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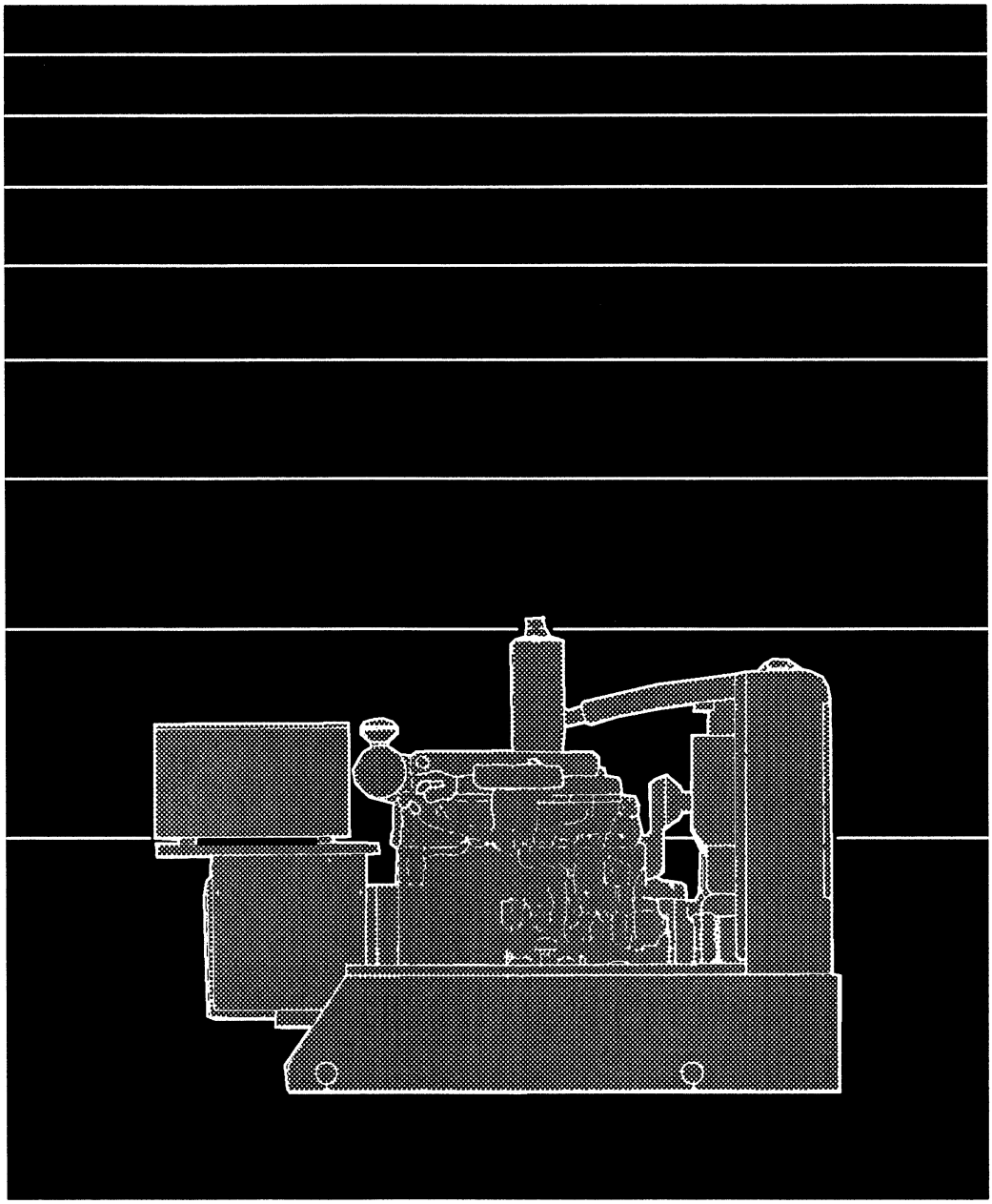
Cummins Onan

Service Manual

RDJC
GENERATOR SET



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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 equipment 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 or death can result from improper practices.

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source 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 line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc..

EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect battery charger from its AC source, then disconnect starting batteries, negative (-) cable first. This will prevent accidental starting.
- 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 in the vicinity of moving parts, or while working on electrical equipment. 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

- Remove electric power 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 surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed 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 isolation switch or an approved paralleling device.

GENERAL SAFETY PRECAUTIONS

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.
- 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.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult the local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguishers rated ABC by NFPA.
- Make sure that rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- 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.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

1. Introduction

ABOUT THIS MANUAL

This service manual is for the RDJC Series generator sets. Engine service instructions are in the engine Service Manual. Operating and maintenance instructions are in the Operator's Manual.

This manual does not have instructions for servicing printed circuit board assemblies. After determining that a printed circuit board assembly is faulty, replace it. Do not repair it. Attempts to repair a printed circuit board can lead to costly damage to the equipment.

This manual contains basic (generic) wiring diagrams and schematics that are included to help in troubleshooting. Service personnel should use the actual wiring diagram and schematic shipped with each unit. The wiring diagrams and schematics that are maintained with the unit should be updated when modifications are made to the unit.

Read ***Safety Precautions*** and carefully observe all instructions and precautions in this manual.

HOW TO OBTAIN ASSISTANCE

When seeking additional service information or replacement parts, always give the complete model and serial number as shown on the genset data tag or nameplate. The genset data tag or nameplate is on the A.C. output box.

TEST EQUIPMENT

Most of the tests in this manual can be done with an AC-DC multimeter, frequency meter, Wheatstone bridge (0.001 ohm precision is necessary for measuring stator winding resistance) and load test panel.

⚠WARNING ***Improper service can lead to equipment damage, severe personal injury or death. Service must be performed by qualified persons who know about fuel, electrical and mechanical hazards. Read the safety precautions page and carefully observe all instructions and precautions in this manual.***

2. AC Control

AC CONTROL PANEL COMPONENTS

The generator set control box is mounted on top of the generator enclosure, facing the rear or either side. Figure 3-1 points out the components on the control panel that have to do with AC output control. Except for the field circuit breaker and the output voltage trimmer, all the AC components shown are optional. The connection and schematic diagrams are on Pages 7-3 and 7-4 (with meters) and Pages 7-5 and 7-6 (without meters). The external wiring harness diagram is on Page 7-7.

Field Circuit Breaker (CB21): The field circuit breaker protects the generator from over-excitation.

AC Voltmeter (M21): The voltmeter indicates output voltage for the phase selected.

AC Ammeter (M22): The ammeter indicates output amperage for the phase selected. Input to the ammeter is from current transformers CT21, CT22 and CT23.

Phase Selector Switch (S21): The selector switch is used to select the phase for voltage and amperage readings.

Scale Indicator Lamps (DS21 and DS22): The scale indicator lamps indicate whether to read the upper or lower scales of the voltmeter and ammeter.

Frequency Meter (M23): The frequency meter indicates output frequency in Hertz (Hz).

Output Voltage Trimmer (R21): The output voltage trimmer can be used to adjust output voltage plus or minus five percent of nominal voltage.

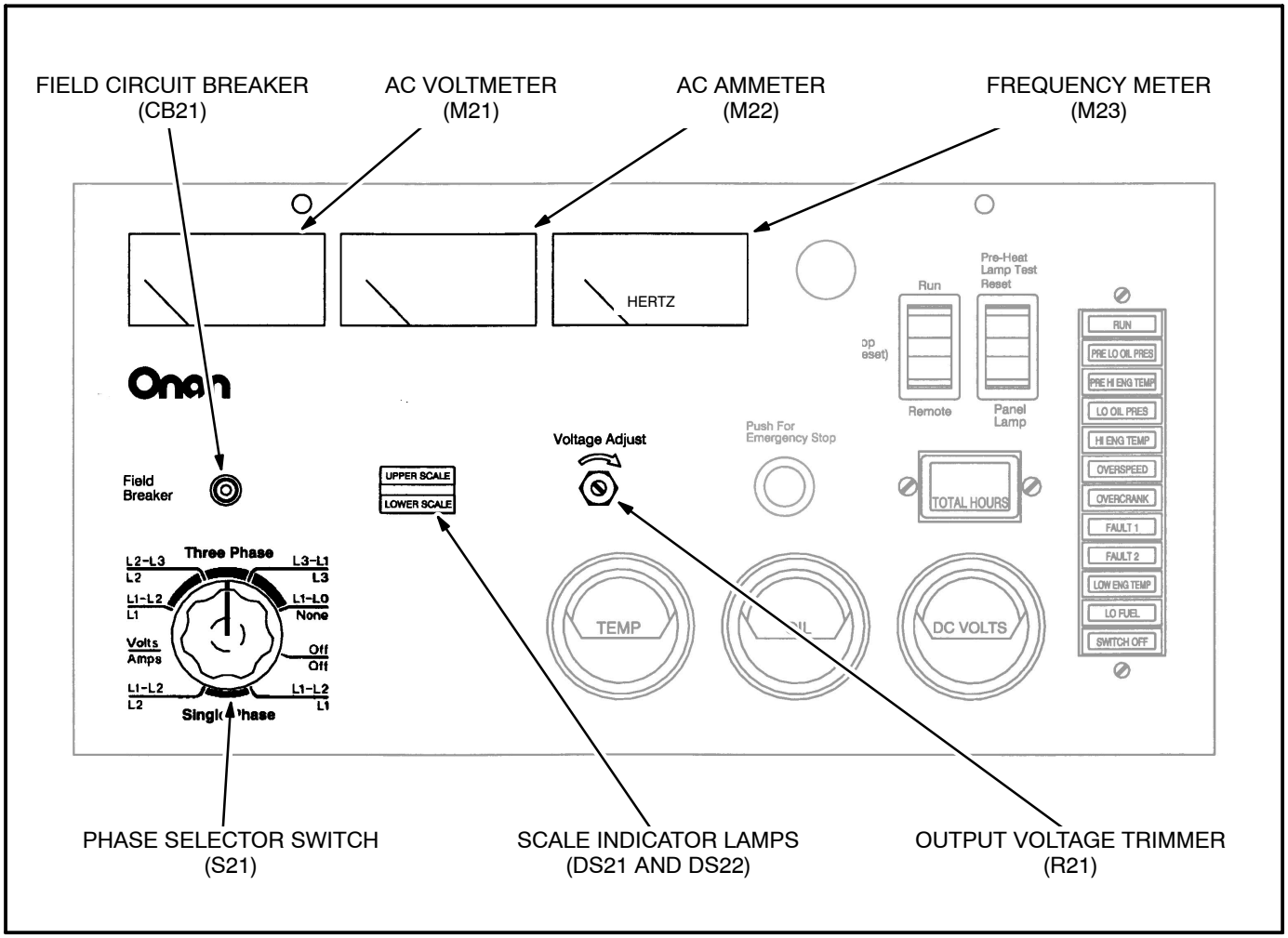


FIGURE 2-1. TYPICAL AC CONTROL PANEL COMPONENTS

CONTROL BOX

Figure 2-2 illustrates the control box with the control panel hinged open. Note the lexan (red plastic) cover secured over the meters to protect from electric shock.

⚠WARNING ***HAZARDOUS VOLTAGE Touching uninsulated live parts inside the control box can result in severe personal injury or death. Reinstall the protective cover to prevent contact with bare, live meter terminals.***

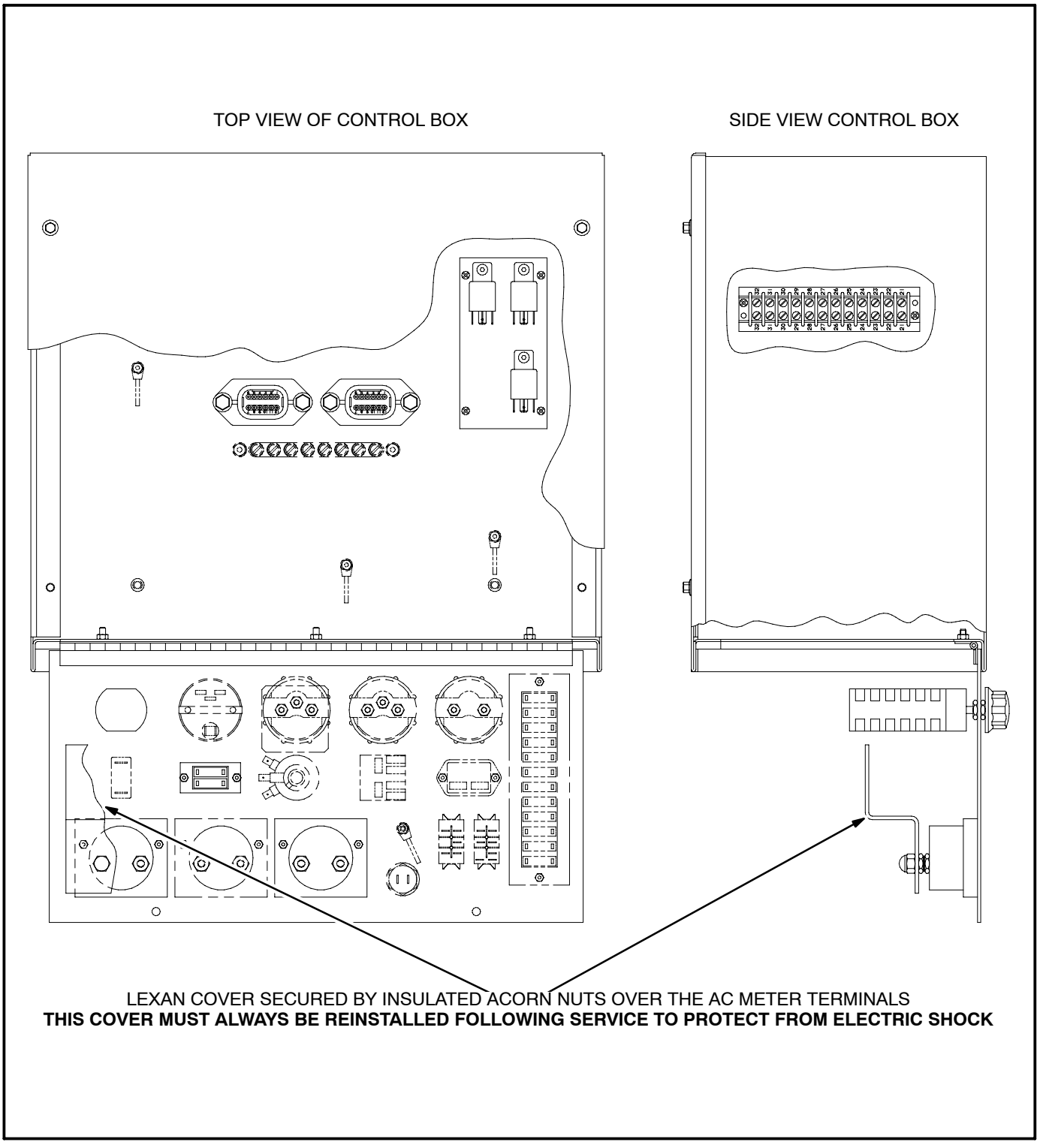


FIGURE 2-2. TYPICAL AC CONTROL PANEL COMPONENTS

AC POWER OUTPUT BOX

Figure 2-3 illustrates the power output box, which is part of the right-hand side of the generator enclosure (facing generator end). See the reconnection diagram on Page 7-11 for line connections.

⚠WARNING ***HAZARDOUS VOLTAGE Touching uninsulated live parts inside the AC power output box can result in severe personal injury or death. Shut down the set and disconnect ALL power sources to the generator set before removing the cover of the AC power output box. See Figure 2-3.***

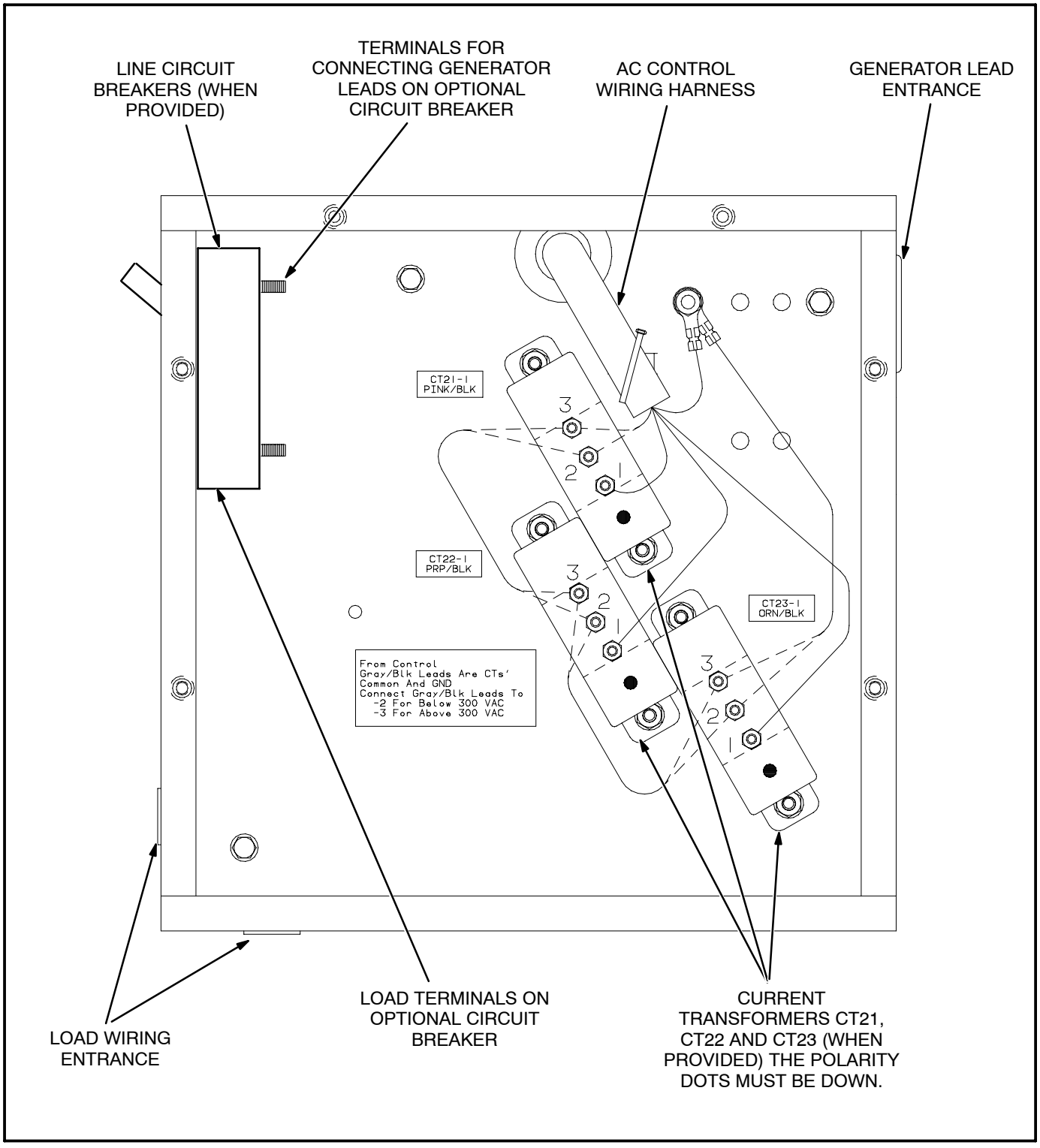


FIGURE 2-3. POWER OUTPUT BOX

AUTOMATIC VOLTAGE REGULATOR (AVR) ADJUSTMENTS

The voltage regulator controls the output of the generator so that a constant voltage is maintained under varying load conditions. There are two types of automatic voltage regulators used on these sets, which are shown in Figures 2-4 and 2-5. For reference purposes only, they are identified as **AVR-A** and **AVR-B**.

The automatic voltage regulator is accessible by folding down the front panel or by removing the top cover of the control box. It is mounted on a plate on the wall opposite the control panel. Note the orientation of the voltage regulator on its mounting plate with terminal block **VR21** at the bottom.

These measurements and adjustments are done while the set is running and require access to uninsulated high voltage parts in the control box and power output boxes.

⚠ DANGER ***HAZARDOUS VOLTAGE. Touching uninsulated high voltage parts inside the control and power output boxes can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching high voltage parts.***

For your protection, stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry and wear elbow length insulating gloves.

Voltage Adjustments (AVR-A and B)

Use the control panel mounted output voltage trimmer (see Figure 2-1), for small voltage adjustments. Measure generator output voltage while the set is running without load at the nominal frequency. If the trimmer does not provide enough adjustment, lock it at its midpoint. Then turn the **VOLTS ADJUST** pot (Figure 2-4 or 2-5) until rated voltage is obtained. Turn clockwise to increase output voltage; counterclockwise to decrease output voltage.

If there is no output voltage, flash the field as follows:

1. Assemble a 6 volt battery and 12 amp, 300 volt diode and 18 volt voltage suppressor as shown in Figure 2-6 or Figure 2-7.

   ⚠ CAUTION ***The voltage regulator could be damaged if the flashing circuit is connected for more than 5 seconds.***

2. While the set is running at nominal frequency, momentarily connect the positive (+) side of the circuit to voltage regulator terminal **VR21-F1** and the negative side (–) to voltage regulator terminal **VR21-F2**. (Refer to Figure 2-6 or Figure 2-7.)
3. Check output voltage, shut down the set and restart it. See *Troubleshooting* if output voltage does not build up without field flashing.

Voltage Stability Adjustment (AVR-A Only)

Voltage stability is set at the factory, but If printed circuit board AVR-A has been replaced or if damping potentiometer **R27** has been unnecessarily adjusted it may be necessary to reset stability. Set stability as follows.

1. With generator set running at no load, turn potentiometer **R27** (Figure 2-4) to a position where voltage tends to be unstable or hunt.
2. Turn **R27** clockwise slowly until voltage first stabilizes. This setting will result in stable voltage under all conditions in maximum voltage regulator response time.

