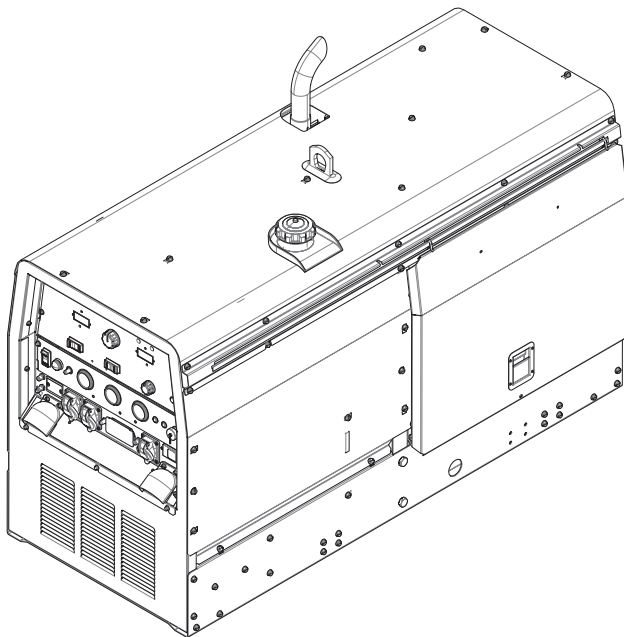


Fleet[™] **650**

For use with machines having Code Numbers:

Fleet[™] **650: 12512**

SERVICE MANUAL



THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

SAFETY DEPENDS ON YOU

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.** And, most importantly, think before you act and be careful.



WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life.



CAUTION

This statement appears where the information must be followed to avoid minor personal injury or damage to this equipment.



KEEP YOUR HEAD OUT OF THE FUMES.

DON'T get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.

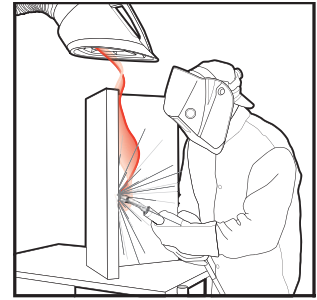
READ and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

USE ENOUGH VENTILATION or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and the general area.

IN A LARGE ROOM OR OUTDOORS, natural ventilation may be adequate if you keep your head out of the fumes (See below).

USE NATURAL DRAFTS or fans to keep the fumes away from your face.

If you develop unusual symptoms, see your supervisor. Perhaps the welding atmosphere and ventilation system should be checked.



WEAR CORRECT EYE, EAR & BODY PROTECTION

PROTECT your eyes and face with welding helmet properly fitted and with proper grade of filter plate (See ANSI Z49.1).

PROTECT your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.

PROTECT others from splatter, flash, and glare with protective screens or barriers.

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

Also, wear safety glasses in work area **AT ALL TIMES.**



SPECIAL SITUATIONS

DO NOT WELD OR CUT containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

DO NOT WELD OR CUT painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.

Additional precautionary measures

PROTECT compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.

BE SURE cylinders are never grounded or part of an electrical circuit.

REMOVE all potential fire hazards from welding area.

ALWAYS HAVE FIRE FIGHTING EQUIPMENT READY FOR IMMEDIATE USE AND KNOW HOW TO USE IT.



SECTION A: WARNINGS



CALIFORNIA PROPOSITION 65 WARNINGS

Diesel Engines

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Gasoline Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.



FOR ENGINE POWERED EQUIPMENT.

- 1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.



- 1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

- 1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.



- 1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.



- 1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- 1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- 1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

- 1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS



- 2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines
- 2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- 2.c. Exposure to EMF fields in welding may have other health effects which are now not known.
- 2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
- 2.d.1. Route the electrode and work cables together - Secure them with tape when possible.
 - 2.d.2. Never coil the electrode lead around your body.
 - 2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
 - 2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.
 - 2.d.5. Do not work next to welding power source.



ELECTRIC SHOCK CAN KILL.



- 3.a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- 3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- Semiautomatic DC Constant Voltage (Wire) Welder.
 - DC Manual (Stick) Welder.
 - AC Welder with Reduced Voltage Control.
- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.
 - 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
 - 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
 - 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
 - 3.g. Never dip the electrode in water for cooling.
 - 3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
 - 3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
 - 3.j. Also see Items 6.c. and 8.



ARC RAYS CAN BURN.



- 4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



FUMES AND GASES CAN BE DANGEROUS.



- 5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding hardfacing (see instructions on container or SDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also be required. Additional precautions are also required when welding on galvanized steel.**
- 5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.
- 5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- 5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 5.e. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the Safety Data Sheet (SDS) and follow your employer’s safety practices. SDS forms are available from your welding distributor or from the manufacturer.
- 5.f. Also see item 1.b.



WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



- 6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.
- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.
- 6.i. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, MA 02269-9101.
- 6.j. Do not use a welding power source for pipe thawing.



CYLINDER MAY EXPLODE IF DAMAGED.

- 7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition. 
- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
 - Away from areas where they may be struck or subjected to physical damage.
 - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association, 14501 George Carter Way Chantilly, VA 20151.



FOR ELECTRICALLY POWERED EQUIPMENT.



- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to
<http://www.lincolnelectric.com/safety>
for additional safety information.

Fleet™ 650

Service Manual

Last update: 2018/03/01

FLEET™ 650	1
Service Manual	1
Troubleshooting & Repair.....	3
HOW TO USE TROUBLESHOOTING GUIDE.....	3
PC BOARD TROUBLESHOOTING PROCEDURES.....	4
Troubleshooting guide	5
Test Procedures	16
CASE COVER REMOVAL AND REPLACEMENT PROCEDURE.....	16
CHOPPER MODULE CAPACITOR DISCHARGE PROCEDURE	19
BRUSH AND SLIP RING SERVICE PROCEDURE.....	21
FLASHING DIODE (D1) & FIELD DIODE (D2) TEST PROCEDURE	23
ENGINE SHUTDOWN RELAY TEST PROCEDURE	25
ENGINE ALTERNATOR TEST PROCEDURE	28
ROTOR RESISTANCE AND GROUND TEST PROCEDURE (STATIC)	30
ROTOR RESISTANCE AND GROUND TEST PROCEDURE (DYNAMIC)	32
ROTOR VOLTAGE TEST PROCEDURE	33
FLASHING VOLTAGE TEST PROCEDURE (ENGINE NOT RUNNING).....	34
STATOR VOLTAGE TEST PROCEDURE	35
OUTPUT RECTIFIER BRIDGE TEST PROCEDURE.....	37
CHOPPER MODULE BOARDS FUNCTION TEST PROCEDURE	40
CHOPPER MODULE BOARDS RESISTANCE TEST PROCEDURE.....	44
WELD CONTROL BOARD PWM GATE SIGNAL TEST PROCEDURE.....	47
WELD CONTROL BOARD FEEDBACK TEST PROCEDURE	49
OUTPUT CONTROL AND ARC CONTROL POTENTIOMETER TEST PROCEDURE.....	52

CHOKE TEST PROCEDURE.....55
PIPE/GOUGE RANGE SWITCH AND WELD MODE SWITCH TEST PROCEDURE57
THERMOSTAT TEST PROCEDURE.....60

Removal And Replacement Procedures 63

FLASHING DIODE (D1) & FIELD DIODE (D2) REMOVAL AND REPLACEMENT PROCEDURE.....63
FRONT PANEL REMOVAL AND REPLACEMENT PROCEDURE65
OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT PROCEDURE69
CHOPPER MODULE BOARDS REMOVAL AND REPLACEMENT PROCEDURE.....72
WELD CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE75
CHOKE REMOVAL AND REPLACEMENT PROCEDURE77
PIPE/GOUGE RANGE SWITCH REMOVAL AND REPLACEMENT PROCEDURE81
WELD MODE SWITCH REMOVAL AND REPLACEMENT PROCEDURE83
THERMOSTAT REMOVAL AND REPLACEMENT PROCEDURE85
FUEL TANK REMOVAL AND REPLACEMENT PROCEDURE87
ROTOR AND STATOR REMOVAL AND REPLACEMENT PROCEDURE89
RETEST AFTER REPAIR94

Troubleshooting & Repair

HOW TO USE TROUBLESHOOTING GUIDE

 **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 and 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.

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 three main categories: Output Problems, Function Problems and 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 cover.

Step 3. PERFORM COMPONENT TESTS. The last column, labeled “Recommended Course of Action” lists the most likely components that may have failed in your 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 section. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the referred to 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 test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

PC BOARD TROUBLESHOOTING PROCEDURES

WARNING

ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.



CAUTION

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

PC board can be damaged by static electricity.

- Remove your body’s static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.



ATTENTION
 Static-Sensitive
 Devices
 Handle only
 at Static-Safe
 Workstations

Reusable
 Container
 Do Not
 Destroy

- If you don’t have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.
- Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.
- Remove the PC board from the static-shielding bag and place it directly into the equipment. Don’t set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can’t be installed immediately, put it back in the static-shielding bag.

- If the PC board uses protective shorting jumpers, don’t remove them until installation is complete.
 - If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.
4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: It is desirable to have a spare (known good) PC board available for PC board troubleshooting.


NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.


5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
 - a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks and terminal strips.
 - b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, “INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM,” will help avoid denial of legitimate PC board warranty claims.

Troubleshooting guide

Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident when the sheet metal covers are removed.	1. Contact your local authorized Lincoln Electric Service Facility.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
No welding output or auxiliary power. The engine operates normally.	<ol style="list-style-type: none"> 1. Check for loose or faulty connections in the auxiliary circuit to the output receptacles and/or the weld circuit to the output terminals. See Wiring Diagram. 2. Check the brushes for wear and proper contact to the rotor slip rings. 	<ol style="list-style-type: none"> 1. Perform the <i>Brush And Slip Ring Service Procedure</i>. 2. Check for flashing voltage at the slip rings (3 – 5 VDC @ .5 amp until generator builds up, then 160 volts). Perform the <i>Flashing Voltage Test Procedure (Engine Not Running)</i>. 3. Perform the <i>Flashing Diode (D1) & Field Diode (D2) Test Procedure</i>. 4. Perform the <i>Rotor Voltage Test Procedure</i>. 5. Perform the <i>Rotor Resistance And Ground Test Procedure (Static)</i>. 6. Perform the <i>Rotor Resistance And Ground Test Procedure (Dynamic)</i>. 7. Perform the <i>Stator Voltage Test Procedure</i>.
<div style="background-color: black; color: white; padding: 5px; display: inline-block;"> CAUTION </div>		
<p>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.</p>		

Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No welding output in any mode. The auxiliary output is normal. The engine operates normally.	<ol style="list-style-type: none"> 1. If the correct OCV is present at the weld output terminals, check the welding cables, connectors, work clamp, electrode holder, etc. for loose or faulty connections. 2. Check for damaged conductors or faulty connections on the heavy current carrying leads that connect the output terminals to the chopper module boards and the output rectifier bridge. Also check the shunt and the choke assemblies for damage and faulty connections. 	<ol style="list-style-type: none"> 1. Check gate leads 23 and 25 on both chopper module boards and weld control board power leads 13 and 14 for loose or faulty connections. See Wiring Diagram. 2. Perform the <i>Chopper Module Boards Function Test Procedure.</i> 3. Perform the <i>Stator Voltage Test Procedure.</i> 4. Perform the <i>Output Rectifier Bridge Test Procedure.</i> 5. Perform the <i>Weld Control Board PWM Gate Signal Test Procedure.</i> 6. The weld control board may be faulty.
No auxiliary power at one or more receptacles. Weld output is normal and the engine operates normally.	<ol style="list-style-type: none"> 1. Check for loose or faulty connections at the output receptacles. 2. Check for tripped circuit breaker and/or tripped GFCI receptacles. 	<ol style="list-style-type: none"> 1. Perform the <i>Stator Voltage Test Procedure.</i> 2. Check the wiring between the auxiliary receptacle and the stator.
 CAUTION		
<p>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.</p>		


Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine has low welding output and low auxiliary output.	<ol style="list-style-type: none"> 1. The engine RPM may be low. 2. The brushes may be sticking or poorly seated or the slip rings may be dirty. 	<ol style="list-style-type: none"> 1. Inspect and if necessary service the brushes and slip rings per the <i>Brush and Slip Ring Service Procedure</i>. 2. Perform the <i>Rotor Voltage Test Procedure</i>. 3. Perform the <i>Rotor Resistance And Ground Test Procedure (Static)</i>. 4. Perform the <i>Rotor Resistance And Ground Test Procedure (Dynamic)</i>. 5. Perform the <i>Stator Voltage Test Procedure</i>.
The machine has no welding output. Thermal LED is illuminated.	<ol style="list-style-type: none"> 1. The machine has overheated. Allow the machine to cool down. 2. Thermostats may be faulty. 3. Dirt or dust may have clogged the cooling channels inside the machine. 4. Air intake and exhaust louvers may be blocked due to inadequate clearance. 	<ol style="list-style-type: none"> 1. Perform the <i>Thermostat Test Procedure</i>.
<div style="background-color: black; color: white; padding: 5px; display: inline-block;">  CAUTION </div>		
<p>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.</p>		


Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine will weld but the welding arc is “COLD”. The engine runs normally and the auxiliary power is normal.	<ol style="list-style-type: none"> 1. Make sure the machine is properly set for the electrode and process being used. Check electrode size, mode switch setting and amps or voltage setting. 2. Make sure the process does not demand more power than the machine can produce. 3. If the current is correct try increasing the “ARC CONTROL” setting. 4. Check for loose or faulty connections at the weld output terminals and welding cable connections. 5. Check for good connections between the work cable and the work piece. 6. The weld cables may be too long or too small of a diameter causing excessive voltage drop. 7. The weld cables should not be coiled or wrapped around metal racks or reels. This can cause excessive inductance in the weld circuit. Try welding with a short set of adequately sized weld cables. 	<ol style="list-style-type: none"> 1. Disconnect all external equipment and perform a “load” test using a resistive load bank and accurate meters. Adjust the load for approximately 600 Amps at 36 Volts; check that the engine speed holds at 1800 rpm. If not perform engine maintenance. If the Fleet 650 has meters, make sure that they read the same as the load bank meters. If not, perform the Weld Control Board Feedback Test Procedure. 2. If the maximum weld output cannot be obtained, check for damaged conductors or loose connections in the large current carrying conductors of the stator, output rectifier bridge, chopper module boards, chokes, shunt and output terminals. See Wiring Diagram. 3. If all these connections are good, perform the Stator Voltage Test Procedure, the Output Rectifier Bridge Test Procedure and the Chopper Module Boards Resistance Test Procedure. 4. Perform the Output Control And Arc Control Potentiometer Test Procedure. 5. Perform the Choke Test Procedure. 6. Perform the Pipe/Gouge Range Switch And Weld Mode Switch Test Procedure.


		7. Replace the weld control board.
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 **CAUTION**


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.


Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine welds but it will not maintain a steady output.	<ol style="list-style-type: none"> 1. This condition may be normal in the Downhill Pipe Mode. The downhill pipe mode allows the arc current to increase and decrease slightly as the arc length changes. 2. Check that the electrode is of good quality, dry and free from contamination. Try using Lincoln Electrode and setting the machine per Lincoln's recommendation. 3. Check for proper work and electrode leads and connections (size, length, coils or bad connections). 	<ol style="list-style-type: none"> 1. If the engine will not maintain the correct load RPM, the engine may be in need of service. Air and fuel filters should be checked. 2. Check large current carrying leads that connect to the stator, chopper module boards, shunt, chokes and output terminals. See Wiring Diagram. Look for damaged conductors or faulty connections. 3. Check the connections at the weld control board and the chopper module boards. 4. The output control or the arc control potentiometer may be defective or grounded. The mode switch may also be faulty. Perform the <i>Output Control And Arc Control Potentiometer Test Procedure.</i> 5. Perform the <i>Pipe/Gouge Range Switch And Weld Mode Switch Test Procedure.</i> 6. Replace the weld control board.
<div style="background-color: black; color: white; padding: 5px; display: inline-block;">  CAUTION </div>		
<p>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.</p>		

Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The weld output cannot be adjusted with the front panel output control knob in one or more weld modes. The weld output terminals have normal OCV (open circuit voltage). The AC auxiliary power is normal and the engine operates normally.	<ol style="list-style-type: none"> 1. Remote control devices completely disable the front output in all modes except TOUCH START TIG mode. *Make sure there is nothing plugged into the 6 pin Amphenol receptacle. 2. Check for dirt or moisture contamination in the 6 pin Amphenol. 	<ol style="list-style-type: none"> 1. The output control potentiometer may be defective. Perform the <i>Output Control And Arc Control Potentiometer Test Procedure.</i> 2. Check the shunt, associated leads and the voltage feedback leads for loose or faulty connections. See Wiring Diagram. 3. The weld control board may be faulty.
The machine front panel output control is still active when the remote control unit is connected to the 6 pin Amphenol.	<ol style="list-style-type: none"> 1. This condition is normal in the TOUCH START TIG mode. *See the operators manual. 2. The remote control unit may be defective. 3. Check the Amphenol receptacle. Look for damage or corroded contact pins in the receptacle and in the plug of the remote control unit. 	<ol style="list-style-type: none"> 1. Check Connector J1 on the weld control board to see that it is properly seated and the pins in both the plug and the board receptacle are in good condition. 2. Check for continuity between the J1 connector and the Amphenol connector. See Wiring Diagram. 3. The weld control board may be defective.
 CAUTION		
<p>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.</p>		

Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The arc quality is poor with excessive spatter. The arc heat can be controlled and maintained normally. The auxiliary output is normal and the engine operates normally.	<ol style="list-style-type: none"> 1. The ARC CONTROL may be set too high. 2. The output control may be set too high for the electrode being used. Check that the electrode is of good quality, dry and free from contamination. Try using Lincoln Electrode and setting the machine per Lincoln's recommendations. 3. Check for proper work and electrode leads and connections (size, length, coils or bad connections). 	<ol style="list-style-type: none"> 1. Perform the <i>Output Control And Arc Control Potentiometer Test Procedure.</i> 2. The weld control board may be faulty. 3. Perform the <i>Choke test Procedure.</i>
<div style="background-color: black; color: white; padding: 5px; display: inline-block;">  CAUTION </div>		
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.		

Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The engine will not crank when the start button is pushed.	<ol style="list-style-type: none"> 1. Check circuit breaker (CB5). Reset if tripped. 2. The battery may be low or faulty. If the battery will not accept a charge, replace it. 	<ol style="list-style-type: none"> 1. Check the wiring and the connections at the starter motor, circuit breaker (CB5), 'RUN/STOP' switch and the start button. See Wiring Diagram. 2. Check the chassis ground connections between the engine block and the negative battery terminal. 3. Place the 'RUN/STOP' switch to the 'RUN' position. Press the start button, while checking for voltage between a good clean chassis ground connection (-) and lead 231 (+) at the starter solenoid. Voltage should be approximately 12 volts. See Wiring Diagram. 4. If battery voltage is present, the starter motor or solenoid may be defective or the engine may be unable to turn over due to a mechanical failure.
The engine starts but shuts down shortly after it starts.	<ol style="list-style-type: none"> 1. Make sure there is an adequate fuel supply in the fuel tank. 2. The fuel filters may be clogged. 3. If the engine protection light is illuminated, there may be a low oil pressure or high oil temperature condition. 	<ol style="list-style-type: none"> 1. The shutdown fuel solenoid may be faulty. See Wiring Diagram. 2. The engine shutdown relay may be faulty. Perform the Engine Shutdown Relay Test Procedure. See Wiring Diagram.
 CAUTION		
<p>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.</p>		

Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The battery does not stay charged.	<ol style="list-style-type: none"> 1. Check for loose, corroded or faulty connections at the battery. 2. Check for loose or damaged alternator drive belt. 3. The battery may be faulty. 	<ol style="list-style-type: none"> 1. Perform the <i>Engine Alternator Test Procedure</i>. 2. There may be a defective component or faulty wiring causing a current draw when the 'RUN/STOP' switch is in the 'STOP' position. 3. Check the 'RUN/STOP' switch, the alternator and the starter solenoid. Also check for damaged wiring and insulation. 4. If the engine charging system is operating properly but the battery is not staying charged, the battery is defective and should be replaced.
Engine runs rough.	<ol style="list-style-type: none"> 1. Dirty fuel or air filter. 2. Water in fuel. 3. Fuel injector may be clogged or malfunctioning. 	<ol style="list-style-type: none"> 1. N/A.
 CAUTION		
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.		

Observe Safety Guidelines detailed in the beginning of this manual.		TROUBLESHOOTING GUIDE
PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The engine cranks when the start button is pressed but will not start.	<ol style="list-style-type: none"> 1. The battery voltage may be low (normally results in slow cranking speed). The battery should be checked and recharged if it is not producing adequate voltage and replaced if it will not accept a full charge. 2. Check that the machine has an adequate supply of fresh, clean fuel. 	<ol style="list-style-type: none"> 1. The fuel filter may be clogged, replace if necessary. 2. Fuel pump may be faulty. Check for fuel flow through filters. Contact local authorized engine service shop. 3. Check oil level. 4. If the 'RUN/STOP' switch is in the 'RUN' position for more than 60 seconds before starting. The 'RUN/STOP' switch will need to be switched off and turned back on again. 5. Perform the Engine Shutdown Relay Test Procedure. 6. The timer delay relay may be faulty. See Wiring Diagram. 7. The fuel shutdown solenoid relay may be faulty. See Wiring Diagram.
The engine will not develop full power.	<ol style="list-style-type: none"> 1. The fuel may be old or contaminated. Supply the engine with clean fresh fuel. 2. The fuel filter may be clogged, replace if necessary. 3. The air filter may be clogged, replace if necessary. 	<ol style="list-style-type: none"> 1. The engine may be in need of adjustment or repair.
 CAUTION		
<p>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.</p>		

Test Procedures

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Case Covers.

MATERIALS NEEDED

1/2" Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine of the Fleet 650 machine.
2. Slide the door assembly off of the door slide. See **Figure F.1**.
3. Using a 1/2" nutdriver, remove the nine screws and flat washers securing the door slide to the machine. See **Figure F.1**. Remove the door slide.
4. Using a 1/2" nutdriver, loosen (do not remove) the two bottom screws securing the right case side to the machine. See **Figure F.1**.
5. Using a 1/2" nutdriver, remove the six screws and flat washers securing the right case side to the machine. See **Figure F.1**. Remove the right case side.
6. Using a 1/2" nutdriver, remove the nine screws and flat washers securing the roof to the machine. See **Figure F.1**.
7. Remove the cover seal, fuel cap and fuel trough.
8. Remove the roof.
9. Attach the fuel cap.
10. Using a 1/2" nutdriver, remove the six screws and flat washers securing the front case side to the machine. See **Figure F.2**.
11. Using a 1/2" nutdriver, loosen (do not remove) the two bottom screws securing the front case side to the machine. See **Figure F.2**. Remove the front case side.
12. Using a 1/2" nutdriver, remove the two screws and flat washers securing the engine case side to the machine. See **Figure F.2**.
13. Using a 1/2" nutdriver, loosen (do not remove) the two bottom screws securing the engine case side to the machine. See **Figure F.2**. Remove the engine case side.

14. Perform any tests / replacement procedure.

REPLACEMENT PROCEDURE

1. Position the engine case side onto the machine.
2. Using a 1/2" nutdriver, tighten the two bottom screws securing the engine case side to the machine.
3. Using a 1/2" nutdriver, attach the two screws and flat washers securing the engine case side to the machine.
4. Position the front case side onto the machine.
5. Using a 1/2" nutdriver, tighten the two bottom screws securing the front case side to the machine.
6. Remove the fuel cap.
7. Carefully position the roof onto the machine.
8. Attach the cover seal, fuel cap and fuel trough to the machine.
9. Using a 1/2" nutdriver, attach the nine screws and flat washers securing the roof to the machine.
10. Position the right case side onto the machine.
11. Using a 1/2" nutdriver, attach the six screws and flat washers securing the right case side to the machine.
12. Using a 1/2" nutdriver, tighten the two bottom screws securing the right case side to the machine.
13. Carefully position the door slide onto the machine.
14. Using a 1/2" nutdriver, attach the nine screws and flat washers securing the door slide to the machine.
15. Position the door assembly into the door slide.

Figure F.1 – Roof, fuel cap, cover seal, door slide, door assembly, fuel trough and right case side location

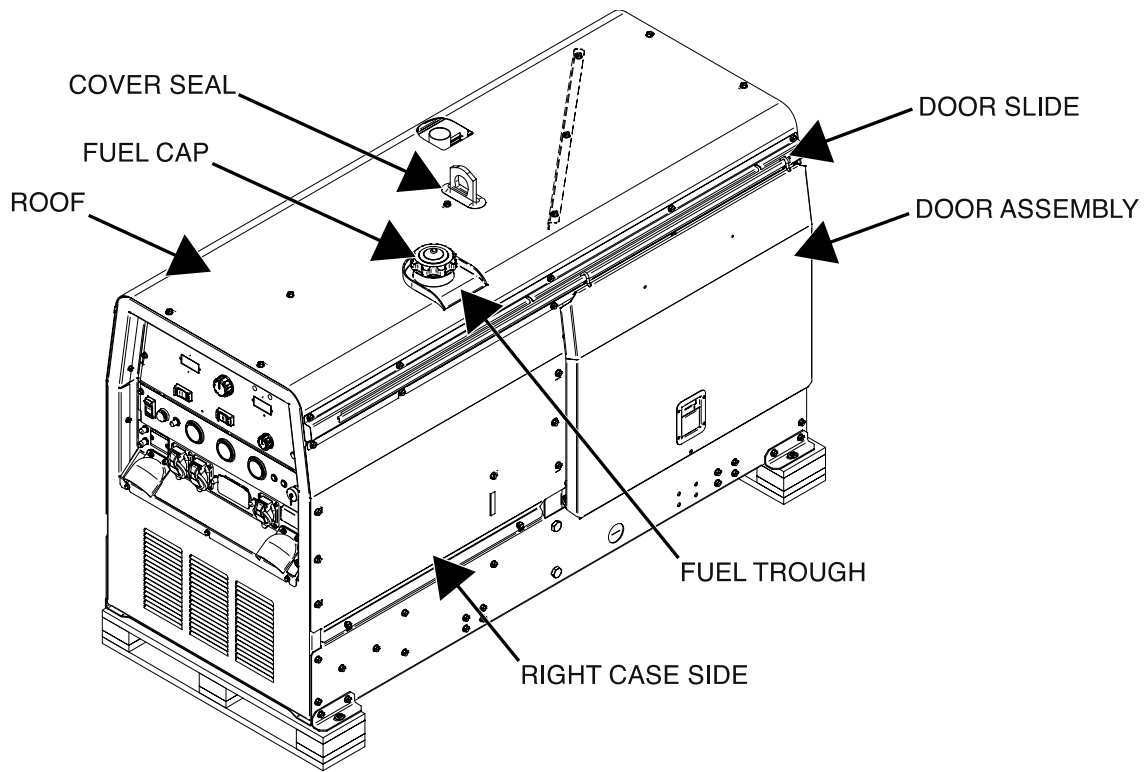
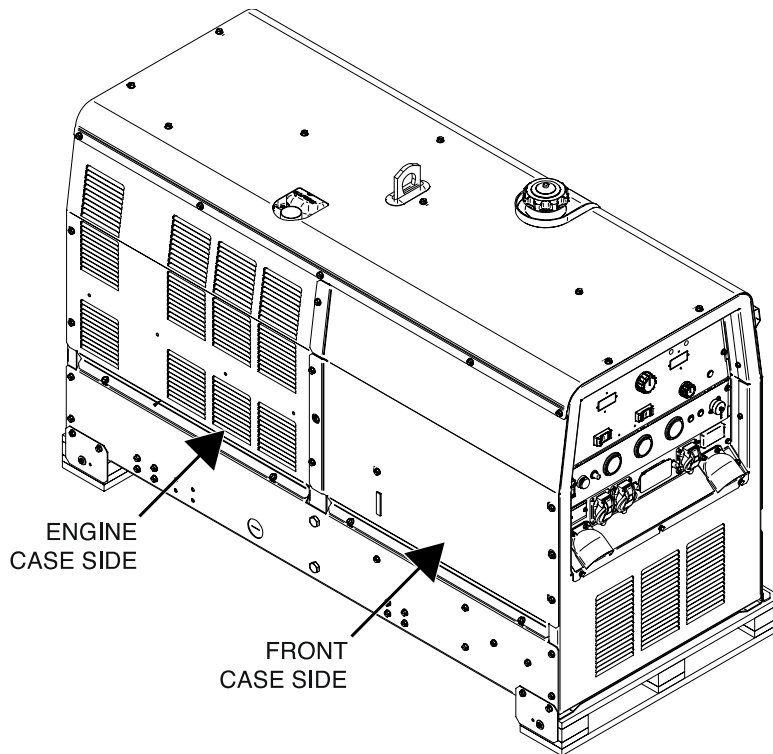


Figure F.2 – Engine case side and front case side location



CHOPPER MODULE CAPACITOR DISCHARGE PROCEDURE

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.

