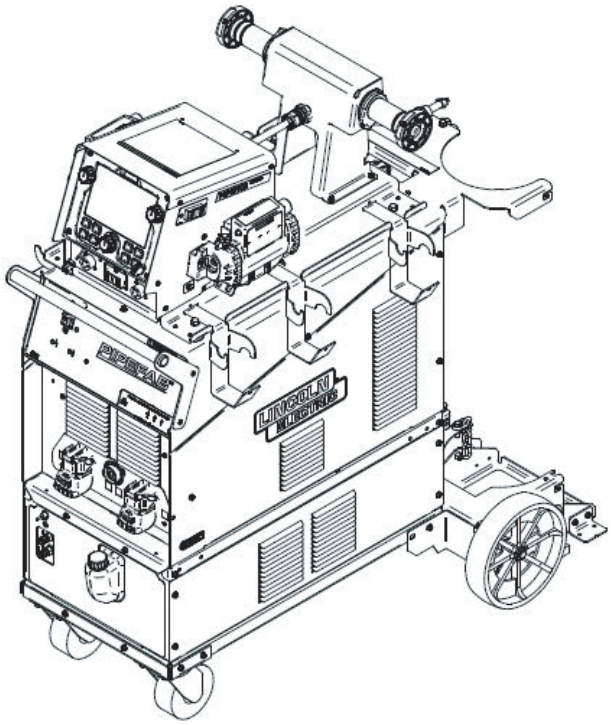
LINCOLN ELECTRIC

Service Manual

PIPEFAB™ WELDING SYSTEM



For use with machines having Code Numbers:

POWER SOURCE: 12858, 13010

FEEDER: 12929

REMOTE UI: 12938

GENUINE LINCOLN PARTS™

Register your machine:
www.lincolnelectric.com/registration

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

* EAC

SVM10549-A | Issue Date Oct - 22

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.

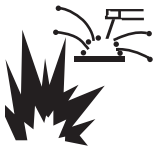
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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.

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d.Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur

ELECTROMAGNETIC COMPATIBILITY (EMC)

CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2004/108/EC. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

INTRODUCTION

All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc.

Warning: This Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electro-magnetic compatibility in those locations, due to conducted as well as radiated disturbances.

INSTALLATION AND USE

The user is responsible for installing and using the welding equipment according to the manufacturer's instructions.

If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons. Follow your local and national standards for installation and use. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

ASSESSMENT OF AREA

Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;

b) radio and television transmitters and receivers;

c) computer and other control equipment;

d) safety critical equipment, e.g., guarding of industrial equipment;

e) the health of the people around, e.g., the use of pacemakers and hearing aids;

f) equipment used for calibration or measurement;

g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;

h) the time of day that welding or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

METHODS OF REDUCING EMISSIONS

Public Supply System

Welding equipment should be connected to the public supply system according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the system. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

Maintenance of the Welding Equipment

The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential Bonding

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, e.g., ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications.

ECO design information

The equipment has been designed in order to be compliant with the Directive 2009/125/EC and the Regulation 2019/1784/EU.

Efficiency and idle power consumption:

Name	Efficiency when max power consumption / Idle power consumption	Equivalent model
Pipefab CE	85% / 30.3W	No equivalent model

Idle state, follow instructions to test idle mode:

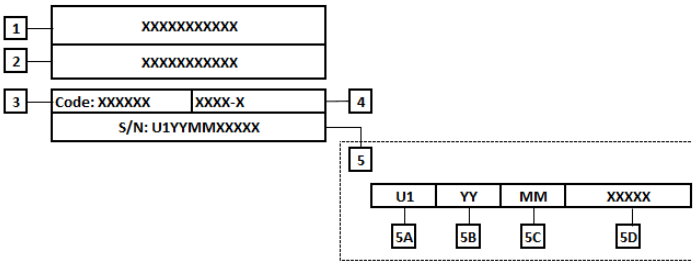
1. Connect an Ethernet cable from the port on the machine to a laptop and start up the machine.
2. Open the Power Wave Manager and configure the connection to the machine that is plugged in through the Ethernet.
3. Check the box for the 'System Hibernation Timer' to allow the machine to enter hibernation mode. Set the Hibernation Timer to 15 minutes (the lowest it can go). Wait 15 minutes and once the fans stop spinning the machine is in Hibernate Mode (Idle State).
4. The machine needs to be turned off and back on to come out of the hibernation mode

Efficiency:

The Efficiency procedure itself requires the use of a grid. Power Wave Manager can be downloaded from powerwavesoftware.com along with the Power Wave Manager instruction. The Power Wave Manager instructions explain how to test a machine using a resistive load. This is described in section 6 under calibration.

The value of efficiency and consumption in idle state have been measured by method and conditions defined in the product standard EN 60974-1

Manufacturer's name, product name, code number, product number, serial number and date of production can be read from rating plate and serial number label.



Where:

1- Manufacturer name and adress
2- Product name
3- Code number
4- Product number
5- Serial number
5A- country of production
5B- year of production
5C- month of production
5D- progressive number different for each machine

Typical gas usage for **MIG/MAG** equipment:

Material type	Wire diameter [mm]	DC electrode positive		Wire Feeding [m/min]	Shielding Gas	Gas flow [l/min]
		Current [A]	Voltage [V]			
Carbon, low alloy steel	0,9 - 1,1	95 - 200	18 - 22	3,5 – 6,5	Ar 75%, CO_2 25%	12
Aluminum	0,8 - 1,6	90 - 240	18 - 26	5,5 – 9,5	Argon	14 - 19
Austenitic stainless steel	0,8 - 1,6	85 - 300	21 - 28	3 - 7	Ar 98%, O_2 2% / He 90%, Ar 7,5% CO_2 2,5%	14 - 16
Copper alloy	0,9 - 1,6	175 - 385	23 - 26	6 - 11	Argon	12 - 16
Magnesium	1,6 - 2,4	70 - 335	16 - 26	4 - 15	Argon	24 - 28

Tig Process:

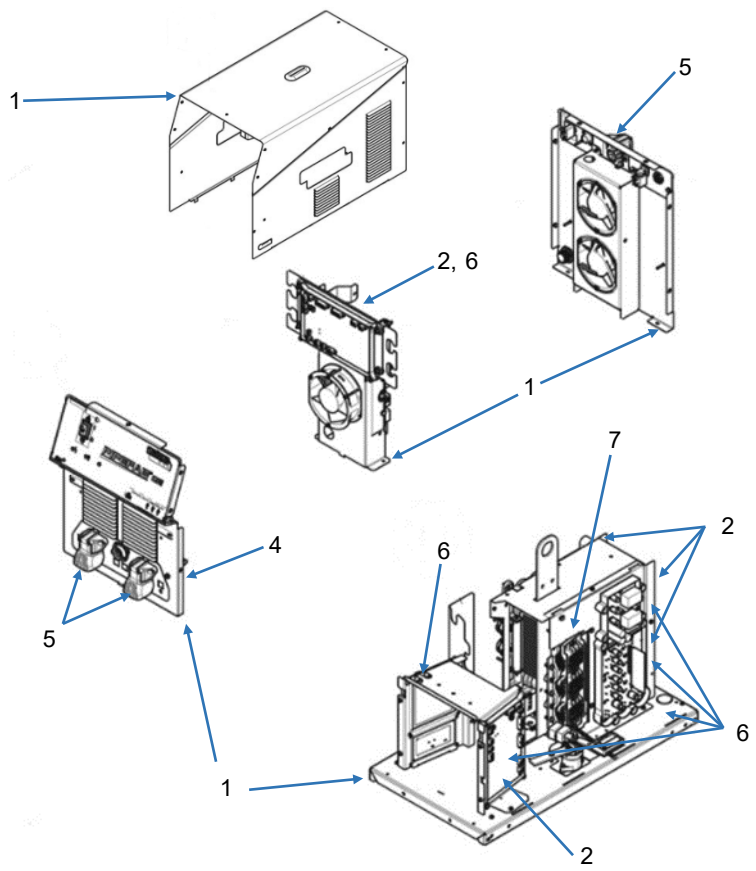
In TIG welding process, gas usage depends on cross-sectional area of the nozzle. For comonly used torches:
Helium: 14-24 l/min
Argon: 7-16 l/min
Notice: Excessive flow rates causes turbulence in the gas stream which may aspirate atmospheric contaminantion into the welding pool.

Notice: A cross wind or draft moving can disrupt the shielding gas coverage, in the interest of saving of protective gas use screen to block air flow.

End of life

At end of life of product, it has to be disposal for recycling in accordance with Directive 2012/19/EU (WEEE), information about the dismantling of product and Critical Raw Material (CRM) present in the product, can be found at: www.lincolnelectriceurope.com

Pipefab CE



Item	Component	Material for recovery	CRM	Selective treatment
1	Enclosure	Steel	-	-
2	Heat sink	Aluminum	Si, 52 g Mg, 87 g	-
3	External cables – not shown	Copper	-	Required
4	Transformer coil	Aluminum	-	-
5	Output terminal	Brass	-	-
6	PC board, 8 total	-	-	Required
7	Choke Internal cables, not shown	Copper	-	-

Reference: P-1484-A, code 13010

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Content/details may be changed or updated without notice. For most current Instruction Manuals, go to parts.lincolnelectric.com.

PRODUCT DESCRIPTION

The PipeFab™ welding system consists of a portable advanced-process power source and feeder designed from the ground up to be the ideal system for welding steel, stainless, and nickel pipe. The PipeFab™ is ideal for applications where critical root, fill, and cap welds are needed to be performed at the highest level of quality. The new state of the art PipeFab™ Feeder features a robust 7" LCD display which offers a bright and easy to use interface to control all processes. With GMAW, GMAW-STT, GMAW-P, FCAW, GTAW (DC) and SMAW functionality, the dedicated process buttons and individual process memories make switching from one process to another simple and intuitive.

Superior arc performance, simplicity, and flexibility are at the core of the PipeFab™. Being an advanced software controlled system, the PipeFab™ is readily user updateable with free software from www.powerwavesoftware.com allowing it to take advantage of the latest and greatest innovations from Lincoln Electric's welding technologies.

PRODUCT LISTING

K NUMBER	PRODUCT NAME
K3731-1	PIPEFAB™ CSA
K3732-1	PIPEFAB™ CE
K3734-1	PIPEFAB™ READY PAK (INCLUDES POWER SOURCE K3731-1, FEEDER K3735-1, AND UNDERCARRIAGE K3736-1)
K3735-1	PIPEFAB™ FEEDER
K3738-1	PIPEFAB™ REMOTE UI

RECOMMENDED PROCESSES AND EQUIPMENT

RECOMMENDED PROCESSES

- GMAW, GMAW-P, GMAW-STT
- FCAW
- SMAW
- GTAW (DC)

RECOMMENDED EQUIPMENT

- The PipeFab™ Power Source and PipeFab™ Feeder make one cohesive unit that must be paired together.

PROCESS LIMITATIONS

- Processes must be within the duty cycle and rating of the power source and wire feeder. See the Technical Specifications section of this manual for more information.

EQUIPMENT LIMITATIONS

- The software based weld tables of the PipeFab™ Power Source limit the process capability within the output range and the safe limits of the machine. In general the processes will be limited to .030- .052 solid steel wire, .030 -.045 stainless wire, .035 -1/16 cored wire.
- The power source and UI may require software updates.
- The system does not include weld cables.
- Not compatible with K1500-1, K1500-2, K1500-3, K1500-4 K1500-5 and K489-7 gun adapter kits.
- PipeFab™ Feeder is only compatible with the PipeFab™ Power Source.
- PipeFab™ Power Source is only compatible with the PipeFab™ Feeder.

DESIGN FEATURES

POWER SOURCE

- Multiple process DC output range: 5 - 400 Amps.
- 200 – 600 VAC, 3 phase, 50-60Hz input power.
- New and Improved Line Voltage Compensation holds the output constant over wide input voltage fluctuations.
- Utilizes next generation microprocessor control, based on the ArcLink® platform.
- State of the art power electronics technology yields superior welding capability.
- Electronic over current protection.
- Input over voltage protection.
- F.A.N. (fan as needed). Cooling fan only runs when needed.
- Thermostatically protected for safety and reliability.
- Ethernet connectivity.
- Panel mounted Status and Thermal LED indicators facilitate quick and easy troubleshooting.
- Potted PC boards for enhanced ruggedness/reliability.
- Waveform Control Technology™ for good weld appearance and low spatter.
- STT® Capable.

FEEDER

- Standard bench can be converted to boom configuration and automatic oscillators.
- The feed plates can be rotated to accommodate different gun angles.
- Uses 5 pin K1543-xx or K2683-xx ArcLink cables. Cables may be joined together to make longer lengths.
- 4 roll wire drive.
- Changeable gun adapters.
- Ball bushing inlet guide.
- High resolution encoder on the motor.
- 7” digital user interface display.
- Displays voltage/trim, wire feed speed/amps, process settings, advanced settings, and more.
- Quick select buttons for switching processes.
- Center push-to-select encoder to navigate menus on screen.
- Total of 24 memories. 4 dedicated memories per process (TIG and STICK) and 4 dedicated memories per process and side (MIG/right, MIG/left, FCAW/right, FCAW/left).
- Digital communication between the feeder and power source.
- Standard USB port of ease of upgrading wire feeder.

TECHNICAL SPECIFICATIONS

PIPEFAB™ (K3731-1, K3732-1, K3734-1, K3735-1)

POWER SOURCE - INPUT VOLTAGE AND CURRENT					
MODEL	**DUTY CYCLE**	**INPUT VOLTAGE ±10%**	**INPUT AMPERES**	**IDLE POWER**	**POWER FACTOR @ RATED OUTPUT**
K3731-1	100% RATING	208/230/400*/460/575 50/60 HZ **(INCLUDED 380V TO 415V)**	53/46/26/24/19	550 WATTS MAX. (FAN ON)	0.94
K3732-1					

WIRE FEEDER - INPUT VOLTAGE AND CURRENT			
MODEL	**COMPONENT**	**VOLTAGE**	**INPUT AMPERES**
K3735-1	WIRE DRIVE	40 VDC	9 A
	USER INTERFACE	40 VDC	1 A

POWER SOURCE - RATED OUTPUT			
INPUT VOLTAGE / PHASE / FREQUENCY	**GMAW / FCAW**	**SMAW**	**GTAW-DC**
	100%	**100%**	**100%**
380-415/3/50/60	400 AMPS 34 VOLTS	400 AMPS 36 VOLTS	400 AMPS 26 VOLTS
460/3/50/60			
575/3/50/60			

WIRE FEEDER - RATED OUTPUT				
DUTY CYCLE	**AMPERES**	**WIRE FEED SPEED**	**WIRE SIZES**	
			SOLID	**CORED**
60%	450 AMPS	50 - 800 IN/MIN 1.3 - 20.3 M/MIN	.023 - 1/16 IN 0.6 - 1.6 MM	.030 - 5/64 IN 0.8 - 2.0 MM

RECOMMENDED INPUT WIRE AND FUSE SIZES[1]			
INPUT VOLTAGE / PHASE / FREQUENCY	EFFECTIVE INPUT AMPERE RATING AND DUTY CYCLE	CORD SIZE[3]	TIME DELAY FUSE OR BREAKER[2]
		AWG SIZES (MM 2)	AMPERAGE
200-208/3/50/60	53A, 100%	4 (25)	100
230/3/50/60	46A, 100%	4 (25)	90
380-415/3/50/60	26A, 100%	8 (10)	60
460/3/50/60	24A, 100%	8 (10)	45
575/3/50/60	19A, 100%	10 (6)	35

1. Based on U.S. National electrical Code.
2. Also called “inverse time” or “thermal/magnetic” circuit breakers; circuit breakers that have a display in tripping action that decreases as the magnitude of the current increases.
3. Type SO cord or similar in 30° C ambient.

AGENCY MARKINGS			
MODEL	MARKET	CONFORMITY MARK	STANDARD
K3731-1	US AND CANADA	$_{C}CSA_{UL}$	CAN/CSA E60974-1 ANSI/IEC 60974-1
K3732-1	US AND CANADA	$_{C}CSA_{UL}$	CAN/CSA E60974-1 ANSI/IEC 60974-1
	EUROPE	CE	EN 60974-1
K3735-1	US AND CANADA	$_{C}CSA_{UL}$	CAN/CSA E60974-5 ANSI/IEC 60974-5
	EUROPE	CE	EN 60974-5

MODEL	IP RATING
K3731-1	IP23
K3732-1	IP23
K3735-1	IP2X

WELDING PROCESS		
PROCESS	**OUTPUT RANGE (AMPERES)**	**MEAN OCV (UO)**
GMAW	40-400 A	73 V
GMAW-P		
FCAW		
GTAW-DC	5-400 A	36 V
SMAW	55-400 A	63 V

PHYSICAL DIMENSIONS				
MODEL	**HEIGHT**	**WIDTH**	**DEPTH**	**WEIGHT**
POWER SOURCE	30 IN (762 MM)	17.5 IN (444.5 MM)	34.8 IN (883.9 MM)	340 LBS. (154.2 KG)
PIPEFAB™ FEEDER	12.6 IN (320 MM)	19.7 IN (500 MM)	16.7 IN (424 MM)	54.5 LBS. (24.7 KG)
WIRE REEL STAND	13.8 IN (351 MM)	22.0 IN (559 MM)	28.2 IN (716 MM)	25.5 LBS. (11.6 KG)
PIPEFAB™ FEEDER AND WIRE REEL STAND	14.5 IN (368 MM)	22.0 IN (550 MM)	30.2 IN (767 MM)	80.0 LBS. (36.3 KG)
COMPLETE SYSTEM	53.2 IN (1351.3 MM)	30.9 IN (784.9 MM)	48.8 IN (1239.5 MM)	500 LBS. (226 KG)

TEMPERATURE RANGES		
MODEL	**OPERATING RANGE**	**STORAGE RANGE**
POWER SOURCE	-4°F TO 104°F (-20°C TO 40°C)	-40°F TO 185°F (-40°C TO 85°C)
PIPEFAB™ FEEDER	-40°F TO 104°F (-40C TO 40°C)	-40°F TO 185°F (-40C TO 85°C)

IP23 - Insulation Class(F) 155º(C)

- Weight does not include input cord

INSTALLATION

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Turn the input power OFF at the disconnect switch or fuse box before attempting to connect or disconnect input power lines, output cables or control cables.**
- **Only qualified personnel should perform this installation.**
- **Do not touch the wire drive, drive rolls, wire coil or electrode when welding output is ON.**
- **Wire feeder may be connected to a piece of automatic equipment that may be remotely controlled.**
- **Do not operate with covers, panels or guards removed.**
- **Do not let the electrode or wire spool touch the wire feeder housing.**
- **Insulate yourself from the work and ground.**
- **Always wear dry insulating gloves.**
- **The lift bail is insulated from the wire feeder enclosure. If an alternate hanging device is used, it must be insulated from the wire feeder enclosure.**

⚠ WARNING

MOVING PARTS can injure.

- **Keep away from moving parts.**
- **Wear Eye Protection.**

SAFETY PRECAUTIONS

Read this entire installation section before operating machine.

SELECT SUITABLE LOCATION

The PipeFab™ will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

- The machine must be located where there is free circulation of clean air such that air movement in the front and back, out the sides and bottom will not be restricted.
- Dirt and dust that can be drawn into the machine should be kept to a minimum. The use of air filters on the air intake is not recommended because normal airflow may be restricted. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.
- Keep machine dry. Shelter from rain and snow. Do not place on wet ground or in puddles.
- Do not mount the PipeFab™ over combustible surfaces. Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least .060" (1.6mm) thick, which shall extend not less than 5.90" (150mm) beyond the equipment on all sides.
- The PipeFab™ feeder is rated IP2X and is suitable for indoor use. For best wire feeding performance, place the PipeFab™ Feeder on a stable and dry surface.
- Do not submerge the feeder.

This equipment is for industrial use only and it is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There can be potential difficulties in residential locations due to conducted as well as radiated radio-frequency disturbances. The EMC or RF classification of this equipment is Class A.

LIFTING

Lift the machine by the lift bail only. The lift bail is designed to lift the power source only. Do not attempt to lift the power source with feeder or accessories attached to it.

When suspending a wire feeder, insulate the hanging device from the wire feeder enclosure.

STACKING

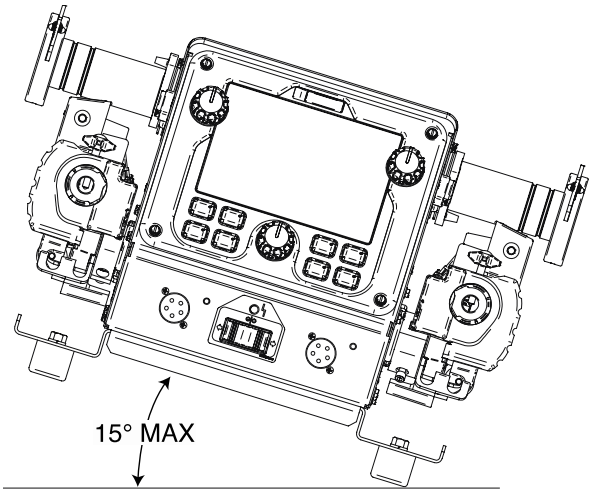
The PipeFab™ cannot be stacked.

TILTING

Place the machine directly on a secure, level surface or on a recommended undercarriage. The machine may topple over if this procedure is not followed.

For bench models, do not angle spindle for the wire spool or coil more than 15 degrees downward.

FIGURE A.1



MECHANICAL INSTALLATION

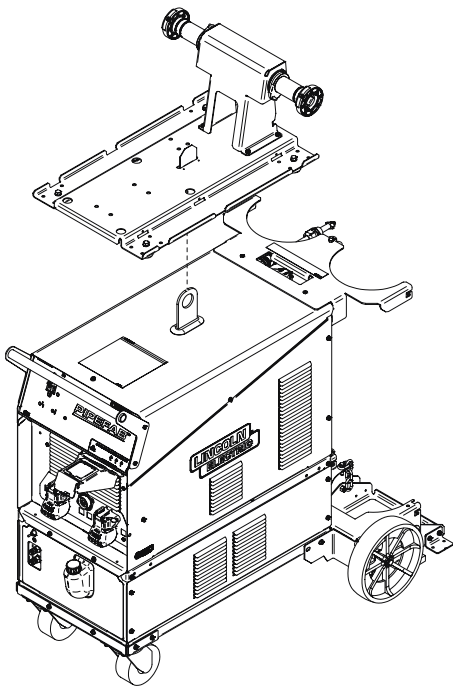
All accessory kits such as the PipeFab™ Undercarriage Kit and PipeFab™ Cooler come with installation instructions. Consult these installation instructions before assembly.

STANDARD (BENCH) CONFIGURATION

The PipeFab™ Feeder is installed on the PipeFab™ Power Source as shown in the steps below. The installation is the same whether or not the power source has the water cooler installed. In the below images, the water cooler is installed. Note that hardware in not necessary for the installation of the feeder. Hardware is included if desired.

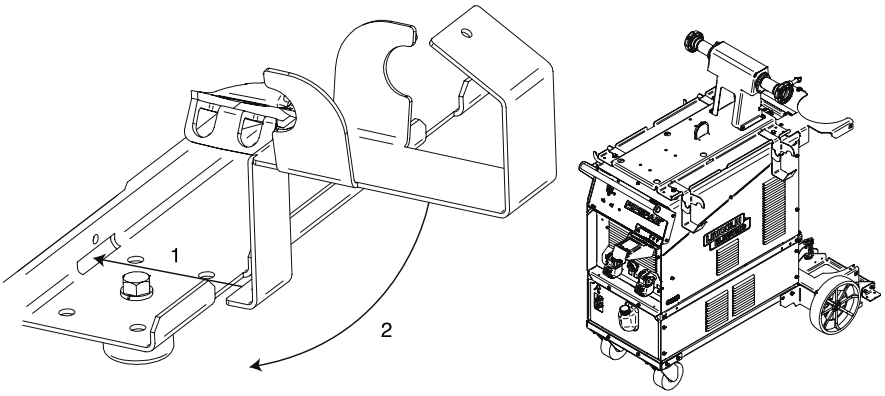
1. Position the Wire Reel Stand onto the Power Source. Ensure the lift bale is routed through the lift bale cutout and the Spindles are towards the rear of the machine.

FIGURE A.2



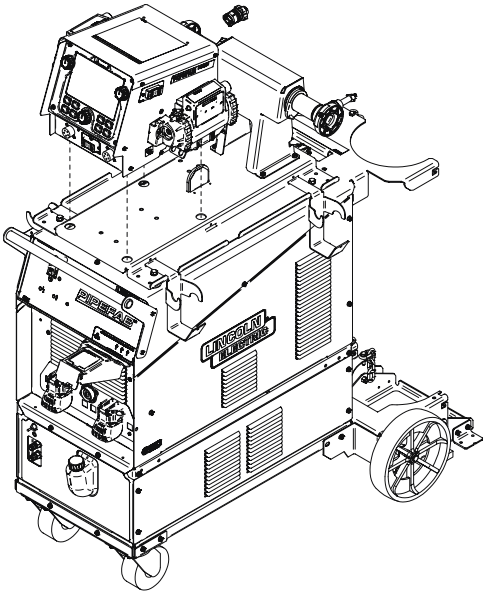
2. Install the Cable Management brackets. There are six slots, and four brackets, so place them in your most desired configuration. To install the brackets, (1) place the tab into the slot and (2) rotate the bracket 90° until it rests against the Power Source.

FIGURE A.3



3. Position the PipeFab™ Feeder onto the Wire Reel Stand. For secure mounting, ensure the feet of the feeder engage with the feet cutouts in the Wire Reel Stand.

FIGURE A.4



4. If desired, the PipeFab™ feeder and cable management brackets can be hard mounted to the wire reel stand using the provided hardware and L brackets as shown below. This is optional as these were designed to align securely without hardware.

FIGURE A.5 - L BRACKET INSTALLATION

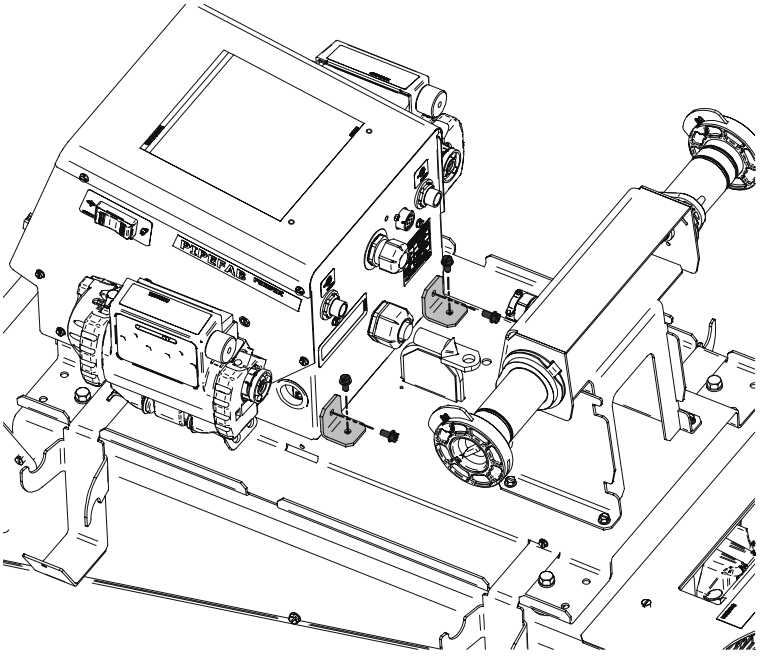
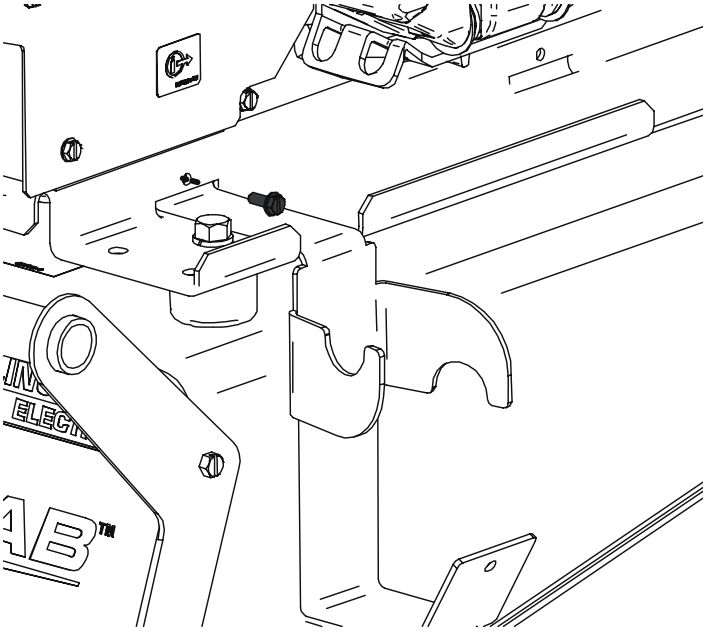
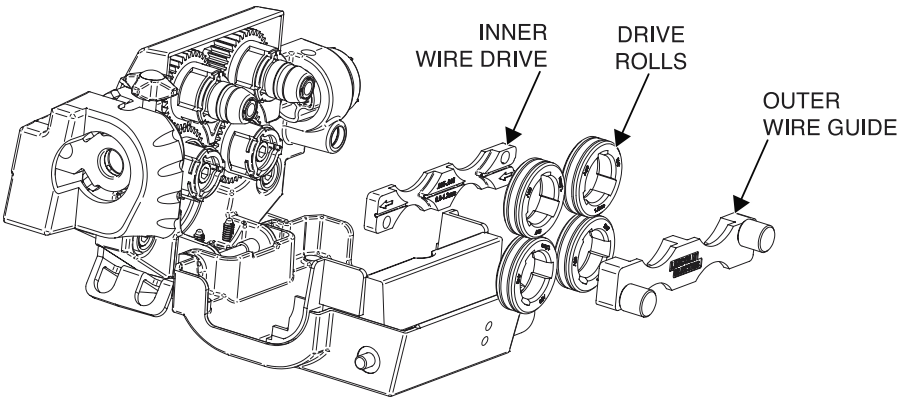


FIGURE A.6 - CABLE MANAGEMENT BRACKET MOUNTING



INSTALLING DRIVE ROLLS

FIGURE A.7



1. Turn power OFF at the welding power source.

2. Open the wire drive door by pulling on the top.

3. Remove the outer wire guide.

4. Remove drive rolls by pulling straight out. It may be necessary to wiggle the drive roll to free it from the snap ring.

5. Remove the inner wire guide.

6. Install the new inner wire guide, with the arrow pointing in the direction of wire travel.

7. Install the drive rolls and outer wire guide.

8. Close the wire drive door and adjust the pressure setting accordingly.

WIRE DRIVE PRESSURE SETTING

Most wires operate well with a pressure setting of “2”. The best drive roll pressure varies with wire type, wire surface, lubrication and hardness. Too much pressure may crush the wire or cause "birdnesting", but too little pressure could cause slippage.

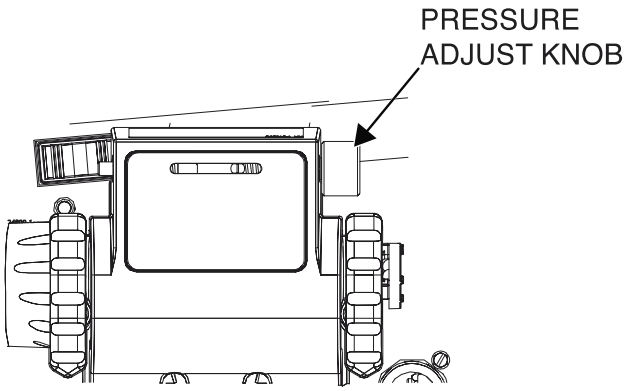
Setting the drive roll pressure

1. Press the end of the gun against a solid object that is electrically isolated from the welder output and press the gun trigger for several seconds.

2. If the wire "birdnests" or jams, the drive roll pressure is too high. Reduce the pressure by one turn of the knob, run new wire through the gun, and repeat step 1.

3. If the only result is slippage, disconnect the gun and pull the gun cable forward about 6" (150mm). There should be a slight waviness in the exposed wire. If there is no waviness, increase the pressure setting one turn, reconnect the gun and repeat the above steps.

FIGURE A.8

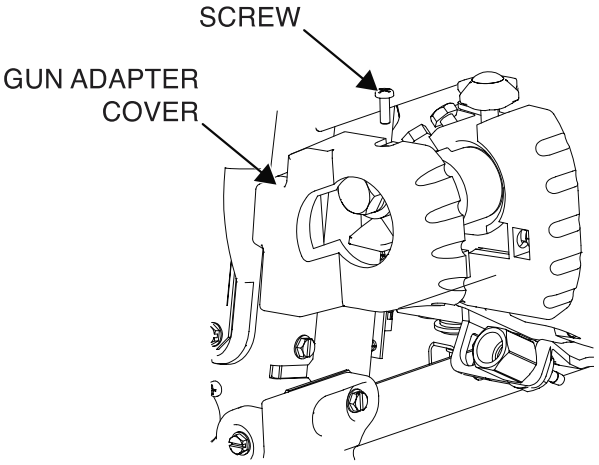


LINCOLN, STANDARD #2-#4, STANDARD #5, MILLER GUN ADAPTER INSTALLATION

1. Turn power OFF at the welding power source.

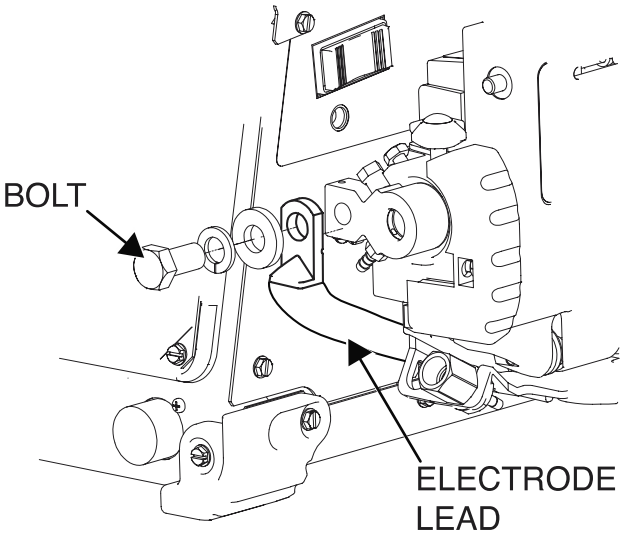
2. Using a Phillips screwdriver, remove the screw, lock washer and washer securing the gun adapter cover. Remove the gun adapter cover.

FIGURE A.9



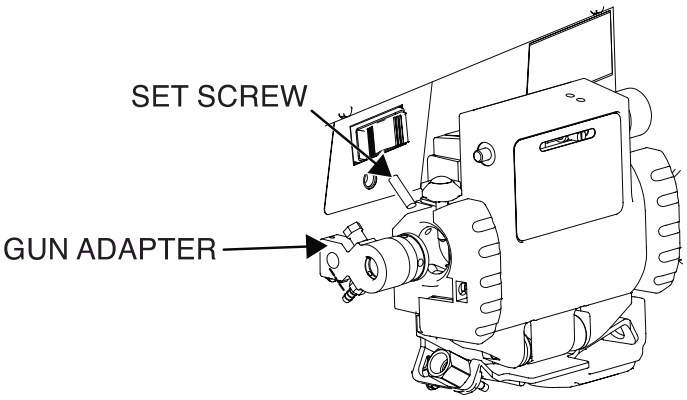
3. Using a ¾" wrench, remove the bolt securing the electrode lead to the gun adapter.

FIGURE A.10



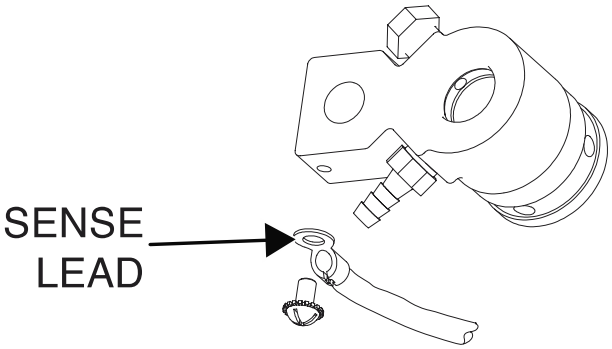
4. Use a 1/8” hex key, loosen the set screw securing the gun adapter.

FIGURE A.11



5. Using a Phillips screwdriver, remove the sense lead.

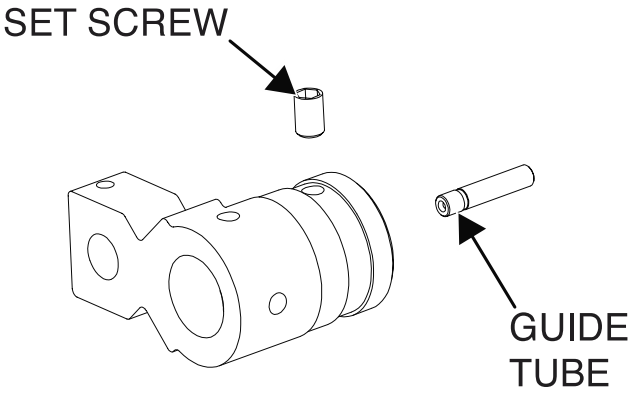
FIGURE A.12



6. If a gas hose is attached to the gun adapter, use pliers to remove the hose clamp and remove the gas hose.

7. If the gun adapter requires guide tubes, install the correct size guide tube and secure with the set screw.

FIGURE A.13



Wire size	Number of grooves in guide tube
.023 – .045" (0.6 – 1.2 mm)	1
.045 – 1/16" (1.2 – 1.6 mm)	2
1/16 – 5/64" (1.6 – 2.0 mm)	3
.068 – 7/64" (2.0 – 2.8 mm)	4

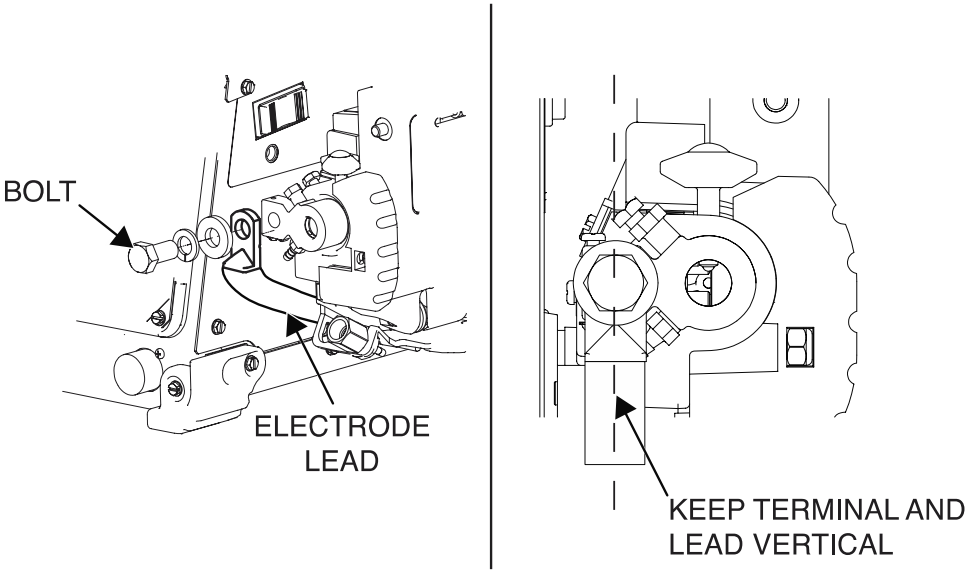
8. Assemble the sense lead to the new gun adapter. Orient the lead towards the rear of the gun adapter.

9. If required, assemble the gas hose to the gun adapter or the fitting on the feed plate and secure with a hose clamp.

10. Assemble the gun adapter to the wire drive. Tighten the set screw once the gun adapter is at a 90° angle.

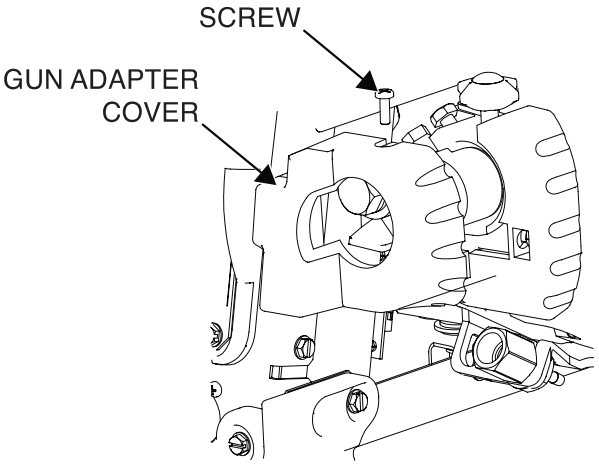
11. Bolt the electrode lead to the gun adapter, making sure to route the lead straight down.

FIGURE A.14



12. Assemble the gun adapter cover and secure with the screw, lock washer and washer.

FIGURE A.15



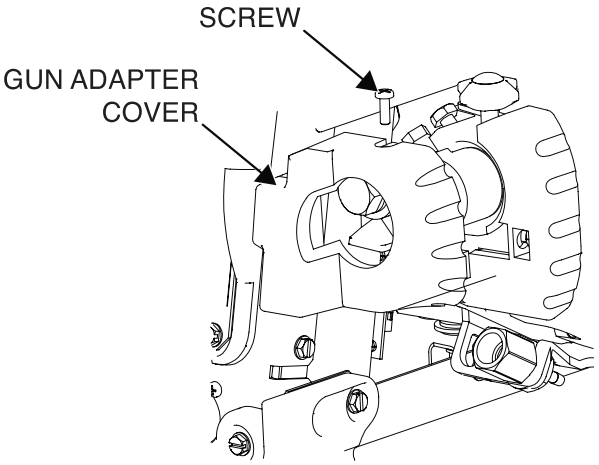
OXO AND FAST MATE GUN ADAPTER INSTALLATION

Using the Oxo or FastMate gun adapters requires a K3344-1 Standard #4 gun adapter to be installed in the wire drive.

1. Turn power OFF at the welding power source.

2. Using a Phillips screwdriver, loosen the screw securing the gun adapter cover. Remove the gun adapter cover.

FIGURE A.16

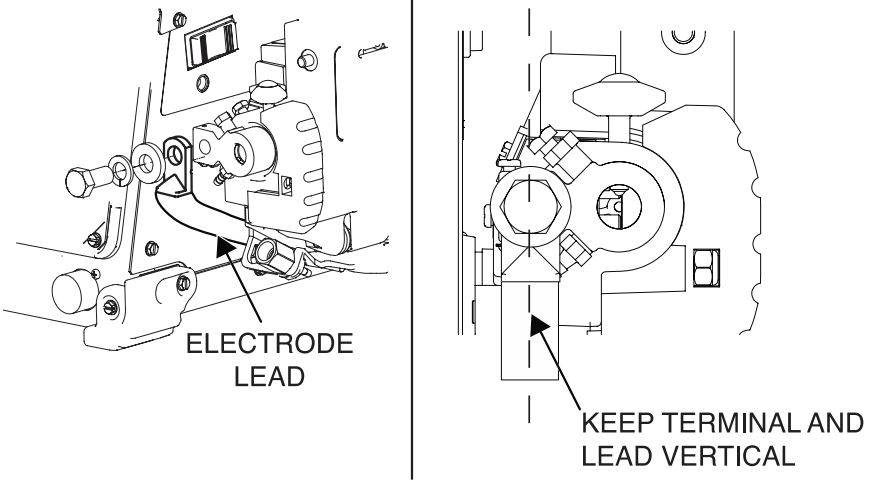


3. Using a ¾" wrench, remove the bolt securing the electrode lead to the gun adapter.

4. Using pliers, remove the hose clamp and hose from the gun adapter.

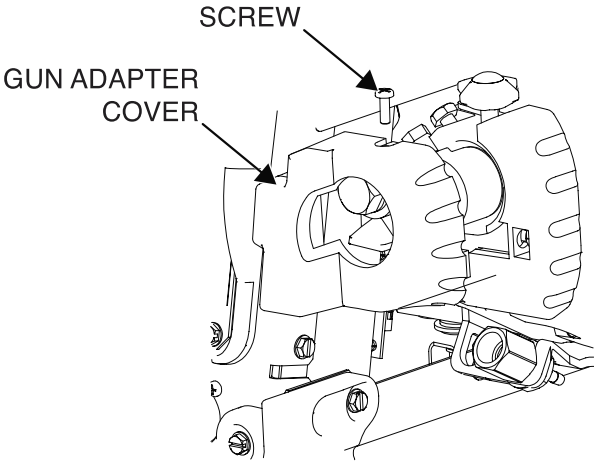
5. Bolt the electrode lead to the gun adapter, making sure to route the lead straight down.

FIGURE A.17



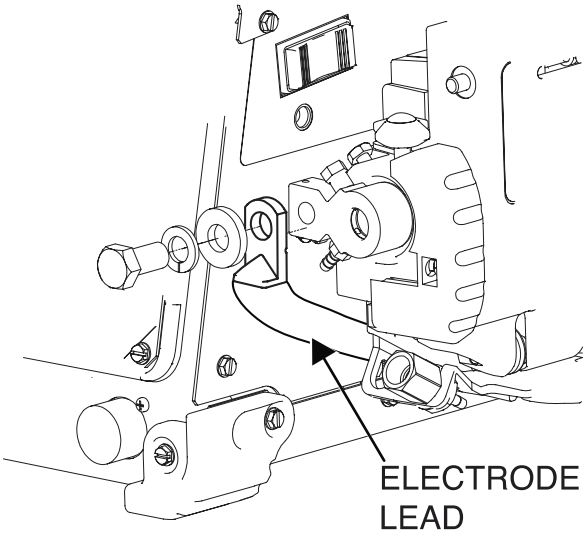
6. Assemble the gun adapter cover and secure with the screw.

FIGURE A.18



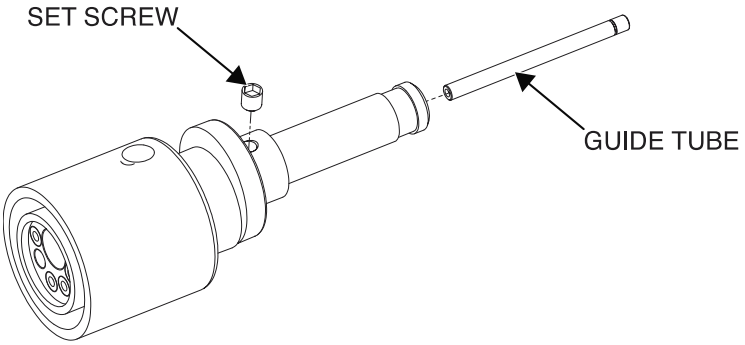
7. Assemble the gas hose to the Oxo or FastMate gun adapter.

FIGURE A.19



8. Select the appropriate guide tube and secure with the set screw.

FIGURE A.20



Wire size	Number of grooves in guide tube
.023 – .045” (0.6 – 1.2 mm)	1
.045 – 1/16” (1.2 – 1.6 mm)	2
1/16 – 5/64” (1.6 – 2.0 mm)	3
.068 – 7/64” (2.0 – 2.8 mm)	4

9. Slide the Oxo or FastMate gun adapter into the wire drive and secure with the thumb screw.

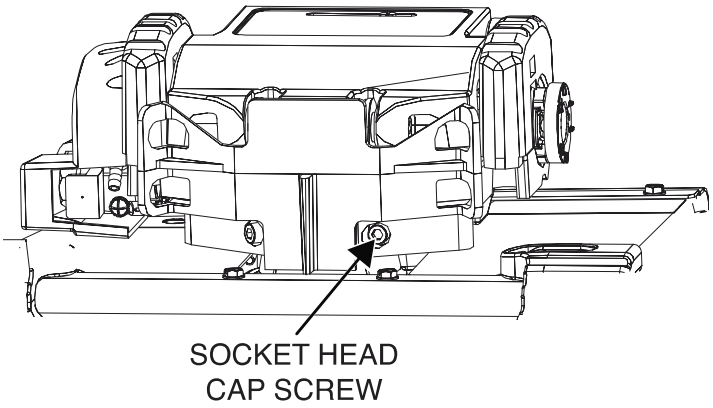
10. For FastMate gun adapters, connect the trigger pigtail to the connector on the front of the feeder.

ROTATING THE WIRE DRIVE

1. Turn power OFF at the welding power source.

2. Locate the socket head cap screw at the bottom of the wire drive. Loosen, but do not remove the screw.

FIGURE A.21



3. Rotate the wire drive to the desired position and tighten the screw.

SHIELDING GAS CONNECTION

⚠ WARNING

CYLINDER may explode if damaged.

BUILD-UP OF SHIELDING GAS may harm health or kill.

- **Keep cylinder upright and chained to support.**
- **Keep cylinder away from areas where it may be damaged.**
- **Never lift welder with cylinder attached.**
- **Never allow welding electrode to touch cylinder.**
- **Keep cylinder away from welding or other live electrical circuits.**
- **Shut off shielding gas supply when not in use.**

SEE AMERICAN NATIONAL STANDARD Z-49.1, "SAFETY IN WELDING AND CUTTING" PUBLISHED BY THE AMERICAN WELDING SOCIETY.

Maximum inlet pressure is 100 psi. (6.9 bar.)
The inlet fitting is 5/8-18 CGA type connection.
Install the shielding gas supply as follows:

1. Secure the cylinder to prevent it from falling.
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.
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, insert regulator adapter between regulator and cylinder valve. If adapter is equipped with a plastic washer, be sure it is seated for connection to the CO_2 cylinder.
5. Attach one end of the inlet hose to the outlet fitting of the flow regulator. Attach the other end to the welding system shielding gas inlet. Using a wrench, tighten the union nuts.
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 gage stops moving, open the valve fully.
8. The flow regulator is adjustable. Adjust it to the flow rate recommended for the procedure and process being used before making a weld.

WATER-COOLED GUN CONNECTIONS

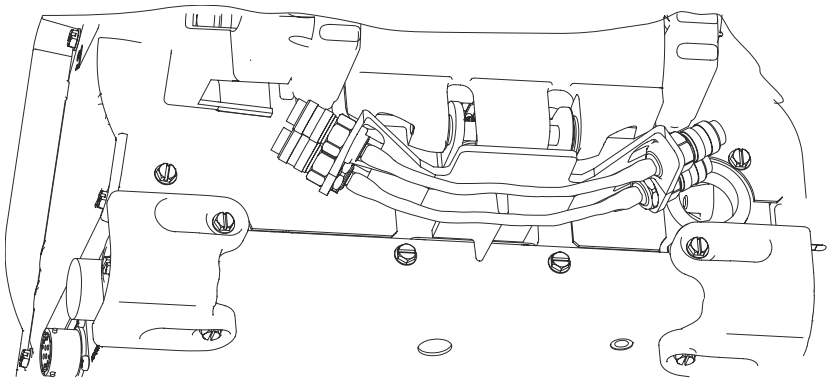
The K590-6 water connection kit installs underneath the wire drive.

1. Turn power OFF at the welding power source.

2. Install the quick disconnect fittings to the plastic bracket, by holding the rear nut stationary and spinning the fitting.

3. Cut the tubing to the desired length, and then install the tubing and hose clamps to the fittings.

FIGURE A.22



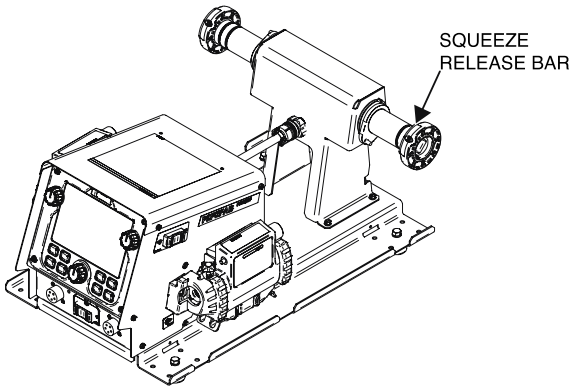
LOADING SPOOLS AND COILS

⚠ WARNING

- **Keep hands, hair, clothing and tools away from rotating equipment.**
- **Do not wear gloves when threading wire or changing wire spool.**
- **Only qualified personnel should install, use or service this equipment.**

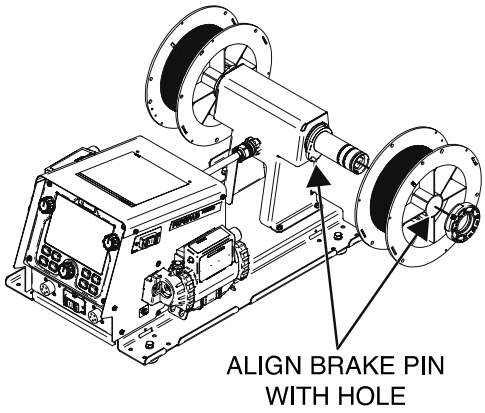
1. Turn power OFF at the welding power source.
2. Squeeze the release bar on the retaining collar and remove it from the spindle.

FIGURE A.23



3. Place the spool on the spindle, aligning the spindle brake pin with one of the holes in the back side of the spool. Be certain the wire feeds off of the spool in the proper direction.

FIGURE A.24



4. Re-install the retaining collar, with the metal bar engaging one of the grooves of the spindle. The release bar will spring out when engaged.

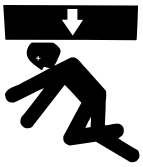
ELECTRICAL INSTALLATION

INPUT AND GROUND CONNECTION

Only a qualified electrician should connect the PipeFab™. Installation should be made in accordance with the appropriate National Electrical Code, all local codes and the information in this manual.

⚠ WARNING

FALLING EQUIPMENT can cause injury.



- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.
- Do not operate machine while suspended when lifting.

MACHINE GROUNDING

The frame of the welder must be grounded. A ground terminal marked with a ground symbol is located next to the input power connection block.

See your local and national electrical codes for proper grounding methods.

HIGH FREQUENCY PROTECTION

Locate the PipeFab™ away from radio controlled machinery. The normal operation of the PipeFab™ may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

INPUT CONNECTION

Use a three-phrase supply line. A 1.40 inch diameter access hole with strain relief is located on the case back. Route input power cable through this hole and connect L1, L2, L3 and ground per connection diagrams and National Electric Code. To access the input power connection block, remove the left door of the machine (four screws). Be sure to reinstall the door before operation.

ALWAYS CONNECT THE POWER WAVE GROUNDING LUG (LOCATED AS SHOWN IN FIGURES A.26 AND A.27) TO A PROPER SAFETY (EARTH) GROUND.

FIGURE A.25 - CASE SIDE REMOVAL

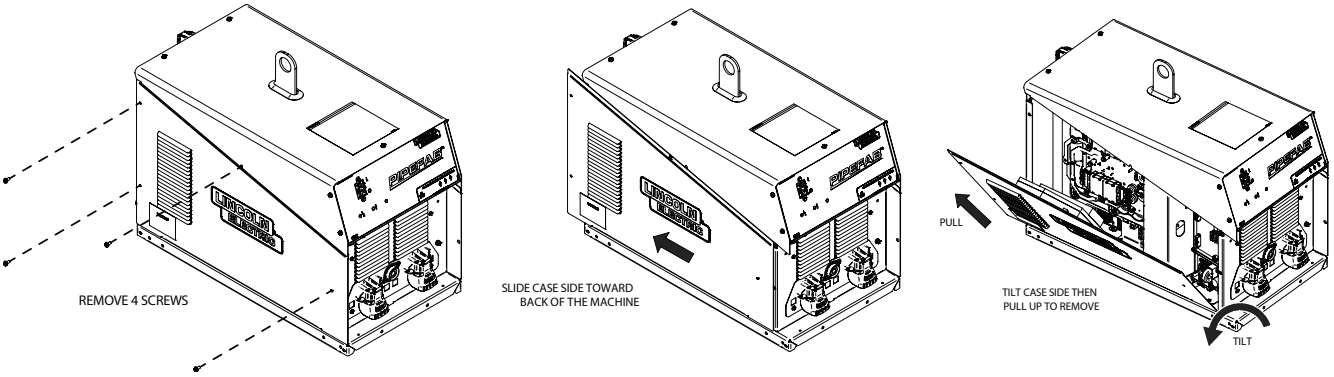


FIGURE A.26 - K3731-1 INPUT POWER CONNECTION

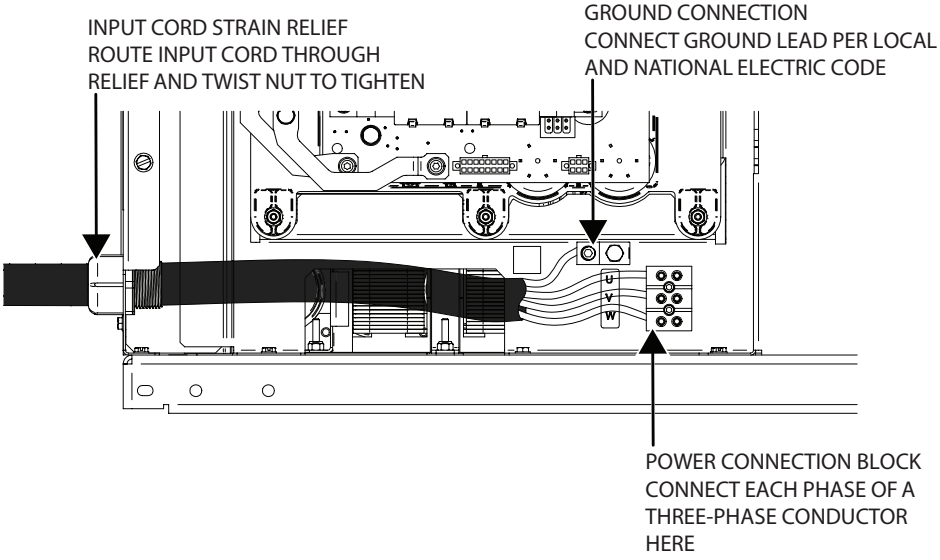
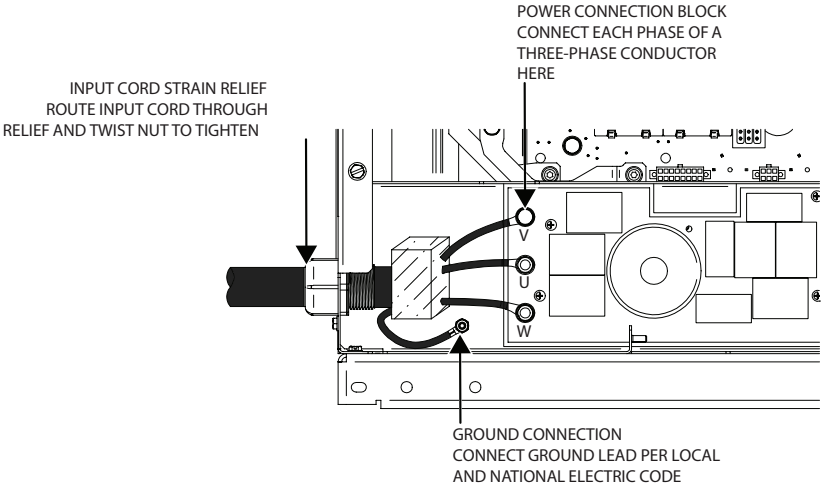


FIGURE A.27 - K3732-1 INPUT POWER CONNECTION



INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS

Refer to Technical Specification Section for recommended fuse, wire sizes and type of the copper wires. Fuse the input circuit with the recommended super lag fuse or delay type breakers (also called "inverse time" or "thermal/magnetic" circuit breakers). Choose input and grounding wire size according to local or national electrical codes. Using input wire sizes, fuses or circuit breakers smaller than recommended may result in "nuisance" shut-offs from welder inrush currents, even if the machine is not being used at high currents.

INPUT VOLTAGE SELECTION

The PipeFab™ automatically adjusts to work with different input voltages. No reconnect switch settings are required.

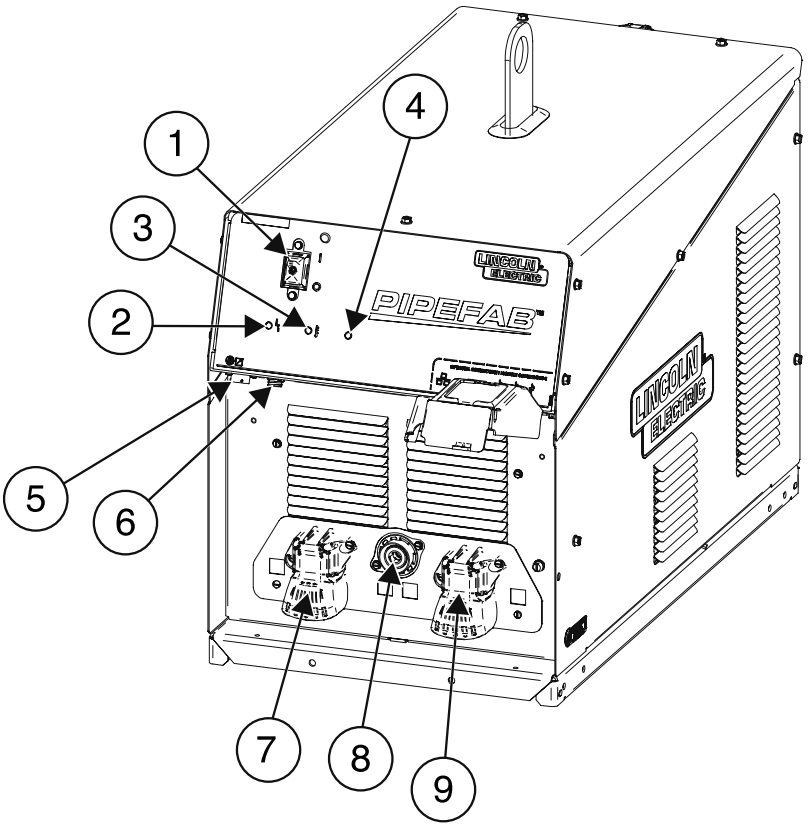
⚠ WARNING

The PipeFab™ ON/OFF switch is not intended as a service disconnect for this equipment. Only a qualified electrician should connect the input leads to the PipeFab™. Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect access door of the machine. Failure to do so may result in bodily injury or death.

PIPEFAB™ POWER SOURCE CONNECTOR LOCATIONS

CASE FRONT LOCATIONS

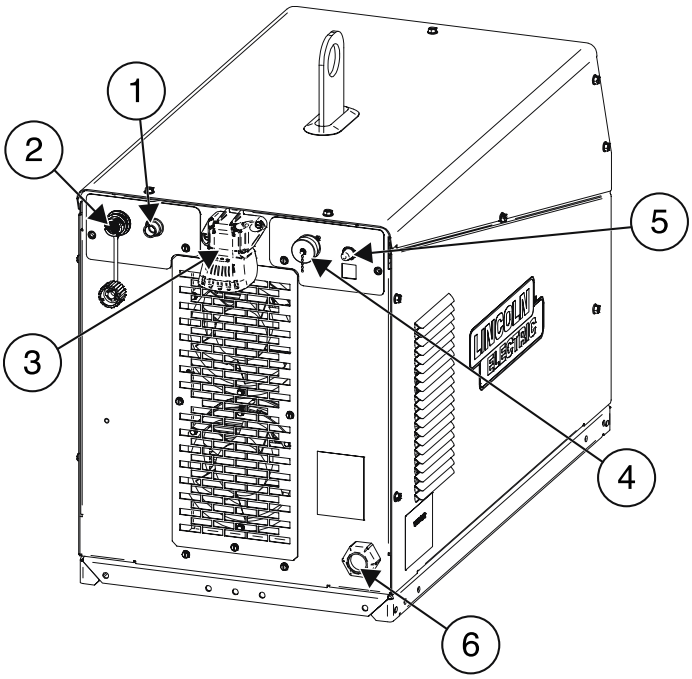
FIGURE A.27



1. **Power Switch**
2. **Status LED**
3. **Thermal LED**
4. **Status II LED**
5. **12 Pin Connector**
6. **Sense Lead Connector**
7. **Work Weld Output Terminal**
8. **TIG Weld Output Terminal**
9. **Stick Weld Output Terminal**

CASE BACK LOCATIONS

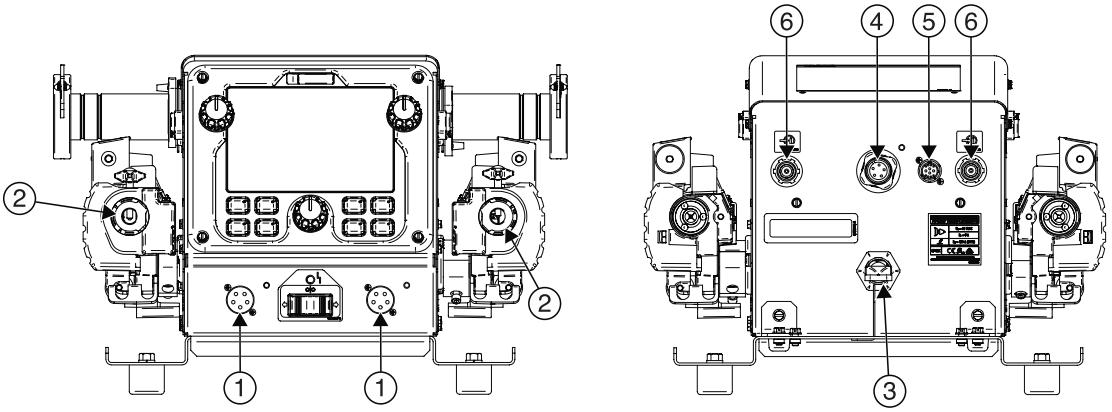
FIGURE A.28



1. **TIG Gas Input Solenoid**
2. **Ethernet**
3. **MIG Weld Output Stud**
4. **ArcLink Connector**
5. **40 Volt Circuit Breaker**
6. **Input Power Cord**

PIPEFAB™ FEEDER CONNECTOR LOCATIONS

FIGURE A.29

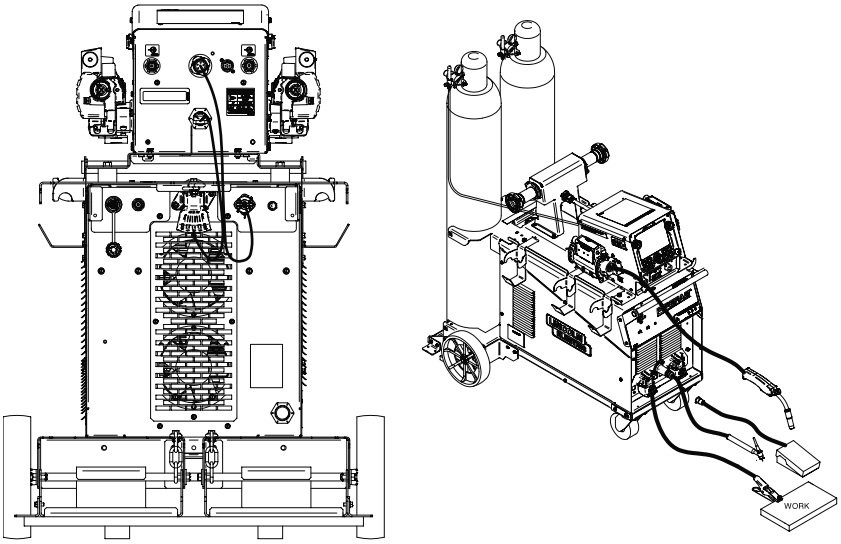


1. **5 Pin Trigger Connector**
2. **Gun Adapter**
3. **Input Weld Cable**
4. **5 Pin ArcLink Cable**
5. **12 Pin Remote UI Connector**
6. **MIG Input Gas Solenoid**

CONNECTION DIAGRAM

The PipeFab™ system was design such that all connections can be maintained when switching welding processes. There is no longer the need to changeover torches and welding cables between processes. The PipeFab™ Power Source will automatically change polarity and active output terminals based on the selected process. This selection is made on the user interface of the PipeFab™ Feeder.

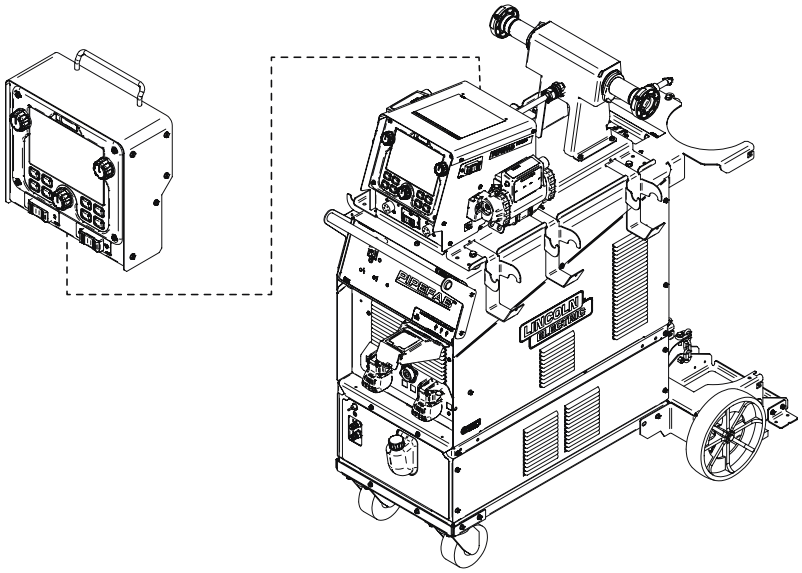
FIGURE A.30



REMOTE USER INTERFACE CONFIGURATION

A remote user interface (UI) can be added by simply plugging the PipeFab™ Remote UI into the PipeFab™ Feeder, 12 pin located on the back of the feeder. The remote UI is designed for hard automation setups with a manipulator.

FIGURE A.31

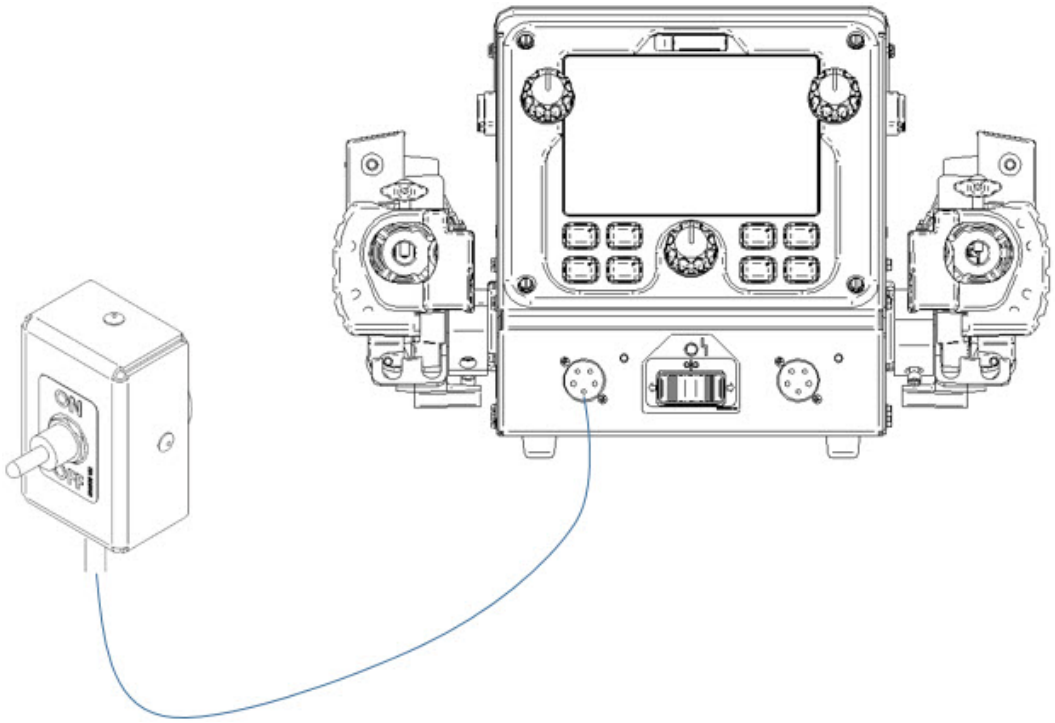


The Remote UI is to be connected to the system in addition to the UI mounted in the Wire Feeder. When a remote UI is connected, only one UI will be active at a time. In order to activate an inactive UI, press any button.

REMOTE TRIGGER SWITCH

A remote trigger switch is available for use in hard automation setups with or without a Remote UI. This is a toggle switch and lead assembly which connects to the appropriate gun trigger connection to start and stop the wire feeder. Turn the switch ON to start welding at the set parameters. Turn the switch OFF to stop welding.

FIGURE A.32: CONNECTION DIAGRAM OF REMOTE TRIGGER



RECOMMENDED WORK CABLE SIZES FOR ARC WELDING

GENERAL GUIDELINES

- **Select the appropriate size cables per the "Output Cable Guidelines" below.** Excessive voltage drops caused by undersized welding cables and poor connections often result in unsatisfactory welding performance. Always use the largest welding cables (electrode and work) that are practical, and be sure all connections are clean and tight.

  NOTE: Excessive heat in the weld circuit indicates undersized cables and/or bad connections.

- **Route all cables directly to the work and wire feeder, avoid excessive lengths and do not coil excess cable.** Route the electrode and work cables in close proximity to one another to minimize the loop area and therefore the inductance of the weld circuit.

- **Always weld in a direction away from the work (ground) connection.**

Table A.1 shows copper cable sizes recommended for different currents and duty cycles. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable drop.

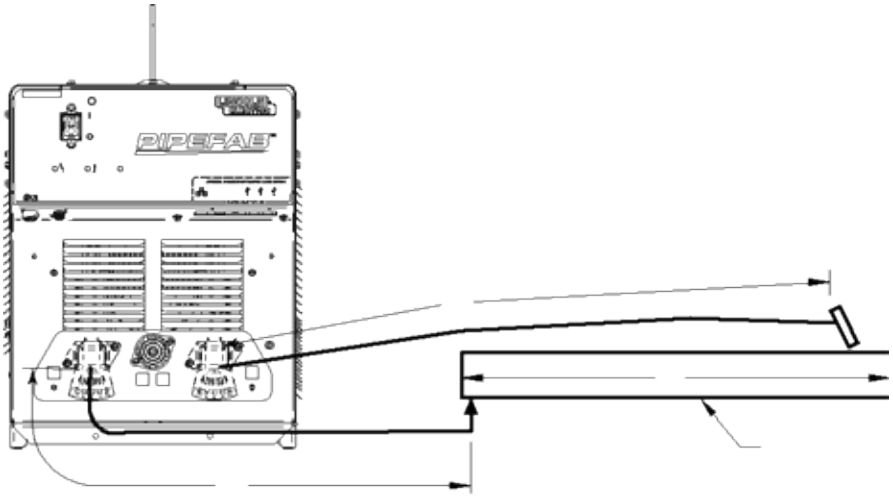
TABLE A.1 - RECOMMENDED CABLE SIZES - RUBBER COVERED COPPER - RATED 167°F (75°C)[1]

AMPERES	PERCENT DUTY CYCLE	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLES				
		0 TO 50 FT.	50 TO 100 FT.	100 TO 150 FT.	150 TO 200 FT.	200 TO 250 FT.
200	100	2	2	2	1	1/0
250	100	1	1	1	1	1/0
300	100	2/0	2/0	2/0	2/0	3/0
400	100	3/0	3/0	3/0	3/0	4/0
450	100	3/0	3/0	4/0	4/0	2–3/0
500	60	2/0	2/0	3/0	3/0	4/0
550	40	2/0	2/0	3/0	3/0	4/0

CABLE INDUCTANCE AND ITS EFFECTS ON WELDING

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size, and loop area. The loop area is defined by the separation distance between the electrode and work cables, and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C).

