SAE-300® MP

Service Manual – SVM263

Code(s): 12268

Last update: 8.20.15

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Theory of Operation

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

General Description

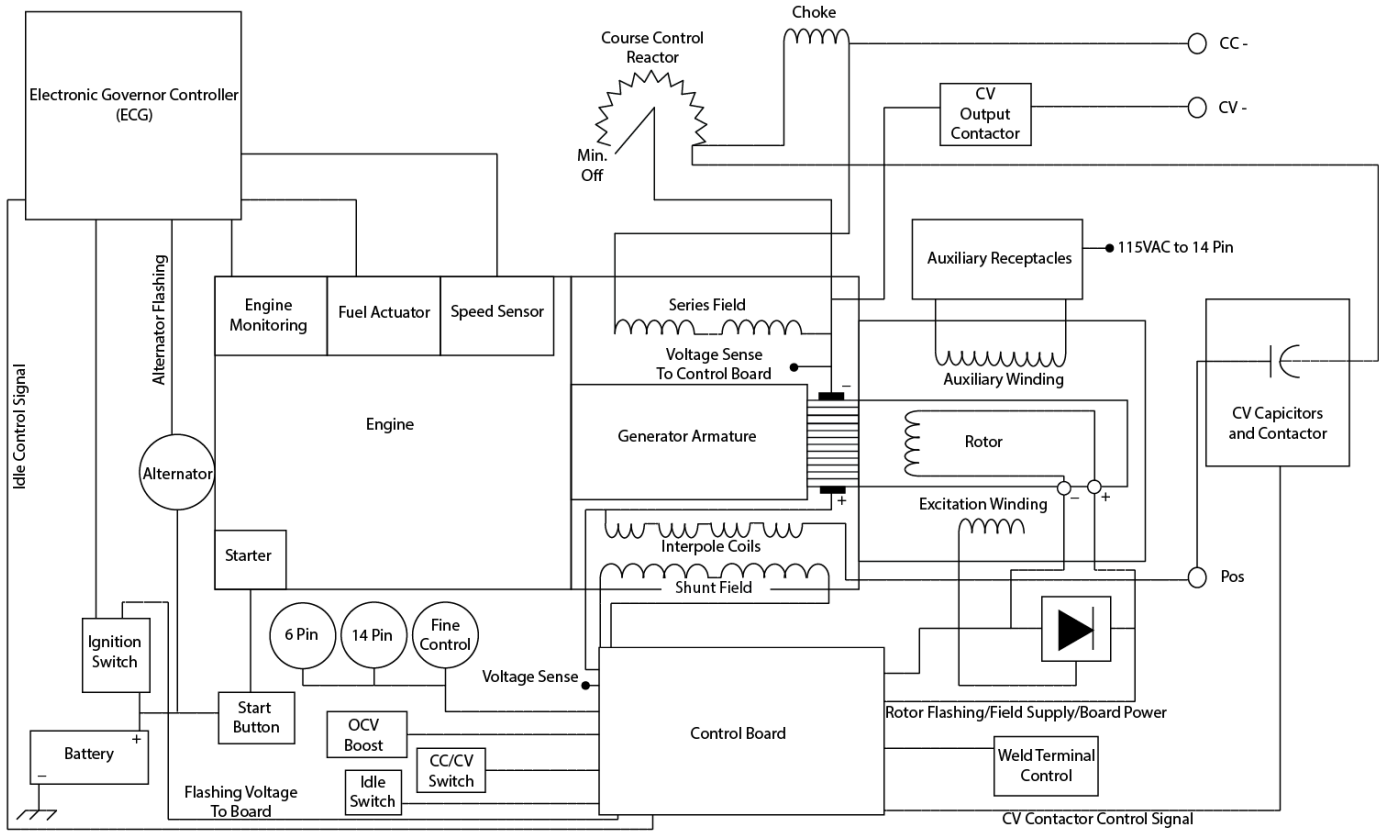

Figure 1

The SAE-300 MP is a diesel engine driven welding power source. It uses a traditional direct current generator with commutator and brushes for DC multipurpose SMAW or GTAW. The SAE-300 MP has a built in CV unit for various wire processes.

It also houses an AC generator which provides 3kW of 120V/240VAC power to run lights and tools.

Engine Starting and Protection

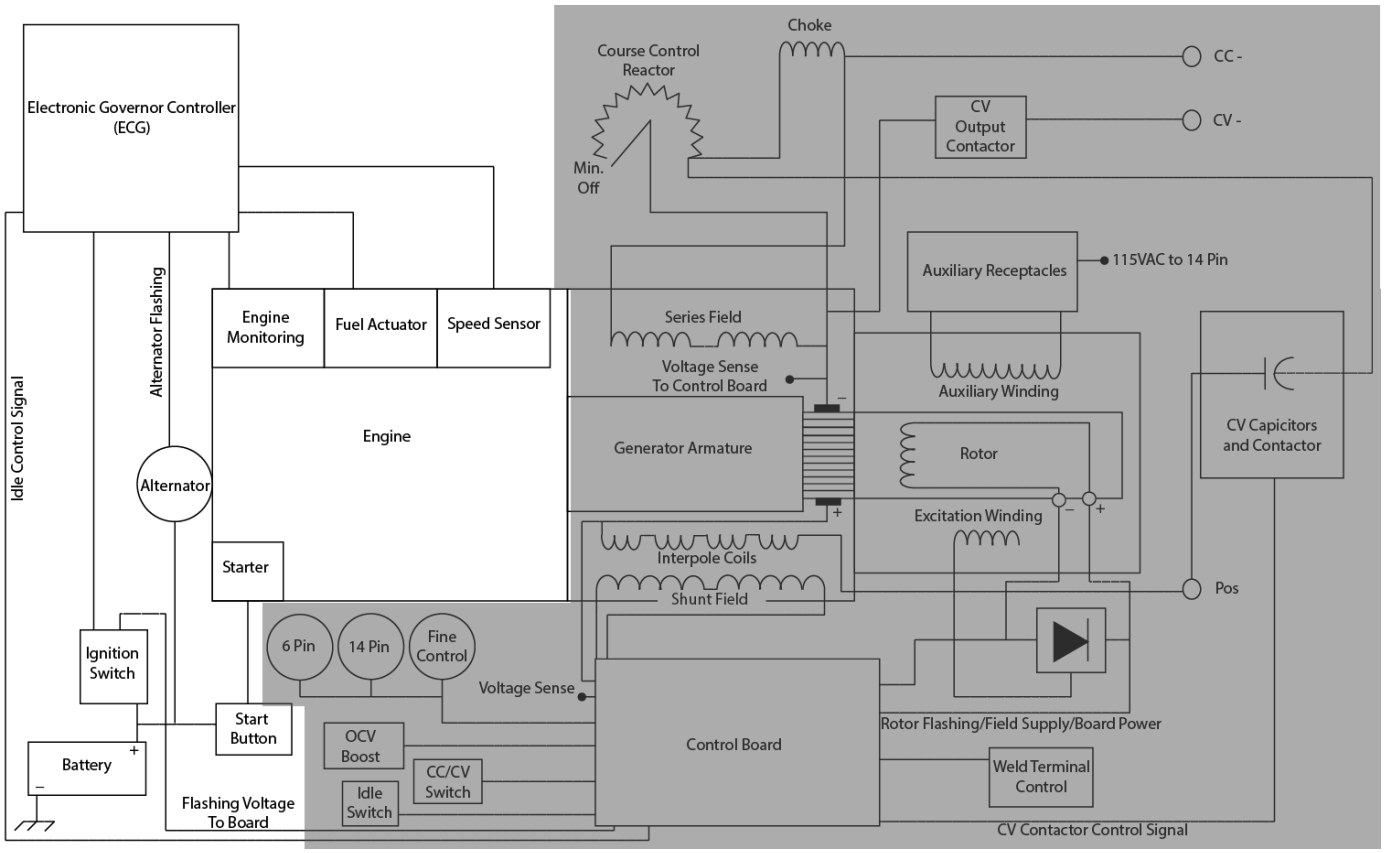

Figure 2

The SAE-300 MP has a 12VDC, negative ground battery for the engine circuitry. Closing the ignition switch applies this voltage to the Electronic Governor Controller (EGC), and the rest of the 12VDC system. There is a 60 second bypass for all engine protections to allow the engine to get to operating specifications. Once voltage is applied to the EGC, it sends a PWM signal to the fuel actuator to open it. This allows fuel to flow into the engine. Pressing the start button activates the starter solenoid, cranking the engine.

After 60 sec, the engine will begin monitoring the engine protection circuits. The EGC looks for a ground on the oil pressure or the temperature switches, indicating a failure condition. Also it monitors the engine speed and makes sure the engine does not go over 115% of the rated speed. If any of the failure conditions are met, the EGC will terminate the PWM signal to actuator, shutting down the engine.

The EGC flashes the alternator and senses charging on the same lead. If there is a failure in the charging circuit, the battery light will come on, but the machine will not shut down.

Engine Speed Control

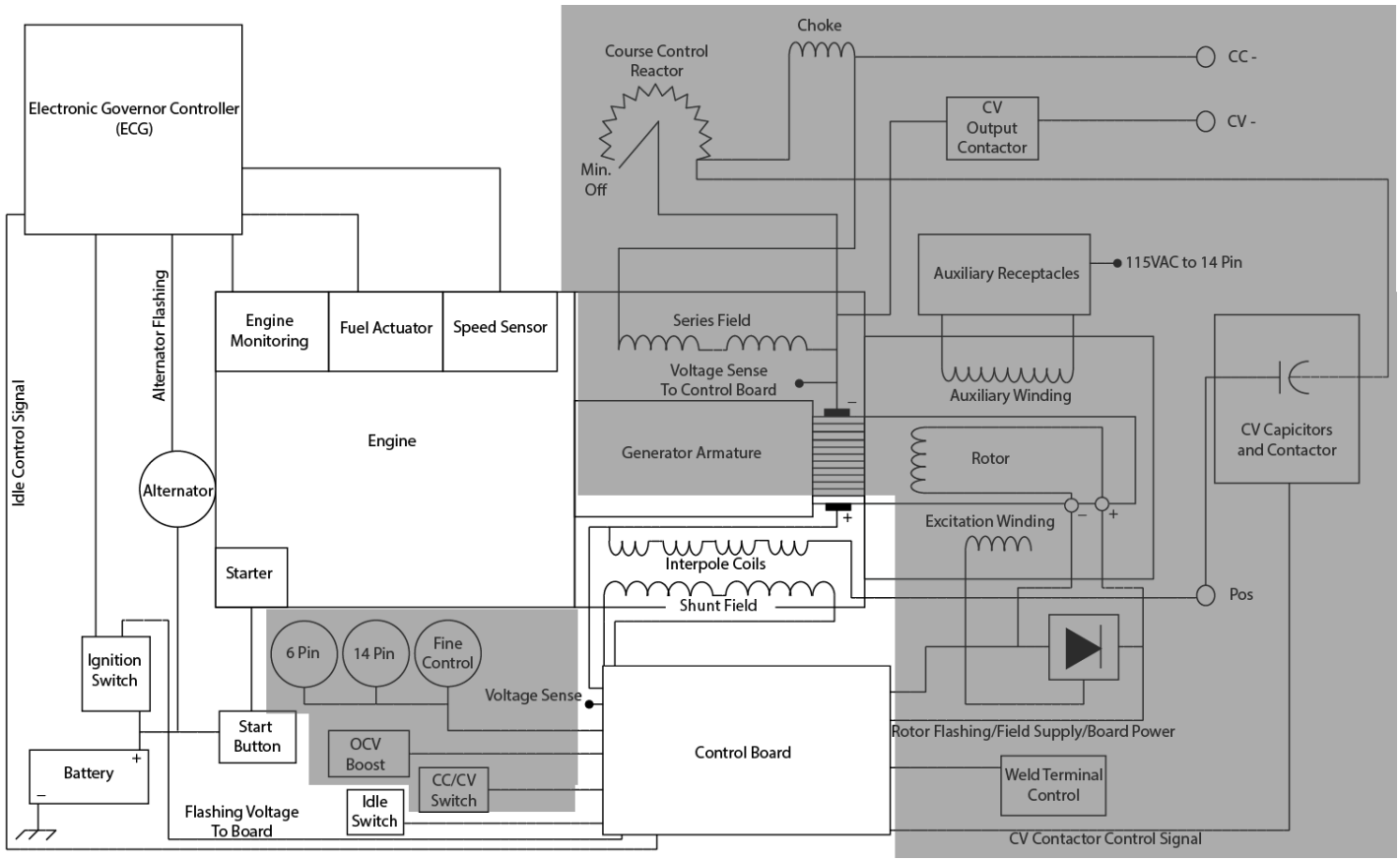

Figure 3

The EGC monitors the engine speed sensor to keep the engine at a steady 1800rpm, regardless of load. It maintains this speed with the fuel actuator. If the idle control switch is set to auto, the EGC will regulate the speed down to 1440rpm.

