



MAINTENANCE INSTRUCTION

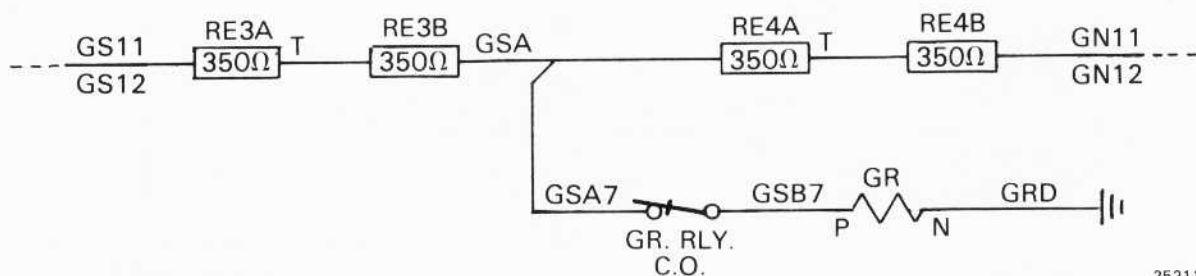
MODIFICATION RECOMMENDATION

IMPROVED GROUND FAULT DETECTION SYSTEM

- PURPOSE:** To provide instructions for a circuit modification which will enhance ground fault and single-phase detection.
- APPLICATION:** Locomotives equipped with AR6, AR10, or AR12 main generators.
- REFERENCES:** Applicable locomotive circuit schematics, and illustrations included in these instructions.
- DISCUSSION:** In the rare event that an alternator-rectifier (AR) main generator would fail in a manner such that one half of the AR generator was single-phased, with present circuitry, the failure could go undetected. This could result in main generator damage.

The improved ground fault detection system described in this publication will react to such a failure by removing generator excitation.

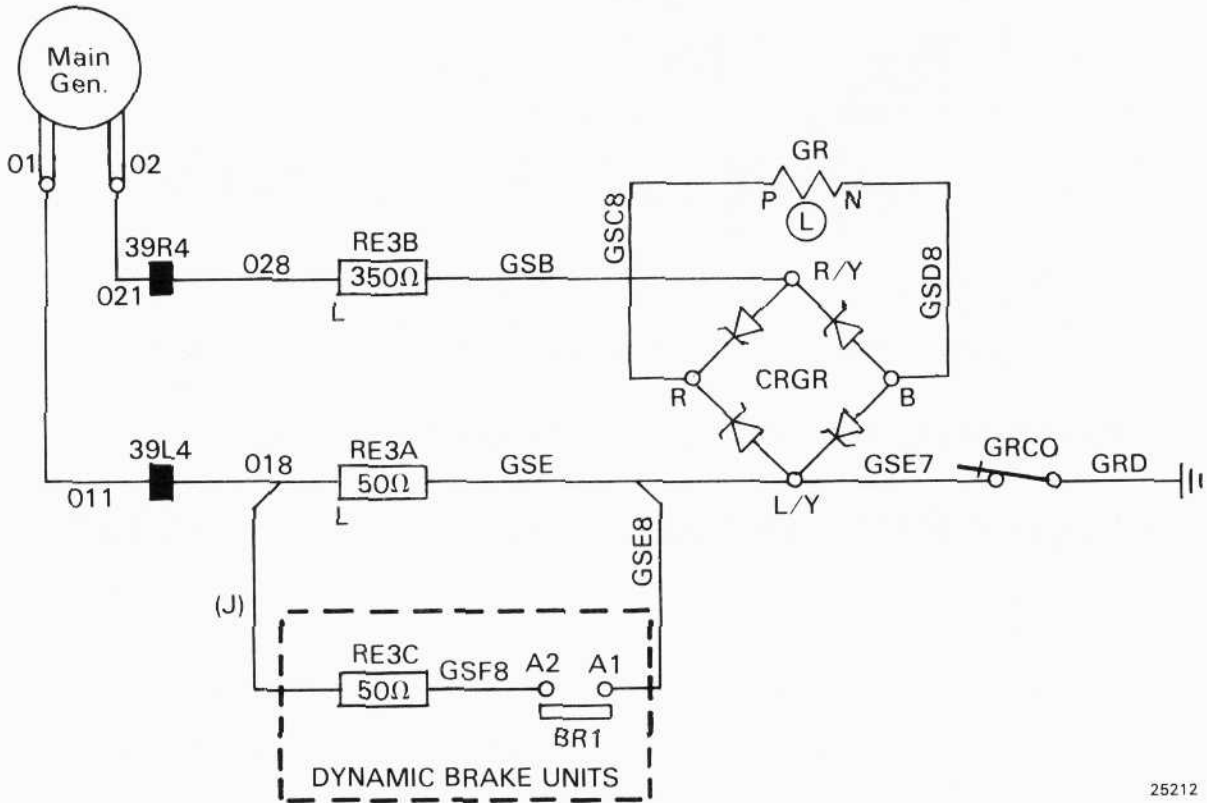
The original ground relay circuit, as applied to early AR10 equipped locomotives is shown in Fig. 1. This circuit was the subject of a field modification in 1967, and there should be very few of these systems currently in service. If this circuit should be found on an existing locomotive, the basic procedure in this M.I. can be followed, except that new wiring must be extended to the 01 and 02 neutral leads in the AR10 airbox, GS11 must be spliced with GS12, and GN11 must be spliced with GN12. Contact your field representative for assistance.