FIGURE A.33



To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and do not coil excess cable. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.

REMOTE SENSE LEAD SPECIFICATIONS

VOLTAGE SENSING OVERVIEW

The best arc performance occurs when the PipeFab™ has accurate data about the arc conditions.

Depending upon the process, inductance within the electrode and work cables can influence the voltage apparent at the studs of the welder, and have a dramatic effect on performance. Remote voltage sense leads are used to improve the accuracy of the arc voltage information supplied to the control pc board. Sense Lead Kits (K940-xx) are available for this purpose.

The PipeFab™ has the ability to automatically sense when remote sense leads are connected. With this feature there are no requirements for setting-up the machine to use remote sense leads. This feature can be disabled through the Weld Manager Utility (available at www.powerwavesoftware.com) or through the set up menu on the PipeFab™ feeder.

⚠ CAUTION

If the auto sense lead feature is disabled and remote voltage sensing is enabled but the sense leads are missing or improperly connected extremely high welding outputs may occur.

GENERAL GUIDELINES FOR VOLTAGE SENSE LEADS

Sense leads should be attached as close to the weld as practical, and out of the weld current path when possible. In extremely sensitive applications it may be necessary to route cables that contain the sense leads away from the electrode and work welding cables.

Voltage sense leads requirements are based on the weld process (See Table A.2).

TABLE A.2

PROCESS	ELECTRODE VOLTAGE SENSING(1) 67 LEAD	WORK VOLTAGE SENSING(2) 21 LEAD
GMAW	67 LEAD REQUIRED	21 LEAD OPTIONAL (3)
GMAW-P	67 LEAD REQUIRED	21 LEAD OPTIONAL (3)
FCAW	67 LEAD REQUIRED	21 LEAD OPTIONAL (3)
STT [1]	67 LEAD REQUIRED	21 LEAD OPTIONAL (3) RECOMMENDED FOR CABLES LONGER THAN 75 FT.
GTAW	VOLTAGE SENSE AT STUDS	VOLTAGE SENSE AT STUDS
SMAW	VOLTAGE SENSE AT STUDS	VOLTAGE SENSE AT STUDS

(1) The electrode voltage sense lead (67) is automatically enabled by the weld process, and integral to the 5 pin ArcLink control cable (K1543-xx).
(2) When a work voltage sense lead (21) is connected the power source will automatically switch over to using this feedback (if the auto sense feature is enable).
(3) Negative polarity semi-automatic process operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set.

ELECTRODE VOLTAGE SENSING

The remote ELECTRODE sense lead (67) is built into the 5-pin ArcLink control cable and is always connected to the wire drive feed plate when a wire feeder is present. Enabling or disabling electrode voltage sensing is application specific, and automatically configured by the active weld mode.

⚠ CAUTION

If the auto sense lead feature is disabled and the weld polarity attribute is improperly configured extremely high welding outputs may occur.

WORK VOLTAGE SENSING

While most applications perform adequately by sensing the work voltage directly at the output stud, the use of a remote work voltage sense lead is recommended for optimal performance. The remote WORK sense lead (21) can be accessed through the four pin voltage sense connector located on the control panel by using the K940 Sense Lead Kit. It must be attached to the work as close to the weld as practical, but out of the weld current path. For more information regarding the placement of remote work voltage sense leads, see in this section entitled "Voltage Sensing Considerations for Multiple Arc Systems."

NEGATIVE ELECTRODE POLARITY

The PipeFab™ has the ability to automatically change the polarity of the power source. With this feature there are no setup requirements for welding with negative electrode polarity. Negative polarity is only available for TIG welding.

VOLTAGE SENSING CONSIDERATIONS FOR MULTIPLE ARC SYSTEMS

Special care must be taken when more than one arc is welding simultaneously on a single part. Multiple arc applications do not necessarily dictate the use of remote work voltage sense leads, but they are strongly recommended.

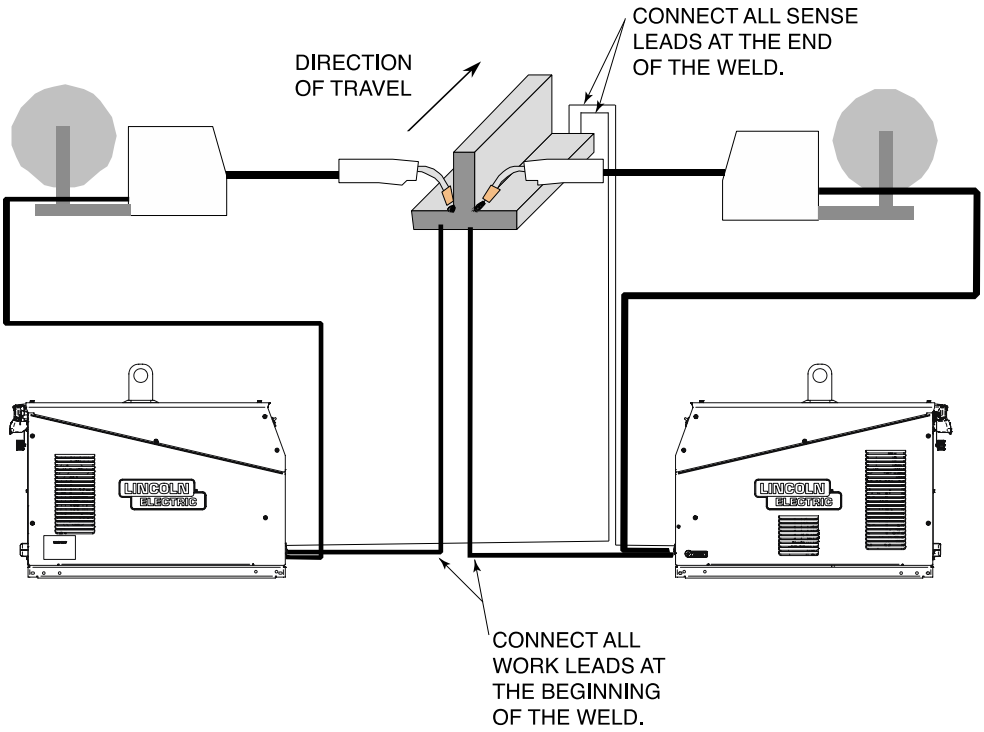
If Sense Leads ARE NOT Used:

- Avoid common current paths. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

If Sense Leads ARE Used:

- Position the sense leads out of the path of the weld current. Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.
- **For longitudinal applications**, connect all work leads at one end of the weldment, and all of the work voltage sense leads at the opposite end of the weldment. Perform welding in the direction away from the work leads and toward the sense leads.
- **For circumferential applications**, connect all work leads on one side of the weld joint, and all of the work voltage sense leads on the opposite side, such that they are out of the current path.

FIGURE A.34



CONTROL CABLE CONNECTIONS

ArcLink Control Cables are available in two forms:

- K1543-xx series for most indoor or factory installations.
- K2683-xx series when the equipment is frequently moved.

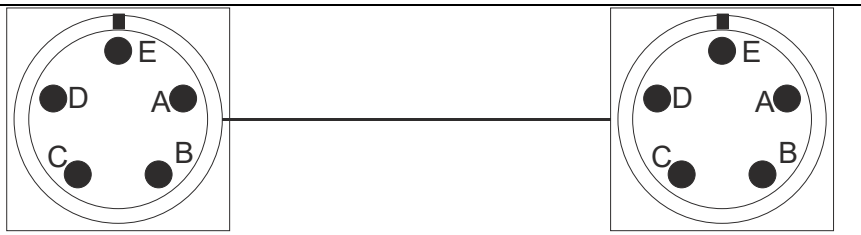
ArcLink/LincNet control cables are special high quality cables for digital communication. The cables are copper 5 conductor cable in a SO-type rubber jacket. There is one 20 gauge twisted pair for network communications. This pair has an impedance of approximately 120 ohms and a propagation delay per foot of less than 2.1 nanoseconds. There are two 12 gauge conductors that are used to supply 40 VDC to the network. The fifth wire is 18 gauge and is used as an electrode sense lead.

GENERAL GUIDELINES

Genuine Lincoln control cables should be used at all times (except where noted otherwise). Lincoln cables are specifically designed for the communication and power needs of the Power Wave® / Power Feed™ systems. Most are designed to be connected end to end for ease of extension. Generally, it is recommended that the total length not exceed 200 ft. (61 m). The use of nonstandard cables, especially in lengths greater than 25 feet, can lead to communication problems (system shutdowns), poor motor acceleration (poor arc starting), and low wire driving force (wire feeding problems). Always use the shortest length of control cable possible, and DO NOT coil excess cable.

Regarding cable placement, best results will be obtained when control cables are routed separate from the weld cables. This minimizes the possibility of interference between the high currents flowing through the weld cables, and the low level signals in the control cables. These recommendations apply to all communication cables including ArcLink® and Ethernet connections.

TABLE A.3



POWER SOURCE	
PIN	**FUNCTION**
A	ARCLINK
B	ARCLINK
C	67 VOLTAGE SENSE
D	40 VDC
E	COMMON

WIRE FEEDER	
PIN	**FUNCTION**
A	ARCLINK
B	ARCLINK
C	67 VOLTAGE SENSE
D	40 VDC
E	COMMON

CONNECTION BETWEEN POWER SOURCE AND ETHERNET NETWORKS

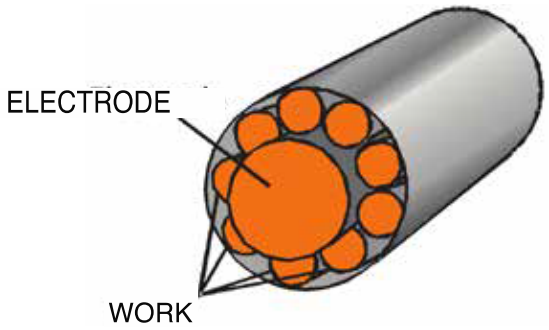
The PipeFab™ is equipped with a ODVA compliant RJ-45 Ethernet connector, which is located on the front panel. It is critical that all Ethernet cables external to either a conduit or an enclosure are solid conductor, shielded cat 5e cable, with a drain. The drain should be grounded at the source of transmission. For best results, route Ethernet cables away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field. For additional guidelines refer to ISO/IEC 11801. Failure to follow these recommendations can result in an Ethernet connection failure during welding.

USB PORTS

When equipped with the Optional Connectivity module K4720-1; the PipeFab™ will be able to connect remotely (wireless) via a USB WIFI adapter (customer must supply) or wired through an Ethernet cable.

WELD CABLES, COAXIAL

FIGURE A.35



Coaxial welding cables are specially designed welding cables for STT™ and pulse welding. Coaxial weld cables feature low inductance, allowing fast changes in the weld current. Regular cables have a higher inductance which may distort the STT™ waveshape. Inductance becomes more severe as the weld cables become longer.

Coaxial cables work best for high performance waveforms and when:

- long cables are present.

- the cables are housed in a metal tray.

A coaxial weld cable is constructed with multiple small leads wrapped around one large lead. The large inner lead connects to the electrode stud on the power source and the electrode connection on the wire feeder. The small leads combine together to form the work lead, one end attached to the power source and the other end to the work piece.

To install:

1. Turn the input power off at the welding power source.

2. Connect one end of the center lead to the power source electrode connection, and the other end to the wire feeder electrode connection.

3. Connect the outer lead bundle to the power source work connection, and the other end to the work piece. Minimize the length of any work lead extension for best results.

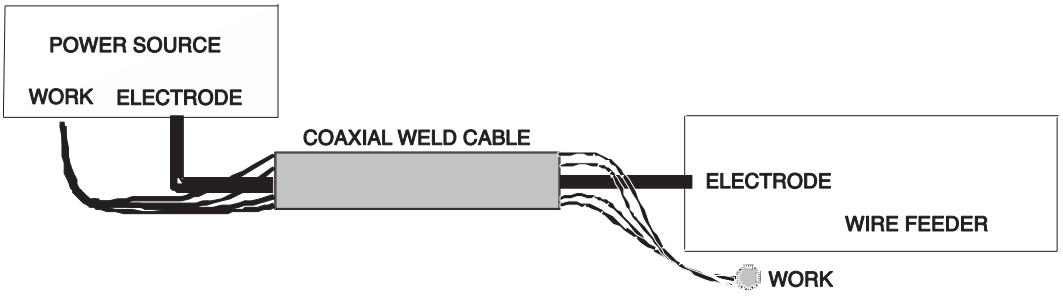
4. Insulate all connections.

TABLE A.4
RECOMMENDED CABLE SIZES (RUBBER COVERED COPPER - RATED 75°C)**

AMPERES	DUTY CYCLE	COAXIAL CABLE LENGTH			
		0 TO 25 FT.	25 TO 50 FT.	50 TO 75 FT.	75 TO 100 FT.
250	100%	1	1	1	1
300	60%	1	1	1	1/0
350	60%	1/0	1/0	--	--

** Tabled values are for operation at ambient temperatures of 40°C and below. Applications above 40°C may require cables larger than recommended or cables rated higher than 75°C.

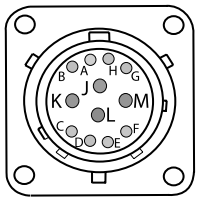
FIGURE A.36



FEEDER CONNECTORS

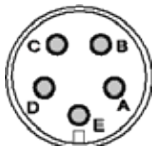
ADVANCED ACCESSORIES CONNECTOR (12 PIN)

TABLE A.5

PICTURE	FUNCTION	PIN	WIRING
	12 PIN CONNECTOR FOR PIPEFAB™ REMOTE UI.	A	CAN LOW
		B	CAN HIGH
		C	NOT USED
		D	NOT USED
		E	NOT USED
		F	NOT USED
		G	NOT USED
		H	NOT USED
		J	40 VDC COMMON
		K	40 VDC +
		L	NOT USED
		M	NOT USED

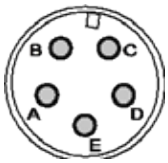
TRIGGER CONNECTOR (5 PIN)

TABLE A.6

PICTURE	FUNCTION	PIN	WIRING
	5 PIN TRIGGER CONNECTOR FOR PUSH-ONLY GUNS.	A	TRIGGER
		B	NOT USED
		C	TRIGGER
		D	N/A
		E	N/A

ARCLINK CONNECTOR (5 PIN)

TABLE A.7

PICTURE	FUNCTION	PIN	WIRING
	5 PIN CONNECTOR FOR COMMUNICATION AND POWER.	A	CAN
		B	CAN
		C	67 ELECTRODE VOLTAGE SENSE
		D	40 VDC
		E	COMMON

OPERATION

SAFETY PRECAUTIONS

READ AND UNDERSTAND ENTIRE SECTION BEFORE OPERATING MACHINE.

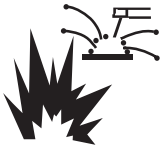
ELECTRIC SHOCK CAN KILL.

- Do not touch electrically live part or electrode with skin or wet clothing.
- Insulate yourself from work and ground.
- Always wear dry insulating gloves.
- Do not operate with covers, panels or guards removed or open.

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.

ARC RAYS can burn

- Wear eye, ear and body protection.

GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

TABLE B.1

	WARNING OR CAUTION	A	WELDING AMPERAGE		THERMAL
	INPUT POWER	V	WELDING VOLTAGE		SHIELDING GAS
I	ON		WIRE FEED SPEED		ARC START PARAMETERS
O	OFF		TRIM		ARC END PARAMETERS
+	POSITIVE OUTPUT		WORK		DANGEROUS VOLTAGE
-	NEGATIVE OUTPUT		COLD FEED		COOLER
	FRAME GROUND		GAS PURGE		STATUS
U_1	INPUT VOLTAGE		SHIELDING GAS INLET		OUTPUT
I_1	INPUT CURRENT		SHIELDING GAS OUTLET		PROTECTIVE GROUND

I_2	OUTPUT CURRENT		4-STEP TRIGGER		OPERATORS MANUAL
	CIRCUIT BREAKER		CV PROCESS		TIG PROCESS
	STICK PROCESS				

DEFINITIONS

BASIC DEFINITIONS

Arc Force – Arc Force adjusts the short circuit current for a soft arc, or for a forceful, driving arc. It helps to prevent sticking and shorting of organic coated electrodes, particularity globular transfer types such as stainless and low hydrogen. Arc Force is especially effective for root pass on pipe with stainless electrode and helps to minimize spatter for certain electrodes and procedures. Only displayed when set to a non-zero value.

Burnback Time – Adjustable time delay between turning off the wire feed and turning off the arc. Burnback helps to prevent wire sticking to the puddle. The burnback feature will allow current to flow for a specified time period at the end of a weld after wire feeding has stopped.

Cold Feed – Method for feeding wire without the contactor or gas valve being energized.

Crater Time – Controls the WFS and voltage for a specified time at the end of the weld after the trigger is released. During the Crater time, the machine will ramp from the Weld Procedure to the Crater Procedure.

FCAW – Weld process that uses gas shielded wire.

Gas Purge – Turns on the gas solenoid for as long as the gas purge switch is held.

Gas Type – Shielding gases that can be used: Argon, CO_2, 98 Ar / 2 CO_2, 90 Ar / 10 CO_2, 85 Ar / 15 CO_2, 80 Ar / 20 CO_2, 75 Ar / 25 CO_2.

HF – TIG starting method. HF turns on to help start the arc when output is enabled. HF start is used when a non-contact arc start method is required.

Hot Start – Increases output current during the start of welding, helps ignite the arc quickly and reliably. Only displayed when set to a non-zero value.

MIG – Weld process that has three different modes: CV, STT, and Pulse.

Pinch – Controls the arc characteristics when short-arc welding.

Postflow – Time that the shielding gas continues to flow after the arc has been terminated. Only displayed when set to a non-zero value.

Preflow Time – Adjusts the time that shielding gas flows before the welding output turns on.

Process – Selection of MIG, FCAW, TIG or Stick.

Run-In – Allows adjusting the wire feed speed prior to the arc being established. A low run-in speed permits smooth arc starts. After the arc is established the run-in value is inactive and the set wire feed speed is present. The run-in option is available in MIG and FCAW modes.

Start Time – Controls the WFS and voltage for a specified time at the end of the weld after the trigger is released. During the Crater time, the machine will ramp from the Weld Procedure to the Crater Procedure.

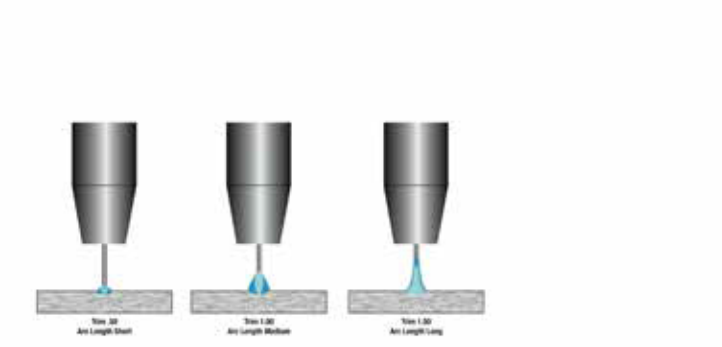
Stick – SMAW weld process, uses either a soft 7018 or crisp 6010 electrode.

Synergic – Use of pre-programmed parameters to determine the needed settings at a specific wire feed speed.

TIG – GTAW weld process, uses either HF or Touch Start weld mode to begin welding.

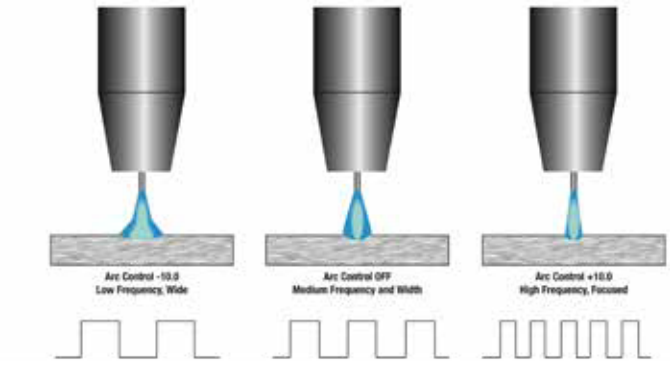
Trim – Adjusts the arc length.

FIGURE B.1



Ultimarc – Ultimarc regulate the focus or shape of the arc. Values greater than 0.0 increase the pulse frequency while decreasing the background current, resulting in a tight, stiff arc best for high speed sheet metal welding. Values less than 0.0 decrease the pulse frequency while increasing the background current, for a soft arc good for out-of-position welding. The MIG mode will determine if Ultimarc is used.

FIGURE B.2



Wire Diameter – Selection of wire size for MIG and FCAW processes.

Wire Type – Selection of wire materials for MIG processes.

POWER-UP SEQUENCE

When the PipeFab™ is powered up, it can take as long as 60 seconds for the machine to be ready to weld. During this time period the user interface will not be active.

DUTY CYCLE

The duty cycle is based on a ten-minute period. A 40% duty cycle represents 4 minutes of welding and 6 minutes of idling in a ten-minute period. Refer to the technical specification section for the PipeFab's duty cycle ratings.

MAKING A WELD

The serviceability of a product or structure utilizing the welding programs is and must be the sole responsibility of the builder/user. Many variables beyond the control of The Lincoln Electric Company affect the results obtained in applying these programs. These variables include, but are not limited to, welding procedure, plate chemistry and temperature, weldment design, fabrication methods and service requirements. The available range of a welding program may not be suitable for all applications, and the builder/user is and must be solely responsible for welding program selection.

Choose the electrode material, electrode size, shielding gas, and process (GMAW, GMAW-P etc.) appropriate for the material to be welded.

Select the weld mode that best matches the desired welding process. The standard weld set shipped with the PipeFab™ encompasses a wide range of common processes that will meet most needs.

All adjustments are made through the user interface of the wire feeder.

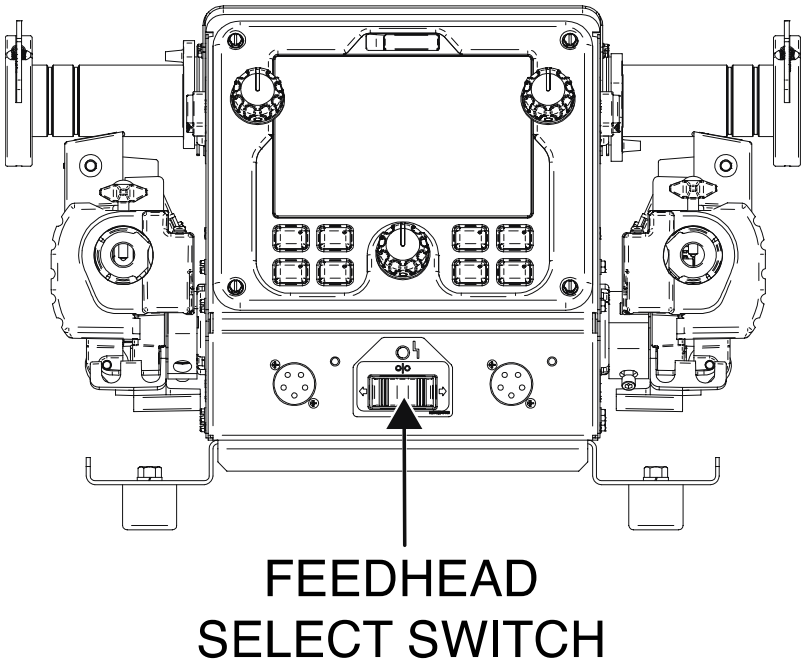
USER INTERACTIONS

WIRE DRIVE SELECTION

Pressing the Feedhead Select rocker towards the left side will activate the left wire drive while pressing the right side will activate the right wire drive. The active wire drive may also be selected by pulling the gun trigger on the left or right wire drive respectively. The green arrow on the top of either the left or right side of the user interface indicates the active wire drive.

When the active wire drive is switched, all parameters of the active drive from the last active procedure are loaded into the display.

FIGURE B.3



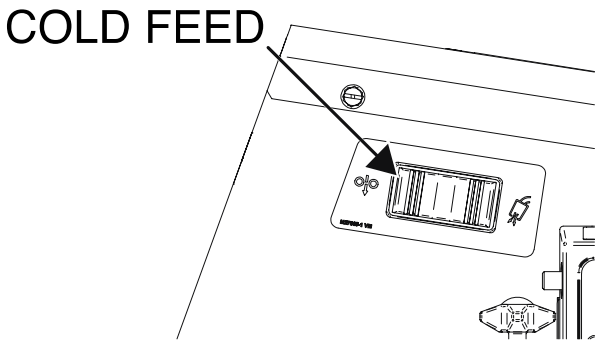
COLD FEED

Pressing the Cold Feed rocker switch feeds wire forward at the indicated speed for as long as the switch is held. When connected to the PipeFab™ Remote UI, Cold Feed may be active by the rocker switch on the side of the feeder or the rocker switch on the front of the Remote UI.

The power source output remains OFF during Cold Feeding.

To set cold feed speed, turn the left knob while holding the cold feed button.

FIGURE B.4

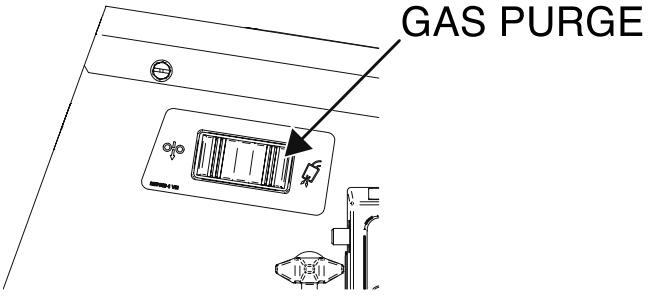


GAS PURGE

Pressing the Gas Purge rocker switch turns on the gas solenoid for as long as the gas purge switch is held. When connected to the PipeFab™ Remote UI, gas purge may be active by the rocker switch on the side of the feeder or the rocker switch on the front of the Remote UI.

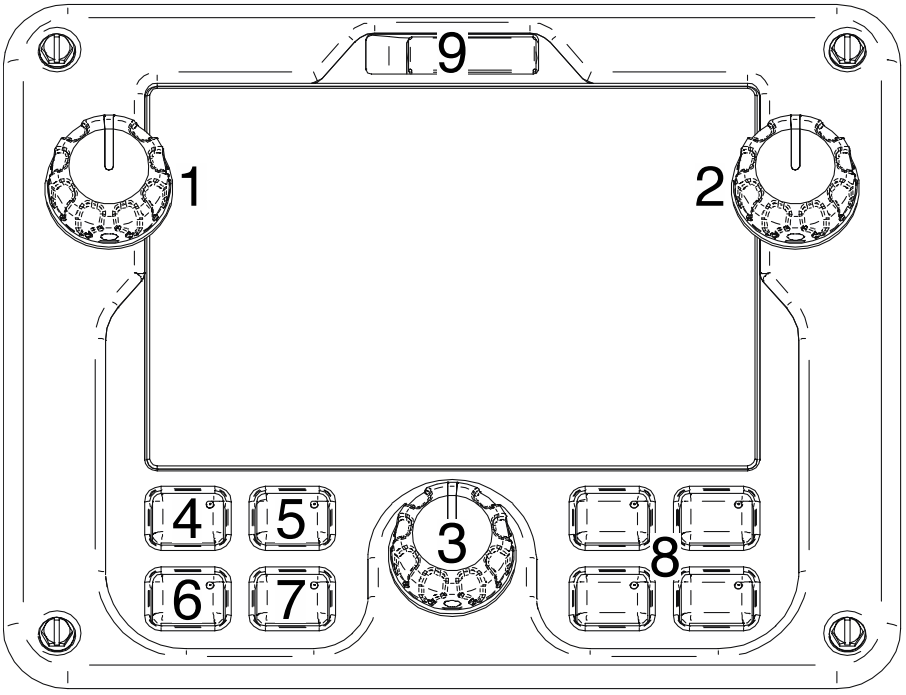
The power source output remains OFF during Gas Purge.

FIGURE B.5



USER INTERFACE LAYOUT

FIGURE B.6



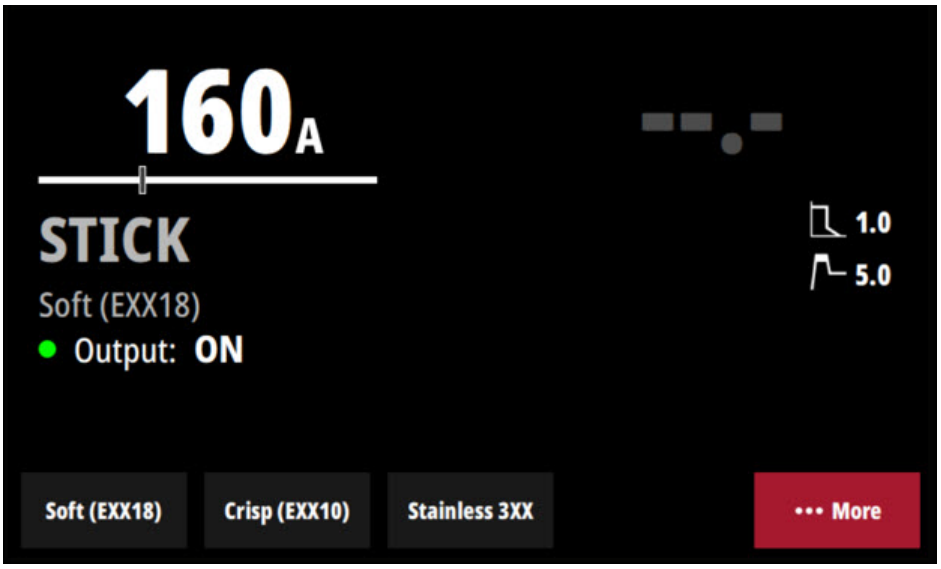
1. Process Adjustment Knob: Turn to adjust setpoint (dependent on the process).
2. Process Adjustment Knob: Turn to adjust setpoint (dependent on the process).
3. Menu Knob: Turn to scroll through the menu and press to select a highlighted option.
4. Stick Button: Press to set the system to Stick mode. This will deactivate all outputs besides the stick output.
5. TIG Button: Press to set the system to TIG mode. This will deactivate all outputs besides the TIG output.
6. MIG Button: Press to set the system to MIG mode. This will deactivate all outputs besides the MIG output.
7. FCAW Button: Press to set the system to FCAW mode. This will deactivate all outputs besides the FCAW output.
8. Memory Buttons: Memories can be saved for each welding mode. These can be accessed by touching the applicable memory button labeled one through four. To save a memory, hold the desired memory location down until the screen indicates the memory is saved.
9. USB Connector: A USB drive can be inserted to upload/download memories and update the user interface software.

USER INTERFACE NAVIGATION

NOTE: simplified home screens are used by default. To see the Home Screens as shown in the examples, set the HOME SCREEN LAYOUT to ADVANCED.

STICK HOME SCREEN

FIGURE B.7



1. Menu Bar - Use the Menu knob to scroll through the options along the bottom of the screen. Press the knob to select the highlighted option.
2. Current Setting-sets the desired current, use the left knob to adjust. Enter the More Settings to adjust the allowable ranges to be set by a remote.
3. Electrode Type Selection – XX10, XX18.
4. Arc Force – Enter the More Settings to adjust the value. Only displayed when set to a non-zero value.
5. Hot Start – Enter the More Settings to adjust the value. Only displayed when set to a non-zero value.
6. Output Indicator (Note: Output is “ON” at all times in Stick process).

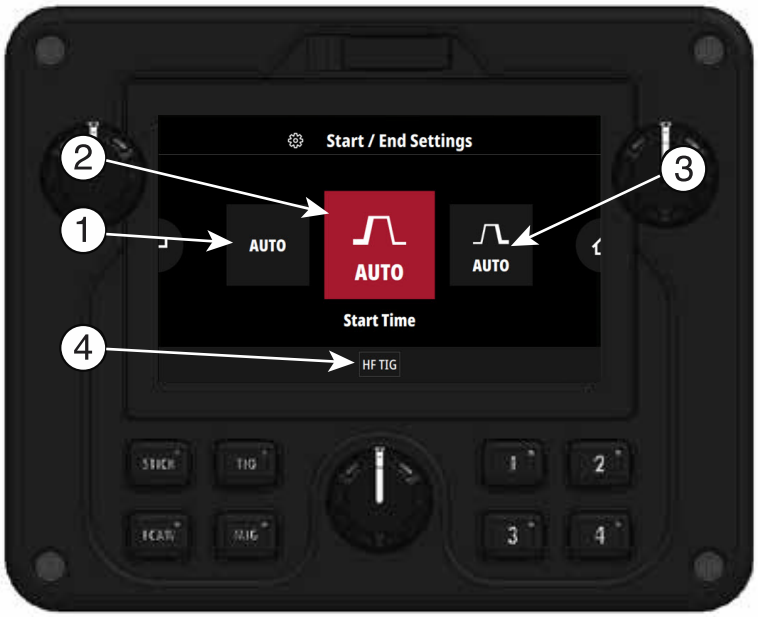
TIG HOME SCREEN

FIGURE B.8

1. Menu Bar - Use the Menu knob to scroll through the options along the bottom of the screen. Press the knob to select the highlighted option.
2. Current Setting - Sets the desired current, use left knob to adjust.
3. Start Type Selection – Touch Start, HF.
4. Post-Flow Time – Time that the shielding gas continues to flow after the arc has been terminated. Only displayed when set to a non-zero value.
5. Pre-Flow Time - Time that the shielding gas continues to flow before the arc has been started. Only displayed when set to a non-zero value.
6. Output Indicator – Output will be on in Touch Start mode without a remote. Output will be off until triggered when a remote is connected. NOTE: HF mode requires a remote to be connected.

TIG START/END SETTINGS

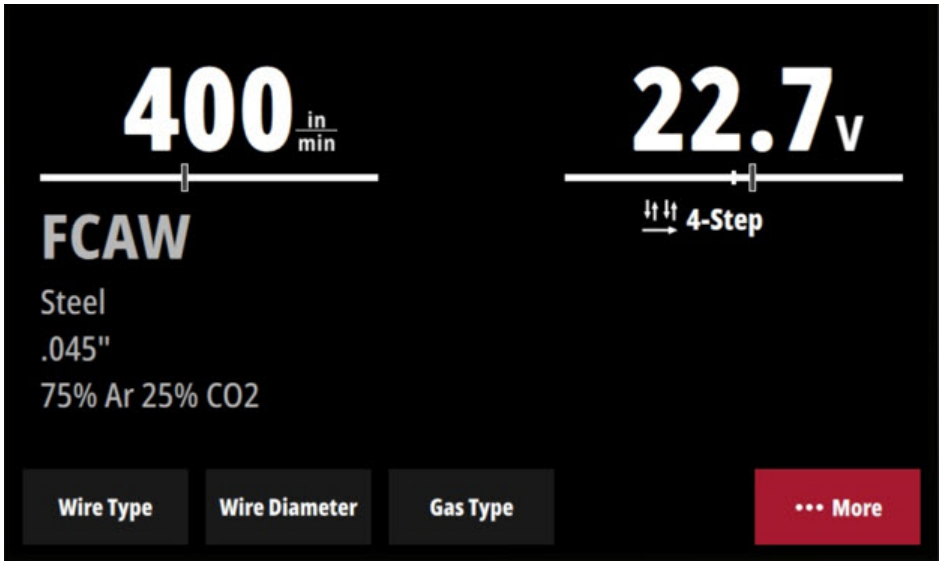
FIGURE B.9



1. Set all to Auto – Start/End settings are set to “auto” by default. These settings are programmed based on process and setpoint to provide ideal welding.
2. Start Time – Controls the voltage for a specified time at the beginning of the weld. During that time, the machine will ramp from the Start Procedure to the Welding Procedure.
3. Crater Time – Controls the voltage for a specified time at the end of the weld after the trigger is released. During the Crater time, the machine will ramp from the Weld Procedure to the Crater Procedure. .
4. Current Settings.

FCAW HOME SCREEN

FIGURE B.10

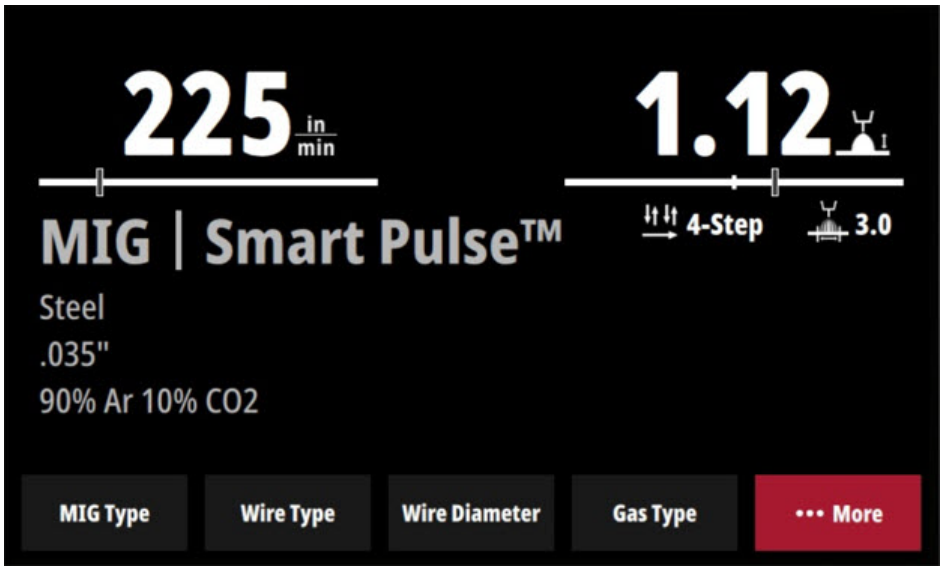


1. Feedhead Indicator – Shows which side of the wire feeder is selected and ready for setup. The active side can be selected by pressing the Feedhead Select Switch, Cold Feed Switch, or the gun trigger for the desired side.
2. Menu Bar - Use the Menu knob to scroll through the options along the bottom of the screen. Press the knob to select the highlighted option.
3. Wire Feed Speed Setting - Sets the desired wire feed speed, use left knob to adjust.
4. Voltage Setting - Sets the voltage, use right knob to adjust.
5. Wire Diameter Selection
6. Gas Type Selection
7. 2-Step/4-Step Trigger Interlock - Toggles between 2-Step and 4-Step Trigger Interlock. 2-Step provides weld power and feeds wire only when the trigger is depressed. 4-Step eliminates the need to hold the trigger while welding. It operates in 4 steps:
    1. Close trigger and establish welding arc.
    2. Release trigger and continue welding.
    3. Reclose trigger near end of weld.
    4. Release trigger again to stop welding.

    NOTE: No symbol will be shown if 2-Step mode is active.

MIG HOME SCREEN

FIGURE B.11

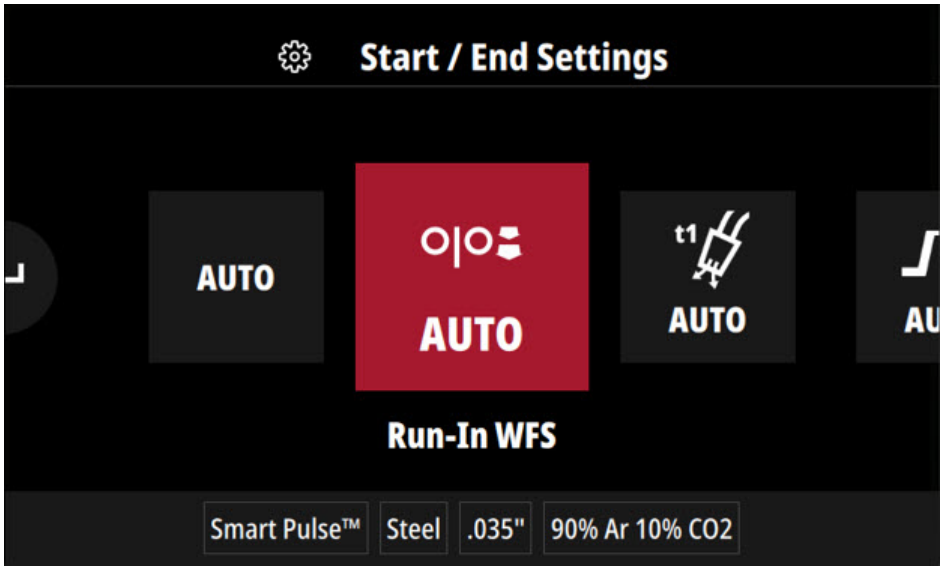


1. Feedhead Indicator – Shows which side of the wire feeder is selected and ready for setup. The active side can be selected by pressing the Feedhead Select Switch, Cold Feed Switch, or the gun trigger for the desired side.
2. Menu Bar - Use the Menu knob to scroll through the options along the bottom of the screen. Press the knob to select the highlighted option.
3. Wire Feed Speed Setting - Sets the desired wire feed speed, use left knob to adjust.
4. Voltage/Trim Setting - Sets the voltage or trim, use right knob to adjust.
5. MIG Mode Selection.
6. Wire Type Selection.
7. Wire Diameter Selection.
8. Gas Type Selection.
9. 2-Step/4-Step Trigger Interlock - Toggles between 2-Step and 4-Step Trigger Interlock. 2-Step provides weld power and feeds wire only when the trigger is depressed. 4-Step eliminates the need to hold the trigger while welding. It operates in 4 steps:
    1. Close trigger and establish welding arc.
    2. Release trigger and continue welding.
    3. Reclose trigger near end of weld.
    4. Release trigger again to stop welding.

    NOTE: No symbol will be shown if 2-Step mode is active.
10. Ultimarc/Pinch – Ultimarc and Pinch regulate the focus or shape of the arc. Values greater than 0.0 increase the pulse frequency while decreasing the background current, resulting in a tight, stiff arc best for high speed sheet metal welding. Values less than 0.0 decrease the pulse frequency while increasing the background current, for a soft arc good for out-of-position welding. The MIG mode will determine if Ultimarc is used or Pinch.
11. Synergic Voltage Indicator – Nominal voltage is shown. Lowering the voltage below nominal will move the bar to the left. Raising the voltage above nominal will move the bar to the right.

FCAW/MIG START/END SETTINGS

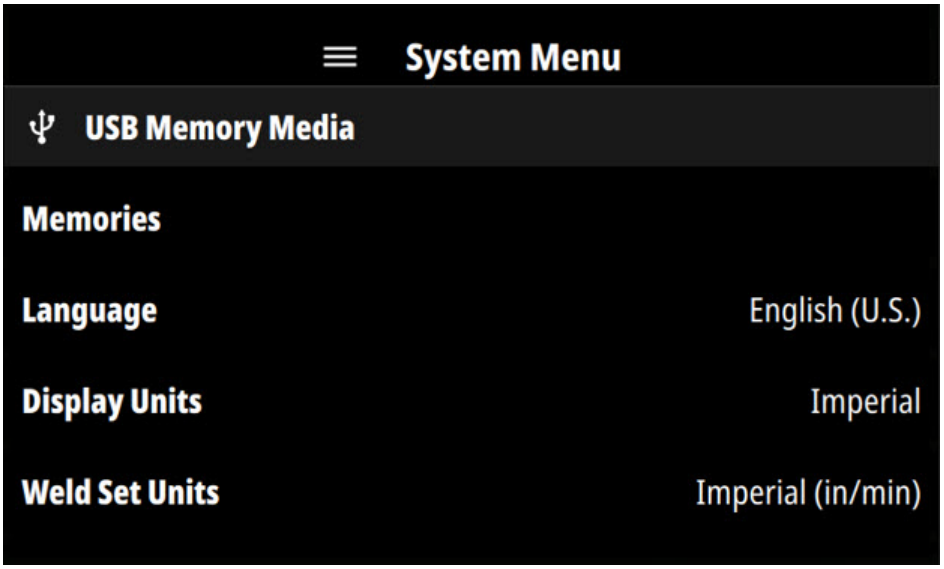
FIGURE B.12



1. Set all to Auto – Start/End settings are set to “auto” by default. These settings are programmed based on process and setpoint to provide ideal welding. The settings may be adjusted if desired.
2. Run-In – Allows adjusting the wire feed speed prior to the arc being established. A low run-in speed permits smooth arc starts. After the arc is speed will change from run-in to welding wire feed speed. The run-in option is available in MIG and FCAW modes.
3. Pre-Flow Time - Adjusts the time that shielding gas flows before the welding output turns on.
4. Start Time – Controls the WFS and Volts for a specified time at the beginning of the weld. During the start time, the machine will ramp from the Start Procedure to the preset Welding Procedure.
5. Crater Time – Controls the WFS and voltage for a specified time at the end of the weld after the trigger is released. During the Crater time, the machine will ramp from the Weld Procedure to the Crater Procedure.
6. Burnback Time – Adjustable time delay between turning off the wire feed and turning off the arc. Burnback helps to prevent wire sticking to the puddle. The burnback feature will allow current to flow for a specified time period at the end of a weld after wire feeding has stopped.
7. Post Flow Time - Adjusts the time that shielding gas flows after the welding output turns off.
8. Current Settings

SYSTEM MENU

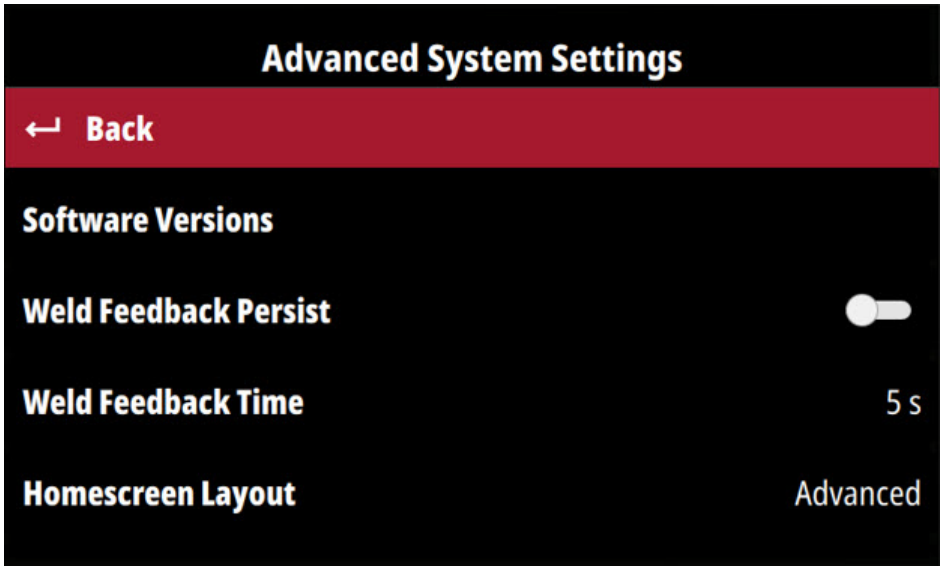
FIGURE B.13

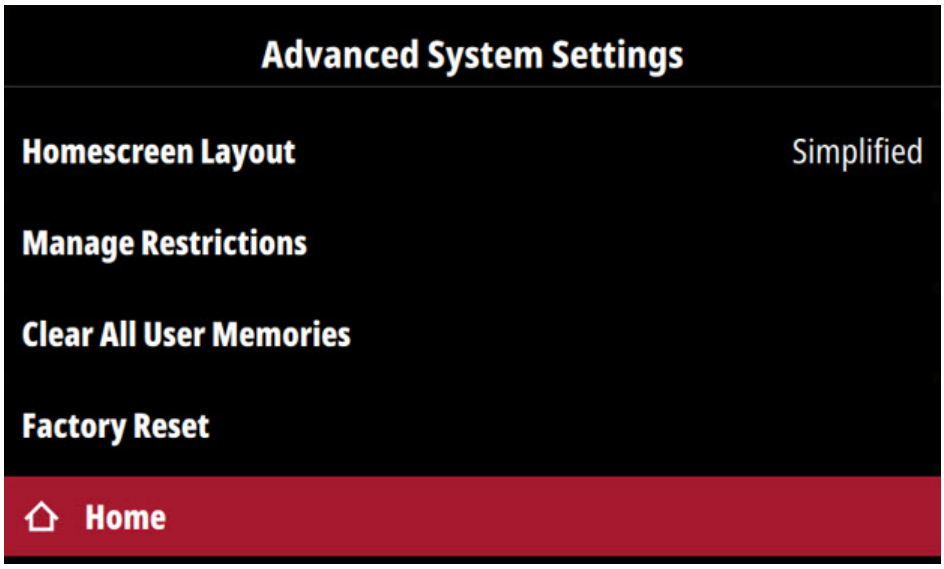


1. USB Memory Media Connected.
2. Memories – View the saved memories for each process.
3. Language – Language of the text present in the user interface.
4. Display Units – Selects the units to display wire feed speed, metric or imperial.
5. Water Cooler Operation – Determines when the optional K3737-1 PipeFab™ Cooler will run (not pictured).
6. Advanced System Settings (not pictured)
   NOTE: System Menu can only be accessed through the More Options menu.
7. Weld Set Units – Changes the weld set in use to be optimized for Imperial or metric units. Machine reset is required for this change to take effect. MIG and FCAW memories will be deleted when changing this setting.

ADVANCED SYSTEM SETTINGS

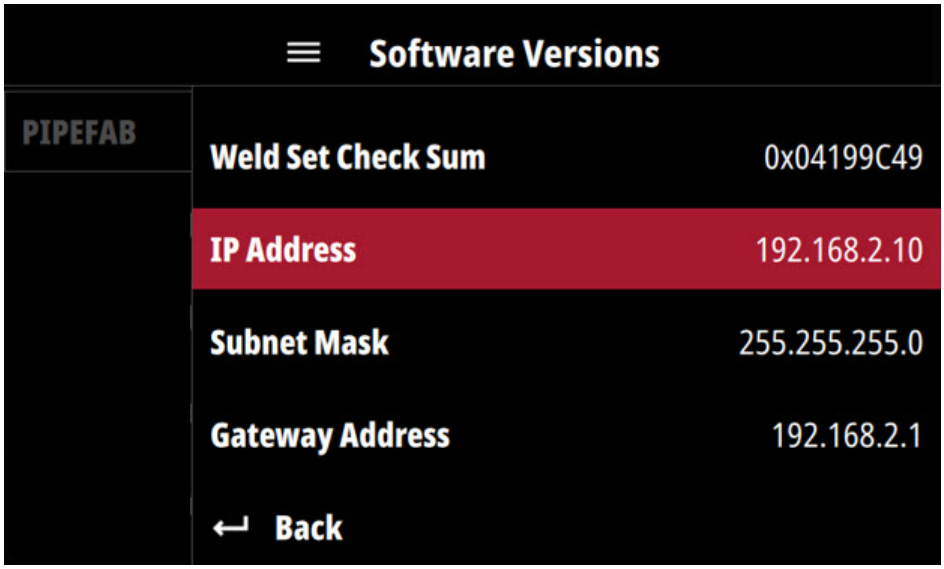
FIGURE B.14





1. Software Versions – Allows access to a list of software components grouped by system component. Also lists the IP address of the Ethernet port. See Figure B.15 on page B-18.

FIGURE B.15



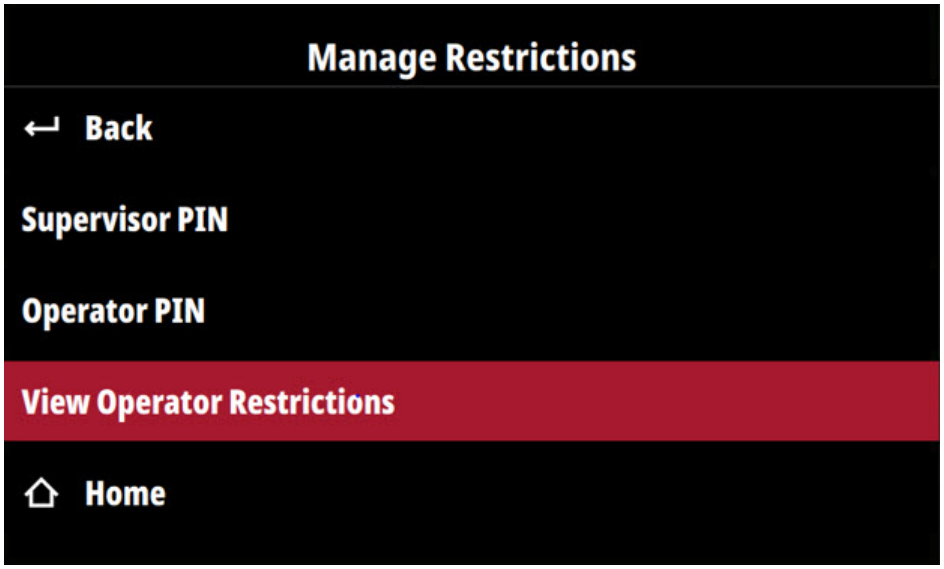
2. Weld Feedback Persist – When Weld Feedback Persist controls how long the actual welding voltage and current are displayed after completion of a weld. When Weld Feedback Persist is ON the actual welding voltage and current will remain on the display until the center knob on the display is turned or until the next weld starts. Weld Feedback Time is inactive when Weld Feedback Persist is ON.

When Weld Feedback Persist is OFF the actual welding voltage and current will be displayed for the time specified in Weld Feedback Time or until the next weld starts.

3. Home Screen – Choose between Simplified (default) or Advanced. The Advanced Home Screen shows more details of parameters set by the user.
4. Manage Restrictions – Allows the user to create, set, or enter a Supervisor PIN, Operator PIN, and to view and change the Operator Restrictions. Enter the correct Supervisor PIN to enter the Supervisor Menu where the user can “Edit Operator Restrictions”.

If a supervisor becomes locked out of a machine because of a forgotten PIN number, PowerWave Manager can be used to unlock the machine and generate a new Supervisor PIN.

FIGURE B.16



Operator Restrictions

System Menu – OFF/ON, restricts changes to the System Menu.
Wave Controls – OFF/ON, restricts changes to Wave Controls (i.e. Pinch, Arc Force, Ultimarc).
Start/End Settings – OFF/ON, restricts changes to Start/End Settings.
Remote Range – OFF/ON, restricts changes to the Remote Range.
Trigger Interlock – OFF/ON, restricts changes to 2-step/4-step settings.

Memory Only Mode – OFF/ON. Restricts the operator to only use processes and parameters stored in Memories. In Memory Only Mode, if no memory exists for a given process, that process button is disabled when using the associated side of the feeder. For example, if Memory Only Mode is ON and no memories are configured for a FCAW process on the left feeder, the machine cannot be put in FCAW mode when the left feeder is active.

Memory Modifications – Memory modifications can be ENABLED, so parameters can be resaved within the full range allowed by the machine. They can be DISABLED, so parameter cannot be resaved at all, or they can be resaved WITHIN LIMITS, to allow fine tuning within preset limits.

SIMPLIFIED HOME SCREEN

FIGURE B.17

1. Feedhead Indicator – Shows which side of the wire feeder is selected and ready for setup. The active side can be selected by pressing the Feedhead Select Switch, Cold Feed Switch, or the gun trigger for the desired side.
2. Menu Bar - Use the Menu knob to scroll through the options along the bottom of the screen. Press the knob to select the highlighted option.
3. Wire Feed Speed Setting - Sets the desired wire feed speed, use the left knob to adjust.
4. Voltage Setting - Sets the voltage, use the right knob to adjust.
5. Wire Type Selection.
6. Wire Diameter Selection.
7. Gas Type Selection.
8. Synergic Voltage Indicator – Nominal voltage is shown. Lowering the voltage below nominal will move the bar to the left. Raising the voltage above nominal will move the bar to the right.
   NOTE: In Simplified mode, advanced settings will not appear on the home screen even when set to a non-zero value.

MORE SETTINGS MENU (ALL PROCESSES)

FIGURE B.18

1. Advanced settings will appear here. Each weld process will have different settings. The most common advanced settings are: Pinch, Arc Force, Hot Start, Pre-Flow Time, Post-Flow Time, 2-Step/4-Step Trigger, and Ultimarc. Advanced settings will only be displayed when set to a non-zero value.

PREVIOUS SETTING INDICATOR

FIGURE B.19

1. Current Setting.
2. Previous Setting Indicator – The dotted line will indicate where on the bar the most recent setting was.
3. Current Setting Indicator – Increasing the value will move the bar to the right, decreasing the value will move the bar to the left.

WELDING SCREEN

FIGURE B.20

1. Output Active.
2. Feedhead Indicator – MIG and FCAW modes only.
3. Actual Current.
4. Actual Voltage.
5. Current Weld Settings.

BACK/HOME BUTTONS

FIGURE B.21

1. Back Button - Selecting the back button takes the system back one screen.
2. Home Button – Selecting the home button takes the system back to the home screen.

MEMORY OPERATION

FIGURE B.22

Memories can be saved for each welding process. These can be accessed by touching the applicable memory button labeled one through four.

To save a memory, hold the desired memory location down until the screen indicates the memory is saved.

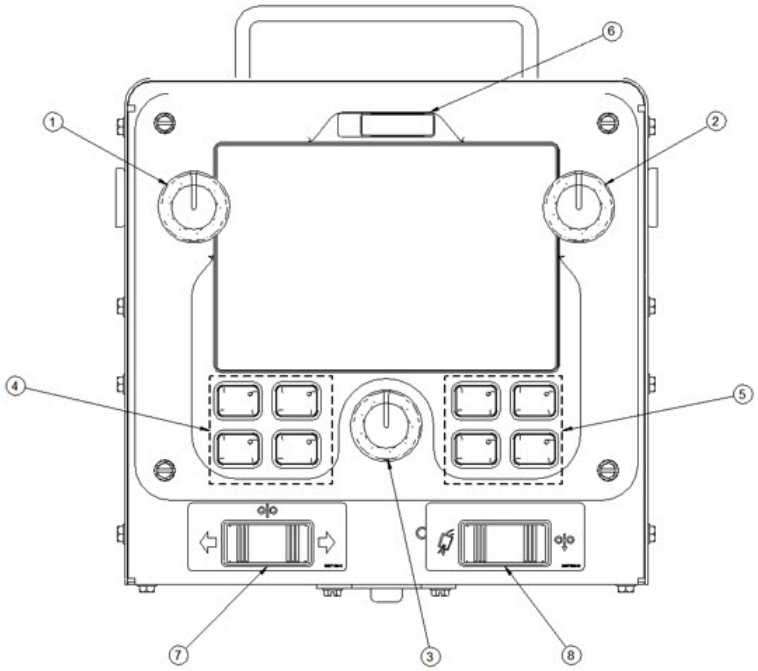
When one memory is selected the LED will be lit, if any settings are changed the LED will go out. If the memory button is pressed again, the settings will revert to the settings saved in the memory.

Four memories each can be saved in the Stick process, TIG process, MIG Left Feedhead, MIG Right Feedhead, FCAW Left Feedhead, and FCAW Right Feedhead.

Memory usage with remotes – If a TIG process is saved with a remote control connected, the remote control must be connected for the memory to be functional. If Memory Only Mode is not enabled, a warning will appear and can be bypassed.

FRONT PANEL CONTROLS OF REMOTE UI

FIGURE B.23



1. Process Adjustment Knob: Turn to adjust setpoint (dependent on the process).

2. Process Adjustment Knob: Turn to adjust setpoint (dependent on the process).

3. Menu Knob: Turn to scroll through the menu and press to select a highlighted option.

4. Process Buttons: Press to select the welding process type (Stick, TIG, MIG, FCAW)

5. Memory Buttons: Memories can be saved for each process type. These can be accessed by touching the applicable memory button labeled one through four. To save a memory, hold the desired memory location down until the screen indicates the memory is saved. The remote UI has its own set of memories. These are not shared with the memories stored in the wire feeder UI.

6. USB Connector: A USB drive can be inserted to upload/download memories and update the user interface software.

7. Feedhead Select Switch: Allows user to select left or right feedhead to be active. A feedhead can also be activated by closing a gun trigger.

8. Cold Feed/Gas Purge Switch: Cold feed will feed wire on the active feedhead when pressed. Gas purge will activate the gas solenoid on the active feedhead when pressed.

USER INTERFACE PROGRAMMING

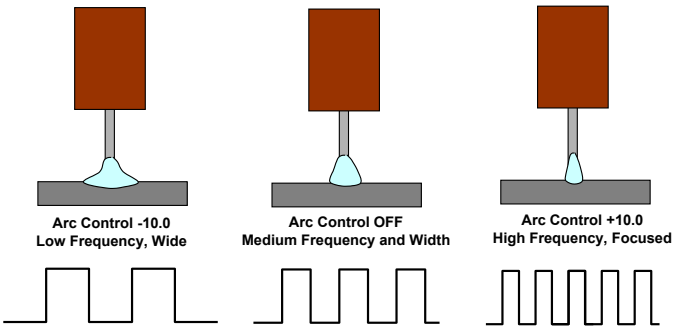
- Connect the 5-pin control cable from the wire feeder to the 5-pin connector on the PipeFab™ power source.
- Turn on the power to the wire feeder and wait for the initialization sequence to complete.
- Insert the USB stick into the USB port on the user interface.
- A message will appear asking if you want to perform a Display Software Update. Turn the center knob to highlight “Yes” in red. Press the center knob to start the update.
- Once a message appears stating display updated successfully, the unit will restart and return to a typical welding screen.
- Remove the USB stick from the USB port.

New user interface software can be found at powerwavesoftware.com.

WAVE CONTROL

TABLE B.2

PROCESS	WAVE CONTROL NAME	EFFECT / RANGE	DESCRIPTION
STICK	ARC FORCE	SOFT (-10.0) TO CRISP (10.0)	ARC FORCE ADJUSTS THE SHORT CIRCUIT CURRENT FOR A SOFT ARC, OR FOR A FORCEFUL, DRIVING ARC. IT HELPS TO PREVENT STICKING AND SHORTING OF ORGANIC COATED ELECTRODES, PARTICULARITY GLOBULAR TRANSFER TYPES SUCH AS STAINLESS AND LOW HYDROGEN. ARC FORCE IS ESPECIALLY EFFECTIVE FOR ROOT PASS ON PIPE WITH STAINLESS ELECTRODE AND HELPS TO MINIMIZE SPATTER FOR CERTAIN ELECTRODES AND PROCEDURE AS WITH LOW HYDROGEN, ETC.
MIG AND FCAW	PINCH	SOFT (-10.0) TO CRISP (10.0)	PINCH CONTROLS THE ARC CHARACTERISTICS WHEN SHORT-ARC WELDING.

PROCESS	WAVE CONTROL NAME	EFFECT / RANGE	DESCRIPTION
MIG	ULTIMARC	SOFT (-10.0) TO STIFF (10.0)	ULTIMARC REGULATES THE FOCUS OR SHAPE OF THE ARC. ULTIMARC VALUES GREATER THAN 0.0 INCREASE THE PULSE FREQUENCY WHILE DECREASING THE BACKGROUND CURRENT, RESULTING IN A TIGHT, STIFF ARC BEST FOR HIGH SPEED SHEET METAL WELDING. ULTIMARC VALUES LESS THAN 0.0 DECREASE THE PULSE FREQUENCY WHILE INCREASING THE BACKGROUND CURRENT, FOR A SOFT ARC GOOD FOR OUT-OF-POSITION WELDING. 
TIG	NO WAVE CONTROLS AVAILABLE .	---	---

TRIGGER SELECTION

2-STEP TRIGGER

2-Step Trigger controls the welding sequence in direct response to the trigger. When the gun trigger is pulled, the welding system (power source and wire feeder) 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.

Example 1: 2-Step Trigger: Simple operation.

The simplest trigger operation occurs with a 2-Step trigger and Start and Crater set to OFF.

For this sequence,

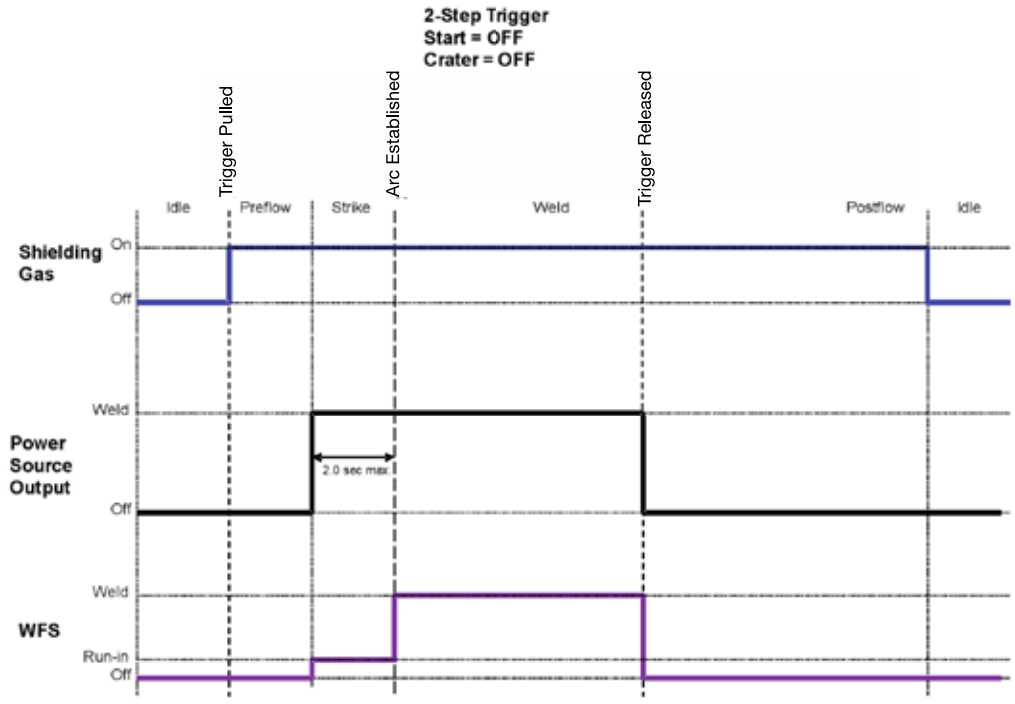
PREFLOW: Shielding gas begins to flow immediately when the gun trigger is pulled.

RUN-IN: After preflow time expires, the power source regulates to the welding output and wire is advanced towards the work piece at the Run-In WFS. If an arc is not established within 2.0 seconds, the wire feed speed will jump to the welding wire feed speed.

WELD: The power source output and the wire feed speed continue at the weld settings for as long as the trigger is pulled.

POSTFLOW: As soon as the trigger is released, the power source output and the wire feed speed are turned OFF. Shielding gas continues until the post flow timer expires.

FIGURE B.24



Example 2: 2-Step Trigger: Improved Arc Start and Arc End.

Tailoring the arc start and arc end is a common method for reducing spatter and improving weld quality. This can be accomplished with the Start and Burnback functions set to a desired values and Crater set to OFF.

For this sequence,

PREFLOW: Shielding gas begins to flow immediately when the gun trigger is pulled.

RUN-IN: After preflow time expires, the power source regulates to the start output and wire is advanced towards the work piece at the Run-In WFS. If an arc is not established within 2.0 seconds, the power source output and wire feed speed skips to the weld settings.

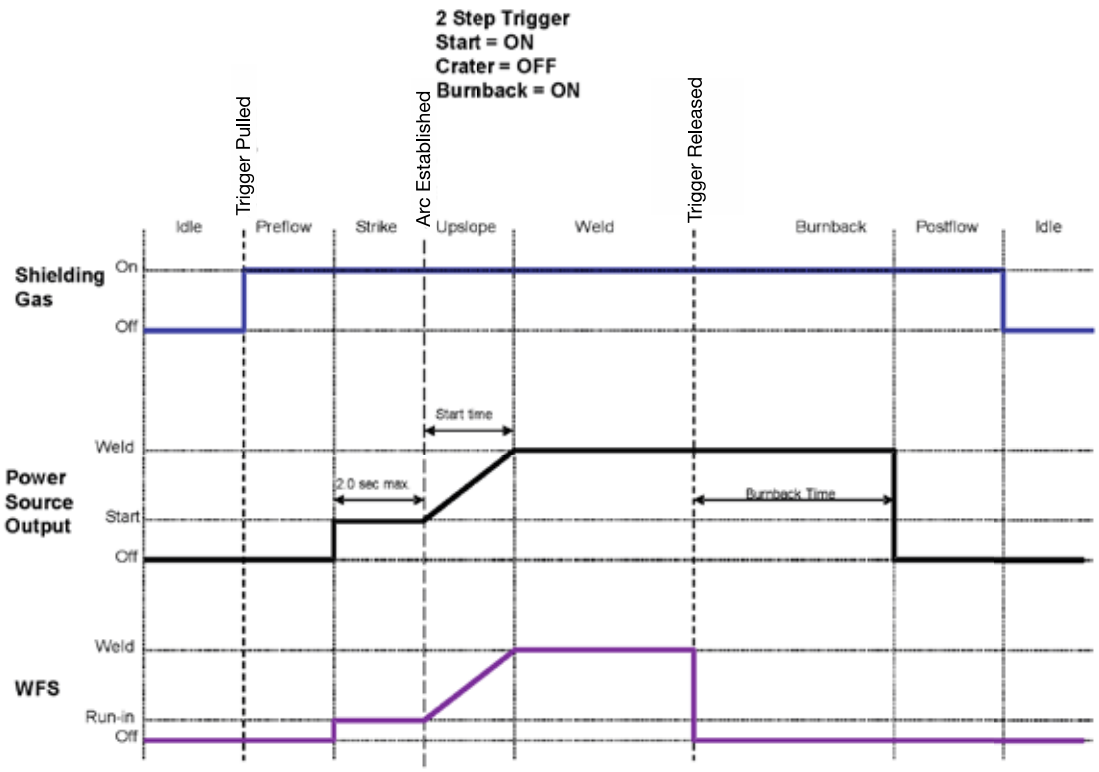
START: Once the wire touches the work and an arc is established, both the machine output and the wire feed speed ramp to the weld settings throughout the start time. The time period of ramping from the start settings to the weld settings is called UPSLOPE.

WELD: After upslope, the power source output and the wire feed speed continue at the weld settings.

BURNBACK: As soon as the trigger is released, the wire feed speed is turned OFF and the machine output continues for the burnback time.

POSTFLOW: Next, the machine output is turned OFF and shielding gas continues until the post flow timer expires.

FIGURE B.25



Example 3: 2-Step Trigger: Customized Arc Start, Crater and Arc End.

For this sequence,

PREFLOW: Shielding gas begins to flow immediately when the gun trigger is pulled.

RUN-IN: After preflow time expires, the power source regulates to the start output and wire is advanced towards the work piece at the Run-In WFS. If an arc is not established within 2.0 seconds, the power source output and wire feed speed skips to the weld settings.

START & UPSLOPE: Once the wire touches the work and an arc is established, both the machine output and the wire feed speed ramp to the weld settings throughout the start time. The time period of ramping from the start settings to the weld settings is called UPSLOPE.

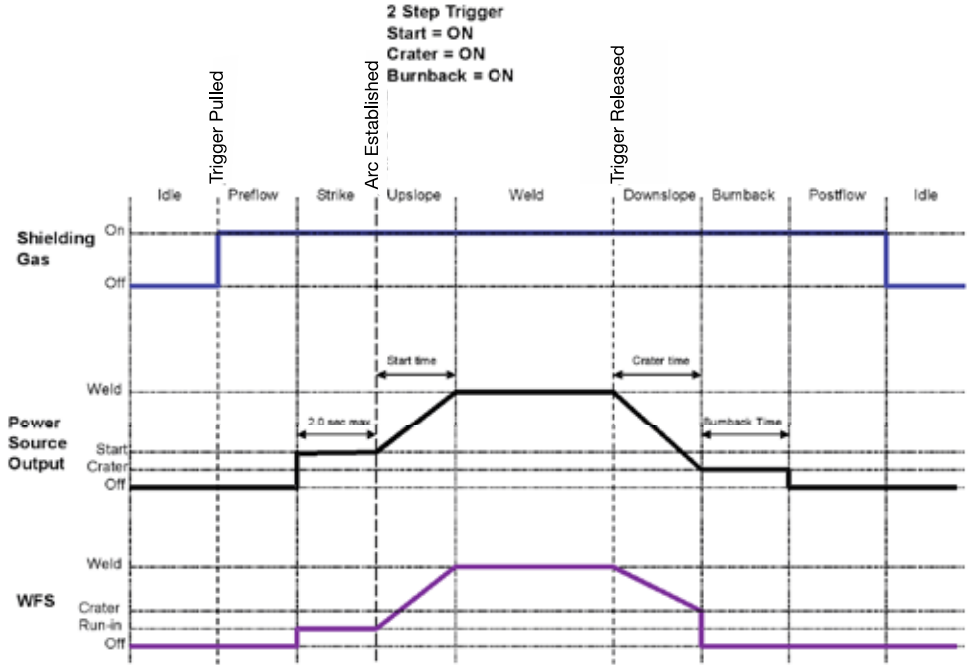
WELD: After upslope, the power source output and the wire feed speed continue at the weld settings.

CRATER & DOWNSLOPE: As soon as the trigger is released, the wire feed speed and power source output ramp to the crater settings throughout the crater time. The time period of ramping from the weld settings to the crater settings is called DOWNSLOPE.

BURNBACK: After the crater time expires, the wire feed speed is turned OFF and the machine output continues for the burnback time.

POSTFLOW: Next, the machine output is turned OFF and shielding gas continues until the post flow timer expires.

FIGURE B.26



2-STEP TRIGGER: SPECIAL CONSIDERATIONS

The weld sequence response depends upon when the trigger is pulled and released and whether or not START or CRATER are active.

An example sequence:

Pull the trigger to start feed of wire. When arc is established the sequencer will begin START/UPSLOPE. If trigger is released during UPSLOPE and CRATER/DOWNSLOPE is active, the machine will begin CRATER/DOWNSLOPE and sloping down over the CRATER time, regardless of when the trigger release occurred.

If the CRATER is disabled and the trigger is released during START/UPSLOPE, the sequencer will move to the BURNBACK state to end the weld.

4-STEP TRIGGER

4-step trigger allows the operator to release the trigger once an arc has been established. To end the weld, the trigger is pulled and then released again.

Two types of 4-Step Trigger are available. Use the set-up menu to select the desired type of operation.

With current interlock, if the arc goes out for more than 0.5 seconds while the trigger is released, the welding process stops and goes to the idle state.

Without the current interlock, if the arc goes out while the trigger is released, output to the power source remains on and the wire feeder will continue to feed wire.

Example 1: 4-Step Trigger: Trigger Interlock.

