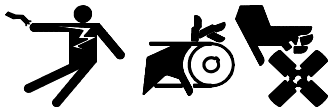

INSTALLATION INSTRUCTIONS

Original Issue Date: 11/98
 Model: 20–300 kW Fast-Response™ II
 Market: Industrial
 Subject: Voltage Regulator Kit 326930

Use the following procedure to replace an existing voltage regulator with a 0.5% regulation voltage regulator. Observe the following safety precautions while installing the kit.

⚠ WARNING



**Accidental starting.
 Can cause severe injury or death.**

Disconnect battery cables before working on generator set. (Remove negative (-) lead first when disconnecting battery. Reconnect negative (-) lead last when reconnecting battery.)

Disabling generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows:
 1) Turn the generator set master switch to OFF position.
 2) Disconnect power to battery charger. 3) Remove battery cables (remove negative (-) lead first). Reconnect negative (-) lead last when reconnecting battery. Follow these precautions to prevent starting of generator set by an automatic transfer switch or remote start/stop switch.

⚠ WARNING

**Hazardous voltage. Moving rotor.
 Can cause severe injury or death.**

Operate generator set only with all guards and electrical enclosures in place.

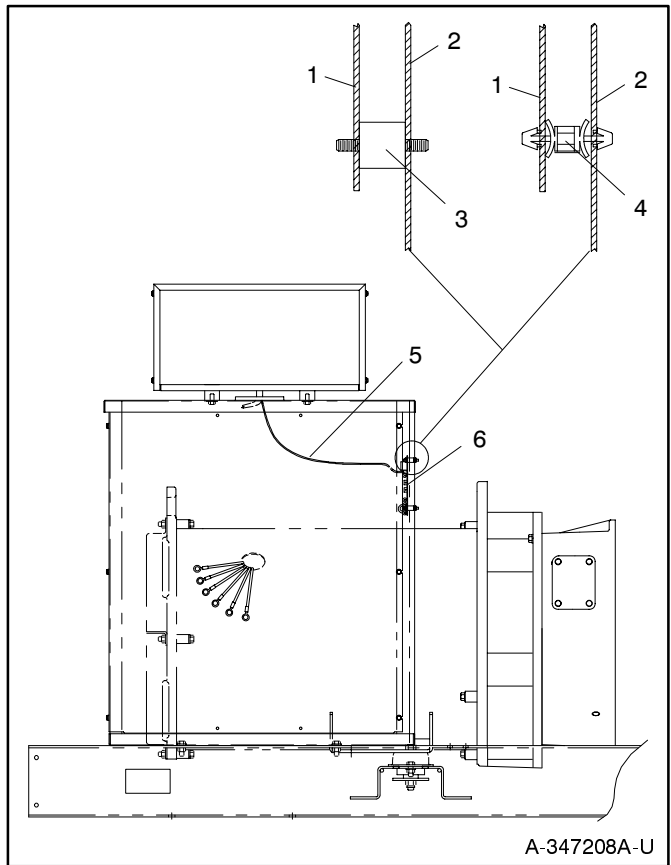
Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocutation is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution increases under such conditions.

Installing photo transistor board. Hazardous voltage can cause severe injury or death. Be sure that foil side of photo transistor board, end of shaft, and threaded holes are clean and free of metal particles and chips. Metal debris may short-circuit photo transistor board and cause hazardous voltage in generator set. Do not reconnect generator set to load until AC voltmeter shows correct output.