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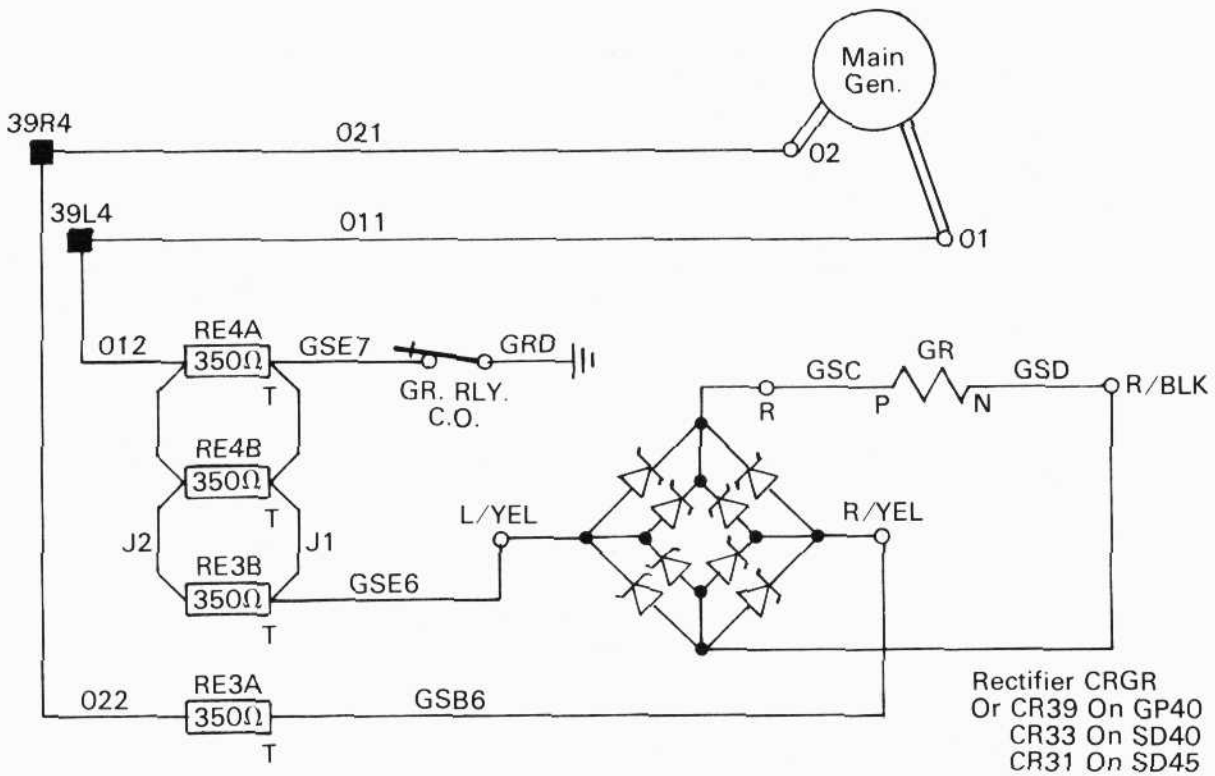
Fig.1 - Ground Relay Circuit On Early AR10 Locomotives

The circuit shown in Fig. 2 (a) (or a variation) should be in most locomotives. A previous circuit which appeared on all GP40, SD40 and SD45 locomotives built prior to July 1, 1967, is shown in Fig. 2 (b). The modification of the circuit shown in Fig. 2 (b) to that in Fig. 2 (a) was covered in M.I. 9557.