The 4-Step trigger can be configured as a trigger interlock. Trigger interlock adds to the welder's comfort when making long welds by allowing the trigger to be released after an initial trigger pull. Welding stops when the trigger is pulled a second time and then released, or if the arc is interrupted. For this sequence,

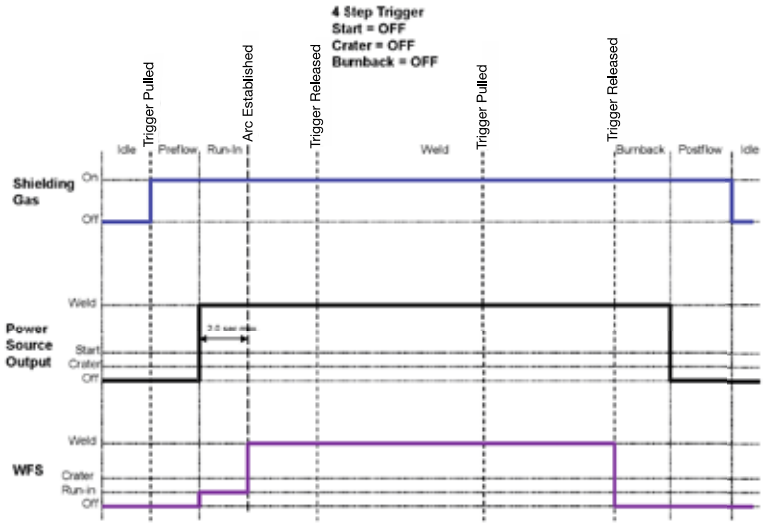
PREFLOW: Shielding gas begins to flow immediately when the gun trigger is pulled.

RUN-IN: After preflow time expires, the power source regulates to the welding output and wire is advanced towards the work piece at the Run-In WFS. If an arc is not established within 1.5 seconds, the wire feed speed will jump to the welding wire feed speed.

WELD: The power source output and the wire feed speed continue at the weld settings. The trigger is released and welding continues. Welding continues when the trigger is pulled a second time.

POSTFLOW: As soon as the trigger is released for the second time, the power source output and the wire feed speed are turned OFF. Shielding gas flows until the post flow timer expires.

FIGURE B.27



Example 2: 4-Step Trigger: Manual Control of Start and Crater times with Burnback ON.

The 4-Step trigger sequence gives the most flexibility when the Start, Crater and Burnback functions are active. With 4-Step trigger, the welder chooses the amount of time to weld at the Start, Weld and Crater settings by using the gun trigger. Burnback reduces the occurrence of wire to sticking into the weld pool at the end of a weld and conditions the end of the wire for the next arc start.

In this sequence,
PREFLOW: Shielding gas begins to flow immediately when the gun trigger is pulled.

RUN-IN: After preflow time expires, the power source regulates to the start output and wire is advanced towards the work piece at the run-in WFS. If an arc is not established within 2.0 seconds, the power source output and wire feed speed skips to the weld settings.

START: The power source welds at the start WFS and voltage until the trigger is released.

UPSLOPE: During upslope, the power source output and the wire feed speed ramp to the weld settings throughout the start time. The time period of ramping from the start settings to the weld settings is called UPSLOPE. If the trigger is pulled before upslope is complete, WELD is skipped and the sequence jumps to DOWNSLOPE.

WELD: After upslope, the power source output and the wire feed speed continue at the weld settings.

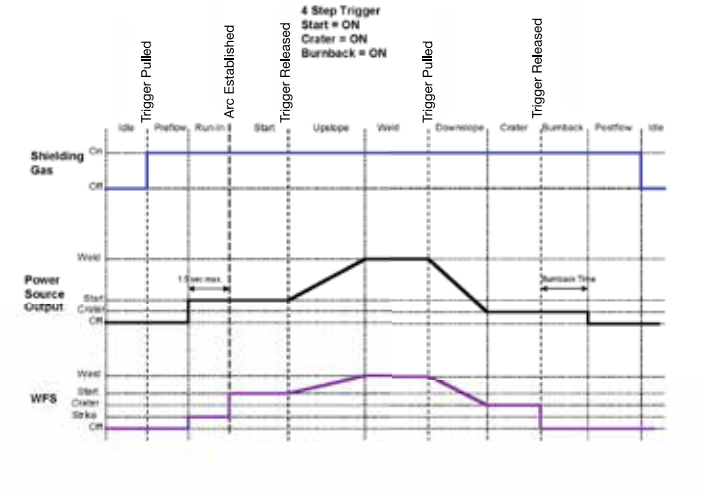
DOWNSLOPE: As soon as the trigger is pulled, the wire feed speed and power source output ramp to the crater settings throughout the crater time. The time period of ramping from the weld settings to the crater settings is called DOWNSLOPE.

CRATER: During CRATER, the power source continues to supply output at the crater WFS and voltage.

BURNBACK: When the trigger is released, the wire feed speed is turned OFF and the machine output continues for the burnback time.

POSTFLOW: Next, the machine output is turned OFF and shielding gas continues until the post flow timer expires.

FIGURE B.28



4-STEP TRIGGER: SPECIAL CONSIDERATIONS

The response to the trigger with 4-step trigger active is dependent upon when the trigger is pulled/released and the settings for START and CRATER.

Example 1:

Pull the trigger to start feed of wire. When arc is established the sequencer will remain in START until the trigger is released. When the trigger is released, UPSLOPE begins. If trigger is pulled again during UPSLOPE and CRATER/DOWNSLOPE is active, the feeder will begin the DOWNSLOPE, sloping down over the CRATER time, regardless of when the trigger pull occurred.

If the CRATER/DOWNSLOPE state is disabled and the trigger is pulled during UPSLOPE, the sequencer will remain in the UPSLOPE state and continue with the weld. If the fourth step (trigger release) occurs during UPSLOPE, the sequencer will jump to the BURNBACK to end the weld.

Example 2:

Pull the trigger to start feed of wire. When arc is established the sequencer will remain in START until the trigger is released. When the trigger is released, UPSLOPE begins and continues into WELD when the START timer is complete. When the trigger is pulled again (step 3) and CRATER/DOWNSLOPE is active, DOWNSLOPE begins and continues until the CRATER timer expires, at which time CRATER will be entered until the trigger is released.

While in DOWNSLOPE, if the trigger is released before the timer expires, the trigger will be ignored and the DOWNSLOPE state will continue until the timer expires, at which point CRATER state will be enabled, check for trigger, and jump to BURNBACK since the trigger has been released.

While in the DOWNSLOPE state and the trigger is released and then pulled again, it will be ignored. During 4-Step operation in DOWNSLOPE, the trigger will always be ignored.

START OPTIONS

The Start Options available depend upon the process and weld mode selected.

TABLE B.3

PROCESS	START OPTION	EFFECT / RANGE	DESCRIPTION
STICK	---	---	---
ALL MIG AND FCAW	PREFLOW TIME	0 – 60.0 SECONDS	
	RUN-IN WFS	AUTO, OFF, 50-150 IN/MIN TO WELD WFS	RUN-IN SETS THE WIRE FEED SPEED FROM THE TIME THE TRIGGER IS PULLED UNTIL AN ARC IS ESTABLISHED OR 2.5 SECONDS. USE RUN-IN FOR SOFTER ARC STARTS.
	START TIME, WFS AND VOLTS	0 – 10.0 SECONDS	THE START PROCEDURE CONTROLS THE WFS AND VOLTS FOR A SPECIFIED TIME AT THE BEGINNING OF THE WELD. DURING THE START TIME, THE MACHINE WILL RAMP UP OR DOWN FROM THE START PROCEDURE TO THE PRESET WELDING PROCEDURE.
TIG	PREFLOW TIME	0 – 60.0 SECONDS	---

END OPTIONS

The End Options available depend upon the process and weld mode selected.

TABLE B.4

PROCESS	START OPTION	EFFECT / RANGE	DESCRIPTION
STICK	---	---	---
ALL MIG AND FCAW	CRATER TIME, WFS AND VOLTS	0 – 10.0 SECONDS	CRATER PROCEDURE CONTROLS THE WFS AND VOLTS FOR A SPECIFIED TIME AT THE END OF THE WELD AFTER THE TRIGGER IS RELEASED. DURING THE CRATER TIME, THE MACHINE WILL RAMP UP OR DOWN FROM THE WELD PROCEDURE TO THE CRATER PROCEDURE. CRATER IS NOT COMMONLY USED WITH STT PROCESSES.
	BURNBACK TIME	AUTO, 0 – 0.25 SECONDS	THE BURNBACK TIME IS THE AMOUNT OF TIME THAT THE WELD OUTPUT CONTINUES AFTER THE WIRE FEEDING STOPS. IT PREVENTS THE WIRE FROM STICKING IN THE PUDDLE AND PREPARES THE END OF THE WIRE FOR THE NEXT ARC START.
	POSTFLOW TIME	0 – 60.0 SECONDS	ADJUSTS THE TIME THAT SHIELDING GAS FLOWS AFTER THE WELDING OUTPUT TURNS OFF.
TIG	POSTFLOW TIME	0 – 60.0 SECONDS	ADJUSTS THE TIME THAT SHIELDING GAS FLOWS AFTER THE WELDING OUTPUT TURNS OFF.

KITS, OPTIONS AND ACCESSORIES

All Kits Options and Accessories are found on the Web site: (www.lincolnelectric.com)

FIELD INSTALLED OPTIONS

PipeFab™ Kits

TABLE C.1

K NUMBER	DESCRIPTION
K3736-1	PIPEFAB™ UNDERCARRIAGE
K3737-1	PIPEFAB™ COOLER
K3738-1	PIPEFAB™ REMOTE UI

PROCESS SPECIFIC KITS

TABLE C.2

K NUMBER	DESCRIPTION	INCLUDED/PURPOSE
	STICK OPTIONS	
K875	ACCESSORY KIT – 150 AMP	INCLUDES 20 FT. (6.1 M) #6 ELECTRODE CABLE WITH LUG, 15 FT. (4.6 M) #6 WORK CABLE WITH LUGS, HEADSHIELD, FILTER PLATE, WORK CLAMP, ELECTRODE HOLDER AND SAMPLE PACK OF MILD STEEL ELECTRODE.
K704	ACCESSORY KIT – 400 AMP	INCLUDES 35 FT. (10.7 M) 2/0 ELECTRODE CABLE WITH LUG, 30 FT. (9.1 M) 2/0 WORK CABLE WITH LUGS, HEADSHIELD, FILTER PLATE, WORK CLAMP AND ELECTRODE HOLDER.
	TIG OPTIONS	
-	PRO-TORCH™ TIG TORCHES	A FULL LINE OF AIR-COOLED AND WATER-COOLED TORCHES AVAILABLE.
K963-4	HAND AMPTROL®	PROVIDES 25 FT. (7.6 M) OF REMOTE CURRENT CONTROL FOR TIG WELDING.
K870-2	FOOT AMPTROL®	PROVIDES 25 FT. (7.6 M) OF REMOTE CURRENT CONTROL FOR TIG WELDING.

WELDING FUME EXTRACTORS

Lincoln offers a wide range of fume extraction environmental system solutions, ranging from portable systems easily wheeled around a shop to shop-wide central systems servicing many dedicated welding stations.

DRIVE ROLL AND WIRE GUIDE KITS

TABLE C.3

DRIVE ROLL KITS, STEEL WIRES		
KP1505-030S	.023 - .030” (0.6 - 0.8 MM)	INCLUDES: 4 SMOOTH V GROOVE DRIVE ROLLS AND INNER WIRE GUIDE.
KP1505-035S	.035” (0.9 MM)	
KP1505-045S	.045” (1.2 MM)	
KP1505-052S	.052” (1.4 MM)	
KP1505-1/16S	1/16” (1.6 MM)	
KP1505-1	.035, .045” (0.9, 1.2 MM)	
KP1505-2	.040” (1.0 MM)	
DRIVE ROLL KITS, CORED WIRES		
KP1505-035C	.030 - .035" (0.8 - 0.9 MM)	INCLUDES: 4 KNURLED DRIVE ROLLS AND INNER WIRE GUIDE.
KP1505-045C	.040 - .045" (1.0 - 1.2 MM)	
KP1505-052C	.052" (1.4 MM)	
KP1505-1/16C	1/16" (1.6 MM)	
DRIVE ROLL KITS, STEEL OR CORED WIRES		
KP1505-068	.068 - .072" (1.8 MM)	INCLUDES: 4 KNURLED DRIVE ROLLS AND INNER WIRE GUIDE.
KP1505-5/64	5/64" (2.0 MM)	

GUN ADAPTER KITS

TABLE C.4

K NUMBER	DESCRIPTION
K3344-1	GUN ADAPTER KIT, LINCOLN BACK-END. INCLUDES A GUIDE TUBE KIT.
KP4069-1	GUIDE TUBE KIT FOR K3344-1 LINCOLN GUN ADAPTERS.
K3345-1	GUN ADAPTER KIT, STANDARD #2-#4 BACK-END.
K3346-1	GUN ADAPTER KIT, STANDARD #5 BACK-END.
K3347-1	GUN ADAPTER KIT, MILLER BACK-END.
K3348-1	GUN ADAPTER KIT, OXO BACK-END. INCLUDES A GUIDE TUBE KIT.
KP4069-2	GUIDE TUBE KIT FOR K3348-1 OXO GUN ADAPTERS.
K3349-1	GUN ADAPTER KIT, FAST-MATE (EURO). INCLUDES A GUIDE TUBE KIT.
KP4069-3	GUIDE TUBE KIT FOR K3349-1 FASTMATE GUN ADAPTERS.

CABLE AND LEAD KITS

TABLE C.5

K NUMBER	DESCRIPTION	PURPOSE
CONTROL CABLES		
K1543-XX	CONTROL CABLE: MALE 5 PIN TO FEMALE 5 PIN ARCLINK CABLE.	CONNECTS THE USER INTERFACE TO THE WIRE DRIVE FOR BOOM SYSTEMS. CONNECTS THE WIRE DRIVE TO THE POWER SOURCE ON BENCH SYSTEMS.
K2683-XX	HEAVY DUTY CONTROL CABLE: MALE 5 PIN TO FEMALE 5 PIN ARCLINK CABLE.	CONNECTS THE USER INTERFACE TO THE WIRE DRIVE FOR BOOM SYSTEMS. CONNECTS THE WIRE DRIVE TO THE POWER SOURCE ON BENCH SYSTEMS.
SENSE LEADS		
K940-XX	WORK VOLTAGE SENSE LEAD KIT	REQUIRED TO ACCURATELY MONITOR VOLTAGE AT THE ARC
K1811-XX		
ADAPTERS		
K2909-1	12 PIN TO 6 PIN ADAPTER	-
K2910-1	12 PIN TO 7 PIN ADAPTER	
COAXIAL WELDING CABLES		
K1796-XX	AWG 1/0 COAXIAL CABLE	OPTIMUM WELD CABLES FOR MINIMIZING CABLE INDUCTANCE AND OPTIMIZING WELDING PERFORMANCE.
K2593-XX	AWG #1 COAXIAL CABLE	

GENERAL ACCESSORIES

TABLE C.6

K NUMBER	DESCRIPTION	NOTES
K1546-1	INCOMING BUSHING FOR LINCOLN CONDUIT	USE WITH .025 – 1/16" WIRES.
K1546-2	INCOMING BUSHING FOR LINCOLN CONDUIT	USE WITH 1/16" TO 1/8" WIRES.
K1733-1	WIRE STRAIGHTENER	STRAIGHTEN WELDING WIRE TO IMPROVE FEEDING
K590-6	WATER CONNECTION KIT	PROVIDES WATER CONNECTIONS UNDER FEED PLATE
K1634-4	WIRE REEL ENCLOSURE	FOR USE WITH 30-40 LB SPOOLS
K4728-1	CASTER KIT	TO CONVERT WIRE REEL BASE TO A FEEDER UNDERCARRIAGE
K1555-1	INSULATED LIFT BALE	TO PROVIDE A LIFTING MECHANISM ON THE WIRE REEL STAND
K4719-1	REMOTE TRIGGER SWITCH	25 FOOT HAND HELD TRIGGER
K586-1	DELUXE ADJUSTABLE GAS REGULATOR & HOSE KIT	ACCOMMODATES CO2, ARGON, OR ARGON-BLEND GAS CYLINDERS. INCLUDES A CYLINDER PRESSURE GAUGE, DUAL SCALE FLOW GAUGE AND 4.3 FT. (1.3 M) GAS HOSE.

ACCESSORIES INCLUDED WITH THE PIPEFAB™ FEEDER:

- Wire drives include a Standard #2-#4 gun adapter.
- 30 tooth pinion gear installed.
- Inlet guides installed.
- Wire Reel Stand.
- Four cable management brackets.

MAINTENANCE

SAFETY PRECAUTIONS
READ AND UNDERSTAND ENTIRE SECTION BEFORE OPERATING MACHINE.

⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not operate with covers removed.
- Turn off power source before installing or servicing.
- Do not touch electrically hot parts.
- Turn the input power to the welding power source off at the fuse box before working in the terminal strip.
- Only qualified personnel should install, use or service this equipment.

ROUTINE MAINTENANCE

Routine maintenance consists of periodically blowing out the machine, using a low-pressure air stream, to remove accumulated dust and dirt from the intake and outlet louvers, and the cooling channels in the machine.

Check weld cables, control cables and gas hoses for cuts.

Clean and tighten all weld terminals.

PERIODIC MAINTENANCE

Calibration of the PipeFab™ is critical to its operation. Generally speaking the calibration will not need adjustment. However, neglected or improperly calibrated machines may not yield satisfactory weld performance. To ensure optimal performance, the calibration of output Voltage and Current should be checked yearly.

Clean the drive rolls and inner wire guide and replace if worn.

Blow out or vacuum the inside of the feeder.

Inspect the motor brushes every 6 months. Replace if shorter than 0.5” (12.7mm).

Every year inspect the gearbox and coat the gear teeth with a moly-disulfide filled grease. DO NOT use graphite grease.

CALIBRATION SPECIFICATION

Output Voltage and Current are calibrated at the factory. Generally the machine calibration will not need adjustment. However, if the weld performance changes, or the yearly calibration check reveals a problem, use the calibration section of the Diagnostics Utility to make the appropriate adjustments.

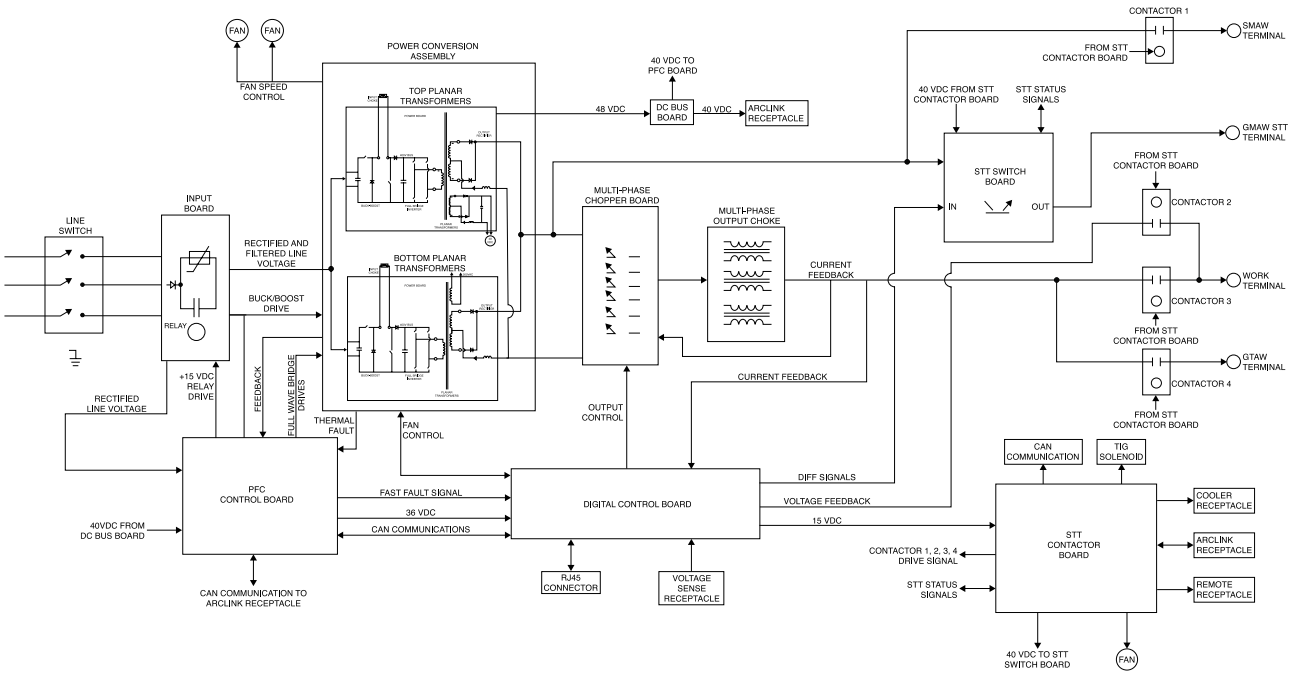
The calibration procedure itself requires the use of a grid, and certified actual meters for voltage and current. The accuracy of the calibration will be directly affected by the accuracy of the measuring equipment you use. The Diagnostics Utility includes detailed instructions and is available at www.powerwavesoftware.com.

Theory of Operation

GENERAL DESCRIPTION E-1
LINE SWITCH, INPUT BOARD AND PFC CONTROL BOARD E-2
POWER CONVERSION BOARD ASSEMBLY E-3
MULTI-PHASE CHOPPER BOARD AND MULTI-PHASE OUTPUT CHOKE E-4
40 VDC BUS BOARD AND DIGITAL CONTROL BOARD E-5
STT CONTACTOR BOARD AND STT SWITCH BOARD E-6
THERMAL PROTECTION E-7
PROTECTIVE CIRCUITS E-7
OVER CURRENT PROTECTION E-7
INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION E-8
PIPEFAB FEEDER FUNCTION AND INPUT E-9
WIRE DRIVE BOARD E-10
WIRE DRIVE MOTORS E-11
USER INTERFACE BOARD E-12

Theory of Operation

Figure E.1 – Block diagram



General Description

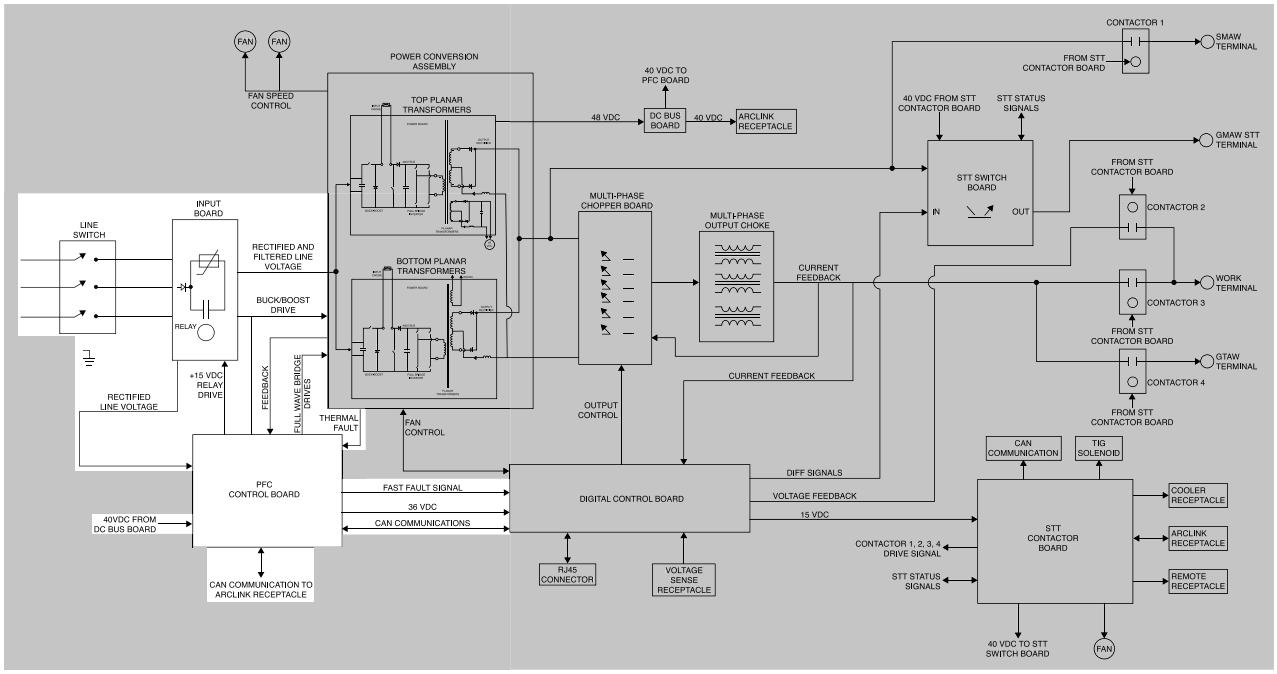
The PipeFab welding system consists of a portable advanced-process power source and feeder designed from the ground up to be the ideal system for welding steel, stainless, and nickel pipe. The PipeFab is ideal for applications where critical root, fill, and cap welds are needed to be performed at the highest level of quality.

The new state of the art PipeFab Feeder features a robust 7” LCD display which offers a bright and easy to use interface to control all processes. With GMAW, GMAW-STT, GMAW-P, FCAW, GTAW (DC) and SMAW functionality, the dedicated process buttons and individual process memories make switching from one process to another simple and intuitive. Superior arc performance, simplicity, and flexibility are at the core of the PipeFab welding system.

The PipeFab is an advanced software-controlled system and is readily user updateable with free software from www.powerwavesoftware.com. Thus, allowing it to take advantage of the latest and greatest innovations from Lincoln Electric’s welding technologies.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.2 – Line switch, input board and power factor control (PFC) board



Line Switch, Input Board and PFC Control Board

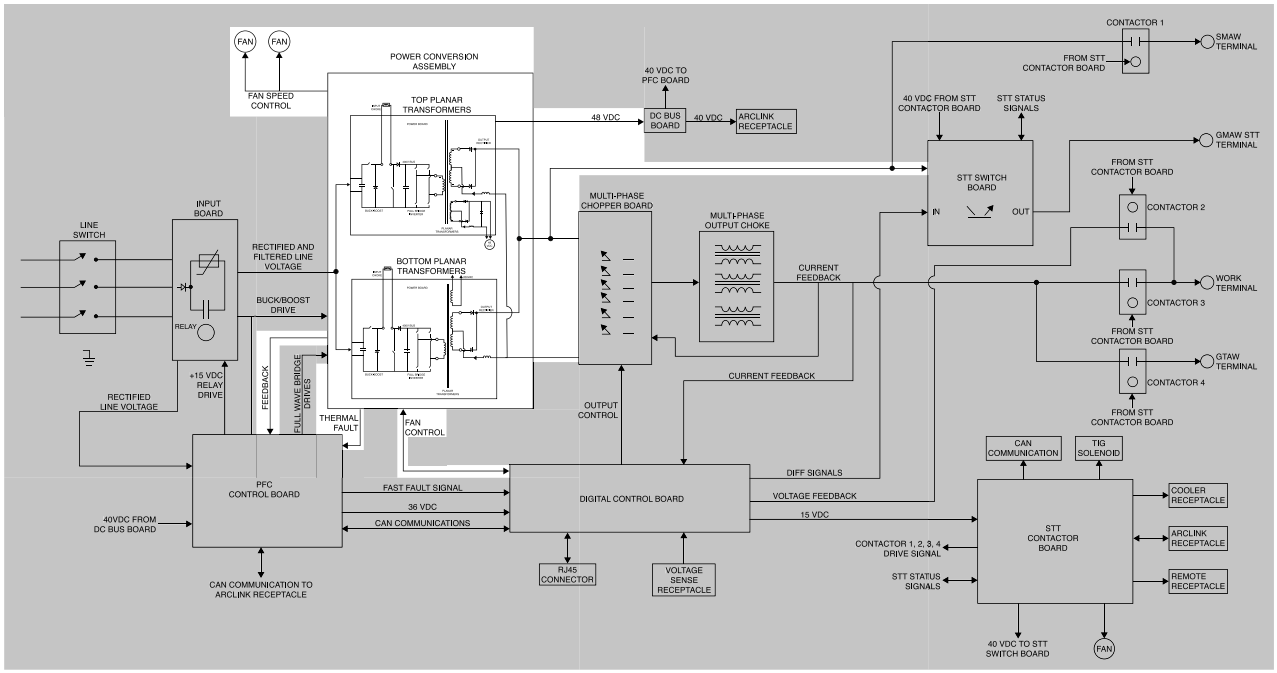
The Pipefab power source can be connected to three-phase AC input voltage. The Pipefab power source automatically adjusts to operate with different AC input voltages. No reconnect switch settings are required. The initial input power is applied through a line switch located on the front panel of the machine. This AC input voltage is applied to an input board where it is rectified to a DC voltage. The DC voltage is then applied to a soft-start circuit consisting of two PTC thermistors and two DC relays. This soft-start circuit limits the initial inrush current to the DC link capacitors to prevent damage to the input rectifier. Two seconds after the input line switch is activated the two relays, which are in parallel with the thermistors, are closed thus applying the full input potential to the DC link capacitor. The two DC relays are activated by the PFC control board.

The rectified input power is also connected to the PFC control board. The PFC control board receives this unregulated DC voltage and converts it to several DC supplies that are used to power the electronics housed on the PFC control board. A 36 VDC supply is also connected to the digital control board.

The PFC control board receives feedback information in the form of buck-boost currents, the 400 VDC bus voltage, the rectified AC input voltage, the full bridge inverter currents, and power module temperatures. The electronic circuits and firmware on the PFC control board generate Pulse Width Modulation (PWM) signals to regulate the 400 VDC bus, drive the buck-boost circuit, shape the input current, drive the full bridge inverters, and control the pre-charge relays.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.3 – Power conversion board assembly



Power Conversion Board Assembly

Several circuits are located on the power conversion board. They are the two interleaved buck-boost converters, two full-bridge inverters, two planar transformers and a fan control circuit.

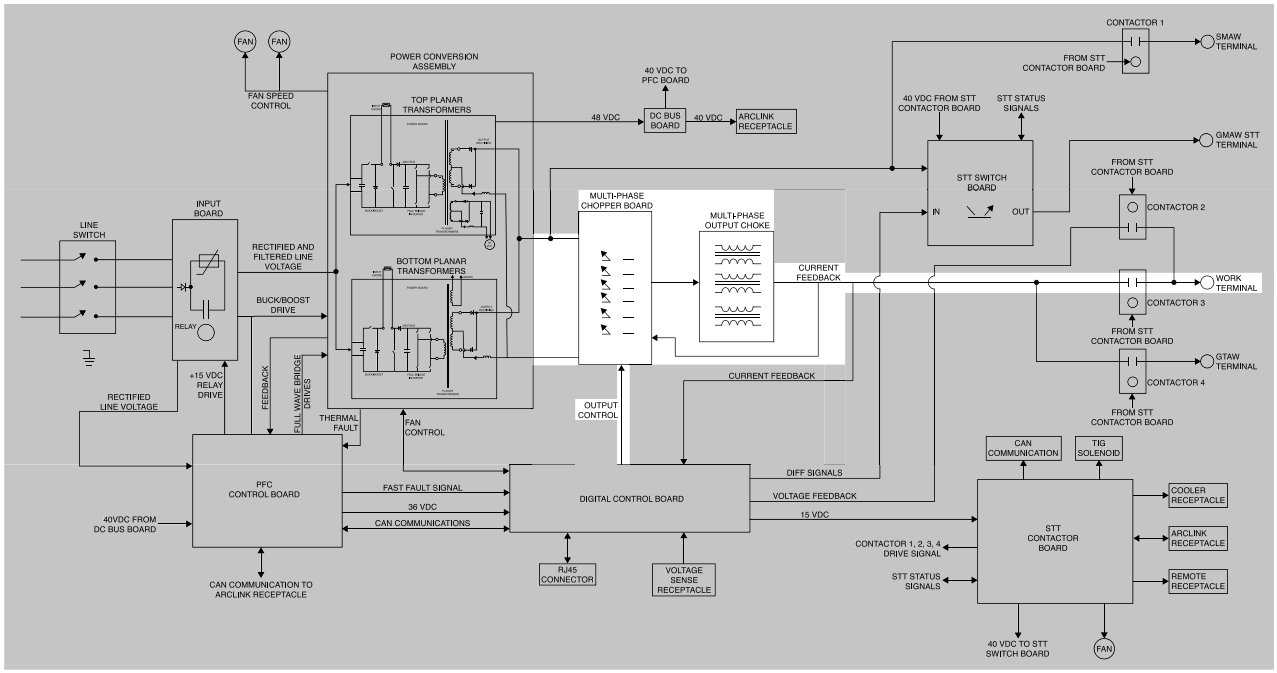
Buck-Boost Converters: The two buck-boost converters operate at 25 KHz. These converters convert the input voltage to a 400 VDC bus. The PFC board regulates the buck-boost circuits to attain a very high power factor. If the rectified input voltage is greater or less than 400 VDC, either the "Buck" portion or the "Boost" portion of the circuitry will be active. The two buck-boost circuits are driven by separate PWM signals from the PFC board.

Full Bridge Inverters: The 400 VDC bus is applied to the two full bridge inverters. The inverters operate at 50KHz. and are driven by two separate PWM signals generated from the PFC board. This PWM signals provide the inverter switches with a 98% on time. The outputs of the full bridge inverters are applied to the primaries of the two planar transformers.

Planar Transformers: The primaries of the two planar transformers are in parallel but are driven 90 degrees out of phase with each other. Both transformers have a 100 volt secondary winding for welding power. The outputs of these 100 volt windings are rectified and coupled to the multi-phase chopper board. The lower planar transformer has a 200 volt secondary winding that is used to power the 115VAC inverter board (in the PipeFab cooler). The upper planar transformer has a 48 volt secondary winding that is rectified and filtered and is applied to the 40 VDC bus board. The 48 VDC is also used to power the fan speed control circuit.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.4 – Multi-phase chopper board and multi-phase output choke section

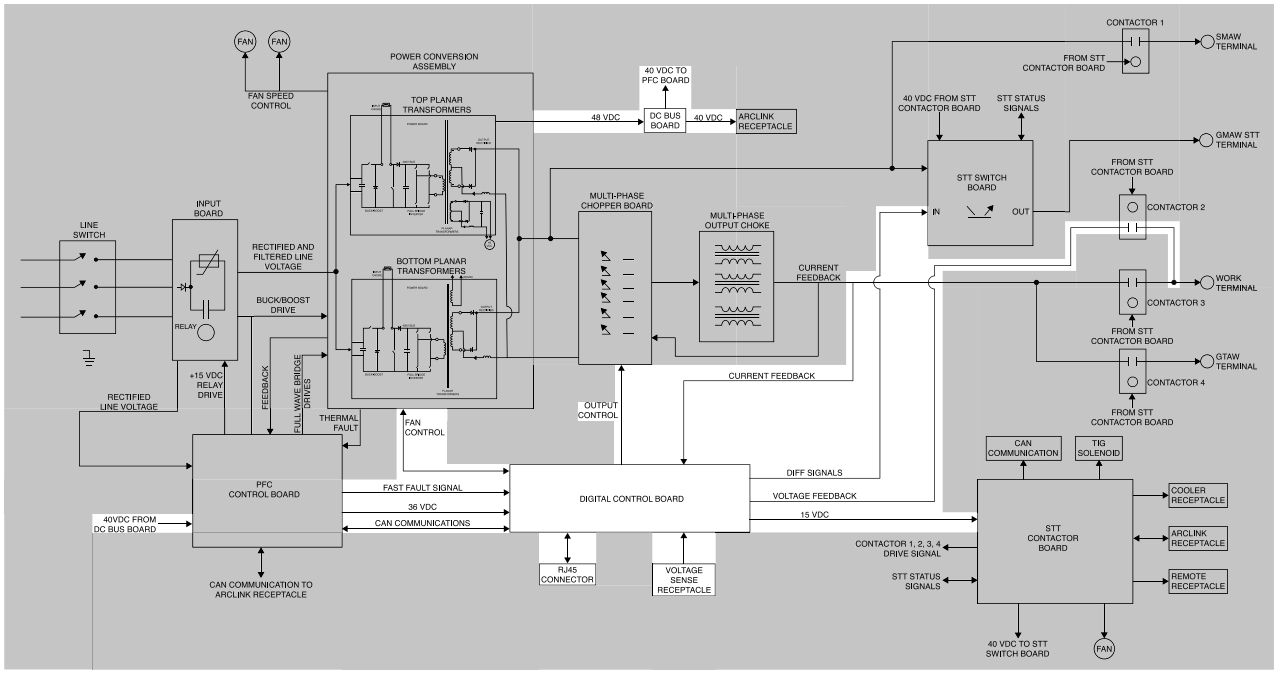


Multi-Phase Chopper Board And Multi-Phase Output Choke

The multi-phase 20KHz. chopper is connected to the 100 VDC bus that is generated by the two 100 volt secondary windings on the two planar transformers. The six high speed electronic switches are connected in parallel to the 100 VDC bus. However, the gate drives are 60 degrees out of phase with independent PWMs drive signals received from the digital control board. The system is equivalent to a 120KHz. chopper. The output of the multi-phase chopper board is connected to the multi-phase output choke. The multi-phase output choke consists of three independent chokes with two windings on each choke core. Each choke coil is connected to one phase of the multi-phase chopper board. This coupled inductor acts like a transformer providing low ripple current and low output inductance to the welding circuit. The output of the multi-phase choke is connected to the negative output terminal.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.5 – 40 VDC bus board and digital control board



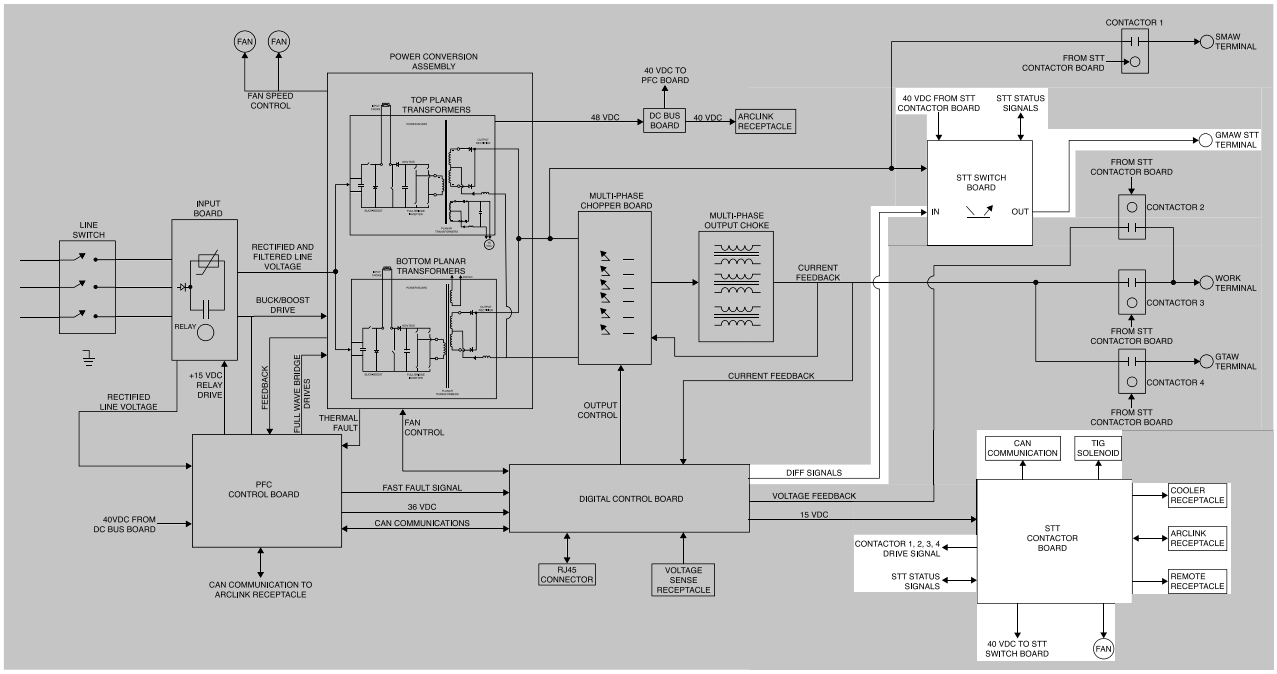
40 VDC Bus Board And Digital Control Board

The 40 VDC bus board receives 48 VDC from the upper planar transformer. The 40 VDC bus board regulates and controls that 48 VDC to a constant 40 VDC output supply. The 40 VDC is applied to the PFC control board and the ArcLink receptacle.

The digital control board receives commands and feedback information via various channels. It receives digital communications and commands from the PFC control board. The digital control board also receives and processes output voltage and output current data. The digital control board uses this feedback information and processes it with the digital commands it receives and sends the appropriate PWM signals to the multi-phase chopper board to control the welding output. It also sends a signal to the power conversion board to control the speed of the two fans. The digital control board houses the software welding tables and monitors the thermostat circuitry.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.6 – STT contactor board and STT switch board section



STT Contactor Board And STT Switch Board

The STT contactor board receives ArcLink power (40 VDC) and CAN communication from the PFC Board. The STT contactor board controls the TIG gas solenoid and the fan speed. It also controls the various output contactors (#1, #2, #3, and/or # 4). Depending on what mode of welding is selected the appropriate contactor will be energized providing output to the appropriate output terminal.

The STT switch board will be active when an SST welding mode is selected. The STT switch board will reduce the peak welding current just before the metal is transferred into the molten puddle thus reducing weld spatter. The STT switch will react dependent on arc voltage feedback and digital commands received from the digital control board.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Thermal Protection

Four normally closed (NC) thermostats protect the machine from excessive operating temperatures. Two thermostats are integrated into the power conversion assembly and monitored by the PFC control board. These protect the machine from high temperatures on the input side. Thermostat number three is located and integrated into the multi-phase chopper board and is monitored by the digital control board. The fourth thermostat is located on the STT switch board and is monitored by the STT contactor board. Excessive temperatures may be caused by several factors including a lack of cooling air flow or by operating the machine beyond its duty cycle or output rating. If excessive operating temperatures should occur, the thermostats will prevent output from the machine. The yellow thermal light, located on the front of the machine, will be illuminated.

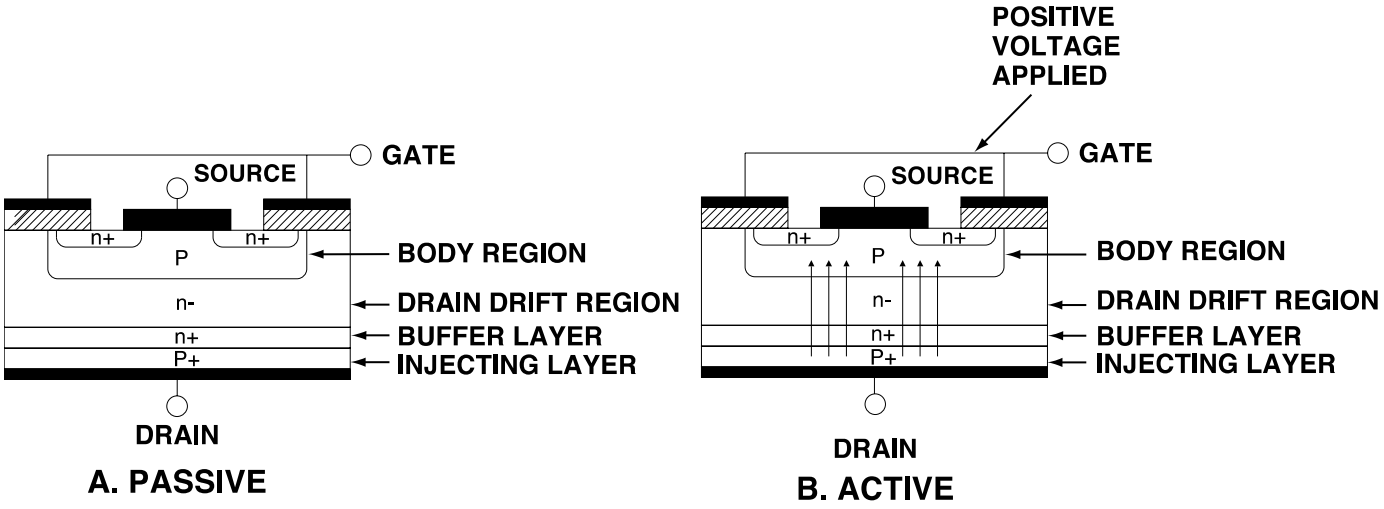
Protective Circuits

Protective circuits are designed into the Pipefab welding system to sense trouble and shut down the machine before damage occurs to the machine's internal components. Error Codes will be flashed out by the light on the front of the machine and will help identify the reason for the shutdown. Fault codes can also be seen by using the diagnostic Software. Various status lights located on the PC boards aid in determining component status and diagnosing problems.

Over Current Protection

If the machine's welding output is shorted the digital control board will limit the current to 375 amps.

Figure E.7 – Insulated gate bipolar transistor (IGBT) operation



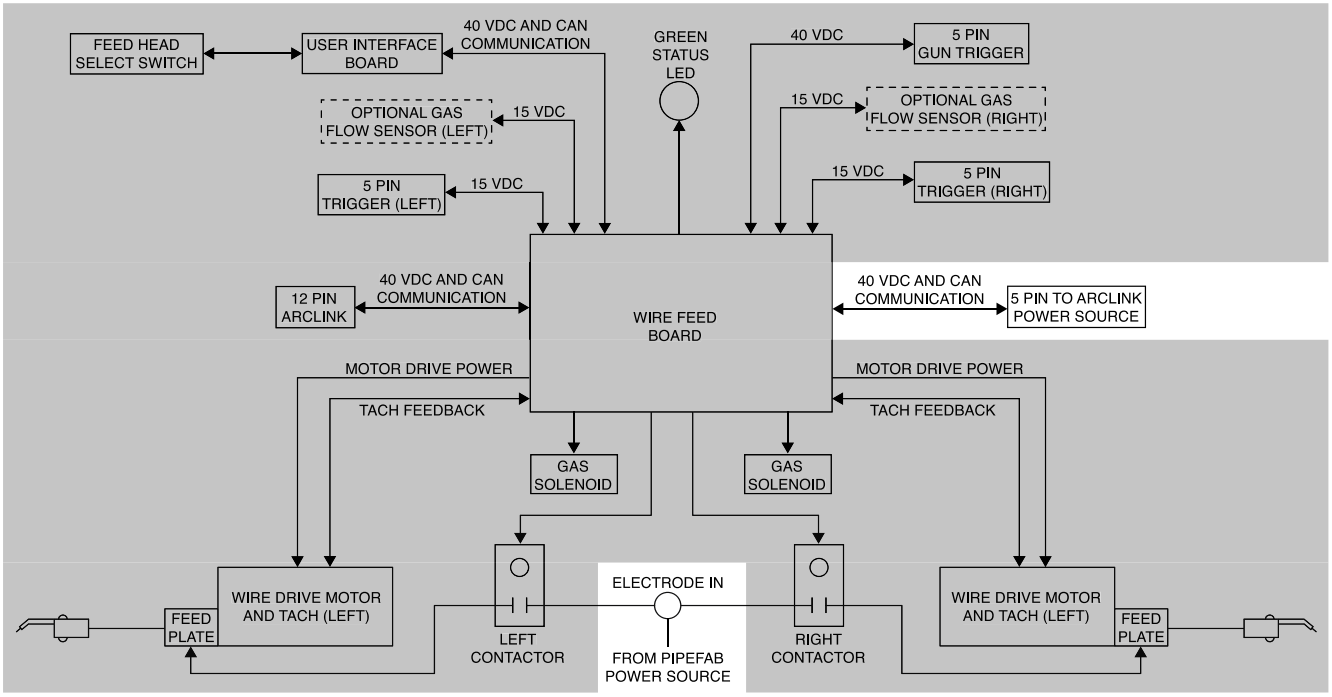
Insulated Gate Bipolar Transistor (IGBT) Operation

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

Example A in Figure E.7 shows an IGBT in 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.

Example B shows the IGBT in an active mode. When the gate signals 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 the 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.8 – Input

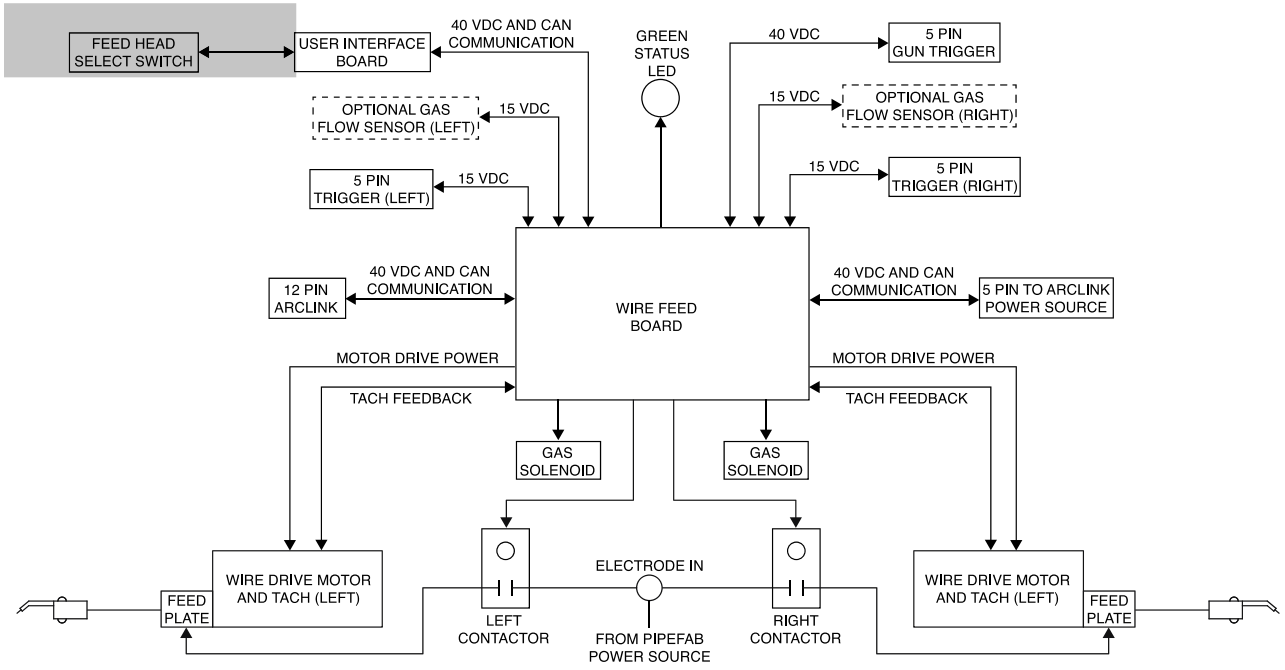


Pipefab Feeder Function And Input

The Pipefab feeder is a four drive roll, digitally controlled, dual modular wire feeder that operates on 40 VDC input power. Network communications (ArcLink CAN), wire drive board power (40 VDC) and electrode voltage feedback (lead 67) are all transmitted and received through the five pin ArcLink receptacle located on the rear of the machine. The five lead ArcLink cable is connected to the PipeFab power supply.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.9 – Wire drive board

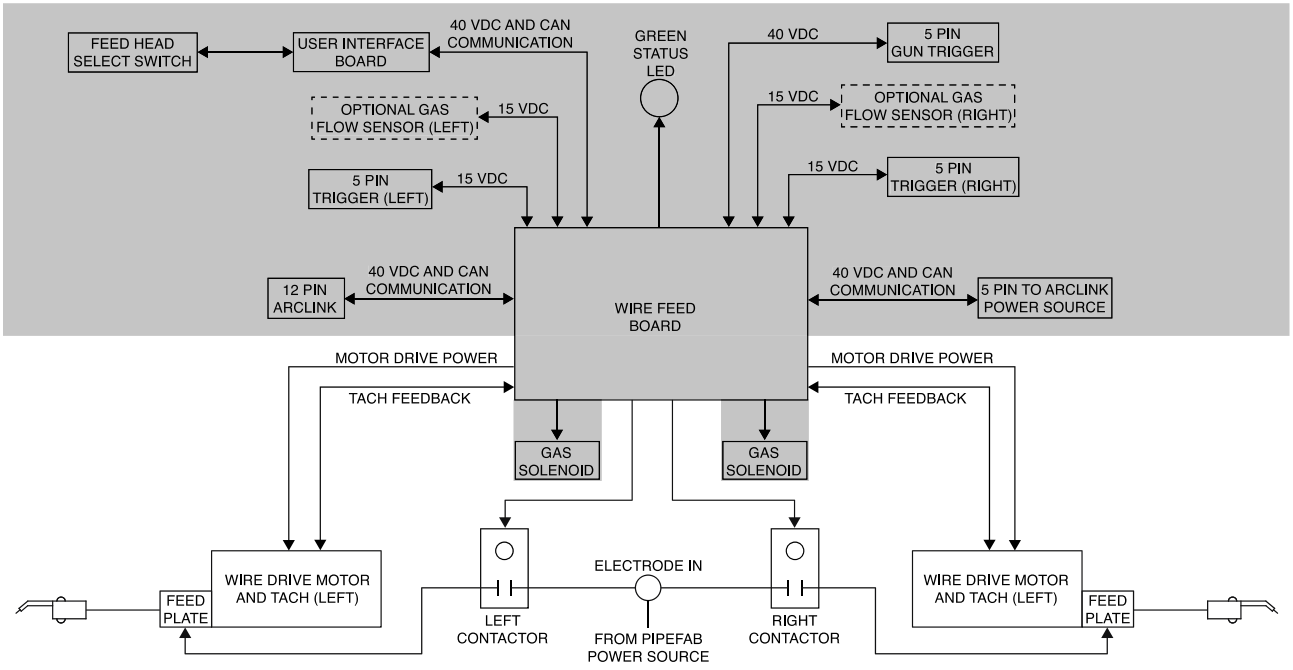


Wire Drive Board

The ArcLink digital communication and 40 VDC are applied to the wire drive board. The electrode voltage feedback leads (67) are connected to the wire drive board. The wire drive board process the various commands receives from the various switches, the 12 pin receptacle, the optional gas flow sensors, and the user interface board. The wire drive board then activates and controls the wire drive motors, the gas solenoids, and the output contactors. The wire drive board also controls the green status light and flash out error codes if a problem should arise.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.10 – Wire drive motors

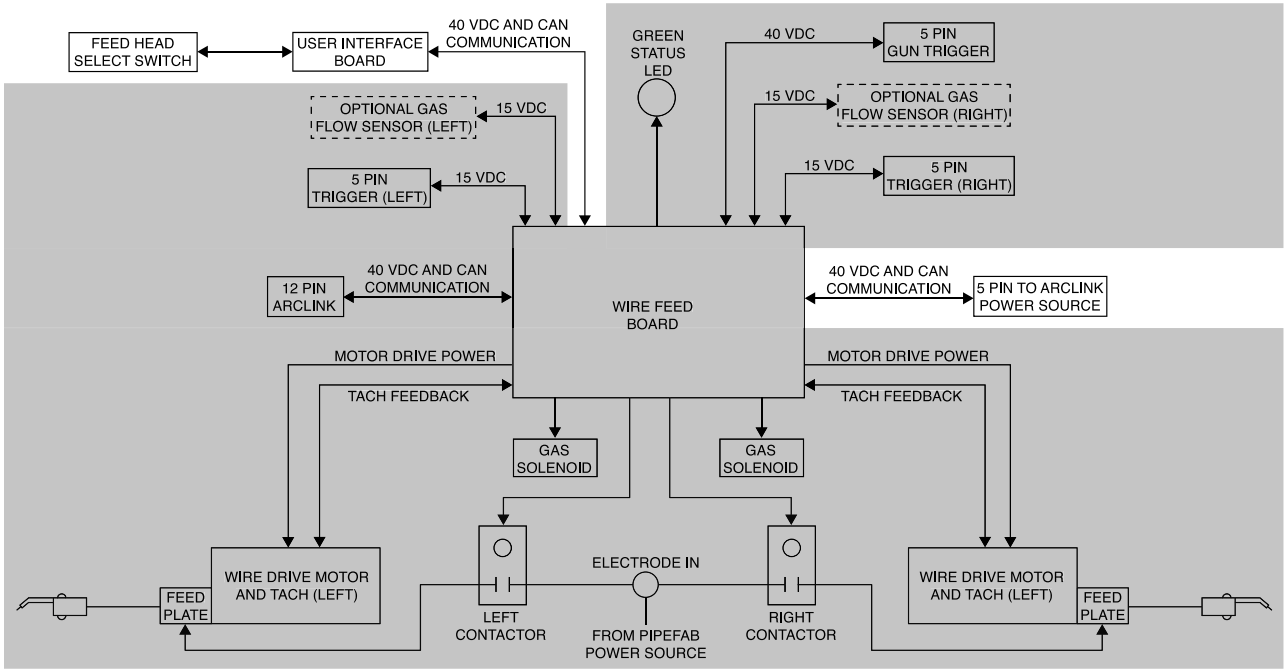


Wire Drive Motors

When either the left or right gun trigger is pulled the appropriate wire drive motor is supplied with an armature voltage from the wire drive board. Also, the correct output contractor is energized to complete the welding current path to the welding gun. Attached to the wire drive motors are tachometer feedback units. These devices send a pulsed feedback signal to the wire drive board. The wire drive board then determines the motor RPM and control the motor speed to provide the correct wire feed speed dictated by the user interface board.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

Figure E.11 – User interface board



User Interface Board

Through the ArcLink (CAN) communications network the user interface board communicates to the wire drive board and to the Pipefab power source. The user interface allows the user to select many welding processes and parameters such as wire feed speed, gun trigger options, arc volts, amps, trim, and store in memory the selected welding procedures.

NOTE: Unshaded areas of the Block Logic Diagram are the subject of discussion.

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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 four main categories: Output Problems, Welding Problems, Function Problems and Wire Feedeing Problems.

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

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

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

⚠ CAUTION

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

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

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

⚠ CAUTION

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

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

PC board can be damaged by static electricity.

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

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

Reusable Container
Do Not Destroy

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

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

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

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

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

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

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

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

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

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

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

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

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

Troubleshooting guide

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
OUTPUT PROBLEMS		
Major physical and electrical damage is evident when the sheet metal cover(s) are removed.	1. Contact your local authorized Lincoln Electric Field Service Facility for technical assistance.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
The input fuses repeatedly fail, or the input circuit breakers keep tripping.	1. Make certain the fuses or breakers are properly sized. 2. The welding procedure may be drawing too much input current, or the duty cycle may be too high. Reduce the welding current and/or reduce the duty cycle.	1. Perform the ***Input Board Test Procedure***. 2. Perform the ***Power Conversion Assembly Test Procedure***. 3. Perform the ***PFC Control Board Test Procedure***. 4. Perform the ***Line Switch Test Procedure***.
The machine will not power up. No lights. The machine appears to be off.	1. Make sure the proper input voltage is being applied to the machine (check fuses or breakers). 2. Make sure the input supply disconnect has been turned ON. 3. Make certain the input power line switch is in the ON position.	1. Check the input line switch for proper operation. Also check the associated leads for loose or faulty connections. See Wiring Diagram. 2. Perform the ***40 Volt DC Bus Board Test Procedure***. 3. Perform the ***Input Board Test Procedure***. 4. Perform the ***PFC Control Board Test Procedure***.
The Pipefab Welding System does not have welding output.	1. There may be an external “short” in the external output circuitry. Remove all loads from the output terminals and restart the machine. 2. If the thermal LED is illuminated the unit may be overheated. Adjust the welding load and /or duty cycle to coincide with the output limits of the system. Also see the symptom “The Thermal LED is ON” in this section.	1. Perform the ***Input Board Test Procedure***. 2. Perform the ***Power Conversion Assembly Test Procedure***. 3. Perform the ***Digital Control Board Test Procedure***. 4. Perform the ***40 Volt DC Bus Board Test Procedure***. 5. Perform the ***Multi-Phase Output Choke Test Procedure***.

The Thermal LED is ON. The machine regularly overheats. There is no welding output.	1. The welding application may be exceeding the recommended duty cycle and/or current limits of the machine. 2. Dirt and dust may have clogged the cooling channels inside the machine. 3. The air intake and exhaust louvers may be blocked due to inadequate clearance around the machine. 4. Make sure the fans are functioning correctly. The fans will run at variable speeds dependent upon the temperature of the Buck/Boost heat sinks. The fans should also run at a high speed if a thermostat has tripped.	1. Perform the ***Thermostat Circuit Test Procedure***. 2. Perform the ***Fan Test Procedure***.
The PipeFab Welding System will not produce full output.	1. Make certain the three-phase input voltage is correct for the machine.	1. Perform the ***Current Transducer Test Procedure***. 2. Perform the ***Digital Control Board Test Procedure***. 3. Perform the ***Power Conversion Assembly Test Procedure***. 4. Perform the ***Multi-Phase Chopper Board Test Procedure***. 5. Perform the ***Multi-Phase Output Choke Test Procedure***.
No welding arc voltage when the gun trigger is activated. The wire feeds normally and the gas solenoid functions properly.	1. The power source may be unable to produce welding output due to a thermal fault or other malfunction. 2. The gun may be faulty.	1. The wire drive board may be faulty. 2. Perform the ***Output Contactor Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
WELDING PROBLEMS		
General degradation of the welding performance.	1. Check for proper wire feeding. Make certain that the actual speed is the same as the preset. 2. Verify that the correct wire drive and gear ratio have been selected. 3. Check the welding cables for loose or faulty connections. 4. Check for adequate gas shielding. 5. Make sure the welding process is correct for the wire feed and voltage settings.	1. Perform the ***Multi-Phase Chopper Board Test Procedure***. 2. Perform the ***Multi-Phase Output Choke Test Procedure***.
During a weld the machine shuts down.	1. The secondary current limit has been exceeded and the machine shuts down to protect itself. Adjust the procedure to reduce the load and lower the output current draw.	1. A non-recoverable internal fault will interrupt the welding output. This condition will also result in a status light blinking. Check for error codes.
The arc is excessively long and erratic.	1. In the wirefeeder make sure the correct wire drive and gear ratio have been selected for the welding process being used. 2. Make sure the shielding gas is correct for the welding process being used. Also make sure the flow rate is correct.	1. N/A.
The welding starting is poor.	1. Make sure the driver roll tension on the wirefeeder is adjusted correctly. Also, the welding wire should travel freely through wire feeding path. Check the welding tip for blockage. 2. Make sure the shielding gas flow is correct.	1. N/A.
The end of the weld is not acceptable.	1. Make sure all of the settings for Burnback and Crater states	1. N/A.

	are set correctly for the welding process being used. Verify that the Burnback has a value other than 0. 2. Verify the burnback set points for workpoint, trim and wave values. 3. Make sure the shielding gas flow is adequate.	
The Pipefab wirefeeder will not power up.	1. Check the ArcLink cable connecting the Pipefab power source to the Pipefab wirefeeder.	1. Perform the ***40 VDC Bus Board Test Procedure***.
There is no output at the output terminals.	1. Make sure the Pipefab is in the correct mode. 2. Check all associated leads. See Wiring Diagram.	1. The contactor may be faulty. 2. Perform the ***STT Contactor Board Test Procedure***.
The STT function does not work correctly.	1. Make sure the Pipefab is in the correct mode.	1. Perform the ***STT Switch 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**
FUNCTION PROBLEMS		
No wire feed, solenoid, or arc voltage. The STATUS LEDs are steady green.	1. The gun trigger may be faulty. Check or replace. 2. Make certain the user interface is configured for a wire feeding mode. 3. Check option panel connections and switch(s) for proper operations.	1. Check the continuity of leads from the gun trigger receptacles to plug J85. See Wiring Diagram. 2. The wire drive board may be faulty.
The wire feed speed does not change when welding current is established. The WFS stays at the run-in-speed. The STATUS LEDs are steady green.	1. The run in and weld wire feed speeds may be set to the same value. Set run in speed to a value that gives best starting results.	1. Perform the ***Current Transducer (LEM) Test Procedure***. 2. If the run in wire feed speed cannot be adjusted, perform the ***Tach Feedback Test Procedure*** and also the ***Wire Drive Motor(s) Test Procedure***. 3. The wire drive board may be faulty.
The purge switch on the wire drive unit does not activate the gas solenoid. The gun trigger closure in the MIG or pulse modes does activate the solenoid. The LEDs are steady green on the power source, control box and wire drive unit.	1. Make certain the cold inch/feed gas purge switch is operating properly. 2. Check for loose or faulty leads between cold inch/feed gas purge switch and the wire drive board. See Wiring Diagram.	1. If the cold inch/feed gas purge switch is operating correctly and the associated leads are OK. The wire drive board may be faulty. 2. Perform the ***Cold Inch/Feed Gas Purge Switch Test Procedure***.
The cold inch/feed gas purge switch does not turn on the wire drive motor. The gun trigger closure in the MIG or Pulse modes does activate the wire drive motor. The LEDs are steady green on the power source, control box and wire drive unit.	1. Make certain the cold inch/feed gas purge switch is operating properly. 2. Check for loose or faulty leads between cold inch/feed gas purge switch and the wire drive board. See Wiring Diagram.	1. If the cold inch/feed gas purge switch is operating correctly and the associated leads are OK, the wire drive board may be faulty. 2. Perform the ***Cold Inch/Feed Gas Purge Switch Test Procedure***.
The voltmeter on the control box does not function properly even though the STATUS LEDs	1. Check the #67 lead on the wire drive unit. Make sure it is connected to the motor gear	1. Check leads #67 and #267 from J86 on the wire drive board to the feed plates. See

are steady green.	box and also the wire drive board. See Wiring Diagram. 2. Check the work sensing leads on the Pipefab power source. See Pipefab Power Source Wiring Diagram.	Wiring Diagram. 2. Perform the ***User Interface Board Test Procedure***. 3. Perform the ***Wire Drive Board Test Procedure***.
The ammeter on the control box does not function properly even though the STATUS LEDs are steady green.	1. N/A.	1. Perform the ***Current Transducer (LEM) Test Procedure***. 2. The user interface board may be faulty.
The displays are blank (not illuminated). The wire feeds when the gun trigger is activated.	1. Check for loose plugs or faulty connections at the user interface board and the wire drive board. See Wiring Diagram.	1. Check for 40 VDC at J31 pins 3 (com) and 4 on the user interface board. If 40 VDC is present, then the user interface board may be faulty. 2. If the 40 VDC is low or not present, check for loose or faulty connections between the user interface board and the wire drive board. See Wiring Diagram. 3. The wire drive board may be faulty. 4. Perform the ***User Interface Board Test Procedure***.
The feeder does not power up - no display, no cold feed.	1. The Pipefab power source is OFF. Turn ON the Pipefab power source. 2. The control cable may be loose or damaged. Tighten, repair or replace the control cable.	1. Check for 40 VDC at J83 leads #540 and #500 on the wire drive board. If voltage is present, replace wire drive board. If voltage is not present, check leads from J83 on wire drive board to 5 pin ArcLink receptacle. See Wiring Diagram. 2. Perform the ***Wire Drive Board Test Procedure***.
No shielding gas.	1. The gas supply is OFF or empty. Verify the gas supply is ON and flowing. 2. The gas hose is cut or crushed. Route the gas hose so it avoids sharp corners and	1. Check for 6.5 VDC with trigger pulled at J87 leads #553 and #552 and also at #652 and #653. If voltage is present replace solenoid. If voltage is not present replace wire drive

	make sure nothing is on top of it. Repair or replace damaged hoses. 3. Dirt or debris is in the solenoid. Apply filtered shop air at 80psi to the solenoid to remove dirt. 4. There is a loose solenoid connection. Remove the cover and check that all connections are in good condition. 5. The gas solenoid has failed.	board. See Wiring Diagram. 2. Perform the ***Gas Solenoid(s) 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**
WIRE FEEDING PROBLEMS		
The wire feed speed is consistent and adjustable, but runs at the wrong speed.	1. The wire drive unit may not be set for the correct gear ratio. See the Installation section of the operator's manual. 2. The drive motor may be overloaded due to a mechanical restriction in the wire feeding path. See Operation section of the operator's manual.	1. Perform the ***Wire Drive Board Test Procedure***. 2. The wire drive board may be faulty. 3. If there are no restrictions in the wire feeding path, the drive motor or gear box may be faulty.
When the gun trigger is activated, the drive rolls do not turn. The arc voltage is present and the solenoid is energized. The STATUS LEDs are steady green.	1. Check plug J84 on the wire drive board and leads #550 and #551 for loose or faulty connections. See Wiring Diagram.	1. Perform the ***Wire Drive Motor(s) Test Procedure***. 2. Perform the ***Wire Drive Board Test Procedure***.
The wire is feeding rough or not feeding at all, but the drive rolls are turning.	1. The drive roll pressure may be incorrect. Set drive roll pressure. See Operation section of the operator's manual. 2. Check for dirty or rusty electrode wire. 3. Make sure the drive rolls and wire guides are positioned and installed correctly. See Operation section of the operator's manual. 4. Check for mechanical restrictions in the wire feeding path.	1. Contact the Lincoln Electric Service Department at 1.888.935.3877.
No control of wire feed speed. All STATUS LEDs are steady green. The preset wire feed speed is adjustable on the user interface.	1. Check for a mechanical restriction in the wire feed path.	1. Perform the ***Tach Feedback Test Procedure***. 2. The wire drive board may be faulty.

⚠ 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**
ERROR CODE (DISPLAY SHOWS ANY OF THE FOLLOWING)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
ERROR CODES		
Err 100	The Power Source issued a shut down command for some reason.	See 'Recommended Course Of Action' for Err 201.
Err 200	No heart beat response from the power source.	See 'Recommended Course Of Action' for Err 201.
Err 201	No heart beat response from an object.	If this occurs while welding, the status LED should be flashing red on the object that lost heart beat. Otherwise, look for any nodes that are flashing green. This indicates they have not been recognized and there is a power source problem (see power source Troubleshooting section). If the status LED is either flashing or solid red, there may be a problem with continuity in the communication lines. Check the lines for continuity, in the cable and harnessing (See Wiring Diagram).
Err 210	EEPROM error.	Parameter recalled at power up was out of range. Rotate encoder knob to reset. Check all settings before proceeding to weld. If this condition persists, then perform the ***Wire Drive Board Removal And Replacement Procedure***.
Err 211	Microprocessor RAM error in control box.	Turn Power off at power source. Wait 5 seconds. Turn power back on. If Err 211 is displayed again, then perform the ***Wire Drive Board Removal And Replacement Procedure***.
Err 212	Microprocessor RAM Error in object board other than control	Cycle power as in Err 211. If Err 212 is still displayed, then

	box (Such as feed head).	replace the PC board in the object with the fault. The object with the fault should be solid red on its status LED.
--- (three dashes)	Appears on right display of user interface board that contains the status LED.	This is an indication that a constant current such as stick or gauge mode has been selected. Turning the right encoder clockwise when in this state will activate output to Power Source. Turning the right encoder counterclockwise will deactivate output.
Err 18 Configuration error.	The DIP switch setting for the user interface does not match the wire drives. The user interface is set for “single” with a “dual” wire drive or the user interface is set for “dual” with a “single” wire drive.	Verify the user interface DIP is in the correct position.
Err 81 Motor overload, long term.	The wire drive motor has overheated.	1. Check that the electrode slides easily through the gun and cable. 2. Remove tight bends from the gun and cable. 3. Check that the spindle brake is not too tight. 4. Verify a high quality electrode is being used. 5. Wait for the error to reset and the motor to cool (approximately 1 minute).
Err 82 Motor overload, short term.	The wire drive motor current draw has exceeded limits, usually because the motor is in a locked rotor state.	1. Check that motor can turn freely when idle arm is open. 2. Verify that the gears are free of debris and dirt.

⚠ 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**
ARCLINK SYSTEM ERROR CODES		
Err 53 Voltage sense loss.	1. The system detected that one of the voltage sense lead cables was disconnected from the welding circuit during a weld.	1. Verify that leads 67 and 21 are enabled and connected.
Err 95 Spool gun or pull gun motor overload.	1. The drive motor in the spool gun or push-pull gun is drawing too much current.	1. Check spool gun brake or feeding for binding. Replace spool gun circuit board.
Err 263 No usable weld modes.	1. The power source does not have any welding programs loaded. Required configuration could not be found.	1. Make sure the status of all devices is connected correctly to the machine. Reflash system software.
⚠ 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

3/8” Nutdriver
3/4” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Using a 3/8” nutdriver, remove the four screws securing each case side cover to the power source. See ***Figure F.1***.
3. Carefully remove the case side covers to gain access to internal components. Most internal components are now accessible. For additional access remove the roof panel using the following steps. **NOTE:** The wire feeder must always be connected to the power source when input power is applied to the system and the system is turned ON.
4. Label and disconnect the ArcLink connector. See Wiring Diagram.
5. Using a 3/4” nutdriver, remove the nut securing the heavy lead to the rear of the power source. See Wiring Diagram.
6. Route leads through the bottle stand. See Wiring Diagram.
7. Carefully lift the wire feeder off of the power source.
8. Using a 3/8” nutdriver, remove the four screws securing the handle to the power source. See ***Figure F.2***.
9. Using a 3/8” nutdriver, remove the four screws securing the bottle holder to the power source. See ***Figure F.2***.
10. Using a 3/8” nutdriver, remove the screw securing the roof to the power source.
11. The roof can now be removed.
    Wire Feeder:
12. Using a 5/16” nutdriver, remove the four screws securing the roof to the feeder. See ***Figure F.3***.
    NOTE: Do not fully remove roof panel as leads are still attached to the wire drive board.
13. Carefully position the roof to allow for access to internal components.

14. Label and disconnect leads 535, 586 and 579 from the left side cold inch/feed gas purge switch or leads 635, 686 and 679 from the right side cold inch/feed gas purge switch. See ***Figure F.4***. See Wiring Diagram.
15. Using a 5/16" nutdriver, remove the three screws securing each side panel to the machine. See ***Figure F.3***.
16. The side panels can now be removed.

Cooler:

17. Using a 3/8" nutdriver, remove the four screws securing the left cooler side cover to the machine. See ***Figure F.5***. The left cooler side cover can now be removed.
18. Using a 3/8" nutdriver, remove the four screws securing the right cooler side cover to the machine. See ***Figure F.5***. The right cooler side cover can now be removed.
19. Using a 3/8" nutdriver, remove the two screws securing the rear connection cover to the machine. See ***Figure F.6***. The rear connection cover can now be removed.

