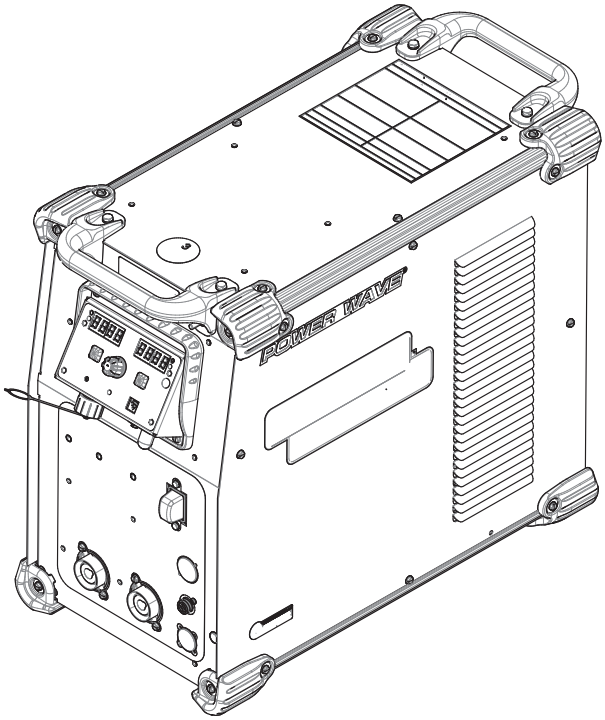
Power Wave® R450

For use with machines having Code Numbers:

Power Wave R450: 12644, 12645, 12712, 12713
12714, 12715

SERVICE MANUAL



SVM283 | Issue Date 18 - Feb

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com

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. I 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.

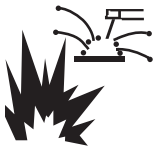
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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 022690-9101.

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-I, "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.

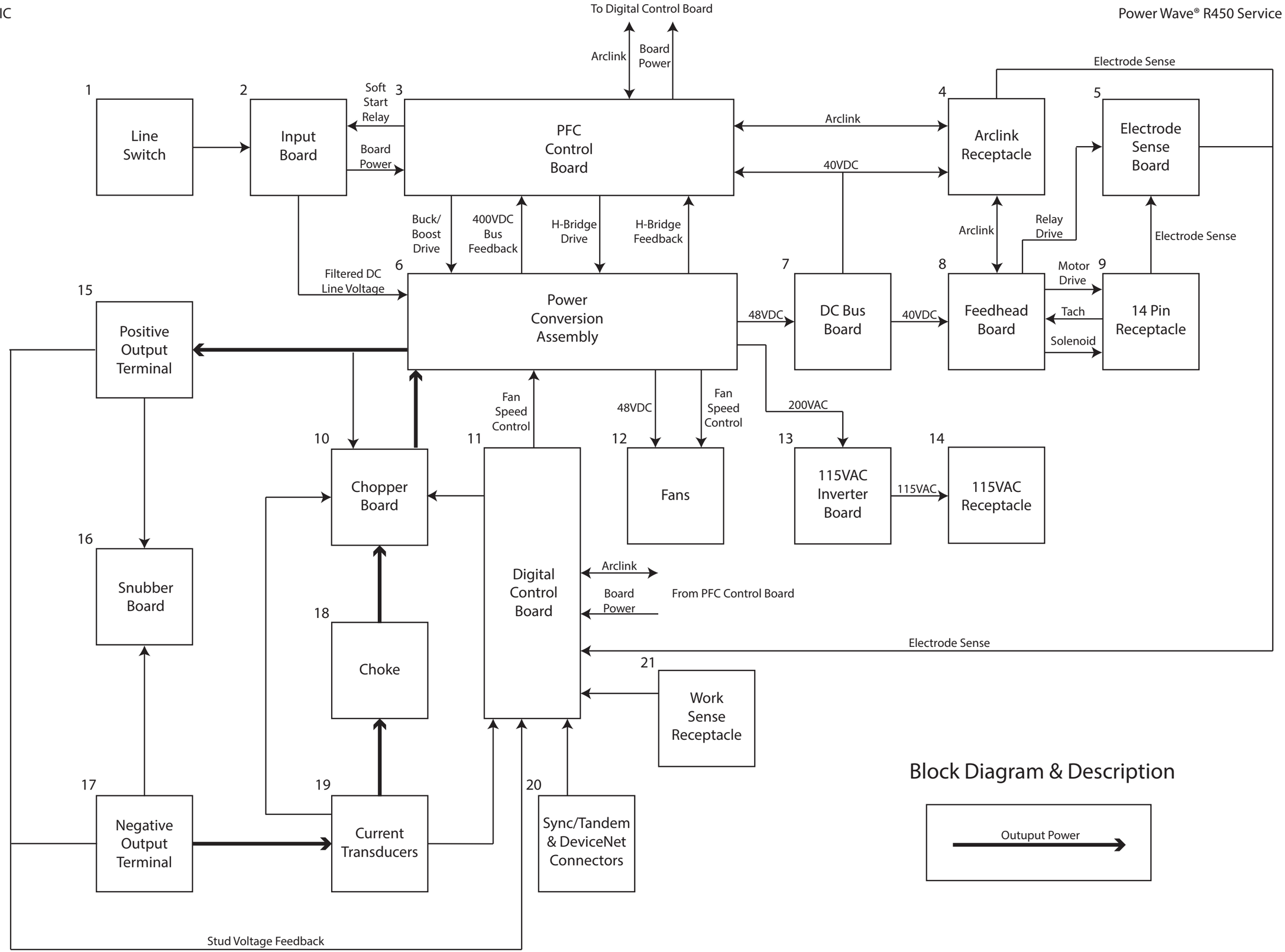
8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

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

Power Wave® R450

Service Manual

Last update: 2018/02/23



Block Diagram & Description

1. **LINE SWITCH**
Applies three phase line power to the machine.

2. **INPUT BOARD**
Rectifies three phase line voltage.

Contains PTCs and relay for soft start functionality.

3. **PFC CONTROL BOARD**
Powered by rectified line voltage.

Closes soft start relay

Drives buck/boost circuitry on the power conversion assembly.

Maintains 400VDC on the inverter bus.

Drives the inverter H-bridge circuitry on the power conversion assembly.

Monitors protection circuitry on the power conversion assembly.

Provides 40VDC to the Digital Control Board, from the DC bus board.

Communicates with the Arclink receptacle and relays info to the Digital control board.

4. **ARCLINK RECEPTACLE**
Interface connection to a Power Feed or other Arclink peripheral.

Provides the following connections:

40VDC feeder power
Arclink communication
Electrode sense lead

5. **ELECTRODE SENSE BOARD**
Isolates electrode sense lead (67) from the sensing network.

Feedhead board drives the relay to bring the 67 lead in circuit while welding.

6. **POWER CONVERSION ASSEMBLY**
Filters rectified line voltage from the input board.

Houses buck/boost and inverter circuitry.

Converts filtered input voltage into the following supplies:

110VDC for the Chopper
48VDC for the DC bus board
200VAC for the 115VAC inverter board.

Provides power and speed control to the fans (speed control comes from the digital control board).

7. **DC BUS BOARD**
Converts 48VDC from the power conversion assembly into 40VDC for Arclink.

8. **FEEDHEAD BOARD**
Powers off 40VDC.

Drives the wire feed motor

Drives the gas/flux solenoid

Receives motor speed feedback via tachometer.

Arclink communication with the digital control board.

Drives the electrode sense board.

9. **14 PIN RECEPTACLE**
Interface between the wire feeder and the Feedhead board.

Provides the following connections:

Motor power
Tachometer feedback
Solenoid
Electrode sense lead (67).

10. **CHOPPER BOARD**
Receives 100VDC from the power conversion assembly.

Receives output control signals from the digital control board.

Receives output feedback from the current transducer.

IGBT's fire to regulate the welding output.

11. **DIGITAL CONTROL BOARD**
Receives user inputs via Arclink or DeviceNet.

Receives 40VDC from the PFC control board.

Receives output feedback.

Sends output control signals to the Chopper Board.

Sends fan control signal to the power conversion assembly.

12. **FANS**
Receive 48VDC from the power conversion assembly.

Receive speed control signal from the power conversion assembly.

Regulate fan speed based on speed control signal.

13. **115VAC INVERTER BOARD**
Receives 200VAC at 50kHz from the power conversion assembly.

Puts out 115VAC at 60Hz to the 115VAC receptacle.

14. **115VAC RECEPTACLE**
115VAC.

15. **POSITIVE OUTPUT TERMINAL**
Positive output connection.

16. **SNUBBER BOARD**
Protects machine from transients.

17. **NEGATIVE OUTPUT TERMINAL**
Negative output connection

18. **CHOKE**
Provides inductance for a smooth arc.

19. **CURRENT TRANSDUCERS**
Provide current feedback to the Chopper and digital control boards.

20. **SYNC/TANDEM AND DEVICENET CONNECTORS**
Interface for peripherals

21. **WORK SENSE RECEPTACLE**
Connection for an external work sense (21) lead.

Troubleshooting & Repair

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and repair should only be performed by 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 four main categories: Output Problems, Welding Problems, Ethernet Problems and Wire Feed 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 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.	1. Contact your local authorized Lincoln Electric Service Facility.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
The input fuses repeatedly fail or the input circuit breakers keep tripping.	1. Make sure the fuses or breakers are properly sized. 2. The welding procedure may be drawing too much input current or the duty cycle may be too high. Reduce the welding current and/or reduce the duty cycle. 3. Check for error codes. See ***Status LED Troubleshooting*** in this section.	1. Perform the ***Input Board Test Procedure***. 2. Perform the ***Power Conversion Assembly Test Procedure***. 3. Perform the ***Power Factor Correction (PFC) Control Board Test Procedure***.
The machine will not power up. No lights or displays. The machine appears to be off.	1. Make sure the proper input voltage is being applied to the machine (check fuses or breakers). 2. Make sure the input supply disconnect has been turned ON. 3. Make certain the input power switch is in the ON position. 4. Check for error codes. See ***Status LED Troubleshooting*** in this section.	1. Check the input line switch for proper operation. Also check the associated leads for loose or faulty connections. See Wiring Diagram. 2. Check to make sure that 40VDC is being applied to the Optional User Interface Board at lead 52D (+) to 51D (-). See Wiring Diagram. 2. Perform the ***40V DC Bus Board Test Procedure***. 3. Perform the ***Input Board Test Procedure***. 4. Perform the ***Power Factor Correction (PFC) Control Board Test Procedure***.

⚠ 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 Power Wave® R450 does not have welding output.	1. If the symptom is accompanied by an error code, see ***Status LED Troubleshooting*** in this section. 2. There may be an external "short" in the external output circuitry. Remove all loads from the output terminals and restart the machine. 3. If the thermal LED is illuminated the unit may be overheated. Adjust the welding load and/or duty cycle to coincide with the output limits of the Power Wave R450. Also see the symptom "The thermal LED is illuminated" in this section.	1. Perform the ***Input Board Test Procedure***. 2. Perform the ***Power Conversion Assembly Test Procedure***. 3. Perform the ***Digital Control Board Test Procedure***. 4. Perform the ***40V DC Bus Board Test Procedure***. 5. Perform the ***Optional User Interface Kit Test Procedure***. 6. Perform the ***Multi-Phase Output Choke Test Procedure***.

⚠ 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 thermal LED is illuminated. The machine regularly overheats. There is no welding output.	1. The welding application may be exceeding the recommended duty cycle and/or current limits of the machine. 2. Dirt and dust may have clogged the cooling channels inside the machine. See the Maintenance Section of the Operators manual. 3. The air intake and exhaust louvers may be blocked due to inadequate clearance around the machine. 4. Make sure the fans are functioning correctly. The fans should run at variable speeds dependent upon the temperature of the buck/boost heat sinks. The fans should also run at a high speed if a thermostat has tripped.	1. Check the thermostats and associated wiring for loose or faulty connections. See Wiring Diagram. 2. Check the DC voltage being applied to the fans. There should be 48VDC at lead 351 (-) to lead 353 (+). See Wiring Diagram.
The “Real Time Clock” no longer functions.	1. The Digital Control Board Battery may be faulty.	1. Replace the battery if necessary (type BS2032). 2. The Digital Control Board may be faulty. 3. Perform the ***Digital Control Board Test Procedure***.
⚠ 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**
WELDING PROBLEMS		
The Power Wave R450 will not produce full output.	1. The input voltage may be too low. See the check for error codes. See ***Status LED Troubleshooting*** in this section. 2. Make certain the three-phase input voltage is correct for the machine.	1. Perform the ***Current Transducer Test Procedure***. 2. Perform the ***Current and Voltage Calibration Test Procedure***. 3. Perform the ***Digital Control Board Test Procedure***. 4. Perform the ***Power Conversion Assembly Test Procedure***. 5. Perform the ***Multi-Phase Output Choke Test Procedure***.
General degradation of the welding performance.	1. Check for proper wire feeding. Make certain that the actual wire feed speed is the same as the preset. 2. Verify that the correct wire drive and gear ratio have been selected. 3. Check the welding cables for loose or faulty connections. 4. Check for adequate gas shielding. 5. Make sure the welding process is correct for wire feed and voltage settings.	1. Perform the ***Current and Voltage Calibration Test Procedure***.
The wire burns back to the tip at the end of the weld.	1. Reduce the burnback time. 2. Reduce the workpoint.	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**
During a weld the machine shuts down.	1. The secondary current limit has been exceeded and the machine shuts down to protect itself. Adjust the procedure to reduce the load and lower the output current draw.	1. A non-recoverable internal fault will interrupt the welding output. This condition will also result in a status light blinking. Check for error codes. See ***Status LED Troubleshooting*** in this section.
The arc is excessively long and erratic.	1. In the wire feeder, make certain the correct wire drive and gear ratio have been selected for the welding process being used. 2. Make sure the shielding gas is correct for the welding process being used. Also make sure the flow rate is correct.	1. Perform the ***Current and Voltage Calibration Test Procedure***.
The welding starting is poor.	1. Make sure the driver roll tension on the wire feeder is adjusted correctly. Also the welding wire should travel freely through wire feeding path. Check the welding tip for blockage. 2. Make sure the shielding gas flow is correct.	N/A
The end of the weld is not acceptable.	1. Make sure all of the settings for Burnback and Crater states are set correctly for the welding process being used. Verify that the Burnback has a value other than 0. 2. Verify the burnback set points for workpoint, trim and wave values. 3. Make sure the shielding gas flow is adequate.	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**
The ArcLink wire feeder will not power up.	1. Check the ArcLink cable connecting the Power Wave® R450 to the ArcLink wire feeder.	Perform the ***40V DC Bus Board Test Procedure***.
⚠ 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**
ETHERNET PROBLEMS		
The system will not connect.	1. Make sure that the correct patch cable or cross cable is being used. 2. Make sure the software is not blocking the connection. See the on line diagnostic utility. 3. Verify that the cables are fully inserted into the bulk head connector. 4. Verify that the network device connected to the Power Wave is either a 10-baseT device or a 10/100-baseT device. 5. The LED located under the PC board Ethernet connector will be lit when the machine is connected to another network device.	1. Use Weld Manager (included on the Power Wave Utilities and available at **www.powerwavesoftware.com** to verify the correct IP address information has been entered. 2. Verify that no duplicate IP addresses exist on the network.
The Ethernet connection drops out while welding.	1. Make sure all of the connections are tight and secure.	1. Make certain that the network cable is not located next to any heavy current carrying conductors. This would include input power cables and welding output cables.
⚠ 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.		

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

Not all of the Power Wave R450 errors will be displayed on the user interface (if it is installed). There are two status lights that display error codes. If a problem occurs it is important to note the condition of the status lights. **Therefore, prior to cycling power to the system, check the power source status light for error sequences as noted below**.

There is one externally mounted status light located on the case front of the machine. This status light corresponds to the digital control board's status. A second status light is internal and is located on the input control board and can be seen by looking through the left case side louvers.

There is an audible beeper associated with this input control board's status light. So the error codes on the input board can be detected through either the status light or the status beeper.

Included in this section is information about the Status Lights and some basic troubleshooting charts for both machine and weld performance.

The status lights for the digital control board are dual-color LED's. Normal operation for each is steady green, whereas the status light on the input control board is one color. Normal operation is for the status light to be off (and the buzzer to be off).

Error conditions are indicated in the following chart.

Observe Safety Guidelines Detailed in the Beginning of This Manual.	**STATUS LED**	
LIGHT CONDITION	**MEANING**	
	POSSIBLE DIGITAL CONTROL BOARD STATUS LIGHT	**INPUT CONTROL BOARD**
STEADY GREEN	System OK. Power source is operational and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.	NOT APPLICABLE.
BLINKING GREEN	Occurs during power up or a system reset, and indicates the Power Wave R450 is mapping (identifying) each component in the system. Normal for first 1-10 seconds after power is turned on or if the system configuration is changed during operation.	NOT APPLICABLE.
FAST BLINKING GREEN	Indicates auto-mapping has failed.	NOT APPLICABLE.

⚠ 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.		**STATUS LED**
LIGHT CONDITION	**MEANING**	
	POSSIBLE DIGITAL CONTROL BOARD STATUS LIGHT	**INPUT CONTROL BOARD**
ALTERNATING GREEN AND RED	Non-recoverable system fault. If the status lights are flashing any combination of red and green, errors are present. **Read the error code(s) before the machine is turned off.**	NOT APPLICABLE.
	Error Code interpretation through the status light is detailed in this service manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. Only active error conditions will be accessible through the status light.	
	Error codes can also be retrieved with the **Diagnostics Utility** (referred to on the **Service Navigator** DVD or available at **www.powerwavesoftware.com**). This is the preferred method, since it can access historical information contained in the error logs.	
	To clear the active error(s), turn power source off and back on to reset.	
STEADY RED	NOT APPLICABLE.	NOT APPLICABLE.
BLINKING RED	NOT APPLICABLE.	ERROR CODE INTERPRETATION - INDIVIDUAL CODE DIGITS ARE FLASHED IN RED WITH A LONG PAUSE BETWEEN DIGITS. THESE ERROR CODES ARE THREE DIGIT CODES THAT ALL START WITH A NUMBER THREE.
STATUS LED OFF	NOT APPLICABLE.	SYSTEM OK.

⚠ 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.

ERROR CODES FOR THE POWER WAVE R350

The following is a list of possible error codes for the Power Wave R450. For a complete listing consult the Power Wave Manager "Lookup Error". Observe Safety Guidelines detailed in the beginning of this manual.

INPUT CONTROL BOARD			
ERROR CODE #		**INDICATION**	**TYPE**
331	INSTANTANEOUS INPUT CURRENT LIMIT	Instantaneous input current limit has been exceeded. Typically indicates short term power overload.	PERSISTENT
334	STARTUP CURRENT CHECK FAILURE	Input current limit was exceeded during machine power-up.	PERSISTENT
335	STARTUP VOLTAGE CHECK FAILURE	Input voltage was too high or too low during machine power-up. Verify that the input voltage is between 200V and 650V.	TEMPORARY
336	THERMAL FAULT	Thermostat on primary module is tripped. Typically caused by a fan malfunction or blocked air vent. Check for proper air flow around and through the system. Verify that the thermal circuit has not been damaged or disconnected.	TEMPORARY
337	PRECHARGE TIMEOUT	The DC bus voltage was not charged to a certain level at end of precharge.	PERSISTENT
338	INPUT POWER LIMIT	The input power drawn by the machine exceeded a safe level.	PERSISTENT
339	CURRENT IMBALANCE FAULT	The current through the power modules is out of balance. Could indicate a faulty connection to a power module or a malfunctioning power module.	TEMPORARY
341	INPUT VOLTAGE DROPOUT	The input voltage momentarily dropped out. Check connections and verify quality of input power.	TEMPORARY
346	TRANSFORMER PRIMARY OVERCURRENT	Transformer current too high. Typically indicates short-term power overload.	PERSISTENT

⚠ 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.

INPUT CONTROL BOARD			
ERROR CODE #		**INDICATION**	**TYPE**
347	AVERAGE INPUT CURRENT LIMIT	Average input current limit has been exceeded. Typically indicates short term power overload.	PERSISTENT
349	BUS UNDERVOLTAGE	The DC bus voltage dropped below the allowable limit.	TEMPORARY

⚠ 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.

NOTE: Persistent errors require power to be cycled for the error to clear.
NOTE: Temporary faults will go away on their own if the error condition is removed.

Observe Safety Guidelines detailed in the beginning of this manual.

MAIN CONTROL BOARD ("STATUS" LIGHT)			
ERROR CODE #		**INDICATION**	**TYPE**
36	THERMAL ERROR	Indicates over temperature. Usually accompanied by thermal LED. Check fan operation. Be sure process does not exceed duty cycle limit of the machine. Check for proper air flow around and through the system. Verify that the thermal circuit has not been damaged or disconnected.	TEMPORARY
45	OUTPUT VOLTAGE HIGH	Welding voltage exceeded allowable limit. Check sense lead connection, voltage feedback circuits and voltage calibration. Verify that the machine is programmed with the latest firmware.	PERSISTENT
52	DSP ADC LOAD HIGH	The control board DSP is experiencing a CPU overload. Verify that the machine is programmed with the latest firmware. If problem persists, perform the ***Control Board Removal and Replacement Procedure***.	PERSISTENT
55	COMMUNICATION WITH DSP FAILED	Communication with the control board DSP failed. Verify that the machine is programmed with the latest firmware. If problem persists, perform the ***Control Board Removal and Replacement Procedure***.	PERSISTENT
54	SECONDARY (OUTPUT) OVERCURRENT ERROR	The long-term average secondary (welding) current limit has been exceeded. **NOTE**: The long-term average secondary current limit is 325A (1 phase) or 575A (3 phase).	TEMPORARY

⚠ 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.

ERROR CODE #		INDICATION	TYPE
56	CHOPPER COMMUNICATION ERROR	Indicates communication link between main control board and chopper has errors. Check the communication link between the control board and the chopper board. Isolate the machine from high frequency noise. Verify that the machine is programmed with the latest firmware. If problem persists, perform the ***Chopper Board Removal and Replacement Procedure***.	TEMPORARY
58	PRIMARY FAULT	The PFC control board is not ready. Check that board for information on what error has occurred. Verify that the PFC board is connected to the control board. Verify that the machine is programmed with the latest firmware. If problem persists, perform the ***PFC Board Removal and Replacement Procedure***.	TEMPORARY
71	SECONDARY (OUTPUT) OVERPOWER ERROR	The long-term secondary (welding) power limit has been exceeded. **NOTE**: The long-term average secondary current limit is 14 kW (1 phase) or 25 kW (3 phase).	TEMPORARY
73	FGEN ISR OVERLAP	The control board DSP is experiencing a CPU overload. Verify that the machine is programmed with the latest firmware. If problem persists, perform the ***Control Board Removal and Replacement Procedure***.	TEMPORARY

⚠ 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.