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Fig.2(a) - Possible Original Circuit



25213

Fig.2(b) Ground Relay Circuit On SD40, GP40, SD45 Units Prior To July, 1967

All instructions in this M.I. are referenced to the circuit in Fig. 2(a). Some differences in wire names may exist between this diagram and wiring existing on a particular locomotive. Therefore, instructions should be checked against the actual locomotive schematics. The final desired circuit is shown in Fig. 3.

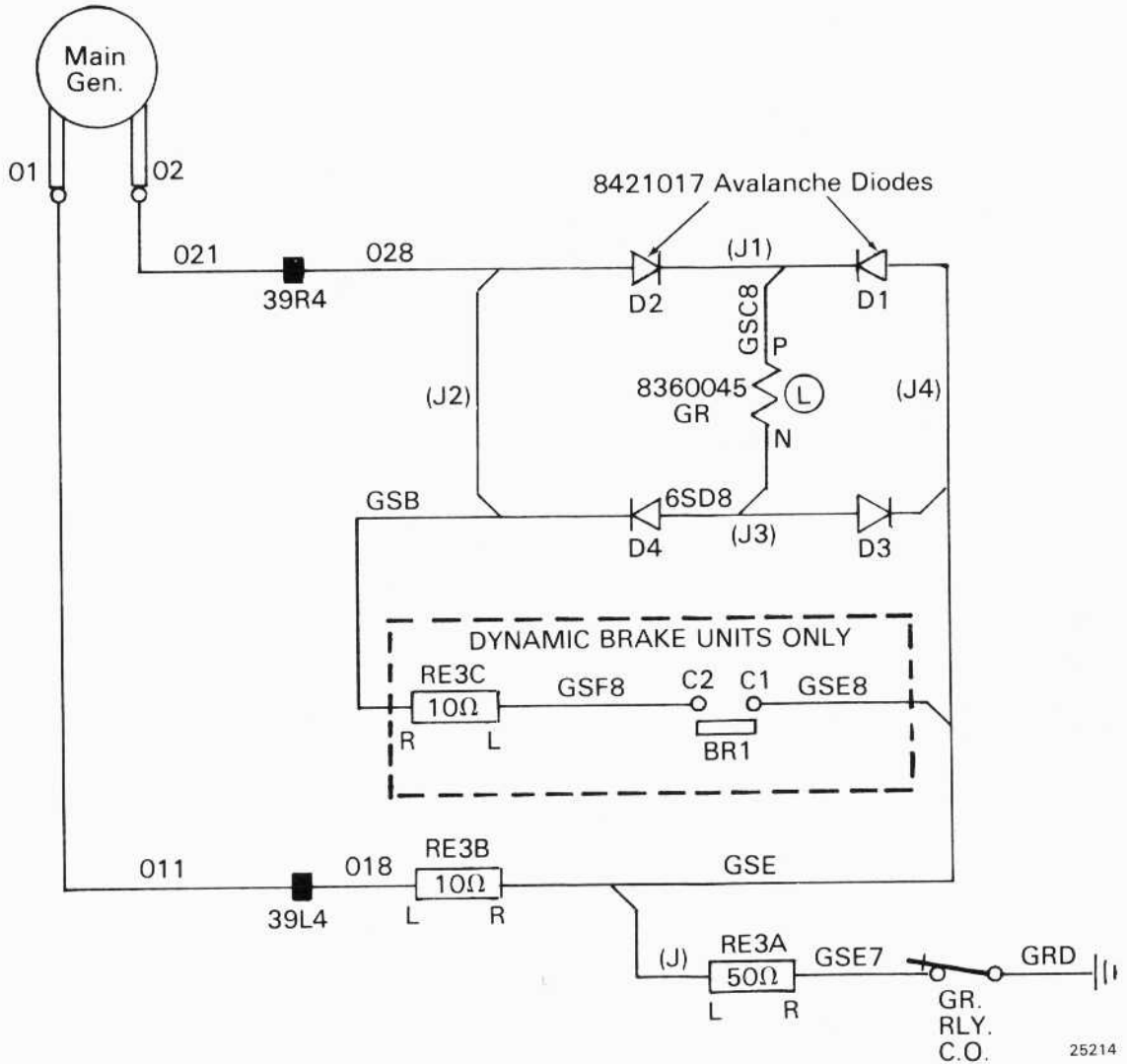
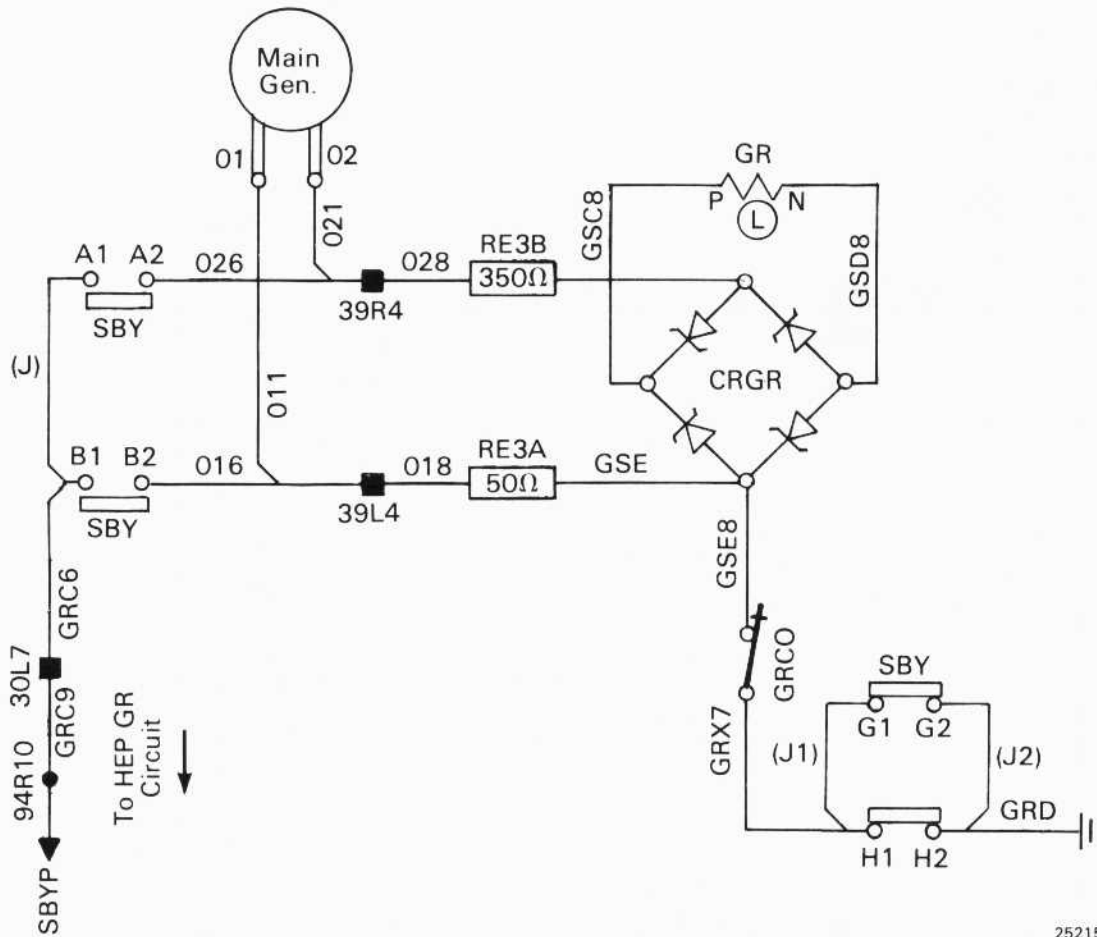


