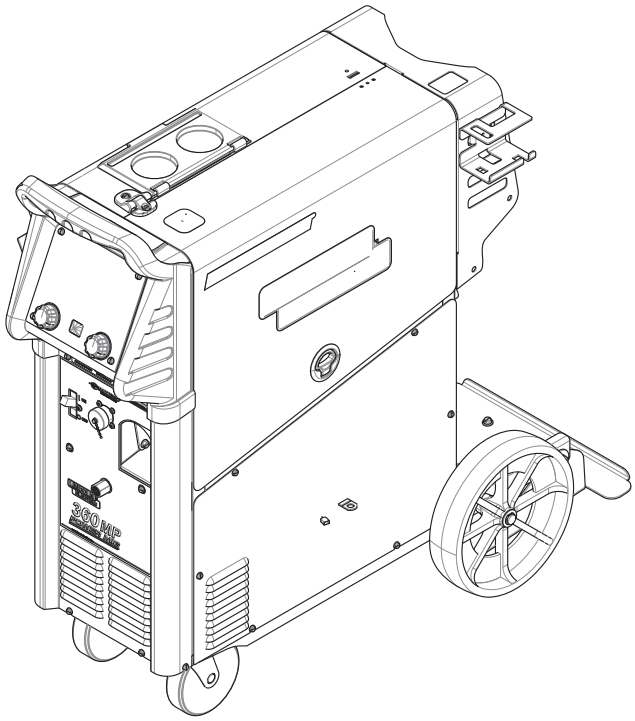
LINCOLN ELECTRIC

Service Manual

Power MIG® 360MP



For use with machines having Code Numbers:

13325, 13450

GENUINE LINCOLN PARTS™

Register your machine:
www.lincolnelectric.com/register

Authorized Service and Distributor Locator:
www.lincolnelectric.com/locator

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

Need Help? Call 1.888.935.3877
to talk to a Service Representative

Hours of Operation:
8:00 AM to 6:00 PM (ET) Mon. thru Fri.

After hours?
Use "Ask the Experts" at lincolnelectric.com
A Lincoln Service Representative will contact you no later than the following business day.

For Service outside the USA:
Email: globalservice@lincolnelectric.com

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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

WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects, or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an exposed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65 warnings.ca.gov/diesel

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 *et seq.)*

WARNING: Cancer and Reproductive Harm www.P65warnings.ca.gov

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. 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.

1.i. Using a generator indoors CAN KILL YOU IN MINUTES.

1.j. Generator exhaust contains carbon monoxide. This is a poison you cannot see or smell.

1.k. NEVER use inside a home or garage, EVEN IF doors and windows are open.

1.l. Only use OUTSIDE and far away from windows, doors and vents.

1.m. Avoid other generator hazards. READ MANUAL BEFORE USE.

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.

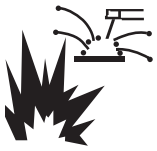
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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.

TECHNICAL SPECIFICATIONS – POWER MIG® 360MP

INPUT-SINGLE PHASE ONLY	
Input Voltage ± 10% 208/230/460/575 Volts 50/60 Hz	Effective Input Amperes 55/50/25/20

RATED OUTPUT									
Input Voltage/ Phase/Frequency	**GMAW**			**GTAW-DC**			**SMAW**		
	40%	**60%**	**100%**	**40%**	**60%**	**100%**	**40%**	**60%**	**100%**
208/230/460/575/ 1/50/60 Hz	350 Amps 31.5 Volts	320 Amps 30 Volts	250 Amps 26.5 Volts	360 Amps 24.4 Volts	320 Amps 22.8 Volts	250 Amps 20 Volts	310 Amps 32.4 Volts	300 Amps 32 Volts	230 Amps 29.2 Volts

OUTPUT		
Welding Current Range (Continuous)	Maximum Open Circuit Voltage	Welding Voltage Range
5 A-360 A	70 V	10 V-45 V

RECOMMENDED INPUT WIRE AND FUSE - SINGLE PHASE			
Input Voltage/Frequency (Hz)	Maximum Input Ampere and Duty Cycle*	Fuse or Breaker Size	Type S, SO, ST, STO or extra hard usage input cord AWG (IEC) Sizes
208/1/50/60	91 A, 40%	100 A	6 (16 mm^2)
230/1/50/60	83 A, 40%	90 A	6 (16 mm^2)
460/1/50/60	42 A 40%	50 A	10 (6 mm^2)
575/1/50/60	32 A 40%	35 A	12 (2.5 mm^2)

WIRE SPEED RANGE
Wire Speed 50-700 IPM (1.27-17.8 m/minute)

PHYSICAL DIMENSIONS			
Height	Width	Depth	Weight
37.5 Inches	18 Inches	37.5 Inches	265 lbs

TEMPERATURE RANGES	
OPERATING TEMPERATURE RANGE -4°F to 104°F (-20°C to 40°C)	STORAGE TEMPERATURE RANGE -40°F to 185°F (-40°C to 85°C)

* With 115V receptacle loaded to 6 Amps.

INSTALLATION

Read entire installation section before starting installation.

Safety Precautions

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Do not touch electrically live parts or electrode with skin or wet clothing.**
- **Insulate yourself from work and ground.**
- **Always wear dry insulating gloves.**

- **Do not use AC welder if your clothing, cloves or work area is damp or if working on, under or inside work piece.**

  Use the following equipment:

  - Semiautomatic DC constant voltage (wire) welder.

  - DC manual (stick) welder.

  - AC welder with reduced voltage control.
- **Do not operate with panels removed.**
- **Disconnect input power before servicing.**

FUMES AND GASES can be dangerous.

- **Keep your head out of fumes.**
- **Use ventilation or exhaust to remove fumes from breathing zone and general area.**

WELDING SPARKS can cause fire or explosion.

- **Keep flammable material away.**
- **Do not weld on closed containers.**

ARC RAYS can burn eyes and skin.

- **Wear eye, ear and body protection.**

Observe all safety information throughout this manual.

UNCRATING THE POWER MIG® 360MP

Cut banding and lift off cardboard carton. Cut banding holding the machine to the skid. Remove foam and corrugated packing material. Untape accessories from Gas Bottle Platform. Unscrew the two wood screws (at the Gas Bottle Platform) holding the machine to the skid. Securely lift and remove the machine from the skid.

LOCATION

Locate the welder in a dry location where there is free circulation of clean air into the louvers in the back and the louvers out the front. A location that minimizes the amount of smoke and dirt drawn into the rear louvers reduces the chance of dirt accumulation that can block air passages and cause overheating.

TILTING

Each machine must be placed on a secure, level surface, either directly or on a recommended cart. The machine may topple over if this precaution is not followed.

OUTPUT POLARITY CONNECTIONS

The welder, as shipped from the factory, is connected for electrode positive (+) polarity. This is the normal polarity for GMAW.

If negative (–) polarity is required, interchange the connection of the two cables located in the wire drive compartment near the front panel. The electrode cable, which is attached to the wire drive, is to be connected to the negative (–) labeled terminal and the work lead, which is attached to the work clamp, is to be connected to the positive (+) labeled terminal.

INPUT POWER, GROUNDING AND CONNECTION DIAGRAM

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Do not touch electrically live parts such as output terminals or internal wiring.**
- **All input power must be electrically disconnected before proceeding.**

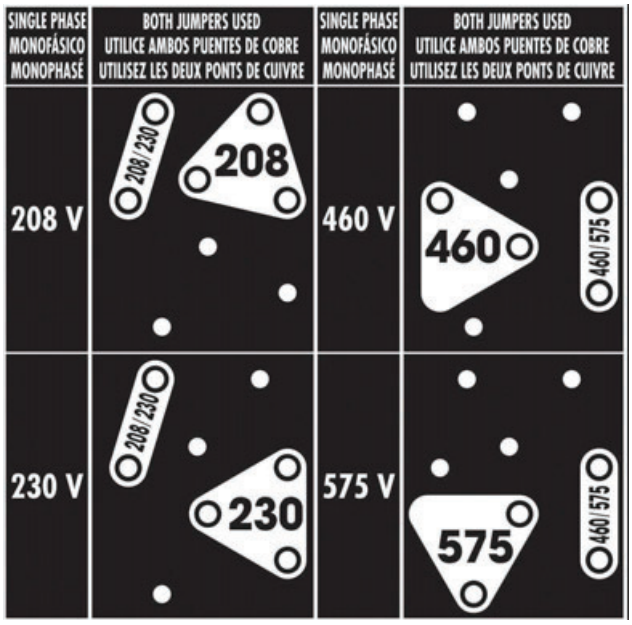
The POWER MIG® 360MP is not equipped with 460/575 volt 60 Hz plug, an input cable or a receptacle.

1. Before starting the installation, check with the local power company if there is any question about whether your power supply is adequate for the voltage, amperes, phase, and frequency specified on the welder rating plate. Also be sure the planned installation will meet the U.S. National Electrical Code and local code requirements. This welder may be operated from a single phase source or from two lines of a three phase source.
2. POWER MIG® 360MP has multiple input voltages specified on the nameplate. The unit is shipped connected for the 230 voltage. If the welder is to be operated on 208 voltage, it must be reconnected according to the instructions in Figure A.1. For higher voltage (460 & 575) reconnect per Figure A.1. Install appropriate input cable per local and national electrical code.

⚠ WARNING

Make certain that the input power is electrically disconnected before removing the screw on the reconnect panel access cover.

FIGURE A.1



3. The POWER MIG® 360MP is shipped with a 10 ft. NEMA R Type 6-50N three prong plug and cable connected to the welder. Obtain a receptacle and mount it in a suitable location. Be sure it can be reached by the plug on the input cable attached to the welder. Mount with the grounding terminal at the top to allow the power cable to hang down without bending.

NOTE:
K4467-2 DOES NOT COME WITH AN INPUT CORD INSTALLED

GUN AND CABLE INSTALLATION

The Magnum® PRO Curve 300 gun and cable provided with the POWER MIG® 360MP is factory installed with a liner for .035-.045" (0.9-1.1 mm) electrode and an .035" (0.9 mm) contact tip. Install the .045" tip (also provided) if this wire size is being used.

⚠ WARNING

Turn the welder power switch off before installing gun and cable.

(See Figure A.4 and A.5)

1. Lay the cable out straight.
2. Unscrew the Hand Screw on the drive unit front end (inside wire feed compartment - Item 3) until tip of screw no longer protrudes into Gun Adapter (Item 2) opening as seen from front of machine.
3. Insert the male end of gun cable into the Gun Adapter (Item 2) through the opening in front panel. Make sure connector is fully inserted and tighten Hand Screw.
4. Connect the Gun Trigger Connector from the gun and cable to the mating Receptacle inside the compartment located on the Front Panel (Item 1). Make sure that the keyways are aligned, insert and tighten retaining ring.
5. A Coil Claw™ (Item 5) and tool holder are included with POWER MIG® 360MP. To remove/reposition the tool holder, remove the screw and insert. Reposition into desired slot on the gas bottle upper bracket.

FIGURE A.5

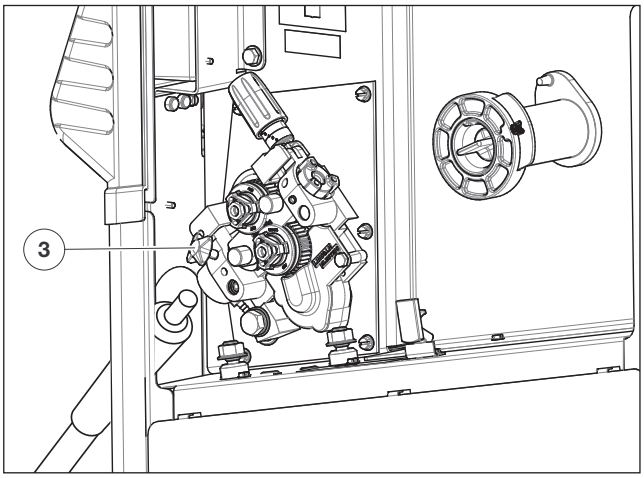
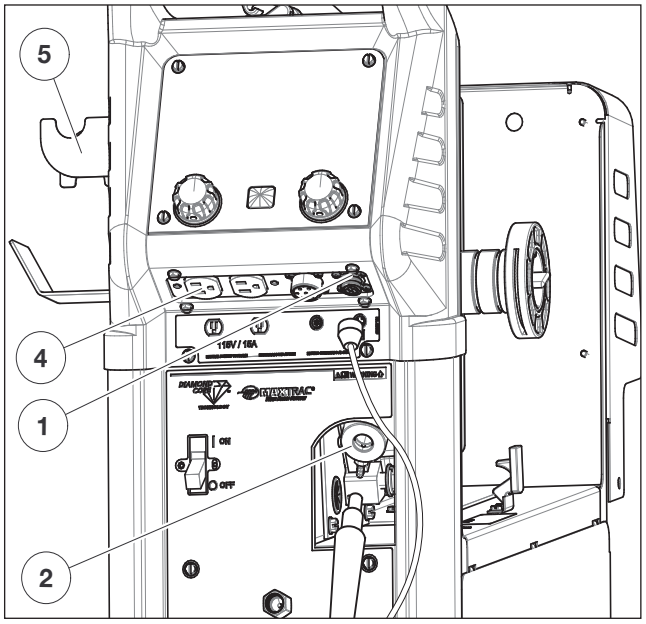


FIGURE A.4



SHIELDING GAS

For necessary processes.

Customer must provide cylinder of appropriate type shielding gas for the process being used.

A gas flow regulator, for Argon blend gas, an inlet gas hose, and a regulator adapter are factory provided with the POWER MIG® 360MP. When using 100% CO_2, the regulator adapter will be required to connect the regulator to the gas bottle.

⚠ WARNING

CYLINDER may explode if damaged.

- **Gas under pressure is explosive. Always keep gas cylinders in an upright position and always keep chained to undercarriage or stationary support.**

See American National Standard Z49.1, "Safety in Welding and Cutting" published by the American Welding Society.

Install shielding gas supply as follows:

1. Set gas cylinder on rear platform of POWER MIG® 360MP. Hook chain in place to secure cylinder to rear of welder.
2. Remove the cylinder cap. Inspect the cylinder valves and regulator for damaged threads, dirt, dust, oil or grease. Remove dust and dirt with a clean cloth.

   DO NOT ATTACH THE REGULATOR IF OIL, GREASE OR DAMAGE IS PRESENT! Inform your gas supplier of this condition. Oil or grease in the presence of high pressure oxygen is explosive.
3. Stand to one side away from the outlet and open the cylinder valve for an instant. This blows away any dust or dirt which may have accumulated in the valve outlet.

⚠ WARNING

Be sure to keep your face away from the valve outlet when "cracking" the valve.

4. Attach the flow regulator to the cylinder valve and tighten the union nut(s) securely with a wrench.

   NOTE: If connecting to 100% CO_2 cylinder, the regulator adapter provided must be installed between the regulator and cylinder valve.
5. Attach one end of the inlet gas hose to the outlet fitting of the flow regulator, the other end to the POWER MIG® 360MP rear fitting marked "Feeder" and tighten the union nuts securely with a wrench.
6. Before opening the cylinder valve, turn the regulator adjusting knob counterclockwise until the adjusting spring pressure is released.
7. Standing to one side, open the cylinder valve slowly a fraction of a turn. When the cylinder pressure gauge pointer stops moving, open the valve fully.

⚠ WARNING

Never stand directly in front of or behind the flow regulator when opening the cylinder valve. Always stand to one side.

8. The flow regulator is adjustable. Adjust it to the flow rate recommended for the procedure and process being used before making the weld.

AUXILIARY POWER RECEPTACLES

This machine is equipped with 15Amp 120V receptacle with 15Amp Circuit Breaker. The receptacle is UL and CSA approved.

OPERATION

SAFETY PRECAUTIONS

Read this entire section of operating instructions before operating the machine.

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Do not touch electrically live parts or electrode with skin or wet clothing. Insulate yourself from work and ground.**
- **Always wear dry insulating gloves.**

FUMES AND GASES can be dangerous.

- **Keep your head out of fumes.**
- **Use ventilation or exhaust to remove fumes from breathing zone.**

WELDING SPARKS can cause fire or explosion.

- **Keep flammable material away.**
- **Do not weld on containers that have held combustibles.**

ARC RAYS can burn.

- **Wear eye, ear, and body protection.**

PRODUCT DESCRIPTION

The POWER MIG® 360MP is a complete, semiautomatic multi-process DC arc welding machine offering CV and CC DC welding built to meet NEMA specifications. The standard machine is equipped to weld CC-Stick, CC-GTAW, CV-FCAW, and synergic and non-synergic CV-GMAW. GMAW-P, Pulse-on-Pulse® and Power Mode® welding processes.

Other features include a 7" Digital User Interface with synergic controls and memory capability, a 2" (51mm) O.D. wire reel spindle with adjustable brake, integral gas cylinder mounting undercarriage, an adjustable CO2 or Argon blend flow regulator with cylinder pressure guage and inlet hose, a 15 ft. (4.6m) Magnum PRO Curve 300 gun and cable, a 10 ft. (3.1m) power cable and NEMA R Type 6-50N three prong plug and a 10 ft. (3.1m) work cable and clamp.

The POWER MIG® 360MP features built in timer functions that provide variable burnback control, a spot function, a selectable 4-step trigger interlock, and an adjustable 'Run-In' for wire starting optimization. ARCFX™ technology comes standard and provides a way tp graphically communicate instant feedback of how the end user settings affect the weld outcome when adjusting wire feed speed and voltage.

WELDING CAPABILITY

The POWER MIG® 360MP is rated at 350 amps @ 31.5 volts, at a 40% duty cycle based on a ten minute cycle time for GMAW processes. It is capable of higher duty cycles at lower output currents and capable of up to 360 Amps at lower duty cycles.

LIMITATIONS

POWER MIG® 360MP WILL NOT operate satisfactorily if powered with a portable or in-plant generating system. The Power MIG 360MP is not dual procedure compatible

SETTING THE POWER MIG® 360 MACHINE TO WELD

Power up the machine using the switch on the front of the machine (See Item 8 of Figure B.1).

Allow machine to go through its booting stage. This will take approximately 20 seconds.

The machine will take you to the Home Screen and display the settings that were last input by the user.

To select a new welding process, press the middle Select Process button

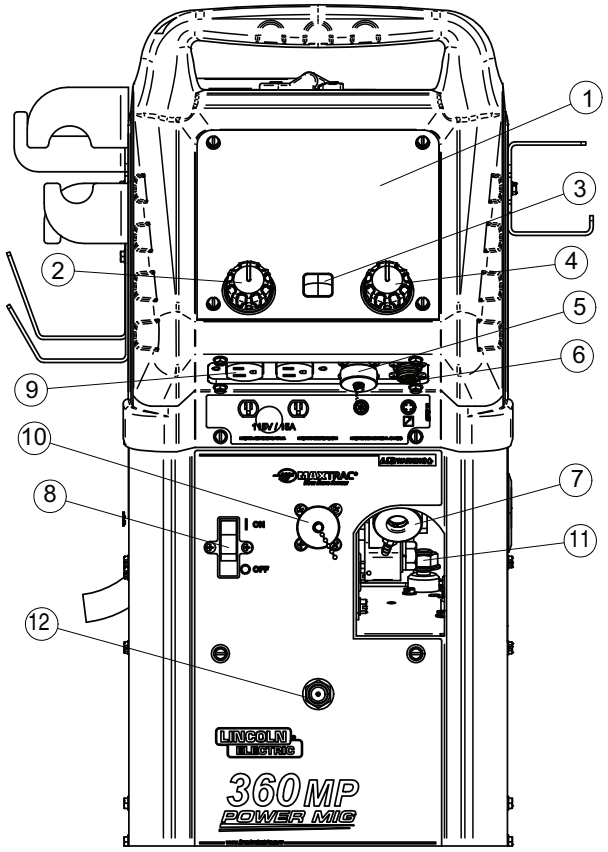
By turning the right knob, select the desired welding process from the list. Press the right knob to make selection.

Welding Processes Screen Selections

-  Manual Mig Mode
-  (GMAW)
-  Self-Shielded Flux Core (FCAW-S)
-  Gas-Shielded Flux Core (FCAW-G)
-  Spool Gun
-  Push-Pull Gun
-  TIG (GTAW)
-  Stick (SMAW)
-  Legacy Mode List
-  Load
-  Configuration

CASE FRONT CONTROLS

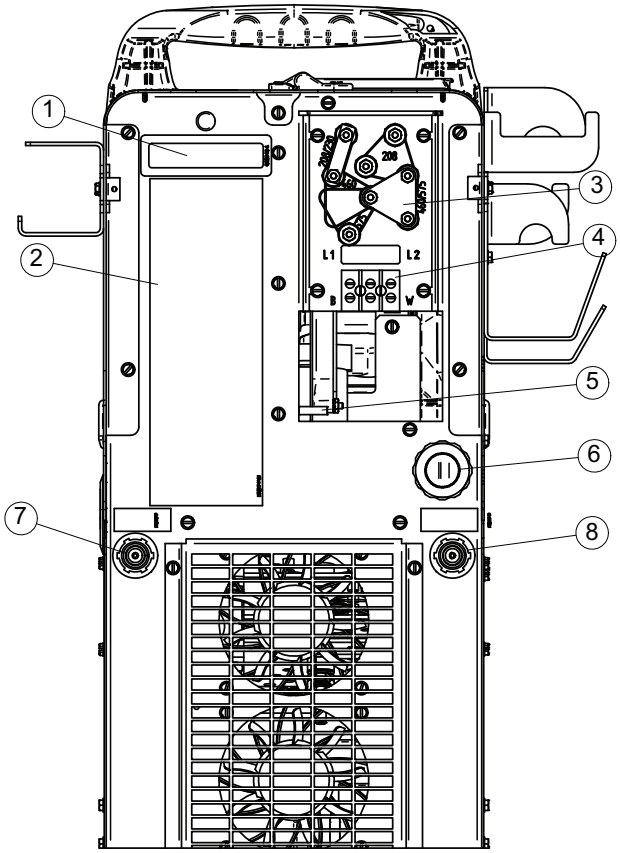
FIGURE B.1



1. **Color LED Screen** – Permits visualization of welding process and parameters. The screen features a replaceable screen shield for protecting against dust & dirt.
2. **Back Button/Knob** – Rotate adjusts value, push to move back to previous selection
3. **Home Button** – Returns the user to the Home Screen. At the Home Screen, the user can select a welding process or the display settings can be configured.
4. **Select Button/Knob** – Rotate adjusts value, push confirms the selected value or choice
5. **Seven Pin Connector** – For attaching optional remote control equipment. Includes auto-sensing remote control circuit.
6. **Four Pin Trigger Receptacle** – Permits triggering the machine for MIG/FCAW or aluminum MIG. Connect the 4-pin connector present on the welding gun to the receptacle.
7. **Gun Connection** – Permits attachment of a MIG welding gun. Ensure the gun is fully seated into the brass receptacle.
8. **Power Switch** – Permits turning the machine on or off.
9. **115V receptacle**
10. **Six Pin Connector** - Permits connecting a remote or TIG pedal.
11. **Output Studs** - Used to connect work and electrode leads.
12. **TIG/Spool Gun Gas Connector** - Used to connect gas to TIG torch or a spool gun.

CASE BACK CONTROLS

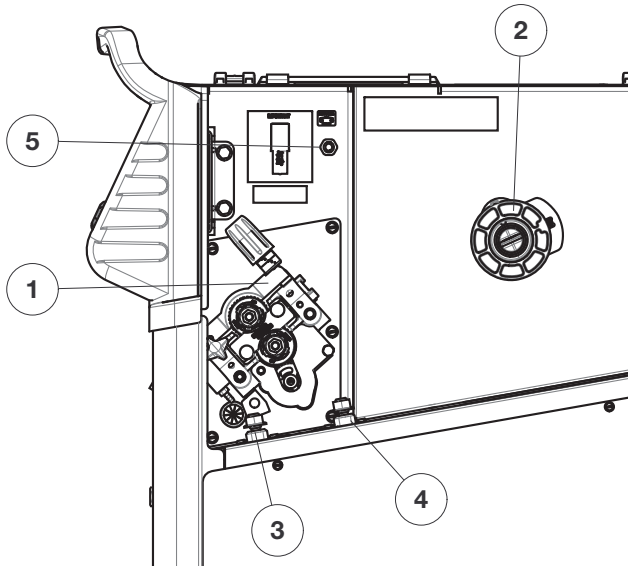
FIGURE B.2



1. **Decal** – Serial number.
2. **Decal** – Input supply connection diagram
3. **Reconnect Panel Assembly**
4. **Input Cable Connecting Block**
5. **Grounding** – Input cable ground cable connector
6. **Input power cord** - Not included in code 13450
7. **Spool Gun/TIG Gas Solenoid Connector**
8. **MIG/Push-Pull Gas Solenoid Connector** – Connection to gas hose

INTERNAL CONTROLS

FIGURE B.3

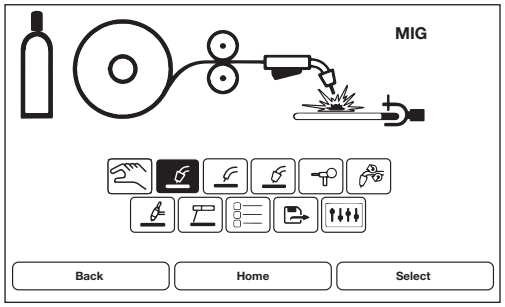


1. **Wire Drive Tension Pressure Adjustment** – Permits increasing or decreasing the pressure applied to the top drive roll.
2. **Wire Drive Spindle** – Supports a 4-inch or 8-inch spool of wire. The center wing-nut can be adjusted to increase tension on the wire.
3. **Negative Output Receptacle** – Permits attaching a work lead, electrode stinger, or the center wire drive polarity lead to DC negative polarity. Rotate connector clockwise to lock into place.
4. **Positive Output Receptacle** – Permits attaching a work lead, electrode stinger or the center wire drive polarity lead to DC positive polarity. Rotate clockwise to lock into place.
5. **Thermal Breaker** – The POWER MIG® 360 features a resettable 15 amp circuit breaker. If the current conducted through the breaker exceeds 15 amps for an extended period of time, the breaker will open and require manual reset.

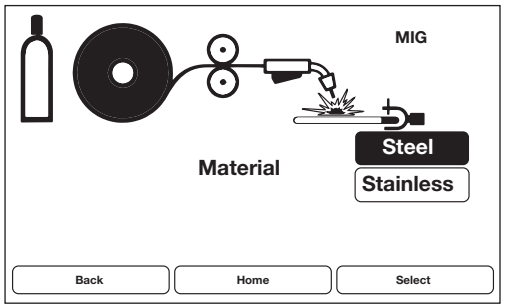
READY.SET.WELD™

The POWER MIG® 360 comes equipped with Ready.Set.Weld™ which allows the user to easily select the correct welding procedure per their application.

Select your process

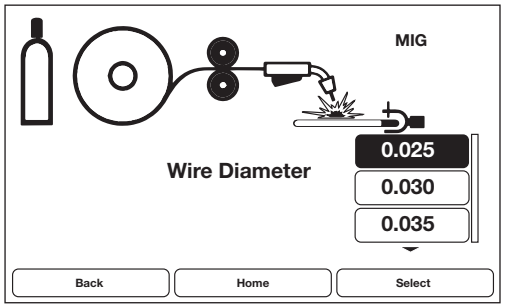


Select your material

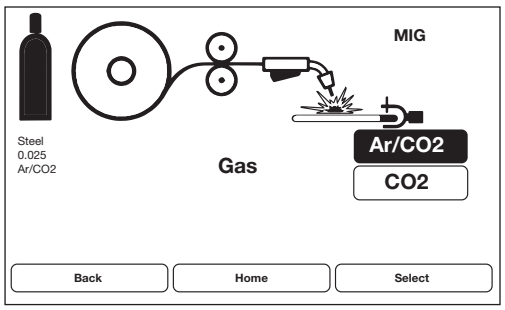


Select wire diameter

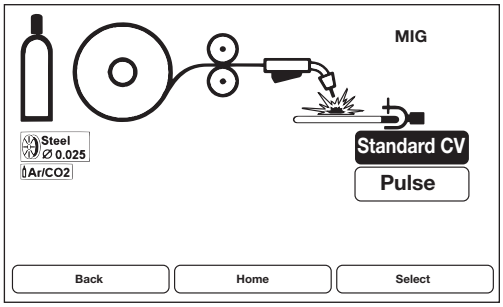
Ensure contact tip, liner, and drive rolls match wire size



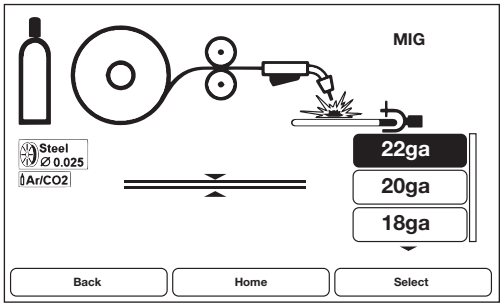
Select gas (If Applicable)



Select wave form type (If Applicable)

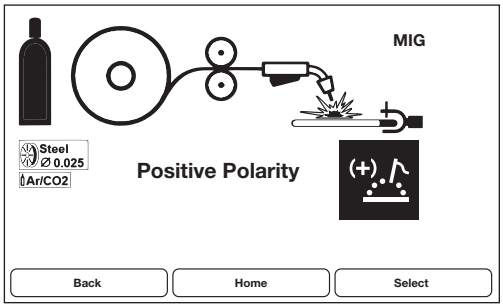


Select the thickness of the material to be welded



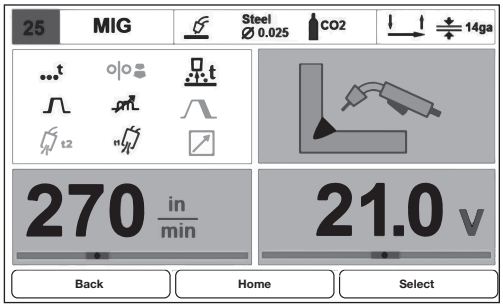
Confirm polarity

Turn off machine before changing polarity



Adjust Wire Feed Speed and Voltage/Trim accordingly

- Note: The green section indicates the ideal range for the input welding parameters



WELDING PROCESSES MENU

Manual MIG

See section on installing wire and setting up MIG gun.

Use this process to bypass Ready.Set.Weld™ options and manually input MIG welding wire feed speed and voltage.

MIG (GMAW) / Flux Core (FCAW-S) / Gas Shielded Flux Core (FCAW-G)

Follow Ready.Set.Weld™ prompts and insert parameters per your application.

Once on the home screen, use the left selector knob to adjust the wire feed speed.

For CV processes, use the right selector knob to adjust voltage.

For pulse processes, use the right selector knob to adjust trim.

Trim adjusts the arc length and ranges from 0.50 to 1.50 with a nominal value of 1.00. Trim values greater than 1.00 increase the arc length, while values less than 1.00 decrease the length.

Access Pulse and Pulse-on-Pulse® via the Weld Settings menu. See Special Welding Processes section for further details.

Spool Gun/Push-Pull

These modes are for use with an optional spool or push-pull gun. These processes may require the calibration of your gun before use. You can choose to calibrate your gun in the Ready.Set.Weld™ options of this process.

When selecting a material, 4xxx indicates aluminum that is primarily alloyed with silicon. 5xxx indicates aluminum that is primarily alloyed with magnesium.

Once on the home screen, adjust the WFS via the remote pot on the gun.

For CV processes, use the right selector knob to adjust voltage.

For pulse processes, use the right selector knob to adjust trim.

Trim adjusts the arc length and ranges from 0.50 to 1.50 with a nominal value of 1.00. Trim values greater than 1.00 increase the arc length, while values less than 1.00 decrease the length.

TIG (GTAW)

Follow Ready.Set.Weld™ prompts and insert parameters per your application.

Use the right selector knob to adjust the weld current.

Note: The green section indicates the ideal range for the input welding parameters.

If no foot pedal is connected, you must turn on the weld output before welding. While on the Home Screen, turn on the weld output by turning the left selector knob clockwise. Turn off the welding output by turning the left selector knob counter clockwise.

If a foot pedal is connected, pressing the foot pedal turns on the welding output, and releasing the pedal turns off the output.

The welding output must be turned off before accessing the Weld Settings.

Access TIG Pulse via the Weld Settings menu. See Special Welding Processes section for further details.

Stick (SMAW)

Select between Soft or Crisp arc

Soft: Has a less penetrating arc characteristic. For low hydrogen types of electrodes (E7018, E8018, E9018, etc) a softer arc is usually desirable.

Crisp: Has a higher energy arc characterized by more penetration. For cellulosic types of electrodes (E6010, E7010, E6011,etc) a higher energy arc is required to maintain arc stability. This is usually indicated when the electrode sticks to the work-piece or when the arc pops-out during manipulative technique.

You must turn on the weld output before welding. While on the Home Screen, turn on the weld output by turning the left selector knob clockwise. Turn off the welding output by turning the left selector knob counter clockwise.

The welding output must be turned off before accessing the Weld Settings.

WELD SETTINGS

The POWER MIG® 360 allows the user to make adjustments to the advanced weld parameters via the Weld Settings screen.

Access the Weld Settings screen from the Home Screen by pressing the right selector knob. The options available are dependent on the weld process that has been selected. The following section lists the weld settings that may available to adjust.

Any settings that have deviated from the default setting will be highlighted on the top left of the Home Screen.

ARC CONTROL- See Arc Control section below.

BURNBACK- Setting the Burnback means setting the adjustable time delay between turning off the wire feeding and turning off the arc. Burnback helps to prevent wire sticking to the puddle.

CRATER- The crater is the end of the weld, which normally solidifies creating a concave surface. This can result in stresses that can cause cracks in the center of the crater. The purpose of the Crater control is to fill up the crater, so that its surface becomes flat.

FREQUENCY (PULSE TIG™, PULSE-ON-PULSE®, VERTICAL UP PULSE)- Adjusts the frequency of the pulse wave.

HOT START- Adjusts current at start of weld to help prevent stubbing of the electrode.

POSTFLOW- The Postflow setting allows a time to be selected for shielding gas to continue to flow after the trigger is released and output current is turned off.

PREFLOW- The Preflow setting allows a time to be selected for shielding gas to flow after the trigger is pulled and prior to wire feeding and establishing an arc.

PULSE- Selecting this mode allows the user to toggle between standard CV TIG welding, and Pulse TIG. See section on Pulse TIG Mode.

RUN-IN- The Run-In function offers the ability to set a wire feed speed, from trigger until an arc is established, that is independent of the Welding or Start wire feed speed. Setting a Run-In WFS lower than the welding WFS avoids stubbing problems when starting the arc.

SAVE- Allows you to save the parameters you have input to access later from the list of memories. See Loading Memories section.

SPOT TIME- The Spot Timer adjusts arc on-time for spot or tack welds.

START- This machine provides the option of setting a Starting Procedure to start the weld, and from there, to ramp to the welding procedure over a specified amount of time. Typically starting on a higher starting procedure than the welding procedure is known as a “Hot Start”. Setting a starting procedure lower than the welding procedure is known as a “Cold Start”.

THICKNESS- Adjusts the material thickness parameter

TRIGGER- Toggles between single and double trigger mode. In single trigger mode, squeeze and release trigger to start and stop welding. In double trigger mode, squeeze and release trigger to start welding. Then squeeze and release trigger to stop welding.

The table below lists the weld process and which weld settings are available to change.

Weld Settings

	Arc Control	Burnback	Crater	Hot Start	Preflow/Postflow	Run In	Spot	Start
CC-Stick	Yes	-----	-----	Yes	-----	-----	-----	Yes
CC-GTAW	Pulse	-----	-----	-----	Postflow Only	-----	-----	Yes
CV-FCAW	Yes	Yes	Yes	-----	-----	Yes	Yes	Yes
CV-GMAW	Yes	Yes	Yes	-----	Yes	Yes	Yes	Yes
CV-GMAW-P	Yes	Yes	Yes	-----	Yes	Yes	Yes	Yes
Power	Yes	Yes	Yes	-----	Yes	Yes	Yes	Yes

ARC CONTROL

The POWER Mig® 360 allows the user to make adjusts to the welding arc via the Weld Settings screen. Options available are dependent on the welding process you have selected. The table below lists the arc controls available per welding process.

PROCESS	ARC CONTROL SYNONYM	SETTING	APPLICATION AND RESULT
SMAW (STICK)	Arc Force	Lower (-1 to -10) for low hydrogen types of electrodes. Higher (+1 to +10) for cellulosic and other types.	Negative settings are soft and buttery for low hydrogen electrodes. Positive settings are harsh and digging for other types of electrodes.
Short circuiting metal transfer	Pinch Control	Setting -1 to -10 for softer higher energy arc. Setting +1 to +10 for a crisper lower energy arc.	Negative settings result in a more fluid puddle and larger droplet size. The positive settings reduce the droplet size and reduce energy to the arc.
Vertical Up, Pulse, Pulse – on –Pulse®	Pulsed frequency control	Negative settings reduces frequency. Positive settings increase frequency.	Negative settings result in a wider bead with more distinct ripples. Positive settings narrow the resultant bead and the ripples are less distinct.
Pulse	Arc Control	Negative settings widen the arc cone. Positive settings focus the arc cone.	Negative settings result in a wider bead with more distinct ripples. Positive settings narrow the resultant arc and weld bead.

Legacy Weld Modes

The POWER MIG® 360 has all the functionality of the POWER MIG® 350, and more. If you are familiar with the weld modes of the POWER MIG® 350, you can access these weld modes via the Legacy Modes menu. You can scroll through the list of Legacy Weld Modes and access all the modes that were available on the POWER MIG® 350. Press the right selector knob to select a Legacy Mode. Turn the left and right selector knobs to make any adjustments to the WFS/Amperage and Voltage/Trim. See Appendix for the complete list of Legacy Weld Modes.

Loading Memories

The POWER MIG® 360 enables the user to save the Ready.Set.Weld™ and Weld Setting parameters they input in order to quickly access in the future.

To save your weld settings, access the Weld Settings from the Home Screen by pressing the right selector knob. Use the right selector knob to scroll to the Save icon. Select the save icon, and assign a spot in the list to save the settings to.

Note: Selecting a spot in the list that is already assigned to another weld process will overwrite the previous weld process.

To access the saved weld settings, from the home screen, press the middle button to select a weld process. Use the right selector knob to scroll to and select the Saved icon.

Scroll to the spot in the list you assigned your desired weld settings.

Configurations

REMOTE GUN POT - Disable or Enable Remote Gun Pot

BRIGHTNESS - The brightness of the display can be adjusted within the settings option.

MEASUREMENT SYSTEM - The units of measure can be chosen by the user. The units can be selected as metric or English. The default units are English.

LANGUAGE - The language of the text present in the user interface software can be modified. The available language options are English, French and Spanish. The default language is English.

FACTORY RESET - The user interface software settings can be reset to the original factory settings.

SYSTEM INFO - Information regarding the software revision of the user interface and the software revision of the inverter board is present in the information section.

DEMO MODE - Selecting demo mode enables a series of automated transitions through the display screen that will provide the user a visual overview of the user interface and the machine's capabilities. Pressing any button while in Demo Mode will pause the demonstration for 30 seconds. In demo mode the output is disabled. To permit welding, the user must exit demo mode or power cycle the machine, or disable it via the Configurations Menu.

Current Calibration - Selecting current calibration mode allows a service technician the ability to calibrate the machine's output current. See Maintenance section for more details.

Voltage Calibration - Selecting voltage calibration mode allows a service technician the ability to calibrate the machine's output voltage. See Maintenance section for more details.

SPECIAL WELDING PROCESSES

PULSE WELDING

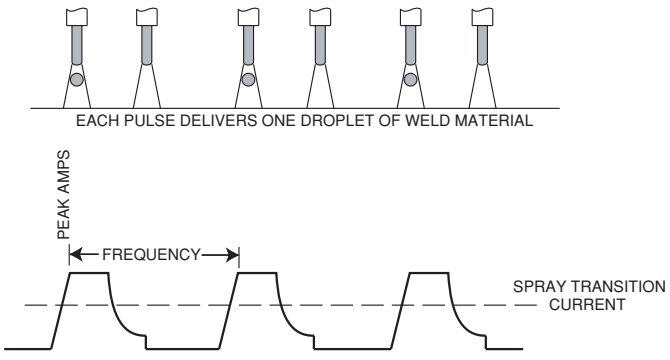
The pulsed-arc process is, by definition, a spray transfer process wherein spray transfer occurs in pulses at regularly spaced intervals. In the time between pulses, the welding current is reduced and no metal transfer occurs.

Pulsed-arc transfer is obtained by operating a power source between low and high current levels. The high current level or “pulse” forces an electrode drop to the workpiece. The low current level or “background” maintains the arc between pulses.