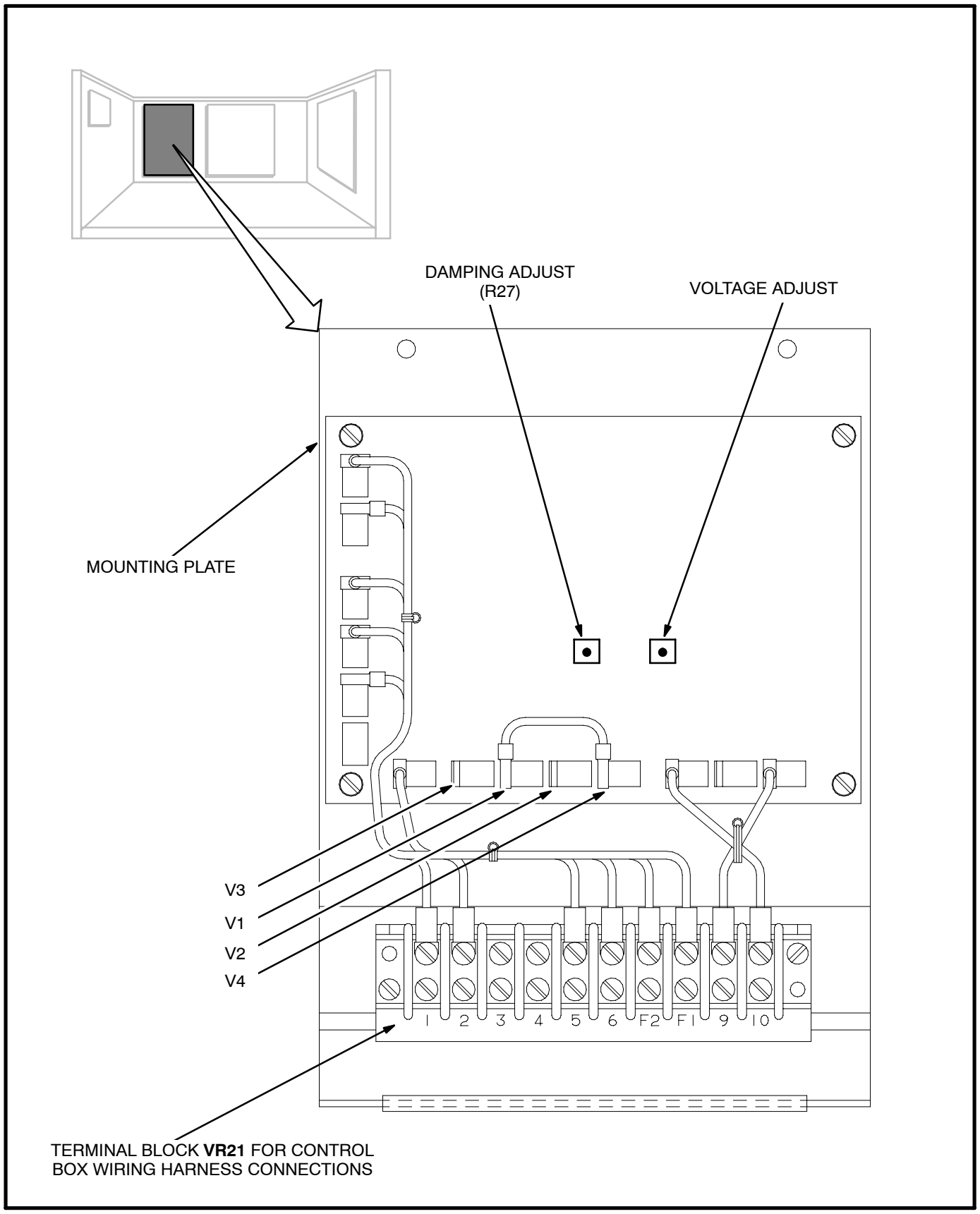


FIGURE 2-4. AVR-A VOLTAGE REGULATOR

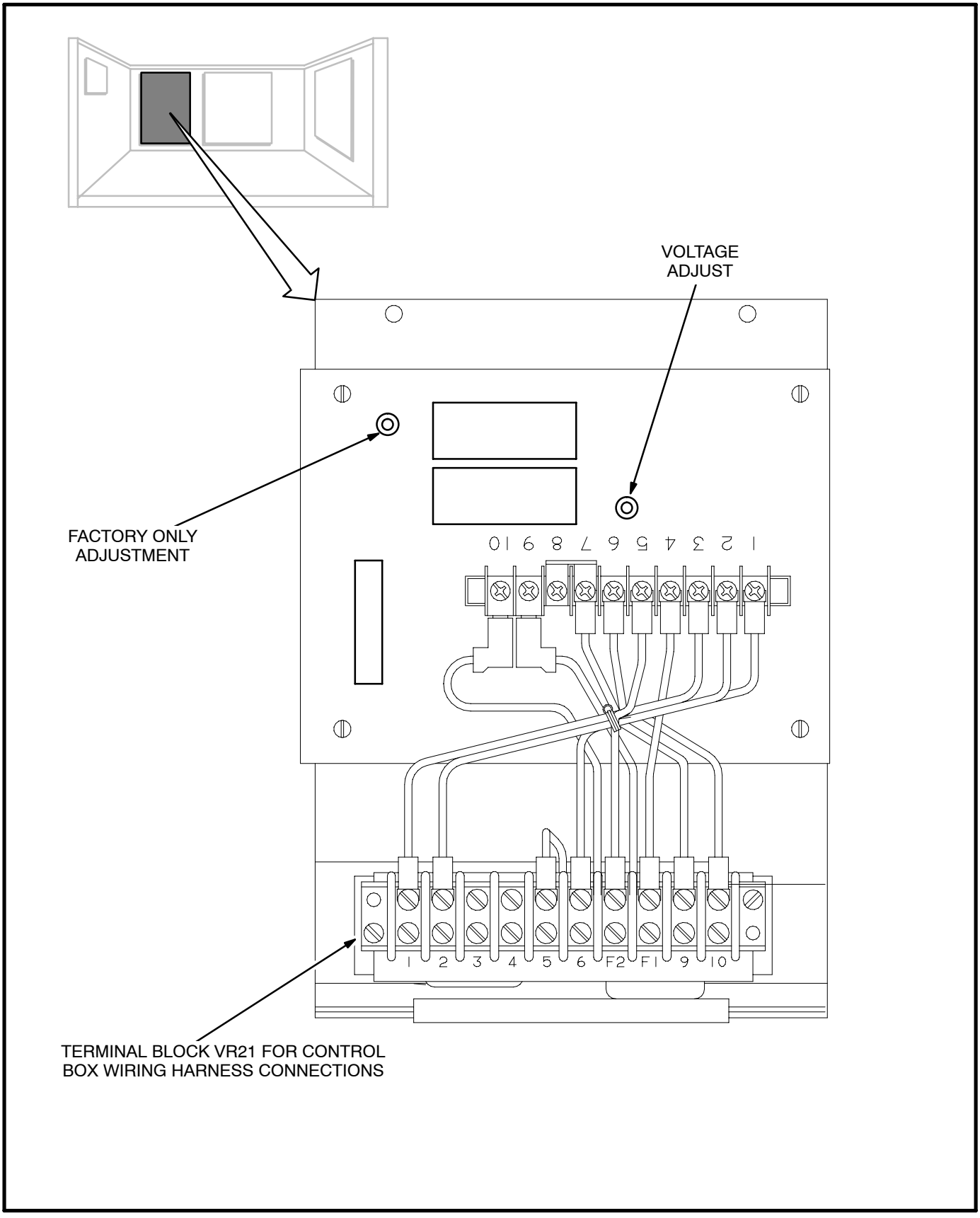
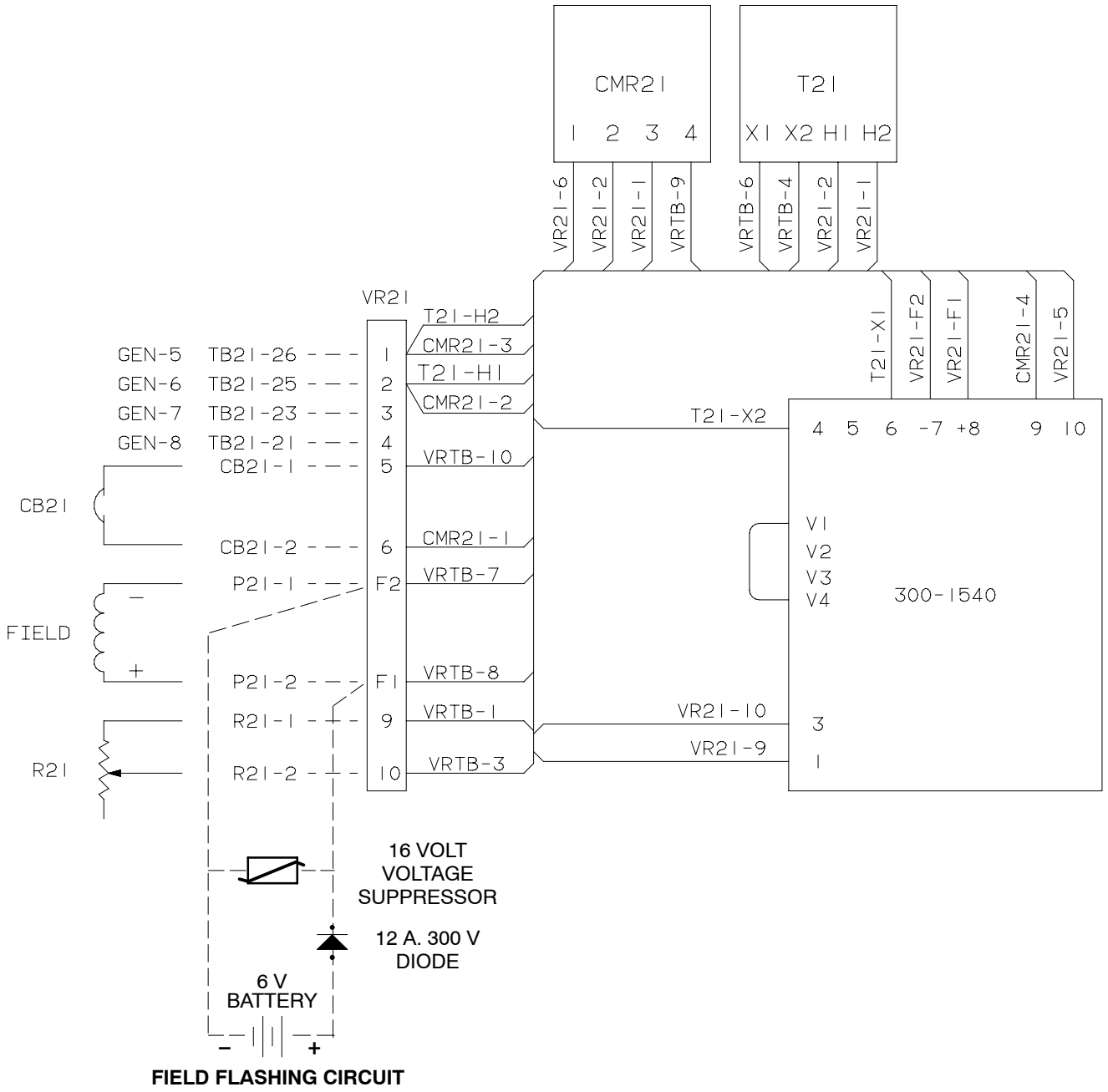


FIGURE 2-5. AVR-B VOLTAGE REGULATOR

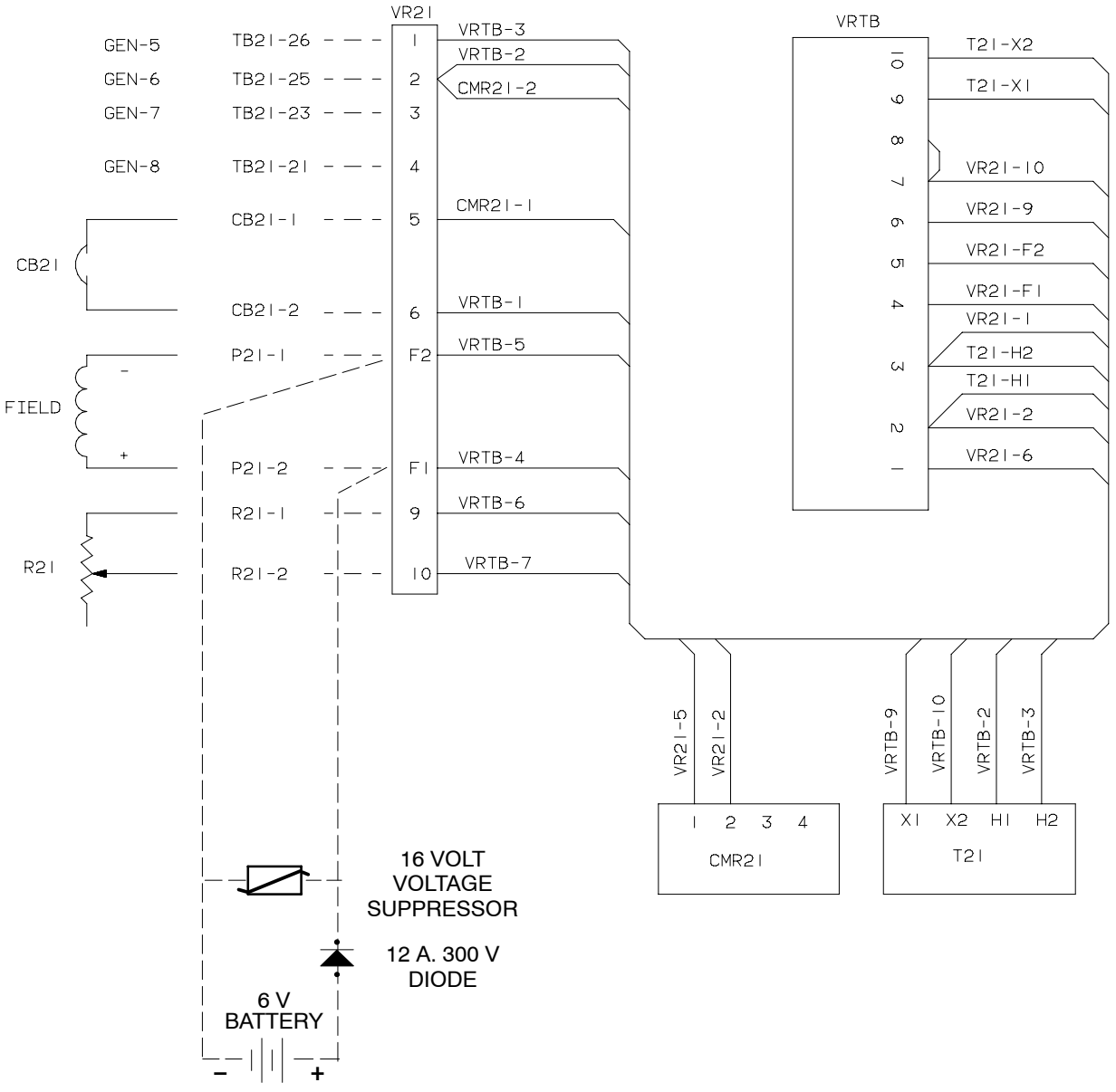


FIELD FLASHING CIRCUIT

— NOTES —

1. Connect jumper from V4-COM to V1, 2 or 3 according to voltage reconnecting diagram. Applies to 300-1540 only.
2. 60 Hz operation: connect T21-X1 to VR21-6. 50 Hz operation: connect T21-X1 to VR21-5. Generators are not 50/60 Hz reconnectable.

FIGURE 2-6. VOLTAGE REGULATING CIRCUIT USING AVR-A (P/N 300-1540)



FIELD FLASHING CIRCUIT

— NOTES —

1. For 50 Hz operation, jumper is required between TB1-7 & TB1-8. Not required for 60 Hz. Generators are not 50/60 Hz reconnectable.

FIGURE 2-7. VOLTAGE REGULATING CIRCUIT USING AVR-B (P/N 305-0688)

PRINCIPLE OF GENERATOR OPERATION

Refer to Figure 2-8 while working through the following explanation.

1. The generator field (main rotor) is rotated by the engine to induce output current (AC) in the main stator windings.
2. Generator output current is proportional to field strength, which is varied to match the load. Output voltage and frequency are held constant by the voltage regulator and engine governor, respectively.
3. Generator field strength is proportional to field current, which is supplied by the exciter.
4. The exciter field (stator) induces current in the exciter rotor windings. A full wave rectifier bridge (rotating rectifiers) mounted on the exciter rotor converts exciter output (3-phase AC) to DC. The exciter rotor is mounted on the main rotor shaft.
5. Exciter output current is proportional to exciter field current.
6. The automatic voltage regulator regulates exciter field current by comparing generator output voltage and frequency with reference values.
7. Exciter field current is supplied by the generator stator through the voltage regulator. Residual field magnetism initiates “self–excitation” during startups.

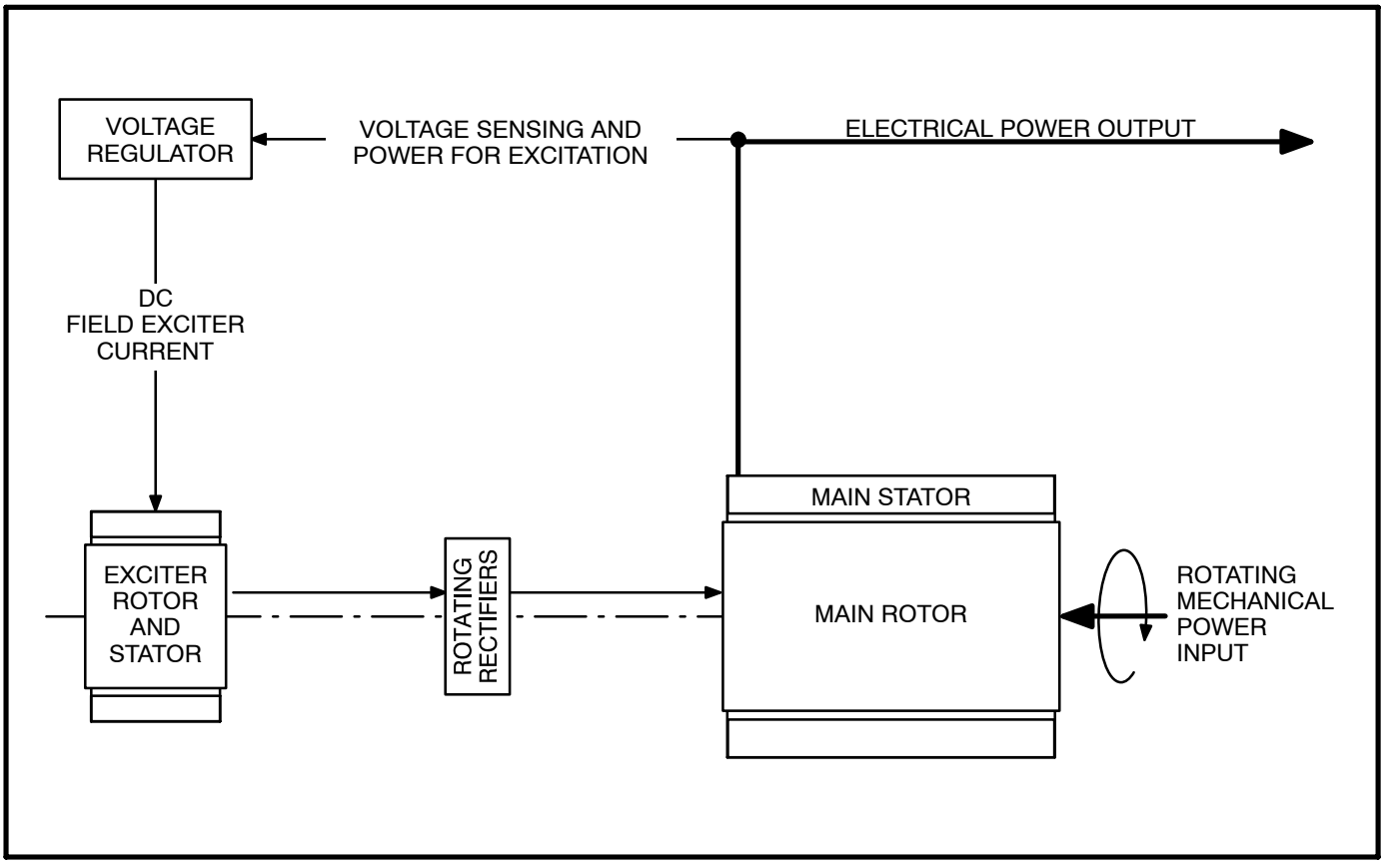


FIGURE 2-8. SCHEMATIC OF GENERATOR OPERATION

3. DC Control

DC CONTROL PANEL COMPONENTS

Figure 3-1 points out the components on the control panel that have to do with DC (engine) control and monitoring. Some of the components shown are optional. Page 7-8 is a connection diagram for all the DC components in the control box.

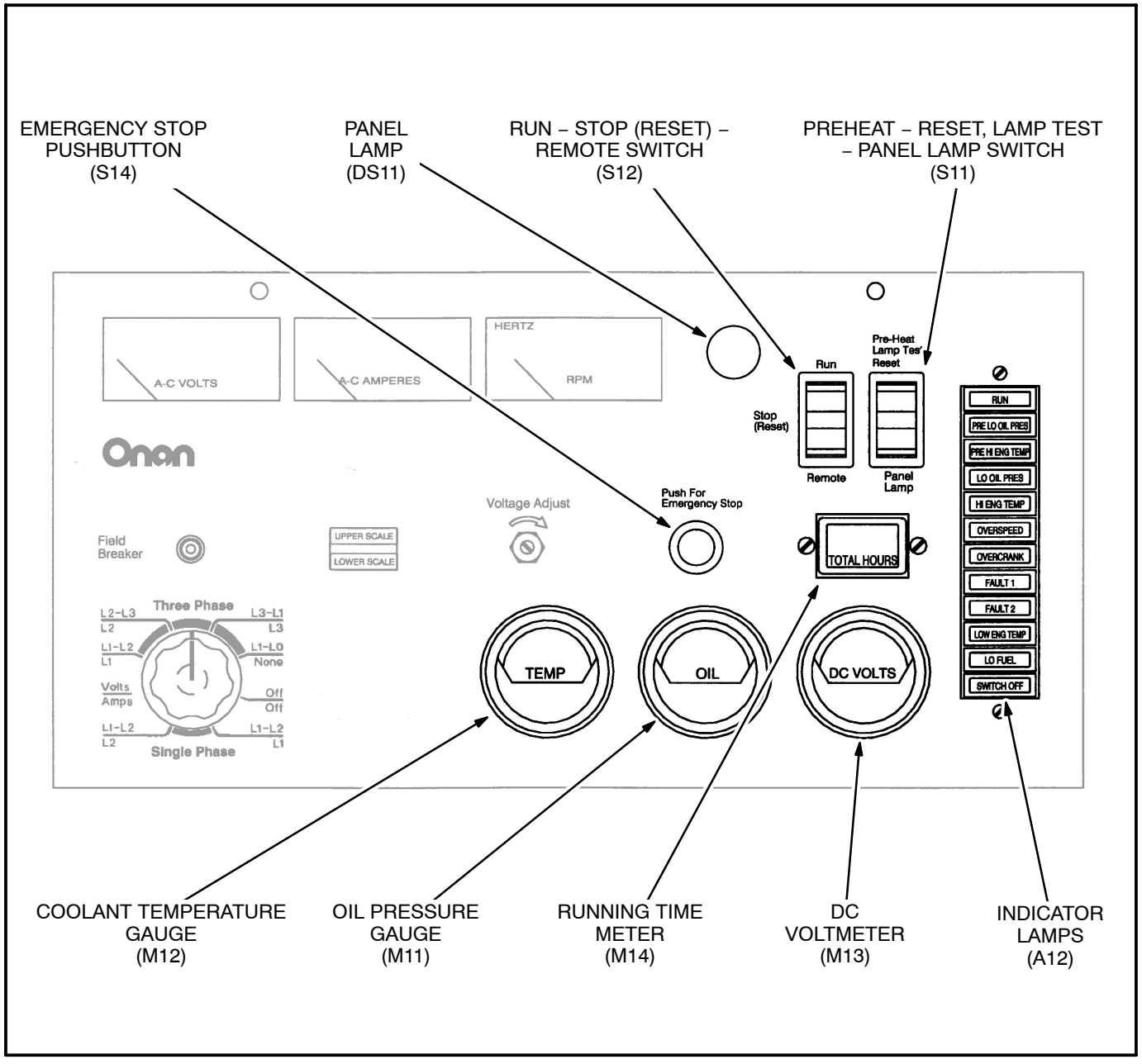


FIGURE 3-1. TYPICAL DC (ENGINE) CONTROL PANEL COMPONENTS

Run – Stop – Remote Switch (S12):

- Push the switch to the **Run** position to start and run the generator set.
- Push the switch to the **Stop** position to stop the set. (The switch must be in the **Stop** position when the reset switch is used to restore generator set operation following a fault shutdown.)
- Push the switch to the **Remote** position to allow a remote controller to automatically run the set.

Preheat – Reset, Lamp Test – Panel Lamp Switch (S11):

- Push the switch to the **Preheat** position (momentary contact) to manually preheat the engine combustion chambers before starting. (This is normally accomplished automatically by the preheat module [A15] inside the control box when the set is operated remotely.)
- Push the switch to the **Reset, Lamp Test** position (momentary contact) to reset the engine control to restore operation following a fault shutdown (the **Run – Stop – Remote** switch must be in the **Stop** position for reset to occur) and to test the indicator lamps. Replace lamps that do not light. Also, this switch has a light which lights following a fault or emergency shutdown. the light remains lit until the engine control has been reset.
- Push the switch to the **Panel Lamp** position to light the panel illumination lamp.

Panel Lamp (DS11): The panel lamp illuminates the control panel.

Coolant Temperature Gauge (M12): The coolant temperature gauge indicates engine coolant temperature.

Oil Pressure Gauge (M11): The oil pressure gauge indicates engine oil pressure.

DC Voltmeter (M13): The DC voltmeter indicates voltage across the battery terminals during operation.

Emergency Stop Button (S14) (Optional): The emergency stop button is a red, push-in switch used to stop the engine. The button lights up when it is pushed in. The button has to be pulled out and the engine control reset to restore operation.

Running Time Meter (M14): The hour meter indicates the accumulated number of hours the set has run. It cannot be reset.

Indicator Lamps (A12): Figure 3-1 illustrates the Detector-12 indicator lamp assembly. The Detector-7 indicator lamp assembly has all but the last five of the following lamps.

- **Run (Green)** This lamp indicates that the generator set is running and that the starter has been disconnected.
- **Pre Low Oil Pressure (Yellow)** This lamp indicates that engine oil pressure is abnormally low (less than 20 psi).
- **Low Oil Pressure (Red)** This lamp indicates that the engine shut down because of excessively low engine oil pressure (less than 14 psi).
- **Pre High Engine Temperature (Yellow)** This lamp indicates that engine coolant temperature is abnormally high (greater than 220° F).
- **High Engine Temperature (Red)** This lamp indicates that the engine shut down because of excessively high engine coolant temperature (greater than 230° F) or low coolant level.