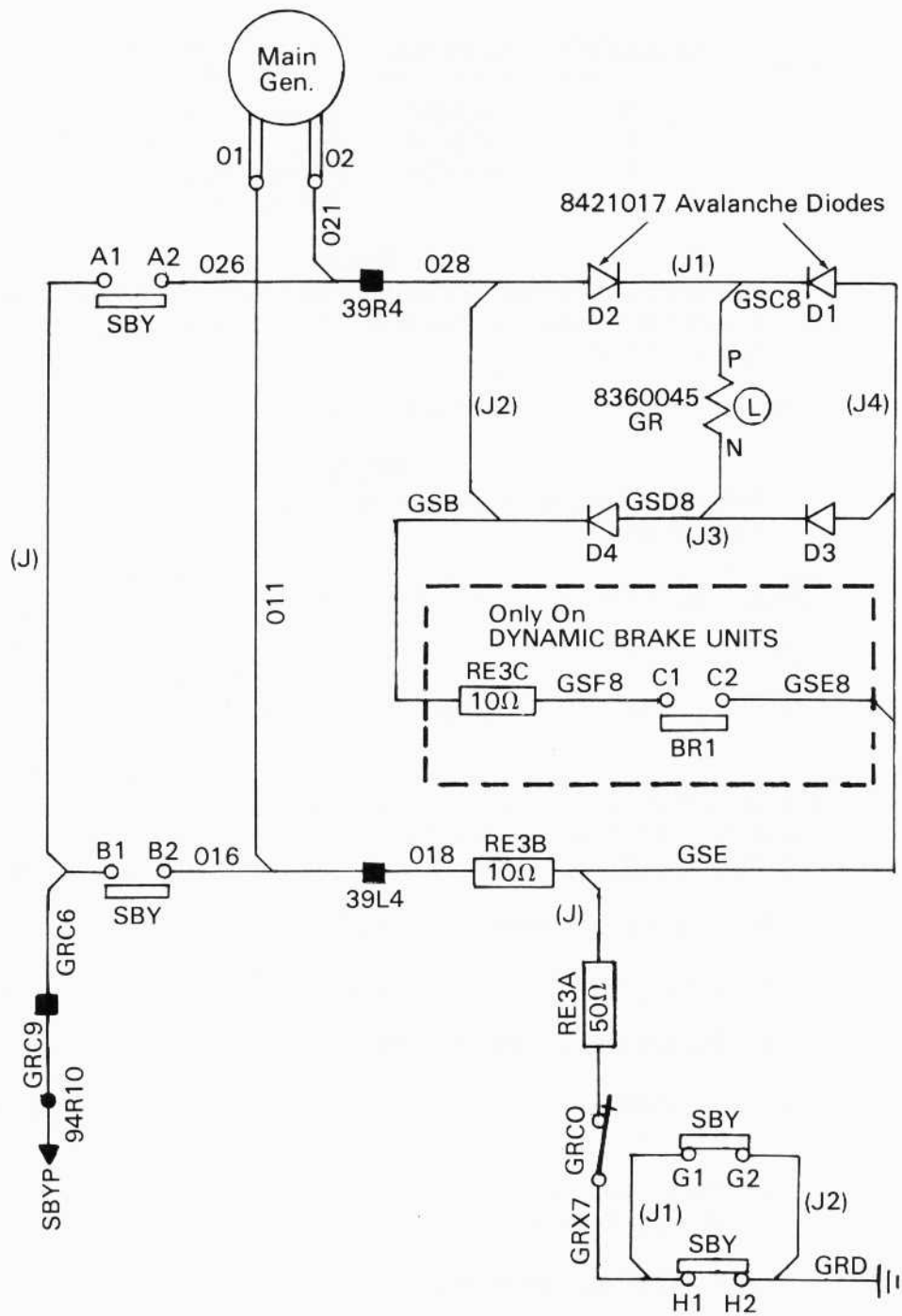
Fig.3 - Modified Ground Relay Detection Circuit

Locomotives equipped with head end power (F40PH) also have an adjoining H.E.P. ground detection circuit as shown in Fig. 4 (a). The wiring to the H.E.P. ground detection circuit should not be disturbed, resulting in the circuit shown in Fig. 4 (b).



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Fig.4(a) - Original Circuit For Head End Power Equipped Units



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Fig.4(b) - Modified Ground Relay Detection Circuit For Head End Power Equipped Units

**MATERIAL
REQUIRED:**

<u>ITEM</u>	<u>QUANTITY</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	4	8421017	Avalanche Diode (D1, D2, D3, D4)
2	1	9519141	Resistor Assembly (RE3A, RE3B)
	1	9336231	Resistor Assembly (RE3A, RE3B, RE3C)

NOTE

Use resistor assembly 9519141 on locomotives without dynamic brakes. Use resistor assembly 9336231 if locomotive is equipped with dynamic brakes.

3	1	8360045	Relay - GR
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NOTE

Some units may already be equipped with ground relay 8360045. It may be reused.