If, while at low idle, at least 100W is drawn from the auxiliaries, the idler toroid will sense this and send a signal to the Control Board. The Control Board will then send a signal to the EGC to put the machine in high idle.

If, while at low idle, a welding arc is struck, the Control board will read a voltage drop across the interpole coils, and it will send a signal to the EGC to put the machine in high idle.

Exciter Alternator

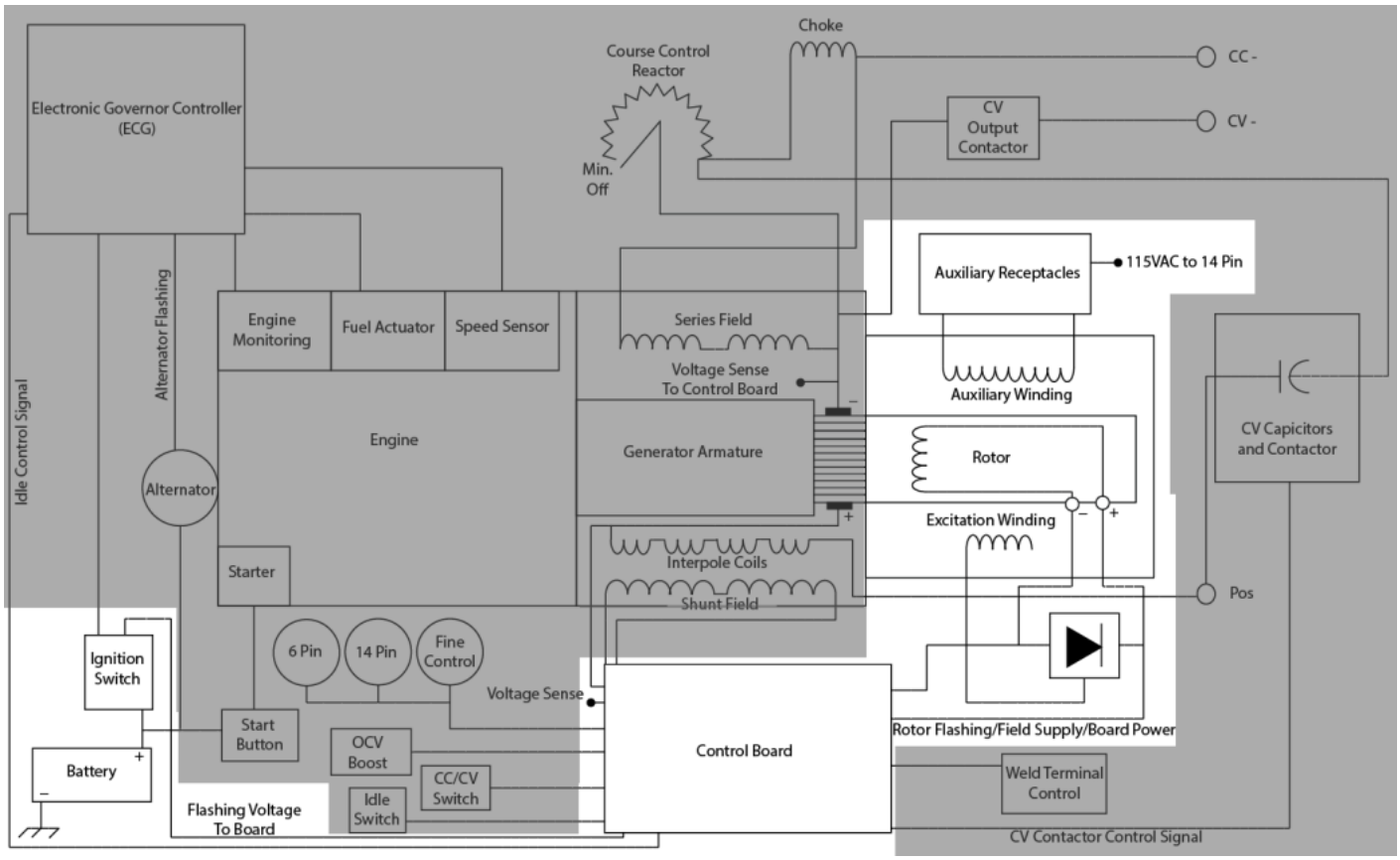

Figure 4

The exciter alternator is mounted to the end of the welding generator. The exciter is responsible for producing auxiliary outputs and power for the control board.

The alternator rotor, which is the revolving field, requires a DC voltage to energize it. This “flashing” voltage is provided by the Control Board, via the slip rings. The Control Board receives this voltage from the ignition switch.

Once this voltage is applied to the rotor a magnetic field is established. This field is then rotated within the stationary stator windings. The passing of the north and south poles of the rotor induces an alternating current onto the stator windings.

The excitation winding is wound in such a manner that it produces a higher AC voltage than the DC voltage on the rotor. This voltage is then rectified on a full wave bridge and put back on the rotor. This occurs until the iron in the generator is saturated (cannot hold any more voltage). This happens at about 120VAC.

Once saturated, the auxiliary, center tapped winding will produce 230VAC across the outside legs and 115VAC to the center tap.

The DC voltage for the rotor is also used to power the Control Board.

Welding Power Generation and Voltage Control

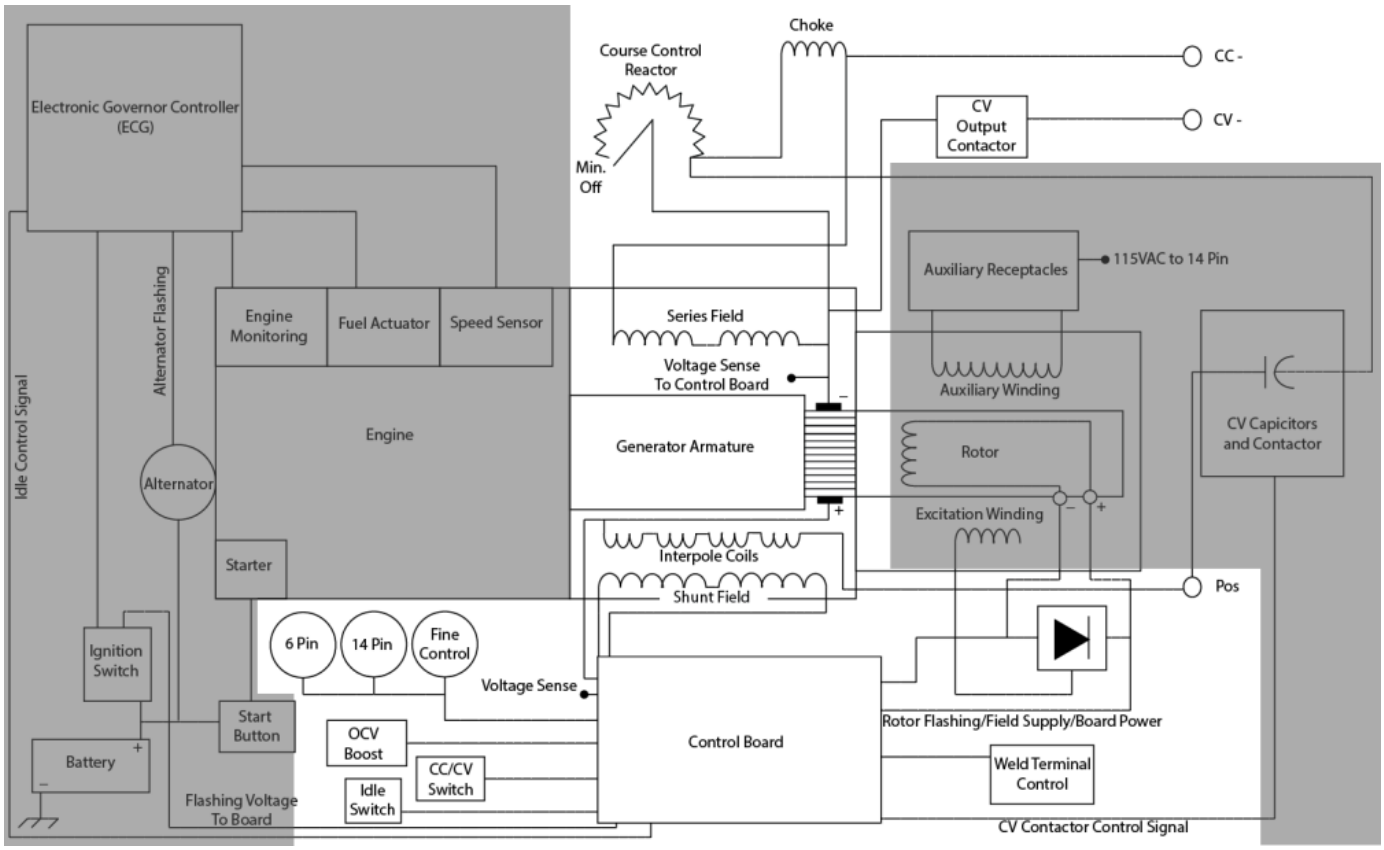

Figure 5

The welding generator is mounted directly to the engine. The welding generator is responsible for producing and controlling the welding output.

The Shunt Field coils provide the magnetic field in which the generator armature spins. The DC voltage for this coil is provided by the Control Board.

Once the field is established, the engine spins the generator armature inside of it. As the armature windings pass the north and south poles of the field, an alternating current is induced onto them. This current is then sent to the commutator, (copper bars at the end of the armature), where it is rectified and a DC output is sent to the brushes. This is your welding power.

The Control Board checks the user input on the Fine Current/Voltage control potentiometer. This tells the Control Board how much voltage to put through the shunts, in order to change the output. In CC mode, you will see the change in the OCV (Open Current Voltage) and in the arc characteristics. In CV, you will control voltage in this manner.

The armature voltage is monitored by the Control Board so it can regulate the field voltage accordingly.

Welding Current Control

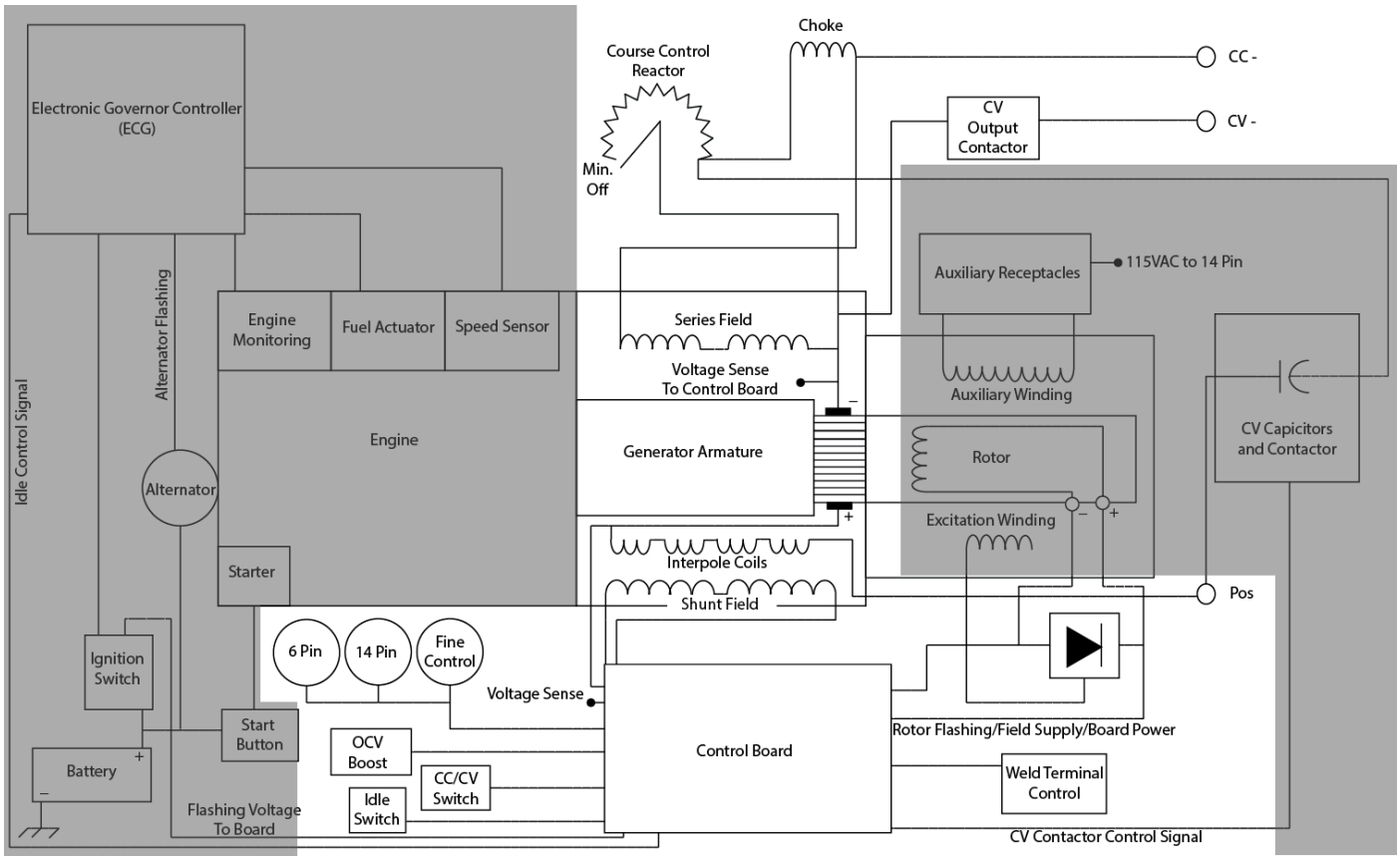

Figure 6

The current control for the SAE-300 MP is done with the Series Field. The Series Field is between the negative brush and the CC– output stud. Current pulled through the series opposes the shunt field. This results in a reduced output when welding. The stronger the opposing field, the lower the current.

