltage should be 18 VAC ± 5 volts.

[B]

FLASHING THE FIELD

If output voltage does not build up it may be necessary to restore residual magnetism by flashing the field. This requires a 12-volt storage battery, 10-amp fuse, momentary-on switch, and diode assembled as shown in Figure 6-1.

⚠CAUTION ***Incorrect flashing procedure can damage the voltage regulator. Do not keep excitation circuitry connected longer than 5 seconds.***

Connect the positive lead to the F1 (+) exciter stator lead, and the negative lead to the F2 (-) exciter lead. Start the generator set and operate at normal speed. Close the momentary-on switch just long enough for the generator output voltage to build up, but not longer than 5 seconds.

Check the output voltage, then shut down the generator set. Restart the generator set and operate at no load. Output voltage must build up without field flashing. If not, shut down the generator set and perform continuity check of all related wiring.

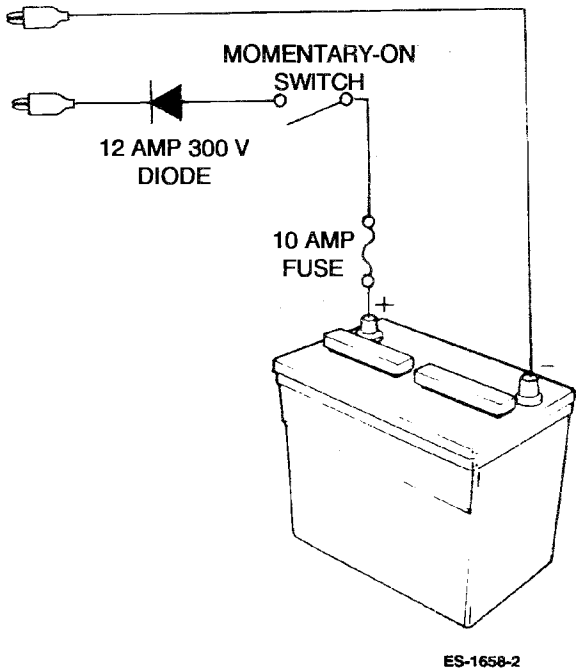


FIGURE 6-1. FIELD FLASHING CIRCUIT

[C] VOLTAGE REGULATOR TEST

The following procedure determines if the problem is in the voltage regulator or the generator. The voltage regulator is temporarily replaced with a 6-volt lantern battery; 6 volts applied to the F!/F2 exciter stator should produce approximately 120 volts generator output voltage at S1 and S2, with no load.

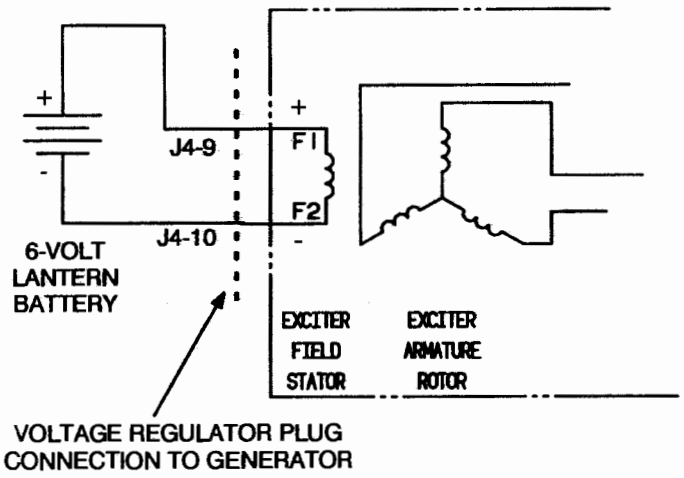
⚠WARNING ***Electrical shock can cause severe personal injury or death. Do not touch electrical wiring or components during testing. Disconnect electrical power by removing starting battery negative (-) cable before handling electrical wiring or components.***

Use a sharp voltage probe and touch it carefully to the voltage regulator pins when making these tests.

1. Stop the generator set.

2. Unplug the voltage regulator from the wiring harness.

3. Using jumpers and a spare plug or other connector, connect a 6-volt lantern battery to the F1/F2 terminals as illustrated in Figure 6-2.