- **Overspeed (Red)** This lamp indicates that the engine shut down because of overspeed.
- **Overcrank (Red)** This lamp indicates that the engine shut down because it did not start during the timed cranking period (approximately 75 seconds, including two rest periods).
- **Fault 1 (Red)** This lamp indicates that the engine shut down because of a system fault. The customer has to make connections to use this lamp. The lamp is a part of a 10 second time delay shutdown circuit. The customer can make reconnections for non-timed shutdown or warning only. See Engine Monitor (A11). Also, the lense might have been changed to indicate more specifically the fault or warning, such as "**CB Trip**" or "**O**/**U Voltage**".
- **Fault 2 (Red)** This lamp indicates that the engine shut down because of a system fault. The customer has to make connections to use this lamp. The lamp is part of a non-time delay shutdown circuit. The customer can make reconnections for 10 second time delay shutdown or warning only. See Engine Monitor (A11). Also, the lense might have been changed to indicate more specifically the fault or warning, such as "**CB Trip**" or "**O**/**U Voltage**".
- **Low Engine Temperature (Yellow)** This lamp indicates that engine temperature is less than 70° F, and the possibility that the engine might not start.
- **Low Fuel (Yellow)** This lamp indicates that the fuel level in the supply tank has dropped to less than the reserve necessary to run the set at full load for the prescribed number of hours. The customer has to make connections to use this lamp.
- **Switch-off (Flashing Red)** This lamp indicates that the **Run** / **Stop** / **Remote** switch is in the **Stop** position, which prevents remote, automatic operation.

ENGINE MONITOR (A11)

The heart of the engine control system is the engine monitor (A11). It is a printed circuit board assembly mounted on the right wall of the control box (Figure 3-2). It starts and stops the engine in response to the control panel switches, engine sensors and remote control signals.

Terminals and Connectors

See Pages 7-8 through 7-10 for the connection and schematic drawings for the DC control system. See Page 7-12 for typical customer connections at terminal boards **TB1** and **TB2** on the engine monitor and page 7-13 if the set is also equipped with the auxiliary relay board.

Fuses

The engine monitor has five replaceable fuses to protect it from overloads and groundfaults. They are:

F1 Starter solenoid circuit, 20 amps

F2 Fuel solenoid (switched B+) circuits, 20 amps

F3 Continuous B+ out to remote circuits, 15 amps

F4 Engine monitor circuits, 5 amps

F5 Engine gauge circuits, 5 amps.

Function Selection Jumpers

The board has six selection jumpers that can be repositioned to provide the following timed or non-timed warnings or timed or non-timed shutdowns with warnings:

W1 Jumper Position (jumper **W8** must be in the **B** position):

- **A** Non-timed warning under **FLT 2** conditions.
- **B** Non-timed shutdown and warning under **FLT 2** conditions.
- **C** Timed warning under **FLT 2** conditions.
- **D** Timed shutdown and warning under **FLT 2** conditions.

W2 Jumper Position (jumper **W9** must be in the **B** position):

- **A** Non-timed warning under **FLT 1** conditions.
- **B** Non-timed shutdown and warning under **FLT 1** conditions.
- **C** Timed warning under **FLT 1** conditions.
- **D** Timed shutdown and warning under **FLT 1** conditions.

W6 Jumper Position:

- **A** Warning under **Pre-High Engine Temperature** conditions.
- **B** Shutdown and warning under **Pre-High Engine Temperature** conditions.

W7 Jumper Position:

- **A** Warning under **Pre-Low Oil Pressure** conditions.
- **B** Shutdown and warning under **Pre-Low Oil Pressure** conditions.

W8 Jumper Position:

- **A** Warning while running or during standby under **FLT 2** conditions.
- **B** Allows selection of functions with **W1** jumper.

W9 Jumper Position:

- **A** Warning while running or during standby under **FLT 1** conditions.
- **B** Allows selection of functions with **W2** jumper.

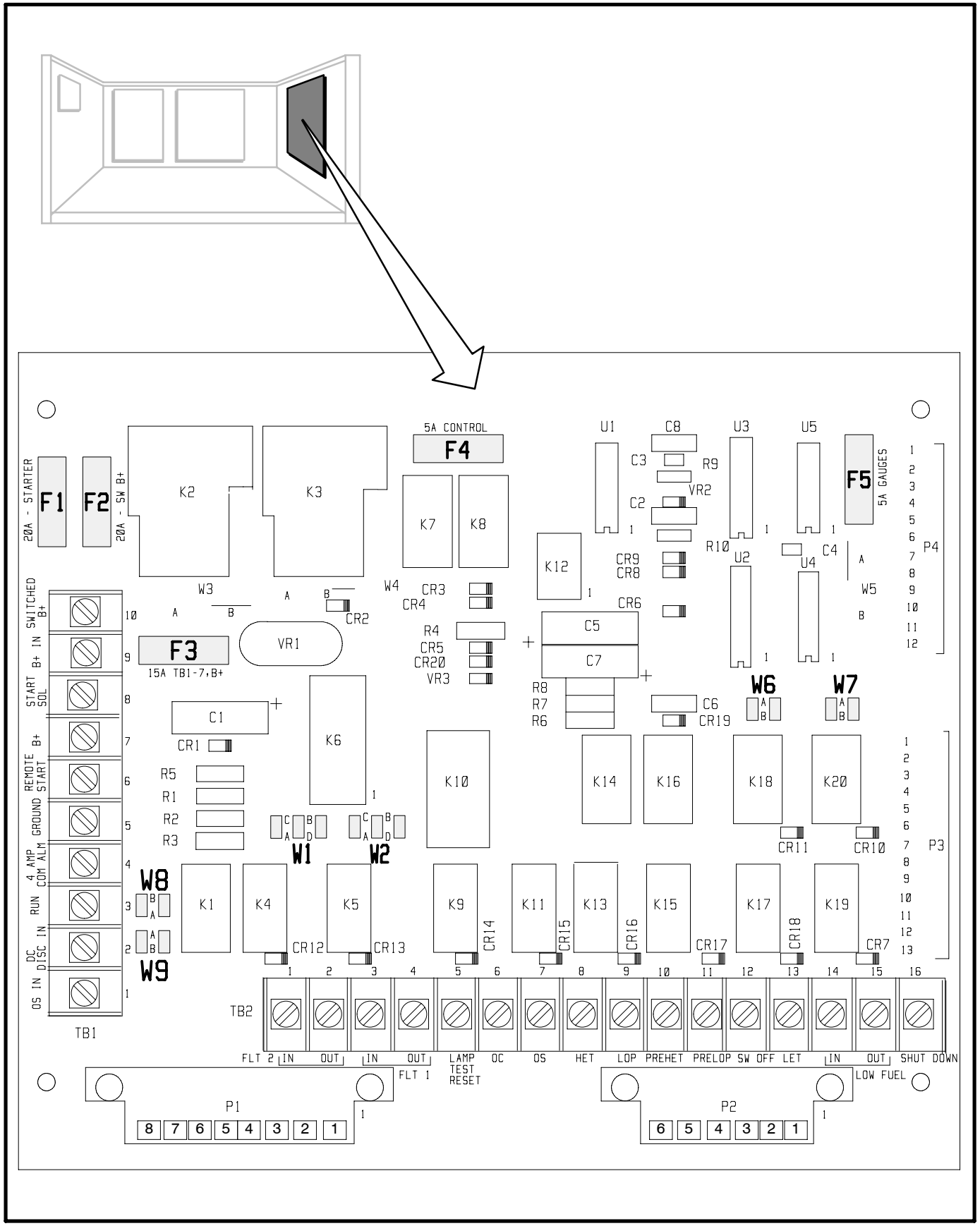


FIGURE 3-2 ENGINE MONITOR FUSES AND FUNCTION SELECTION JUMPERS

OPTIONAL AUXILIARY RELAY BOARD (A28)

The following describes the design/functional criteria for the auxiliary relay board (ARB) with a Detector-7 or -12 Genset control. When provided, the board is mounted on the back wall of the control box. See Figure 3-3. There are two versions of the ARB; with and without the set of 12 Fault relays. Page 7-13 is a detailed connection diagram for the ARB.

Terminal Blocks:

- **TB1** – ARB TB1 and engine monitor TB1 are identically numbered and provide the same remote control connection points. Note that additional terminals are provided for terminals 5, 7, and 10 of ARB TB1.

- **TB2 through TB5** – Connection points for relays K1 through K3. TB2 provides the N/O and N/C connections (three form 'C' contacts for each relay). TB3 through TB5 provide the common connection points (TB3 for K1, TB4 for K2 and TB5 for K3).

- **TB6 and TB7** – Connection points for fault relays K4 through K15. Three terminals are provided for each relay, which are labeled COM, N/C, N/O.

Plug-In Relays (K1, K2, K3): The ARB can be equipped with one to three 3-pole, double-throw relays. These relays (K1, K2, K3) are field changeable plug-in relays for easy field addition and replacement.

Each relay can be operated as a RUN, COMMON ALARM, or ISOLATED COIL with the changing of a jumper.

The relay contact ratings are:

- 10 amps at 28 VDC or 120 VAC, 80% PF

- 6 amps at 240 VAC, 80% PF

- 3 amps at 480 VAC, 80% PF

Jumper Positions for Plug-In Relays: Jumpers W1, W2 and W3 perform the same functions for their respective relays, W1 for relay K1, W2 for relay K2, and W3 for relay K3. They can be located in any of 3 positions (A, B, C) independently of each other.

- **Jumper Position A (Run)** – The relay operates as a Run relay, energizing when SW B+ is applied from the engine monitor.

- **Jumper Position B (Common Alarm)** – The relay operates as a Common Alarm relay. The relay energizes any time there is an engine shutdown. This signal is provided from the engine.

- **Jumper Position C (Isolated)** – The relay operates as an Isolated relay. The relay coil is energized by a customer applied B+ signal through the terminal block; TB3-1 for relay K1, TB4-1 for relay K2, and TB5-1 for relay K3.

Jumpers W11, W12, and W13 perform the same functions for their respective relays; W11 for relay K1, W12 for relay K2, and W13 for relay K3. They can be located in two different positions (A, B) independently of one another.

- **Jumper Position A** – The relay operates isolated from the board. The customer provides the circuit completion through terminal block; TB3 for relay K1, TB4-5 for relay K2, and TB5-5 for relay K3. The customer can operate the relay with switched ground logic or use this relay in the middle of more complex logic circuits if needed.

- **Jumper Position B** – The relays operate with the coils connected to ground through the board connections. The coil will require a B+ signal to energize with the jumper in this position.

Fault Relays (K4 through K15): These optional relay modules are used to operate a remote alarm annunciator that has an independent power source. This allows the use of either AC or DC for alarm drives. The relays are energized through the latching relays on the engine monitor and provided N/O and N/C contacts for each external alarm connection.

The 12 relays with form 'C' contacts are rated:

- 10 Amp, 120 VAC

- 10 Amp. 30 VDC

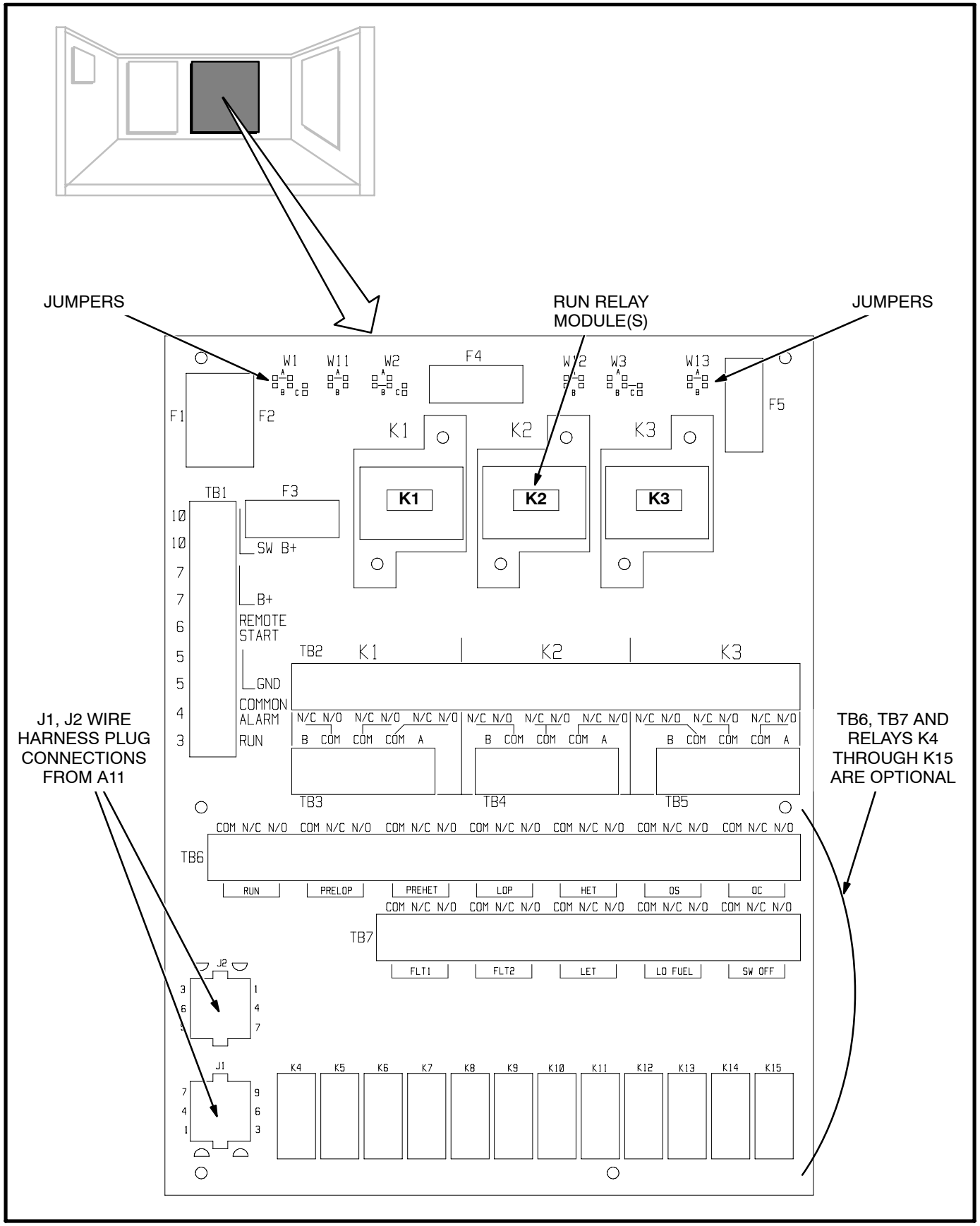


FIGURE 3-3. AUXILIARY RELAY BOARD (ARB)

PREHEAT/TIME-DELAY MODULE (A15)

The start delay is adjustable from 1/2 to 15 seconds and the stop delay from 1 to 30 minutes. Turn the delay adjusting potentiometers clockwise to increase delay and counterclockwise to decrease delay. Pre-heat occurs during the delayed start period and continues through cranking.

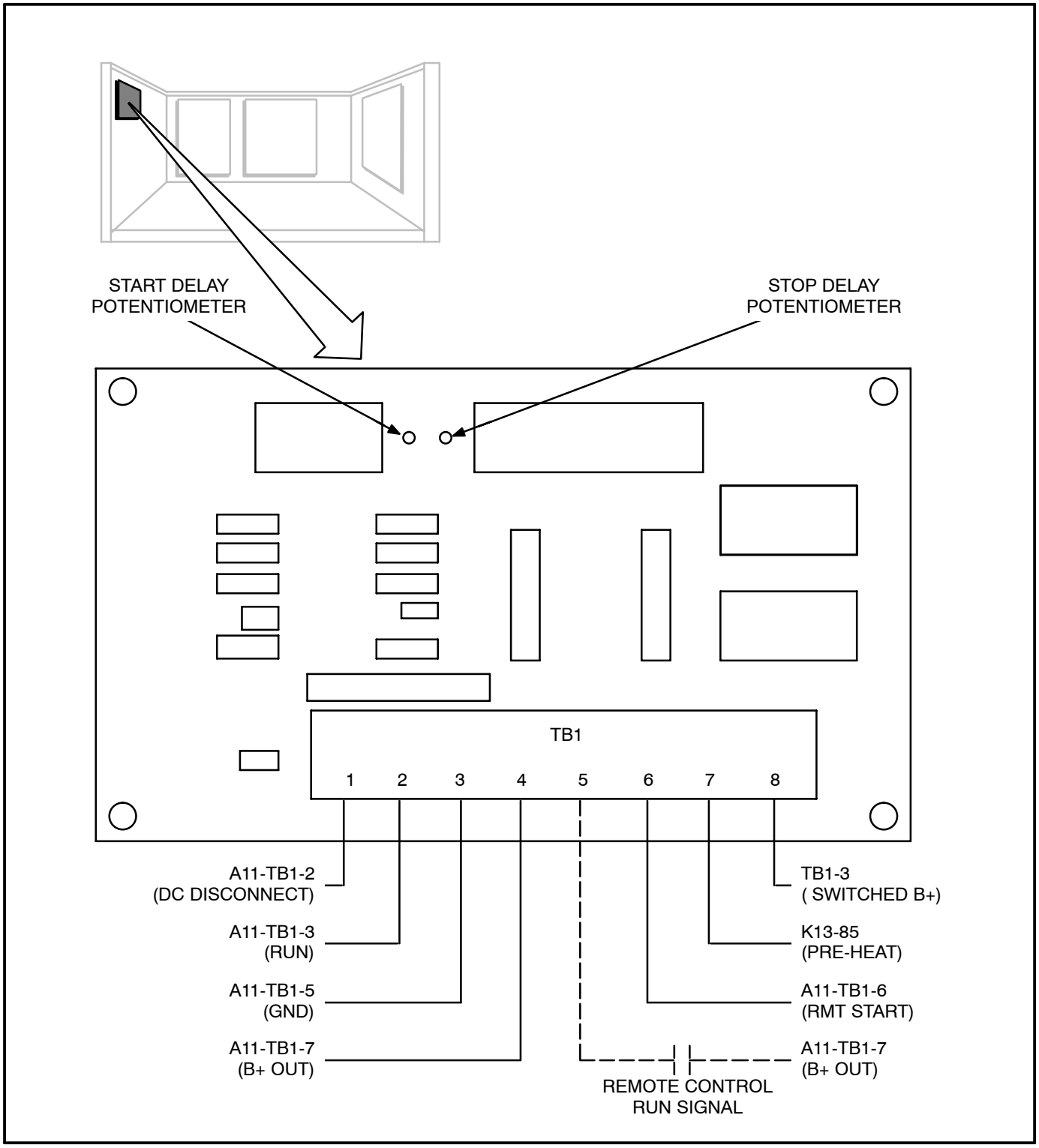


FIGURE 3-4. PREHEAT/TIME-DELAY MODULE

COOLANT TEMPERATURE GAUGE AND WARNING LIGHT CIRCUITS

An electronic PCB assembly is mounted on the back of the coolant temperature gauge (M12) with three terminal nuts. The PCB assembly carries two relays that provide signals for the low engine temperature and pre-high temperature warning lamps on the basis of the gauge sender output. See Figure 3-5.

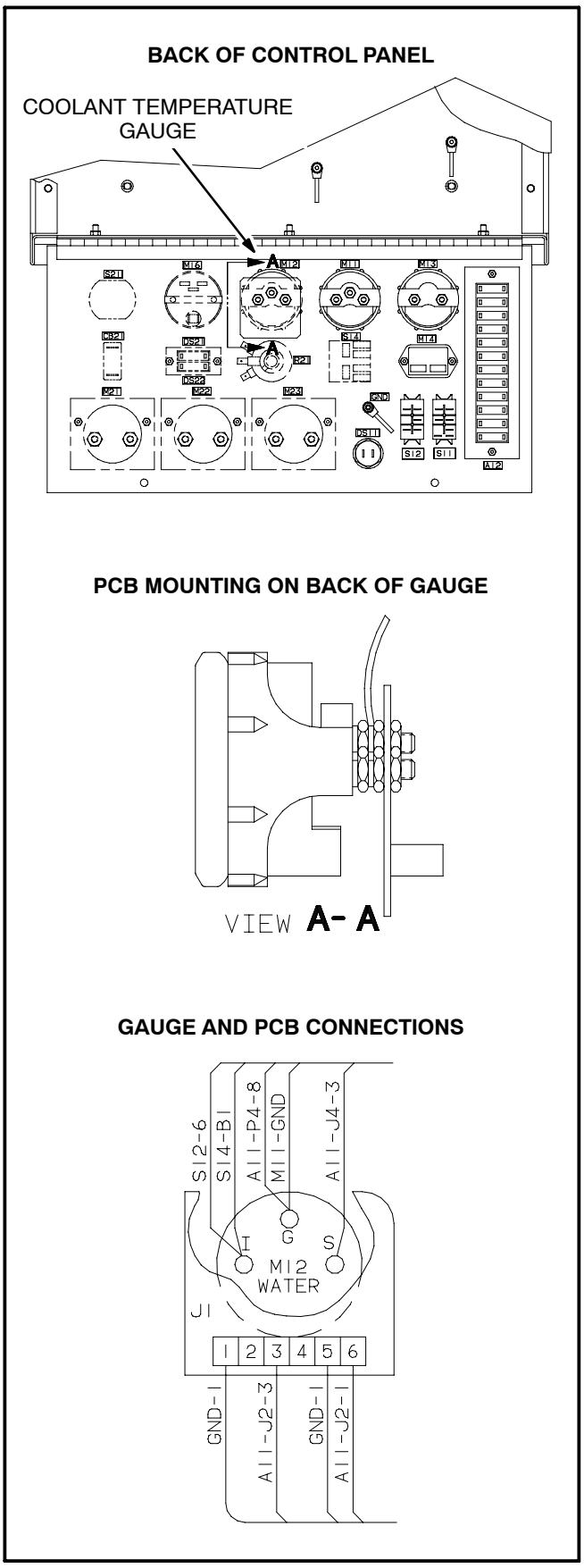


FIGURE 3-5. COOLANT TEMPERATURE GAUGE

RELAYS K11, K12 AND K13

Relays **K11**, **K12** and **K13** are provided for the switched B+, starter and glow plug circuits to handle the higher DC currents in these circuits. They feed through terminal block **TB1** to the engine wiring harness.

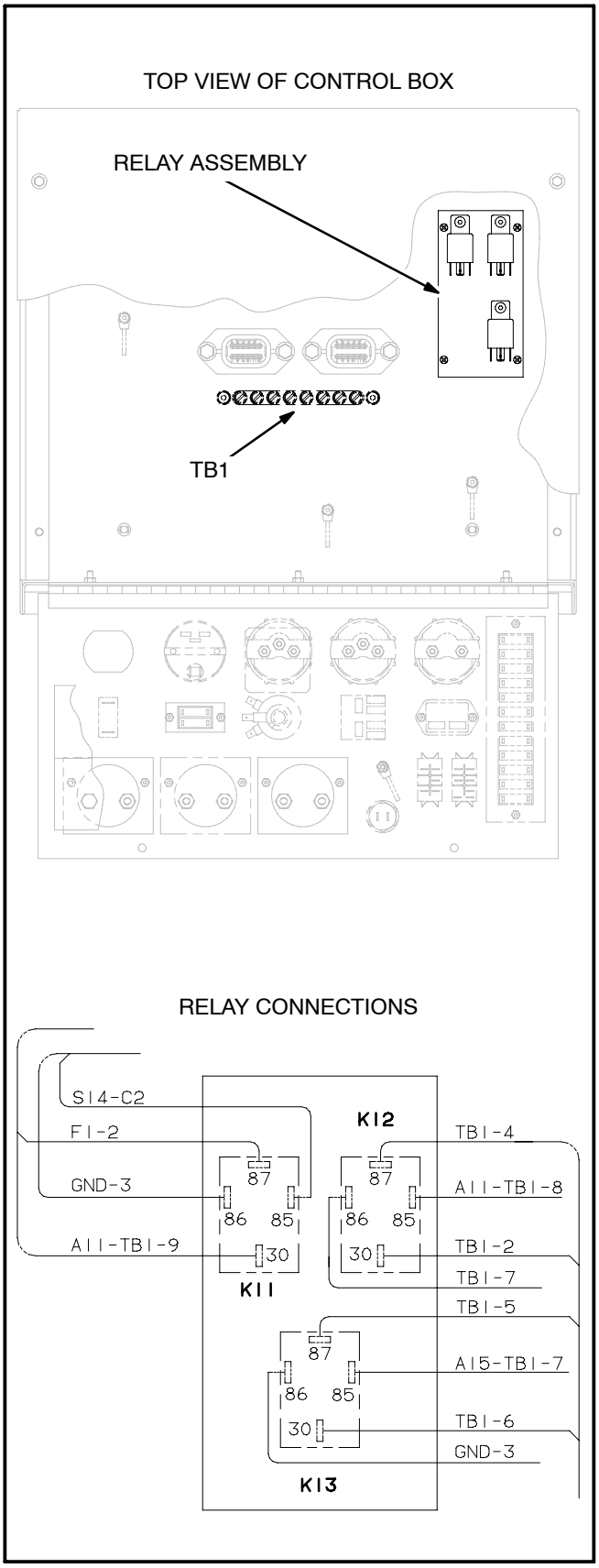


FIGURE 3-6. RELAYS K11, K12 AND K13

SEQUENCE OF OPERATION

The sequence of operation is as follows. Refer to the schematic on Page 7-9.