Test Procedures

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed only by 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

5/16" Nutdriver
7/16" Wrench

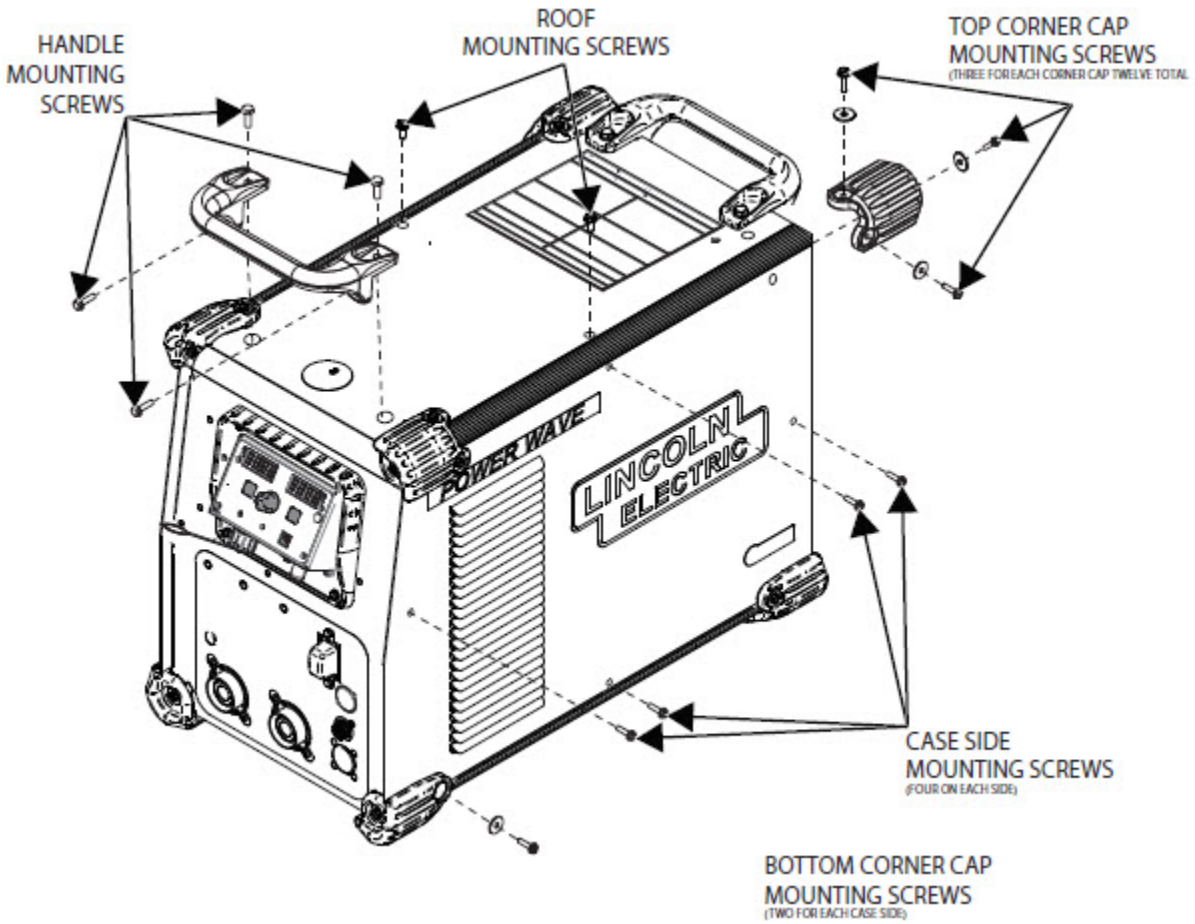
REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Using the 5/16" nutdriver, remove the three screws and flat washers securing each of the four (top) corner end caps (twelve screws and flat washers total) to the machine. See ***Figure F.1***.
   NOTE: Keep the screws and flat washers for reassembly.
3. Using a 5/16" nutdriver, remove the two screws and flat washers from the bottom corner end caps that secure each case side to the machine (four screws and flat washers total). See ***Figure F.1***.
   NOTE: Keep the screws and flat washers for reassembly.
4. Using a 5/16" nutdriver, remove the six screws securing the left case side to the machine. See ***Figure F.1***.
5. The left case side can now be removed.
6. Using a 5/16" nutdriver, remove the six screws securing the right case side to the machine. See ***Figure F.1***.
7. The right case side can now be removed.
8. Using a 7/16" nutdriver, remove the four screws and washers securing each handle to the machine (eight screws and washers total). See ***Figure F.1***.
9. Using a 5/16" nutdriver, remove the two screws securing the roof to the machine. See ***Figure F.1***.
10. Perform any tests/replacement procedures.

REPLACEMENT PROCEDURE

1. Carefully position the roof onto the machine.
2. Using a 5/16” nutdriver, attach the two screws securing the roof to the machine.
3. Carefully position each handle onto the machine.
4. Using a 7/16” nutdriver, attach the four screws and washers securing each handle to the machine (eight screws and washers total).
5. Carefully position the right case side onto the machine.
6. Using a 5/16” nutdriver, attach the six screws securing the right case side to the machine.
7. Carefully position the left case side onto the machine.
8. Using a 5/16” nutdriver, attach the six screws securing the left case side to the machine.
9. Using the 5/16” nutdriver, attach the two screws and flat washers to the bottom corner end caps that secure each case side to the machine (four screws and flat washers total).
10. Carefully position the four (top) corner end caps onto the machine.
11. Using the 5/16” nutdriver, attach the three screws and flat washers securing each of the four (top) corner end caps (twelve screws and flat washers total) to the machine.

Figure F.1 – Case Cover Mounting Screw Locations



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 help determine if the Capacitors are discharged.

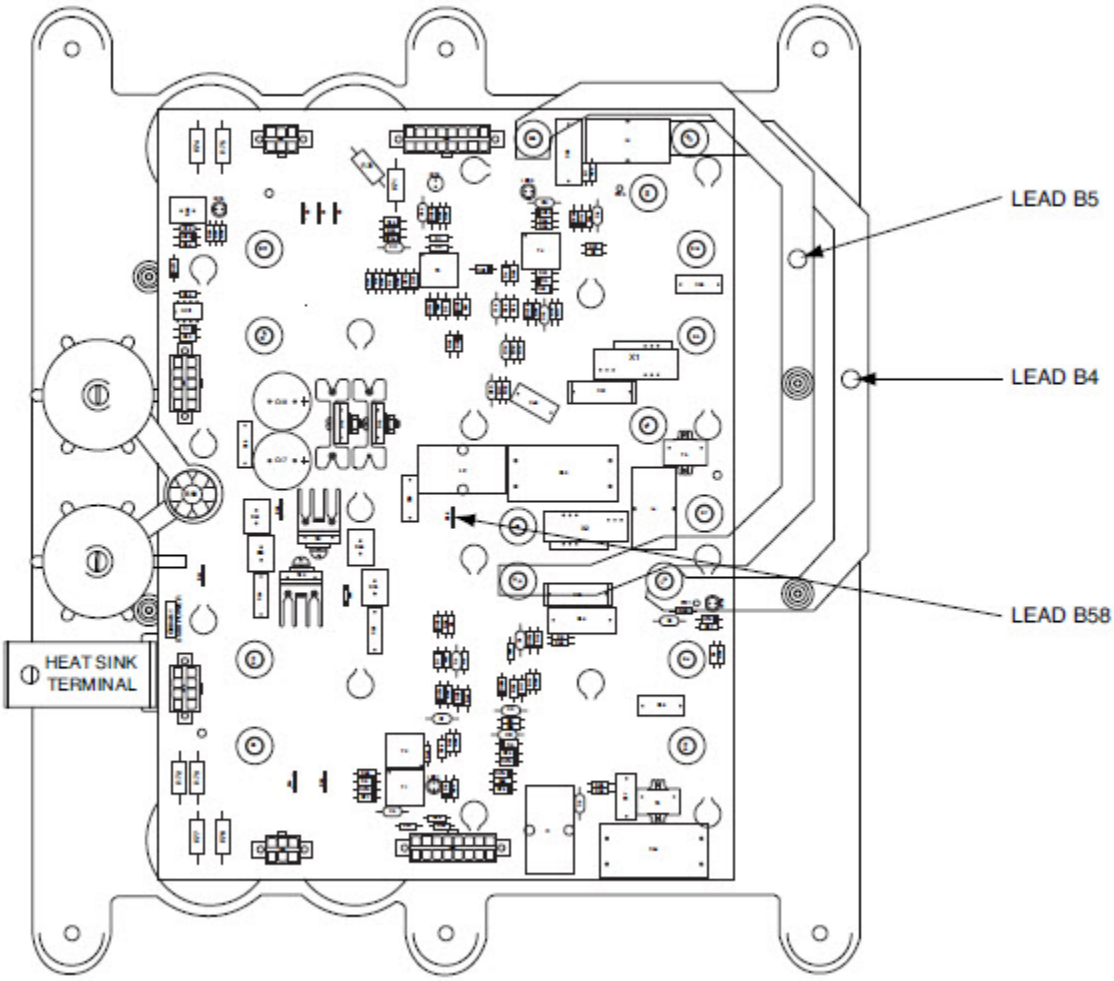
MATERIALS NEEDED

Resistor (25-1000 ohms and 25 watts minimum) - Lincoln Part #S01404-114 Works Well For This Purpose
Electrically Insulated Gloves
Electrically Insulated Pliers
Jumper Leads
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. The DC link capacitor is located on the switch board. See ***Figure F.2***. See Wiring Diagram.
4. Using a volt/ohmmeter, check the voltage across the capacitor terminals B4 (+) and B5 (-) of the DC link capacitor. See ***Figure F.2***. See Wiring Diagram.
5. If any voltage is present, using the high wattage resistor (25-1000 ohms @ 25 watts minimum), electrically insulated gloves and pliers, discharge the capacitor by holding the resistor terminals on the capacitor terminals for 10 seconds. See ***Figure F.2***. See Wiring Diagram.
   NOTE: DO NOT TOUCH THE CAPACITOR TERMINALS WITH YOUR BARE HANDS. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
6. Using a volt/ohmmeter, recheck the voltage across the capacitor terminals B4 and B5. See ***Figure F.2***. See Wiring Diagram. The voltage should be zero.
7. If any voltage remains, repeat the discharge procedure.
   NOTE: Any voltage present after discharge has been performed is an abnormal condition and may indicate a switch board problem.
8. Using a volt/ohmmeter, carefully check for DC voltage from B58 (+) to connection point B5 (-) of the DC link capacitor. See ***Figure F.2***. See Wiring Diagram.
9. If voltage is present, wait for voltage to decay before proceeding, then repeat Step 5.

Figure F.2 – Capacitor Discharge Test Point Locations



POWER FACTOR CORRECTION (PFC) CONTROL BOARD TEST PROCEDURE

Service and repair should only be performed by 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 PFC Control Board is functioning correctly. There are very high voltages present on the PFC Control Board. This test will be limited to LED and audio error codes and also resistance and diode checks with the input power removed from the machine. This test will not test all of the circuits on the board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the PFC Control Board. See ***Figure F.3***. See Wiring Diagram.
5. Carefully apply the correct input power to the Power Wave R450 machine.
6. Check for the correct operation of the LED lights on the PFC Control Board. See ***Figure F.4*** and ***Tables F.1*** and ***F.2***.
7. Carefully remove the input power to the Power Wave R450 machine.
8. Perform the ***Capacitor Discharge Procedure***.
9. If further testing is required, perform the ***PFC Control Board Removal Procedure***.
10. Using a volt/ohmmeter, perform the resistance and diode checks per ***Tables F.3*** and ***F.4*** and ***Figure F.4***.
11. When testing is complete, perform the ***PFC Control Board Replacement Procedure***.
12. Perform the ***Case Cover Replacement Procedure***.
13. Perform the ***Retest After Repair Procedure***.

Figure F.3 – PFC Control Board Location

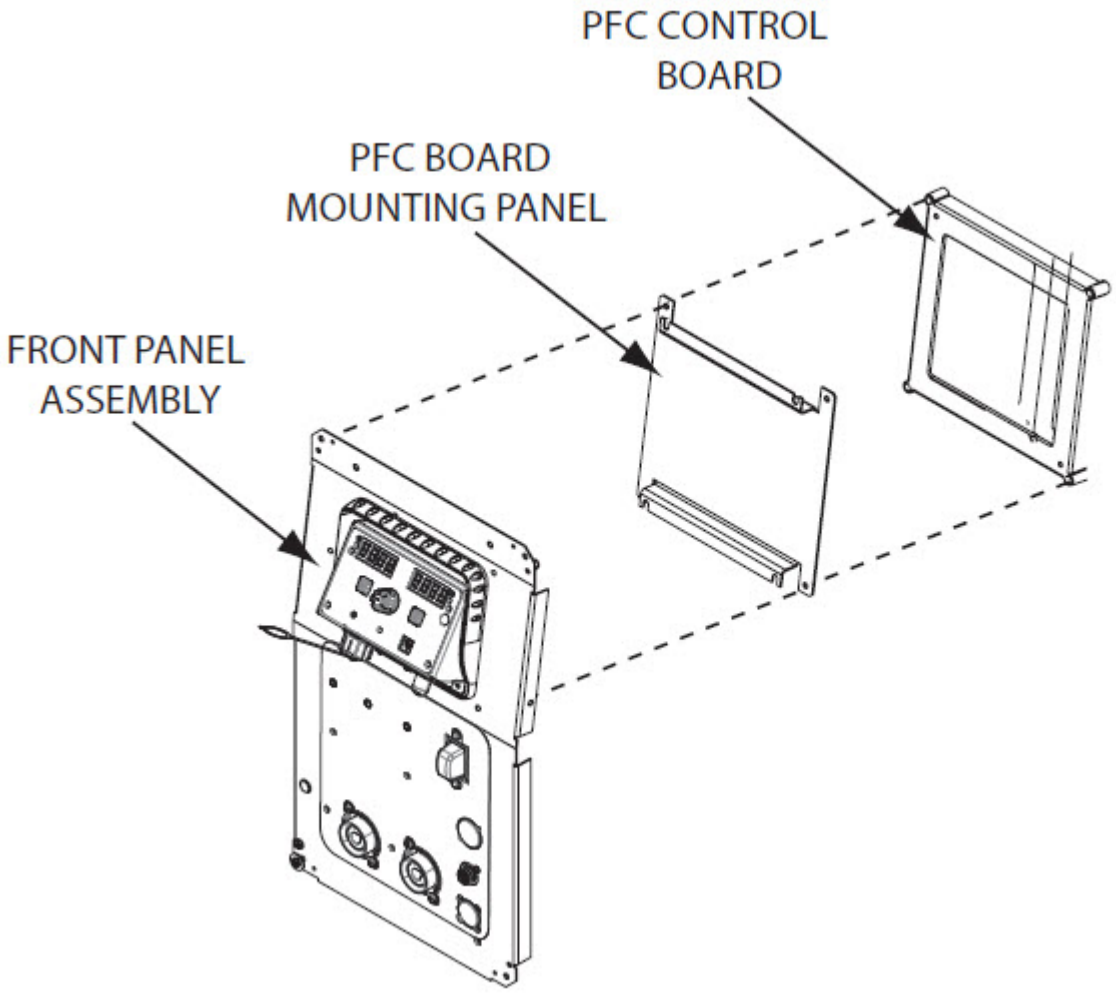


Figure F.4 – PFC Control Board LED and Test Points

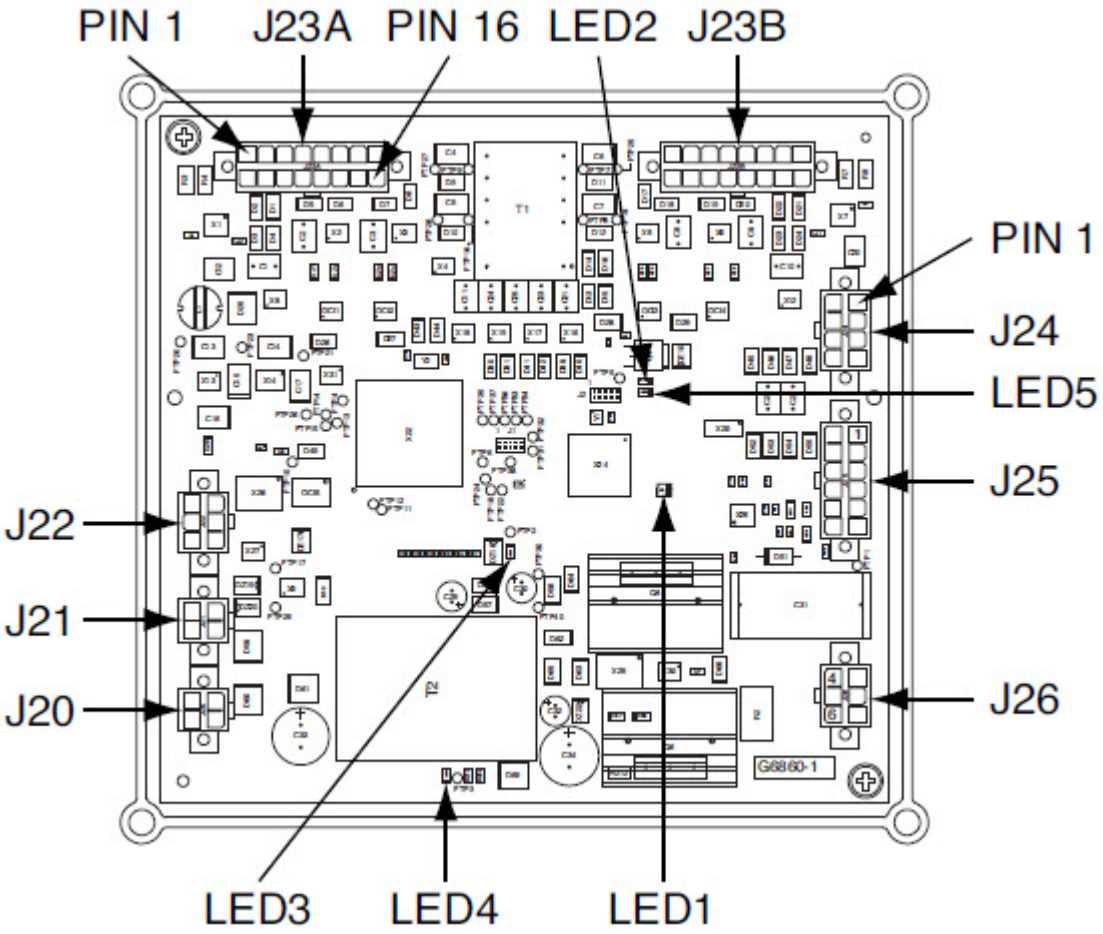


Table F.1 – PFC Control Board LED Description and Functions

LED	COLOR	FUNCTION
1	GREEN	Status is OK
2	RED/FLASHING	Error Code (Blinking)
3	RED	Fault on “B” side of bridge
4	GREEN	-15VDC present
5	GREEN	+15VDC present
6	RED	Fault on “A” side of bridge

Table F.2 – PFC Control Board Error Codes

ERROR CODE NUMBER	EXPLANATION
331	Peak input current limit
334	Start up current check failure
335	Start up current check failure
336	Thermal fault
337	Precharge failure
338	Input power limit
341	Input voltage drop-out
346	Transformer primary overcurrent
347	Average input current limit
349	Bus undervoltage

Table F.3 – PFC Control Board Resistance Checks

DESCRIPTION	METER TEST POINTS AND POLARITY	EXPECTED READINGS	CONDITIONS
INPUT POWER CIRCUIT	PLUG J26 PIN 4 (+) TO PLUG J26 PIN 6 (-)	VERY HIGH RESISTANCE. GREATER THAN 20,000 OHMS	INPUT POWER REMOVED. PLUG J26 REMOVED FROM PFC BOARD
INPUT LINE SENSING	PLUG J25 PIN 1 (+) TO PLUG J26 PIN 6 (-)	VERY HIGH RESISTANCE. GREATER THAN 500,000 OHMS	IF LOWER REPLACE THE PFC BOARD

Table F.4 – PFC Control Board Diode Checks

DESCRIPTION	POSITIVE METER LEAD	NEGATIVE METER LEAD	EXPECTED READINGS +/- 10%*
MAIN BUCK DRIVE “A”	PLUG J23A PIN 8	PLUG J23A PIN 16	0.130VDC
AUX. BUCK DRIVE “A”	PLUG J23A PIN 6	PLUG J23A PIN 14	0.130VDC
MAIN BOOST DRIVE “A”	PLUG J23A PIN 12	PLUG J25 PIN 12	0.130VDC
MAIN BOOST DRIVE “A”	PLUG J23A PIN 4	PLUG J23A PIN 12	0.130VDC
AUX. BOOST DRIVE “A”	PLUG J23A PIN 11	PLUG J25 PIN 12	0.130VDC
AUX. BOOST DRIVE “A”	PLUG J23A PIN 3	PLUG J23A PIN 11	0.130VDC
FULL BRIDGE “A”	PLUG J24 PIN 7	PLUG J25 PIN 12	0.130VDC
FULL BRIDGE “A”	PLUG J23A PIN 3	PLUG J24 PIN 7	0.130VDC
FULL BRIDGE “A”	PLUG J24 PIN 3	PLUG J25 PIN 12	0.130VDC
FULL BRIDGE “A”	PLUG J23A PIN 3	PLUG J24 PIN 3	0.130VDC
MAIN BUCK DRIVE “B”	PLUG J23B PIN 1	PLUG J23B PIN 9	0.130VDC
AUX. BUCK DRIVE “B”	PLUG J23B PIN 3	PLUG J23B PIN 11	0.130VDC
MAIN BUCK DRIVE “B”	PLUG J23B PIN 13	PLUG J25 PIN 12	0.130VDC
MAIN BUCK DRIVE “B”	PLUG J23B PIN 5	PLUG J23B PIN 13	0.130VDC
AUX. BUCK DRIVE “B”	PLUG J23B PIN 14	PLUG J25 PIN 12	0.130VDC
AUX. BUCK DRIVE “B”	PLUG J23B PIN 6	PLUG J23B PIN 14	0.130VDC
FULL BRIDGE “B”	PLUG J24 PIN 6	PLUG J25 PIN 12	0.130VDC
FULL BRIDGE “B”	PLUG J23B PIN 6	PLUG J24 PIN 6	0.130VDC
FULL BRIDGE “B”	PLUG J24 PIN 2	PLUG J25 PIN 12	0.130VDC
FULL BRIDGE “B”	PLUG J23B PIN 6	PLUG J24 PIN 2	0.130VDC

NOTE: *An open or short indicates a faulty PFC Control Board.

DIGITAL CONTROL BOARD TEST PROCEDURE

Service and repair should only be performed by 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 Digital Control Board is receiving the correct input voltage and the board is functioning properly. This test will not test all of the circuits on the board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Digital Control Board. See ***Figure F.5***. See Wiring Diagram.
5. Locate Plugs J4, J5, J8, J9, J5 and J12 on the Digital Control Board. See ***Figure F.6***. See Wiring Diagram.
6. Carefully apply the correct input voltage to the Power Wave R450 machine.
7. Check for the correct operation of the LED lights on the Digital Control Board. See ***Figure F.6*** and ***Table F.5***.
8. Using a volt/ohmmeter, perform the voltage tests per ***Table F.6***. See ***Figure F.6***.
9. Carefully remove the input power to the Power Wave R450 machine
10. Using a volt/ohmmeter, perform the resistance checks per ***Table F.7***.
11. If the correct input voltage is being applied to the Digital Control Board and the correct output voltages are not being generated, the Digital Control Board may be faulty.
12. If faulty, perform the ***Digital Control Board Removal and Replacement Procedure***.
13. Perform the ***Case Cover Replacement Procedure***.
14. Perform the ***Retest After Repair Procedure***.