The Current Control Reactor is in parallel with the series. At minimum, **it is not in use**, and all of the current runs through the series. As we decrease the resistance in the reactor, more current runs through it than the Series Field. This results in a higher output.

In CV mode, the series are bypassed by the CV- stud, and they are used, along with the reactor, for inductance control.

The Interpole Coils are between the positive brush and the positive output stud. Their purpose is to counteract the field distortion caused by running current through the series.

CV Capacitors and Contactors

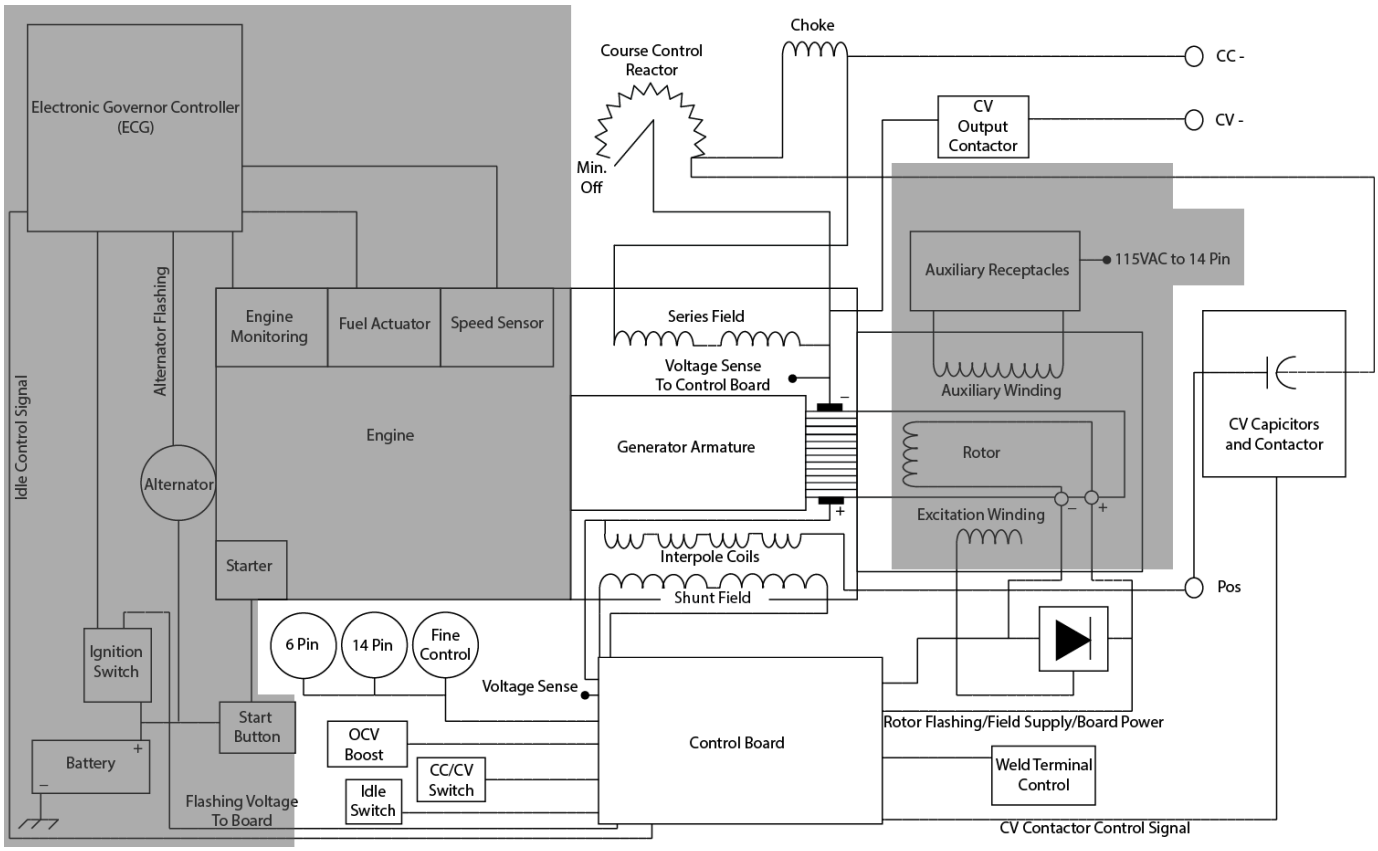

Figure 7

The output contactor is in line with the CV- output stud. This will energize, closing the weld circuit, by the Control Board, when the 2 – 4 output command circuit is closed. THIS ONLY AFFECTS THE CV- STUD.

The capacitors are brought into play by a contactor. This contact is energized by the Control Board when the machine is put into CV mode. The caps go across the positive and negative studs to filter the voltage in CV.

The CV- stud bypasses the series coils. The reactor and series coils are used for inductance or pinch control.

Troubleshooting

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).

Look under the column labeled “PROBLEM (SYMPTOMS)”. This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories:

- output problems,
- function problems,
- welding problems,
- engine problems

Step 2. PERFORM EXTERNAL TESTS.

The second column labeled “POSSIBLE AREAS OF MISADJUSTMENT(S)” lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. RECOMMENDED COURSE OF ACTION

The last column labeled “Recommended Course of Action” lists the most likely components that may have failed in the machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the specified test points, components, terminal strips, etc. can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed.

Call 1-888-935-3877.

Problems (Symptoms)	Possible areas of maladjustment	Recommended course of action
Engine Problems		
Engine does not crank.	Starter solenoid is not energizing	Check battery, start button, and related circuitry for voltage and faulty connections
Engine cranks but does not start	Fuel actuator not energizing This is normal if the engine is not started within 60 sec of the ignition switch being closed.	Check ignition switch and lead 212D on the ECG for voltage and faulty connections Check for voltage across 58 and 58N at the fuel actuator Check the resistance of the actuator coil, should be 2.8Ω
Engine shuts down after 60 sec of running	Engine monitoring system is experiencing a fault condition.	Check for engine speed, oil pressure, or engine temperature Make sure the pressure and temperature switches are not grounded. Contact Perkins
Engine will not go to low idle	Make sure idle switch is set to auto Make sure there is no welding or auxiliary load on the machine The Control Board may be faulty The ECG may be faulty	Check the idle switch for faulty connections Perform the Engine Idle Command Test

Output Problems		
Problems (Symptoms)	Possible areas of maladjustment	Recommended course of action
Engine runs, but there is no weld or auxiliary output.	Control Board is not flashing the exciter rotor There is an issue in the exciter field, check the 15A field fuse.	Perform the Exciter Rotor Flashing Test Perform the Exciter Rotor Brush and Slip Ring Procedure Perform the Exciter Rotor Resistance and Ground Test Perform the Exciter Rotor Voltage Test
Weld output is ok, but there is low or no auxiliary output.	Check breakers on the front panel Check GFCI, engine needs to be at full speed to reset the GFCI	Perform the Exciter Stator Resistance and Ground Test
There is no, or very low weld output on the CC - or CV- Stud	If there is a remote plugged into the remote receptacles, remove it and try in local	Perform the Shunt Field Voltage Test Perform the Shunt Field Coil Resistance and Ground Test Perform the Welding Generator Brush and Commutator Inspection and Service Procedure If all tests pass, check voltage from any adjacent set of brushes. You should read ocv. If it is low, or 0, the armature may be faulty.
There is no, or very low weld output on the CV- Stud. CC- stud is ok.	Make sure the CV Terminals switch is set to on.	Perform the CV Box Contactor Test

Welding Problems		
Problems (Symptoms)	Possible areas of maladjustment	Recommended course of action
CC welding output varies abnormally, is too low or too high. Auxiliary voltage is normal.	Check welding cables for damaged or poor connections. Welding cable may be excessively long, too small, or coiled. Try using a set of short test cables of adequate size. If a remote current control is being used, remove and use the local control. The remote current control may be faulty. The engine may not be maintaining steady RPM. Make sure there is an adequate supply of clean, fresh fuel. Replace fuel filters if necessary. Have engine serviced by a qualified engine technician. Check all the large weld current carrying leads inside the machine for damaged conductors, insulation and poor connections.	Perform the Welding Generator Brush and Commutator Inspection and Service Procedure Check the wiring that connects the exciter, diode bridges, potentiometer, control board and the shunt coils. Check for damaged conductors, insulation and connections Check Fine Current / OCV control potentiometer, replace if necessary. Perform the Shunt Field Coil Resistance and Ground Test Perform the Weld Output Control Circuit Ground and Short Circuit Test. Perform the Course Current Control Unit Inspection and Service Procedure Check the Generator brush rocker position; perform the Rocker Adjustment Procedure if necessary

Welding Problems		
CV welding output varies abnormally, is too low or too high. Auxiliary voltage is normal.	Check welding cables for damaged or poor connections. Welding cable may be excessively long, too small, or coiled. Try using a set of short test cables of adequate size. If a remote current control is being used, remove and use the local control. The remote current control may be faulty. The engine may not be maintaining steady RPM. Make sure there is an adequate supply of clean, fresh fuel. Replace fuel filters if necessary. Have engine serviced by a qualified engine technician. Check all the large weld current carrying leads inside the machine for damaged conductors, insulation and poor connections.	Perform the Welding Generator Brush and Commutator Inspection and Service Procedure Check the wiring that connects the exciter, diode bridges, potentiometer, control board and the shunt coils. Check for damaged conductors, insulation and connections Check Fine Current / OCV control potentiometer, replace if necessary. Perform the Shunt Field Coil Resistance and Ground Test Perform the Weld Output Control Circuit Ground and Short Circuit Test. Perform the CV Box Contactor Test Check the Generator brush rocker position; perform the Rocker Adjustment Procedure if necessary

Test Procedures

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Engine Idle Command Test

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TEST DESCRIPTION

This test will help determine if the ECG is receiving the command to go to high idle.

MATERIALS NEEDED

- Miscellaneous Hand Tools
- Multimeter
- Wiring Diagram

Procedure

1. Check the voltage across the idle switch (844A to GND-B). There should be 12VDC when in auto and 0VDC in high. If the voltage does not go away in high, check the ground stud on the front panel.
2. Set the idle switch to auto. Check voltage across J12 pins 2 and 4 (842 and 844). Without an auxiliary or weld load it should be 12VDC, when a load is applied, it should go to 0VDC.
3. If it fails on an auxiliary load check the connection at J6. Also check the resistance across J6 pins 3 and 4. It should be~12Ω.
4. If it fails on a weld load, check the voltage at J2 pin 16 and 14 (yellow lead and 206) while under load. There should be at least .25VDC to kick up into high idle.

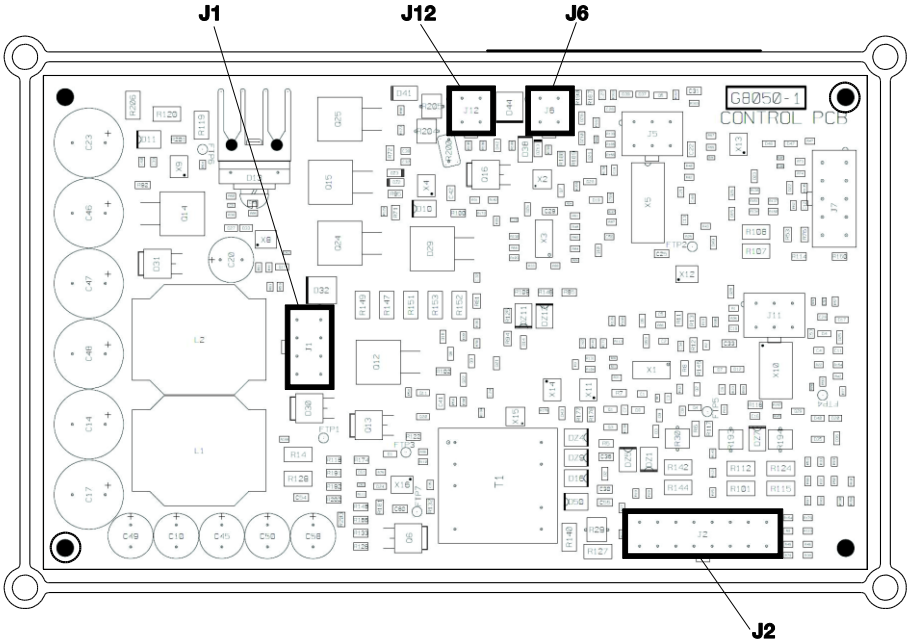

Figure F-1

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Test Description

This test will determine if the flashing voltage is being provided to the exciter rotor to energize the field.