1. The engine monitor (A11) is powered by battery voltage (12 VDC). Terminal **TB1-9** is connected to battery positive (+) and terminal **TB1-5** to battery negative (-).

2. The manual starting cycle begins by pressing and holding preheat switch **S11** in the **Preheat** position for one minute if below 55° F (13° C) or thirty seconds if above 55° F (13° C) prior to pushing run switch **S12** to the **Run** position. **S11** should be kept in the **Preheat** position while cranking until the engine starts.

3. The automatic starting cycle begins when a start signal is received from the transfer switch and switch **S12** is in the **Remote** position. (The transfer switch is connected by the customer to terminal **5** of time delay/preheat module **A15**. After the preset start delay, **A15** sends the start signal to engine monitor terminal **A11-TB1-6**.)

4. During the start delay period and extending through the cranking period, terminal **A15-7** (time delay/preheat module) energizes the coil of relay **K13**, energizing the cylinder glow plugs.[1]

5. The start signal received at engine monitor terminal **A15-TB1-5** (automatic) or **A11-P4-6** (manual), causes engine monitor **A11** to energize the engine gauges and terminals **A11-TB1-8** and **A11-TB1-10**.

6. **A11-TB1-10** energizes the coil of relay **K11** to energize the SW B+ circuit.

7. **A11-TB1-8** energizes the coil of relay **K12** (starter circuit).

8. With the fuel solenoid pulled in and 12 VDC to the starter and glow plugs, the engine should crank, start and run up to governed speed in a matter of seconds.

9. The engine monitor disconnects the starter when engine speed reaches approximately 660 RPM. There are two, redundant, starter disconnect circuits. One is activated by 120 VAC generator output voltage (plug connectors **A11-P1-1** and **A11-P1-2**). The other is activated by 12 VDC through the start disconnect centrifugal switch (plug connector **A11-P1-5**).[2]

10. Shutdown occurs if the engine does not start within 75 seconds. The **Overcrank** indicator lamp lights and common alarm terminal **A11-TB1-4** is powered.

    The engine monitor has a cycle crank feature whereby the engine is cranked for three 15 second periods alternated with two 15 second rest periods.

11. Shutdown occurs during operation when a low oil pressure (S1) or high engine temperature (S2) is detected, or the emergency stop button (S14) is pressed. The appropriate fault indicator lamp lights and common alarm terminal **A11-TB1-4** is powered. (There is no fault lamp for emergency stop. The switch button will light, however, and the light in switch S11 will light.)

    The low oil pressure and high engine temperature shutdowns have 10 second time delays to allow oil pressure and engine temperature to stabilize during startup.

12. To restore operation after a shutdown fault has been serviced, reset the engine monitor by pushing the panel **Stop** switch and then the **Reset** switch. The set should run or be ready to run when the panel switch is pushed to **Run** or to **Remote**.

    If the emergency stop switch has been used, the control will have to be reset to restore operation. First pull the emergency stop switch button and then push the panel Stop and Reset switches.

13. The set is stopped manually by pressing the panel **Stop** switch or automatically by the transfer switch. (The panel switch must be in the **Remote** position for remote, automatic operation.)

1. The transfer switch may also have a preset start delay period. Preheat is a function of module **A15** only, and does not begin until **A15** receives the start signal.

2. If the starter disconnects normally but the local control panel **Run** indicator light does not come on, the DC start disconnect circuit (start disconnect module) may not be working. If the starter disconnects normally but neither the local nor the remote **Run** indicator light comes on, the AC start disconnect circuit may not be working. See *Section 4. Troubleshooting*.

4. Troubleshooting

These troubleshooting charts are designed to help you think through generator set problems. To save time troubleshooting, read the entire manual ahead of time to understand the generator set. Try to think through problems. Go over what was done during the last service call. The problem could be as simple as an empty fuel tank, closed fuel shutoff valve, loose wire, blown fuse or tripped circuit breaker.

THE ENGINE DOES NOT CRANK IN RUN MODE	
⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***	
Possible Cause	**Corrective Action**
1. The **Emergency Stop** switch has been used. (No fault lamp is on.)	Pull the **Emergency Switch** button. To reset the engine control, push the **Run-Stop-Remote** switch to **Stop** and the **Reset** switch to **Reset**. Then push the **Run-Stop-Remote** switch to **Run**.
2. A **Fault Shutdown** is being indicated by one of the red lights on the control panel.	Service the set as necessary. To reset the engine control, push the **Run-Stop-Remote** switch to **Stop** and the **Reset** switch to **Reset**. Then push the **Run-Stop-Remote** switch to **Run**.
3. Cranking voltage is too low to crank the engine.	a. Clean and tighten or replace the positive (+) and negative (–) battery cable connectors and cables at the battery and the set. b. Recharge or replace the battery. Specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C). c. If the set is in standby service, install a battery charger. d. Adjust charge rate of battery charging circuit. Refer to *Battery Charge Rate Adjustment* in Section 5.
4. The **starter motor** or **solenoid** is malfunctioning.	Push the **Run-Stop-Remote** switch to **Run** and check for battery voltage (12 VDC) at starter solenoid terminal **SW**. Replace the starter motor if there is voltage but the motor does not function.
5. Fuse **F1** on engine monitor board A11 has blown.	a. Replace the fuse with one of the same type and amp rating (20 A). b. If fuse **F1** blows again, the wire between **A11-TB1-8** and terminal **85** on relay **K12** in the control box may be loose and shorting to ground. Repair as necessary. c. If fuse **F1** still blows, replace relay **K12**.

THE ENGINE DOES NOT CRANK IN RUN MODE (CONT.)

⚠ **WARNING** ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
6. Fuse **F2** on engine monitor board A11 has blown.	a. Replace the fuse with one of the same type and amp rating (20 A). b. If fuse **F2** blows again, either the wire between terminal **A11-TB1-10** and emergency stop switch S14 terminal **S14-C-1** or between **S14-C-2** and relay **K11** terminal **85** may be loose and shorting to ground. Repair as necessary. c. If fuse **F2** still blows, replace relay **K11**.
7. Fuse **F4** on engine monitor board A11 has blown.	a. Replace the fuse with one of the same type and amp rating (5 A). b. If fuse **F4** blows again, the lead to terminal **3** on switch **S12** (Run-Stop-Remote) or to terminal **5** on switch **S11** (Lamp Test-Reset–Preheat) or a lead in the indicator lamp (A12) harness or engine gauge (M11 through M16) harness may be loose and shorting to ground. Repair as necessary.
8. Fuse **F1** in the control box wiring harness has blown.	a. Replace the fuse with one of the same type and amp rating (30 A). b. If fuse **F1** blows again, check for loose wires that may be shorting to ground, including the leads to **TB1-3** and **A15-TB1-8** (Start/Stop delay module) in the control box and the red/orange leads in the engine wiring harness. Repair as necessary.
9. The black engine harness grounding lead from control box terminal **TB1-1** (bottom side) to the engine block **GND** terminal is loose, damaged or missing.	Check for electrical continuity (zero ohms) between **TB1-1** on the floor of the control box and the battery negative (–) terminal. Repair as necessary.
10. Emergency stop switch **S14** is faulty.	Bypass **S14** with a jumper lead from **A11-TB1-10** to terminal **85** on relay **K11**. If the engine can now start, replace **S14**.
11. Relay **K11** is faulty.	Push the **Run-Stop-Remote** switch to **Run** and check for battery voltage (12 VDC) at relay **K11** terminals **85** and **87** while the engine is cranking. Replace relay **K11** if there is voltage at terminal **85** but not at terminal **87**.

THE ENGINE DOES NOT CRANK IN RUN MODE (CONT.)

⚠ **WARNING** ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
12. Relay **K12** is faulty.	Push the **Run-Stop-Remote** switch to **Run** and check for battery voltage (12 VDC) at relay **K12** terminals **85** and **87**. Replace relay **K12** if there is voltage at terminal **85** but not at terminal **87**.
13. One of the following leads is loose, damaged or missing: **K12-87** to **TB1-4**, **TB1-4** to starter solenoid terminal **SW** (gray/orange), **K12-86** to **TB1-7**, or **TB1-7** to fuel solenoid auxiliary terminal.	Check, clean and tighten the connectors at both ends and replace the wire if it is damaged.
14. The **Run-Stop-Remote** switch (S12) or wiring is faulty.	a. Disconnect pin connector **J4** from engine monitor board A11 and check for electrical continuity (zero ohms) between switch terminals **2** and **3** when the switch is in the **Run** position and between terminals **1** and **2** when it is in the **Remote** position. Replace the switch if either set of contacts is faulty. b. If the switch works, check for electrical continuity (zero ohms) between **J4-6** and **J4-7** on the wire harness when the switch is in the **Run** position and between **J4-5** and **J4-6** when the switch is in the **Remote** position. Replace the wire harness if there is no electrical continuity in either position of the switch.
15. Engine monitor board **A11** is faulty. (Check fuses **F1**, **F2** and **F4** again.)	Push the **Run-Stop-Remote** switch to **Run** and check for battery voltage (12 VDC) at terminals **A11-TB1-8** and **A11-TB1-10**. Replace engine monitor board **A11** if there is no voltage at either terminal during cranking.

THE ENGINE DOES NOT CRANK IN REMOTE MODE

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The **Run-Stop-Remote** switch is at **Stop. (**The **Switch-Off** light will be flashing, if provided.)	Push the **Run-Stop-Remote** switch to **Remote.**
2. The **Emergency Stop** switch has been used. (No fault lamp is on.)	Pull the **Emergency Switch** button. To reset the engine control, push the **Run-Stop-Remote** switch to **Stop** and the **Reset** switch to **Reset**. Then push the **Run-Stop-Remote** switch to **Remote**.
3. A **Fault Shutdown** is being indicated by one of the red lights on the control panel.	Service the set as necessary. To reset the engine control, push the **Run-Stop-Remote** switch to **Stop** and the **Reset** switch to **Reset**. Then push the **Run-Stop-Remote** switch to **Remote.**
4. There is no remote circuit signal (12 VDC at **A15-TB1-5**) because fuse **F3** on engine monitor board A11 has blown.	a. Replace the fuse with one of the same type and amp rating (15 A). b. If fuse **F3** blows again, find and repair the fault in the remote control circuit, such as a loose wire that may be shorting to ground or a shorted relay coil or other component.
5. There is no remote circuit signal (12 VDC at **A15-TB1-5**) because the remote circuit is not functioning properly.	Apply 12 VDC to **A15-TB1-5**. If the engine cranks, find and repair the fault in the remote control circuit.
6. Start delay module **A15** is not functioning properly.	Check for misconnections (see Figure 3-4) and loose connections and replace start/stop delay module **A15** if there is 12 VDC at terminals **A15-TB1-4** and **A15-TB1-5** but not at **A15-TB1-6** after a time delay of up to 15 seconds.
7. Same as Steps 3 through 16 in the **RUN** mode.	Same as Steps 3 through 16 in the **RUN** mode.

THE ENGINE CRANKS BUT DOES NOT START

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The engine is not getting fuel.	a. Open any closed shutoff valve in the fuel line supplying the engine. b. Fill the main fuel supply tank. c. Restore fuel pump prime according to the Operator's Manual.
2. The air cleaner is blocked.	Service as necessary.
3. Low engine temperature is causing too low a cranking speed for starting.	a. Plug in, repair or install engine coolant and engine oil heaters. b. Replace the engine oil if it is not of the recommended viscosity for the ambient temperature.
4. Cranking voltage is too low to reach required cranking speed.	a. While cranking the engine, measure voltage directly across the battery terminals and then immediately across the starter motor terminal and the grounding bolt on the block. Cable, terminal or relay contact resistance is too high if the difference is more than 2 volts. Service as necessary. b. Recharge or replace the battery. Specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C). c. Adjust charge rate of battery charging circuit. Refer to *Battery Charge Rate Adjustment* in *Section 5*.
5. The preheat time delay is not long enough for the ambient temperature.	Adjust preheat/start delay module **A15** for up to 15 seconds preheat time delay if permitted by the applicable Codes. See *Section 3. DC Control*.
6. The glow plugs and manifold air heaters are not heating.	Each glow plug and manifold air heater should be warm to the touch if the engine has just been cranking. First clean and tighten the terminal of any cold glow plug and then replace it if necessary. If none of the glow plugs gets warm, go to Step 7.

THE ENGINE CRANKS BUT DOES NOT START(CONT.)

⚠ **WARNING** ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
7. Preheat/start delay module **A15** is not functioning properly.	If the glow plugs and manifold air heaters do not warm while cranking in either the **Run** or **Remote** modes, press the **Preheat** switch (S11) for ten seconds and verify if the glow plugs and manifold heaters are heating. a. If none of the glow plugs/manifold heaters get warm, go to Step 9. b. If any glow plug/manifold heater gets warm, open the control box and check for 12 VDC at terminals **A15-TB1-7** and **A15-TB1-8** on the preheat/start delay module while the engine is cranking. If there is voltage at **A15-TB1-8**, but not at **A15-TB1-7**, replace preheat/start delay module **A15**. If there is voltage at **A15-TB1-7**, check for proper connections between **A15-TB1-7** and terminal **85** on relay **K13**.
8. Fuel solenoid **K1** is not functioning properly.	Push the **Run-Stop-Remote** switch to **Run** and watch for fuel solenoid **K1** to pull in. If it does not, push the **Run-Stop-Remote** switch to **Stop** and connect the positive (+) terminal on fuel solenoid **K1** to the **BAT** terminal on the starter solenoid with a jumper wire and the negative (–) terminal to **GND**. Replace the fuel solenoid if it does not pull in and stay in each time power is connected.
9. Relay **K13** is not is not functioning properly.	Push the **Run-Stop-Remote** switch to **Run** and check for battery voltage (12 VDC) at relay **K13** terminals **85** and **30** while the engine is cranking. Replace relay **K13** if there is voltage at terminal **85** but not at terminal **30**. If there is voltage at terminal **30**, check for proper connections of the lead between terminal **87** and terminal **TB1-6** on the floor of the the control box and the white lead in the engine harness between **TB1-6** and the glow plugs.
10. The engine fuel system is worn or malfunctioning or has lost prime (fuel lift pump, injection pump, injectors, timing).	Service according to the engine service manual.
11. The engine is worn or malfunctioning mechanically.	Service according to the engine service manual.

THE ENGINE RUNS UNTIL FAULT SHUTDOWN

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The **OVERSPEED** lamp comes on when the engine shuts down.	Reset engine monitor board **A11** by pushing the **Run-Stop-Remote** switch to **Stop** and the **Reset** switch to **Reset** and restart the set, monitoring engine speed and adjust the governor according to *Section 6, Adjustments.*
2. The **LO OIL PRES** lamp comes on when the engine shuts down.	a. Reset engine monitor board **A11** by pushing the **Run-Stop-Remote** switch to **Stop** and the **Reset** switch to **Reset** and fill up with as much engine oil as necessary and repair all oil leaks. b. If the set still shuts down due to low oil pressure, crank the engine by supplying battery positive (+) to the **SW** terminal of the starter solenoid and observe oil pressure while cranking the engine. Service the lubricating oil system according to the engine service manual if oil pressure is less than 10 psi. Replace the low oil pressure cutout switch if oil pressure is greater than 10 psi.
3. The **HI ENG TEMP** lamp comes on when the engine shuts down.	a. Reset engine monitor board **A11** by pushing the **Run-Stop-Remote** switch to **Stop** and the **Reset** switch to **Reset** and fill up with as much engine coolant as necessary and repair all leaks. b. If the set still shuts down due to high engine temperature, start the engine and observe coolant temperature as the system heats up. If shutdown occurs before the coolant reaches 200° F (93° C), replace the high engine temperature cutout switch. If coolant temperature exceeds 200° F (93° C), clean and service the entire cooling system as required to restore full cooling capacity. See Page 7-10 to locate the switch.
4. The **FAULT 1** or **FAULT 2** lamp (may be specifically labeled) comes on when the engine shuts down.	Service as required. (The customer has supplied the system fault indicating switches. By means of selection jumpers, either fault may be chosen to display the warning only. See *Section 3, Engine Control*.)

THE ENGINE LACKS POWER OR IS UNSTABLE

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. Fuel delivery to the set is inadequate.	a. Check for and replace clogged fuel lines and filters. b. Check for air in the fuel lines and repair all air leaks. c. Measure the vertical distance between the fuel lift pump on the engine and the bottom of the dip tube in the supply tank. Make necessary provisions so that lift does not exceed 6 feet (1.8 metres).
2. The fuel is contaminated.	Connect the set to a container of fuel of known quality and run the set under various loads. Replace the contents of the fuel supply tank if there is a noticeable improvement in performance.
3. The engine air filter element is dirty.	Replace the air filter element.
4. The governor adjustment is incorrect.	a. Adjust the governor according to *Section 6, Adjustments.* b. Service the fuel injection unit according to the engine service manual if it cannot be adjusted for full power or stable speed.
5. The engine fuel system (lift pump, injection pump, injectors, timing) is faulty.	Service the fuel system according to the engine service manual.
6. The engine is worn.	Service the engine according to the engine service manual.

AN AMBER WARNING LAMP IS ON

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The **PRE LO OIL PRES** lamp comes on while the engine is running.	Shut down the set if possible or disconnect non-critical loads.(Oil pressure will be less than 20 psi but greater than 14 psi.) Service the engine lubricating system according to the engine service manual.
2. The **PRE HI ENG TEMP** lamp comes on while the engine is running.	Shut down the set if possible or disconnect non-critical loads. (Engine temperature will be greater than 220° F but less than 230° F.) Service the engine cooling system to restore full cooling capacity.
3. The **LOW ENGINE TEMPERATURE** lamp comes on while the set is in standby.	a. Plug in, repair or install engine coolant and engine oil heaters. b. If the engine coolant gauge indicates more than 70° F (21° C), replace the gauge board. See Figure 3-4.
4. The **LO FUEL** lamp comes on.	Fill the main fuel supply tank with the appropriate grade of fuel. (The customer has supplied the fuel level switch to make use of this warning.)
5. The **FAULT 1** or **FAULT 2** lamp (may be a specifically labeled amber lamp) comes on.	Service as required. (The customer has supplied the system fault indicating switches. By means of selection jumpers, either fault may be chosen to shut down the engine. See *Section 3, Engine Control*.)

THE GREEN RUN LAMP STAYS OFF BUT THE SET RUNS NORMALLY

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The set mounted **RUN** lamp does not light although the starter has disconnected normally and the engine is running	a. Press the panel **Lamp Test** switch and replace the run lamp bulb if it does not light. b. Check for loose or missing wiring between the start disconnect centrifugal switch and pin connector **P1-5** on engine monitor board **A11**. See the connection diagram on Page 7-9. c. Check for 12 VDC at **A11-P1-5** while the set is running. If there is no voltage, check to see that the start disconnect centrifugal switch is properly adjusted. Refer to *Section 6, Adjustments*. d. Replace engine monitor board **A11** if there is voltage at **A11-P1-5** while the set is running normally but the **RUN** lamp does not light.
2. Neither the remote nor the set mounted **RUN** lamp light although the starter has disconnected normally and the engine is running.	a. Press the panel **Lamp Test** switch and replace the run lamp bulb if it does not light. Test the remote **RUN** lamp by suitable means and replace it if it does not light. b. If both lamps are good, this indicates that the AC disconnect circuit is not working. Check the AC voltmeter to determine whether or not there is generator output voltage and service as necessary. See *There Is No Output Voltage*. c. If there is generator output voltage, check for 120 VAC across pin connectors **P1-1** and **P1-2** on the ECM. If there is no voltage, check for loose or missing leads between the connectors and **TB21-21** and **TB21-32** inside the control box and service as necessary. d. Replace engine monitor board **A11** if there is 120 VAC across pin connectors **P1-1** and **P1-2** but neither **RUN** lamp lights during normal operation.

NO OUTPUT VOLTAGE

⚠ **WARNING** ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The line circuit breaker is **OFF**.	Find out why the circuit breaker was turned **OFF**, make sure it is safe to reconnect power, and then throw the circuit breaker **ON**.
2. The line circuit breaker has **TRIPPED**.	Shut down the set and service as necessary to clear the short circuit or ground fault that caused tripping, and then **RESET** the circuit breaker and start the set.
3. The line circuit breaker is faulty.	Shut down the set, make sure the power output lines from the set have been disconnected from all other sources of power, attempt to **RESET** the circuit breaker and throw it **ON** and check for electrical continuity across each line contact. Replace the circuit breaker if there is measurable resistance across any contact.
4. Field circuit breaker **CB21** has **TRIPPED**.	**RESET** the circuit breaker. If it keeps tripping, troubleshoot according to the chart, *Field Circuit Breaker Keeps Tripping*.
5. Field circuit breaker **CB21** is faulty.	Shut down the set, attempt to **RESET** the circuit breaker and disconnect either lead. Replace the circuit breaker if there is measurable resistance across the terminals.
6. The field has lost its residual magnetism.	Flash the field according to Figure 2-6 or 2-7 in *Section 2, AC Control*.

NO OUTPUT VOLTAGE (CONT.)

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
If flashing the field does not work, isolate the problem to the voltage regulator or to the generator as follows: a. Throw the line circuit breaker **OFF** and shut down the set. **⚠ CAUTION** ***This test involves unregulated excitation of the generator. To prevent damage to the generator due to overcurrent, make sure that all loads have been disconnected and that all faults have been cleared from the power output terminals of the generator.*** b. Disconnect the field leads from terminals **VR21-F1** and **VR21-F2** on the voltage regulator (See Figure 2-6 or 2-7 in *Section 2, AC Control*) and connect the leads to a **6 volt battery**: **F1** to battery positive (**+**) and **F2** to battery negative (**–**). Polarity must be correct or this test will be inconclusive because the induced and residual magnetic polarities in the exciter stator will be opposed. c. Read output voltage across the generator terminals while the set is running. **⚠ DANGER** ***HIGH VOLTAGE. Touching uninsulated high voltage parts inside the control box can result in severe personal injury or death. Measurements and adjustments must be done with care to avoid touching high voltage parts. For your protection, stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry from your hands.*** d. If rated output voltage or higher is obtained and the voltages for all phases are balanced, the generator is probably okay. Troubleshoot the voltage regulator—Step 7. e. If the output voltages are not balanced, or are less than ninety percent of rated output voltage, the problem is probably in the generator. If the voltages are unbalanced, first troubleshoot the main stator—Step 12. If the voltages are uniformly low, first troubleshoot the exciter and field circuits—Steps 8, 9, 10 and 11.	
7. Voltage Regulator **VR21** is faulty.	Check all connections against the applicable reconnection diagram (Page 7-11) and rewire as necessary. Replace the voltage regulator if the wiring is correct and there is no output voltage. **⚠ CAUTION** ***Replacing the voltage regulator before servicing other faults can lead to damage to the new voltage regulator.***
8. The exciter field winding is open.	Shut down the set and check exciter field winding resistance according to *Section 5, Servicing the Generator*. Replace the exciter field assembly if winding resistance does not meet specifications.
9. The rotating rectifier assembly (diodes **CR1** through **CR6**) is faulty.	Shut down the set and check each diode according to *Section 5, Servicing the Generator*. Service as necessary.

NO OUTPUT VOLTAGE (CONT.)	
⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***	
Possible Cause	**Corrective Action**
10. The exciter rotor windings are open.	Shut down the set and check exciter winding resistances according to *Section 5, Servicing the Generator*. Replace the generator rotor assembly if exciter rotor winding resistances do not meet specifications.
11. The main rotor winding is open.	Shut down the set and check main rotor winding resistance according to *Section 5, Servicing the Generator*. Replace the generator rotor assembly if main rotor winding resistance does not meet specifications.
12. The stator windings are open.	Shut down the set and check stator winding resistances according to *Section 5, Servicing the Generator*. Replace the generator stator assembly if stator winding resistances do not meet specifications.