Pulsed MIG is an advanced form of welding that takes the best of all the other forms of transfer while minimizing or eliminating their disadvantages. Unlike short circuit, pulsed MIG does not create spatter or run the risk of cold lapping. The welding positions in pulsed MIG are not limited as they are with globular or spray and its wire use is definitely more efficient. Unlike the spray arc process, pulsing offers controlled heat input that allows better welding on thin materials, lower wire feed speeds and leads to less distortion and improved overall quality and appearance. This is especially important with stain- less, nickel and other alloys that are sensitive to heat input.

In Pulse MIG mode, arc control adjusts the background current and frequency of the wave. When arc control goes up, the frequency increases thus increasing the droplet transfer rate.

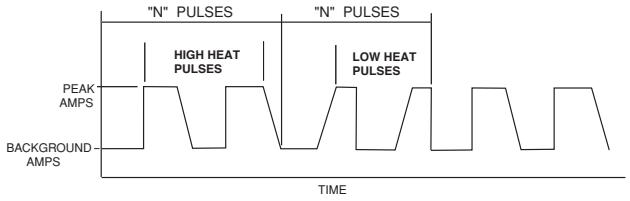
FIGURE B.5



PULSE-ON-PULSE®

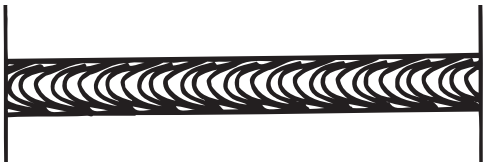
Pulse on Pulse™ is a Lincoln process specifically designed for use in welding relatively thin (less than 1/4" thick) aluminum (See Table B.3). It gives weld beads with very consistent uniform ripple.

FIGURE B.6



In Pulse on Pulse modes, two distinct pulse types are used, instead of the single pulse type normally used in GMAW-P. A number of high energy pulses are used to obtain spray transfer and transfer metal across the arc. Such pulses are shown in Figure B.6. After a number "N" of such pulses, depending on the wire feed speed used, an identical number "N" of low energy pulses are performed. These low energy pulses, shown in Figure B.6, do not transfer any filler metal across the arc and help to cool the arc and keep the heat input low.

FIGURE B.7



The Peak Current, Background Current, and Frequency are identical for the high energy and low energy pulses. In addition to cooling the weld down, the major effect of the low energy pulses is that they form a weld ripple. Since they occur at very regular time intervals, the weld bead obtained is very uniform with a very consistent ripple pattern. In fact, the bead has its best appearance if no oscillation of the welding gun ("whipping") is used.

Pulse Tig

Use Pulse TIG welding to help minimize burn through on thin materials. It can help to increase travel speed and result in a smaller bead width. Lower heat input may lessen warpage of parts, especially stainless steel materials.

The Pulse TIG feature has a single knob control which sets the Pulse Frequency over the range of .5-19.5 Hz (0.5-19.5 pulses per second). Setting the frequency to “off” disables the Pulse TIG feature. The pulse setting automatically regulates the output current between the peak amperage, set by the max output current between the peak amperage, set by the max output control and the remote amtrol (if used), ad a background amperage setting that is equal to 60% of the peal amperage setting. The Peak pulse % on-time is fixed at 50%.

Power Mode®

The Power Mode® process was developed by Lincoln to maintain a stable and smooth arc at low procedure settings which are needed to weld thin metal without pop-outs or burning-through. For Aluminum welding, it provides excellent control and the ability to maintain constant arc length. This results in improved welding performance in two primary types of applications.

- Short Arc MIG at low procedure settings.
- Aluminum MIG welding.

Power Mode® is a method of high speed regulation of the output power whenever an arc is established. It provides a fast response to changes in the arc. The higher the Power Mode® Setting, the longer the arc. If a welding procedure is not established, the best way to determine the Power Mode® Setting is by experimentation until the desired output result is established.

In the Power Mode® two variables need to be set:

- Wire Feed Speed
- Power Mode® Trim

Setting up a Power Mode® procedure is similar to setting a CV MIG procedure. Select a shielding gas appropriate for a short arc process.

- For steel, use 75/25 Ar/CO2 shield gas.
- For Stainless, select a Helium/Argon/CO2 blend.
- For Aluminum, use 100% Ar.

Start by setting the wire feed speed based upon material thickness and appropriate travel speed. Then adjust the Trim knob as follows.

- For steel, listen for the traditional “frying egg” sound of a good short-arc MIG procedure to know you have the process set correctly.
- For aluminum, simply adjust the Trim knob until the desired arc length is obtained.

Note: Trim display is simply a relative number and DOES NOT correspond to voltage.

Drive Rolls

The drive rolls installed with the POWER MIG® 360MP have two grooves one for .035" (0.9mm) wire Solid Steel electrode and the other for .045" (1.1mm) wire. Drive roll size is stenciled on each side of the drive roll. If feeding problems occur, check to make sure that the wire size and the drive roll size matches. See "Procedure for Changing Drive Roll" in this section. This information also appears on the Procedure Decal on the door inside the wire compartment.

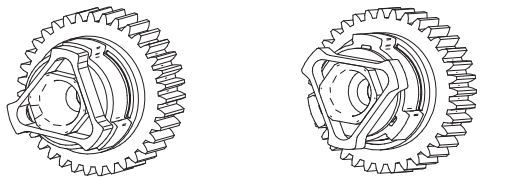
WIRE SIZE CONVERSION PARTS

The drive roll kits and Magnum® PRO Curve 300 gun and cable parts are available to feed different sizes and types of electrodes. See Accessories section.

PROCEDURE FOR CHANGING DRIVE AND IDLE ROLL SETS

1. Turn off the power source.
2. Release the pressure on the idle roll by swinging the adjustable pressure arm down toward the back of the machine. Lift the cast idle roll assembly and allow it to sit in an upright position.
3. Remove the outside wire guide retaining plate by loosening the two large knurled screws.
4. Twist the drive roll retaining mechanism to the unlocked position as shown below and remove the drive roll. (See Figure B.2)

FIGURE B.2



UNLOCKED POSITION LOCKED POSITION

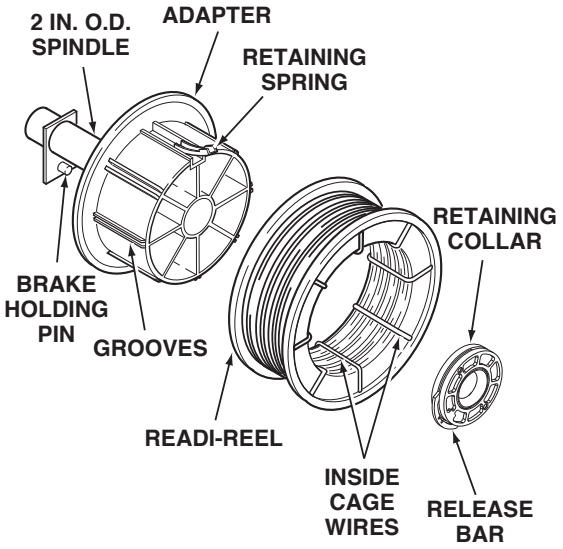
5. Remove the inside wire guide plate.
6. Replace the drive and idle rolls and inside wire guide with a set marked for the new wire size. NOTE: Be sure that the gun liner and contact tip are also sized to match the selected wire size.
7. Manually feed the wire from the wire reel, over the drive roll groove and through the wire guide and then into the brass bushing of the gun and cable assembly.
8. Replace the outside wire guide retaining plate by tightening the two large knurled screws. Reposition the adjustable pressure arm to its original position to apply pressure. Adjust pressure as necessary.

WIRE REEL LOADING - READI REELS, SPOOLS OR COILS

To Mount a 30 Lb. (14 kg) Readi-Reel Package (Using the Molded Plastic K363-P Readi-Reel Adapter:)

(See Figure B.3)

FIGURE B.3



1. Open the Wire Drive Compartment Door.
2. Depress the Release Bar on the Retaining Collar and remove it from the spindle.
3. Place the Optional Adapter on the spindle.
4. Re-install the Retaining Collar. Make sure that the Release Bar "pops up" and that the collar retainers fully engage the retaining ring groove on the spindle.
5. Rotate the spindle and adapter so the retaining spring is at the 12 o'clock position.
6. Position the Readi-Reel so that it will rotate in a direction when feeding so as to be de- reeled from top of the coil.
7. Set one of the Readi-Reel inside cage wires on the slot in the retaining spring tab.
8. Lower the Readi-Reel to depress the retaining spring and align the other inside cage wires with the grooves in the molded adapter.
9. Slide cage all the way onto the adapter until the retaining spring "pops up" fully.

⚠ CAUTION

CHECK TO BE SURE THE RETAINING SPRING HAS FULLY RETURNED TO THE LOCKING POSITION AND HAS SECURELY LOCKED THE READI-REEL CAGE IN PLACE. RETAINING SPRING MUST REST ON THE CAGE, NOT THE WELDING ELECTRODE.

10. To remove Readi-Reel from Adapter, depress retaining spring tab with thumb while pulling the Readi-Reel cage from the molded adapter with both hands. Do not remove adapter from spindle.

To Mount 10 to 44 Lb. (4.5-20 kg) Spools (12"/300 mm Diameter) or 14Lb.(6 Kg) Innershield Coils:

(For 13-14 lb. (6 Kg) Innershield coils, a K435 Coil Adapter must be used).

(For 10 lb.(4.5 Kg) 8 inch(203mm) diameter spools, a K468 spindle adapter must be used).

1. Open the Wire Drive Compartment Door.
2. Depress the Release Bar on the Retaining Collar and remove it from the spindle.
3. Place the spool on the spindle making certain the spindle brake pin enters one of the holes in the back side of the spool (Note: an arrow mark on the spindle lines up with the brake holding pin to assist in lining up a hole). Be certain the wire comes off the reel in a direction so as to de-reel from the top of the coil.
4. Re-install the Retaining Collar. Make sure that the Release Bar "pops up" and that the collar retainers fully engage the retaining ring groove on the spindle.

TO START THE WELDER

Turn the "Power Switch" switch to "ON". With the desired voltage and wire speed selected, operate the gun trigger for welder output and to energize the wire feed motor.

FEEDING WIRE ELECTRODE

⚠ WARNING

When triggering, the electrode and drive mechanism are electrically "hot" relative to work and ground and remain "hot" several seconds after the gun trigger is released.

NOTE: Check that drive rolls, guide plates and gun parts are proper for the wire size and type being used. Refer to Table C.1 in Accessories section.

1. Turn the Readi-Reel or spool until the free end of the electrode is accessible.
2. While securely holding the electrode, cut off the bent end and straighten the first six inches. (If the electrode is not properly straightened, it may not feed properly through the wire drive system).
3. Release the pressure on the idle roll by swinging the adjustable pressure arm down toward the back of the machine. Lift the cast idle roll assembly and allow it to sit in an upright position. Leave the outer wire guide plate installed. Manually feed the wire through the incoming guide bushing and through the guide plates (over the drive roll groove). Push a sufficient wire length to assure that the wire has fed into the gun and cable assembly without restriction. Reposition the adjustable pressure arm to its original position to apply pressure to the wire.
4. Press gun trigger to feed the electrode wire through the gun.

IDLE ROLL PRESSURE SETTING

⚠ WARNING

ELECTRIC SHOCK can kill.

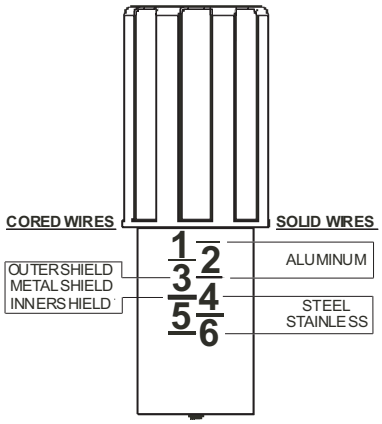
- **Turn the input power OFF at the welding power source before installation or changing drive rolls and/or guides.**
- **Do not touch electrically live parts.**
- **When inching with the gun trigger, electrode and drive mechanism are "hot" to work and ground and could remain energized several seconds after the gun trigger is released.**
- **Only qualified personnel should perform maintenance work.**

The pressure arm controls the amount of force the drive rolls exert on the wire. Proper adjustment of the pressure arm gives the best welding performance.

Set the pressure arm as follows (See Figure B.4):

Aluminum wires	**between 1 and 3**
Cored wires	**between 3 and 4**
Steel, Stainless wires	**between 4 and 6**

FIGURE B.4



WIRE DRIVE CONFIGURATION

CHANGING THE GUN RECEIVER BUSHING

Tools required:

- 1/4" hex key wrench.

Note: Some gun bushings do not require the use of the thumb screw.

1. Turn power off at the welding power source.
2. Remove the welding wire from the wire drive.
3. Remove the thumb screw from the wire drive.
4. Remove the welding gun from the wire drive.
5. Loosen the socket head cap screw that holds the connector bar against the gun bushing.

   Important: Do not attempt to completely remove the socket head cap screw.
6. Remove the outer wire guide, and push the gun bushing out of the wire drive. Because of the precision fit, light tapping may be required to remove the gun bushing.
7. Disconnect the shielding gas hose from the gun bushing, if required.
8. Connect the shielding gas hose to the new gun bushing, if required.
9. Rotate the gun bushing until the thumb screw hole aligns with the thumb screw hole in the feed plate. Slide the gun receiver bushing into the wire drive and verify the thumb screw holes are aligned.
10. Tighten the socket head cap screw.
11. Insert the welding gun into the gun bushing and tighten the thumb screw.

MAKING A WELD

1. Check that the electrode polarity is correct for the process being used, then turn the power switch ON.
2. Set desired arc voltage and wire speed for the particular electrode wire, material type and thickness, and gas (for GMAW) being used.
3. Select the desired procedure as described in "Description of Controls" Section.
4. Press the trigger to feed the wire electrode through the gun and cable and then cut the electrode within approximately 3/8" (10 mm) of the end of the contact tip [3/4" (20 mm) Outershield®].

NOTE: If set for slow run-in when the trigger is pulled, the wire feeder feeds wire at low speed regardless of the set wire feed speed until the welding arc starts or 1 second has elapsed. This feature enhances starting and makes it easier to set the stickout. The 1 second limit permits high speed loading of the gun and cable. To change run-in mode, see "Run-In Mode" in Description of Controls Section.

5. If welding gas is to be used, turn on the gas supply and set the required flow rate (typically 25-35 CFH; 12-16 liters/min).
6. When using Innershield electrode, the gas nozzle may be removed from the insulation on the end of the gun and replaced with the gasless nozzle. This will give improved visibility and eliminate the possibility of the gas nozzle overheating.
7. Connect work cable to metal to be welded. Work clamp must make good electrical contact to the work. The work must also be grounded as stated in "Arc Welding Safety Precautions".

⚠ WARNING

When using an open arc process, it is necessary to use correct eye, head, and body protection.

8. Position electrode over joint. End of electrode may be lightly touching the work.
9. Lower welding helmet, close gun trigger, and begin welding. Hold the gun so the contact tip to work distance is about 3/8" (10 mm) [3/4" (20 mm) for Outershield].
10. To stop welding, release the gun trigger and then pull the gun away from the work after the arc goes out.
11. When no more welding is to be done, close valve on gas cylinder (if used), momentarily operate gun trigger to release gas pressure, and turn off POWER MIG® 360MP.

AVOIDING WIRE FEEDING PROBLEMS

Wire feeding problems can be avoided by observing the following gun handling procedures:

- Do not kink or pull cable around sharp corners.
- Keep the gun cable as straight as possible when welding or loading electrode through cable.
- Do not allow dolly wheels or trucks to run over cables.
- Keep cable clean by following maintenance instructions.
- Use only clean, rust-free electrode. The Lincoln electrodes have proper surface lubrication.
- Replace contact tip when the arc starts to become unstable or the contact tip end is fused or deformed.
- Keep wire reel spindle brake tension to minimum required to prevent excess reel over-travel which may cause wire "loop-offs" from coil.
- Use proper drive rolls and wire drive idle roll pressure for wire size and type being used.

FAN CONTROL

The fan is designed to come on automatically when a weld arc is established. The fan will also stay on when the machine's welding and feeding are disabled during thermostatic over temperature protection. (See Welding Thermal Overload Protection)

INPUT LINE VOLTAGE PROTECTION

High Line Voltage — If the line voltage exceeds 110% of rated input voltage, the output will be reduced to the lower level to protect voltage rating of the capacitor bank.

Low Line Voltage — You may not be able to get maximum output from the machine if the line voltage is less than rated input. The unit will continue to weld, but the output may be less than what is set.

WIRE FEED OVERLOAD PROTECTION

The POWER MIG® 360MP has solid state overload protection of the wire drive motor. If the motor becomes overloaded, the protection circuitry turns off the wire feed speed weld output and gas solenoid. Check for proper size tip, liner, and drive rolls, for any obstructions or bends in the gun cable, and any other factors that would impede the wire feeding.

To resume welding, simply pull the trigger. There is no circuit breaker to reset, as the protection is done with reliable solid state electronics.

WELDING THERMAL OVERLOAD PROTECTION

The POWER MIG® 360MP has built-in protective thermostats that respond to excessive temperature. They open the wire feed and welder output circuits if the machine exceeds the maximum safe operating temperature because of a frequent overload, or high ambient temperature plus overload. The thermostats automatically reset when the temperature reaches a safe operating level and welding and feeding are allowed again, when gun is retriggered.

LIST OF LEGACY WELD MODES

Mode	Process	Procedure	Wire Size	Wire Type	Gas Type	ArcControl
1	SMAW	Stick General Purpose				Arc Force
2	SMAW	Stick Crisp				Arc Force
3	GTAW	Touch Start TIG				
5	GMAW	CV MIG				Pinch
6	FCAW-S	CV Flux Core Self Shield				Pinch
7	FCAW-G	CV Flux Core Gas Shield				Pinch
8	GTAW	TIG Pulse (0.5 - 20 Hz)				Frequency
9	GTAW	TIG Pulse (20-300 Hz)				Frequency
10	GMAW	CV	.035in	Steel	CO2	Pinch
11	GMAW	CV	.035in	Steel	Argon Blends	Pinch
14	GMAW	Pulse	.035in	Steel	Argon Blends	Arc Control
16	GMAW	Vertical Up Pulse	.035in	Steel	Argon Blends	Frequency Offset
19	GMAW	Pulse	.045in	Steel	Argon Blends	Arc Control
20	GMAW	CV	.045in	Steel	CO2	Pinch
21	GMAW	CV	.045in	Steel	Argon Blends	Pinch
23	GMAW	Vertical Up Pulse	.045in	Steel	Argon Blends	Frequency Offset
28	GMAW	CV	.025in	Steel	CO2	Pinch
29	GMAW	CV	.025in	Steel	Argon Blends	Pinch
30	GMAW	Pulse	.025in	Steel	Argon Blends	Arc Control
31	GMAW	CV	.035in	Stainless	Argon Blends	Pinch
32	GMAW	Pulse	.035in	Stainless	Argon Blends	Arc Control
33	GMAW	CV	.035in	Stainless	He Ar CO2	Pinch
34	GMAW	Pulse	.035in	Stainless	He Ar CO2	Arc Control
38	GMAW	Vertical Up Pulse	.035in	Stainless	Argon Blends	Frequency Offset
40	GMAW	Power Mode® (Non Syn)		Gas Shield		Pinch
41	GMAW	CV	.045in	Stainless	Argon Blends	Pinch
42	GMAW	Pulse	.045in	Stainless	Argon Blends	Arc Control
43	GMAW	CV	.045in	Stainless	He Ar CO2	Pinch
44	GMAW	Pulse	.045in	Stainless	He Ar CO2	Arc Control
48	GMAW	Vertical Up Pulse	.045in	Stainless	Argon Blends	Frequency Offset
61	GMAW	CV	.030in	Stainless	Argon Blends	Pinch
62	GMAW	Pulse	.030in	Stainless	Argon Blends	Arc Control
63	GMAW	CV	.030in	Stainless	He Ar CO2	Pinch
64	GMAW	Pulse	.030in	Stainless	He Ar CO2	Arc Control
71	GMAW	CV	3/64in	Aluminum 4043	Argon	Pinch
72	GMAW	Pulse	3/64in	Aluminum 4043	Argon	Arc Control
75	GMAW	CV	3/64in	Aluminum 5356	Argon	Pinch
76	GMAW	Pulse	3/64in	Aluminum 5356	Argon	Arc Control
81	GMAW	CV	.045in	Metal Core	Argon Blends	Pinch
82	GMAW	Pulse	.045in	Metal Core	Argon Blends	Arc Control
83	GMAW	CV	.052in	Metal Core	Argon Blends	Pinch
84	GMAW	Pulse	.052in	Metal Core	Argon Blends	Arc Control
85	GMAW	CV	1/16in	Metal Core	Argon Blends	Pinch
86	GMAW	Pulse	1/16in	Metal Core	Argon Blends	Arc Control
93	GMAW	CV	.030in	Steel	CO2	Pinch
94	GMAW	CV	.030in	Steel	Argon Blends	Pinch
95	GMAW	Pulse	.030in	Steel	Argon Blends	Arc Control
97	GMAW	Pulse On Pulse	.030in	Aluminum 4043	Argon	Modulation Freq
98	GMAW	Pulse On Pulse	.035in	Aluminum 4043	Argon	Modulation Freq
99	GMAW	Pulse On Pulse	3/64in	Aluminum 4043	Argon	Modulation Freq
101	GMAW	Pulse On Pulse	.035in	Aluminum 5356	Argon	Modulation Freq
102	GMAW	Pulse On Pulse	3/64in	Aluminum 5356	Argon	Modulation Freq
138	GMAW	CV	.040in	Steel	CO2	Pinch
140	GMAW	Pulse	.040in	Steel	Argon Blends	Arc Control
146	GMAW	CV	.030in	Aluminum 4043	Argon	Pinch
147	GMAW	Pulse	.030in	Aluminum 4043	Argon	Arc Control
148	GMAW	CV	.035in	Aluminum 4043	Argon	Pinch
149	GMAW	Pulse	.035in	Aluminum 4043	Argon	Arc Control
151	GMAW	CV	.035in	Aluminum 5356	Argon	Pinch
152	GMAW	Pulse	.035in	Aluminum 5356	Argon	Arc Control
190	GMAW	Pulse	.030in	Si Bronze	Argon	Arc Control
191	GMAW	Pulse	.045in	Si Bronze	Argon	Arc Control
192	GMAW	Pulse	.035in	Si Bronze	Argon	Arc Control
196	GMAW	Pulse	.045in	Copper	75He/25Ar	Arc Control

OPTIONS / ACCESSORIES

DRIVE ROLL KITS

Refer to Table C.1 for various drive roll kits that are available for the POWER MIG® 360MP.The item in Bold is supplied standard with the POWER MIG® 360MP.

TABLE C.1

Wire	Wire Size	Drive Roll Kit
Solid Steel	.023"-.030" (0.6-0.8 mm)	KP1696-030S
	.035" (0.9 mm)	KP1696-035S
	.045" (1.1 mm)	KP1696-045S
	.035"-.045" (0.9-1.1mm)	KP1696-1
	.040" (1.0mm)	KP1696-2
Cored	.035" (0.9 mm)	KP1697-035C
	.045" (1.1 mm)	KP1697-045C
Aluminum	3/64" (1.2 mm)	KP1695-3/64A
	.035" (0.9 mm)	KP1695-035A

K3675-1 Canvas Cover

K1738-1 Spool Gun Holder for POWER MIG® - provide neat storage of spool gun cable, and gas hose for POWER MIG®. Also provide hardware for routing gas inside POWER MIG® when using a Prince XL gun. (Note: included in K1809-1 and K2310-1)

K468 Spindle Adapter - for 8" (203.2mm) O.D. spool.

K363P READI-REEL™ ADAPTER - The K363P Readi-Reel Adapter mounts to the 2" spindle. It is needed to mount the 22-30 lb. Readi-Reels.

K435 Spindle Adapter for 14 lbs. coils - the K435 spindle adapter allows 14lbs. (6kg.) Innershield coils to be mounted on 2" (51mm) O.D. spindle.

K3676-1 Dual Cylinder Mounting Kit - Used to hold two gas bottle

K4493-1 36VDC Power Supply - Used to power machine off of 120V input in order to display demo mode. To power the machine via the external power supply, connect the power supply the the 4-pin connector located on the front of the machine then plug in the power supply.

ALTERNATIVE MAGNUM GMAW GUN AND CABLE ASSEMBLIES

The following Magnum® PRO 250L gun and cable assembly is separately available for use with the POWER MIG® 360MP. Each is rated 200 amps 60% duty cycle (or 250 amps 40% duty) and is equipped with the integrated connector, twist-lock trigger connector, fixed nozzle and insulator, and includes a liner, diffuser, and contact tips for the wire sizes specified:

Length	Part No.	English Wire Size[1]	Metric Wire Size
15' (4.6 m)	K3081-2	.035 – .045"	0.9 – 1.2 mm

[1] Optional liners for different wire diameters are sold separately, see table D.1 Maintenance Section.

20' and 25' Magnum® PRO Curve 300 Guns -

K2951-3 Magnum® PRO Curve 300, 20'*

K2951-4 Magnum® PRO Curve 300, 25'*

* Requires K466-6 adapter and KP44-3545-25 liner

**Not compatible with dual procedure guns

MAGNUM GUN CONNECTION KIT (OPTIONAL K466-6)

Using the optional K466-6 Magnum® Connection kit for the POWER MIG permits use of standard Magnum® 200, 300 or 400 gun and cable assemblies.

SPOOL GUN

⚠ WARNING

Remove all input power to the POWER MIG® 360MP before proceeding.

The POWER MIG® 360MP provides direct connection and use of the Spool Gun (with remote speed control).

It also provides gun trigger switch transfer between the machine's use with its feeder gun or the spool gun for same polarity welding with different wire and gas processes.

K2490-1 Magnum® 250LX

K487-25 Magnum® SG Spool Gun (requires K2445-1 Cable Adapter)

K2445-1 Magnum® SG Spool gun Control Cable Adapter. Allows the K487-25 Magnum® SG spool gun's 6-pin control cable plug to connect to the POWER MIG® 360MP's 7-pin spool gun control cable receptacle.

DUAL PROCEDURE

The Power MIG 360MP is not dual procedure compatible.

MAINTENANCE

Safety Precautions

⚠ 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.**

See additional warning information throughout this Operator's Manual

GENERAL MAINTENANCE

In extremely dusty locations, dirt may clog the air passages causing the welder to run hot. Blow dirt out of the welder with low-pressure air at regular intervals to eliminate excessive dirt and dust build-up on internal parts.

The fan motors have sealed ball bearings which require no service.

DRIVE ROLLS AND GUIDE PLATES

After every coil of wire, inspect the wire drive mechanism. Clean it as necessary by blowing with low pressure compressed air. Do not use solvents for cleaning the idle roll because it may wash the lubricant out of the bearing.

All drive rolls are stamped with the wire sizes they will feed. If a wire size other than that stamped on the roll is used, the drive roll must be changed.

For instructions on replacing or changing drive roll, see "Wire Drive Rolls" in Operation section.

CONTACT TIP AND GAS NOZZLE INSTALLATION

1. Choose the correct size contact tip for the electrode being used (wire size is stenciled on the side of the contact tip) and screw it snugly into the gas diffuser.
2. Screw the appropriate fixed gas nozzle fully onto the diffuser. Either the standard .50" (12.7 mm) flush nozzle or other optional flush or recessed (spray arc) nozzle sizes may be used. (Refer to www.lincolnelectric.com)
3. If using optional adjustable slip-on nozzles. (Refer to www.lincolnelectric.com)
   - Be sure the nozzle insulator is fully screwed onto the gun tube and does not block the gas holes in the diffuser.
   - Slip the appropriate gas nozzle onto the nozzle insulator. Either a standard .50" (12.7 mm) or optional .62" (15.9 mm) I.D. slip-on gas nozzle may be used and should be selected based on the welding application. mmi)
   - Adjust the gas nozzle as appropriate for the GMAW process to be used. Typically, the contact tip end should be flush to .12" (3.2 mm) extended for the short-circuiting transfer process and .12" (3.2 mm) recessed for spray transfer.

GUN TUBES AND NOZZLES

1. Replace worn contact tips as required.
2. Remove spatter from inside of gas nozzle and from tip after each 10 minutes of arc time or as required.

GUN CABLE CLEANING

To help prevent feeding problems, clean cable liner after using approximately 300 pounds (136 kg) of electrode. Remove the cable from the wire feeder and lay it out straight on the floor. Remove the contact tip from the gun. Using an air hose and only partial pressure, gently blow out the cable liner from the gas diffuser end.

⚠ CAUTION

Excessive pressure at the beginning of the cleaning procedure may cause the dirt to form a plug.

Flex the cable over its entire length and again blow out the cable. Repeat this procedure until no further dirt comes out. If this has been done and feed problems are experienced, try liner replacement, and refer to trouble shooting section on rough wire feeding.

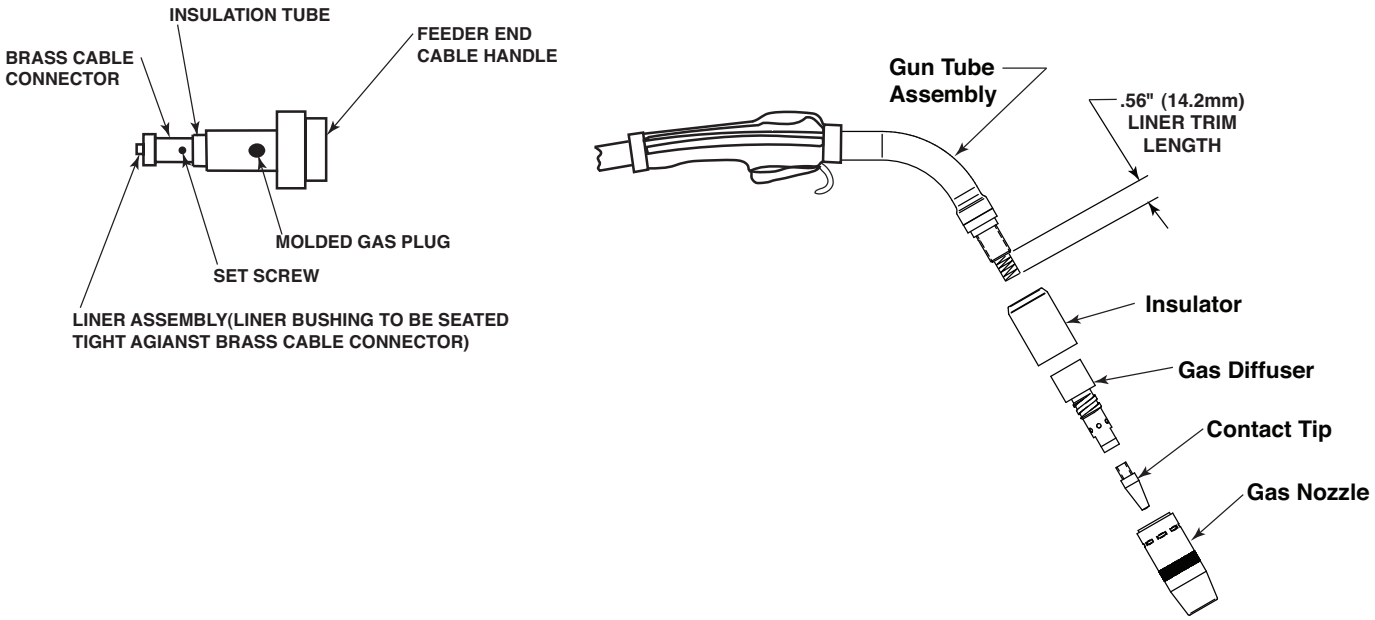
LINER REMOVAL, INSTALLATION AND TRIMMING

(See Figure D.1)

NOTE: The variation in cable lengths prevents the interchangeability of liners between guns. Once a liner has been cut for a particular gun, it should not be installed in another gun unless it can meet the liner cutoff length requirement. Liners are shipped with the jacket of the liner extended the proper amount.

1. Remove the gas nozzle.
2. Remove the gas diffuser from the gun tube.
3. Lay gun and cable out straight on a flat surface. Loosen set screw of the connector on the back end of the gun.
4. Insert the untrimmed Liner into the back end of the gun.
5. Seat Liner bushing into back of gun. Secure Liner by tightening set screw. Do not install the gas diffuser at this time.
6. Lay the cable straight and trim Liner to 9/16". Remove burrs.
7. Install insulator and secure the gas diffuser into the tube.

FIGURE D.1



Current Calibration

1. Access the Current Calibration mode from the Configuration menu.
2. Connect work and output leads to a grid load. Set grid load to approximately 80-120 mΩ. (Grid load should produce 20-30 V when supplied with 250 A.)
3. Connect a certified calibrated current probe or current meter and shunt to the output circuit.
4. Select Adjust to calibrate the machine.
5. Adjust the right selector knob until the current probe or current meter reads 250 Amps.
6. Press the right selector knob to save the calibration settings.
7. To revert to the factory calibration settings, access the Current Calibration mode from the Configuration menu and select Factory.

Voltage Calibration

1. Access the Voltage Calibration mode from the Configuration menu.
2. Connect work and output leads to a grid load. Set grid load to approximately 80-120 mΩ. (Grid load should produce 20-30 V when supplied with 250 A.)
3. Connect a certified calibrated voltmeter to the output circuit.
4. Select Adjust to calibrate the machine.
5. Adjust the right selector knob until the voltage meter reads 20 Volts.
6. Press the right selector knob to save the calibration settings.
7. To revert to the factory calibration settings, access the Voltage Calibration mode from the Configuration menu and select Factory.

Spool/Push-Pull Gun Calibration

Checking Calibration

A variety of factors affect the calibration of the Spool and Push-Pull Gun. Therefore, it is important to check the gun's calibration whenever the machine's input voltage is changed, or a new gun is connected to the machine. Follow the steps below to calibrate the gun:

1. Turn off all weld settings in the weld mode (pre/post flow, run-in, start/spot/crater time, and burn back).
2. Adjust wire feed speed to 360 (360 inches per minute = 60 inches in 10 sec).
3. Disengage the rear drive motor (By opening the tension lever).
4. Disconnect the gun from the gun receiver bushing and cut the wire at the front of the machine (Wire should run through the conduit only).
5. Make sure the gun and cable assembly are straight.
6. Using a stop watch, pull the trigger for 10 seconds.
7. Measure the wire from the tip of the torch to the end of the wire.
8. The wire should measure just under 60 inches.
9. Perform the gun calibration if the measurement is less than 57 or greater than 63.

Calibrating Spool Gun

1. To calibrate the spool gun, select Spool Gun from the Weld Process selection screen.
2. Select the appropriate gun from the list of spool gun options.
3. Select Manual calibration.
4. Adjust the offset to calibrate the spool gun. (Increase the offset if the wire measured in the Checking Calibration steps was too short. Decrease if it was too long.)
5. Press the right selector knob to select an offset.
6. Repeat the Checking Calibration steps above to confirm calibration. If wire measurement still deviates more than 3 inches, repeat calibration steps using different offset.

Calibrating Push-Pull Gun When using machine with: Magnum® PRO AL, Magnum® PRO Pistol and Magnum® PRO Cougar

1. To calibrate the push-pull gun, select Push-Pull from the Weld Process selection screen.
2. Select the appropriate gun from the list of Push-Pull gun options.
3. Select either Auto Calibration or Manual calibration.

Auto Calibration: This procedure provides an automatic means to synchronize the speeds of the rear push motor and front pull motor. Before running the auto calibration procedure, make sure the machine and the gun cable are set up and ready for welding. Pull the gun trigger and hold it closed throughout the procedure. Wire will feed out of the gun while the calibration is being performed, however the welding output will NOT be energized. Wire will stop feeding when the calibration is complete. Auto calibration should be performed whenever the wire or gun is changed.

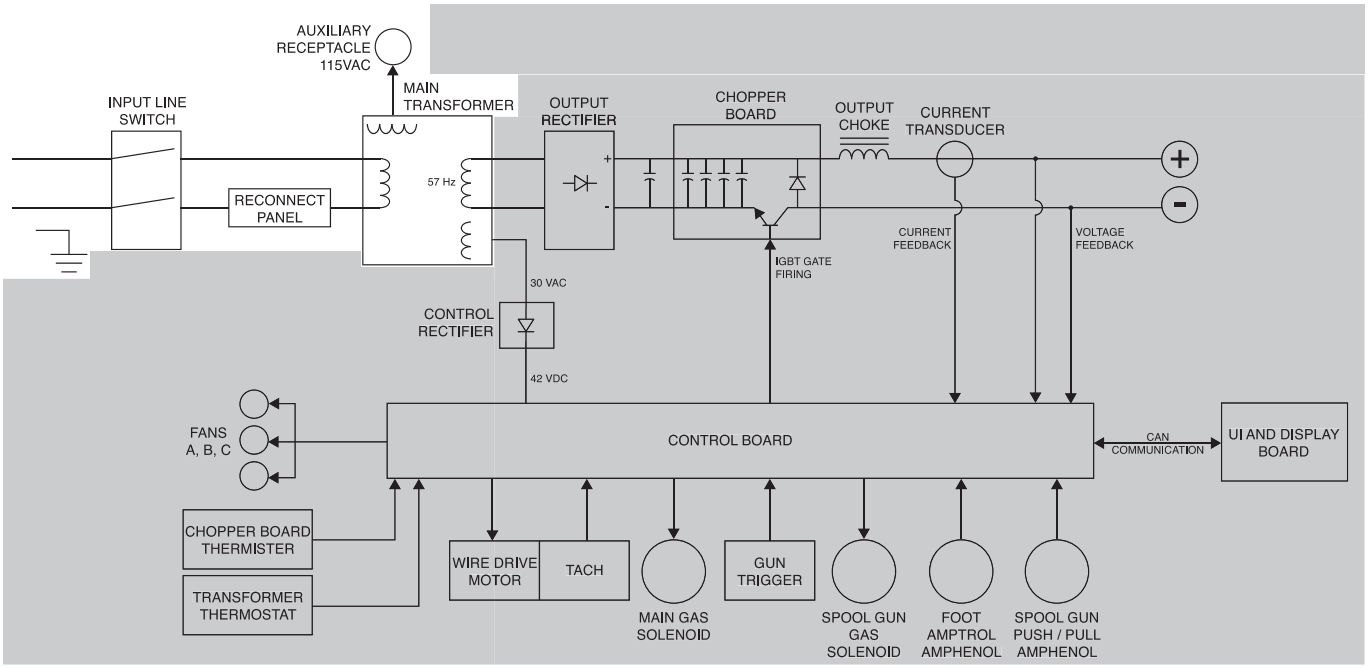
Manual Calibration: this procedure allows a direct adjustment on the pull motor speed by Offset value. The default is 90. A wire nesting or tangling issue can be resolved by increasing this value, and a wire slipping or shaving issue can be resolved by decreasing this value.

When using the machine with Custom push-pull guns, only manual calibration is available. This operation is described in the previous section.

Theory of Operation

Theory of Operation

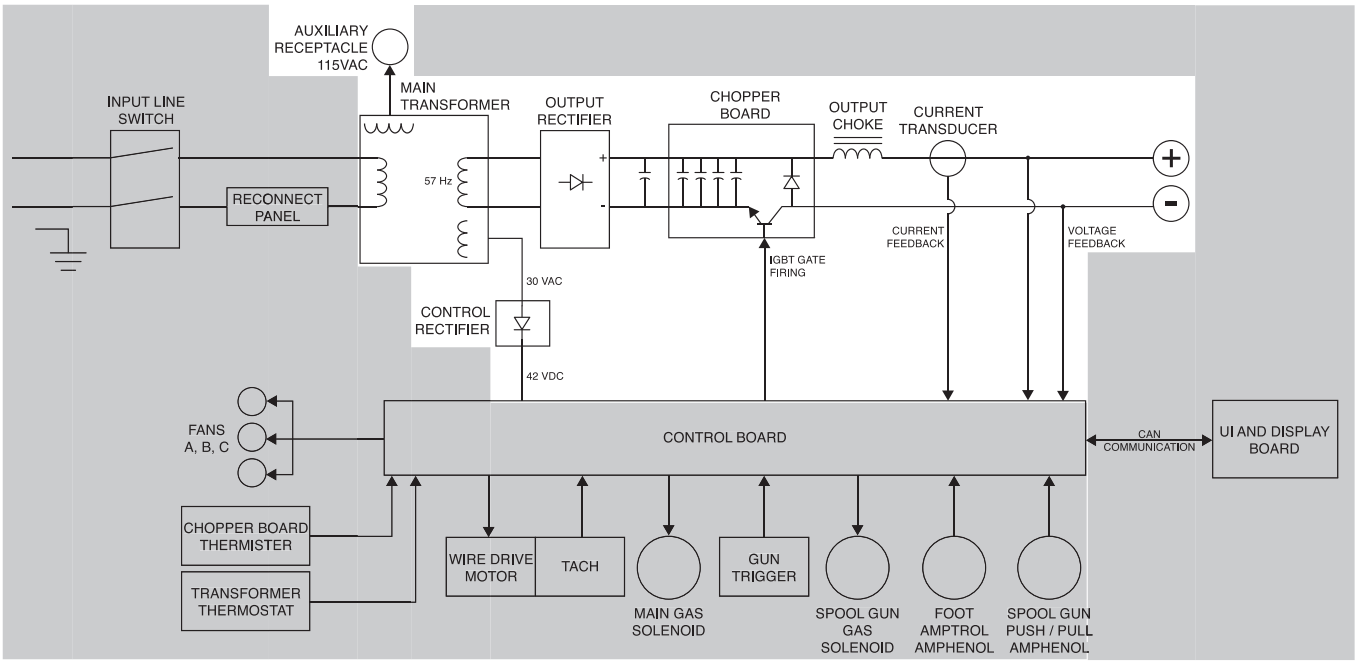
Figure E.1 – Input voltage and main transformer



Input Voltage And Main Transformer

The appropriate single phase input power is brought into the rear of the machine. A reconnect panel, also located at the rear of the unit, allows the user to configure the primary windings in the main transformer for the AC input voltage being applied. When the input line switch is closed AC input power is routed through the reconnect panel and then to the primary windings of the main transformer. The main transformer converts the high voltage, low current input power to a lower voltage, high current output. The main transformer has three secondary windings. One supplies 57 VAC to the output rectifier for welding power. One supplies 30 VAC to the control rectifier that powers the control board. The other winding supplies 120 VAC to the 120 VAC receptacle located on the case front.