<u>ITEM</u>	<u>QUANTITY</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
4	AR	8468611	No. 14 control wire - Exane insulation (500 FT.)
5	AR	8250906	Terminal receptacle

**APPROXIMATE
COST:**

The estimated cost of equipping a unit requiring a new GR relay is \$332.43 (not including wire and terminal receptacles). On units already equipped with ground relay 8360045, the estimated cost is \$36.51 (not including wire and terminal receptacles).

PROCEDURE:

1. Disconnect the following wires and leave hanging free:
 - a. The 028 wire on RE3B. (This may be 022 on some applications).
 - b. The 018 wire on RE3A. (This may be 012 on some applications).
 - c. The GSB wire on RE3B. On non-dynamic brake units cut wire back and insulate.
 - d. The GSB wire on CRGR R/Y terminal. On non-dynamic brake units cut wire back and insulate.
 - e. The GSE wire on RE3A.
 - f. The GSE wire on CRGR L/Y terminal.
 - g. The GSC8 wire on CRGR R terminal. (This may be GSC on some applications.)
 - h. The GSD8 wire on CRGR R/B terminal. (This may be GSC on some applications.)
 - i. The GSE7 wire on CRGR L/Y terminal.

2. On units with dynamic brakes only, disconnect the following wires and leave hanging free:
 - a. The GSE8 wire on BR1 A1 terminal.
 - b. The GSE8 wire on RE3A.
 - c. The GSF8 wire on BR1 A2 terminal.
 - d. The GSF8 wire on RE3C.
3. Remove the CRGR rectifier.
4. Remove the RE3 resistor. The jumper wire between RE3A and RE3C should also be removed.
5. Mount the new resistor assembly in the RE3 position. (9519141 on non-dynamic brake equipped units and 9336231 on dynamic brake equipped units.)
6. Install four Avalanche Diodes (8421017) near the original position of the CRGR rectifier (or near the ground relay). Connect diodes as shown in Fig. 2 (b) to form a single-phase full wave bridge rectifier. Label diodes as D1, D2, D3 and D4.
7. If the existing ground relay is not an 8360045 relay, remove it and replace it with an 8360045 relay. After changeout reconnect control wiring that was on the original relay.
8. Connect the wires disconnected in Step 1 as follows (extend wire if necessary by splicing):
 - a. The 028 wire to the "anode" of D2.



- b. The 018 wire to the left side of the RE3B (10 Ohm) resistor.
 - c. The GSE wire (end originally on RE3A) to the right side of RE3B.
 - d. The GSE wire (end originally on CRGR L/Y terminal) to the anode of D1.
 - e. The GSC8 wire to the cathode of D1.
 - f. The GSD8 wire to the anode of D4.
 - g. The GSE7 wire on the right side of RE3A (50 Ohm).
9. On units with dynamic brakes only, connect wires disconnected in Step 1 and Step 2 as follows:
 - a. The GSB wire (end originally on RE3B) to the right side of RE3C (10 Ohm).
 - b. The GSB wire (end originally on CRGR R/Y terminal) to the cathode of D4.
 - c. The GSF8 wire (end originally on BR1 A2 terminal) to the C2 terminal of BR1 (or another terminal of an empty, normally-open interlock of the BR1 relay).
 - d. The GSF8 wire (end originally on RE3C) to the left side of RE3C.

- e. The GSE8 wire (end originally on BR1 A1 terminal) to the C1 terminal of BR1 (or terminal of the interlock selected above).
 - f. The GSE8 wire (end originally on RE3A) to the right side of RE3B.
10. Add a jumper wire from the left side of RE3A to the right side of RE3B.

**TESTING
PROCEDURE:**

The detection system can be checked by removing the five right, B phase fuses and loading the generator on stalled motors. The response should be set to occur at throttle 4 (or lower), and at no more than 500 amperes motor current. The system is more sensitive at higher throttle positions.

With the normal generator, grounding either the positive or negative generator bus should yield a ground relay response at no more than 150 volts generator output.

As an alternative to checking the single-phase detection provision by removing fuses, an *ungrounded* A.C. signal can be injected into that part of the circuit. Jumper terminal board locations 39R4 and 39L4 together. Remove wire 018 from 39L4, and insert an AC voltage supply capable of 1 ampere at 12 volts between the 39L4 terminal and wire 018. The ground relay should respond at no more than 12 volts.