Materials Needed

- Miscellaneous Hand Tools
- Multimeter
- Wiring Diagram

Procedure

1. Remove the exciter cover that sticks out of the front of the machine.
2. Put your positive probe on the slip ring nearest the lamination, and set the ignition switch to run. There should be ~1.5VDC across the rings.
3. If no voltage is present, perform the Control Board Access Procedure
4. Set the ignition switch to run. Check the voltage from J1 pin 6 (lead 610) to a good chassis ground. This is the flashing voltage coming from the board. (Note: you will only have 60 sec to perform this test, after that, you will have to cycle power.) You should see ~5.5VDC.
5. If the voltage is low, or 0, Check the voltage from J12 pin 1 (lead 841) to a good chassis ground. You should read battery voltage. This is the power supply for the flashing circuit.

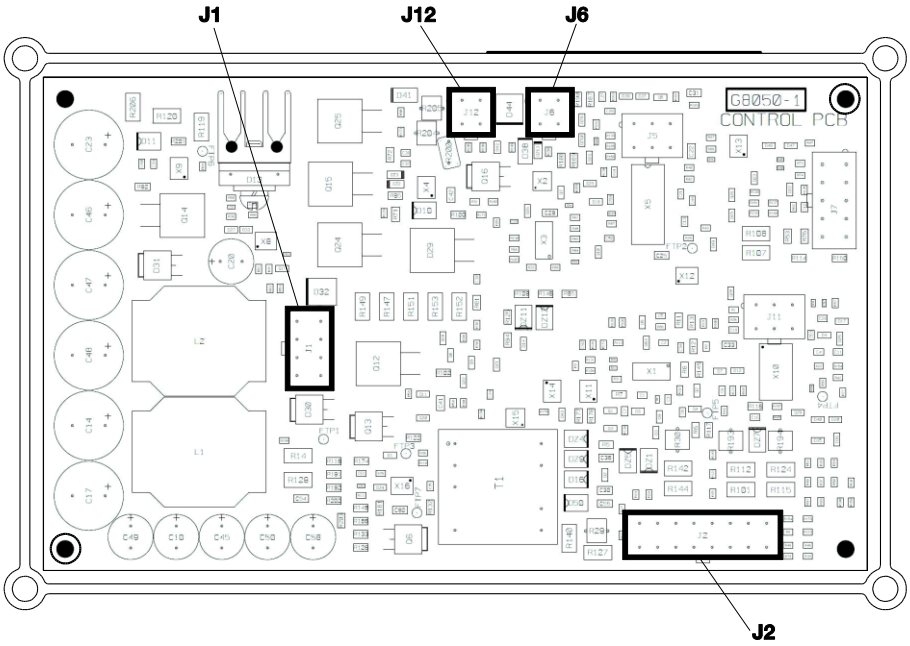

Figure F-2

Exciter Rotor Brush and Slip Ring Procedure

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Test Description

This procedure explains proper care and maintenance of the exciter rotor brushes and slip rings.

Materials Needed

- 500-600 grit emory cloth

Procedure

1. Remove the exciter cover that sticks out of the front of the machine.
2. Examine brushes, slip rings and brush holder.
    - Brushes should be clean and free from oil or grease.
    - The brushes should be of sufficient length and have adequate spring tension.
    - Brushes should be making good contact with the slip rings and should be riding near the center of the slip rings. (The brush holder bracket may need to be slightly bent to achieve acceptable alignment.)
    - Generally, the brushes should be replaced if either brush has less than 1/4” remaining before it reaches the end of its travel.
3. Check for evidence of sticking brushes. Sticking brushes will normally result in the slip rings being pitted and discolored from excessive arcing. Another sign of sticking brushes is instability or loss of both weld and auxiliary output, but the machine may begin to work properly, for a short time, after being jarred or moved.
4. In the event that the slip rings have become dirty, discolored or mildly pitted, it will be necessary to clean them, using very fine (500 or 600 grit) emery cloth.

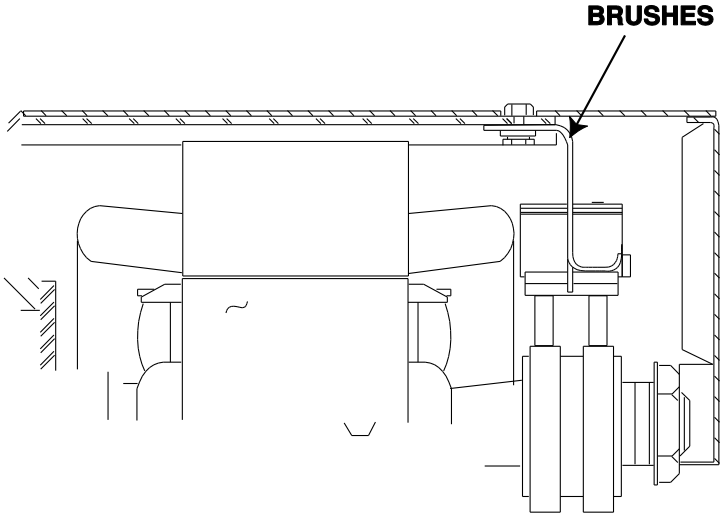

Figure F-3

Exciter Rotor Resistance and Ground Test

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Test Procedure

This test will help determine is the exciter rotor is defective.

Materials Needed

- Miscellaneous hand tools
- Ohmmeter (analog type is required for dynamic resistance tests)
- Wiring Diagram

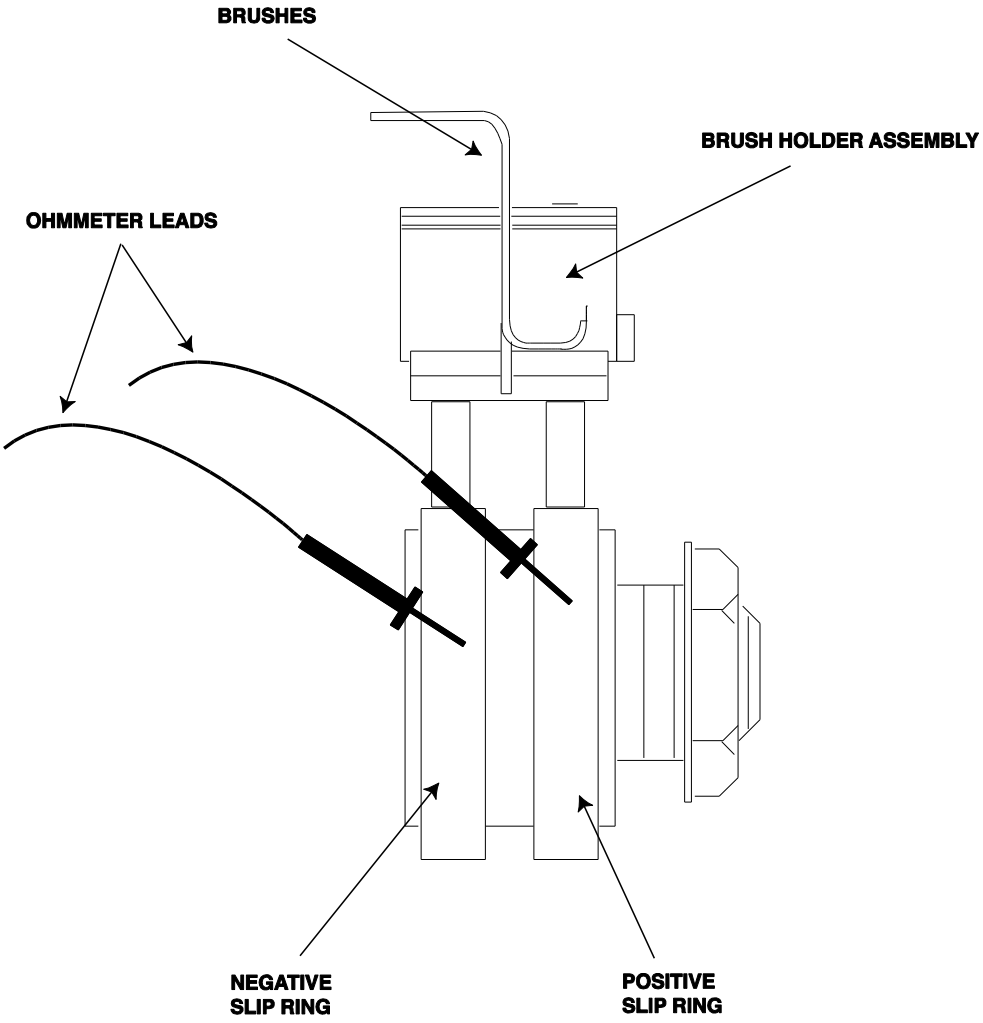

Figure F-4

Procedure

Static (engine not running)

1. Remove the exciter cover that sticks out of the front of the machine
2. Isolate the brushes from the slip rings
3. Place one probe of your multimeter on each slip ring. The resistance should be ~42Ω.
4. Place one probe on a slip ring and one on a good, chassis ground. The resistance should be very high, >500,000Ω (.5MΩ). Repeat with the other slip ring.
5. If these tests fail, the rotor may be faulty and need replaced.
6. If the values are normal, continue to the dynamic test.

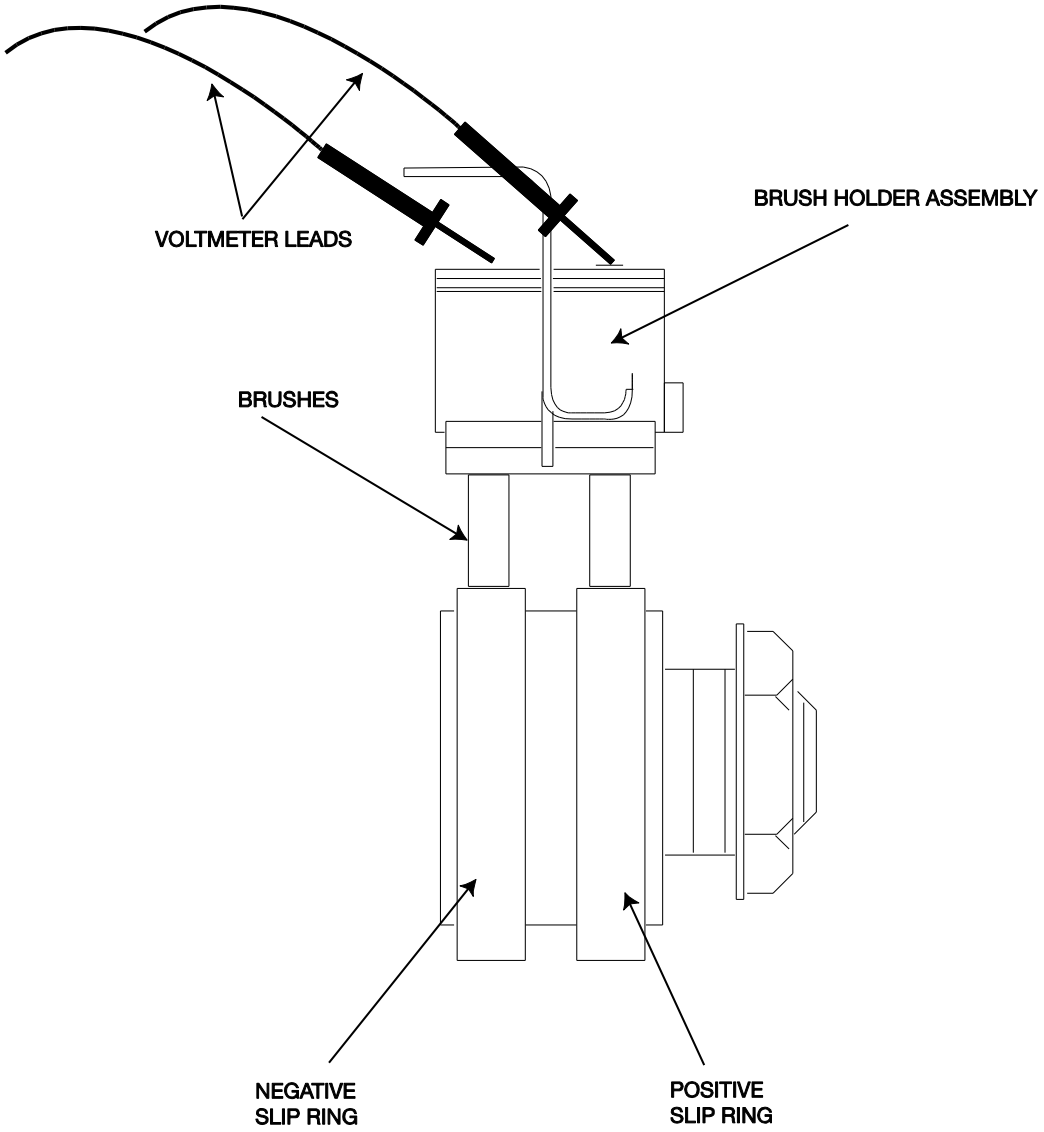

Figure F-5

Dynamic (engine running)

Note: An analog ohmmeter is required for this test. Most digital meters so not respond quickly enough to read the changes in resistance.