Figure E.2 – Output rectifier, chopper assembly, output choke and feedback

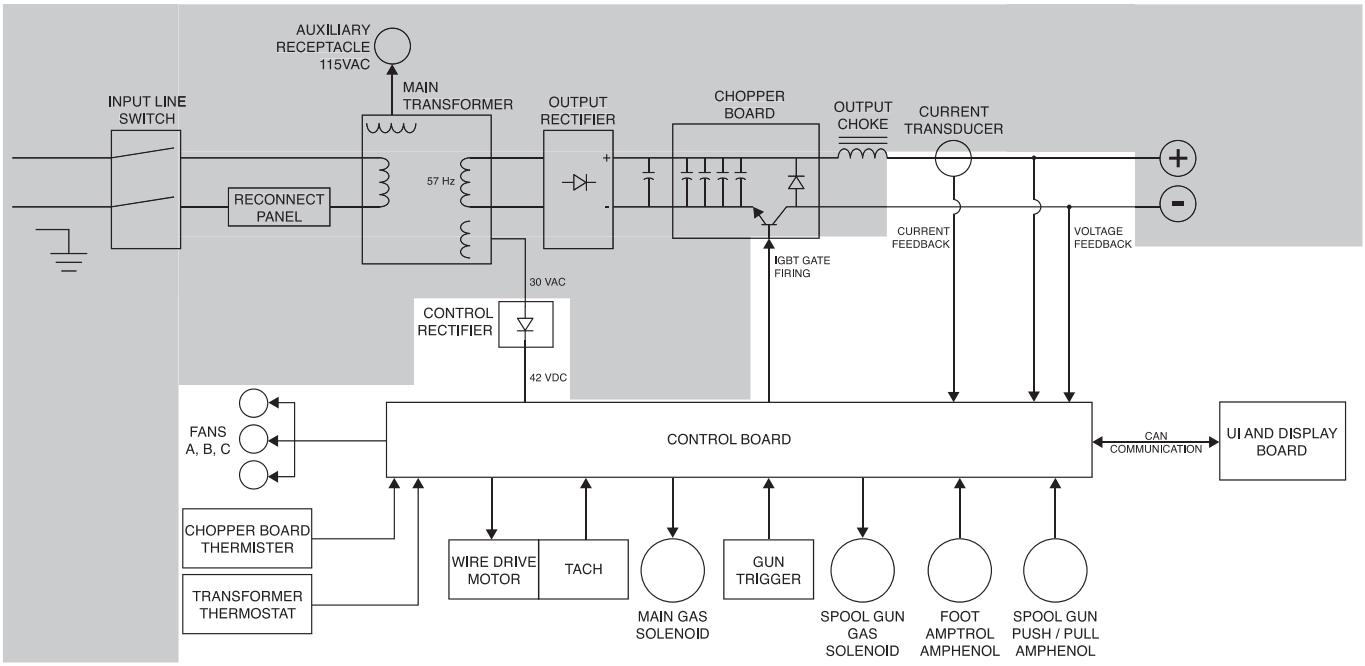


Output Rectifier, Chopper Assembly, Output Choke and Feedback

The 57 VAC output from the main transformer secondary winding is connected to the output rectifier. This rectified and filtered DC voltage (approx. 80 VDC) is applied to the chopper assembly. The four capacitors located on the chopper assembly function as filters and also as power supplies for the insulated gate bipolar transistors or IGBTs. See ***IGBT Operation*** in this section. The IGBTs act as a high-speed switch operating at 20 Khz. The IGBTs are switched ON and OFF by pulse width modulation gate signals sent from the control board. See ***Pulse Width Modulation*** in this section. This resultant "chopped" DC output is applied through the output choke and current transducer to the welding output terminals. The choke functions as a current filter. A free-wheeling diode is incorporated in the chopper assembly to provide a current path for the stored energy in the choke when the IGBTs are turned off. See ***Chopper Technology Fundamentals*** in this section.

Output voltage and current feedback information is fed to the control board. This feedback information is processed on the control board.

Figure E.3 – Control board and user interface/display board



Control Board And User Interface/Display Board

The control board performs the primary interactions to establish and maintain output control of the Power MIG 360MP. The control board receives digital command (CAN) information from the user-interface board. This command information is compared to voltage and current feedback information. The control board then sends the appropriate gate firing signals to the chopper board. The result is a digitally controlled high-speed welding waveform. In addition, the control board monitors the chopper board thermistor and the main transformer thermostat. If the machine should overheat for any reason the control board will remove the gate firing signals to the chopper board and the welding output will be disabled until the machine cools.

The control board is responsible to control the three cooling fans. The fans are off when the machine is not welding. They will run at low speed when welding at low currents. They will run at high speed when welding at higher currents. The control board supplies and controls the wire drive motor speed and receives motor speed feedback information from the tachometer circuit. The control board compares the motor speed feedback with the commands sent from the user interface board and sends the appropriate motor armature voltage to the wire drive motor. The control board also operates the gas solenoids and interacts with the 6 pin remote amptrol receptacle and 7 pin spool gun receptacle. The display board provides the user with process and parameter information.

Thermal Protection

The chopper board and main transformer are protected from an over temperature condition. If such a condition should occur, make sure the fans are operating correctly and the intake louvers are not blocked.

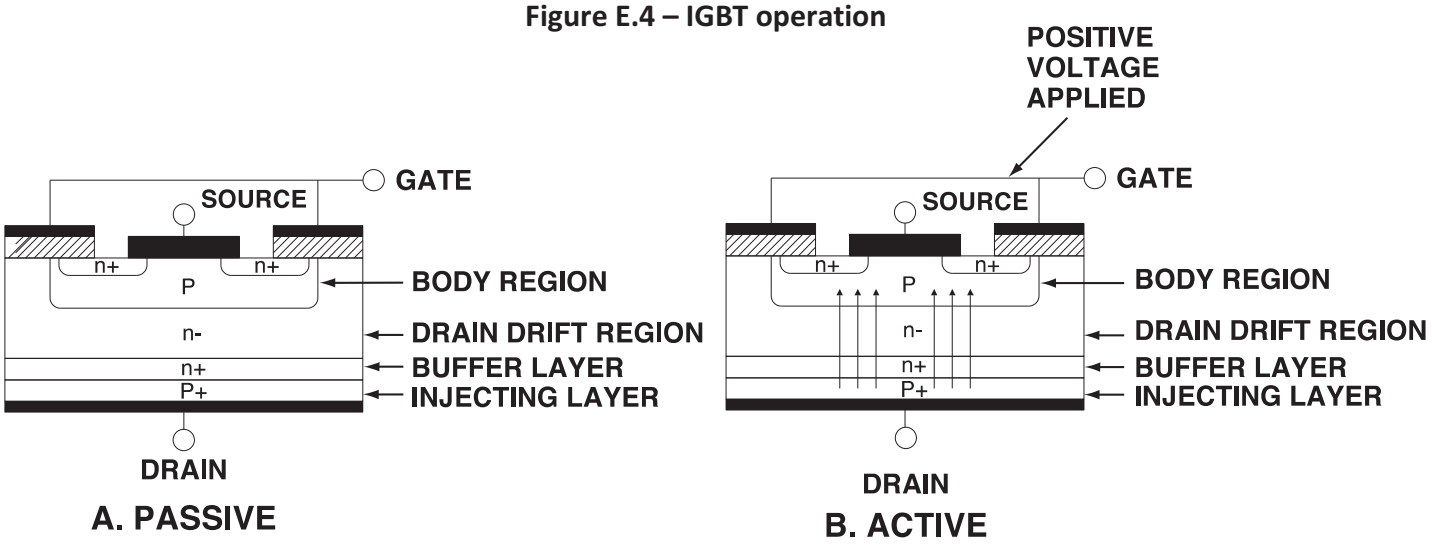
Over Current Protection

If the average current exceeds 375 amps the peak current will be limited to 100 amps until the system is re-triggered or the average current decreases to under 50 amps.

Wire Feeder Overload Protection

The Power MIG 360MP wire drive motor is protected from drawing too much armature current. If the motor becomes overloaded the motor armature voltage will be removed by the control board. Overload conditions may result from improperly sized gun liner, drive rolls obstruction or bends in the gun cable. If an overload should occur the gun trigger will need to be reset and the obstruction removed.

Figure E.4 – IGBT operation



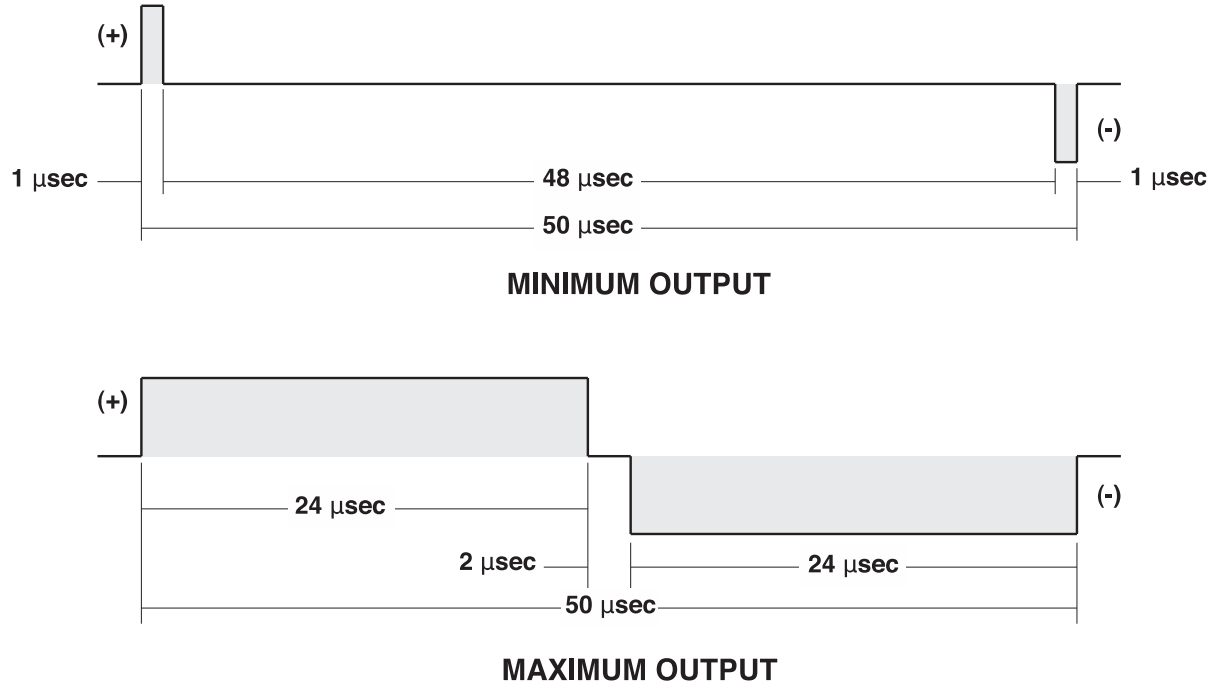
INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.

Drawing A shows an IGBT in a passive mode. There is no gate signal, zero volts relative to the source, and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source, is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

Figure E.5 – Typical IGBT outputs



PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION is used to describe how much time is devoted to conduction in the positive and negative portions of the cycle.

Changing the pulse width is known as MODULATION. Pulse Width Modulation (PWM) is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

MINIMUM OUTPUT

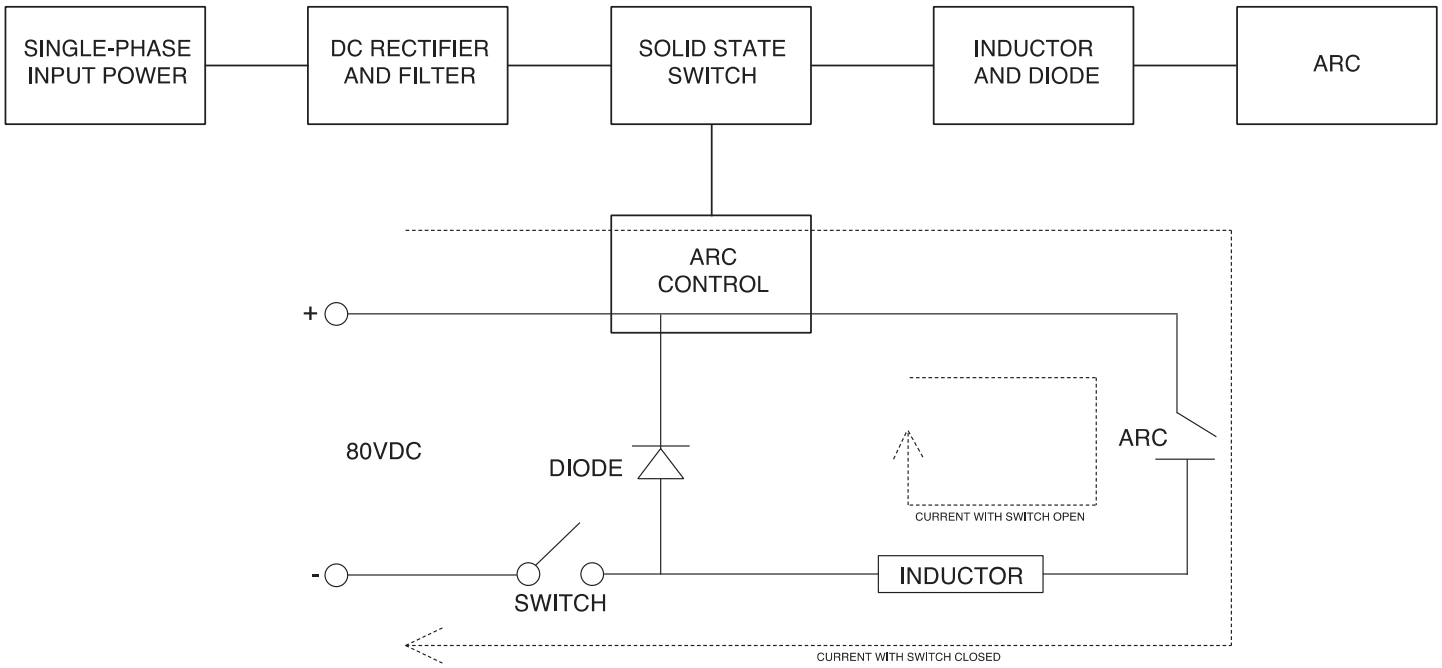
By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing above shows the minimum output signal possible over a 50-microsecond time period.

The positive portion of the signal represents one IGBT group conducting for 1 microsecond. The negative portion is the other IGBT group. The dwell time (off time) is 48 microseconds (both IGBT groups off). Since only 2 microseconds of the 50-microsecond time period is devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

By holding the gate signals on for 48 microseconds each and allowing only 2 microseconds of dwell time (off time) during the 50-microsecond cycle, the output is maximized. The darkened area under the top curve can be compared to the area under the bottom curve. The more dark area under the curve, the more power is present.

Figure E.6 – Chopper technology fundamentals



CHOPPER TECHNOLOGY FUNDAMENTALS

The new era of welding machines such as the Power MIG 360MP employ a technology whereby a DC source is turned on and off (chopped up) at high speed, then smoothed through an inductor to control an arc. Hence the name "Chopper". The biggest advantage of chopper technology is the high-speed control of the arc, similar to the inverter machines. A block diagram for this is as follows:

In this system, the engine drives a three-phase alternator, which generates power that is rectified and filtered to produce about 80 VDC. The current is applied through a solid state switch to an inductor. By turning the switch on and off, current in the inductor and the arc can be controlled. The above diagram depicts the current flow in the system when the switch is open and closed:

When the switch is closed, current is applied through the inductor to the arc. When the switch opens, current stored in the inductor sustains flow in the arc and through the diode. The repetition rate of switch closure is 20 Khz, which allows ultra-fast control of the arc. By varying the ratio of on time versus off time of the switch (Duty Cycle), the current applied to the arc is controlled. This is the basis for Chopper Technology: Controlling the switch in such a way as to produce superior welding.

Troubleshooting & Repair

Test Procedures

Removal And Replacement Procedures

Troubleshooting & Repair

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

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

Step 1. LOCATE PROBLEM (SYMPTOM). Look under the column labeled "PROBLEM" (SYMPTOMS). This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into three main categories: Output Problems, Function Problems and Engine Problems.

Step 2. PERFORM EXTERNAL TESTS. The second column, labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)", lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case cover.

Step 3. PERFORM COMPONENT TESTS. The last column, labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

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

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

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

⚠ CAUTION

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

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

PC board can be damaged by static electricity.

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

ATTENTION

Static-Sensitive Devices Handle only at Static-Safe Workstations

• If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

• Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.

• Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.

• If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

• f you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

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

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

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.

a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks and terminal strips.

b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.

6. Always indicate that this procedure was followed when warranty reports are to be submitted.

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

Troubleshooting guide

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS **(SYMPTOMS)**	**POSSIBLE AREAS OF** **MISADJUSTMENT(S)**	**RECOMMENDED** **COURSE OF ACTION**
OUTPUT PROBLEMS		
Major physical or electrical damage is evident when the sheet metal covers are removed.	1. Do not plug in machine or turn it on. Contact your local authorized Lincoln Electric Service Facility.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
No wire feed, weld output or gas flow when gun trigger is pulled. Fans do NOT operate.	1. Make sure correct voltage is applied to the machine. 2. Make certain that the power switch is in the ON position. 3. Make sure the circuit breaker is reset.	1. Perform the ***Control Board Test Procedure***. 2. Perform the ***Fan Test Procedure***. 3. Perform the ***Line Switch Test Procedure***. 4. Perform the ***Control Rectifier Test Procedure***. 5. Perform the ***Main Transformer Test Procedure***. 6. Perform the ***Input Rectifier Test Procedure***.
No wire feed, weld output or gas flow when gun trigger is pulled. Fans operate normally.	1. The thermostat may be tripped due to overheating. Let the machine cool. Weld at lower duty cycle. 2. Check for obstructions in the air flow. Check gun trigger connections. 3. Gun trigger may be faulty.	1. Perform the ***Control Board Test Procedure***. 2. Perform the ***Thermostat Test Procedure***. 3. Perform the ***Main Transformer Test Procedure***. 4. Perform the ***Input Rectifier Test Procedure***. 5. Perform the ***Chopper Board Function Test Procedure***. 6. Perform the ***Chopper Board Resistance Test Procedure***. 7. Check the trigger circuit. Leads #121 to #122 should have continuity (zero ohms) when the gun trigger is pulled. If not, then the gun may be faulty – replace.

Arc is unstable – Poor starting.	1. Check for correct input voltage to machine. 2. Check machine reconnect panel is configured properly for the applied voltage. 3. Check gun tip for wear or damage and proper size – Replace. 4. Check for proper gas and flow rate for process. 5. Check work cable for loose or faulty connections. 6. Check gun for damage or breaks. 7. Check for proper drive roll orientation and alignment. 8. Check liner for proper size.	1. Check for loose connections at the output terminals, the choke and all heavy current carrying leads. See Wiring Diagram. 2. Make sure that the main transformer secondary leads are securely connected to the input rectifier assembly. 3. Perform the ***Input Rectifier Test Procedure***. 4. Perform the ***Control Board Test Procedure***. 5. Perform the ***Output Choke Test Procedure***. 6. Perform the ***Control Rectifier 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		
Output voltage and wire feed is present when gun trigger is not pulled (not activated).	1. Remove gun assembly from machine. If problem is solved, gun assembly is faulty. Repair or replace. If all recommended possible areas of misadjustment have been checked and the problem persists, contact your local Lincoln Authorized Field Service Facility. 2. If problem persists when gun assembly is removed from machine, then the problem is within the Power MIG 360MP.	1. Check the machine's internal trigger leads for grounds or shorts. See Wiring Diagram. 2. Perform the ***Control Board Test Procedure***.
Machine output is low. Welds are "cold", weld bead is rounded or bumped up demonstrating poor wetting into plate.	1. Check input voltage. Make sure input voltage matches nameplate rating and reconnect panel configuration. 2. Make sure settings for wire feed speed and voltage are correct for the process being used. 3. Make sure output polarity is correct for process being used. 4. Check welding cables and gun assembly for loose or faulty connections.	1. Perform the ***Choke Test Procedure***. 2. Perform the ***Main Transformer Test Procedure***. 3. Perform the ***Control Rectifier Test Procedure***. 4. Perform the ***Control Board Test Procedure***. 5. Perform the ***Current Transducer (LEM) Test Procedure***.

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS **(SYMPTOMS)**	**POSSIBLE AREAS OF** **MISADJUSTMENT(S)**	**RECOMMENDED** **COURSE OF ACTION**
FEEDING PROBLEMS		
No wire feed when gun trigger is pulled. Fans run, gas flows and machine has correct open circuit voltage (38V Max.) –weld output.	1. If the wire drive motor is running, make sure that the correct drive rolls are installed in the machine. 2. Check for clogged cable liner or contact tip. 3. Check for proper size cable liner and contact tip. 4. Check if the spool gun mode is selected on the screen. 5. Check wire spindle for ease of rotation and adjust break tension knob if necessary.	1. Perform the ***Drive Motor And Tach Feedback Test Procedure***. 2. Perform the ***Control Board Test Procedure***. 3. Perform the ***User Interface Board Test Procedure***.
The wire feed stops while welding. When trigger is released and pulled again the wire feed starts.	1. Check the wire feed drive rolls and motor for smooth operation. 2. Check for restrictions in the wire feed path. 3. Make sure gun liner and tip are correct for wire size being used. 4. Check spindle for ease of rotation. 5. Make sure drive rolls and guide plates are clean and the correct size.	1. Perform the ***Drive Motor And Tach Feedback Test Procedure***.
No control of wire feed speed. Other machine functions are normal.	1. The wire feed speed control may be dirty. Rotate several times and check if problem is resolved.	1. Perform the ***Drive Motor And Tach Feedback Test Procedure***. 2. Perform the ***Control Board Test Procedure***. 3. Perform the ***User Interface 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**
GAS FLOW PROBLEMS		
Gas does not flow when gun trigger is pulled.	1. Make sure gas supply is connected properly and turned "ON". 2. If the gas solenoid does not actuate (click) when the gun trigger is pulled, there may be a restriction in the gas supply line. 3. The gun cable assembly may be faulty. Check or replace. 4. I gas solenoid does not operate when gun trigger is pulled, the problem is within the Power MIG 360MP. 5. Make sure the gun is pushed all the way into gun mount and is properly seated.	1. Perform the ***Gas Solenoid Test Procedure***. 2. Perform the ***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**
SCREEN PROBLEMS		
ERROR CODE 213 is displayed on screen.	1. Communication between display board and power control board.	1. Cycle power to machine.
ERROR CODE 36, Thermal trip.	1. Machine is overloaded. 2. Poor airflow.	1. Welding duty should not exceed machine rating. 2. Not enough space behind the back of the machine.
ERROR CODE 81, Main motor overload.	1. Drive rolls don't match wire size or wire type. 2. Bad gun liner.	1. Check drive rolls. 2. Try different gun.
ERROR CODE 95, Gun motor overload.	1. Drive rolls don't match wire size or wire type. 2. Bad gun liner.	1. Check drive rolls. 2. Try different gun.
ERROR CODE 213, Control board offline.	1. No communication between user interface and control board.	1. Check user interface and control board connection. 2. Replace control board.

⚠ 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**
PUSH PULL WIRE FEEDING PROBLEMS		
While loading wire, the rear drive rolls stop while pushing wire through the torch.	1. Check torch cable for kinks. Torch cable should be laid out relatively straight. 2. Check the wire at the spool. Make sure wire is not crossed and is de-reeling properly. 3. Increase wire feed speed to 350-400 ipm.	1. See Operator's Manual. 2. If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local Lincoln Authorized Field Service Facility.
While loading wire, the wire bird nests before the wire gets all the way through the torch.	1. Check torch cable for kinks. Torch cable should be laid out relatively straight. 2. Make sure liner conduit is inserted all the way into the rear wire drive so that it is up against the inner black plastic wire guide. 3. Inner black plastic wire guide is worn out. Replace guide. 4. Slow down wire feed speed while pushing wire up through the liner. Recommended setting = 350 ipm. 5. Clean or replace contact tip.	1. See Operator's Manual. 2. If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local Lincoln Authorized Field Service Facility.
While loading wire, the wire bird nests if the wire misses the outlet guide while shooting the gap in the torch.	1. Straighten the first six inches of the wire before feeding it into the rear wire drive. 2. Make sure the torch drive rolls are tightened slightly to help the wire jump the gap. 3. Slow down wire feed speed while pushing wire through torch liner. Recommend setting = 350 ipm.	1. See Operator's Manual. 2. If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local Lincoln Authorized Field Service Facility.
⚠ 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**
PUSH PULL WIRE FEEDING PROBLEMS		
Arc length varies while welding (arc length is not constant).	1. Power MIG 360MP drive rolls set too tight. The tension arm should be set at 1 to 1-1/2. 2. Clean or replace contact tip.	1. See Operator's Manual. 2. If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local Lincoln Authorized Field Service Facility.
During welding the wire continues to burn back to the tip.	1. Check to see that the spindle brake is not set too tight. There should be an aluminum spacer behind the spindle brake. Refer to the push-pull connection kit for this spacer. 2. Power MIG 360MP drive rolls set too tight. The tension arm should be set at 1 to 1-1/2. 3. Push-Pull torch drive rolls set too tight. See Operator's manual for proper setting. 4. If pulse welding the trim value may be set too high. 5. Clean or replace contact tip.	1. See Operator's Manual. 2. If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local Lincoln Authorized Field Service Facility.
Wire bird nests while welding.	1. Torch liner conduit not inserted all the way so that it is touching the inner black plastic wire guide. 2. Inner black plastic wire guide is worn out. Replace guide. 3. Push-Pull torch drive rolls set too tight. See Operator's manual for proper setting.	1. See Operator's Manual. 2. If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local Lincoln Authorized Field Service Facility.

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

TEST DESCRIPTION

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

MATERIALS NEEDED

5/16” Nutdriver

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Open the door on the right side of the machine and carefully disengage it from the hinge. See ***Figure F.1***.
3. Using a 5/16” nutdriver, remove the two screws from the left side of the hinge securing the left case side to the machine. See ***Figure F.1***.
4. Using a 5/16” nutdriver, remove the two screws securing the cable claw to the machine. See ***Figure F.2***.
5. Using a 5/16” nutdriver, remove the four screws securing the left case side to the machine. See ***Figure F.2***.
6. Using a 5/16” nutdriver, remove the six screws securing the left lower-case side to the machine. See ***Figure F.2***.
7. Using a 5/16” nutdriver, remove the six screws securing the right lower-case side to the machine. See ***Figure F.1***.
8. Perform any tests / replacement procedure.

REPLACEMENT PROCEDURE

1. Using a 5/16” nutdriver, attach the six screws securing the right lower-case side to the machine.
2. Using a 5/16” nutdriver, attach the six screws securing the left lower-case side to the machine.
3. Using a 5/16” nutdriver, attach the four screws securing the left case side to the machine.
4. Using a 5/16” nutdriver, attach the two screws securing the cable claw to the machine.
5. Using a 5/16” nutdriver, attach the two screws to the left side of the hinge securing the left case side to the machine.
6. Carefully attach the door to the hinge and close the door.

Figure F.1 – Door, hinge and right lower-case side location

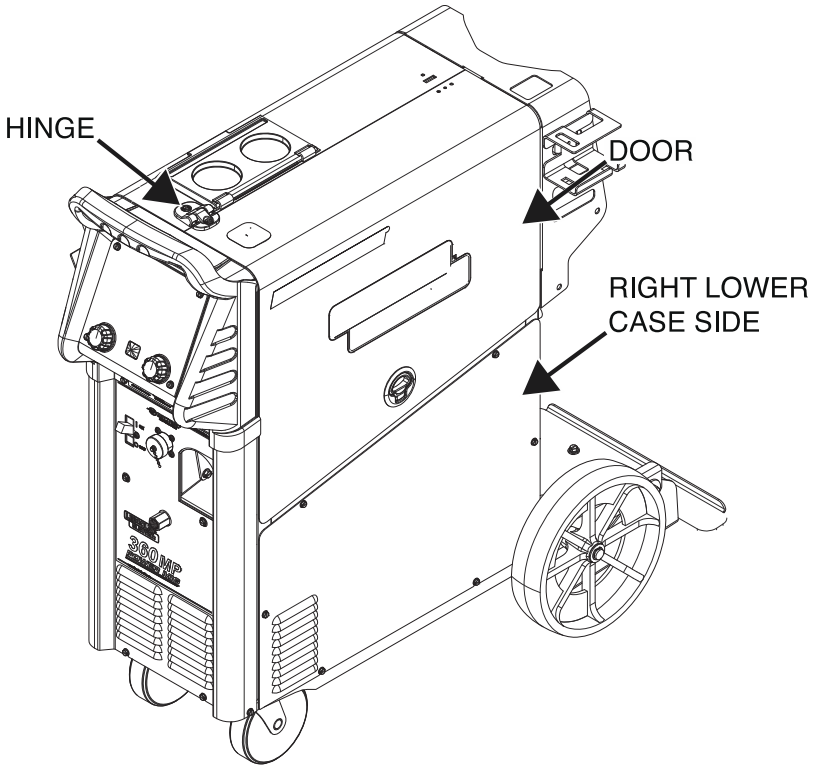
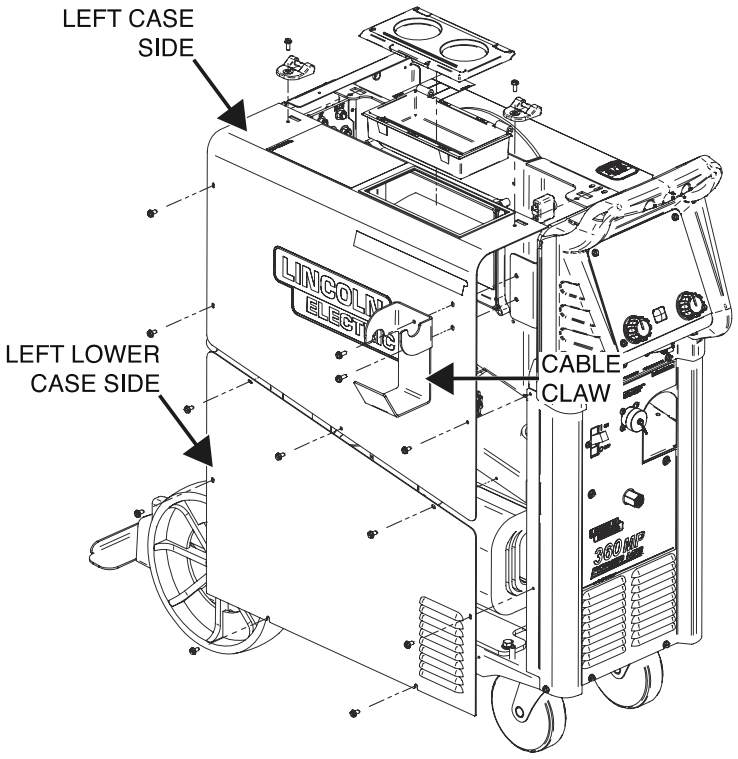


Figure F.2 – Cable claw, left case side and left lower case side location



CAPACITOR DISCHARGE PROCEDURE

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

TEST DESCRIPTION

This procedure will ensure that the Capacitors within the machine have been discharged.

MATERIALS NEEDED

Volt/Ohmmeter

Resistor (25-1000 ohms and 25 watts minimum)

Electrically Insulated Gloves

Electrically Insulated Pliers

Jumper Leads

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. There are capacitors located on the chopper board and a capacitor located on the top shelf. See ***Figure F.1***. See Wiring Diagram.
4. Using a volt/ohmmeter, check the voltage across the terminals of the capacitor on the top shelf. See ***Figure 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. 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 problem.
8. Using a volt/ohmmeter, check the voltage across the terminals B1/B4 to B2/B5 of the chopper board. See ***Figure F.3***. See Wiring Diagram.
9. 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 chopper board terminals for 10 seconds. See ***Figure F.3***. See Wiring Diagram.

NOTE: DO NOT TOUCH THE TERMINALS WITH YOUR BARE HANDS. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.

10. Using a volt/ohmmeter, recheck the voltage across the chopper board terminals. See Figure F.3. See Wiring Diagram. The voltage should be zero.
11. 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 problem.
12. If voltage is present, wait for voltage to decay before proceeding.

Figure F.1 – Capacitor locations

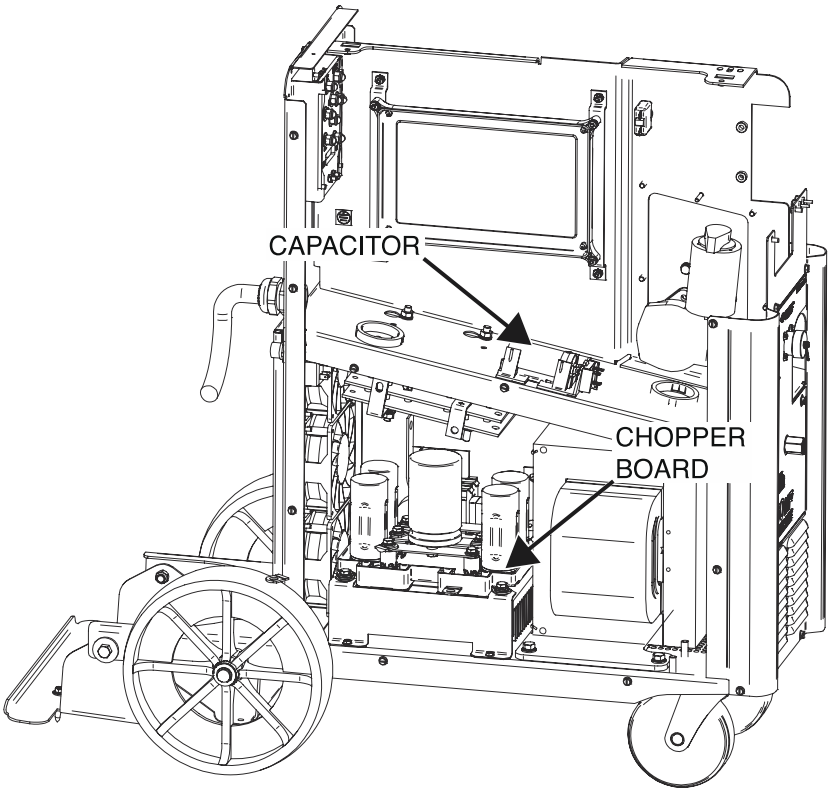


Figure F.2 – Capacitor terminals

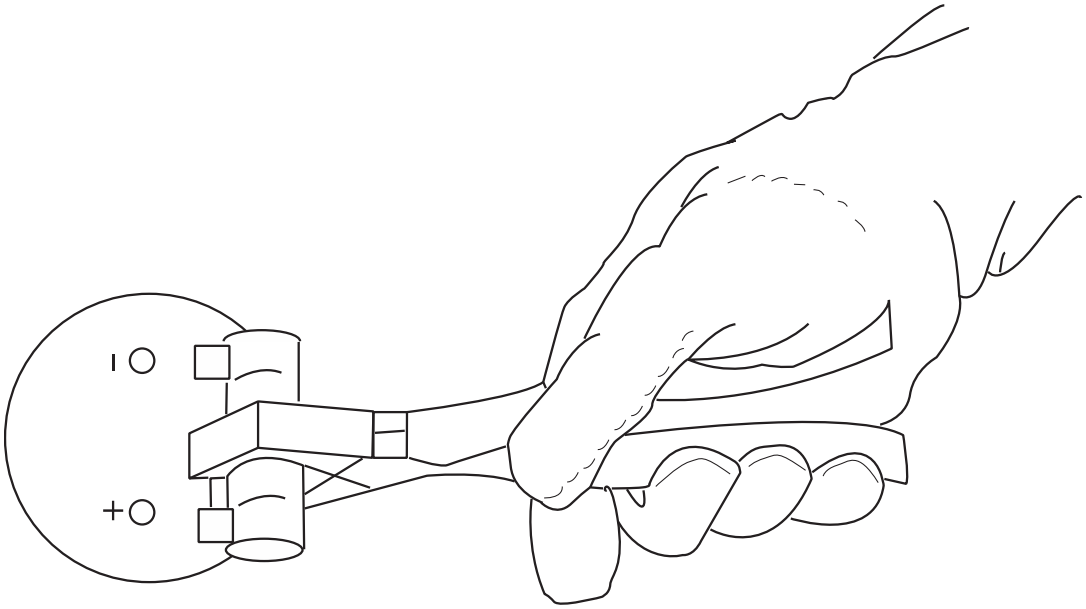
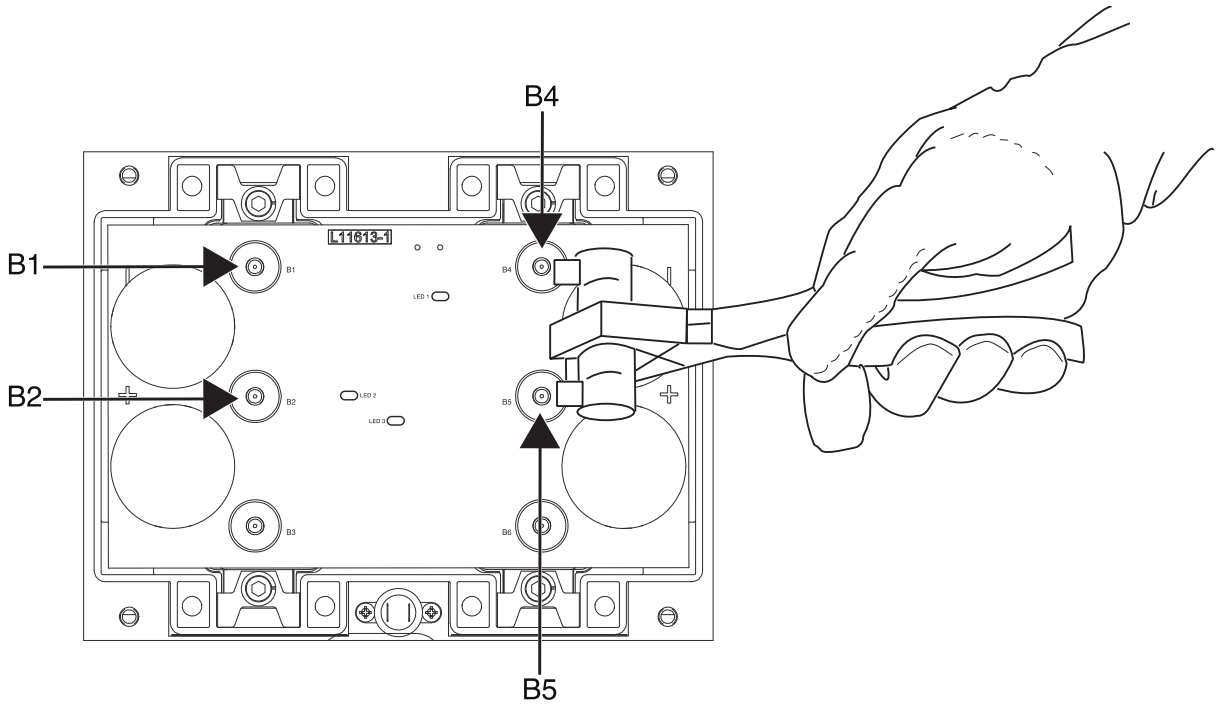