Installation

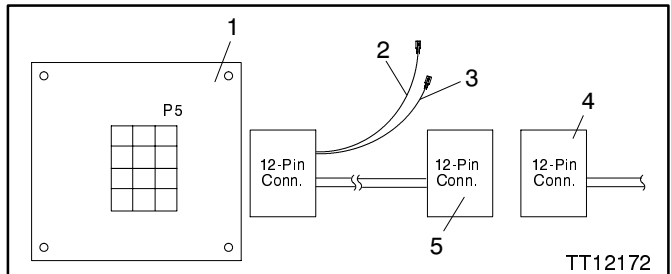
1. Place the generator set master switch in the OFF position.
2. Disconnect the power to the battery charger, if equipped.
3. Disconnect the generator set engine starting battery(ies), negative (-) lead first.
4. Remove the junction box rear and right-side panels.
5. Disconnect the 12-pin wiring harness connector connected to the existing voltage regulator circuit board.
6. Disconnect the circuit board standoffs or vibromounts securing the voltage regulator circuit board to the junction box and remove the circuit board. See Figure 1.

7. Install the circuit board standoffs (360459) or vibromounts (282829) on the new circuit board (A-360420).
8. Install the new circuit board with standoffs or vibromounts in the junction box where the original circuit board was removed.
9. Connect the existing voltage regulator wiring harness 12-pin connector to the adapter harness (360597). See Figure 2.
10. Connect the adapter harness 12-pin connector with leads to the voltage regulator circuit board. See Figure 2.
11. Remove the controller cover.
12. Route the two loose leads (V0 and V9) from the adapter harness 12-pin connector along the original voltage regulator wiring harness into the controller box. Secure the leads to the voltage regulator wiring harness with cable ties (X-468-2).
13. Disconnect lead V9 connected to the AC fuse block (TB4).
14. Connect the V9 lead from the adapter harness to TB4 where the lead was disconnected from in step 13.
15. Connect the original V9 lead disconnected in step 13 to the piggyback terminal of the adapter harness lead V9 installed in step 14. See Figure 3.
16. Disconnect lead V0 connected to the C.T./meter scale terminal block (TB3).
17. Connect the V0 lead from the adapter harness to TB3 where the lead was disconnected from in step 16.
18. Connect the original V0 lead disconnected in step 16 to the piggyback terminal of the adapter harness lead V0 installed in step 17. See Figure 3.
19. Reinstall the controller cover.



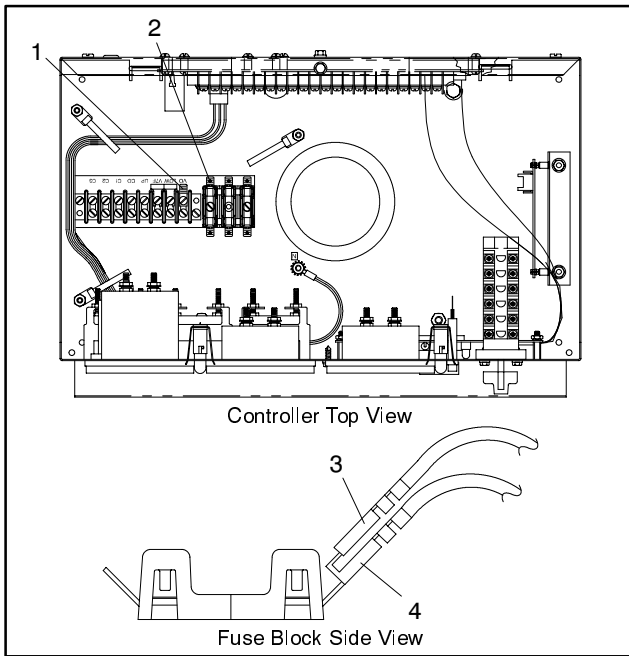
1. Voltage regulator circuit board
2. Junction box
3. Voltage regulator circuit board vibromount (282829)
4. Voltage regulator circuit board standoff (360459)
5. Voltage regulator wiring harness
6. Voltage regulator circuit board

Figure 1. Voltage Regulator Location



1. Voltage regulator circuit board
2. Lead V0
3. Lead V9
4. Existing voltage regulator wiring harness 12-pin connector
5. Voltage regulator adapter harness