Figure F.5 – Digital Control Board Location

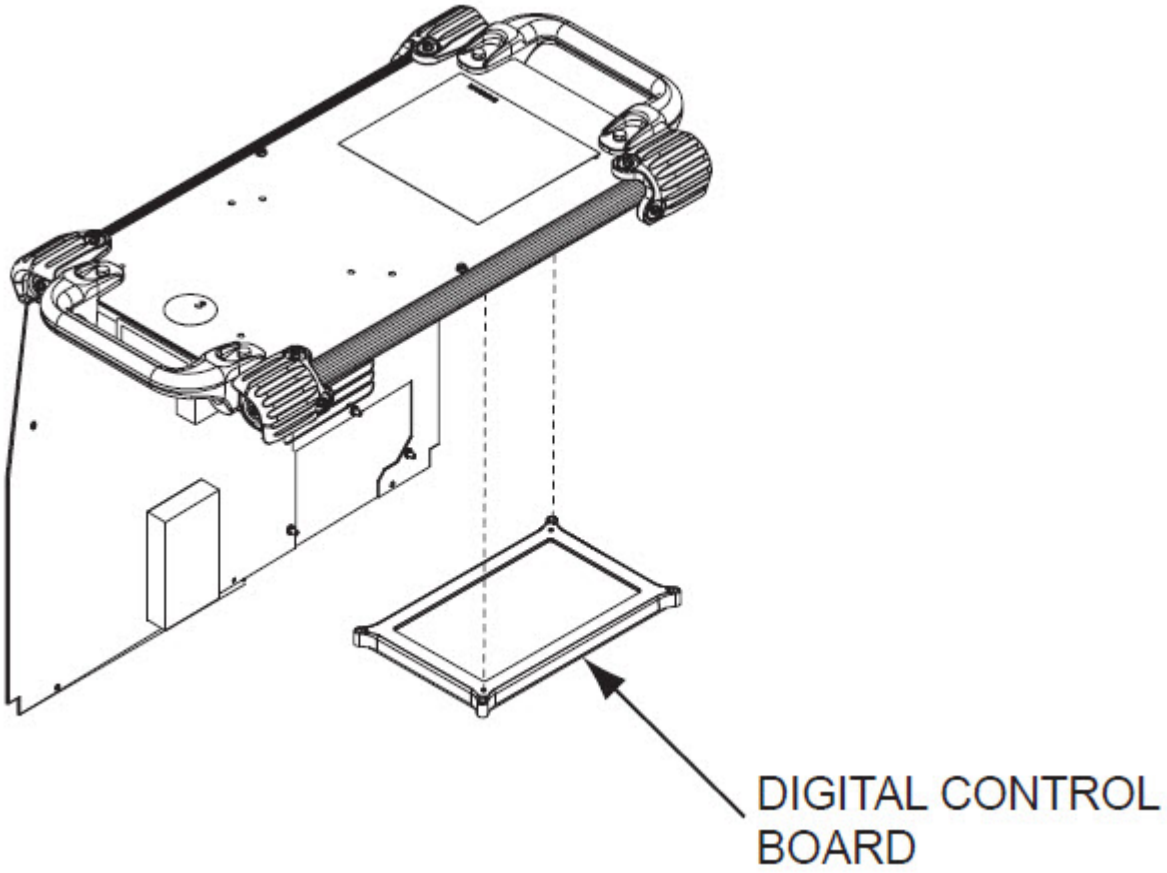


Figure F.6 – Digital Control Board LED and Test Point Locations

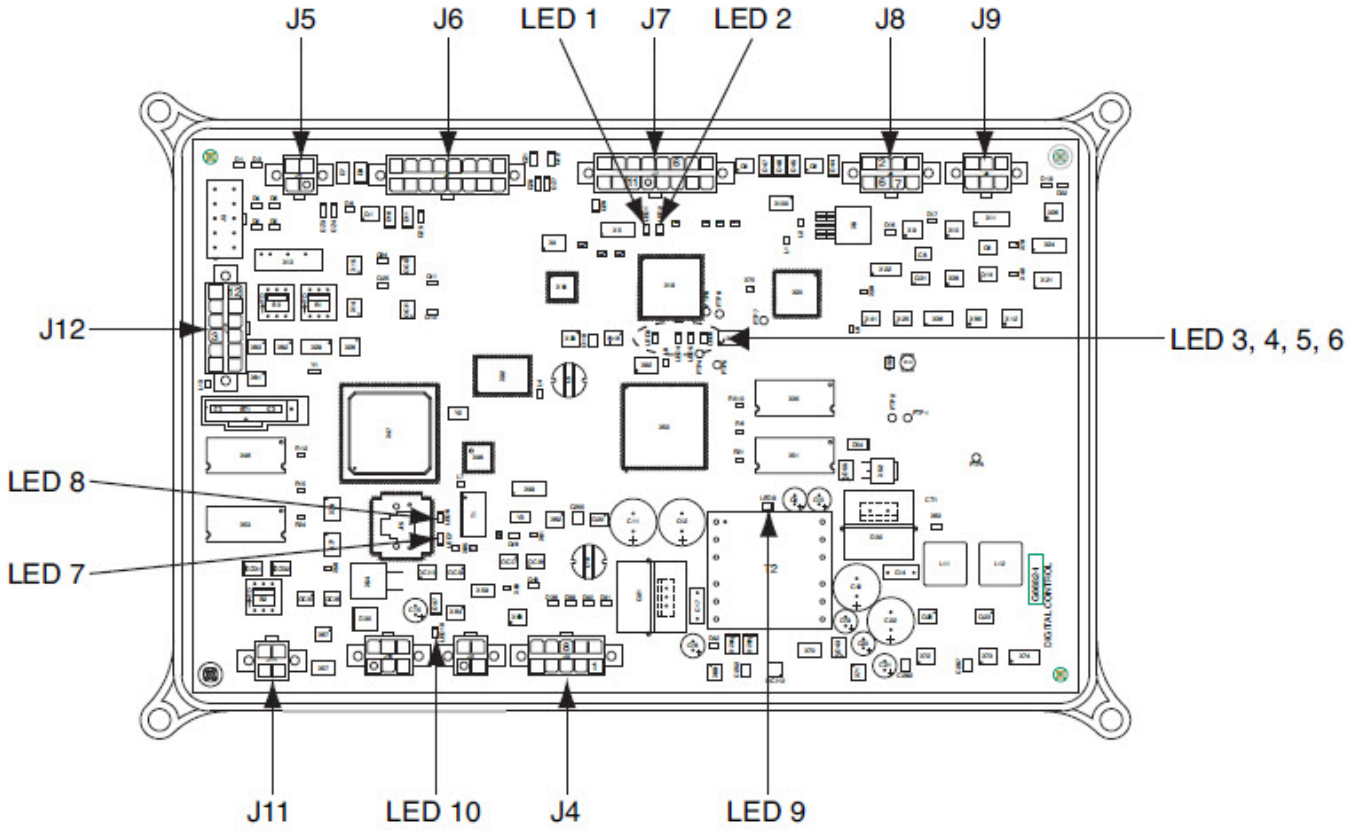


Table F.5 – Digital Control Board LED Description and Functions

LED NUMBER	COLOR	FUNCTION
1	GREEN	STATUS IS OK
2	RED	ERROR CODE (BLINKING)
3	GREEN	WELDING OUTPUT ENABLED
4	GREEN	SINGLE PHASE INPUT
5	GREEN	ELECTRODE SENSE
6	GREEN	WORK SENSE
7	GREEN	ETHERNET LINK/ACTIVITY STATUS
8	GREEN	ETHERNET SPEED STATUS
9	GREEN	INPUT SUPPLY STATUS (30VDC TO 50VDC
10	GREEN	DEVICENET ETHERNET 24VDC PRESENT

Table F.6 – Digital Control Board Voltage Test Points and Expected Readings

DESCRIPTION	TEST POINTS	LEAD NUMBERS	EXPECTED READINGS	CONDITIONS
INPUT SUPPLY FROM PFC BOARD	J4 PIN 2 TO J4 PIN 1	LEAD 356 (–) TO LEAD 358 (+)	40VDC	INPUT POWER APPLIED TO MACHINE
POWER FROM DIGITAL CONTROL BOARD TO CHOPPER BOARD	J12 PIN 12 TO J12 PIN 3	LEAD 348 (–) TO LEAD 344 (+)	5VDC	INPUT POWER APPLIED TO MACHINE
FAN CONTROL SIGNAL	J7 PIN 16 TO J7 PIN 6	LEAD 350 (–) TO LEAD 355 (+)	10VDC	INPUT POWER APPLIED AND FAN RUNNING
POWER SUPPLY TO CURRENT TRANSDUCER	J8 PIN 6 TO J8 PIN 2	LEAD 214 (–) TO LEAD 212 (+)	+15VDC	INPUT POWER APPLIED TO MACHINE
POWER SUPPLY TO CURRENT TRANSDUCER	J8 PIN 6 TO J8 PIN 3	LEAD 214 (–) TO LEAD 213 (+)	-15VDC	INPUT POWER APPLIED TO MACHINE
SUPPLY TO OPTIONAL INVERTER BOARD	J8 PIN 7 TO J4 PIN 8	LEAD 417 (–) TO LEAD 416 (+)	15VDC	INPUT POWER APPLIED TO MACHINE

Table F.7 – Digital Control Board Resistance Checks and Expected Readings

DESCRIPTION	TEST POINTS	LEAD NUMBERS	EXPECTED READINGS	CONDITIONS
CONNECTIONS TO OUTPUT TERMINALS	J9 PIN 3 TO NEGATIVE OUTPUT TERMINAL	LEAD 202 TO NEGATIVE OUTPUT TERMINAL	ZERO OHMS	NO INPUT POWER APPLIED TO MACHINE
	J9 PIN 1 TO POSITIVE OUTPUT TERMINAL	LEAD 206 TO POSITIVE OUTPUT TERMINAL	ZERO OHMS	
CONNECTIONS TO NORMALLY CLOSED THERMOSTATS	J5 PIN 2 TO J5 PIN 3	LEAD 410 TO LEAD 409	ZERO OHMS	NO INPUT POWER APPLIED TO MACHINE

OPTIONAL USER INTERFACE KIT TEST PROCEDURE

Service and repair should only be performed by 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 Optional User Interface Kit is receiving the correct input voltage and if the boards are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Optional User Interface Kit Boards. See ***Figure F.7***. See Wiring Diagram.
   NOTE: The Remote Interface Board is located on the underside of the roof panel.
5. Carefully apply the correct input power to the Power Wave R450 machine.
6. Locate Plugs J114, J111, J112 and J115 on the Remote Interface Board. See ***Figure F.8***. Also locate Plug J115 on the User Interface Board. See ***Figure F.9***. See Wiring Diagram.
7. Using a volt/ohmmeter, carefully check for the expected voltages per ***Tables F.8*** and ***F.9***.
8. If the correct input voltages are being applied to the Remote Interface Board and the correct outputs are not being generated, the Remote Interface Board may be faulty.
9. If faulty, replace the Remote Interface Board.
10. If the correct voltages are present remove the input power and perform the resistance tests per ***Table F.10***. See Wiring Diagram.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

Figure F.7 – User Interface and Remote Interface Board Locations

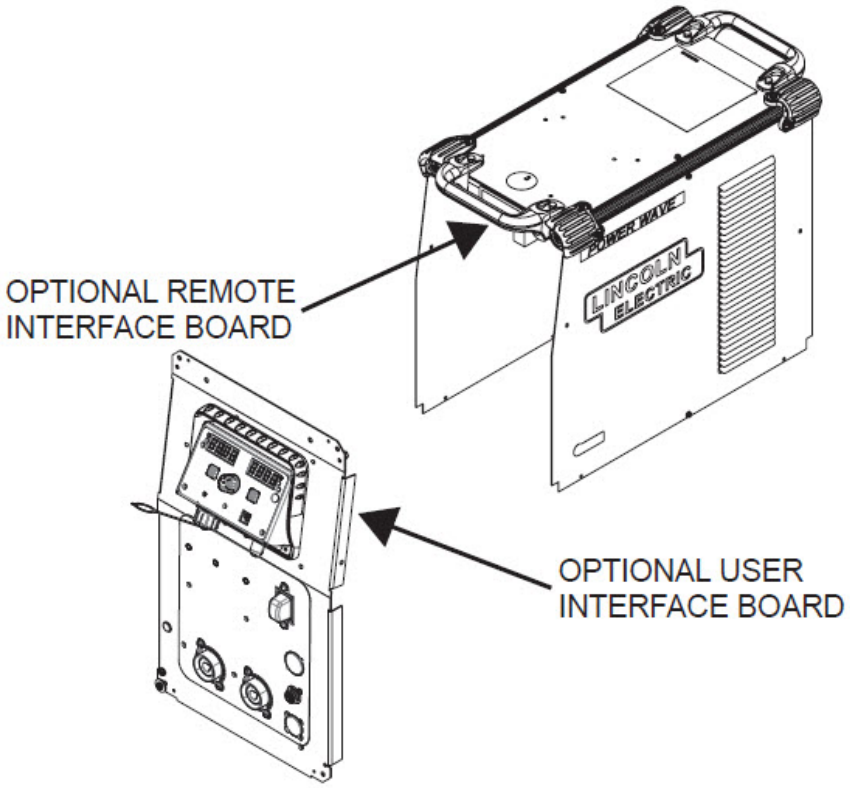


Figure F.8 – Input rectifier test point locations

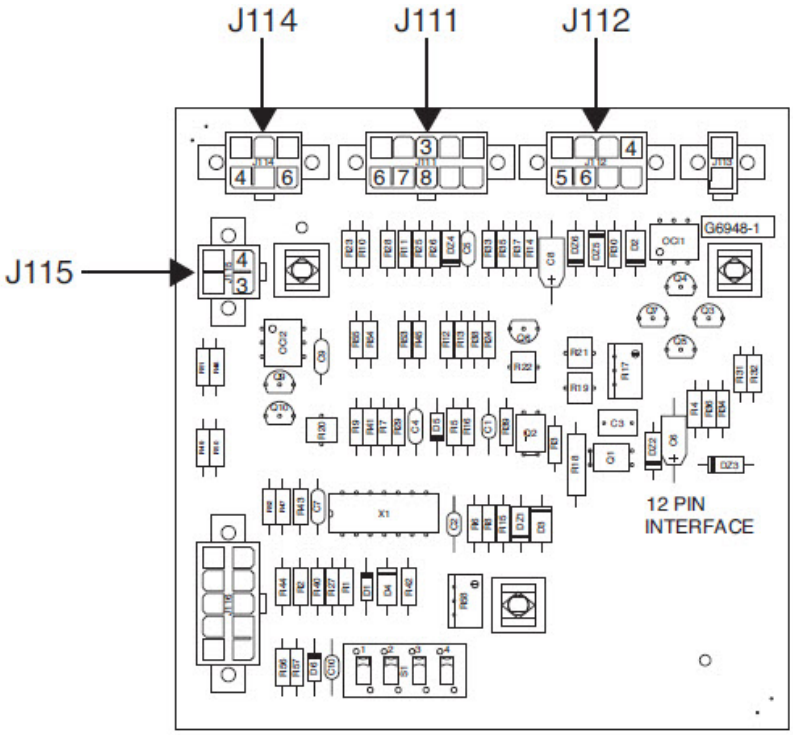


Figure F.9 – User Interface Board Test Points

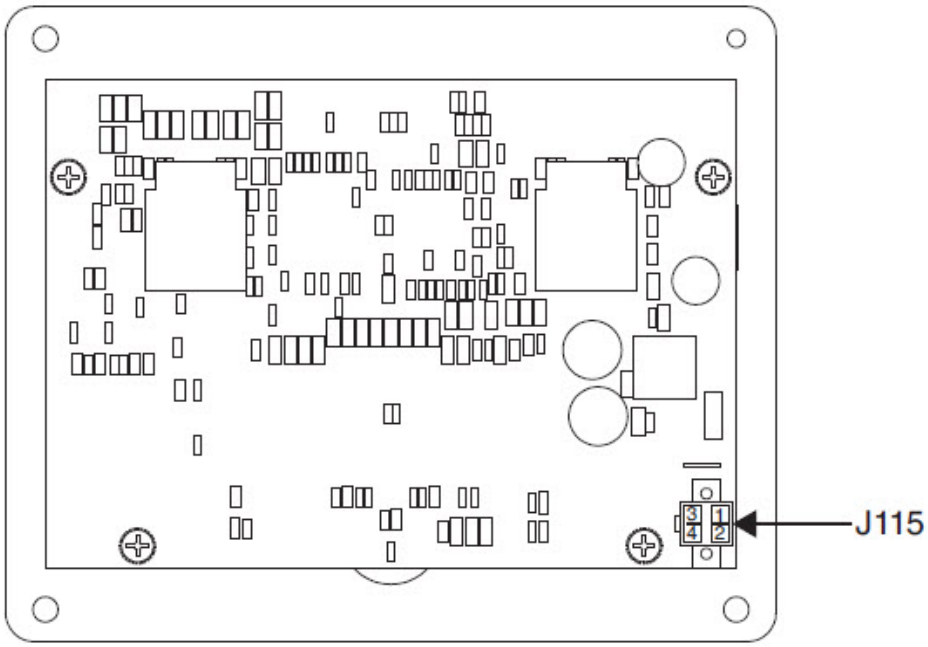


Table F.8 – Voltage Checks On Remote Interface Board

DESCRIPTION	TEST POINT METER PROBE (+)	TEST POINT METER PROBE (-)	EXPECTED READINGS	CONDITIONS
40VDC BUS SUPPLY FROM DC BUSS BOARD	PLUG J114 PIN 6 (LEAD 52C)	PLUG J114 PIN 4 (LEAD 51C)	40VDC	CORRECT INPUT POWER APPLIED TO MACHINE
40VDC FROM REMOTE INTERFACE BOARD TO S1 REMOTE RECEPTACLE	PLUG J111 PIN 8 (LEAD 52F)	PLUG J111 PIN 7 (LEAD 51F)	40VDC	CORRECT INPUT POWER APPLIED TO MACHINE
40VDC FROM REMOTE INTERFACE BOARD TO THE USER INTERFACE BOARD	PLUG J115 PIN 4 (LEAD 52D)	PLUG J115 PIN 3 (LEAD 51D)	40VDC	CORRECT INPUT POWER APPLIED TO MACHINE
15VDC TRIGGER SUPPLY FROM THE DIGITAL CONTROL BOARD	PLUG J112 PIN 6 (LEAD 373)	PLUG J112 PIN 5 (LEAD 370)	12VDC	CORRECT INPUT POWER APPLIED TO MACHINE
15VDC TRIGGER SUPPLY FROM THE REMOTE BOARD	PLUG J111 PIN 6 (LEAD 2)	PLUG J111 PIN 3 (LEAD 4)	15VDC	TRIGGER NOT ACTIVATED (OPEN)
15VDC TRIGGER SUPPLY FROM REMOTE BOARD	PLUG J111 PIN 6 (LEAD 2)	PLUG J111 PIN 3 (LEAD 4)	0VDC	TRIGGER ACTIVATED (CLOSED)
15VDC TRIGGER SUPPLY FROM REMOTE BOARD	PLUG J112 PIN 4 (LEAD 372)	PLUG J112 PIN 5 (LEAD 370)	0VDC	TRIGGER NOT ACTIVATED (OPEN)
15VDC TRIGGER SUPPLY FROM REMOTE BOARD	PLUG J112 PIN 4 (LEAD 372)	PLUG J112 PIN 5 (LEAD 370)	15VDC	TRIGGER ACTIVATED (CLOSED)

Table F.9 – Voltage Checks on User Interface Board

DESCRIPTION	TEST POINT METER PROBE (+)	TEST POINT METER PROBE (-)	EXPECTED READING	CONDITIONS
40VDC SUPPLY FROM REMOTE BOARD	PLUG J115 PIN 4 (LEAD 52D)	PLUG J115 PIN 3 (LEAD 51D)	40VDC	CORRECT INPUT POWER APPLIED TO MACHINE

Table F.10 – Resistance Checks

DESCRIPTION	TEST POINT METER PROBE (+)	TEST POINT METER PROBE (-)	EXPECTED READINGS	CONDITIONS
CONTINUITY CHECK FROM PLUG J111 TO 12 PIN S1 RECEPTACLE	PLUG J111 PIN 5 (LEAD 75)	S1 RECEPTACLE PIN C (LEAD 75)	ZERO OHMS	POWER TO MACHINE REMOVED
CONTINUITY CHECK FROM PLUG J111 TO 12 PIN S1 RECEPTACLE	PLUG J111 PIN 4 (LEAD 76)	S1 RECEPTACLE PIN D (LEAD 76)	ZERO OHMS	POWER TO MACHINE REMOVED
CONTINUITY CHECK FROM PLUG J111 TO 12 PIN S1 RECEPTACLE	PLUG J111 PIN 1 (LEAD 77)	S1 RECEPTACLE PIN E (LEAD 77)	ZERO OHMS	POWER TO MACHINE REMOVED
CONTINUITY CHECK FROM PLUG J115 ON REMOTE BOARD TO PLUG J115 ON USER INTERFACE BOARD	PLUG J115 PIN 1 (LEAD 53D)	PLUG J115 PIN 1 (LEAD 53D)	ZERO OHMS	POWER TO MACHINE REMOVED
CONTINUITY CHECK FROM PLUG J115 ON REMOTE BOARD TO PLUG J115 ON USER INTERFACE BOARD	PLUG J115 PIN 2 (LEAD 54D)	PLUG J115 PIN 2 (LEAD 54D)	ZERO OHMS	POWER TO MACHINE REMOVED
CONTINUITY CHECK FROM PLUG J115 ON REMOTE BOARD TO PLUG J115 ON USER INTERFACE BOARD	PLUG J115 PIN 3 (LEAD 51D)	PLUG J115 PIN 3 (LEAD 51D)	ZERO OHMS	POWER TO MACHINE REMOVED
CONTINUITY CHECK FROM PLUG J115 ON REMOTE BOARD TO PLUG J115 ON USER INTERFACE BOARD	PLUG J115 PIN 4 (LEAD 52D)	PLUG J115 PIN 4 (LEAD 52D)	ZERO OHMS	POWER TO MACHINE REMOVED

POWER CONVERSION ASSEMBLY TEST PROCEDURE

Service and repair should only be performed by 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 "power section" of the Power Conversion Assembly is functioning properly. This test will NOT indicate if the entire PC Board is functional.

MATERIALS NEEDED

1/2" Wrench
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Power Conversion Assembly. See ***Figure F.10***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the Power Conversion diode tests per ***Table F.11*** and ***Figure F.11***. See Wiring Diagram.
   NOTE: When diode test is complete make sure all internal leads are connected before applying input power to the machine.
6. Locate the five Green LEDs on the Power Conversion Assembly. See ***Figure F.12***. See Wiring Diagram.
7. Carefully apply the correct three phase input power to the Power Wave R450 machine.
8. Check the Buck/Boost Circuits using the LED ***Table F.12***. See ***Figure F.12***.
9. Using a volt/ohmmeter, perform the voltage tests per ***Table F.13***. See ***Figure F.12***. See Wiring Diagram.
10. Remove the input power to the Power Wave R450 machine.
11. If any of the tests fail, the Power Conversion Assembly may be faulty.
12. If faulty, perform the ***Power Conversion Board Assembly Removal and Replacement Procedure***.
13. Perform the ***Case Cover Replacement Procedure***.
14. Perform the ***Retest After Repair Procedure***.

Figure F.10 – Power Conversion Assembly Location

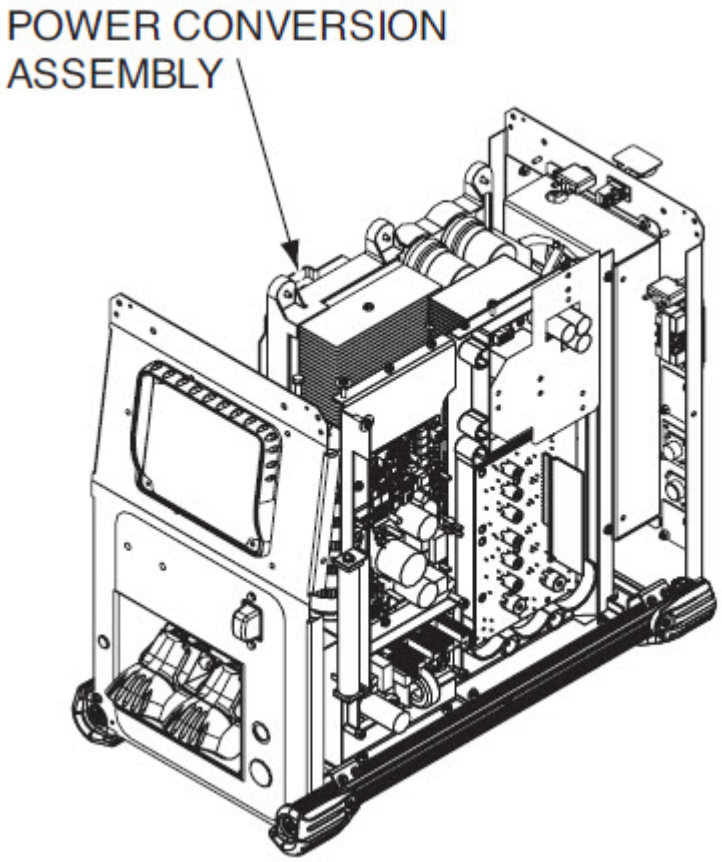
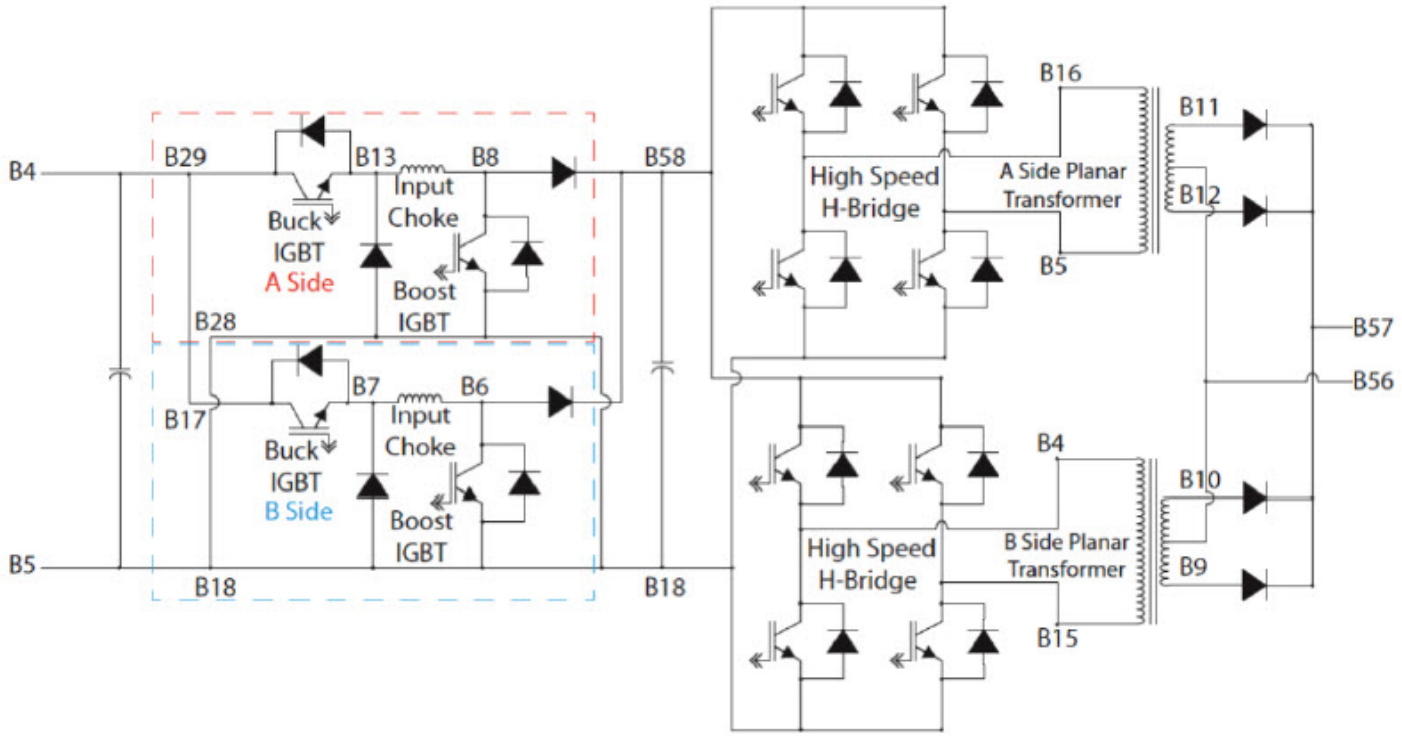


Table F.11 – Diode Tests

NOTE: Make sure the input power is removed from the Power Wave® S500 and the three leads are removed from terminal B56 and electrically isolated from each other. See ***Figure F.11***. When test is complete reconnect the three leads to terminal B56.