OUTPUT VOLTAGE IS TOO HIGH OR TOO LOW

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. Engine speed is too high or too low.	a. Adjust engine speed according to *Section 6, Adjustments*. b. If engine speed is unstable, troubleshoot according to the chart, *The Engine Lacks Power or is Unstable*.
2. The voltage has been adjusted improperly.	Adjust output voltage according to *Section 2, AC Control*.
3. Improper connections have been made at the generator output terminals.	Shut down the set and reconnect according to the appropriate reconnection diagram. See *Section 7, Wiring Diagrams*.
4. The rotating rectifier assembly (diodes **CR1** through **CR6**) is faulty.	Shut down the set and check each diode according to *Section 5, Servicing the Generator*. Service as necessary.
5. Voltage Regulator VR21 is faulty.	Replace the voltage regulator. ⚠ CAUTION ***Replacing the voltage regulator before servicing other faults can lead to damage to the new voltage regulator.***

OUTPUT VOLTAGE IS UNSTABLE

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The voltage has been adjusted improperly.	Adjust output voltage according to *Section 2, AC Control*.
2. The voltage adjusting rheostat on the control panel is faulty (if provided).	Unlock the voltage adjusting screw on the front of the control panel and disconnect either lead from the rheostat. Measure resistance between terminals **1** and **2** while turning the adjusting screw fully one way and then the other. Replace the rheostat if it is open at any point, or if resistance does not vary smoothly from zero to approximately 2,500 ohms.
3. Voltage Regulator **VR21** is faulty.	Replace the voltage regulator. ⚠ CAUTION ***Replacing the voltage regulator before servicing other faults can lead to damage to the new voltage regulator.***

THE FIELD CIRCUIT BREAKER KEEPS TRIPPING

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The rotating rectifier assembly (diodes **CR1** through **CR6**) is faulty.	Shut down the set and check each diode according to *Section 5, Servicing the Generator*. Service as necessary.
2. The exciter field winding is shorted.	Shut down the set and check exciter field winding resistance according to *Section 5, Servicing the Generator*. Replace the exciter field assembly if winding resistance does not meet specifications.
3. The exciter rotor windings are shorted.	Shut down the set and check exciter winding resistances according to *Section 5, Servicing the Generator*. Replace the generator rotor assembly if exciter rotor winding resistances do not meet specifications.
4. The main rotor winding is shorted.	Shut down the set and check main rotor winding resistance according to *Section 5, Servicing the Generator*. Replace the generator rotor assembly if main rotor winding resistance does not meet specifications.
5. The stator windings are shorted.	Shut down the set and check stator winding resistances according to *Section 5, Servicing the Generator*. Replace the generator stator assembly if stator winding resistances do not meet specifications.
6. Voltage Regulator **VR21** is faulty.	Replace the voltage regulator. ⚠ CAUTION ***Replacing the voltage regulator before servicing other faults can lead to damage to the new voltage regulator.***

THE PHASE CURRENTS ARE UNBALANCED

⚠ WARNING ***There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read the safety precautions on pages iii and iv and observe all instructions and precautions in this manual.***

Possible Cause	Corrective Action
1. The connected loads are distributed unevenly among the phases.	Shut down the set and redistribute the loads as evenly as possible.
2. Improper connections have been made at the generator output terminals.	Shut down the set and reconnect according to the appropriate reconnection diagram. *See Section 7, Wiring Diagrams*.
3. The stator windings are faulty (open or shorted).	Shut down the set and check stator winding resistances according to *Section 5, Servicing the Generator*. Replace the generator stator assembly if stator winding resistances do not meet specifications.
4. A load has a ground fault or short circuit.	Service the faulty equipment as necessary.

5. Servicing the Generator

GENERAL

The following tests and adjustments can be performed without disassembly of the generator. Before starting resistance measurements, disconnect the starting battery cables (negative [–] first) to make sure the engine will not start while performing these tests.

⚠ CAUTION ***Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.***

⚠WARNING ***Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [–] first).***

Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (–) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (–) cable first, and reconnect it last.

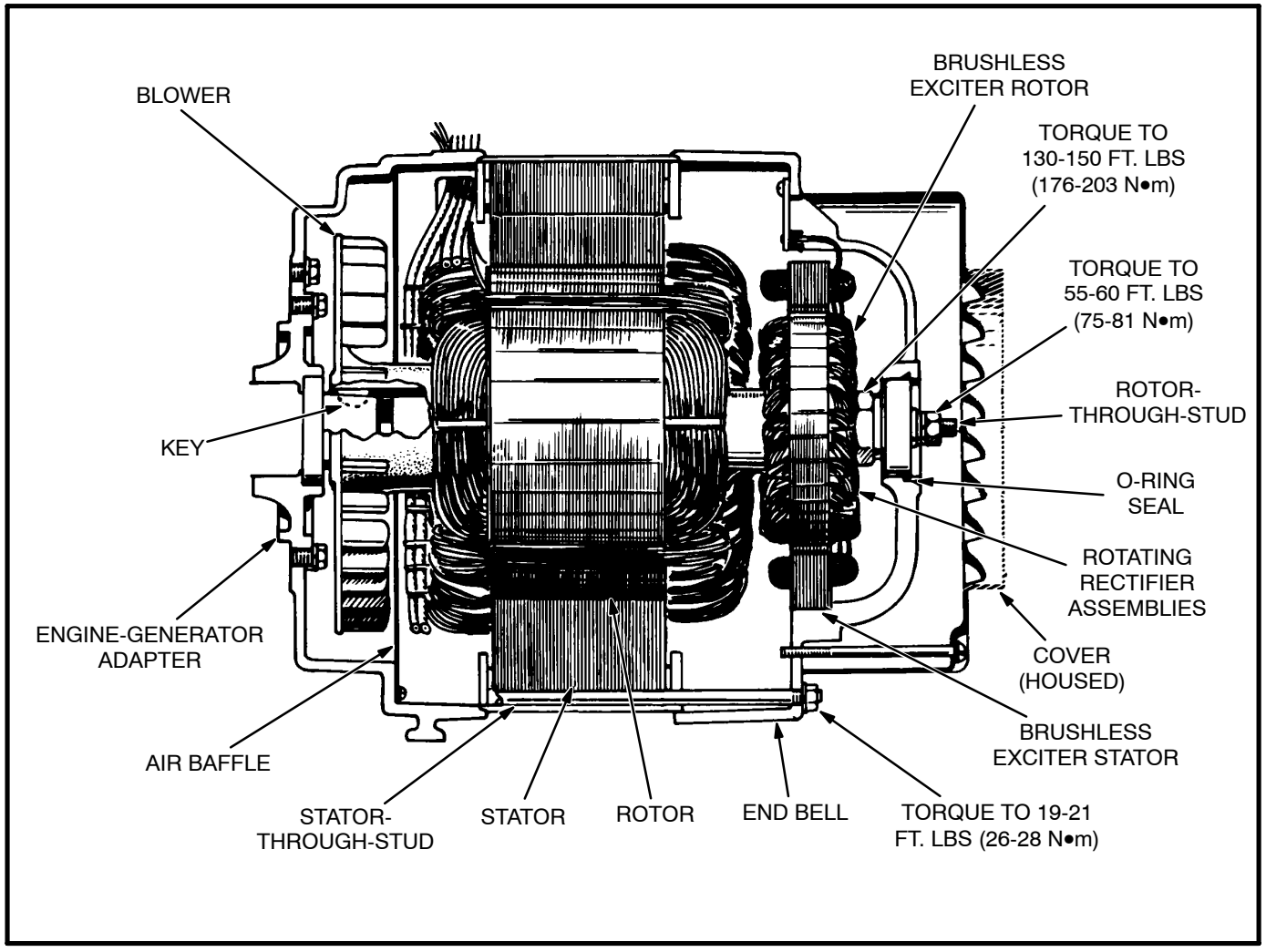


FIGURE 5-1. GENERATOR

BATTERY CHARGE RATE ADJUSTMENT

One generator winding (leads B1 and B2) supplies current for the battery charging circuit. The current flows through diode CR21, resistor R21 and ammeter M21 to the battery.

1. The slide tap on adjustable resistor R21 (see Figure 5-2), should be set to give about 2 amperes charging rate. For applications requiring frequent starts, check battery charge condition (specific gravity) periodically, and if necessary, increase charging rate slightly (slide tap nearer ungrounded lead) until it keeps battery charged. Having engine stopped when readjusting avoids accidental shorts. Avoid overcharging.
2. If charge winding AC output is below:
   a. 19 volts on 12 volt battery charge models,
   b. 38 volts on 24 volt battery charge models,

   test the charging circuit for opens or grounds in the leads and charging winding. If leads are defective, replace them. If winding is defective, replace generator stator.
3. If a separate automatic demand control for starting and stopping is used, adjust charge rate for maximum 4.5 amperes. This normally keeps battery charged even if starts occur as often as 15 minutes apart.

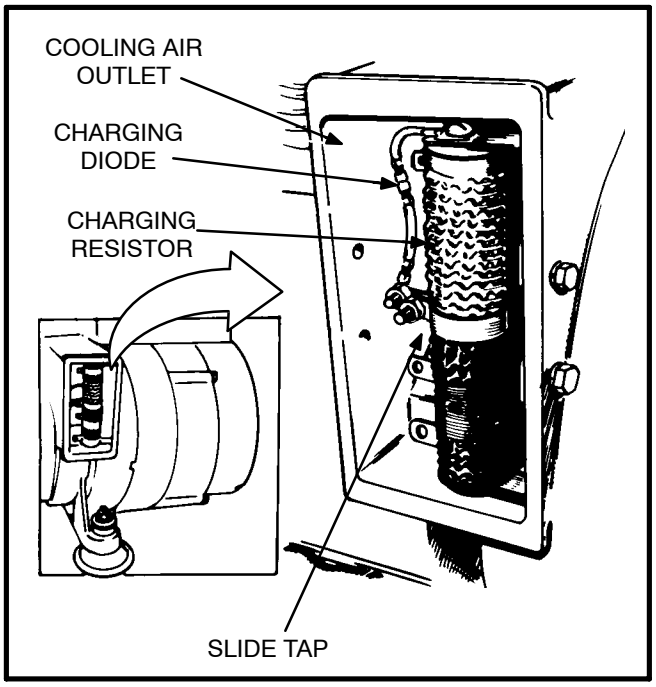


FIGURE 5-2. BATTERY CHARGE RATE RESISTOR (R21) LOCATION

TESTING REACTOR CMR21

The reactor assembly CMR21 leads are marked 1, 2, 3 and 4. Wires 1-2 and 3-4 are wound on the same iron core.

Resistance between 1-2 and 3-4 should be 0.38 to 0.39 ohms and 0.38 to 0.46 ohms respectively at 77° F (25° C). Resistance between coils (e.g. 1-3) and from any terminal to reactor frame should be infinity.

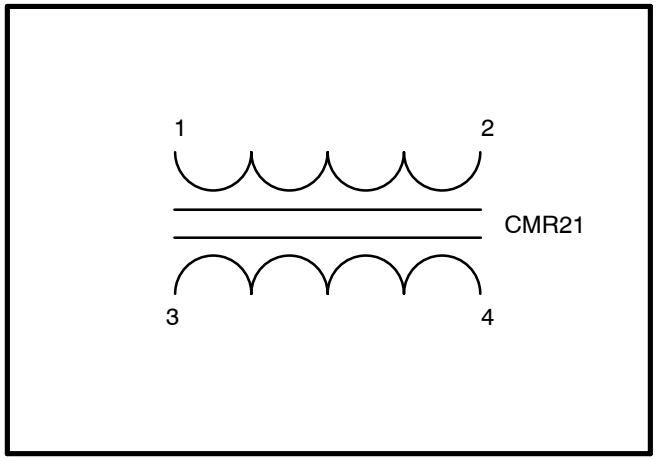


FIGURE 5-4. REACTOR CMR21

TESTING REFERENCE TRANSFORMER T21

The reference transformer T21 has four leads marked H1, H2, X1 and X2. H1-H2 are the primary leads. X1-X2 are the secondary leads.

Resistance between H1-H2 should be 133 to 139 ohms, between X1-X2, 133 to 163 ohms at 77° F (25° C). Resistance between coils and from any terminal to transformer frame should be infinity.

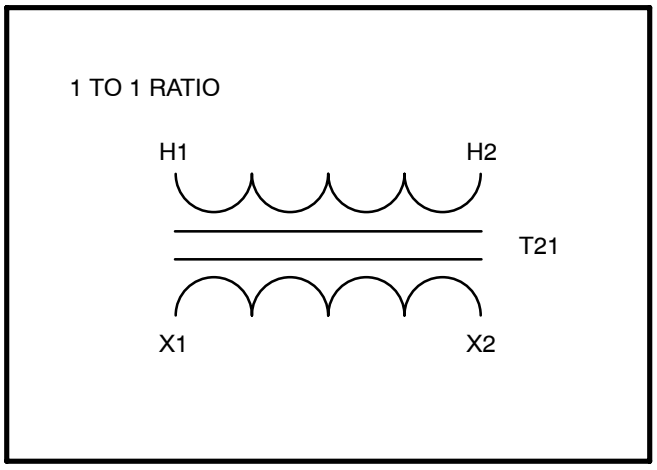


FIGURE 5-5. TRANSFORMER T21

TESTING EXCITER ROTATING RECTIFIERS

Two different rectifier assemblies make up the rotating rectifier bridge assembly (Figure 5-6). Using an accurate ohmmeter, test each CR using negative and positive polarities.

⚠ CAUTION ***Layers of dust can cause diodes to overheat and fail. Brush dust off regularly.***

1. Disconnect all leads from assembly to be tested.
2. Connect one test lead to F1+ stud and connect 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 CR3, CR4 and CR5 in turn; record resistance value of each rectifier.
4. Reverse ohmmeter leads and repeat steps 2 and 3. Record resistance value of each rectifier F1+ to CR1, CR2, and CR3 and F2- to CR4, CR5 and CR6.
5. All three 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 24 lbs-in. (2.7 N•m) torque when tightening nuts on F1+ and F2- and CR1 through CR6.

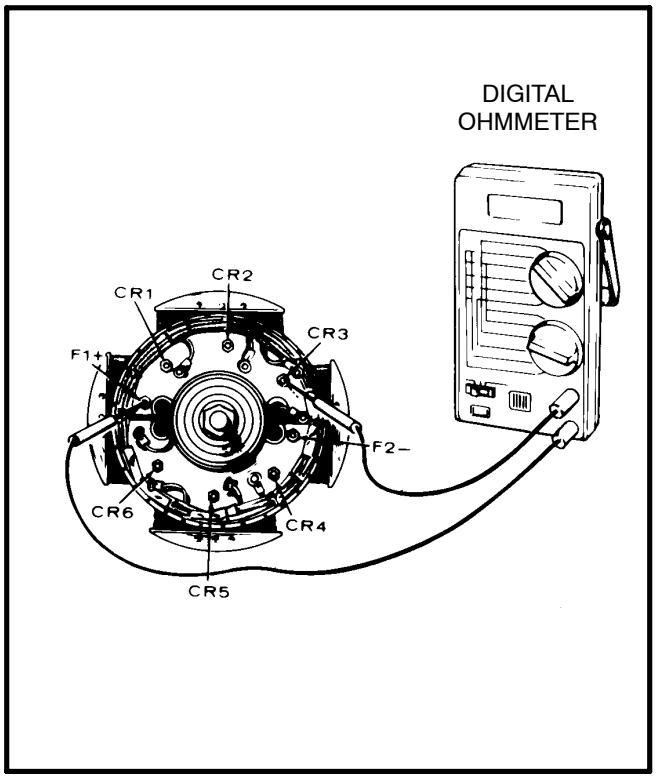


FIGURE 5-6. TESTING ROTATING RECTIFIERS

TESTING EXCITER STATOR

Test the exciter stator (Figures 5-7 and 5-8) for open or shorted windings and grounds as follows.

Testing For Open or Shorted Winding

Measure winding resistance with a Wheatstone bridge or digital ohmmeter.

Disconnect F1+ and F2– exciter field leads from terminal block in generator end bell. The resistance between field leads should be 10.98 to 13.42 ohms at 68° F (20° C). Replace the stator if winding resistance is not as specified.

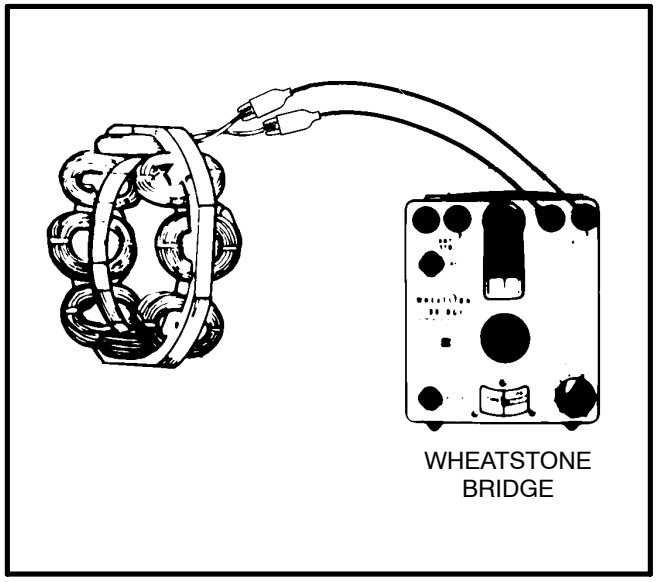


FIGURE 5-7. TESTING WINDING RESISTANCE

Testing For Grounds

Use a Megger or insulation resistance meter that applies 500 VDC or more for this test.

Disconnect F1+ and F2– exciter field leads from terminal block in generator end bell. Measure resistance between either lead and the stator laminations. Reading should be 1 megohm (1,000,000 ohms) or greater. If not, the exciter stator is questionable and might require removal for oven drying and retest. A shorted stator must be replaced.

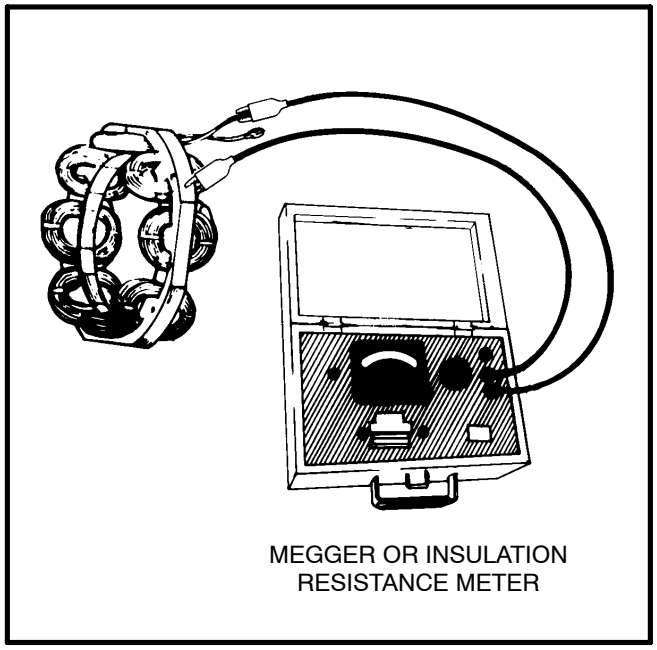


FIGURE 5-8. TESTING WINDING FOR GROUNDS

TESTING EXCITER ROTOR

Disconnect the main rotor field leads that connect to the rotating rectifier assemblies at F1+ and F2-.

Testing For Open or Shorted Winding

Use a Wheatstone Bridge or a digital ohmmeter for this test.

Disconnect main rotor field leads which connect to rotating rectifier assemblies at F1+ and F2-. Disconnect lead wires from diodes CR1 through CR6. Test between exciter lead pairs T1-T2, T2-T3 and T1-T3. Resistance should be 0.5 to 0.6 ohms at 68° F (20° C).

Testing For Grounds

Use a Megger or insulation resistance meter that applies 500 VDC or more for this test.

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 1 megohm (1,000,000 ohms) or greater. If not, the exciter rotor is questionable and might require removal for oven drying and retest. A shorted rotor must be replaced.

Use 24 lbs-in. (2.7 N•m) torque when tightening nuts on F1+ and F2- and CR1 through CR6.

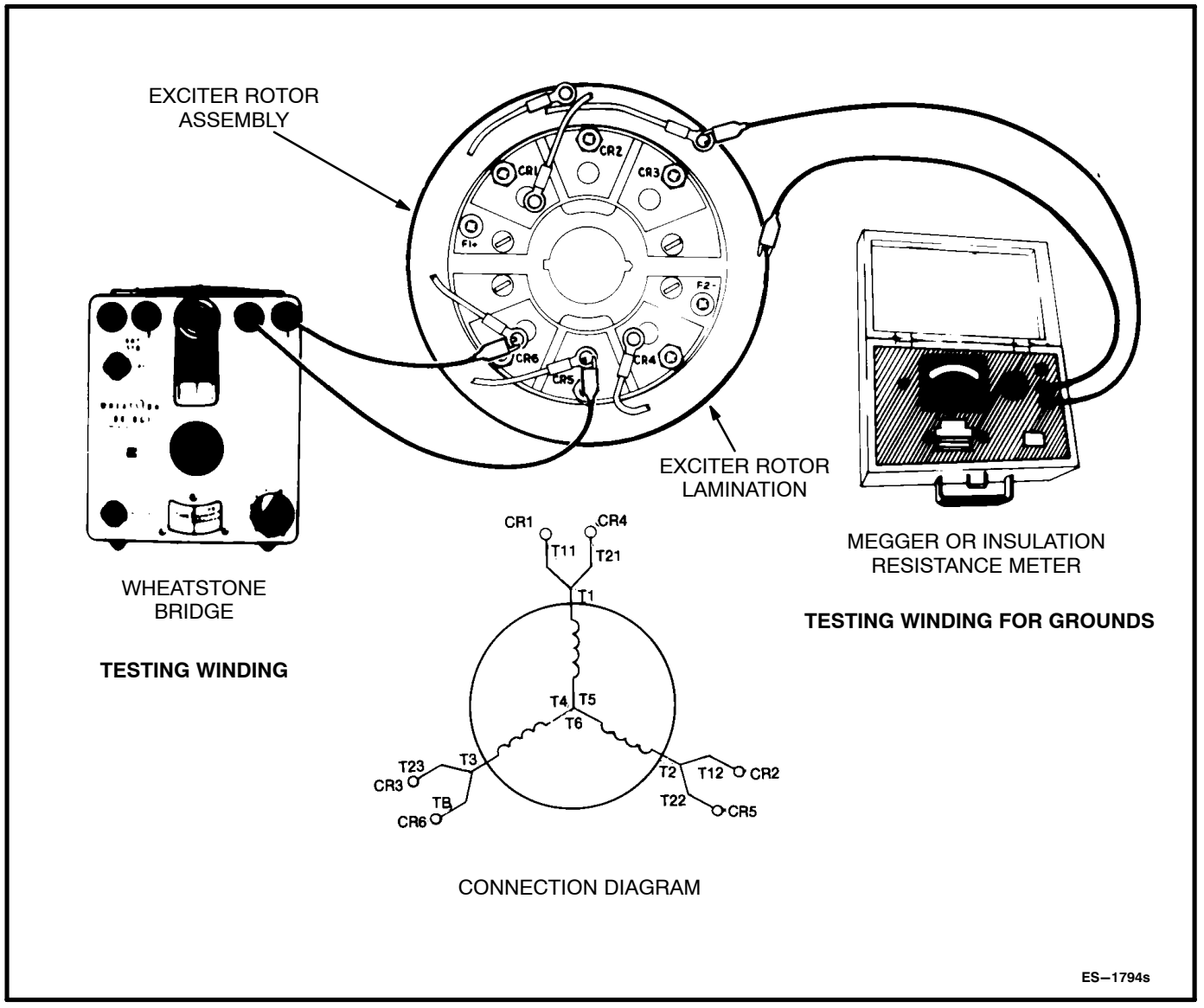


FIGURE 5-9. TESTING THE EXCITER ROTOR

TESTING MAIN ROTOR WINDING

Test the main rotor winding (Figures 5-10 and 5-11) for grounds, opens, and shorts as follows.

Testing For Open or Shorted Winding

Use a digital ohmmeter for this test.

1. Disconnect main rotor field leads which connect to rotating rectifier assemblies at F1+ and F2-.
2. Check resistance across F1+ and F2- leads. Resistance should be 2.50 to 2.55 ohms at 77° F (25° C). If resistance is low, there are shorted turns. If resistance is high, rotor winding is open. In either case, rotor must be replaced.

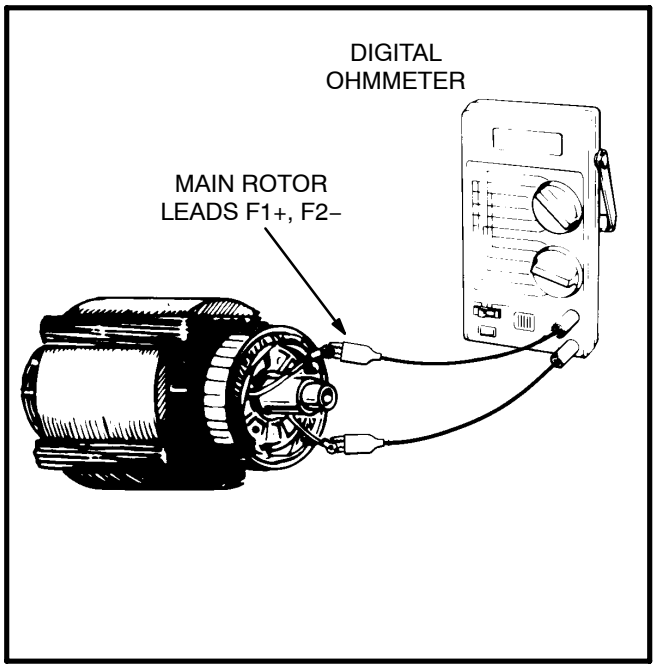


FIGURE 5-10. TESTING WINDING RESISTANCE

Testing For Grounds

Check for grounds between the rotor winding and the rotor shaft as shown. Use a Megger or insulation resistance meter which applies 500 VDC or more for this test.