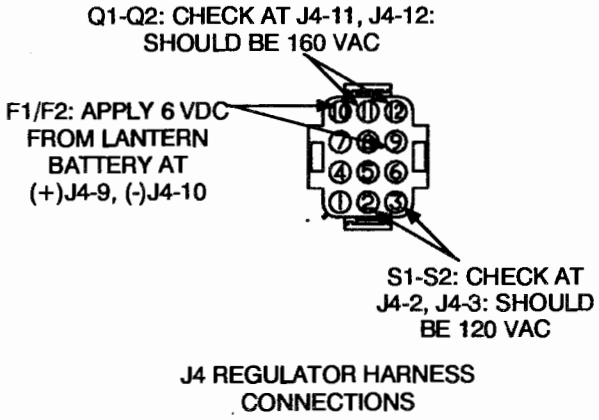


FIGURE 6-2. VOLTAGE REGULATOR CHECK

4. Start the generator set. Use a voltmeter to measure the output at S1-S2 (pins 2 and 3) and the output at Q1-Q2 (pins 11-12). S1-S2 output should be 120 VAC ± 20 VAC. Q1-Q2 output should be 160 VAC ± 20 VAC. If these voltages are measured, then the generator is operating correctly and the problem is elsewhere.

[D] VOLTAGE REGULATOR REPLACEMENT

Use the following procedure for replacing the AC voltage regulator assembly.

1. Stop the generator set and disconnect the starting battery leads, negative (-) lead first.

2. Unscrew the voltage regulator from the AC control box.

3. Unplug the regulator from the wiring harness.

4. Remove the mounting screws from the old voltage regulator, then install the new regulator.

5. Reconnect the plug connection to the wiring harness.

6. Set voltage as outlined in test [K] Voltage Adjustment.

[E]

TESTING ROTATING RECTIFIERS

Two different rectifier assemblies make up the rotating rectifier bridge assembly (Figure 6-3). Using an ohmmeter, test each CR rectifier using negative (-) and positive (+) polarities. Use the following procedure.

1. Disconnect all leads from assembly to be tested.

2. Connect one ohmmeter test lead to F1+ stud and connect the other lead to CR1, CR2 and CR3 in turn; record resistance value of each rectifier.

3. Connect one lead to F2- stud and connect other lead to CR4, CR5, and CR6 in turn; record resistance value of each rectifier.

4. Reverse ohmmeter leads from steps 2 and 3 and record resistance value of each rectifier F1+ to CR1, CR2 and CR3 and F2- to CR4, CR5 and CR6.

5. All the resistance readings should be high in one test and low in the other test. If any reading is high or low in both tests, rectifier assembly is defective.

6. Replace defective rectifier assembly with new identical part.

Use 23 to 26 inch lbs (2.6 to 2.9 N.m) torque when replacing nuts of F1+ and F2-, CR1, CR2, CR3, CR4, CR5 and CR6.

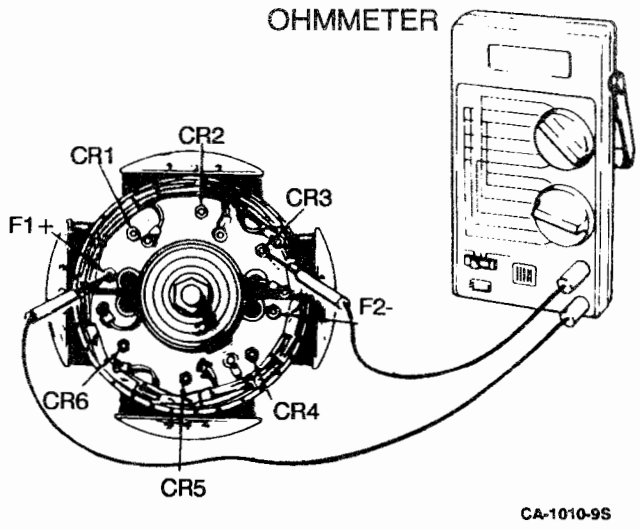


FIGURE 6-3. TESTING ROTATING RECTIFIERS

[F]

TESTING EXCITER STATOR

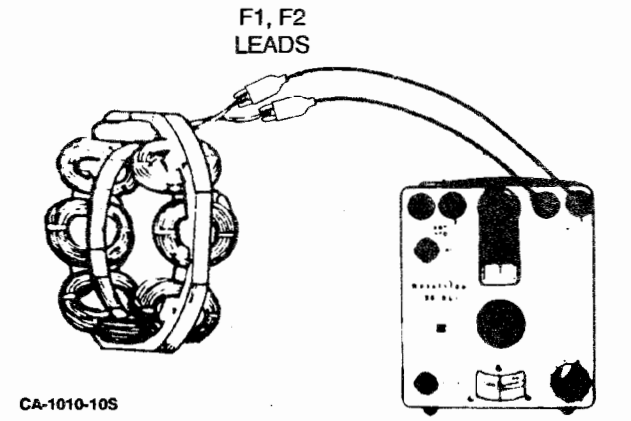
Test the exciter stator (Figure 6-4) for open or shorted windings and grounds as follows:

Testing for Open or Shorted Windings

Use a Wheatstone bridge or digital ohmmeter for this test. Disconnect F1+ and F2- exciter field leads from terminal block in generator end bell. The resistance between field leads should be 12.1 ohms ± 10% at 77°F (25°C).