TEST DESCRIPTION	POSITIVE METER LEAD	NEGATIVE METER LEAD	MEASURED LEAD
SIDE A BUCK IGBT	B13	B29	0.395 (+/- 10%)
SIDE A BOOST IGBT	B28	B8	0.395 (+/- 10%)
SIDE A HIGH SPEED H-BRIDGE	B16	B58	0.395 (+/- 10%)
	B5	B58	0.395 (+/- 10%)
	B28	B16	0.395 (+/- 10%)
	B28	B5	0.395 (+/- 10%)
SIDE B BUCK IGBT	B7	B17	0.395 (+/- 10%)
SIDE B BOOST IGBT	B18	B6	0.395 (+/- 10%)
SIDE B HIGH SPEED H-BRIDGE	B4	B58	0.395 (+/- 10%)
	B15	B58	0.395 (+/- 10%)
	B18	B4	0.395 (+/- 10%)
	B18	B15	0.395 (+/- 10%)
OUTPUT RECTIFIER	B11	B57	0.335 (+/- 10%)
	B12	B57	0.335 (+/- 10%)
	B9	B57	0.335 (+/- 10%)
	B10	B57	0.335 (+/- 10%)

Figure F.11 – Power Conversion Assembly Diode Test Points

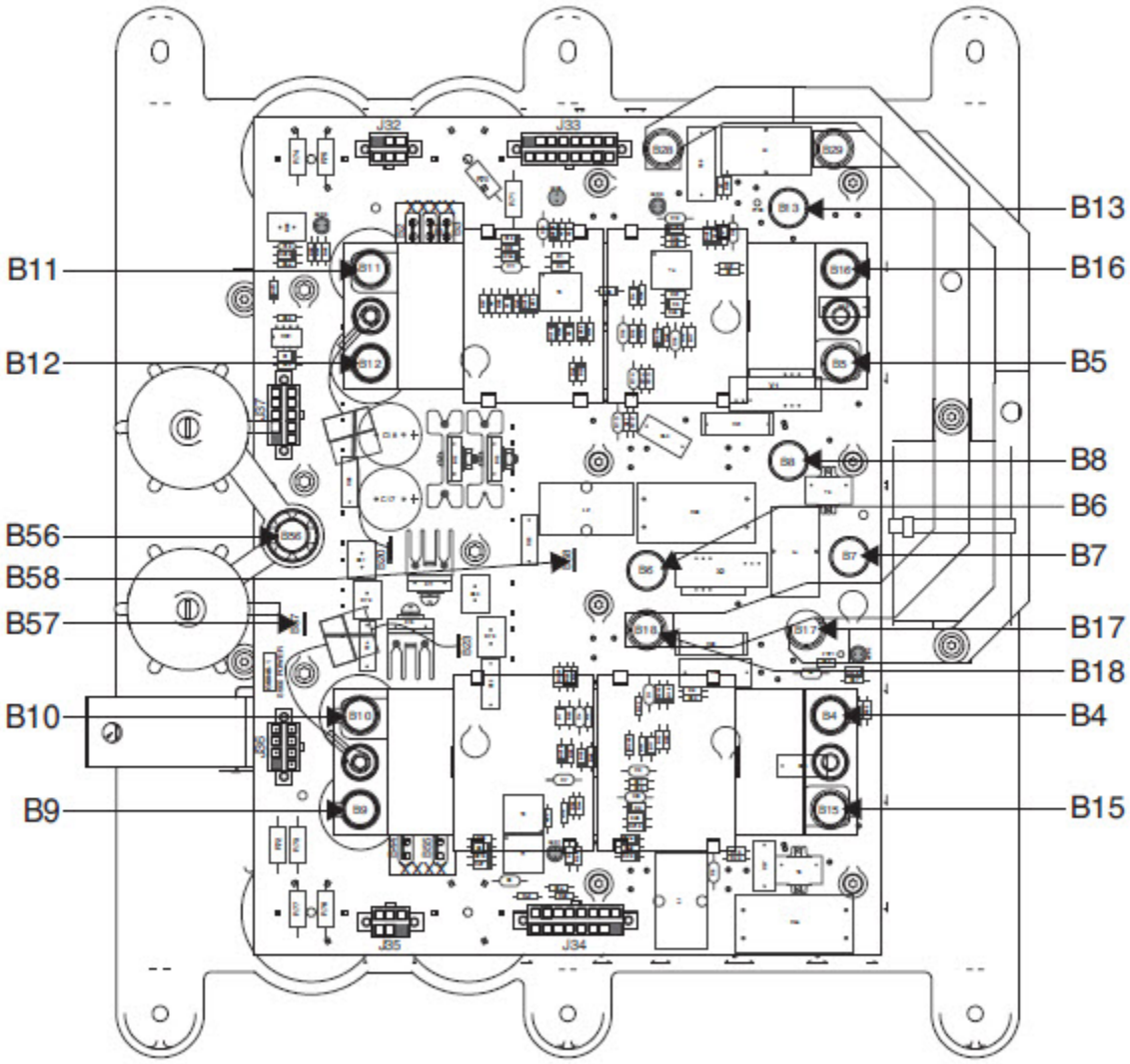


Figure F.12 – Power Conversion Assembly Voltage Check Test Points

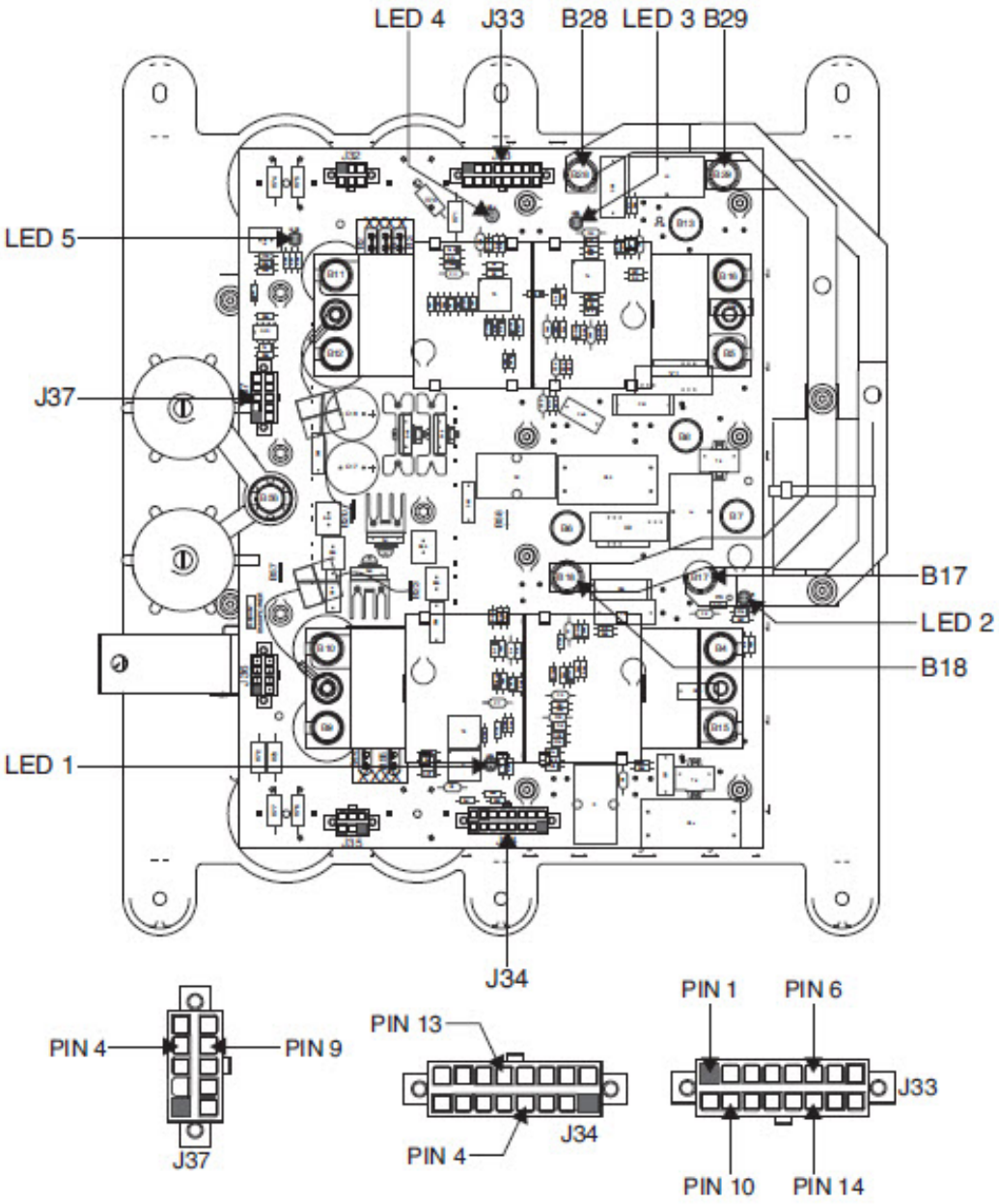


Table F.12 – Power Conversion LED Legend

LED NUMBER	DESCRIPTION	CONDITIONS	LED STATUS
LED 1	BOTTOM BOOST IGBT DRIVE	INPUT POWER (472VAC) APPLIED AND MACHINE “ON”	OFF
LED 2	BOTTOM BUCK IGBT DRIVE	INPUT POWER (472VAC) APPLIED AND MACHINE “ON”	ON
LED 3	TOP BUCK IGBT DRIVE	INPUT POWER (472VAC) APPLIED AND MACHINE “ON”	ON
LED 4	TOP BOOST IGBT DRIVE	INPUT POWER (472VAC) APPLIED AND MACHINE “ON”	OFF
LED 5	+48VDC AUXILIARY	INPUT POWER (472VAC) APPLIED AND MACHINE “ON”	ON

LED NUMBER	DESCRIPTION	CONDITIONS	LED STATUS
LED 1	BOTTOM BOOST IGBT DRIVE	INPUT POWER (255VAC) APPLIED AND MACHINE “ON”	ON
LED 2	BOTTOM BUCK IGBT DRIVE	INPUT POWER (255VAC) APPLIED AND MACHINE “ON”	ON
LED 3	TOP BUCK IGBT DRIVE	INPUT POWER (255VAC) APPLIED AND MACHINE “ON”	ON
LED 4	TOP BOOST IGBT DRIVE	INPUT POWER (255VAC) APPLIED AND MACHINE “ON”	ON
LED 5	+48VDC AUXILIARY	INPUT POWER (255VAC) APPLIED AND MACHINE “ON”	ON

Table F.13 – Power Conversion Assembly Voltage Tests

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READINGS	CONDITIONS
INPUT TO TOP BUCK/BOOST CIRCUIT	B29(+)	B28(–)	635VDC	472VAC INPUT AND MACHINE “ON”
INPUT TO BOTTOM BUCK/BOOST CIRCUIT	B17(+)	B18(–)	635VDC	472VAC INPUT AND MACHINE “ON”
OUTPUT OF BUCK/BOOST CIRCUITS	J33 PIN 1 (+)	J33 PIN 10 (–)	402VDC	472VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE TOP BUCK/BOOST LEM	J33 PIN 6 (+)	J33 PIN 10 (–)	+15VDC	472VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE TOP BUCK/BOOST LEM	J33 PIN 14 (+)	J33 PIN 10 (–)	–15VDC	472VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE BOTTOM BUCK / BOOST LEM	J34 PIN 13 (+)	J33 PIN 10 (–)	+15VDC	472VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE BOTTOM BUCK / BOOST LEM	J34 PIN 4 (+)	J33 PIN 10 (–)	–15VDC	472VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE DC BUS BOARD	J37 PIN 4 (+)	J37 PIN 9 (–)	+48VDC	472VAC INPUT AND MACHINE “ON”

MULTI-PHASE OUTPUT CHOKE TEST PROCEDURE

Service and repair should only be performed by 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 Multi-Phase Choke Coils are not open and are not ground or shorted together.

MATERIALS NEEDED

7/16” Wrench
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Multi-Phase Chopper Board. See ***Figure F.13***. See Wiring Diagram.
5. Using a 7/16” wrench, label and disconnect leads BL1, BL2, BL3, BL4, BL5 and BL6 from the Chopper Board. See ***Figure F.14***. See Wiring Diagram.
   NOTE: Save the bolts and lock washers for reassembly.
6. Label and disconnect the six Output Choke leads from the negative bus bar. See ***Figure F.14***. See Wiring Diagram.
   NOTE: The choke leads are connected in pairs. The same lead pairs must be reconnected to each other on the bus bar.
7. Using a volt/ohmmeter, check the continuity of each of the individual choke coils. See Wiring Diagram.
   NOTE: The resistance should be less than 0.5 ohms of resistance. Also, when all of the individual choke coils are separated they should NOT have continuity to each other. See Wiring Diagram.
8. Using a volt/ohmmeter, check the individual choke coils to ground. There should be a minimum of 500,000 ohms of resistance to ground. See Wiring Diagram.
9. When testing is complete, reconnect all of the leads to the correct terminals and tighten securely. See ***Figure F.14***. See Wiring Diagram.
10. Perform the ***Case Cover Replacement Procedure***.

Figure F.13 – Test Component Locations

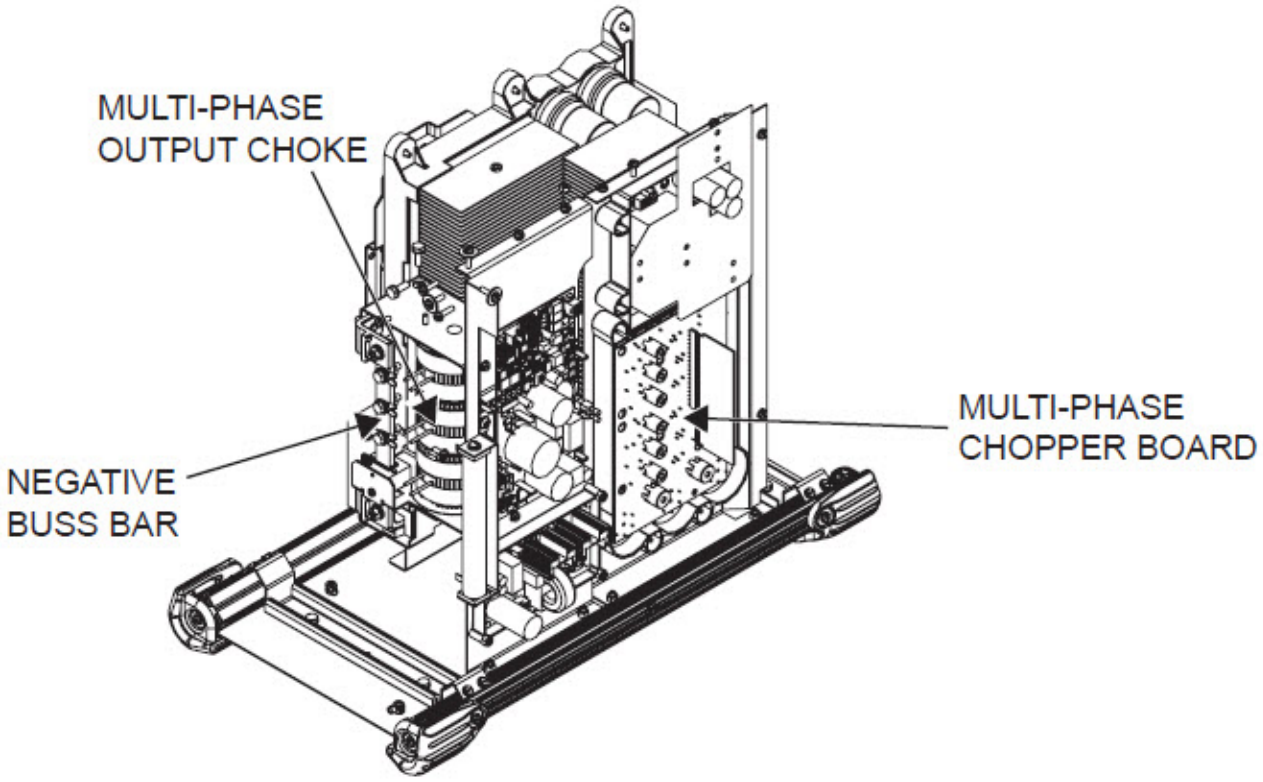
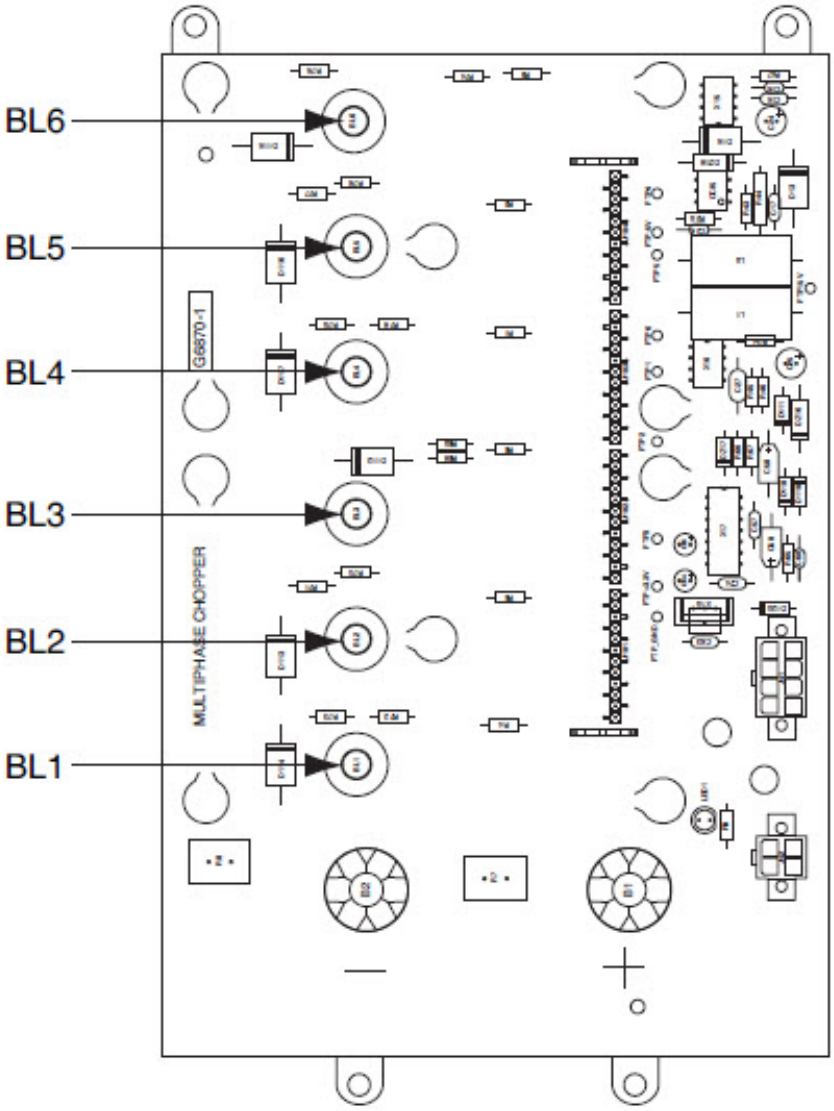


Figure F.14 – Multi-Phase Output Chopper Board Lead Locations



CURRENT TRANSDUCER TEST PROCEDURE

Service and repair should only be performed by 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 Current Transducers are receiving the correct input voltages and are producing the correct feedback voltages.

MATERIALS NEEDED

Laptop Computer
Power Wave Manager Software (Diagnostic Utilities Software)
Ethernet Cross Connect Cable (LE Co. #M19969-7)
Resistive Load Bank (Optional 50 ft. 4/0 Weld Cable)
Calibrated Ammeter
Volt/Ohmmeter
Wiring Diagram

NOTE: The Diagnostic Utility Software is on the Utilities Disc that was shipped with the machine. It can also be accessed from the Lincoln Service Navigator or downloaded from the web at www.Powerwavemanager.com.

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Multi-Phase Output Choke assembly and two Current Transducers. See ***Figure F.15***. See Wiring Diagram.
5. Locate plug J8 on the Digital Control Board. See ***Figure F.16***. See Wiring Diagram.
6. Locate plug J42 on the Multi-Phase Chopper Board. See ***Figure F.17***. See Wiring Diagram.
7. Carefully apply the correct input power to the Power Wave R450.
8. Using a volt/ohmmeter, perform the voltage tests per ***Table F.14***.
   NOTE: Do not attempt to check the voltages at the current transducers' connector. The terminals are small and delicate and may be damaged if probed with meter leads.

For the following steps refer to the information in the Diagnostic Utility found on the Lincoln Service Navigator or at *www.Powerwavemanager.com*.

9. Using the Ethernet cross connect cable, connect a laptop computer to the Power Wave R450 via the Ethernet port located at the top rear of the machine.
10. Connect a resistive load bank (or 50 ft. weld cable) to the positive and negative output terminals on the Power Wave R450. See Wiring Diagram.
11. Using the Diagnostic Utility Software:
    A. Establish communication with the Power Wave R450.
    B. Select the "Calibrate" tab.
    C. Select the "50 amp" current set point.
    D. Select "Turn Output On".
    E. Use an external calibrated ammeter that is not affected by inverter noise to read the actual current.
12. Check the current transducer's feedback voltage at the Digital Control Board plug J8 and Multi-Phase Chopper Board plug J42 per ***Table F.15***. See ***Figures F.16*** and ***F.17*** for pin locations. See Wiring Diagram.
13. Repeat the test at several other current levels. If the transducers' feedback voltages are correct for the actual current, the transducers are functioning properly. If there is no feedback voltage, check the wiring from the PC boards and the current transducers. See Wiring Diagram.
14. If the supply voltages are correct per ***Table F.14*** but the current transducers' feedback voltages are incorrect, the current transducers or wiring from the current transducers to the Digital Control Board may be defective. See Wiring Diagram.
15. Click on "Turn Output Off".
16. Disconnect the laptop computer.
17. Remove the input power to the Power Wave R450 machine.
18. Perform the ***Case Cover Replacement Procedure***.