REPLACEMENT PROCEDURE

1. Carefully position the rear connection cover onto the machine.
2. Using a 3/8" nutdriver, attach the two screws securing the rear connection cover to the machine.
3. Carefully position the right cooler side cover to the machine.
4. Using a 3/8" nutdriver, attach the four screws securing the right cooler side cover to the machine.
5. Carefully position the left cooler side cover to the machine.
6. Using a 3/8" nutdriver, attach the four screws securing the left cooler side cover to the machine.
7. Carefully position the side panels onto the machine.
8. Using a 5/16" nutdriver, attach the three screws securing each side panel to the machine.
9. Connect leads 535, 586 and 579 to the left side cold inch/feed gas purge switch or leads 635, 686 and 679 to the right side cold inch/feed gas purge switch. See Wiring Diagram.
10. Carefully position the roof onto the machine.
11. Using a 5/16" nutdriver, attach the four screws securing the roof to the feeder.
12. Carefully position the roof onto the power source.
13. Using a 3/8" nutdriver, attach the screw securing the roof to the power source.
14. Using a 3/8" nutdriver, attach the four screws securing the bottle holder to the power source.
15. Using a 3/8" nutdriver, attach the four screws securing the handle to the power source.
16. Carefully position the wire feeder off onto the power source.
17. Route leads through the bottle stand. See Wiring Diagram.
18. Using a 3/4" nutdriver, attach the nut securing the heavy lead to the rear of the power source. See Wiring Diagram.
19. Connect the ArcLink connector. See Wiring Diagram.
20. Carefully position the case side covers onto the power source.
21. Using a 3/8" nutdriver, attach the three screws securing each case side cover to the power source.

Figure F.1 – Case side cover mounting screw locations

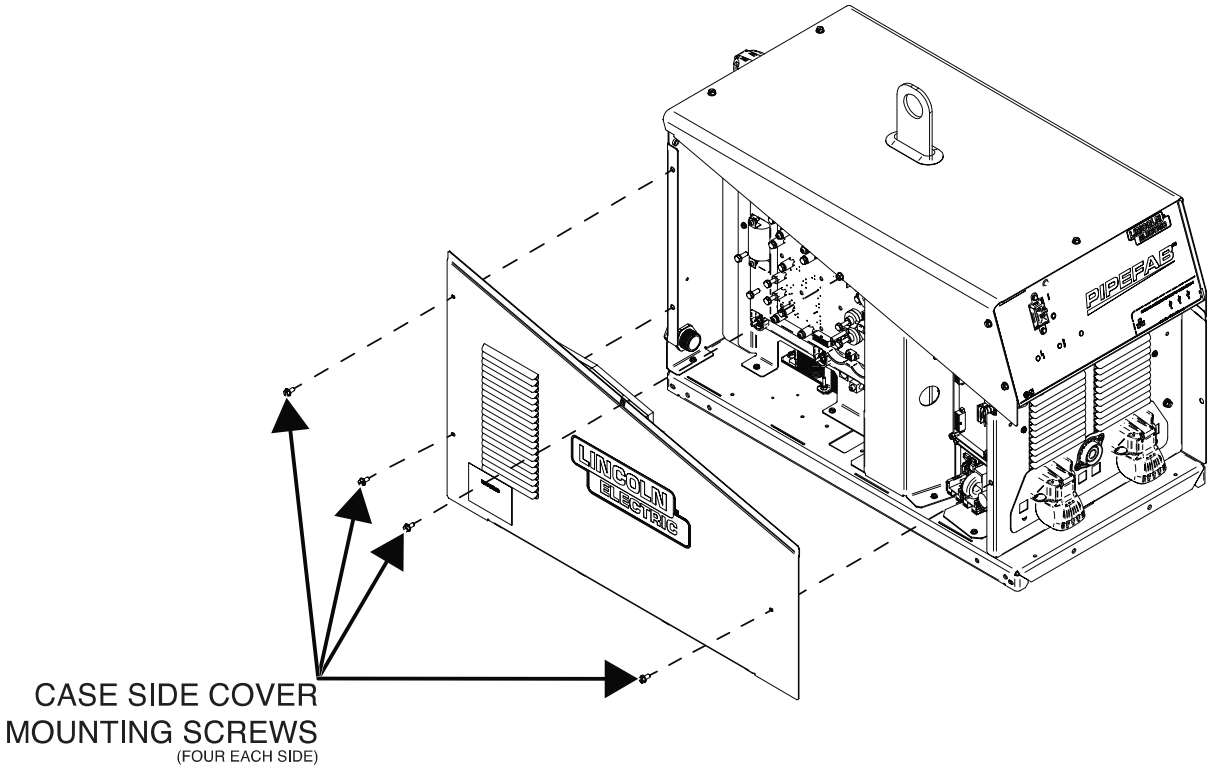


Figure F.2 – Roof mounting screw locations

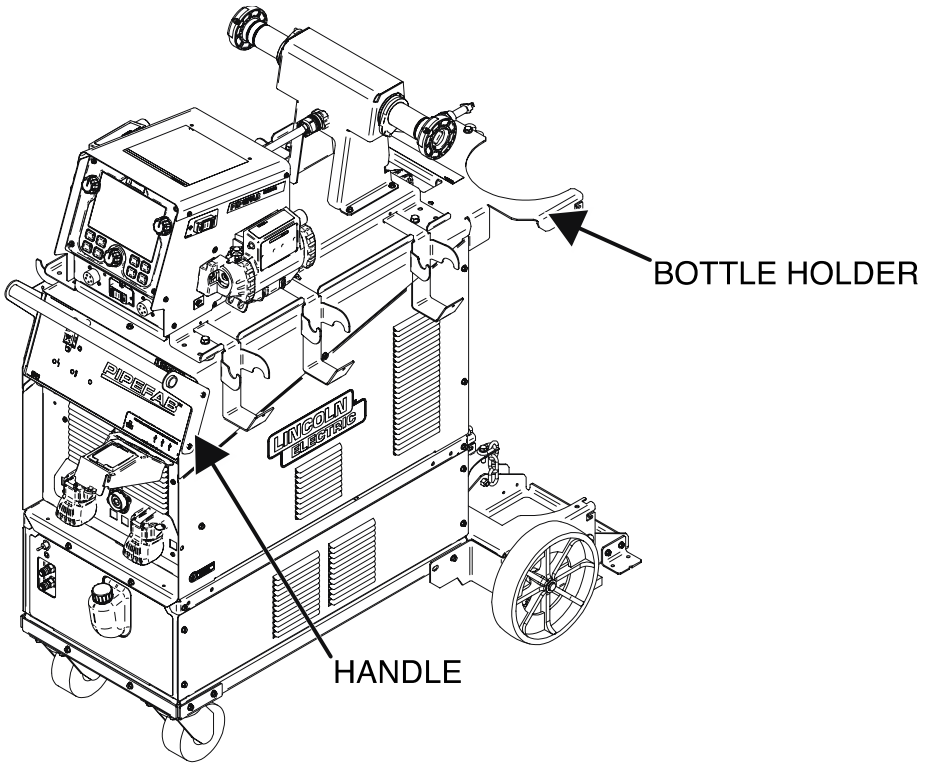


Figure F.3 – Roof and side panel mounting screw locations

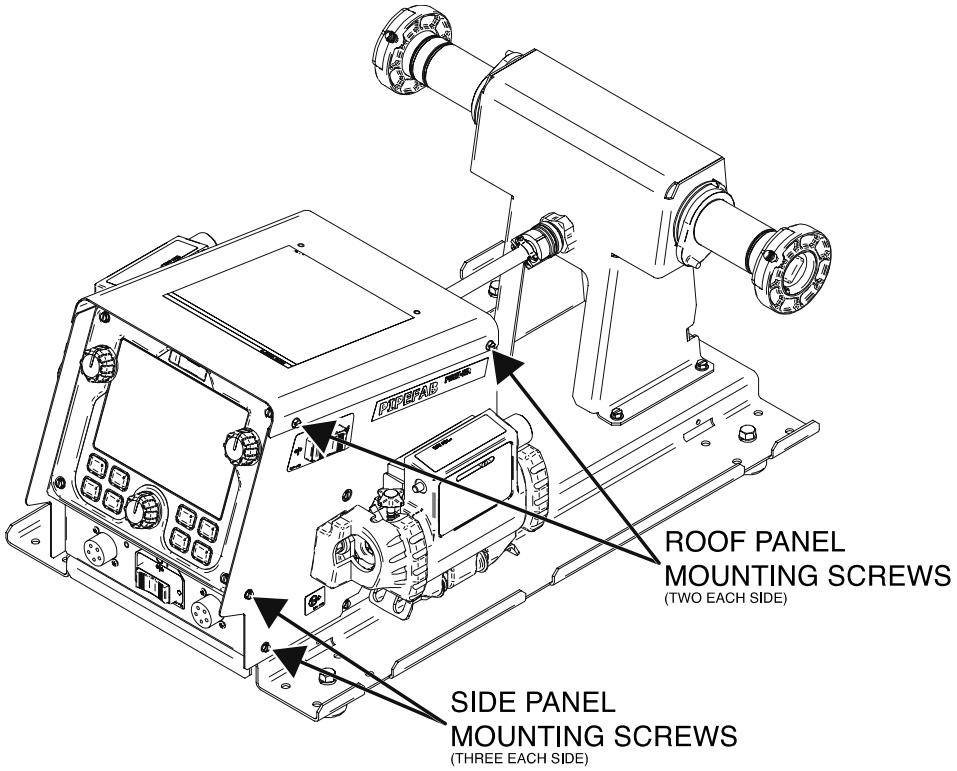


Figure F.4 – Cold inch/feed gas purge lead locations

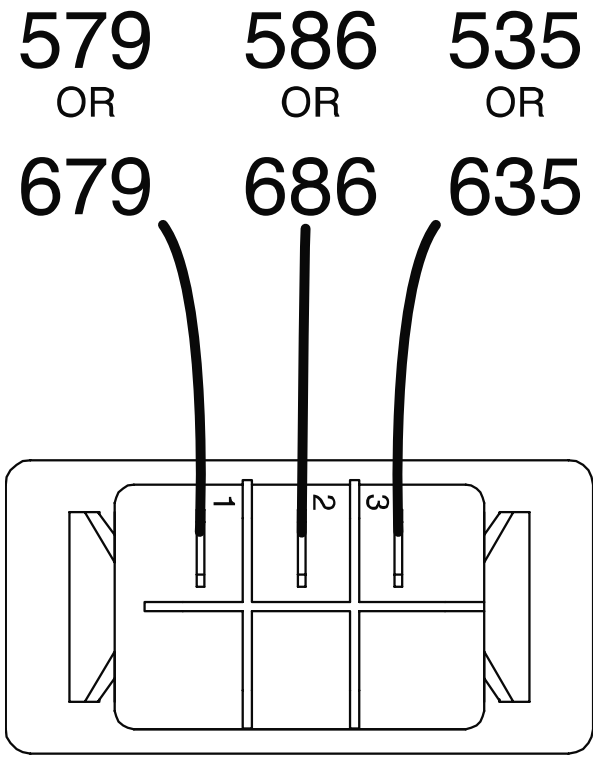


Figure F.5 – Cooler side cover mounting screw locations

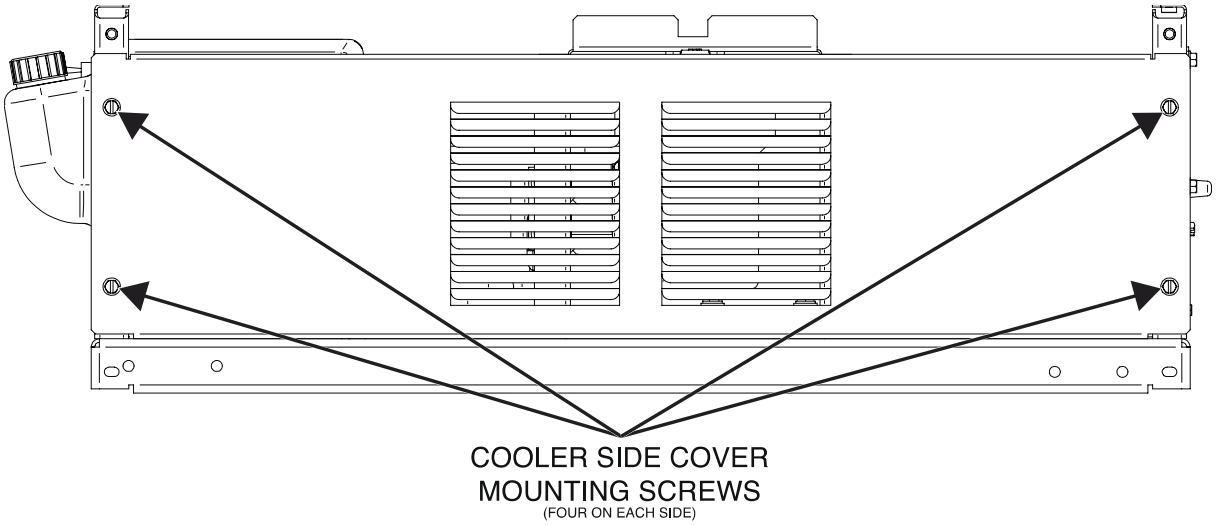
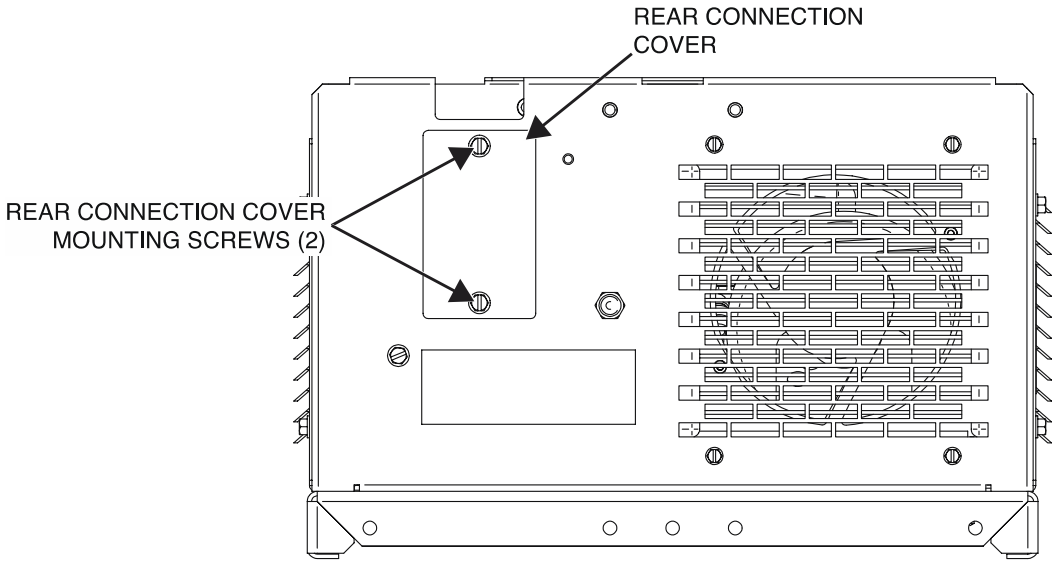


Figure F.6 – Rear connection cover mounting screw locations



CAPACITOR DISCHARGE PROCEDURE

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

TEST DESCRIPTION

This procedure will help determine if the capacitors have been discharged.

MATERIALS NEEDED

Volt/Ohmmeter
Resistor (1000 ohms and 25 watts minimum)
Electrical Insulating Gloves
Wiring Diagram

PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Locate the power conversion assembly. See ***Figure F.1***. See Wiring Diagram.
4. Using a volt/ohmmeter, carefully check the voltage across lead B4 (bus bar) and lead B5 (bus bar) on the power conversion assembly. See ***Figure F.2***. See Wiring Diagram. If any voltage is present discharge the capacitor using the high wattage resistor (25-1000 ohms @25 watts minimum), electrically insulated gloves and pliers. **CAUTION:** Rectified and filtered input line voltage may be present. Hold the resistor terminals on the capacitor terminals for 10 seconds.
5. Using a volt/ohmmeter, recheck the voltage across lead B4 (bus bar) and lead B5 (bus bar) of the power conversion assembly. See ***Figure F.2***. See Wiring Diagram. The voltage should be zero. If any voltage remains repeat the procedure. **NOTE:** Any voltage present after discharge has been performed is an abnormal condition and may indicate a problem.
6. Using a volt/ohmmeter, check the DC voltage from terminal B58 to lead B5 (bus bar) of the power conversion assembly. See ***Figure F.2***. See Wiring Diagram. If any voltage is present, use the high wattage resistor (25-1000 ohms @25 watts minimum), electrically insulated gloves and pliers to discharge the 400 VDC bus line (B58 to B5).
7. Locate the multi-phase chopper board. See ***Figure F.3***. See Wiring Diagram.
8. Using a volt/ohmmeter, carefully check the voltage across terminals B1 (+) and B2 (-) on the multi-phase chopper board. See ***Figure F.4***. See Wiring Diagram. If any voltage is present discharge the capacitor using the high wattage resistor (25-1000 ohms @25 watts minimum), electrically insulated gloves and pliers. **CAUTION:** high voltage may be present. Hold the resistor terminals on the capacitor terminals for 10 seconds.

9. Using a volt/ohmmeter, recheck the voltage across terminals B1 (+) and B2 (-) on the multi-phase chopper board. See ***Figure F.4***. See Wiring Diagram. The voltage should be zero. If any voltage remains repeat the procedure. **NOTE:** Any voltage present after discharge has been performed is an abnormal condition and may indicate a problem.
10. Perform desired test(s) / repair procedure(s).
11. When testing is complete, perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Power conversion assembly location

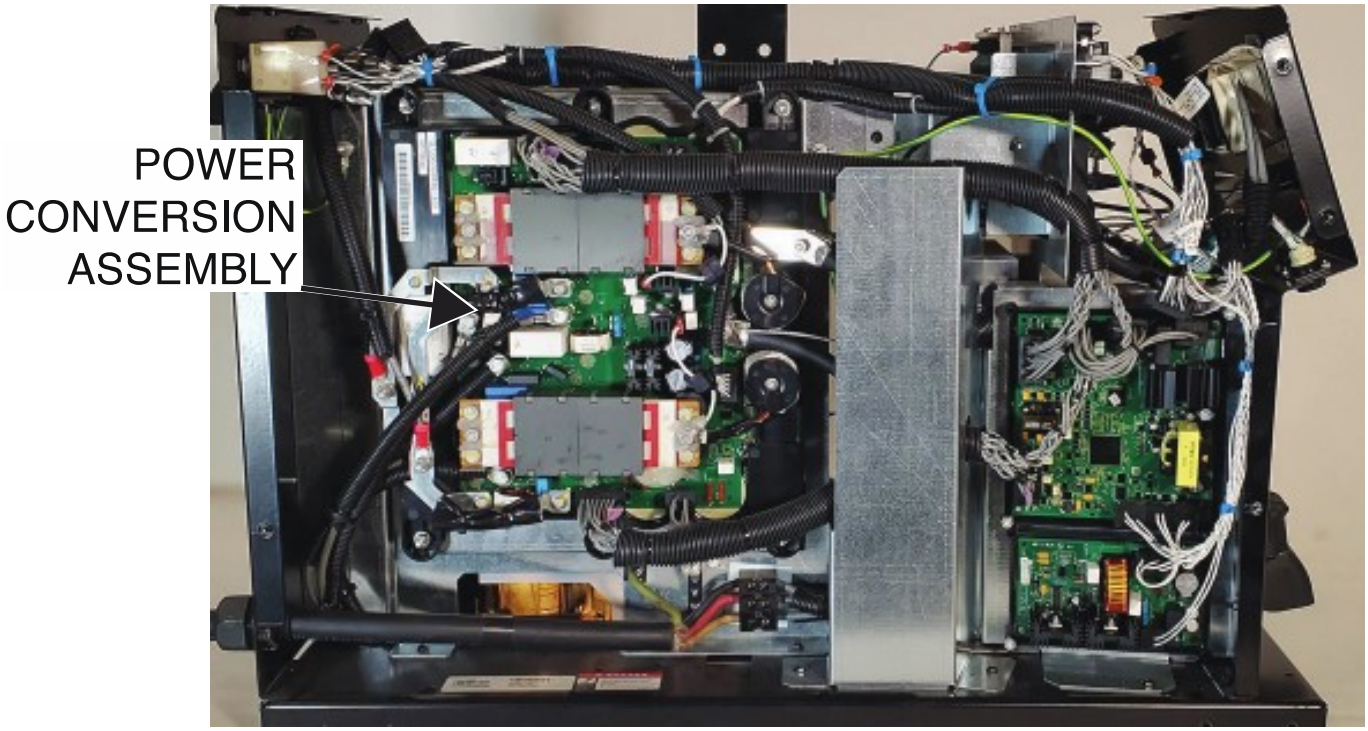


Figure F.2 – Power conversion assembly terminal locations

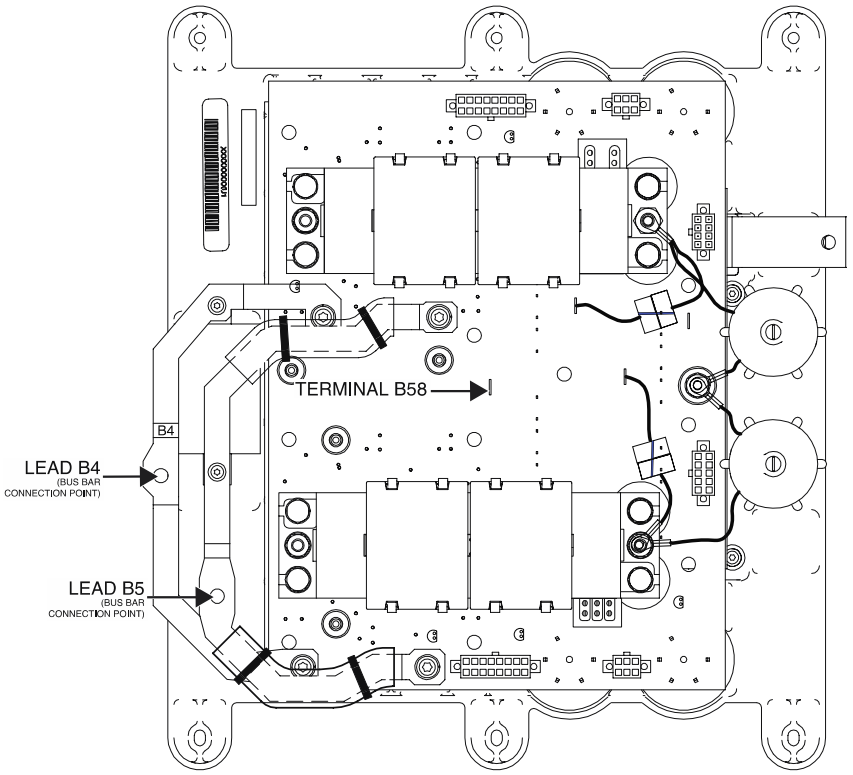


Figure F.3 – Multi-phase chopper board location

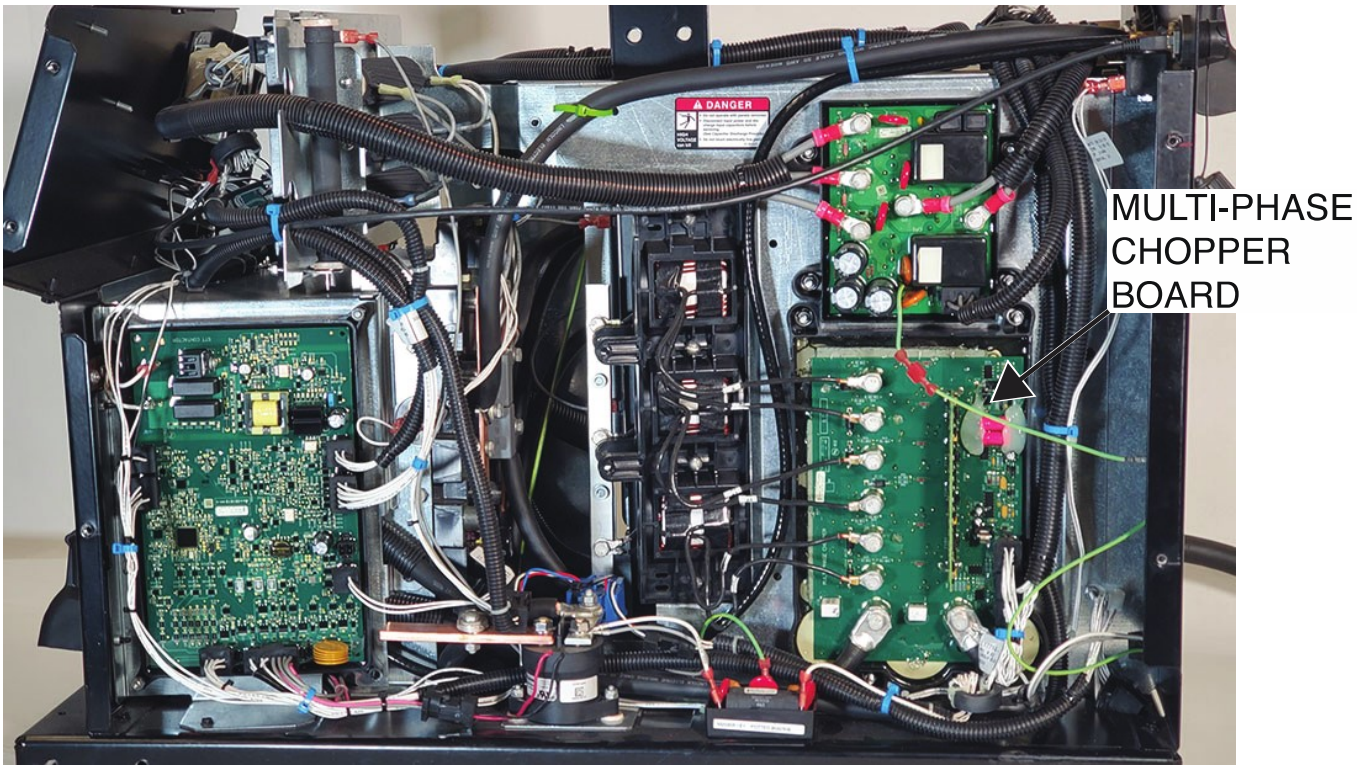
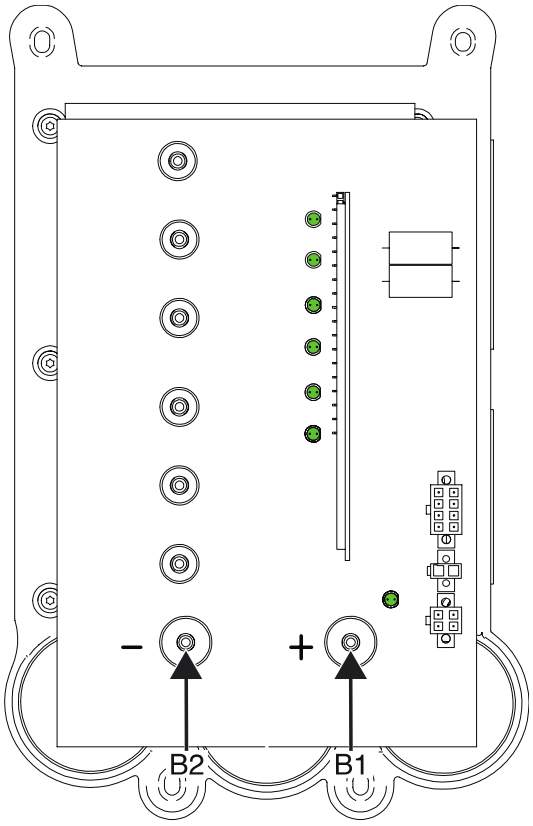


Figure F.4 – Multi-phase chopper board terminal locations



INPUT 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

These tests will help determine if the Input Board is receiving the correct input voltage and if the board is functioning correctly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the input board. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the diode tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
6. Locate the Green LED on the input board. See ***Figure F.2***. See Wiring Diagram.
7. Carefully apply the correct three phase input power to the machine and turn ON the machine.
8. Visually verify that the Green LED is illuminated on the input board. See ***Figure F.2***.
9. If the Green LED is illuminated, the input board is receiving input power.
10. If the Green LED is not illuminated, the input board is not receiving input power.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
12. If the correct input voltage is being applied to the input board and the correct output voltages are not being generated the input board may be faulty.
13. If faulty, perform the ***Input Board Removal and Replacement Procedure***.
14. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Input board diode tests

DESCRIPTION	TEST POINT (+)	TEST POINT (-)	EXPECTED READING
SMALL 3-PHASE RECTIFIER	TERMINAL B1	PLUG J1 PIN 3 (LEAD 369)	APPROX .562 VDC
SMALL 3-PHASE RECTIFIER	TERMINAL B2	PLUG J1 PIN 3 (LEAD 369)	APPROX .562 VDC
SMALL 3-PHASE RECTIFIER	TERMINAL B3	PLUG J1 PIN 3 (LEAD 369)	APPROX .562 VDC
SMALL 3-PHASE RECTIFIER	PLUG J1 PIN 3 (LEAD 369)	TERMINAL B1	OL
SMALL 3-PHASE RECTIFIER	PLUG J1 PIN 3 (LEAD 369)	TERMINAL B2	OL
SMALL 3-PHASE RECTIFIER	PLUG J1 PIN 3 (LEAD 369)	TERMINAL B3	OL
LARGER 3-PHASE BRIDGE	TERMINAL B1	TERMINAL B4	APPROX .480 VDC
LARGER 3-PHASE BRIDGE	TERMINAL B2	TERMINAL B4	APPROX .480 VDC
LARGER 3-PHASE BRIDGE	TERMINAL B3	TERMINAL B4	APPROX .480 VDC
LARGER 3-PHASE BRIDGE	TERMINAL B4	TERMINAL B1	OL
LARGER 3-PHASE BRIDGE	TERMINAL B4	TERMINAL B2	OL
LARGER 3-PHASE BRIDGE	TERMINAL B4	TERMINAL B3	OL
LARGER 3-PHASE BRIDGE	TERMINAL B5	TERMINAL B1	APPROX .456 VDC
LARGER 3-PHASE BRIDGE	TERMINAL B5	TERMINAL B2	APPROX .456 VDC
LARGER 3-PHASE BRIDGE	TERMINAL B5	TERMINAL B3	APPROX .456 VDC
LARGER 3-PHASE BRIDGE	TERMINAL B1	TERMINAL B5	OL
LARGER 3-PHASE BRIDGE	TERMINAL B2	TERMINAL B5	OL
LARGER 3-PHASE BRIDGE	TERMINAL B3	TERMINAL B5	OL

Table F.2 – Input board voltage tests (nominal 248 VAC applied)

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READING
THREE-PHASE INPUT	TERMINAL B1	TERMINAL B2	AC LINE VOLTAGE (EX. 248 VAC)
THREE-PHASE INPUT	TERMINAL B2	TERMINAL B3	AC LINE VOLTAGE (EX. 248 VAC)
THREE-PHASE INPUT	TERMINAL B3	TERMINAL B1	AC LINE VOLTAGE (EX. 248 VAC)
DC TO POWER CONVERSION BOARD	TERMINAL B4 (+)	TERMINAL B5 (-)	AC LINE VOLTAGE X 1.414 +/-10% (EX. 334 VAC)
FILTERED DC TO PFC BOARD	PLUG J1 PIN 6 (LEAD 366) (+)	TERMINAL B5 (-)	402 VDC
RECTIFIED AC TO PFC BOARD	PLUG J1 PIN 3 (LEAD 369) (-)	TERMINAL B5 (-)	334 VDC

Figure F.1 – Input board location

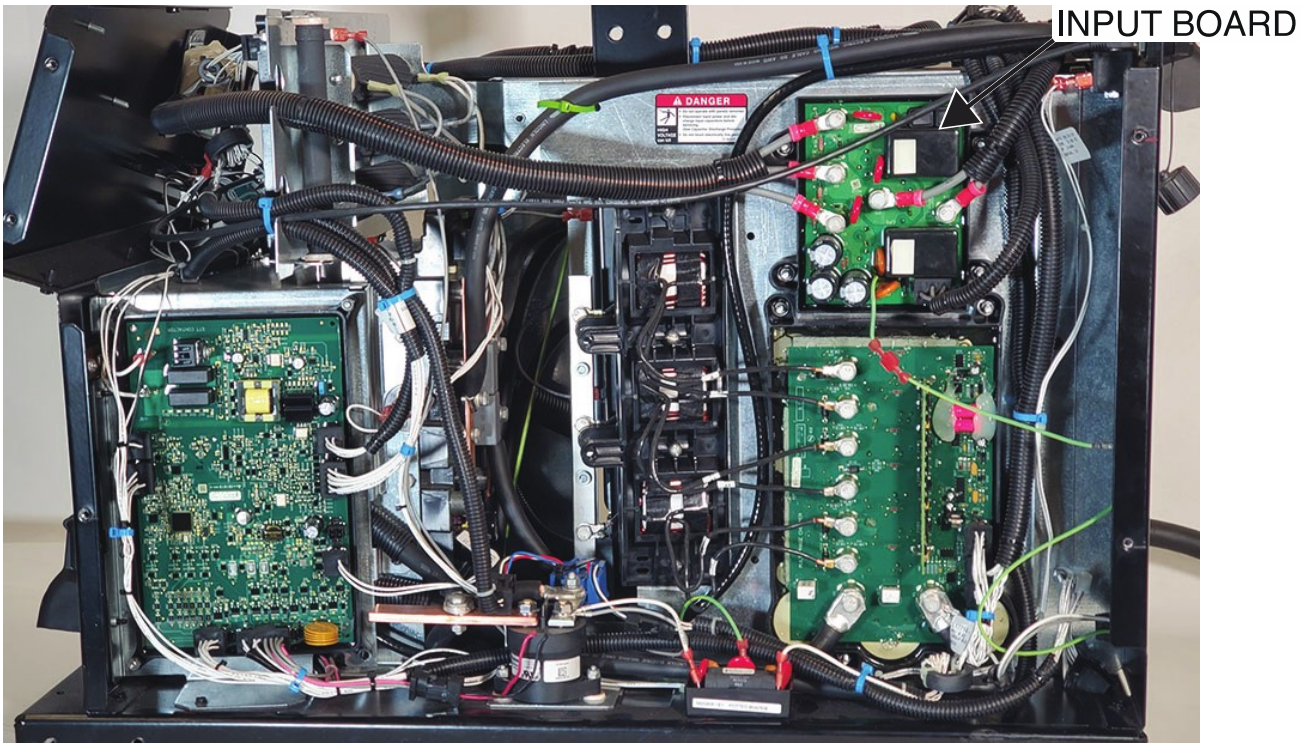


Figure F.2 – Input board test point locations

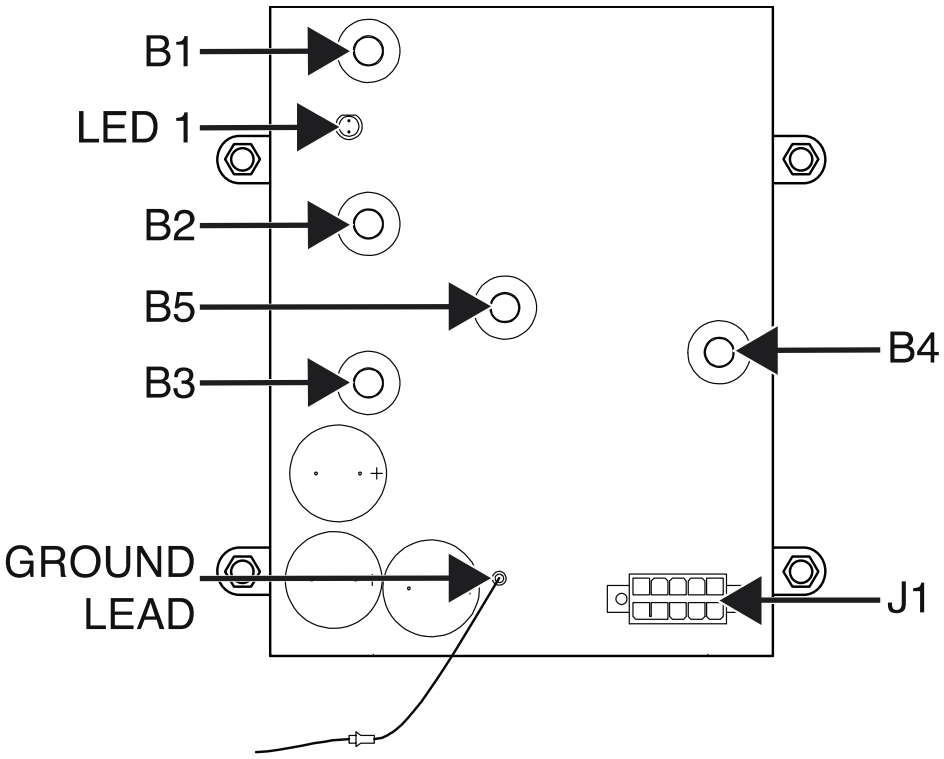
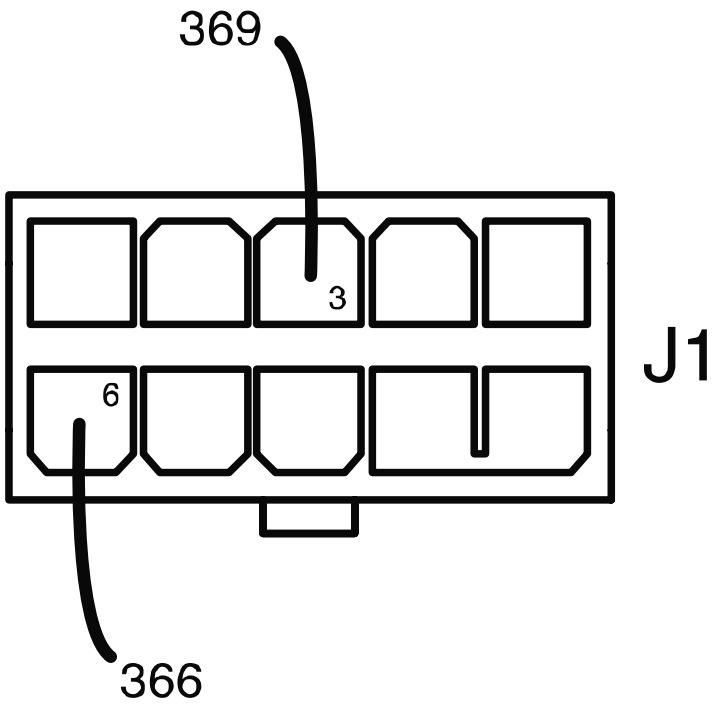


Figure F.3 – Input board lead locations



POWER CONVERSION ASSEMBLY TEST PROCEDURE

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

TEST DESCRIPTION

This test will help determine if the "power section" of the Power Conversion Assembly is functioning correctly. This test will NOT indicate if the entire assembly is functional.

MATERIALS NEEDED

7/16" Nutdriver
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the power conversion assembly. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16" nutdriver, remove the bolt and lock washer securing the three leads to terminal B56. See ***Figure F.2***. See Wiring Diagram. Disconnect leads from terminal and electrically isolate leads from one another.
6. Using a volt/ohmmeter, perform the diode tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram. When diode testing is complete make sure all internal leads are connected before applying input power to the machine.
7. Locate the five Green LEDs on the power conversion assembly. See ***Figure F.2***.
8. Carefully apply the correct three phase input power to the machine and turn ON the machine.
9. Check the buck/boost circuits using LED ***Tables F.2*** and ***F.3***. See ***Figure F.2***.
10. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.4***. See ***Figures F.2*** and ***F.3***.
11. Remove input power from the machine.
12. If any of the above test results are not correct the power conversion assembly may be faulty.
13. If faulty, perform the ***Power Conversion Assembly Removal And Replacement Procedure***.
14. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Power conversion assembly diode tests

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READING
SIDE A BUCK IGBT	TERMINAL B13	TERMINAL B29	0.395 VDC (+/- 10%)
SIDE A BOOST IGBT	TERMINAL B28	TERMINAL B8	0.395 VDC (+/- 10%)
SIDE A HIGH SPPED H-BRIDGE	TERMINAL B16	TERMINAL B58	0.395 VDC (+/- 10%)
SIDE A HIGH SPPED H-BRIDGE	TERMINAL B5	TERMINAL B58	0.395 VDC (+/- 10%)
SIDE A HIGH SPPED H-BRIDGE	TERMINAL B28	TERMINAL B16	0.395 VDC (+/- 10%)
SIDE A HIGH SPPED H-BRIDGE	TERMINAL B28	TERMINAL B5	0.395 VDC (+/- 10%)
SIDE B BUCK IGBT	TERMINAL B7	TERMINAL B17	0.395 VDC (+/- 10%)
SIDE B BOOST IGBT	TERMINAL B18	TERMINAL B6	0.395 VDC (+/- 10%)
SIDE B HIGH SPPED H-BRIDGE	TERMINAL B4	TERMINAL B58	0.395 VDC (+/- 10%)
SIDE B HIGH SPPED H-BRIDGE	TERMINAL B15	TERMINAL B58	0.395 VDC (+/- 10%)
SIDE B HIGH SPPED H-BRIDGE	TERMINAL B18	TERMINAL B4	0.395 VDC (+/- 10%)
SIDE B HIGH SPPED H-BRIDGE	TERMINAL B18	TERMINAL B15	0.395 VDC (+/- 10%)
OUTPUT RECTIFIER	TERMINAL B11	TERMINAL B57	0.395 VDC (+/- 10%)
OUTPUT RECTIFIER	TERMINAL B12	TERMINAL B57	0.395 VDC (+/- 10%)
OUTPUT RECTIFIER	TERMINAL B9	TERMINAL B57	0.395 VDC (+/- 10%)
OUTPUT RECTIFIER	TERMINAL B10	TERMINAL B57	0.395 VDC (+/- 10%)

Table F.2 – Power conversion assembly LED resistance tests (472 VAC)

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

Table F.3 – Power conversion assembly LED resistance tests (248 VAC)

LED NUMBER	DESCRIPTION	CONDITIONS	LED STATUS
LED 1	BOTTOM BOOST IGBT DRIVE	INPUT POWER (248 VAC) APPLIED AND MACHINE "ON"	ON
LED 2	BOTTOM BUCK IGBT DRIVE	INPUT POWER (248 VAC) APPLIED AND MACHINE "ON"	ON
LED 3	TOP BUCK IGBT DRIVE	INPUT POWER (248 VAC) APPLIED AND MACHINE "ON"	ON
LED 4	TOP BOOST IGBT DRIVE	INPUT POWER (248 VAC) APPLIED AND MACHINE "ON"	ON
LED 5	+48 VDC AUXILIARY	INPUT POWER (248 VAC) APPLIED AND MACHINE "ON"	ON

Table F.4 – Power conversion assembly voltage tests (248 VAC input)

DESCRIPTION	TEST POINTS	EXPECTED READING	CONDITIONS
INPUT TO TOP BUCK/BOOST CIRCUIT	TERMINAL B29 (+) TO TERMINAL B28 (-)	337 VDC	248 VAC INPUT AND MACHINE “ON”
INPUT TO BOTTOM BUCK/BOOST CIRCUIT	TERMINAL B17 (+) TO TERMINAL B18 (-)	333 VDC	248 VAC INPUT AND MACHINE “ON”
OUTPUT OF BUCK/BOOST CIRCUITS	PLUG J33 PIN 1 (+) (LEAD 368) TO PLUG J33 PIN 10 (-) (LEAD 361)	400 VDC	248 VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE TOP BUCK/BOOST LEM	PLUG J33 PIN 6 (+) (LEAD 331A) TO PLUG J33 PIN 10 (-) (LEAD 361)	+15 VDC	248 VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE TOP BUCK/BOOST LEM	PLUG J33 PIN 14 (+) (LEAD 335A) TO PLUG J33 PIN 10 (-) (LEAD 361)	-15 VDC	248 VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE BOTOM BUCK/BOOST LEM	PLUG J34 PIN 13 (+) (LEAD 331B) TO PLUG J33 PIN 10 (-) (LEAD 361)	+15 VDC	248 VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE BOTOM BUCK/BOOST LEM	PLUG J34 PIN 4 (+) (LEAD 335B) TO PLUG J33 PIN 10 (-) (LEAD 361)	-15 VDC	248 VAC INPUT AND MACHINE “ON”
SUPPLY FOR THE DC BUS BOARD	PLUG J37 PIN 4 (+) (LEAD 65) TO PLUG J37 PIN 9 (-) (LEAD 66)	49 VDC	248 VAC INPUT AND MACHINE “ON”
	TERMINAL B1A/B1C (+) TO TERMINAL B18 (-)	100 VDC	248 VAC INPUT AND MACHINE “ON”
	PLUG J36 PIN 8 (+) (LEAD 318) TO PLUG J36 PIN 5 (-) (LEAD 317)	278 VDC	248 VAC INPUT AND MACHINE “ON”

Figure F.1 – Power conversion assembly location

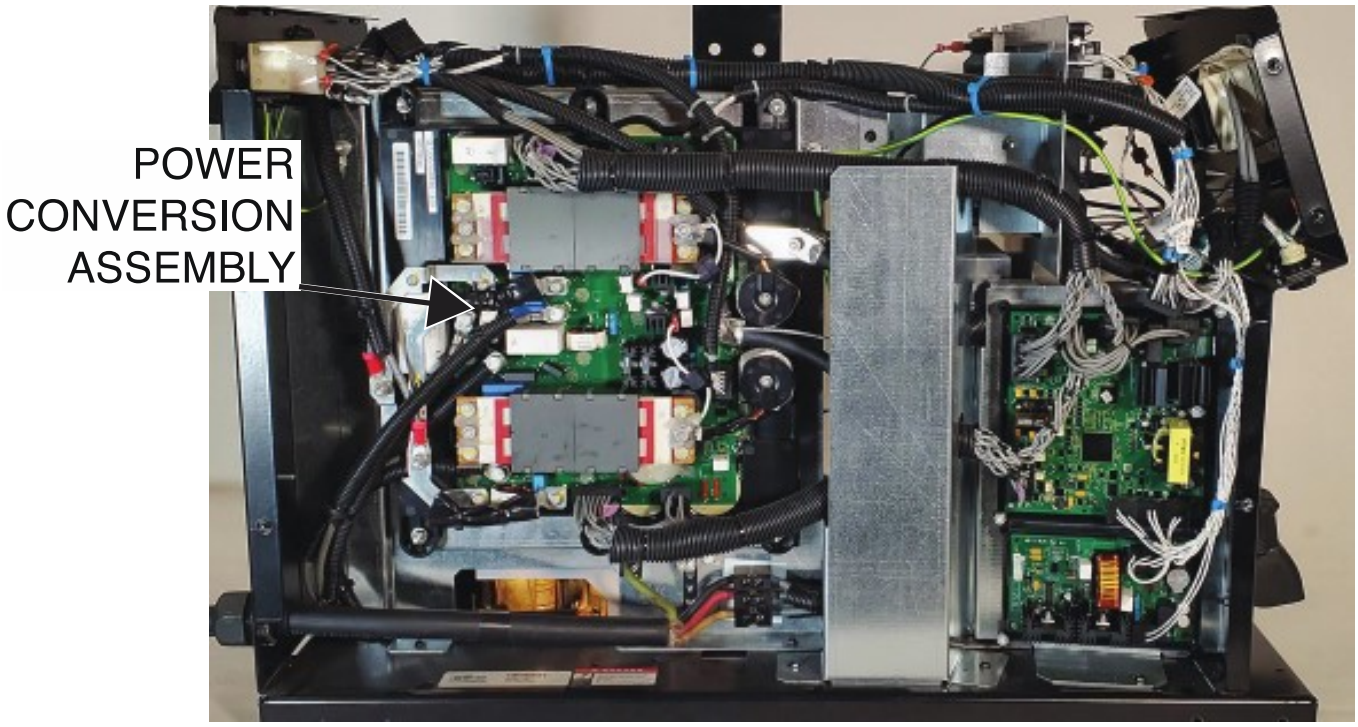


Figure F.2 – Power conversion assembly LED and terminal locations

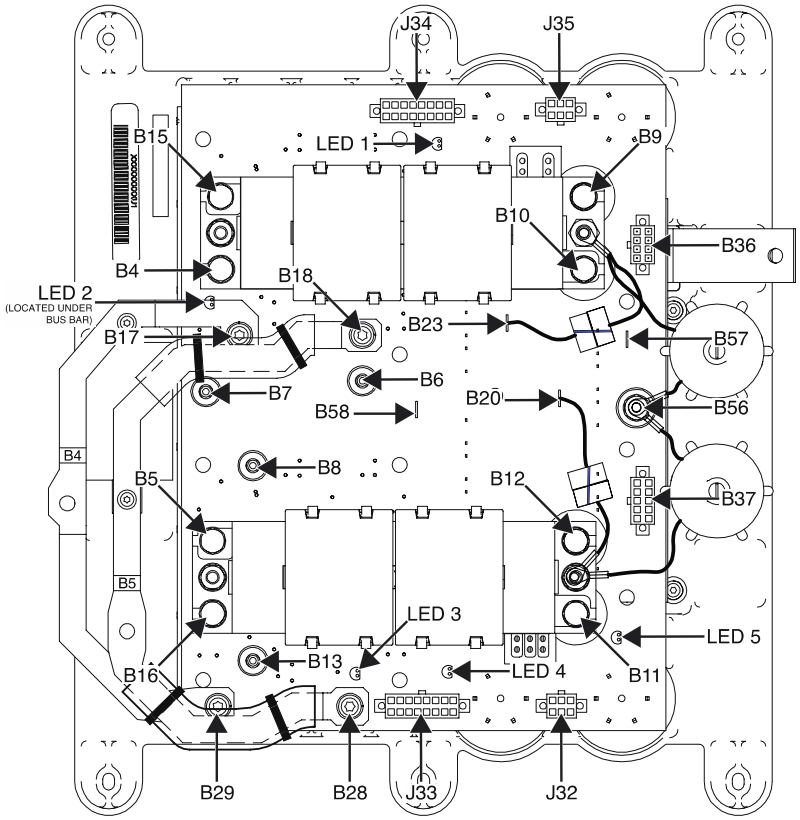
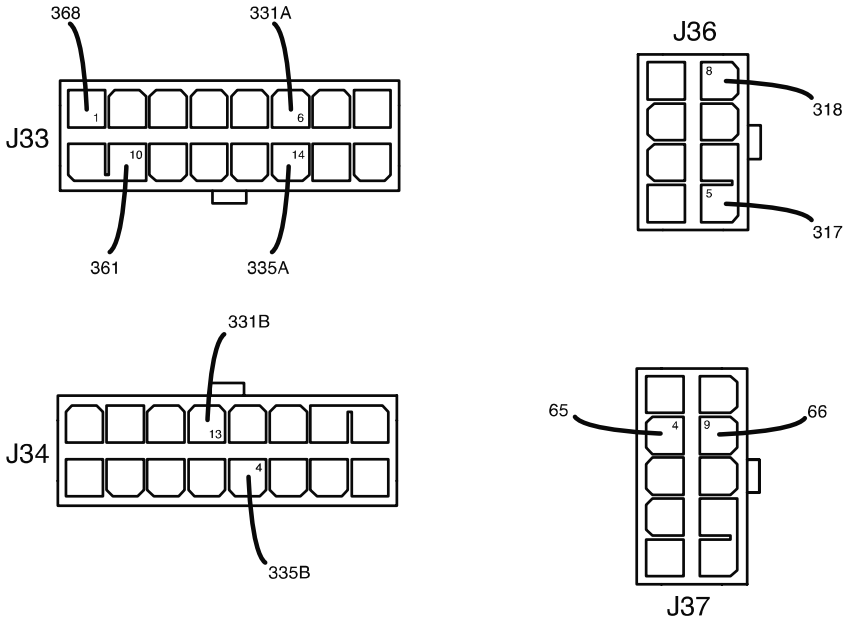


Figure F.3 – Power conversion assembly LED and terminal locations



DIGITAL 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 Digital Control Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the digital control board. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct three phase input power to the machine and turn ON the machine.
6. Visually inspect the LEDs on the board according to ***Table F.1***. See ***Figure F.2***.
7. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
8. If any of the tests fail, the digital control board may be faulty.
9. If faulty, perform the ***Digital Control Board Removal And Replacement Procedure***.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Digital control board LED indications

LED NUMBER	COLOR	FUNCTION
1	GREEN	STATUS "OK"
2	RED	STATUS "ERROR" (CHECK CODE FOR SPECIFIC ERROR)
3	GREEN	OUTPUT ENABLE
4	GREEN	SINGLE PHASE FAULT
5	GREEN	ELECTRODE SENSE
6	GREEN	WORK SENSE
7	GREEN	ETHERNET LINK/ACTIVITY STATUS
8	GREEN	ETHERNET SPEED STATUS
9	GREEN	INPUT SUPPLY 30 VDC TO 55 VDC
10	GREEN	DEVICENET EXTERNAL 24 VDC PRESENT

Table F.2 – Digital control board voltage tests

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READING
CAN COMMUNICATION	PLUG J11 PLUG 2 (LEAD 53)	PLUG J11 PLUG 1 (LEAD 54)	2 VDC
	PLUG J4 PLUG 1 (LEAD 358)	PLUG J4 PLUG 2 (LEAD 356)	40 VDC
	PLUG J6 PLUG 13 (LEAD 402)	PLUG J6 PLUG 10 (LEAD 403)	5 VDC
FAN CONTROL	PLUG J7 PLUG 6 (LEAD 355)	PLUG J7 PLUG 11 (LEAD 350)	10 VDC
LEM SUPPLY	PLUG J8 PLUG 3 (LEAD 213)	PLUG J8 PLUG 6 (LEAD 214)	-15 VDC
LEM SUPPLY	PLUG J8 PLUG 2 (LEAD 212)	PLUG J8 PLUG 6 (LEAD 214)	15 VDC
	PLUG J4 PLUG 8 (LEAD 675)	PLUG J8 PLUG 7 (LEAD 676)	15 VDC
	PLUG J4 PLUG 9 (LEAD 655)	PLUG J8 PLUG 7 (LEAD 676)	15 VDC

Figure F.1 – Digital control board location

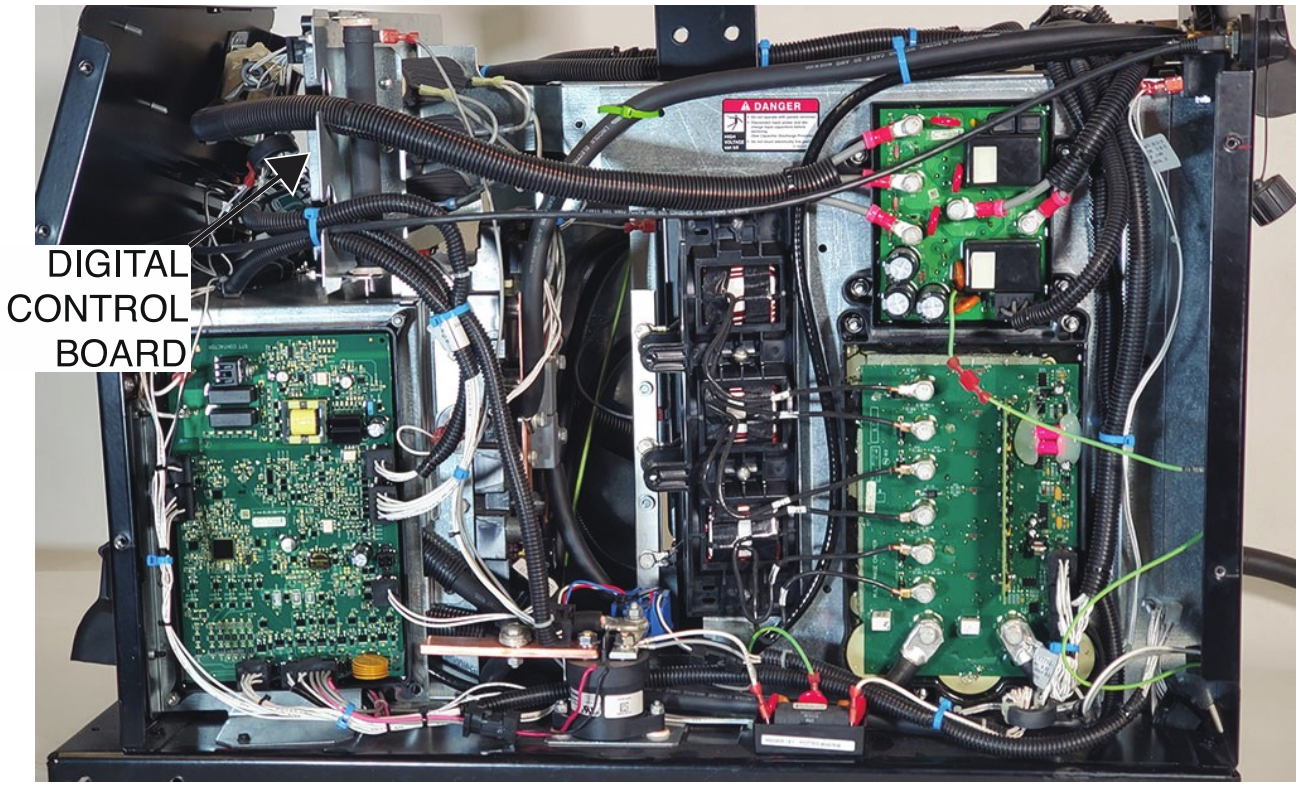


Figure F.2 – Digital control board LED and plug location

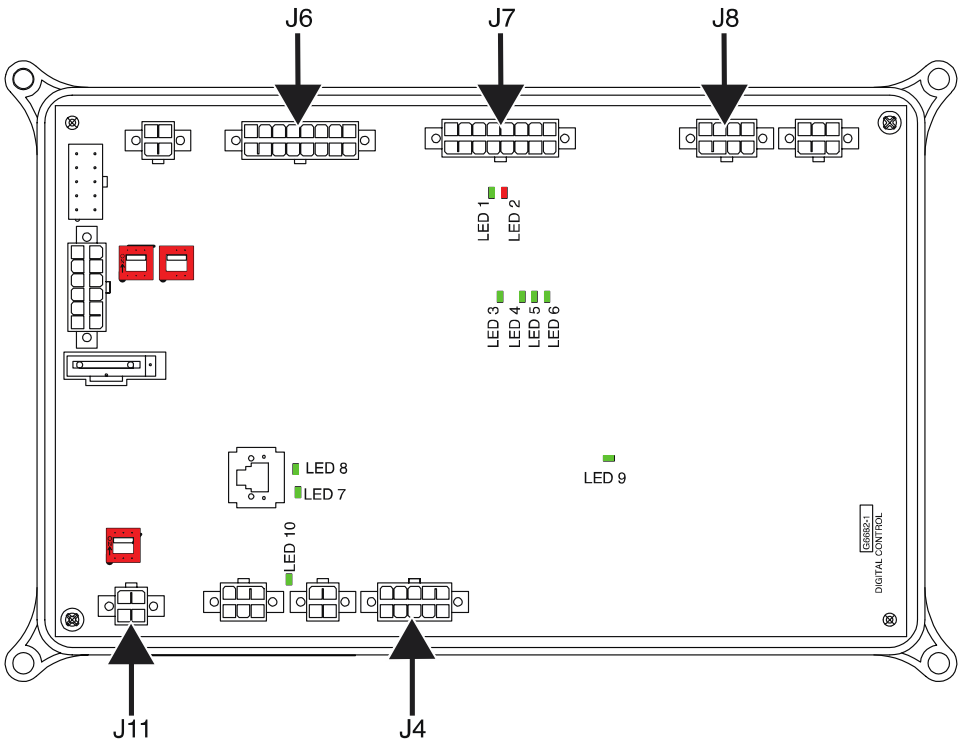
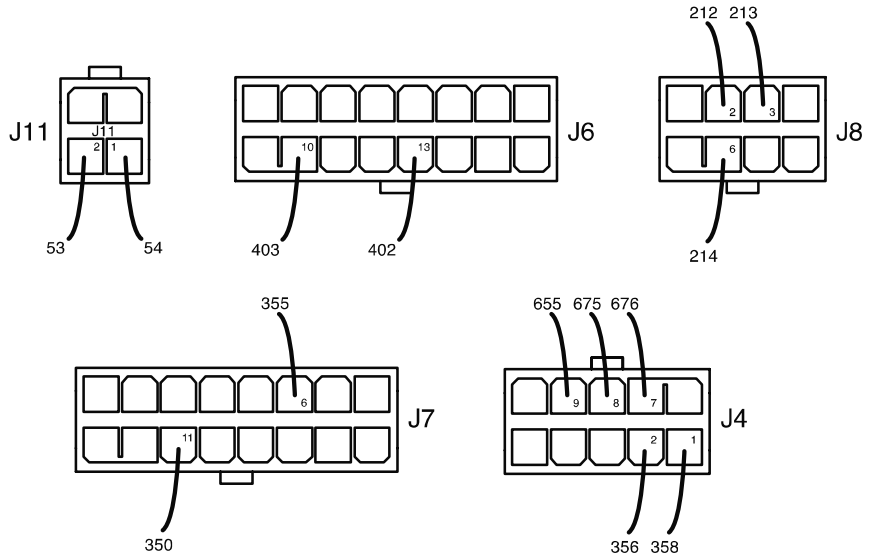


Figure F.3 – Digital control board lead locations



MULTI-PHASE CHOPPER 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

These tests will help determine if the Multi-Phase Chopper Board is receiving the correct input voltage and if the board is functioning correctly.

MATERIALS NEEDED

7/16” Nutdriver
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the multi-phase chopper board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the bolt and lock washer securing leads to terminals B1 and B2 of the multi-phase chopper board. See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads. When diode testing is complete make sure all leads are connected before applying input power to the machine.
6. Using a volt/ohmmeter, perform the diode checks outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. Using a 7/16” nutdriver, attach the bolt and lock washer securing the previously disconnected leads to terminals B1 and B2 of the multi-phase chopper board. See ***Figure F.2***. See Wiring Diagram.
8. Locate the Green LED on the multi-phase chopper board. See ***Figure F.2***. See Wiring Diagram.
9. Carefully apply the correct three phase input power to the machine and turn ON the machine.
10. If the Green LED is illuminated, the board is receiving input power from the power conversion assembly (100 VDC).
11. If the Green LED is not illuminated, the board may not be receiving the 100 VDC from the power conversion assembly. See the Wiring Diagram.
12. Energize the output of the machine. Visually verify that the six LEDs on the board are illuminated. This is an indication that the multi-phase control board is receiving gate firing signals from the control board and the multi-phase board is providing gate driving signals to the multi-phase chopper board. See ***Figure F.2***.

13. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.2***.
14. If the correct input voltage is being applied to the multi-phase chopper board and the correct output voltages are not being generated, the multi-phase chopper board may be faulty.
15. If any of the tests fail, the multi-phase chopper board may be faulty.
16. If faulty, perform the ***Multi-Phase Chopper Board Removal And Replacement Procedure***.
17. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Multi-phase chopper board diode tests

DESCRIPTION	TEST POINTS (POS/NEG)	CONDITIONS	EXPECTED READING +/- 10%
PHASE 3 DRIVER	TERMINAL B2 TO TERMINAL BL1	ALL LEADS REMOVED FROM TERMINALS B1 AND B2	.410 VDC
PHASE 2 DRIVER	TERMINAL B2 TO TERMINAL BL2	ALL LEADS REMOVED FROM TERMINALS B1 AND B2	.410 VDC
PHASE 1 DRIVER	TERMINAL B2 TO TERMINAL BL3	ALL LEADS REMOVED FROM TERMINALS B1 AND B2	.410 VDC
PHASE 6 DRIVER	TERMINAL B2 TO TERMINAL BL4	ALL LEADS REMOVED FROM TERMINALS B1 AND B2	.410 VDC
PHASE 5 DRIVER	TERMINAL B2 TO TERMINAL BL5	ALL LEADS REMOVED FROM TERMINALS B1 AND B2	.410 VDC
PHASE 4 DRIVER	TERMINAL B2 TO TERMINAL BL6	ALL LEADS REMOVED FROM TERMINALS B1 AND B2	.410 VDC

Table F.2 – Multi-phase chopper board voltage tests

MODE	OPEN CIRCUIT VOLTAGE	TEST POINTS (POS/NEG)	EXPECTED READING +/- 10%
TIG	24 VDC	TERMINAL B1 TO TERMINAL B2	100 VDC
TIG	24 VDC	TERMINAL BL1 TO TERMINAL B2	75 VDC
TIG	24 VDC	TERMINAL BL2 TO TERMINAL B2	75 VDC
TIG	24 VDC	TERMINAL BL3 TO TERMINAL B2	75 VDC
TIG	24 VDC	TERMINAL BL4 TO TERMINAL B2	75 VDC
TIG	24 VDC	TERMINAL BL5 TO TERMINAL B2	75 VDC
TIG	24 VDC	TERMINAL BL6 TO TERMINAL B2	75 VDC
CV	70 VDC	TERMINAL B1 TO TERMINAL B2	100 VDC
CV	70 VDC	TERMINAL BL1 TO TERMINAL B2	39 VDC (WITH TRIGGER ACTIVATED)
CV	70 VDC	TERMINAL BL2 TO TERMINAL B2	39 VDC (WITH TRIGGER ACTIVATED)
CV	70 VDC	TERMINAL BL3 TO TERMINAL B2	39 VDC (WITH TRIGGER ACTIVATED)
CV	70 VDC	TERMINAL BL4 TO TERMINAL B2	39 VDC (WITH TRIGGER ACTIVATED)
CV	70 VDC	TERMINAL BL5 TO TERMINAL B2	39 VDC (WITH TRIGGER ACTIVATED)
CV	70 VDC	TERMINAL BL6 TO TERMINAL B2	39 VDC (WITH TRIGGER ACTIVATED)
STICK	60 VDC	TERMINAL B1 TO TERMINAL B2	100 VDC
STICK	60 VDC	TERMINAL BL1 TO TERMINAL B2	39 VDC
STICK	60 VDC	TERMINAL BL2 TO TERMINAL B2	39 VDC
STICK	60 VDC	TERMINAL BL3 TO TERMINAL B2	39 VDC
STICK	60 VDC	TERMINAL BL4 TO TERMINAL B2	39 VDC
STICK	60 VDC	TERMINAL BL5 TO TERMINAL B2	39 VDC
STICK	60 VDC	TERMINAL BL6 TO TERMINAL B2	39 VDC

Figure F.1 – Multi-phase chopper board location

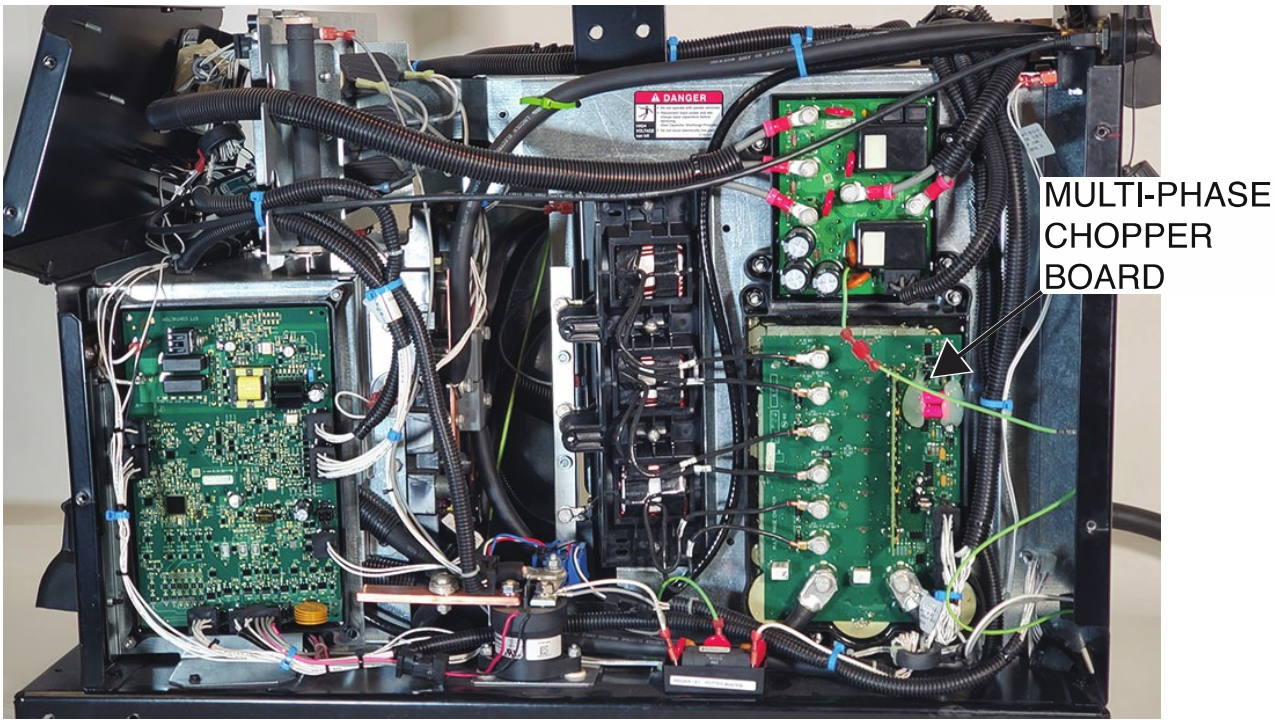
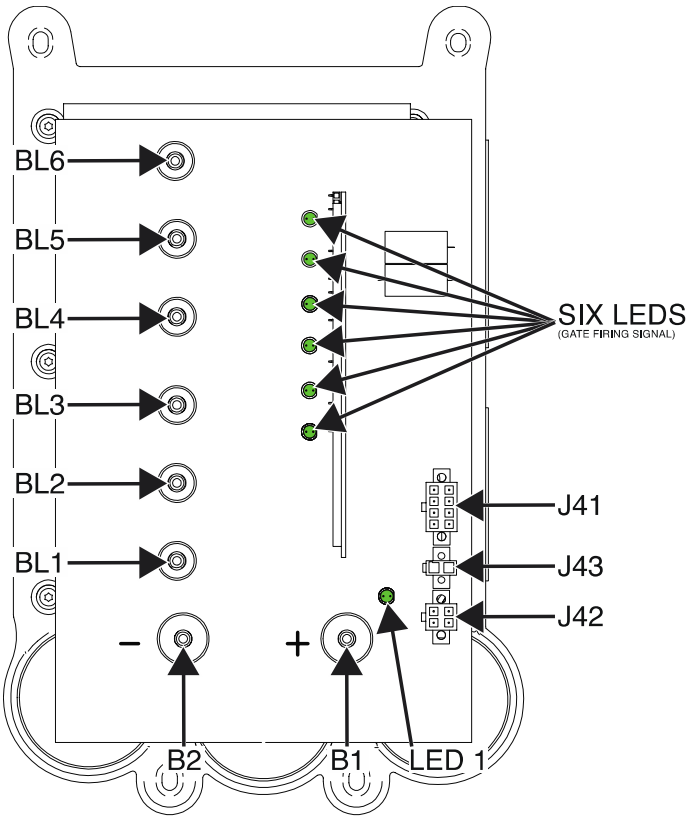


Figure F.2 – Multi-phase chopper board terminal locations



MULTI-PHASE 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

These tests will help determine if the Multi-Phase Choke Coils are not open and that they are not ground or shorted together.

MATERIALS NEEDED

7/16” Nutdriver
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the multi-phase chopper board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the bolt and lock washer securing leads BL1, BL2, BL3, BL4, BL5 and BL6 to the multi-phase chopper board. Label and disconnect leads. See ***Figure F.2***. See Wiring Diagram.
6. Using a 7/16” nutdriver, remove the bolt and lock washer securing the six output choke leads to the negative bus bar. See ***Figure F.1***. Note the choke leads are connected in pairs. The same lead pairs must be reconnected to each other on the bus bar. See the Wiring Diagram.
7. Using a volt/ohmmeter, check the continuity of each of the individual choke coils. See the Wiring Diagram. The resistance should be less than 0.5 ohms of resistance. Also, when all the individual choke coils are separated, they should NOT have continuity to each other. See the Wiring Diagram.
8. Using a volt/ohmmeter, measure the individual choke coils to ground. There should be a minimum of 500,000 ohms of resistance to ground. See Wiring Diagram.
9. If any of the tests fail, the multi-phase output choke may be faulty.
10. If faulty, perform the ***Multi-Phase Output Choke Removal And Replacement Procedure***.
11. Perform the ***Case Cover Replacement Procedure***.

Multi-phase chopper board, multi-phase output choke and negative bus bar locations

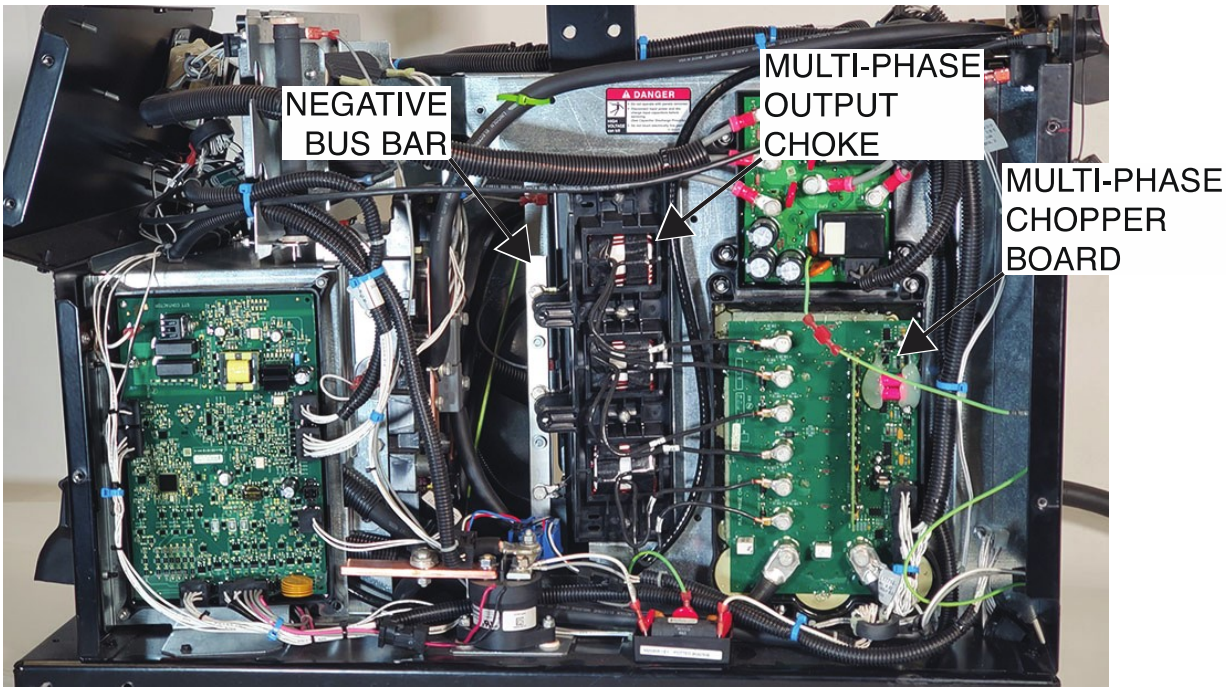
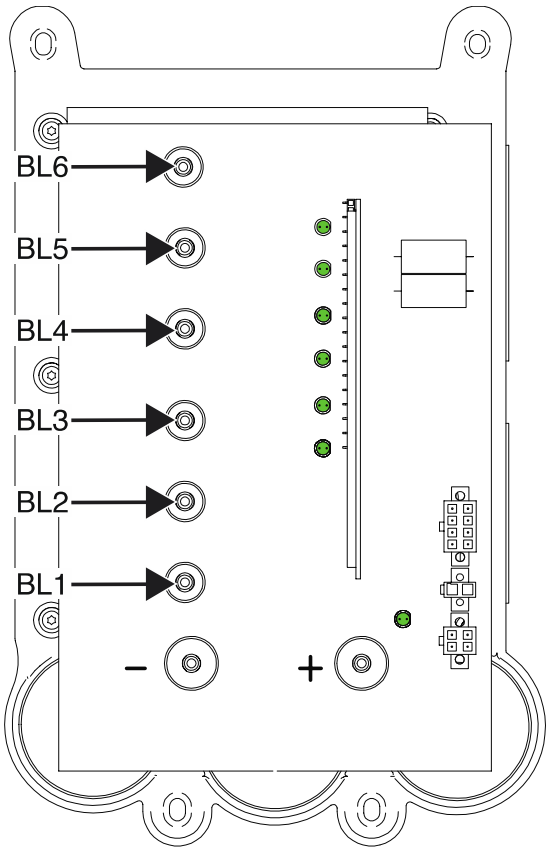


Figure F.2 – Multi-phase chopper board lead locations



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 help determine if the Current Transducers are receiving the correct input voltages and if they are producing the correct feedback voltages.