Testing for Grounds

Connect a megger or insulation resistance meter that applies 500 VDC or more between either field lead and the exciter stator lamination. Be sure both exciter leads are disconnected from the terminal block. Reading should be 100,000 ohms or greater. If not, the exciter stator is questionable and may require removal for oven drying and retest. A shorted stator must be replaced.



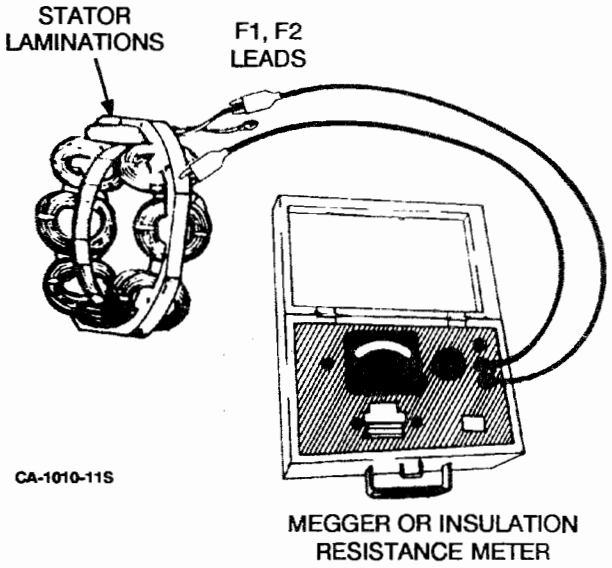


FIGURE 6-4. TESTING EXCITER STATOR

[G]

TESTING EXCITER ROTOR

Test the exciter rotor (Figure 6-5) for open or shorted windings or grounds as follows:

Testing for Open or Shorted Windings

Use a Wheatstone bridge or digital ohmmeter for this test. Disconnect main rotor field leads that connect to rotating rectifier assemblies at F1+ and F2-. Disconnect lead wires from diodes CR1, CR2, CR3, CR4, CR5, and CR6. Test between exciter lead pairs T1-T2, T2-T3 and T1-T3. Resistance at 77°F (25°C) should be 540 milliohms ± 10%.

Testing for Grounds

Test with an insulation resistance meter or Megger that applies not more than 500 volts to the test leads. With all generator leads disconnected from rotating rectifiers CR1 through CR6, apply test leads between any CR lead and the rotor laminations. Reading should be 100,000 ohms or higher. If not, the exciter rotor is questionable and may require removal for oven drying and retest. A shorted rotor must be replaced.

Use 23 to 26 inch pounds (2.6 to 2.9 N•m) torque when replacing nuts of F1+ and F2- leads, CR1, CR2, CR3, CR4, CR5, and CR6.