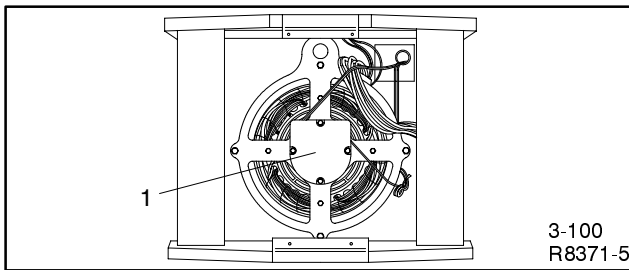
Figure 2. Voltage Regulator Connections



1. TB3 V0 terminal
2. TB4 V9 terminal
3. Original terminal connection
4. Adapter harness lead connection

Figure 3. Controller Lead Connections

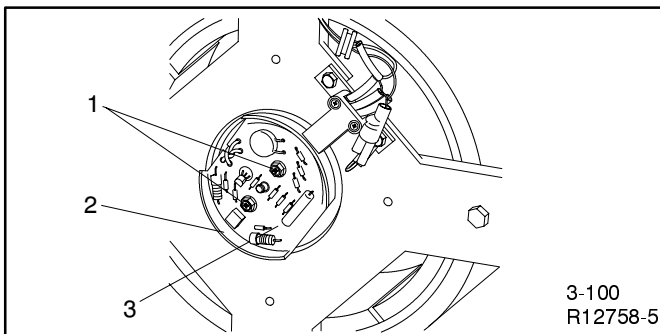
20. Remove the screws securing the LED board cover to the end bracket. See Figure 4.



1. Photo transistor/LED board cover

Figure 4. Panels Removed

21. Remove two screws securing the photo transistor board and the magnetic actuator to the rotor. Save the mounting screws. See Figure 5.



1. Screws
2. Magnetic actuator
3. Photo transistor board

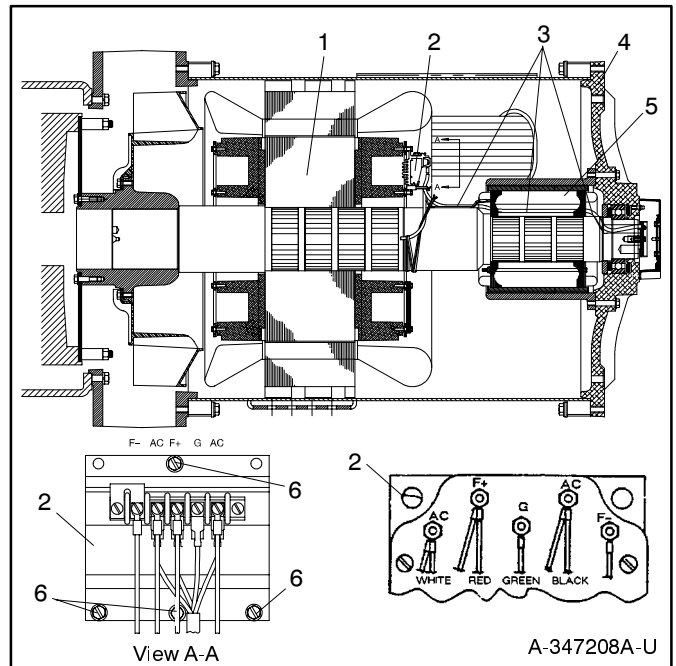
Figure 5. End Bracket

22. Locate the silicon controlled rectifier (SCR) assembly on the back of the alternator rotor through the alternator end bracket. See Figure 6.

NOTE

On smaller kW generator sets it may be necessary to remove the alternator end bracket to gain access to the SCR leads.

23. Disconnect the four photo transistor board leads (F+, G, and two AC leads) connected to the SCR. See Figure 6 and Figure 7.