MATERIALS NEEDED

Volt/Ohmmeter
Laptop Computer
Resistive Load Bank
External Calibrated Ammeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the two current transducers (LEM). See ***Figure F.1***. See Wiring Diagram.
5. Locate the digital control board and the multi-phase chopper board. See ***Figure F.1***. See Wiring Diagram.
6. Carefully apply the correct three phase input power to the machine and turn ON the machine.
7. Using a volt/ohmmeter, perform the supply voltage tests outlined in ***Tables F.1*** and ***F.2***. See ***Figure F.2***. See Wiring Diagram.
8. **For the following steps refer to the information in the Diagnostic Utility found at Powerwavemanager.com.** Using an Ethernet Cross Connect cable, connect a laptop computer to the PipeFab Welding System via the Ethernet port located at the rear of the machine.
9. Connect a resistive load bank (or 50 Ft. weld cable) to the positive and negative output terminals on the machine.
10. Using the Diagnostic Utility Software:
    Establish communications with the machine.
    Select the “Calibrate” tab.
    Select the “50 amp” current set point.
    Select “Turn Output On”.
    Use an external calibrated ammeter that is not affected by inverter noise to read the actual current.

11. Using an external calibrated ammeter, check the feedback voltage according to ***Tables F.3*** and ***F.4***. See ***Figure F.2*** and ***F.3***.
12. Repeat the test at several other current levels. If the transducers feedback voltages are correct for the actual current, the transducers are functioning properly. If there is no feedback check the connections between the current transducers and the appropriate board. See the Wiring Diagram.
13. If any of the tests fail, the Current Transducer may be faulty.
14. If faulty, perform the ***Current Transducer Removal And Replacement Procedure***.
15. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Current transducer voltage tests

DESCRIPTION	TEST POINT (+) (ON DIGITAL CONTROL BOARD)	TEST POINT (-) (ON DIGITAL CONTROL BOARD)	EXPECTED READING
OUTERMOST CURRENT TRANSDUCER NEGATIVE SUPPLY VOLTAGE	PLUG J8 PIN 3 (LEAD 213)	PLUG J8 PIN 6 (LEAD 214)	-15 VDC
OUTERMOST CURRENT TRANSDUCER POSITIVE SUPPLY VOLTAGE	PLUG J8 PIN 2 (LEAD 212)	PLUG J8 PIN 6 (LEAD 214)	+15 VDC

Table F.2 – Current transducer voltage tests

DESCRIPTION	TEST POINT (+) (ON MULTI-PHASE CHOPPER BOARD)	TEST POINT (-) (ON MULTI-PHASE CHOPPER BOARD)	EXPECTED READING
INERMOST CURRENT TRANSDUCER SUPPLY VOLTAGE	PLUG J42 PIN 2 (LEAD 217)	PLUG J42 PIN 4 (LEAD 218)	+5 VDC
INERMOST CURRENT TRANSDUCER SUPPLY VOLTAGE	PLUG J42 PIN 1 (LEAD 216)	PLUG J428 PIN 4 (LEAD 218)	+15 VDC

Table F.3 – Digital control board current transducer feedback voltage tests

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

Table F.4 – Multi-phase chopper current transducer feedback voltage tests

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

Current transducer(s), digital control board and multi-phase chopper board locations

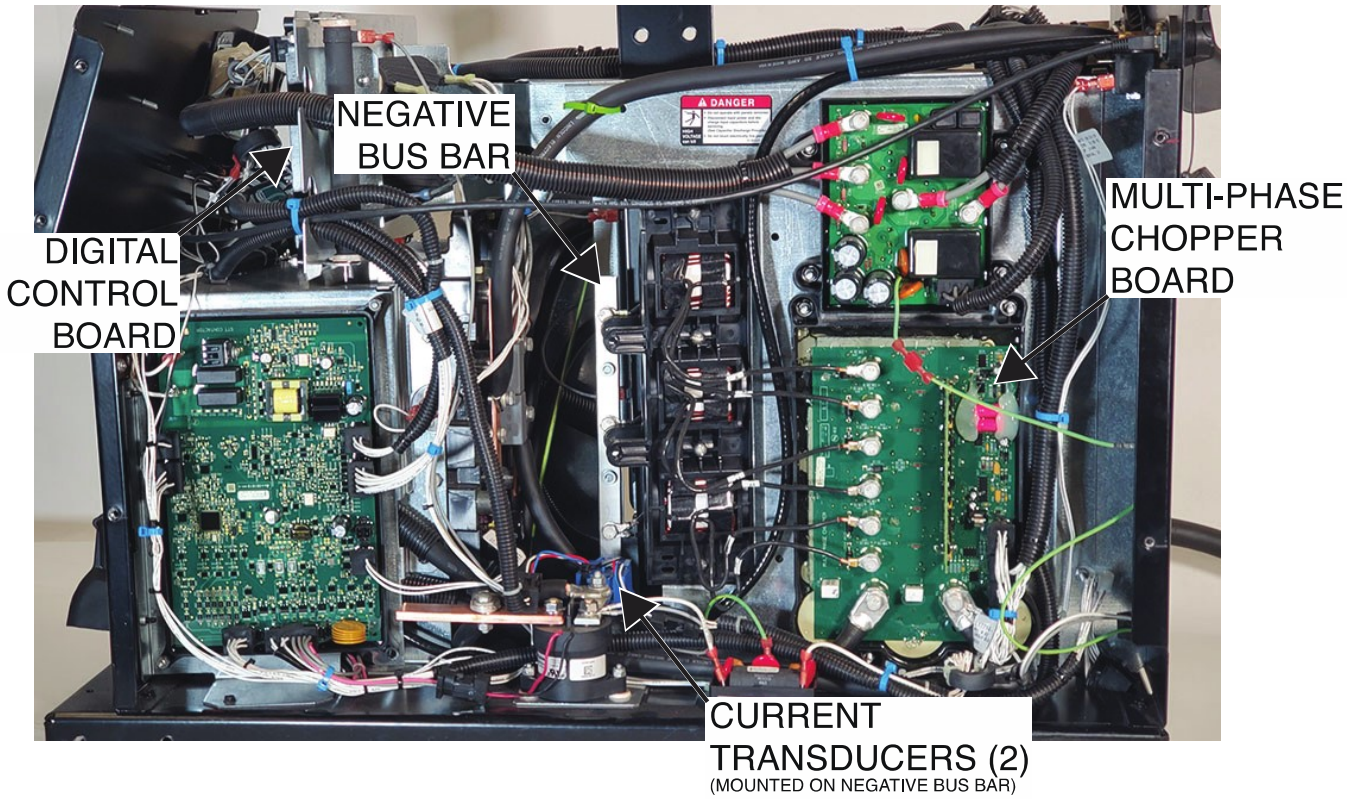


Figure F.2 – Digital control board plug and lead locations

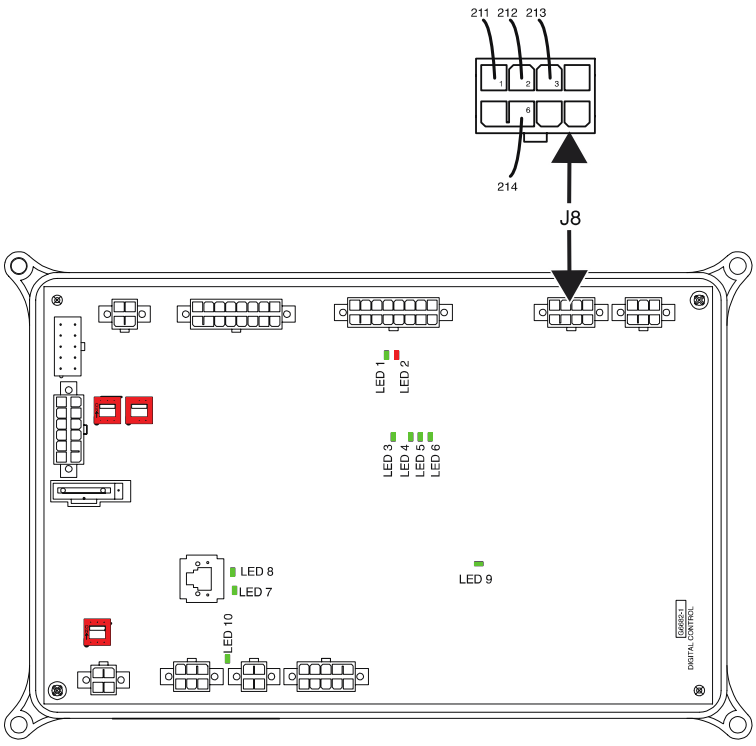
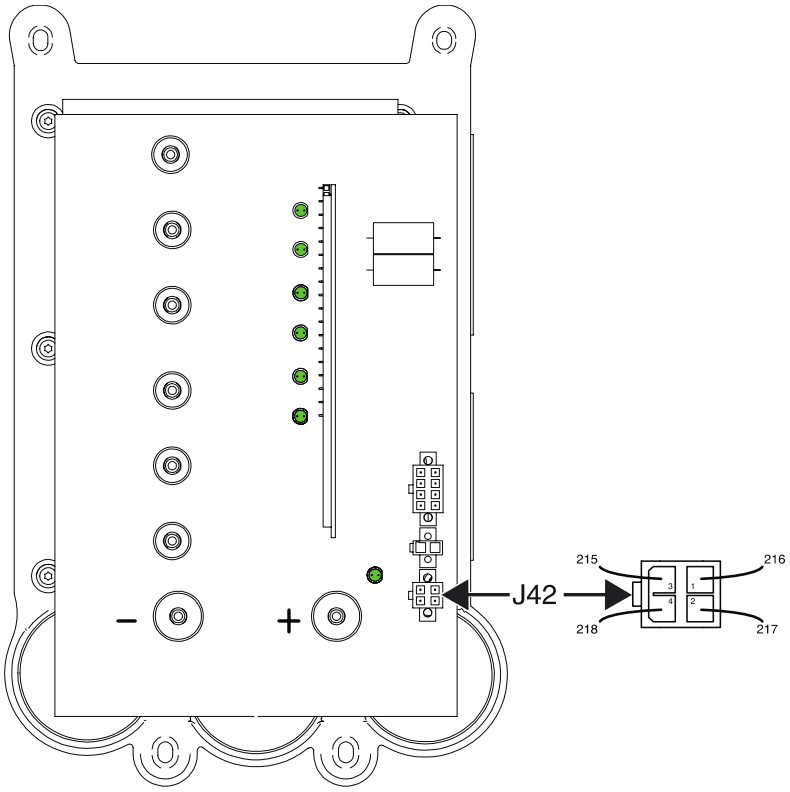


Figure F.3 – Multi-phase chopper board plug and lead locations



THERMOSTAT CIRCUIT 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

These tests will help determine if the STT Switch board Thermostat Circuit is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the STT switch board and STT contactor 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.2*** and ***F.3***. See Wiring Diagram.
6. If any of the tests fail, label, and disconnect leads from thermostat terminals and test for continuity.
7. If any of the tests fail, the thermostat may be faulty.
8. Connect any previously disconnected leads when testing is complete.
9. If faulty, perform the ***Thermostat Removal And Replacement Procedure***.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Thermostat tests

TEST POINT (+) (ON STT SWITCH BOARD)	TEST POINT (-) (ON STT CONTACTOR BOARD)	EXPECTED READING	CONDITION
PLUG J2 PIN 6 (LEAD 625A)	PLUG J62 PIN 5 (LEAD 625)	VERY LOW RESISTANCE (LESS THAN ONE OHM)	MACHINE OFF

Figure F.1 – STT switch board and STT contactor locations

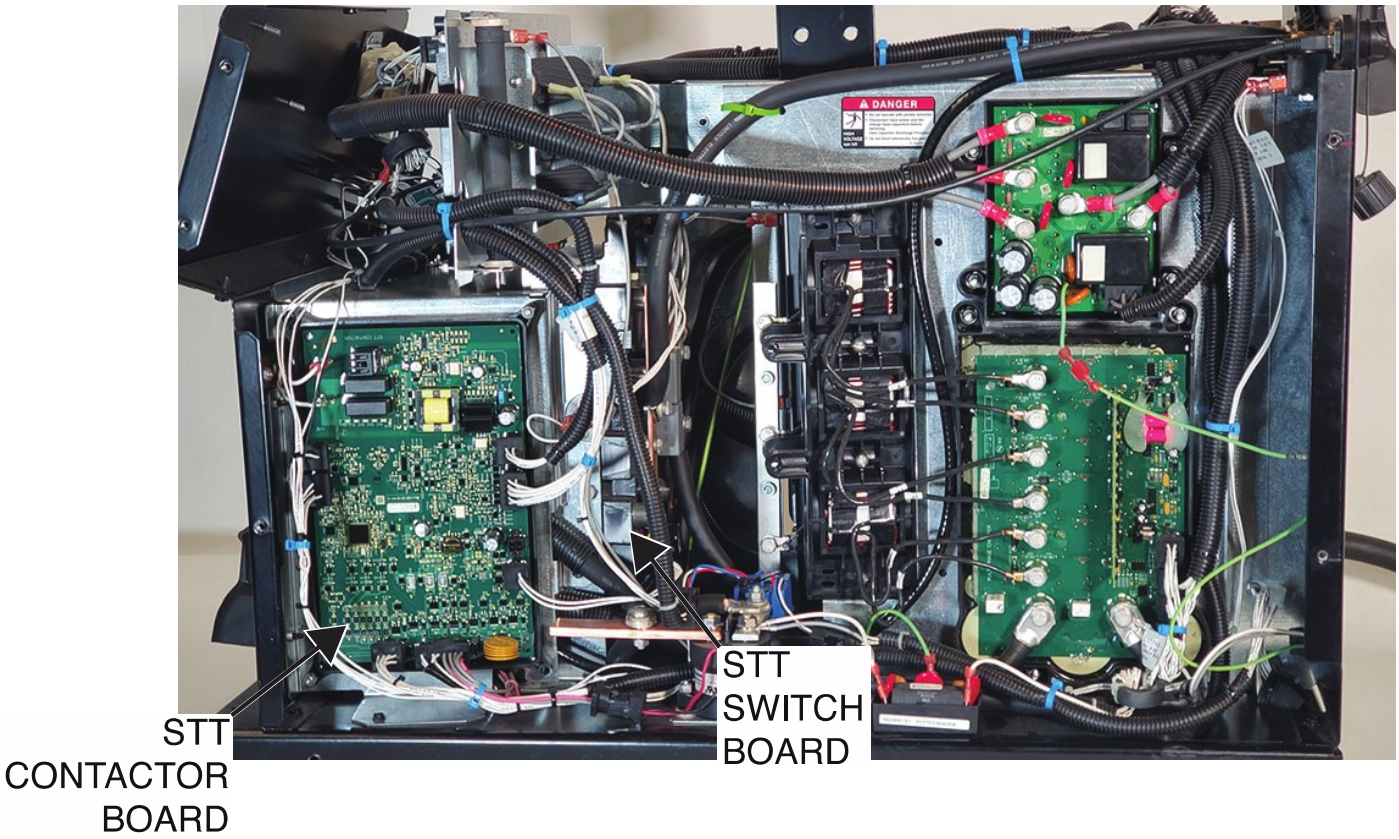


Figure F.2 – STT switch board plug and lead location

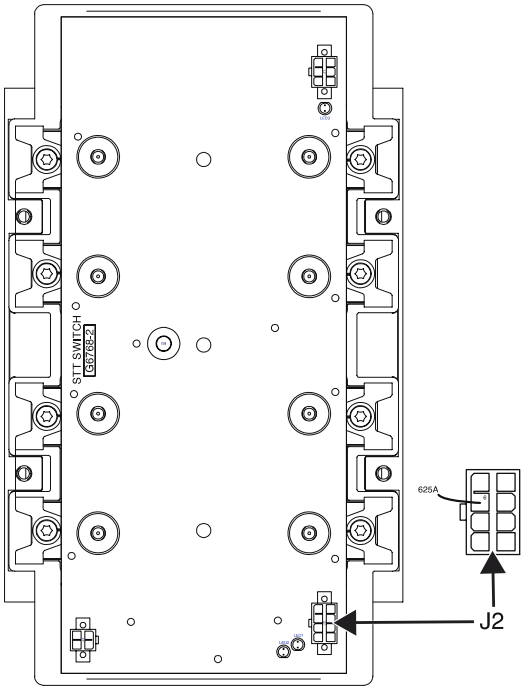
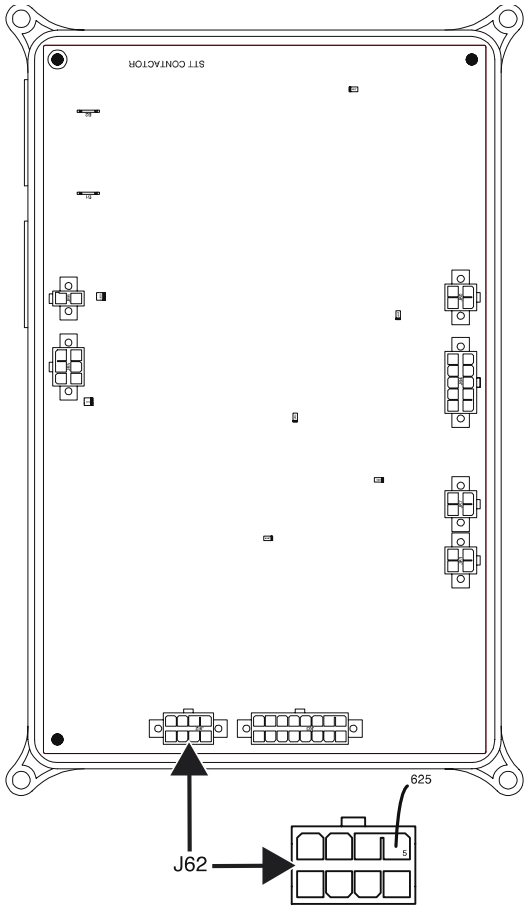


Figure F.3 – STT contactor plug and lead location



PFC 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

These tests will help determine if the PFC Control Board is functioning correctly. There are very high voltages present on the PFC Control Board. This test will be limited to LED, resistance and diode checks with the input power removed from the machine. This test will not test all of the circuits on the board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the PFC control board. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct three phase input power to the machine and turn ON the machine.
6. Visually verify the correct operation of the LEDs according to ***Tables F.1*** and ***F.2***. See ***Figure F.2***.
7. Carefully remove input power from the PipeFab Welding System.
8. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.3***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the diode tests outlined in ***Table F.4***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
10. If any of the tests fail, the PFC control board may be faulty.
11. If faulty, perform the ***PFC Control Board Removal And Replacement Procedure***.
12. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – PFC control board LED descriptions and functions resistance tests

LED NUMBER	COLOR	FUNCTION
1	GREEN	STATUS IS OK
1	RED / FLASHING	ERROR CODE (BLINKING). SEE ***ERROR CODE TABLE*** FOR DETAILS.
2	RED	FAULT ON "B" SIDE OF BRIDGE
3	GREEN	-15 VDC PRESENT
4	GREEN	+15 VDC PRESENT
5	RED	FAULT ON "A" SIDE OF BRIDGE

Table F.2 – PFC control board error codes

ERROR CODE NUMBER	EXPLANATION
331	PEAK INPUT CURRENT LIMIT
334	START UP CURRENT CHECK FAILURE
335	START UP VOLTAGE CHECK FAILURE
336	THERMAL FAULT (NO FIRST STAGE FAN)
337	PRECHARGE TIMEOUT
338	INPUT POWER LIMIT
341	INPUT VOLTAGE DROP-OUT
346	TRANSFORMER PRIMARY OVERCURRENT
347	AVERAGE INPUT CURRENT LIMIT
349	BUS UNDERVOLTAGE

Table F.3 – PFC control board resistance tests

DESRIPTION	TEST POINTS (POS/NEG)	EXPECTED READING	CONDITION
INPUT POWER CIRCUIT	PLUG J26 PIN 4 (LEAD 366) TO PLUG J26 PIN 6 (LEAD 367)	VERY HIGH RESISTANCE (GREATER THAN 20,000 OHMS)	INPUT POWER REMOVED. PLUG J26 REMOVED FROM PFC CONTROL BOARD.
INPUT LINE SENSING	PLUG J25 PIN 1 (LEAD 369) TO PLUG J26 PIN 6 (LEAD 367)	VERY HIGH RESISTANCE (GREATER THAN 500,000 OHMS)	IF LOWER REPLACE THE PFC CONTROL BOARD.

Table F.4 – PFC control board diode tests

DESCRIPTION	TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING +/- 10%*
MAIN BUCK DRIVE "A"	PLUG J23A PIN 8 (LEAD 315A)	PLUG J23A PIN 16 (LEAD 316A)	0.130 VDC
AUX. BUCK DRIVE "A"	PLUG J23A PIN 6 (LEAD 313A)	PLUG J23A PIN 14 (LEAD 314A)	0.130 VDC
MAIN BOOST DRIVE "A"	PLUG J23A PIN 12 (LEAD 336A)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
MAIN BOOST DRIVE "A"	PLUG J23A PIN 4 (LEAD 332A)	PLUG J23A PIN 12 (LEAD 336A)	0.130 VDC
AUX. BOOST DRIVE "A"	PLUG J23A PIN 11 (LEAD 337A)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
AUX. BOOST DRIVE "A"	PLUG J23A PIN 3 (LEAD 333A)	PLUG J23A PIN 11 (LEAD 337A)	0.130 VDC
FULL BRIDGE "A"	PLUG J24 PIN 7 (LEAD 308A)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
FULL BRIDGE "A"	PLUG J23A PIN 3 (LEAD 333A)	PLUG J24 PIN 7 (LEAD 308A)	0.130 VDC
FULL BRIDGE "A"	PLUG J24 PIN 3 (LEAD 307A)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
FULL BRIDGE "A"	PLUG J23A PIN 3 (LEAD 333A)	PLUG J24 PIN 3 (LEAD 307A)	0.130 VDC
MAIN BUCK DRIVE "B"	PLUG J23B PIN 1 (LEAD 315B)	PLUG J23B PIN 9 (LEAD 316B)	0.130 VDC
AUX. BUCK DRIVE "B"	PLUG J23B PIN 3 (LEAD 313B)	PLUG J23B PIN 11 (LEAD 314B)	0.130 VDC
AUX. BOOST DRIVE "B"	PLUG J23B PIN 13 (LEAD 336B)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
AUX. BOOST DRIVE "B"	PLUG J23B PIN 5 (LEAD 332B)	PLUG J23B PIN 13 (LEAD 336B)	0.130 VDC
AUX. BOOST DRIVE "B"	PLUG J23B PIN 14 (LEAD 337B)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
AUX. BOOST DRIVE "B"	PLUG J23B PIN 6 (LEAD 333B)	PLUG J23B PIN 14 (LEAD 337B)	0.130 VDC
FULL BRIDGE "B"	PLUG J24 PIN 6 (LEAD 308B)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
FULL BRIDGE "B"	PLUG J23B PIN 6 (LEAD 333B)	PLUG J24 PIN 6 (LEAD 308B)	0.130 VDC
FULL BRIDGE "B"	PLUG J24 PIN 2 (LEAD 307B)	PLUG J25 PIN 12 (LEAD 362)	0.130 VDC
FULL BRIDGE "B"	PLUG J23B PIN 6 (LEAD 333B)	PLUG J24 PIN 2 (LEAD 307B)	0.130 VDC

NOTE: * An open or short indicates a faulty PFC control board.

Figure F.1 – PFC control board location

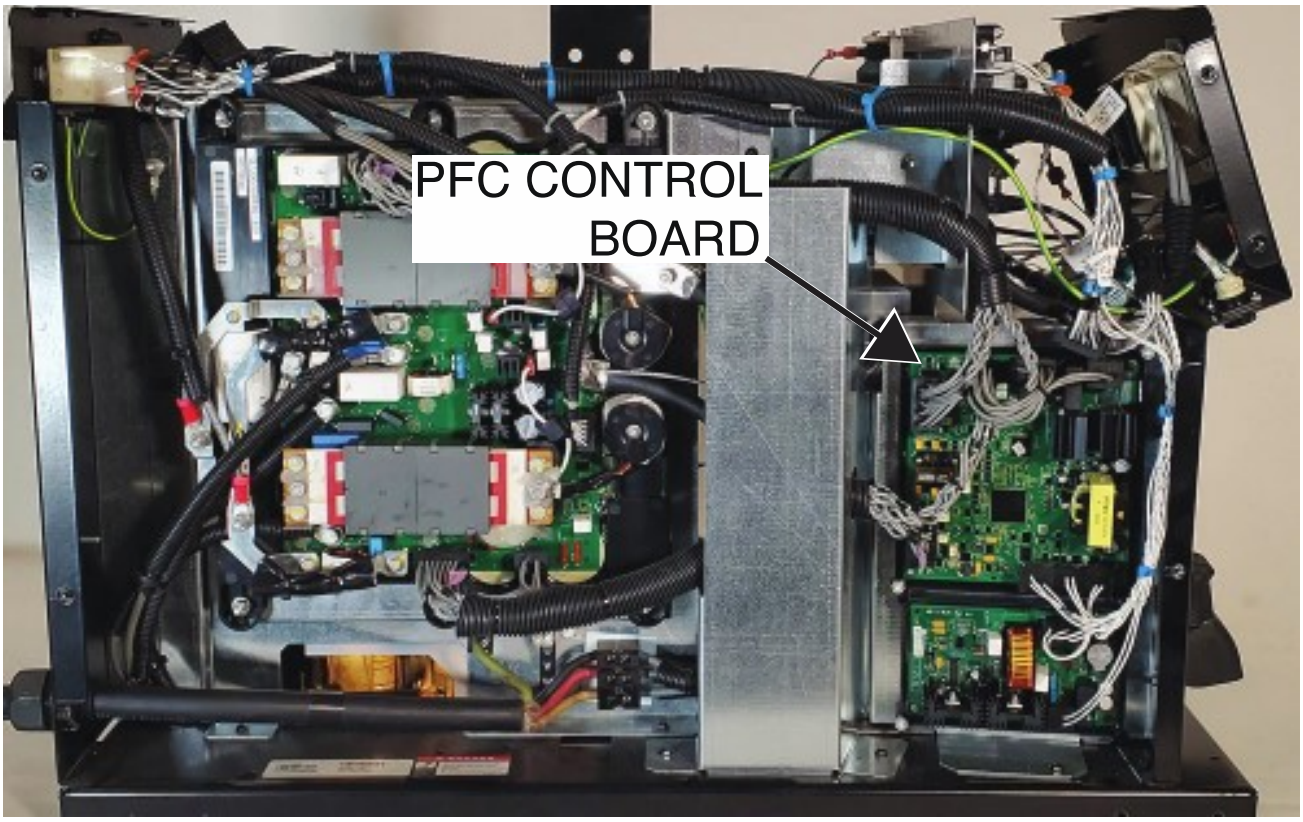


Figure F.2 – PFC control board plug locations

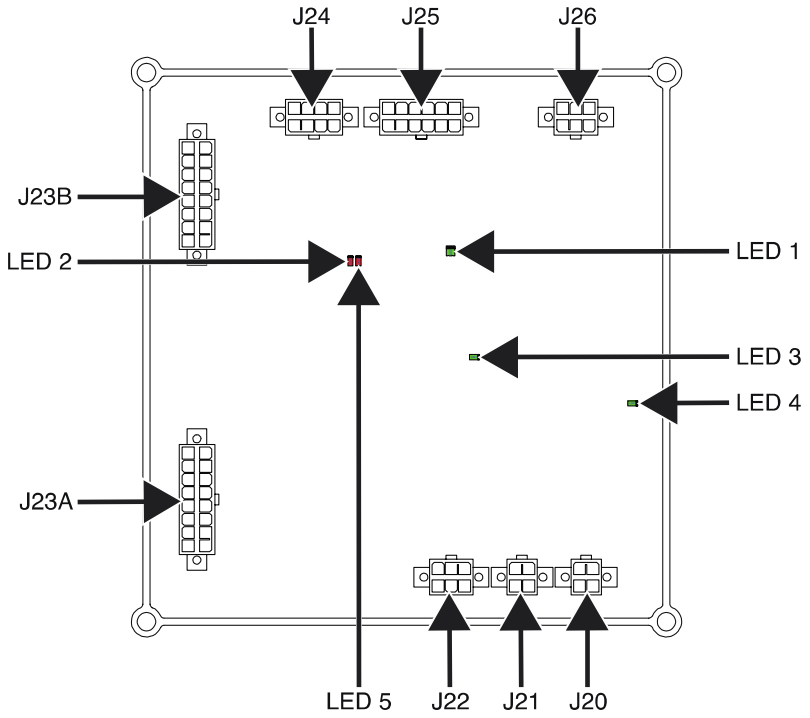
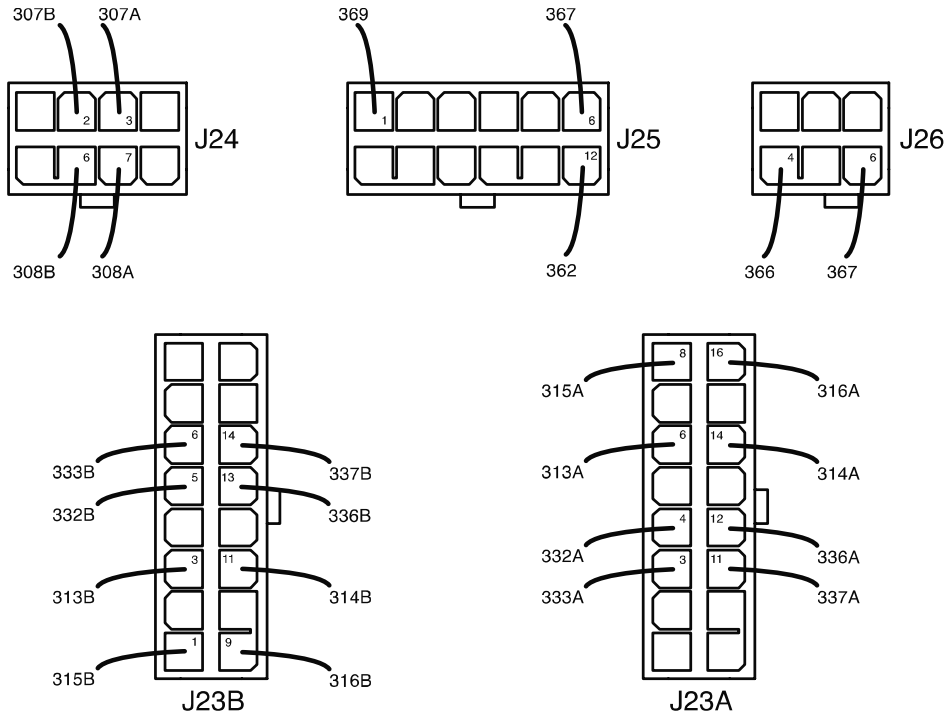


Figure F.3 – PFC control board lead locations



40 VDC BUS 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

These tests will help determine if the 40 VDC Bus Board is receiving the correct input voltage and if the board is functioning correctly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the 40 VDC bus board. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct three phase input power to the machine and turn ON the machine.
6. Locate the red LED on the 40 VDC bus board. See ***Figure F.2***.
7. If the red LED is illuminated, the 40 VDC bus board is receiving input voltage from the DC bus rectifier circuit.
8. If the red LED is not illuminated check circuit breaker CB1. Reset if tripped. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***.
10. If the correct input voltage is being applied to the 40 VDC bus board and the correct output voltages are not being generated, the 40 VDC bus board is faulty.
11. If any of the tests fail, the 40 VDC bus board may be faulty.
12. If faulty, perform the ***40 VDC Bus Board Removal And Replacement Procedure***.
13. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – 40 VDC bus board voltage tests

DESCRIPTION	TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING
INPUT FROM THE POWER CONVERSION BOARD	PLUG J46 PIN 1 (LEAD 65A)	PLUG J46 PIN 3 (LEAD 66)	50 VDC
40 VDC OUTPUT TO PFC CONTROL BOARD	PLUG J47 PIN 4 (LEAD 52)	PLUG J47 PIN 5 (LEAD 51)	40 VDC
40 VDC OUTPUT TO ARCLINK RECEPTACLE	PLUG J47 PIN 8 (LEAD 52A)	PLUG J47 PIN 1 (LEAD 51A)	40 VDC

Figure F.1 – 40 VDC bus board location

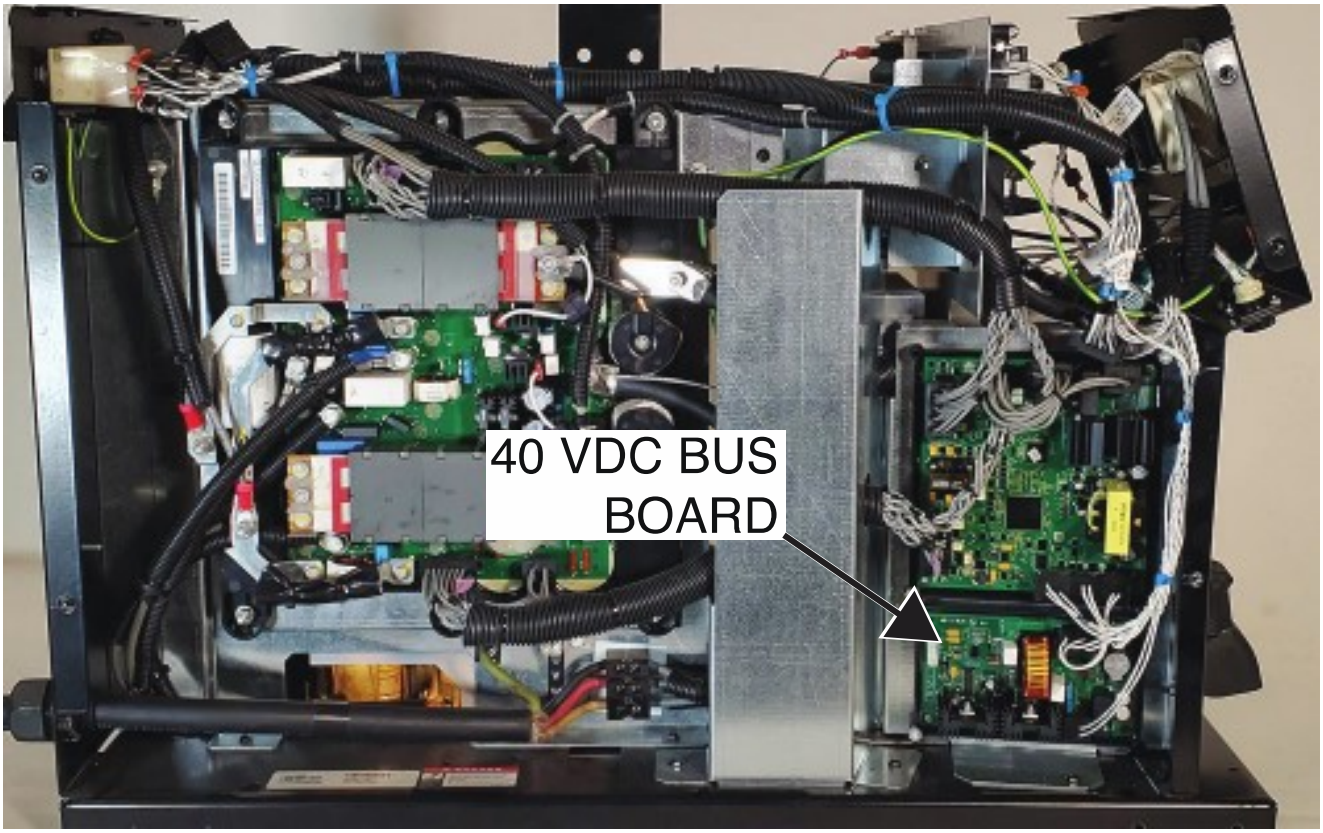


Figure F.2 – 40 VDC bus board LED and plug locations

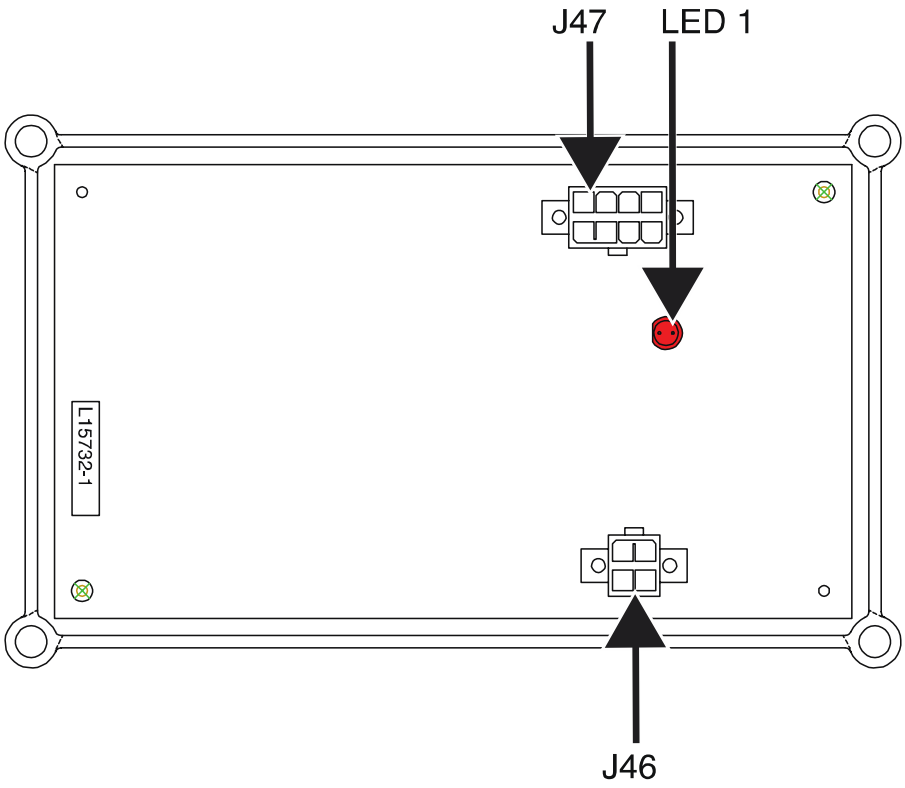
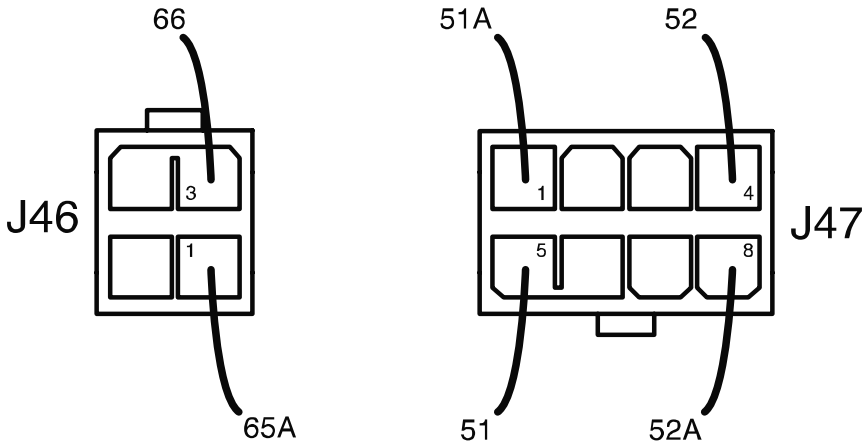


Figure F.3 – 40 VDC bus board lead locations



STT CONTACTOR 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

These tests will help determine if the STT Contactor board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the STT contactor board. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct three phase input power to the machine and turn ON the machine.
6. Visually verify the LEDs are functioning properly according to ***Tables F.1*** and ***F.2***. See ***Figure F.2***.
7. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.3***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
8. If any of the tests fail, the STT contactor board may be faulty.
9. If faulty, perform the ***STT Contactor Board Removal And Replacement Procedure***.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – STT contactor board LED indications

LED NUMBER	FUNCTION
1	+5V CAN
2	+12V
3	STT STATUS
4	+5VNTC
5	HI-FREQ SIGNAL
6	HI-FREQ SIGNAL +15V
7	COOLER STATUS

Table F.2 – STT contactor board error codes

ERROR CODE NUMBER	EXPLANATION
99	STT HARDWARE FAULT, 15V BUS TOO LOW. IF MODULE WAS RECENTLY REPLACED, CHECK WIRING ORIENTATION OF THE STT MODULE.
814	NO COOLANT FLOW DETECTED, WHILE PUMP IS SUPPOSED TO BE RUNNING. IF NO COOLER IS ATTACHED, CHECK THAT THE JUMPER PLUG IN THE POWER SOURCE IS PLUGGED IN.
815	COOLANT RESERVIOR LEVEL IS TOO LOW. IF NO COOLER IS ATTACHED, CHECK THAT THE JUMPER PLUG IN THE POWER SOURCE IS PLUGGED IN.

Table F.3 – STT contactor board voltage tests

TEST POINT	TEST POINT	EXPECTED READING
PLUG J61 PIN 4 (LEAD 52F)	PLUG J61 PIN 3 (LEAD 51F)	40 VDC
PLUG J60 PIN 4 (LEAD 52H)	PLUG J60 PIN 3 (LEAD 51H)	40 VDC
PLUG J60 PIN 1 (LEAD 53H)	PLUG J60 PIN 2 (LEAD 54H)	2 VDC
PLUG J64 PIN 4 (LEAD 52E)	PLUG J64 PIN 3 (LEAD 51E)	40 VDC
PLUG J64 PIN 1 (LEAD 53E)	PLUG J64 PIN 2 (LEAD 54E)	2 VDC
PLUG J64 PIN 7 (LEAD 77)	PLUG J64 PIN 9 (LEAD 75)	10 VDC
PLUG J63 PIN 8 (LEAD 643)	PLUG J63 PIN 16 (LEAD 644)	40 VDC
PLUG J63 PIN 6 (LEAD 636)	PLUG J63 PIN 14 (LEAD 642)	28 VDC
PLUG J63 PIN 4 (LEAD 634)	PLUG J63 PIN 12 (LEAD 640)	40 VDC
PLUG J63 PIN 1 (LEAD 631)	PLUG J63 PIN 9 (LEAD 637)	40 VDC
PLUG J63 PIN 2 (LEAD 632)	PLUG J63 PIN 10 (LEAD 638)	40 VDC
PLUG J63 PIN 3 (LEAD 633)	PLUG J63 PIN 11 (LEAD 639)	40 VDC (WITH TRIGGER ACTIVATED)

Figure F.1 – STT contactor board location

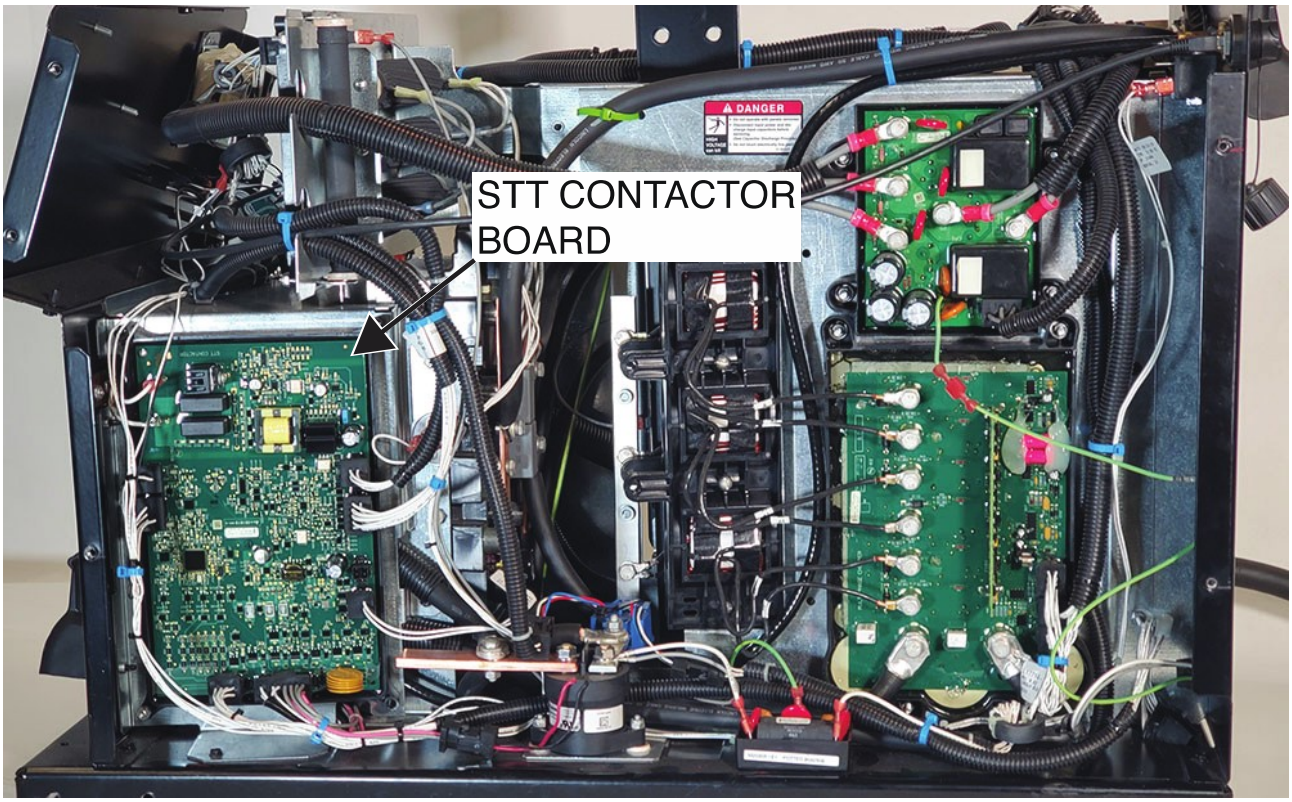


Figure F.2 – STT contactor board plug and LED locations

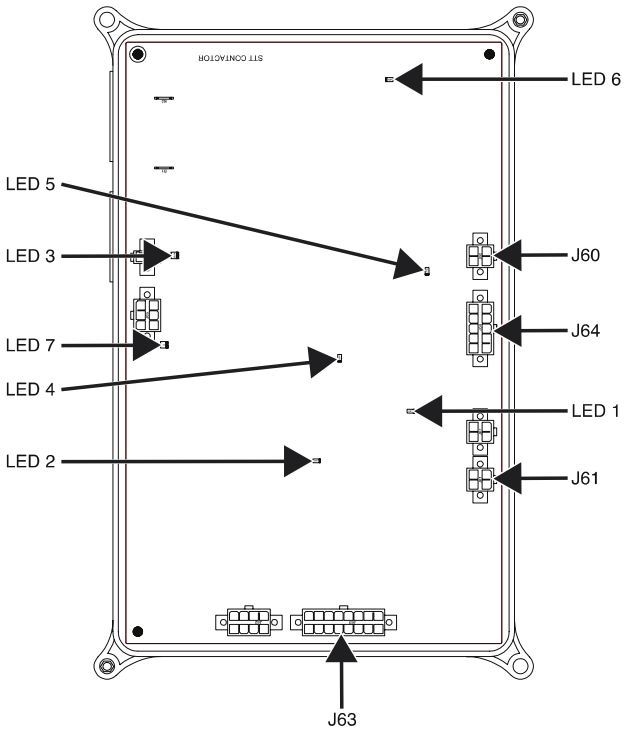
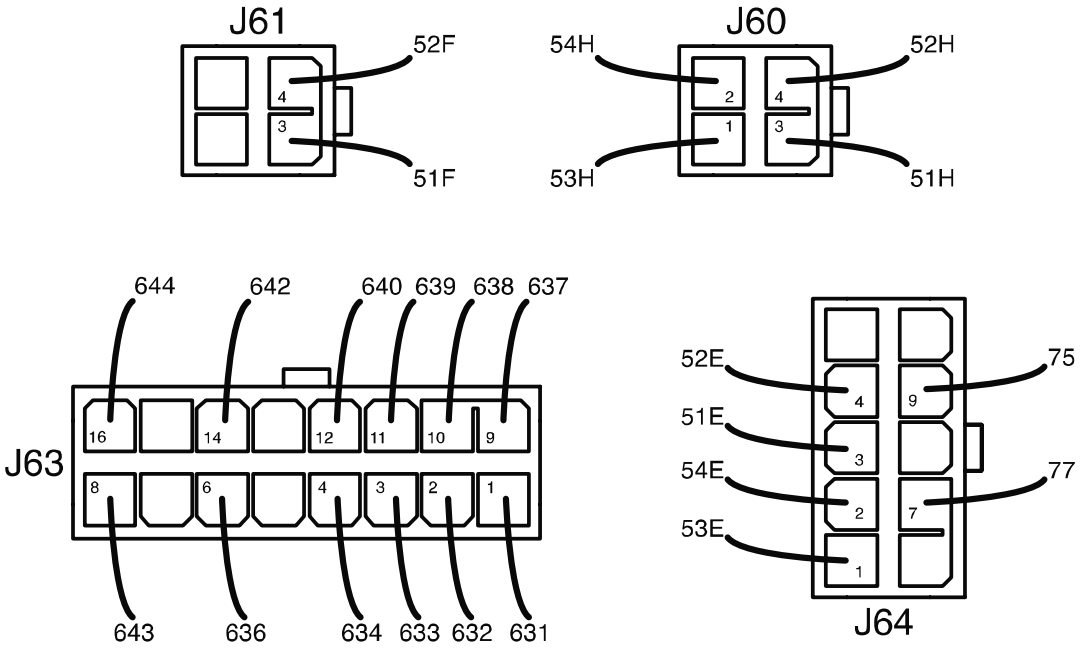


Figure F.3 – STT contactor lead locations



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

These tests will help determine if the Line Switch is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

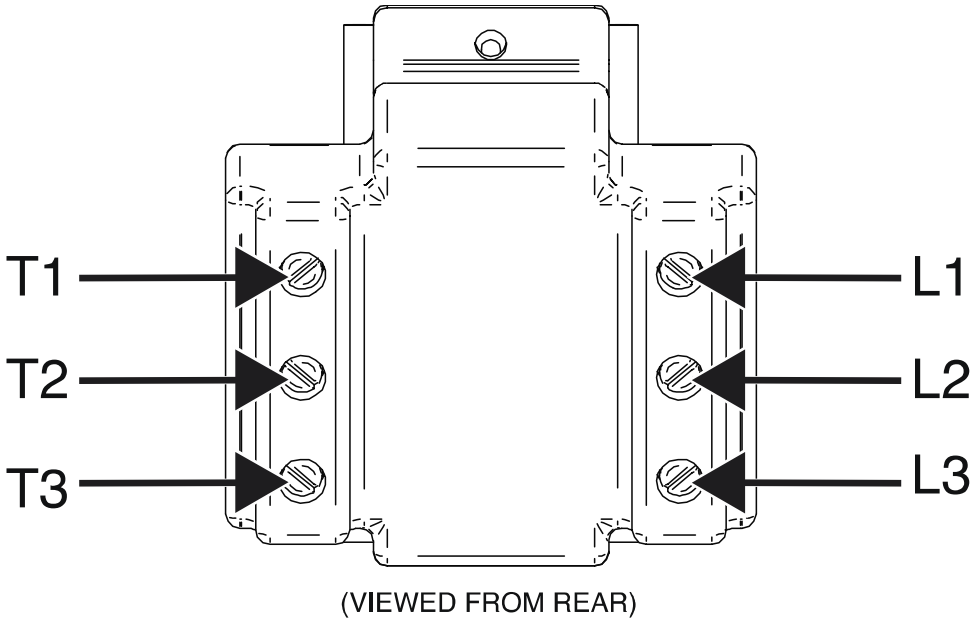
1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the line switch. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
6. If any of the tests fail, the line switch may be faulty.
7. If faulty, perform the ***Line Switch Removal And Replacement Procedure***.
8. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Line switch resistance tests

TEST POINT	TEST POINT	EXPECTED READING	SWITCH POSITION
T1	L1	VERY LOW RESISTANCE (LESS THAN ONE OHM)	“ON” POSITION
T2	L2	VERY LOW RESISTANCE (LESS THAN ONE OHM)	“ON” POSITION
T3	L3	VERY LOW RESISTANCE (LESS THAN ONE OHM)	“ON” POSITION
T1	L1	VERY HIGH RESISTANCE (GREATER THAN 500,000 OHMS)	“OFF” POSITION
T2	L2	VERY HIGH RESISTANCE (GREATER THAN 500,000 OHMS)	“OFF” POSITION
T3	L3	VERY HIGH RESISTANCE (GREATER THAN 500,000 OHMS)	“OFF” POSITION

Figure F.1 – Line switch location

Figure F.2 – Line switch terminal 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

These tests will help determine if the fans are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the fans at the rear of the machine. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
6. If the voltage is present and the fans do not operate, the fans may be faulty.
7. If faulty, perform the ***Fan Removal And Replacement Procedure***.
8. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Fan voltage tests

TEST POINT	TEST POINT	EXPECTED READING	MACHINE CONDITION
PLUG J53 PIN 1 (LEAD 353A)	PLUG J53 PIN 5 (LEAD 351A)	48 VDC	MACHINE ON.
PLUG J53 PIN 4 (LEAD 353)	PLUG J53 PIN 8 (LEAD 351)	48 VDC	MACHINE ON. FANS RUNNING.

Figure F.1 – Fan location

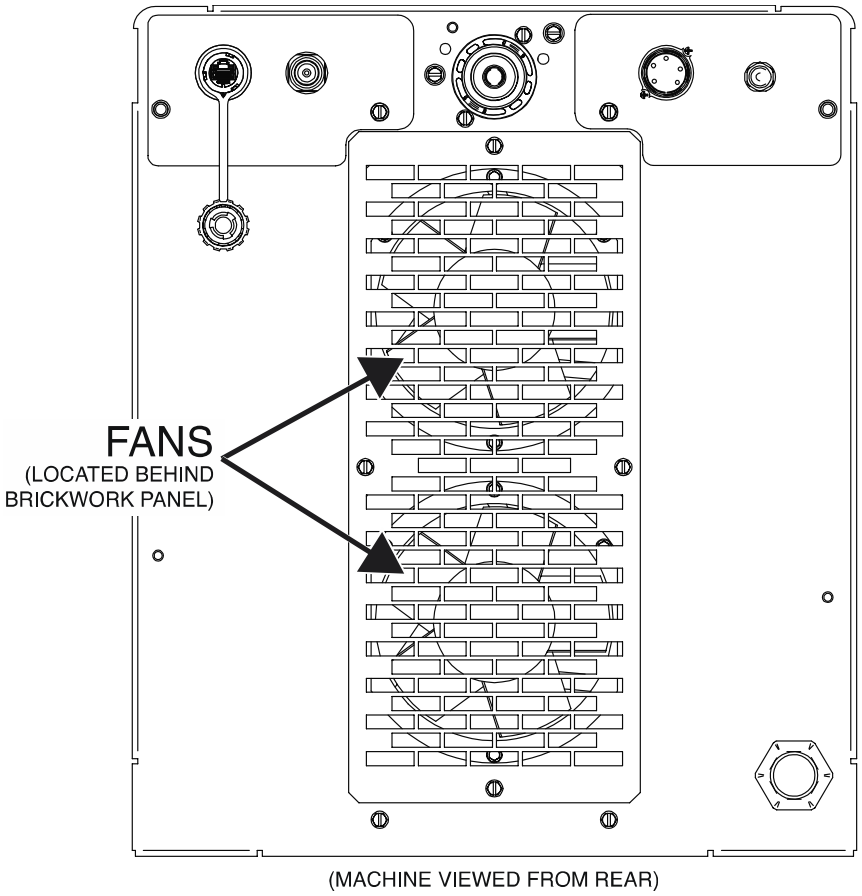
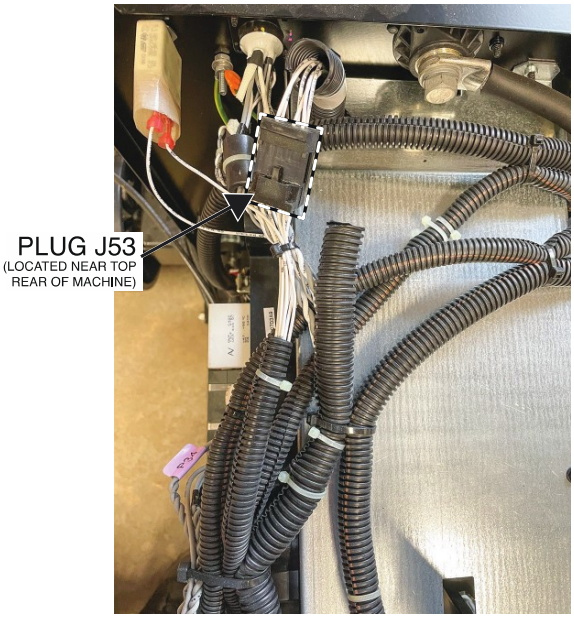


Figure F.2 – Plug J53 locations



STT SWITCH 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

These tests will help determine if the STT Switch Board is functioning properly. This test will not test all of the circuits of the STT Switch Board.

MATERIALS NEEDED

Volt/Ohmmeter
7/16” Nutdriver
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the STT switch board. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct three phase input power to the machine and turn ON the machine.
6. Visually verify the LEDs are functioning properly according to ***Table F.1***. See ***Figure F.2***.
7. Using a volt/ohmmeter, measure the voltage from plug J1 pin 3 (lead 53F) to plug J1 pin 1 (lead 51F). See ***Figures F.2*** and ***F.3***. See Wiring Diagram. Normal reading is 40 VDC.
8. Carefully remove input power from the PipeFab Welding System.
9. Using a 7/16” nutdriver, remove the bolt, lock washer and flat washer securing the leads to terminal B9 of the STT switch board. Label and disconnect lead 288 from terminal B9. See ***Figure F.2***. See Wiring Diagram.
10. Using a volt/ohmmeter, perform the diode drop tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
11. Using a 7/16” nutdriver, attach the bolt, lock washer and flat washer securing the previously disconnected leads to terminal B9 of the STT switch board. See Wiring Diagram.
12. If any of the tests fail, the STT switch board may be faulty.
13. If faulty, perform the ***STT Switch Board Removal And Replacement Procedure***.
14. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – STT switch board LED function tests

MACHINE OUTPUT	LED 1 (GATE)	LED 2 (STATUS)	LED 3 (+15V)	INDICATION
ON/OFF	ON	ON	ON	NORMAL CONDITION – STT SWITCH IS ON.
ON	OFF	ON	ON.	NORMAL CONDITION - STT SWITCH HAS BEEN COMMANDED OFF. **NOTE:** DURING NORMAL STT OPERATION THE OFF STATE OF THE LED MAY ONLY BE DETECTABLE AS A SLIGHT DIMMING.
ON	OFF	OFF	ON	STATUS FAILURE (ONLY WHEN TRIGGERED). SHOULD BE ACCOMPNAIED BY ERROR 99 ON THE EXTERNAL STT MODULE STATUS LED.
ON/OFF	OFF	OFF	ON/ OFF	STATUS FAILURE (CONSTANTLY). SHOULD BE ACCOMPANIED BY ERROR 99 ON THE EXTERNAL STT MODULE STATUS LED. MOST LIKELY CAUSED BY THE ON BOARD POWER SUPPLY UNDER-VOLTAGE LOCKOUT. VERIFY INPUT VOLTAGE TO THE STT SWITCH BOARD.

Table F.2 – STT switch board diode drop tests

TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING
BUS BAR CONNECTING TERMINALS B1 THRU B4	TERMINAL B9	0.3 - 0.7 VDC
TERMINAL B9	BUS BAR CONNECTING TERMINALS B1 THRU B4	OL
BUS BAR CONNECTING TERMINALS B5 THRU B8	BUS BAR CONNECTING TERMINALS B1 THRU B4	0.3 - 0.7 VDC
BUS BAR CONNECTING TERMINALS B1 THRU B4	BUS BAR CONNECTING TERMINALS B5 THRU B8	OL

Figure F.1 – STT switch board location

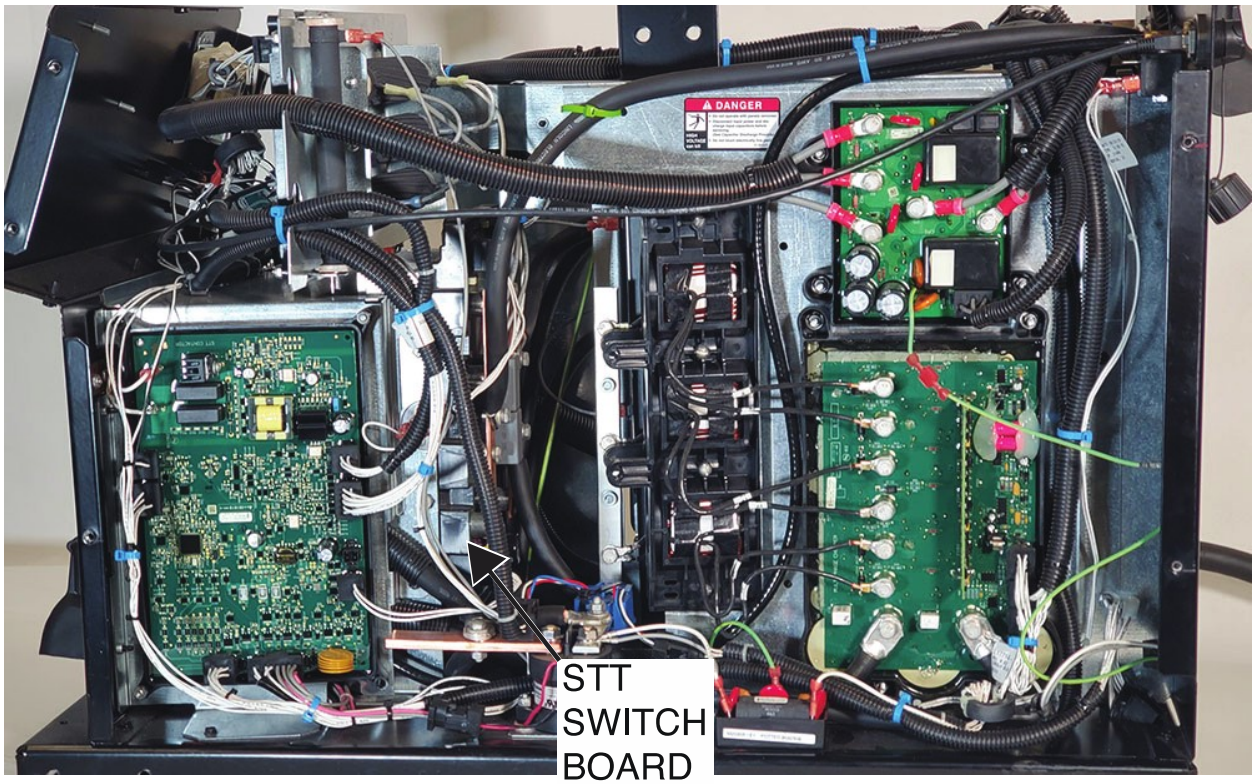


Figure F.2 – STT switch board plug location

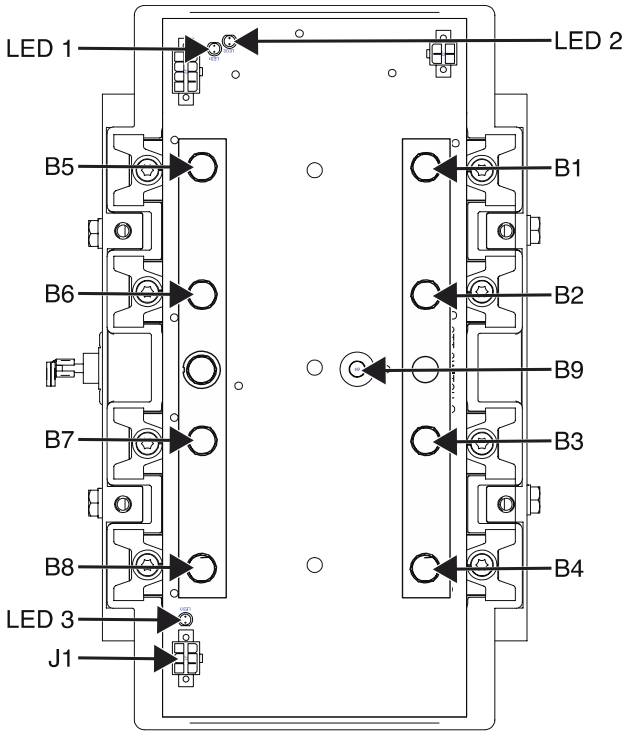
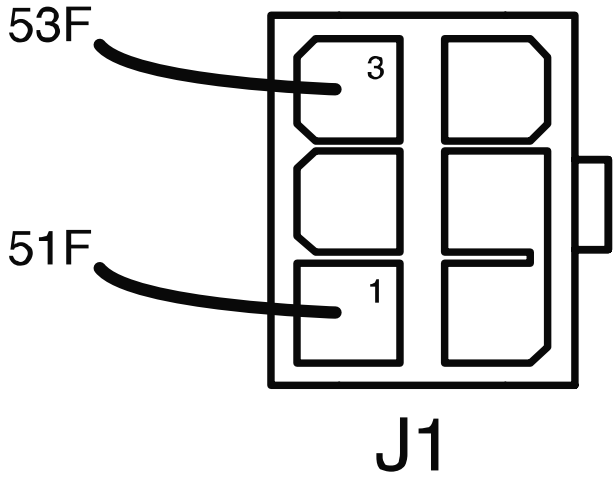


Figure F.3 – STT switch board lead location



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

These tests will help determine if the Tach Unit is receiving the correct supply voltage from the Wire Drive Board and also if the Tach Unit is sending feedback information to the Wire Drive Board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the tachometers. See Wiring Diagram.
   NOTE: There are two tachometers, one on each side of the machine attached to the motor. Test each tachometer separately.
5. Locate the wire drive board. See ***Figure F.1***. See Wiring Diagram.
6. Carefully apply the correct input power to the machine and turn ON the machine.
7. Using a volt/ohmmeter, check for 5 VDC at plug J84 (on the wire drive board) from the red wire (531+ / 631+) to the black wire (534- / 634-). This is the supply voltage from the wire drive board. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
8. If 5 VDC is not present, the wire drive board may be faulty. Also check for loose or faulty wires and connections.
9. Using a volt/ohmmeter, check for feedback voltage of approximately 2 VDC at plug J84 (on the wire drive board) from blue wire (537+ (Pin 5) / 637+ (Pin 11)) to the black wire (534- (Pin 4) / 634- (Pin 10)), with the gun trigger activated and the motor running. If the correct supply voltage is present and the feedback voltage is missing, the tachometer may be faulty. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
10. Remove input power to the machine.
11. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Wire drive board location

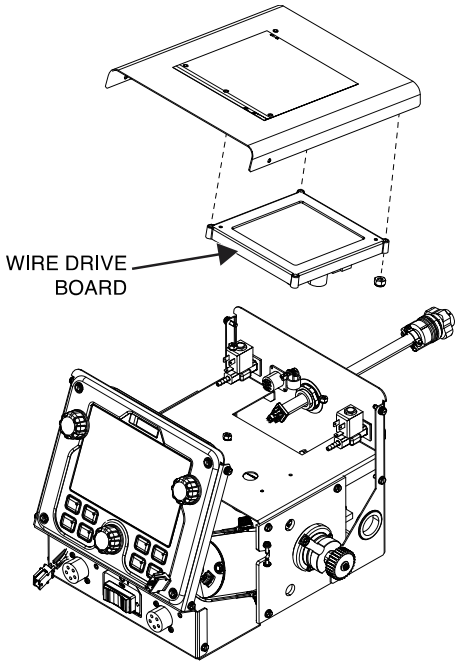


Figure F.2 – Wire drive board plug location

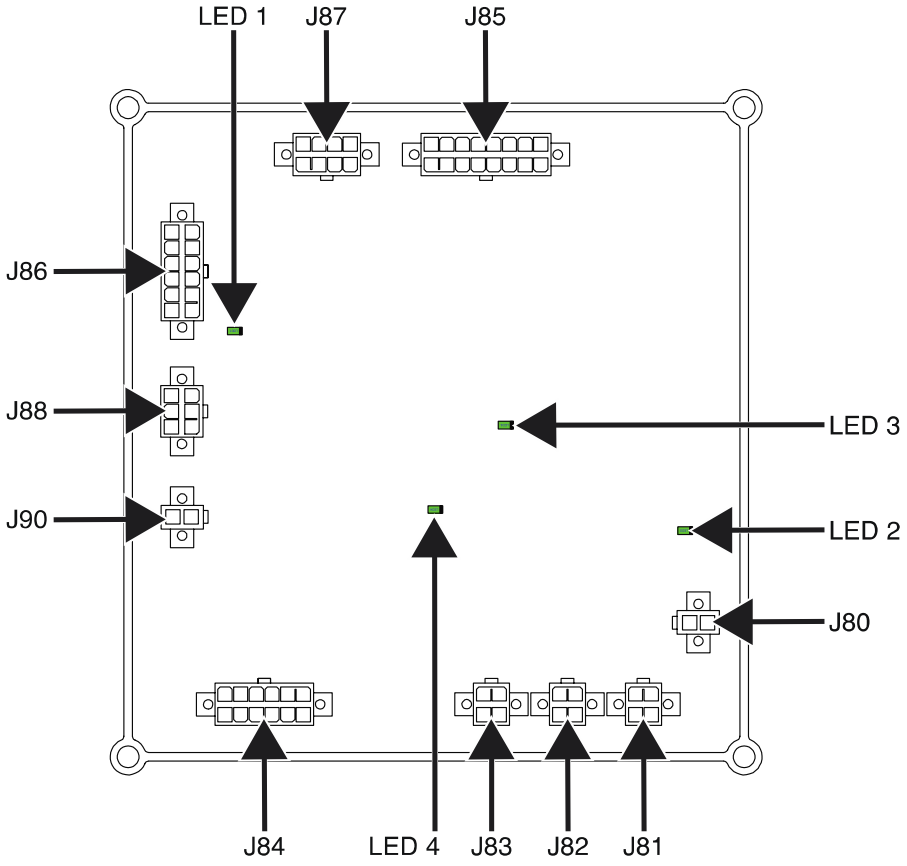
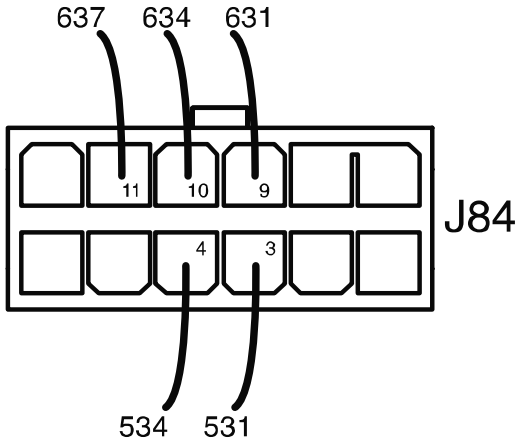


Figure F.3 – Wire drive board lead locations



GAS SOLENOID(S) 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

These tests will help determine if the Gas Solenoid(s) are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
12 VDC Power Supply
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the gas solenoid to be tested. See ***Figure F.1***. See Wiring Diagram.
   NOTE: There are two gas solenoids, one on each side of the machine. Test separately.
5. Label and disconnect leads 552 or 652 and 553 or 653 from the gas solenoid. See ***Figure F.2***. See Wiring Diagram.
6. Check the resistance between the two input terminals. Normal resistance should be approximately 20 ohms.
7. Using a 12 VDC power supply, carefully apply 12 VDC to the top two terminals where leads were attached. The gas solenoid should open. If the gas solenoid does not open, it may be faulty.
8. If faulty, perform the ***Gas Solenoid(s) Removal and Replacement Procedure***.
9. 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 associated wire drive board. If the leads are intact, the wire drive board may be faulty. Perform the ***Wire Drive Board Test Procedure***.
10. Remove input power to the machine.
11. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Gas solenoid locations

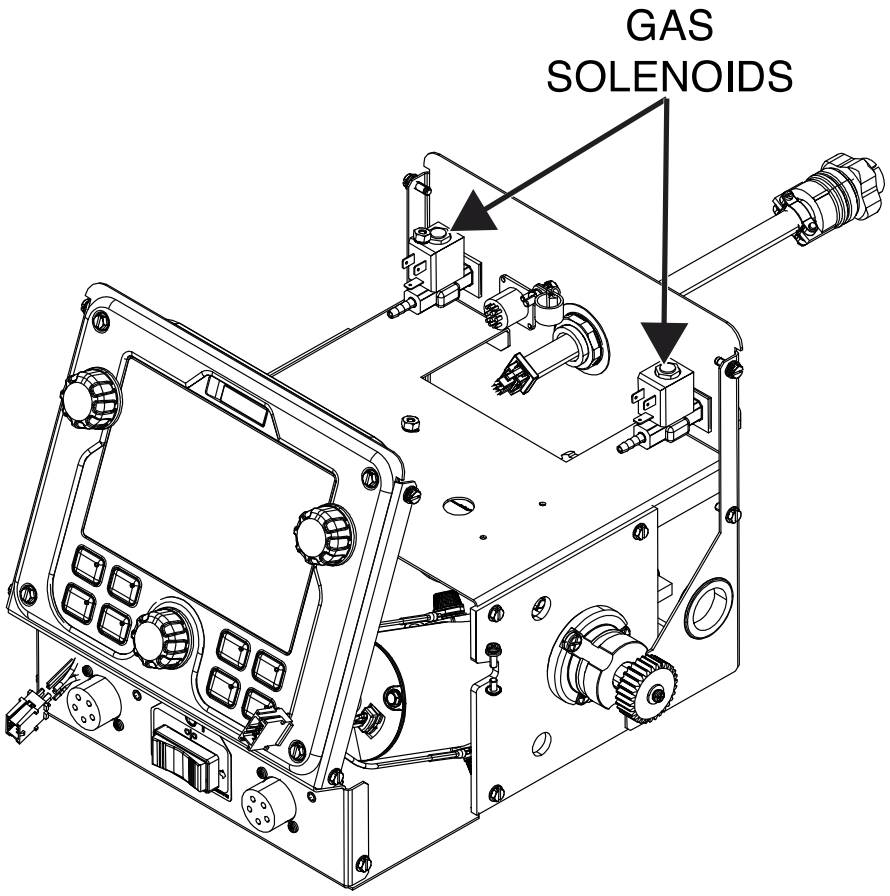
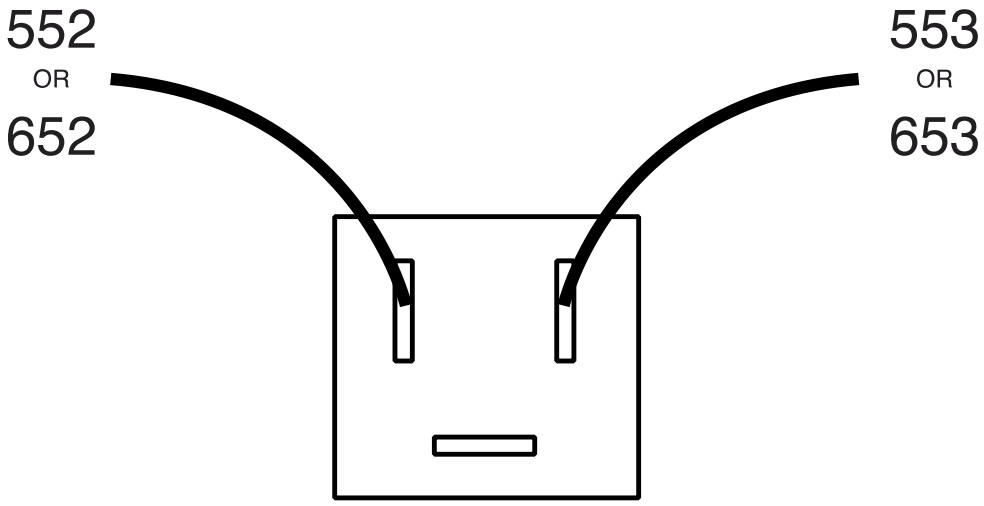


Figure F.2 – Gas solenoid lead locations



COLD INCH/FEED GAS PURGE 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

These tests will help determine if the Cold Inch/Feed Gas Purge Switch is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the cold inch/feed gas purge switch. See ***Figure F.1***.
   NOTE: There are two cold inch/feed gas purge switches, one on each side of the machine. Test separately.
5. Label and disconnect leads 586, 535 and 579 (or leads 686, 635 and 679) from the cold inch/feed gas purge switch to be tested. See ***Figure F.2***. See Wiring Diagram.
6. Using the volt/ohmmeter, perform continuity checks from the switch terminal 2 (lead 586 or 686) to terminal 3 (lead 535 or 635) and from terminal 2 (586 or 686) to terminal 1 (579 or 679) while pressing the rocker switch forward or back. If continuity test fails, the cold inch/feed gas purge switch may need replaced. See Wiring Diagram.
7. If necessary, perform the ***Cold Inch/Feed Gas Purge Switch Removal and Replacement Procedure***.
8. Reconnect any previously removed leads. See Wiring Diagram.
9. If necessary, perform the appropriate ***Wire Drive Board Test Procedure***.
10. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Cold inch/feed gas purge switch location

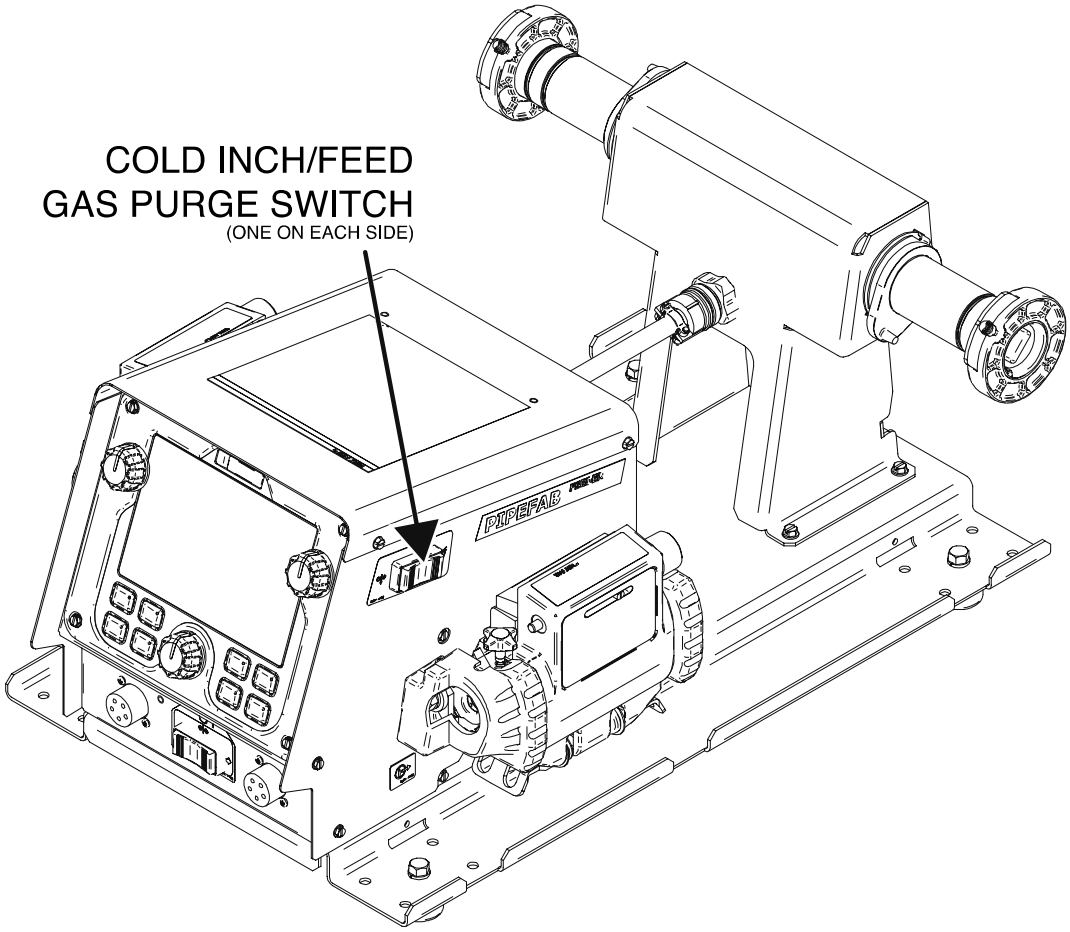
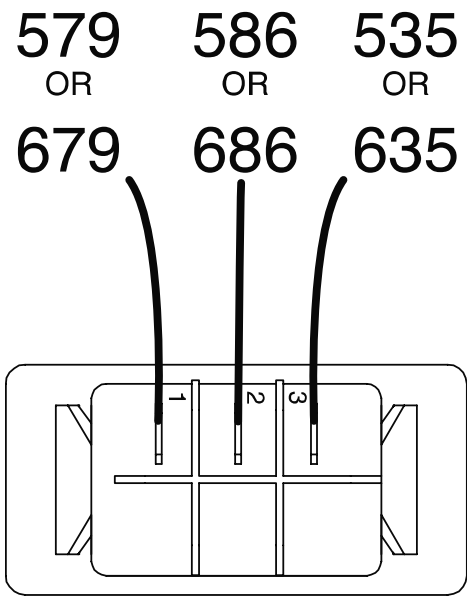


Figure F.2 – Cold inch/feed gas purge switch lead locations



WIRE DRIVE MOTOR(S) 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

These tests will help determine if the Wire Drive Motor is receiving the correct voltage, and if it is capable of running properly.