7. Connect the brushes back to the machine.
8. Mark and remove the leads from the brush terminals.
9. Attach the probes from your multimeter to the terminals.
10. Start the engine.
11. Make sure you meter holds steady around 42Ω.
12. Turn engine off.
13. Remove one probe and attach to a good, chassis ground.
14. Start engine.
15. Make sure the resistance does not dip below 500,000Ω (.5MΩ).
16. Repeat with the other slip ring.

Exciter Rotor Voltage Test

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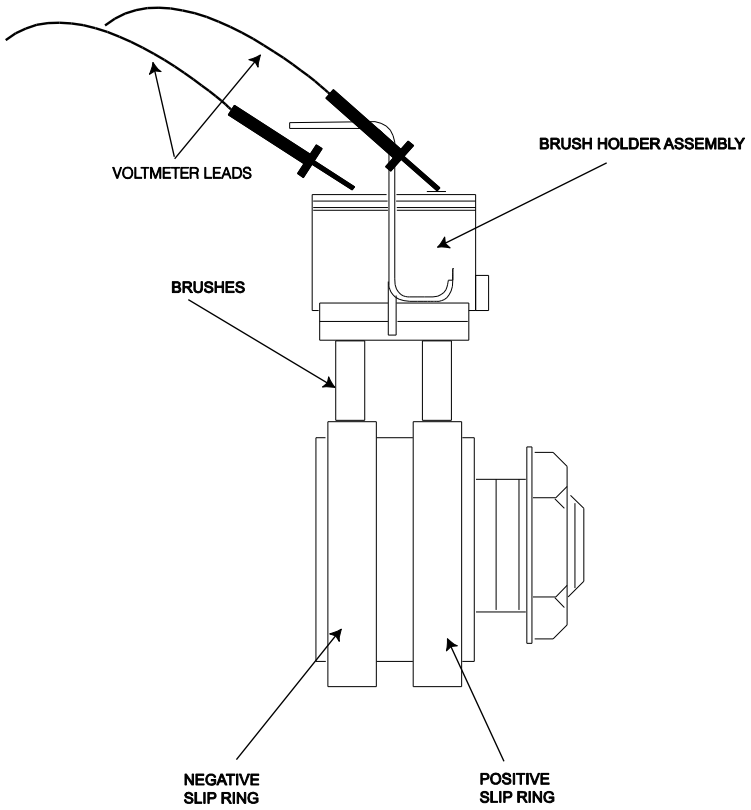
Test Procedure

This test will help determine is the exciter rotor field is operating properly.

Materials Needed

- Miscellaneous hand tools
- Multimeter with diode check functionality
- Wiring Diagram



FigureF6

Procedure

1. With the engine off, remove the cover from the exciter that sticks out of the front of the machine.
2. Connect your voltmeter to the exposed part of the brush terminals.
3. Start the engine.
4. The voltage should be ~140VDC.
5. Turn off engine.
6. If the voltage is low or 0VDC check the 15A fuse and associated wiring. Then perform the Exciter Rotor Flashing Test, Exciter Rotor Brush and Slip Ring Procedure, and the Exciter Rotor Resistance and Ground Test.
7. If those tests are good, check the field diode bridge on the control panel. Mark the leads and remove them from the bridge see Fig 9. Using the diode check function on the multimeter, check the voltage drop across each diode (there are 4, one in between each set of terminals). It should be ~.45VDC when the positive probe is on the anode and the negative is on the cathode.
8. Perform the **Exciter Stator Resistance and Ground Test**

Exciter Stator Resistance and Ground Test

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Test Procedure

This will test the windings of the exciter stator.

Materials Needed

- Miscellaneous hand tools
- Multimeter
- Wiring diagram

Procedure

1. With the engine off, open the side doors and secure them with the provided hooks.
2. Set the two pole breaker to off.
3. Remove the fuse from the front panel.
4. Disconnect lead 820 from the ground stud on the control panel.
5. Check the resistance from 810 to 11B and 820. The resistance should be <1Ω.
6. Check the resistance from 214 to 215. It should read ~.5Ω.
7. If any of these tests fail, isolate the leads and test again. If everything reads fine, continue on.
8. Check across the two windings by measuring the resistance from 214 to 810. It should be very high >500,000Ω (.5MΩ).
9. Check for grounds by measuring from 214 to a good chassis ground. Repeat with 810 to a good chassis ground. It should be very high >500,000Ω (.5MΩ).

Shunt Field Coil Resistance Test

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Test Procedure

This test will check the integrity of the shunt field coil

Materials Needed

- Miscellaneous hand tools
- Multimeter
- Wiring Diagram

Procedure

1. With the engine off, open the side doors and secure them with the provided hooks.
2. Locate the blue and brown wires in the lead bundle exiting the top of the generator frame and disconnect them.
3. Measure the resistance from blue to brown. The resistance should be ~52Ω.
4. Measure the resistance from either the blue or brown wire to a good chassis ground. The resistance should be very high, >500,000Ω (.5MΩ).
5. If the resistance is low blow out the generator and check again.
6. If any of these tests fail, the shunt field coils should be replaced.

Shunt Field Voltage Test

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Test Procedure

This test will determine if the generator shunt field circuitry is operating properly.

Materials Needed

- Miscellaneous hand tools
- Multimeter
- Wiring Diagram

Procedure

1. With the engine off, lift the doors and secure them with the provided hooks.
2. Perform the Control Board Access Procedure.
3. Set your multimeter to DC volts and put your meter probes in J1 pins 1 and 2 (leads 612 and 602). This is the output of the control board to the shunt field.
4. Start engine.
5. Voltage should be ~55 - 120VDC.
6. If this reading is very low or 0, turn engine off and proceed.
7. Put your meter probes into J1 pins 6 and 7 (leads 610 and 600). This is the input to the control board.
8. Start engine.
9. Voltage should be ~120VDC.
10. If there is input, but no output, check connections and replace the control board.
11. If there is no input perform the **Exciter Rotor Field Voltage Test**, as this feeds the control board.

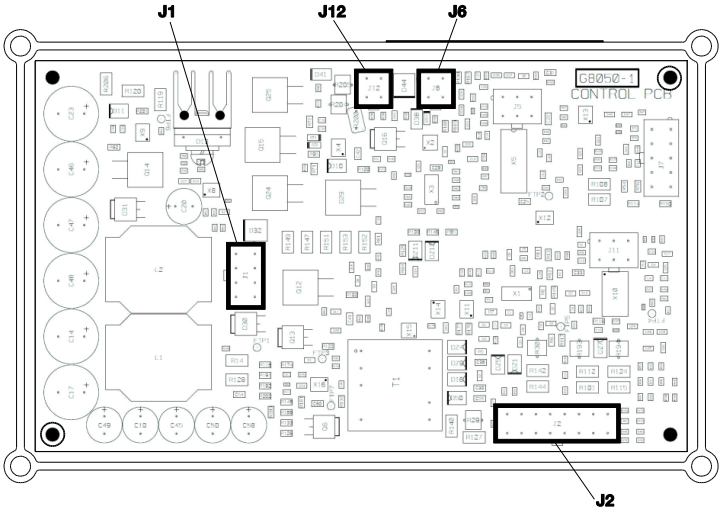

Figure F-7

WELDING GENERATOR BRUSH AND COMMUTATOR INSPECTION AND SERVICE

⚠ WARNING

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Test Procedure

These are the guidelines for checking and servicing the welding generator commutator and brushes

Materials Needed

- Miscellaneous Hand Tools
- 120-150 Grit Commutator Stone
- 220-320 Grit Commutator Stone

Caution: Do not use emery cloth or paper to clean the commutator. Use only sand paper or a commutator stone.

Caution: Stoning the commutator involves pressing an abrasive stone against a spinning commutator. This procedure can be hazardous if done without proper training, tools and protective equipment. Consult the commutator stone manufacturer's instructions before attempting this procedure.

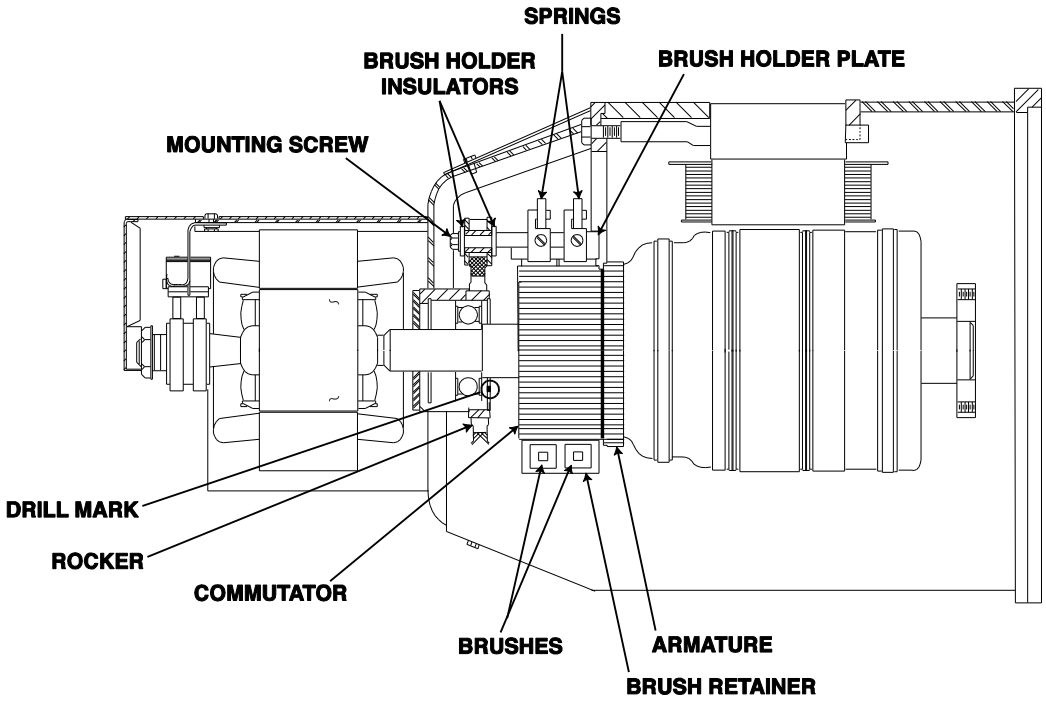

Figure F5

Procedure

1. With the engine off, lift the doors and secure them with the provided hooks.
2. Remove the two screws holding the band at the end of the large welding generator frame, and remove band exposing the brushes and commutator.

Normal Appearance:

3. The commutator should appear smooth and have an even brown color where the brushes ride.

Blackened Commutator:

4. A commutator that appears to have an even black color all around may indicate a grounded armature, shorted weld circuit, a serious overload condition, or out-of-adjustment rocker. It could also indicate the use of poor quality brushes, or brushes that have been contaminated with oil or some other foreign substance.
5. Check the rocker position. Be certain that it is aligned with or very close to the factory drill mark. IMPORTANT: If the rocker position requires adjustment, do not over tighten the rocker clamping screw. This screw should be tightened to a torque of 70 to 75 Inch-Lbs. Over tightening can destroy the rocker
6. Perform the Weld Circuit Ground and Short Circuit Test.
7. If the weld circuit is not grounded or shorted and poor brush quality or contamination is suspected, replace the brushes and seat them with a commutator stone or sand paper.
8. If brush quality or contamination is not suspected, clean the commutator by lightly stoning the surface.

Caution: Stoning the commutator involves pressing an abrasive stone against a spinning commutator. This procedure can be hazardous if done without proper training, tools and protective equipment. Consult the commutator stone manufacturer's instructions before attempting this procedure.