Figure F.3 – Chopper board terminal locations



MAIN TRANSFORMER TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the correct voltages are being applied to the primary windings of the main transformer and induced on the secondary and auxiliary windings.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the main transformer. See ***Figure F.1***. See Wiring Diagram.
5. Confirm the reconnect panel is connected properly for the supplied input voltage. See Operator's Manual.
6. Using a volt/ohmmeter, measure the voltage between leads L1 and L2 at the line switch. See ***Figure F.2***. See Wiring Diagram. Voltage reading should match reconnect panel voltage setup.
7. If the voltage is incorrect, check for loose or broken leads between the reconnect panel and the line switch. Also, test the line switch for proper operation.
8. If the voltage is correct, check for the same voltage at S1 and S2 and at the bottom of the line switch with the switch in the ON position. See ***Figure F.2***. See Wiring Diagram.
9. If the voltage is incorrect, check for loose or broken leads between the reconnect panel and the line switch. See Wiring Diagram.
10. If the correct voltage is being applied to the main transformer primary winding, proceed with testing for the secondary winding.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figures F.3*** and ***F.4***. See Wiring Diagram.
12. If the correct voltage is being applied to the main transformer and one or more of the secondary voltages are missing or incorrect, the main transformer may be faulty.
13. If faulty, perform the ***Main Transformer Removal And Replacement Procedure***.
14. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Main transformer secondary voltage tests

TEST POINT	TEST POINT	EXPECTED READING
LEAD X1 (INPUT RECTIFER AC TERMINAL)	LEAD X2 (INPUT RECTIFER AC TERMINAL)	57 VAC
LEAD X9 (CIRCUIT BREAKER ABOVE WIRE DRIVE MOTOR)	LEAD X8 (QUICK CONNECT TERMINAL NEAR TOP SHELF)	115 VAC
LEAD X5 (CONTROL RECTIFER AC TERMINAL)	LEAD X6 (CONTROL RECTIFIER AC TERMNAL)	30 VAC

Figure F.1 – Main transformer location

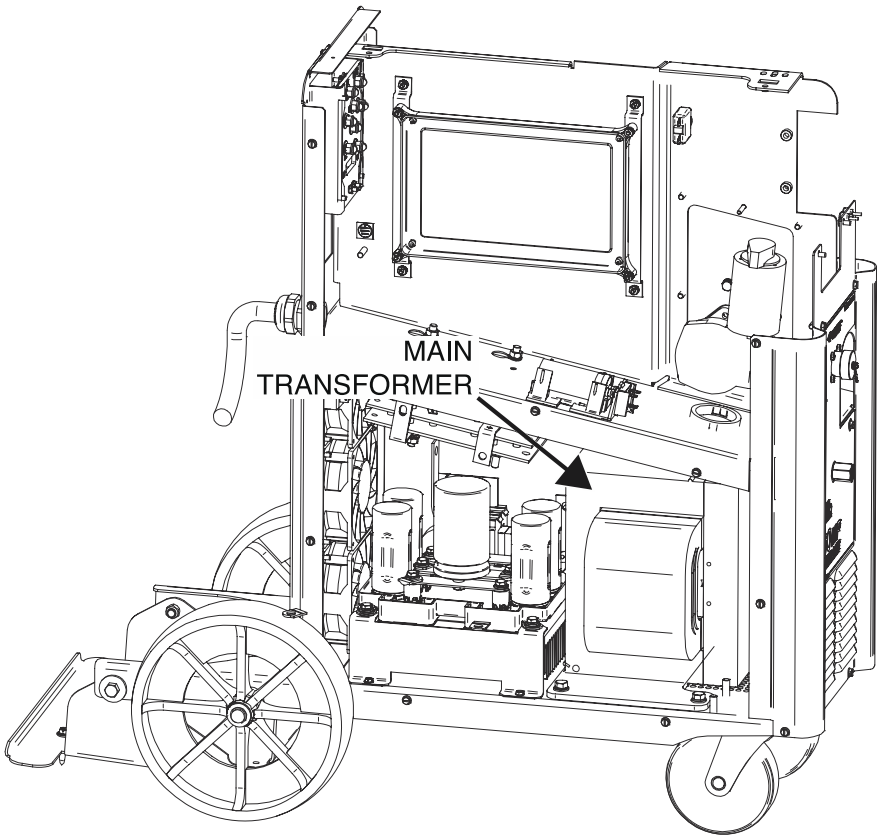


Figure F.2 – Line switch test points

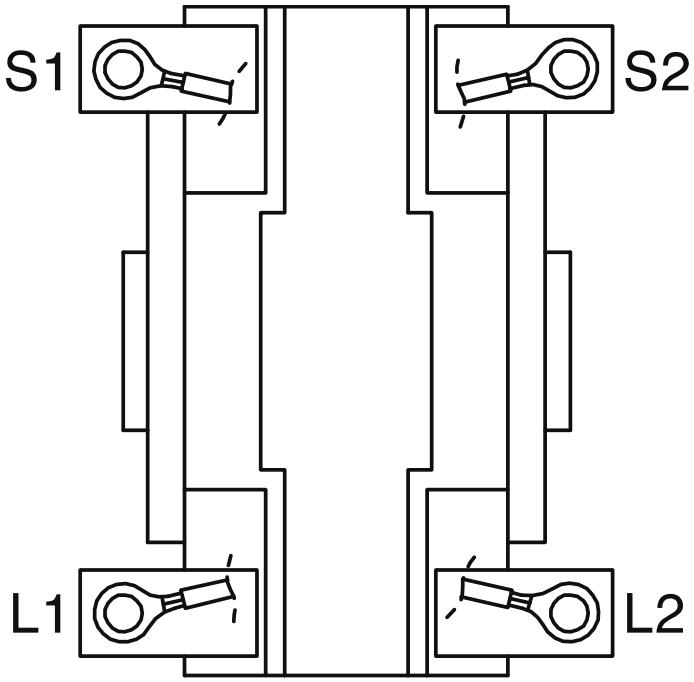


Figure F.3 – Main transformer leads X1 and X2 location

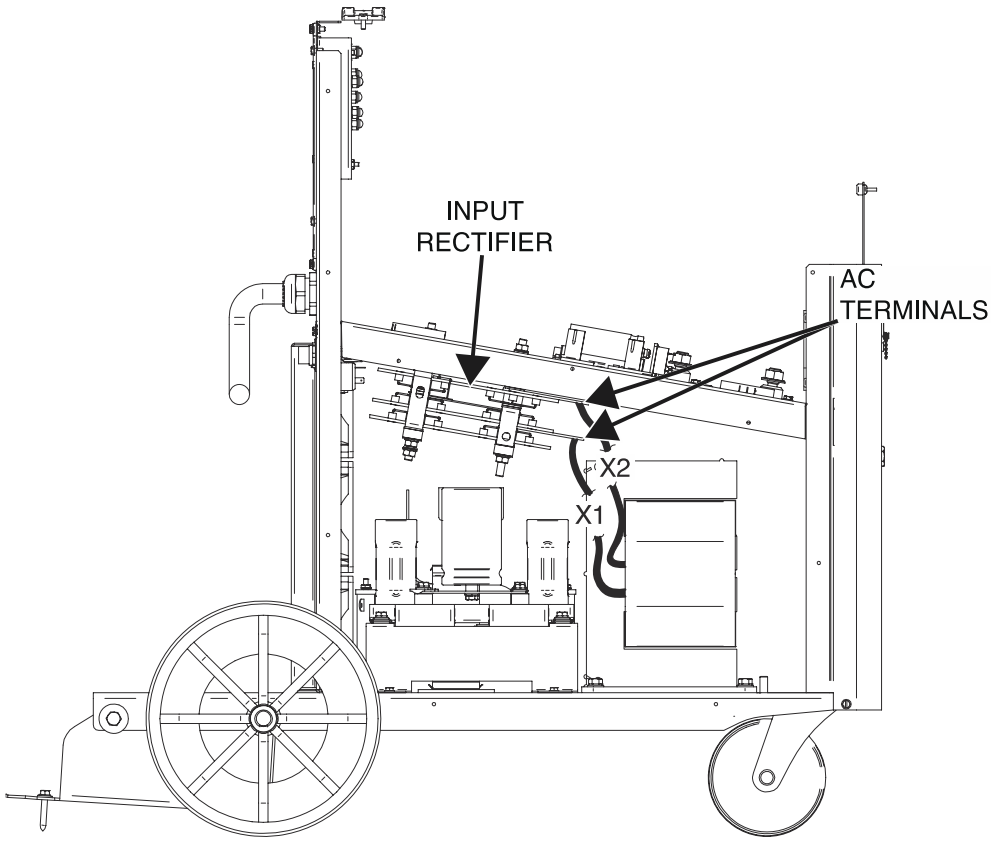
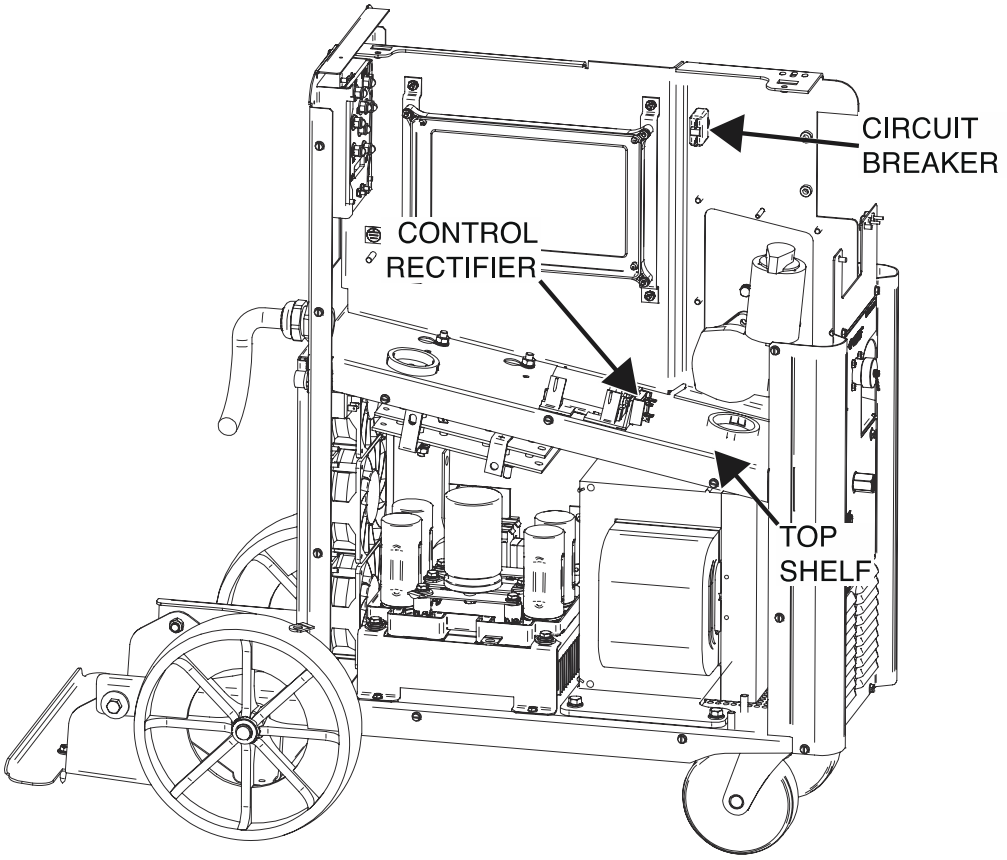


Figure F.4 – Main transformer lead connection locations



INPUT RECTIFIER TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Input Rectifier is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

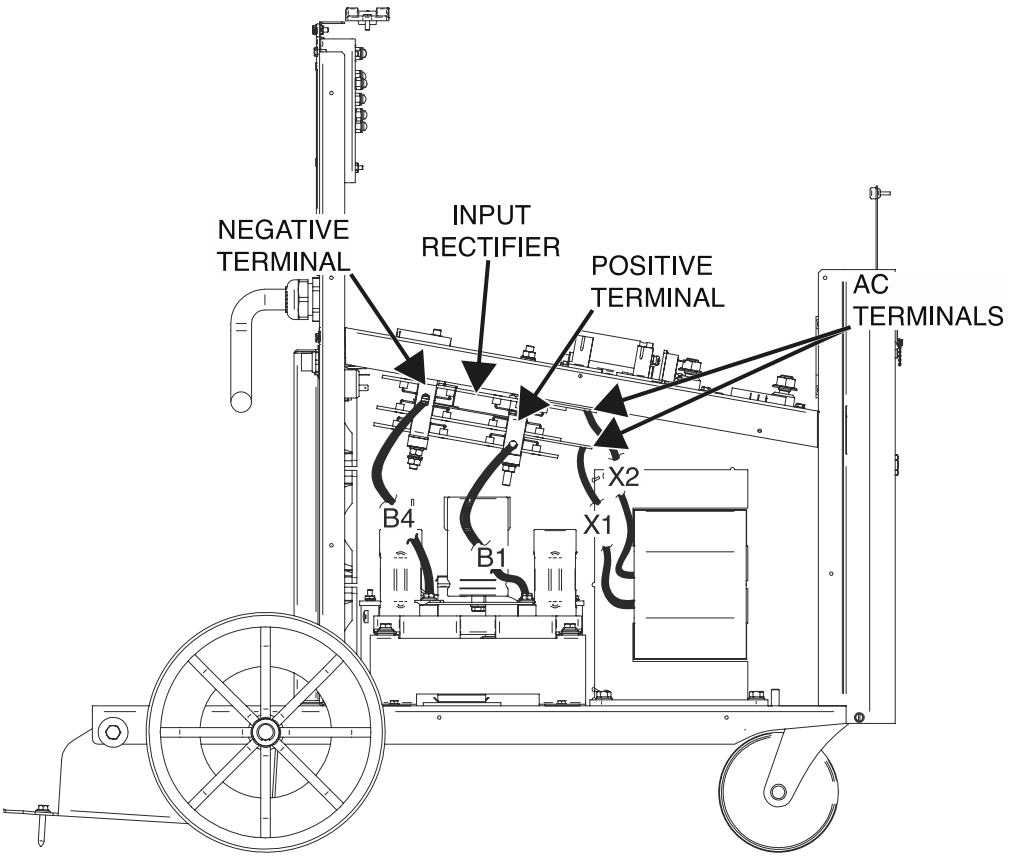
TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the input rectifier. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads X1, X2, B1 and B4 from the input rectifier terminals. See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the diode drop and resistance tests outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
7. If any of the tests fail, the input rectifier may be faulty.
8. If faulty, perform the ***Input Rectifier Removal And Replacement Procedure***.
9. Connect leads X1, X2, B1 and B4 to the input rectifier terminals. See Wiring Diagram.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Input rectifier diode drop and resistance tests

TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING
AC TERMINAL 1	POSITIVE TERMINAL	0.3 VDC – 0.7 VDC
AC TERMINAL 2	POSITIVE TERMINAL	0.3 VDC – 0.7 VDC
NEGATIVE TERMINAL	AC TERMINAL 1	0.3 VDC – 0.7 VDC
NEGATIVE TERMINAL	AC TERMINAL 2	0.3 VDC – 0.7 VDC
POSITIVE TERMINAL	AC TERMINAL 1	HIGH RESISTANCE (GREATER THAN 500K OHMS)
POSITIVE TERMINAL	AC TERMINAL 2	HIGH RESISTANCE (GREATER THAN 500K OHMS)
AC TERMINAL 1	NEGATIVE TERMINAL	HIGH RESISTANCE (GREATER THAN 500K OHMS)
AC TERMINAL 2	NEGATIVE TERMINAL	HIGH RESISTANCE (GREATER THAN 500K OHMS)

Figure F.1 – Input rectifier terminal and lead locations



CHOPPER BOARD FUNCTION TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Chopper Board is functioning properly and receiving the correct input from the Input Rectifier and the Control Board. This test can only provide meaningful results if the machine is producing normal AC auxiliary output.

MATERIALS NEEDED

Volt/Ohmmeter (With Frequency Counting Functionality)

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the chopper board. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct input voltage to the machine and turn the unit ON.
6. Visually verify the LED's on the board(s) are illuminated according to ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. Using a volt/ohmmeter, check for 90 to 100 VDC at terminals B1 to B2 and B4 to B5 of the chopper board. See ***Figure F.2***. See Wiring Diagram.
8. If the correct DC voltage is not present at terminals B1 to B2 and B4 to B5, check for damaged conductors or faulty connections between the chopper board and the main transformer. See Wiring Diagram. Perform the ***Main Transformer Test Procedure***.
9. If any of the tests fail, the chopper board may be faulty.
10. If faulty, perform the ***Chopper Board Removal And Replacement Procedure***.
11. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Chopper board LED tests

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

Figure F.1 – Chopper board location

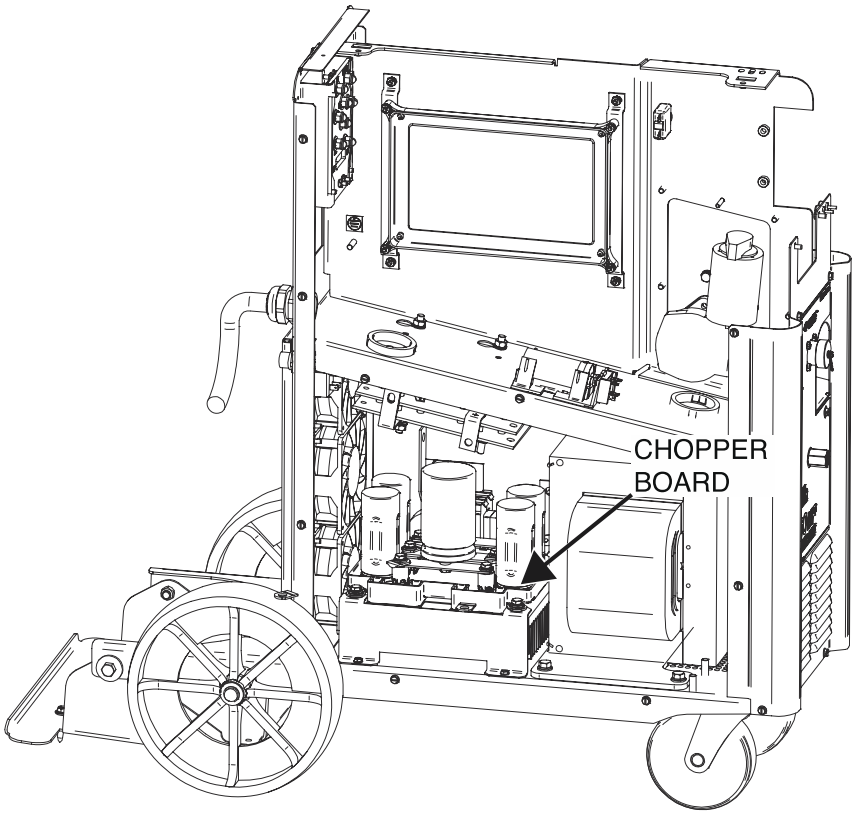
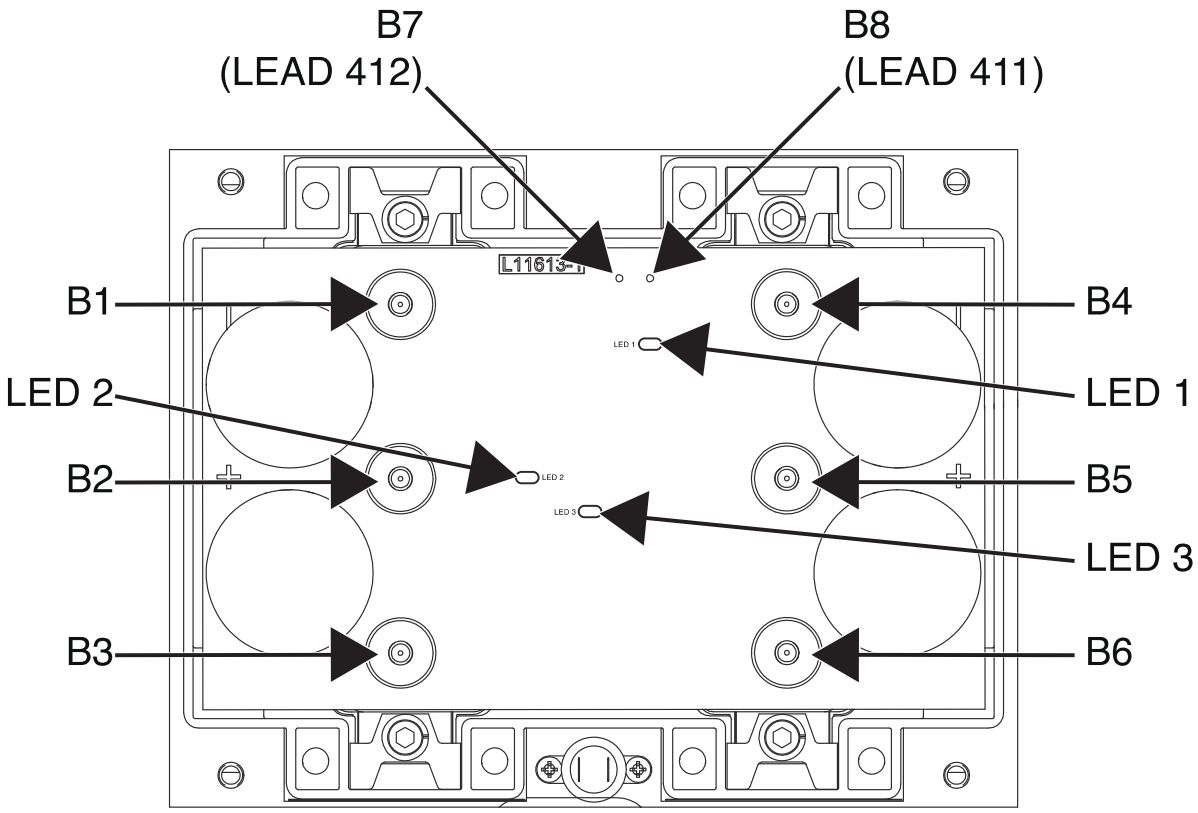


Figure F.2 – Chopper board LEDs, terminals and lead locations



CHOPPER BOARD RESISTANCE TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Chopper Board is shorted. This test can only detect some problems in the "Power" section of the board. Problems in some other board components may not be detected.

MATERIALS NEEDED

7/16" Nutdriver

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the chopper board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16" nutdriver, remove the six screws, lock washers and flat washers securing the leads and bus bars to terminals B1, B2, B3, B4, B5 and B6 of the chopper board. See ***Figure F.2***. See Wiring Diagram. Label leads for reassembly.
6. Using a volt/ohmmeter, perform the wide diode resistance tests outlined in ***Table F.1***. See ***Figures F.1*** and ***F.2***. See Wiring Diagram.
7. If any of the tests fail, the chopper board may be faulty.
8. If faulty, perform the ***Chopper Board Removal And Replacement Procedure***.
9. Using a 7/16" nutdriver, attach the six screws, lock washers and flat washers securing the leads and bus bars to terminals B1, B2, B3, B4, B5 and B6 of the chopper board. See Wiring Diagram.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Chopper board diode resistance tests

OHMMETER		OHMMETER READING
(+) PROBE	(–) PROBE	EXPECTED READING
B6	B5	0.3 – 0.5 VDC
B4	B6	1.50 – 1.90 VDC
B3	B2	0.3 – 0.5 VDC
B1	B3	0.3 – 0.5 VDC

Figure F.1 – Chopper board location

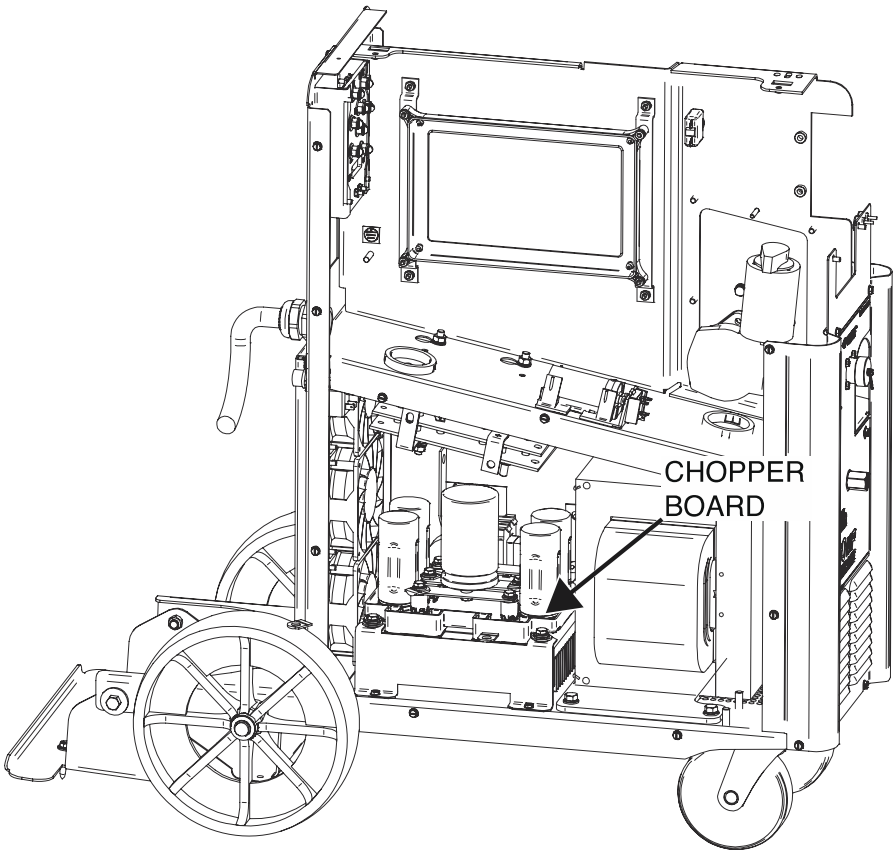
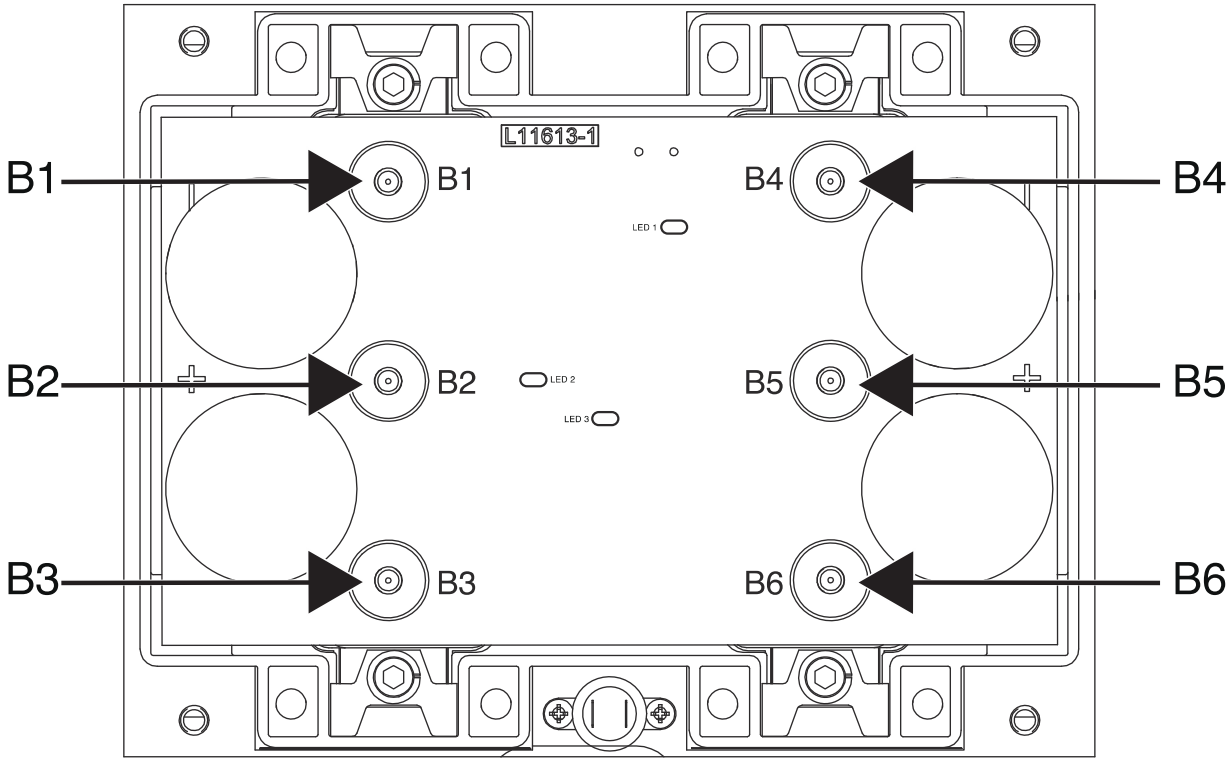


Figure F.2 – Chopper board terminal locations



CONTROL RECTIFIER TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the correct AC voltages are being applied to the Control Rectifier and supplied from the Control Rectifier to the Control Board.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the control rectifier. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads X5, X6, 104A and 103A from the control rectifier terminals. See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the diode drop tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the control rectifier may be faulty.
8. If faulty, perform the ***Control Rectifier Removal And Replacement Procedure***.
9. Connect the leads X5, X6, 104A and 103A to the control rectifier. See Wiring Diagram.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Control rectifier diode drop tests

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

Figure F.1 – Control rectifier location

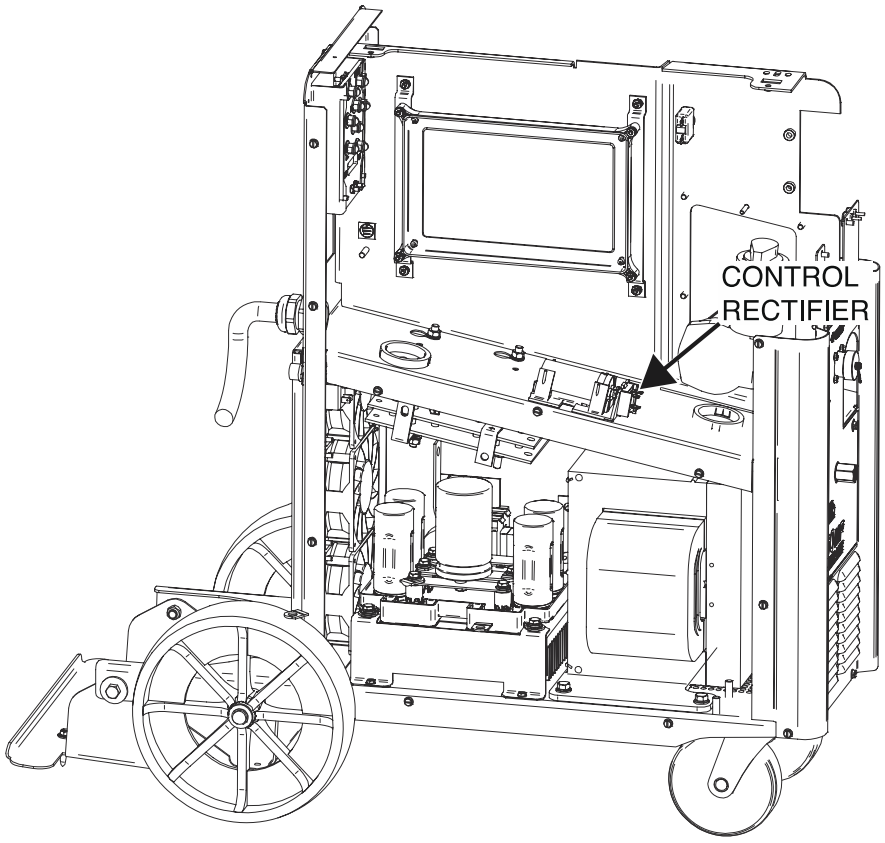
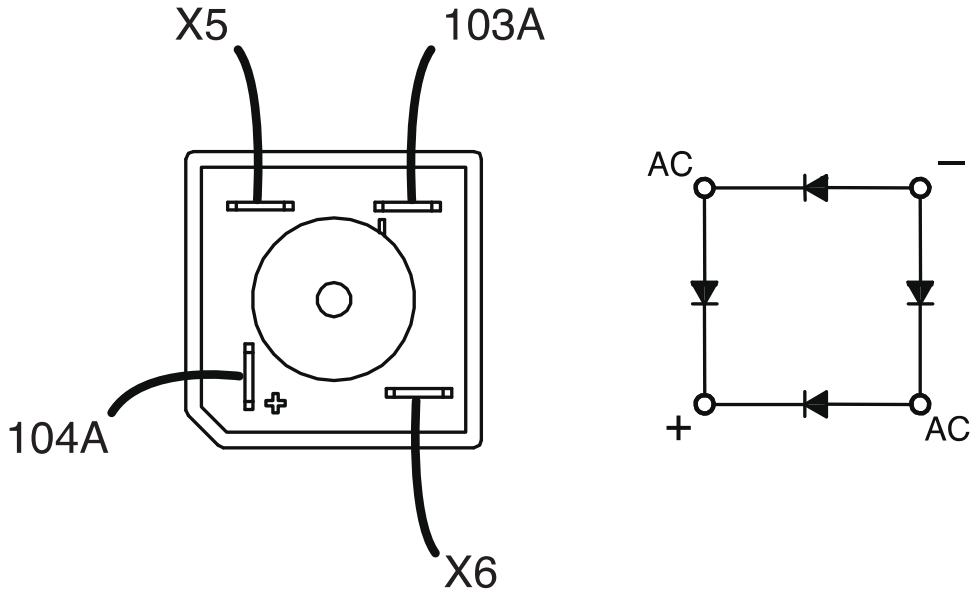


Figure F.2 – Control rectifier lead locations



FAN TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Fans(s) are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the fans. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct input power to the machine.
6. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
7. If the correct voltage is present at the control board but the fans do not operate, verify all leads between the fans and control board are in good condition. If the leads are in good condition the fans may be faulty.
8. If the correct voltage is not present at the control board, perform the ***Control Board Test Procedure***.
9. If any of the tests fail, the fans may be faulty.
10. If faulty, replace the fan.
11. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Control board fan voltage tests

TEST POINT	TEST POINT	EXPECTED READING	MACHINE CONDITION
CONTROL BOARD PLUG J7 PIN 4 (LEAD F4)	CONTROL BOARD PLUG J7 PIN 1 (LEAD F1)	48 VDC	MACHINE ON.
CONTROL BOARD PLUG J8 PIN 4 (LEAD F4)	CONTROL BOARD PLUG J8 PIN 1 (LEAD F1)	48 VDC	MACHINE ON.
CONTROL BOARD PLUG J9 PIN 4 (LEAD F4)	CONTROL BOARD PLUG J9 PIN 1 (LEAD F1)	48 VDC	MACHINE ON.

Figure F.1 – Fan location

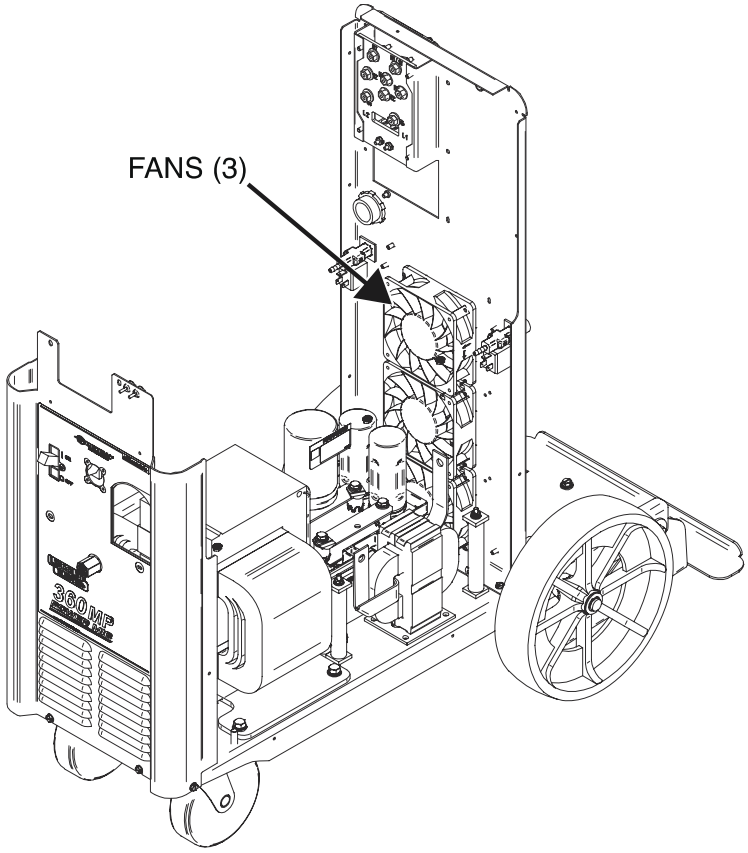


Figure F.2 – Control board plug J7, J8 and J9 locations

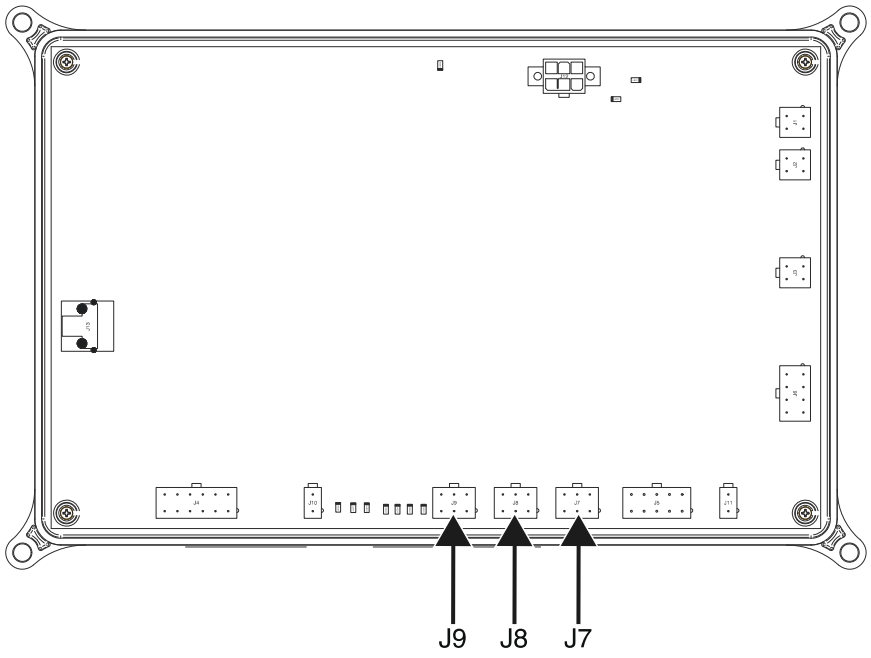
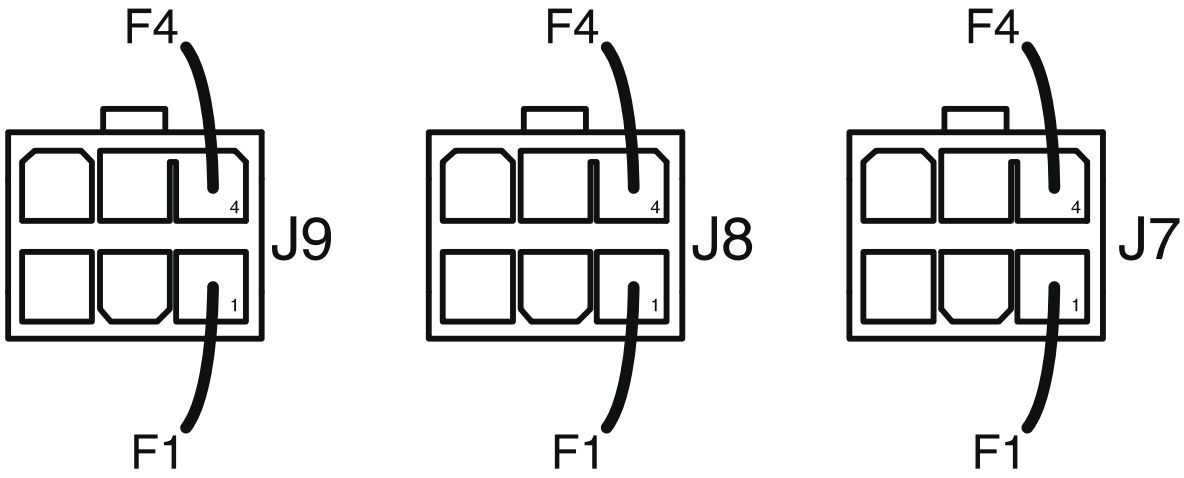


Figure F.3 – Control board plug J7, J8 and J9 lead locations



GAS SOLENOID TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Main Gas Solenoid and the Spool Gas Solenoid are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

12 VDC Power Supply

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the main and spool gas solenoids. See ***Figure F.1***. See Wiring Diagram. **NOTE:** There are two gas solenoids, one on each side of the machine. Test separately.

MAIN GAS SOLENOID:

5. Label and disconnect plug J6 from the control board. See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, measure the resistance between plug J6 pin 7 to plug J6 pin 8. See ***Figures F.2*** and ***F.3***. See Wiring Diagram. Normal resistance should be approximately 15 – 20 ohms.