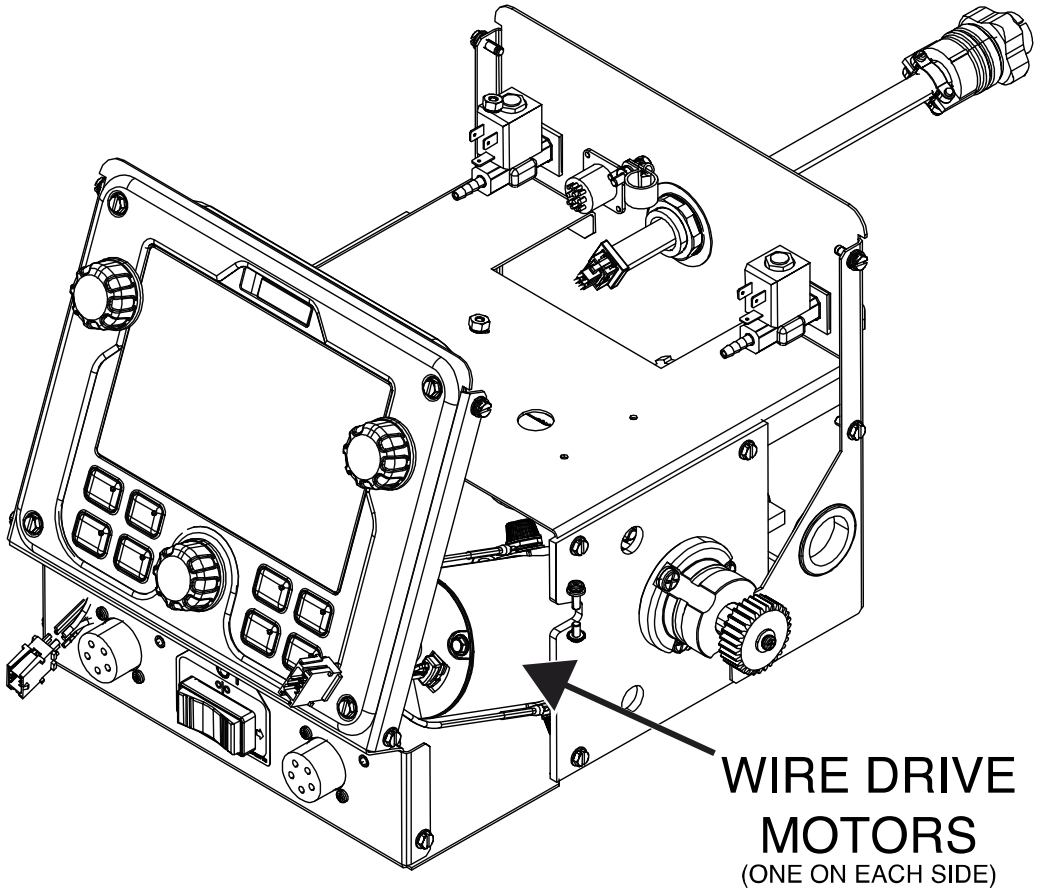
MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the wire drive motor to be tested. See ***Figure F.1***.
   NOTE: There are two wire drive motors, one on each side of the machine. Test separately.
5. Locate plug P9 or P19. See Wiring Diagram.
6. Carefully apply the correct input power to the machine and turn ON the machine.
7. Activate the gun trigger.
8. Using a volt/ohmmeter, measure the voltage from white lead (550+ or 650+) to black lead (551- or 651-) with the motor running. See Wiring Diagram. Voltage should measure approximately 24 VDC regardless of motor speed. See Wiring Diagram.
9. If the correct voltage range is NOT present at the motor leads, check associated leads between the motor being tested and plug J84 on the wire drive board. See Wiring Diagram. If the leads are intact, the wire drive board may be faulty. Perform the ***Wire Drive Board Test Procedure***.
10. If the correct voltages are present at the motor leads and the motor does not run, the wire drive motor may be faulty.
11. Remove input power to the machine.
12. If faulty, perform the ***Wire Drive Motor Removal And Replacement Procedure***.
13. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Wire drive motor 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

These tests will help determine if the User Interface Board is receiving the correct input voltage and CAN communication voltage. This test will not test all circuits on the User Interface Board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
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. Carefully apply the correct input power to the machine and turn ON the machine.
6. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the user interface board may be faulty.
8. If faulty, perform the ***User Interface Board Removal And Replacement Procedure***.
9. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – User interface board voltage tests

TEST POINT	TEST POINT	EXPECTED READING
PLUG J31 PIN 4 (LEAD 540C)	PLUG J31 PIN 3 (LEAD 500C)	40 VDC
PLUG J31 PIN 1 (LEAD 541C)	PLUG J31 PIN 2 (LEAD 542C)	2 VDC

Figure F.1 – User interface board location

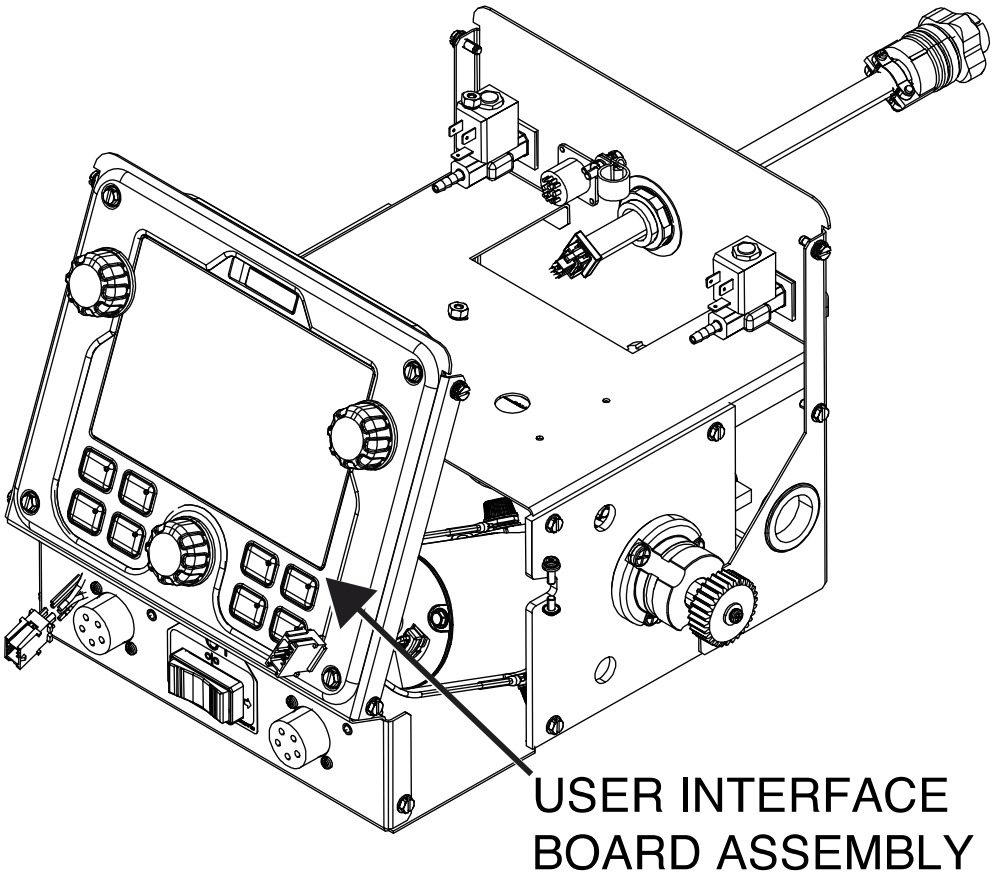
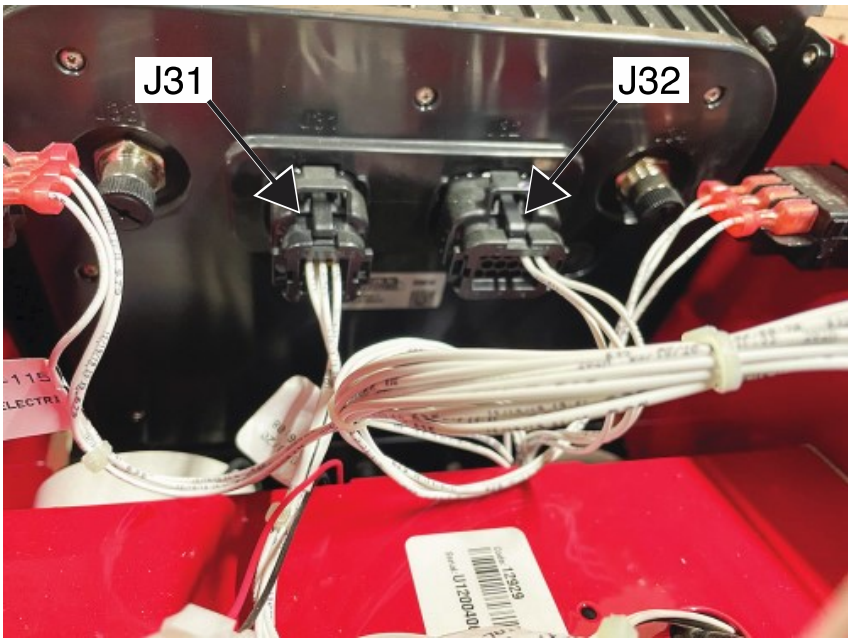


Figure F.2 – User interface board plug J31 location



FEEDHEAD SELECT 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

These tests will help determine if the Feedhead Select Switch is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the feedhead select switch. See ***Figure F.1***. See Wiring Diagram.
5. Carefully apply the correct input power to the machine and turn ON the machine.
6. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the feedhead select switch may be faulty.
8. If faulty, perform the ***Feedhead Select Switch Removal And Replacement Procedure***.
9. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Feedhead select switch voltage tests

TEST POINT	TEST POINT	EXPECTED READING	SWITCH POSITION
PLUG J32 PIN 4 (LEAD 511) ON USER INTERFACE BOARD	PLUG J32 PIN 5 (LEAD 512) ON USER INTERFACE BOARD	5 VDC	“RIGHT FEEDHEAD” POSITION
PLUG J32 PIN 4 (LEAD 511) ON USER INTERFACE BOARD	PLUG J32 PIN 5 (LEAD 512) ON USER INTERFACE BOARD	-5 VDC	“LEFT FEEDHEAD” POSITION

Figure F.1 – Feedhead select switch location

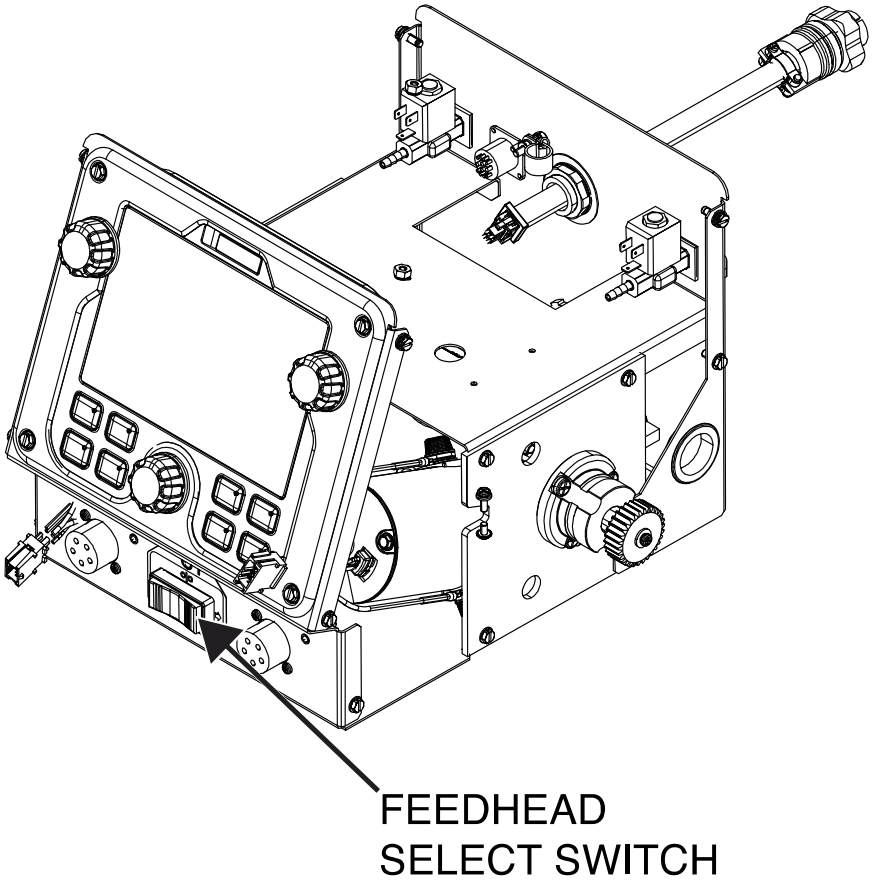
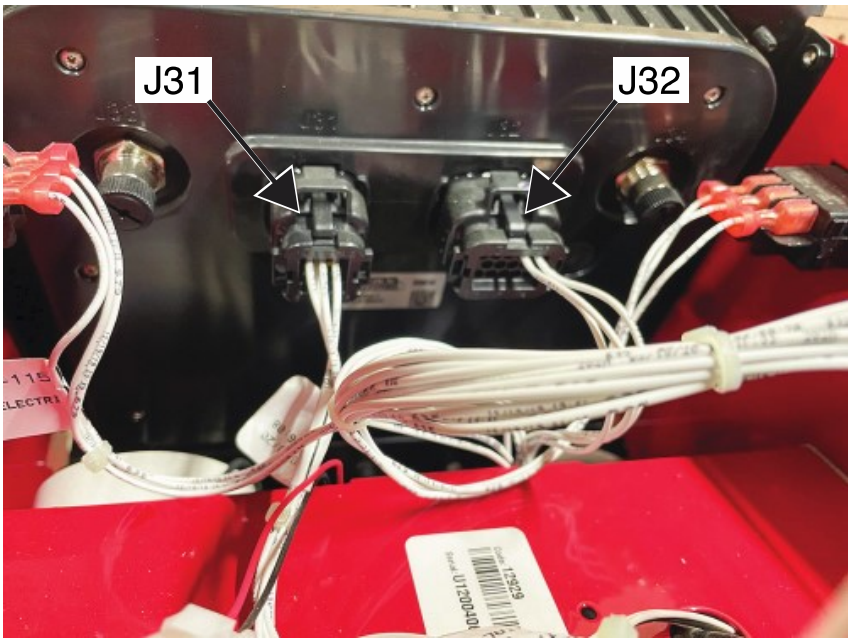


Figure F.2 – User interface board plug locations



WIRE DRIVE 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

These tests will help determine if the Wire Drive Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the wire drive board. See ***Figure F.1***. See Wiring Diagram.
   NOTE: Leave wire drive board connected to roof and associated wiring.
5. Carefully apply the correct input power to the machine and turn ON 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 any one of these voltage tests fails, check all leads for loose or faulty connections. If all leads are in good condition, the wire drive board may be faulty.
8. Carefully remove input power from the machine.
9. If any of the tests fail, the wire drive board may be faulty.
10. If faulty, perform the ***Wire Drive Board Removal And Replacement Procedure***.
11. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Wire drive board voltage tests

DESCRIPTION	TEST POINTS (POS TO NEG)	EXPECTED READING	CONDITIONS
POWER SUPPLY TO USER INTERFACE BOARD	PLUG J83 PIN 4 (LEAD 540C) TO PLUG J83 PIN 3 (LEAD 500C)	40 VDC	PIPEFAB WELDING SYSTEM ON.
ARCLINK SUPPLY	PLUG J82 PIN 4 (LEAD 540A) TO PLUG J82 PIN 3 (LEAD 500A)	40 VDC	PIPEFAB WELDING SYSTEM ON.
CAN COMMUNICATION	PLUG J83 PIN 1 (LEAD 541C) TO PLUG J83 PIN 2 (LEAD 542C)	2 VDC	PIPEFAB WELDING SYSTEM ON.
CAN COMMUNICATION	PLUG J82 PIN 1 (LEAD 541A) TO PLUG J82 PIN 2 (LEAD 542A)	2 VDC	PIPEFAB WELDING SYSTEM ON.
15 VDC TO COLD FEED / GAS PURGE SWITCH (RIGHT)	PLUG J85 PIN 11 (LEAD 635) TO PLUG J85 PIN 9 (LEAD 686)	15 VDC	PIPEFAB WELDING SYSTEM ON. RIGHT SWITCH IN 'COLD FEED/INCH' POSITION.
15 VDC TO COLD FEED / GAS PURGE SWITCH (RIGHT)	PLUG J85 PIN 10 (LEAD 679) TO PLUG J85 PIN 9 (LEAD 686)	15 VDC	PIPEFAB WELDING SYSTEM ON. RIGHT SWITCH IN 'GAS PURGE' POSITION.
15 VDC TO COLD FEED / GAS PURGE SWITCH (LEFT)	PLUG J85 PIN 3 (LEAD 535) TO PLUG J85 PIN 1 (LEAD 586)	15 VDC	PIPEFAB WELDING SYSTEM ON. LEFT SWITCH IN 'COLD FEED/INCH' POSITION.
15 VDC TO COLD FEED / GAS PURGE SWITCH (LEFT)	PLUG J85 PIN 2 (LEAD 579) TO PLUG J85 PIN 1 (LEAD 586)	15 VDC	PIPEFAB WELDING SYSTEM ON. LEFT SWITCH IN 'GAS PURGE' POSITION.
RIGHT FEED HEAD CONTACTOR COIL	PLUG J87 PIN 4 (LEAD 649) TO PLUG J87 PIN 8 (LEAD 648)	12 VDC	PIPEFAB WELDING SYSTEM ON. TRIGGER ACTIVATED.
LEFT FEED HEAD CONTACTOR COIL	PLUG J87 PIN 3 (LEAD 549) TO PLUG J87 PIN 7 (LEAD 548)	12 VDC	PIPEFAB WELDING SYSTEM ON. TRIGGER ACTIVATED.
RIGHT SIDE TACH SUPPLY	PLUG J84 PIN 9 (LEAD 631) TO PLUG J84 PIN 10 (LEAD 634)	5 VDC	PIPEFAB WELDING SYSTEM ON. TRIGGER ACTIVATED.
LEFT SIDE TACH SUPPLY	PLUG J84 PIN 3 (LEAD 531) TO PLUG J847 PIN 4 (LEAD 534)	5 VDC	PIPEFAB WELDING SYSTEM ON. TRIGGER ACTIVATED.

TACH FEEDBACK CHANNEL A	PLUG J84 PIN 11 (LEAD 637) TO PLUG J84 PIN 10 (LEAD 634)	2.5 VDC 900 Hz. @ Min WFS, 2.5 VDC	PIPEFAB WELDING SYSTEM ON. TRIGGER PULLED MOTOR RUNNING.
TACH FEEDBACK CHANNEL B	PLUG J84 PIN 5 (LEAD 537) TO PLUG J84 PIN 4 (LEAD 534)	2.5 VDC 900 Hz. @ Min WFS, 2.5 VDC	PIPEFAB WELDING SYSTEM ON. TRIGGER PULLED MOTOR RUNNING.
GAS SOLENOID SUPPLY (RIGHT)	PLUG J87 PIN 2 (LEAD 652) TO PLUG J87 PIN 6 (LEAD 653)	6.5 VDC GAS FLOWING	PIPEFAB WELDING SYSTEM ON. TRIGGER PULLED MOTOR RUNNING.
GAS SOLENOID SUPPLY (LEFT)	PLUG J87 PIN 1 (LEAD 552) TO PLUG J87 PIN 5 (LEAD 553)	6.5 VDC GAS FLOWING	PIPEFAB WELDING SYSTEM ON. TRIGGER PULLED MOTOR RUNNING.
RIGHT MOTOR ARMATURE VOLTAGE	PLUG J84 PIN 7 (LEAD 650) TO PLUG J84 PIN 8 (LEAD 651)	APPROXIMATELY 24 VDC REGARDLESS OF WIRE FEED SPEED	PIPEFAB WELDING SYSTEM ON. TRIGGER PULLED MOTOR RUNNING.
LEFT MOTOR ARMATURE VOLTAGE	PLUG J84 PIN 1 (LEAD 551) TO PLUG J84 PIN 2 (LEAD 550)	APPROXIMATELY 24 VDC REGARDLESS OF WIRE FEED SPEED	PIPEFAB WELDING SYSTEM ON. TRIGGER PULLED MOTOR RUNNING.
FAN VOLTAGE	PLUG J90 PIN 1 (BLACK LEAD) TO PLUG J90 PIN 2 (RED LEAD)	5 VDC	PIPEFAB WELDING SYSTEM ON.

Figure F.1 – Wire drive board location

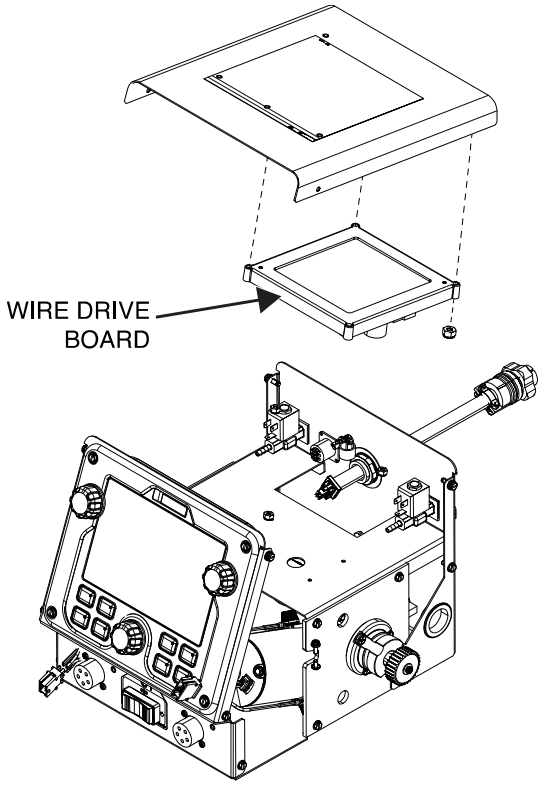


Figure F.2 – Wire drive board plug locations

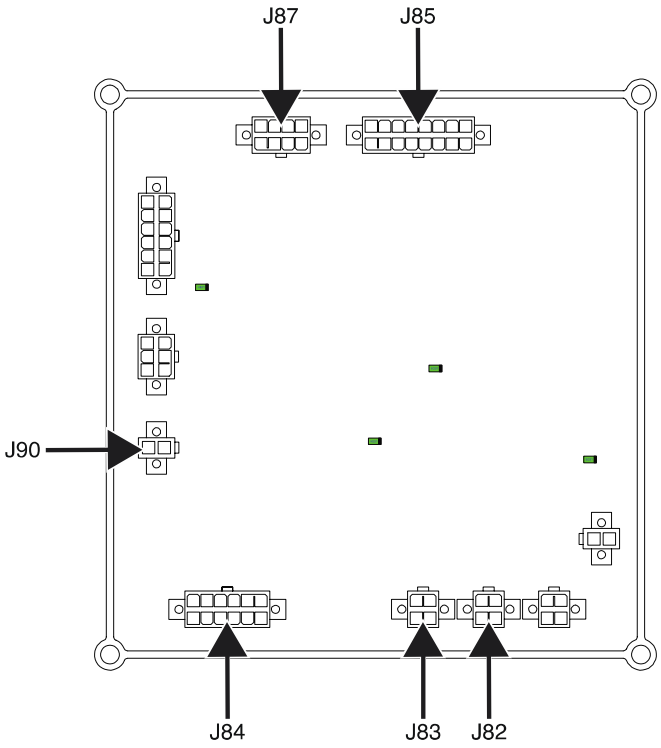
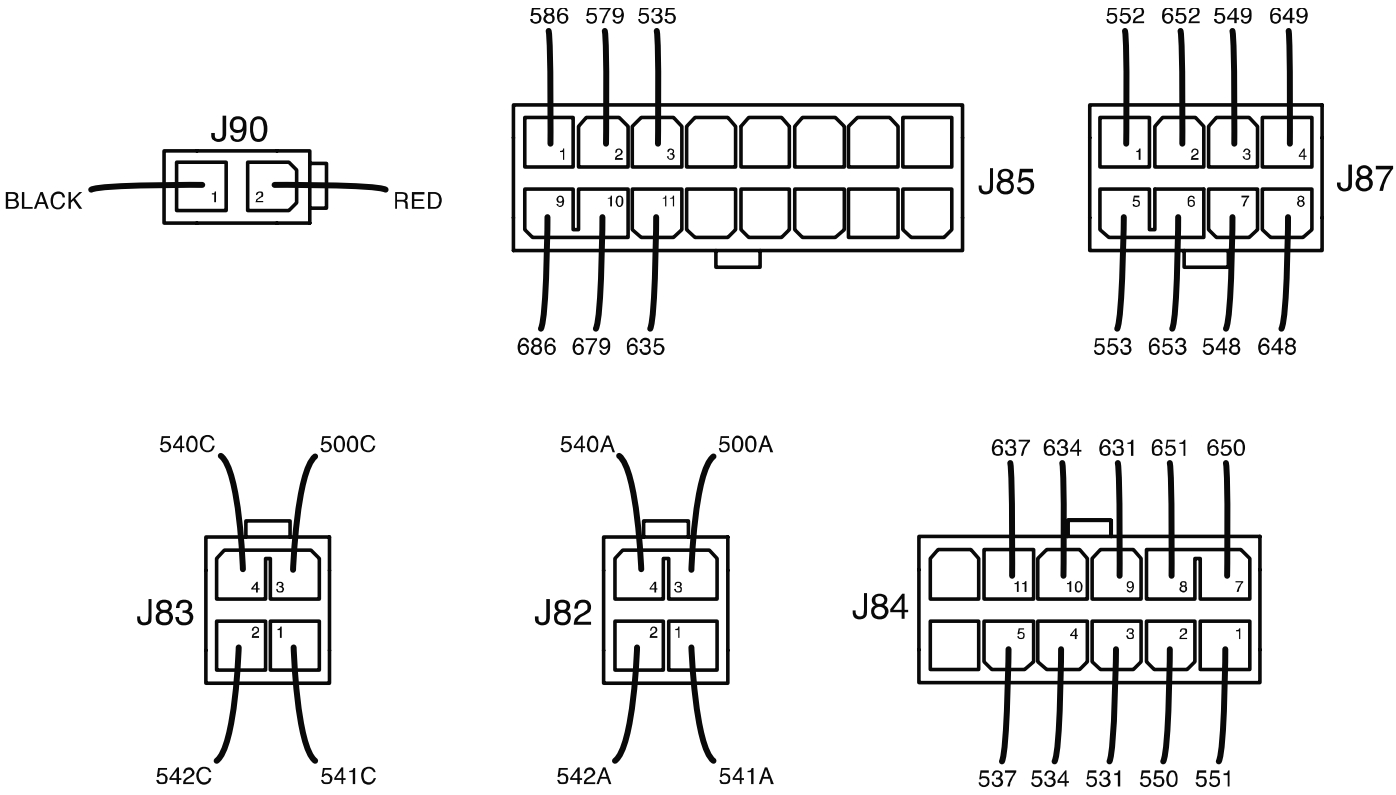


Figure F.3 – Wire drive board lead locations



OUTPUT CONTACTOR 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

These tests will help determine if the Output Contactor Coils are receiving the correct DC voltage and if the Contacts are closing and opening.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the contactor to be tested. See Wiring Diagram.
5. Locate the red and black contactor coil leads (549 or 649 - 548 or 648) in plug J87 on the wire drive board. See ***Figures F.1*** and ***F.2***. See Wiring Diagram.
6. Label and disconnect plug J87 from the wire drive board. See ***Figure F.2***. See Wiring Diagram.
7. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***.
8. Connect plug J87 to the wire drive board. See ***Figure F.2***. See Wiring Diagram.
9. Carefully apply the correct input power to the machine and turn ON the machine. With the contactor energized, there should be approximately 11 VDC at the red and black leads.
10. If the voltage is not present, check the associated leads between the wire drive board and the contactor coil. See the Wiring Diagram.
11. If the contactor does not activate with the correct DC voltage applied, the contactor may be faulty.
12. With the contactor activated there should be less than one ohm of resistance across the contactor terminals. See Wiring Diagram.
13. When the contactor is not activated, there should be very high resistance across the contactor terminals - more than 500,000 ohms.
14. If any of the tests fail, the line switch may be faulty.
15. If faulty, perform the ***Contactor Removal And Replacement Procedure***.
16. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Output contactor resistance tests

TEST POINT	TEST POINT	EXPECTED READING
PLUG J87 PIN 8 (LEAD 648)	PLUG J87 PIN 4 (LEAD 649)	APPROX. 120 OHMS
PLUG J87 PIN 7 (LEAD 548)	PLUG J87 PIN 3 (LEAD 549)	APPROX. 110 OHMS

Figure F.1 – Wire drive board location

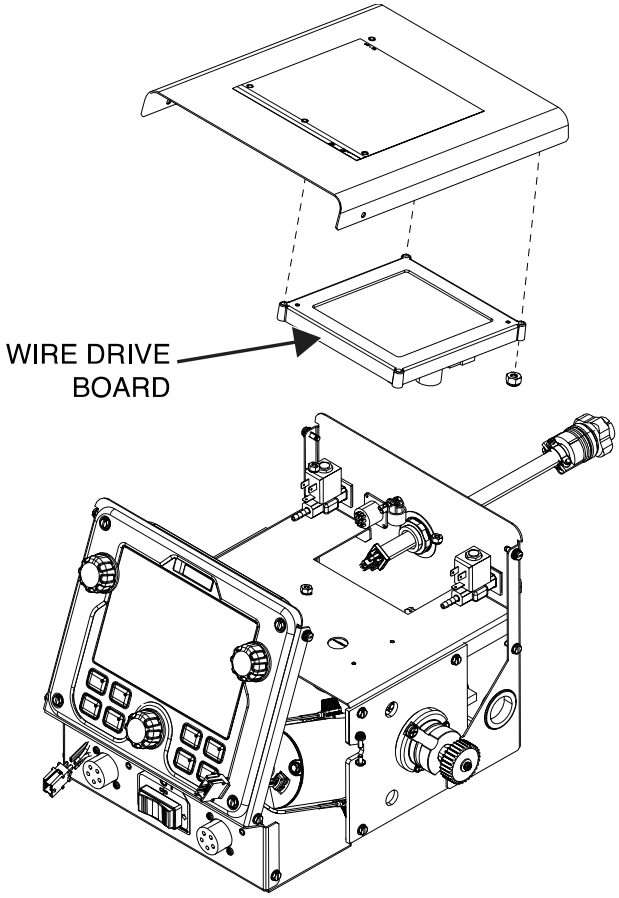


Figure F.2 – Wire drive board plug J87 location

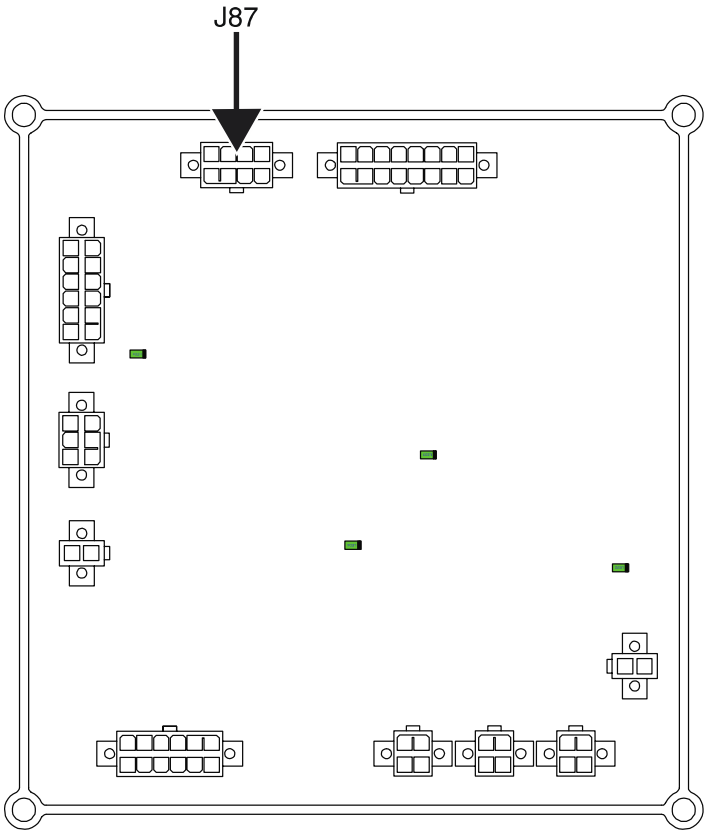
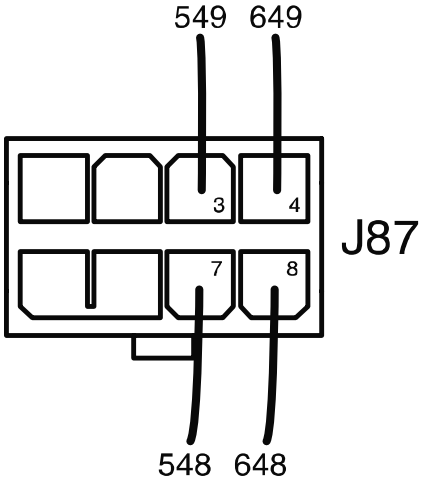


Figure F.3 – Wire drive board plug J87 lead location



FLOW 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

These tests will help determine if the Flow Switch is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the flow switch. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect plug J54 from the inline connection. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the flow switch tests open and there is more than .5 gallons per minute of coolant flow, the flow switch may be faulty.
8. If the flow switch tests closed and there is less than .5 gallons per minute of coolant flow, the flow switch may be faulty.
9. If faulty, perform the ***Flow Switch Removal And Replacement Procedure***.
10. Connect plug J54 to the inline connection. See Wiring Diagram.
11. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Flow switch resistance tests

TEST POINT	TEST POINT	EXPECTED READING	FLOW RATE
PLUG J54 PIN 1 (LEAD 723)	PLUG J54 PIN 4 (LEAD 722)	CLOSED (LOW RESISTANCE)	MORE THAN .5 GALLONS PER MINUTE COOLANT FLOW
PLUG J54 PIN 1 (LEAD 723)	PLUG J54 PIN 4 (LEAD 722)	OPEN (HIGH RESISTANCE)	NO COOLANT FLOW

Figure F.1 – Flow switch location

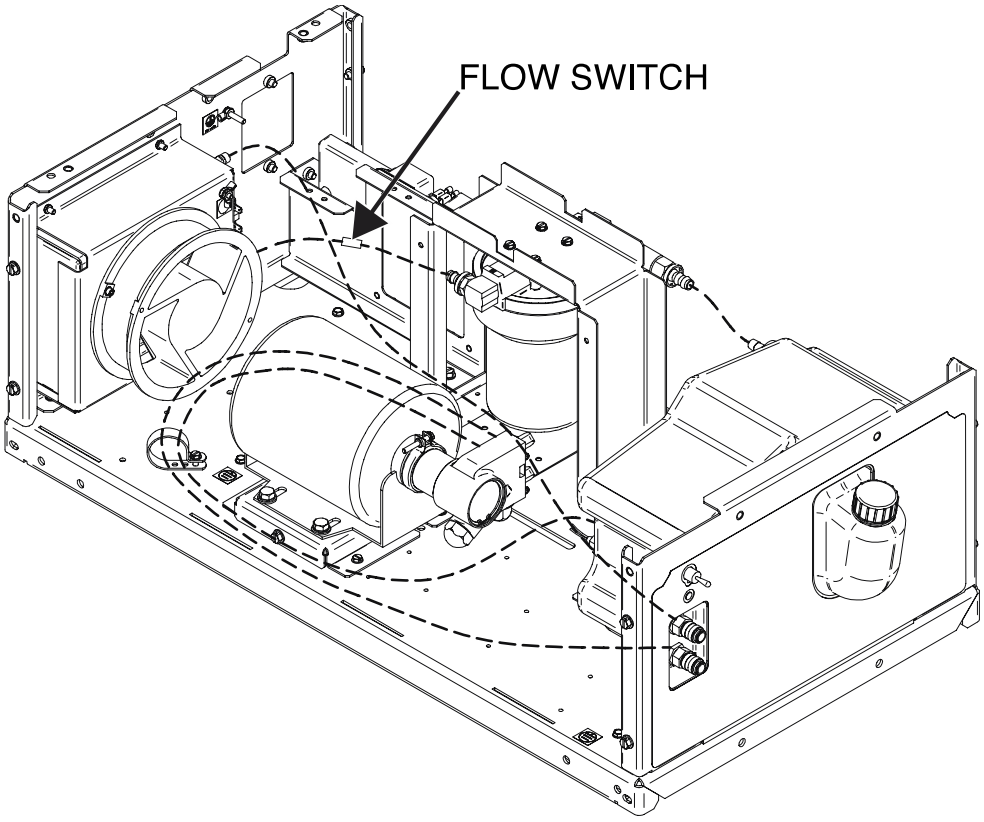
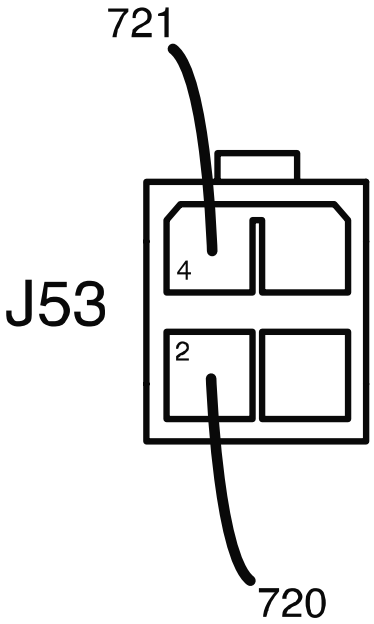


Figure F.2 – Plug J54 lead locations



FLOAT 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

These tests will help determine if the Float Switch is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the float switch. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect plug J53 from the inline connection. See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the level switch tests open and there is more than .9 gallons of coolant in the reservoir, the float switch may be faulty.
8. If the level switch tests closed and there is less than .9 gallons of coolant in the reservoir, the float switch may be faulty.
9. If faulty, perform the ***Float Switch Removal And Replacement Procedure***.
10. Connect plug J53 to the inline connection. See Wiring Diagram.
11. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Float switch resistance tests

TEST POINT	TEST POINT	EXPECTED READING	COOLANT LEVEL
PLUG J53 PIN 2 (LEAD 720)	PLUG J53 PIN 4 (LEAD 721)	CLOSED (LOW RESISTANCE)	MORE THAN .9 GALLONS OF COOLANT
PLUG J53 PIN 2 (LEAD 720)	PLUG J53 PIN 4 (LEAD 721)	OPEN (HIGH RESISTANCE)	LESS THAN .9 GALLONS OF COOLANT

Figure F.1 – Float switch location

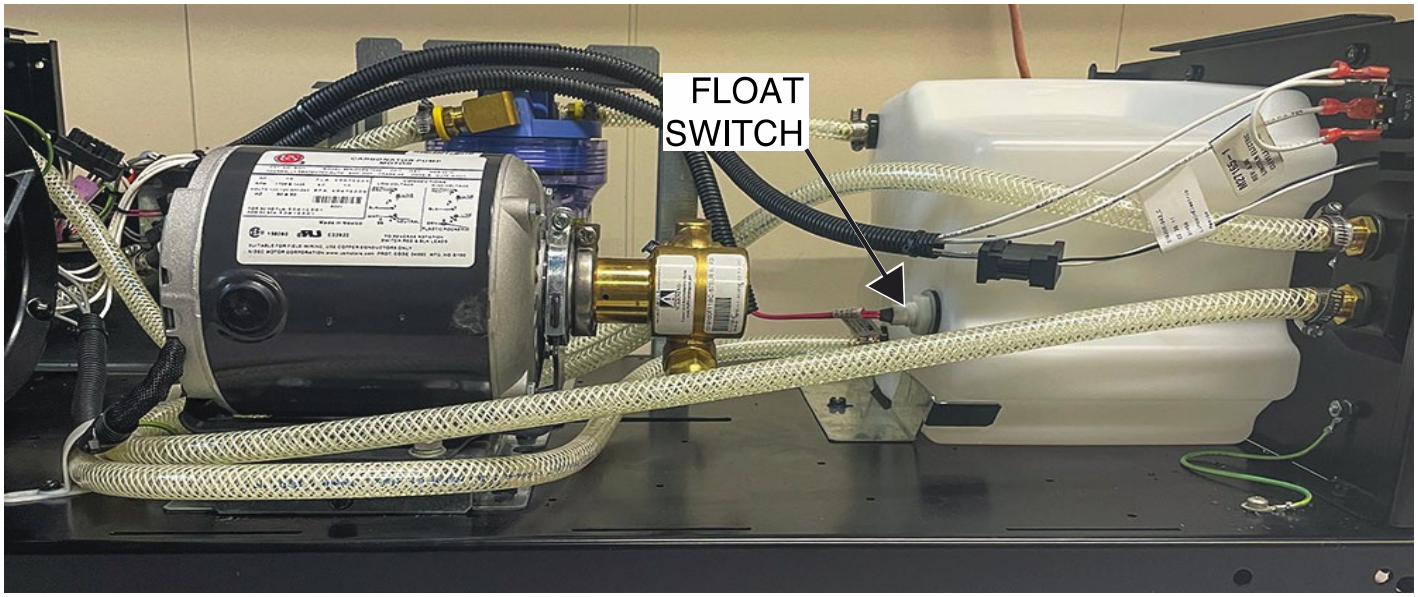
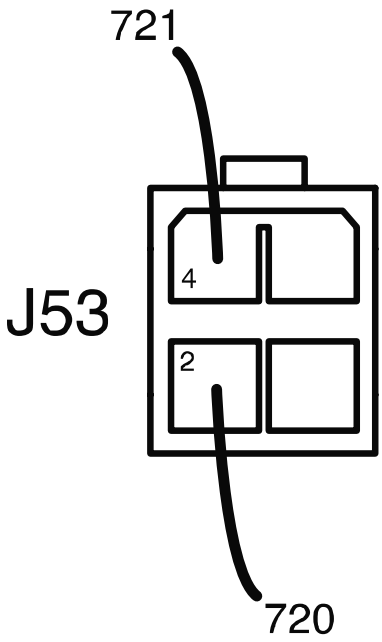


Figure F.2 – Float switch lead location



MOMENTARY TOGGLE 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

These tests will help determine if the Momentary Toggle Switch is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the momentary toggle switch. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 724, 737B and the jumper lead (737C) from the momentary toggle switch terminals. See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. Connect leads 724, 737B and the jumper lead (737C) to the momentary toggle switch terminals. See Wiring Diagram.
8. If faulty, perform the ***Momentary Toggle Switch Removal And Replacement Procedure***.
9. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – Momentary toggle switch resistance tests

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

Figure F.1 – Momentary toggle switch location

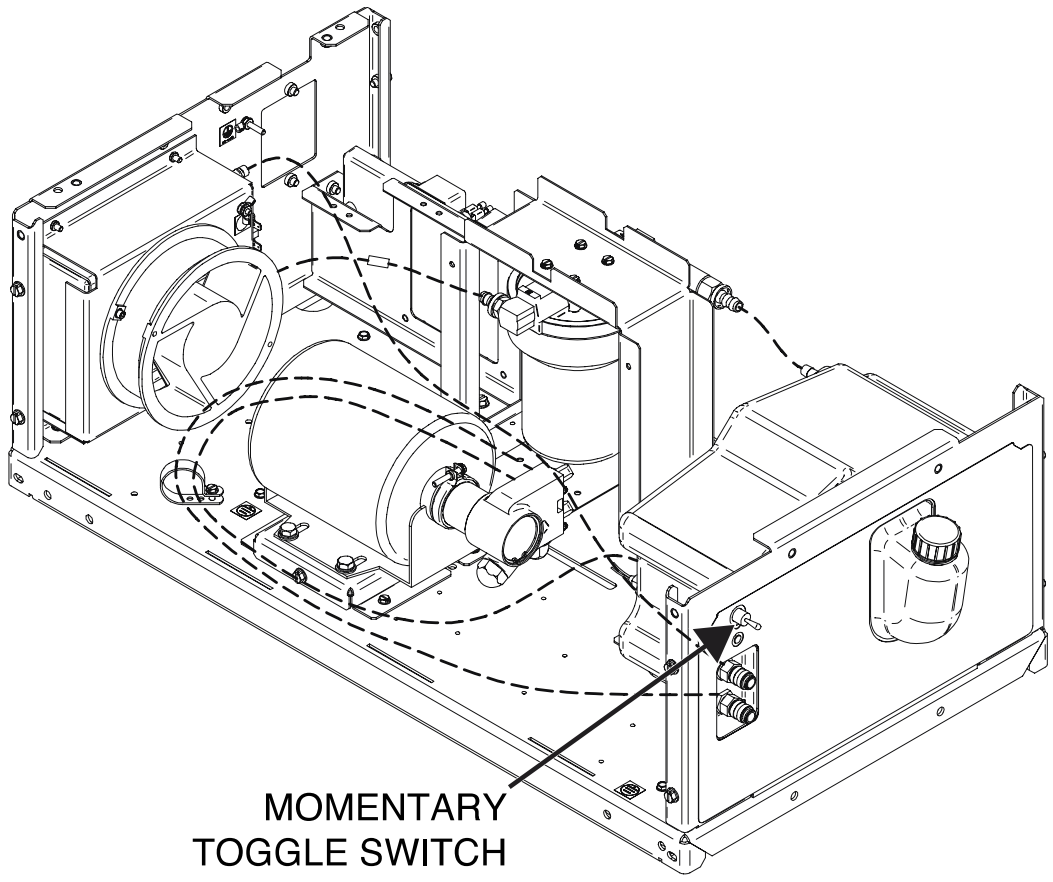
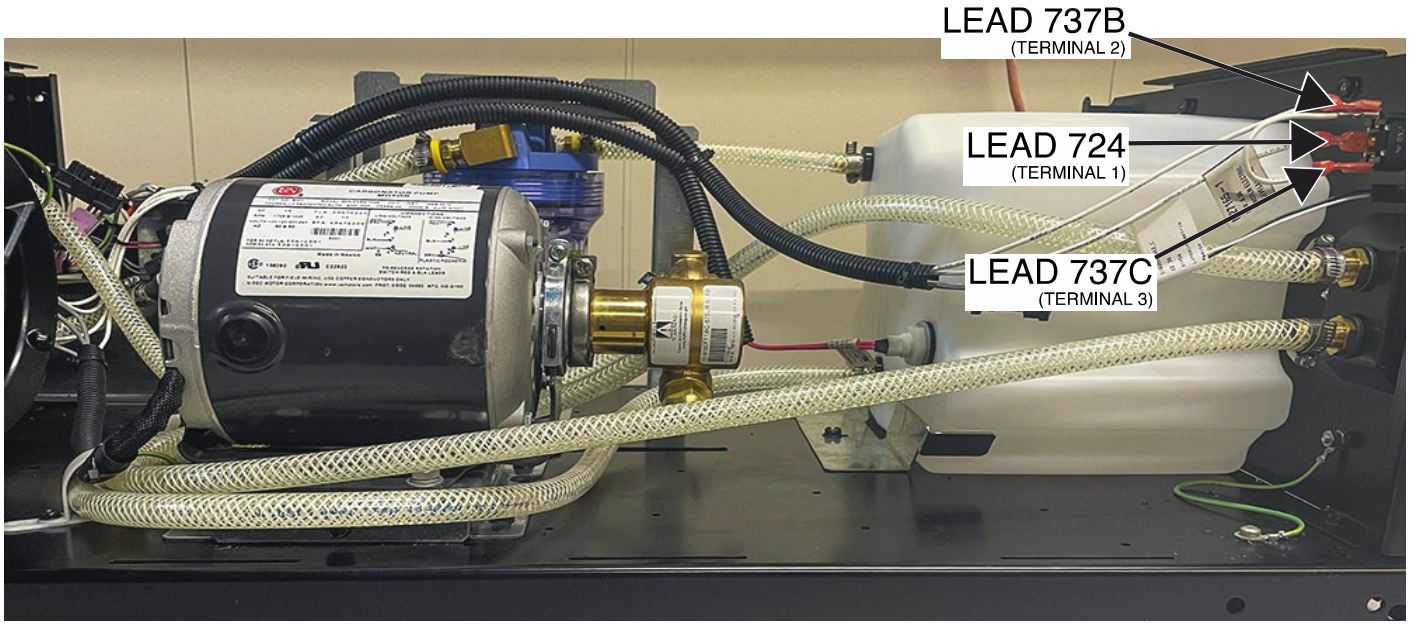


Figure F.2 – Momentary toggle switch lead and terminal locations



PUMP MOTOR 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

These tests will help determine if the Pump Motor is functioning properly.

MATERIALS NEEDED

Molex Removal Tool
115 VAC Power Supply
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the pump motor assembly. See ***Figure F.1***. See Wiring Diagram.
5. Check for loose or faulty connections at the pump motor. See Wiring Diagram.
6. Label and disconnect plug J63 from the 115VAC inverter board. See ***Figure F.2***. See Wiring Diagram.
7. Label and disconnect lead 734A from the circuit breaker. See ***Figure F.3***. See Wiring Diagram.
8. Using a Molex removal tool, remove lead 732A from plug J63. See ***Figure F.4***. See Wiring Diagram.
9. Using a 115 VAC power supply, briefly apply power directly to leads 732A and 734A. See Wiring Diagram. The pump motor should activate.
10. If the pump motor does not activate, the pump motor assembly may be faulty. See Wiring Diagram.
11. If faulty, perform the ***Pump Motor Assembly Removal And Replacement Procedure***.
12. Connect lead 734A to the circuit breaker. See Wiring Diagram.
13. Carefully attach lead 734A to the plug J63. See Wiring Diagram.
14. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Pump motor location

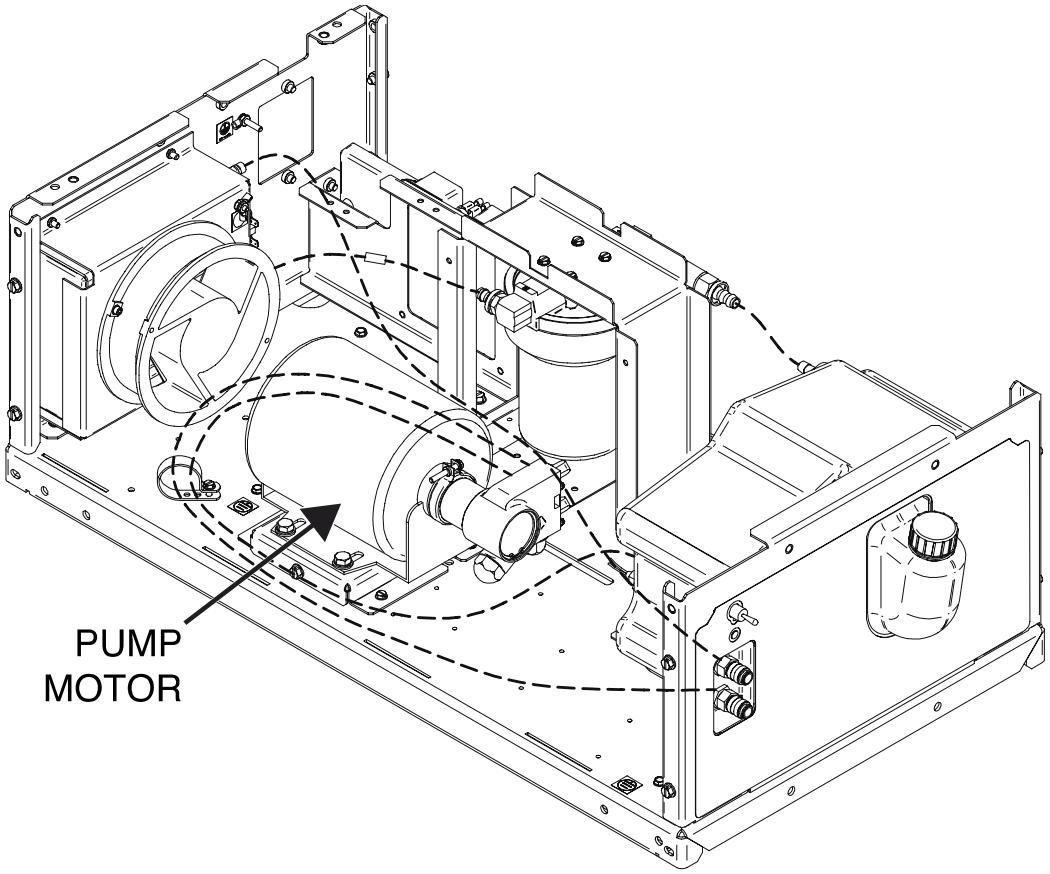


Figure F.2 – 115VAC inverter board plug J63 locations

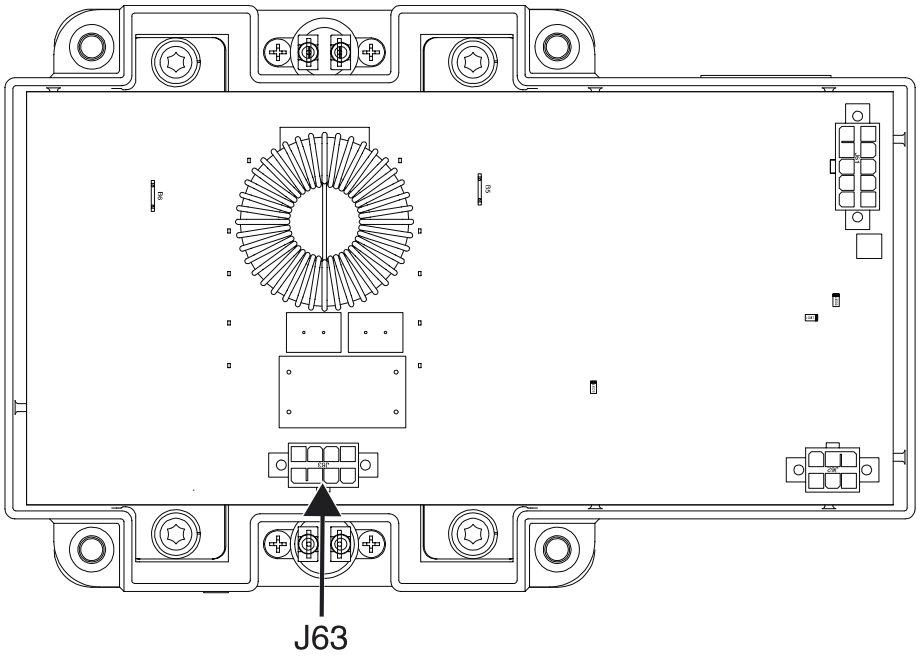


Figure F.3 – Circuit breaker and lead 734A location

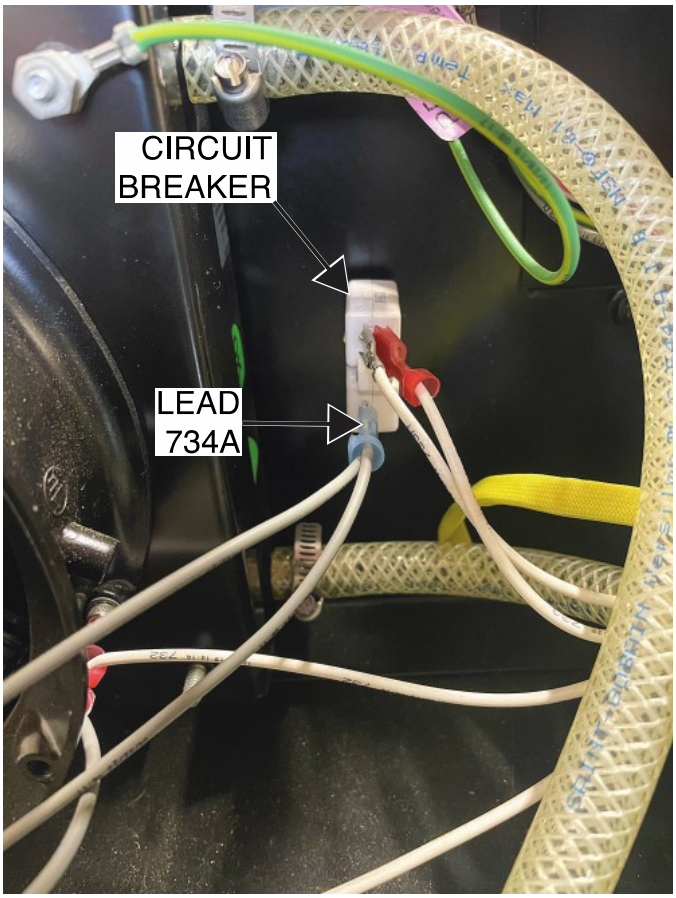
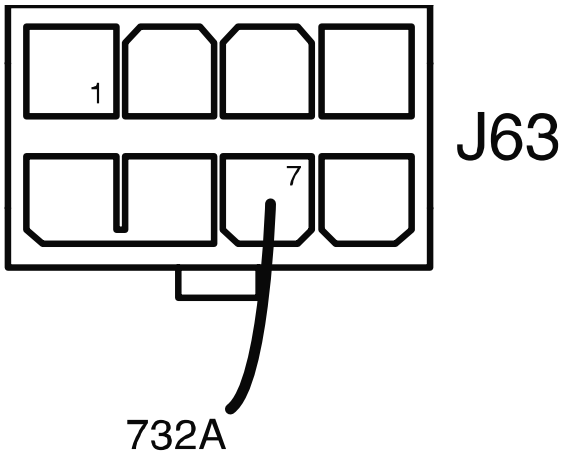


Figure F.4 – 115VAC inverter board plug J63 lead location



COOLER 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

These tests will help determine if the Cooler Fan is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
115 VAC Power Supply
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the fan assembly. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 732 and 734 from the fan terminals. See ***Figure F.2***. See Wiring Diagram.
6. Using a 115 VAC power supply, briefly apply 115 VAC to the fan terminals. See ***Figure F.2***. See Wiring Diagram. The fan should operate.
7. If the tests fail, the fan motor may be faulty.
8. If faulty, perform the ***Cooler Fan Removal And Replacement Procedure***.
9. Connect leads 732 and 734 to the fan terminals. See Wiring Diagram.
10. Perform the ***Case Cover Replacement Procedure***.

Figure F.1 – Fan assembly location

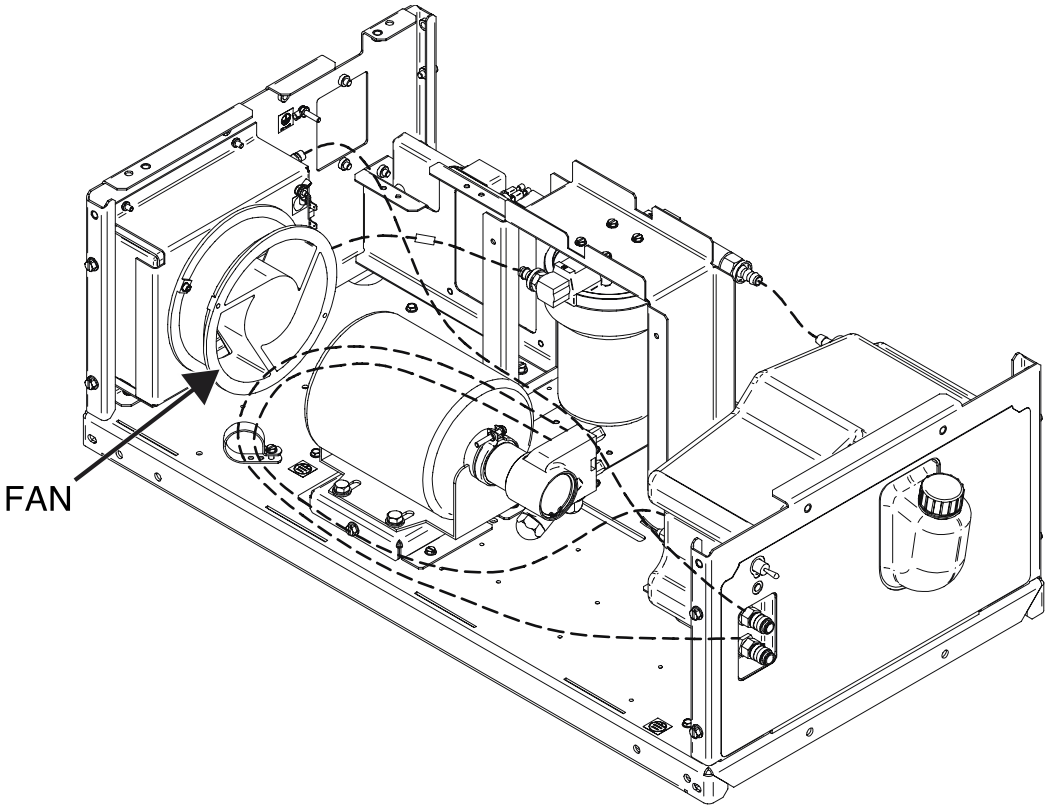
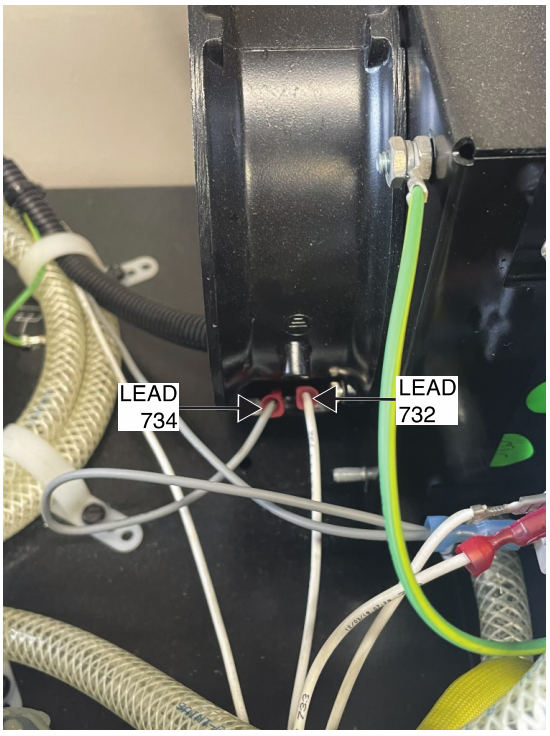


Figure F.2 – Fan motor lead locations



115 VAC INVERTER 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

These tests will help determine if the 115 VAC Inverter Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the 115 VAC inverter board. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
6. Carefully apply the correct input power to the machine and turn ON the machine.
7. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
8. If any of the tests fail, the 115 VAC inverter board may be faulty.
9. If faulty, perform the ***115 VAC Inverter Board Removal And Replacement Procedure***.
10. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – 115 VAC inverter board resistance tests

TEST POINT	TEST POINT	EXPECTED READING
PLUG J61 PIN 1 (LEAD 411)	PLUG J61 PIN 6 (LEAD 412)	VERY LOW RESISTANCE (LESS THAN ONE OHM)
PLUG J61 PIN 2 (LEAD 413)	PLUG J61 PIN 7 (LEAD 414)	VERY LOW RESISTANCE (LESS THAN ONE OHM)

Table F.2 – 115 VAC inverter board voltage tests

TEST POINT	TEST POINT	EXPECTED READING	MACHINE CONDITION
TERMINAL B5 (LEAD 730)	TERMINAL B6 (LEAD 729)	315 VAC	MACHINE “ON”.
PLUG J63 PIN 1 (LEAD 733)	PLUG J63 PIN 3 (LEAD 732)	115 VAC	MACHINE “ON”. MOTOR ACTIVATED.
PLUG J63 PIN 5 (LEAD 733A)	PLUG J63 PIN 7 (LEAD 732A)	115 VAC	MACHINE “ON”. MOTOR ACTIVATED.