Figure F.15 – Current Transducer Test Component Locations

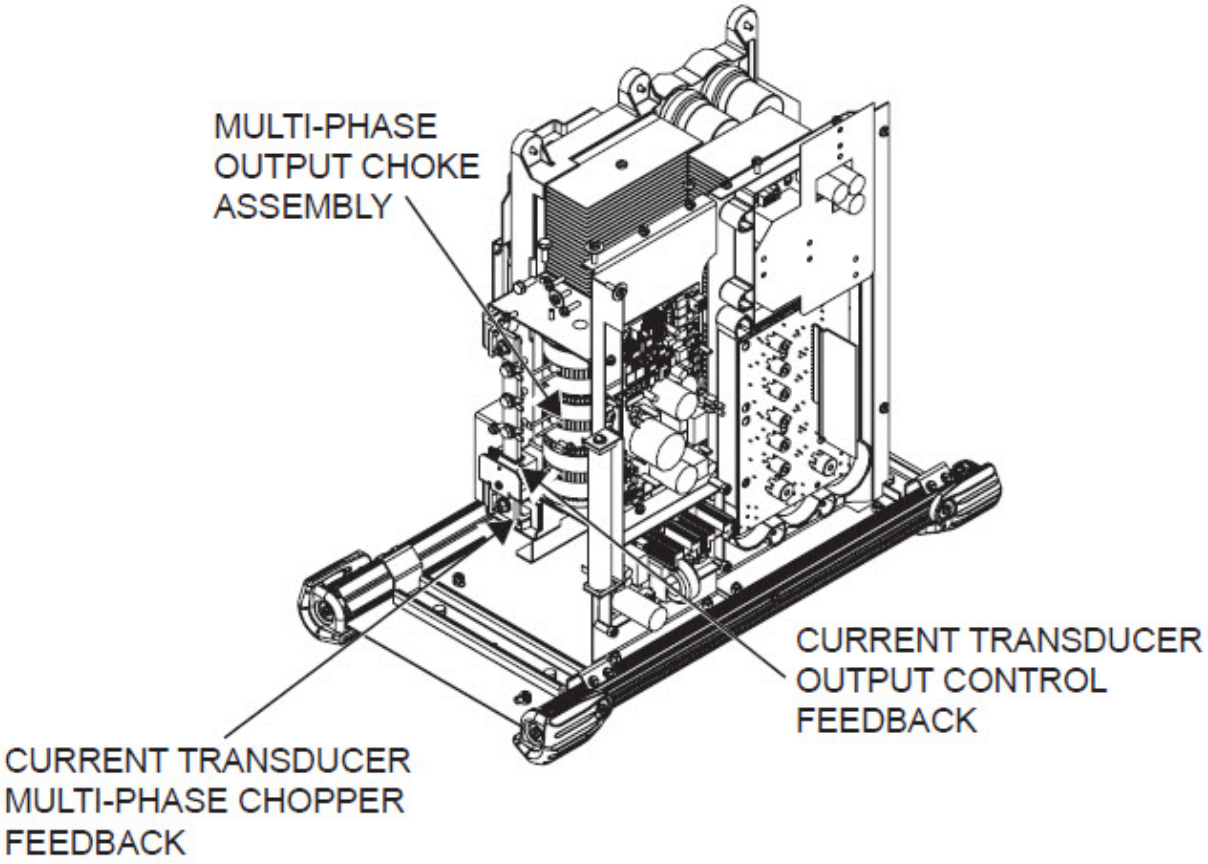


Figure F.16 – Digital Control Board Test Points

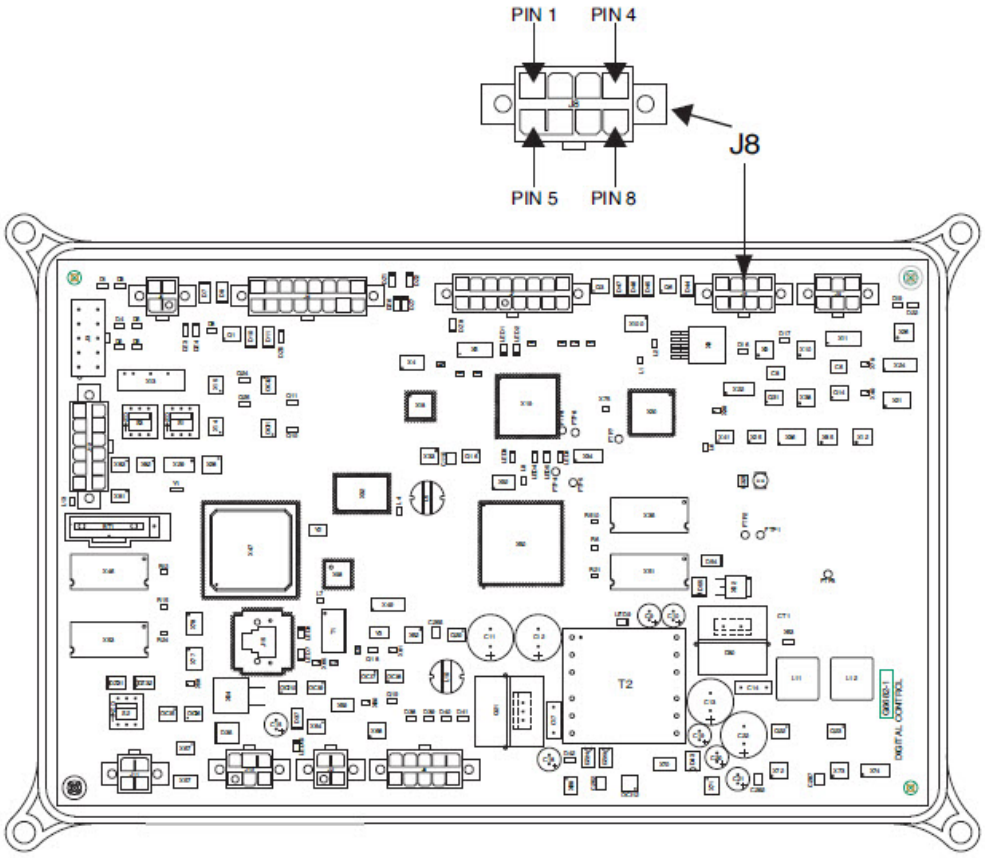


Figure F.17 – Multi-Phase Chopper Board Test Points

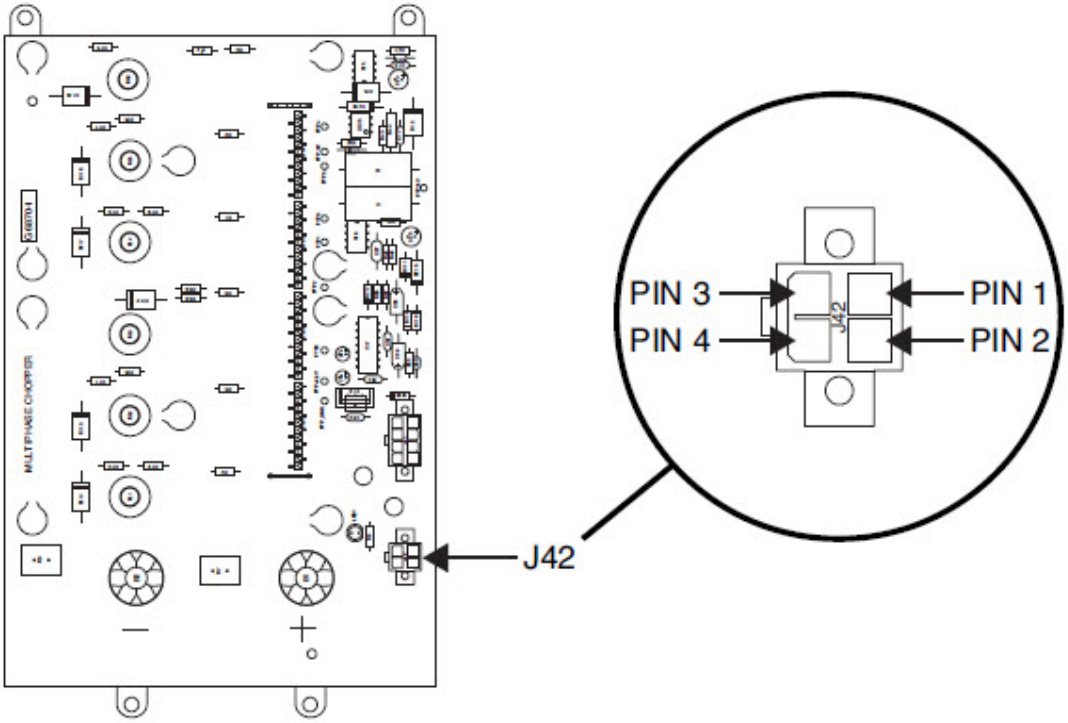


Table F.14 – Current Transducers Supply Voltage Checks

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READINGS	CONDITIONS
SUPPLY VOLTAGE TO MULTI-PHASE CHOPPER TRANSDUCER	J42 PIN 1 LEAD 216	J42 PIN 4 LEAD 218	+15VDC	MACHINE "ON"
SUPPLY VOLTAGE TO MULTI-PHASE CHOPPER TRANSDUCER	J42 PIN 2 LEAD 217	J42 PIN 4 LEAD 218	–15VDC	MACHINE "ON"
SUPPLY VOLTAGE TO MULTI-PHASE CHOPPER TRANSDUCER	J8 PIN 2 LEAD 212	J8 PIN 6 LEAD 214	+15VDC	MACHINE "ON"
SUPPLY VOLTAGE TO MULTI-PHASE CHOPPER TRANSDUCER	J8 PIN 3 LEAD 213	J8 PIN 6 LEAD 214	–15VDC	MACHINE "ON"

Table F.15 – Current Transducers Feedback Voltage Checks

Multi-Phase Chopper Transducer

OUTPUT CURRENT (AMPS)	TEST POINT	TEST POINT	EXPECTED READING
500	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	4.0VDC
450	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	3.6VDC
400	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	3.2VDC
350	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	2.8VDC
300	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	2.4VDC
250	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	2.0VDC
200	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	1.6VDC
150	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	1.2VDC
100	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	0.8VDC
50	J42 PIN 3 LEAD 215	J42 PIN 4 LEAD 218	0.4VDC

Output Control Transducer

OUTPUT CURRENT (AMPS)	TEST POINT	TEST POINT	EXPECTED READING
500	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	4.0VDC
450	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	3.6VDC
400	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	3.2VDC
350	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	2.8VDC
300	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	2.4VDC
250	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	2.0VDC
200	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	1.6VDC
150	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	1.2VDC
100	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	0.8VDC
50	J8 PIN 1 LEAD 211	J8 PIN 6 LEAD 214	0.4VDC

40V DC BUS BOARD TEST PROCEDURE

Service and repair should only be performed by 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 40V DC Bus Board is receiving the correct input voltage and is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the 40V DC Bus Board. See ***Figure F.18***. See Wiring Diagram.
5. Carefully apply the correct input voltage to the Power Wave R450 machine.
6. Locate the red LED on the 40V DC Bus Board. See ***Figure F.19***. See Wiring Diagram.
7. If the red LED is bright red and lit steadily (not blinking), the 40V DC Bus Board is receiving 48VDC voltage from the Power Conversion Assembly and is OK.
8. If the red LED is blinking, remove the input power and carefully disconnect plug J47 from the 40V DC Bus Board. See ***Figure F.19***. When power is reapplied, if the red LED is bright and steady, check leads 65A and 66 for a heavy load or short on leads 51, 51A, 52 and 52A. See Wiring Diagram.
9. If the red LED is not lit check circuit breaker CB2 located on the case back. Reset if tripped.
10. Using a volt/ohmmeter, perform the voltage tests per ***Table F.16***. See ***Figure F.19***.
11. If the correct input voltage is being applied to the 40V DC Bus Board and the output voltages are not correct or missing, the 40V DC Bus Board may be faulty.
12. If faulty, perform the ***40V DC Bus Board Removal and Replacement Procedure***.
13. Perform the ***Case Cover Replacement Procedure***.
14. Perform the ***Retest After Repair Procedure***.

Figure F.18 – 40 Volt DC Bus Board Location

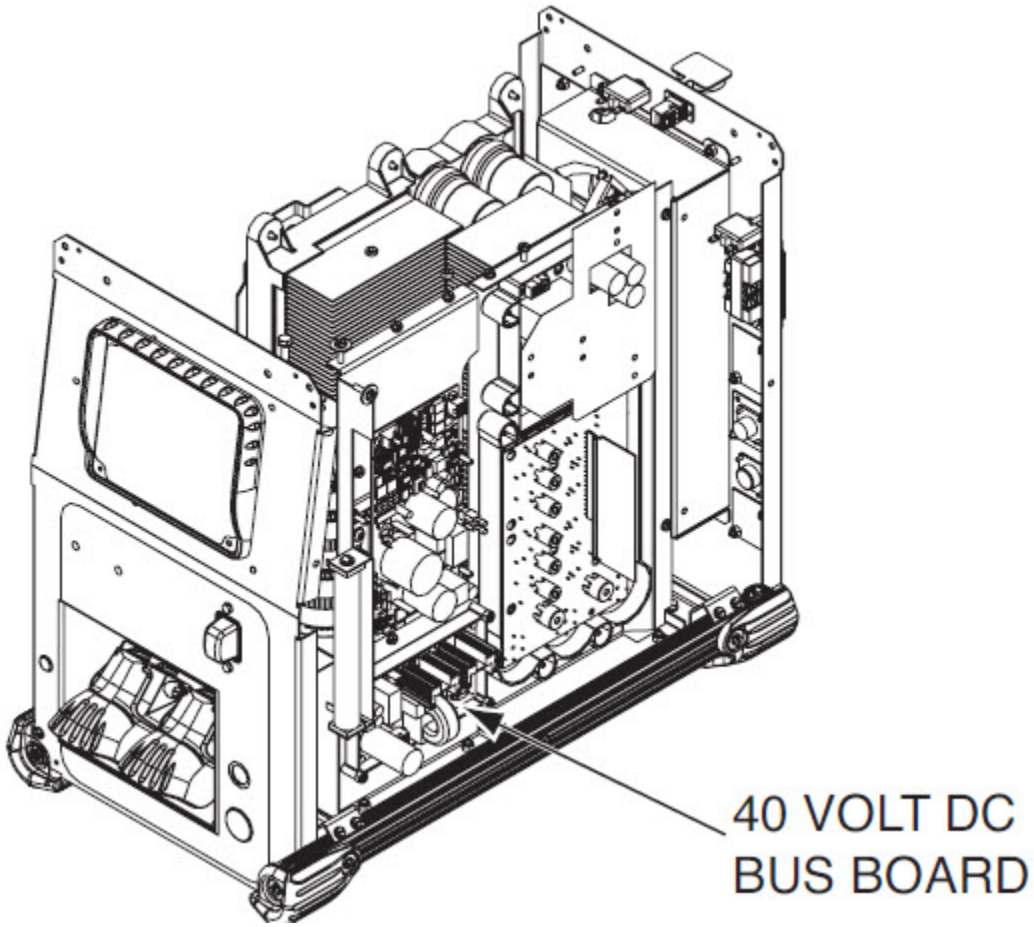


Figure F.19 – 40 Volt DC Bus Board Test Points

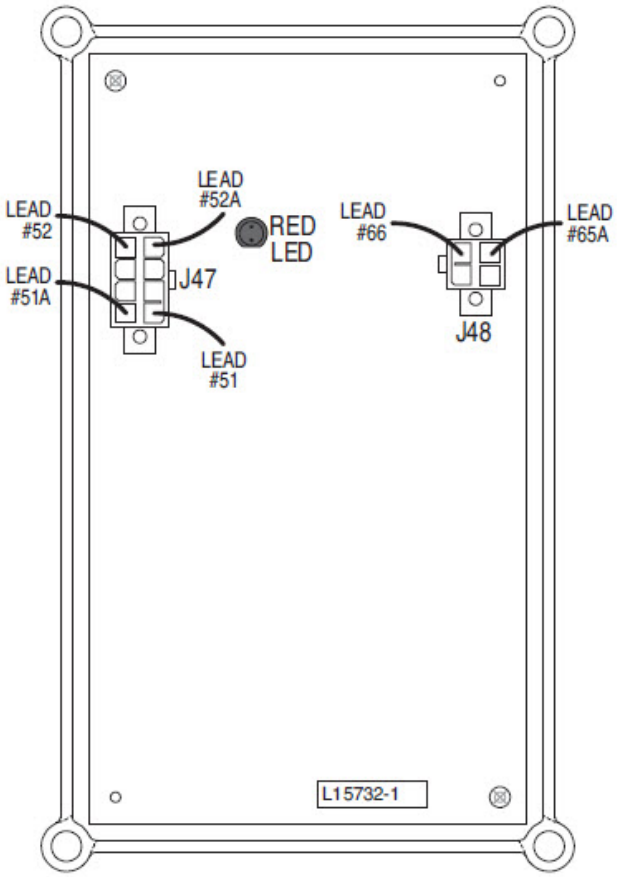


Table F.16 – 40 Volt DC Bus Board Test Points and Expected Readings

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READING
INPUT FROM THE POWER CONVERSION ASSEMBLY	PLUG J48 PIN 1 (+) LEAD #65A	PLUG J48 PIN 3 (–) LEAD #66	48VDC
40VDC OUTPUT TO ArcLink RECEPTACLE	PLUG J47 PIN 8 (+) LEAD #52A	PLUG J47 PIN 1 (+) LEAD #51A	40VDC
40VDC OUTPUT TO PFC CONTROL BOARD	PLUG J47 PIN 4 (+) LEAD #52	PLUG J47 PIN 5 (+) LEAD #51	40VDC

INPUT BOARD TEST PROCEDURE

Service and repair should only be performed by 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 Input Board is receiving the correct input voltage and is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Input board. See ***Figure F.20***. See Wiring Diagram.
   NOTE: To gain access to the Input Board the insulating cover will have to be removed. Cut the three cable ties securing the insulating cover.
5. Using a volt/ohmmeter, perform the Input Board diode checks per ***Table F.17*** and ***Figure F.21***.
6. Locate the Green LED on the Input Board. See Figure F.21. See Wiring Diagram.
7. Carefully apply the correct three phase input power to the Power Wave R450 machine.
8. If the Green LED is lit, the Input Board is receiving input power. See ***Figure F.21***. See Wiring Diagram.
9. If the Green LED is not lit, the Input Board is not receiving input power. See Wiring Diagram.
10. Using a volt/ohmmeter, carefully perform the voltage tests per ***Table F.18***. See ***Figure F.21***.
11. If the correct input voltage is being applied to the Input Board and the correct output voltages are not being generated the Input Board may be faulty.
12. If faulty, perform the ***Input Board Removal and Replacement Procedure***.
    NOTE: Be sure to replace the insulating cover on the Input Board.
13. Perform the ***Case Cover Replacement Procedure***.
14. Perform the ***Retest After Repair Procedure***.

Figure F.20 – Input Board Location

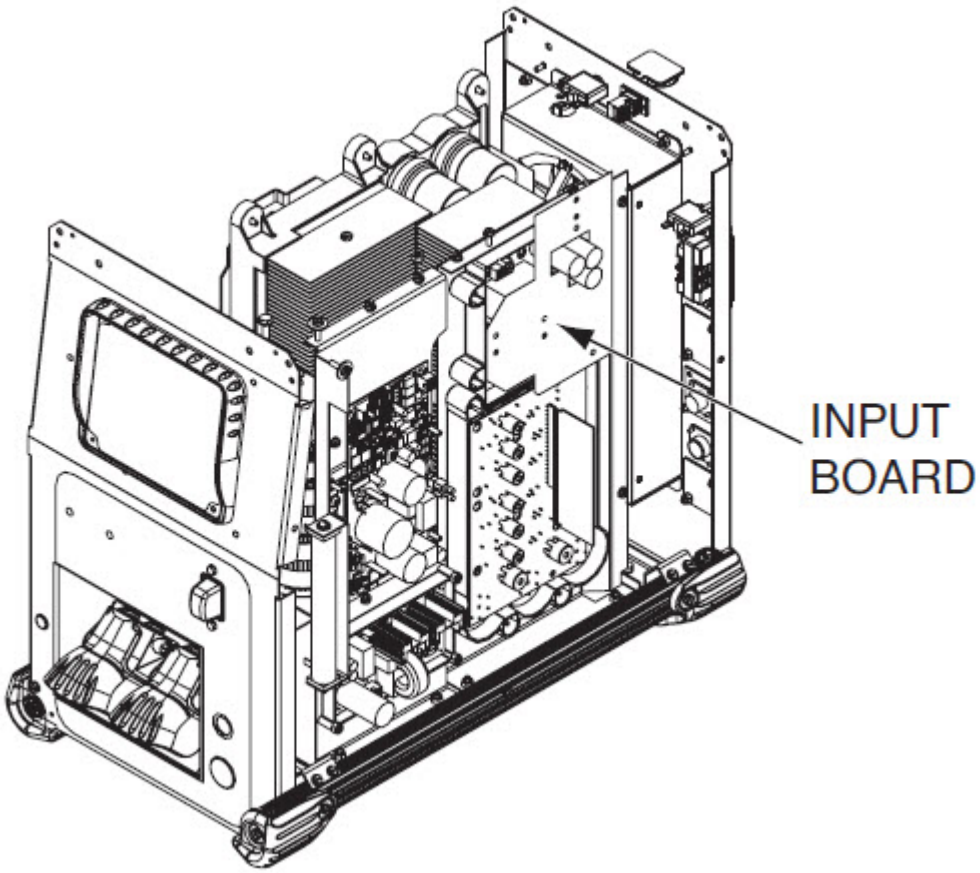


Table F.17 – Input Board Diode Checks

DESCRIPTION	TEST POINT METER PROBE (+)	TEST POINT METER PROBE (-)	EXPECTED READING
SMALL 3-PHASE RECTIFIER	B1	J1 PIN 3 ON BOARD PLUG REMOVED	.578V
SMALL 3-PHASE RECTIFIER	B2	J1 PIN 3 ON BOARD PLUG REMOVED	.578V
SMALL 3-PHASE RECTIFIER	B3	J1 PIN 3 ON BOARD PLUG REMOVED	.578V
SMALL 3-PHASE RECTIFIER	J1 PIN 3 ON BOARD PLUG REMOVED	B1	OPEN
SMALL 3-PHASE RECTIFIER	J1 PIN 3 ON BOARD PLUG REMOVED	B2	OPEN
SMALL 3-PHASE RECTIFIER	J1 PIN 3 ON BOARD PLUG REMOVED	B3	OPEN
LARGER 3-PHASE BRIDGE	B1	B4	.511V
LARGER 3-PHASE BRIDGE	B2	B4	.511V
LARGER 3-PHASE BRIDGE	B3	B4	.511V
LARGER 3-PHASE BRIDGE	B4	B1	OPEN
LARGER 3-PHASE BRIDGE	B4	B2	OPEN
LARGER 3-PHASE BRIDGE	B4	B3	OPEN
LARGER 3-PHASE BRIDGE	B5	B1	.470V
LARGER 3-PHASE BRIDGE	B5	B2	.470V
LARGER 3-PHASE BRIDGE	B5	B3	.470V
LARGER 3-PHASE BRIDGE	B1	B5	OPEN
LARGER 3-PHASE BRIDGE	B2	B5	OPEN
LARGER 3-PHASE BRIDGE	B3	B5	OPEN

Figure F.21 – Input Board Test Point Location

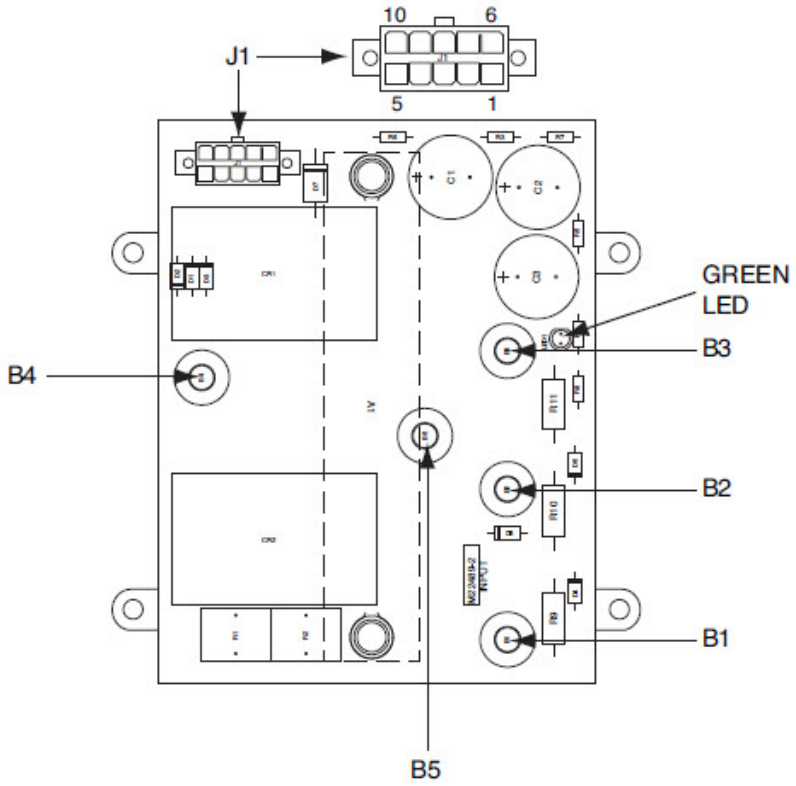


Table F.18 – Input Board Voltage Test Points and Expected Readings (Nominal 460VAC Applied)

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READING
THREE-PHASE INPUT	B1	B2	AC LINE VOLTAGE (Ex. 470VAC)
THREE-PHASE INPUT	B2	B3	AC LINE VOLTAGE (Ex. 470VAC)
THREE-PHASE INPUT	B3	B21	AC LINE VOLTAGE (Ex. 470VAC)
DC TO POWER CONVERSION BOARD	B4(+)	B5(–)	AC LINE VOLTAGE X 1.414 +/–10% (Ex. 629VDC)
FILTERED DC TO PFC BOARD	PLUG J1 PIN 6 (LEAD 366) (+)	B5(–)	AC LINE VOLTAGE X 1.414 +/–10% (Ex. 629VDC)
RECTIFIED AC TO PFC BOARD	PLUG J1 PIN 3 (LEAD 369) (+)	B5(–)	AC LINE VOLTAGE X 1.414 +/–10% (Ex. 629VDC)
DC POWER TO RELAYS CR1 AND CR2 FROM PFC BOARD	PLUG J1 PIN 10 (LEAD 362) (+)	PLUG J1 PIN 5 (LEAD 367) (–)	15VDC

MULTI-PHASE CHOPPER BOARD TEST PROCEDURE

Service and repair should only be performed by 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 Multi-Phase Chopper Board is receiving the correct input voltage and is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Multi-Phase Chopper Board. See ***Figure F.22***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the Multi-Phase Chopper Board diode checks per ***Table F.19*** and ***Figure F.23***.
6. Locate the Green LED on the Multi-Phase Chopper Board. See ***Figure F.23***. See Wiring Diagram.
7. Carefully apply the correct three phase input power to the Power Wave R450 machine.
8. If the Green LED is lit, the Multi-Phase Chopper Board is receiving input power from the Power Conversion Assembly (100VDC). See ***Figure F.23***. See Wiring Diagram.
9. If the Green LED is not lit, the Multi-Phase Chopper Board may not be receiving the 100VDC from the Power Conversion Board. See Wiring Diagram.
10. Energize the output of the Power Wave R450 machine. Check to make sure the six LEDs on the Multi-Phase Control board are lit. This is an indication that the Multi-Phase Control Board is receiving gate firing signals from the Control Board and the Multi-Phase Board is providing gate driving signals to the Multi-Phase Chopper Board. See ***Figure F.23***. See Wiring Diagram.
11. Using a volt/ohmmeter, carefully perform the voltage tests per ***Table F.20***. See ***Figure F.23***.
12. If the correct input voltage is being applied to the Multi-Phase Chopper Board and the correct output voltages are not being generated, the Multi-Phase Chopper Board may be faulty.
13. If faulty, perform the ***Chopper Board Removal and Replacement Procedure***.
14. Perform the ***Case Cover Replacement Procedure***.
15. Perform the ***Retest After Repair Procedure***.