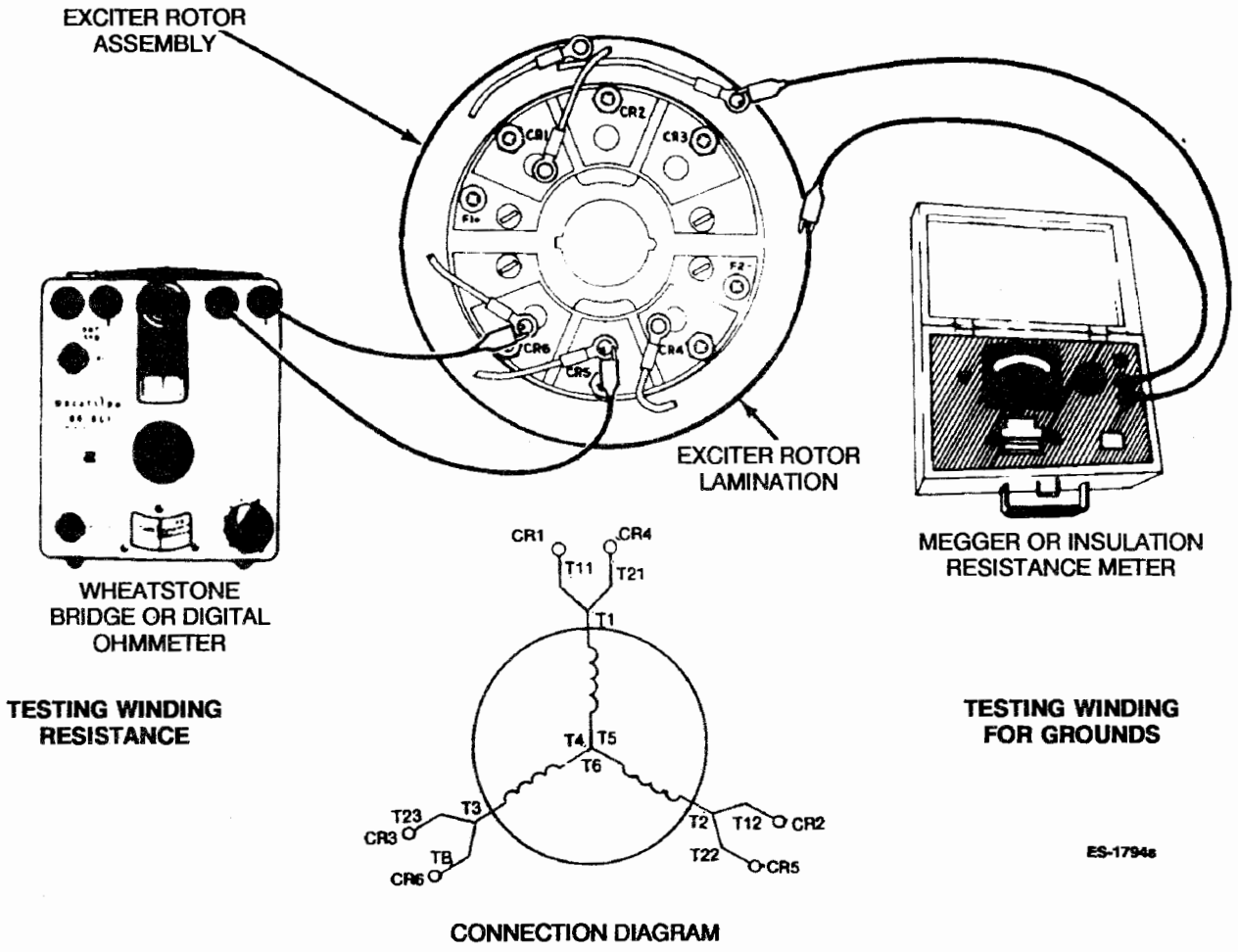


FIGURE 6-5. TESTING EXCITER ROTOR

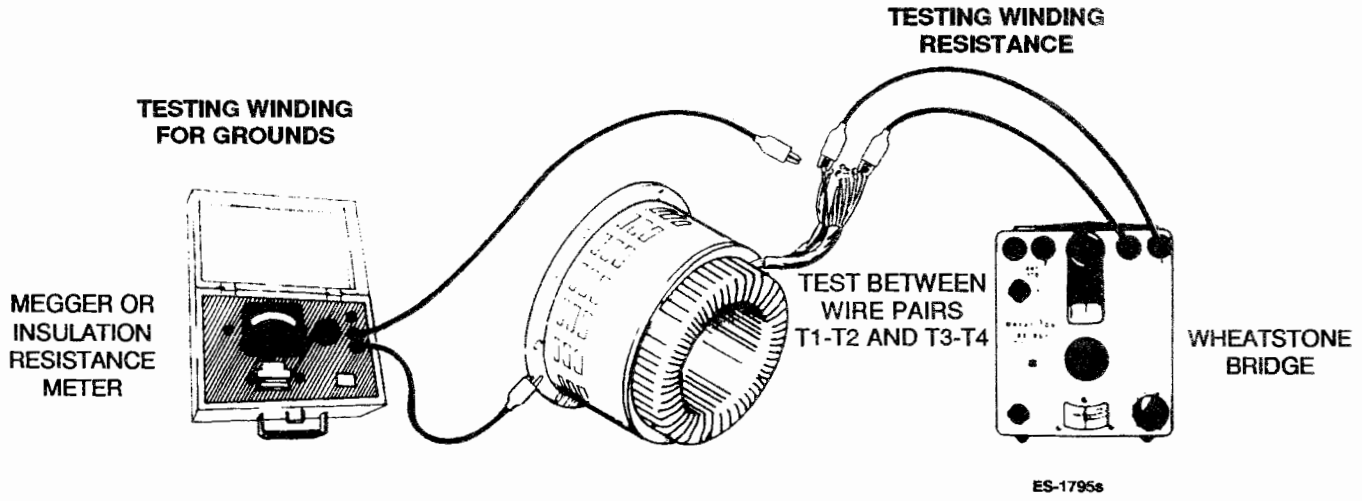


FIGURE 6-6. TESTING STATOR WINDINGS

[H]

TESTING GENERATOR STATOR

Using proper test equipment, check the stator for grounds, opens, and shorts in the windings.