1. Rotor
2. SCR assembly
3. Photo board leads
4. End bracket
5. Exciter armature
6. Screws (10-24 x 1.0 in.)

Figure 6. Rotor Assembly—Side View

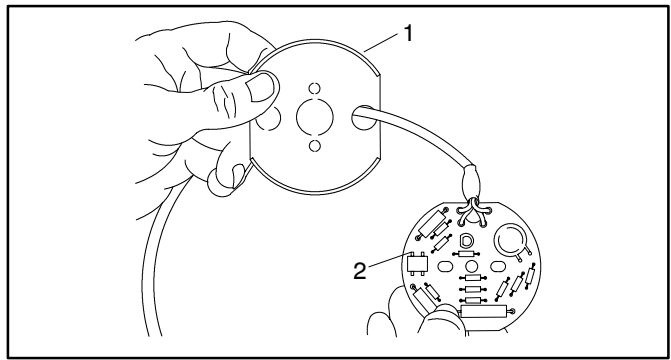
SCR Terminal	Lead Connection(s)
F-	Rotor field lead
AC	White lead and exciter armature lead
F+	Red lead and rotor field lead
G	Green lead
AC	Black lead and exciter armature lead

Figure 7. SCR Lead Connections

24. Cut the ring terminals connected to the end of the photo transistor leads disconnected in step 23. Discard the ring terminals.

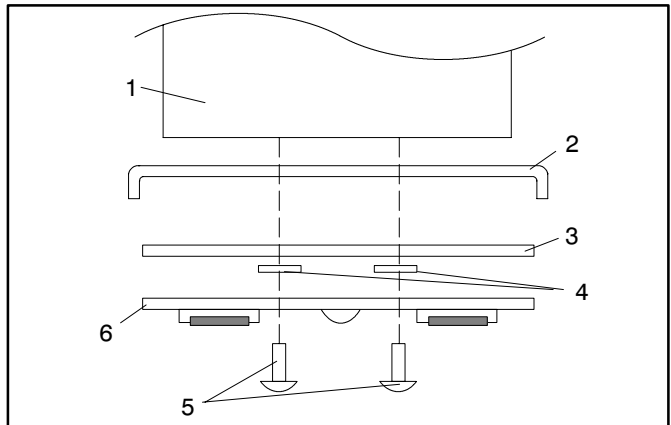
25. Remove the photo transistor board assembly.

26. Install the new photo transistor board (A-360418). Route the photo transistor board leads through the magnetic actuator cup as shown in Figure 8.
27. Route the photo transistor board lead through the hole in the rotor shaft and then through the exciter laminations to exit near the SCR assembly. See Figure 6.
28. Secure the magnetic actuator and the photo transistor board to the end of the rotor shaft using the two screws removed in step 21. Torque the hardware to 10 in. lbs. (1.1 Nm). See Figure 9.
29. Cut off the excess photo transistor board lead wire, leaving enough wire to reach the SCR assembly.
30. Strip 2-3 in. (50-75 mm) of the gray insulator jacket from the photo transistor board leads.
31. Strip a 1/4 in. (0.6 mm) of insulation from the photo transistor board leads.
32. Crimp #8 electrical terminals (X-283-7) to the photo transistor board leads.
33. Reconnect the photo transistor board leads to the SCR. See Figure 7 for lead connections. Torque the SCR connections to 8 in. lbs. (0.9 Nm) maximum.
34. Secure the photo transistor board leads to the rotor shaft with the cable tie (X-468-3). See Figure 6.
35. Reinstall the LED board cover. See Figure 4.
36. Reinstall the junction box right-side and rear panels.
37. Check that the generator master switch is in the OFF position.
38. Reconnect the generator set engine starting battery, negative (-) lead last.
39. Reconnect the power to the battery charger, if equipped.
40. Refer to the voltage regulator adjustment procedure following.