Figure F.22 – Multi-Phase Chopper Board Location

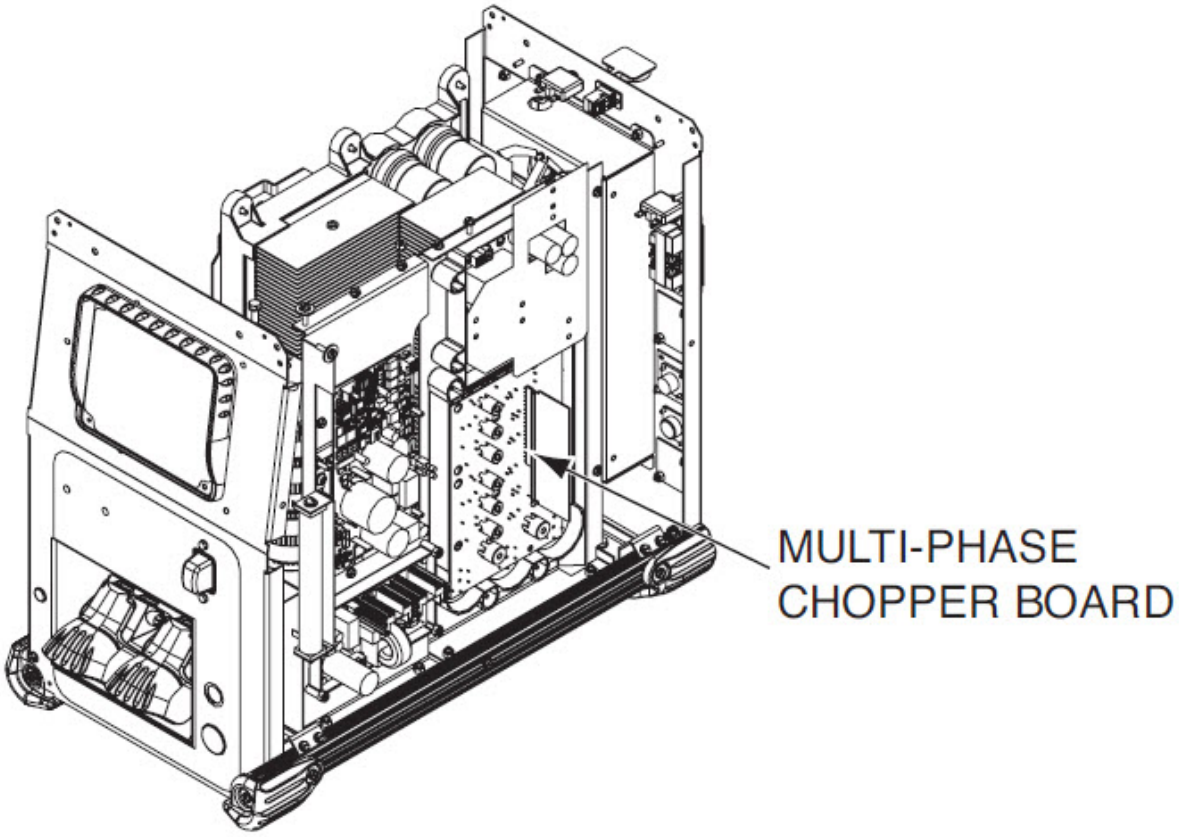


Figure F.23 – Multi-Phase Chopper Board Test Points

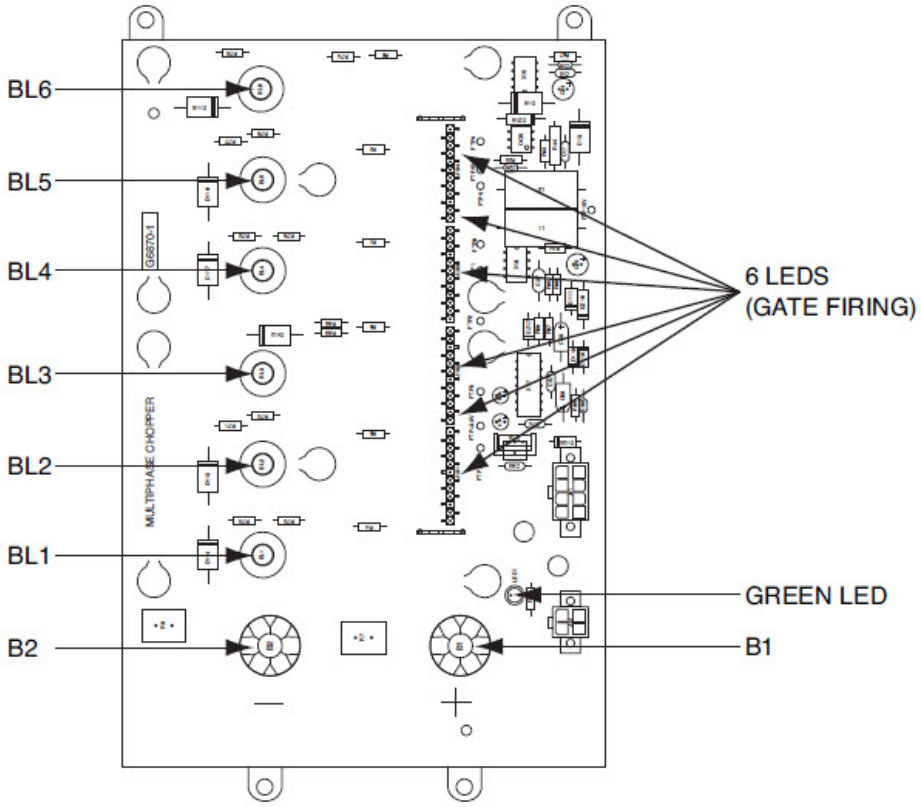


Table F.19 – Multi-Phase Chopper Board Diode Checks

NOTE: Prior to testing make sure the input power is removed from the Power Wave® S500 machine and that all leads are removed from terminals B1 and B2 on the Multi-Phase Chopper Board. See ***Figure F.23***.

DESCRIPTION	TEST POINT METER PROBE (+)	TEST POINT METER PROBE (-)	CONDITIONS	EXPECTED READING +/- 10%
PHASE 3 DRIVER	B2	BL1	ALL LEADS REMOVED FROM B1 AND B2	.413V
PHASE 2 DRIVER	B2	BL2	ALL LEADS REMOVED FROM B1 AND B2	.413V
PHASE 1 DRIVER	B2	BL3	ALL LEADS REMOVED FROM B1 AND B2	.413V
PHASE 6 DRIVER	B2	BL4	ALL LEADS REMOVED FROM B1 AND B2	.413V
PHASE 5 DRIVER	B2	BL5	ALL LEADS REMOVED FROM B1 AND B2	.413V
PHASE 4 DRIVER	B2	BL6	ALL LEADS REMOVED FROM B1 AND B2	.413V

Table F.20 – Multi-Phase Chopper Board Voltage Test Points and Expected Readings

MODE	OPEN CIRCUIT VOLTAGE	TEST POINT (+)	TEST POINT (-)	EXPECTED READING (+/- 10%)
TIG	24VDC	B1	B2	97VDC
TIG	24VDC	BL1	B2	73VDC
TIG	24VDC	BL2	B2	73VDC
TIG	24VDC	BL3	B2	73VDC
TIG	24VDC	BL4	B2	73VDC
TIG	24VDC	BL5	B2	73VDC
TIG	24VDC	BL6	B2	73VDC

MODE	OPEN CIRCUIT VOLTAGE	TEST POINT (+)	TEST POINT (-)	EXPECTED READING (+/- 10%)
CV	70VDC	B1	B2	97VDC
CV	70VDC	BL1	B2	26VDC
CV	70VDC	BL2	B2	26VDC
CV	70VDC	BL3	B2	26VDC
CV	70VDC	BL4	B2	26VDC
CV	70VDC	BL5	B2	26VDC
CV	70VDC	BL6	B2	26VDC

MODE	OPEN CIRCUIT VOLTAGE	TEST POINT (+)	TEST POINT (-)	EXPECTED READING (+/- 10%)
STICK	60VDC	B1	B2	97VDC
STICK	60VDC	BL1	B2	36VDC
STICK	60VDC	BL2	B2	36VDC
STICK	60VDC	BL3	B2	36VDC
STICK	60VDC	BL4	B2	36VDC
STICK	60VDC	BL5	B2	36VDC
STICK	60VDC	BL6	B2	36VDC

Removal And Replacement Procedures

POWER FACTOR CORRECTION (PFC) CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 Power Factor Correction (PFC) Control Board.

MATERIALS NEEDED

3/8” Wrench
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J20, J21, J22, J23A, J23B, J24, J25 and J26 from the PFC Control Board. See ***Figure F.26***. See Wiring Diagram.
5. Using a 3/8” wrench, remove the four nuts securing the PFC Control Board to the PFC board mounting panel. See ***Figure F.25***.
6. Carefully slide the PFC Control Board off of the mounting studs.
7. The power factor correction (PFC) control board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Place the new PFC Control Board onto the mounting studs.
2. Using a 3/8” wrench, attach the four nuts securing the PFC Control Board to the PFC board mounting panel. See ***Figure F.25***.
3. Connect plugs J20, J21, J22, J23A, J23B, J24, J25 and J26 to the PFC Control Board. See ***Figure F.26***. See Wiring Diagram.
4. Attach any cable ties that may have been removed.
5. Perform the ***Case Cover Replacement Procedure***.

6. Perform the ***Retest After Repair Procedure***.

Figure F.25 – Power Factor Correction (PFC) Control Board Location

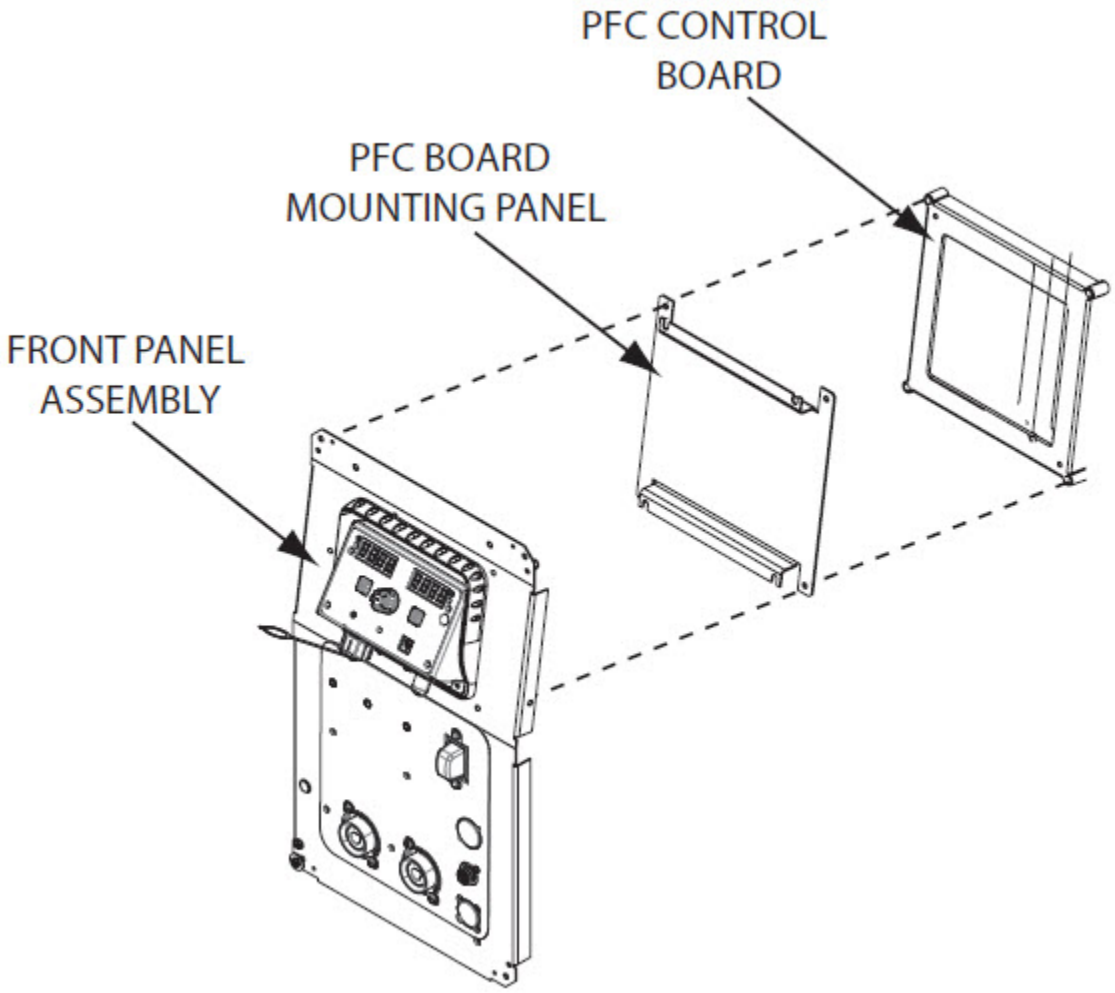
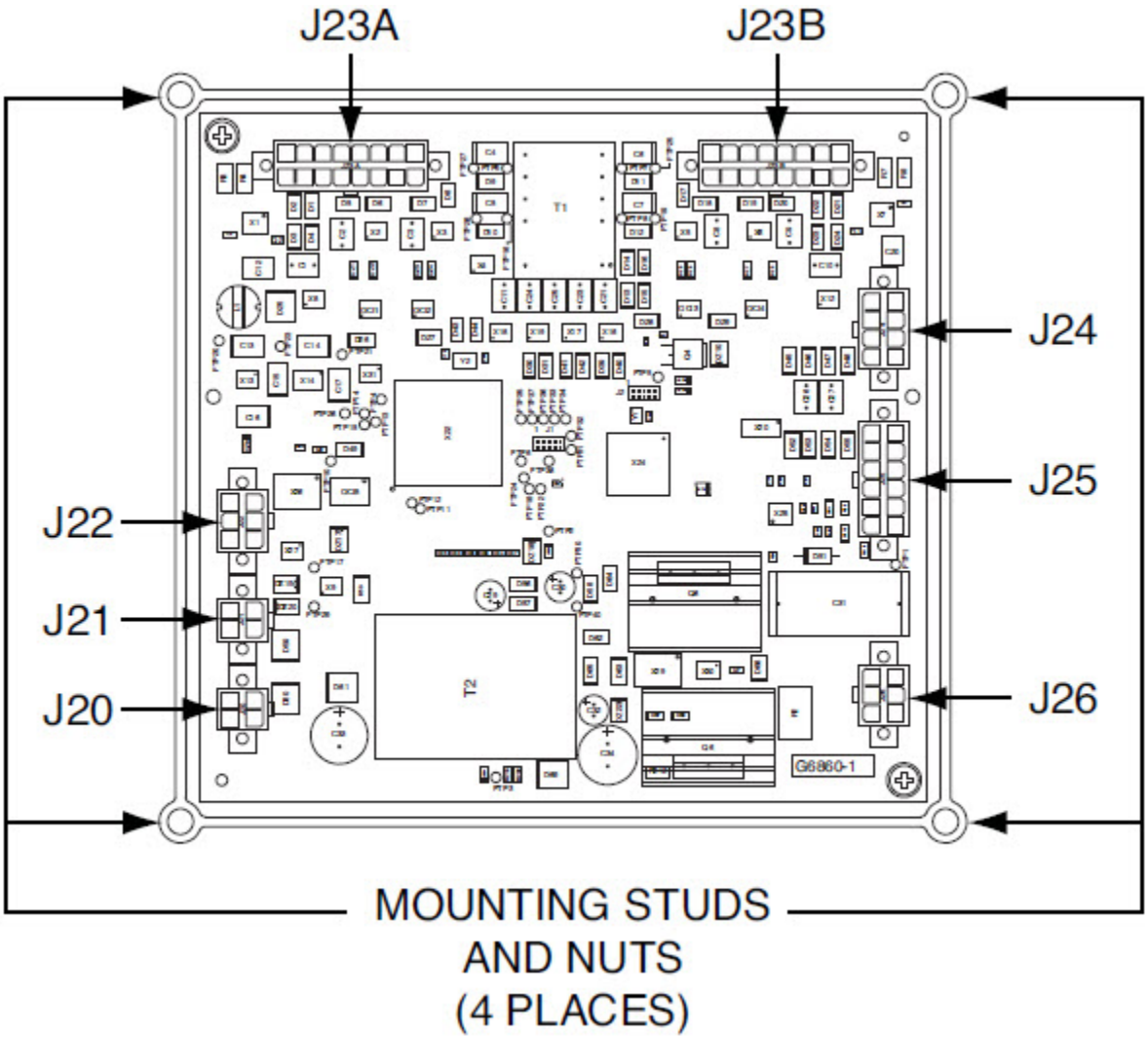


Figure F.26 – Power Factor Correction (PFC) Control Board Plug Locations



115V SUPPLY BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 115V Supply Board.

MATERIALS NEEDED

3/8” Wrench
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the 115 Volt Supply Board. See ***Figure F.27***. See Wiring Diagram.
5. Label and disconnect plugs J82 and J83 from the 115V Supply Board (it is not necessary to remove plug J81). See ***Figure F.28***. See Wiring Diagram.
6. Label and disconnect the leads connected to tab terminals B5 and B6. See ***Figure F.28***. See Wiring Diagram.
7. Using a 3/8” nutdriver, remove the four nuts securing the 115V Supply Board to the front divider panel. See ***Figure F.28***.
8. Carefully remove the 115V Supply Board from the mounting studs. Cut any cable ties that may inhibit the removal.

REPLACEMENT PROCEDURE

1. Place the new 115V Supply Board onto the mounting studs.
2. Using a 3/8” nutdriver, attach the four nuts securing the 115V Supply Board to the front divider panel. See ***Figure F.28***.
3. Connect plugs J82 and J83 to the 115V Supply Board. See ***Figure F.28***. See Wiring Diagram.
4. Connect the leads previously disconnected from tab terminals B5 and B6. See ***Figure F.28***. See Wiring Diagram.
5. Replace any cable ties that may have been removed.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.27 – 115 Volt Supply Board Location

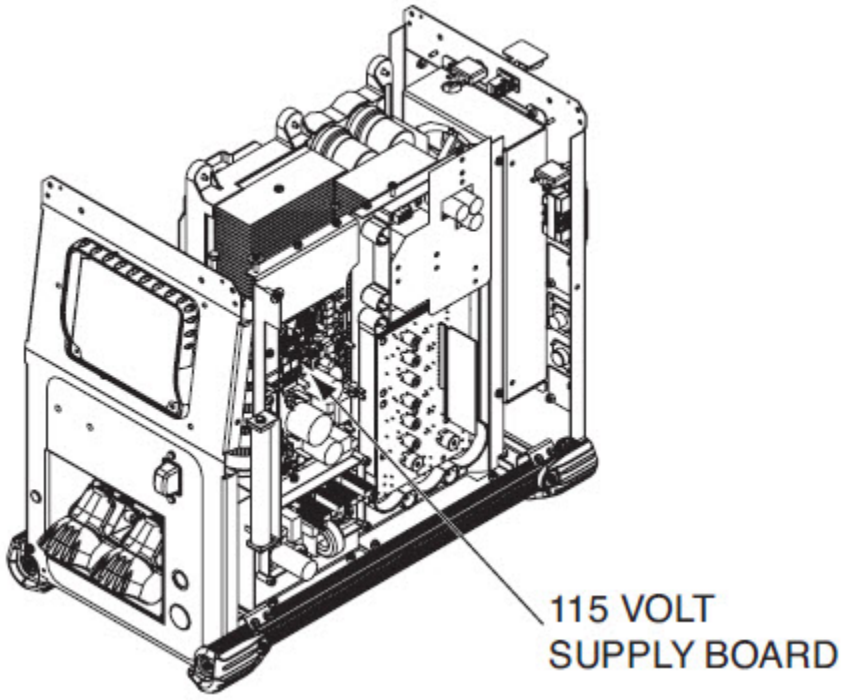
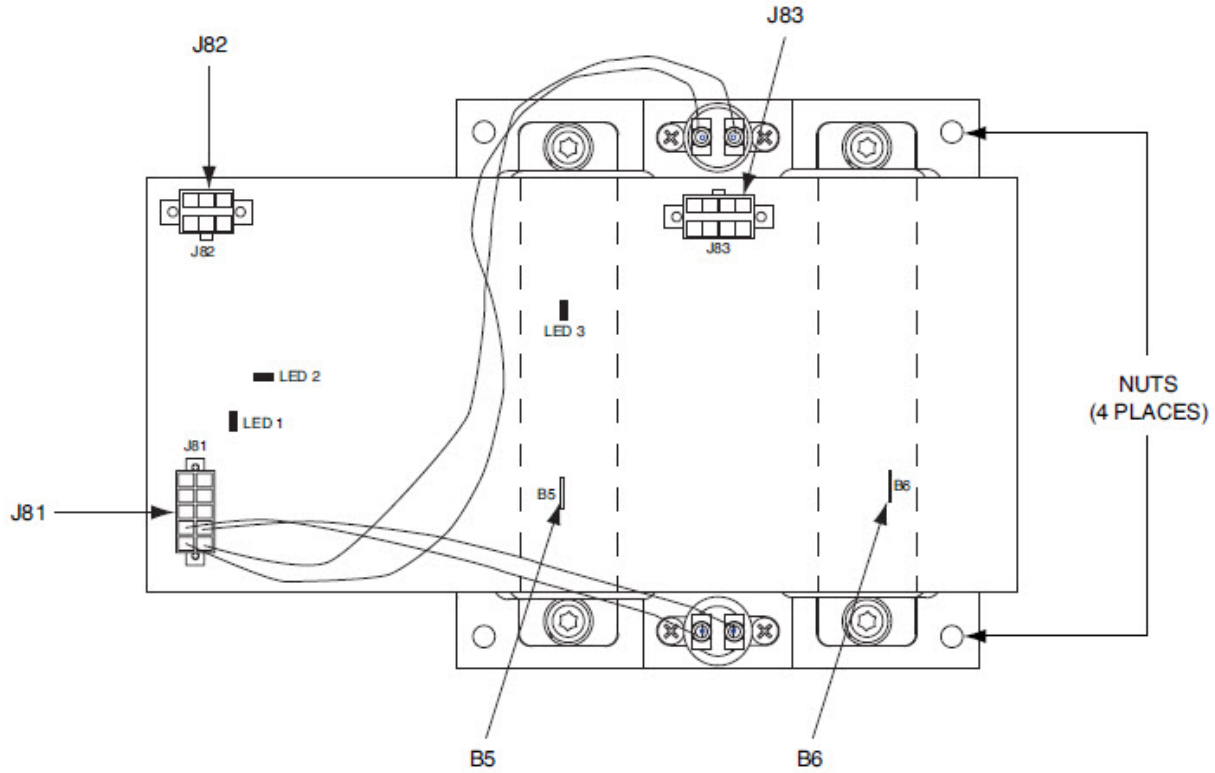


Figure F.28 – 115 Volt Supply Board Lead Locations



40V DC BUS BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 40V DC Bus Board.

MATERIALS NEEDED

3/8” Wrench
Wiring Diagram

REMOVAL PROCEDURE

9. Carefully remove input power from the Power Wave R450 machine.
10. Perform the ***Case Cover Removal Procedure***.
11. Perform the ***Capacitor Discharge Procedure***.
12. Locate the 40V DC Bus Board. See ***Figure F.29***. See Wiring Diagram.
13. Locate and disconnect plugs J46 and J47 from the 40V DC Bus Board. See ***Figure F.30***. See Wiring Diagram.
14. Using a 3/8” nutdriver, remove the four nuts securing the 40V DC Bus Board to the front divider panel. See ***Figure F.30***.
15. Carefully remove the 40V DC Bus Board from the mounting studs.