TEST DESCRIPTION

This procedure will ensure that the large Capacitors on each of the Chopper Module Boards have been discharged. This procedure should be performed whenever work is to be attempted on or near the Chopper Module Boards.

MATERIALS NEEDED

Volt/Ohmmeter
Resistor (25-1000 ohms and 25 watts minimum)
Electrically Insulated Gloves
Electrically Insulated Pliers
Jumper Leads
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Locate the two chopper module boards on the choppers and choke bracket. See **Figure F.3**. See Wiring Diagram.
4. NEVER USE A SHORTING STRAP TO DISCHARGE CAPACITORS. If the Lincoln recommended resistor or an equivalent resistor is used, the capacitors can be discharged by holding the resistor with insulated gloves and insulated pliers and using the resistor terminals to bridge chopper module board terminals B1 to B2 and B4 to B5 on each chopper module board. DO NOT TOUCH THE TERMINALS OR METAL PARTS OF THE PLIERS WITH YOUR BARE HANDS. Hold the resistor in place for about ten seconds. If another type of resistor is used, jumper leads may need to be attached to the resistor. See **Figure F.4**. See Wiring Diagram.
5. Using a volt/ohmmeter, check the voltage across terminals B1 and B2 then across terminals B4 and B5 on each chopper module board. See **Figure F.4**. See Wiring Diagram. Voltage should be zero.
6. If any voltage is present on either chopper module board, repeat step 4 until reading is zero volts.
7. Perform the **Case Cover Replacement Procedure**.

Figure F.3 – Chopper module board locations

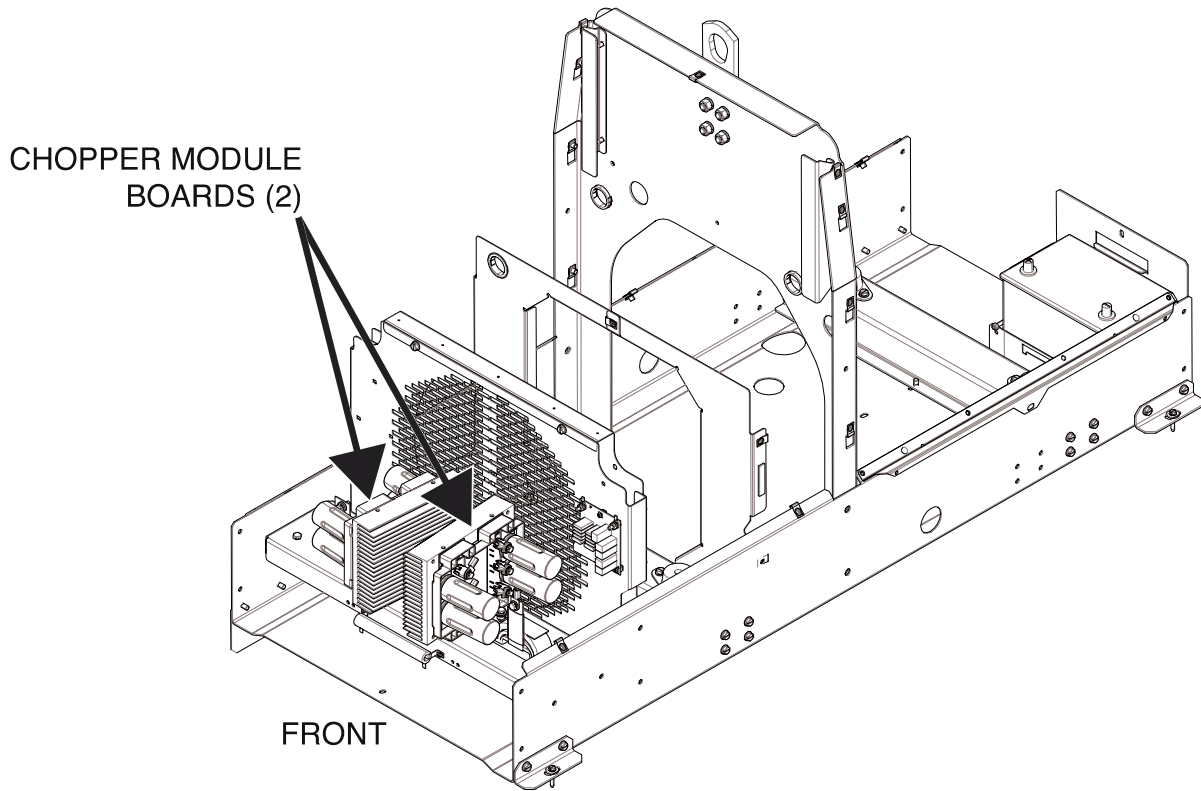
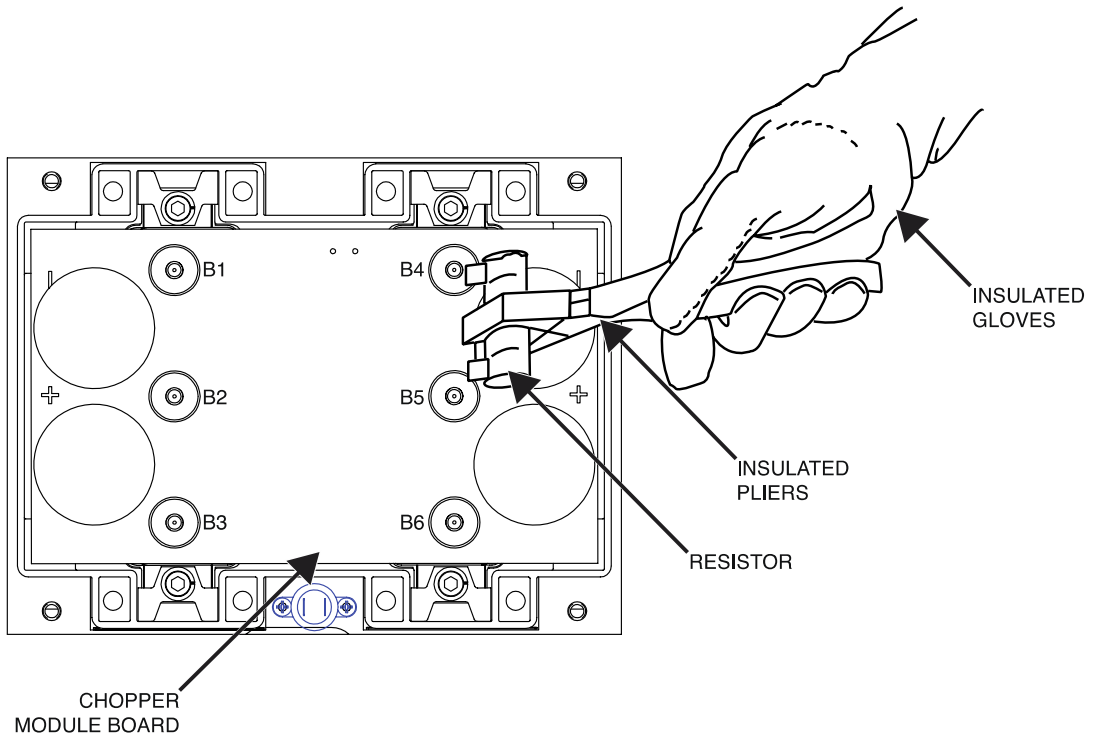


Figure F.4 – Chopper module board discharge



BRUSH AND SLIP RING SERVICE PROCEDURE

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.

TEST DESCRIPTION

This procedure provides guidance in testing and maintaining the Brush and Slip Ring system.

MATERIALS NEEDED

Volt/Ohmmeter
500 or 600 Grit Sand Paper
180 Grit Sand Paper
Low Pressure Compressed Air
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Remove the brush holder bracket.
5. Examine brushes and slip rings. The slip rings, brush holder and brushes should be clean and free from oil or grease. The brushes should be making good, continuous contact with the slip rings.
6. The brushes should be of sufficient length and have adequate spring tension. Generally, the brushes should be replaced if either brush has less than 1/4" remaining before it reaches the end of its travel. Spring tension should be sufficient to hold the brushes firmly against the slip rings.
7. The brushes should be removed from the brush holder and examined. The terminals should be clean.
8. If the slip rings are discolored, display evidence of excessive sparking or the brushes have worn prematurely. These may be signs of a grounded or a shorted rotor. Perform the **Rotor Resistance and Ground Test Procedures (Static) and (Dynamic)**.
9. 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 intermittent instability or loss of both weld and auxiliary output. If there is any evidence that the brushes may have been sticking in the brush holders, a new brush holder and brush assembly should be installed.

CLEANING SLIP RINGS:

10. 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 sand paper.

SEATING BRUSHES:

11. If brushes have been replaced, repositioned or are not making full contact with the slip rings, it may be necessary to re-seat them. This can be done by placing a strip of 180 grit sandpaper between the slip rings and the brushes, with the abrasive side against the brushes. Pull the sandpaper strip around the circumference of the slip rings in the direction of rotor rotation only. Repeat this procedure until the surface of each brush is in full contact with its matching slip ring.
12. Use a low pressure compressed air to thoroughly blow the carbon and/or sandpaper dust from the machine before operating.
13. Perform the ***Case Cover Replacement Procedure***.

FLASHING DIODE (D1) & FIELD DIODE (D2) TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Flashing Diode (D1) & Field Diode (D2) are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Locate the flashing diode (D1) & field diode (D2). See **Figure F.5**. See Wiring Diagram.
5. Label and disconnect leads 232P, 232N, 232M and 204C from the flashing diode (D1). See **Figure F.6**. See Wiring Diagram.
6. Label and disconnect leads 201A, 200A, 204B, 5H and 3A from the field diode (D2). See **Figure F.6**. See Wiring Diagram.
7. Using a volt/ohmmeter, perform the forward voltage drop tests outlined in **Table F.1** for each diode. See **Figures F.5** and **F.6**. See Wiring Diagram.
8. If any of the tests fail, the diode may be faulty.
9. If faulty, perform the **Flashing Diode (D1) & Field Diode (D2) Removal And Replacement Procedure**.
10. Connect the previously removed leads to the flashing diode (D1) & field diode (D2). See Wiring Diagram.
11. Perform the **Case Cover Replacement Procedure**.

Table F.1 – Flashing diode (D1) & field diode (D2) resistance tests

TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING
TOP AC TERMINAL	POSITIVE TERMINAL	0.3 VDC – 0.7 VDC
BOTTOM AC TERMINAL	POSITIVE TERMINAL	0.3 VDC – 0.7 VDC
NEGATIVE TERMINAL	TOP AC TERMINAL	0.3 VDC – 0.7 VDC
NEGATIVE TERMINAL	BOTTOM AC TERMINAL	0.3 VDC – 0.7 VDC

Figure F.5 – Flashing diode (D1) & field diode (D2) location

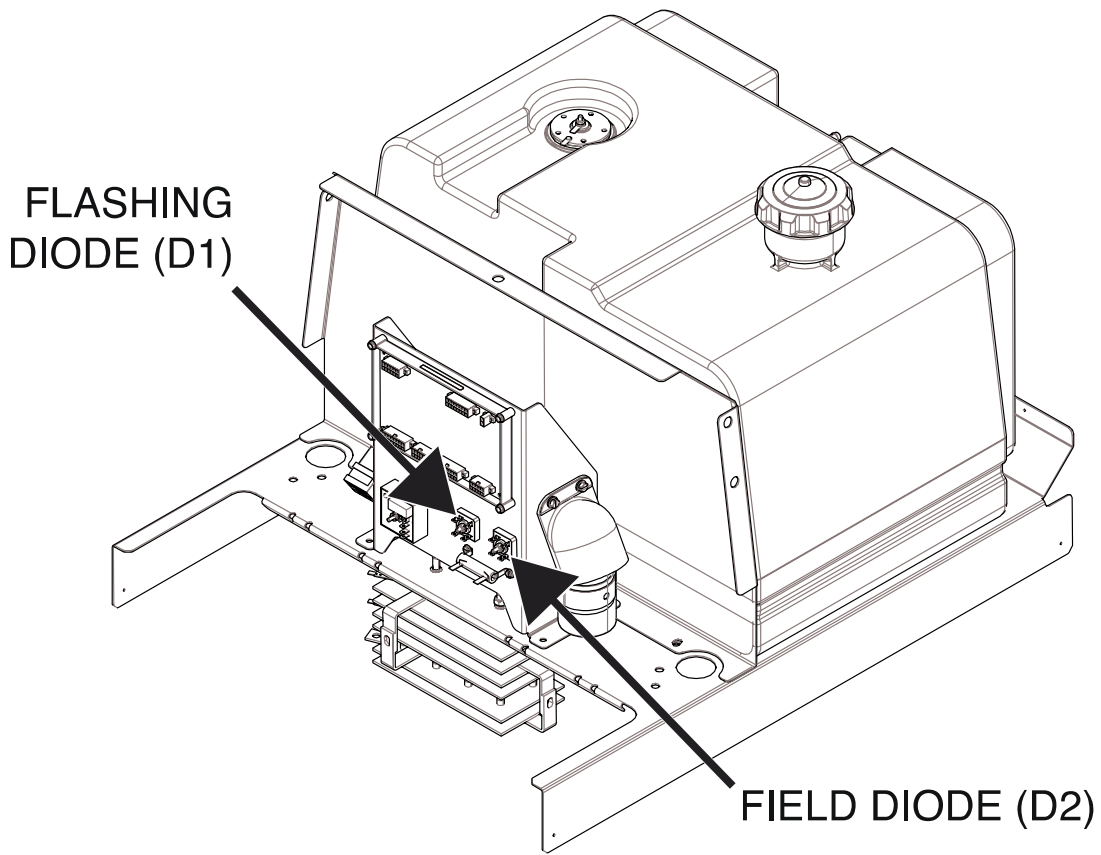
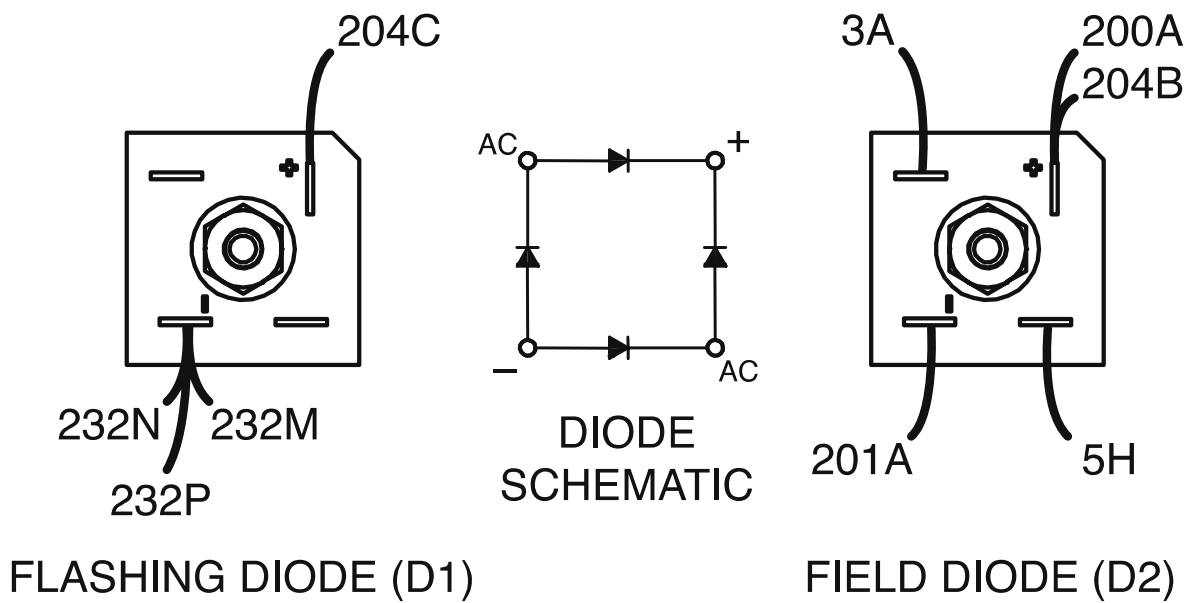


Figure F.6 – Flashing diode (D1) & field diode (D2) lead locations



ENGINE SHUTDOWN RELAY TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Engine Shutdown Relay is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
12 VDC Power Supply
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Locate the engine shutdown relay. See **Figure F.7**. See Wiring Diagram.
4. Carefully remove the relay from it's mounting / wiring bracket.
5. Using a volt/ohmmeter, measure the resistance of the relay coil from terminal 86 (+) to terminal 85 (-). See **Figure F.8**. See Wiring Diagram. Normal resistance should be approximately 90 ohms.
6. Using a volt/ohmmeter and a 12 VDC power supply, perform the tests outlined in **Table F.2**. See **Figure F.8**. See Wiring Diagram. Apply positive 12 VDC to terminal 86 and negative to terminal 85.
7. If any of the tests fail, the engine shutdown relay may be faulty and should be replaced.
8. Carefully place the engine shutdown relay into it's mounting / wiring bracket.
9. Perform the **Case Cover Replacement Procedure**.

Table F.2 – Engine shutdown relay resistance tests

TEST POINT	TEST POINT	EXPECTED READING	MACHINE CONDITION
TERMINAL 87	TERMINAL 30	OPEN (HIGH RESISTANCE)	NO POWER APPLIED TO RELAY COILS.
TERMINAL 87A	TERMINAL 30	CLOSED (LOW RESISTANCE)	NO POWER APPLIED TO RELAY COILS.
TERMINAL 87	TERMINAL 30	CLOSED (LOW RESISTANCE)	12 VDC APPLIED TO RELAY COILS. POSITIVE TO TERMINAL 86.
TERMINAL 87A	TERMINAL 30	OPEN (HIGH RESISTANCE)	12 VDC APPLIED TO RELAY COILS. POSITIVE TO TERMINAL 86.

Figure F.7 – Engine shutdown relay location

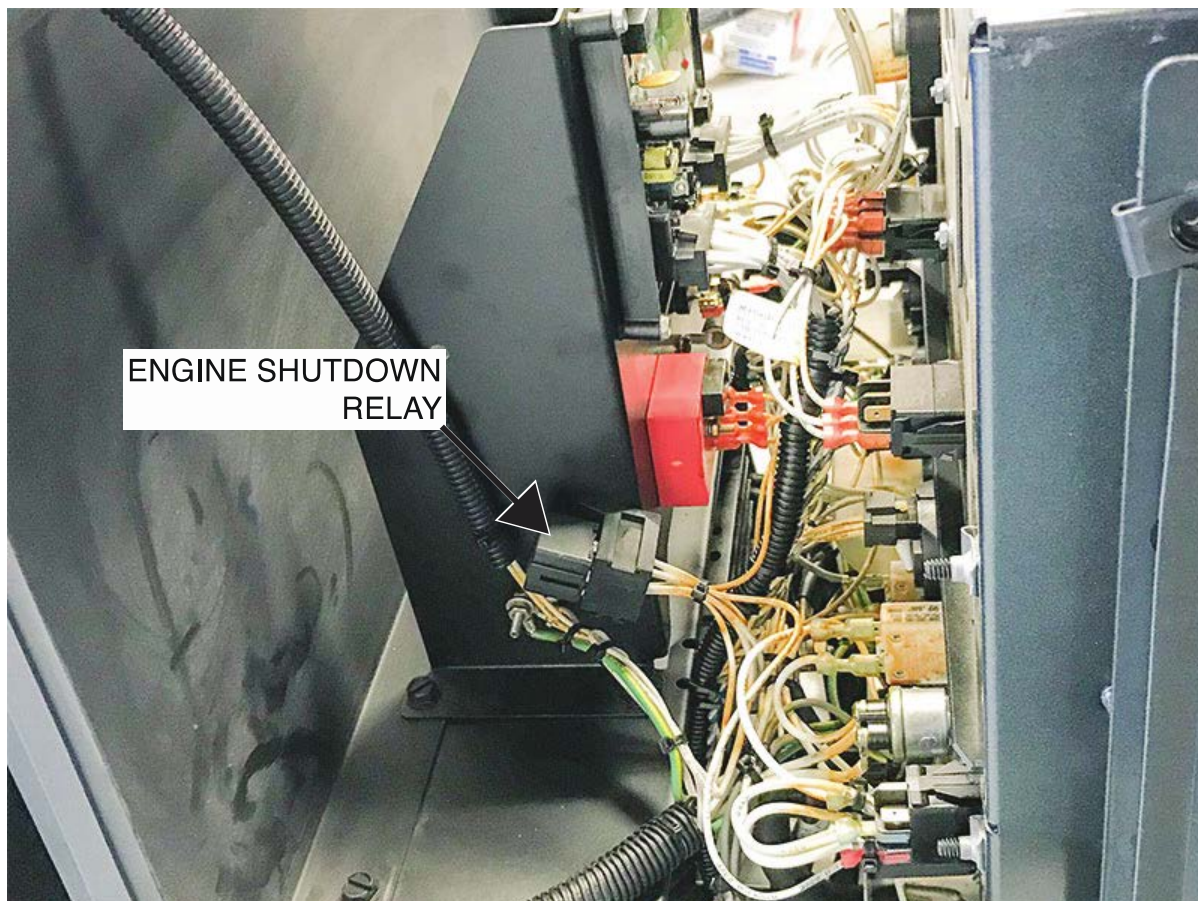
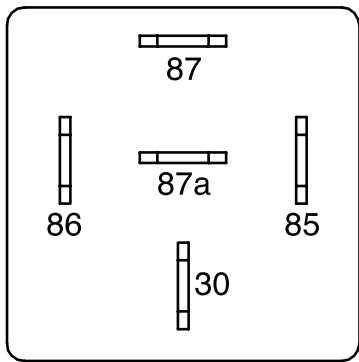
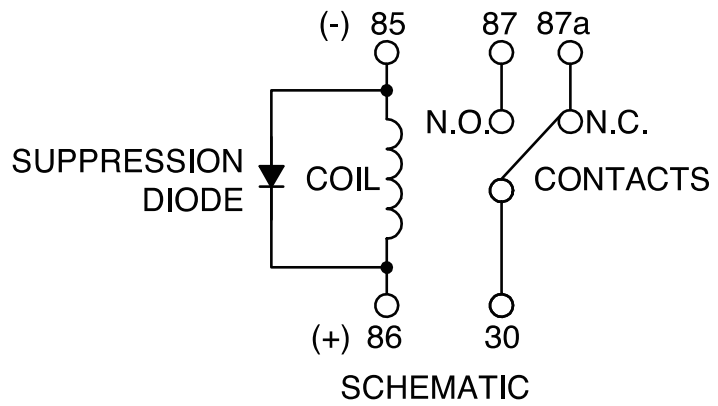


Figure F.8 – Engine shutdown relay terminal locations and schematic



TERMINAL LOCATIONS



SCHEMATIC

ENGINE ALTERNATOR TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Engine Alternator is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Using a volt/ohmmeter, measure the voltage at the battery terminals. The voltage should be approximately 12 VDC. See Wiring Diagram.
4. Attach the meter leads to the battery terminals, being careful to position them so they stay clear of moving parts while the engine is running.
5. Start the engine and allow it to run for about 15 to 30 seconds.
6. Using a volt/ohmmeter, measure the battery voltage. See Wiring Diagram. The meter should read about 13.7 to 14.2 VDC.
7. If the meter reads correctly, the engine alternator is producing adequate power to charge the battery and this test is complete.
8. If the voltage is significantly higher than the above values, the alternator is not properly regulating the battery charging voltage and should be replaced. If the voltage reads the same or less than the measurement taken in Step 4, proceed with the following tests.
9. Turn off the engine and disconnect the meter from the battery.
10. Start the engine and allow it to run for about 15 to 30 seconds.
11. Place the negative meter probe on a good chassis ground or the negative battery terminal. Place the positive meter probe on the 'B+' terminal (lead 238) on the back of the alternator. See Wiring Diagram.
12. The meter should read about 13.7 to 14.2 VDC.
13. Move the positive probe to the 'D' terminal on the back of the alternator (lead 239). See Wiring Diagram.
14. The meter should read about 13.7 to 14.2 VDC.

15. If the meter reads correctly, check the connections between the alternator and the battery. See Wiring Diagram.
16. If the voltage at both of the above test points reads the same or less than the battery voltage measurement in Step 4, the alternator is defective. Repair or replace it.
17. Perform the ***Case Cover Replacement Procedure***.

ROTOR RESISTANCE AND GROUND TEST PROCEDURE (STATIC)

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.

TEST DESCRIPTION

This test will determine if the Rotor Winding is open, shorted or grounded.

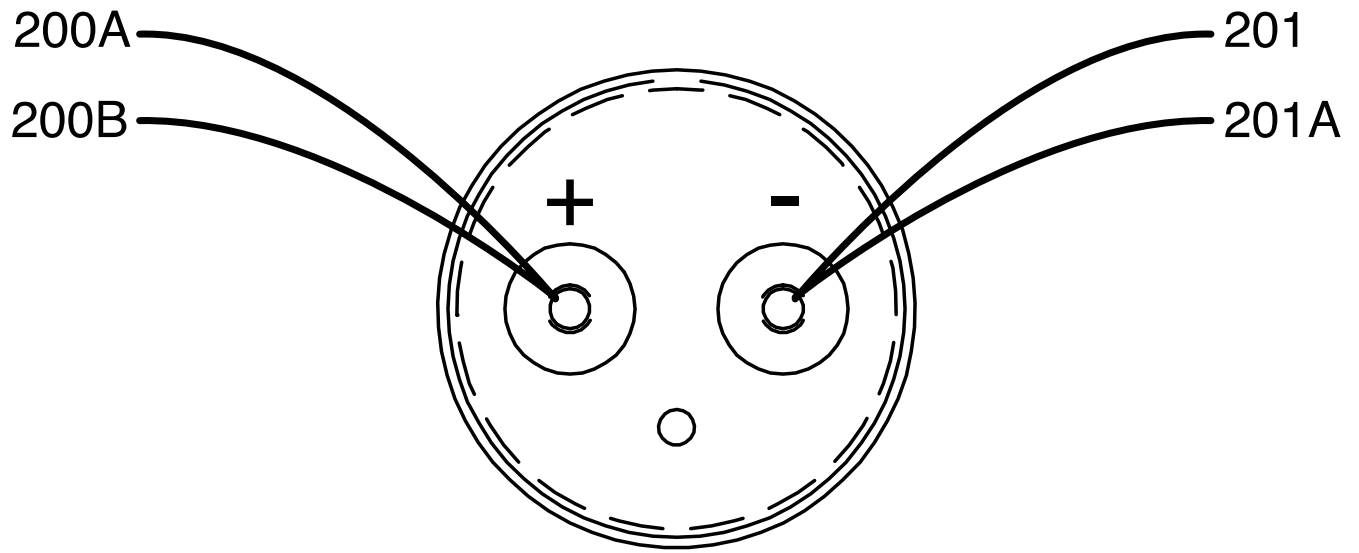
MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Label and disconnect leads 201 and 200B from the field capacitor located on the right side of the PCB bracket. See **Figure F.9**. See Wiring Diagram. This will electrically isolate the rotor windings.
5. Using the volt/ohmmeter, measure the resistance from lead 201 to 200B. It should read approximately 28 ohms. See **Figure F.9**. See Wiring Diagram.
6. If reading is incorrect, remove the brush holder bracket and measure directly across the slip rings. If reading is correct, check the brushes and the leads. If reading is still incorrect, the rotor is defective.
7. Measure the resistance to ground from either of the slip rings to any good unpainted chassis ground. The resistance should be very high, at least 500,000 ohms (500k).
8. If the test does not meet the resistance specifications, then the rotor is grounded and should be replaced.
9. If this test meets the resistance specifications, continue testing using the **Rotor Resistance and Ground Test Procedure (Dynamic)**.
10. Re-connect leads 201 and 200B to the field capacitor. Be sure to connect them to the proper polarity terminals. See **Figure F.9**. See Wiring Diagram.
11. Perform the **Case Cover Replacement Procedure**.