1. Magnetic actuator
2. Photo transistor board

Figure 8. Installing Photo Transistor Board



1. End of rotor shaft
2. Magnetic actuator cup
3. Insulator board
4. Insulator washers
5. Mounting screws
6. Photo transistor board

Figure 9. Photo Transistor Board Mounting

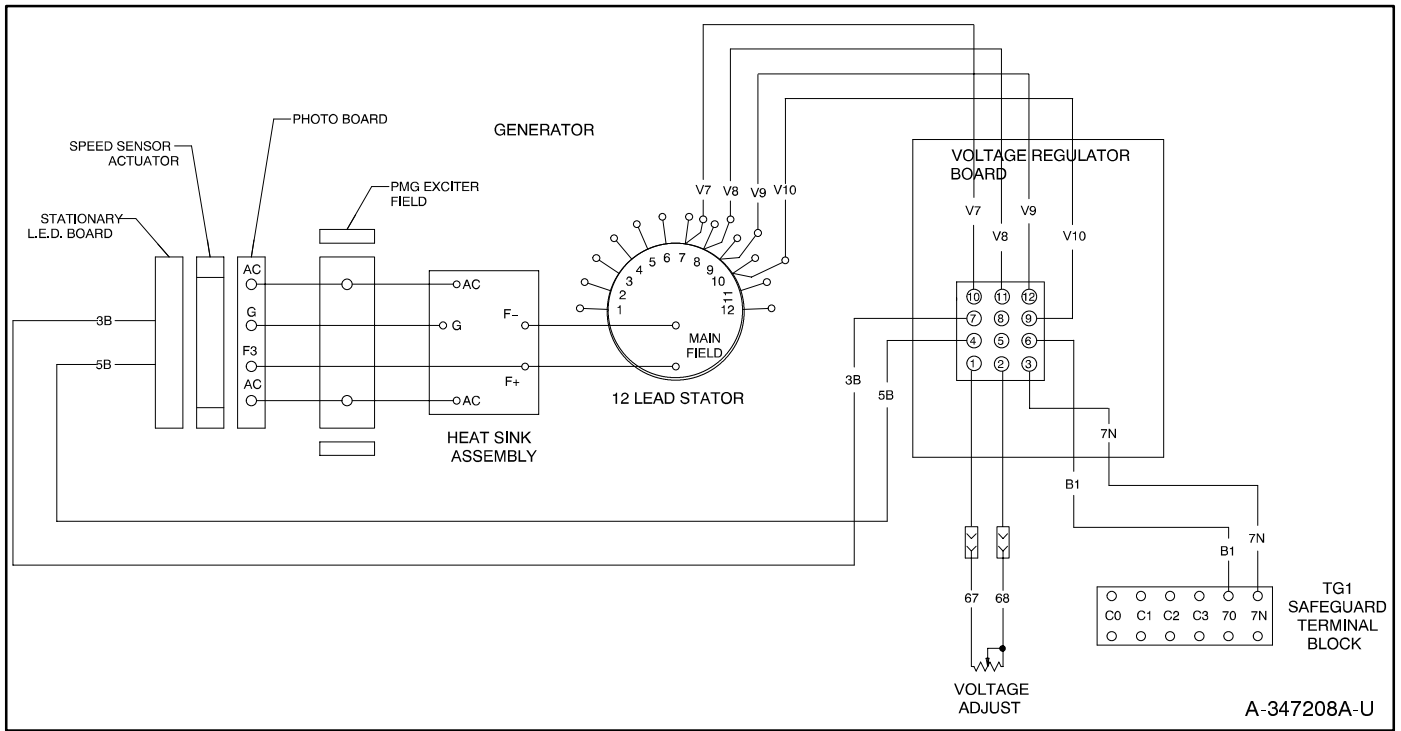


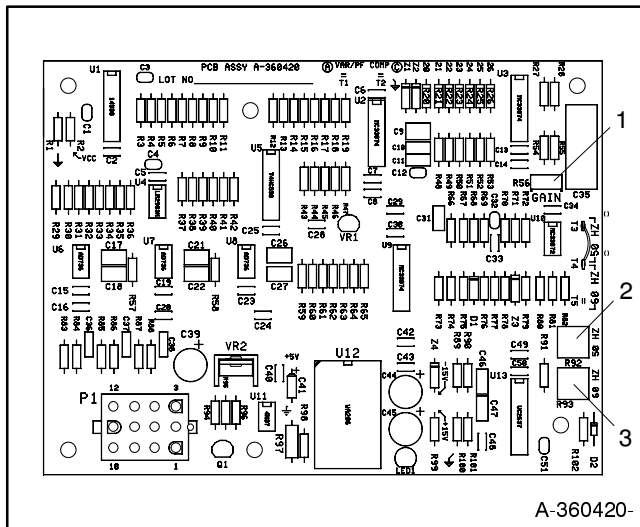
Figure 10. Wiring Diagram

Voltage Regulator Kit

Parts List		
Kit: 326930		
Qty.	Description	Part Number
6	Washer, lock	X-22-7
12	Nuts	X-72-4
4	Terminal, ring #8	X-283-7
6	Tie, cable	X-468-2
1	Tie, cable	X-468-3
6	Vibromount	282829
6	Standoff, circuit board	360459
1	Adapter, wiring harness	360597
1	PCB Assy, activator photo	A-360418
1	PCB Assy, voltage regulator	A-360420

Automatic Voltage Regulator (AVR) Operation and Adjustment

The AVR monitors output voltage magnitude and frequency to supply current to the stationary LED board. The AVR circuit board includes volts/Hz and stability adjustment potentiometers (pots). The two pots labeled 50 Hz and 60 Hz are for underfrequency unloading or volts-per-hertz (V/Hz). The pot labeled gain adjusts the stability. The V/Hz adjustment is factory set and normally requires no further adjustment. If replacement of the controller circuit board or operation of the generator under extreme loads results in voltage instability, adjust the pots according to the procedure following. See Figure 1-1.



1. Stability potentiometer
2. 50 Hz voltage adjustment potentiometer
3. 60 Hz voltage adjustment potentiometer

Figure 1-1. AVR Circuit Board

Stability Pot. Fine tunes voltage regulator to reduce light flicker.

V/Hz. Pot. This adjustment determines the engine speed (Hz) at which the generator output voltage begins to drop.

1. Turn the generator set master switch to the OFF/RESET position.
2. Connect a 100-watt light bulb across terminals V0 and V7 on the controller terminal strip or across the terminals on the controller frequency meter.