Testing for Grounds

Some generators have ground connections to the frame. Check wiring diagram. All stator leads must be isolated for testing.

Use a megger or insulation resistance meter which applies not more than 500 VDC to the test leads (Figure 6-6). Test each stator winding for short to laminations. A reading less than 100,000 ohms indicates a questionable stator. Oven dry the stator and retest.

Testing for Open or Shorted Windings

Test for continuity between coil leads shown in Figure 6-6; all pairs should have equal resistance. Use an accurate instrument for this test such as a Wheatstone Bridge. The resistance at 77°F (25°C) is 0.167 ohms ± 10%.

If a winding is shorted, open or grounded, replace the stator assembly. Before replacing the assembly, check the leads for broken wires or insulation.

[I]

TESTING GENERATOR ROTOR

For these tests, use a megger or insulation resistance meter which applies 500 VDC or more to the test leads.

Testing for Grounds

Check for grounds between each rotor lead and the rotor shaft, Figure 6-7. Use a Megger or insulation resistance meter which applies 500 VDC or more at the test leads. Perform test as follows:

1. Remove rotor leads F1+ and F2- from the rotating rectifier assemblies.
2. Connect test leads between F1+ and rotor shaft, then between F2- and rotor shaft. Meter should register 100,000 ohms or greater.
3. If less than 100,000 ohms, rotor is questionable. Oven dry the rotor and retest.
4. Replace a grounded rotor with a new identical part.

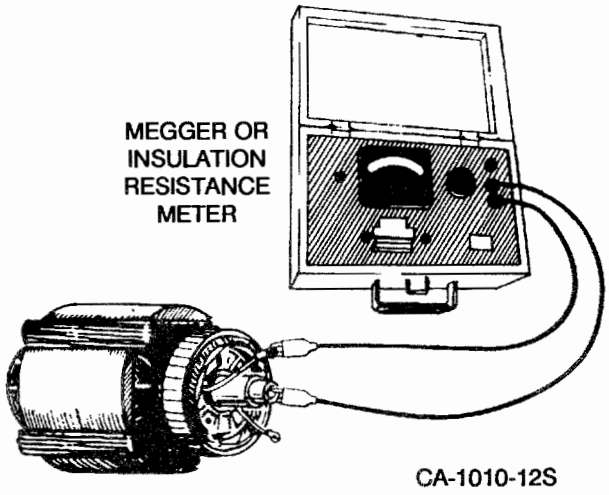
Testing for Open or Shorted Windings

Perform this test with an accurate meter such as a digital ohmmeter.

1. Remove rotor leads F1+ and F2- from rotating rectifier assemblies.

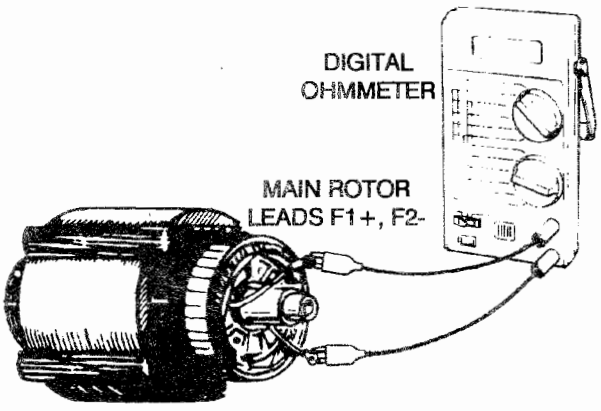
2. Using ohmmeter, check resistance between F1 and F2 leads, Figure 6-8.

   The resistance values at 77°F (25°C) should be 2.09 ohms, ±10%. If not, replace defective rotor with new, identical part.



TESTING WINDING FOR GROUNDS

FIGURE 6-7. TESTING ROTOR FOR GROUNDS



TESTING WINDING RESISTANCE

FIGURE 6-8. TESTING ROTOR FOR AN OPEN CIRCUIT

[J]

WIRING HARNESS CHECK

Carefully check the wiring harness as follows:

1. Inspect all wires for breaks, loose connections, and reversed connections. Refer to applicable wiring diagram.

2. Remove wires from terminals at each end and with an ohmmeter, check each wire end to end for continuity or opens.

3. Using an ohmmeter, check each wire to other wires and to ground for possible shorts or insulation breaks under areas covered by wrapping material.