Pitted and Arc Damaged Commutator:

9. If pitting and arc damage to the commutator is evident, the machine may have been used with badly worn brushes. The brush spring tension may have been too low, or the brushes may have been sticking in the holders. An out-of-adjustment rocker or a serious overload may also cause this condition.
10. Examine the inside of the brush covers and other parts that are close to the commutator. If there is a significant amount of solder and debris that has been thrown from the commutator, the armature will need to be replaced and the stator coils must be carefully examined and tested for damage.
11. Perform the Weld Circuit Ground and Short Circuit Test.
12. If the brushes are worn out, replace them and resurface or clean the commutator as needed. If the brush springs appear weak, discolored or damaged in any way, replace them as well. The brush holder plates and retainers should be clean, smooth and undamaged so the brushes can move freely as they wear.
13. Check the rocker position. Be certain that it is aligned with or very close to the factory drill mark. **See Figure 9**.

IMPORTANT: If the rocker position requires adjustment, do not over tighten the rocker clamping screw. This screw should be tightened to a torque of 70 to 75 Inch-Lbs. Over tightening can destroy the rocker.

Uneven Commutator Appearance:

14. If the commutator appears to have some normal colored bars and some blackened bars, the armature may be shorted.
15. If excessive sparking is observed and/or the weld output is abnormal, the armature should be replaced.
16. If the commutator has uneven color, but there is no sign of serious generator performance problems, the commutator may only need to be cleaned by lightly stoning the surface. See caution note on commutator stone usage.

Examine the brushes:

17. The brushes and springs should all be in place and not be excessively worn. Brushes should be replaced if they are worn to within ¼" of the pigtail lead.
18. The pigtail lead of each brush should be positioned so it allows free movement of the brush while it wears.
19. The brushes should be seated so that the face of each brush makes 95% minimum contact with the commutator. Lightly stone the commutator to seat the brushes. See caution note on commutator stone usage.

Examine the brush holders:

20. The brush holder insulators must be clean and in good condition and all of the hardware must be in place. **See Figure F.10**. Replace any insulators that are cracked or damaged in any way.
21. When installing the brush holders, they should be rotated toward the brush retainer (clockwise rotation when facing the brush holder mounting screw.) until they stop. The edge of the brush holder plate should be parallel with the surface of the commutator and positioned .030" to .090" from the surface of the commutator. The brush holder mounting screw should be tightened to a torque of 24 to 28 Ft Lbs.
22. The brush holder plate and retainer assembly must be clean and smooth; nothing should prevent free movement of the brushes. All electrical connections to the brush holders must be clean and tight. The recommended torque for 5/16-18 brush holder connection screws is 8 Ft.-Lbs.

CV Box Contactor Test

⚠ WARNING

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Test Procedure

This test will determine if the CV box contactors are operating correctly.

Materials Needed

- Miscellaneous hand tools
- Multimeter
- Wiring Diagram

Procedure

1. Perform the control board access procedure.
2. Set the mode switch to CV and the CV weld terminal switch to on.
3. Start engine.
4. Check voltage from J1 pins 3 and 5 (leads 630 and 631). It should read ~130VDC.
5. Check voltage from J1 pins 4 and 8 (leads 366 and 634). It is a 35VDC pwm signal. While holding, it should read ~3VDC. If the voltage is 35VDC, check connections and coil resistance.

Weld Output Control Circuit Ground and Short Circuit Test

⚠ WARNING

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Test Procedure

This test looks for grounds or shorts in the weld output circuit. This will not detect a turn to turn short within a coil, just a short between coils.

Materials Needed

- Miscellaneous hand tools
- Multimeter
- Wiring Diagram

Procedure

1. With the engine off, lift the doors and secure them with the provided hooks.
2. Remove the two screws holding the band at the end of the large welding generator frame, and remove band exposing the brushes and commutator.
3. Remove the weld generator brushes from the brush holder assembly.
4. Rotate the coarse current control to the minimum output position.
5. Measure the resistance between the CC- and the Pos (+) stud. It should read very high >500,000Ω (.5MΩ). If it is <.5MΩ blow out the generator coils and try again. If the reading is good, proceed.
6. Measure the resistance between the CC- stud and a clean chassis ground connection. Repeat with the CV- and the Pos (+) studs and ground.
7. It should read very high >500,000Ω (.5MΩ). If the resistance is <.5MΩ, move the course current off of minimum and retest.
8. If the resistance is now >.5MΩ Ohms or greater; check for a damaged or missing insulator bushing at the output control unit.
9. If the resistance is still <.5MΩ, blow out the machine and retest.

Coarse Current Control Unit (Variable Reactor) Inspection and Service Procedure

⚠ WARNING

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Test Procedure

This will test if the course current control reactor is functioning properly.

Materials Needed

- Miscellaneous hand tools
- Multimeter
- 400 to 600 grit sandpaper
- Wiring diagram
- Grease

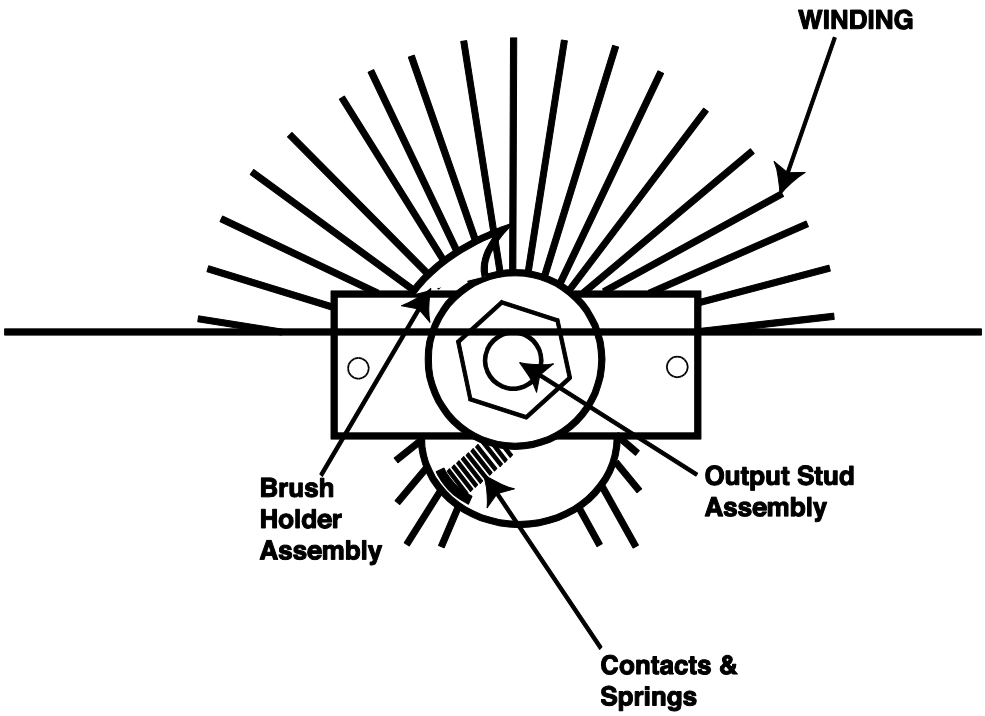

Figure F6

Procedure

1. Turn the engine off, open the doors and disconnect the negative battery cable. The doors must be secured while disconnecting the battery cable.
2. Remove the roof and doors.
3. Inspect the output control unit:
4. Carefully examine the unit. Check for arc damage, missing or broken springs, burned and/or badly worn contacts. Also look for missing or damaged insulators, poor lead connections and damaged lead insulation. If there is serious damage to the inside diameter of the winding, the Output Control Unit should be replaced. See **Figure F6** and **Figure F7**.
5. Disassemble the continuous control unit:
6. If service is necessary, remove the fuel tank and disconnect the heavy cable attached to the output stud, at the center back on the output control.
7. Remove the Output control handle.
8. Remove the two screws holding the Brush holder stud assembly. Use caution, the shaft is under spring tension. The stud assembly and the rotating brush holder/contact assembly can now be removed through the back of the unit. **See Figure F6** and **Figure F7**.

Servicing the continuous control unit:

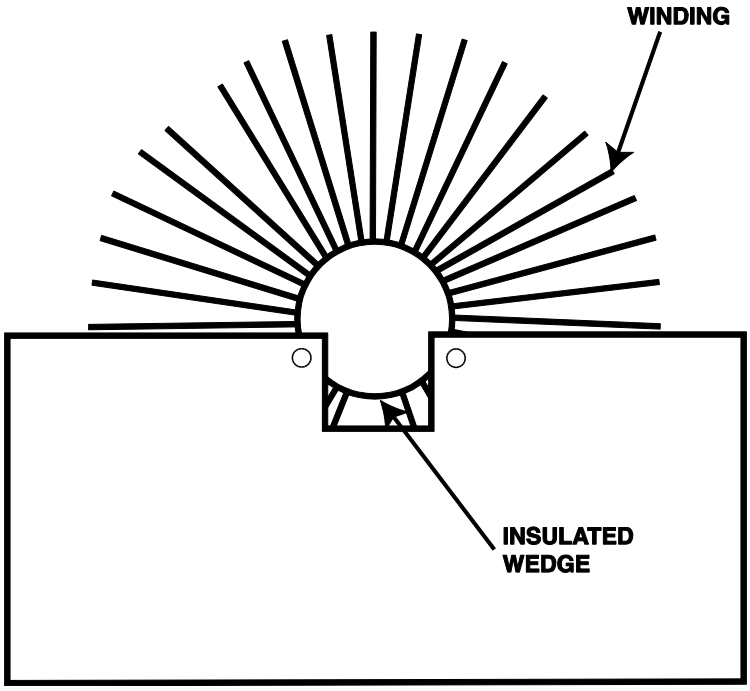

Figure F7

9. Clean the continuous output control unit by using low pressure air to remove any excess dust and dirt. If the unit is greasy or oily, a more thorough cleaning will be required. The unit must be clean and completely dry before continuing.
10. Ground test the unit by testing the resistance between the following points:
    a. Chassis ground to winding
    b. Chassis ground to the insulated steel wedge (at the bottom of continuous output control inside diameter)
    c. Insulated steel wedge to the winding. **See Figure F7.**
11. The resistance should be very high, >500,000Ω (.5MΩ).
12. If the resistance is too low, disconnect the remaining connection cable and look for any connection with chassis ground, including any buildup of conductive dirt contacting the winding. Repeat the above resistance tests. If the low resistance is determined to be within the continuous output control unit, it will need to be replaced.
13. Use very fine, 400 to 600 grit sand paper or a cylinder hone to clean away any dirt, oxidation, or minor arc pitting from the output control bore.

Servicing the rotating brush holder and output stud assembly:

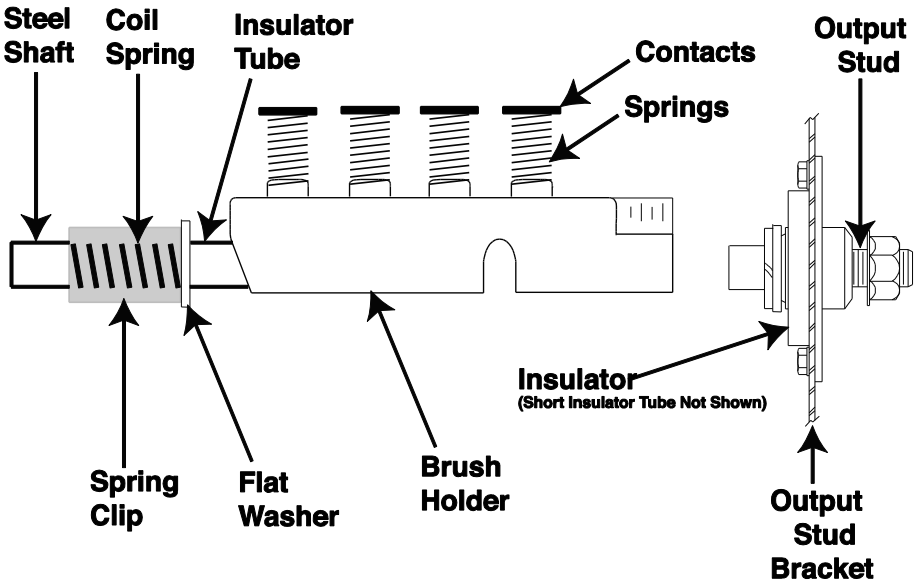

Figure F8

14. Thoroughly clean and inspect the rotating brush holder assembly and the output stud assembly.
15. Examine the insulators on both assemblies. See **Figure F8**. Replace any that are worn, damaged or missing. If the shaft insulation tube requires replacement, position the shaft and tube per **Figure F8** and torque the two 5/16-18 Hex head screws to 8 Ft-Lbs.
16. Disassemble the output stud assembly and check the insulating washers and tube. Replace them if they are damaged or worn and re-assemble the output stud assembly. **See Figure F8.**
17. Check for grounded output stud and brush holder assemblies by measuring the resistance as follows:
    a. From the steel shaft to the rotating brush holder
    b. From the copper output stud to the output stud bracket
18. The resistance should be very high, >500,000Ω (.5MΩ).
19. If any of the contacts on the brush holder assembly are damaged, install all new contacts and new springs.
20. Assemble the flat washer, spring clip and coil spring to the shaft. **See figure F8**.
21. Apply a thin layer of grease to both the output stud and the inside of the brush holder that mates to the output stud. Grease should also be applied to the area around the hole where the shaft passes through the front panel.
22. Insert the brush holder and output stud assembly through the output control unit and through the hole in the front panel. Be sure the output stud bracket is positioned correctly. The insulated stop should be on the left when facing the back on the output control unit.