3. Start the generator set. With the generator running at no load, observe light bulb flicker. Excessive light bulb flicker indicates poor stability.
4. Adjust the stability using the gain pot until obtaining minimum flicker.
5. Use the controller voltage adjustment pot (or remote voltage adjustment pot) to make adjustments to the generator set while running under normal load (if required).
6. Adjust the engine speed to the desired cut-in frequency (factory setting is 56.5–57.0 Hz for 60 Hz models or 46.5–47.0 Hz for 50 Hz models) as measured on a frequency meter. See the generator set service manual governor section for more information on engine adjustment.
7. Rotate the V/Hz adjustment pot clockwise until the voltage level begins to drop (as measured on a voltmeter). When set to these specifications, the generator will attempt to maintain normal output until the engine speed drops below the frequency set in the previous step (as load is applied).
8. Adjust the engine speed to obtain a full load engine speed of 1800 rpm (60 Hz) or 1500 rpm (50 Hz).
9. Use the controller voltage adjustment pot (or remote voltage adjustment pot) to make final adjustments to the generator while running under normal load.
10. Readjust the stability using the gain pot (if necessary).

To determine whether the AVR is functioning correctly, reduce the engine speed (Hz) and watch for a corresponding drop in AC voltage. At 60 Hz operation, the voltage will remain constant until the engine speed drops below 58 Hz (approximately). If AC frequency drops below 58 Hz, AC voltage will decline. At 50 Hz operation, AC voltage remains constant until the engine speed is reduced to 48 Hz (approximately). If the AVR is not functioning correctly, refer to the following test to determine the cause of the malfunction.