Figure F.9 – Capacitor lead and terminal locations



ROTOR RESISTANCE AND GROUND TEST PROCEDURE (DYNAMIC)

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.

TEST DESCRIPTION

This test checks for faults in the Rotor Winding, while these windings are being stressed by the mechanical forces encountered during normal operation.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

NOTE: Some digital meters will not provide stable or accurate resistance readings while the rotor is spinning.

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. This test requires that the brushes and slip rings are clean, in good condition and are properly seated.
5. Perform the **Brush and Slip Ring Service Procedure**, if necessary.
6. Label and disconnect leads 201 and 200B from the field capacitor and connect an ohmmeter across the two leads and insulate the connections. See Wiring Diagram.
7. Start the engine. The resistance should read approximately 28 ohms. The resistance of the windings will change with temperature. Higher temperatures will produce higher resistance and lower temperatures will produce lower resistance.
8. Shut off engine and move one of the ohmmeter leads to a good clean chassis ground.
9. Restart the engine. The resistance should be very high, at least 500,000 (500k) ohms.
10. If the resistance readings differ significantly from the values indicated, re-check the brushes and the brush spring tension. If the brushes and slip rings are good, replace the rotor.
11. If all testing is complete, reconnect the leads to the field capacitor.
12. Perform the **Case Cover Replacement Procedure**.

ROTOR VOLTAGE TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Rotor Winding is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Connect the voltmeter probes to the field capacitor terminals (201 & 200B). See Wiring Diagram.
5. Set the 'RUN/STOP' switch to the 'RUN' position. Start the engine and allow the RPM to stabilize for about 15 to 30 seconds. The meter should read 145-175 VDC.
6. Set the 'RUN/STOP' switch to the 'STOP' position.
7. If the meter reading is normal, this test is complete.
8. If the voltage measures zero or very near zero, the rotor flashing circuit may be faulty, the leads may be open or the rotor may be shorted. Check the flashing resistor (R1 10 ohm). See Wiring Diagram.
9. Perform the **Rotor Resistance and Ground Test Procedures (Static) and (Dynamic)** and the **Flashing Voltage Test Procedure (Engine Not Running)**.
10. If voltage is higher than 175 VDC, the engine RPM may be too high or there may be voltage intrusion from one of the higher voltage stator windings to the stator exciter winding.
11. If the voltage is lower than 145 VDC, the engine RPM may be too low or there may be problems in the windings, capacitor or other exciter circuit components or connections.
12. If the meter reading indicates battery voltage, about 12 to 14 VDC, the rotor may be open or the brushes may be faulty or not making proper contact with the slip rings.
13. If the voltage measures about 3 to 5 VDC, the generator is not building-up to normal output even though the flashing circuit appears to be functioning normally.
14. Perform the **Flashing Diode (D1) & Field Diode (D2) Test Procedure**.
15. Perform the **Case Cover Replacement Procedure**.

FLASHING VOLTAGE TEST PROCEDURE (ENGINE NOT RUNNING)

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.

TEST DESCRIPTION

This test checks the flashing voltage with the engine stopped.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Make sure that the battery is fully charged and in good condition and the battery connections are clean and tight.
5. Connect the voltmeter probes to the terminals of the field capacitor.
6. Place the 'RUN/STOP' switch in the 'RUN' position (the engine protection light should remain on).
7. Measure the voltage; it should read about 7 to 8 VDC.
8. If the meter reading indicates battery voltage, about 12 to 14 VDC, the rotor may be open or the brushes may be faulty or not making proper contact with the slip rings.
9. Set the 'RUN/STOP' switch to the 'STOP' position.
10. Perform the **Rotor Resistance and Ground Test Procedures (Static) and (Dynamic)**. Perform the **Brush and Slip Ring Service Procedure**.
11. If the voltage measures zero or very near zero; check the flashing diode (D1) and the flashing resistor (R1 10 ohm) and associated wiring, this condition could be caused by a poor connection. See Wiring Diagram.
12. Perform the **Case Cover Replacement Procedure**.

STATOR VOLTAGE TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Stator is able to produce the correct voltage from its Windings. It will only yield meaningful data if the engine idle speed is correct (1890 RPM) and approximately 160 VDC is present across the Rotor Slip Rings.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
NOTE: Voltage tests of the 120 and 240 VAC receptacles can be performed by placing the meter probes directly into the appropriate connection slots in the front of the receptacles rather than testing at the lead connections described below. If the meter probes are not long enough to make contact with the conductors inside the receptacles, test pins may be used.
4. Start the engine and allow it to stabilize.
5. Check for the correct AC voltages at each of the 120 and 240 VAC receptacles. See **Figure F.10**. See Wiring Diagram.
6. Turn off the engine on the Fleet 650 machine.
7. If these voltage readings are not within the specified limits, check for tripped or defective circuit breakers, loose connections or broken wires between the test points and the stator windings. If there are no wiring problems and the circuit breakers are not tripped or defective, the stator is defective and should be replaced.
To test the three-phase weld winding:
8. Locate the weld winding leads W1/W6, W2/W3 and W4/W5 where they connect to the output rectifier bridge. See **Figure F.11**. See Wiring Diagram.
9. Start the engine and allow it to stabilize (1890 RPM).
10. Check for about 60 to 65 VAC from leads W1/W6 to W2/W3, W2/W3 to W4/W5 and W4/W5 to W1/W6. See Wiring Diagram.
11. Turn off the engine on the Fleet 650 machine.

12. If these voltage readings are not within the specified limits, check for loose connections or broken wires between the test points and the stator windings. If there are no wiring problems, the stator is defective and should be replaced.
13. Perform the **Case Cover Replacement Procedure**.

Figure F.10 – 120 and 240 VAC receptacle locations

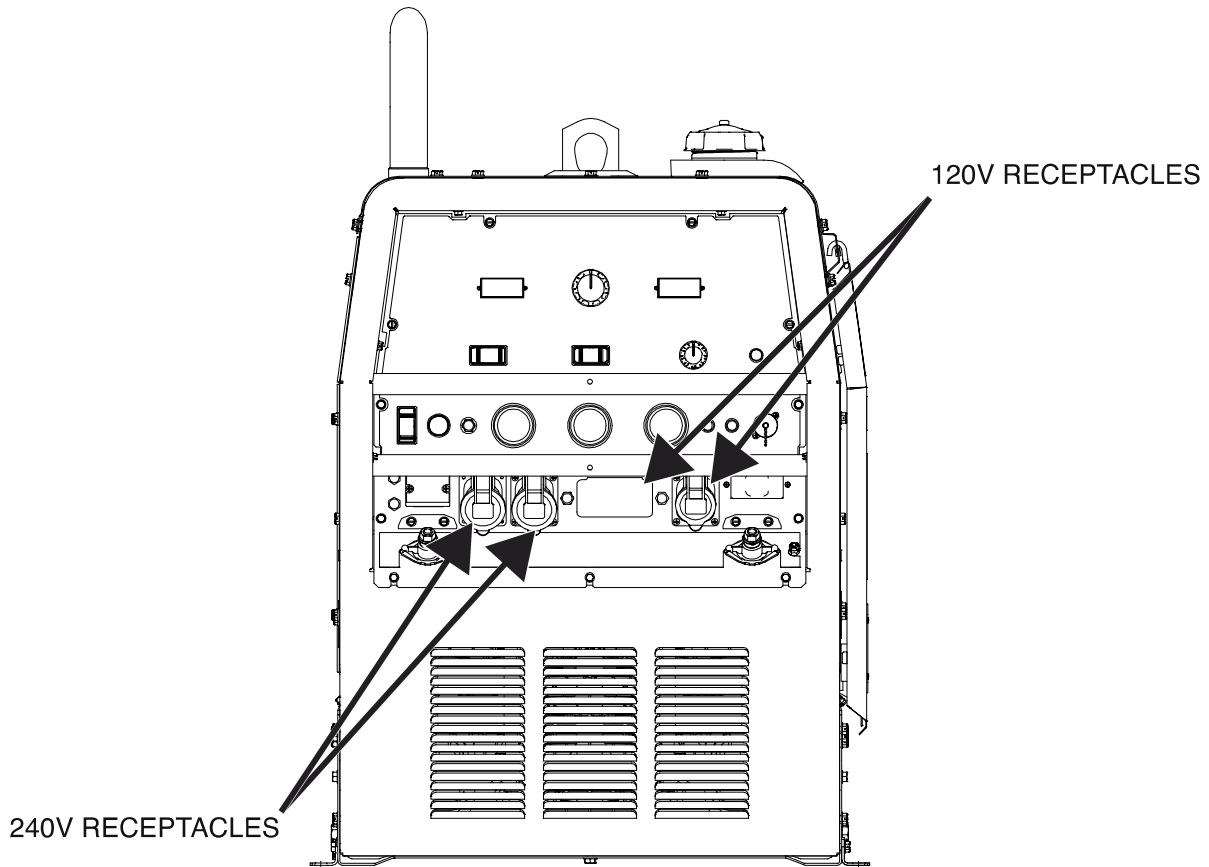
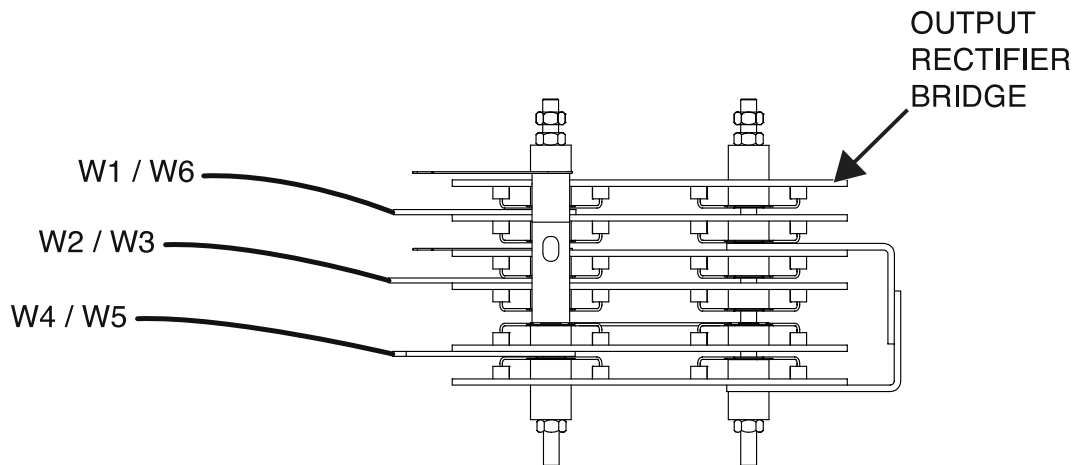


Figure F.11 – Output rectifier bridge lead locations



OUTPUT RECTIFIER BRIDGE TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Output Rectifier Bridge is grounded or if there are any failed Diode groups.

NOTE: This test will not be able to detect individual open Diodes within a group.

MATERIALS NEEDED

7/16" Socket
7/16" Open-End Wrench
1/2" Socket
1/2" Open-End Wrench
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

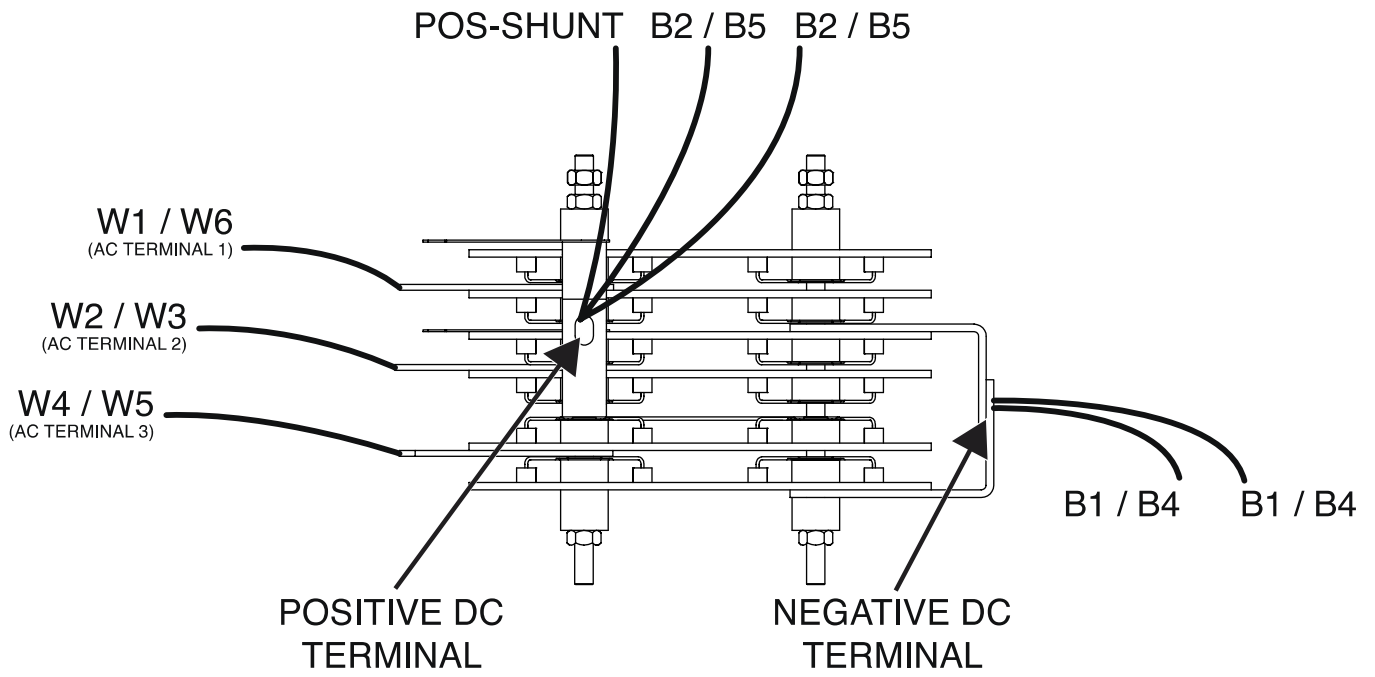
1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
Electrically isolate the three-phase input terminals of the output rectifier bridge as follows:
4. Using a 7/16" socket and a 7/16" open-end wrench, remove the bolt, nut, lock washer and two flat washers securing each lead set (W1/W6, W2/W3 and W4/W5) to the AC terminals of the output rectifier bridge. See **Figure F.12**. See Wiring Diagram.
5. Label and disconnect leads W1/W6, W2/W3 and W4/W5 and position them so they do not come in contact with any part of the rectifier. See **Figure F.12**. See Wiring Diagram.
Electrically isolate the DC output terminals of the rectifier:
6. Using a 1/2" socket and a 1/2" open-end wrench, remove the bolt, nut, lock washer and two flat washers securing leads B2/B5, B2/B5 and POS-SHUNT to the positive terminal of the output rectifier bridge and leads B1/B4 and B1/B4 from the negative terminal of the output rectifier bridge. See **Figure F.12**. See Wiring Diagram.
7. Label and disconnect leads B2/B5, B2/B5 and POS-SHUNT from the positive terminal of the rectifier and leads B1/B4 and B1/B4 from the negative terminal of the rectifier. Position these leads so they do not come to contact with any part of the output rectifier bridge. See **Figure F.12**. See Wiring Diagram.

8. Check for grounds by placing one of the ohmmeter probes on a clean, unpainted metal surface of the machine. Touch the other probe to each of the five rectifier terminals. The resistance to chassis ground from each terminal should be very high, 500,000 (500K) ohms minimum. If the resistance reading is less than specified, the rectifier is grounded and should be replaced.
9. If using diode checker or a multi-meter with diode check functionality, read and understand the instructions that accompany your test equipment.
10. Using the appropriate volt/ohmmeter, perform the tests outlined in **Table F.3**. See **Figure F.12**. See Wiring Diagram.
11. If any tests fail, the output rectifier bridge may be faulty.
12. If faulty, perform the **Output Rectifier Bridge Removal And Replacement Procedure**.
13. When testing is complete, reconnect all previously disconnected leads to the output rectifier bridge.
14. Perform the **Case Cover Replacement Procedure**.

Table F.3 – Output rectifier bridge diode tests

TEST POINT (+)	TEST POINT (-)	DIODE BIAS AND EXPECTED RESULT
AC TERMINAL 1	POSITIVE DC TERMINAL	0.3VDC - 0.7VDC
AC TERMINAL 2	POSITIVE DC TERMINAL	0.3VDC - 0.7VDC
AC TERMINAL 3	POSITIVE DC TERMINAL	0.3VDC - 0.7VDC
NEGATIVE DC TERMINAL	AC TERMINAL 1	0.3VDC - 0.7VDC
NEGATIVE DC TERMINAL	AC TERMINAL 2	0.3VDC - 0.7VDC
NEGATIVE DC TERMINAL	AC TERMINAL 3	0.3VDC - 0.7VDC
AC TERMINAL 1	NEGATIVE DC TERMINAL	OL
AC TERMINAL 2	NEGATIVE DC TERMINAL	OL
AC TERMINAL 3	NEGATIVE DC TERMINAL	OL
POSITIVE DC TERMINAL	AC TERMINAL 1	OL
POSITIVE DC TERMINAL	AC TERMINAL 1	OL
POSITIVE DC TERMINAL	AC TERMINAL 1	OL

Figure F.12 – Output rectifier bridge lead locations



CHOPPER MODULE BOARDS FUNCTION TEST PROCEDURE

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.

TEST DESCRIPTION

This test will help determine if the Chopper Module Boards are functioning properly and receiving the correct input from the Output Rectifier Bridge and the Weld Control Board.

This test can only provide meaningful results if the machine is producing normal AC auxiliary output.

MATERIALS NEEDED

Volt/Ohmmeter

Frequency Counter or Digital Multimeter With Frequency Counter Function

Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Make sure that there is nothing plugged into the Amphenol receptacle.
5. Place the 'RUN / STOP' switch into the 'RUN' position.
6. Place the weld mode switch in the 'PIPE/GOUGE' position.
7. Start the engine and allow it to stabilize.
8. Locate the chopper module boards. See **Figure F.13**. See Wiring Diagram.
9. Visually verify the LED's on each board are illuminated according to **Table F.4**. See **Figure F.14**.
10. Using a volt/ohmmeter, check for 80 to 100 VDC at terminals B1- to B2+ and B4- to B5+ on each of the chopper module boards. See **Figure F.14**. See Wiring Diagram.
11. If the correct DC voltage is not present at terminals B1- to B2+ and B4- to B5+ on the chopper module boards, check for damaged conductors or faulty connections between the chopper module boards, the output rectifier bridge and the stator weld winding. See **Figure F.14**. See Wiring Diagram. Perform the **Stator Voltage Test Procedure** and the **Output Rectifier Bridge Test Procedure**.
12. If the correct voltage is present at terminals B1- to B2+ and B4- to B5+ of the chopper module boards, check for DC voltage at the chopper module board terminals B2+ to B3- and B5+ to B6-. If voltage is present it should vary with a change in output commands from the output control potentiometer.
13. Turn off the engine on the Fleet 650 machine.

14. Label and disconnect leads 23A, 25A, 23 and 25 at the quick-connect terminals. See Wiring Diagram.
15. Start the engine and allow it to stabilize.
16. If the voltage drops to 0 VDC after leads 23A, 25A, 23 and 25 have been disconnected and the modules are not shorted, the weld control board is driving the chopper module.
17. Turn off the engine on the Fleet 650 machine.
18. Reconnect leads 23A, 25A, 23 and 25 and perform the **Weld Control Board PWM Gate Signal Test Procedure**.
19. Start the engine and allow it to stabilize.
20. Check for about 58 VDC between chopper module board terminals B2+ to B3- and B5+ to B6 and between the welder output terminals. See **Figure F.15**. See Wiring Diagram.
21. If about 58 VDC is present at chopper module board terminals B2+ to B3- and B5+ to B6-, but not at the weld output terminals, there is a problem between the chopper module boards and one of the weld output terminals. Check for damaged conductors or faulty connections. Also check the shunt, the chokes and the connections at the back of the weld output terminals. See Wiring Diagram.
22. If the voltage at terminals B2+ to B3- and B5+ to B6- of the chopper module boards are significantly higher than 58 VDC, check for an open R4 load resistor. See Wiring Diagram.
23. If the voltage at terminals B2+ to B3- and B5+ to B6- of the chopper module boards are very low or not present, use a frequency counter to check for the presence of a 20 kHz PWM signal between leads 23+ and 25- and 23A+ and 25A-, where they connect to the chopper module board. See Wiring Diagram.
24. If the 20 kHz signal is present but low or no OVC, the chopper module board(s) is defective. Perform the **Chopper Module Boards Removal And Replacement Procedure**.
25. If the 20 kHz signal is not present, perform the **Weld Control Board PWM Gate Signal Test Procedure**.
26. If the weld control board is producing a PWM gate signal, check leads 23, 25, 23A and 25A for damaged conductors and faulty connections between the weld control board and the chopper module boards.
27. Turn off the engine on the Fleet 650 machine.
28. When testing is complete, connect any previously disconnected leads.
29. When testing is complete, perform the **Case Cover Replacement Procedure**.

Table F.4 – Chopper module LED tests

LED	COLOR	INDICATION
1	GREEN	PWM INPUT PRESENT
2	GREEN	15 VDC POWER SUPPLY PRESENT
3	GREEN	CHOPPER OUTPUT PRESENT

Figure F.13 – Chopper module boards location

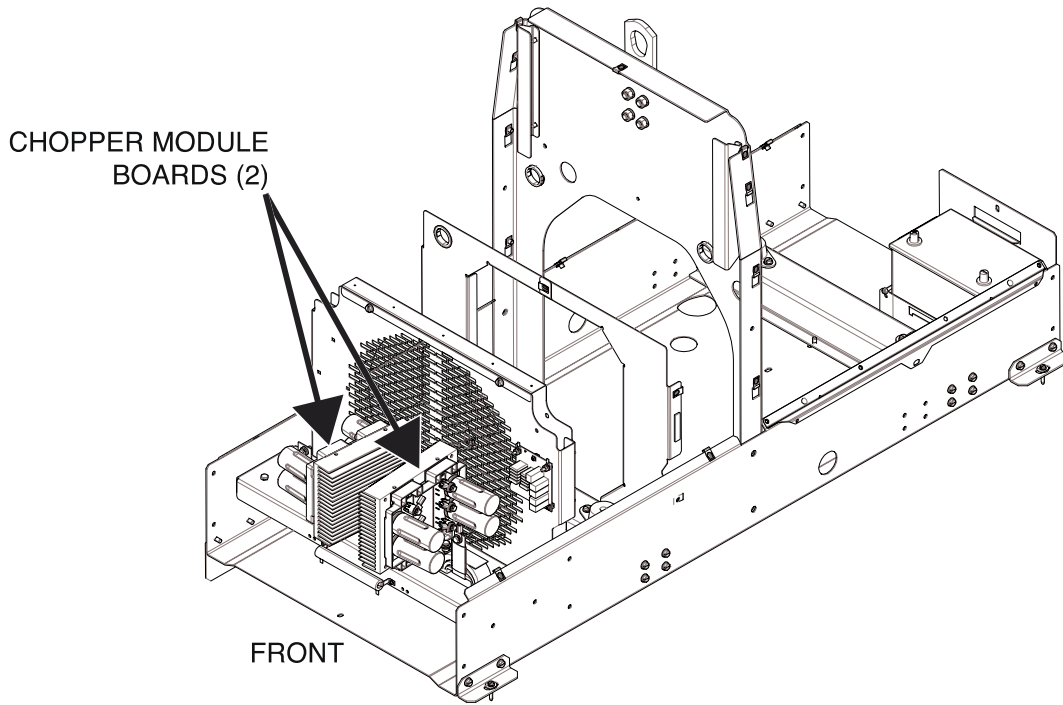


Figure F.14 – Chopper module board terminal locations

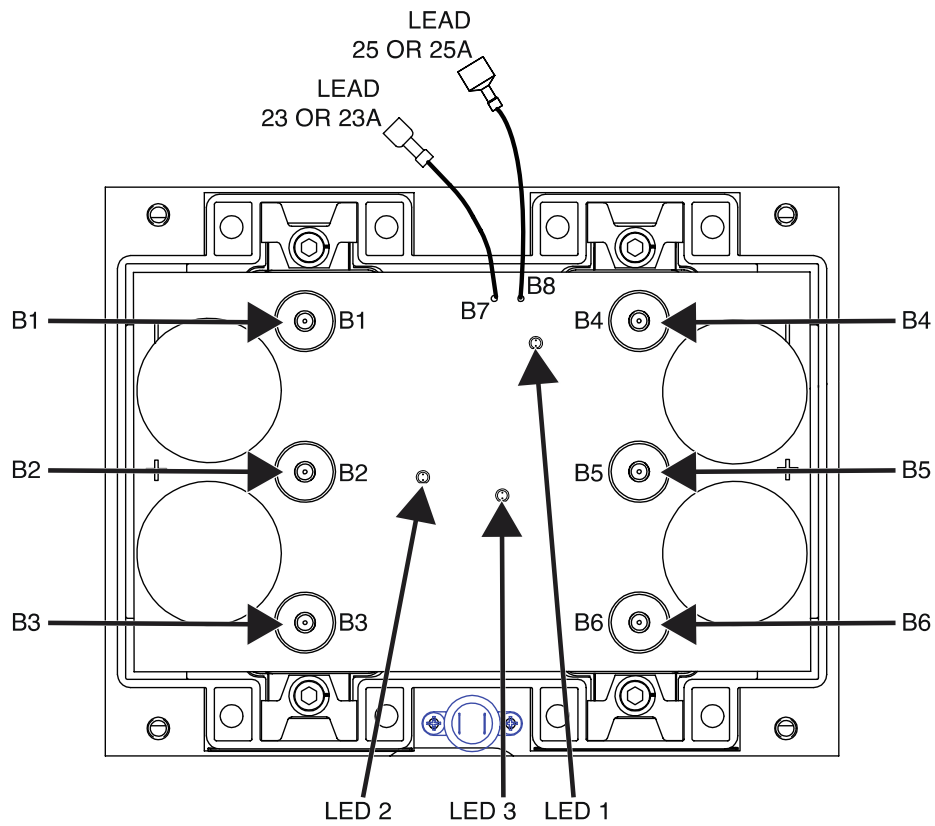
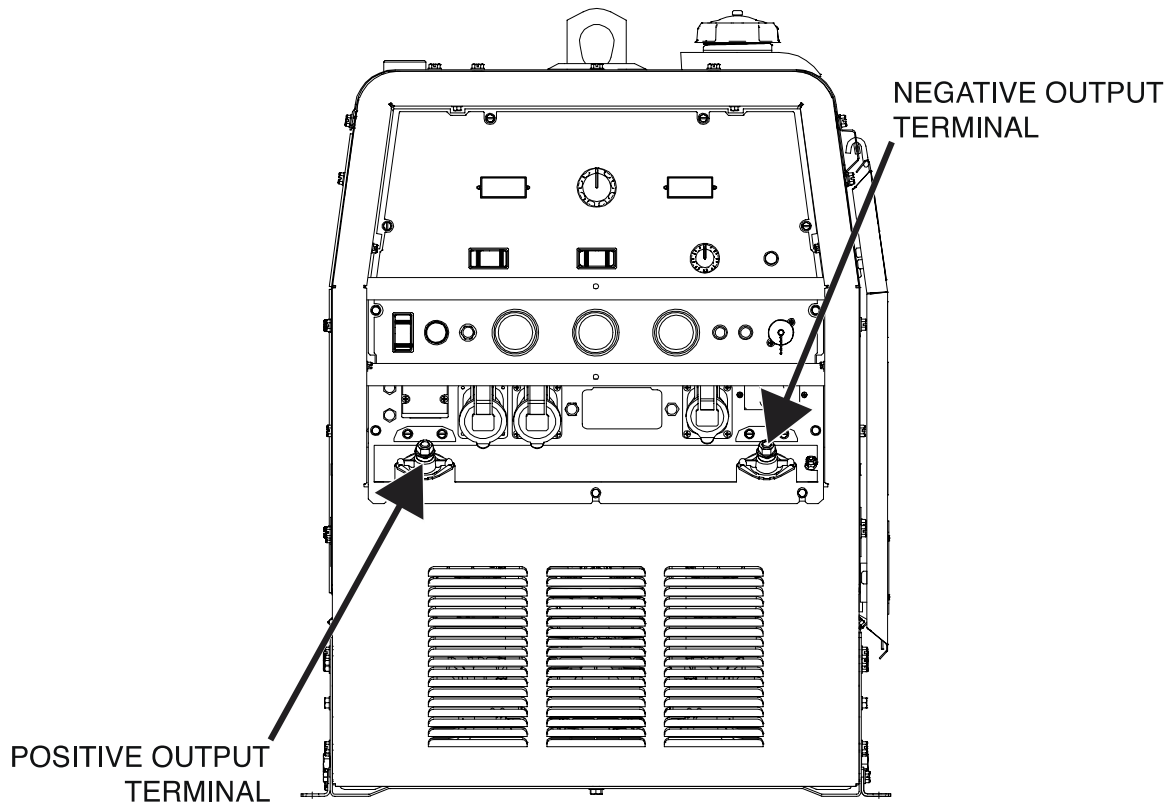


Figure F.15 – Welder output terminal locations



CHOPPER MODULE BOARDS RESISTANCE TEST PROCEDURE

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.