REPLACEMENT PROCEDURE

8. Place the new 40V DC Bus Board onto the mounting studs.
9. Using a 3/8” nutdriver, attach the four nuts securing the 40V DC Bus Board to the front divider panel. See ***Figure F.30***.
10. Connect plugs J46 and J47 to the 40 Volt DC Bus Board. See ***Figure F.30***. See Wiring Diagram.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

FIGURE F.29 – 40 Volt DC Bus Board Location

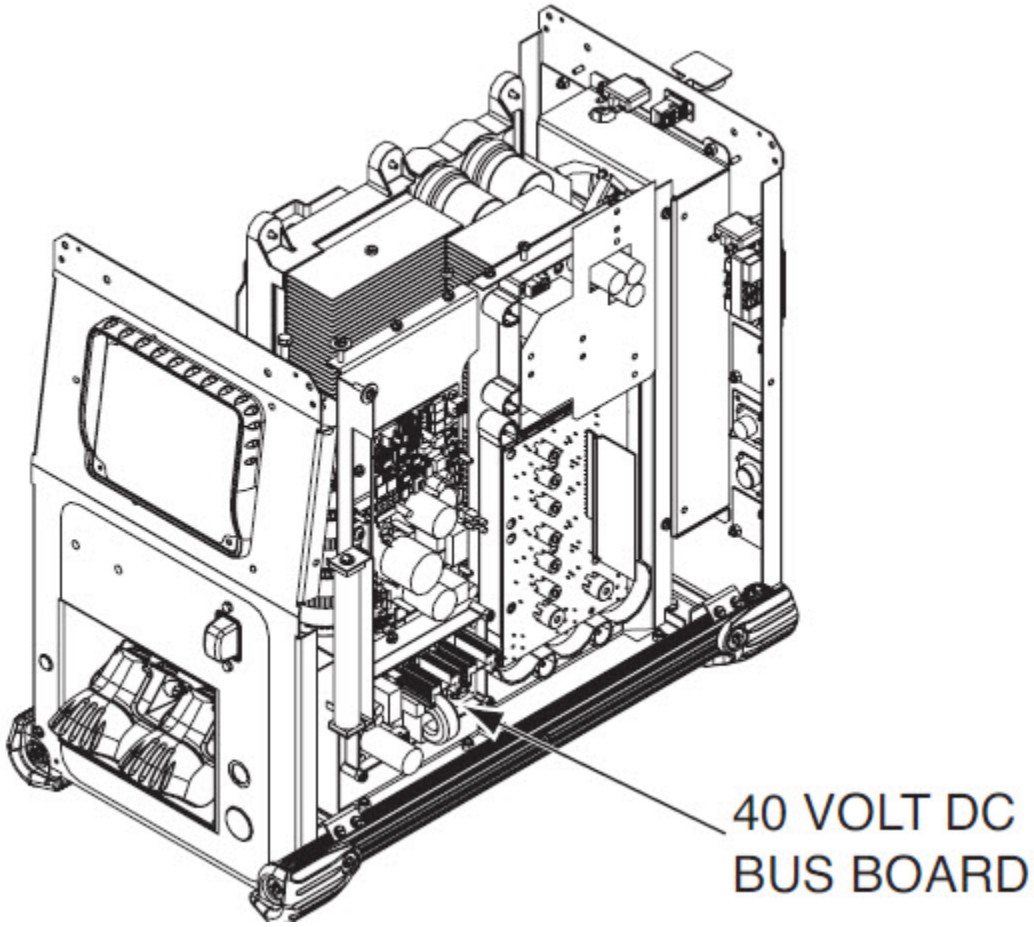
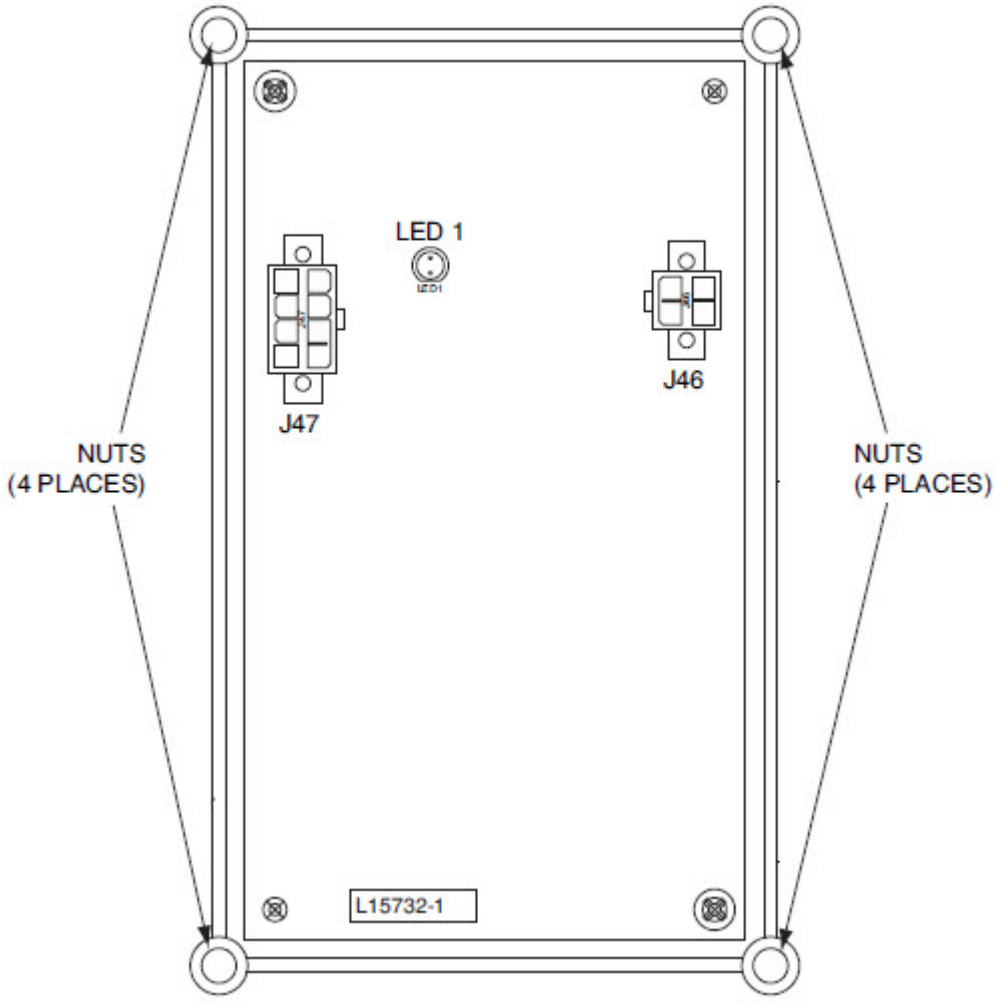


FIGURE F.30 – 40 Volt DC Bus Board Mounting Nut and Lead Locations



LINE SWITCH REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 Line Switch.

MATERIALS NEEDED

5/16” Nutdriver
Wiring Diagram
Electrical Tape
Slotted Screwdriver

REMOVAL PROCEDURE

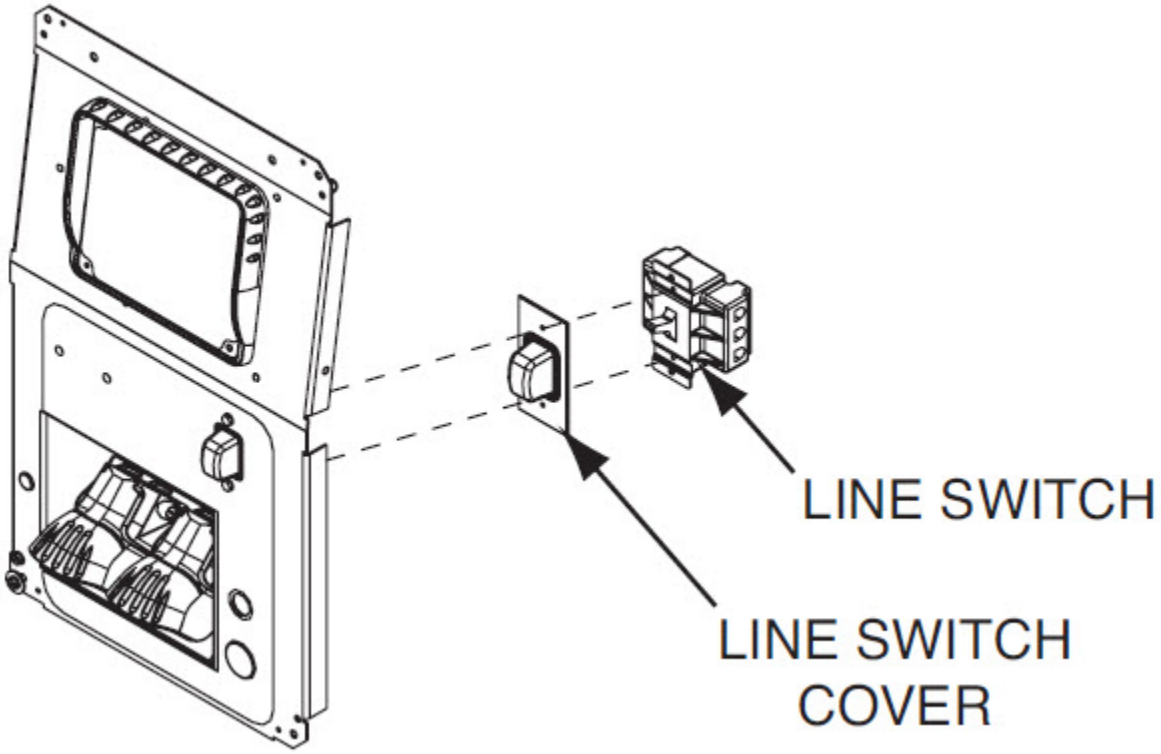
16. Carefully remove input power from the Power Wave R450 machine.
17. Perform the ***Case Cover Removal Procedure***.
18. Perform the ***Capacitor Discharge Procedure***.
19. Using a 5/16” nutdriver, remove the two screws securing the Line Switch to the front panel. See ***Figure F.31***.
20. Carefully remove the Line Switch from the front panel and slide it to the right side to gain access to the leads. Remove the electrical tape and take note of the line switch cover for reassembly.
21. Using a slotted screwdriver, label and disconnect leads L4A, L5A and L6A from the Line Switch. See Wiring Diagram.
22. Using a slotted screwdriver, label and disconnect leads L4, L5 and L6 from the Line Switch. Take note of the MOV assembly for reassembly. See Wiring Diagram.
23. The Line Switch can now be removed and replaced.

REPLACEMENT PROCEDURE

13. Attach and securely tighten leads L4, L5 and L6 into the new Line Switch. Make sure the MOV assembly is also attached securely. See Wiring Diagram.
14. Attach and securely tighten leads L4A, L5A and L6A into the new Line Switch. See Wiring Diagram.
15. Replace the electrical tape with new tape as required.
16. Using a 5/16” nutdriver, mount the new Line Switch and switch cover onto the front panel and replace the two mounting screws previously removed. See ***Figure F.31***.
17. Make sure all leads are cleared and the Line Switch cover is in place.

18. Perform the ***Case Cover Replacement Procedure***.
19. Perform the ***Retest After Repair Procedure***.

Figure F.31 – Line Switch Location



INPUT BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 Input Board.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Wrench
Cable Ties
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Input Board. See ***Figure F.32***. See Wiring Diagram.
5. Carefully remove the input board cover from the Input Board. Cut the three cable ties holding the input board cover in place. See ***Figure F.32***.
6. Label and disconnect plug J1 from the Input Board. See ***Figure F.33***. See Wiring Diagram.
7. Using a 7/16” wrench, label and disconnect leads B1, B2 and B3 from the Input Board. See **Figure F.33**. See Wiring Diagram.
8. Using a 7/16” wrench, label and disconnect leads B4 and B5 from the Input Board. See ***Figure F.33***. See Wiring Diagram.
9. Using a 3/8” nutdriver, remove the four nuts securing the Input Board to the mounting posts. See ***Figure F.33***.

REPLACEMENT PROCEDURE

1. Carefully position the new Input Board and heat sink assembly onto the four mounting posts.
2. Using a 3/8” nutdriver, attach the four nuts securing the Input Board to the mounting posts. See ***Figure F.33***.
3. Connect Plug J1 into the new Input Board. See ***Figure F.33***. See Wiring Diagram.
4. Connect leads B4 and B5 onto the new Input Board. Torque to 50 to 60 Inch Pounds. See ***Figure F.33***. See Wiring Diagram.

5. Using a 7/16” wrench, attach leads B1, B2 and B3 to the new Input Board. Torque to 50 to 60 Inch Pounds. See **Figure F.33**. See Wiring Diagram.
6. Replace the input board cover using three new cable ties. ***Figure F.32***.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.32 – Input Board Location

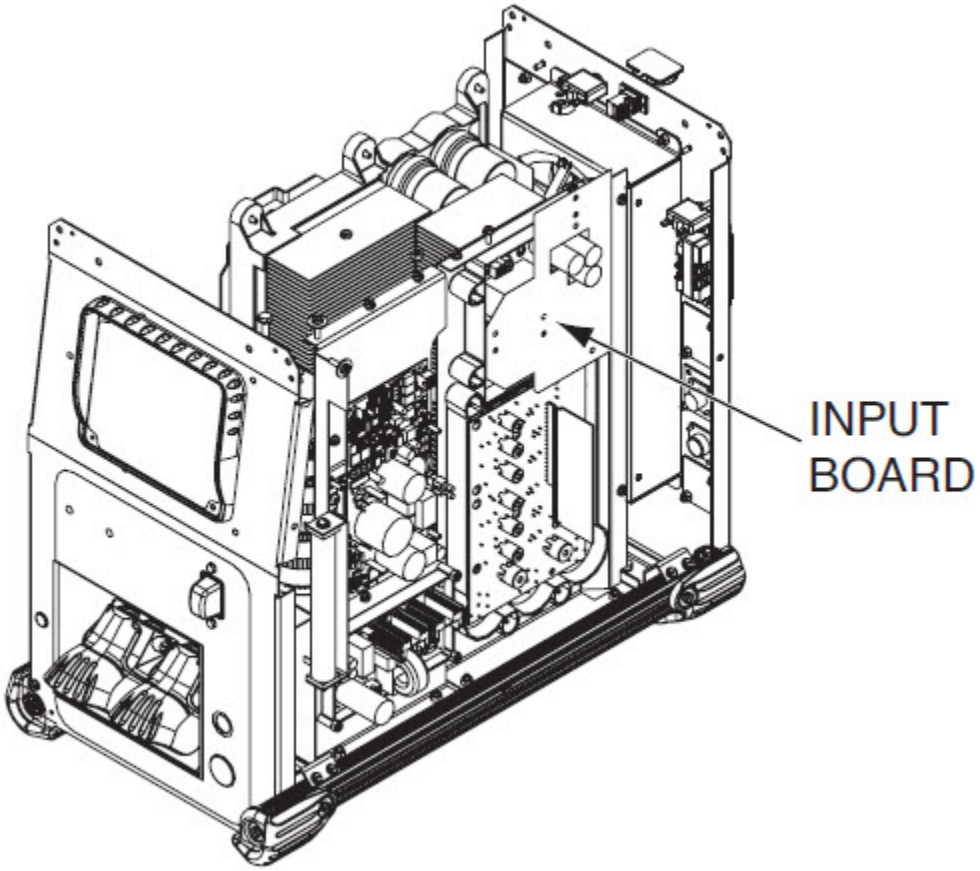
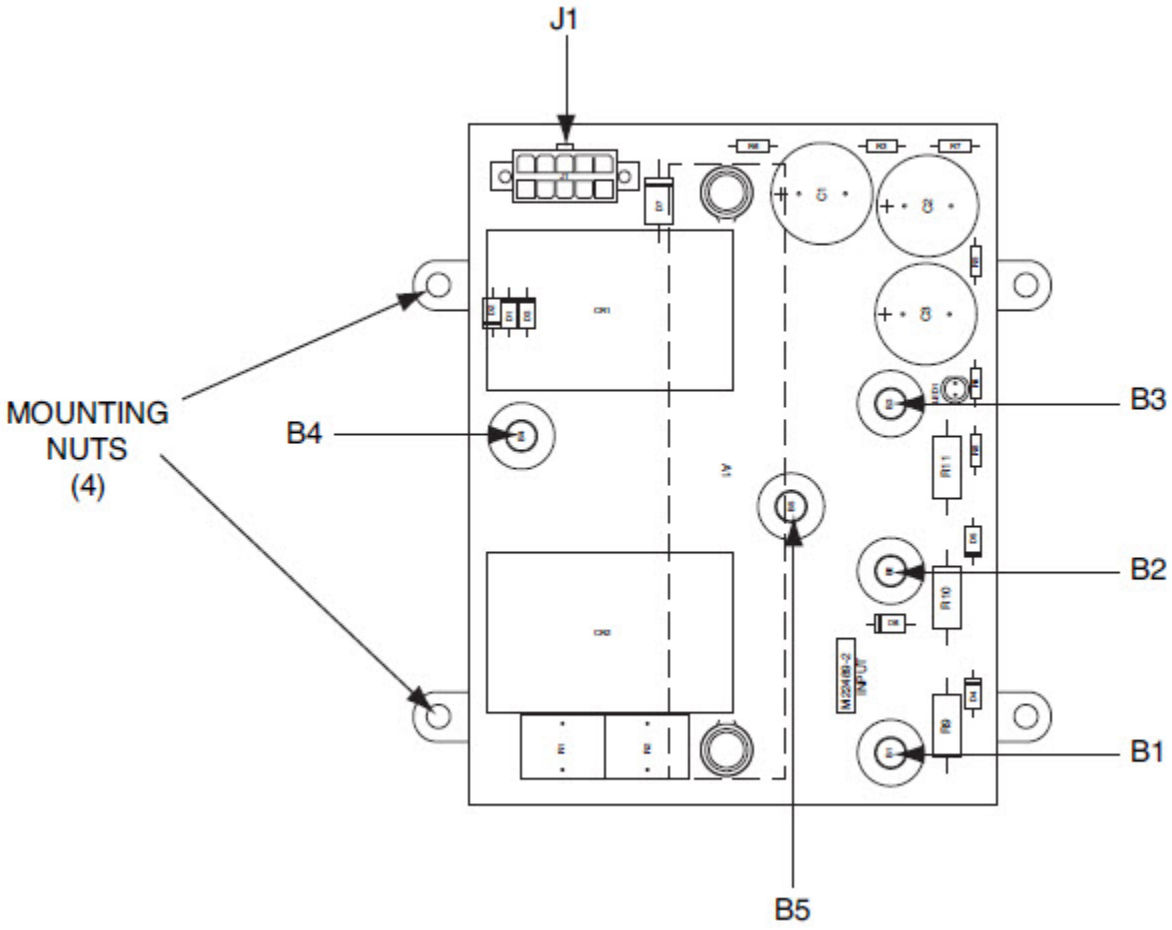


Figure F.33 – Input Board Lead Locations



DIGITAL CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 Digital Control Board.

MATERIALS NEEDED

3/8” Wrench
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Carefully lift up the top case cover.
5. Locate the Digital Control Board. See ***Figure F.34***. See Wiring Diagram.
6. Label and disconnect plugs J5, J6, J7, J8, J9, J12, J11 and J14 from the Digital Control Board. See ***Figure F.35***. See Wiring Diagram.
7. Label and disconnect the Ethernet cable from the Digital Control Board. See Wiring Diagram.
8. Using a 3/8” nutdriver, remove the four nuts securing the Digital Control Board to the top case cover. See **Figure F.35**.
9. Carefully remove the Digital Control Board from the mounting studs.

REPLACEMENT PROCEDURE

1. Carefully position the new Digital Control Board onto the mounting studs.
2. Using a 3/8” nutdriver, attach the four nuts securing the Digital Control Board to the top case cover. See ***Figure F.35***.
3. Connect the Ethernet cable into the Digital Control Board.
4. Connect plugs J5, J6, J7, J8, J9, J12, J11 and J14 to the Digital Control Board. See ***Figure F.35***. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.34 – Digital Control Board Location

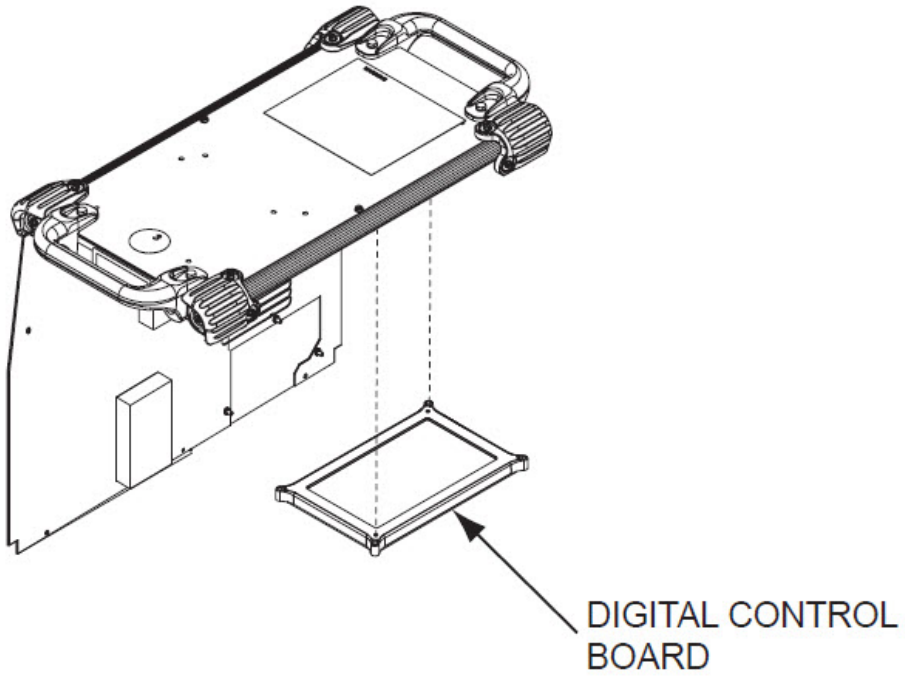
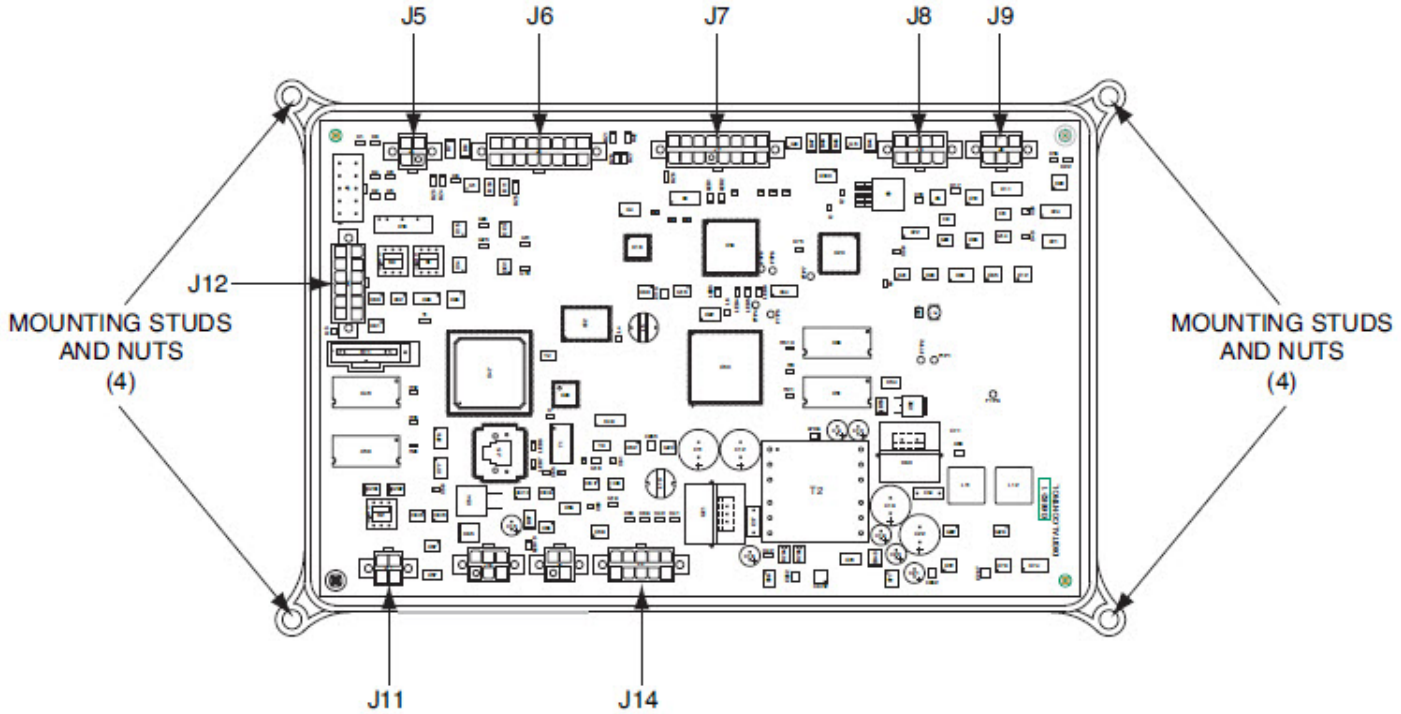


Figure F.35 – Digital Control Board Lead Locations



FAN REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 Fan Assembly.