AVR Testing

With the safeguard breaker closed (if equipped):

1. Disconnect the wiring harness connector from the voltage regulator and check for continuity between the voltage sensing leads V7 and V8 (pins 4 and 10). See Figure 1-2. If this circuit is open, repair or replace. An open circuit normally results in a high voltage or overvoltage condition. Check the 15-amp fuse (if equipped).
2. If there is continuity between V7 and V8, check for continuity in the voltage adjustment circuit (leads 67 and 68). With the harness disconnected check the resistance between pins 1 and 3. This resistance should change as the voltage adjust rheostat is turned. Repair or replace defective components as necessary. A defective voltage adjust rheostat usually results in a nonadjustable voltage.
3. Check for battery voltage at the voltage regulator harness plug (pins 2 and 11) with the generator set running. If there is not a voltage reading, check the safeguard circuit breaker. If battery voltage is not present, there should be a very low voltage at the main output leads.
4. While the generator set is running, check for approximately 0.5–1.0 volts DC output at terminals 3B (+) and 5B (-) on the LED board or separate 3B/5B connector and check for 8 volts (approximately) at the connector. If voltage is not measured at the connector, check for open or short circuit in the wiring back to the voltage regulator. If a fault exists in the voltage regulator wiring, repair or replace as necessary. If the voltage regulator wiring tests good, replace the voltage regulator. Low voltage at the LED circuit board may cause a low output voltage fault.

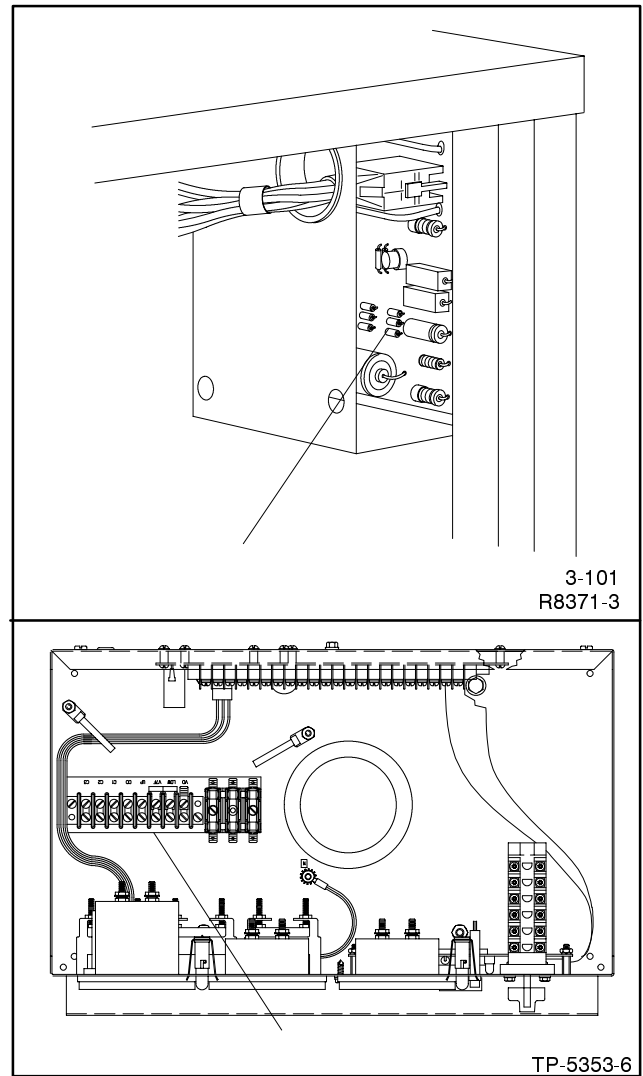


Figure 1-2. AVR and Controller Connections