TEST DESCRIPTION

This test will help determine if either of the Chopper Module Boards is shorted. This test can only detect some problems in the “Power” section of the Module. Problems with some other board components may not be detected.

MATERIALS NEEDED

7/16” Nutdriver
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Locate the chopper module boards. See **Figure F.16**. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the six screws, lock washers and flat washers securing leads to terminals B1, B2, B3, B4, B5 and B6 of the chopper module boards. See **Figure F.17**. See Wiring Diagram.
6. Label and disconnect all of the leads from the chopper module boards and position them so they do not make electrical contact with any part of the chopper module boards. See **Figure F.17**. See Wiring Diagram.
7. Using a volt/ohmmeter, perform the tests outlined in **Table F.5** on each chopper module board. See **Figure F.17**. See Wiring Diagram.
8. When testing is complete, connect all previously disconnected leads to the chopper module boards. See Wiring Diagram.
9. If any of the tests fail, the chopper module board(s) may be faulty.
10. If faulty, perform the **Chopper Module Boards Removal And Replacement Procedure**.
11. Perform the **Case Cover Replacement Procedure**.

Table F.5 – Chopper module board resistance tests

TEST POINT (+)	TEST POINT (-)	EXPECTED RESULT
B6	B5	0.3 VDC – 0.7 VDC
B4	B5	1.0 VDC – 1.4 VDC
B4	B6	0.3 VDC – 0.7 VDC
B3	B2	0.3 VDC – 0.7 VDC
B1	B2	1.0 VDC – 1.4 VDC
B1	B3	0.3 VDC – 0.7 VDC

Figure F.16 – Chopper module board locations

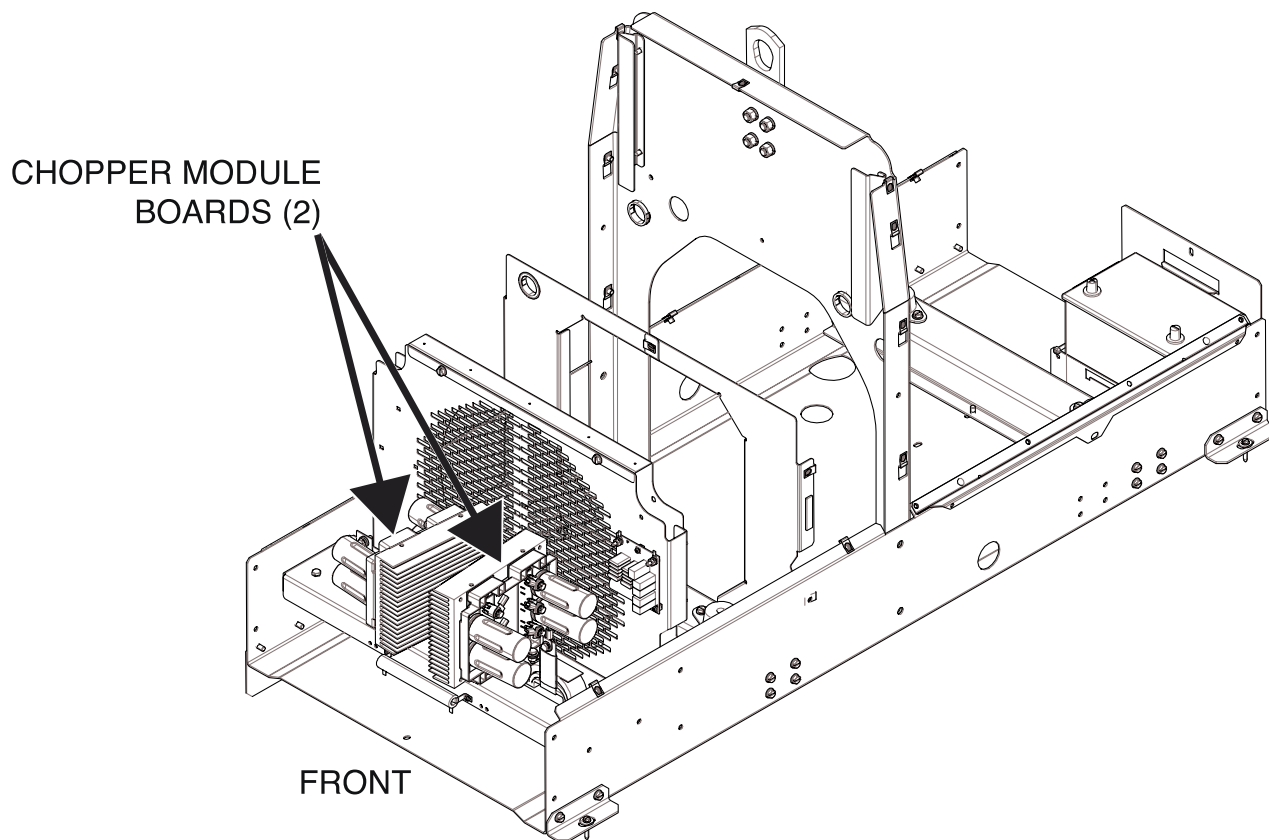
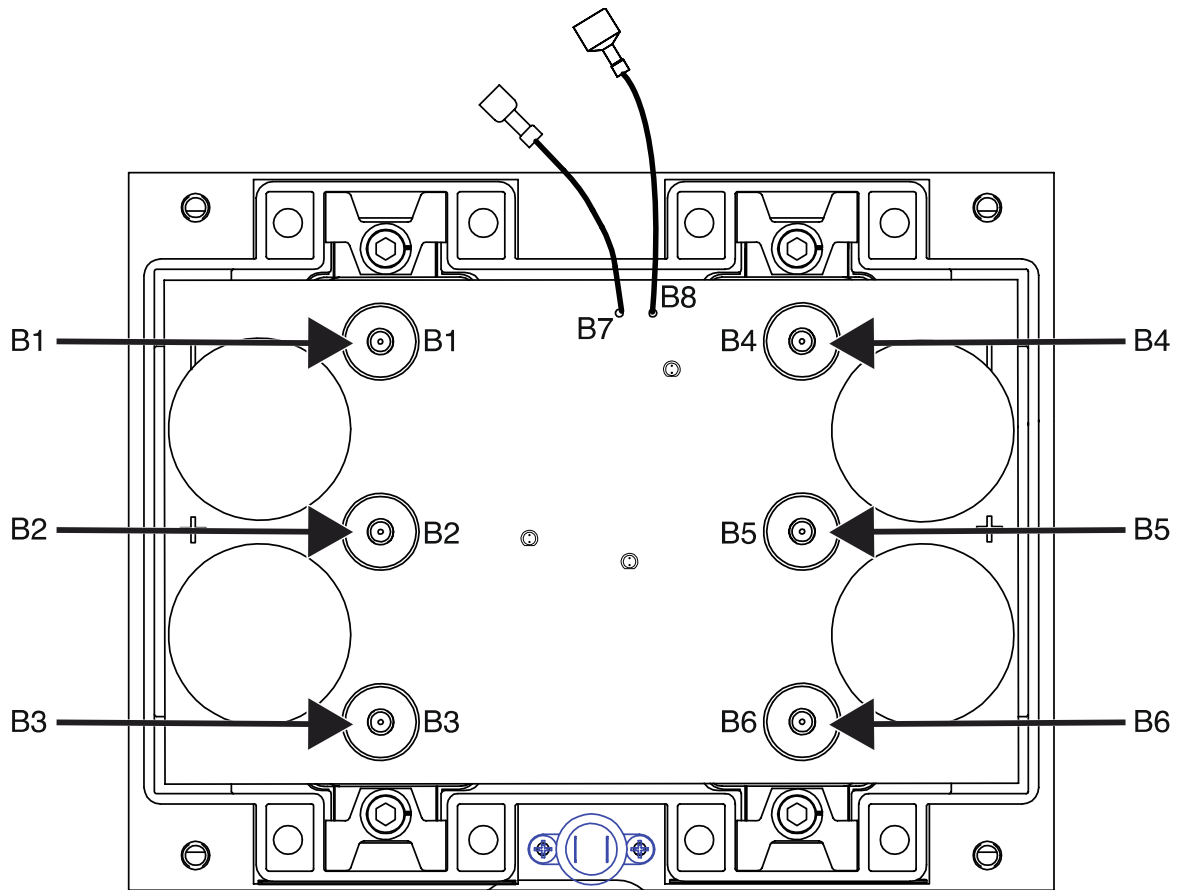


Figure F.17 – Chopper module board terminal locations



WELD CONTROL BOARD PWM GATE SIGNAL TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Weld Control Board is able to produce the PWM (Pulse Width Modulated) gate signal needed to control the IGBTs (Insulated Gate Bipolar Transistor) on the Chopper Module Boards.

MATERIALS NEEDED

Volt/Ohmmeter

Frequency counter or digital multi-meter with frequency counter function

Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Unplug any device that may be attached to the 6-pin Amphenol receptacle.
5. Place the weld mode switch in the 'CC-STICK' position.
6. Start the engine and let it run and stabilize.
7. Locate plug J3 on the weld control board. See **Figure F.18**. See Wiring Diagram.
8. Using the frequency counter, test for 20kHz PWM gate signal between leads 23+ (J3-10) and 25- (J3-9) on chopper module board A (right side) and between leads 23A+ (J3-12) and 25A- (J3-11) on chopper module board B (left side). See **Figure F.19**. See Wiring Diagram.
9. If there is no 20 KHz gate signal, test for the presence of 80 to 100 VDC, at leads 13+ (J3-8) to 14- (J3-16) of the weld control board. See Wiring Diagram.
10. If voltage is very low or not present, check leads 13 and 14 for faulty or damaged wiring or connections between the weld control board and the chopper module boards. See Wiring Diagram.
11. Using a volt/ohmmeter, test for 80 to 100 VDC at the terminals where the leads 13 and 14 connect to the chopper module boards. See Wiring Diagram. If there is no voltage at the chopper module, perform the **Output Rectifier Bridge Test Procedure** and the **Stator Voltage Test Procedure**.
12. If the test fails, the weld control board may be faulty.
13. If faulty, perform the **Weld Control Board Removal And Replacement Procedure**.
14. Perform the **Case Cover Replacement Procedure**.

Figure F.18 – Weld control board plug locations

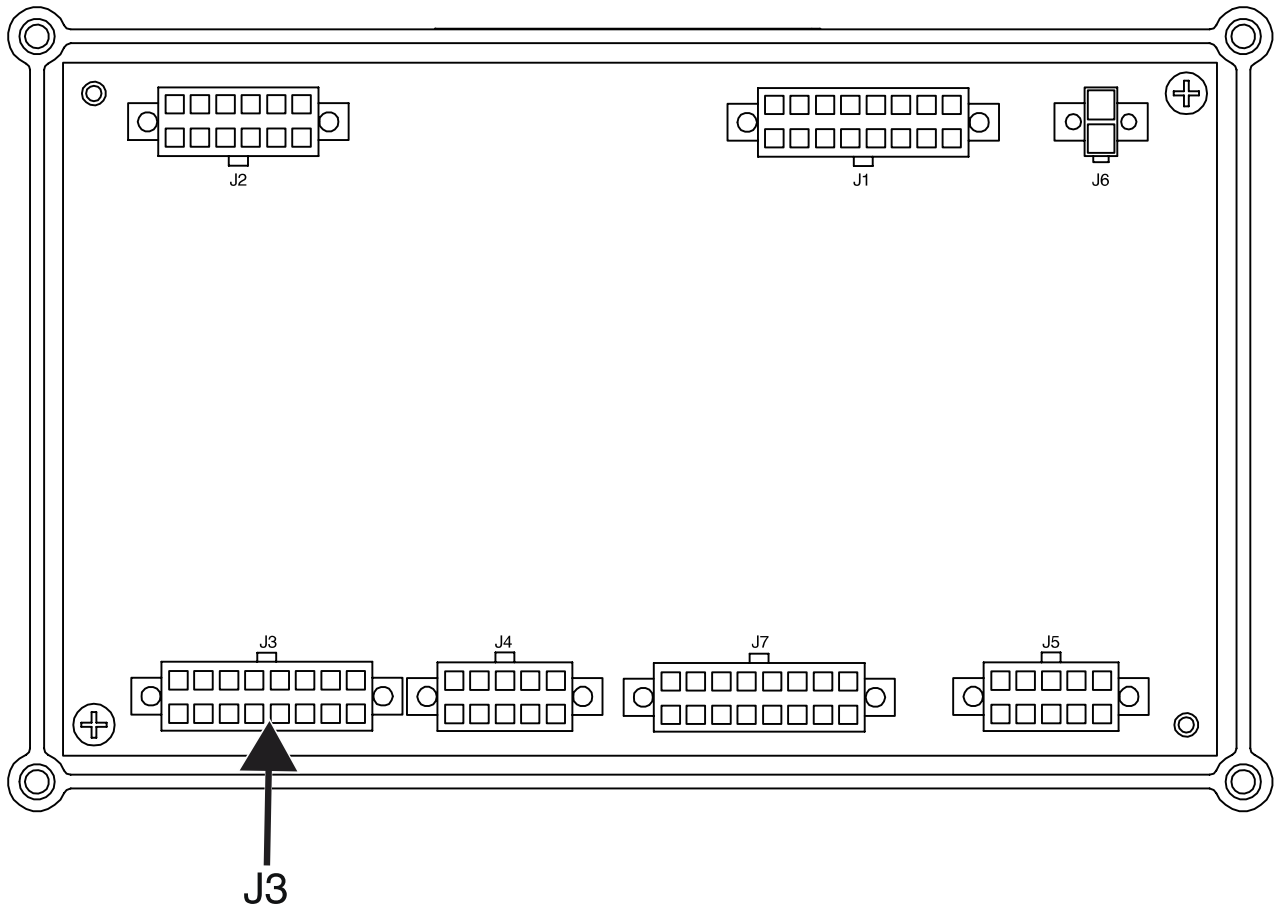
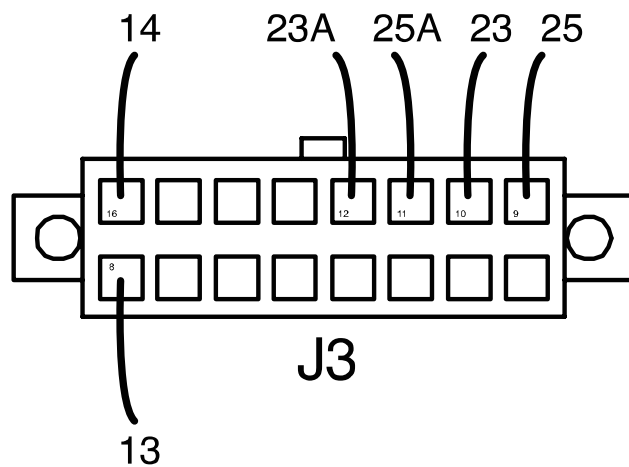


Figure F.19 – Weld control board plug J1 and J3 lead locations



WELD CONTROL BOARD FEEDBACK TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Weld Control Board is receiving accurate current and voltage feedback from the weld circuit. This test will only yield usable information if the machine is producing some weld output.

MATERIALS NEEDED

Resistive Load Bank
Volt And Ammeter
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Place the weld mode switch in the 'CC-STICK' position.
5. Make sure that nothing is plugged into the 6-pin Amphenol receptacle.
6. Connect the resistive load bank and the ammeter to the weld output terminals per the equipment manufacturer's instructions; also connect the voltmeter probes across the weld output terminals.
7. Start the machine and apply a load of about 200 Amps, as shown on the external ammeter. If the machine will not produce 200 amps, apply as much load as you can.
8. Using the voltmeter, measure and note the DC voltage at the weld output terminals.
9. Check the voltage between leads 204S+ (J6-1) and lead 208C- (J3-15) at the weld control board Molex plugs. See **Figures F.20** and **F.21**. See Wiring Diagram. The voltage should be the same as was measured at the weld terminals.
10. If the voltage readings are different, check the wiring and connections between the welding terminals and the weld control board. See Wiring Diagram.
11. Connect the millivolt meter probes between lead 206S+ (J6-2) and lead 204S- (J6-1). See **Figures F.20** and **F.21**. See Wiring Diagram. If the machine is currently producing 200 amps the millivolt meter should read 25 millivolts.
12. If the machine cannot produce 200 amps of weld current, the correct millivolt signal will need to be calculated by dividing the reading displayed on the external ammeter by 8. See the following explanation.

The shunt used in this machine will produce 50 millivolts at a load of 400 amps or 8 amps per millivolt.

To calculate the correct millivolt signal for a given load, you divide the number of amps displayed on the ammeter by 8.

Example: If your ammeter reads 75, $(75/8= 9.4)$. If the shunt is working correctly and the wiring between the shunt and the weld control board is in good condition, the meter connected at the weld control board should be reading about 9.4 millivolts.

13. If the millivolt reading is incorrect, check the wiring between the shunt and the weld control board for damage, grounds and faulty connections. If the wiring is good, the shunt and lead assembly is faulty and should be replaced.
14. Perform the **Case Cover Replacement Procedure**.

Figure F.20 – Weld control board plug locations

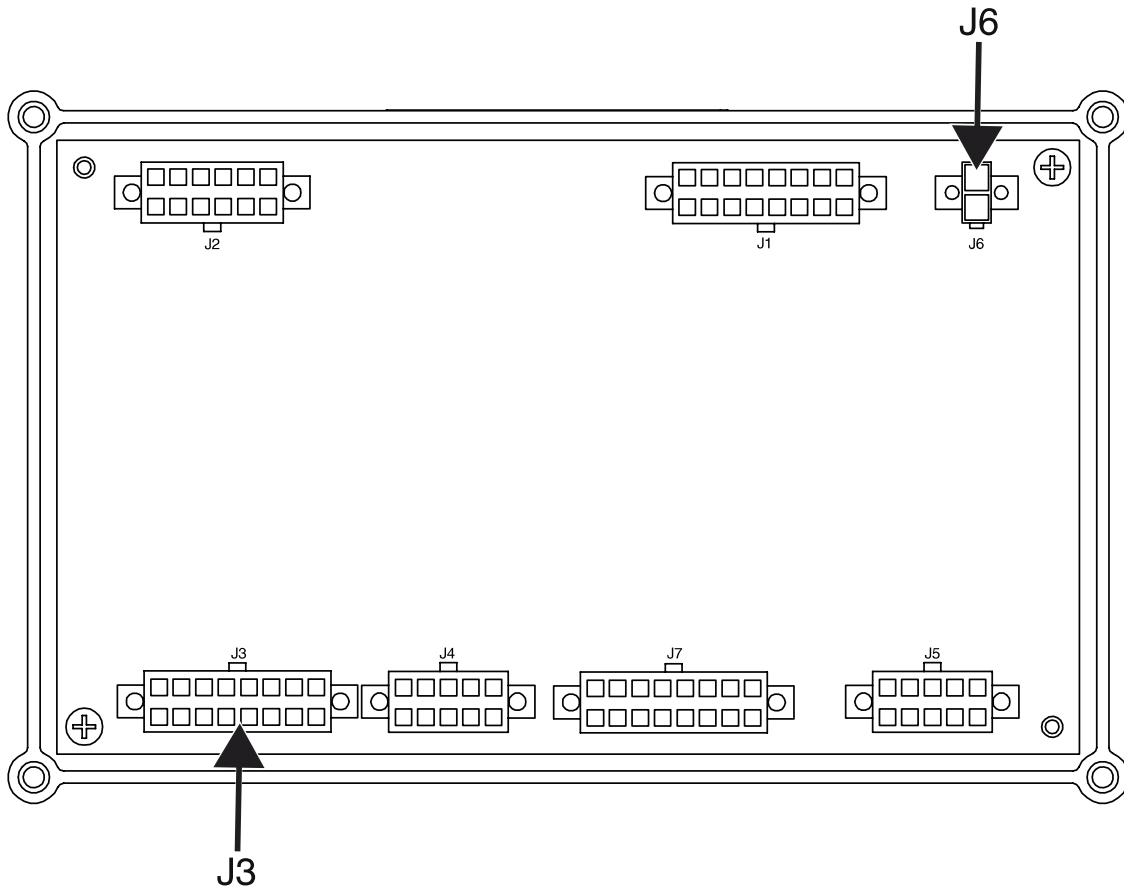
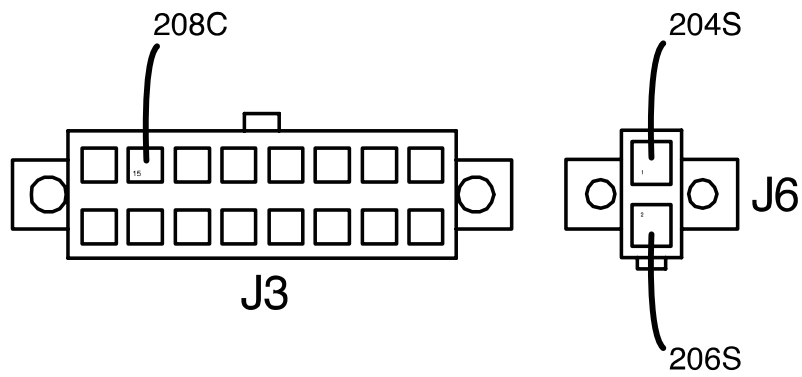


Figure F.21 – Weld control board plug J3 and J6 lead locations



OUTPUT CONTROL AND ARC CONTROL POTENTIOMETER TEST PROCEDURE

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.

TEST DESCRIPTION

This test will check the Output Control Potentiometer, Arc Control Potentiometer and associated wiring for damage, proper operation, tracking and grounds.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Label and disconnect plug J7 from the weld control board and visually check the plug and attached wiring for damage, corrosion, improperly seated or damaged contact pins. Plug J7 will remain unplugged for the following test. See **Figure F.22**. See Wiring Diagram.
4. Set the weld mode switch into the 'CC-Stick' position.
5. Using a volt/ohmmeter, measure the resistance between each of the leads in plug J7 and a good clean chassis ground connection. Be very careful that the connection pins in J7 are not damaged or spread out. The resistance should be very high. A reading of 500,000 (500k) ohms or higher is acceptable.
6. If the resistance is lower than 500k Ohms, replace the potentiometer, weld mode switch plug and lead assembly or replace the defective component within the assembly. See Wiring Diagram.
7. Using a volt/ohmmeter, perform the resistance tests outlined in **Table F.6**. See **Figures F.22** and **F.23**. See Wiring Diagram.
8. If the resistance readings are not as specified in **Table F.6**, replace the potentiometer or replace the defective component. See Wiring Diagram.
9. If testing is complete, connect plug J7 to the weld control board. See Wiring Diagram.
10. Perform the **Case Cover Replacement Procedure**.

Table F.6 – Output control and arc control potentiometer test points

POTENTIOMETER	TEST POINTS	OHMMETER READING
OUTPUT CONTROL	J7-5 (75) TO J7-1 (77)	ABOUT 10K
OUTPUT CONTROL	J7-1 (77) TO J7-4 (76)	OHMS VALUE SHOULD SWEEP SMOOTHLY FROM 10K TO 0 WHEN OUTPUT CONTROL IS TURNED FROM MIN. TO MAX.
ARC CONTROL	J7-6 (279) TO J7-8 (277)	ABOUT 10K
ARC CONTROL	J7-8 (277) TO J7-7 (278)	OHMS VALUE SHOULD SWEEP SMOOTHLY FROM 10K TO 0 WHEN ARC CONTROL IS TURNED FROM MIN. TO MAX.