MATERIALS NEEDED

5/16” Nutdriver
Screwdriver
Wiring Diagram

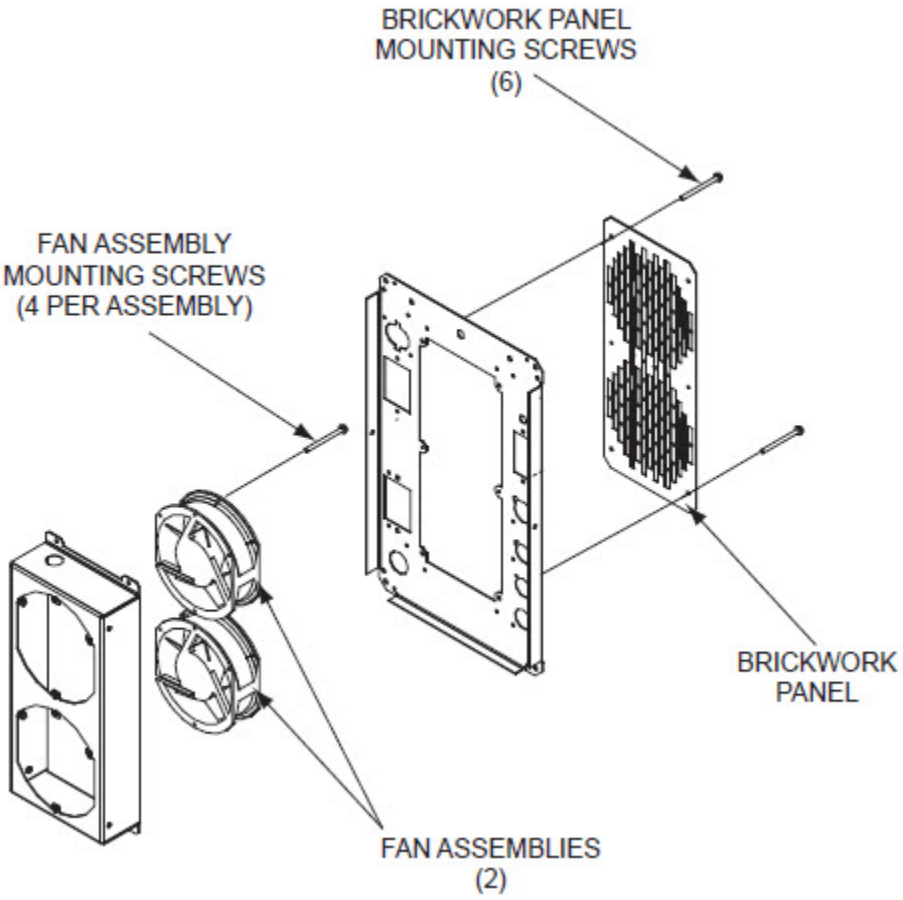
REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Using a 5/16” nutdriver, remove the six screws from the brickwork panel located at the rear of the machine to gain access to the Fan Assembly. See ***Figure F.36***.
3. Using a screwdriver, remove the four machine screws and associated lock washers and flat washers from the Fan Assembly. See ***Figure F.36***.
4. Carefully remove the Fan Assembly from the machine and disconnect the appropriate lead connection plug. (J55 or J56). See the Wiring Diagram.
   NOTE: Cut any necessary cable ties.

REPLACEMENT PROCEDURE

1. Carefully place the new Fan Assembly into position in the machine.
2. Connect the lead connection plug (J55 or J56). See the Wiring Diagram.
3. Replace any cable ties previously removed.
4. Using a screwdriver, attach the four machine screws and associated lock washers and flat washers to the Fan Assembly.
5. Make sure the fan spins freely without any obstruction.
6. Using a 5/16” nutdriver, attach the six screws securing the brickwork panel at the rear of the machine. See ***Figure F.36***.

Figure F.36 – Fan Assembly Component Locations



POWER CONVERSION BOARD ASSEMBLY REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 Power Conversion Board Assembly.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Wrench
5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Power Conversion Board Assembly. See ***Figure F.37***. See Wiring Diagram.
5. Using a 5/16” and 3/8” nutdrivers, remove the air baffle from the Power Conversion Board Assembly. See ***Figure F.37***. See Wiring Diagram.
6. Label and disconnect plugs J32, J33, J34, J35, J36 and J37 from the Power Conversion Board. See ***Figure F.38***. See Wiring Diagram.
7. Using a 7/16” wrench, label and disconnect the heavy lead B2 from terminal B56. See ***Figure F.38***.
   NOTE: Save the bolt and washer for reassembly. Note chokes’ lead placement on terminal B56.
8. Using a 7/16” wrench, label and disconnect the heavy leads 901C and 901A from the heat sink terminal. See ***Figure F.38***. See Wiring Diagram.
   NOTE: Save the bolt, washers and nut for reassembly.
9. Using a 7/16” wrench, label and disconnect the top choke leads from terminals B13 and B8. See ***Figure F.38***. See Wiring Diagram.
   NOTE: Save the bolts and lock washers for reassembly.
10. Using a 7/16” wrench, label and disconnect the bottom choke leads from terminals B6 and B7. See ***Figure F.38***. See Wiring Diagram.
    NOTE: Save the bolts and lock washers for reassembly.

11. Using a 7/16” wrench, label and disconnect the leads B4 and B5 from the buss bars. See ***Figure F.38***. See Wiring Diagram.
    NOTE: Save the bolts, lock washers and nuts for reassembly.
12. Using a 5/16” nutdriver, remove the five screws securing the Power Conversion Board Assembly to the frame of the machine. See ***Figure F.38***.
13. Using a 3/8” nutdriver, remove the nut and washer from the mounting post lower left hand corner. See ***Figure F.38***.
14. Clear all leads and carefully remove the Power Conversion Power Board Assembly with heat sink from the machine.

REPLACEMENT PROCEDURE

1. Carefully position the new Power Conversion Board Assembly onto the mounting post.
   NOTE: The top of the Power Conversion Board Assembly will have to be positioned into place first.
2. Using a nut and washer previously removed, secure the new Power Conversion Board Assembly onto the mounting post. See ***Figure F.37***.
3. Using a 5/6” nutdriver, replace the five mounting screws and washers previously removed.
4. Connect leads B4 and B5 onto their respective bus bars. Torque the bolts to between 50 and 60 inch pounds. See ***Figure F.38***. See Wiring Diagram.
5. Connect the bottom choke leads to terminals B6 and B7. Torque the bolts to between 50 and 60 inch pounds. See ***Figure F.38***. See Wiring Diagram.
6. Connect the top choke leads to terminals B13 and B8. Torque the bolts to between 50 and 60 inch pounds. See ***Figure F.38***. See Wiring Diagram.
7. Connect the two heavy leads 901C and 901A to the heat sink terminal. Torque the bolts to between 50 and 60 inch pounds. See ***Figure F.38***. See Wiring Diagram.
8. Connect the heavy lead B2 to terminal B56. Torque the bolts to between 50 and 60 inch pounds. See ***Figure F.38***. See Wiring Diagram (**Note chokes’ lead placement**).
9. Connect plugs J32, J33, J34, J35, J36 and J37. See ***Figure F.38***. See Wiring Diagram.
10. Connect the air baffle. See ***Figure F.37***.
11. Clear and position all leads.
12. Perform the ***Case Cover Replacement Procedure***.
13. Perform the ***Retest After Repair Procedure***.

Figure F.37 – Power Conversion Board Assembly Location

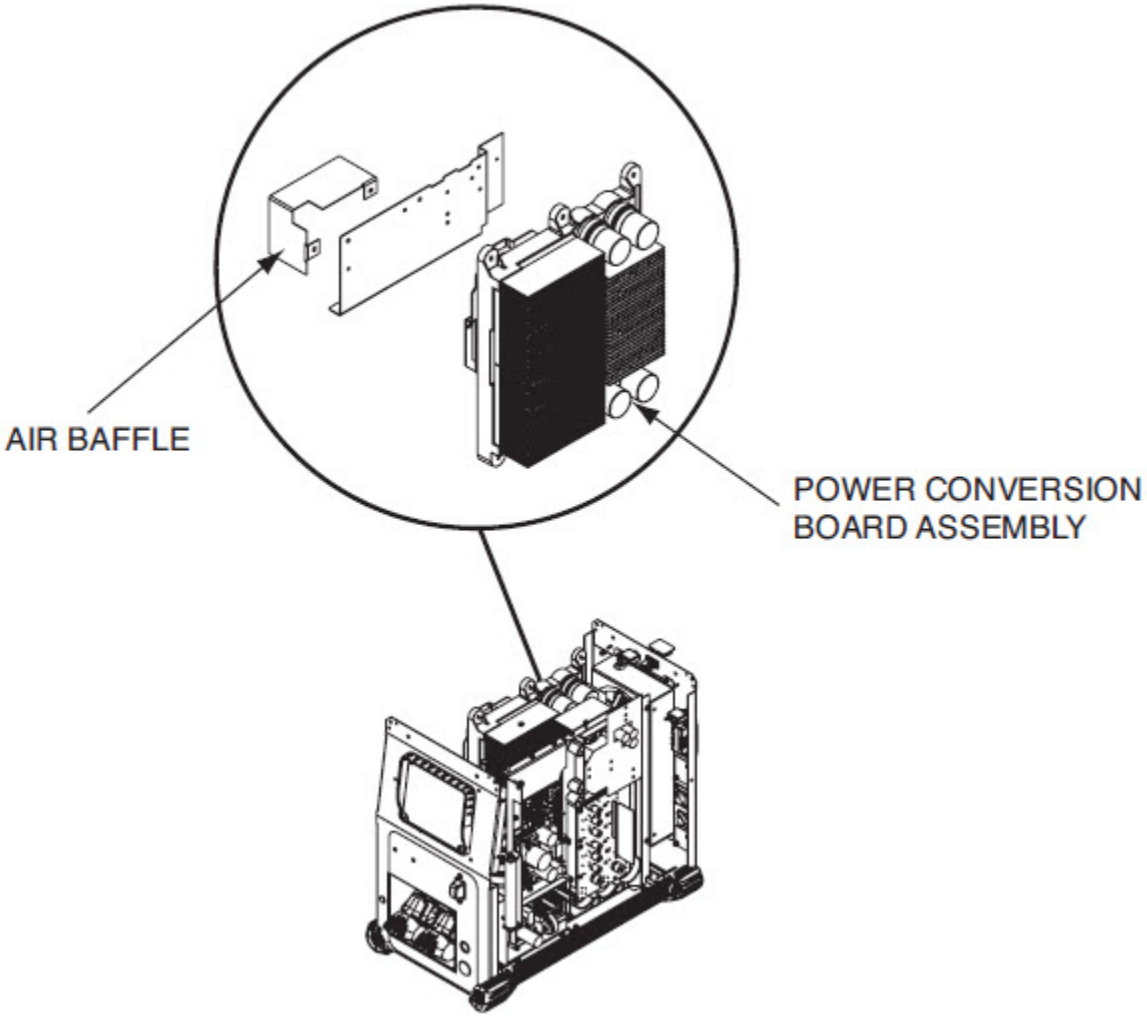
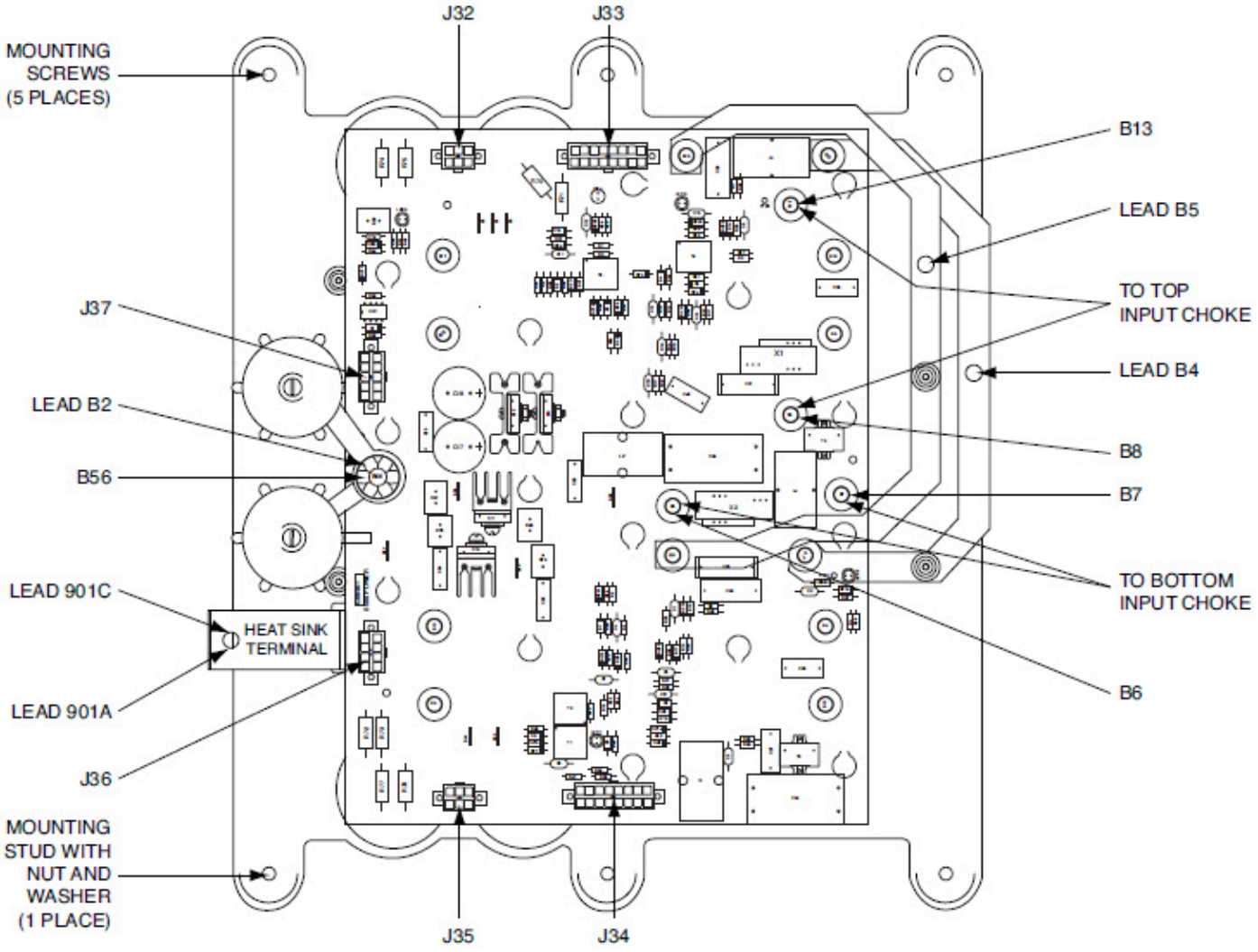


Figure F.38 – Power Conversion Board Assembly Lead Locations



CHOPPER BOARD ASSEMBLY REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should only be performed by 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 Board.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Wrench
Cable Ties
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R450 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the Chopper Board. See ***Figure F.39***. See Wiring Diagram.
5. Disconnect plugs J41 and J42 from the Chopper Board. See ***Figures F.39*** and ***F.40***. See Wiring Diagram.
6. Using a 7/16’ wrench, label and disconnect leads BL1, BL2, Bl3, BL4, BL5, and BBL6 from the Chopper Board. See ***Figure F.40***. See Wiring Diagram.
   NOTE: Save the bolts and lock washers for reassembly.
7. Using a 7/16” wrench, label and disconnect leads 901, 901C and 206A from terminal B1. See ***Figure F.40***. See Wiring Diagram.
   NOTE: Save the bolts and lock washers for reassembly.
8. Using a 7/16” wrench, label and disconnect leads B2 and 207 from terminal B2. See ***Figure F.40***. See Wiring Diagram.
   Note: Save the bolts and lock washers for reassembly.
9. Label and disconnect the two thermostat leads 409 and 410 (These leads can be disconnected at the two in-line push-on connectors). See ***Figure F.40***. See Wiring Diagram.
10. Using a 3/8” nutdriver, remove the four nuts securing the Chopper Board Assembly to the mounting posts. See ***Figure F.40***.
11. Carefully remove the Chopper Board Assembly (with heat sink) from the machine by clearing all leads and lifting the lower portion up and out first.

REPLACEMENT PROCEDURE

1. Carefully position the new Chopper Board and heat sink assembly onto the four mounting posts. **Note**: The bottom of the Chopper Board Assembly will have to be positioned into place first.
2. Using the four nuts previously removed, secure the new Chopper Board onto the mounting posts.
3. Connect plugs J41 and J42 into the new Chopper Board. See Wiring Diagram.
4. Connect the thermostat leads 409 and 410. See Wiring Diagram.
5. Connect leads 901, 901C and 206A to terminal B1. Torque the bolts to between 50 to 60 inch pounds. See Wiring Diagram.
6. Connect leads B2 and 207 to terminal B2. Torque the bolts to between 50 to 60 inch pounds. See Wiring Diagram.
7. Connect the six output choke leads previously removed from terminals BL1, BL2, BL3, BL4, BL5 and BL6. Torque the bolts to between 50 to 60 inch pounds. See Wiring Diagram.
8. Perform the ***Case Cover Replacement Procedure***.
9. Perform the ***Retest After Repair Procedure***.

FIGURE F.39 – Chopper Board Location

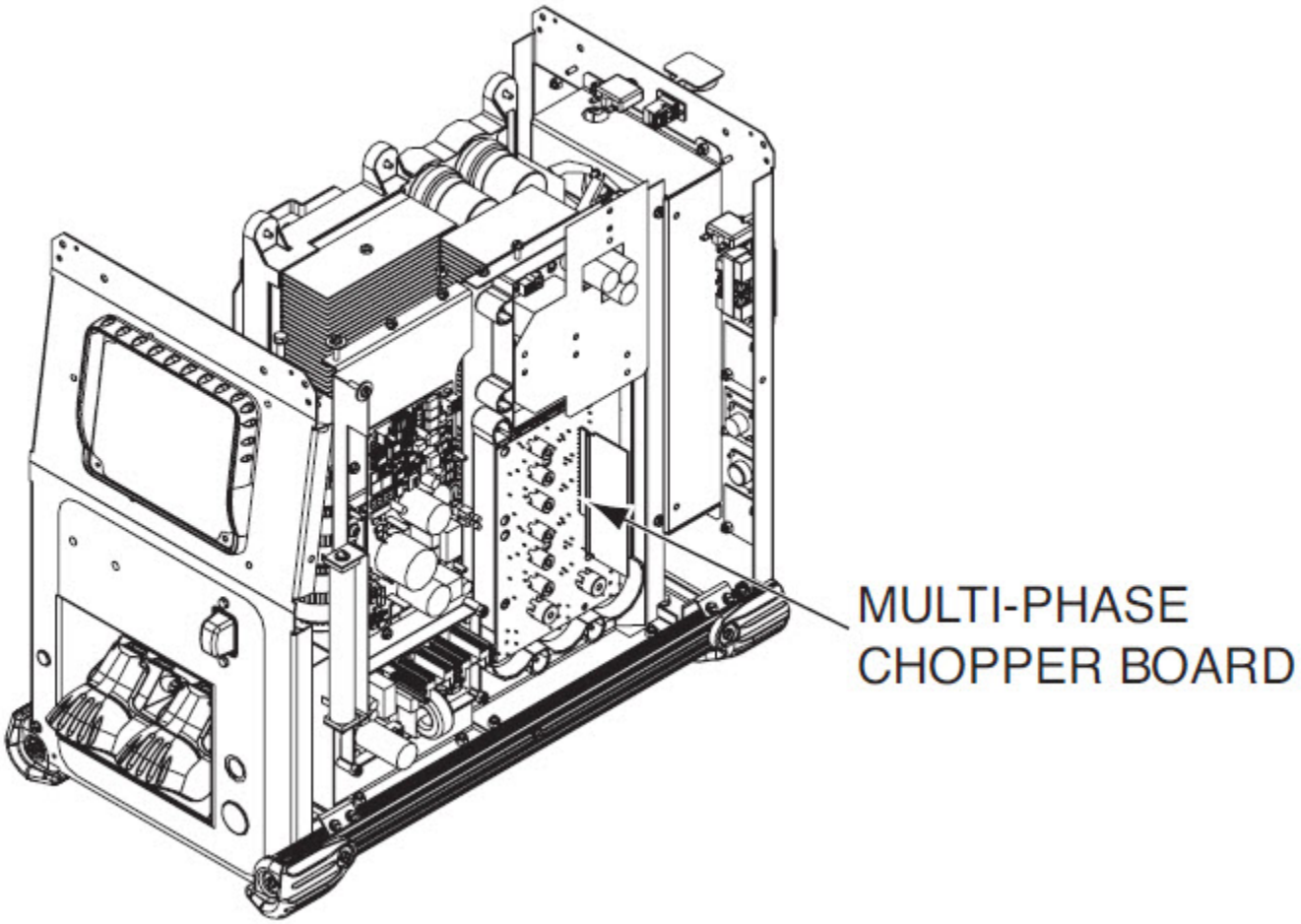
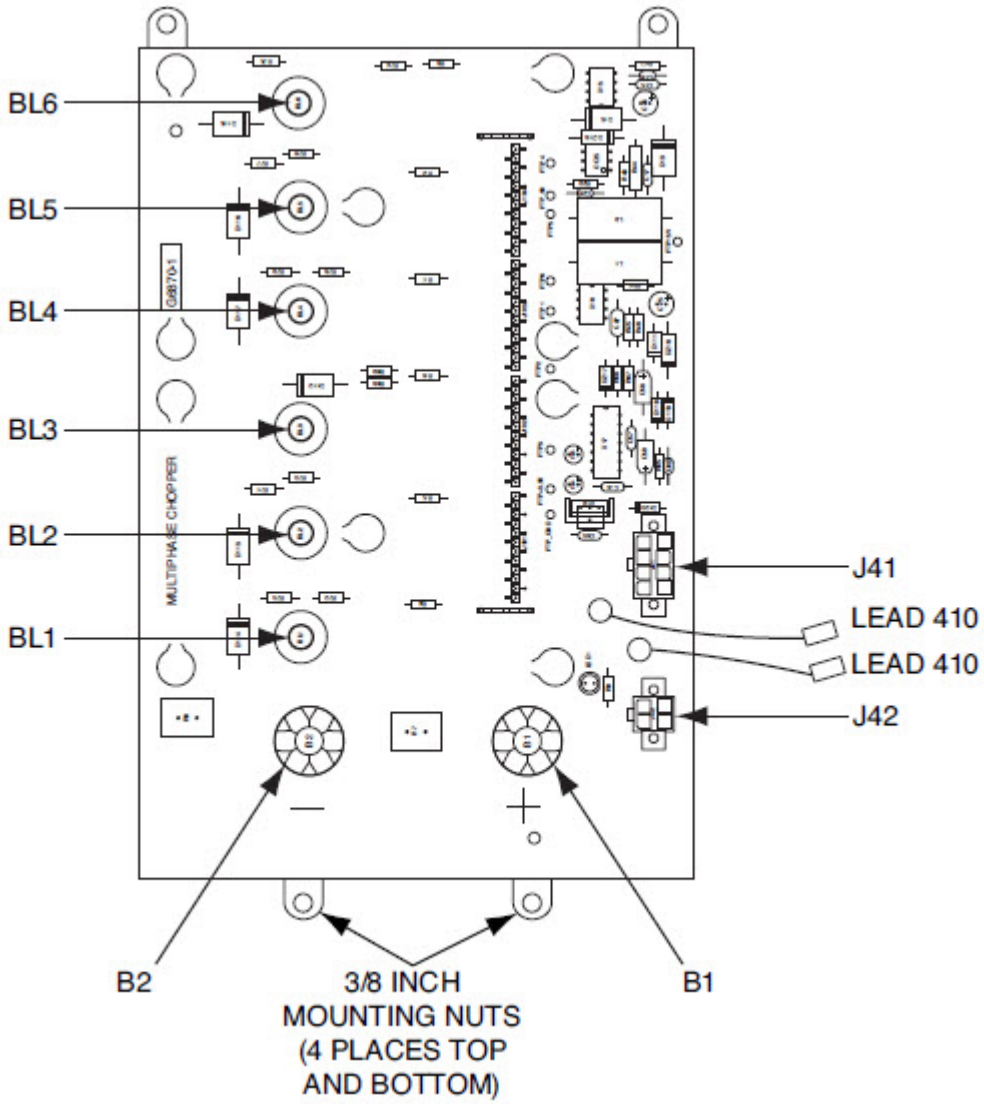


FIGURE F.40 – Chopper Board Lead Locations



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.

PROCEDURE

1. Be certain the machine is properly connected for the input voltage being applied.
2. Turn the power switch ON and see that the machine goes through the Start-up routine and the status light is steady green.
3. Turn the power switch OFF and connect a resistive load across the output studs and a computer to the Ethernet.
4. Perform the Power Wave Verification And Calibration Procedures, see SVM251.