⚠ CAUTION ***Be sure to remove both rotor leads so the rotating rectifiers are isolated. Failure to do this will damage the rectifiers.***

1. Disconnect main rotor field leads which connect to rotating rectifier assemblies at F1+ and F2-.
2. Connect test leads between one of the two leads and the rotor shaft. Meter should read 1 megohm (1,000,000 ohms) or greater. If not, the rotor is questionable and might require removal for oven drying and retest. A shorted rotor must be replaced.

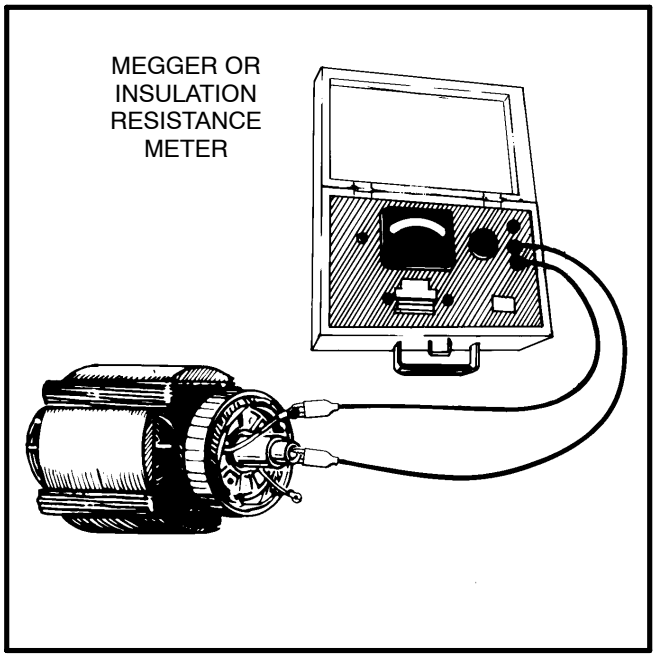


FIGURE 5-11. TESTING MAIN ROTOR WINDING

TESTING MAIN STATOR WINDINGS

Test the main stator (Figure 5-12) for opens, shorted windings, and grounds as follows.

Testing For Open or Shorted Windings

Use a Wheatstone bridge or ohmmeter having at least 0.001 ohm precision for this test.

Measure electrical resistance across each pair of stator leads as shown in Figure 5-12. The proper resistance values are shown in Table 5-1. All resistances should be ±10% of value shown at 68° F (20° C).

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

TABLE 5-1. RESISTANCE VALUES FOR STATORS

GENERATOR	RESISTANCE
12 Lead 60Hz	0.220 ohms
12 Lead 50Hz	0.198 ohms
4 Lead 60Hz	0.087 ohms
4 Lead 50Hz	0.110 ohms

Testing For Grounds

Use a Megger or insulation resistance meter that applies 500 VDC or more for this test.

Some generators have ground connections to the frame. Check wiring diagram.

Disconnect all stator leads and winding taps from their respective terminals and make sure the ends do not touch the generator frame. Measure electrical resistance between any stator lead and the stator laminations. Replace the stator if insulation resistance is less than 1 megohm.

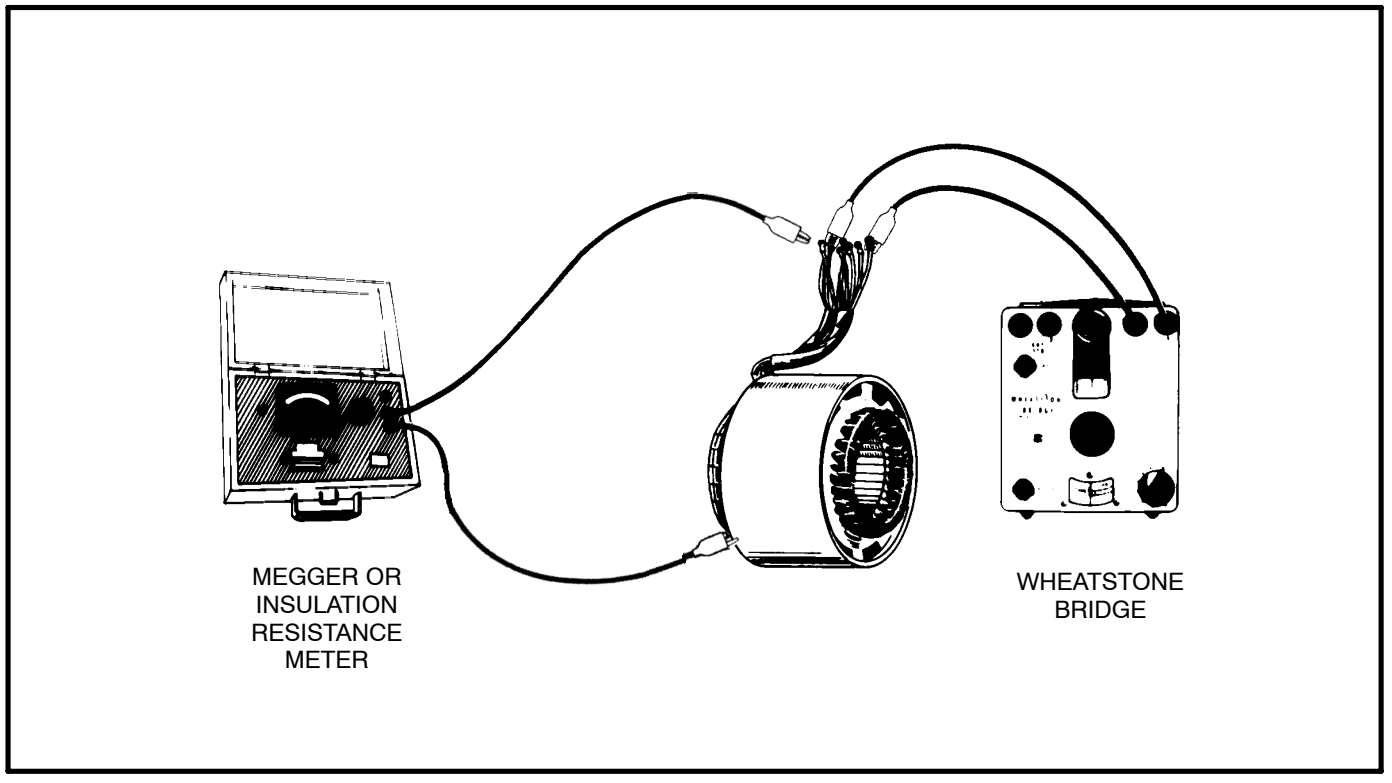


FIGURE 5-12. TESTING THE GENERATOR STATOR

REMOVING AND DISASSEMBLING THE GENERATOR

The generator is heavy. You will need an assistant and a hoist of sufficient capacity to remove and service the generator.

⚠WARNING ***Accidentally dropping the generator can damage it and cause severe personal injury and death. The hoist, straps and chains must have sufficient capacity and be attached properly so that the load cannot shift.***

Before starting, disconnect the starting battery cables (negative [–] first) to make sure the set will not start while working on it.

⚠CAUTION ***Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.***

⚠WARNING ***Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [–] first).***

Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (–) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (–) cable first, and reconnect it last.

Disconnecting Generator Leads

1. Disconnect the line cables and conduit. For reconnections later, make sure each cable is clearly marked to indicate the correct terminal.
2. Disconnect the remote control wiring and conduit. For reconnections later, make sure each wire is clearly marked to indicate the correct terminal.
3. Disconnect all engine wiring harness connections in the generator control and output boxes. For reconnections later, make sure each wire is clearly marked to indicate the correct terminal.
4. Disconnect all generator control leads (winding taps) from connections in the output box. For reconnections later, make sure each wire is clearly marked to indicate the correct terminal.
5. If the set has a mounted line circuit breaker, disconnect the cables to the circuit breaker. For reconnections later, make sure each cable is clearly marked to indicate the correct terminal.
6. Remove B1 lead from tapped adjustable resistor in generator air outlet opening (Figure 5-13).

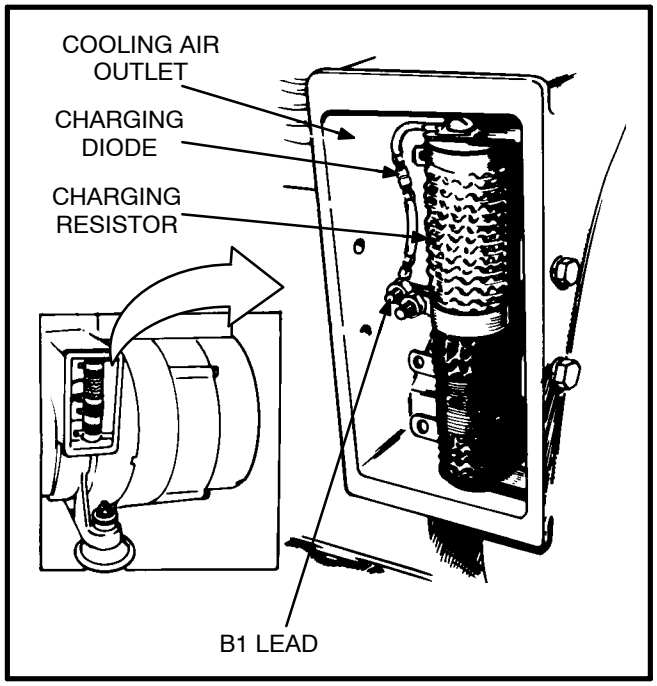


FIGURE 5-13. B1 LEAD LOCATION

Removing The Generator From The Set

7. Remove stator-through-stud nuts, end bell, and stator assembly (Figure 5-14). Screwdriver slots in adapter provide a means for prying stator loose from the adapter. Be careful not to let stator touch or drag on rotor.
8. Remove air baffle from adapter.
9. Support rotor with hoist and sling to avoid bending rotor through-stud (Figure 5-15).
10. Loosen rotor-through-stud nut and turn out until nut is at the end of the shaft.
11. While pulling rotor outward with one hand, strike nut a sharp blow. Use a heavy, soft faced hammer to loosen the rotor from its tapered shaft fit. If rotor does not come loose, strike it a sharp downward blow in the center of the lamination stack. Rotate rotor and repeat until it comes loose. Be careful not to hit bearing or windings.
12. Raise the generator end approximately one inch (12 mm) and securely block the engine under the flywheel housing. Lower the generator slightly so that the blocks carry most of the weight.
13. After disassembly, all parts should be wiped clean and visually inspected.

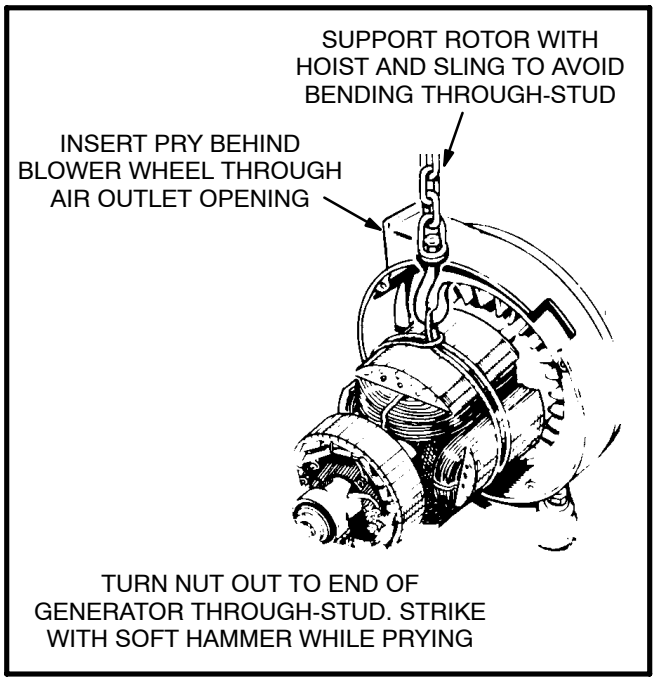


FIGURE 5-15. ROTOR REMOVAL

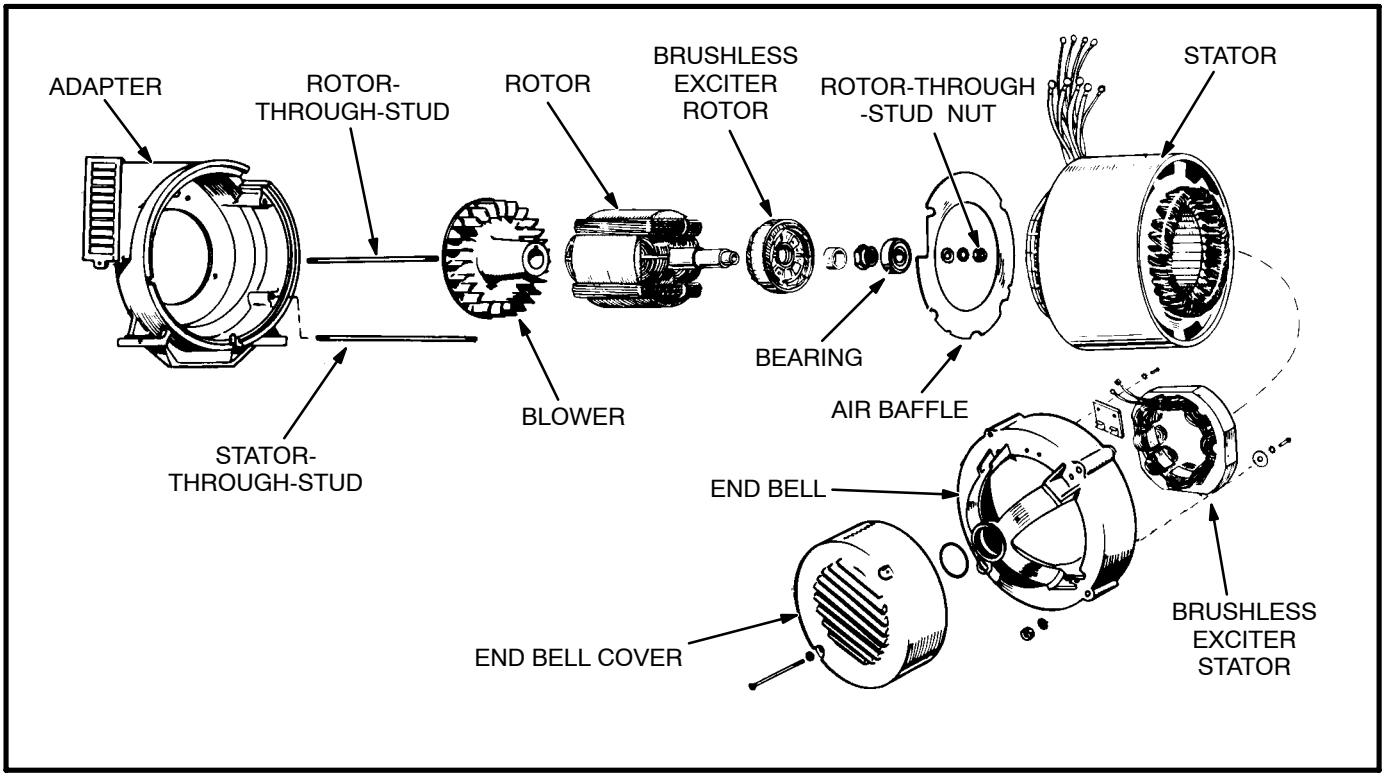


FIGURE 5-14. GENERATOR ASSEMBLY

REASSEMBLING THE GENERATOR

Reassembling is the reverse of disassembling. Note the following.

1. Clean and inspect all mating surfaces.
2. Coat mating area between generator bearing and end bell bearing hole with a thin film of Molykote or equal.
3. Install rotor-through-stud in engine crankshaft.
4. Install key in the crankshaft.
5. Slide rotor over through-stud and onto crankshaft. Be careful not to let weight of rotor rest on or bend the through-stud.
6. Install air baffle.
7. Install stator through-studs in adapter.
8. Install stator and end bell. Torque nuts on through-studs to 19-21 ft-lbs (26-28 N•m).

   Make certain the B1 lead is placed through the grommet in the baffle ring and out the air discharge opening in the adapter.

9. Torque the rotor-through-stud nut to 55-60 ft-lbs (75-81 N•m). The rotor and stator are automatically aligned because the stator and bearing support were tightened in Step 8.
10. Tap end bell to align at horizontal and vertical plane; use a lead hammer to relieve stresses on components (recheck torque).
11. Reconnect all generator leads.
12. Reconnect lead B1 on adjustable resistor, R21.

    ⚠ CAUTION ***Check B1 lead to see that it is short and is kept away from the blower. If necessary when installing a new stator or leads, cut B1 lead shorter and reinstall the connector.***

13. Install end bell cover.

6. Adjustments

CENTRIFUGAL SWITCH

The start-disconnect centrifugal switch (Figure 6-1) is located on the side of the engine, above the oil filter. The switch opens when the engine stops, and closes when engine speed reaches 900 rpm. If necessary, loosen the stationary contact and adjust the point gap to 0.020 inch (51 mm). Replace burned or faulty points.

⚠WARNING ***High voltage, which can cause severe personal injury or death, is present at the breaker point gap. Disconnect the battery cable, negative (–) terminal first, before setting the breaker point gap.***

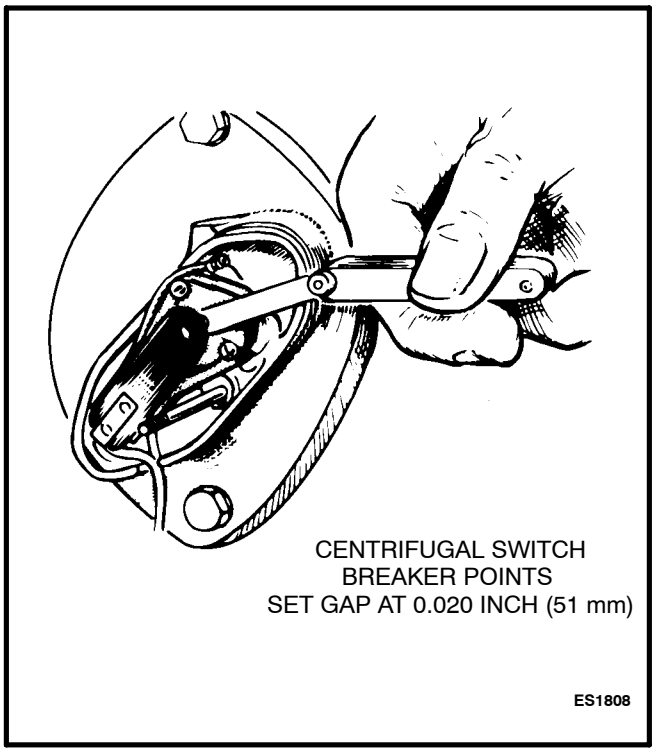


FIGURE 6-1. CENTRIFUGAL SWITCH ADJUSTMENT

GOVERNOR

The governor controls engine speed. On a 4 pole generator, engine speed equals frequency multiplied by 30. Thus 1800 rpm generates 60 hertz. Preferred engine speed does not vary more than 3 hertz from no-load to full-load operation. Be sure that the throttle, linkage, and governor mechanism operate smoothly.

Speed Adjustment

To change the governor speed, change the spring tension by turning the governor speed adjusting nut (Figure 6-2). Turn the nut clockwise (more spring tension) to increase rpm, or counterclockwise to reduce governed speed. Use a stroboscope or a frequency meter to make this adjustment.

Sensitivity Adjustment

If the governor is too sensitive, a rapid hunting condition occurs (alternate increasing and decreasing speed). Adjust the governor for maximum sensitivity without hunting. After making the sensitivity adjustment, readjust the speed.

To adjust governor sensitivity (no-load to full-load speed droop), turn the sensitivity adjusting ratchet as follows.

Radiator cooled Sets: Turning the ratchet clockwise provides more sensitivity (less speed drop when full load is applied), and turning it counterclockwise provides less sensitivity (more speed drop).

City Water Cooled Sets: Turning the ratchet counterclockwise provides more sensitivity (less speed drop when full load is applied), and turning it clockwise provides less sensitivity (more speed drop).

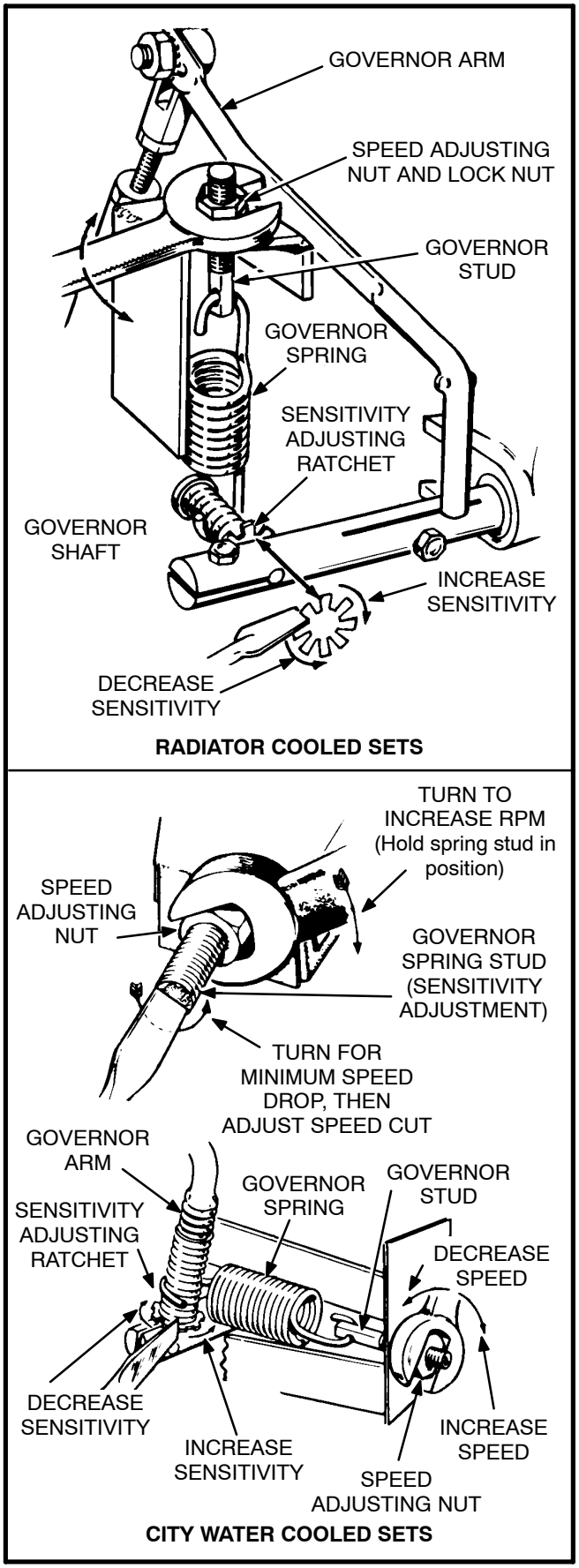


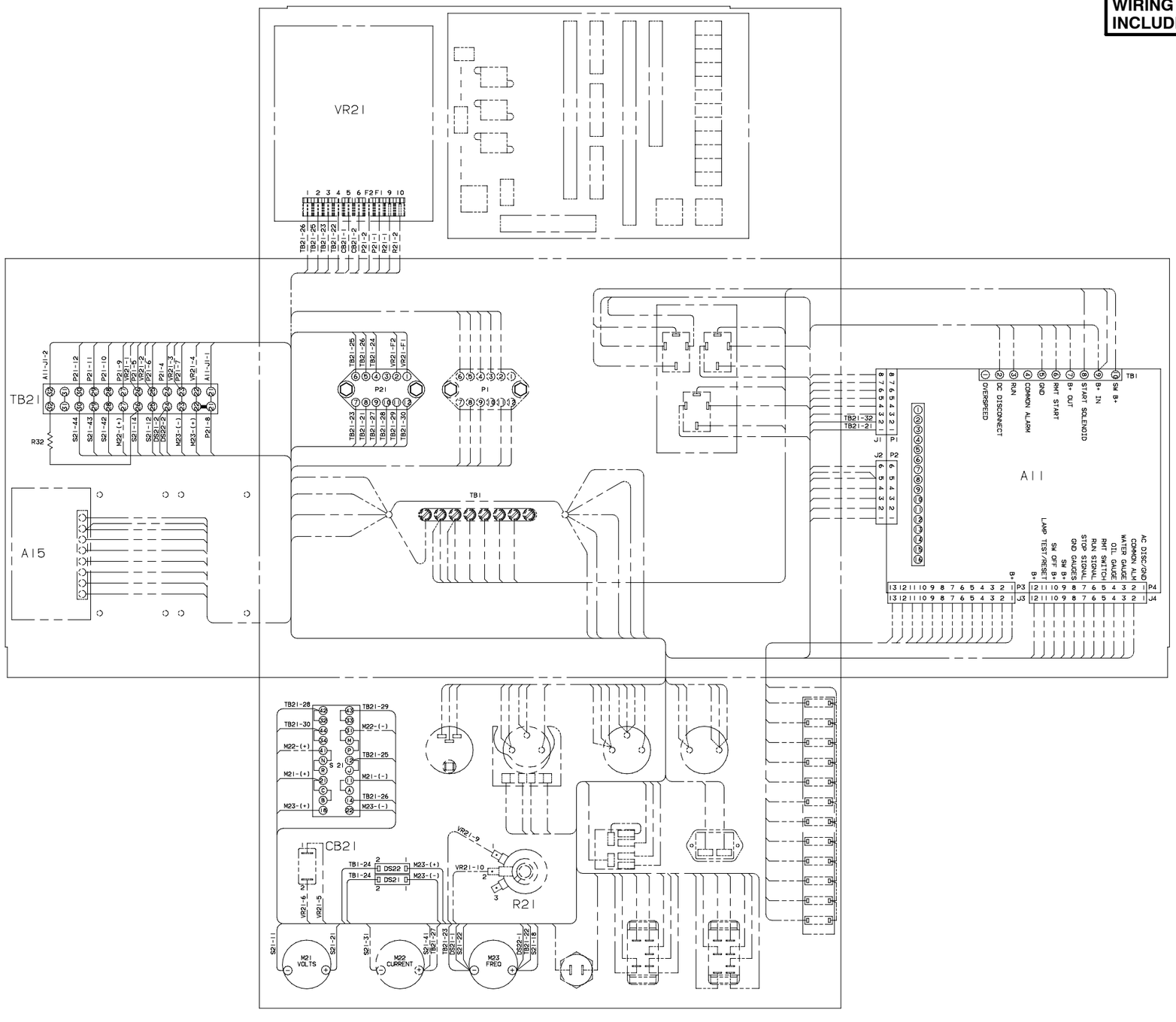
FIGURE 6-2. ADJUSTING GOVERNOR

7. WIRING DIAGRAMS

GENERAL

This section consists of the schematic and connection wiring diagrams referenced in the text. The following drawings are included.