Figure F.22 – Weld control board plug J7 location

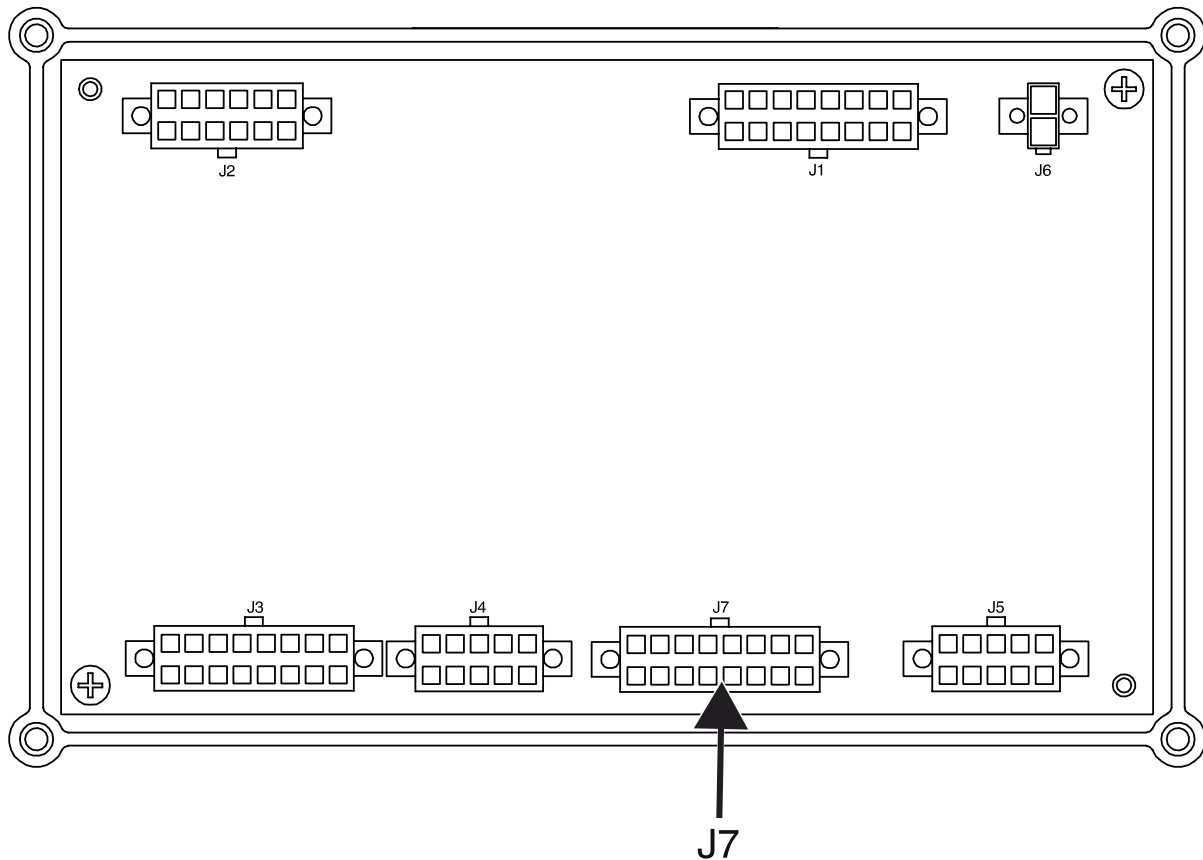
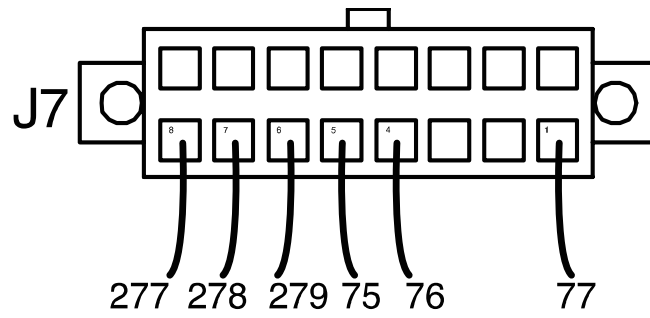


Figure F.23 – Weld control board plug J7 lead locations



CHOKE TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if either of the Chokes are open, shorted (turn to turn) or grounded.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Locate the two choke assemblies and perform the following test on each choke assembly. See **Figure F.24**. See Wiring Diagram.
5. **Open:** No weld output. Using a volt/ohmmeter, test the resistance from the B3/B6-Choke lead to the negative output terminal. See **Figures F.24** and **F.25**. See Wiring Diagram. Typical resistance is less than one ohm.
6. **Turn To Turn Short:** Reduced inductance, arc instability, excessive heating of the choke. Check for any physical signs of arcing within the choke assembly. See Wiring Diagram.
7. **Choke Coil Grounded:** Reduced inductance, alternate weld current path. Electrically isolate the choke coil by disconnecting the leads B3-Choke and B6-Choke from the chopper board and the heavy choke lead from the negative output terminal. Using a digital volt/ohmmeter, check the resistance from choke coil to chassis ground. Resistance should be at least 500,000 ohms. See Wiring Diagram.
8. If any of the tests fail, the choke may be faulty.
9. If faulty, perform the **Choke Removal And Replacement Procedure**.
10. Connect any previously disconnected leads. See Wiring Diagram.
11. Perform the **Case Cover Replacement Procedure**.

Figure F.24 – Choke assembly locations

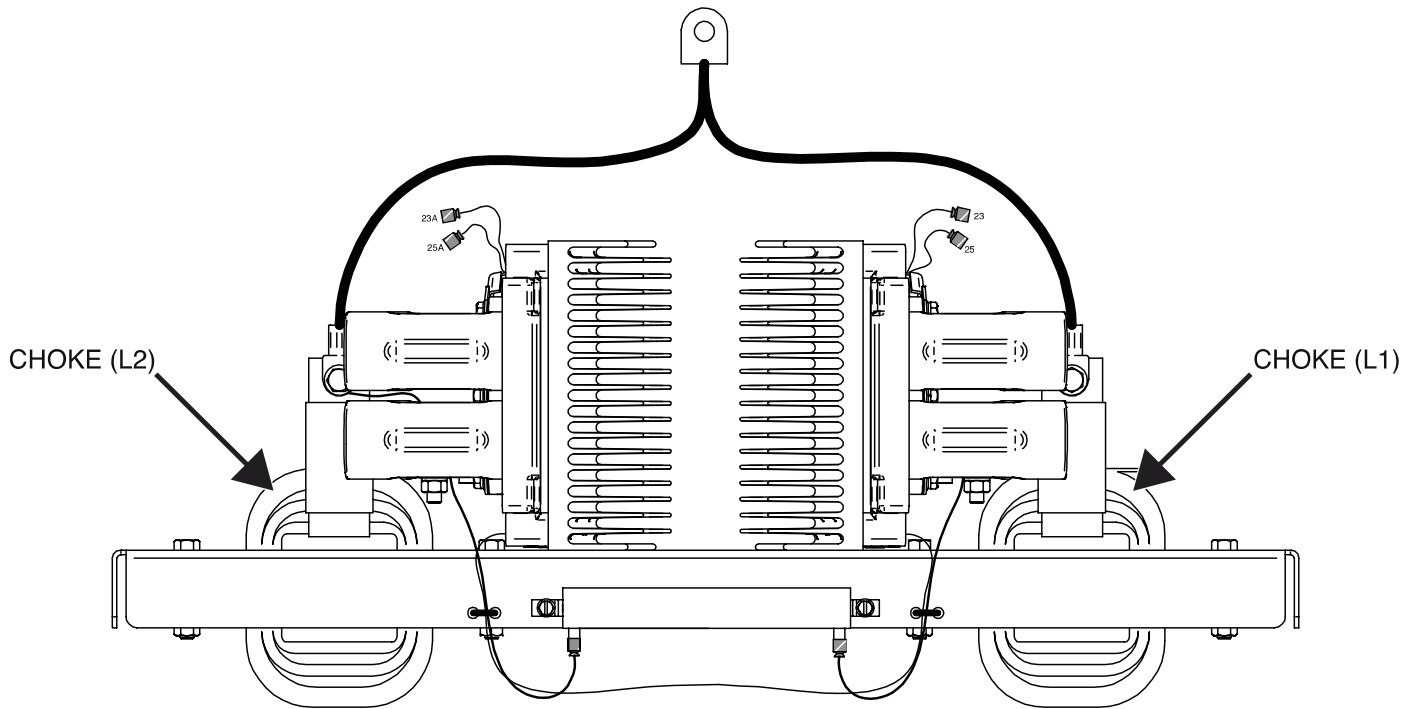
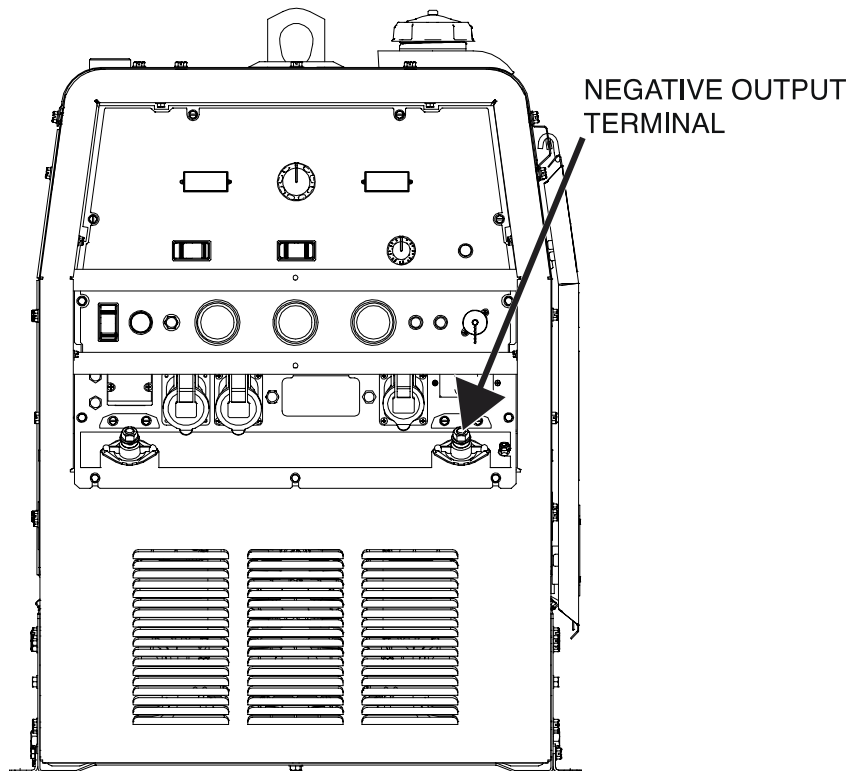


Figure F.25 – Negative output terminal location



PIPE/GOUGE RANGE SWITCH AND WELD MODE SWITCH TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if the Pipe/Gouge Range Switch and Weld Mode Switch are functioning properly.

MATERIALS NEEDED

3/8" Nutdriver
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Locate the 'PIPE/GOUGE RANGE' and 'WELD MODE' switches. See **Figure F.26**. See Wiring Diagram.
5. Using a 3/8" nutdriver, remove the four screws securing the upper control panel to the machine. See **Figure F.26**.
6. Lower the upper control panel to gain access to the switches.
7. Label and disconnect leads 218, JP2 and 217 from the terminals of the 'PIPE/GOUGE RANGE' switch. See **Figure F.27**. See Wiring Diagram.
8. Using a volt/ohmmeter, perform the resistance tests outlined in **Table F.7**. See **Figure F.27**. See Wiring Diagram.
9. If any of the tests fail, the 'PIPE/GOUGE RANGE' switch may be faulty.
10. If faulty, perform the **Pipe/Gouge Range Switch Removal And Replacement Procedure**.
11. Connect leads 218, JP2 and 217 to the terminals of the 'PIPE/GOUGE RANGE' switch. See Wiring Diagram.
12. Label and disconnect leads 220, JP1, JP2 and 222 from the terminals of the 'WELD MODE' switch. See **Figure F.27**. See Wiring Diagram.
13. Using a volt/ohmmeter, perform the resistance tests outlined in **Table F.8**. See **Figure F.27**. See Wiring Diagram.
14. If any of the tests fail, the 'WELD MODE' switch may be faulty.
15. If faulty, perform the **Weld Mode Switch Removal And Replacement Procedure**.
16. Connect leads 220, JP1, JP2 and 222 to the terminals of the 'WELD MODE' switch. See Wiring Diagram.

17. Place the upper control panel into the closed position.
18. Using a 3/8" nutdriver, attach the four screws securing the upper control panel to the machine.
19. Perform the **Case Cover Replacement Procedure**.

Table F.7 – Pipe/gouge range switch resistance tests

TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING	SWITCH POSITION
TERMINAL 1	TERMINAL 2	CLOSED (LOW RESISTANCE)	LOW POSITION
TERMINAL 1	TERMINAL 2	OPEN (HIGH RESISTANCE)	HIGH POSITION
TERMINAL 3	TERMINAL 2	CLOSED (LOW RESISTANCE)	HIGH POSITION
TERMINAL 3	TERMINAL 2	OPEN (HIGH RESISTANCE)	LOW POSITION

Table F.8 – Weld mode switch resistance tests

TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING	SWITCH POSITION
TERMINAL 2	TERMINAL 3	CLOSED (LOW RESISTANCE)	PIPE/GOUGE
TERMINAL 5	TERMINAL 6	CLOSED (LOW RESISTANCE)	PIPE/GOUGE
TERMINAL 5	TERMINAL 4	OPEN (HIGH RESISTANCE)	PIPE/GOUGE
TERMINAL 2	TERMINAL 3	CLOSED (LOW RESISTANCE)	TOUCH START TIG
TERMINAL 5	TERMINAL 4	CLOSED (LOW RESISTANCE)	TOUCH START TIG
TERMINAL 5	TERMINAL 6	OPEN (HIGH RESISTANCE)	TOUCH START TIG
TERMINAL 1	TERMINAL 2	CLOSED (LOW RESISTANCE)	CC-STICK
TERMINAL 5	TERMINAL 4	CLOSED (LOW RESISTANCE)	CC-STICK
TERMINAL 5	TERMINAL 6	OPEN (HIGH RESISTANCE)	CC-STICK

Figure F.26 – Pipe/gouge range switch and weld mode switch locations

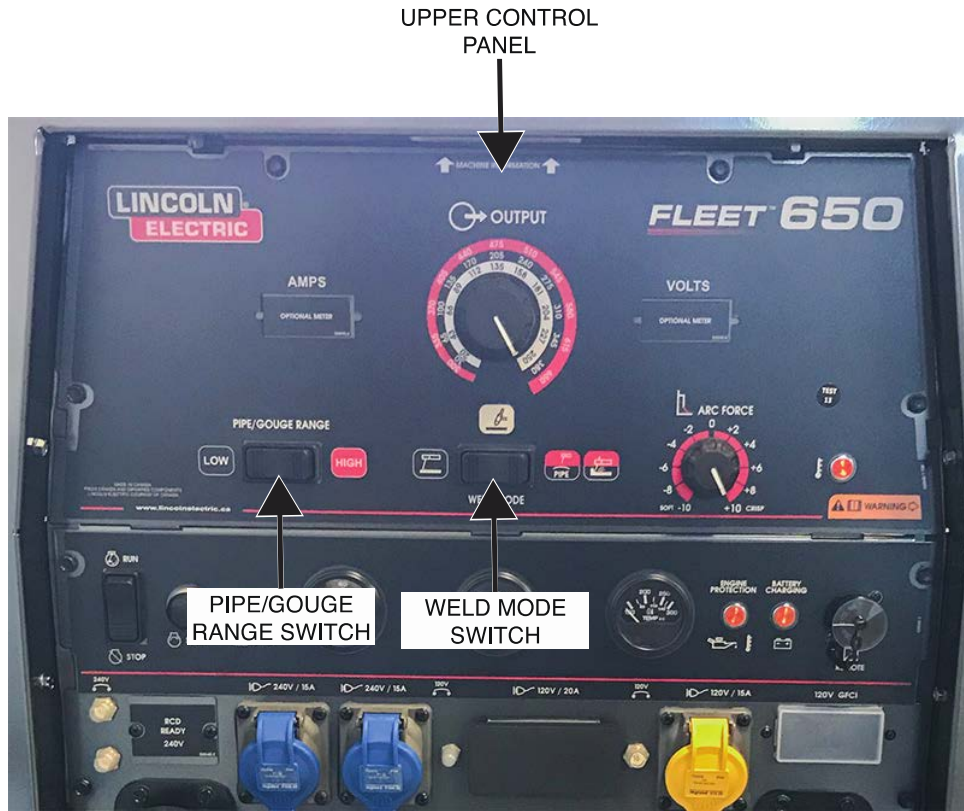
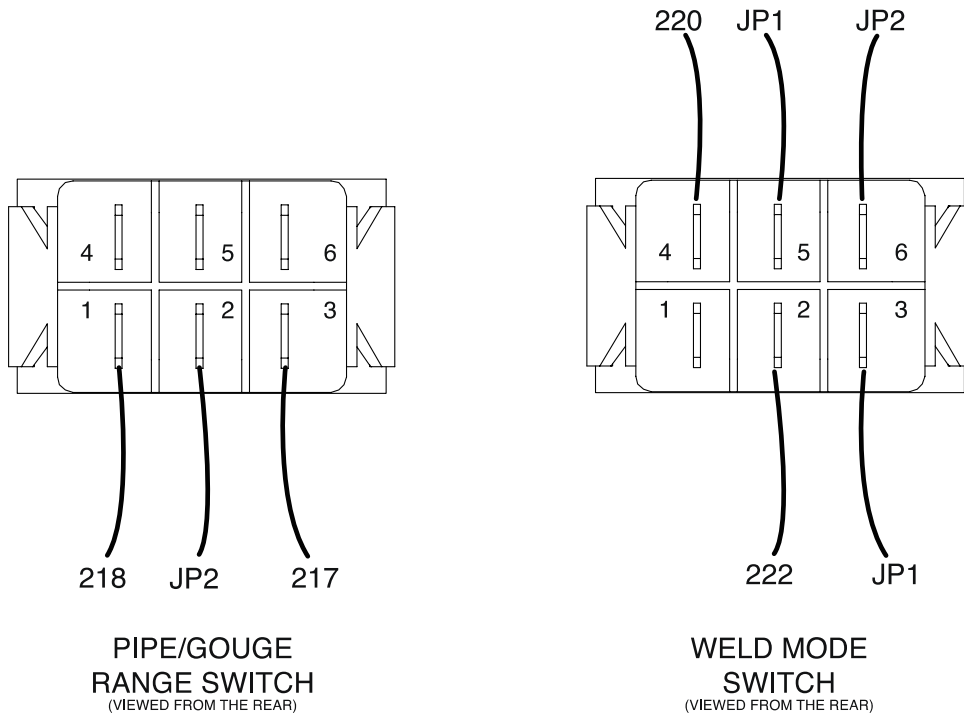


Figure F.27 – Pipe/gouge range switch and weld mode switch lead locations



THERMOSTAT TEST PROCEDURE

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.

TEST DESCRIPTION

This test will determine if either of the Chopper Module Board Thermostats are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Locate the thermostat on each chopper module board. See **Figure F.28**. See Wiring Diagram.
5. Label and disconnect plug J3 from the weld control board. See **Figure F.29**. See Wiring Diagram.
6. Using a volt/ohmmeter, measure the resistance from plug J3 pin 1 to plug J3 pin 5. The resistance should be very low (less than one ohm). See **Figure F.30**. See Wiring Diagram.
7. If the resistance is high (greater the two or three ohms), one or both thermostats are open and need to be tested individually.
8. Label and disconnect leads from the thermostat terminals. See Wiring Diagram.
9. Using a volt/ohmmeter, measure the resistance from one thermostat terminal to the other. The resistance should be very low (less than one ohm). See Wiring Diagram.
10. If the resistance is high (greater the two or three ohms), the thermostat may be faulty.
11. If faulty, perform the **Thermostat Removal And Replacement Procedure**.
12. Connect any previously disconnected leads to the thermostat terminals and connect plug J3 to the weld control board. See Wiring Diagram.
13. Perform the **Case Cover Replacement Procedure**.

Figure F.28 – Thermostat location

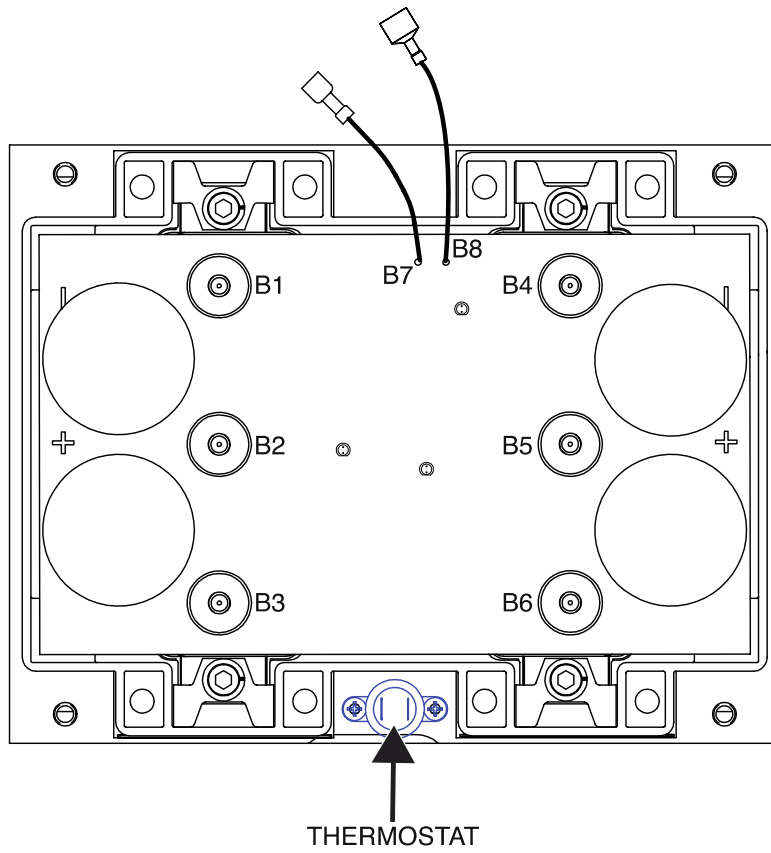


Figure F.29 – Weld control board plug J3 location

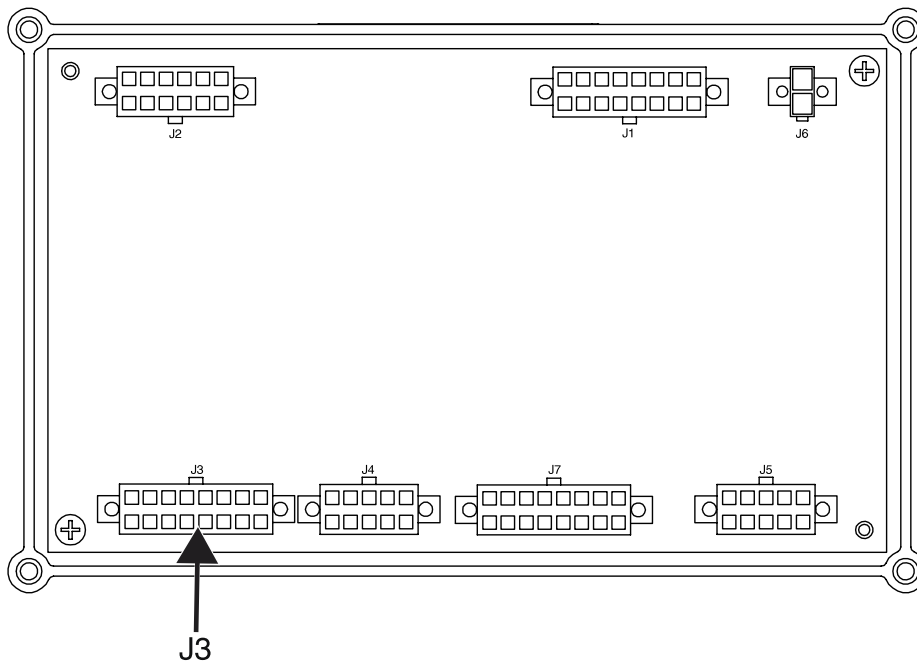
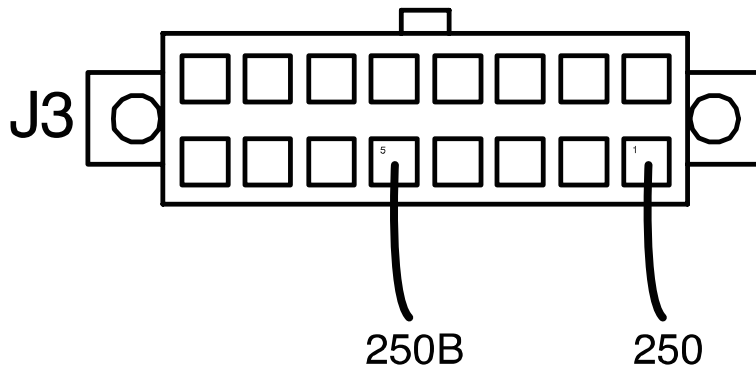


Figure F.30 – Weld control board plug J3 lead locations



Removal And Replacement Procedures

FLASHING DIODE (D1) & FIELD DIODE (D2) REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Flashing Diode (D1) and/or Field Diode (D2).

MATERIALS NEEDED

3/8" Nutdriver
Dow Corning 340 Heat Sink Compound (Lincoln Part #T12837)
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Label and disconnect leads 232P, 232N, 232M and 204C from the flashing diode (D1) and leads 201A, 200A, 204B, 5H and 3A from the field diode (D2). See **Figure F.31**. See Wiring Diagram.
5. Using a 3/8" nutdriver, remove the nut and insulating washer securing each diode to the PCB bracket. See **Figure F.32**.
6. The flashing diode (D1) and/or field diode (D2) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Apply a thin coating of Dow Corning 340 heat sink compound to the mating surfaces of the diodes.
2. Carefully position the new flashing diode (D1) and/or field diode (D2) onto the PCB bracket.
3. Using a 3/8" nutdriver, attach the nut and insulating washer securing each diode to the PCB bracket.
4. Connect leads 232P, 232N, 232M and 204C to the flashing diode (D1) and leads 201A, 200A, 204B, 5H and 3A to the field diode (D2). See Wiring Diagram.
5. Perform the **Case Cover Replacement Procedure**.
6. Perform the **Retest After Repair Procedure**.