4. Reconnect or replace wires/harness according to applicable wiring diagram.

[K]

VOLTAGE ADJUSTMENT

This section describes adjustment of the output voltage regulator. When checking output voltage, be sure the generator set has stabilized and is running at the correct speed (frequency). The regulator is adjusted with the set running.

⚠WARNING ***Accidental starting of the set can cause severe personal injury or death. Disconnect both battery cables, negative (-) cable first, when repairs are made to the engine, controls, or generator.***

⚠WARNING ***Contact with high voltage can cause severe personal injury or death. Do not touch any exposed wiring or components with any part of the body, clothing, tool or jewelry. Do not use non-insulated tools inside the control. Stand on an insulating mat or dry wood platform when the control doors are open.***

The output voltage adjustment potentiometer is found on the back of the set AC control box. See Figure 6-9.

1. Attach a voltmeter securely to the L1 and L2 leads.

2. Start the generator set and place a typical load on its output.

3. Loosen the hex locking nut securing the voltage adjustment pot. Use a flat-blade screwdriver to set the voltage adjust potentiometer for correct voltage.

   For most RV and mobile applications, the ideal setting is 117 VAC at 60-61 hz, measured at L1-L0 terminals. Retighten the locking nut when complete.

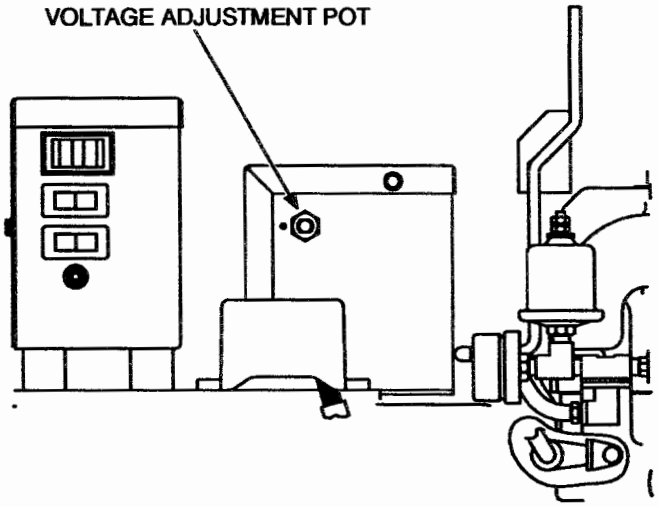


FIGURE 6-9. LOCATION, OUTPUT VOLTAGE REGULATOR ADJUSTMENT

[L]