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.



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AC CONTROL WITH METERS, SHEET 1

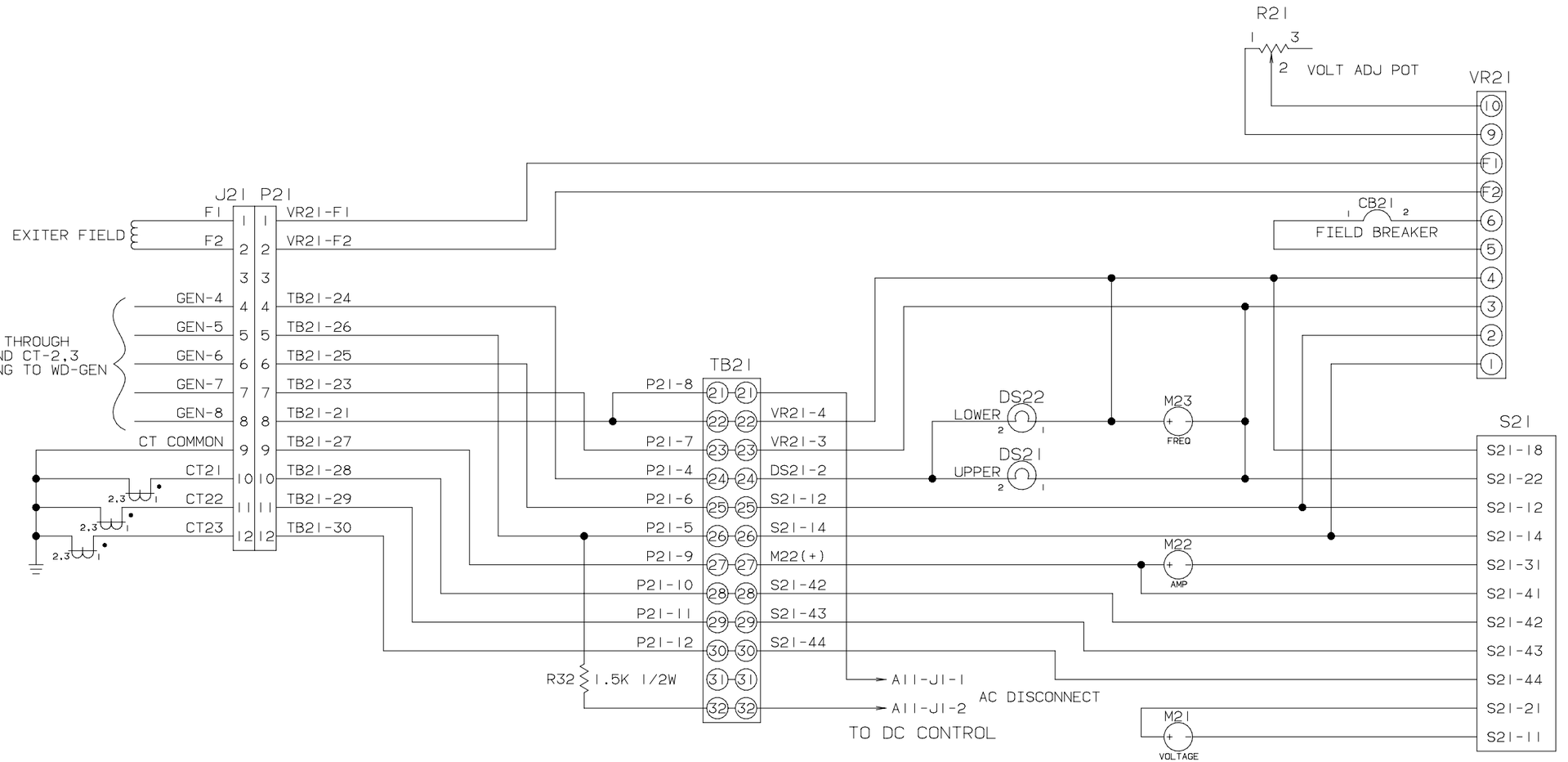
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

S21 JUMPERS

EXTERNAL	INTERNAL
M-P	N-41
34-44	M-31
C-21	A-11
32-42	B-C
12-J	33-43
N-R	

S21 SWITCH LOGIC

	18-11	22-C	14-21	M-32	41-42	P-43	12-A	J-B	31-34	N-44	R-33
L1-L2 3Ø	X	X		X						X	X
L2-L3 3Ø		X			X	X	X			X	
L3-L1 3Ø	X				X			X	X		X
L1-L0 3Ø	X		X		X					X	X
OFF					X					X	X
L1-L2 1ØA	X	X		X						X	X
L1-L2 1ØB	X	X			X	X				X	



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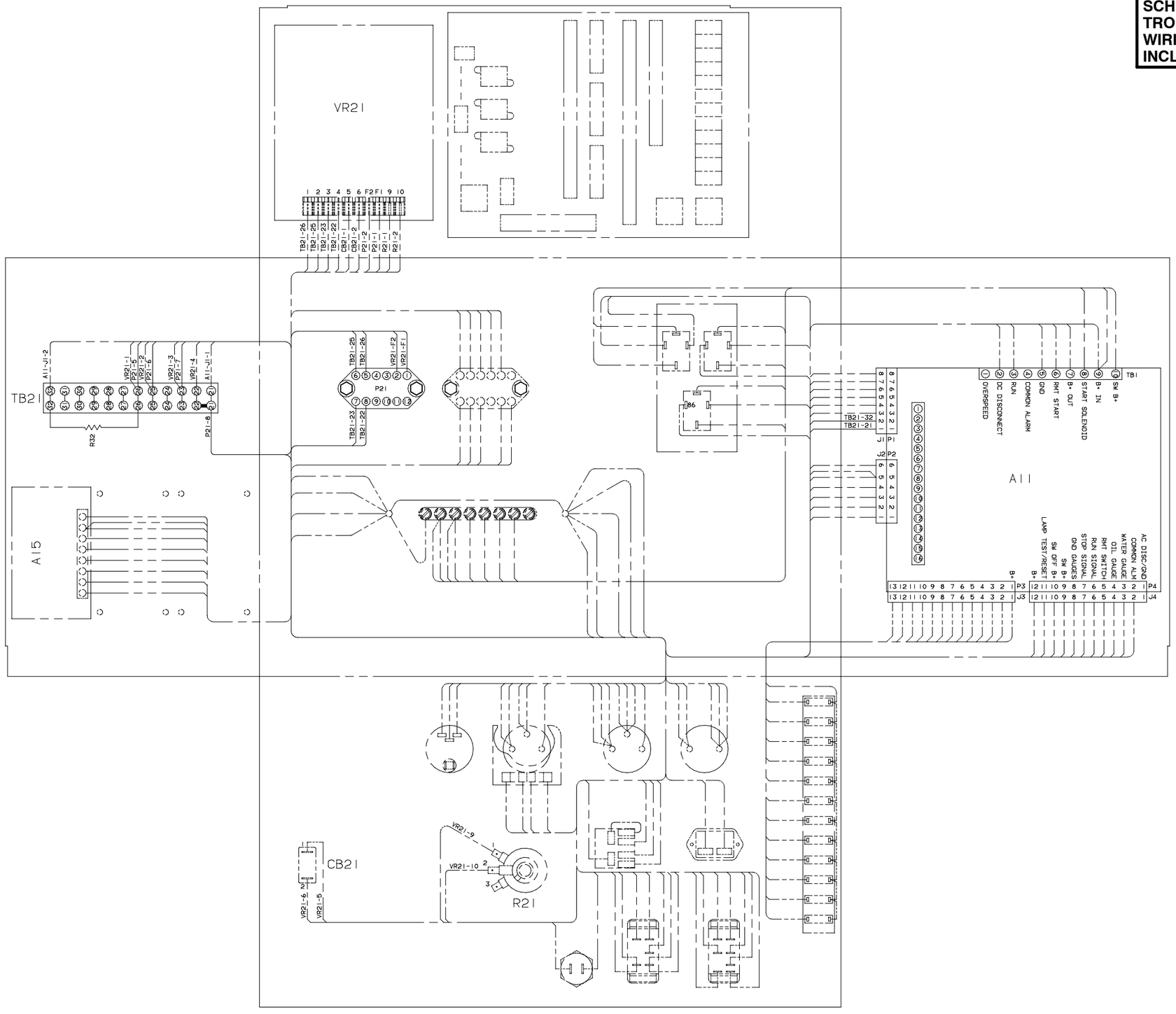
REV. C
MODIFIED 1/12/94

AC CONTROL WITH METERS, SHEET 2

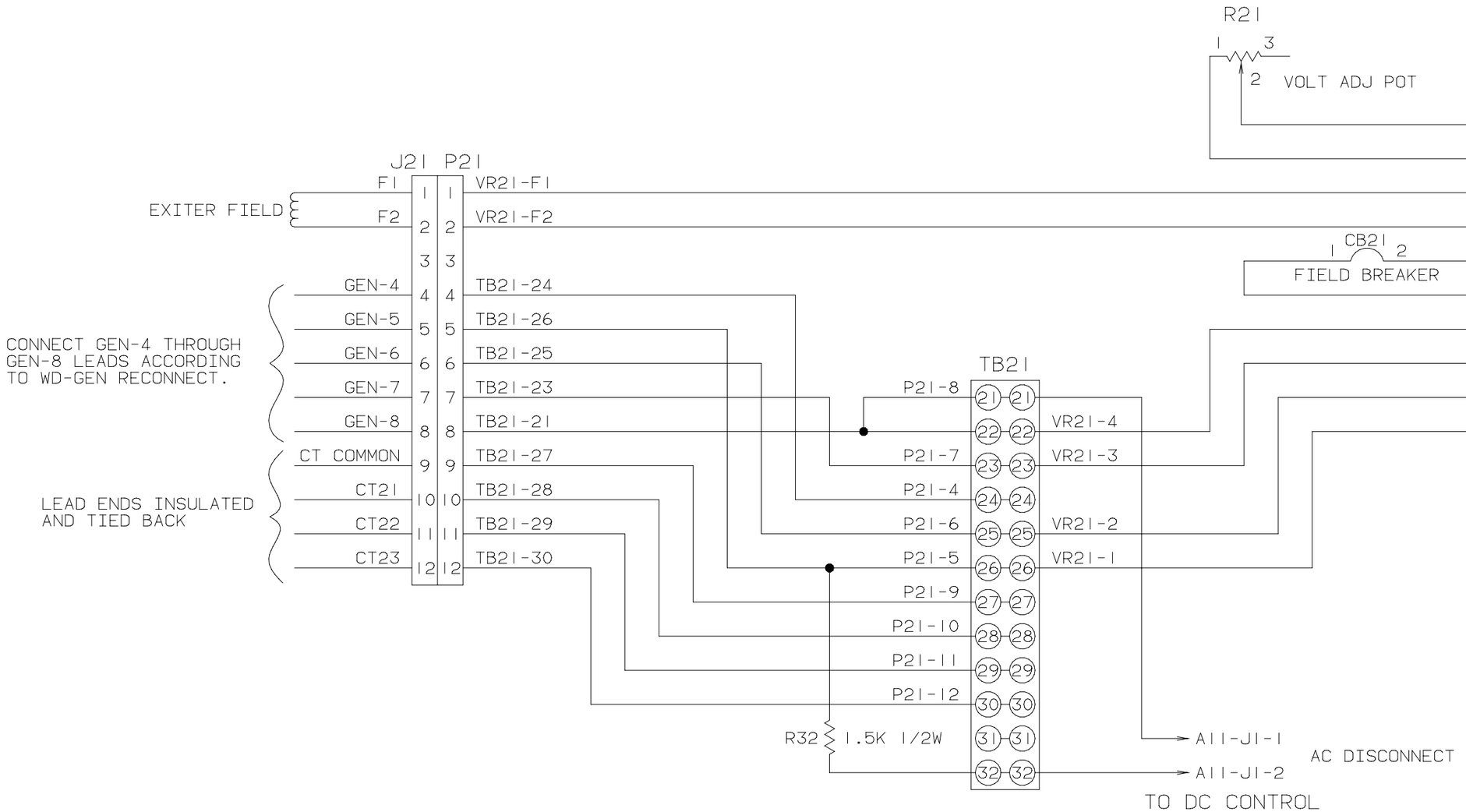
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.



NO. 612–6653 sh2 of 3
REV. A
MODIFIED 1/7/94

AC CONTROL WITHOUT METERS, SHEET 1

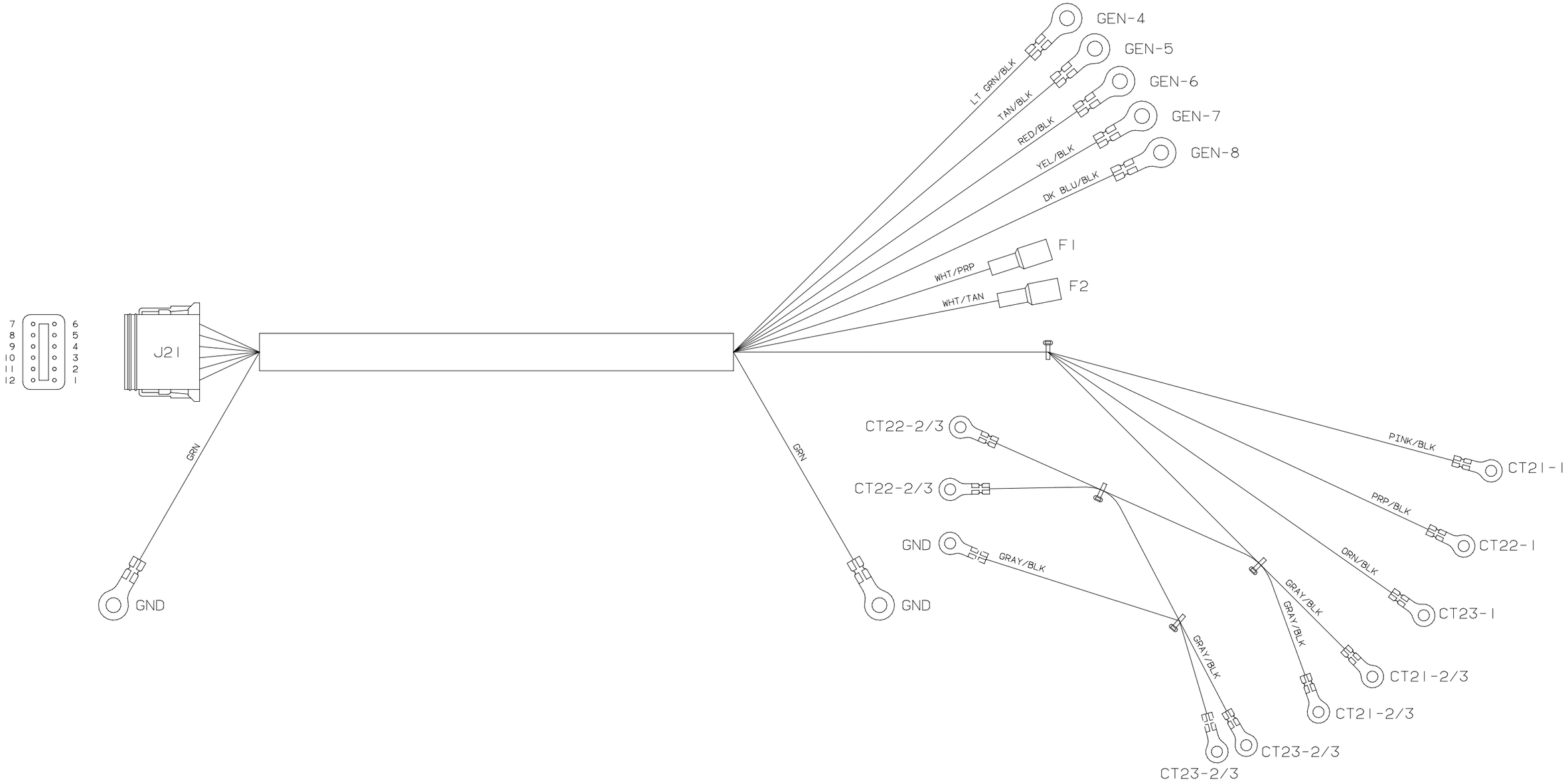
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.



NO. 612–6653 sh 3 of 3
REV. C
MODIFIED 1/7/94

AC CONTROL WITHOUT METERS, SHEET 2

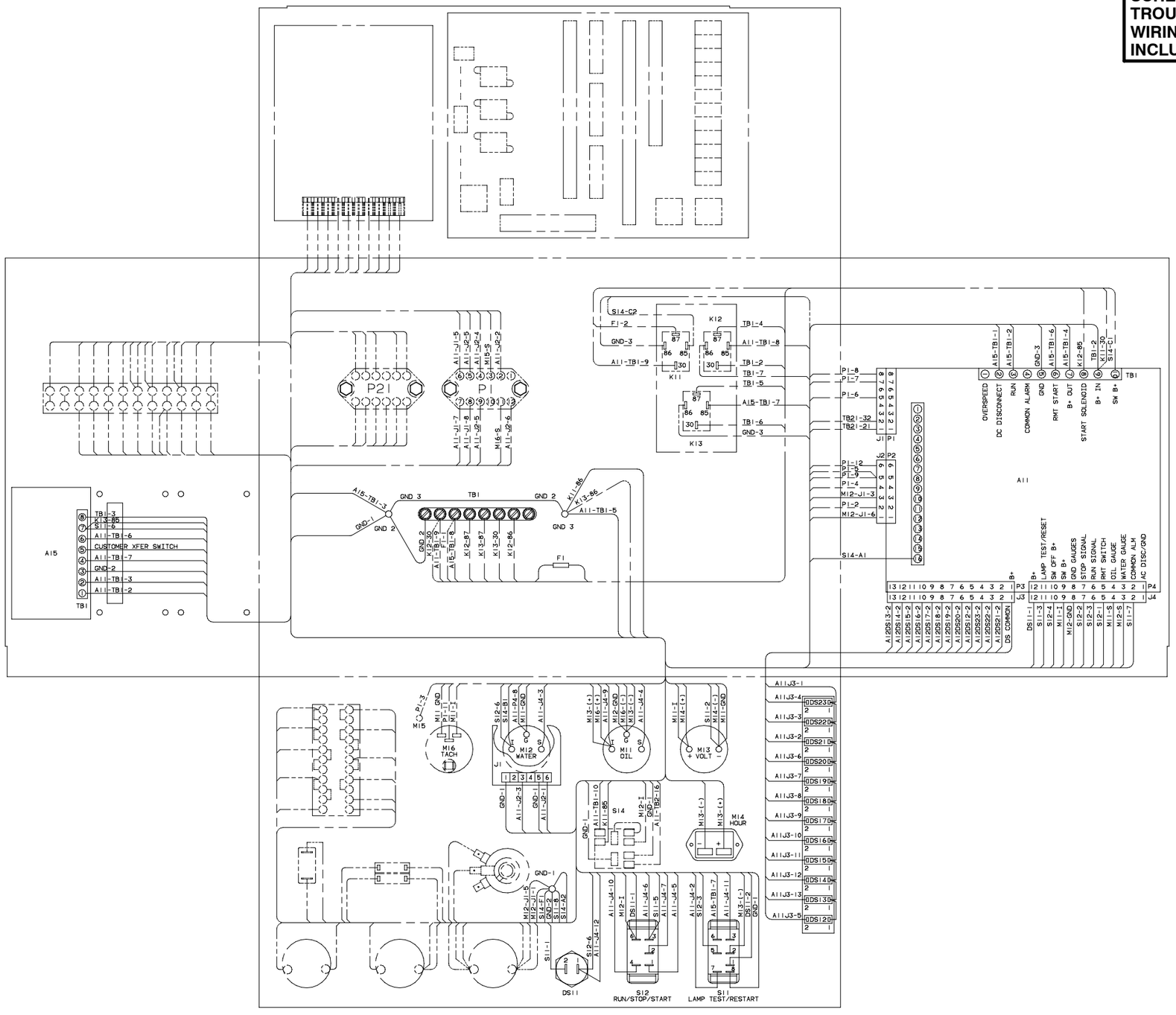
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.