Figure F.31 – Flashing diode (D1) & field diode (D2) lead locations

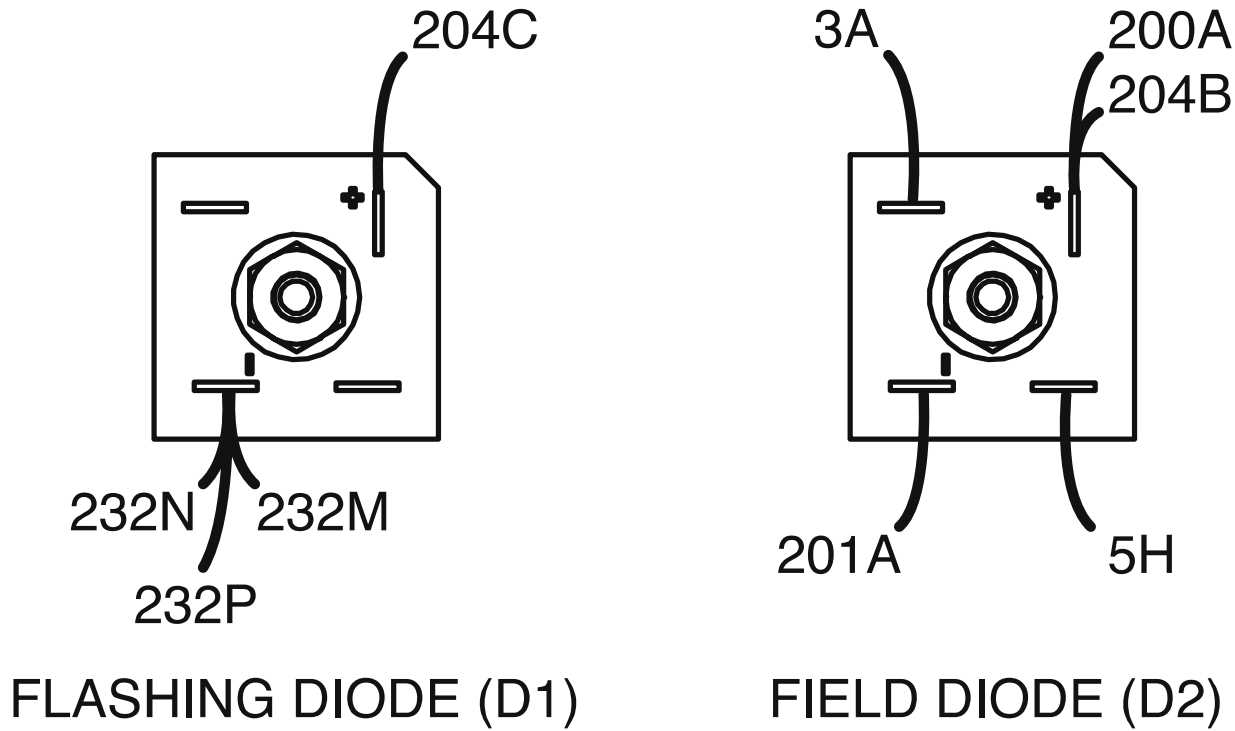
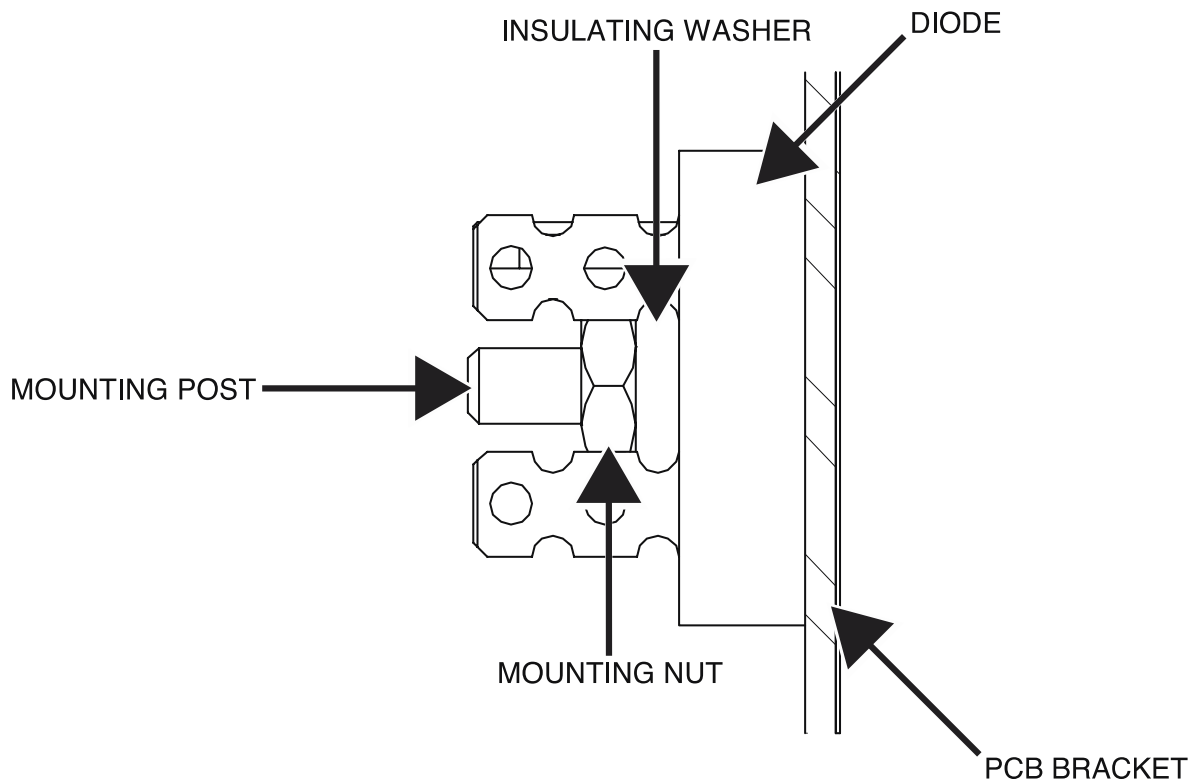


Figure F.32 – Diode mounting hardware locations



FRONT PANEL REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Front Panel assembly.

MATERIALS NEEDED

3/4" Nutdriver
1/2" Nutdriver
3/8" Nutdriver
Hoist And Appropriate Rigging
Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Using a 3/4" nutdriver, remove the bolt, lock washer and flat washer securing the copper bus bar to the rear of the positive output terminal. See **Figure F.33**. See Wiring Diagram.
5. Label and disconnect lead 206 from the rear of the positive output terminal. See Wiring Diagram.
6. Using a 3/4" nutdriver, remove the bolt, lock washer and flat washer securing the leads to the rear of the negative output terminal. See Wiring Diagram.
7. Label and disconnect leads 208, 208B and both choke leads from the rear of the negative output terminal. See **Figure F.33**. See Wiring Diagram.
8. Using a 1/2" nutdriver, remove the two screws securing the front panel to the shelf. See **Figure F.34**.
9. Using a 1/2" nutdriver, remove the four screws securing the front panel to the base of the machine. See **Figure F.34**.
10. Using a 3/8" nutdriver, remove the two screws and washers securing the mounting bracket to the wood framing, if necessary. See **Figure F.34**.
11. Using a hoist and appropriate rigging attached to the lift bail, lift the machine to gain access to the lower front panel mounting screw. See **Figure F.34**.
12. Using a 1/2" open-end wrench, remove the lower front panel screw securing the front panel to the base of the machine.

13. Using a hoist and appropriate rigging attached to the lift bail, lower the machine onto the wood framing, if necessary.
14. Using a 3/8" nutdriver, attach the two screws and washers securing the mounting bracket to the wood framing, if necessary. See **Figure F.34**.
15. Carefully slide the front panel away from the machine to gain access to the leads to be disconnected.
16. Using a 3/8" nutdriver, remove the nut, lock washer and flat washer securing leads to the neutral stud on the auxiliary power receptacle. Label and disconnect leads. See Wiring Diagram.
17. Label and disconnect stator leads 5 and 5A. See Wiring Diagram. Cut cable ties as necessary.
18. Label and disconnect lead 3A from the field diode (D2). See Wiring Diagram. Cut cable ties as necessary.
19. Label and disconnect lead C from circuit breaker (CB3). See Wiring Diagram. Cut cable ties as necessary.
20. Label and disconnect lead 3 from circuit breaker (CB1). See Wiring Diagram. Cut cable ties as necessary.
21. Carefully remove the engine shutdown relay from it's mounting bracket. See **Figure F.35**. See Wiring Diagram.
22. Using a Phillips screwdriver, remove the screw securing the engine shutdown relay mounting bracket to the PCB bracket. See **Figure F.35**.
23. Label and disconnect any other leads and plugs necessary to allow for the removal of front panel assembly. Cut cable ties as necessary.
24. When all leads and plugs have been disconnected from the front panel, the front panel can now be removed to gain access to internal components.

REPLACEMENT PROCEDURE

1. Carefully position the front panel near the front of the machine.
2. Carefully connect all previously disconnected leads and plugs to the front panel. Replace cable ties as necessary.
3. Using a Phillips screwdriver, attach the screw securing the engine shutdown relay mounting bracket to the PCB bracket.
4. Carefully position the engine shutdown relay into it's mounting bracket. See Wiring Diagram.
5. Connect lead 3 to circuit breaker (CB1). See Wiring Diagram. Replace cable ties as necessary.
6. Connect lead C to circuit breaker (CB3). See Wiring Diagram. Replace cable ties as necessary.
7. Connect lead 3A to the field diode (D2). See Wiring Diagram. Replace cable ties as necessary.
8. Connect stator leads 5 and 5A to the neutral stud on the auxiliary power receptacle. See Wiring Diagram.
9. Using a 3/8" nutdriver, attach the nut, lock washer and flat washer securing all previously disconnected leads to the neutral stud on the auxiliary power receptacle. See Wiring Diagram.
10. Replace cable ties as necessary.
11. Carefully position the front panel assembly onto the front of the machine.
12. Using a 3/8" nutdriver, remove the two screws and washers securing the mounting bracket to the wood framing, if necessary.
13. Using a hoist and appropriate rigging attached to the lift bail, lift the machine to gain access to the lower front panel mounting screw.

14. Using a 1/2" open-end wrench, attach the lower front panel screw securing the front panel to the base of the machine.
15. Using a hoist and appropriate rigging attached to the lift bail, lower the machine onto the wood framing, if necessary.
16. Using a 3/8" nutdriver, attach the two screws and washers securing the mounting bracket to the wood framing, if necessary.
17. Using a 1/2" nutdriver, attach the four screws securing the front panel to the base of the machine.
18. Using a 1/2" nutdriver, attach the two screws securing the front panel to the shelf.
19. Connect leads 208, 208B and both choke leads to the rear of the negative output terminal. See Wiring Diagram.
20. Using a 3/4" nutdriver, attach the bolt, lock washer and flat washer, securing the previously disconnected leads to the rear of the negative output terminal. See Wiring Diagram.
21. Connect lead 206 to the rear of the positive output terminal. See Wiring Diagram.
22. Using a 3/4" nutdriver, attach the bolt, lock washer and flat washer securing the copper bus bar to the rear of the positive output terminal. See Wiring Diagram.
23. Perform the **Case Cover Replacement Procedure**.
24. Perform the **Retest After Repair Procedure**.

Figure F.33 – Positive and negative output terminal locations

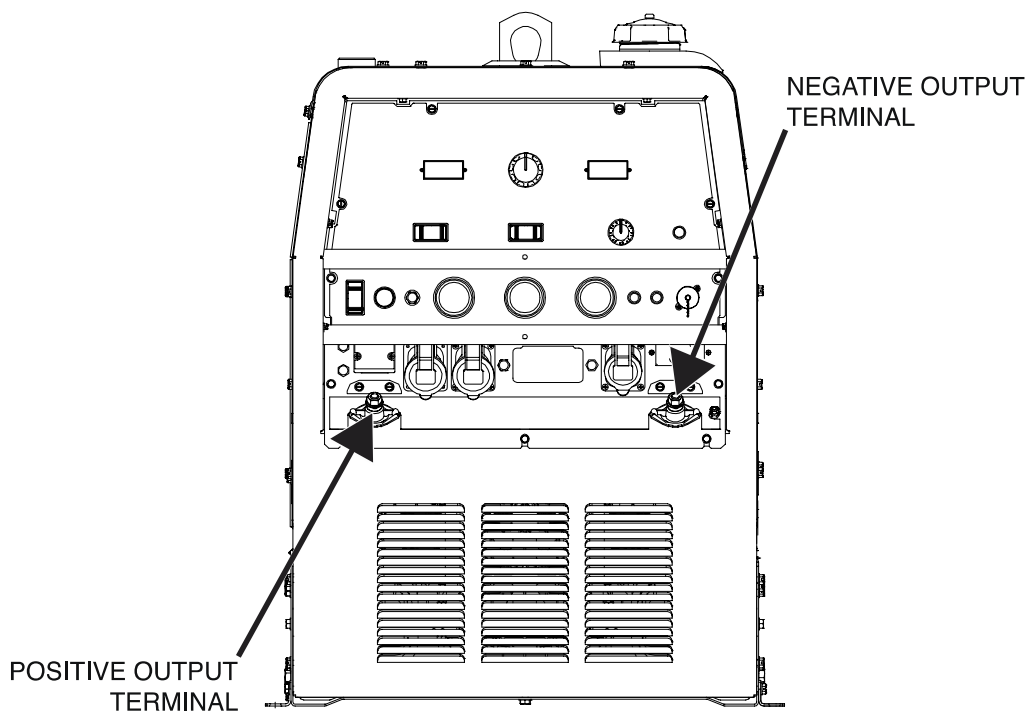


Figure F.34 – Lift bail and front panel mounting screw locations

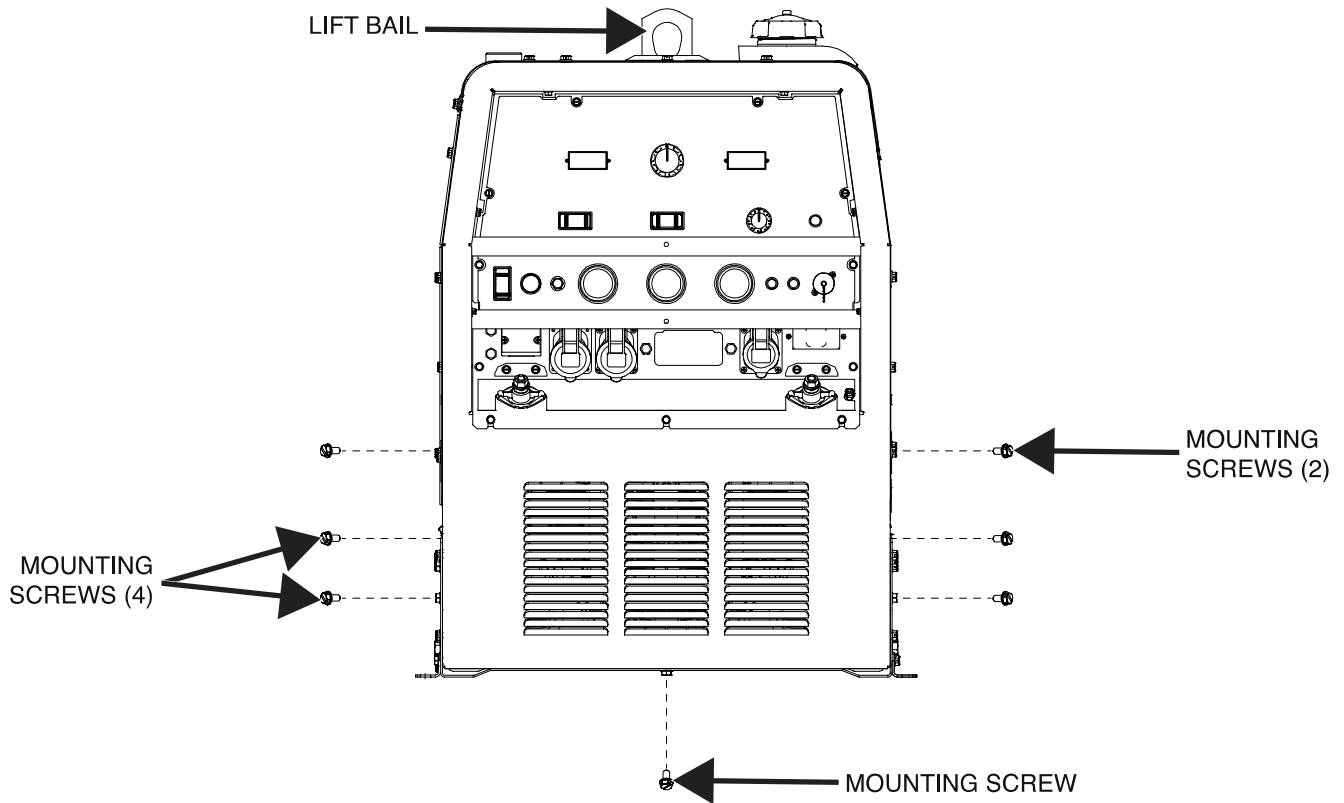
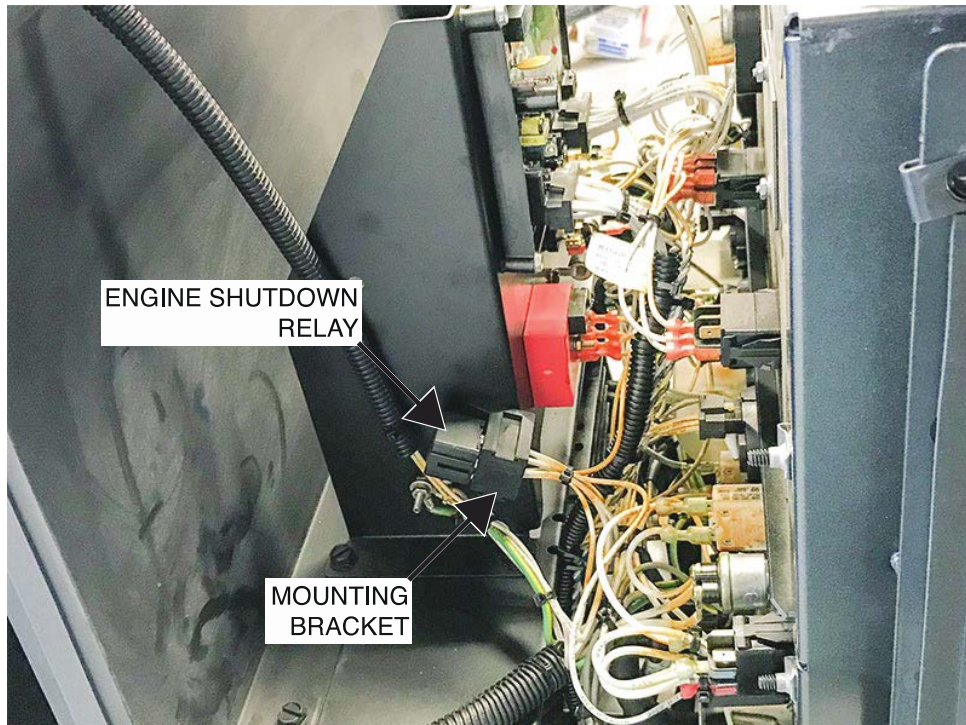


Figure F.35 – Engine shutdown relay and mounting bracket location



OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Output Rectifier Bridge.

MATERIALS NEEDED

7/16" Socket
7/16" Open-End Wrench
1/2" Socket
1/2" Open-End Wrench
1/2" Nutdriver
Penetrox Heat Sink Compound (Lincoln Part #T12837-1)
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Perform the **Front Panel Removal Procedure**.
5. Using a 7/16" socket and a 7/16" open-end wrench, remove the bolt, nut, lock washer and two flat washers securing each lead set (W1/W6, W2/W3 and W4/W5) to the AC terminals of the output rectifier bridge. See **Figure F.36**. See Wiring Diagram. Label and disconnect leads.
6. Using a 1/2" socket and a 1/2" open-end wrench, remove the two bolts, nuts, lock washers and four flat washers securing leads B2/B5, B2/B5 and POS-SHUNT to the positive terminal of the output rectifier bridge and leads B1/B4 and B1/B4 from the negative terminal of the output rectifier bridge. See **Figure F.36**. See Wiring Diagram. Label and disconnect leads.
7. Using a 1/2" nutdriver, remove the two nuts, lock washers and four flat washers securing the output rectifier bridge to the shelf. See **Figure F.37**.
8. The output rectifier bridge can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new output rectifier bridge into the machine.

2. Using a 1/2" nutdriver, attach the two nuts, lock washers and four flat washers securing the output rectifier bridge to the shelf.
3. Carefully apply a thin coating of Penetrox heat sink compound to the mating surfaces of the leads.
4. Using a 1/2" socket and a 1/2" open-end wrench, attach the two bolts, nuts, lock washers and four flat washers securing leads B2/B5, B2/B5 and POS-SHUNT to the positive terminal of the output rectifier bridge and leads B1/B4 and B1/B4 to the negative terminal of the output rectifier bridge.
5. Using a 7/16" socket and a 7/16" open-end wrench, attach the bolt, nut, lock washer and two flat washers securing each lead set (W1/W6, W2/W3 and W4/W5) to the AC terminals of the output rectifier bridge.
6. Perform the **Front Panel Replacement Procedure**.
7. Perform the **Case Cover Replacement Procedure**.
8. Perform the **Retest After Repair Procedure**.

Figure F.36 – Output rectifier bridge lead locations

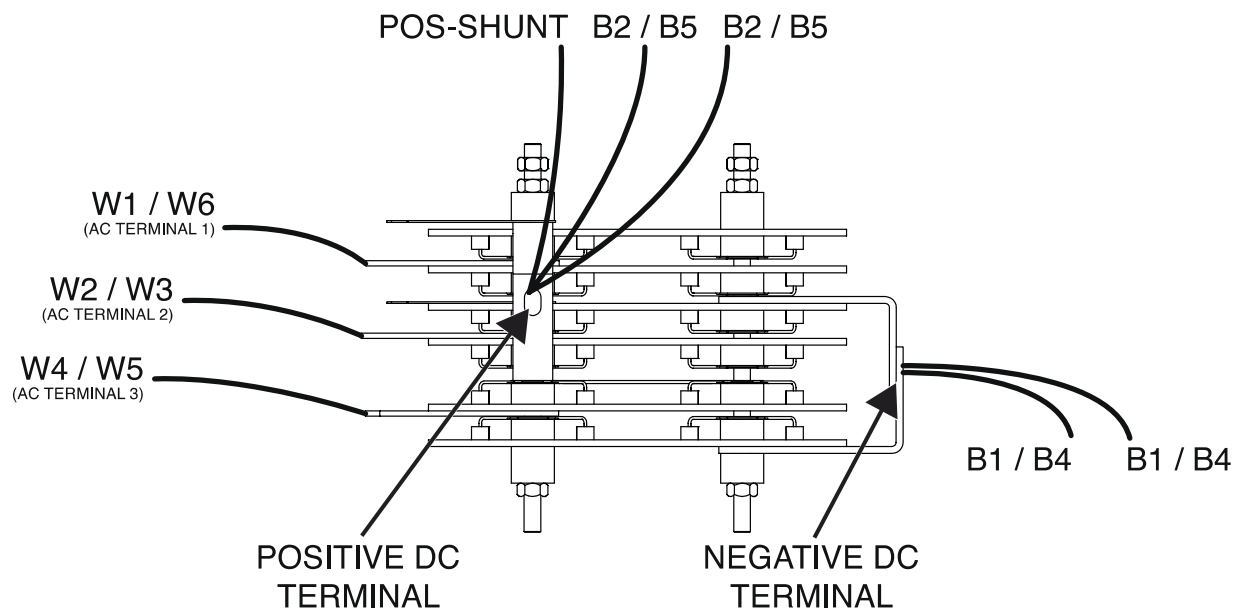
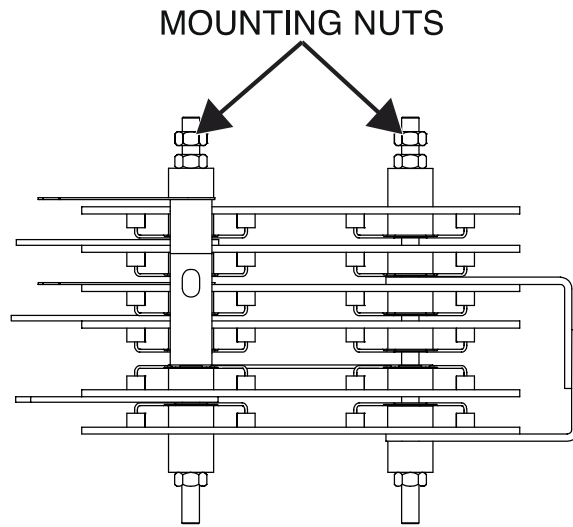


Figure F.37 – Output rectifier bridge mounting nut locations



CHOPPER MODULE BOARDS REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Chopper Module Boards.

MATERIALS NEEDED

7/16" Nutdriver
Penetrox Heat Sink Compound (Lincoln Part #T12837-1)
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Perform the **Front Panel Removal Procedure**.
5. Using a 7/16" nutdriver, remove the six screws, lock washers and flat washers securing leads to terminals B1, B2, B3, B4, B5 and B6 on each of the chopper module boards. See **Figure F.38**. See Wiring Diagram.
6. Label and disconnect leads 23A, 25A, 23 and 25 from quick-connect terminals B7 and B8 on each chopper module board. See **Figure F.38**. See Wiring Diagram.
7. Label and disconnect the two leads attached to each thermostat. See Wiring Diagram.
8. Using a 7/16" nutdriver, remove the two screws and lock washers securing each of the chopper module boards to the choppers and chokes bracket. See **Figure F.39**.
9. The chopper module board(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new chopper module board(s) onto the choppers and chokes bracket.
2. Using a 7/16" nutdriver, attach the two screws and lock washers securing each of the chopper module boards to the choppers and chokes bracket.
3. Connect the two previously disconnected leads to each thermostat. See Wiring Diagram.
4. Connect leads 23A, 25A, 23 and 25 to quick-connect terminals B7 and B8 on each chopper module board. See Wiring Diagram.

5. Carefully apply a thin coating of Penetrox heat sink compound to the mating surfaces of the leads and terminals B1, B2, B3, B4, B5 and B6 of each chopper module board. See Wiring Diagram.
6. Using a 7/16" nutdriver, attach the six screws, lock washers and flat washers securing leads to terminals B1, B2, B3, B4, B5 and B6 on each of the chopper module boards. See Wiring Diagram. Torque to 110 in-lbs.
7. Perform the **Front Panel Replacement Procedure**.
8. Perform the **Case Cover Replacement Procedure**.
9. Perform the **Retest After Repair Procedure**.

Figure F.38 – Chopper module board terminal locations

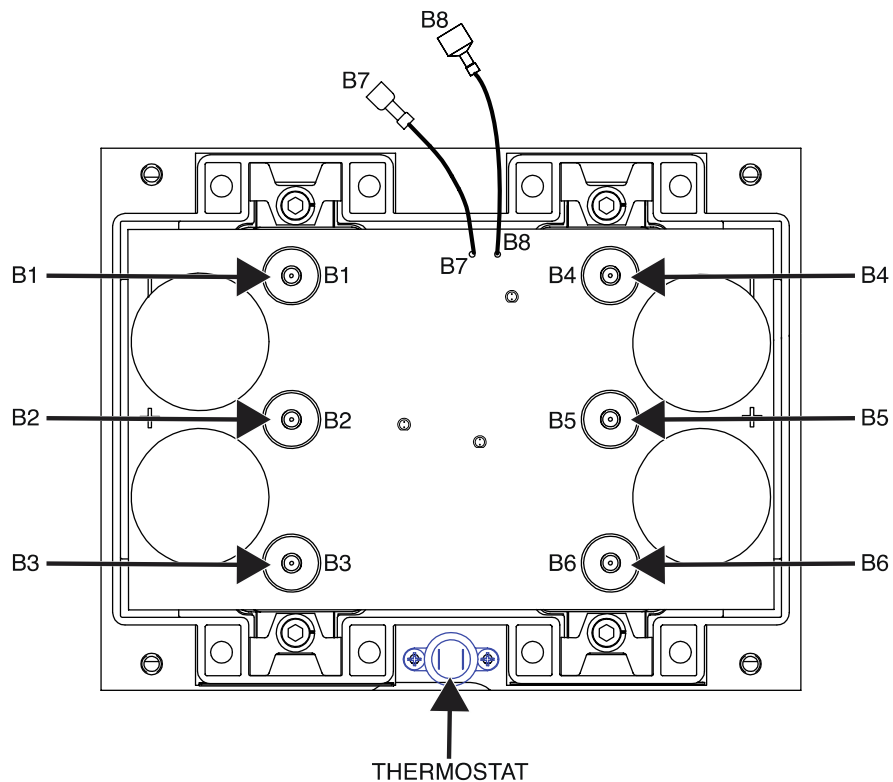
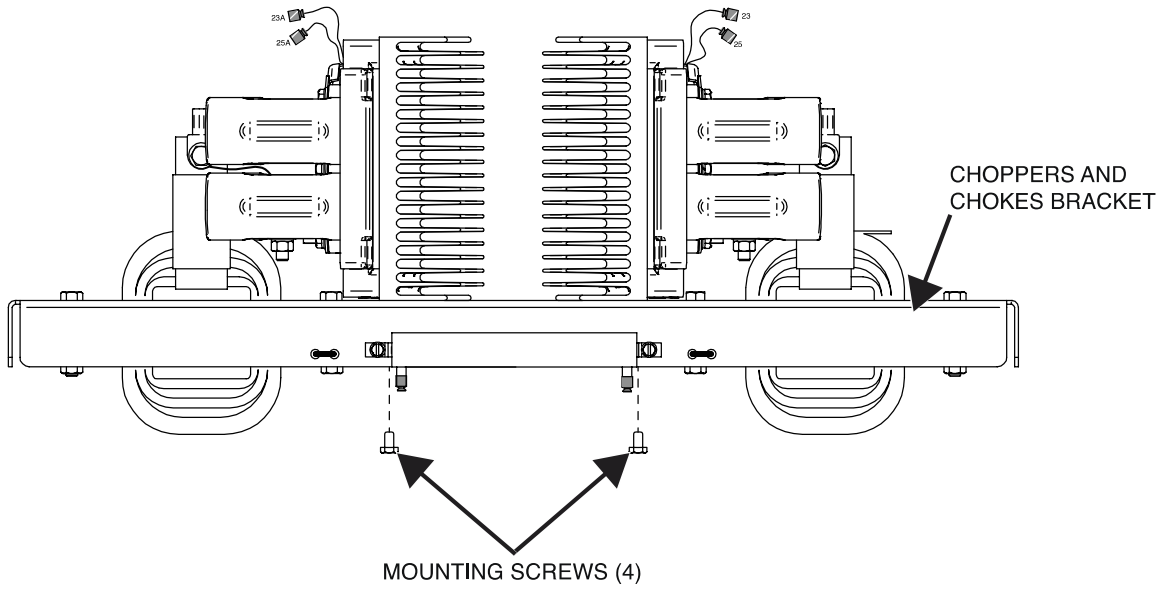


Figure F.39 – Chopper module board mounting screw locations



WELD CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Weld Control Board.