Figure F.1 – 115 VAC inverter board location

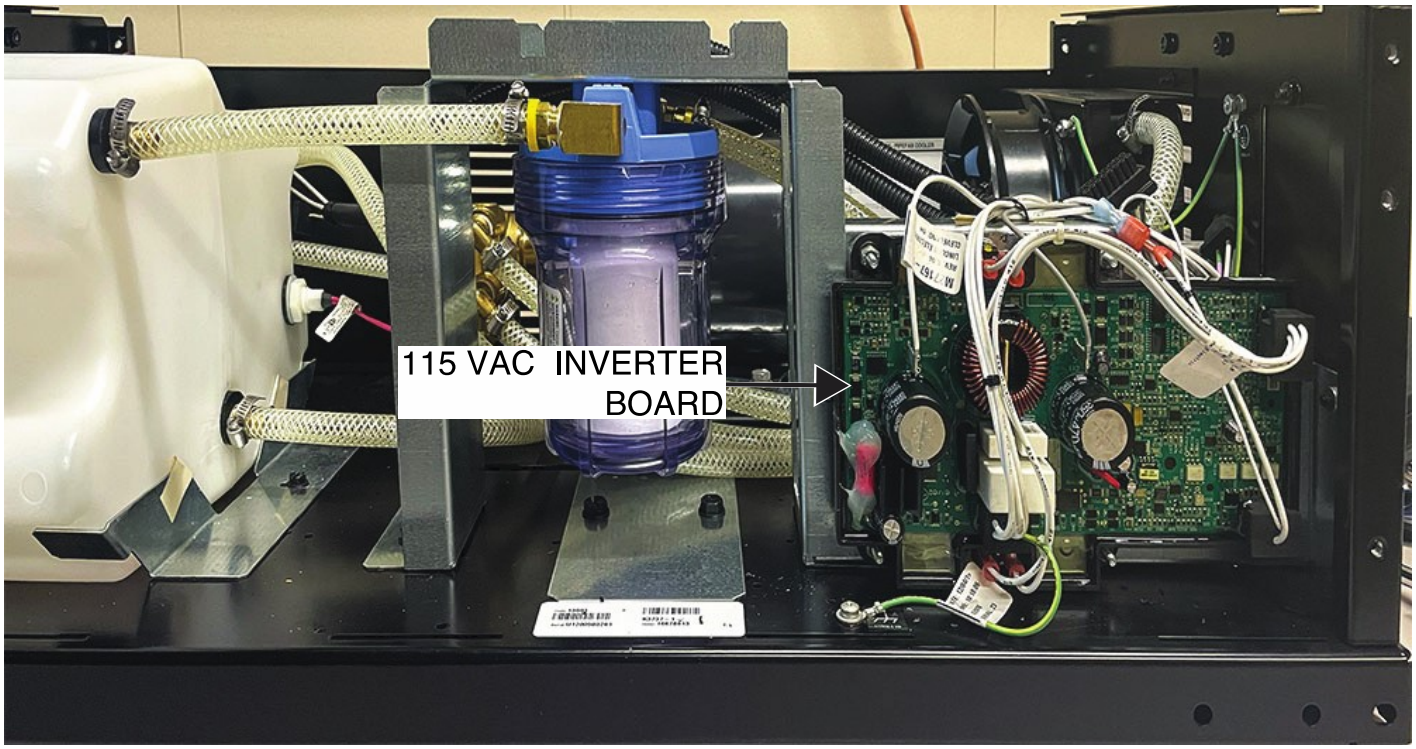


Figure F.2 – 115 VAC inverter board terminal and plug locations

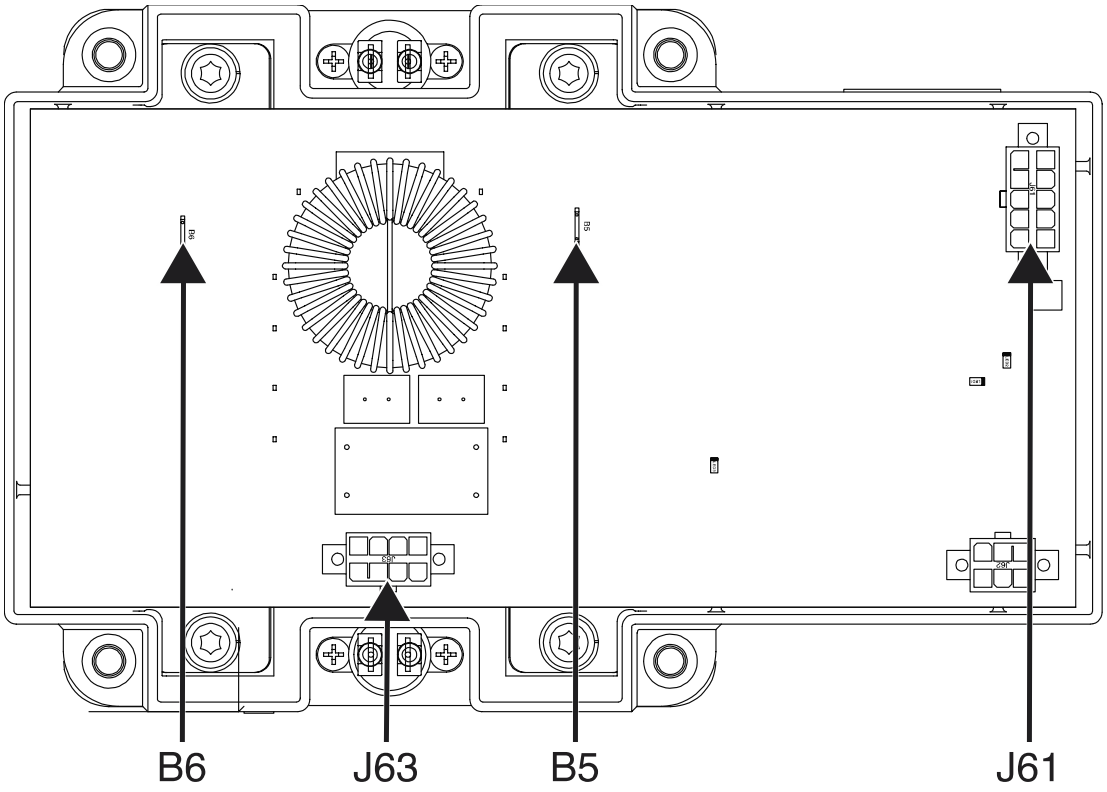
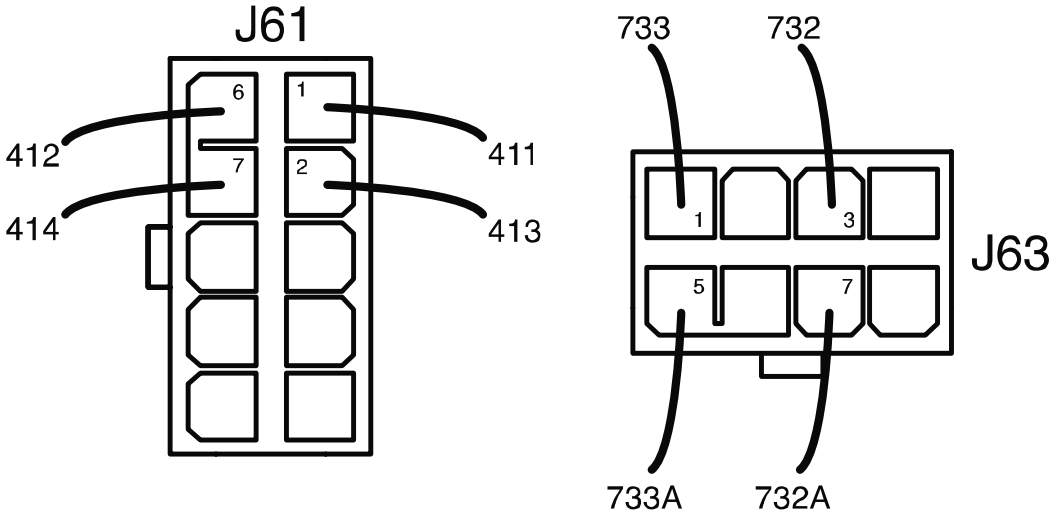


Figure F.3 – 115 VAC inverter board lead locations



Removal And Replacement Procedures

INPUT 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 Input Board.

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plug J1 from the input board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the five bolts and lock washers securing the leads to terminals B1, B2, B3, B4 and B5 on the input board. See ***Figure F.1***. See Wiring Diagram.
6. Label and disconnect the ground lead from the quick-connect terminal. See ***Figure F.1***. See Wiring Diagram.
7. Using a 3/8” nutdriver, remove the four nuts and washers securing the board to the machine. See ***Figure F.2***.
8. Carefully maneuver the input board assembly (including heatsink) out of the machine.
9. The input board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new input board assembly into the machine.
2. Using a 3/8” nutdriver, attach the four nuts and washers securing the board to the machine.
3. Connect the ground lead to the quick-connect terminal. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the five bolts and lock washers securing the leads to terminals B1, B2, B3, B4 and B5 on the input board. See Wiring Diagram.
5. Connect plug J1 to the input board. See Wiring Diagram.

6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Input board plug and lead locations

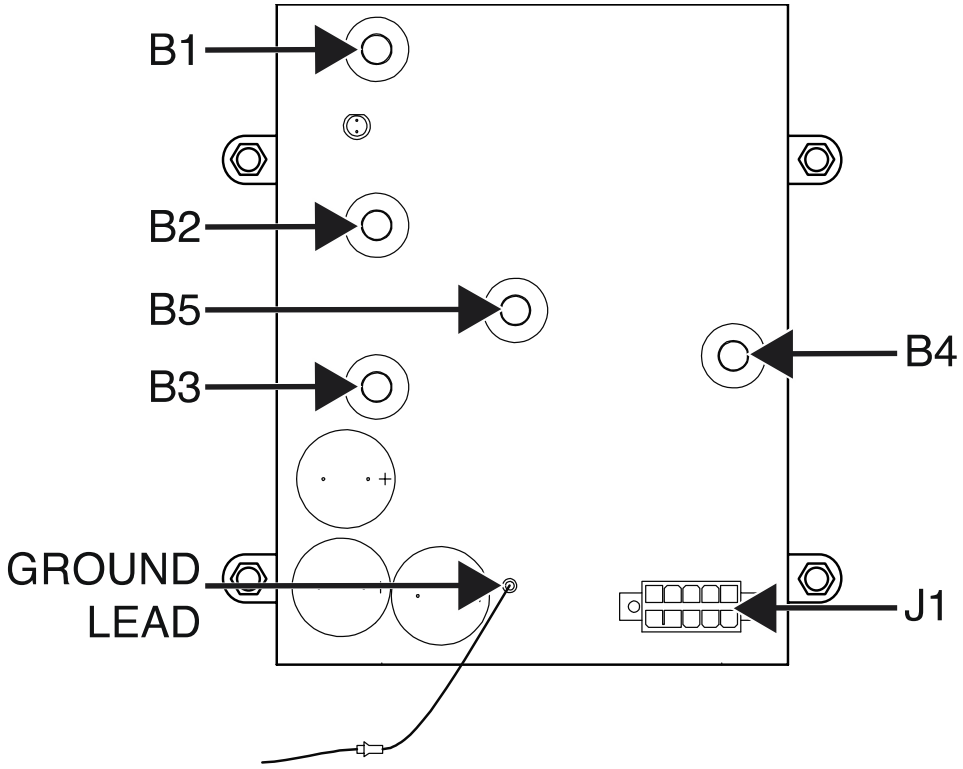
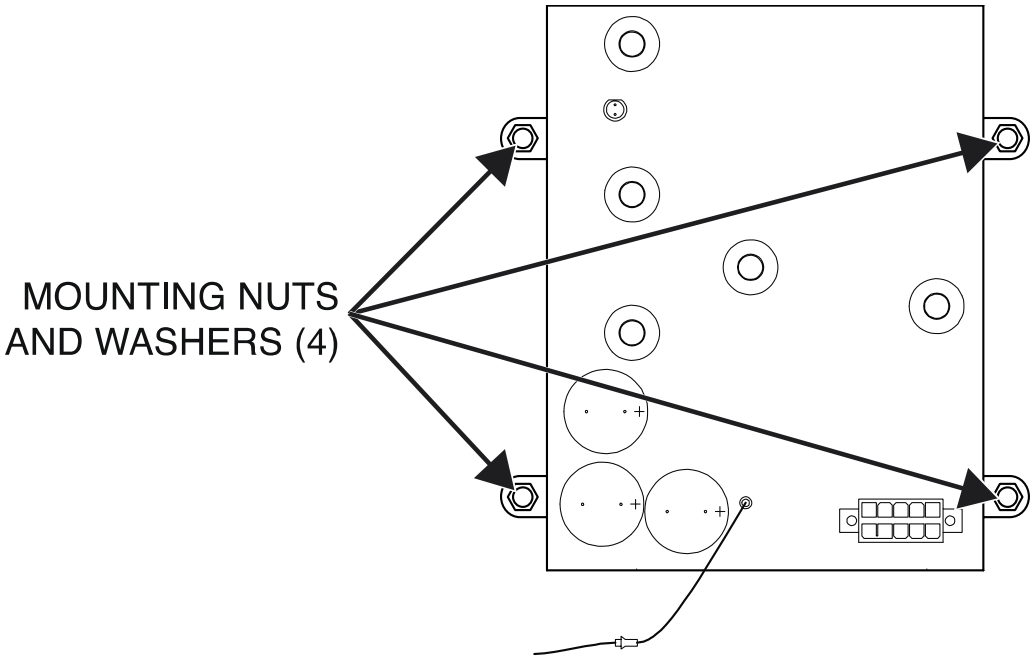


Figure F.2 – Input board mounting screw locations



POWER CONVERSION ASSEMBLY 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 Power Conversion Assembly.

MATERIALS NEEDED

7/16” Nutdriver
7/16” Open-End Wrench
5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J32, J33, J34, J35, J36 and J37 from the power conversion assembly. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the bolt and lock washer securing the lead B2 and the two smaller leads to terminal B56 of the power conversion assembly. Label and disconnect leads. Note lead placement for reassembly. See ***Figure F.1***. See Wiring Diagram.
6. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut and washer securing the two heavy leads and one small lead to the top right of the heat sink terminal. See ***Figure F.1***. See Wiring Diagram.
7. Using a 7/16” nutdriver, remove the bolts and lock washers securing the top choke leads to terminals B12 and B8 of the power conversion assembly. See ***Figure F.1***. See Wiring Diagram.
8. Using a 7/16” nutdriver, remove the bolts and lock washers securing the bottom choke leads to terminals B6 and B7 of the power conversion assembly. See ***Figure F.1***. See Wiring Diagram.
9. Using a 7/16” nutdriver, remove the bolts, lock washers and nuts securing the leads B4 and B5 to the bus bars. See ***Figure F.1***. See Wiring Diagram.
10. Using a 5/16” nutdriver, remove the six screws and washers securing the power conversion assembly to the machine. See ***Figure F.2***.
11. Clear leads and cut cable ties as necessary to allow for the removal of the power conversion assembly. See Wiring Diagram.
12. The power conversion assembly can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new power conversion assembly into the machine.
2. Using a 5/16” nutdriver, attach the six screws and washers securing the power conversion assembly to the machine.
3. Using a 7/16” nutdriver, attach the bolts, lock washers and nuts securing the leads B4 and B5 to the bus bars. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the bolts and lock washers securing the bottom choke leads to terminals B6 and B7 of the power conversion assembly. See Wiring Diagram.
5. Using a 7/16” nutdriver, attach the bolts and lock washers securing the top choke leads to terminals B12 and B8 of the power conversion assembly. See Wiring Diagram.
6. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut and washer securing the two heavy leads and one small lead to the top right of the heat sink terminal. See Wiring Diagram.
7. Using a 7/16” nutdriver, attach the bolt and lock washer securing the lead B2 and the two smaller leads to terminal B56 of the power conversion assembly. See Wiring Diagram.
8. Connect plugs J32, J33, J34, J35, J36 and J37 to the power conversion assembly. See Wiring Diagram.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Power conversion assembly plug and terminal locations

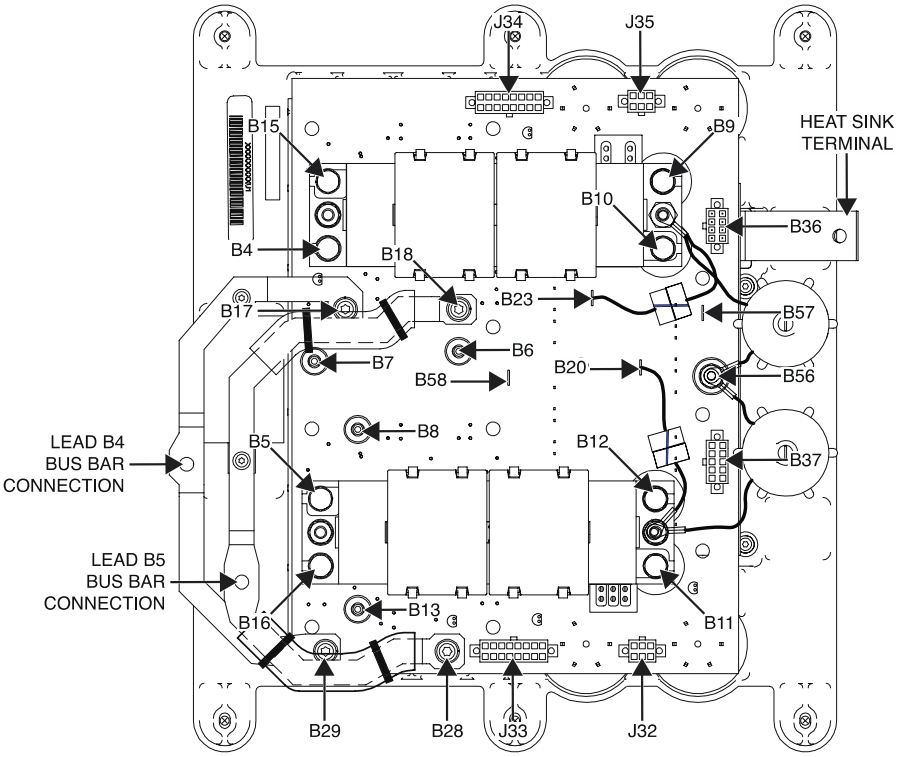
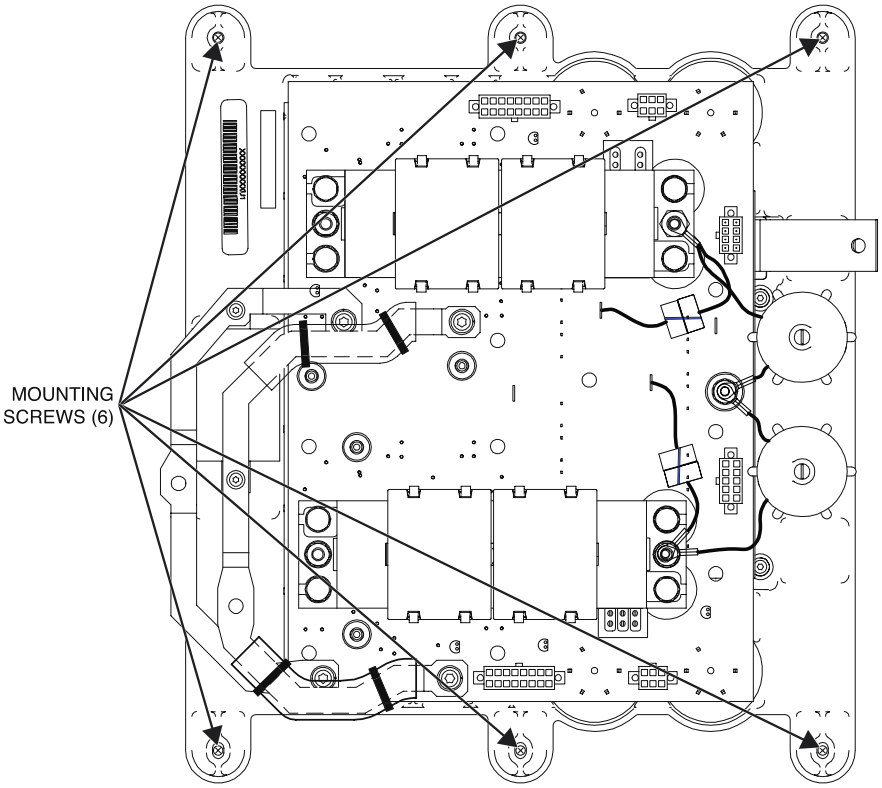


Figure F.2 – Power conversion assembly mounting screw locations



DIGITAL 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 Digital Control Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J4, J5, J6, J7, J8, J9, J11 and J12 from the digital control board. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect the ethernet plug from the digital control board. See ***Figure F.1***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the two nuts securing the digital control board to the machine. See ***Figure F.2***.
7. The digital control board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new digital control board onto the mounting posts in the machine.
2. Using a 3/8” nutdriver, attach the two nuts securing the digital control board to the machine.
3. Connect the ethernet plug to the digital control board. See Wiring Diagram.
4. Connect plugs J4, J5, J6, J7, J8, J9, J11 and J12 to the digital control board. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Digital control board plug and ethernet connection locations

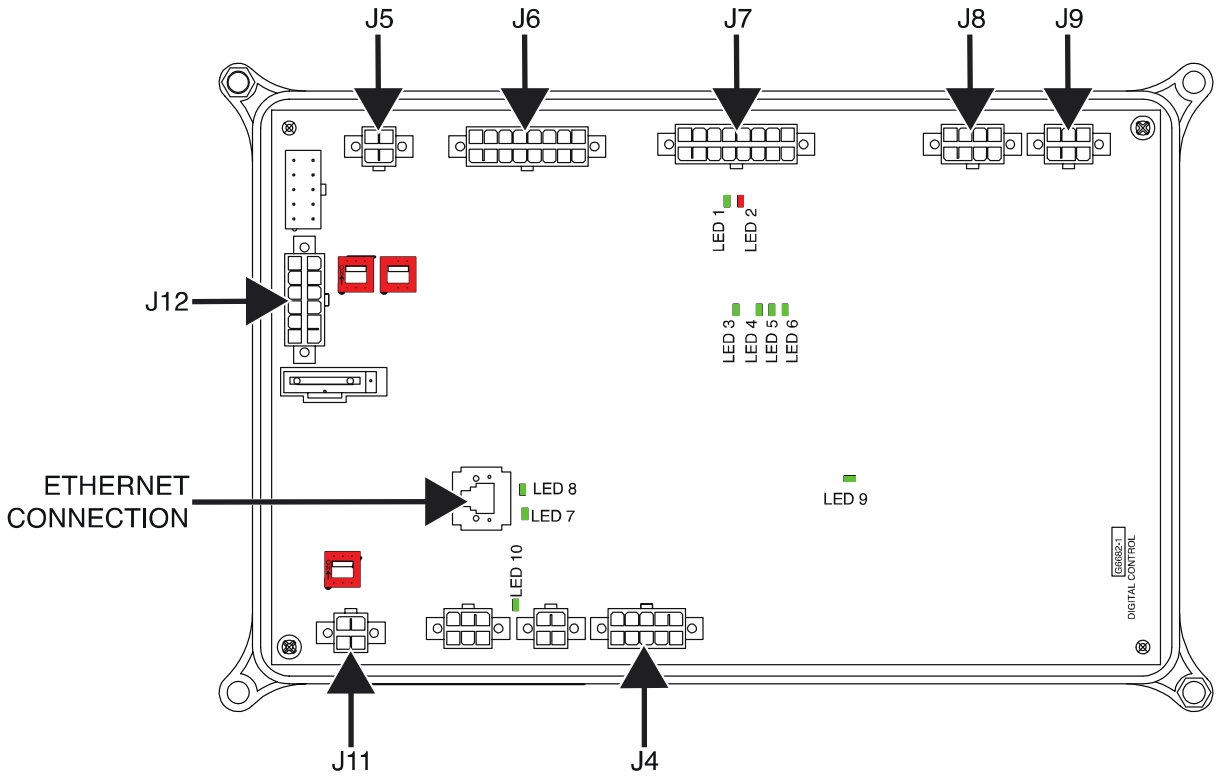
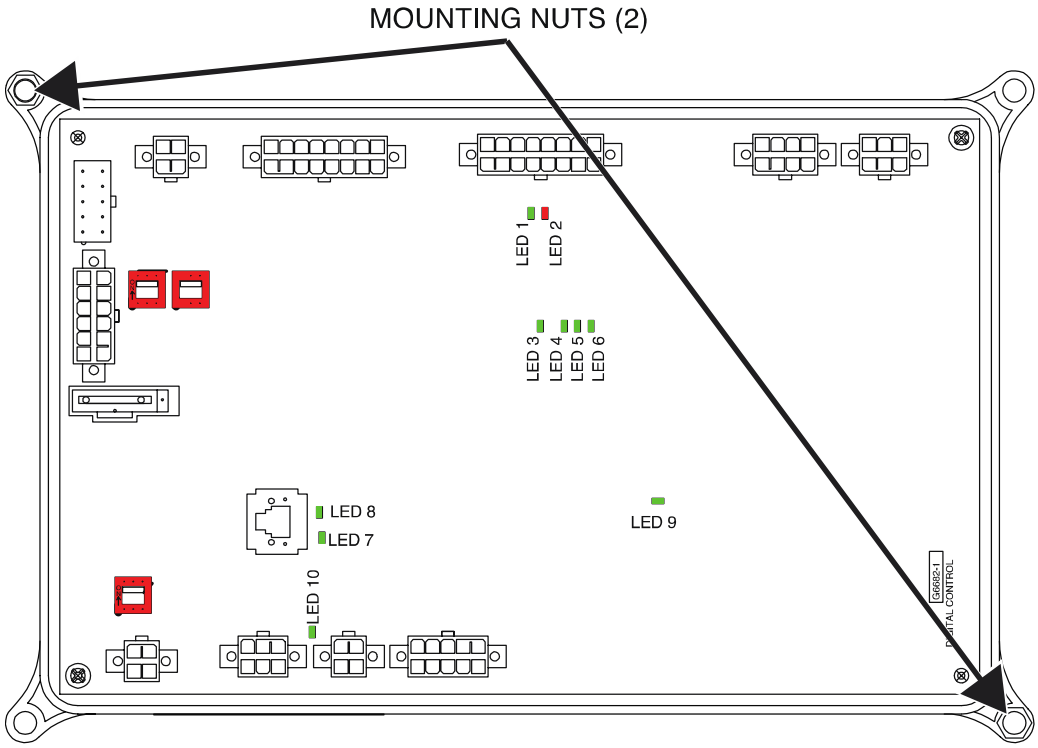


Figure F.2 – Digital control board mounting nut locations



MULTI-PHASE 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 Multi-Phase Chopper Board.

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J41, J42 and J43 from the multi-phase chopper board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the bolt and lock washer securing leads to terminals BL1, BL2, BL3, BL4, BL5 and BL6 of the multi-phase chopper board. See ***Figure F.1***. See Wiring Diagram. Label and disconnect leads.
6. Using a 7/16” nutdriver, remove the bolt and lock washer securing leads 901 and B1G to terminal B1 of the multi-phase chopper board. See ***Figure F.1***. See Wiring Diagram. Label and disconnect leads.
7. Using a 7/16” nutdriver, remove the bolt and lock washer securing lead B2 to terminal B2 of the multi-phase chopper board. See ***Figure F.1***. See Wiring Diagram. Label and disconnect lead.
8. Using a 5/16” nutdriver, remove the two screws securing the snubber board bracket to the base of the machine. See ***Figure F.2***.
9. Carefully maneuver the snubber board to allow for the removal of the multi-phase chopper board.
10. Using a 3/8” nutdriver, remove the four nuts and washers securing the multi-phase chopper board to the machine. See ***Figure F.3***.
11. Carefully maneuver the multi-phase chopper board assembly out of the machine.
12. The multi-phase chopper board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new multi-phase chopper board into the machine.
2. Using a 3/8” nutdriver, attach the four nuts and washers securing the multi-phase chopper board to the machine.
3. Using a 5/16” nutdriver, attach the two screws securing the snubber board bracket to the base of the machine.
4. Using a 7/16” nutdriver, attach the bolt and lock washer securing lead B2 to terminal B2 of the multi-phase chopper board. See Wiring Diagram.
5. Using a 7/16” nutdriver, attach the bolt and lock washer securing leads 901 and B1G to terminal B1 of the multi-phase chopper board. See Wiring Diagram.
6. Using a 7/16” nutdriver, attach the bolt and lock washer securing leads to terminals BL1, BL2, BL3, BL4, BL5 and BL6 of the multi-phase chopper board. See Wiring Diagram.
7. Connect plugs J41, J42 and J43 to the multi-phase chopper board. See Wiring Diagram.
8. Perform the ***Case Cover Replacement Procedure***.
9. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Multi-phase chopper board plug and terminal locations

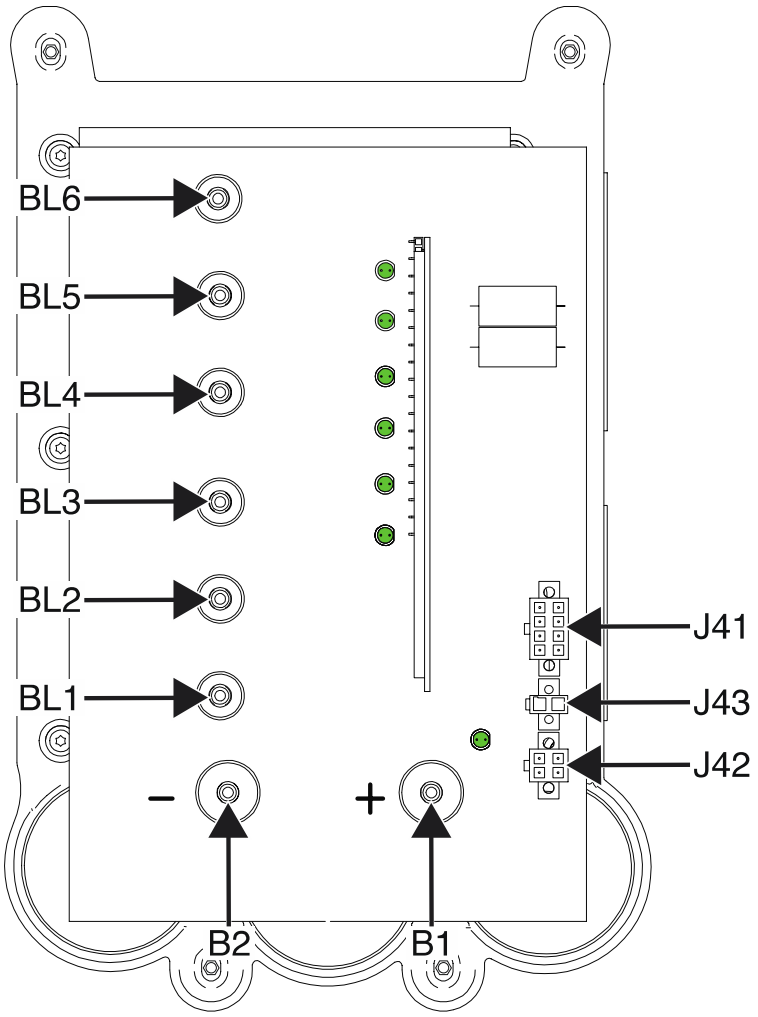


Figure F.2 – Snubber board location

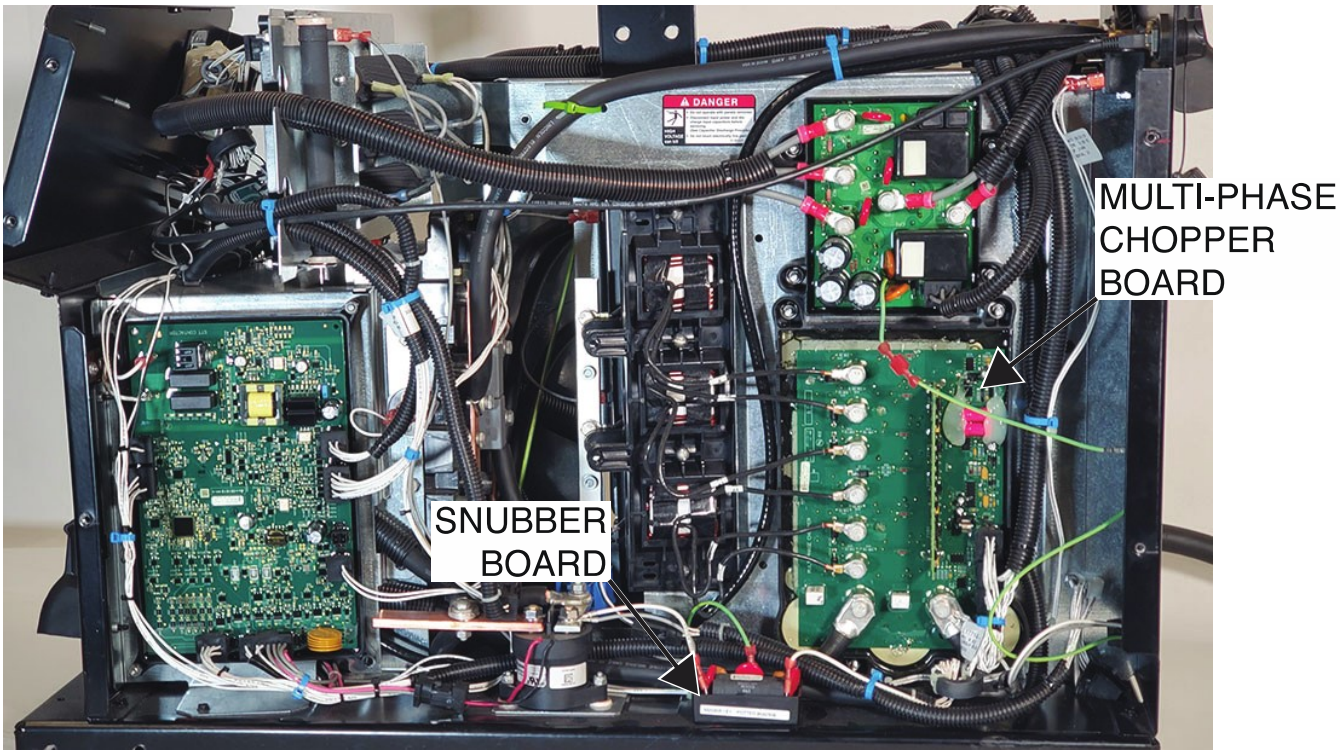
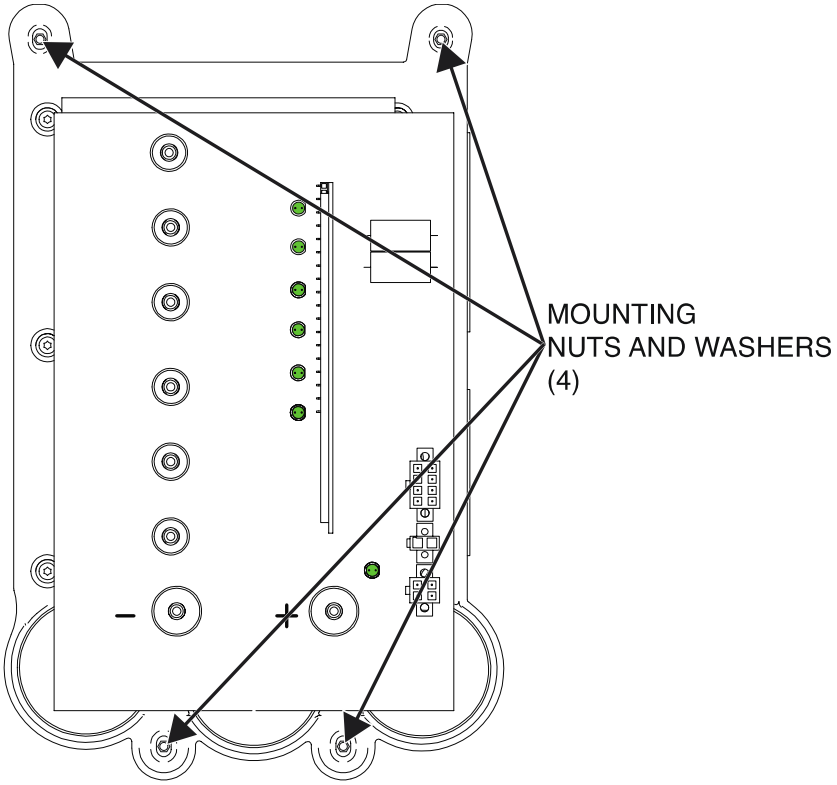


Figure F.3 – Multi-phase chopper board mounting nut and washer locations



MULTI-PHASE 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 Multi-Phase Output Choke.

MATERIALS NEEDED

7/16” Nutdriver
Slotted Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 7/16” nutdriver, remove the bolt and lock washer securing each of the three choke lead pairs to the bus bar. See ***Figure F.1***. See Wiring Diagram. Label and disconnect leads.
5. Using a 7/16” nutdriver, remove the six bolts and lock washers securing the choke leads to terminals BL1, BL2, BL3, BL4, BL5 and BL6 of the multi-phase chopper board. See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
6. Remove cable ties as necessary to allow for the removal of the multi-phase output choke.
7. Using a slotted screwdriver, remove the two screws securing the multi-phase output choke to the machine. See ***Figure F.3***.
8. The multi-phase output choke can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new multi-phase output choke into the machine.
2. Using a slotted screwdriver, attach the two screws securing the multi-phase output choke to the machine.
3. Using a 7/16” nutdriver, attach the six bolts and lock washers securing the choke leads to terminals BL1, BL2, BL3, BL4, BL5 and BL6 of the multi-phase chopper board. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the bolt and lock washer securing each of the three choke lead pairs to the bus bar. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Multi-phase output choke lead bus bar connection locations

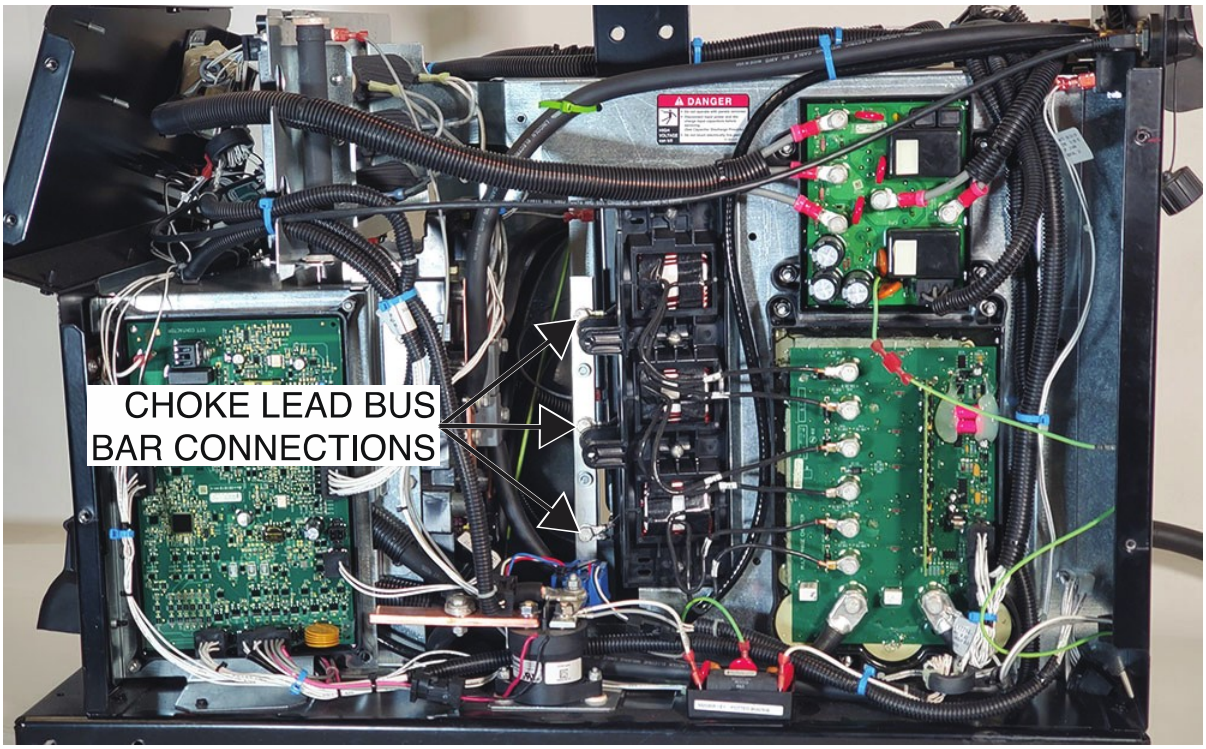


Figure F.2 – Multi-phase output choke lead connection locations

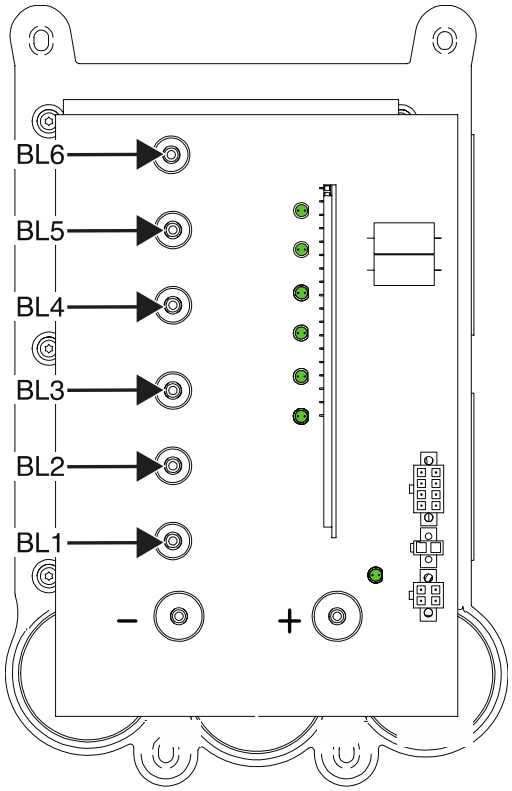
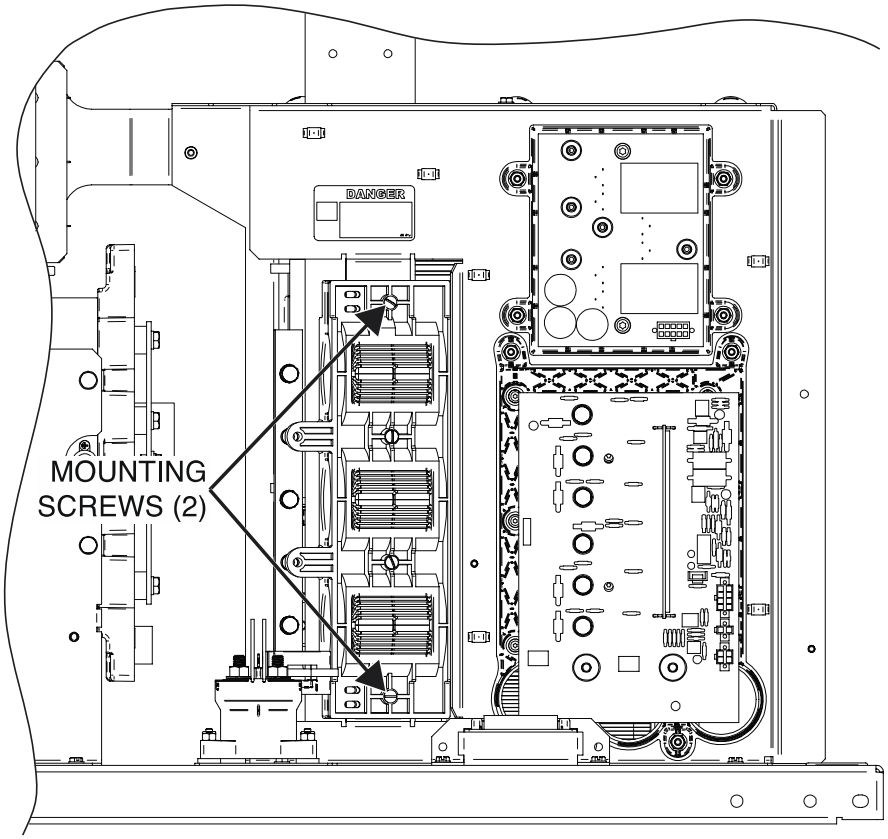


Figure F.3 – Multi-phase output choke mounting screw locations



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 Transducers (LEM).

MATERIALS NEEDED

1/2” Nutdriver
7/16” Nutdriver
7/16” Open-End Wrench
Pliers
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 1/2” nutdriver, remove the nut securing the two leads to the negative bus bar. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer and two flat washers securing the heavy lead to the negative bus bar. See ***Figure F.1***. See Wiring Diagram.
6. Using a 7/16” nutdriver, remove the bolt and lock washer securing each of the three choke lead pairs to the negative bus bar. See ***Figure F.1***. See Wiring Diagram. Label and disconnect leads.
7. Label and disconnect the Molex plug from each of the current transducers. See ***Figure F.1***. See Wiring Diagram.
8. Using pliers, remove the cable tie securing current transducers (LEM) to the bus bar. See ***Figure F.2***. Note placement on bus bar for reassembly.
9. The current transducer(s) (LEM) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new current transducer(s) (LEM) onto the bus bar.
2. Using a cable tie, secure the current transducers (LEM) to the bus bar.
3. Connect the Molex plug to each of the current transducers. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the bolt and lock washer securing each of the three choke lead pairs to the negative bus bar. See Wiring Diagram.

5. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer and two flat washers securing the heavy lead to the negative bus bar. See Wiring Diagram.
6. Using a 1/2” nutdriver, attach the nut securing the two leads to the negative bus bar. See Wiring Diagram.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Current transducers (LEM) and Negative bus bar location

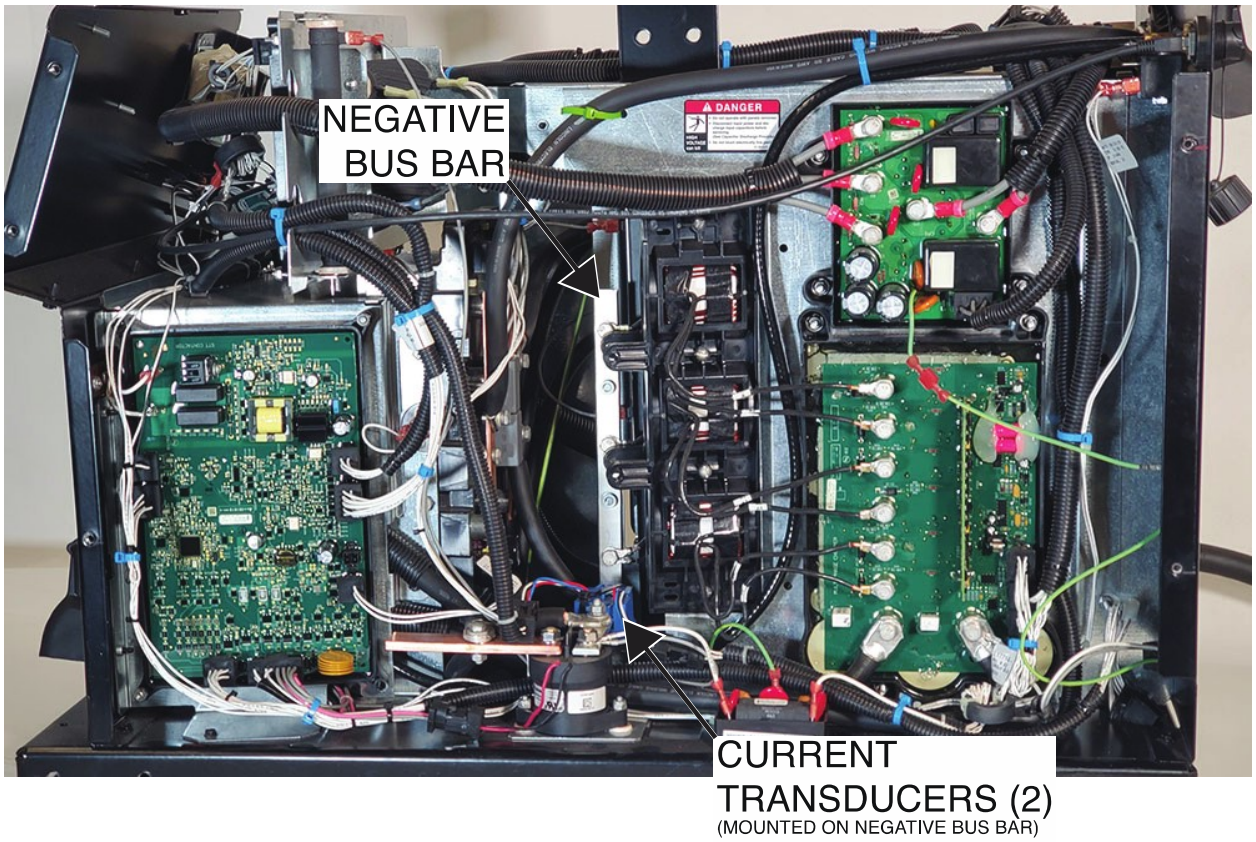
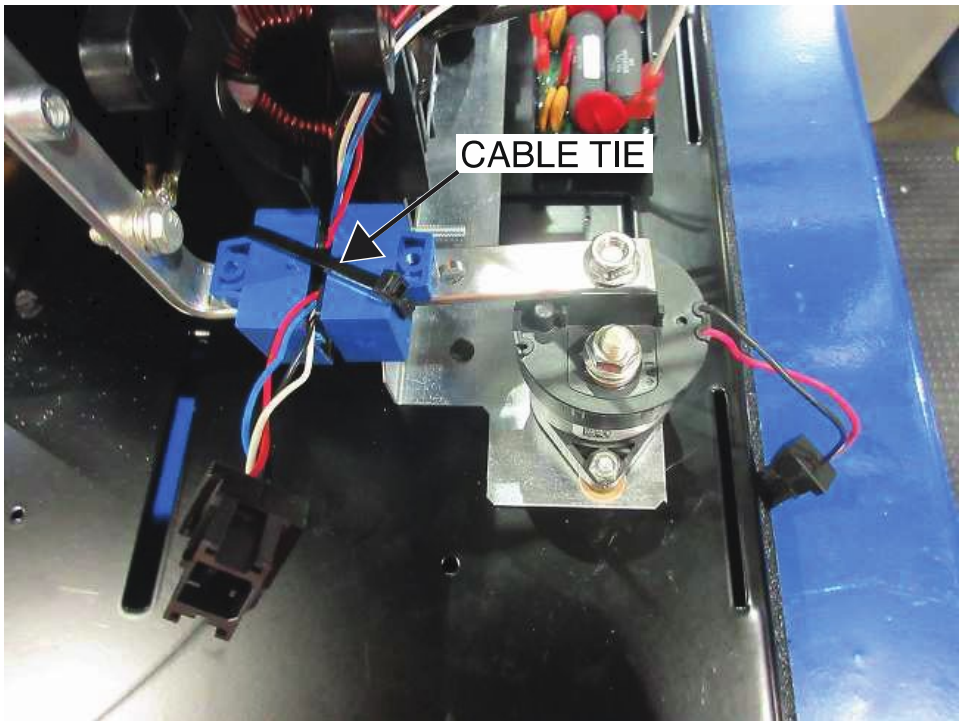


Figure F.2 – Current transducers (LEM) mounting cable tie location



THERMOSTAT REMOVAL AND REPLACEMENT PROCEDURE

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

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Thermostat attached to the STT Switch Board.

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 625 and 625A from the thermostat. See ***Figure F.1***. See Wiring Diagram.
5. Using a Philips screwdriver, remove the two screws securing the thermostat to the STT switch board. See ***Figure F.2***.
6. The thermostat can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Apply a coating of Dow Corning 340 heat sink compound to the mating surface of the thermostat and the STT switch board heat sink.
2. Carefully position the new thermostat onto the side of the STT switch board.
3. Using a Philips screwdriver, attach the two screws securing the thermostat to the STT switch board.
4. Connect leads 625 and 625A to the thermostat. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Thermostat lead locations

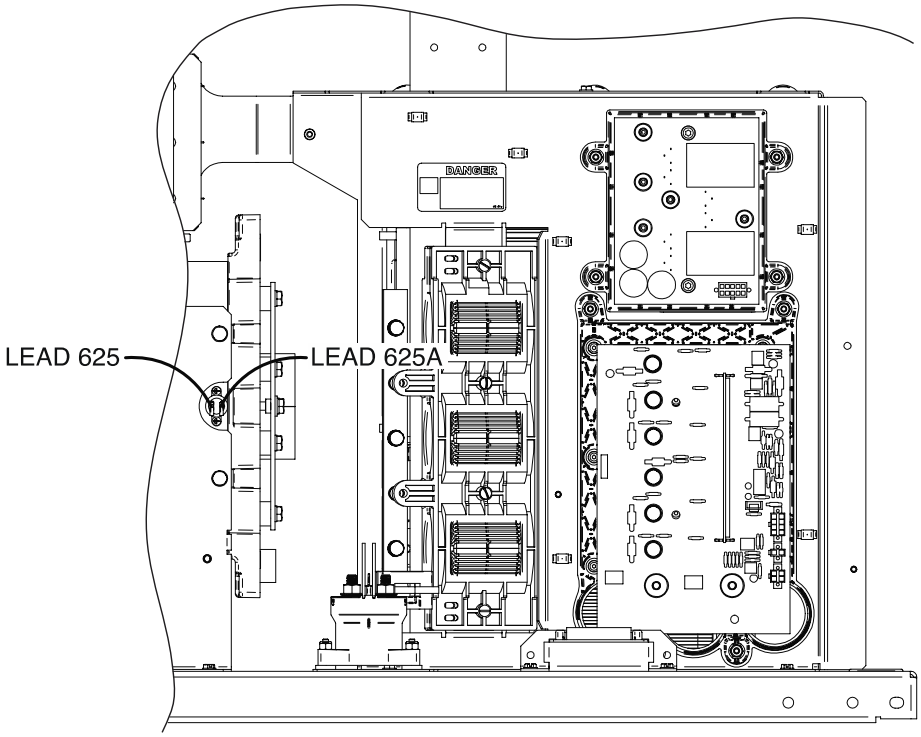
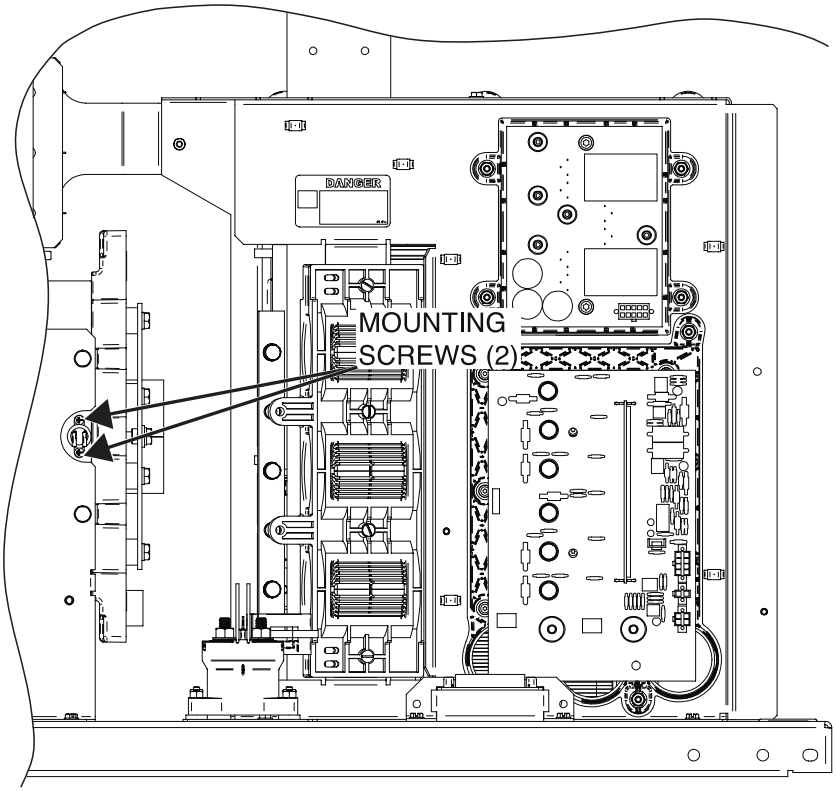


Figure F.2 – Thermostat mounting screw locations



PFC 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 PFC Control Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J23A, J23B, J24, J25, J26, J20, J21 and J22 from the PFC control board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the two mounting nuts securing the PFC control board to the machine. See ***Figure F.2***.
6. The PFC control board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new PFC control board into the machine.
2. Using a 3/8” nutdriver, attach the two mounting nuts securing the PFC control board to the machine.
3. Connect plugs J23A, J23B, J24, J25, J26, J20, J21 and J22 to the PFC control board. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – PFC control board plug locations

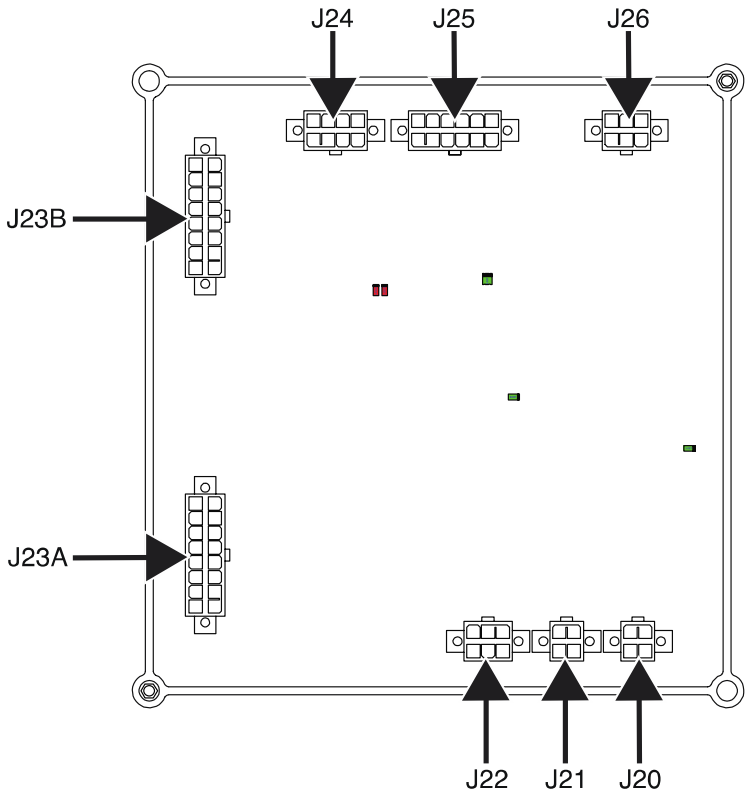
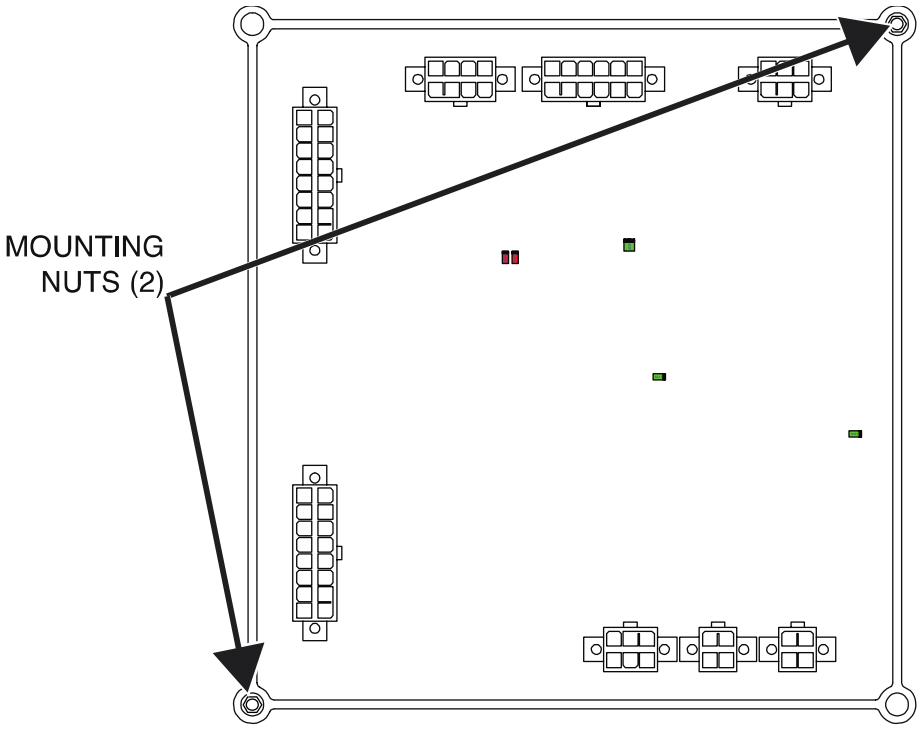


Figure F.2 – PFC control board mounting nut locations



40 VDC BUS 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 40 VDC Bus Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J46 and J47 from the 40 VDC bus board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the two mounting nuts securing the 40 VDC bus board to the machine. See ***Figure F.2***.
6. The 40 VDC bus board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 40 VDC bus board into the machine.
2. Using a 3/8” nutdriver, attach the two mounting nuts securing the 40 VDC bus board to the machine.
3. Connect plugs J46 and J47 to the 40 VDC bus board. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – 40 VDC bus board plug locations

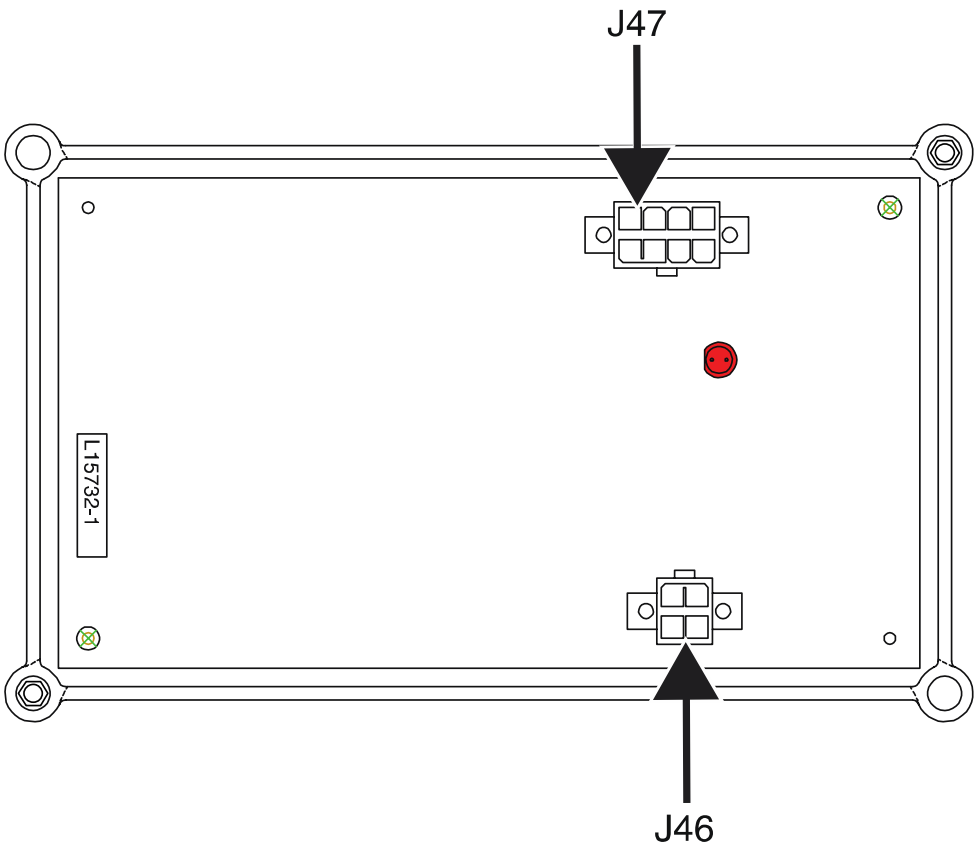
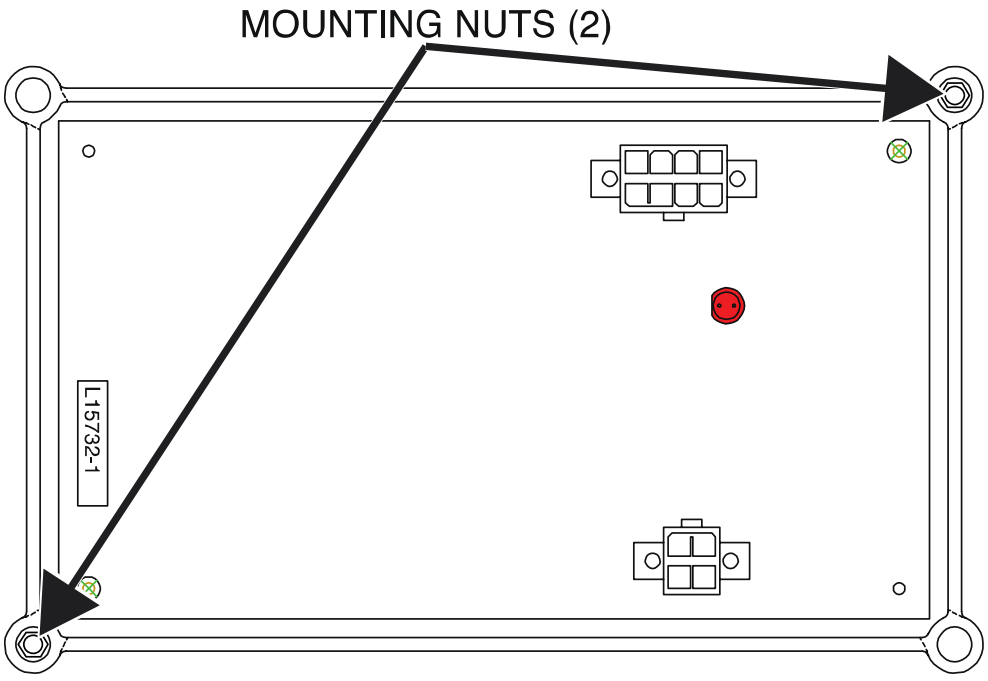


Figure F.2 – 40 VDC bus board mounting nut locations



STT CONTACTOR 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 STT Contactor Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect the leads connected to terminals B1 and B2 of the STT contactor board. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect plugs J66, J65, J62, J63, J61, J64 and J60 from the STT contactor board. See ***Figure F.1***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the two nuts securing the STT contactor board to the machine. See ***Figure F.2***.
7. The STT contactor board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new STT contactor board into the machine.
2. Using a 3/8” nutdriver, attach the two nuts securing the STT contactor board to the machine.
3. Connect plugs J66, J65, J62, J63, J61, J64 and J60 to the STT contactor board. See Wiring Diagram.
4. Connect the previously disconnected leads to terminals B1 and B2 of the STT contactor board. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – STT contactor board terminal and plug locations

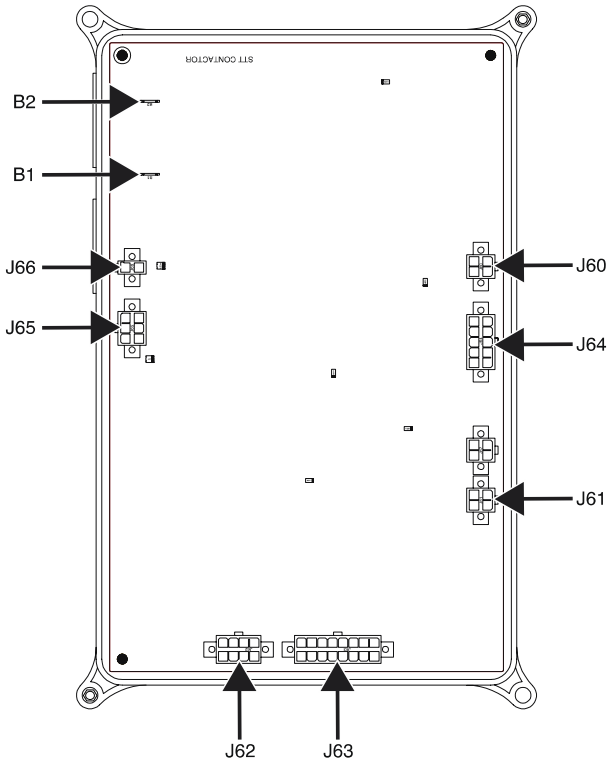
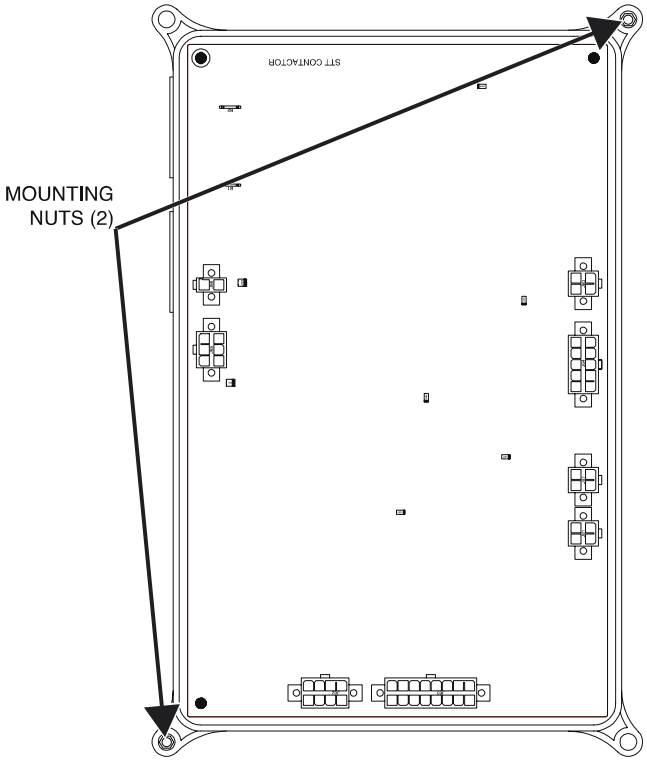


Figure F.2 – STT contactor board mounting nut locations



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

5/16” Nutdriver
Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

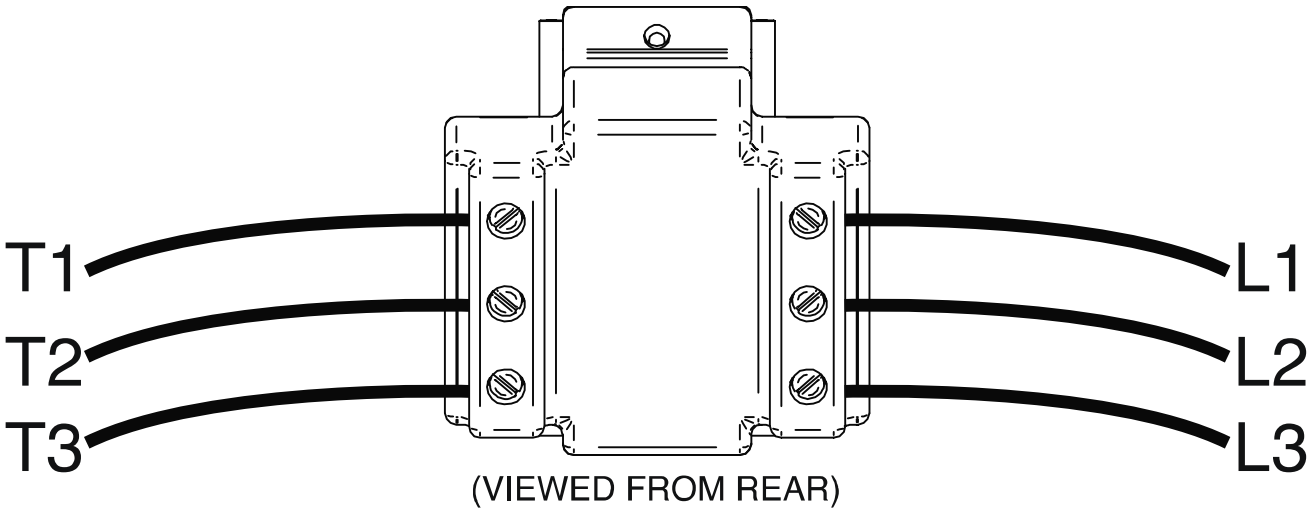
1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the two screws and washers securing the line switch to the front panel. See ***Figure F.1***.
5. Using a Philips screwdriver, loosen the six screws securing the leads T1, T2, T3, L1, L2 and L3 to the rear of the line switch. See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
6. The line switch can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Using a Philips screwdriver, tighten the six screws securing leads T1, T2, T3, L1, L2 and L3 to the rear of the line switch. See Wiring Diagram.
2. Carefully position the new line switch into the machine.
3. Using a 5/16” nutdriver, attach the two screws and washers securing the line switch to the front panel.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Line switch front panel mounting screw and washer locations

Figure F.2 – Line switch lead locations



FAN 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 Fans.

MATERIALS NEEDED

5/16” Nutdriver
1/4” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

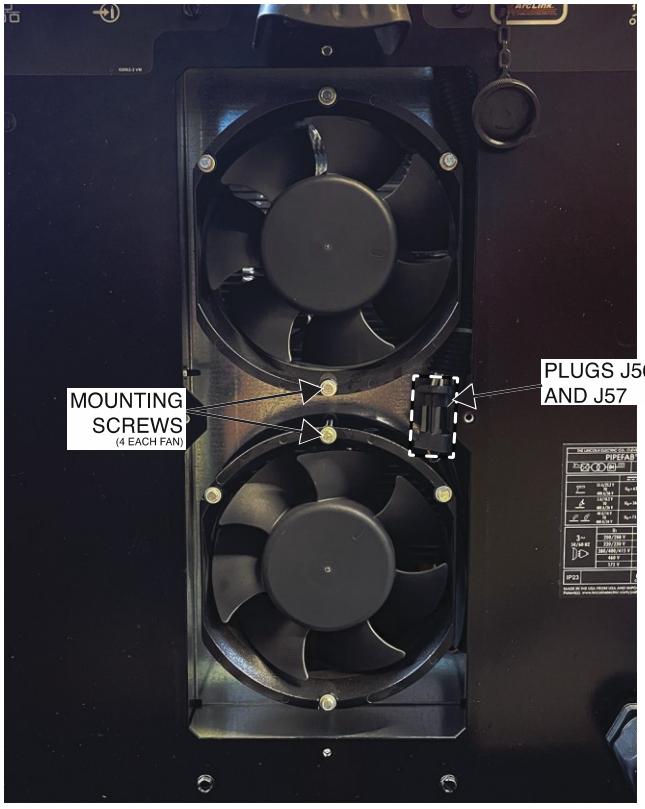
1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the rear brickwork cover to the machine. See ***Figure F.1***.
5. Label and disconnect plugs J56 and J57 from the fans. See ***Figure F.2***. See Wiring Diagram.
6. Using a 1/4” nutdriver, remove the four screws, flat washers and lock washers securing each fan to the machine. See ***Figure F.2***. Note fan direction for reassembly.
7. The fans can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new fans into the machine.
2. Using a 1/4” nutdriver, attach the four screws, flat washers and lock washers securing each fan to the machine.
3. Connect plugs J56 and J57 to the fans. See Wiring Diagram.
4. Using a 5/16” nutdriver, attach the four screws securing the rear brickwork cover to the machine.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Rear brickwork cover mounting screw locations

Figure F.2 – Fan mounting screw locations



STT SWITCH 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 STT Switch Board.

MATERIALS NEEDED

7/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J1, J2 and J3 from the STT switch board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the bolt, lock washer and flat washer securing the two leads to terminal B9 of the STT switch board. See ***Figure F.1***. See Wiring Diagram.
6. Using a 7/16” nutdriver, remove the bolt, lock washer and flat washer securing the two leads to terminal B6 of the STT switch board. See ***Figure F.1***. See Wiring Diagram.
7. Using a 7/16” nutdriver, remove the bolt, lock washer and flat washer securing the heavy lead to the left bus bar. See ***Figure F.1***. See Wiring Diagram.
8. Using a 7/16” nutdriver, remove the bolt, lock washer and flat washer securing the heavy lead to the terminal B2 of the STT switch board. See ***Figure F.1***. See Wiring Diagram.
9. Using a 7/16” nutdriver, remove the bolt, lock washer and flat washer securing the heavy lead to the terminal B3 of the STT switch board. See ***Figure F.1***. See Wiring Diagram.
10. Label and disconnect leads 625 and 625A from the thermostat. See ***Figure F.2***. See Wiring Diagram.
11. Using a 7/16” nutdriver, remove the four bolts and lock washers securing the STT switch board to the machine. See ***Figure F.3***.
12. The STT switch board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new STT switch board into the machine.
2. Using a 7/16” nutdriver, attach the four bolts and lock washers securing the STT switch board to the machine.
3. Connect leads 625 and 625A to the thermostat. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the bolt, lock washer and flat washer securing the heavy lead to the terminal B3 of the STT switch board. See Wiring Diagram.
5. Using a 7/16” nutdriver, attach the bolt, lock washer and flat washer securing the heavy lead to the terminal B2 of the STT switch board. See Wiring Diagram.
6. Using a 7/16” nutdriver, attach the bolt, lock washer and flat washer securing the heavy lead to the left bus bar. See Wiring Diagram.
7. Using a 7/16” nutdriver, attach the bolt, lock washer and flat washer securing the two leads to terminal B6 of the STT switch board. See Wiring Diagram.
8. Using a 7/16” nutdriver, attach the bolt, lock washer and flat washer securing the two leads to terminal B9 of the STT switch board. See Wiring Diagram.
9. Connect plugs J1, J2 and J3 to the STT switch board. See Wiring Diagram.
10. Perform the ***Case Cover Replacement Procedure***.
11. Perform the ***Retest After Repair Procedure***.