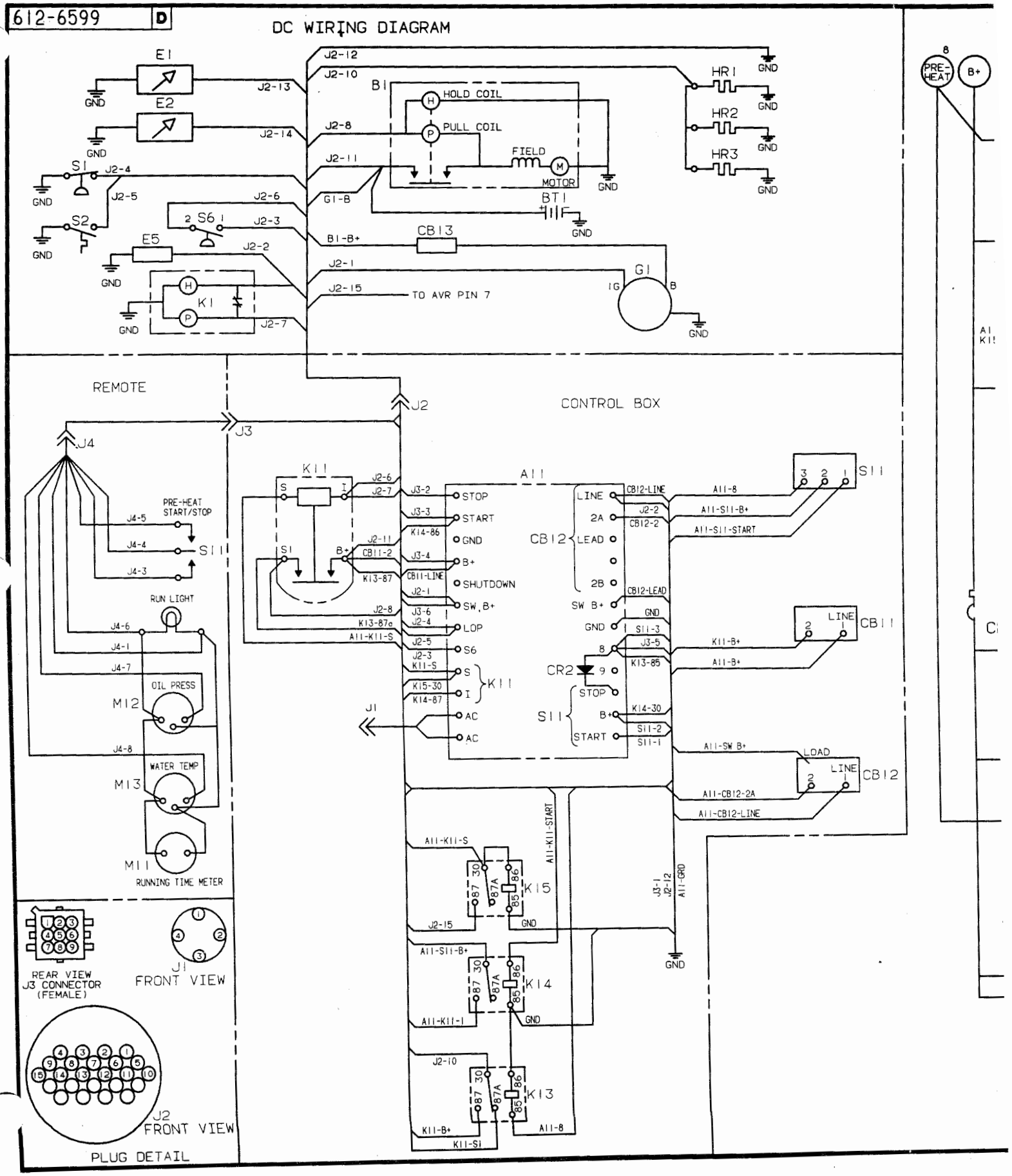
RECONNECTION

Generator reconnection is dependent upon the nameplate code. Diagram 612-6595, reproduced in Section 7 of this manual, shows reconnection possibilities.