MATERIALS NEEDED

5/16" Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Chopper Module Capacitor Discharge Procedure***.
4. Label and disconnect plugs J1, J3, J6 and J7 from the weld control board. See ***Figure F.40***. See Wiring Diagram.
5. Using a 5/16" nutdriver, remove the four screws securing the weld control board to the PCB bracket. See ***Figure F.41***.
6. The weld control board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new weld control board onto the PCB bracket.
2. Using a 5/16" nutdriver, attach the four screws securing the weld control board to the PCB bracket.
3. Connect plugs J1, J3, J6 and J7 to the weld control board. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.40 – Weld control board plug locations

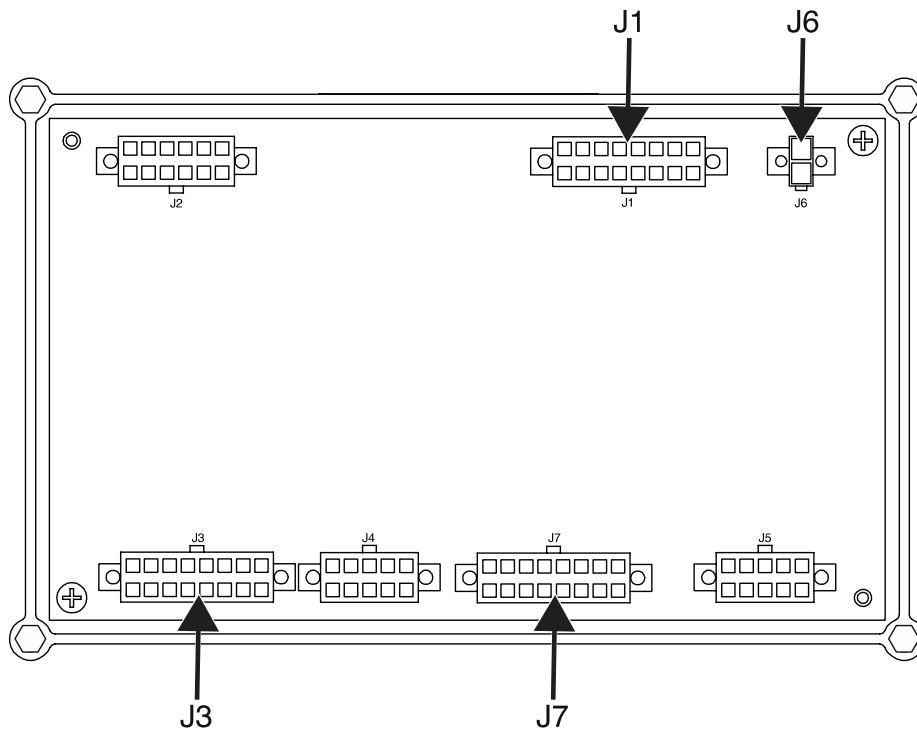
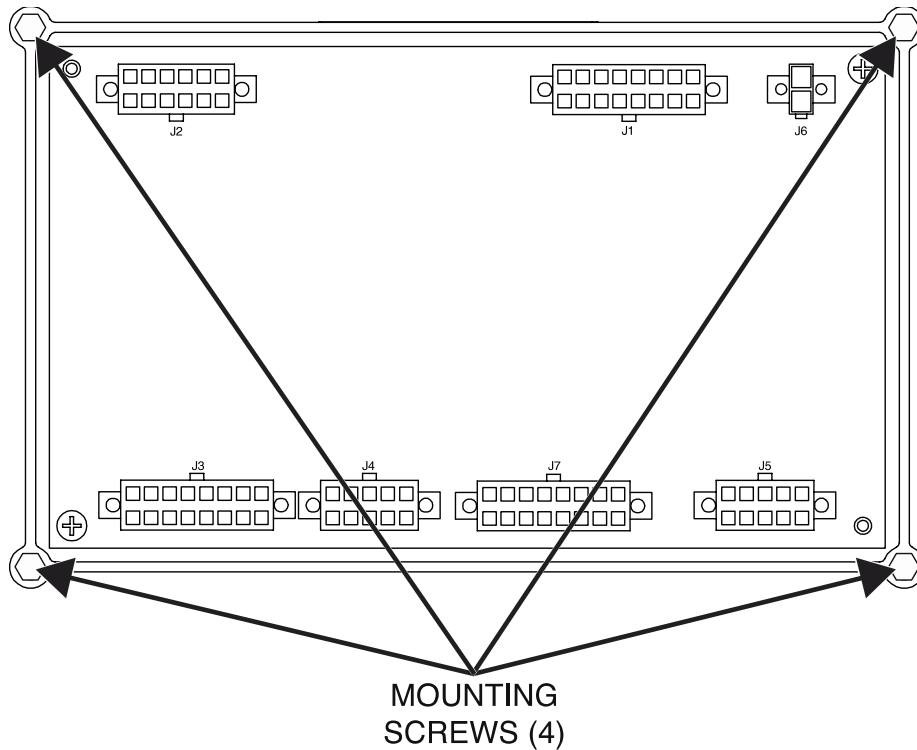


Figure F.41 – Weld control board mounting screw locations



CHOKE REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Choke assemblies.

MATERIALS NEEDED

1/2" Socket
1/2" Open-End Wrench
1/2" Nutdriver
Penetrox Heat Sink Compound (Lincoln Part #T12837-1)
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Perform the **Front Panel Removal Procedure**.
5. Using a 1/2" socket and a 1/2" open-end wrench, remove the two bolts, nuts, lock washers and four flat washers securing leads B2/B5, B2/B5 to the positive terminal of the output rectifier bridge and leads B1/B4 and B1/B4 to the negative terminal of the output rectifier bridge. See **Figure F.42**. See Wiring Diagram. Label and disconnect leads.
6. Label and disconnect plug J3 from the weld control board. See **Figure F.43**. See Wiring Diagram.
7. Using a 1/2" nutdriver, remove the four screws securing the choppers and chokes bracket to the machine. See **Figure F.44**.
8. Carefully remove the choppers and chokes bracket from the machine.
9. Using a 1/2" socket and a 1/2" open-end wrench, remove the nut, bolt, lock washer and flat washer securing leads to each terminal of the choke being removed. See **Figure F.45**. See Wiring Diagram. Repeat this step for the other choke assembly, if necessary.
10. Using a 1/2" socket and a 1/2" open-end wrench, remove the two bolts, nuts and flat washers securing the choke assembly to the choppers and chokes bracket. See **Figure F.45**.
11. The choke assembly(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new choke assembly(s) onto the choppers and chokes bracket.
2. Using a 1/2" socket and a 1/2" open-end wrench, attach the two bolts, nuts and flat washers securing the choke assembly to the choppers and chokes bracket.
3. Carefully apply a thin coating to the mating surfaces of the choke leads and the choke terminals. See Wiring Diagram.
4. Using a 1/2" socket and a 1/2" open-end wrench, attach the nut, bolt, lock washer and flat washer securing leads to each terminal of the choke assembly being replaced. See Wiring Diagram. Repeat this step for the other choke assembly, if necessary.
5. Carefully position the choppers and chokes bracket into the machine.
6. Using a 1/2" nutdriver, attach the four screws securing the choppers and chokes bracket to the machine.
7. Connect plug J3 to the weld control board. See Wiring Diagram.
8. Using a 1/2" socket and a 1/2" open-end wrench, attach the two bolts, nuts, lock washers and four flat washers securing leads B2/B5, B2/B5 to the positive terminal of the output rectifier bridge and leads B1/B4 and B1/B4 to the negative terminal of the output rectifier bridge. See Wiring Diagram.
9. Perform the **Front Panel Replacement Procedure**.
10. Perform the **Case Cover Replacement Procedure**.
11. Perform the **Retest After Repair Procedure**.

Figure F.42 – Output rectifier bridge lead and terminal locations

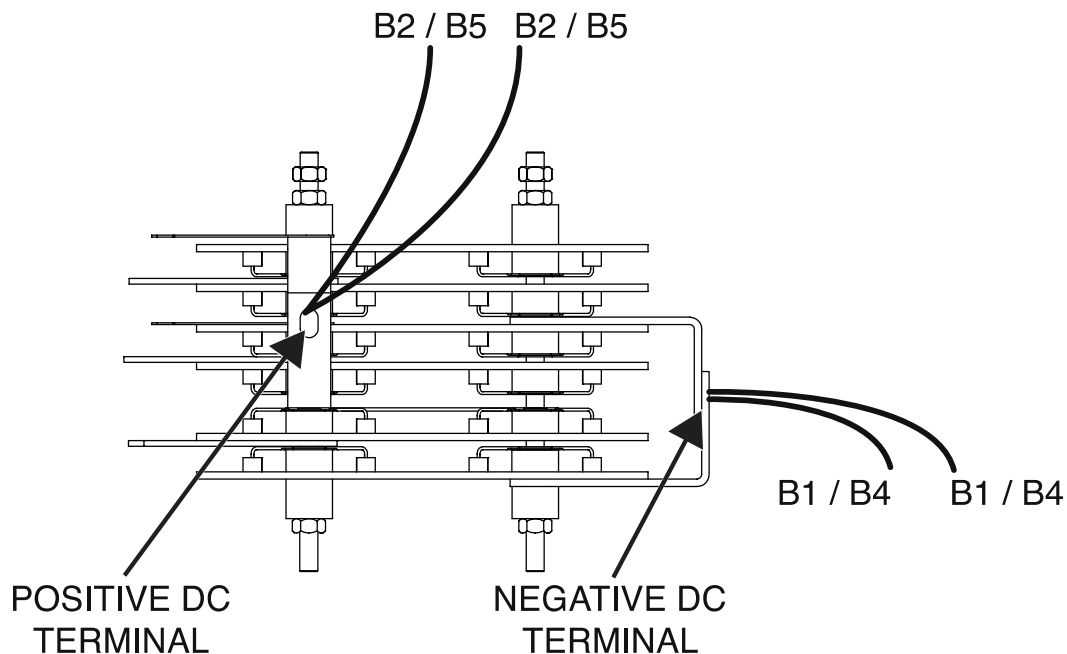


Figure F.43 – Weld control board plug J3 location

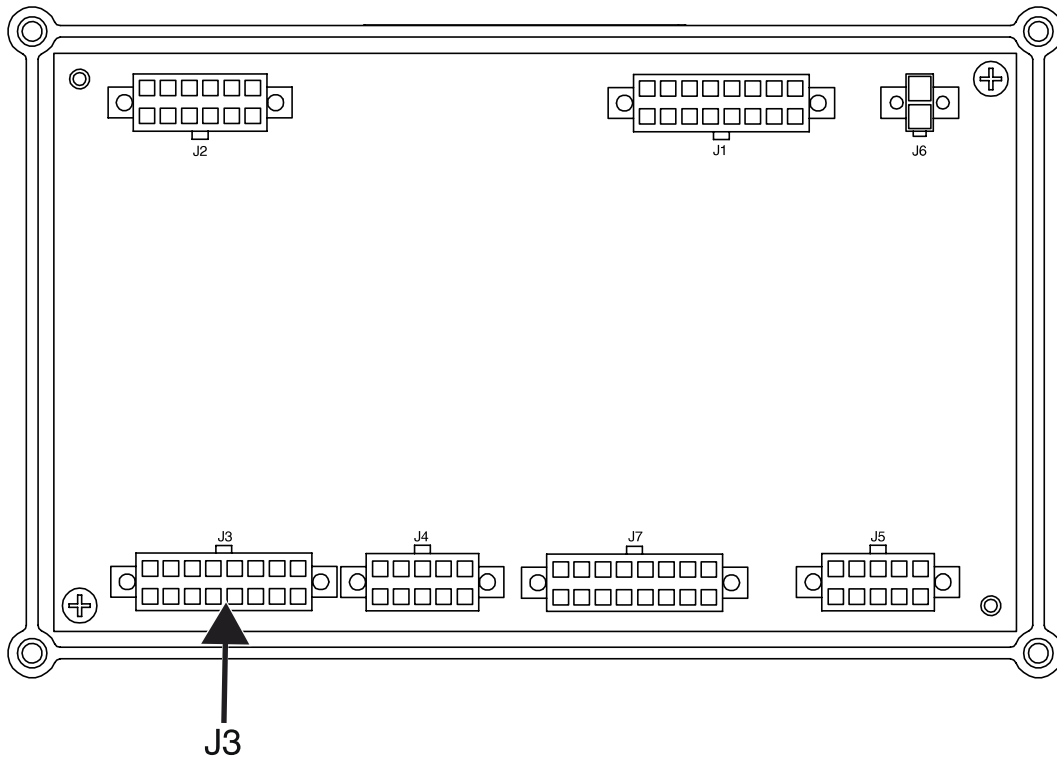


Figure F.44 – Choppers and chokes bracket mounting screw locations

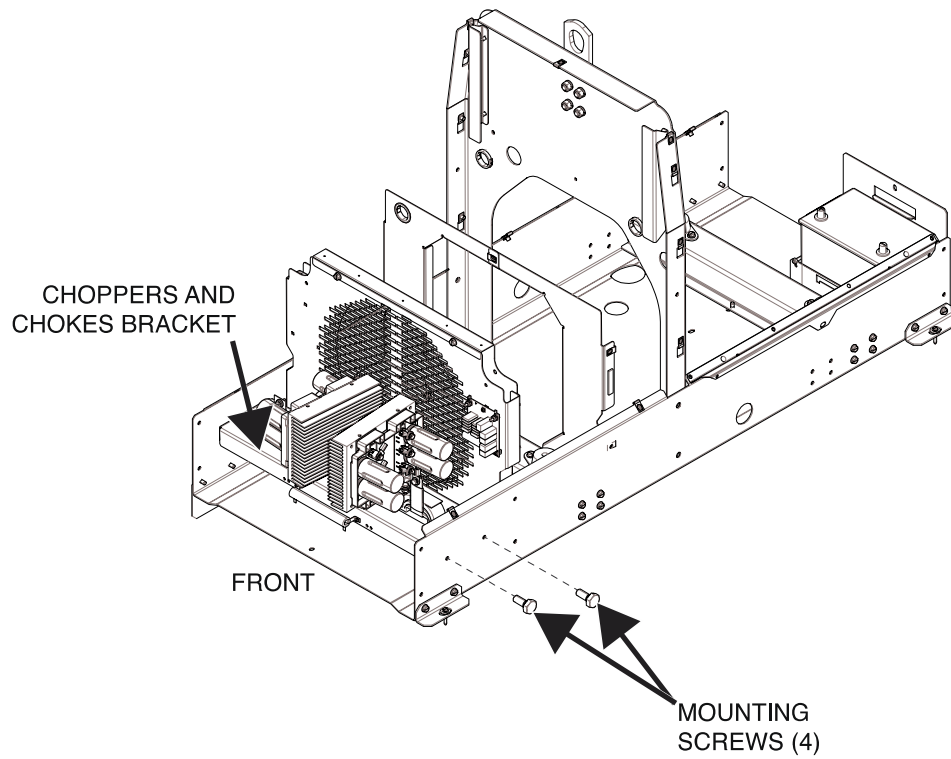
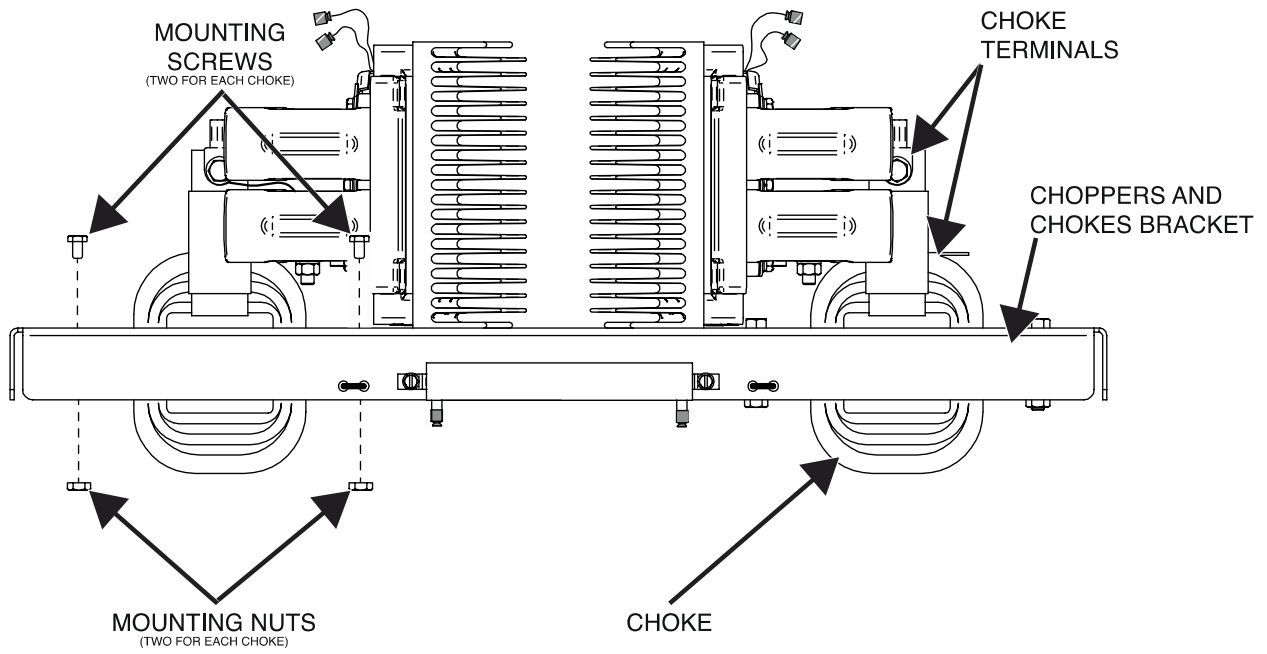


Figure F.45 – Choke terminals and choke mounting hardware locations



PIPE/GOUGE RANGE SWITCH REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Pipe/Gouge Range Switch.

MATERIALS NEEDED

3/8" Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Using a 3/8" nutdriver, remove the four screws securing the upper control panel to the machine. See **Figure F.46**.
3. Lower the upper control panel to gain access to the switch.
4. Label and disconnect leads 218, JP2 and 217 from the terminals of the switch. See **Figure F.47**. See Wiring Diagram.
5. Carefully depress the tabs at the left and right of the of the rear side of the switch. See **Figure F.47**.
6. Carefully maneuver the switch thru the front of the upper control panel.
7. The switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new switch into the upper control panel.
2. Connect leads 218, JP2 and 217 to the terminals of the switch. See Wiring Diagram.
3. Place the upper control panel into the closed position.
4. Using a 3/8" nutdriver, attach the four screws securing the upper control panel to the machine.
5. Perform the **Retest After Repair Procedure**.

Figure F.46 – Upper control panel mounting screw locations

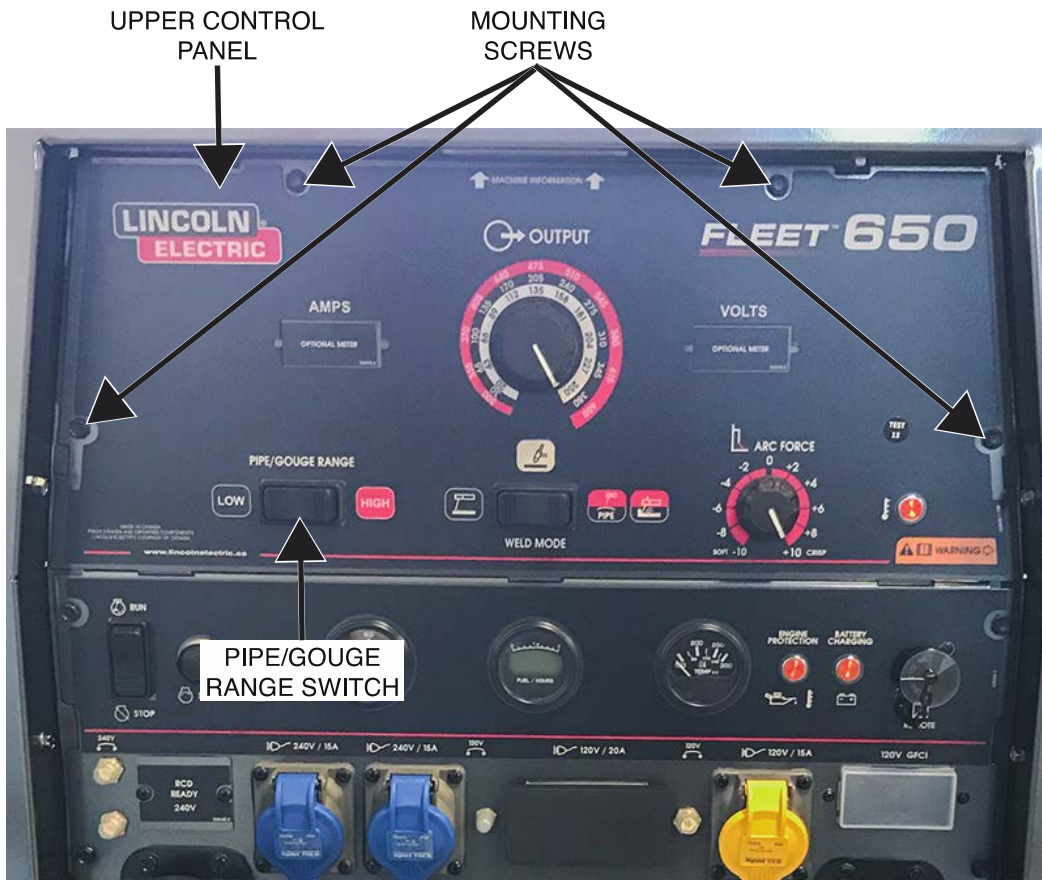
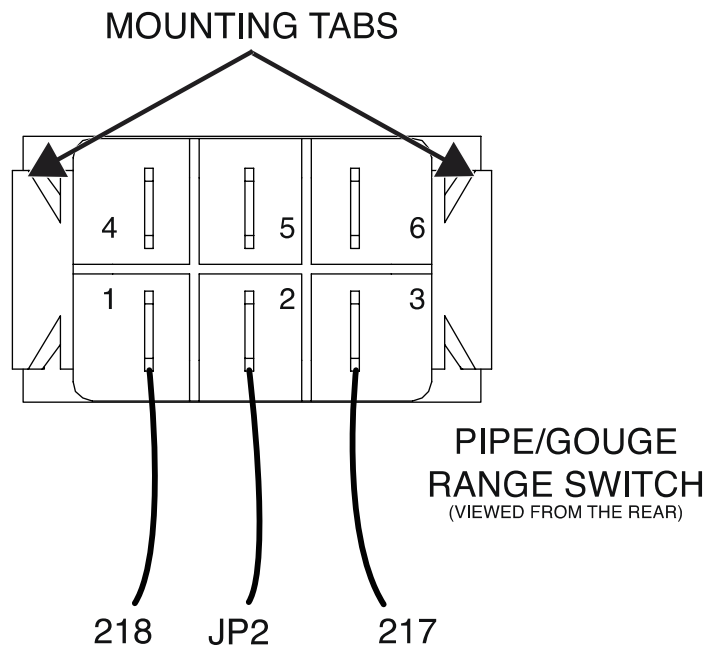


Figure F.47 – Pipe/gouge range switch lead and mounting screw locations



WELD MODE SWITCH REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Weld Mode Switch.

MATERIALS NEEDED

3/8" Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Using a 3/8" nutdriver, remove the four screws securing the upper control panel to the machine. See **Figure F.48**.
3. Lower the upper control panel to gain access to the switch.
4. Label and disconnect leads 220, JP1, JP2 and 222 from the terminals of the switch. See **Figure F.49**. See Wiring Diagram.
5. Carefully depress the tabs at the left and right of the of the rear side of the switch. See **Figure F.49**.
6. Carefully maneuver the switch thru the front of the upper control panel.
7. The switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new switch into the upper control panel.
2. Connect leads 220, JP1, JP2 and 222 to the terminals of the switch. See Wiring Diagram.
3. Place the upper control panel into the closed position.
4. Using a 3/8" nutdriver, attach the four screws securing the upper control panel to the machine.
5. Perform the **Retest After Repair Procedure**.