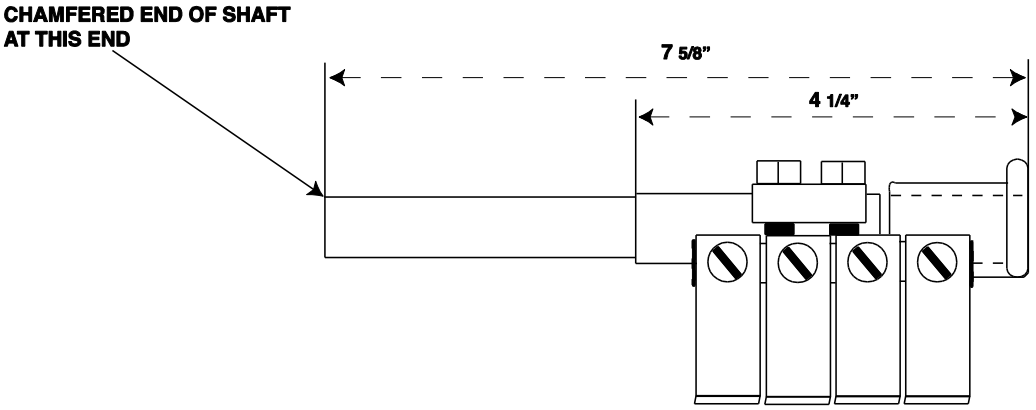

Figure F9

23. The shaft spring will need to be compressed and the bracket drawn close to the back of the output control before the screws can be started and tightened. Locking type pliers and a drift punch can be used to maneuver the bracket into position. Tighten the screws.
24. Connect any cables that had been removed. Install fuel tank, roof and doors. Reconnect the battery cable.

Control Board Access Procedure

⚠ WARNING

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Test Description

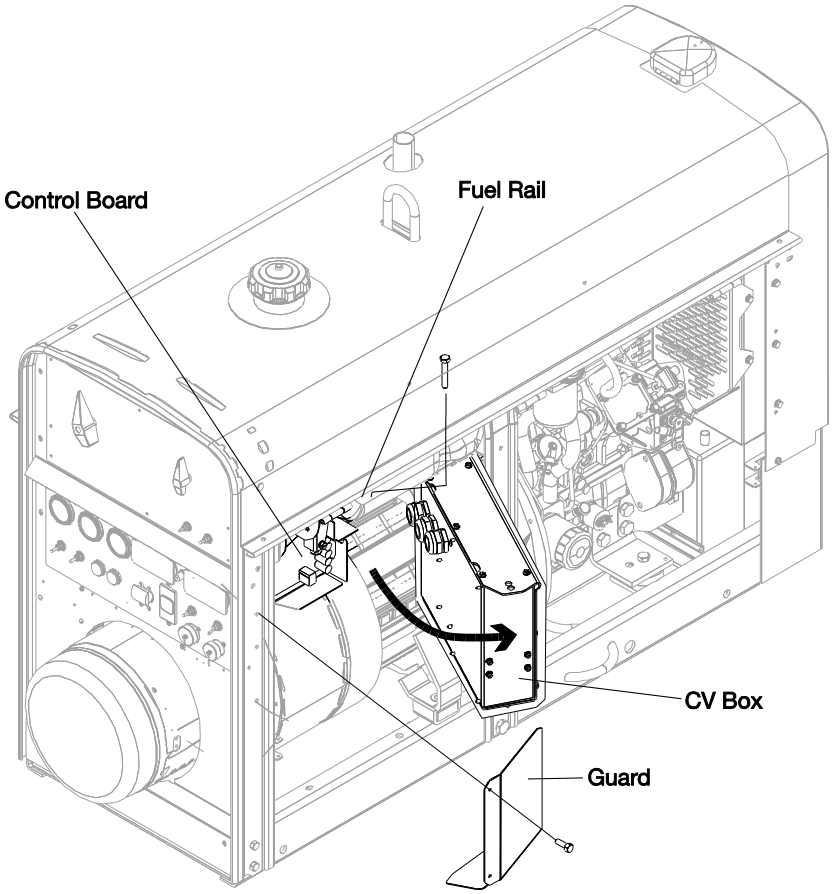
This procedure will aid the technician in accessing the control board for service.

Materials Needed

- 3/8” socket
- 9/16” socket and wrench

Procedure

1. Lift the right door and secure with the provided hook.
2. Remove the bolts holding the guard to the case front.
3. Remove the bolt, closest to the case front, holding the CV box to the fuel rail.
4. Swing out the CV Box to get access



Exciter Rotor Removal and Replacement Procedure

⚠ WARNING

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Test Description

This will show you how to remove the exciter rotor.

Materials Needed

- Large standard screwdriver
- Small gear puller
- Miscellaneous hand tools

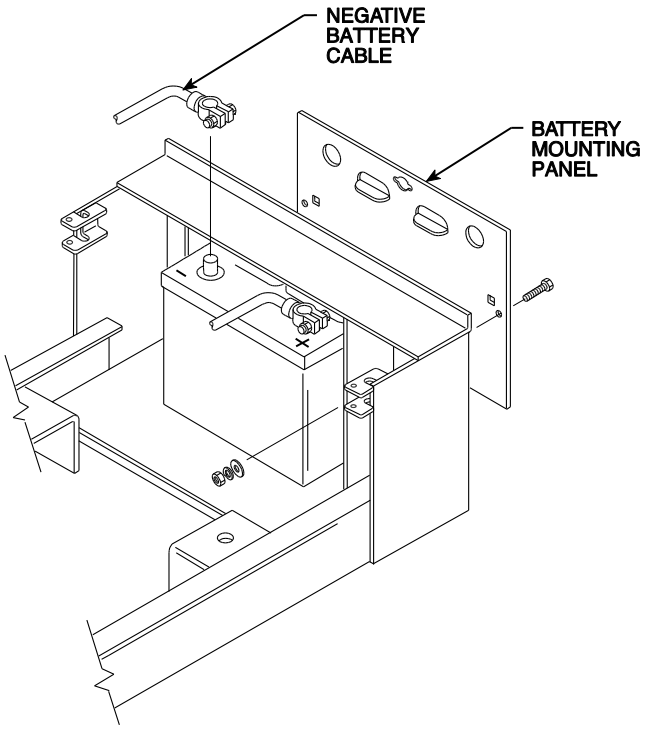

Figure 11

Removal

1. Turn the engine off
2. Using the 7/16” wrench, remove the two bolts and washers and partially slide out the battery mounting panel. **See Figure 11**.
3. With the 1/2" wrench, disconnect the negative battery cable.

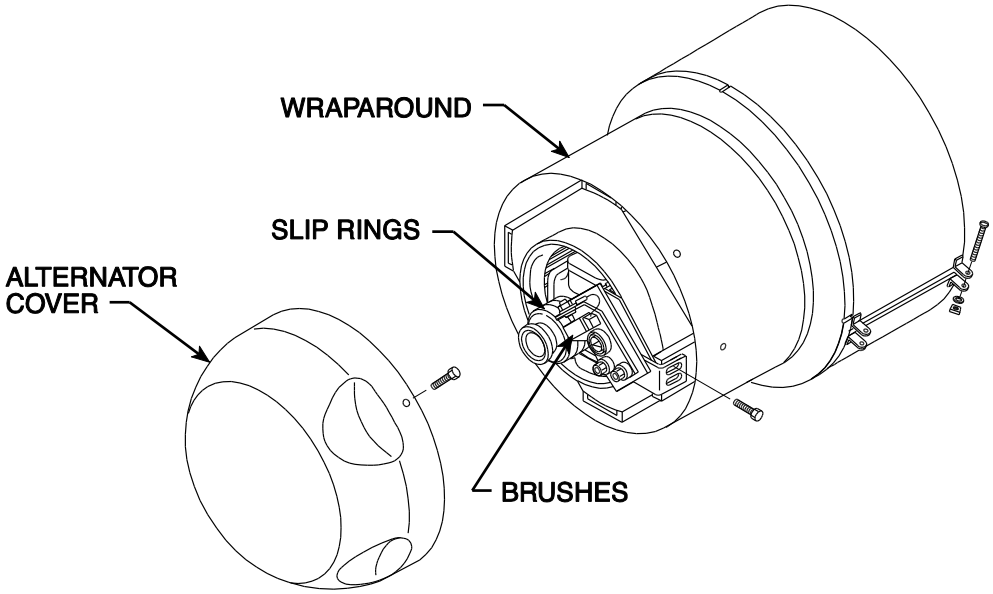

Figure 12

See Figure 12

4. With the 5/16" wrench, remove the 4 screws from the alternator cover.
5. Remove the alternator cover and wrap-around. Be careful to clear the leads.

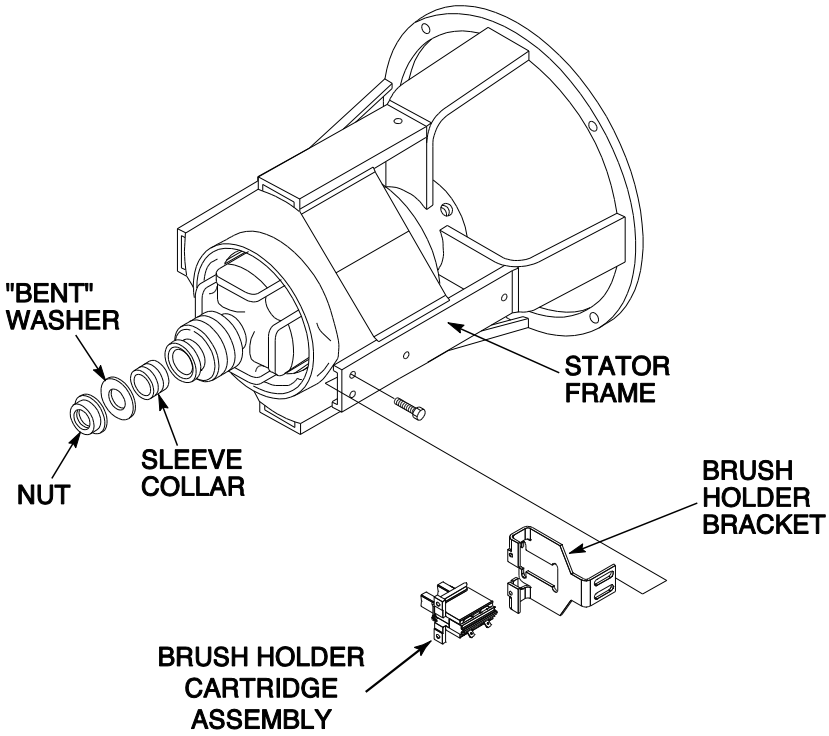

Figure 13

See Figure 13

6. With the 7/16" wrench, remove the two bolts, nuts and washers mounting the brush holder assembly to the stator frame.
7. Bend the flat washer away from the rotor locking nut.

8. With the 1-5/8" socket wrench, remove the rotor locking nut, washer and sleeve collar.
9. NOTE: The sleeve collar will have to be removed with a gear puller. Be careful not to damage the rotor slip ring assembly. Remove the rotor by pulling it free of the generator shaft.

Replacement

10. Carefully mount the rotor onto the generator shaft. Install a new sleeve collar (part number T14337), washer and rotor locking nut.

NOTE: Be careful not to damage or deform the new sleeve collar. Carefully tap the new sleeve collar into position. The rotor locking nut should be torqued to 175 ft.-lbs.

11. After the rotor locking nut is properly torqued, bend the washer down over the locking nut.
12. Check rotor air gap. .017" minimum is allowed. Rotate ¼ turn and check again.
13. Mount the brush holder assembly to the stator frame using two bolts, washers and nuts.
14. Install the alternator cover.
15. Connect the negative battery cable.

Alternator Stator Removal and Replacement Procedure

⚠ WARNING

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Test Description

This will show you how to remove the exciter stator.