SPOOL GAS SOLENOID:

7. Label and disconnect plug J5 from the control board. See ***Figure F.2***. See Wiring Diagram.
8. Using a volt/ohmmeter, measure the resistance between plug J5 pin 8 to plug J5 pin 9. See ***Figures F.2*** and ***F.3***. See Wring Diagram. Normal resistance should be approximately 15 – 20 ohms.
9. Connect plugs J6 and J5 to the control board. See Wiring Diagram.
10. Label and disconnect leads 607 and 608 from the main gas solenoid. Label and disconnect leads 508 and 509 from the spool gas solenoid. See ***Figure F.4***. See Wiring Diagram.
11. Using a 12 VDC power supply, carefully apply 12 VDC to the two terminals where leads were attached. The gas solenoid should open.
12. If the gas solenoid does not open, it may be faulty.
13. If the gas solenoid does open with 12 VDC applied to the terminals, check the condition of the leads from the gas solenoid to the control board. If the leads are intact, the control board may be faulty. Perform the ***Control Board Test Procedure***.
14. If any of the tests fail, the gas solenoids may be faulty.
15. If faulty, perform the ***Gas Solenoids Removal And Replacement Procedure***.
16. Connect the previously removed leads to the main and spool gas solenoids. See Wiring Diagram.
17. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Main and spool gas solenoid locations

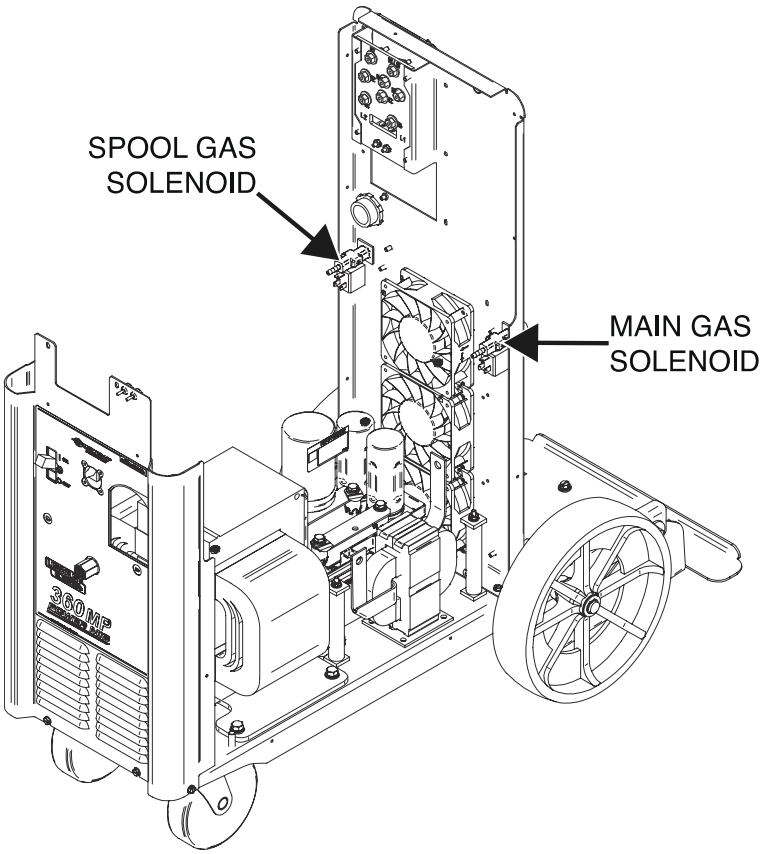


Figure F.2 – Control board plug J6 and J5 locations

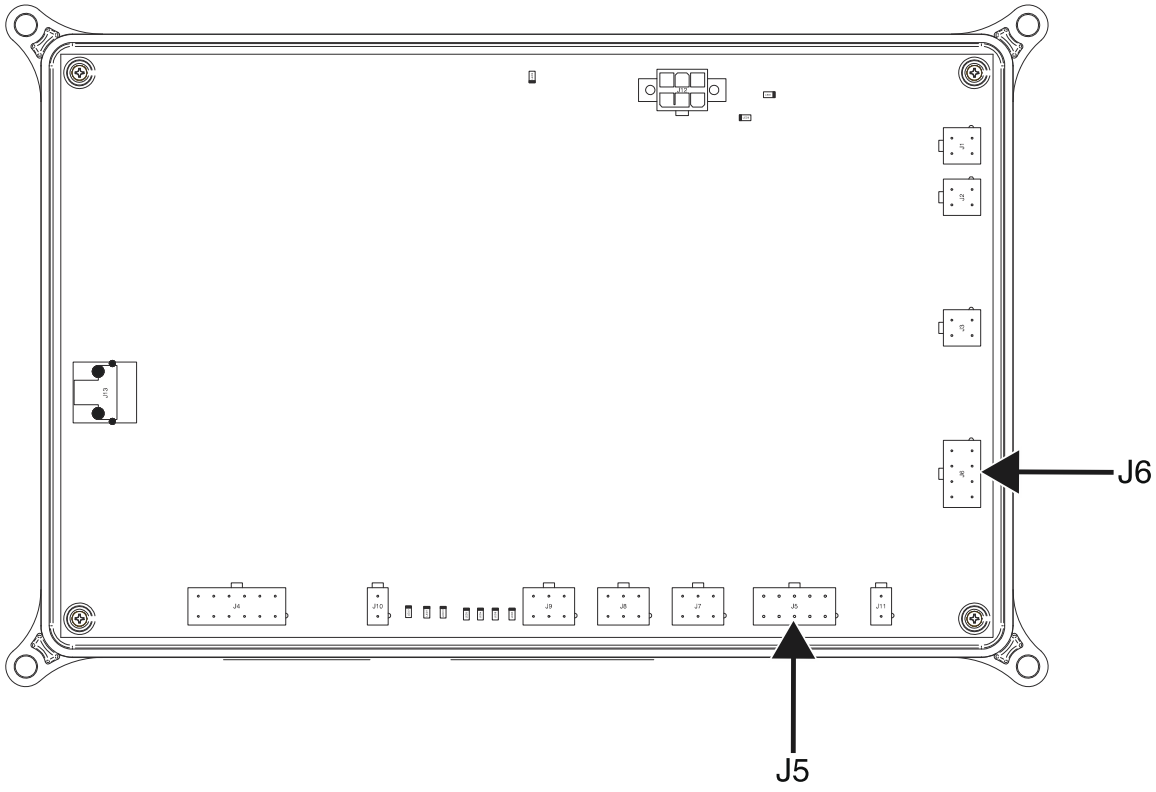


Figure F.3 – Control board plug J6 and J5 lead locations

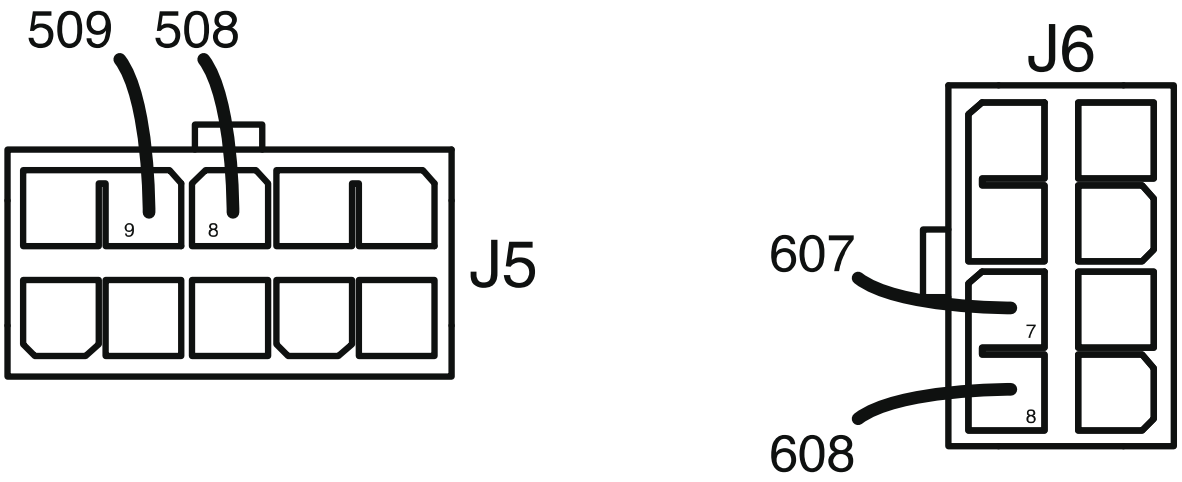
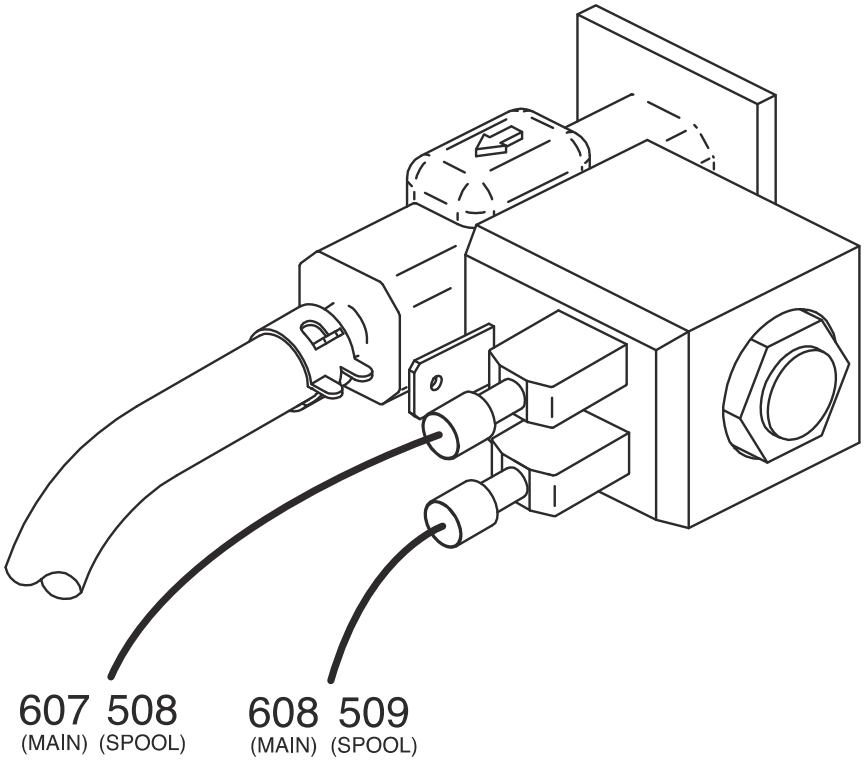


Figure F.4 – Main and spool gas solenoid lead locations



DRIVE MOTOR AND TACH FEEDBACK TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Wire Drive Motor and Voltage Feedback Circuit are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the wire drive motor assembly. See ***Figure F.1***. See Wiring Diagram.
5. Remove the tension from the wire feed drive rolls by pushing the tension arm adjustment assembly toward the rear of the machine.
   Test for correct wire drive motor armature voltage:
6. Carefully apply the correct input power to the machine and turn the machine ON.
7. Using a volt/ohmmeter, measure the voltage from control board plug J6 pin 1 (lead 601) to pin 2 (lead 602) with the gun trigger engaged. See ***Figures F.2*** and ***F.3***. See Wiring Diagram. Typical voltage is 0 – 28 VDC (dependent on wire feed speed).
8. If voltage is present but drive motor does not operate, check the wiring between the point where the voltage readings were taken and the wire drive motor. If the wiring and connections are good, the wire drive motor may be faulty.
9. If the voltage is not present, the control board may be faulty. Perform the ***Control Board Test Procedure***.
10. If the motor is running at high speed and the armature voltage is high and uncontrollable, proceed with the tachometer test.
11. If the wire drive motor is faulty, perform the ***Wire Drive Motor Removal And Replacement Procedure***.
12. Carefully remove input power from the machine.

    Test for supply voltage to tachometer:

13. Carefully apply the correct input power to the machine and turn the machine ON.
14. Using a volt/ohmmeter, measure the voltage from control board plug J6 pin 3 (lead 603) to pin 5 (lead 605) with the gun trigger engaged. See ***Figures F.2*** and ***F.3***. See Wiring Diagram. Typical voltage is 5 VDC.
15. If the 5 VDC is present, check the leads to the tachometer circuit.
16. If the leads are okay and 5 VDC is present, the correct voltage is being received from the control board.
17. If the 5 VDC is not present and the leads are okay, the control board may be faulty. Perform the ***Control Board Test Procedure***.
18. Carefully remove input power from the machine.

Test for feedback voltage to control board:

19. Carefully apply the correct input power to the machine and turn the machine ON.
20. Using a volt/ohmmeter, measure the voltage from control board plug J6 pin 4 (lead 604) to pin 5 (lead 605) with the gun trigger engaged. See ***Figures F.2*** and ***F.3***. See Wiring Diagram. Typical voltage is approximately 2 – 3 VDC.
21. If approximately 2 – 3 VDC is present, the tachometer circuit is sending the correct feedback signal to the control board.
22. If approximately 2 – 3 VDC is not present or not correct, the control board is not receiving the proper feedback voltage from the tachometer circuit. Check the leads from the tachometer circuit to the control board for loose or broken connections.
23. If the leads are okay, the tachometer may be faulty.
24. If faulty, perform the ***Wire Drive Motor Removal And Replacement Procedure***.
25. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Wire drive motor location

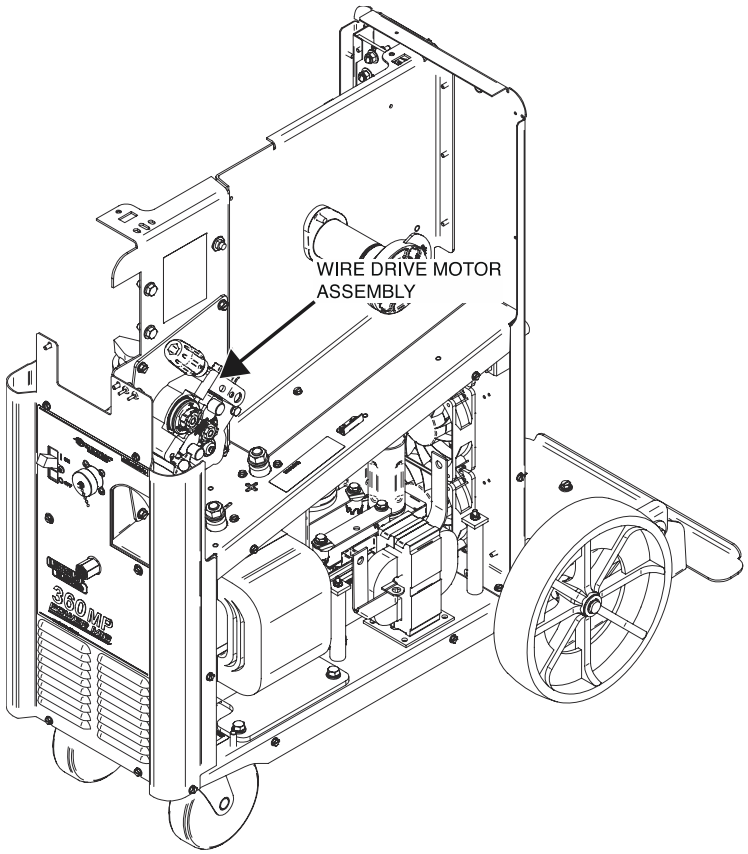


Figure F.2 – Control board plug J6 location

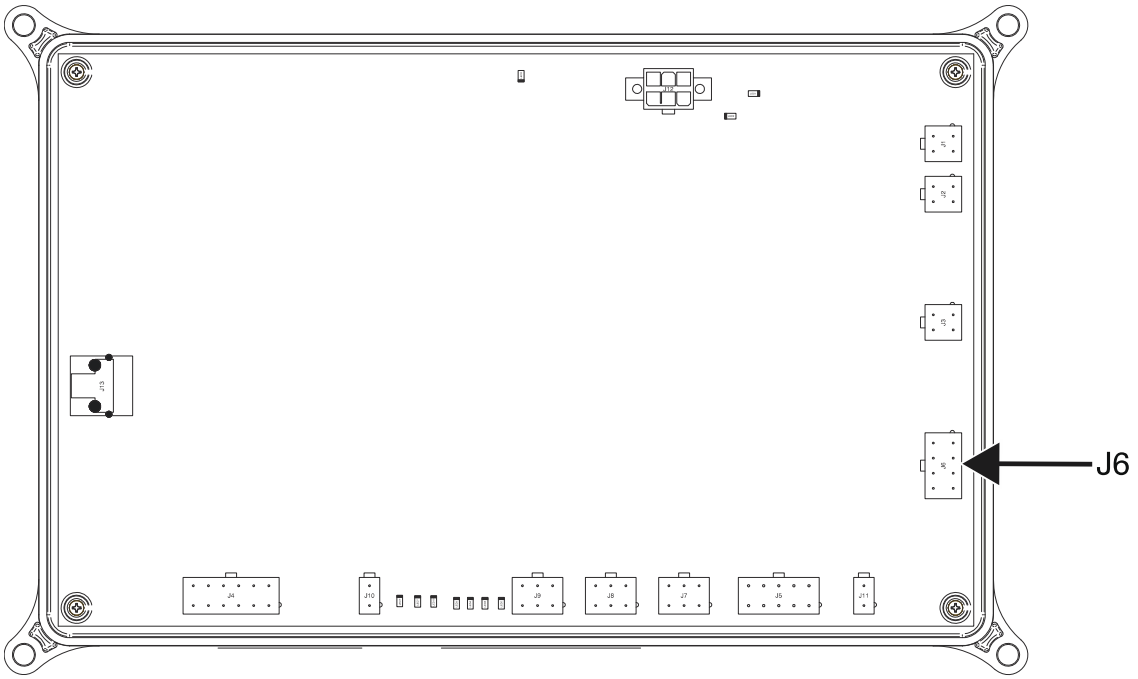
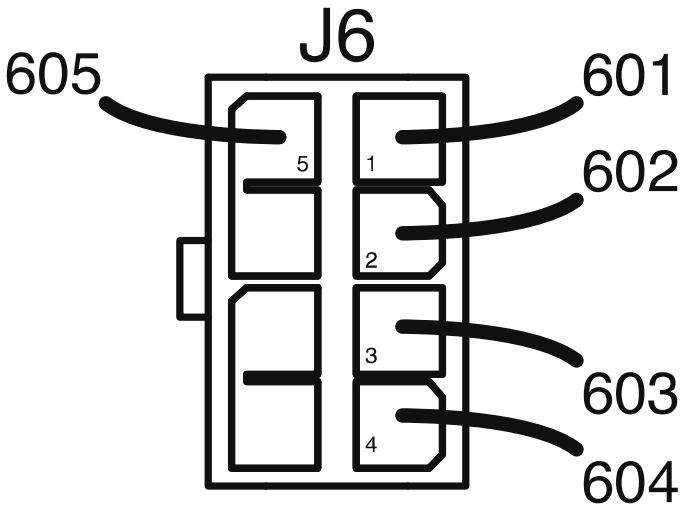


Figure F.3 – Control board plug J1 lead locations



CONTROL BOARD TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Control Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the control board. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figures F.1***, ***F.2*** and ***F.3***. See Wiring Diagram.
6. If any of the tests fail, the control board may be faulty.
7. If faulty, perform the ***Control Board Removal And Replacement Procedure***.
8. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Control board voltage tests

TEST POINT	TEST POINT	EXPECTED READING	MACHINE CONDITION
PLUG J3 PIN 4 (LEAD 304)	PLUG J3 PIN 3 (LEAD 303)	48 VDC	MACHINE ON.
PLUG J3 PIN 1 (LEAD 301)	PLUG J3 PIN 2 (LEAD 302)	2 VDC	MACHINE ON.
PLUG J4 PIN 2 (LEAD 402)	PLUG J4 PIN 4 (LEAD 404)	-15 VDC	MACHINE ON.
PLUG J4 PIN 1 (LEAD 401)	PLUG J4 PIN 4 (LEAD 404)	+15 VDC	MACHINE ON.
PLUG J7 PIN 4 (LEAD F4)	PLUG J7 PIN 1 (LEAD F1)	48 VDC	MACHINE ON.
PLUG J8 PIN 4 (LEAD F4)	PLUG J8 PIN 1 (LEAD F1)	48 VDC	MACHINE ON.
PLUG J9 PIN 4 (LEAD F4)	PLUG J9 PIN 1 (LEAD F1)	48 VDC	MACHINE ON.
PLUG J6 PIN 1 (LEAD 601)	PLUG J6 PIN 2 (LEAD 602)	0 – 28 VDC	VOLTAGE VARIES DEPENDANT ON WIRE FEED SPEED. MACHINE ON.
PLUG J6 PIN 3 (LEAD 603)	PLUG J6 PIN 5 (LEAD 605)	5 VDC	MACHINE ON. TRIGGER ACTIVATED.
PLUG J6 PIN 8 (LEAD 608)	PLUG J6 PIN 7 (LEAD 607)	4 VDC	MACHINE ON. TRIGGER ACTIVATED.
PLUG J5 PIN 8 (LEAD 508)	PLUG J5 PIN 9 (LEAD 509)	4 VDC	MACHINE ON. TRIGGER ACTIVATED.
PLUG J5 PIN 6 (LEAD 506)	PLUG J5 PIN 7 (LEAD 507)	15 VDC	MACHINE ON.
PLUG J5 PIN 5 (LEAD 75)	PLUG J5 PIN 3 (LEAD 77)	10 VDC	MACHINE ON.
PLUG J5 PIN 1 (LEAD 2)	PLUG J5 PIN 2 (LEAD 4)	15 VDC	MACHINE ON.
PLUG J1 PIN 4 (LEAD R)	PLUG J1 PIN 3 (LEAD W)	48 VDC	MACHINE ON.

Figure F.1 – Control board location

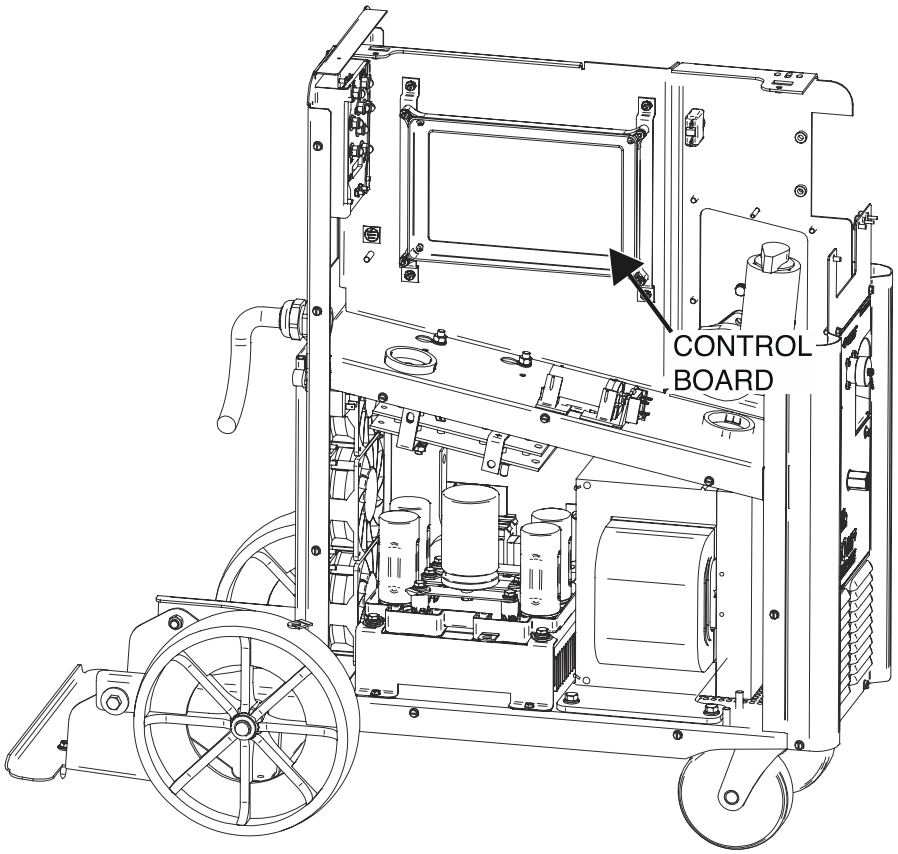


Figure F.2 – Control board plug locations

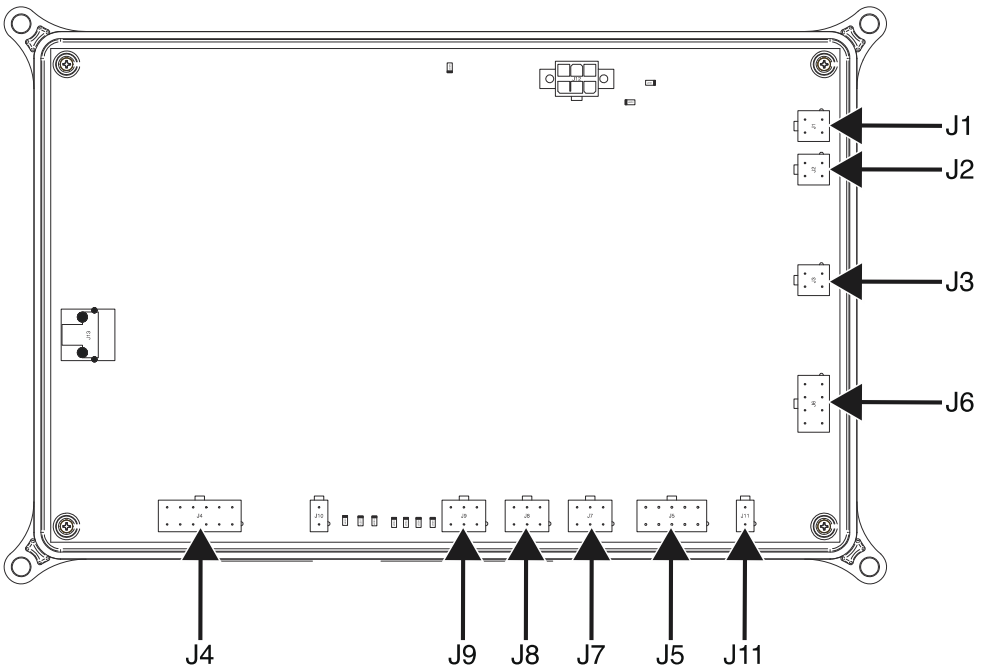
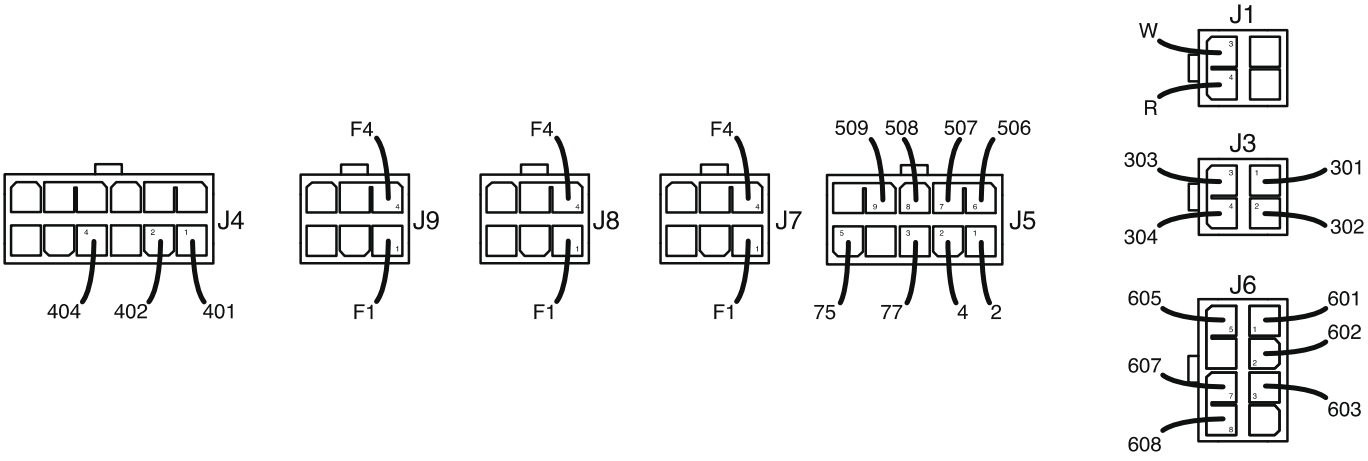


Figure F.3 – Control board lead locations



OUTPUT CHOKE TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Output Choke is functioning properly.

MATERIALS NEEDED

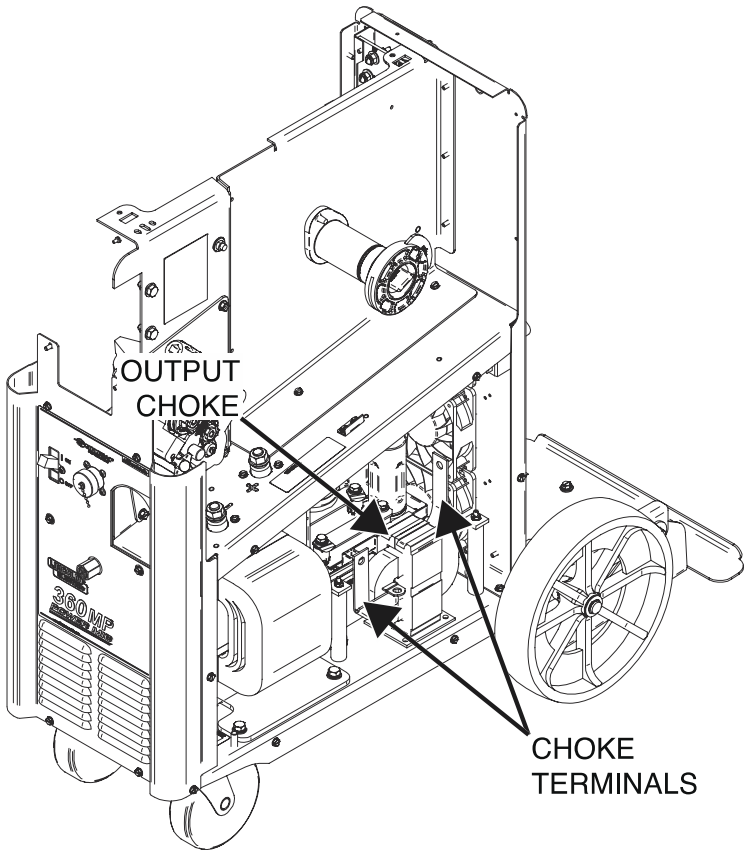
Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the output choke. See ***Figure F.1***. See Wiring Diagram.
5. **Open:** No welding output. Using a volt/ohmmeter, test the resistance from one choke terminal to the other choke terminal. See ***Figure F.1***. See Wiring Diagram. Typical resistance is less than one ohm.
6. Check for any physical signs of arcing within the choke assembly. See Wiring Diagram.
7. **Choke Coil Grounded:** Reduced inductance, alternate cutting weld path. Electrically isolate the choke coil by disconnecting all leads connected to the choke terminals. Using a volt/ohmmeter, check the resistance from choke coil to chassis ground. Resistance should be at least 500,000 ohms. See Wiring Diagram.
8. If any of the tests fail, the output choke may be faulty.
9. If faulty, perform the ***Output Choke Removal And Replacement Procedure***.
10. Connect the previously removed leads to the output choke. See Wiring Diagram.
11. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Output choke and output choke terminals location



CURRENT TRANSDUCER (LEM) TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Current Transducer (LEM) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Resistive Load Bank

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the current transducer (LEM). See ***Figure F.1***. See Wiring Diagram.
5. Locate plug J4 on the control board. See ***Figure F.2***. See Wiring Diagram.
6. Carefully apply the correct input power to the machine and turn the machine ON.
7. Using a volt/ohmmeter, carefully check for the DC supply voltages to the current transducer (LEM) per ***Table 1***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
   NOTE: Do not attempt the check the voltages at the current transducer (LEM) connector. The terminals are small and delicate and may be damaged if probed with meter leads.
8. If the correct voltages are NOT present at the control board, perform the ***Control Board Test Procedure***.
9. Place the machine into a constant current output mode. Using a load bank, load the machine according to ***Table F.2***.
10. Using a volt/ohmmeter, test the current transducer (LEM) feedback versus actual output current. See ***Table 2***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
11. If the DC supply voltages are correct but the feedback voltages are incorrect the current transducer (LEM) may be faulty.
12. If faulty, perform the ***Current Transducer (LEM) Removal And Replacement Procedure***.
13. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – DC supply voltages from control board

DESCRIPTION	TEST POINT (+)	TEST POINT (–)	EXPECTED READING
POSITIVE VOLTAGE SUPPLY	PLUG J4 PIN 1 (LEAD 401)	PLUG J4 PIN 4 (LEAD 404)	+15 VDC
NEGATIVE VOLTAGE SUPPLY	PLUG J4 PIN 2 (LEAD 402)	PLUG J4 PIN 4 (LEAD 404)	-15 VDC

Table F.2 – Current transducer (LEM) feedback versus actual output current

ACTUAL OUTPUT CURRENT (AMPS)	TEST POINT (POS)	TEST POINT (NEG)	CURRENT TRANSDUCER (LEM) FEEDBACK VOLTAGE
500	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	4.0 VDC
450	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	3.6 VDC
400	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	3.2 VDC
350	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	2.8 VDC
300	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	2.4 VDC
250	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	2.0 VDC
200	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	1.6 VDC
150	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	1.2 VDC
100	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	0.8 VDC
50	PLUG J4 PIN 3 (LEAD 403)	PLUG J4 PIN 4 (LEAD 404)	0.4 VDC

Figure F.1 – Current transducer (LEM) location

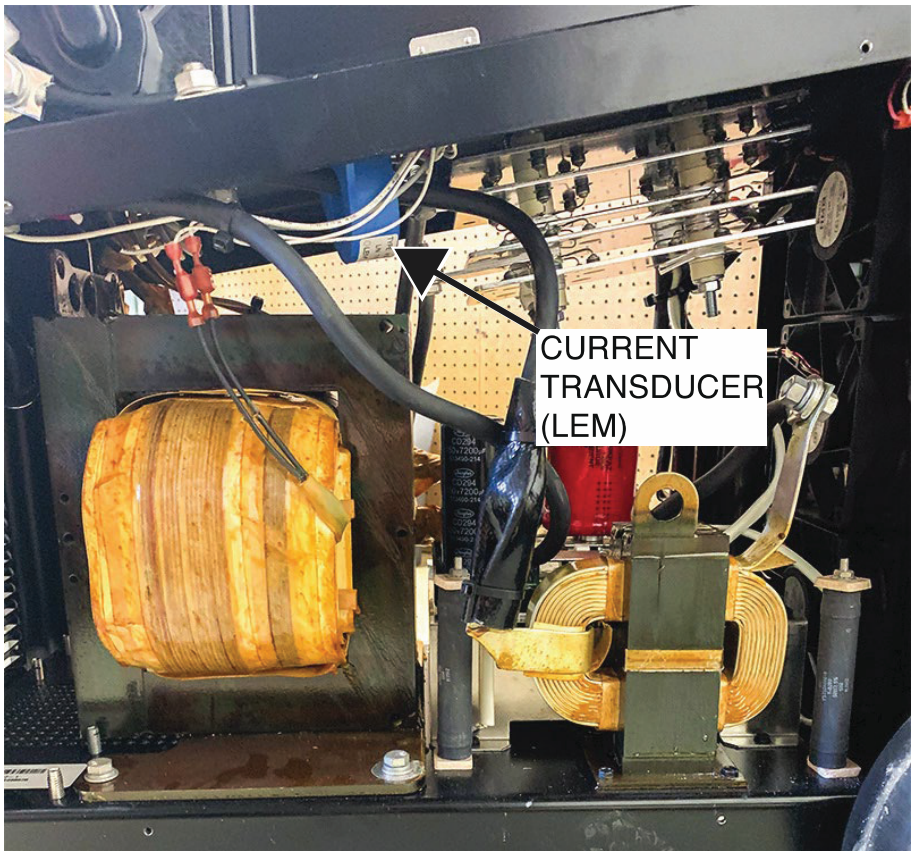


Figure F.2 – Control board plug J4 location

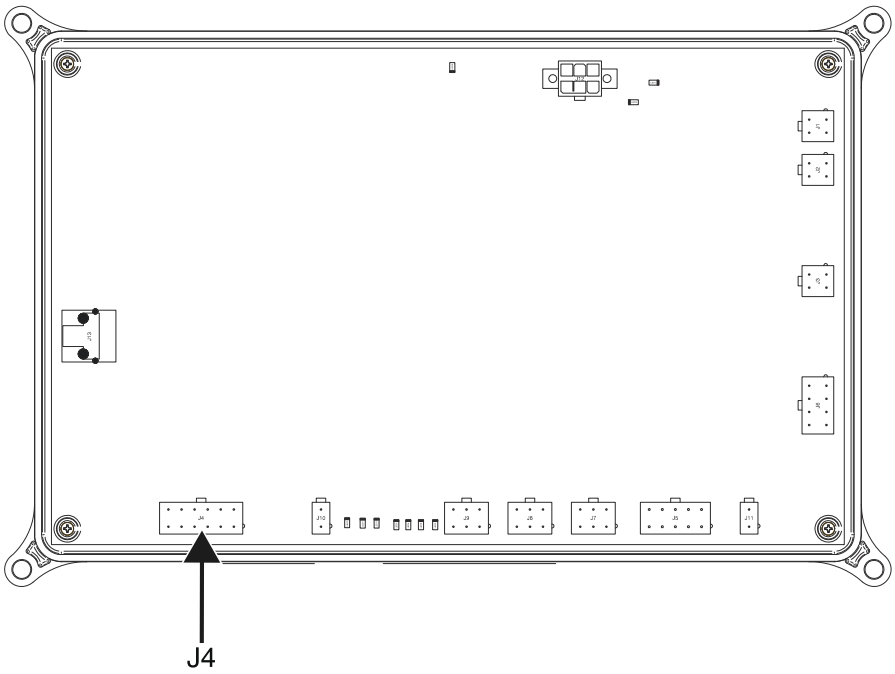
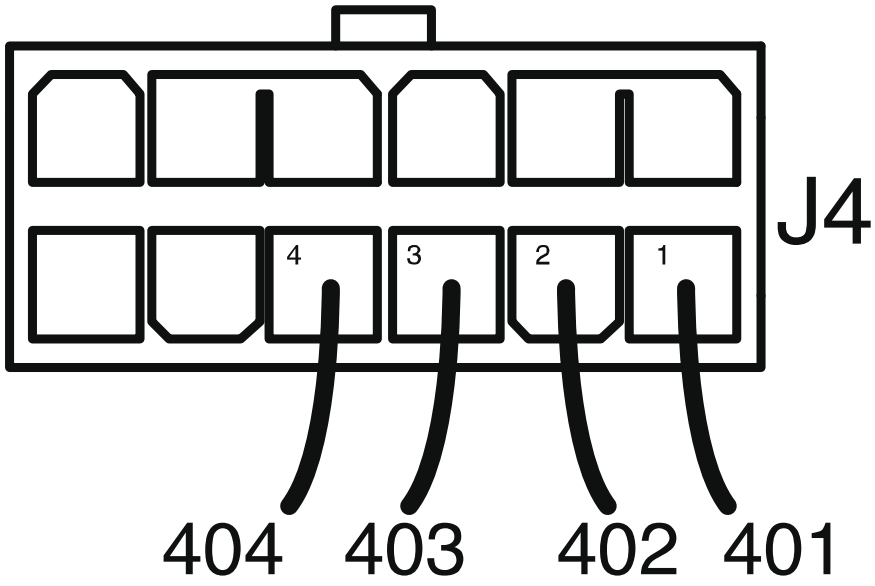


Figure F.3 – Control board plug J4 lead locations



USER INTERFACE BOARD TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the User Interface Board is functioning properly.