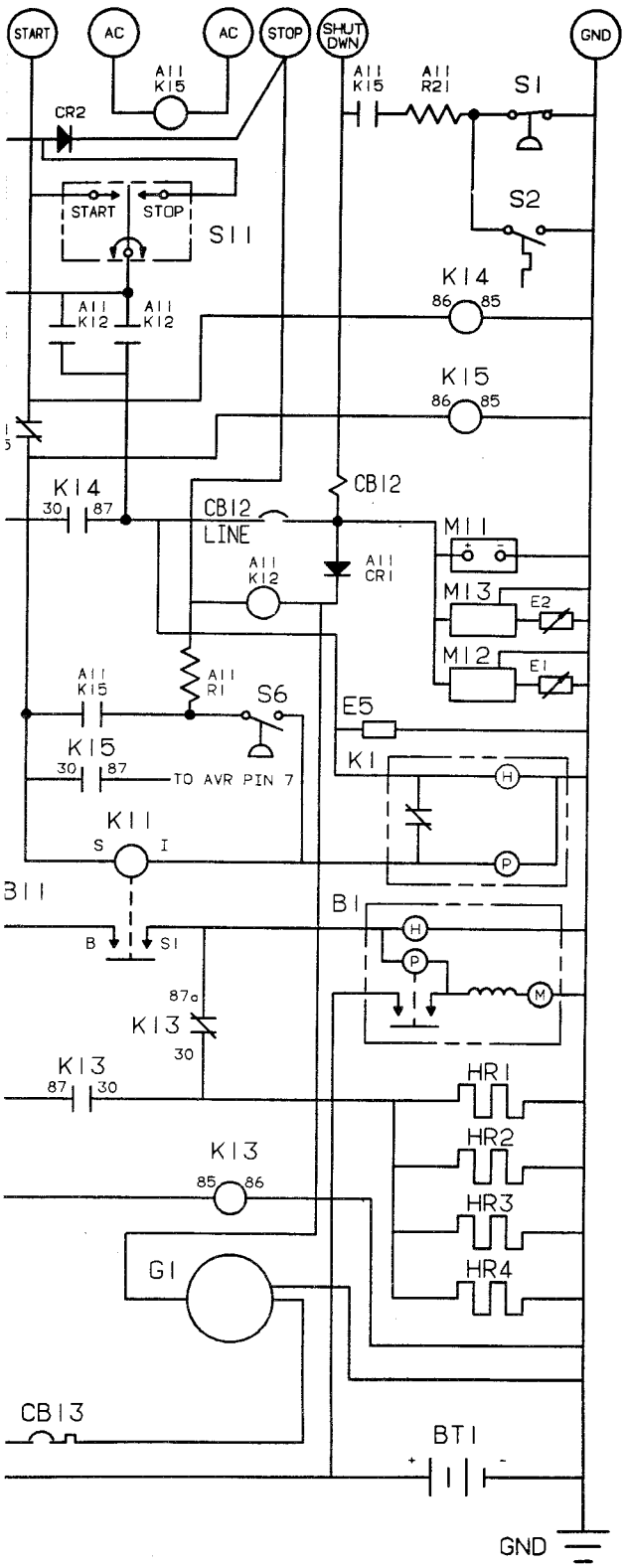
7. Wiring Diagrams

The electrical schematics and wiring diagrams that apply to the generator set covered in this manual are listed below.

WIRING DIAGRAM	DRAWING NO.	PAGE
DC Control Assembly	612-6599	7-2
AC Control Assembly	612-6595	7-3


612-6599 D
DC WIRING DIAGRAM
E1
E2
S1
S2
S6
E5
K1
B1
HOLD COIL
PULL COIL
FIELD
MOTOR
BT1
G1
HR1
HR2
HR3
CB13
TO AVR PIN 7
GND
J2-12
J2-10
J2-13
J2-14
J2-8
J2-11
J2-4
J2-5
J2-6
J2-3
J2-2
J2-1
J2-15
J2-7
G1-B
B1-B+
IG
B
PRE-HEAT
B+
REMOTE
CONTROL BOX
J2
J3
J4
PRE-HEAT START/STOP
RUN LIGHT
OIL PRESS
WATER TEMP
M12
M13
M11
RUNNING TIME METER
A11
K11
S11
CB12
CB11
CR2
STOP
START
GND
B+
SHUTDOWN
SW. B+
LOP
S6
AC
LINE
LOAD
A11-K11-S
A11-K11-START
A11-K11-I
A11-SW B+
A11-CB12-2A
A11-CB12-LINE
A11-GRD
K15
K14
K13
REAR VIEW J3 CONNECTOR (FEMALE)
J1 FRONT VIEW
J2 FRONT VIEW
PLUG DETAIL

SCHEMATIC



ENGINE PARTS LIST (FOR REF ONLY)				
B1			(1)	STARTER & SOLENOID
BT1			(1)	BATTERY (12V)
E1			(1)	SENDER-OIL PRESSURE
E2			(1)	SENDER-COOLANT TEMP
E5			(1)	FUEL PUMP-ELECTRIC
G1			(1)	ALTERNATOR
HR1-3			(3)	HEATER-GLOW PLUG
K1			(1)	SOLENOID-FUEL
S1			(1)	SWITCH-LOW OIL PRESSURE
S2			(1)	SWITCH-HIGH COOLANT TEMP
S6			(1)	SWITCH-CONTROL POWER LATCH

CONTROL BOX PARTS				
	319-1448	D	1	CONTROL ASSY
	338-2781	D	1	HARNESS-ENG
A11	300-2604	D	(1)	PCB ASSY-ENGINE MONITOR
CB11	320-1140	C	(1)	CIRCUIT BREAKER (CONTROL)
CB12	320-1141	A	(1)	CIRCUIT BREAKER (FAULT)
CB13	320-1658	B	(1)	CIRCUIT BREAKER
J3-J4			REF	CONNECTOR-REMOTE
K11	307-1617	B	(1)	RELAY-START SOLENOID(STARTER)(12V)
A11-K12			REF	RELAY-POWER
K13	307-1886	P	(1)	RELAY-HEATER (12V)
K14	307-1886	P	(1)	RELAY-FUEL SOLENOID
A11-K15			REF	RELAY-STARTER PROTECTION
K15	307-1886	P	(1)	RELAY-
A11-R1			REF	RESISTOR (K12)
A11-R2			REF	RESISTOR (LOP TIMING)
S11	308-0739	A	(1)	SWITCH-START STOP

NO.612-6599
REV. B
MODIFIED

Onan

Onan Corporation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-ONAN
612-574-5000 International Use
Telex: 275477
Fax: 612-574-8087