Figure F.48 – Upper control panel mounting screw locations

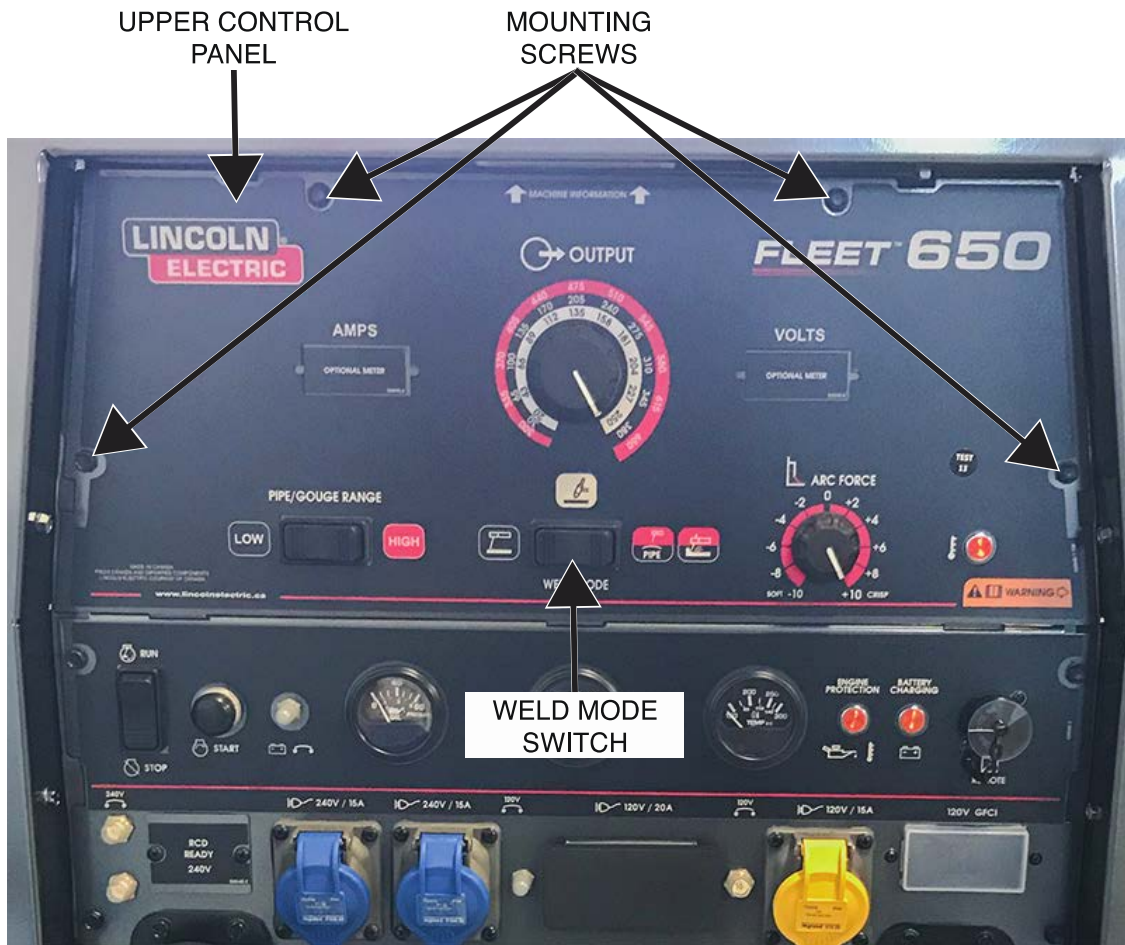
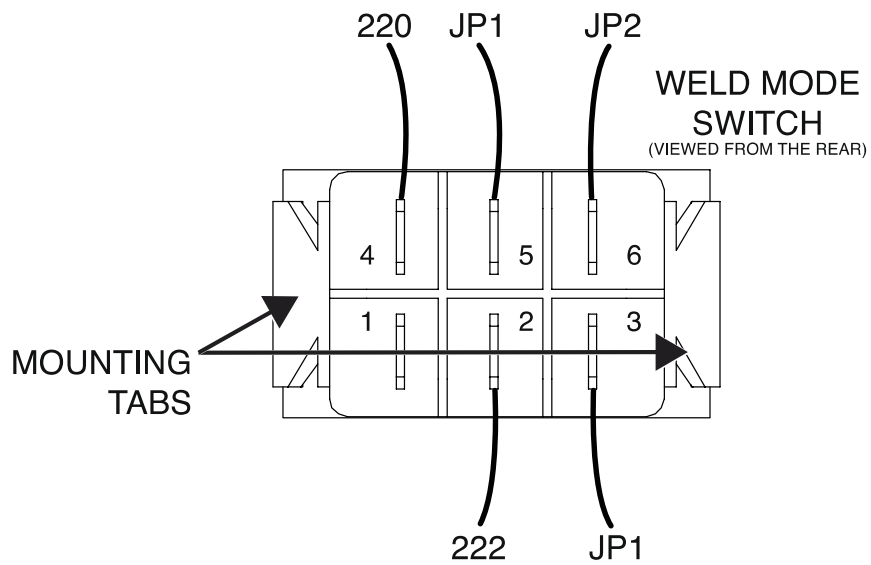


Figure F.49 – Weld mode switch leads and mounting hardware locations



THERMOSTAT REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Thermostats.

MATERIALS NEEDED

Phillips Screwdriver
Dow Corning 340 Heat Sink Compound (Lincoln Part #T12837)
Wiring Diagram

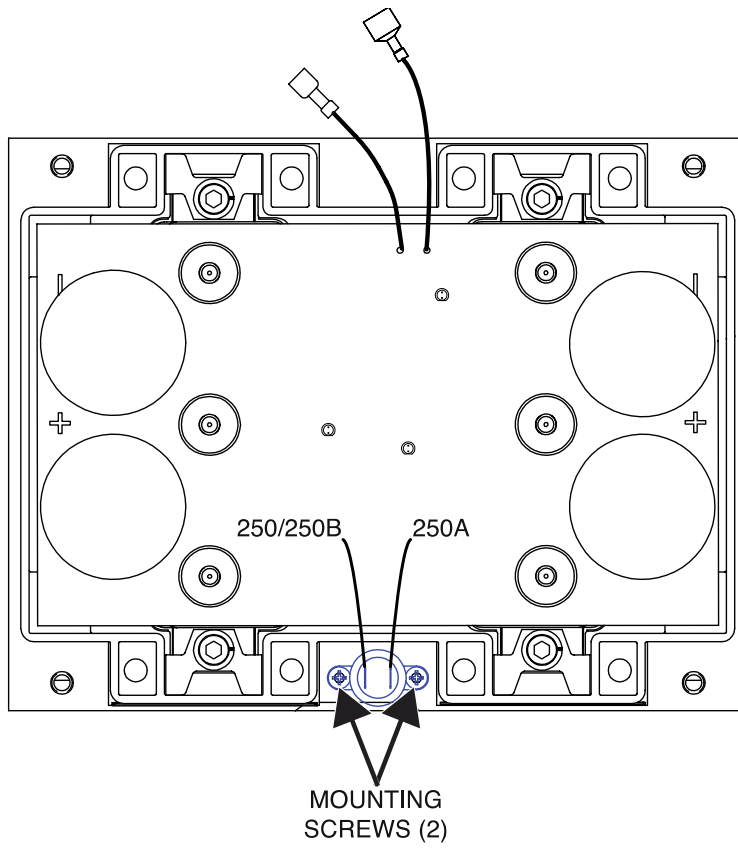
REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Perform the **Chopper Module Boards Removal Procedure**.
5. Label and disconnect leads 250, 250A and 250B from thermostat terminals. See **Figure F.50**. See Wiring Diagram.
6. Using a Phillips screwdriver, remove the two screws securing the thermostat to the chopper module board(s). See **Figure F.50**. Repeat for the other thermostat, if necessary.
7. The thermostat(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Apply a thin coating of Dow Corning 340 heat sink compound to the rear of the thermostat(s).
2. Carefully position the new thermostat(s) onto the chopper module board.
3. Using a Phillips screwdriver, attach the two screws securing the thermostat to the chopper module board(s).
4. Attach leads 250, 250A and 250B to the thermostat terminals. See Wiring Diagram.
5. Perform the **Chopper Module Boards Replacement Procedure**.
6. Perform the **Case Cover Replacement Procedure**.
7. Perform the **Retest After Repair Procedure**.

Figure F.50 – Thermostat lead and mounting screw locations



FUEL TANK REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Fuel Tank.

MATERIALS NEEDED

Needle-Nose Pliers
Fuel Siphon
Fuel Storage Container
Paper Towels
Wiring Diagram

REMOVAL PROCEDURE

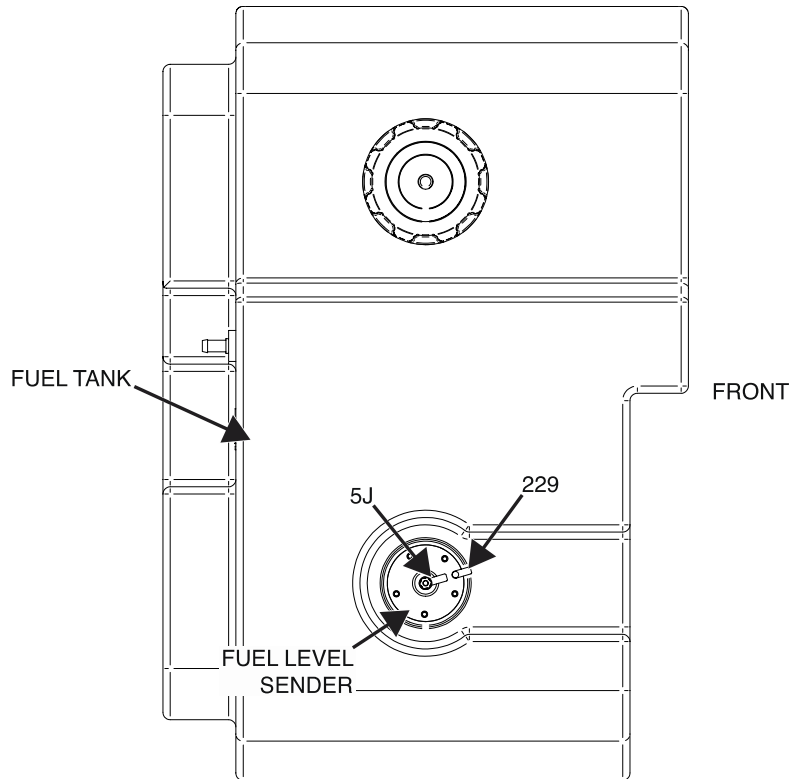
1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Label and disconnect leads 229 and 5J from the fuel level sender. See **Figure F.51**. See Wiring Diagram. Cut cable ties as necessary. Route leads thru the fuel tank shield.
5. Using a fuel siphon, remove the fuel from the fuel tank and store in an appropriate fuel storage container.
6. Using needle-nose pliers, loosen the hose clamps securing the fuel hoses to the fuel tank.
NOTE: To avoid spills, temporarily wrap fuel hoses with paper towels to absorb any residual fuel. If there is any fuel left in the fuel tank, drain it into an appropriate fuel storage container.
7. Route the fuel hoses thru the shelf and lift bail frame.
8. Carefully lift the fuel tank out of the machine.

REPLACEMENT PROCEDURE

1. Carefully position the new fuel tank into the machine.
2. Route the fuel hoses thru the shelf and lift bail frame.
3. Using needle-nose pliers, tighten the hose clamps securing the fuel hoses to the fuel tank.
4. Route leads 229 and 5J thru the fuel tank shield.
5. Connect leads 229 and 5J to the fuel level sender. See Wiring Diagram.
6. Perform the **Case Cover Replacement Procedure**.

7. Perform the *Retest After Repair Procedure*.

Figure F.51 – Fuel level sender lead locations



ROTOR AND STATOR REMOVAL AND REPLACEMENT PROCEDURE

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.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Rotor and Stator assemblies.

MATERIALS NEEDED

7/16" Nutdriver
3/8" Nutdriver
1/2" Nutdriver
1 1/8" Wrench
3/4" Deep Well Socket
3/4" Open-End Wrench
Hoist And Appropriate Rigging
Wood Or Steel Blocking
5/8" Socket
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Fleet 650 machine.
2. Perform the **Case Cover Removal Procedure**.
3. Perform the **Chopper Module Capacitor Discharge Procedure**.
4. Perform the **Front Panel Removal Procedure**.
5. Perform the **Output Rectifier Bridge Removal Procedure**.
6. Perform the **Fuel Tank Removal Procedure**.
7. Using a 7/16" nutdriver, remove the nut, lock washer and flat washer securing lead 200B to the positive terminal of the field capacitor. See **Figure F.52**. See Wiring Diagram. Label and disconnect lead 200B.
8. Using a 7/16" nutdriver, remove the nut, lock washer and flat washer securing lead 201 to the negative terminal of the field capacitor. See **Figure F.52**. See Wiring Diagram. Label and disconnect lead 201.
9. Using a 3/8" nutdriver, remove the nut, lock washer and flat washer securing the leads to the PCB bracket ground stud. See **Figure F.53**. See Wiring Diagram. Label and disconnect leads.
10. Using a 1/2" nutdriver, remove the four screws securing the PCB bracket to the shelf. See **Figure F.53**. Remove the PCB bracket.

11. Using a 1/2" nutdriver, remove the remaining three screws securing the fuel tank shield to the shelf. See **Figure F.53**. Remove the fuel tank shield.
12. Carefully route leads thru the holes in the shelf.
13. Using a 1/2" nutdriver, remove the five screws securing the shelf to the lift bail frame. See **Figure F.54**. Remove the shelf.
14. Using a 1/2" nutdriver, remove the four screws securing the choppers and chokes bracket to the machine. See **Figure F.54**.
15. Carefully remove the choppers and chokes bracket from the machine.
16. Using a 1/2" nutdriver, remove the four screws securing the fan baffle to the machine. See **Figure F.54**. Remove the fan baffle.
17. Using a 1/2" nutdriver, remove the four screws and lock washers securing the fan to the fan coupling. See **Figure F.55**. Remove the fan.
18. Route leads thru the hole in the left baffle. See **Figure F.54**.
19. Using a 1/2" nutdriver, remove the screw securing the left and right baffles together. See **Figure F.54**.
20. Using a 1/2" nutdriver, remove the screw securing the left baffle to the machine. See **Figure F.54**. Remove the left baffle.
21. Using a 1/2" nutdriver, remove the screw securing the right baffle to the machine. See **Figure F.54**. Remove the right baffle.
22. Using a 3/8" nutdriver, remove the two screws securing the brush holder bracket into the machine. See **Figure F.55**. Remove the brush holder bracket.
23. Using a 1 1/8" wrench, remove the nut and washer securing the fan coupling to the rotor shaft. See **Figure F.55**.
24. Slide the fan coupling off the rotor shaft.
25. Using a 3/4" deep well socket and a 3/4" open-end wrench, remove the two bolts, nuts and associated washers securing the stator frame to the rubber mounts. See **Figure F.55**.
26. Using a hoist and the appropriate rigging attached to the stator frame, lift the stator frame up slightly off of the rubber mounts.
27. Place wood or steel blocking under the flywheel housing to support the engine.
28. Using a 5/8" socket, remove the eight screws and lock washers securing the stator frame to the engine.
29. Using a hoist and appropriate rigging, carefully remove the stator frame from the engine.
NOTE: It may be necessary to use a gear puller to remove the stator frame from the engine.
30. Using a hoist and appropriate rigging, support the rotor and shaft assembly.
31. Remove the eight screws securing the rotor coupling disc to the engine.
32. The rotor assembly can now be removed.

REPLACEMENT PROCEDURE

1. Using a hoist and appropriate rigging, carefully position the rotor assembly into the machine.
2. Attach the eight screws securing the rotor coupling disc to the engine.
3. Using a hoist and appropriate rigging, carefully position the stator frame assembly into the machine.
4. Using a 5/8" socket, attach the eight screws and lock washers securing the stator frame to the engine.

5. Using a hoist and the appropriate rigging attached to the stator frame, lift the stator frame up slightly off of the rubber mounts.
6. Remove the wood or steel blocking from under the flywheel housing.
7. Using a 3/4" deep well socket and a 3/4" open-end wrench, attach the two bolts, nuts and associated washers securing the stator frame to the rubber mounts.
8. Slide the fan coupling onto the rotor shaft.
9. Using a 1 1/8" wrench, attach the nut and washer securing the fan coupling to the rotor shaft.
10. Carefully position the brush holder bracket assembly into the machine.
11. Using a 3/8" nutdriver, attach the two screws securing the brush holder bracket into the machine.
12. Carefully position the right baffle into the machine.
13. Using a 1/2" nutdriver, attach the screw securing the right baffle to the machine.
14. Carefully position the left baffle into the machine.
15. Using a 1/2" nutdriver, attach the screw securing the left baffle to the machine.
16. Using a 1/2" nutdriver, attach the screw securing the left and right baffles together.
17. Route leads thru the hole in the left baffle.
18. Carefully position the fan onto the shaft.
19. Using a 1/2" nutdriver, attach the four screws and lock washers securing the fan to the fan coupling.
20. Carefully position the fan baffle into the machine.
21. Using a 1/2" nutdriver, attach the four screws securing the fan baffle to the machine.
22. Carefully position the choppers and chokes bracket into the machine.
23. Using a 1/2" nutdriver, attach the four screws securing the choppers and chokes bracket to the machine.
24. Carefully position the shelf into the machine.
25. Using a 1/2" nutdriver, attach the five screws securing the shelf to the lift bail frame.
26. Carefully route leads thru the holes in the shelf.
27. Carefully position the fuel tank shield onto the shelf.
28. Using a 1/2" nutdriver, attach the three screws securing the fuel tank shield to the shelf.
29. Carefully position the PCB bracket onto the shelf.
30. Using a 1/2" nutdriver, attach the four screws securing the PCB bracket to the shelf.
31. Using a 3/8" nutdriver, attach the nut, lock washer and flat washer securing the leads to the PCB bracket ground stud. See Wiring Diagram.
32. Using a 7/16" nutdriver, attach the nut, lock washer and flat washer securing lead 201 to the negative terminal of the field capacitor. See Wiring Diagram.
33. Using a 7/16" nutdriver, attach the nut, lock washer and flat washer securing lead 200B to the positive terminal of the field capacitor. See Wiring Diagram.
34. Perform the ***Fuel Tank Replacement Procedure***.
35. Perform the ***Output Rectifier Bridge Replacement Procedure***.
36. Perform the ***Front Panel Replacement Procedure***.
37. Perform the ***Case Cover Replacement Procedure***.
38. Perform the ***Retest After Repair Procedure***.

Figure F.52 – Field capacitor lead locations

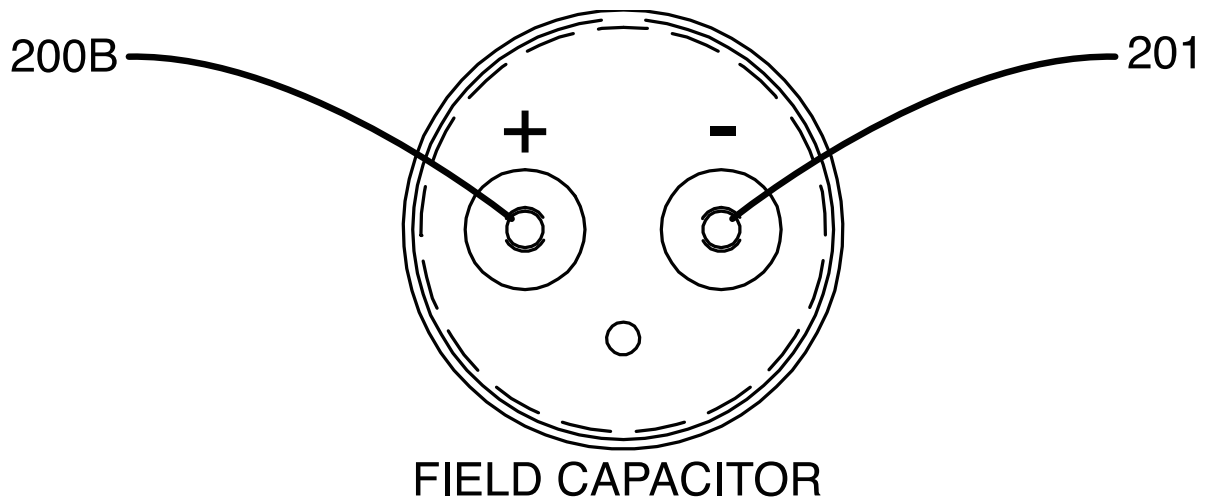


Figure F.53 – PCB bracket ground stud, shelf and fuel tank shield locations

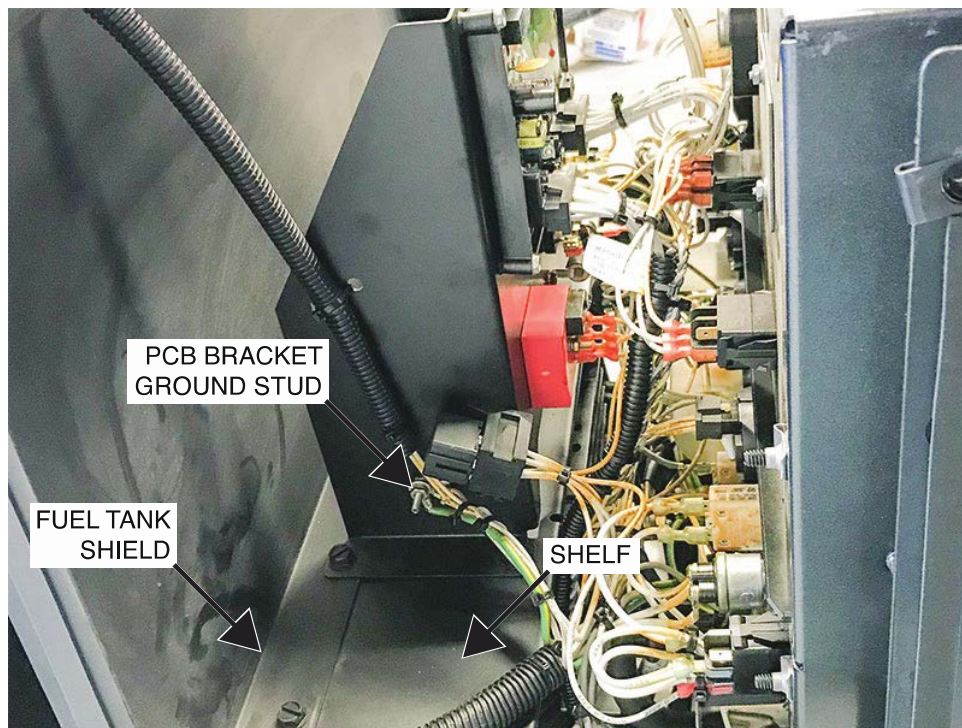


Figure F.54 – Choppers and chokes bracket mounting screw, fan baffle, lift bail frame, left and right baffle locations

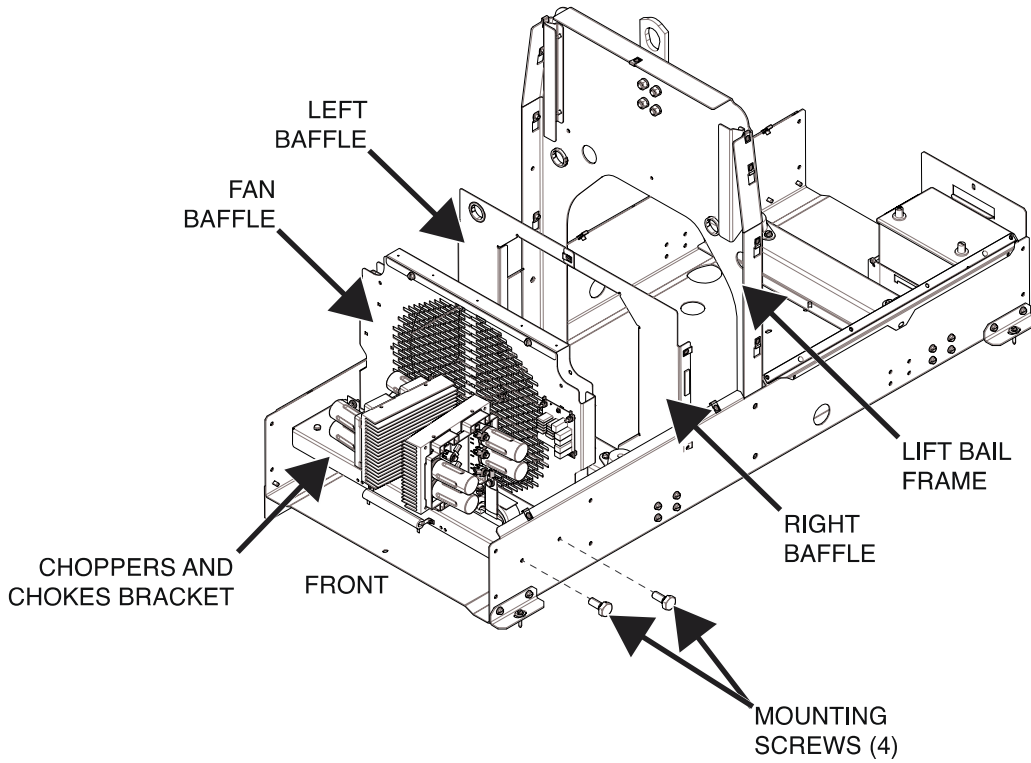
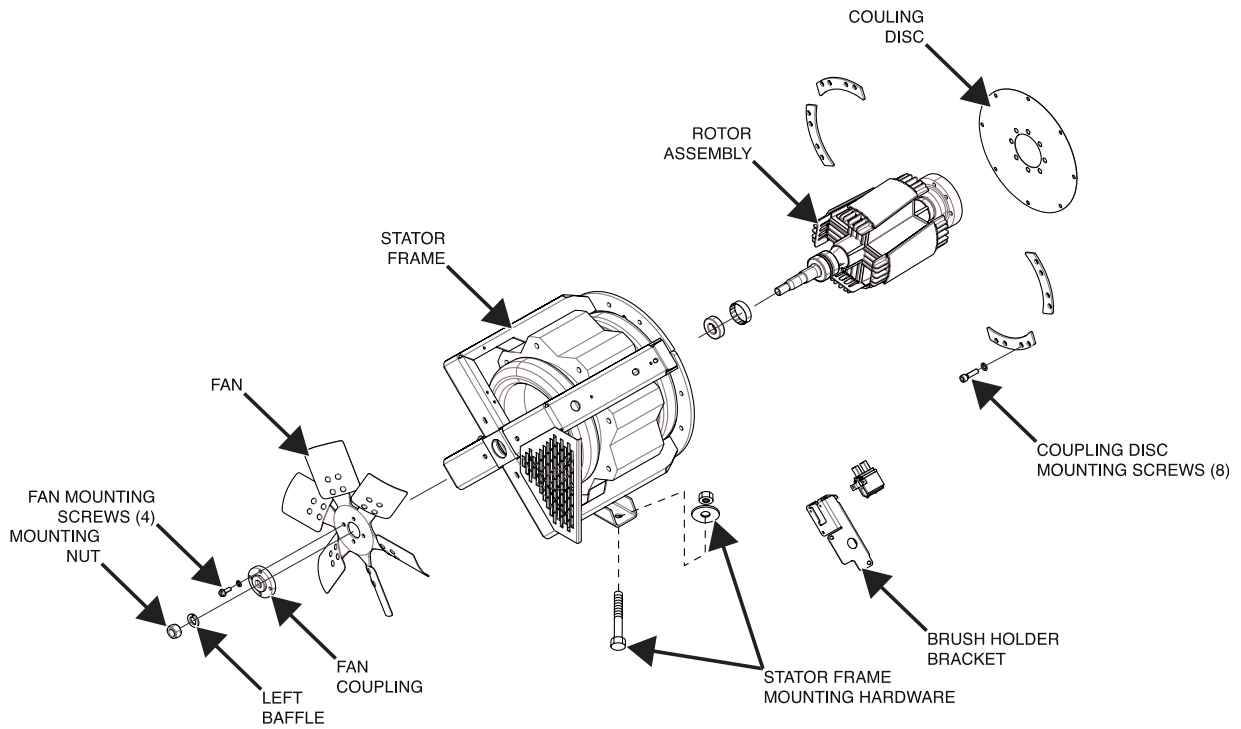


Figure F.55 – Rotor and stator mounting hardware locations



RETEST AFTER REPAIR

Retest a machine:

- If it is rejected under test for any reason that requires you to remove any part which could affect the machine's electrical characteristics.

OR

- If you repair or replace any electrical components.

ENGINE OUTPUT

IDLE RPM	FULL LOAD RPM
1890	1800

RATED OUTPUT @ 104° F (40° C) – WELDER

WELDING PROCESS	WELDING OUTPUT CURRENT/VOLTAGE/DUTY CYCLE	OUTPUT RANGE AMPS	MAX. WELD OCV @ FULL LOAD RPM
DC CONSTANT CURRENT	500A / 40V 100% 650A / 36V / 60%	30A TO 650A	82 VOLTS PEAK
TIG	250A / 20V / 100%	20A TO 250A	82 VOLTS PEAK

RATED OUTPUT @ 104° F (40° C) - GENERATOR

AUXILIARY POWER SINGLE PHASE 60 HZ AC			
OUTLETS	VOLTS	AMPS	POWER
1	120	20	2400 WATTS
1	120	15	1800 WATTS
2	240	2 X 15	2 X 3600 WATTS