MATERIALS NEEDED

5/16” Nutdriver

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the user interface board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 5/16” nutdriver, remove the four screws securing the user interface assembly to the front of the machine. See ***Figure F.1***. Carefully position the user interface assembly to gain access to the plug for testing.
6. Carefully apply the correct input power to the machine and turn ON the machine.
7. Using a volt/ohmmeter, measure the voltage at plug X1 pins 4 to 3. See ***Figures F.2*** and ***F.3***. See Wiring Diagram. Voltage should be approximately 48 VDC.
8. Using a volt/ohmmeter, measure the voltage at plug X1 pins 1 to 2. See ***Figures F.2*** and ***F.3***. See Wiring Diagram. Voltage should be approximately 2 VDC.
9. If any of the voltages are not present, perform the ***Control Board Test Procedure***.
10. If the voltages are present and the user interface board is still not functioning, the user interface board may be faulty.
11. If faulty, perform the ***User Interface Board Removal And Replacement Procedure***.
12. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – User interface assembly and mounting screw locations

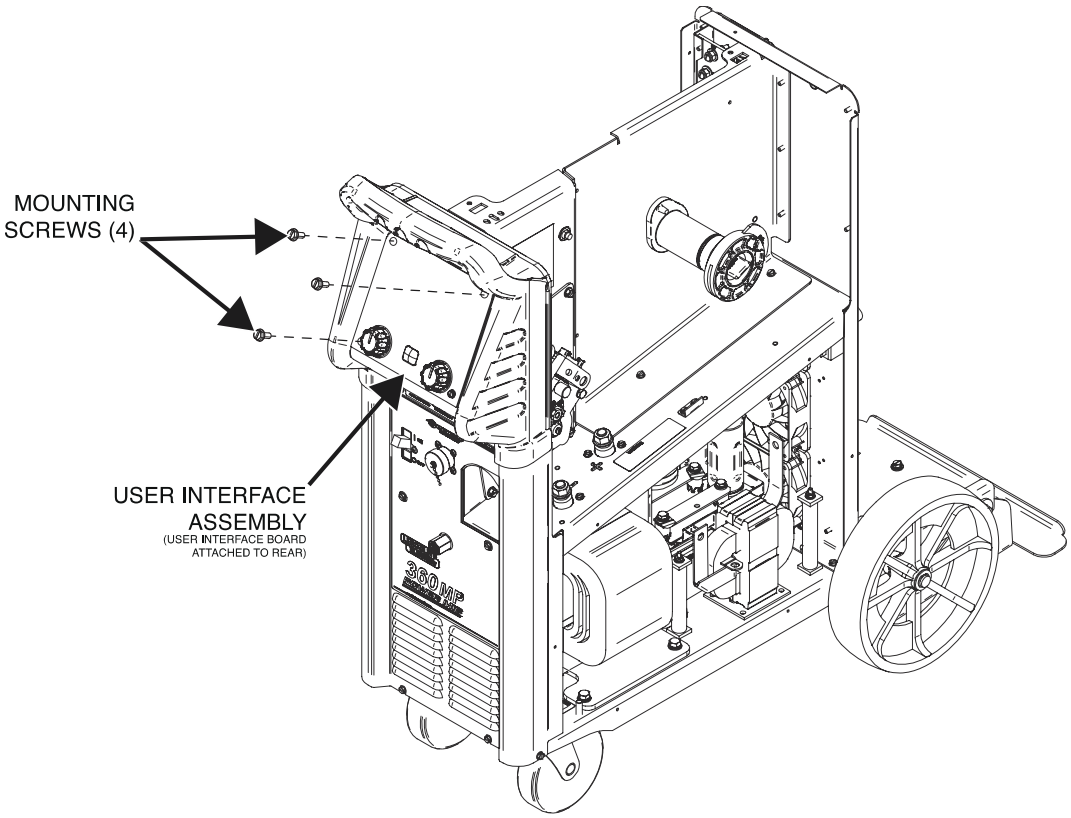


Figure F.2 – User interface assembly mounting screw locations

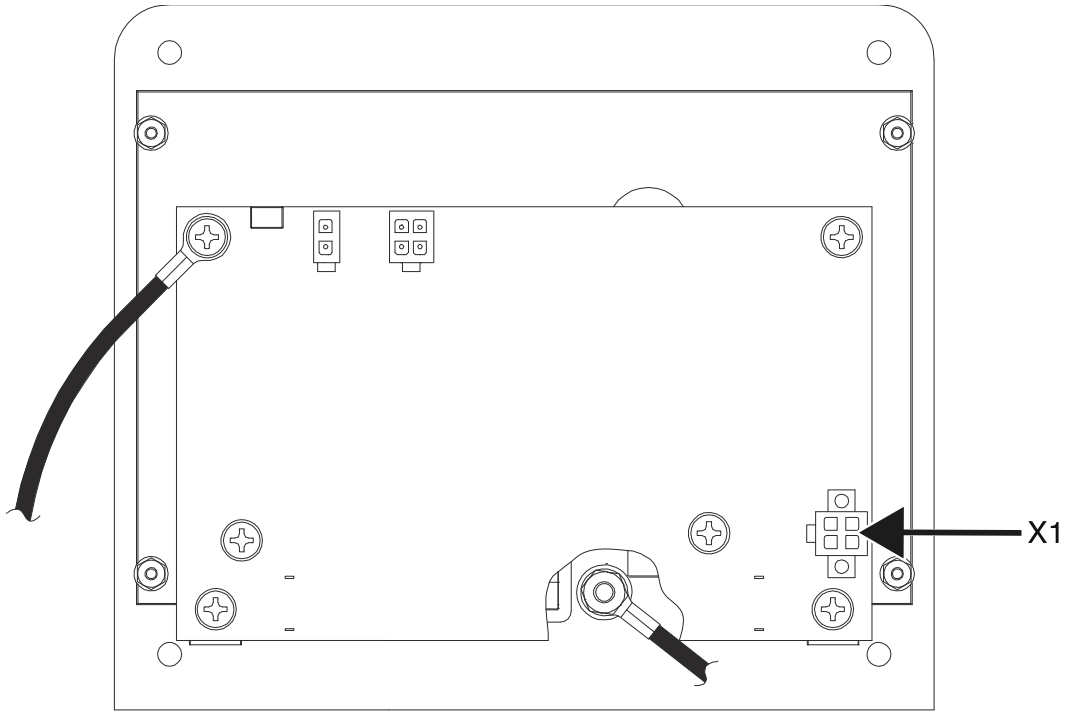
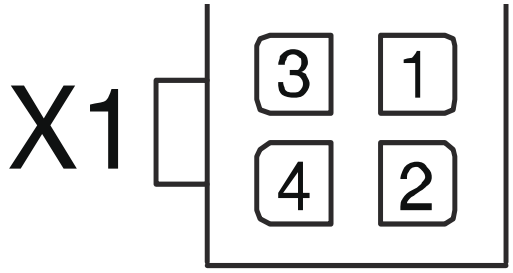


Figure F.3 – User interface board plug locations



THERMOSTAT TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the main transformer and chopper board thermostats are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the thermostat, on the chopper board and inside the main transformer. See Wiring Diagram.
5. Locate plug J4 on the control board. Label and disconnect plug J4 from the control board. See ***Figure F.1***. See Wiring Diagram.
6. Using a digital volt/ohmmeter, check the resistance between plug J4 pin 7 (lead 407) and plug J4 pin 8 (lead 408). See ***Figures F.1*** and ***F.2***. See Wiring Diagram. The resistance should be very low (less than one ohm). This tests the main transformer thermostat.
7. Using a digital volt/ohmmeter, check the resistance between plug J4 pin 9 (lead 409) and plug J4 pin 10 (lead 410). See ***Figures F.1*** and ***F.2***. See Wiring Diagram. The resistance should be approximately 10,000 ohms. This This tests the chopper board thermistor.
8. If main transformer thermostat test fails, the main transformer may be faulty.
9. If the main transformer is faulty, perform the ***Main Transformer Removal And Replacement Procedure***.
10. If chopper board thermostat test fails, perform the ***Chopper Board Removal And Replacement Procedure***.
11. Connect the previously disconnected plug J5 to the control board. See Wiring Diagram.
12. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Control board plug J4 location

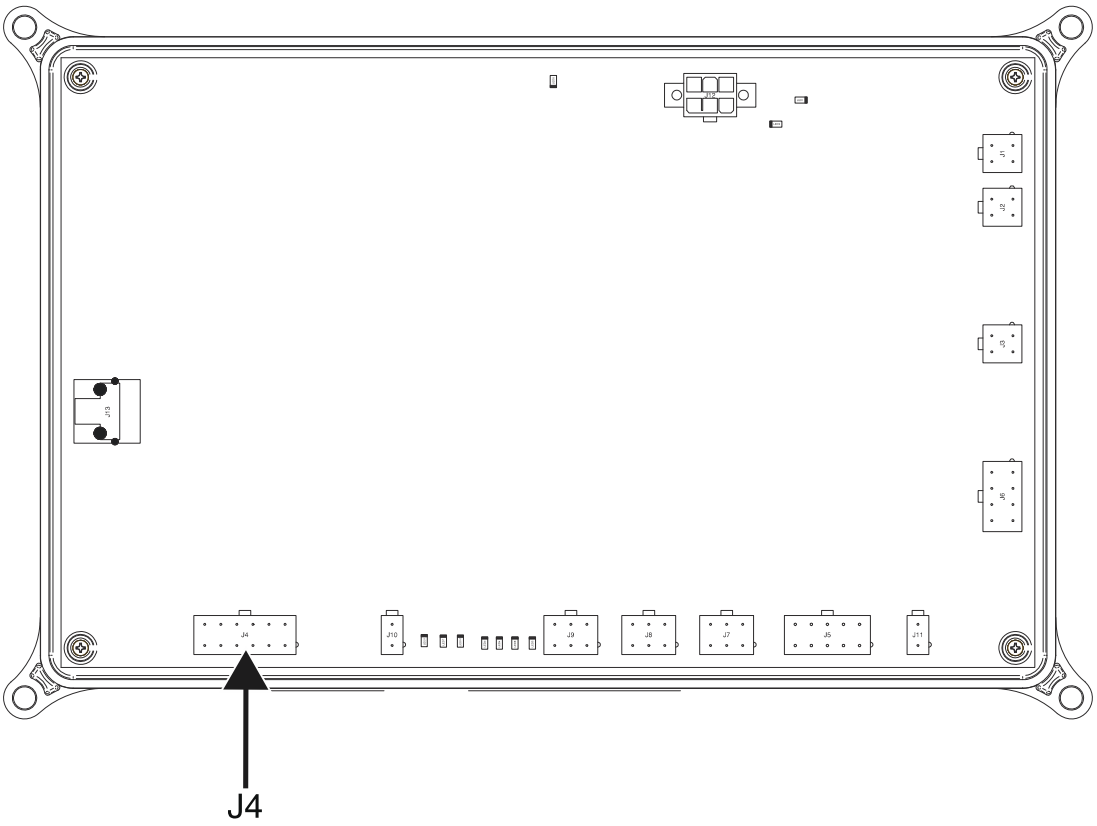
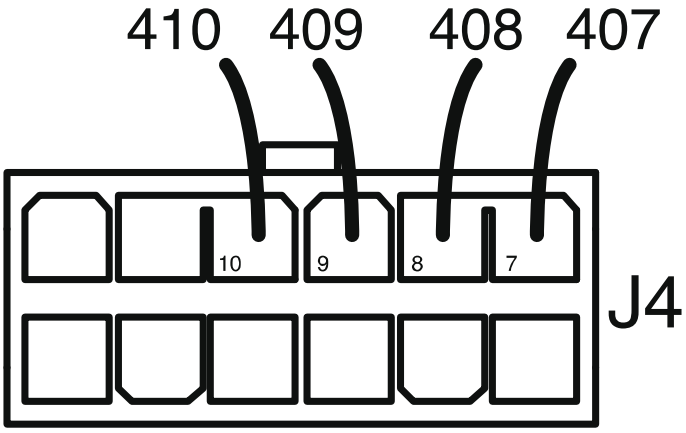


Figure F.2 – Control board plug J4 lead locations



LINE SWITCH TEST PROCEDURE

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

TEST DESCRIPTION

This test will determine if the Line Switch is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter

Wiring Diagram

TEST PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the line switch. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figures F.1*** and ***F.2***. See Wiring Diagram.
6. If the readings differ from ***Table F.1***, label and disconnect leads from the line switch and retest.
7. If any of the tests fail, the line switch may be faulty.
8. If faulty, perform the ***Line Switch Removal And Replacement Procedure***.
9. Connect the previously removed leads to the line switch. See Wiring Diagram.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Line switch resistance tests

TEST POINT	TEST POINT	EXPECTED READING	SWITCH POSITION
L1	S1	VERY LOW RESISTANCE (LESS THAN ONE OHM)	“ON” POSITION
L2	S2	VERY LOW RESISTANCE (LESS THAN ONE OHM)	“ON” POSITION
L1	S1	HIGH RESISTANCE (GREATER THAN 500K OHMS)	“OFF” POSITION
L2	S2	HIGH RESISTANCE (GREATER THAN 500K OHMS)	“OFF” POSITION

Figure F.1 – Line switch location

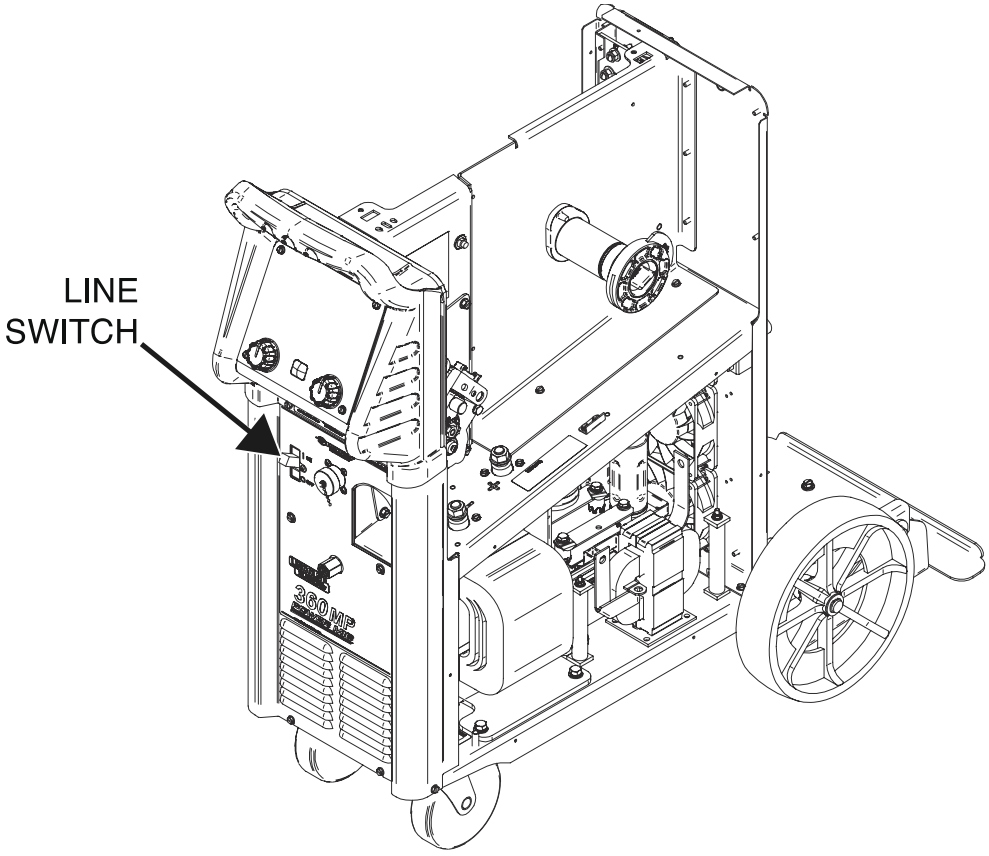
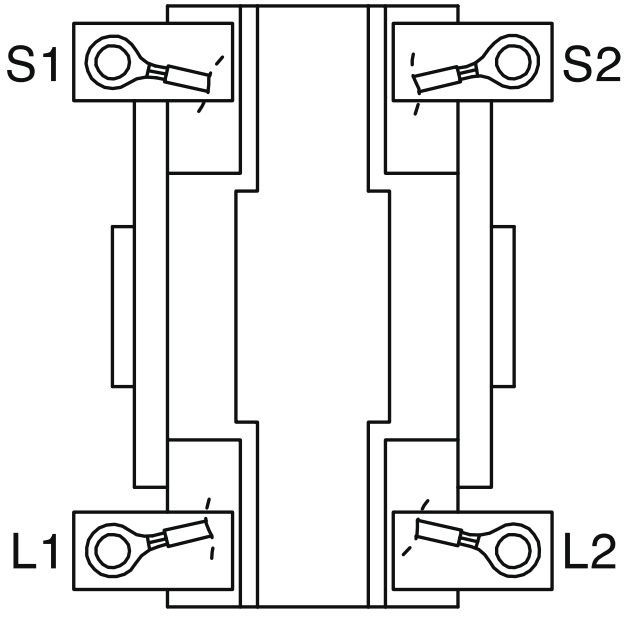


Figure F.2 – Line switch lead and terminal locations



Removal And Replacement Procedures

MAIN TRANSFORMER REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

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

MATERIALS NEEDED

Phillips Screwdriver

1/2" Open-End Wrench

1/2" Nutdriver

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a Phillips screwdriver, remove the screw and lock washer securing each primary transformer lead to the reconnect panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads H1, H6, H2, H5, H3, H7 and H4 from the reconnect panel. See Wiring Diagram.
6. Carefully route leads through the top shelf to allow for removal. Cut cable ties as necessary.
7. Label and disconnect leads X5 and X6 from the control rectifier terminals. See ***Figure F.2***. See Wiring Diagram.
8. Carefully route leads through the top shelf to allow for the removal. Cut cable ties as necessary.
9. Using a 1/2" open-end wrench and a 1/2" nutdriver, remove the bolt, nut, lock washer and two flat washers securing leads X1 and X2 to the two AC terminals of the input rectifier. See ***Figure F.2***. See Wiring Diagram.
10. Label and disconnect leads X1 and X2 from the input rectifier terminals. See Wiring Diagram.
11. Label and disconnect lead X9 from the circuit breaker located above the wire drive assembly. See ***Figure F.2***. See Wiring Diagram.
12. Label and disconnect lead X8 from the quick connect terminal near the top shelf. See ***Figure F.2***. See Wiring Diagram.
13. Using a 1/2" nutdriver, remove the four bolts, lock washers and flat washers securing the main transformer to the machine. See ***Figure F.3***.
14. Carefully route leads through the top shelf to allow for removal. Cut cable ties as necessary.
15. The main transformer can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully route leads through the center panel.
2. Carefully position the new main transformer into the machine.
3. Carefully route leads through the top shelf. Attach cable ties as necessary.
4. Using a 1/2” nutdriver, attach the four bolts, lock washers and flat washers securing the main transformer to the machine.
5. Connect lead X8 to the quick connect terminal near the top shelf. See Wiring Diagram.
6. Connect lead X9 to the circuit breaker located above the wire drive assembly. See Wiring Diagram.
7. Using a 1/2” open-end wrench and a 1/2” nutdriver, attach the bolt, nut, lock washer and two flat washers securing leads X1 and X2 to the two AC terminals of the input rectifier. See Wiring Diagram.
8. Connect leads X5 and X6 to the control rectifier terminals. See Wiring Diagram.
9. Using a Phillips screwdriver, attach the screw and lock washer securing each primary transformer lead (H1, H6, H2, H5, H3, H7 and H4) to the reconnect panel. See Wiring Diagram.
10. Replace previously removed cable ties as necessary.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Main transformer primary lead locations

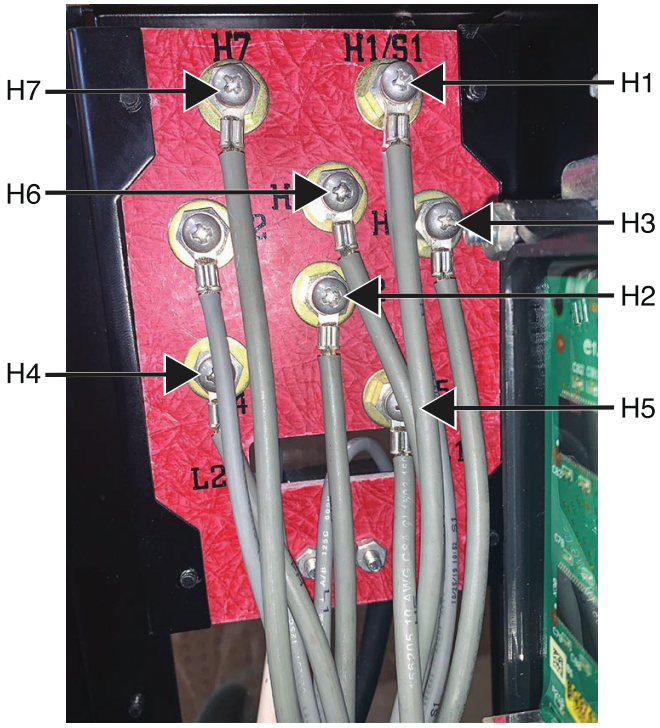


Figure F.2 – Main transformer secondary lead connection locations

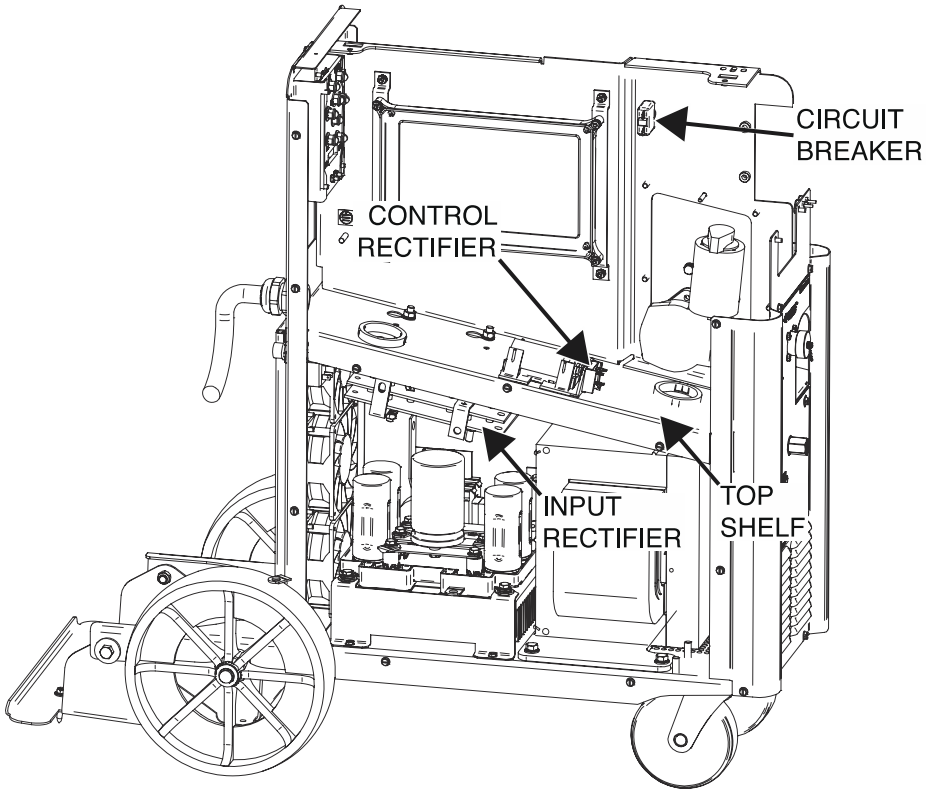
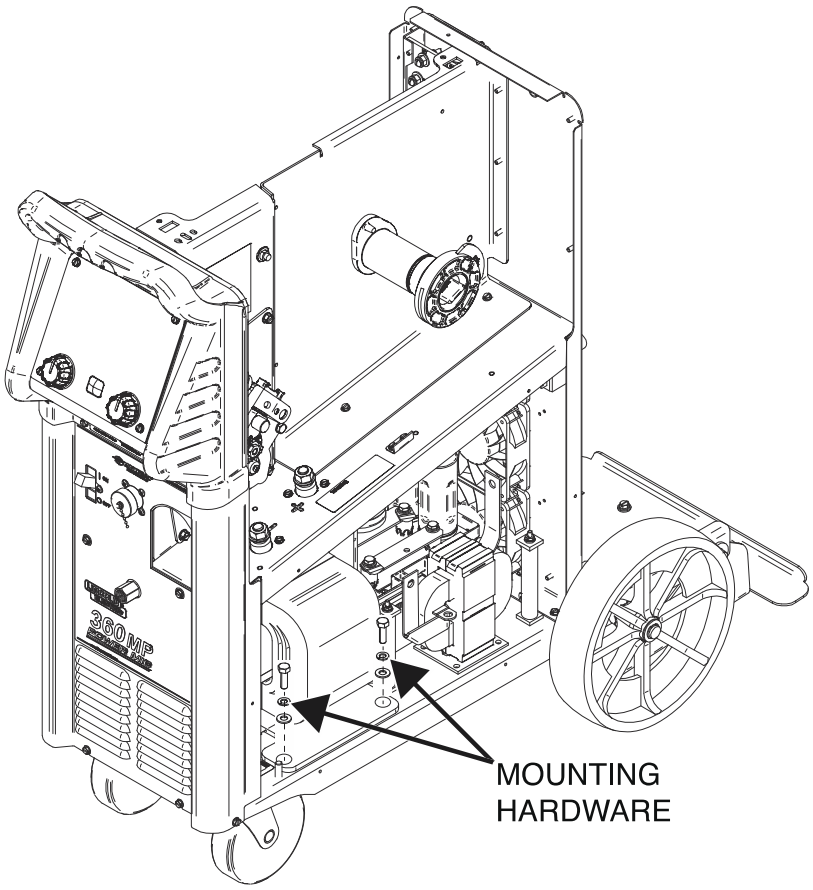


Figure F.3 – Main transformer mounting hardware locations



INPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

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

MATERIALS NEEDED

1/2” Open-End Wrench

1/2” Nutdriver

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 1/2” open-end wrench and a 1/2” nutdriver, remove the bolt, nut, lock washer and two flat washers securing leads to the positive and negative terminals of the input rectifier. Label and disconnect leads. See ***Figure F.1***. See Wiring Diagram.
5. Using a 1/2” open-end wrench and a 1/2” nutdriver, remove the bolt, nut, lock washer and two flat washers securing leads X1 and X2 to the two AC terminals of the input rectifier. Label and disconnect leads. See ***Figure F.1***. See Wiring Diagram.
6. Using a 1/2” nutdriver, loosen the two mounting nuts securing the input rectifier to the top shelf. See ***Figure F.2***. Do not remove the mounting nuts completely.
7. Carefully slide the input rectifier forward and maneuver the input rectifier out of the mounting notch in the top shelf. Note orientation of the input rectifier for reassembly.
8. The input rectifier can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new input rectifier into the mounting notch in the top shelf.
2. Using a 1/2” nutdriver, tighten the two mounting nuts securing the input rectifier to the top shelf.
3. Using a 1/2” open-end wrench and a 1/2” nutdriver, attach the bolt, nut, lock washer and two flat washers securing leads X1 and X2 to the two AC terminals of the input rectifier.
4. Using a 1/2” open-end wrench and a 1/2” nutdriver, attach the bolt, nut, lock washer and two flat washers securing leads to the positive and negative terminals of the input rectifier.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Input rectifier terminal locations

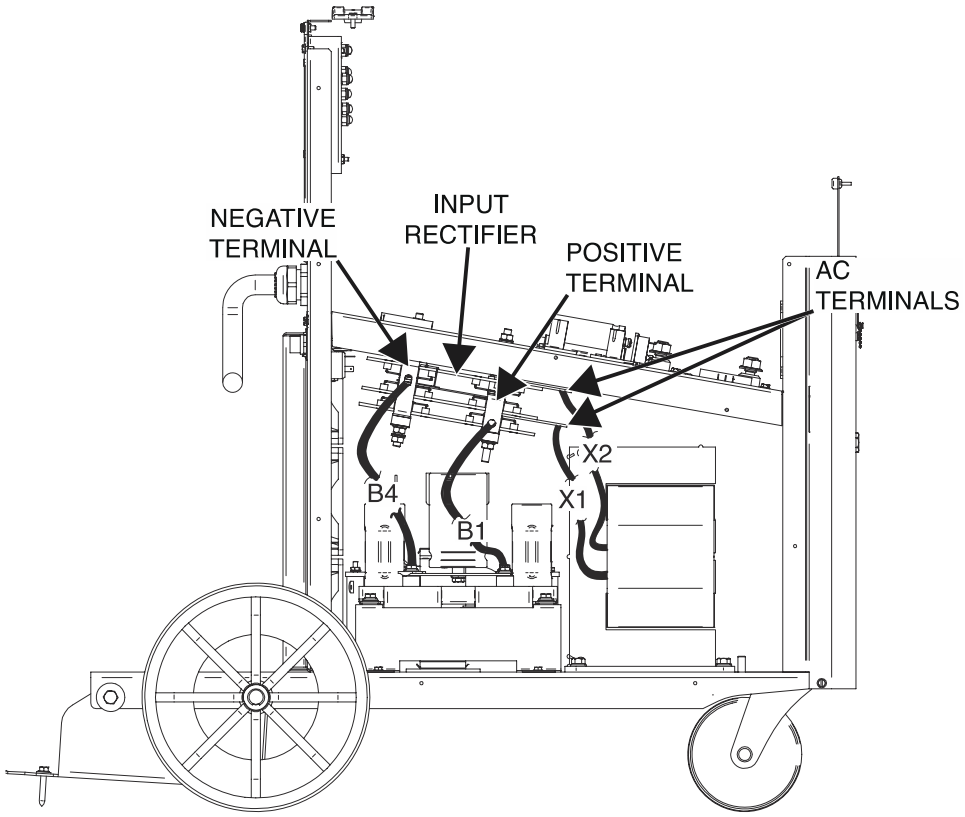
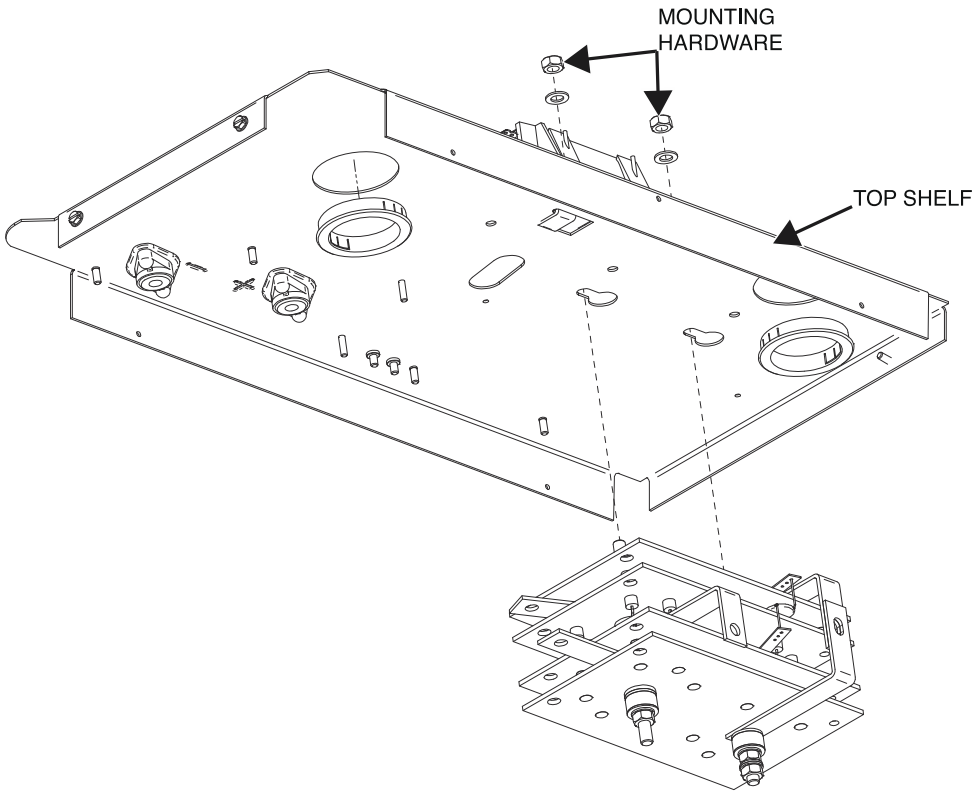


Figure F.2 – Input rectifier mounting hardware locations



CHOPPER BOARD REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

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

MATERIALS NEEDED

7/16” Nutdriver

5/16” Nutdriver

Penetrox Heat Sink Compound (Lincoln Part #T12837-1)

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 7/16” nutdriver, remove the six bolts, lock washers and flat washers securing the bus bars and leads to terminals B1, B2, B3, B4, B5 and B6 of the chopper board. See ***Figure F.1***. See Wiring Diagram. Label leads for reassembly.
5. Label and disconnect the leads 412 and 411 from the quick connect terminals B7 and B8 of the chopper board. See ***Figure F.1***. See Wiring Diagram.
6. Using a 7/16” nutdriver, remove the two bolts, lock washers and flat washers securing the capacitor to the bus bars. See ***Figure F.2***. See Wiring Diagram. Note capacitor orientation and polarity for reassembly.
7. Using a 5/16” nutdriver, remove the four screws securing the chopper board assembly to the machine. See ***Figure F.3***.
8. The chopper board assembly can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new chopper board assembly into the machine.
2. Apply a thin coating of Penetrox heat sink compound to terminals B1, B2, B3, B4, B5 and B6 of the chopper board.
3. Apply a thin coating of Penetrox heat sink compound to the mating surfaces of the capacitor and the bus bars.
4. Using a 7/16” nutdriver, attach the two bolts, lock washers and flat washers securing the capacitor to the bus bars. See Wiring Diagram.
5. Using a 7/16” nutdriver, attach the six bolts, lock washers and flat washers securing the bus bars and leads to terminals B1, B2, B3, B4, B5 and B6 of the chopper board. See Wiring Diagram.

6. Connect leads 412 and 411 to the quick connect terminals B7 and B8 of the chopper board. See Wiring Diagram.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Chopper board terminal locations

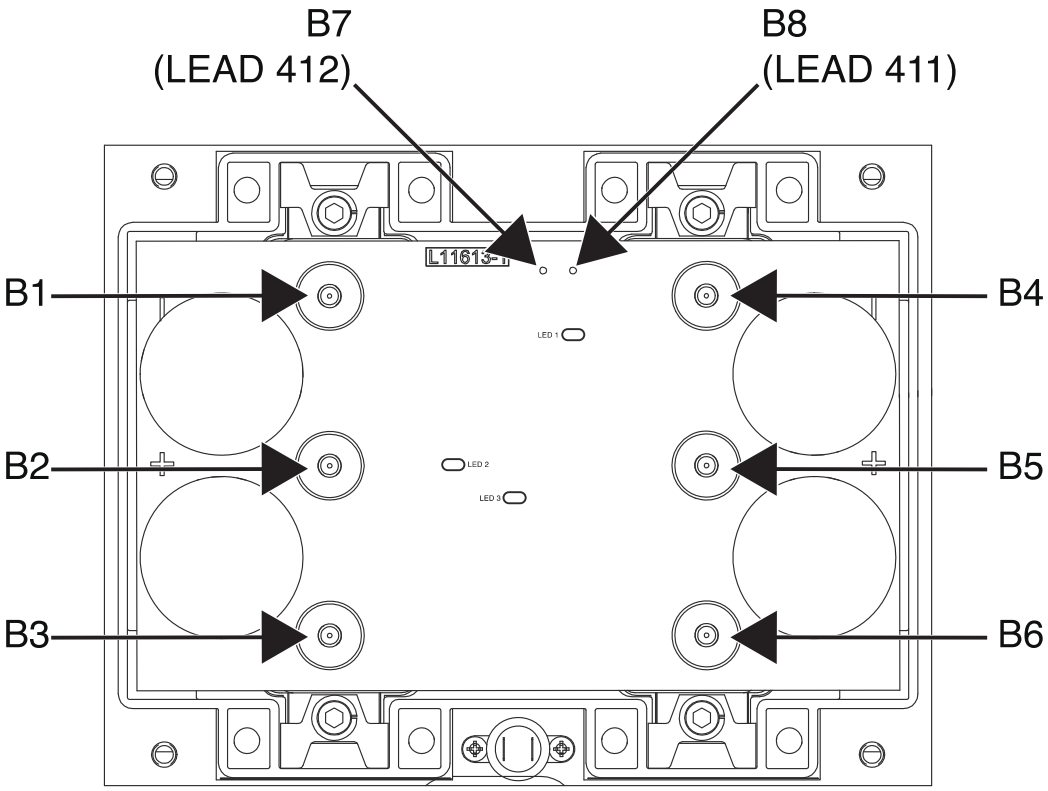


Figure F.2 – Capacitor and bus bar mounting hardware locations

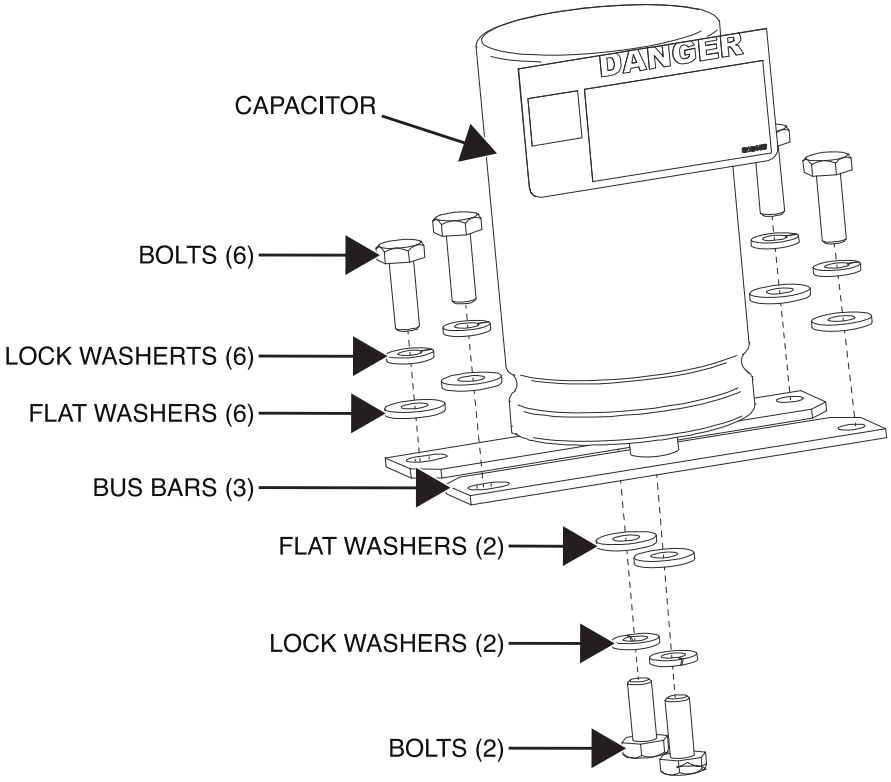
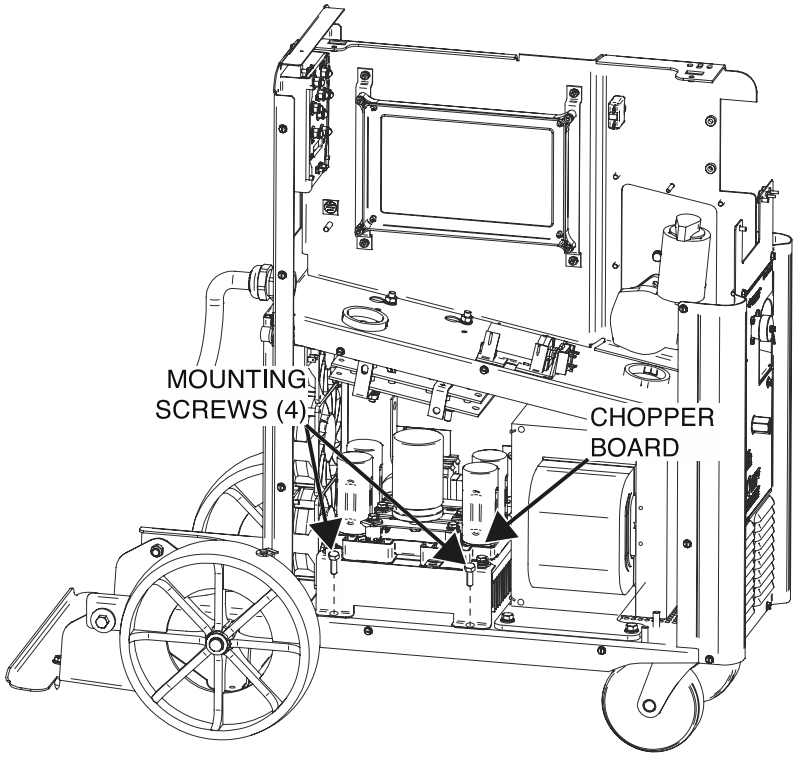


Figure F.3 – Chopper board mounting hardware locations



CONTROL RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

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

MATERIALS NEEDED

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads X5, X6, 103A and 104A from the control rectifier terminals. See ***Figure F.1***. See Wiring Diagram.
5. Carefully remove the fastener securing the control rectifier to the capacitor bracket. See ***Figure F.2***.
6. Carefully maneuver the control rectifier out of the capacitor bracket.
7. The control rectifier can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new control rectifier into the capacitor bracket.
2. Attach the fastener securing the control rectifier to the capacitor bracket.
3. Connect leads X5, X6, 103A and 104A to the control rectifier terminals. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control rectifier lead locations

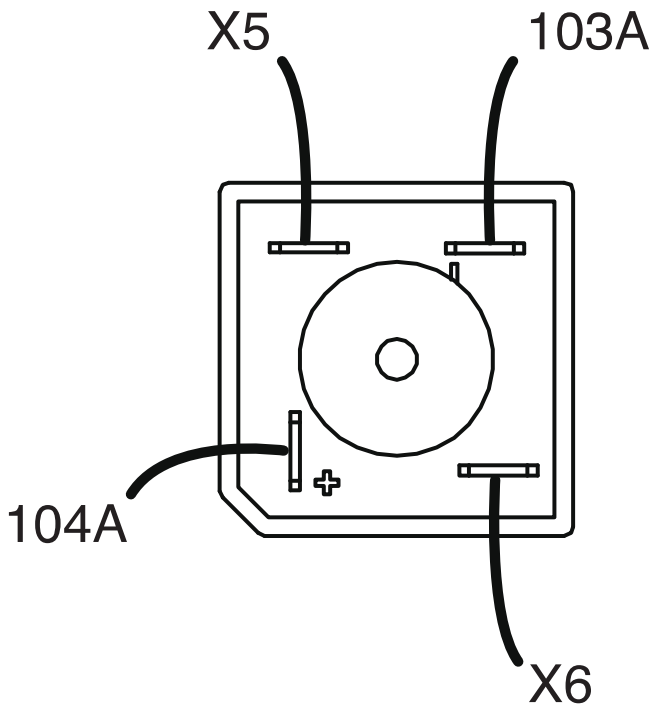
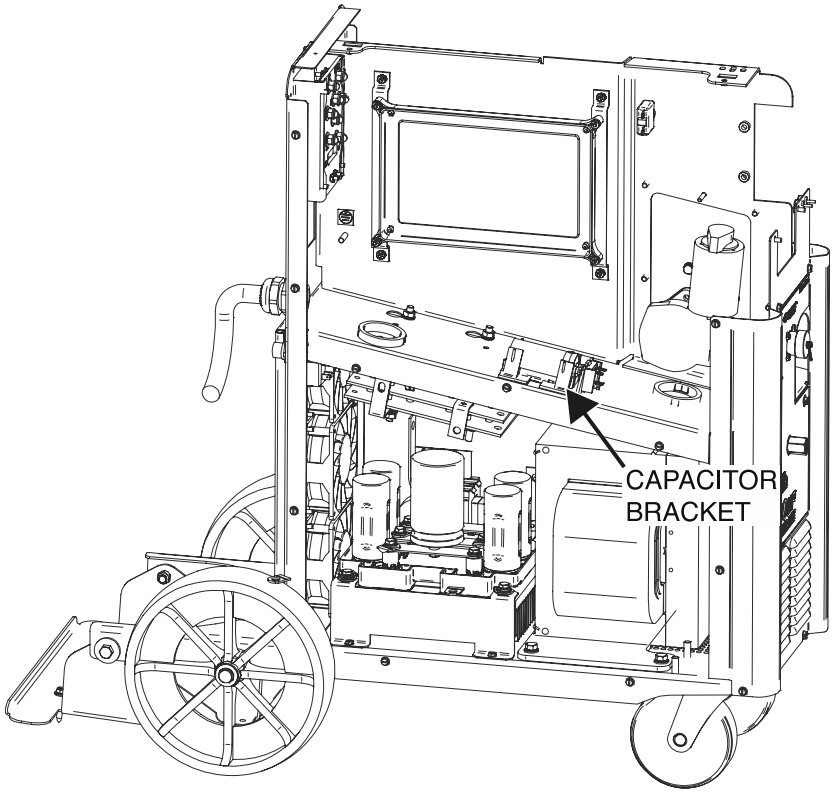


Figure F.2 – Capacitor bracket location



GAS SOLENOID REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Main and/or Spool Gas Solenoids.