Materials Needed

- Miscellaneous hand tools
- Pry bar
- Wiring diagram

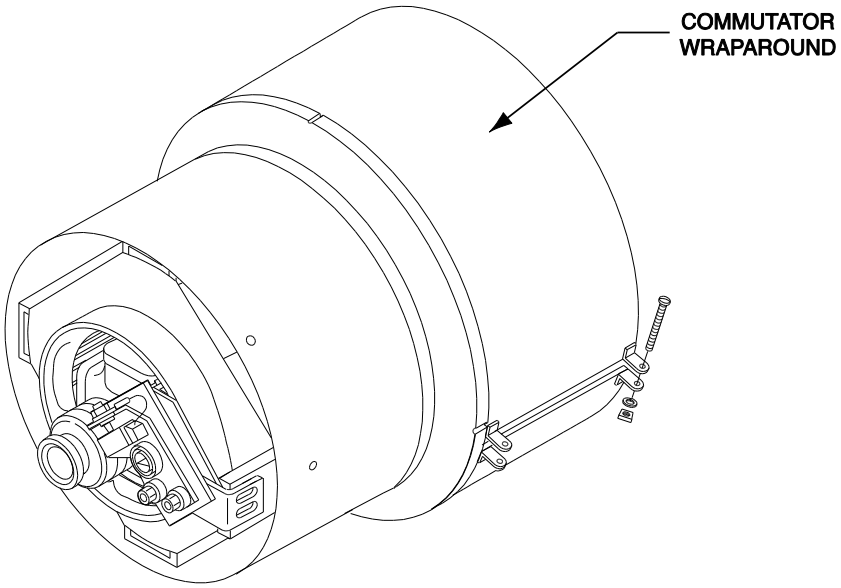

Figure 14

Removal

1. Turn off the engine.
2. Perform the **Exciter Rotor Removal Procedure**
3. Using a 3/8” socket, remove the four bolts from the exciter stator.
4. Using a screwdriver, remove the wrap-around cover protecting the welding generator brushes and commutator. **See Figure 14**
5. Use the wiring diagram to identify all of the wires connected to the exciter stator winding. Carefully mark these leads, for later reassembly and then disconnect them. Cut cable ties as needed.
6. Lift the eight welding generator brushes from the commutator. Note the position of the brushes for later reassembly.

7. To assure accurate reconnection, carefully mark the heavy leads connected to the brush holders and then disconnect them. To aid in reassembly, note the way these leads are connected, routed and positioned.
8. The front panel of the machine can be unbolted and moved to the side to provide the clearance necessary to remove the exciter stator. This can normally be done by disconnecting only the wires and cutting only the cable ties necessary to allow the front panel to be moved. Most wiring can remain connected. Be sure to carefully mark all of the wires that were disconnected to aid in reassembly

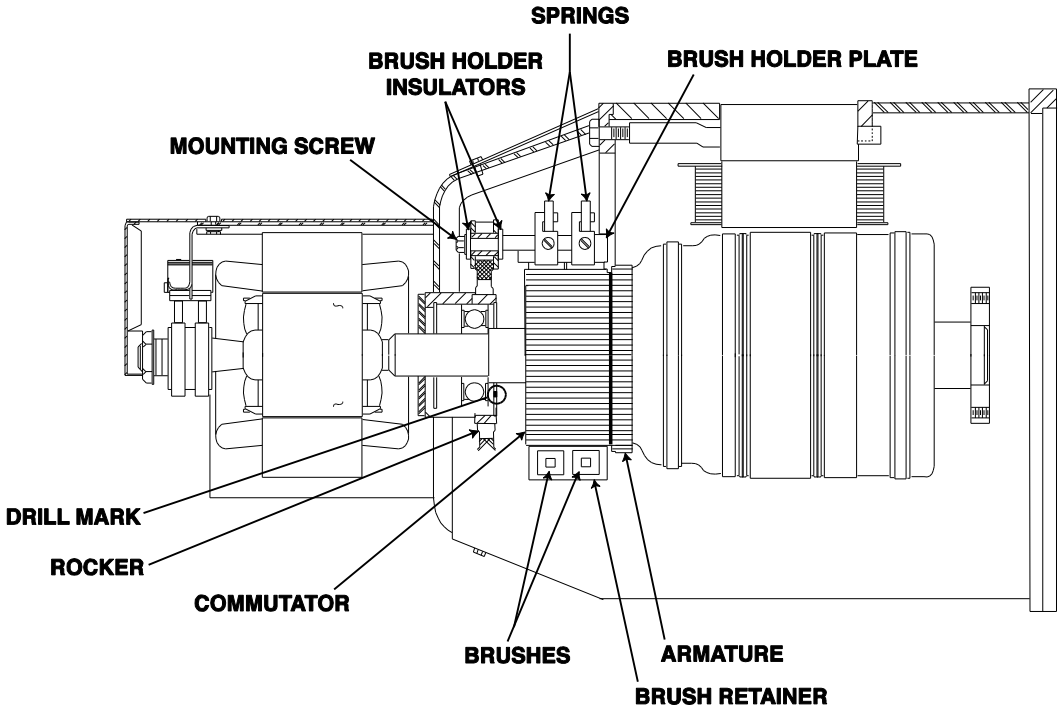

Figure 15

9. Drain the fuel and store it in an approved container. Disconnect the fuel line from the bottom of the tank and plug the line to avoid getting dirt or other contaminants into the fuel system. Remove the fuel tank and the tank mounting rails.
10. Note the drill spots marking the position of the exciter bracket and the rocker. It is very important that these marks be precisely aligned during reassembly. **See Figure 15**.

NOTE: If these drill marks cannot be found, the positions of the rocker and exciter bracket should be clearly marked so these parts can be precisely aligned when the machine is reassembled.

11. Loosen the rocker clamping screw, but do not remove it.
12. Use a hoist, or other appropriate means to support the weight of the exciter frame assembly.
13. Remove the four screws securing the exciter end bracket to the generator frame.
14. Carefully pry the exciter stator/end bracket assembly away from the generator frame.

NOTE: The welding generator brush holder and rocker assembly will also be removed.

Replacement

15. During reassembly, anti-seize compound should be applied to the screw threads.
16. Inspect the mating surfaces of the generator frame and the exciter bracket assembly. These surfaces must mate together completely so it is very important that the surfaces are completely clean and undamaged. The bearing and bearing housing should also be clean and undamaged.

NOTE: Be sure that the rocker assembly is placed on the bearing housing with the locking screw positioned on top.

17. Place some bearing grease in the bearing housing. Chevron SRI or equivalent is recommended.
18. Mount the exciter stator/end bracket assembly to the welding generator frame. Carefully line up the drill spot between the two mating parts. Carefully and evenly tighten the four mounting bolts. **See Figure 15**.
19. Check the armature air gap. At the smallest point, the gap should be wide enough to allow a .035" thick ½" wide feeler gage to fit between the armature and stator through the entire length.
20. Position the rocker tightly against the hub, align the drill mark and tighten the rocker lock screw to 70 to 75 Inch-Lbs. **DO NOT OVERTIGHTEN**.
21. Be certain that the brush holders are properly positioned and parallel with the commutator. **See the Commutator and Brush Service Procedure**
22. Re-attach the heavy generator leads to the brush holders. Use the notes made during disassembly to assure that the leads are connected and routed correctly.
23. If the original brushes are used, install them in the same positions that they had been. Form the braided brush leads so they will not interfere with the travel of the brushes as they wear.
24. Reverse the removal procedure to finish reassembling the machine.
25. Replace all the tie wraps that had been removed during disassembly
26. Replace and connect the battery. Connect the positive cables first, followed by the negative cables
27. Connect the fuel line and fill the tank. The fuel system may require bleeding. See the engine instruction manual for more information on the fuel system bleeding procedure.
28. Start the engine and seat the brushes using a commutator stone. **See the Commutator and Brush Service Procedure**
29. Replace the brush and exciter sheet metal covers.
30. Replace the roof and doors.

Welding Generator Frame Removal and Replacement

⚠ WARNING

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Test Description

This will show you how to remove the welding generator frame.

Materials Needed

- Miscellaneous hand tools
- Anti Seize Compound

Removal

1. Turn off Engine
2. Perform the **Exciter Rotor Removal Procedure**
3. Perform the **Exciter Stator Removal Procedure**.
4. Disconnect all of the wires and cables that connect to the stator/frame assembly. Carefully mark them for reassembly.
5. Remove the mounting bolts from the generator feet.
6. Using a hoist and sling, very carefully lift the generator only enough so the generator frame will clear the welder frame and can be removed. The sling should be positioned near the center of the generator frame.

NOTE: Carefully watch the clearance between the engine and any other components while hoisting, especially the clearance between the engine fan, the fan shroud and radiator. Loosen or remove the radiator if necessary

7. Support the engine at the generator adapter plate end
8. With the generator frame still supported by the sling, (Be certain the sling is positioned at the center of gravity of the generator frame.) and the weight of the engine resting on the supports that were placed in the previous step, remove the screws securing the generator frame to the engine adapter plate.
9. Carefully pry and wiggle the generator frame to free it from the adapter plate and then slide the generator frame off of the armature. Adjust the height of the stator frame as needed to assure that it can slide off the armature without damage to any of the armature or stator windings.

Replacement

10. During reassembly, anti-seize compound should be applied to the screw threads.
11. Carefully inspect the mating surfaces of the engine adapter plate and the generator frame. The mating surfaces must be clean and undamaged.
12. Lift the generator frame with the rope sling and very carefully slide it over the armature. Be very careful that the armature and stator windings are not damaged.
13. Align the bolt holes and install the screws that had been removed earlier. Carefully and evenly tighten them, making sure that the mating surfaces come together cleanly all the way around. Tighten the screws.
14. Remove the supports from the engine and carefully lower the generator frame. Install the rubber mounts.

15. Reverse the removal procedure to reassemble the machine. Be sure to secure all cables and wires. Replace all cable ties that had been removed during disassembly.
16. Perform the **Exciter Stator Replacement Procedure**
17. Perform the **Exciter Rotor Replacement Procedure**.

Generator Armature Removal and Replacement Procedure

⚠ WARNING

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Test Description

This will show you how to remove the welding generator frame.

Materials Needed

- Miscellaneous hand tools
- Rope sling

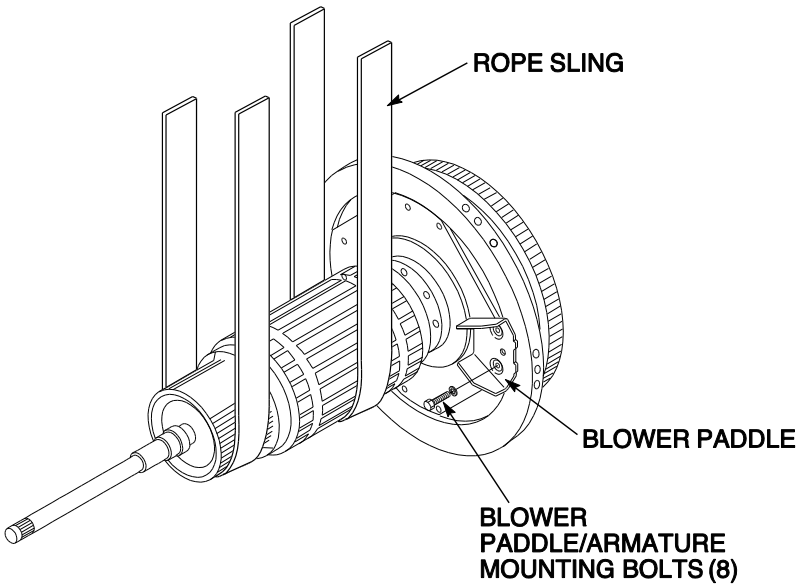

Figure 16

Removal

1. Turn off the engine
2. Perform the **Exciter Rotor Removal Procedure**.
3. Perform the **Exctier Stator Removal Procedure**.
4. Perform the **Welding Generator Frame Removal Procedure**.
5. Using the rope sling, support the armature. Position the sling at the center of gravity of the armature assembly. **See Figure 16**.
6. Remove the eight screws securing the blower paddle segments and the outer diameter of the flexible coupling disk to the flywheel.
7. With the armature securely supported in the sling, unlock it from the flywheel by carefully rotating it 1/8 of a turn in either direction.

Replacement

8. Carefully inspect the mating surfaces of the flywheel and armature coupling parts. These surfaces must be clean and undamaged.
9. Support the armature in a rope sling and carefully move it into position and align it to the flywheel.
10. Rotate the armature 1/8 of a turn, in either direction, to engage the locking mechanism and line up the bolt holes. Be certain that the coupling plate is fully and cleanly seated in the flywheel.
11. Replace the eight screws and four blower segments. Tighten the screws
12. Perform the **Welding Generator Frame Replacement Procedure.**
13. Perform the **Exciter Stator Replacement Procedure**.
14. Perform the **Exciter Rotor Replacement Procedure**.

Retest After Repair

Mode	No Load RPM	Loaded Rpm
Low Idle	1440	N/A
High Idle	1800	1800

Welder Output	Output	Open Circuit Volt	Load Volt	Load Amps
CC	Maximum	86-93	38-46	300
CV	Maximum	39.5-41.2	35-36.5	300

240 Volt Receptacle			120 Volt Receptacle		
Open Circuit Voltage	Load Volts	Load Amps	Open Circuit Voltage	Load Volts	Load Amps
230-264	216-252	14	115-132	108-126	20