NO. 338–2990 sh1 of 1
REV.B
MODIFIED 01/04/94

AC CONTROL WIRING HARNESS (EXTERNAL)

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

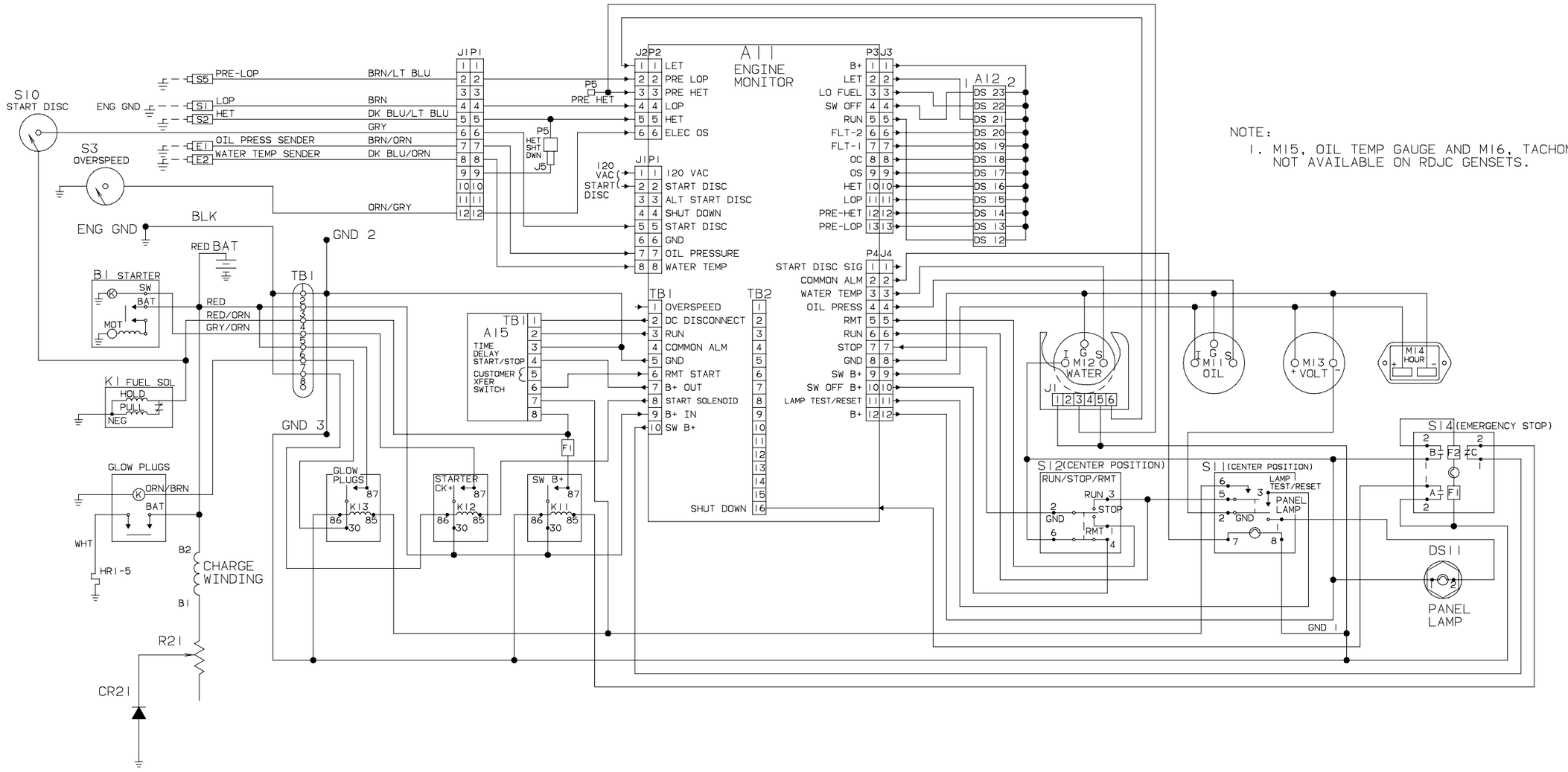


NO. 612–6655 sh 2 of 4
REV. D
MODIFIED 1/7/94

DC CONTROL, SHEET 1

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

RDJC

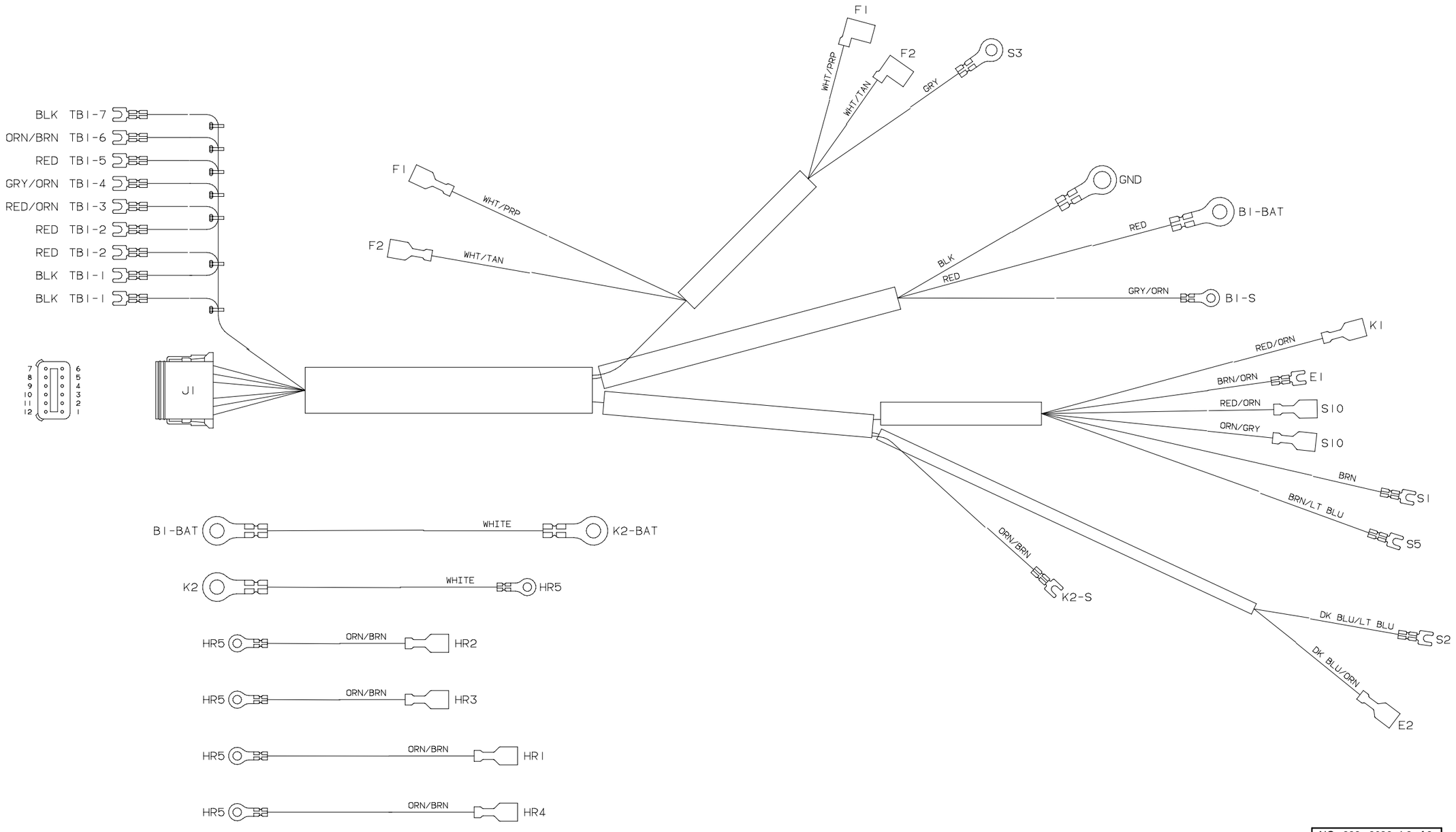


NOTE:
1. M15, OIL TEMP GAUGE AND M16, TACHOMETER, NOT AVAILABLE ON RDJC GENSETS.

NO. 612–6655 sh 4 of 4
REV. D
MODIFIED1/12/94

DC CONTROL, SHEET 2

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.



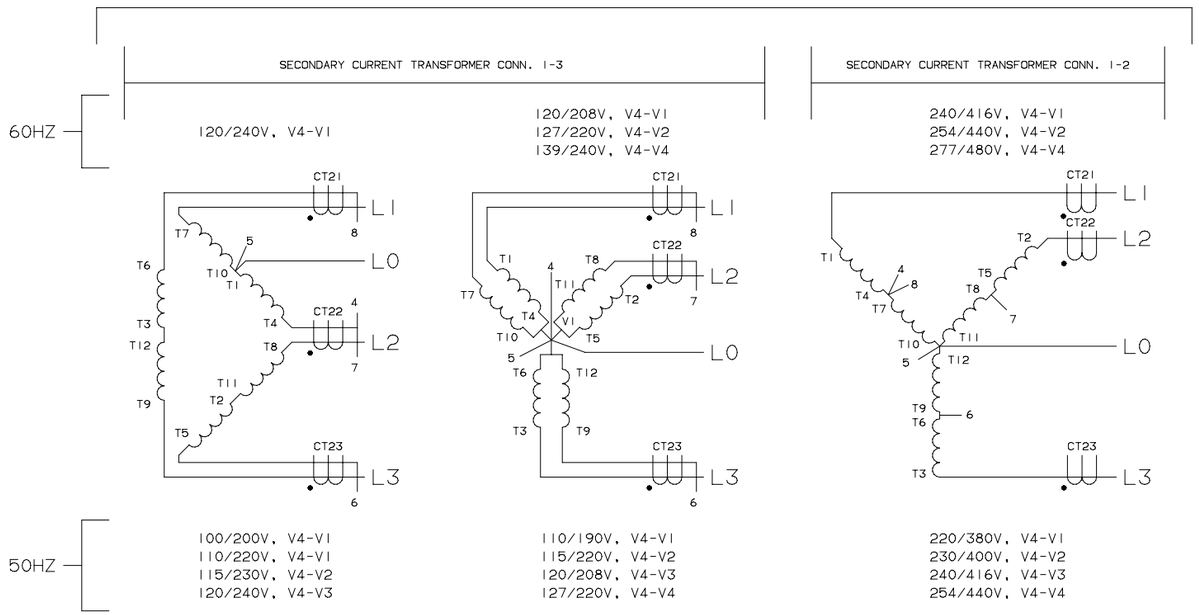
NO. 338–3036 sh2 of 2
REV.B
MODIFIED 12/23/93

ENGINE WIRING HARNESS

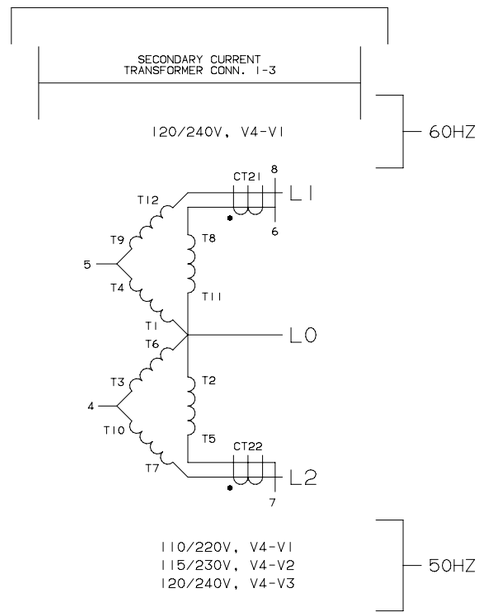
THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

YD GENERATORS

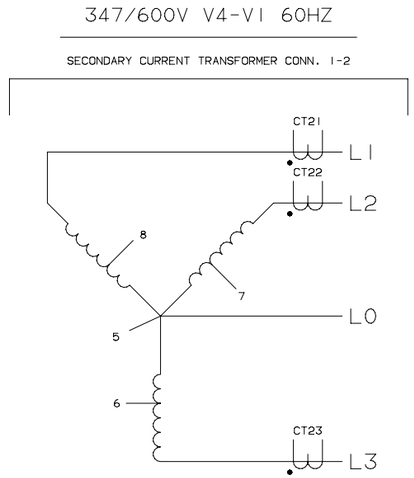
3 PHASE RECONNECTABLE, 12 LEAD



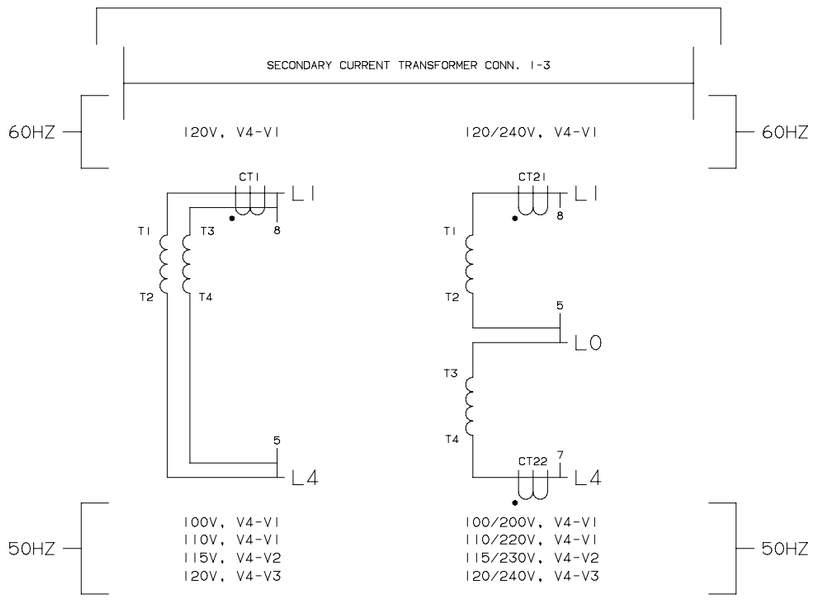
1 PHASE RECONNECTABLE, 12 LEAD



347/600V V4-V1 60HZ



1 PHASE RECONNECTABLE, 4 LEAD



VOLTAGE SENSING CONTINUITY		
CONTROL INPUT TB2I	GENERATOR SENSING LEADS	347/600 CONNECT SENSING LEADS TO
-2I	8	8
-23	7	7
-24	4	-
-25	6	6
-26	5	5

NOTES:

1. CURRENT TRANSFORMER SECONDARY MUST BE MANUALLY SELECTED:
   ABOVE 300 VOLTS AC, TERMINALS 1 & 2;
   BELOW 300 VOLTS AC, TERMINALS 1 & 3.
   TERMINALS 2/3 ARE COMMON AND CONNECTED TO GROUND.
2. DESIGNATIONS V4-V1,-V2 OR -V3 INDICATE CONNECTION OF JUMPER WIRE ON VOLTAGE REGULATOR, VR21. JUMPER MUST BE CONNECTED IN ACCORDANCE WITH OUTPUT VOLTAGE AND FREQUENCY. ALSO, THE LEAD FROM X1-1 MUST BE RECONNECTED TO VR21-6 FOR 60HZ OR VR21-5 FOR 50HZ. THESE INSTRUCTIONS APPLY TO 300-1540 REGULATOR ONLY.
3. WHEN 300-0688 SWITCHING REGUALTOR IS USED, A JUMPER IS INSTALLED ON VR21 BETWEEN TB1-7 AND TB1-8 FOR 50HZ. THIS JUMPER IS REMOVED FOR 60 HZ.
4. GENERATOR VOLTAGE SENSING LEADS GEN-4,-5,-6,-7, & -8 MUST BE CONNECTED TO GENERATOR OUTPUT LEADS AS SHOWN FOR PROPER METERING AND VOLTAGE REGUALATOR OPERATION. LEADS MAY BE COLOR CODED IN LIEU OF MARKING AS FOLLOWS:

   GEN-4 LT GRN/BLK
   GEN-5 TAN/BLK
   GEN-6 RED/BLK
   GEN-7 YEL/BLK
   GEN-8 DK BLU/BLK

   INSULATE AND TIE BACK ANY UNUSED LEADS.

NO. 625–2758 1 of 1
REV. A
MODIFIED 12/1/93

RECONNECTION DIAGRAMS

TB1-10 (SWITCHED B+ OUTPUT) OUTPUT TO RELAY K12, FUSED AT 20 AMPS, ENERGIZED WHEN THE START SIGNAL IS APPLIED AND DE-ENERGIZED AT SHUTDOWN (NORMAL AND FAULT)

TB1-9 (B+ INPUT) BATTERY POSITIVE (+) CONNECTION

TB1-8 (START SOLENOID) OUTPUT TO RELAY K11, FUSED AT 20 AMPS

TB1-7 (B+ OUTPUT) OUTPUT TO TIME DELAY START/STOP MODULE A15, FUSED AT 15 AMPS, AVAILABLE WHEN THE STARTING BATTERIES ARE CONNECTED

TB1-6 (REMOTE START) CONNECTED TO TIME DELAY START/STOP MODULE A15. CONNECT REMOTE START CONTACT OF THE AUTOMATIC TRANSFER SWITCH TO TERMINAL TB1-5 OF MODULE A15.

TB1-5 (GROUND)

TB1-4 (COMMON ALARM B+ OUTPUT) 4 AMP RATED DEVICE MAXIMUM

TB1-3 (RUN) CONNECTED TO TIME DELAY START/STOP MODULE A15

TB1-2 (DC DISCONNECT) CONNECTED TO TIME DELAY START/STOP MODULE A15

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.

TB2-1 (FAULT 2) GROUND INPUT FROM SENDER

TB2-2 (FAULT 2) GROUND OUTPUT TO LIGHT/RELAY*

TB2-3 (FAULT 1) GROUND INPUT FROM SENDER

TB2-4 (FAULT 1) GROUND OUTPUT TO LIGHT/RELAY*

TB2-5 (REMOTE RESET) MOMENTARY CONTACT TO GROUND

TB2-6 (OVERCRANK FAULT) GROUND OUTPUT TO LIGHT/RELAY*

TB2-7 (OVERSPEED FAULT) GROUND OUTPUT TO LIGHT/RELAY*

TB2-8 (HIGH ENGINE TEMPERATURE FAULT) GROUND OUTPUT TO LIGHT/RELAY*

TB2-9 (LOW OIL PRESSURE FAULT) GROUND OUTPUT TO LIGHT/RELAY*

TB2-10 (PRE-HIGH ENGINE TEMPERATURE WARNING) GROUND OUTPUT TO LIGHT/RELAY*

TB2-11 (PRE-LOW OIL PRESSURE WARNING) GROUND OUTPUT TO LIGHT/RELAY*

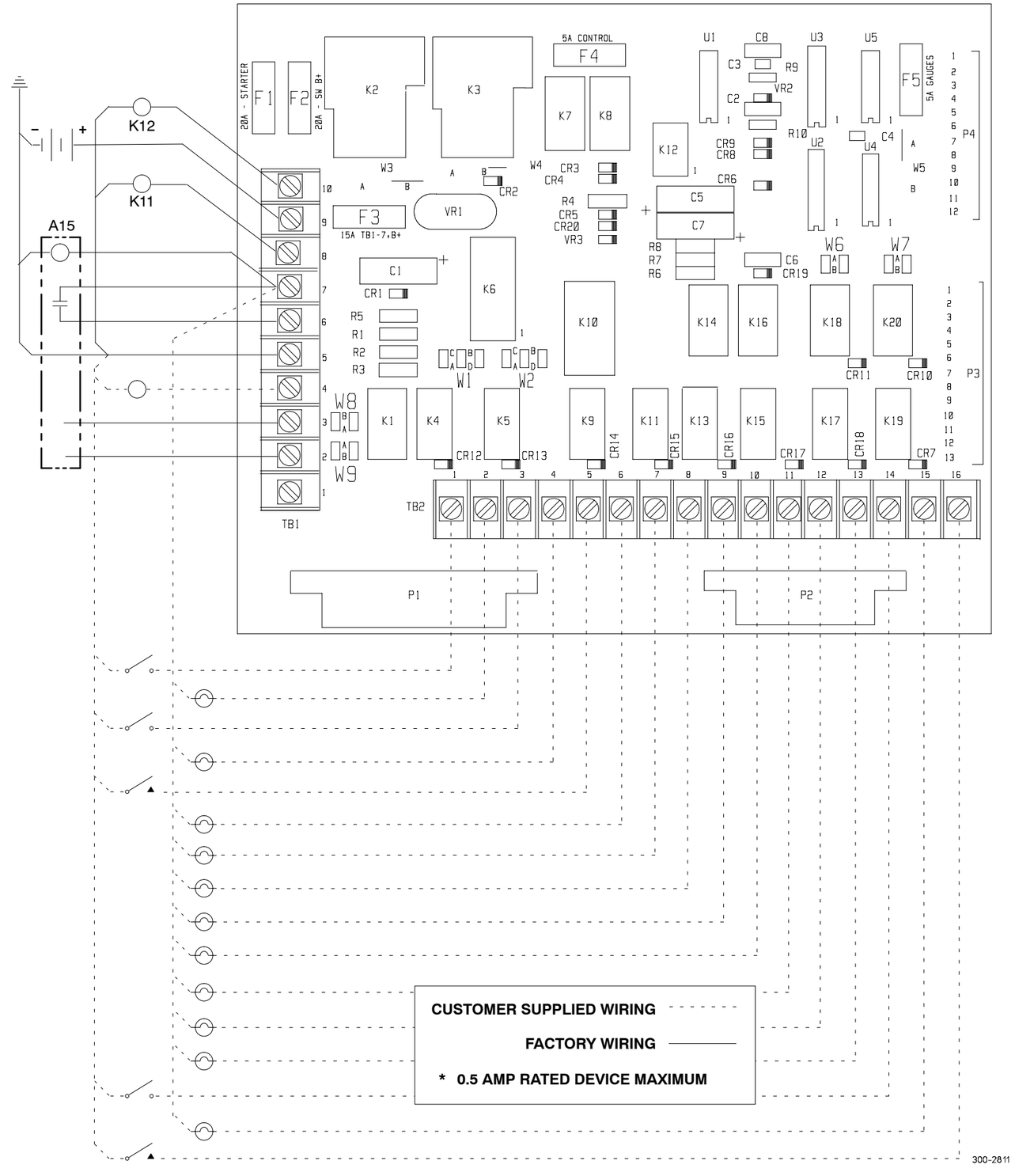
TB2-12 (SWITCH OFF WARNING) GROUND OUTPUT TO LIGHT/RELAY*

TB2-13 (LOW ENGINE TEMPERATURE WARNING) GROUND OUTPUT TO LIGHT/RELAY*

TB2-14 (LOW FUEL WARNING) GROUND INPUT FROM SENDER

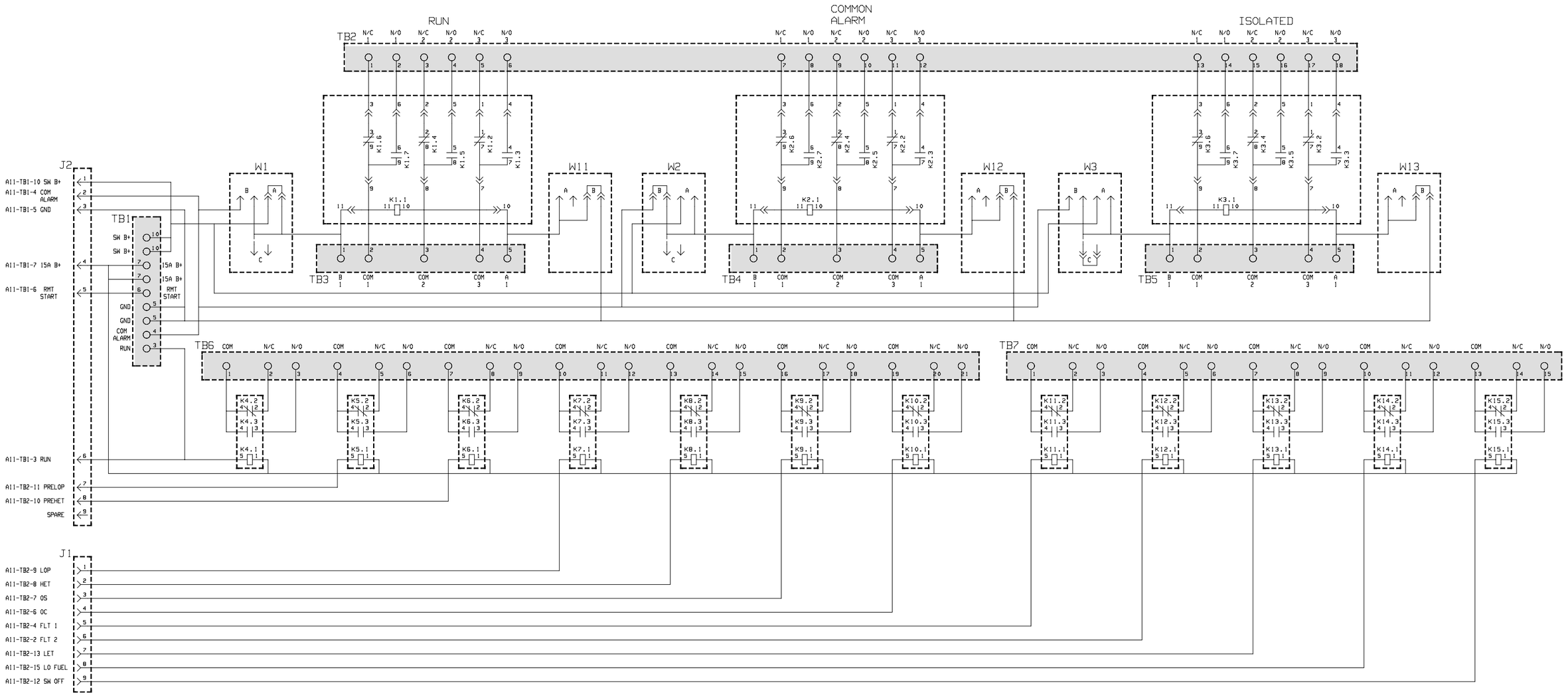
TB2-15 (LOW FUEL WARNING) GROUND OUTPUT TO LIGHT/RELAY*

TB2-16 (EMERGENCY SHUT DOWN) MOMENTARY CONTACT TO GROUND



FACTORY AND CUSTOMER CONNECTIONS AT THE ENGINE MONITOR BOARD TERMINALS

THIS IS A REPRESENTATIVE (GENERIC) SCHEMATIC/WIRING DIAGRAM. FOR TROUBLESHOOTING, REFER TO THE WIRING DIAGRAM PACKAGE THAT WAS INCLUDED WITH YOUR GENSET.



THE TERMINALS IN THE SHADED BOXES ARE FOR CUSTOMER CONNECTIONS

CUSTOMER CONNECTIONS AT THE AUXILIARY RELAY BOARD