MATERIALS NEEDED

Needle Nose Pliers

Slotted Screwdriver

Hammer

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Disconnect the gun from the machine.
5. Label and disconnect leads 607 and 608 from the main gas solenoid or leads 508 and 509 from the spool gas solenoid. Needle nose pliers may be necessary for removal. See ***Figure F.1***. See Wiring Diagram.
6. Using needle nose pliers and a slotted screwdriver, loosen hose clamp and carefully pry the gas hose from the rear of the gas solenoid to be replaced.
7. Using a hammer and slotted screwdriver, carefully loosen the nut on the back of the machine securing each gas solenoid to the case back. Note washer placement for reassembly. See ***Figure F.2***.
8. The gas solenoids can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new gas solenoid into the case back of the machine.
2. Using a hammer and slotted screwdriver, carefully tighten the nut and washer on the back of the machine securing each gas solenoid to the case back.
3. Carefully position the gas hose onto the rear of the gas solenoid.
4. Using needle nose pliers, attach the hose clamp securing the gas hose onto the rear of the gas solenoid.
5. Connect leads 607 and 608 to the main gas solenoid or leads 508 and 509 to the spool gas solenoid. See Wiring Diagram.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Gas solenoid lead locations

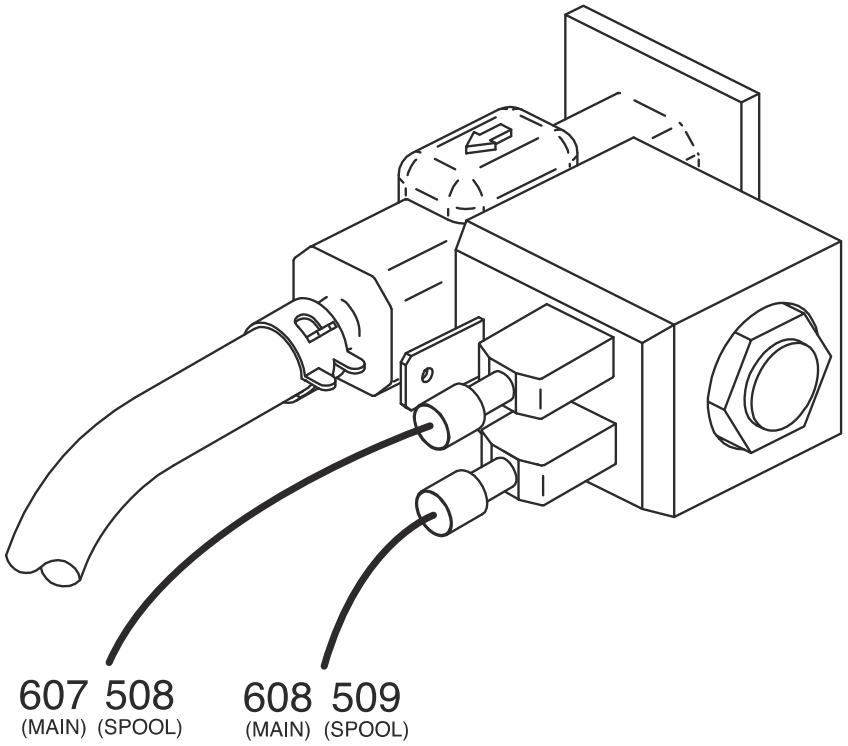
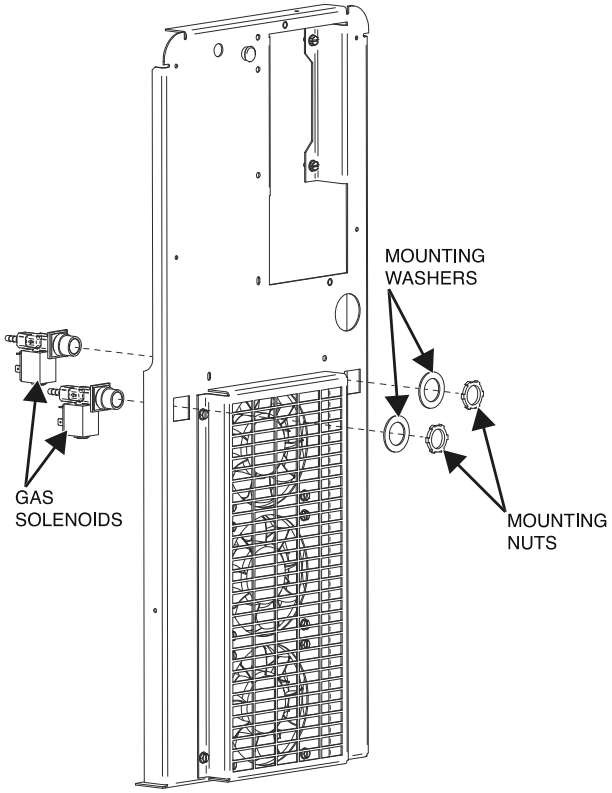


Figure F.2 – Gas solenoid mounting hardware locations



WIRE DRIVE MOTOR REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Wire Drive Motor And Tachometer Assembly.

MATERIALS NEEDED

3/4" Nutdriver

Needle Nose Pliers

3/8" Nutdriver

9/16" Nutdriver

7/16" Nutdriver

Phillips Screwdriver

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plug J21 from plug P21. See Wiring Diagram. Cut cable ties as necessary.
5. Using a 3/4" nutdriver, remove the screw, lock washer and flat washer securing the heavy lead to the wire drive assembly. See ***Figure F.1***. See Wiring Diagram.
6. Using needle nose pliers, loosen the hose clamp securing the gas hose to the wire drive assembly and disconnect the gas hose. Carefully route the gas hose thru the divider panel.
7. Using a 3/8" nutdriver, remove the six screws securing the gearbox mounting panel to the machine. See ***Figure F.1***.
8. Carefully remove the gearbox mounting panel with the wire drive motor and wire drive assembly attached. Be careful the wires do not catch while removing it. See ***Figure F.2***.
9. Remove the outer wire guide from the wire drive assembly by loosening the thumb screws until the outer wire guide can be removed. See ***Figure F.2***.
10. Move the adjustment arm assembly up and toward the rear of the assembly to relieve the drive roll tension. See ***Figure F.2***.
11. Rotate the twist lock rings to release the drive rolls. See ***Figure F.3***. Remove the drive rolls.
12. Remove the inner wire guide. See ***Figure F.2***.
13. Using a 9/16" nutdriver, remove the drive hub retainers and the drive roll shaft assemblies. See ***Figure F.3***. Remove the drive roll shaft assemblies.

14. Using a 7/16” nutdriver, remove the screw and lock washer securing the plastic cover to gain access to the drive gear.
15. Using a Phillips screwdriver, remove the screw, lock washer and collar from the drive gear shaft and remove the drive gear. See ***Figure F.4***.
16. Using a Phillips screwdriver, remove the three screws and lock washers securing the wire drive motor and tachometer assembly to the wire drive assembly. See ***Figure F.5***.
17. The wire drive motor assembly can now be removed and replaced.
18. Using a 7/16” nutdriver, remove the four screws, lock washers and flat washers securing the wire drive assembly to the gearbox mounting panel.

REPLACEMENT PROCEDURE

1. Carefully position the wire drive assembly onto the gearbox mounting panel.
2. Using a 7/16” nutdriver, attach the four screws, lock washers and flat washers securing the wire drive assembly to the gearbox mounting panel.
3. Carefully position the wire drive motor assembly onto the gearbox mounting panel.
4. Using a Phillips screwdriver, attach the three screws and lock washers securing the wire drive motor and tachometer assembly to the wire drive assembly.
5. Using a Phillips screwdriver, attach the screw, lock washer and collar securing the drive gear shaft and drive gear to the wire drive assembly.
6. Using a 7/16” nutdriver, attach the screw and lock washer securing the plastic cover to the wire drive assembly.
7. Carefully position the drive roll shaft assemblies into the wire drive assembly.
8. Using a 9/16” nutdriver, attach the drive hub retainers to the drive roll shaft assemblies.
9. Carefully position the inner wire guide into the wire drive assembly.
10. Carefully position the drive rolls into the wire drive assembly.
11. Rotate the twist lock rings to secure the drive rolls.
12. Move the adjustment arm assembly up and toward the front of the assembly to apply the drive roll tension.
13. Attach the outer wire guide to the wire drive assembly by tightening the thumb screws.
14. Carefully position the gearbox mounting panel with the wire drive motor and tachometer assembly and wire drive assembly attached into the machine.
15. Using a 3/8” nutdriver, attach the six screws securing the gearbox mounting panel to the machine.
16. Carefully route the gas hose thru the divider panel.
17. Using a 3/4” nutdriver, attach the screw, lock washer and flat washer securing the heavy lead to the wire drive assembly. See Wiring Diagram.
18. Connect plug J21 to plug P21. See Wiring Diagram.
19. Perform the ***Case Cover Replacement Procedure***.
20. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Gearbox mounting panel, heavy lead and hex head screw locations

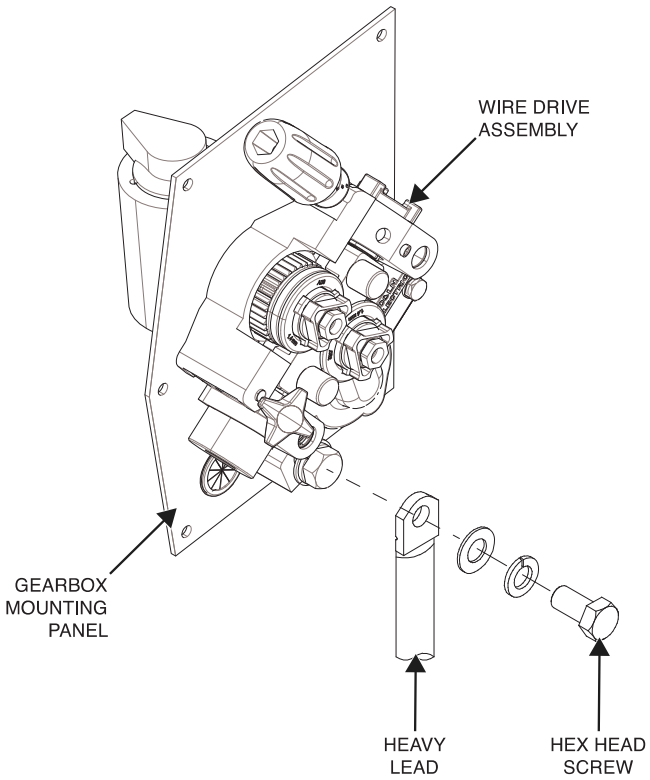


Figure F.2 – Adjustment arm, inner wire guide and outer wire guide locations

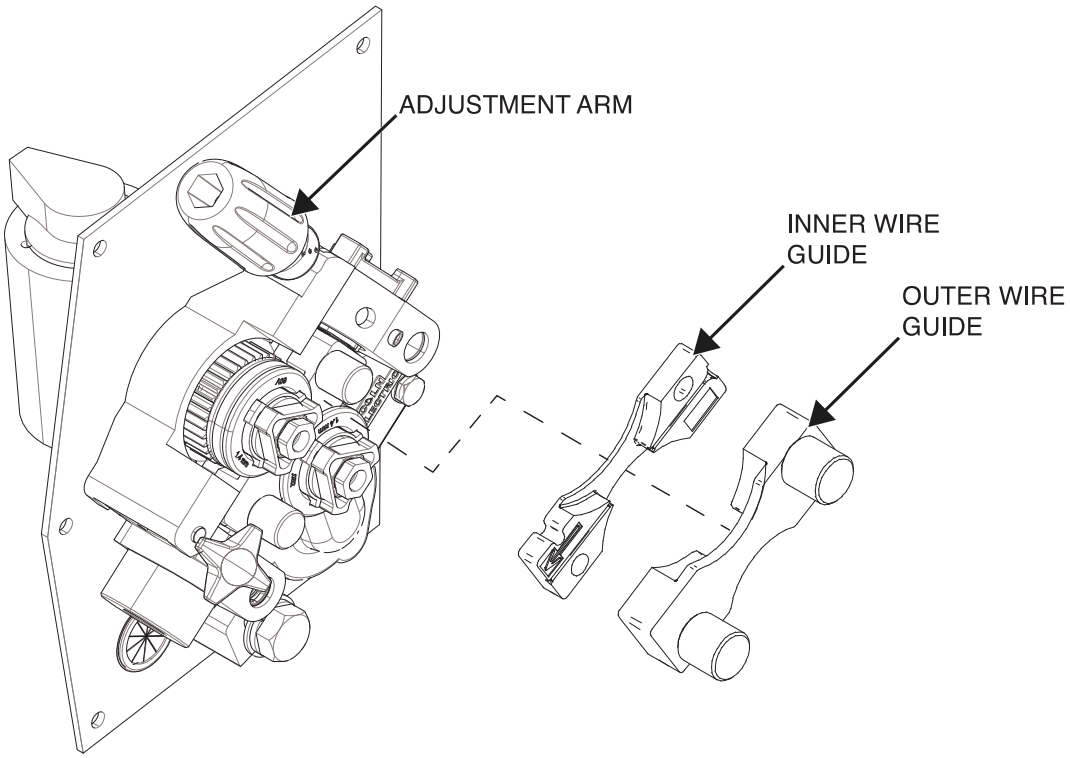


Figure F.3 – Drive roll shaft assembly location

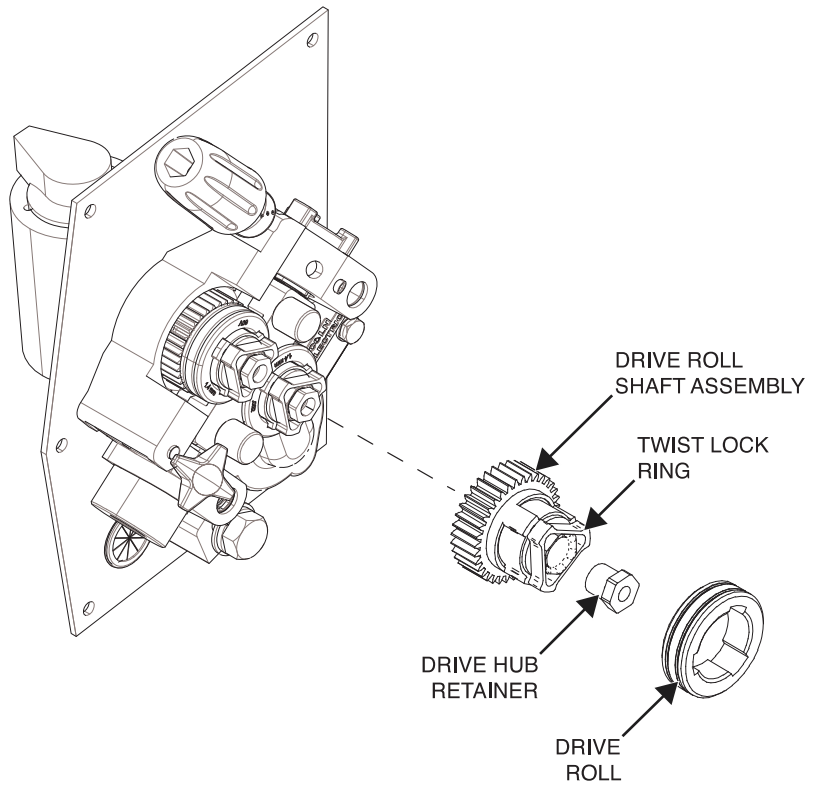


Figure F.4 – Drive roll gear removal

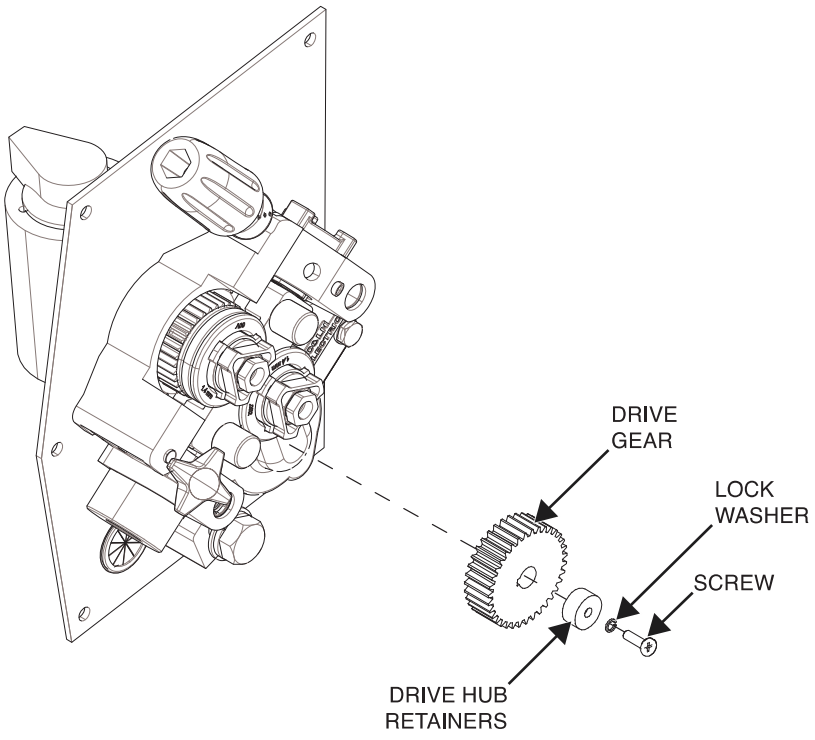
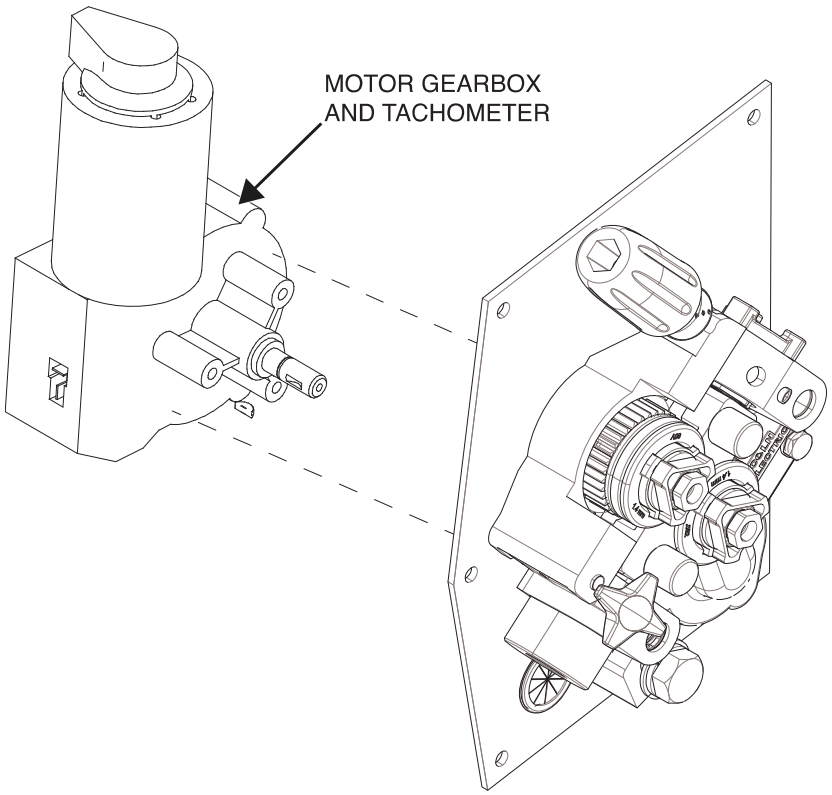


Figure F.5 – Motor gearbox removal



CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

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

MATERIALS NEEDED

3/8” Nutdriver

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J1, J2, J3, J6, J11, J5, J7, J8, J9 and J4 from the control board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four mounting nuts securing the control board to the mounting bracket. See ***Figure F.2***.
6. The control board can now be removed from the mounting bracket and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new control board onto the mounting bracket.
2. Using a 3/8” nutdriver, attach the four mounting nuts securing the control board to the mounting bracket.
3. Connect plugs J1, J2, J3, J6, J11, J5, J7, J8, J9 and J4 to the control board. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control board plug locations

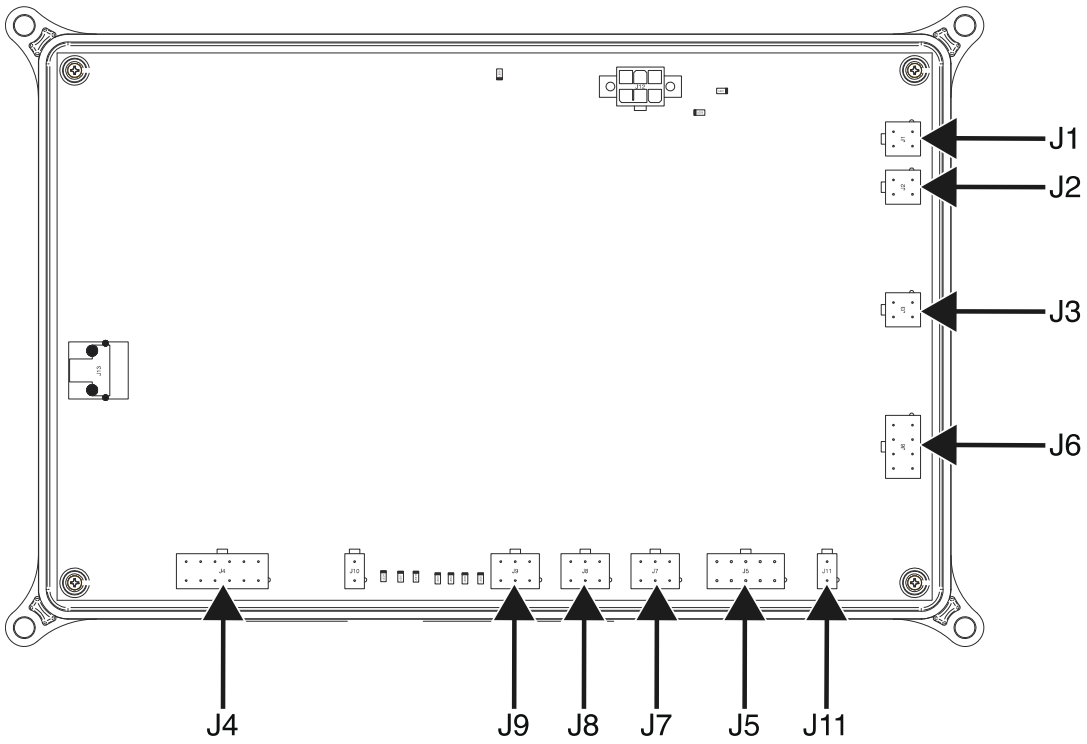
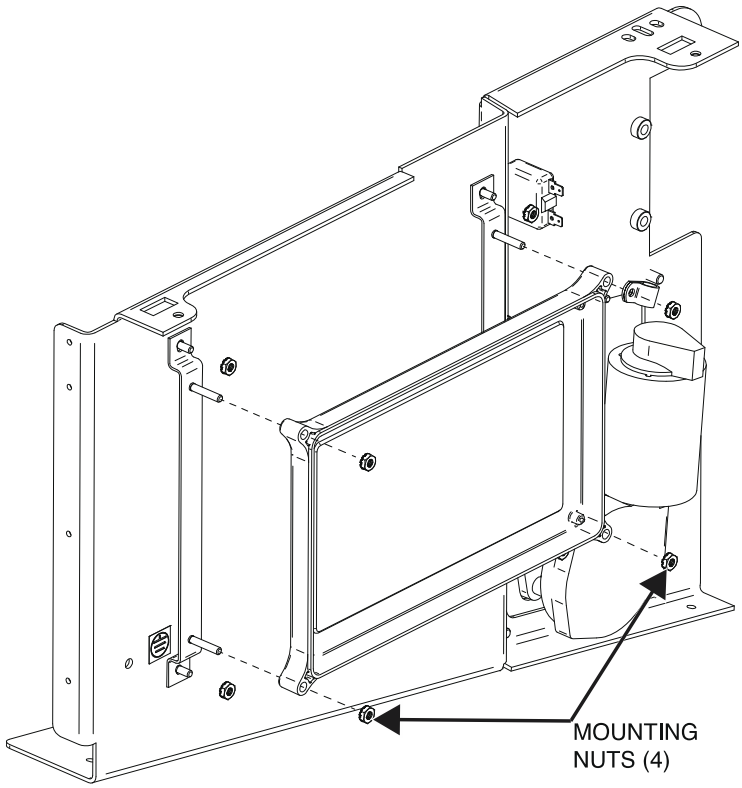


Figure F.2 – Control board mounting nut locations



OUTPUT CHOKE REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

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

MATERIALS NEEDED

9/16” Open-End Wrench

9/16” Nutdriver

5/16” Nutdriver

Penetrox Heat Sink Compound (Lincoln Part #T12837-1)

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 9/16” open-end wrench and a 9/16” nutdriver, remove the bolt, nut, lock washer and two flat washers securing leads B2 and 901B to the output choke terminal. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads B2 and 901B from the output choke terminal. See ***Figure F.1***. See Wiring Diagram.
6. Using a 9/16” open-end wrench and a 9/16” nutdriver, remove the bolt, nut, lock washer and two flat washers securing lead B5 to the output choke terminal. See ***Figure F.1***. See Wiring Diagram.
7. Label and disconnect lead B5 from the output choke terminal. See ***Figure F.1***. See Wiring Diagram.
8. Using a 5/16” nutdriver, remove the three mounting screws securing the output choke to the base of the machine. See ***Figure F.2***.
9. The output choke can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new output choke into the machine.
2. Using a 5/16” nutdriver, attach the three mounting screws securing the output choke to the base of the machine.
3. Using a 9/16” open-end wrench and a 9/16” nutdriver, attach the bolt, nut, lock washer and two flat washers securing lead B5 to the output choke terminal. See Wiring Diagram.
4. Apply a thin coating of Penetrox heat sink compound to the mating surfaces of the leads and output choke terminals.
5. Using a 9/16” open-end wrench and a 9/16” nutdriver, attach the bolt, nut, lock washer and two flat washers securing leads B2 and 901B to the output choke terminal.

6. Apply a thin coating of Penetrox heat sink compound to the mating surfaces of the leads and output choke terminals.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Output choke lead and terminal locations

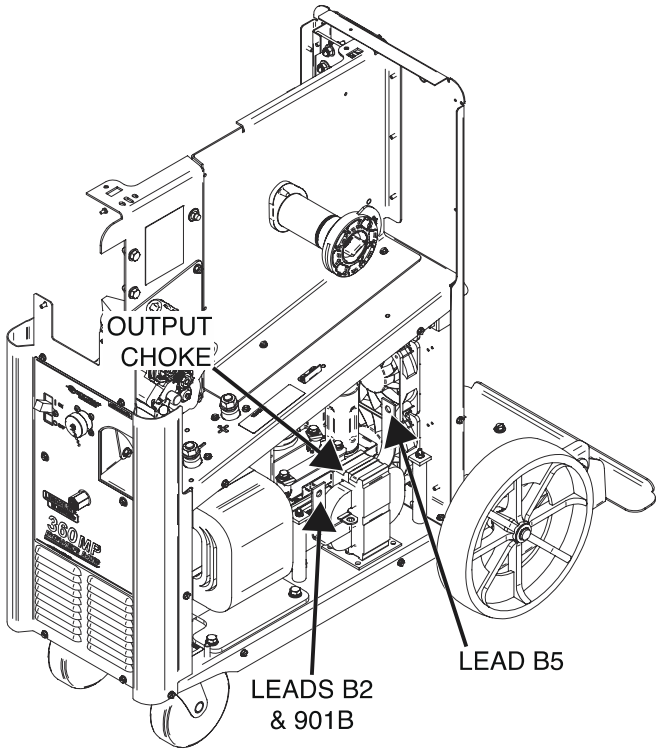
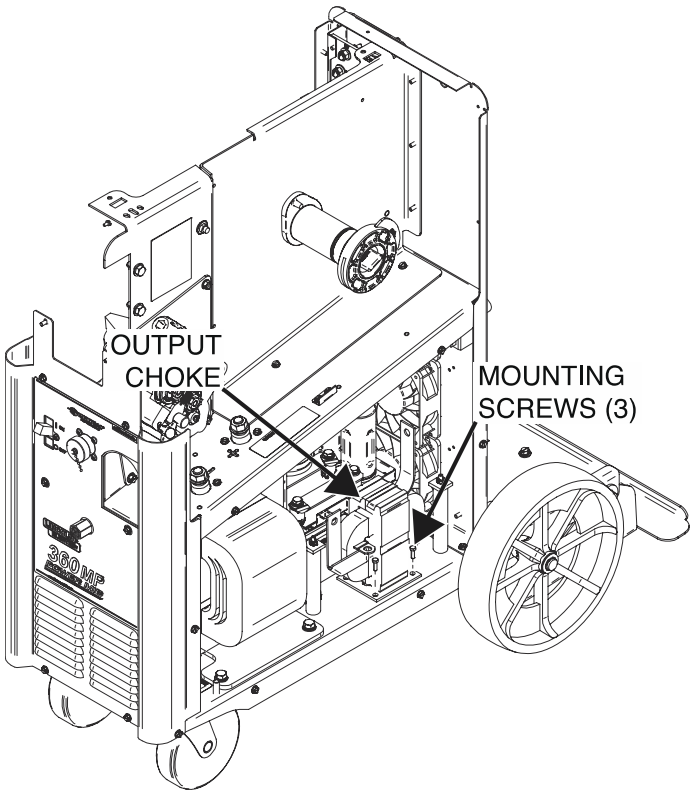


Figure F.2 – Output choke mounting screw locations



CURRENT TRANSDUCER (LEM) REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Current Transducer (LEM).

MATERIALS NEEDED

9/16” Nutdriver

11/32” Nutdriver

Wiring Diagram

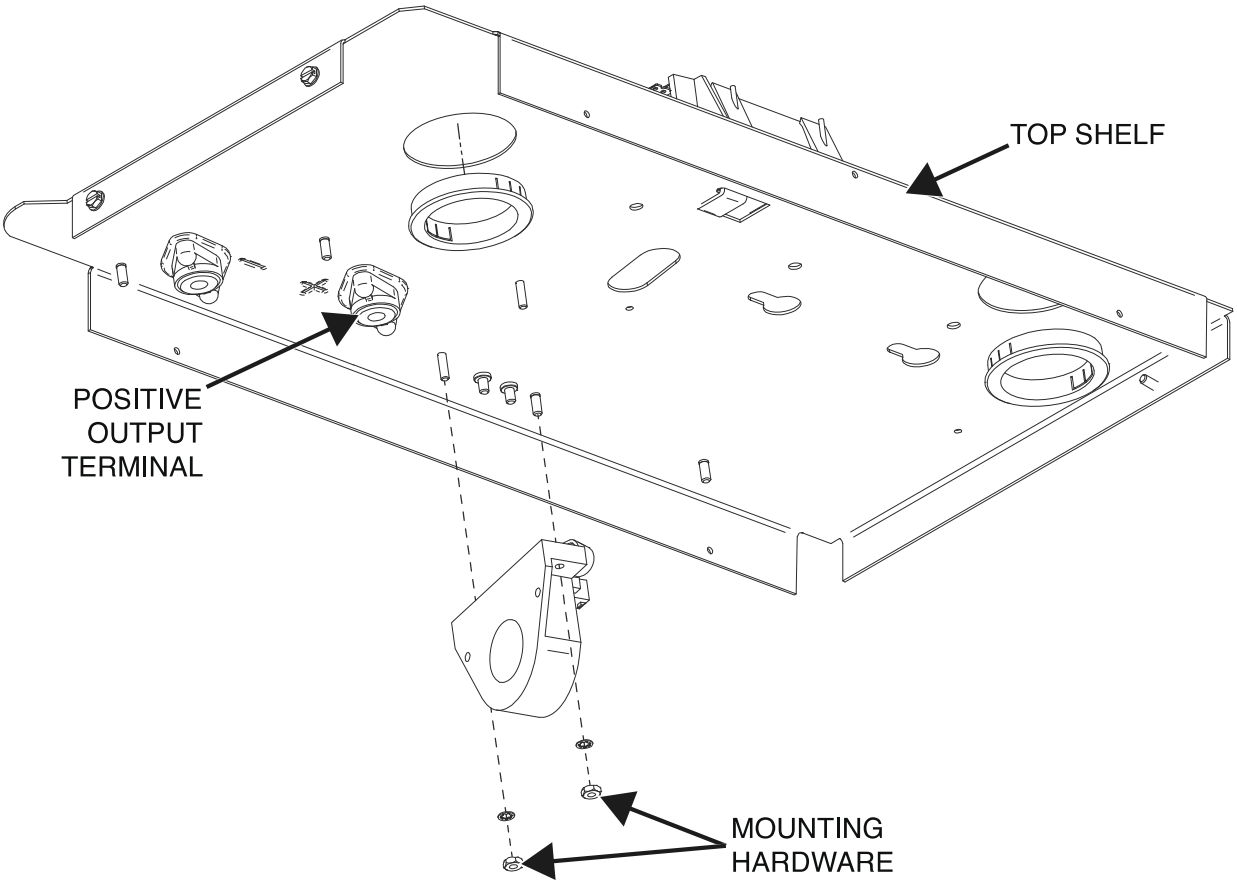
REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect the small Molex plug from the current transducer (LEM). See Wiring Diagram.
5. Using a 9/16” nutdriver, remove the bolt, lock washer and flat washer securing lead B2 to the bottom of the positive output terminal. See ***Figure F.1***. See Wiring Diagram. Route lead through the current transducer (LEM).
6. Using a 11/32” nutdriver, remove the two mounting nuts securing the current transducer (LEM) to the top shelf. See ***Figure F.1***.
7. The current transducer (LEM) can now be removed from its mounting posts and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new current transducer (LEM) onto it’s mounting posts.
2. Using a 11/32” nutdriver, attach the two mounting nuts securing the current transducer (LEM) to the top shelf.
3. Carefully route lead B2 through the current transducer (LEM). See Wiring Diagram.
4. Using a 9/16” nutdriver, attach the bolt, lock washer and flat washer securing lead B2 to the bottom of the positive output terminal. See Wiring Diagram.
5. Connect the small Molex plug to the current transducer (LEM). See Wiring Diagram.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Current transducer (LEM) mounting hardware location



USER INTERFACE BOARD REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the User Interface Board.

MATERIALS NEEDED

5/16” Nutdriver

2mm Allen Wrench

Phillips Screwdriver

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the user interface assembly to the case front. See ***Figure F.1***.
5. Remove the UI front panel cover. See ***Figure F.1***.
6. Using a 2mm Allen wrench, loosen the set screw securing each encoder knob to the UI assembly. See ***Figure F.1***.
7. Carefully maneuver the UI assembly to gain access to the rear mounting screws.
8. Label and disconnect plug X1 from the user interface board. See ***Figure F.2***. See Wiring Diagram.
9. Using a Phillips screwdriver, remove the six screws securing the user interface board and the ground lead to UI assembly. See ***Figure F.2***. See Wiring Diagram. Do not fully remove the user interface board until the ribbon cable is disconnected.
10. Carefully disconnect the ribbon cable from the rear of the user interface board. See Wiring Diagram.
11. The user interface board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully connect the ribbon cable to the rear of the user interface board. See Wiring Diagram.
2. Using a Phillips screwdriver, attach the six screws securing the user interface board and the ground lead to UI assembly. See Wiring Diagram.
3. Connect plug X1 to the user interface board. See Wiring Diagram.
4. Carefully position the UI assembly into the machine.
5. Using a 2mm Allen wrench, tighten the set screw securing each encoder knob to the UI assembly.
6. Attach the UI front panel cover.
7. Using a 5/16” nutdriver, attach the four screws securing the user interface assembly to the case front.

8. Perform the ***Case Cover Replacement Procedure***.
9. Perform the ***Retest After Repair Procedure***.

Figure F.1 – User interface component locations

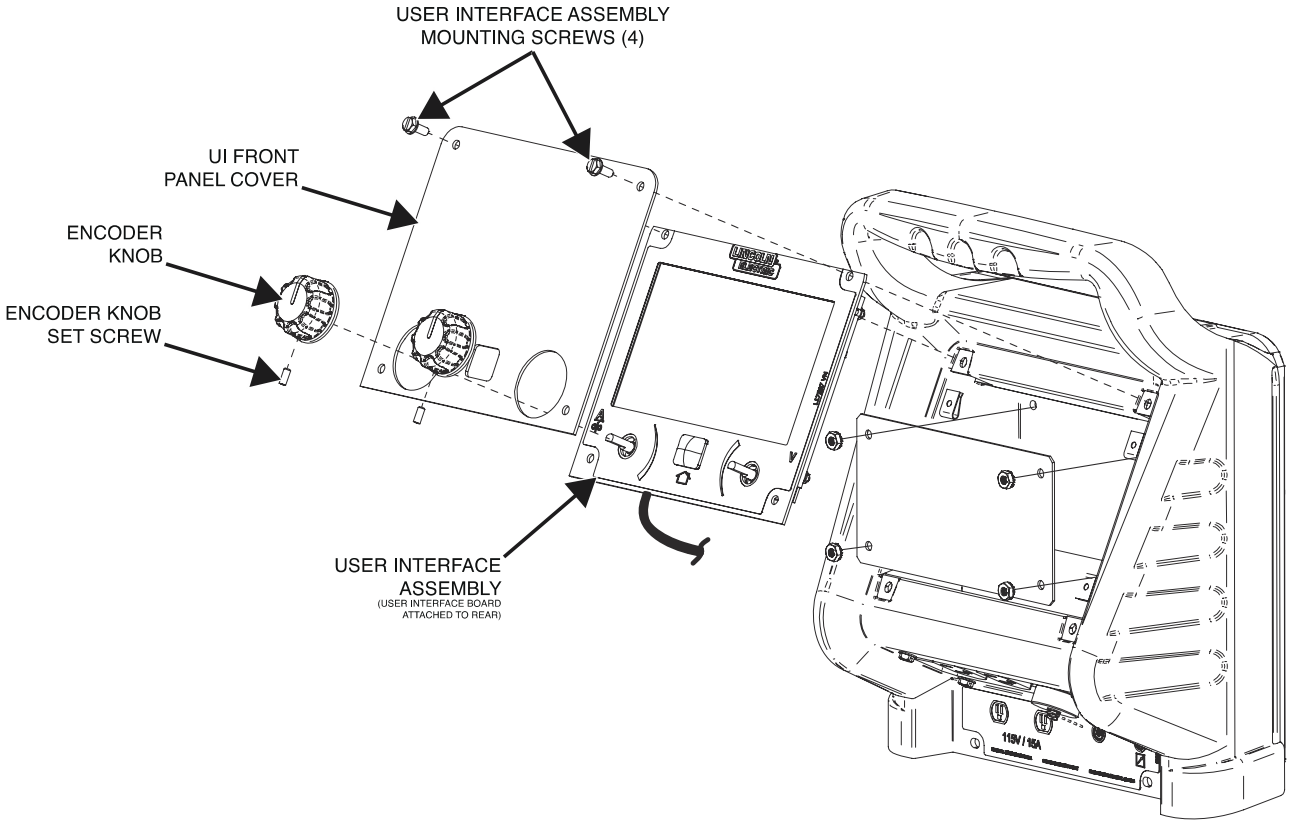
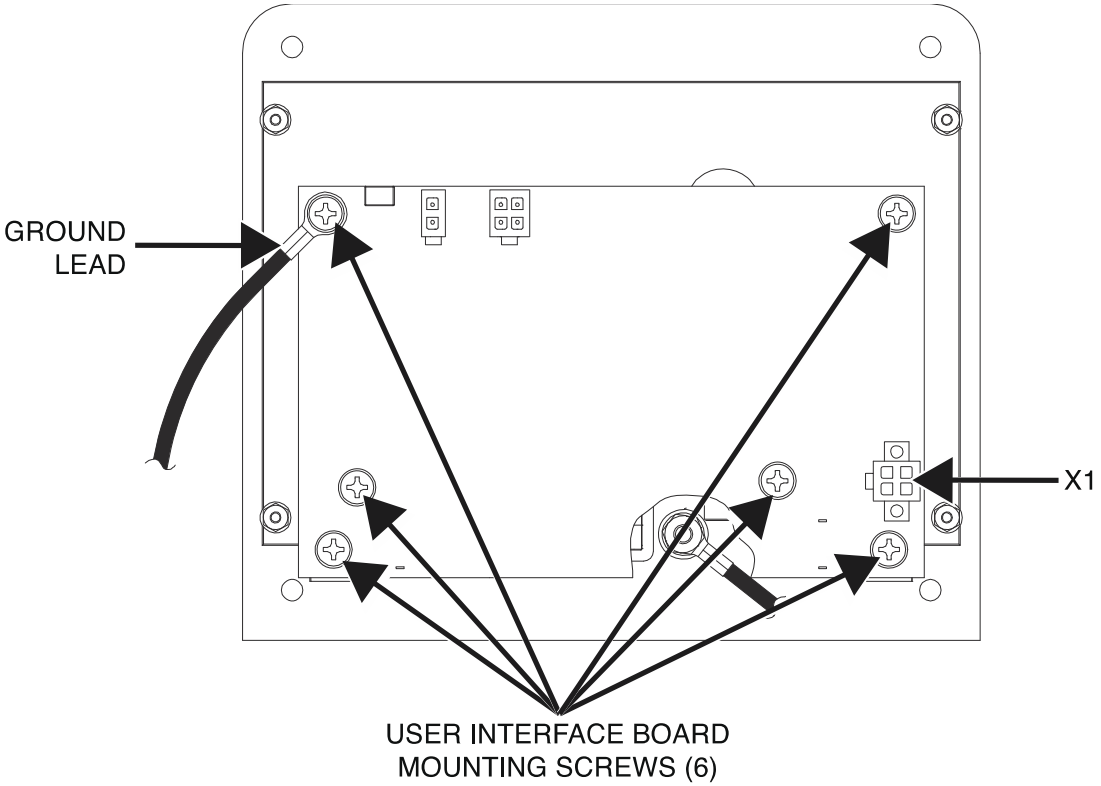


Figure F.2 – User interface board terminal X1 and mounting hardware locations



LINE SWITCH REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

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

MATERIALS NEEDED

3/8” Nutdriver

Phillips Screwdriver

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully disconnect the main input power supply to the machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four nuts and lock washers securing leads L1, L2, S1 and S2 to the mounting screw and terminal. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect the leads L1, L2, S1 and S2 from the line switch. See Wiring Diagram.
6. Using a Phillips screwdriver, remove the two screws securing the line switch to the front panel. See ***Figure F.2***.
7. The line switch can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new line switch into the front panel.
2. Using a Phillips screwdriver, attach the two screws securing the line switch to the front panel.
3. Using a 3/8” nutdriver, attach the four nuts and lock washers securing leads L1, L2, S1 and S2 to the mounting screws and terminals. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Line switch lead locations

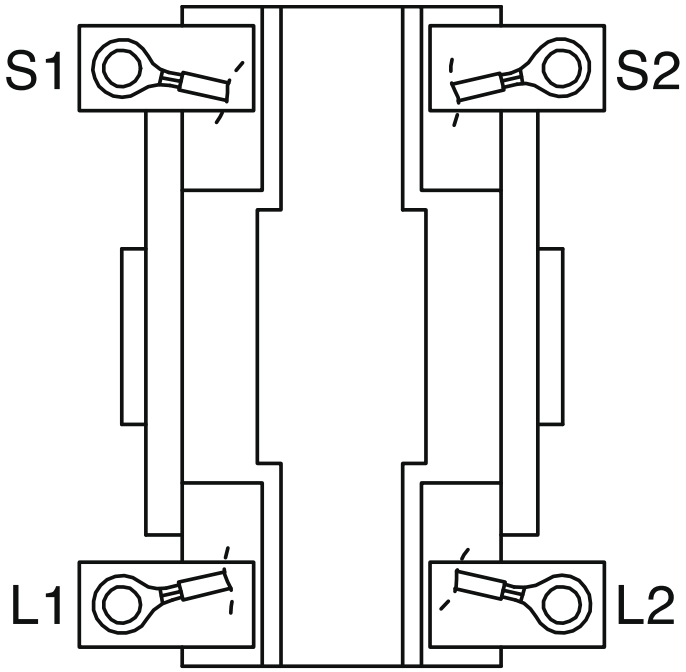
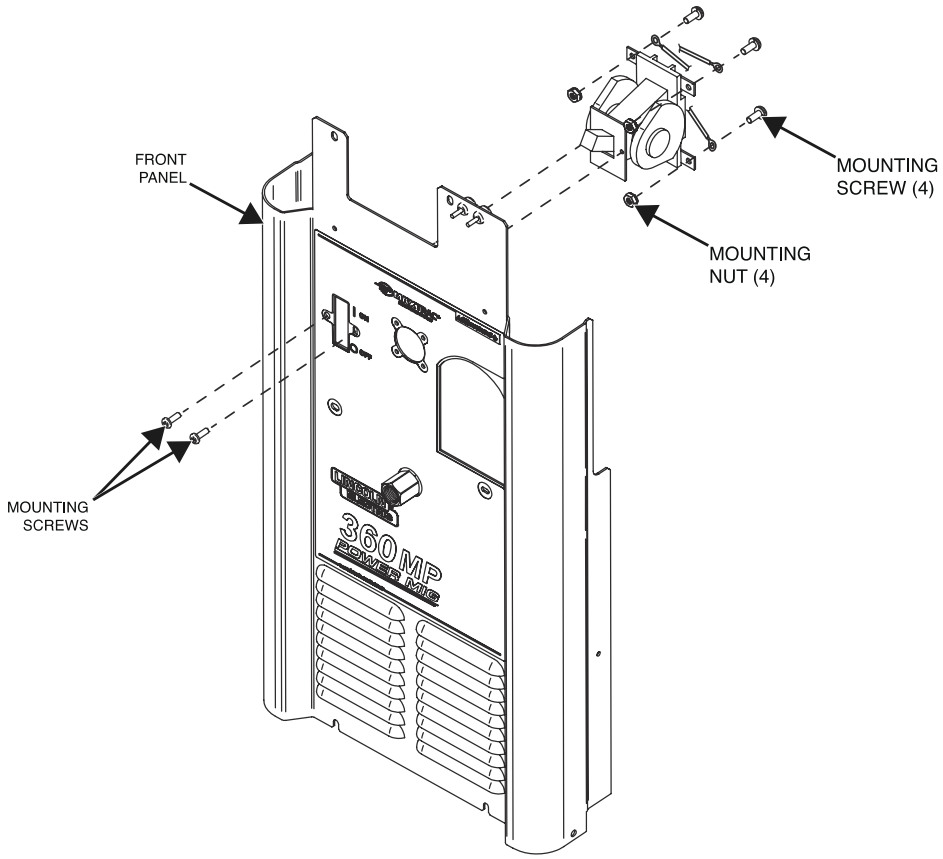


Figure F.2 – Line switch mounting hardware locations



RETEST AFTER REPAIR

Retest a machine:

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

OR

• If you repair or replace any electrical components.

INPUT - SINGLE PHASE ONLY

STANDARD VOLTAGE / PHASE / FREQUENCY	EFFECTIVE IMPUT AMPERES
208V / 230V / 460V / 575V / 1 / 50 / 60 HZ	55 / 50 / 25 /20 AMPS

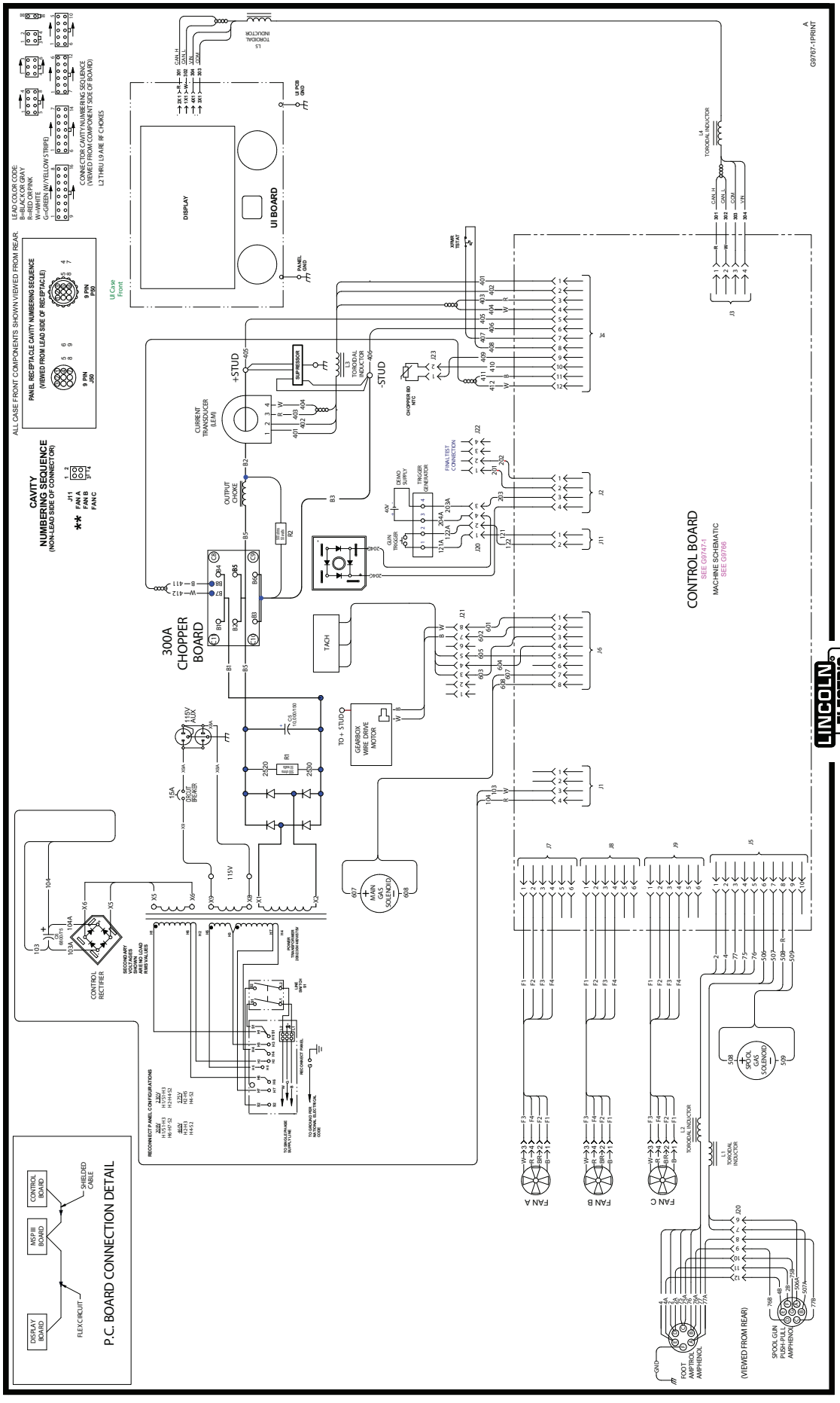
RATED OUTPUT

INPUT VOLTAGE / PHASE / FREQUENCY	GMAW			GTAW-DC			SMAW		
	40%	**60%**	**100%**	**40%**	**60%**	**100%**	**40%**	**60%**	**100%**
208 / 230 / 460 / 575 / 1 / 50 / 60 Hz	350 AMPS 31.5 VOLTS	320 AMPS 30 VOLTS	250 AMPS 26.5 VOLTS	360 AMPS 24.4 VOLTS	320 AMPS 22.8 VOLTS	250 AMPS 20 VOLTS	310 AMPS 32.4 VOLTS	300 AMPS 32 VOLTS	230 AMPS 29.2 VOLTS

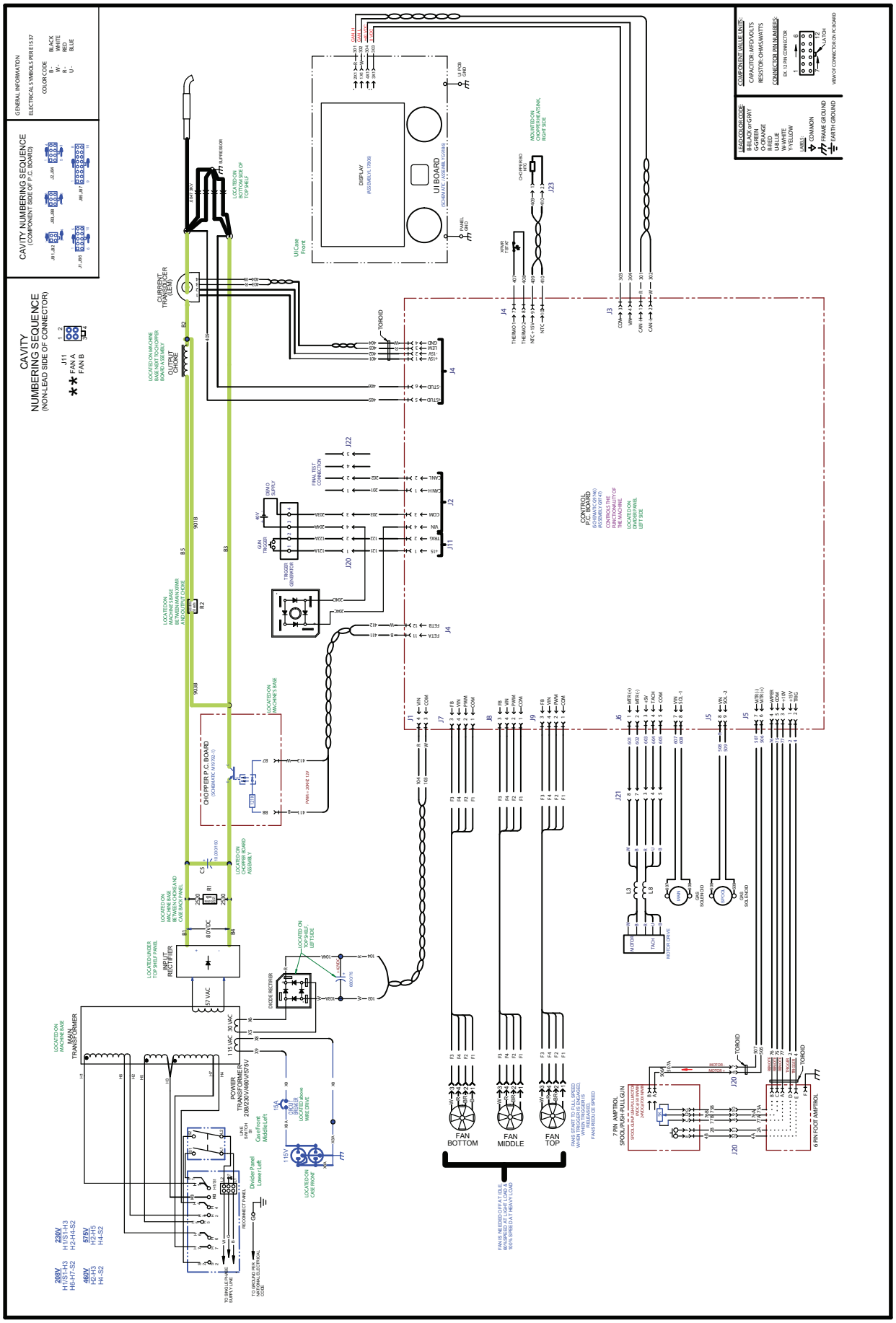
OUTPUT

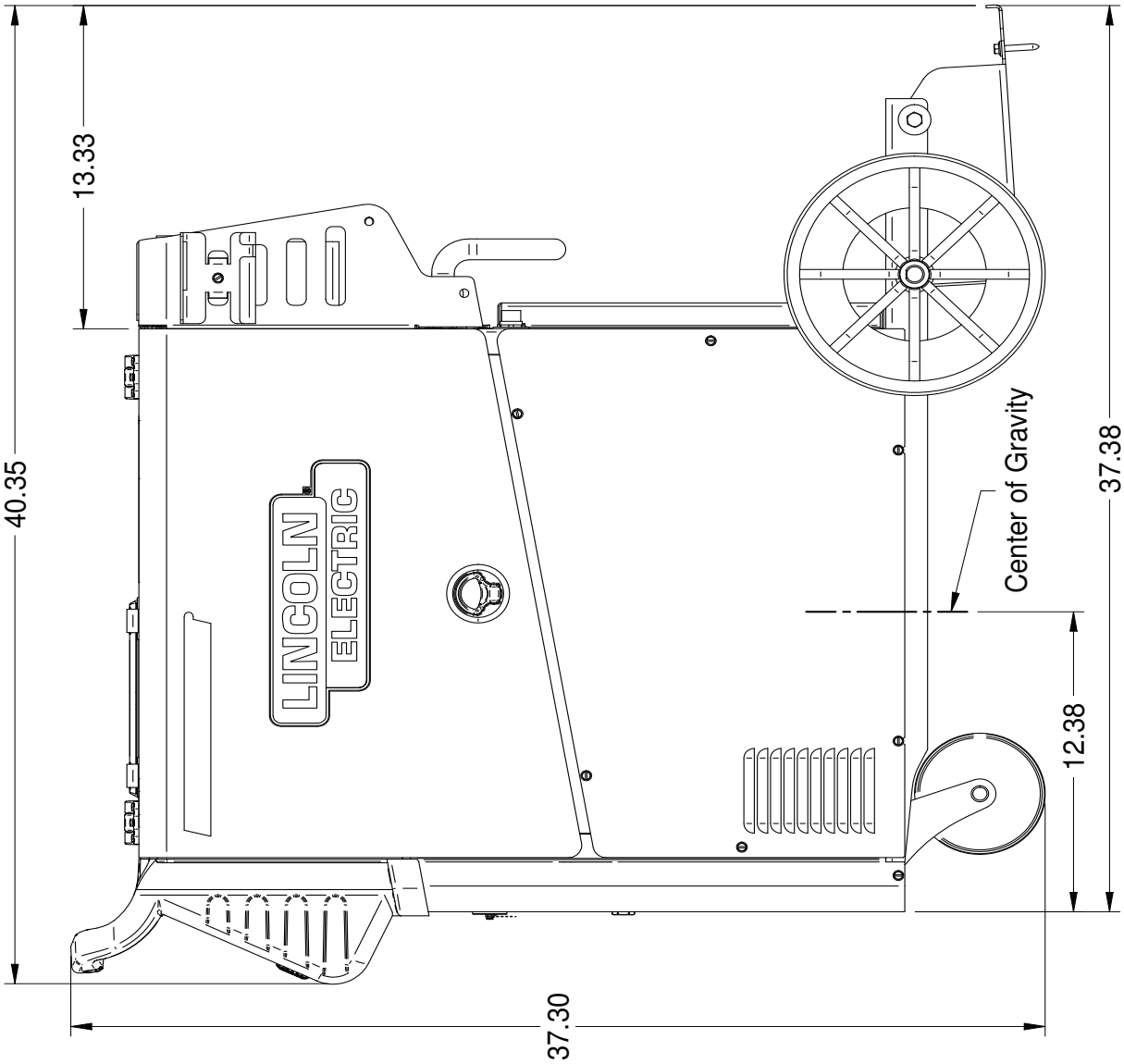
WELDING CURRENT RANGE (CONTINUOUS)	MAXIMUM OPEN CIRCUIT VOLTAGE	WELDING VOLTAGE RANGE
5 – 360 AMPS	70 VOLTS	10 – 45 VOLTS

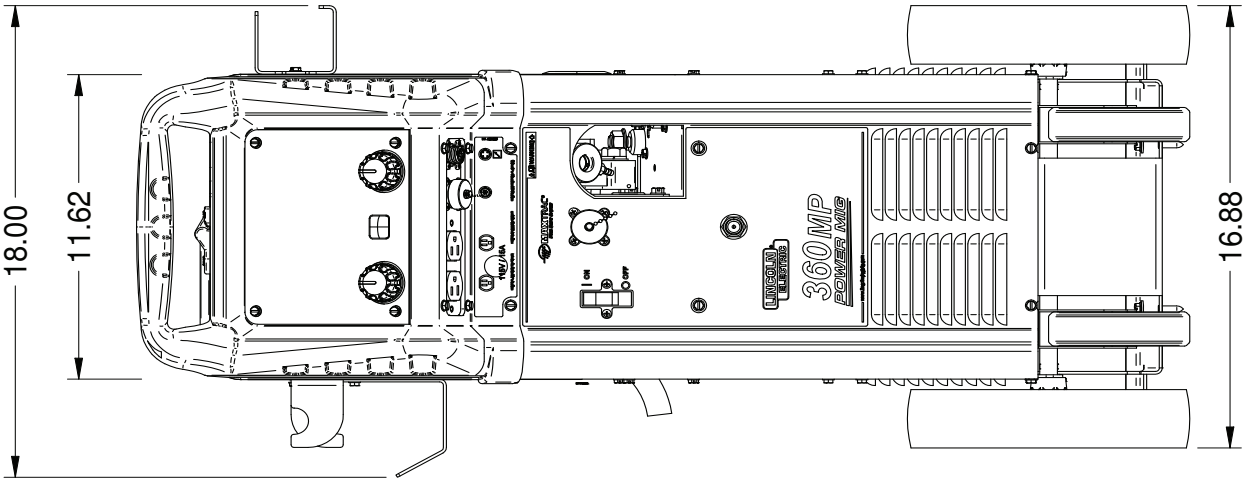
WIRING DIAGRAM POWER MIG 360MP CODE: 13324, 13450



SCHEMATIC POWER MIG 360MP CODE: 13324, 13450




13.33
40.35
37.38
Center of Gravity
12.38
37.30
LINCOLN ELECTRIC


18.00
11.62
16.88
LINCOLN ELECTRIC
360MP
POWER MIG

2 Step – When the gun trigger is pulled, the welding system cycles through the arc starting sequence and into the main welding parameters. The welding system will continue to weld as long as the gun trigger is activated. Once the trigger is released, the welding system cycles through the arc ending steps.

3 Phase voltage – Three AC voltage sources that are phase shifted 120° with respect to each other.

4 Step – The 4 step trigger adds to the welder's comfort when making long welds by allowing the trigger to be released after an initial trigger pull. When the gun trigger is pulled, the welding system cycles through the arc starting sequence and into the main welding parameters. Welding stops when the trigger is pulled a second time and then released and the welding system cycles through the arc ending steps.

A-lead – The single wire used to configure the machine reconnect for various input Voltages.

AC (Alternating Current) – Voltage or current that changes polarity or direction, respectively, over time.

Active Condition – The machine is energized either by connection to a power source or has some kind of mechanical motion within the unit.

Alternator – An electric generator that produces alternating current. The main function of this device is to change mechanical energy into electrical energy. The mechanical energy can be supplied by either a motor or engine.

Ampere (Amp) – The standard measurement unit of current flow. Symbol: A

Anode – The positively charged electrode of a device.

Arc Control (Pinch) – Adjusts how quickly the current will rise when the wire is shorted to the work resulting in a soft or crisp arc.

Arc Force – A temporary increase of the output current during SMAW welding when the arc is too short.

Arc Length – The physical gap between the end of the electrode and the weld puddle.

Across the Arc – The device is electrically connected to the welding terminals. This device is powered by the same voltage that is used for welding.

Arc-link cable – Used between the power source and wire feeder in a bench system and between the power source, control box and wire drive in a boom system. This 5 pin cable supplies voltage from the power source to power the feeder and also transmits digital signals between the two.

Armature – The part of an electric device that includes the main current-carrying winding and in which the electromotive force is induced.

Armature Reaction – A force set up by the current induced in the armature of a generator that results in altering as to both magnitude and direction the flux due to the field magnet.

Asynchronous Welder Generator – An alternator that utilizes an air-gap rotating magnetic-field between a stator and a rotor to interact with an induced current in a rotor winding. It is sometimes called an induction generator.

Auxiliary Windings – Stator winding used to power the auxiliary connections.

Battery – A combination of two or more cells electrically connected to work together to produce electric energy.

Block Diagram – visual representation of a machine that utilizes simplified blocks to represent the principal parts or functions of the machine.

Boost Converter – The boost converter increases applied voltage to a higher level. This circuitry only applies to DC voltage and is only active if the applied voltage is below a predetermined value.

Bridge Rectifier – A type of full wave rectifier which uses four or more diodes in a bridge circuit configuration to efficiently convert the Alternating Current (AC) into Direct Current (DC).

Brushes – An electrical contact which conducts current between stationary wires and moving parts, most commonly in a rotating shaft.

Buck Converter – The buck converter decreases applied voltage to a lower level. This circuitry only applies to DC voltage and is only active if the applied voltage is above a predetermined value.

Buck/Boost Converter – The combined buck/boost circuitry is utilized to increase or decrease an applied voltage to a predetermined value.

CAN communication – Controller Area Network (CAN bus) is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computer. It broadcasts messages to the nodes presented in a network.

Cathode – The negatively charged electrode of a device.

Capacitance – The ability of a body to store an electrical charge.

Capacitor – A device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator. Capacitance is measured in Farad's (F) and some capacitors are polarity sensitive which is typically noted on the device as such.

Circuit Breaker – A device to prevent excessive current flow in a circuit that may be caused by a short circuit or heavy loads. The circuit breaker will stop the flow of current (open) if such a situation occurs.

Collector – The positively charged electrode of a transistor device.

Commutator – A cylindrical ring or disk assembly of conducting members, individually insulated in a supporting structure with an exposed surface for contact with current-collecting brushes and mounted on the armature shaft, for changing the frequency or direction of the current in the armature windings.

Conductor – A type of material that allows the flow of charge (**electrical** current) in one or more directions

Connectors – Various devices for connecting one object to another.

Constant Current – A process where the power source keeps the current as constant as possible even when the operator varies the arc length. The voltage varies, formerly known as "variable voltage". Mainly used for Stick and TIG welding.

Constant Voltage – A process where the power source keeps the voltage as constant as possible and allows amperage to vary considerably. Mainly used for MIG and Flux core welding using wire feeders.

Contactor – A mechanically or electrically operated switch used in high current applications.

Control cable – A multistrand cable used for transmission of power, command and feedback information.

Crosslinc – A welding system communication technology. When using a Crosslinc enabled power source and wire feeder, welding voltage can be controlled remotely, through the welding cable without the use of an additional control cable.

Current – The flow of electrons through a conductor.

Current Transducer – A device used to detect DC current flow.

Cycle – One complete wave of alternating current or voltage.

DC (Direct Current) – A voltage or current that never crosses zero and maintains current flow in one direction.

Diode – A device used in a circuit that allows current to flow in one direction only. Typically current flow will occur if the diode's anode is more positive than its cathode. Typical configurations used can be: blocking, flashing, free-wheeling, full wave bridge rectifier, half wave rectifier.

Display – An electronic device with a screen used for displaying information.

Duty Cycle – The percentage of a ten (10) minute period that a power source can operate its rated load before exceeding its thermal limit.

Efficiency – The ratio of the output power divided by the input power.

Electrical Interference (noise) – Unwanted noise or other effects from electromagnetic radiation.

Electricity – The flow of electrons through a conductor from the source to a ground.

Electrode Negative – When the electrode is connected to the negative output terminal.

Electrode Positive – When the electrode is connected to the positive output terminal.

Electromagnetism – Magnetism developed by a current of electricity.

Emitter – The negatively charged electrode of a transistor device.

Encoder – An electro-mechanical device that converts the angular position or motion of a shaft or axle to digital output signals.

Excitation – The process of generating a magnetic field by means of an electric current. The source of this can be from a magnet or an external voltage source.

Excitation Windings – Stator winding that powers the excitation process in an alternator or generator.

Farads – The standard measurement unit of capacitance. Symbol: f

Feedback – To provide actual output information to a control circuit so as to maintain a constant output.

Feeder Winding – Stator winding that powers the wire feeders.

Field Windings – The stationary windings of a generator.

Field Current – The current flow through the Field Windings

Light Emitting Diode (LED) – A semiconductor device that emits light when an electric current passes through it.

Flashing – A generic term referring to the initial excitation of an electrical magnetic field.

Forward Biased – When voltage is applied to a semiconductor device in the direction that allows current to flow.

Frequency – The number of occurrences of a repeating event (cycles) per unit of Time.

Full Wave – A rectifier that converts alternating current into continuous current and that utilizes both halves of each cycle of the alternating current.

Fuse – An electrical safety device that operates to provide overcurrent protection of an electrical circuit. Its essential component is a metal wire or strip that melts when too much current flows through it, thereby interrupting current flow.

Gate – Is the control terminal in a semiconductor device. Typically a small voltage is applied to the Gate to trigger or latch the device.

Generator – An electric generator that produces direct current. The main function of this device is to change mechanical energy into electrical energy. The mechanical energy can be supplied by either a motor or engine.

GFCI (Ground Fault Circuit Interrupter) – A device which interrupts current flow when it senses an imbalance between the outgoing and incoming current.

Ground Connection – A safety connection from a welding machine frame to an earth ground.

Half Wave - A rectifier that utilizes one half cycle of alternating current and suppresses the other.

Henry – The standard measurement unit of inductance. Symbol: H

Hertz – The standard measurement unit of electrical frequency. Symbol: Hz

High Frequency – A high frequency used for arc ignition and stabilization when TIG welding.

Hot Start – Increases the output amperage for a designated amount of time at the start of a weld.

Insulated Gate Bipolar Transistor (IGBT) – A high speed solid state switching device that can be turned on by applying a voltage signal to the gate. When the gate signal is removed the IGBT will turn off. An IGBT will operate on DC voltage only.

Inductance – The tendency of an electrical conductor to oppose a change in the electric current flowing through it.

Inductor – A passive component which stores the electrical energy in a magnetic field when the electric current passes through it.

Interpole Coils – Utilized in generators. They counteract the effects of armature reaction.

Inverter – circuitry that changes direct current (DC) to alternating current (AC).

Life Cycle – The length of time a product is introduced to consumers until it's removal from the shelves.

Motor – An electrical device that converts electrical energy into mechanical energy.

Magnetic Field – The area around a magnet or coil in which there is magnetic force.

Magnetic Flux – The measurement of the total magnetic field lines that pass throug a given surface area.

Magnetism – The force that arises from the motion of electric charges.

MOLEX – Is the vernacular term for a two-piece pin and socket interconnection that was pioneered by Molex Connector Company.

Negative Temperature Co-efficient (NTC) – A type of thermistor in which the resistance decreases in relation to a rise in temperature.

OCV (Open Circuit Voltage) –The potential voltage in the welding circuit before the arc is initiated or a load applied; measured in volts.

Ohms – The standard measurement unit of electrical resistance. Symbol: Ω

Ohm's Law – current passing through a conductor is proportional to the voltage over the resistance. I = V / R.

Parallel Circuit – a circuit that has multiple current paths.

Peak Value – The maximum value attained by the current during one cycle. There is a positive and negative peak.

Peak to Peak Value – The maximum value attained by both peaks during one cycle.

Phase – A relative variation or change of state or a cycle.

Phaseback (foldback) – A current limiting feature (a type of overload protection).

Pilot Arc – The electrical pathway between the torch nozzle and electrode tip. This function aids in the transfer of current from the electrode tip to the work piece.

Polarity – The polarity of the electrode as compared to the polarity of the work piece.

Positive Temperature Co-efficient (PTC) – A type of thermistor in which the resistance increases in relation to a rise in temperature.

Potentiometer – It is a variable resistor with three terminals. The middle terminal is adjustable. The potential at the third terminal can be adjusted to give any fraction of the potential voltage across the two outer terminals.

Power – The rate, over time, in which electrical energy is transferred within an electrical circuit.

Power Factor – The ratio of the real power that is used to do work to the apparent power that is supplied to the circuit.

Printed Circuit Boards – A physical device that houses one or more electrical circuits.

Pulsating DC – A periodic current which changes in value but never changes direction.

Rated Load – The average amperage and voltage the power source is designed to produce for a given specific duty cycle time period. For example, 400 amps, 36 load volts, at 60 percent duty cycle.

RCBO (Residual Current Breaker with Over-current) – A combination of a RCD and Circuit Breaker.

RCD (Residual Current Device) – Detects imbalance in the currents of the supply and return conductors of a circuit. Does not protect against shorts.

Reactor – An electrical magnetic component used to maintain current at constant levels by resisting any changes in the current.

Reconnect Panel – Used to configure the machine's internal components for various input power voltages

Rectification – The process of converting alternating current to direct current.

Relay – An electrically operated switch used in low current applications.

Resistance – The opposition to the passage of an electric current through a conductor. Measured in Ohms (Ω) and is not polarity sensitive.

Resistor – Used to regulate voltage and current levels in a circuit.

Reverse Biased – When voltage is applied to a semiconductor device in the direction that does not allows current to flow.

Rheostat – A two terminal adjustable resistor that may have its resistance value changed without opening the circuit in which it is connected, thereby controlling the current through the circuit.

Ripple – The residual periodic variation of the DC voltage within a power supply which has been derived from an alternating current source.

RMS (Root Means Squared) – The same amount of heat dissipation across a resistor as Direct Current.

Rotor – A rotating component of an electromagnetic system in an electric motor, or alternator.

RPM (Revolutions per minute) – A unit of rotational speed or the frequency of rotation around a fixed axis.

Saturation – The state reached when an increase in applied external magnetic field cannot increase the magnetization of the material further.

Saw Tooth Wave Form – A non-sinusoidal waveform. It is so named based on its resemblance to the teeth of a plain-toothed saw.

Schematic Diagram – A representation of the electronic components of a machine utilizing graphic symbols rather than realistic pictures.

Schematic Symbols – A standardized pictogram used to represent various electrical and electronic devices or function.

Series Circuit – a circuit that has only one current path.

Series - Parallel Circuit – a circuit that has both a single current path and multiple current paths.

Silicon Controlled Rectifier (SCR) – Very similar to a Diode in which it allows current to flow when the anode is more positive than the cathode. However, current flow will occur only if a small signal is applied to its Gate and will stop flowing when the voltage drops to zero or goes negative.

Shunt – A type of low value resistance used to detect circuit current.

Sinusoidal Wave Form – A curve that describes a smooth repetitive oscillation of a waveform.

Slip Rings – An electromechanical device that allows the transmission of electrical power from a stationary to a rotating structure. Normally a copper or brass circular device attached to a rotating member.

Solenoid – An electromechanical device that when energized acts like a magnet so that a movable core is drawn into the coil when a current flows and that is used especially as a switch or control for a mechanical device (such as a valve).

Source – Provides the electrical potential that is required for electricity to flow.

Spark Gap Generator – Used to initiate and maintain the arc in a TIG machine.

Square Wave Form – A type of waveform where the signal has only two levels. The signal transitions between these levels at regular intervals and the switching time is very rapid.

Standard Units of Measurement – Is a quantifiable language that helps everyone understand the association of the object with the measurement.

Static Condition – The machine is not connection to a power source and has no mechanical motion.

Stator – The stationary part of a rotary system, found in electric alternators, generators and electric motors.

Switch – A mechanical device used to interrupt the flow of current in a circuit. Switches are essentially binary devices: they are either completely on (closed) or completely off (open).

Tachometer – A device or circuit used to measure the rotations of a mechanical device.

Thermistor – A type of resistor in which resistance changes due to temperature, two main types: Positive Temperature Co-efficient (PTC), Negative Temperature Co-efficient (NTC).

Thermostat – A mechanical device that interrupts or closes a circuit when a pre-determined temperature limit is reached.

Toroid – A device used to filter unwanted electrical noise.

Trigger Interlock – The gun trigger will stay closed (activated) as long as welding current is flowing and will open (deactivate) when welding current stops.

Transformer – A device with a group of mutually-inductive coils used to magnetically induce AC power from one coil to the other. Typical examples are as follows:

> ***Isolation Transformer*** – A transformer usually used for circuit protection.
>
> ***Step Down Transformer*** – A transformer where the secondary voltage is lower than the primary voltage.
>
> ***Step Up Transformer*** – A transformer where the secondary voltage is higher than the primary voltage.
>
> ***Current Transformer*** – A type of transformer used as a current monitoring device.
>
> ***Power Transformer*** – A transformer that contains multiple primary windings to accommodate a variety of input voltages.

Twisted Pair – A cable consisting of two wires of a single circuit twisted around each other for the purposes of improving electromagnetic compatibility.

Voltage – The pressure or difference in electrical potential between two points in a circuit that causes current to flow.

Volts – The standard unit of measurement for Voltage. Symbol: V

User Interface – A device where interactions between operators and machines occur.

Watts – The standard measurement unit of electrical power. Symbol: W

Watts Law – power of an electrical circuit is the product of its voltage and current. P = I x V.

Weld Winding – Stator winding that provides the power for the welding components.

Welding Electrode – A consumable component of the welding circuit through which current is conducted between the electrode holder and the arc that becomes part of the weldment.

Welding Gun – In semi-automatic or automatic welding, a device to transfer current and guide the electrode wire into the arc puddle.

Wire Harness – A system of insulated conducting wires bound together with insulating materials.

Wiring Diagram – a simple visual representation of the physical connections and physical layout of the electrical system of the machine.

WFS (Wire Feed Speed) – The speed at which the consumable wire is fed into the weld joint puddle.

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WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。	● 燃えやすいものの側での溶接作業は絶対にしてはなりません。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或濕衣物切勿接觸帶電部件及銲條。 ● 使你自己與地面和工件絕緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● パネルやカバーを取り外したままで機械操作をしないで下さい。	Japanese **注意事項**
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	●維修前切斷電源。	●儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه.	Arabic **تحذير**

LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的説明以及應該使用的銀焊材料，並請遵守貴方的有関勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

CUSTOMER ASSISTANCE POLICY

The business of Lincoln Electric is manufacturing and selling high quality welding equipment, automated welding systems, consumables, and cutting equipment. Our challenge is to meet the needs of our customers, who are experts in their fields, and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or technical information about their use of our products. Our employees respond to inquiries to the best of their ability based on information and specifications provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment, or to provide engineering advice in relation to a specific situation or application. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or communications. Moreover, the provision of such information or technical information does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or technical information, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose or any other equivalent or similar warranty is specifically disclaimed.

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WELD FUME CONTROL EQUIPMENT

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.

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