Figure F.1 – STT switch board plug and terminal locations

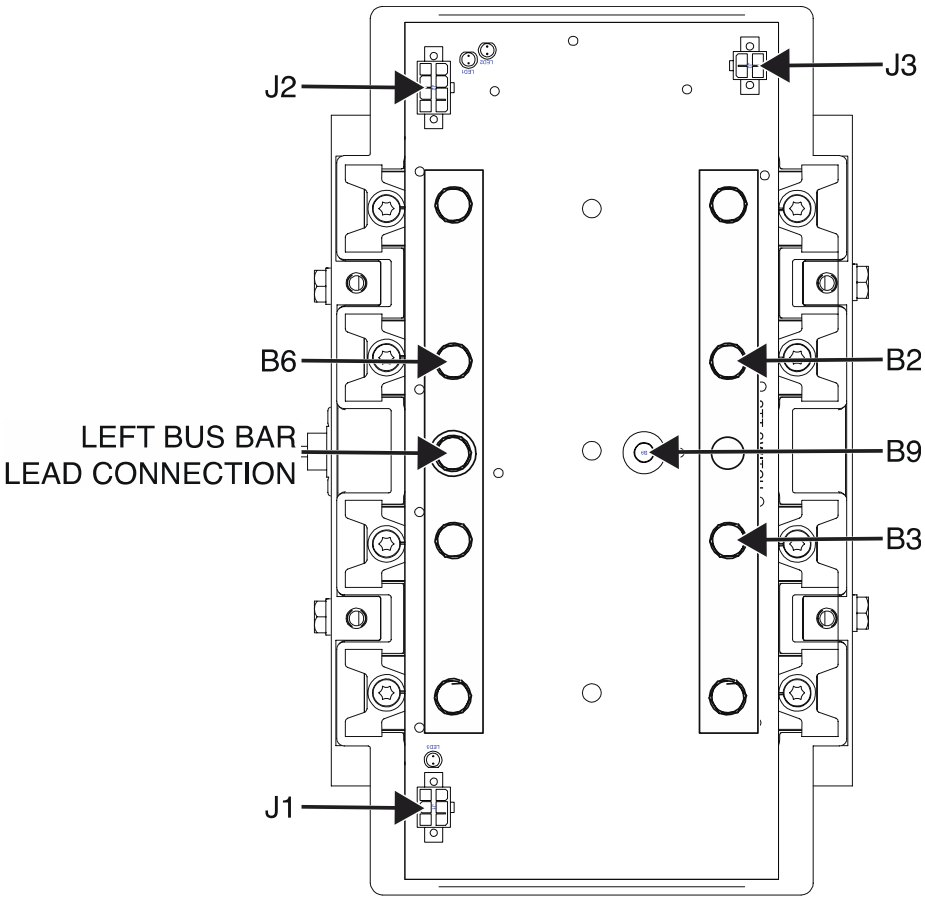


Figure F.2 – Thermostat lead locations

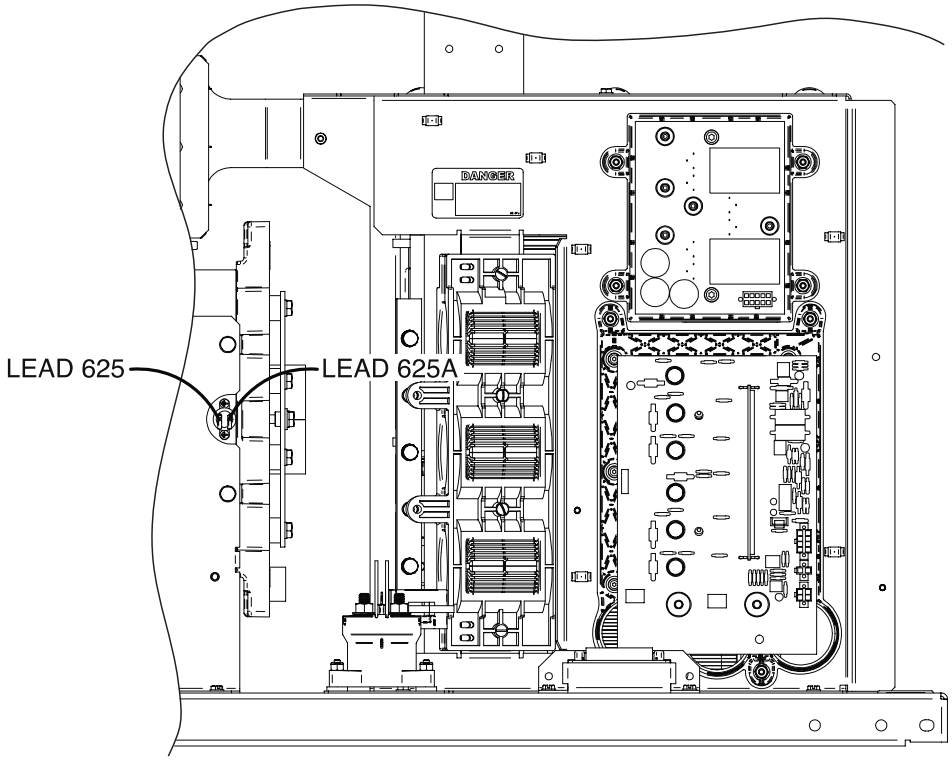
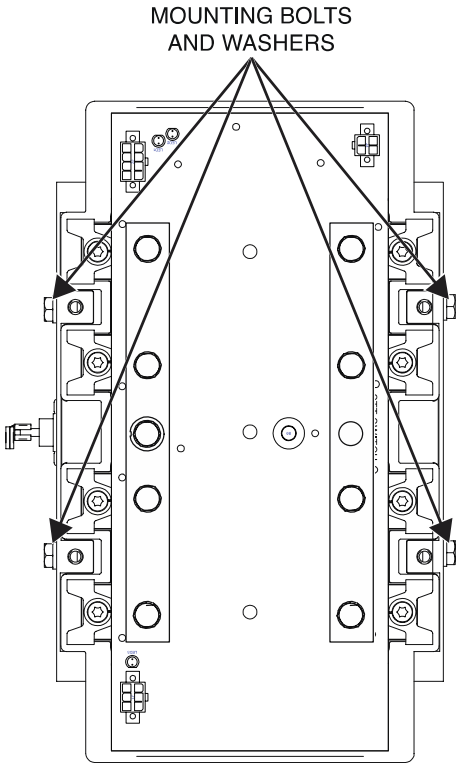


Figure F.3 – STT switch board mounting bolt locations



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 Gas Solenoid(s).

MATERIALS NEEDED

Slotted Screwdriver
Hammer
Needle-Nose Pliers
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads from the gas solenoid (652 and 653 for right gas solenoid, 552 and 553 for left gas solenoid). See ***Figure F.1***. See Wiring Diagram.
5. Using a slotted screwdriver and a hammer, remove the nut and flat washer securing the gas solenoid to the rear of the machine. See ***Figure F.2***. Repeat procedure for second gas solenoid if necessary.
6. Using needle-nose pliers, loosen the hose clamp and disconnect the gas hose from the gas solenoid. See ***Figure F.2***. Repeat procedure for second gas solenoid if necessary.
7. The gas solenoid(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new gas solenoid(s) into the rear panel of the machine.
2. Using a slotted screwdriver and a hammer, attach the nut and flat washer securing the gas solenoid to the rear of the machine. Repeat procedure for second gas solenoid if necessary.
3. Connect leads to the gas solenoid (652 and 653 for right gas solenoid, 552 and 553 for left gas solenoid). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Gas solenoid lead locations

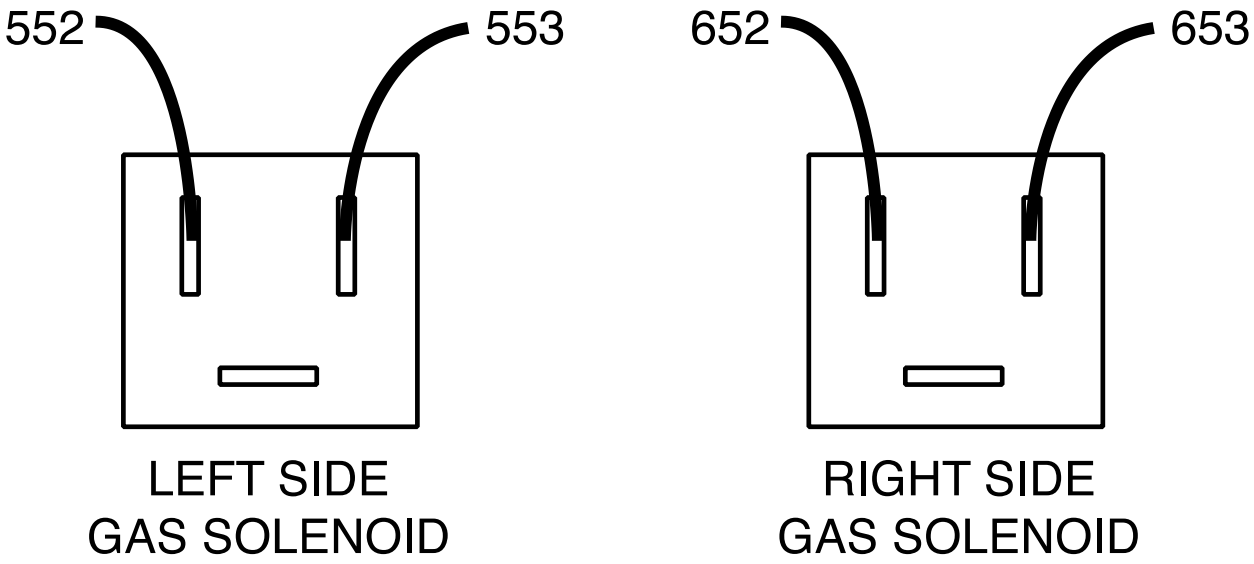
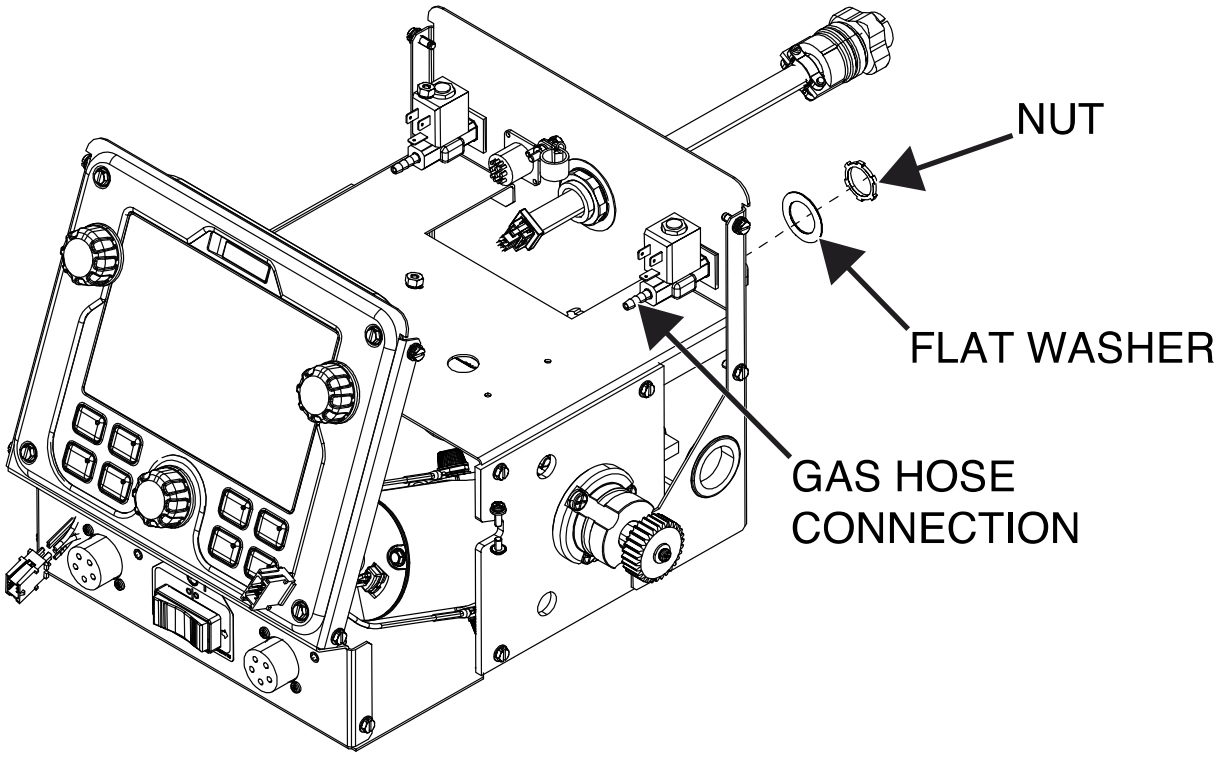


Figure F.2 – Gas solenoid removal



COLD INCH / FEED GAS PURGE 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 Cold Inch/Feed Gas Purge Switch(s).

MATERIALS NEEDED

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 535, 586 and 579 from the left side cold inch/feed gas purge switch or leads 635, 686 and 679 from the right side cold inch/feed gas purge switch. See ***Figure F.1***. See Wiring Diagram.
5. Squeeze the side tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***.
6. The cold inch/feed gas purge switch(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new cold inch/feed gas purge switch(s) into the machine and press firmly to seat the switch.
2. Connect leads 535, 586 and 579 to the left side cold inch/feed gas purge switch or leads 635, 686 and 679 to the right side cold inch/feed gas purge switch. See Wiring Diagram.
3. Perform the ***Case Cover Replacement Procedure***.
4. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Cold inch/feed gas purge switch lead locations

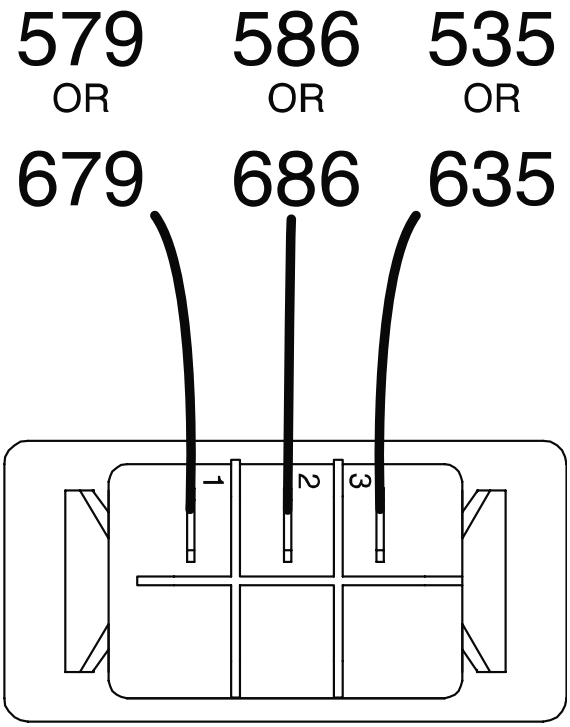
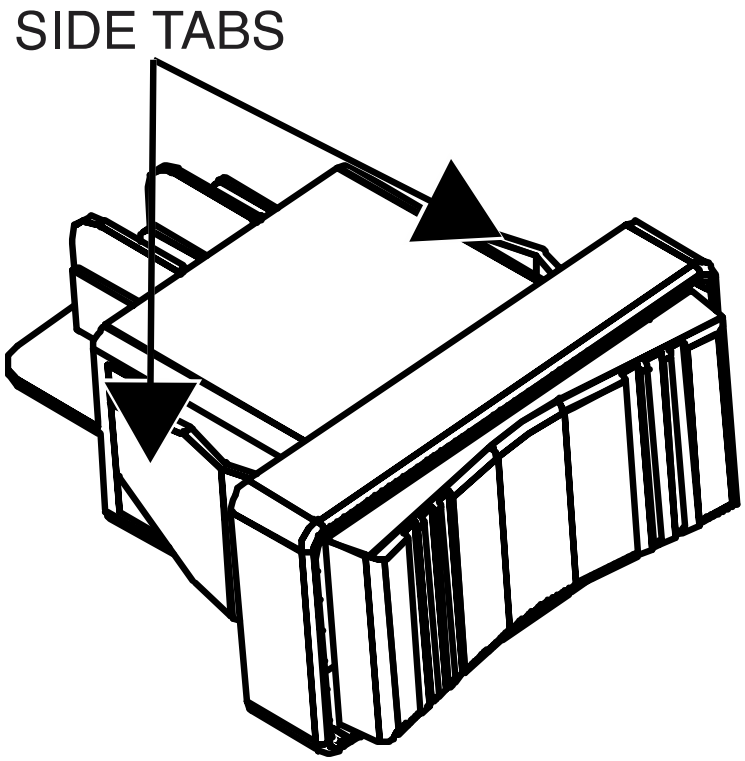


Figure F.2 – Cold inch/feed gas purge switch side tab locations



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 Assembly.

MATERIALS NEEDED

5/16” Nutdriver
Phillips Screwdriver
3/4” Nutdriver
Needle-Nose Pliers
3/16” Alle Wrench
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws (two on side and two on the back) securing the feedplate mounting bracket to the machine. See ***Figure F.1***.
5. The feedplate mounting bracket can now be moved to allow access to components below.
6. Using a Philips screwdriver, remove the screw, lock washer and flat washer securing the gun adapter cover to the gear box assembly. See ***Figure F.2***. Repeat this step for each wire drive motor assembly if necessary.
7. Using a 3/4” nutdriver, remove the bolt and washers securing the heavy black lead to the gun adapter. See ***Figure F.3***. See Wiring Diagram. Repeat this step for each wire drive motor assembly if necessary.
8. Label and disconnect plug 19 from the right tachometer and plug 9 from the left tachometer. See Wiring Diagram.
9. Using needle-nose pliers, loosen hose clamp securing gas hose to gun adapter. See ***Figure F.4***. Repeat this step for each wire drive motor assembly if necessary.
10. Disconnect the gas hose from the gun adapter. See ***Figure F.4***. Repeat this step for each wire drive motor assembly if necessary.
11. Using a Philips screwdriver, label and disconnect the screw and washer securing lead #67B from the left gun adapter and lead #267B from the right gun adapter. See ***Figure F.5***. See Wiring Diagram.

12. Using a 5/16” nutdriver, remove the two screws securing the gearbox mounting panel to the base of the machine.
13. Carefully route leads through the gearbox mounting panel. Cut cable ties as necessary to allow for the removal of the wire drive motor assembly.
14. Carefully maneuver and remove entire wire drive motor assembly out of the machine. **NOTE:** It may be necessary to route gas hoses out of the way to allow for the removal of the wire drive motor assembly.
15. Using a 3/16” Allen wrench, remove the two Allen type screws at the bottom of the wire drive unit. See ***Figure F.6***. Note screw length and placement for reassembly.
16. Carefully separate the wire drive motor assembly from the gearbox.
17. Using a Philips screwdriver, remove the screw, lock washer and flat washer securing the drive gear to the motor shaft. See ***Figure F.7***. Remove the drive gear from the motor shaft.
18. Using a Philips screwdriver, remove the three screws securing the tilt feedplate adapter to gearbox mounting panel. See ***Figure F.7***. Remove the tilt feedplate adapter from the motor shaft.
19. Remove the gearbox mounting panel from the motor shaft.
20. The wire drive motor assembly can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the gearbox mounting panel onto the motor shaft.
2. Carefully position the tilt feedplate adapter onto the motor shaft.
3. Using a Philips screwdriver, attach the three screws securing the tilt feedplate adapter to gearbox mounting panel.
4. Carefully position the drive gear onto the motor shaft.
5. Using a Philips screwdriver, remove the screw, lock washer and flat washer securing the drive gear to the motor shaft.
6. Carefully position the wire drive motor assembly into the gearbox.
7. Using a 3/16” Allen wrench, attach the two Allen type screws at the bottom of the wire drive unit.
8. Route leads and gas hose through gearbox mounting panel as necessary.
9. Using a 5/16” nutdriver, attach the two screws securing the gearbox mounting panel to the base of the machine.
10. Using a Philips screwdriver, connect the screw and washer securing lead #67B to the left gun adapter and lead #267B to the right gun adapter. See Wiring Diagram.
11. Connect the gas hose to the gun adapter. Repeat this step for each wire drive motor assembly if necessary.
12. Connect plug 19 to the right tachometer and plug 9 to the left tachometer. See Wiring Diagram.
13. Using a 3/4” nutdriver, attach the bolt and washers securing the heavy black lead to the gun adapter. See Wiring Diagram. Repeat this step for each wire drive motor assembly if necessary.
14. Using a Philips screwdriver, attach the screw, lock washer and flat washer securing the gun adapter cover to the gear box assembly. Repeat this step for each wire drive motor assembly if necessary.
15. Using a 5/16” nutdriver, attach the four screws (two on side and two on the back) securing the feedplate mounting bracket to the machine.
16. Perform the ***Case Cover Replacement Procedure***.
17. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Feedplate mounting bracket location

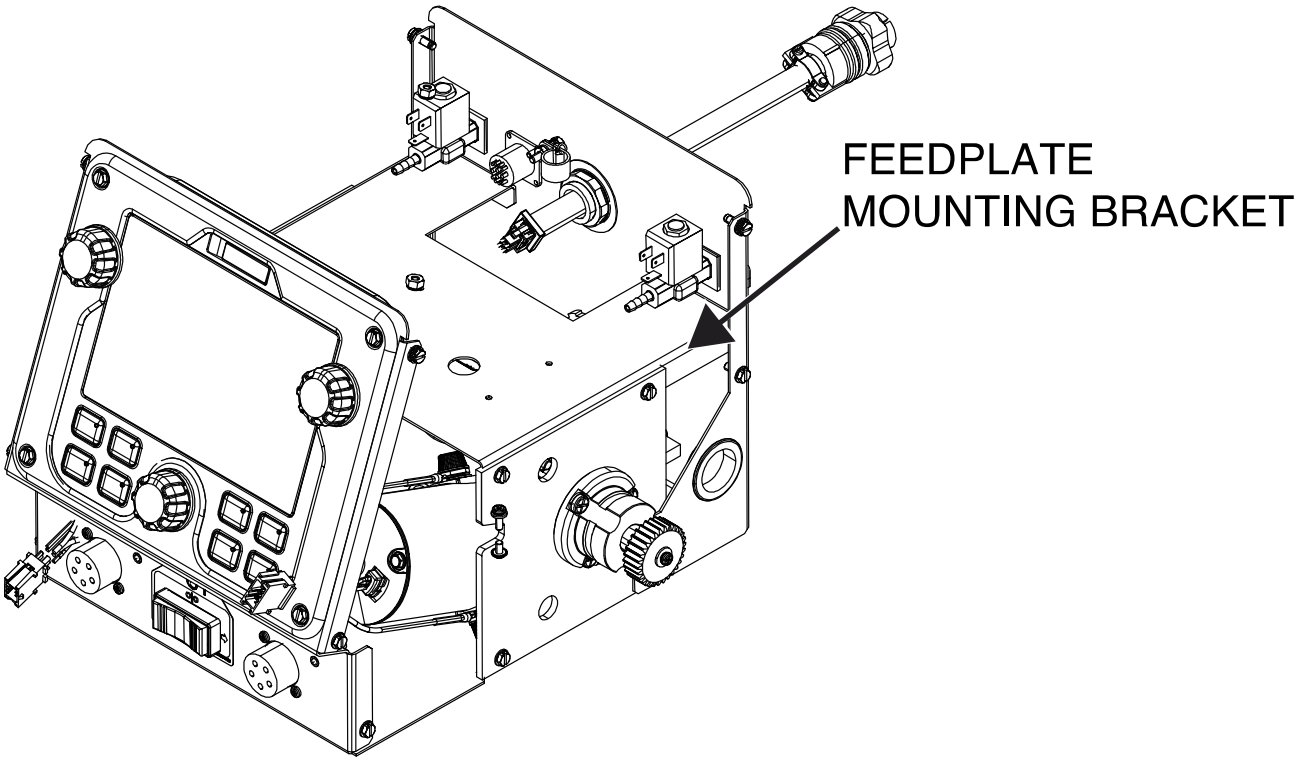


Figure F.2 – Gun adapter cover removal

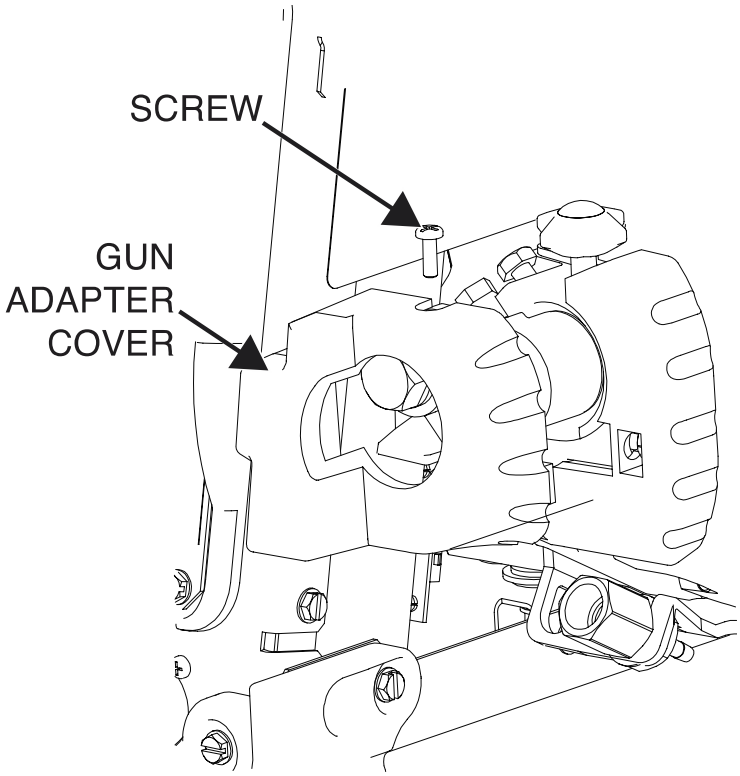


Figure F.3 – Heavy black lead mounting hardware location

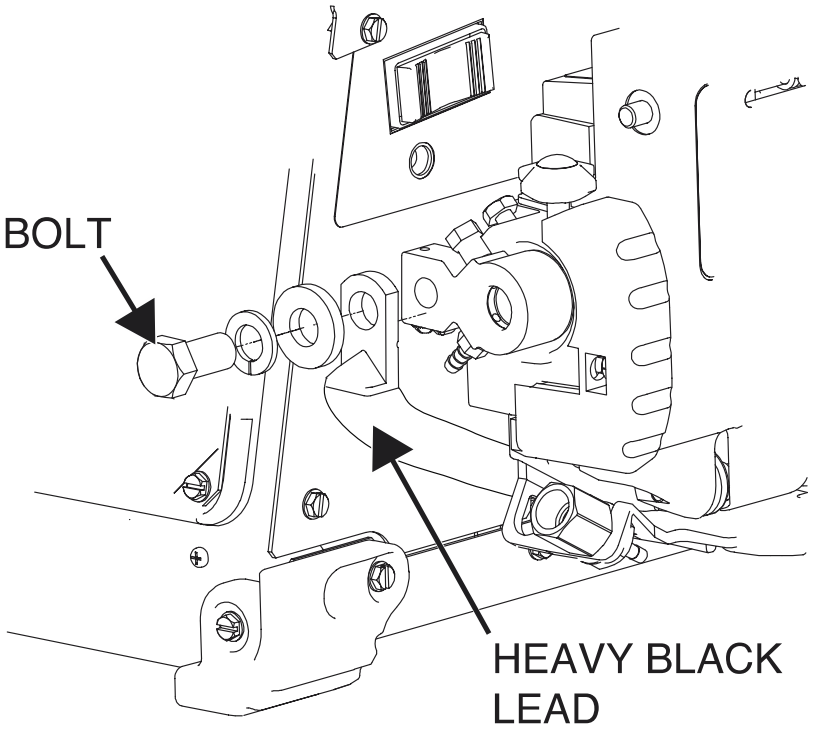


Figure F.4 – Gas hose and hose clamp location

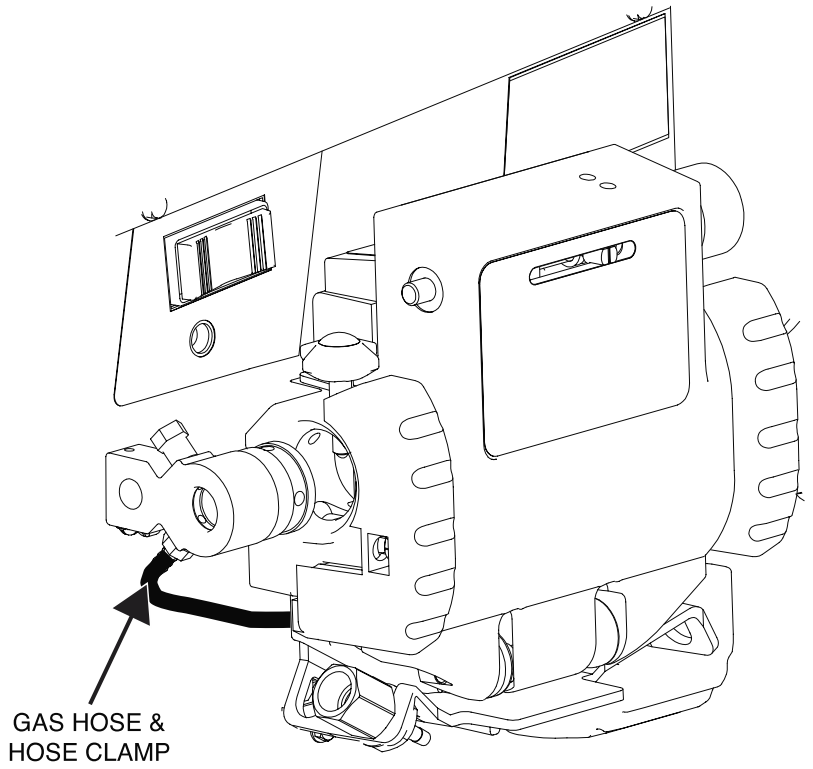


Figure F.5 – Leads #67B and #267B locations

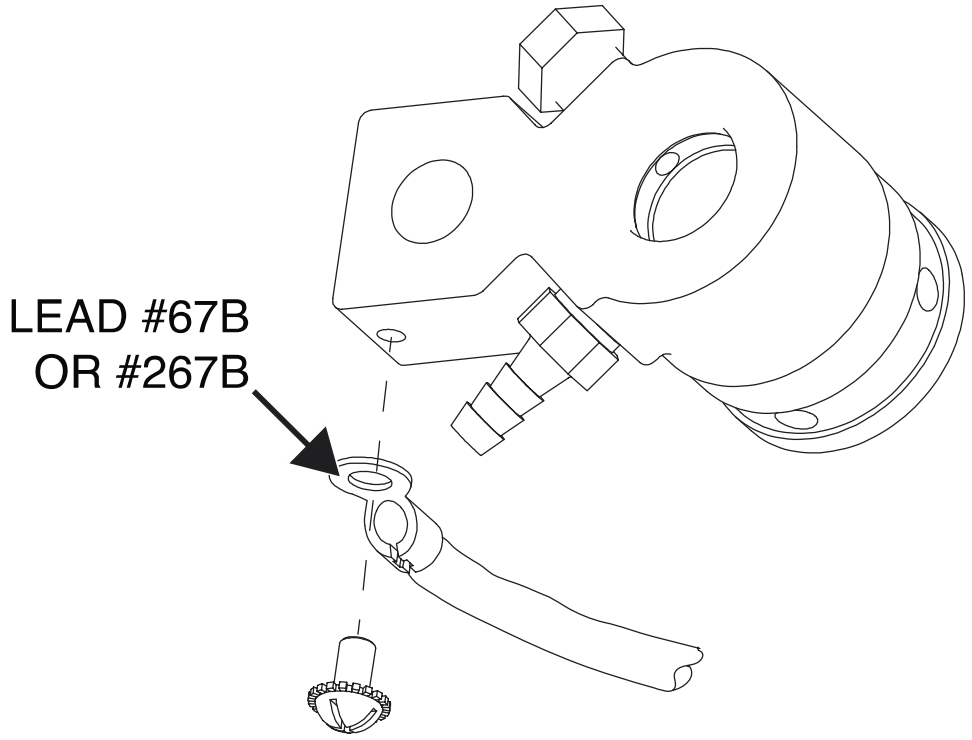


Figure F.6 – Wire drive allen type mounting screw locations

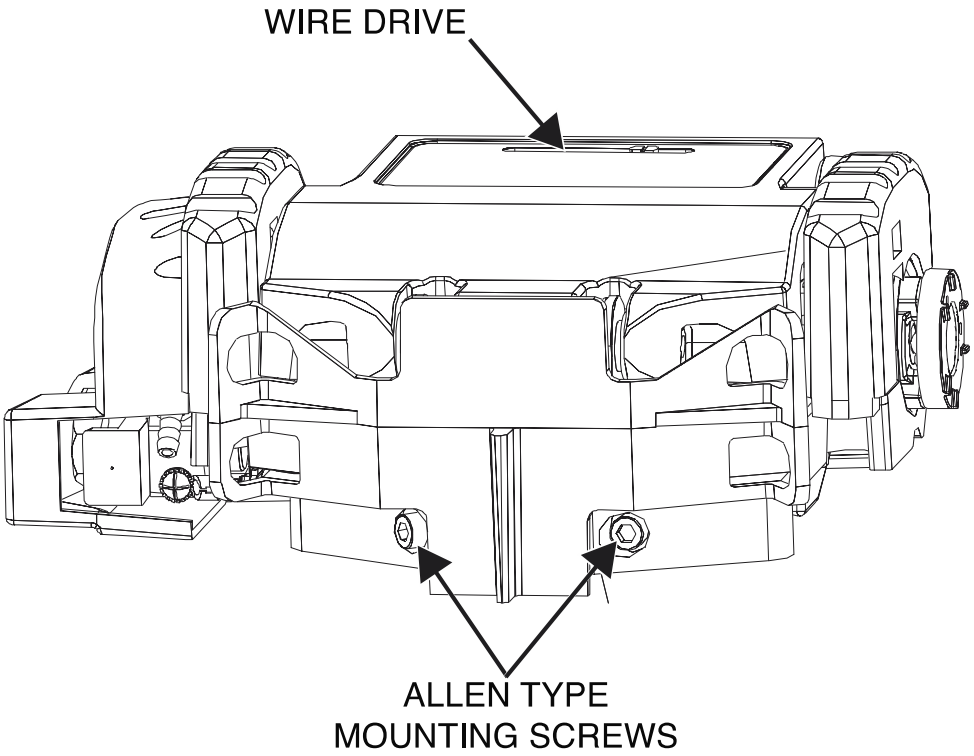
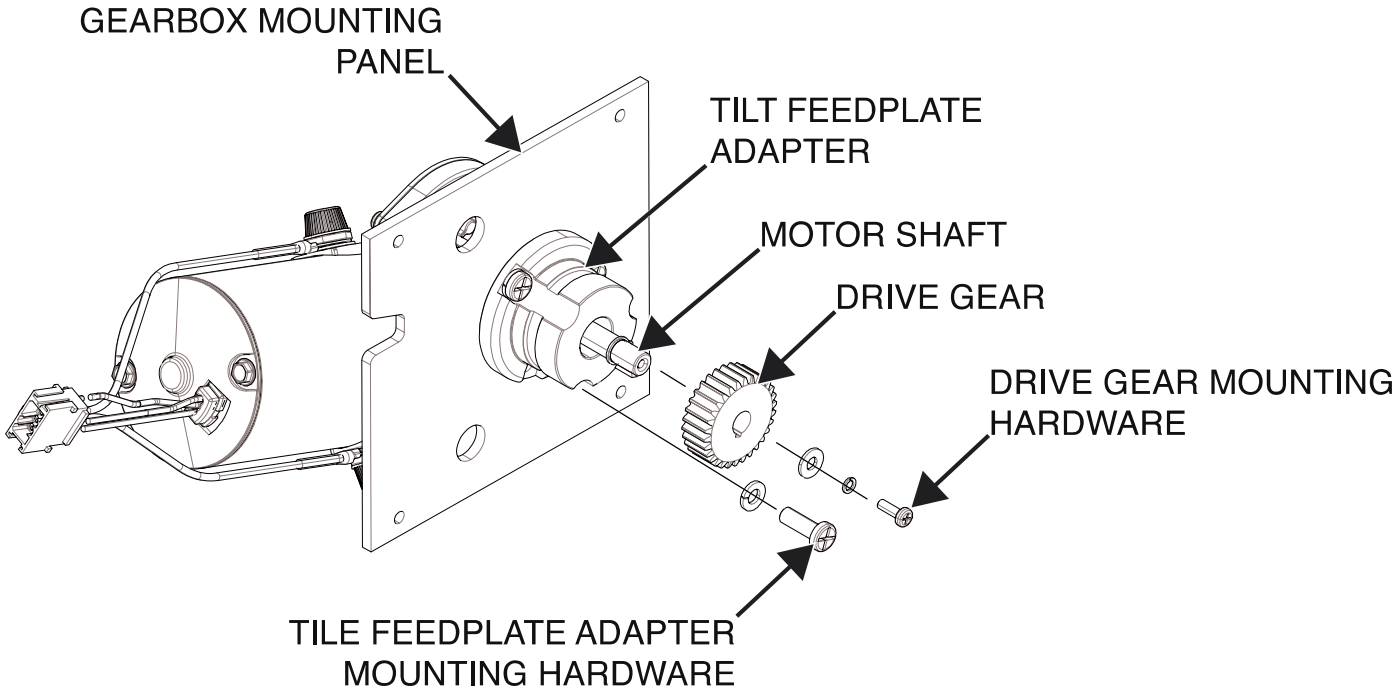


Figure F.7 – Wire drive motor removal



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
5/64” Allen Wrench
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J31 and J32 from the user interface board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 5/64” Allen wrench, loosen the three set screws securing the three knobs to the user interface board assembly and remove the knobs. See ***Figure F.2***.
6. Using a 5/16” nutdriver, remove the four screws securing the user interface board to the front panel of the feeder. See ***Figure F.2***.
7. The user interface board assembly can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new user interface board assembly into the machine.
2. Using a 5/16” nutdriver, remove the four screws securing the user interface board to the front panel of the feeder.
3. Using a 5/64” Allen wrench, tighten the three set screws securing the three knobs to the user interface board assembly.
4. Connect plugs J31 and J32 to the user interface board. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – User interface board lead locations

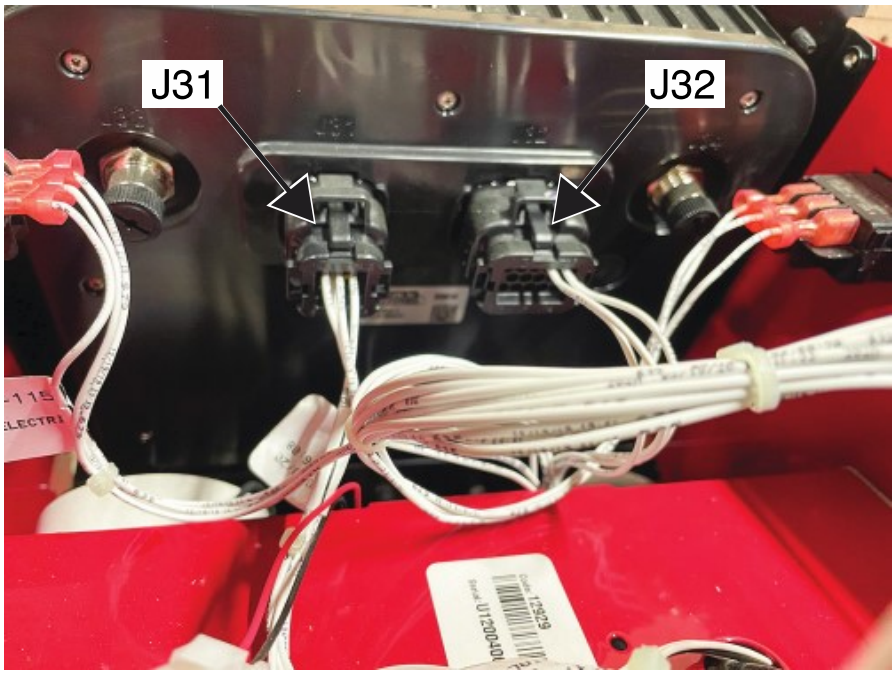
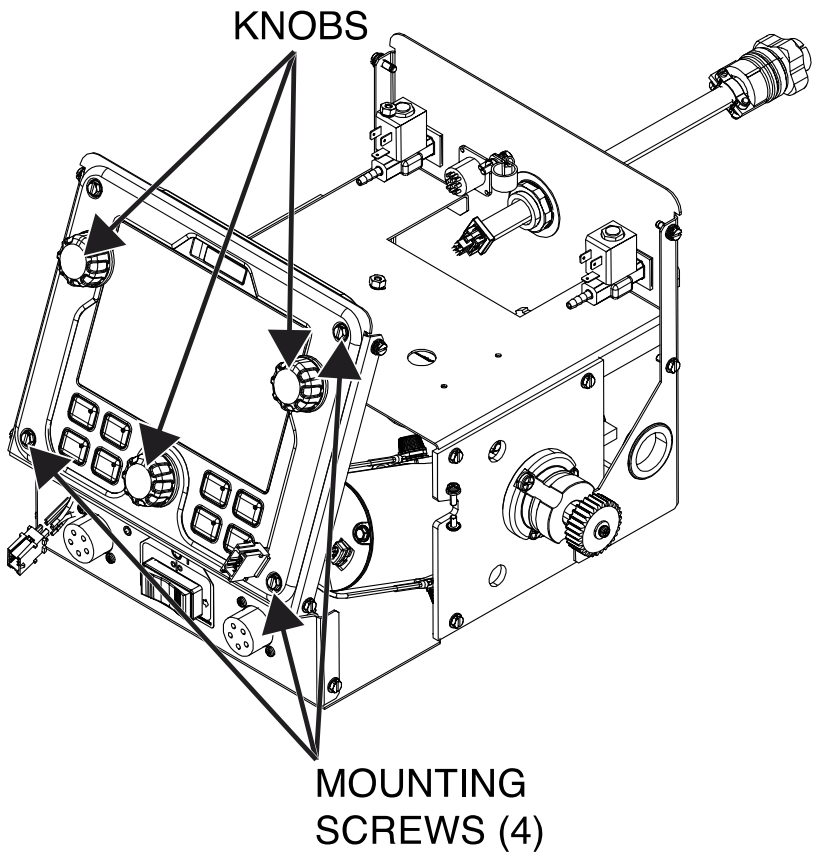


Figure F.2 – User interface board knob and mounting screw locations



FEEDHEAD SELECT 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 Feedhead Select Switch.

MATERIALS NEEDED

Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 511, 512 and 513 from the feedhead select switch. See ***Figure F.1***. See Wiring Diagram.
5. Squeeze the side tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***.
6. The feedhead select switch can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new feedhead select switch into the machine and press firmly to seat the switch.
2. Connect leads 511, 512 and 513 to the feedhead select switch. See Wiring Diagram.
3. Perform the ***Case Cover Replacement Procedure***.
4. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Feedhead select switch lead locations

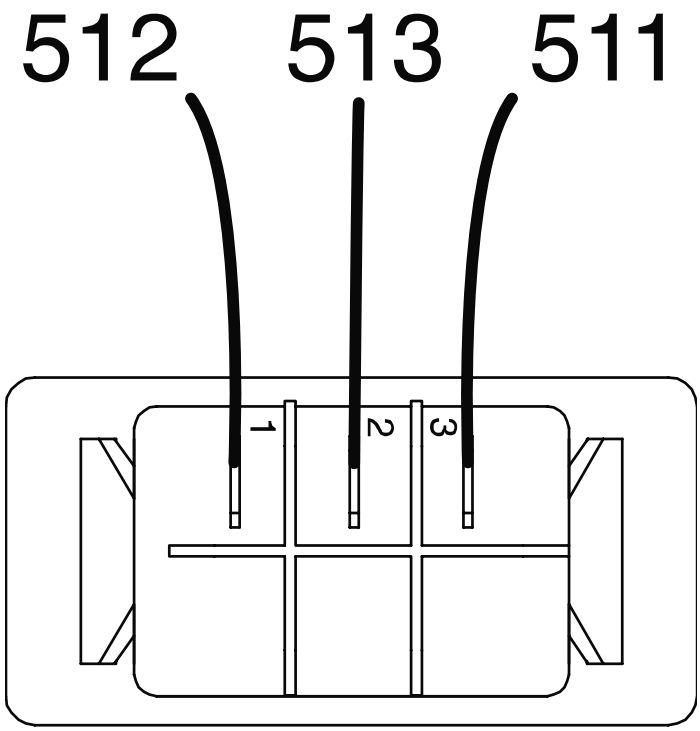
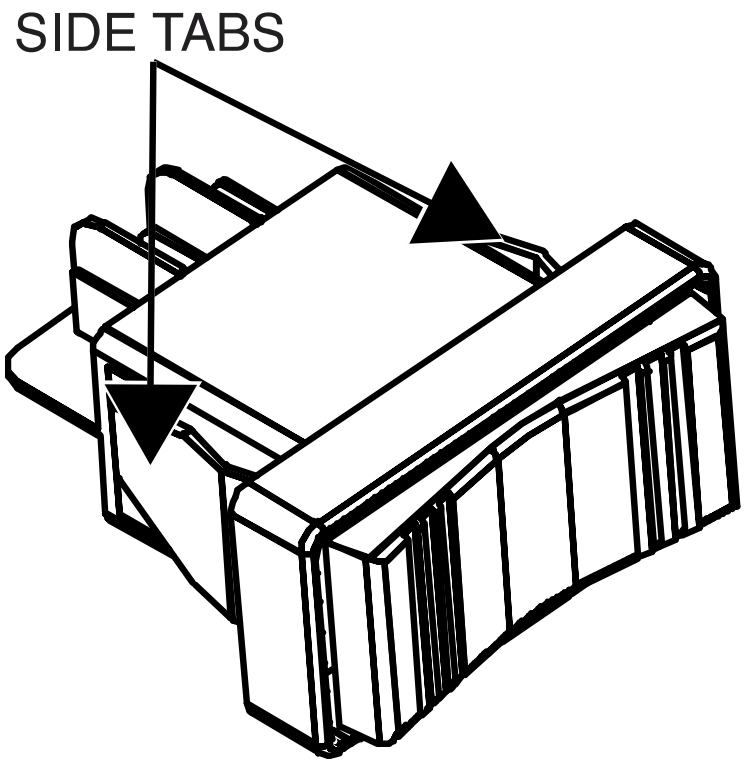


Figure F.2 – Feedhead select switch side tab locations



WIRE DRIVE 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 Wire Drive Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J81, J82, J83, J84, J85, J86, J87, J88, J89 and J90 from the wire drive board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four nuts securing the wire drive board to the roof panel. See ***Figure F.2***. Note position for reassembly.
6. The wire drive board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new wire drive board onto the roof panel.
2. Using a 3/8” nutdriver, attach the four nuts securing the wire drive board to the roof panel.
3. Connect plugs J81, J82, J83, J84, J85, J86, J87, J88, J89 and J90 to the wire drive board. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Wire drive board plug locations

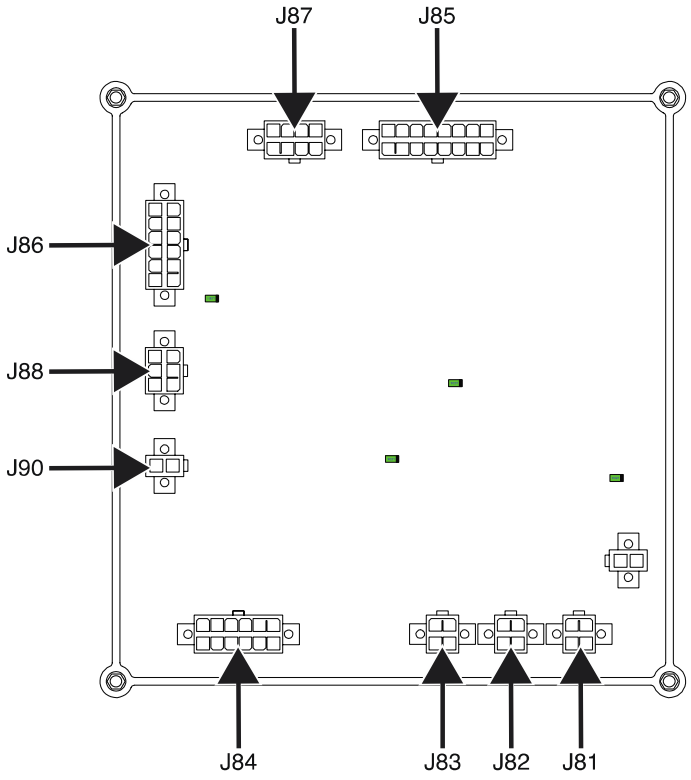
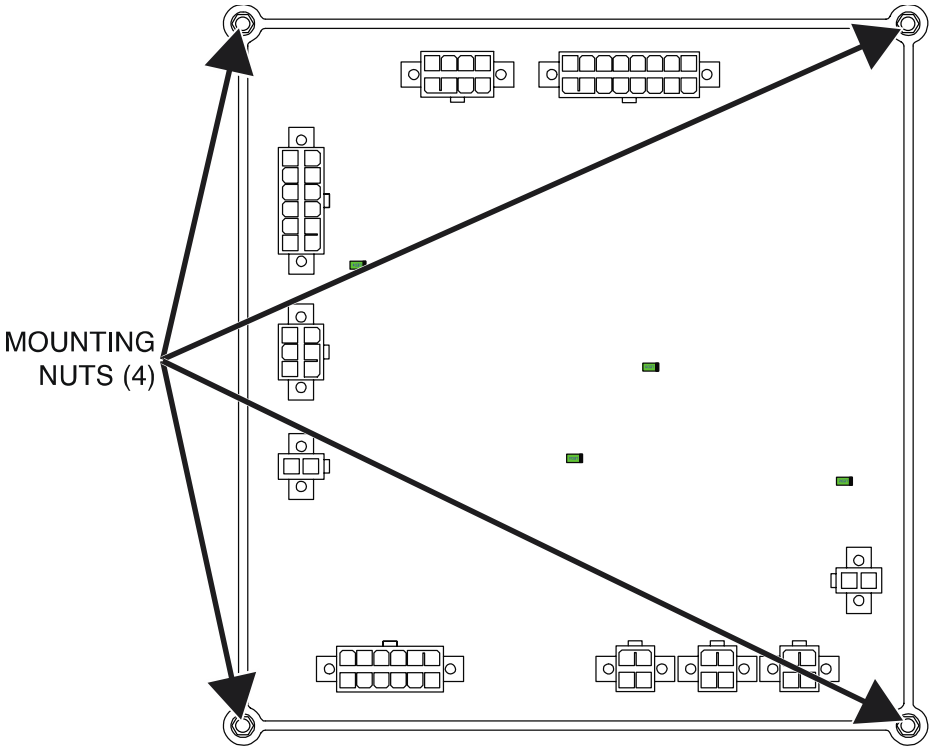


Figure F.2 – Wire drive board mounting nut locations



CONTACTOR 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 Contactors.

MATERIALS NEEDED

5/16” Nutdriver
3/4” Nutdriver
3/4” Open-End Wrench
1/2” Nutdriver
3/8” Nutdriver
Wiring Diagram

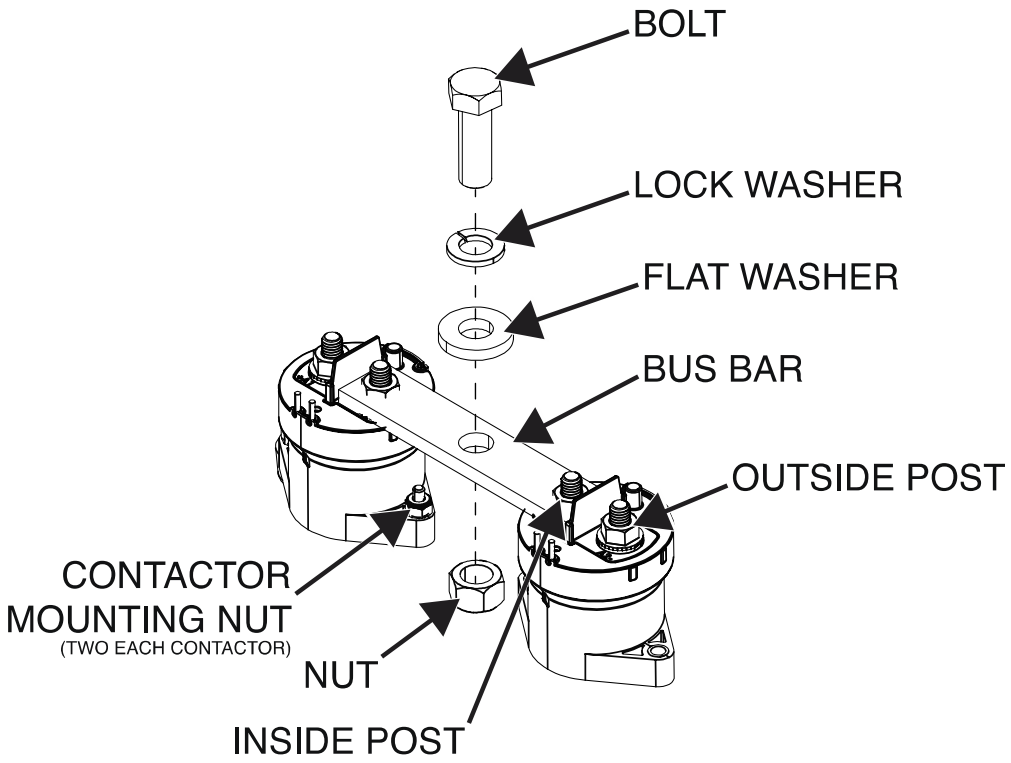
REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws (two on side and two on the back) securing the feedplate mounting bracket to the machine.
5. Using a 3/4” nutdriver and 3/4” open-end wrench, remove the bolt, nut, lock washer and flat washer from the center of the bus bar. See ***Figure F.1***.
6. Using a 1/2” nutdriver, remove the nut and associated washers attached to the inside post of each contactor. See ***Figure F.1***.
7. The copper bus bar can now be removed.
8. Using a 1/2” nutdriver, remove the nut and washers securing the heavy black lead to the outside post of each contactor. See ***Figure F.1***. See Wiring Diagram.
9. Label and disconnect red and black leads from each contactor. See Wiring Diagram.
10. Using a 3/8” nutdriver, remove the two bolts and washers securing contactor to base of the machine.
11. The contactor(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new contactor(s) into the machine.
2. Using a 3/8” nutdriver, attach the two bolts and washers securing contactor to base of the machine.
3. Connect red and black leads to each contactor. See Wiring Diagram.
4. Using a 1/2” nutdriver, attach the nut and washers securing the heavy black lead to the outside post of each contactor. See Wiring Diagram.
5. Carefully position the copper bus bar onto the contactors.
6. Using a 1/2” nutdriver, attach the nut and associated washers attached to the inside post of each contactor.
7. Using a 3/4” nutdriver and 3/4” open-end wrench, attach the bolt, nut, lock washer and flat washer from the center of the bus bar.
8. Using a 5/16” nutdriver, attach the four screws (two on side and two on the back) securing the feedplate mounting bracket to the machine.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Contactor mounting hardware locations



FLOW 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 Flow Switch.

MATERIALS NEEDED

Slotted Screwdriver
Wiring Diagram

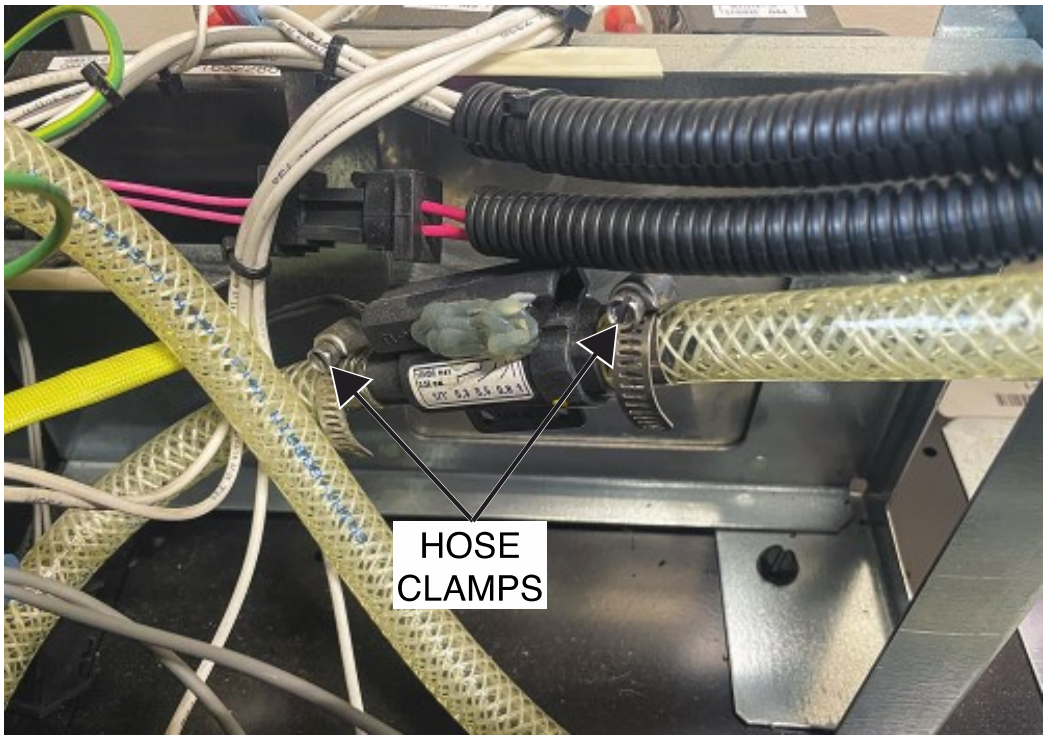
REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plug J54 from the in-line connection. See Wiring Diagram.
5. Using a slotted screwdriver, loosen the two hose clamps securing the flow switch to the coolant hoses. See ***Figure F.1***.
6. Carefully remove the flow switch from the coolant hoses. Note flow switch orientation for reassembly.
7. The flow switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully attach the coolant hoses to the new flow switch.
2. Using a slotted screwdriver, tighten the two hose clamps securing the flow switch to the coolant hoses.
3. Connect plug J54 to the in-line connection. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Coolant hose clamp locations



FLOAT 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 Float Switch.

MATERIALS NEEDED

Wiring Diagram

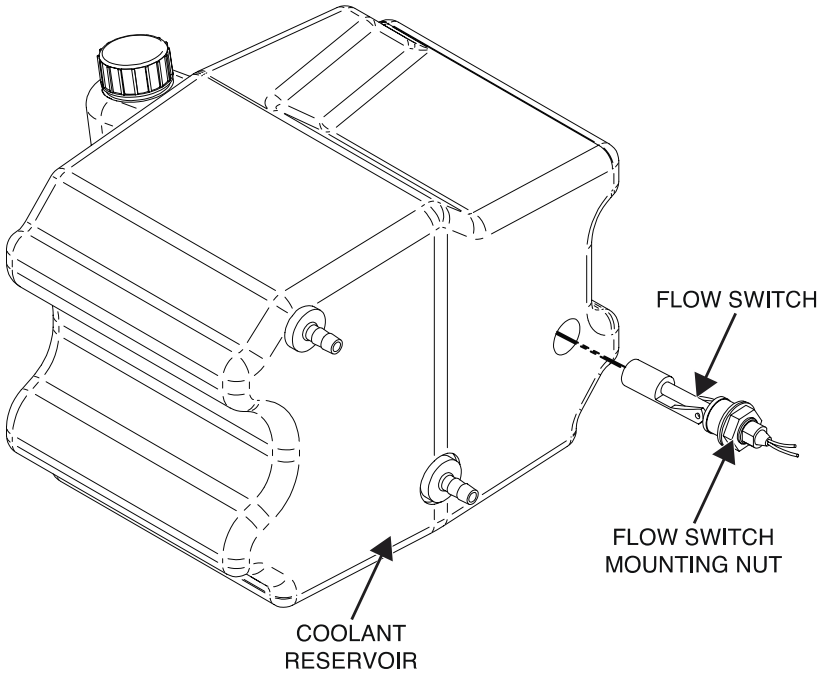
REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Remove any coolant from the reservoir.
5. Label and disconnect plug J53 from the in-line connection. See Wiring Diagram. Cut cable ties as necessary.
6. Loosen the nut securing the float switch to the coolant reservoir. See ***Figure F.1***.
7. Carefully pull the float switch out of the rear of the coolant reservoir. See ***Figure F.1***.
8. The float switch can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully insert the float switch into the rear of the coolant reservoir with the float extended downward.
2. Press the float switch tight against the rear of the coolant reservoir.
3. While holding the back of the float switch to prevent spinning, tighten the nut until finger tight.
4. Tighten the nut clockwise one half additional turn.
5. Connect plug J53 to the in-line connection. See Wiring Diagram.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Float switch mounting nut location



MOMENTARY TOGGLE 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 Momentary Toggle Switch.

MATERIALS NEEDED

9/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 737C, 724 and 737B from the momentary toggle switch. See ***Figure F.1***. See Wiring Diagram.
5. Using a 9/16” nutdriver, remove the nut securing the momentary toggle switch to the front panel. See ***Figure F.2***. See Wiring Diagram.
6. The momentary toggle switch can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new momentary toggle switch into the machine.
2. Using a 9/16” nutdriver, attach the nut securing the momentary toggle switch to the front panel.
3. Connect leads 737C, 724 and 737B to the momentary toggle switch. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Momentary toggle switch lead locations

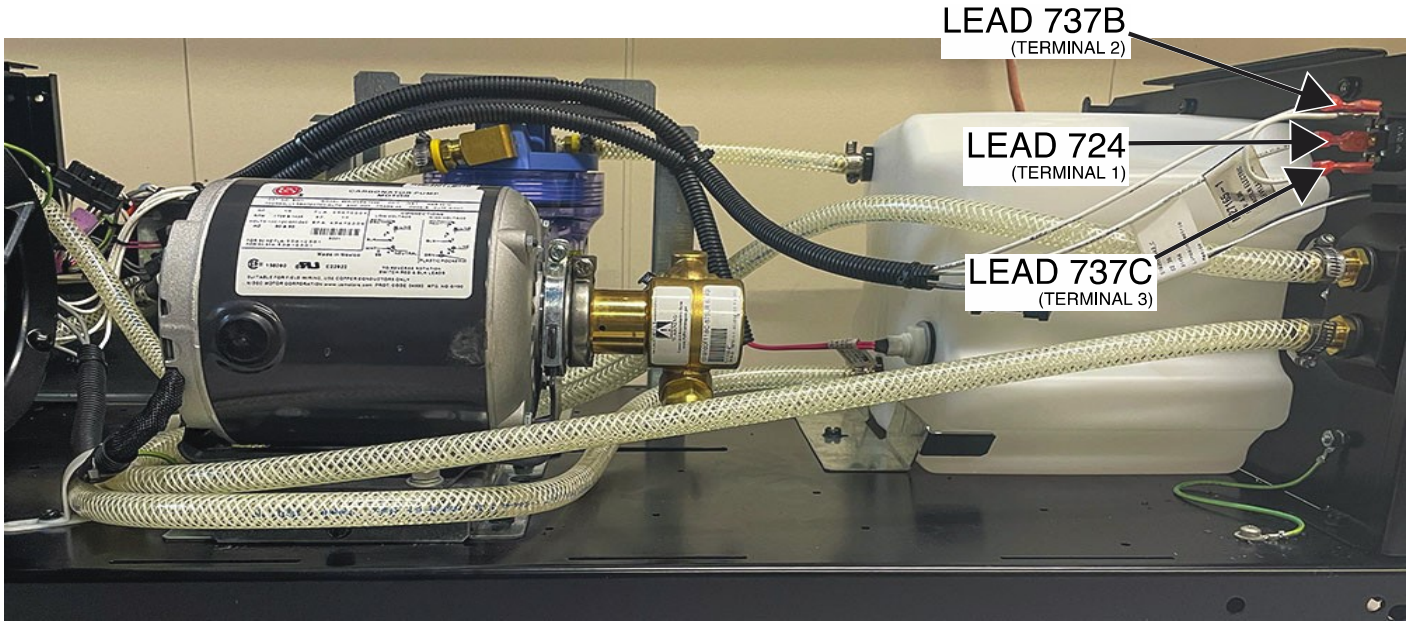


Figure F.2 – Momentary toggle switch mounting nut location

PUMP 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 Pump Motor Assembly.

MATERIALS NEEDED

Slotted Screwdriver
1/2” Nutdriver
1/4” Nutdriver
11/32” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a slotted screwdriver, loosen the hose clamps securing the two hoses to the pump motor assembly.
5. Using a 1/2” nutdriver, remove the four screws, lock washers and flat washers securing the pump motor assembly to the mounting bracket. See ***Figure F.1***.
6. Using a 1/4” nutdriver, remove the two screws securing the cover plate to the motor.
7. Using a 1/4” nutdriver, remove the screws securing the ground lead to the motor. See ***Figure F.2***. See Wiring Diagram.
8. Using a 11/32” nutdriver, remove the two washers and four nuts securing the white and black leads to the motor terminals. See ***Figure F.2***. See Wiring Diagram.
9. The pump motor assembly can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Using a 11/32” nutdriver, attach the two washers and four nuts securing the white and black leads to the motor terminals. See Wiring Diagram.
2. Using a 1/4” nutdriver, attach the screws securing the ground lead to the motor. See Wiring Diagram.
3. Using a 1/4” nutdriver, attach the two screws securing the cover plate to the motor.

4. Using a 1/2” nutdriver, attach the four screws, lock washers and flat washers securing the pump motor assembly to the mounting bracket.
5. Using a slotted screwdriver, tighten the hose clamps securing the two hoses to the pump motor assembly.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Pump motor mounting hardware locations

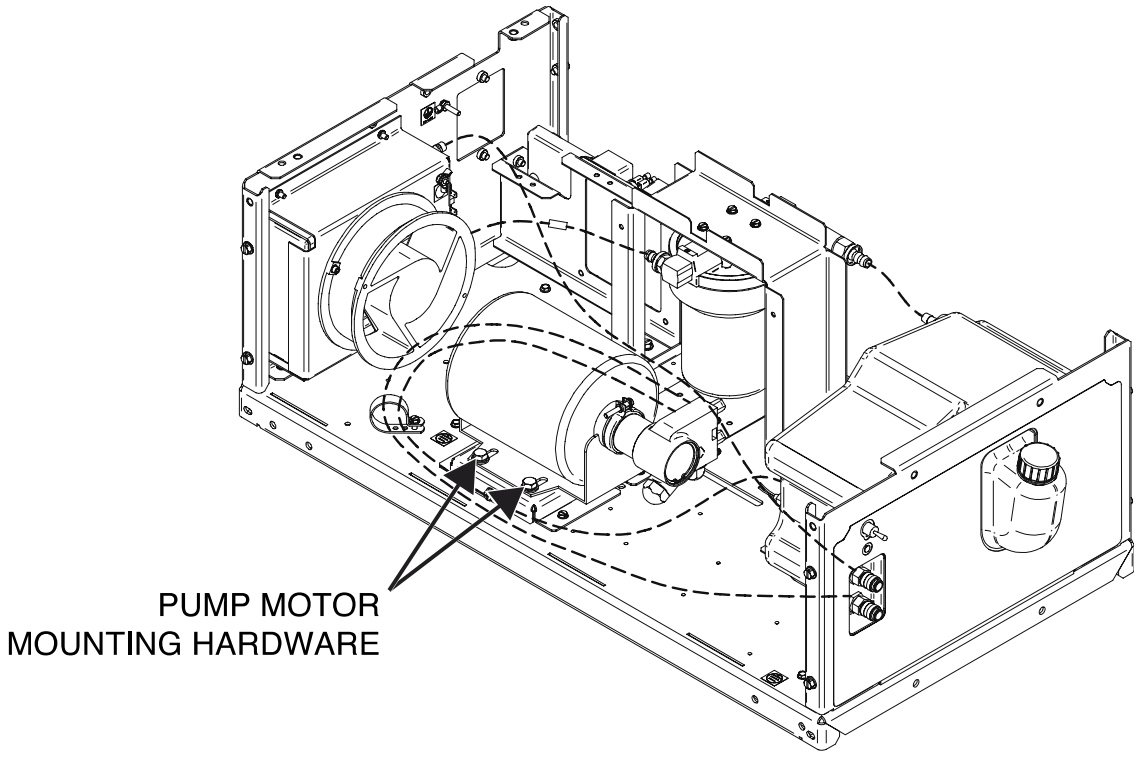
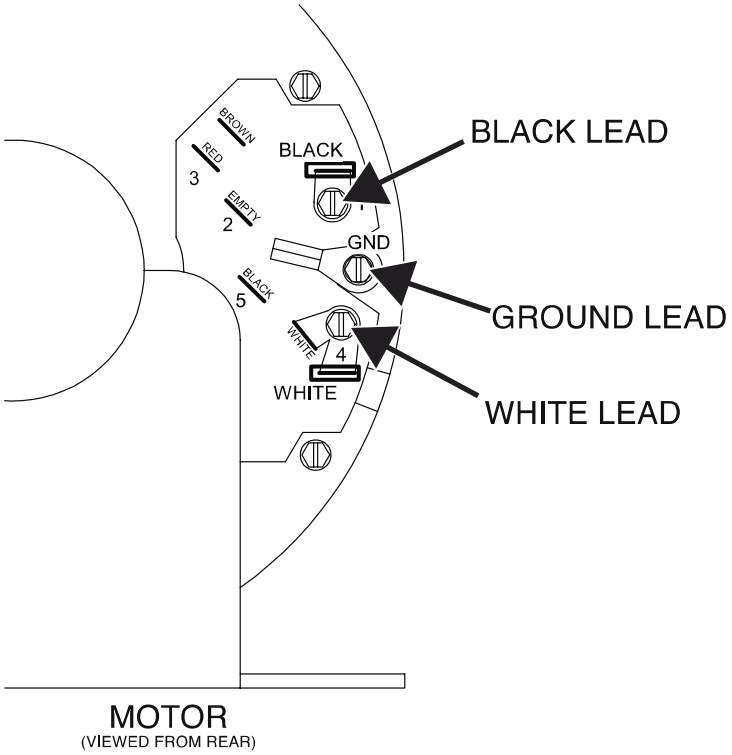


Figure F.2 – Motor terminal connections



COOLER FAN 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 Cooler Fan.

MATERIALS NEEDED

9/64” Allen Wrench
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 734 and 732 from the fan terminals. See ***Figure F.1***. See Wiring Diagram.
5. Using a 9/64” Allen wrench, remove the two screws and washers securing the fan to the fan shroud. See ***Figure F.2***.
6. The fan can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new fan into the machine.
2. Using a 9/64” Allen wrench, attach the two screws and washers securing the fan to the fan shroud.
3. Connect leads 734 and 732 to the fan terminals. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Fan lead locations

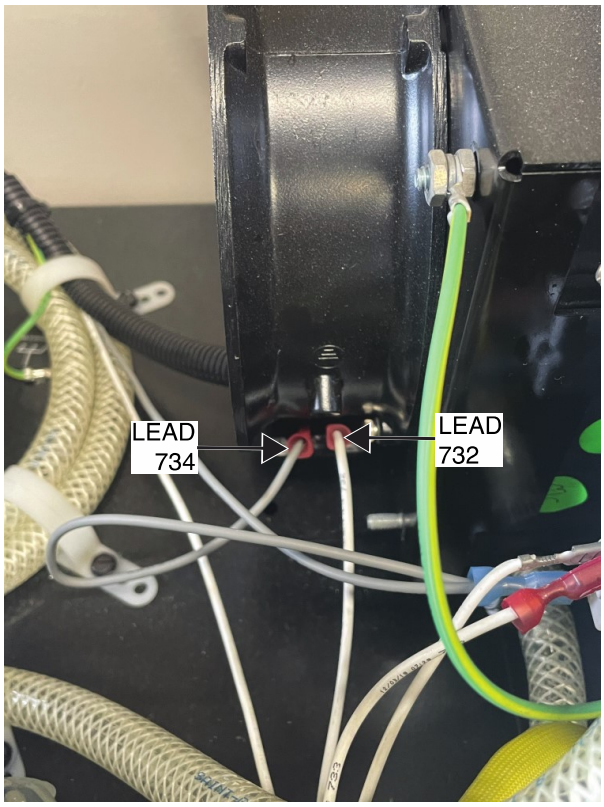
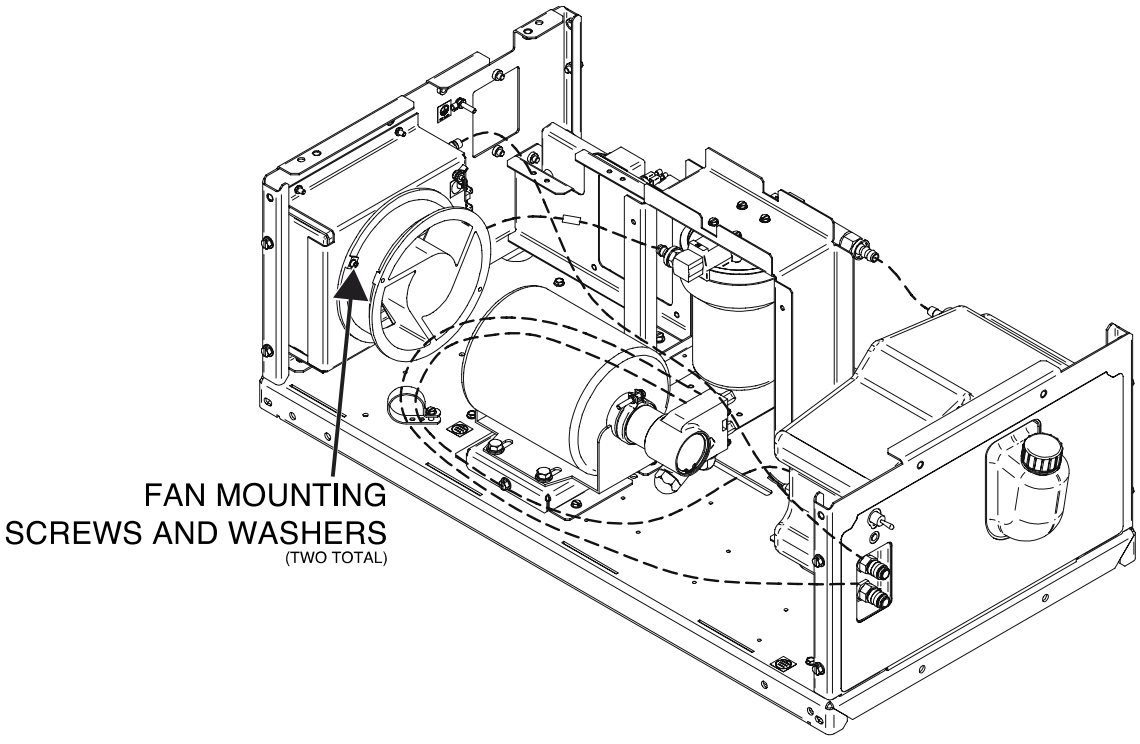


Figure F.2 – Fan mounting screw and washer locations



115 VAC INVERTER 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 115 VAC Inverter Board.

MATERIALS NEEDED

Phillips Screwdriver
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the PipeFab Welding System.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J61, J62 and J63 from the 115 VAC inverter board. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 730 and 729 form terminals B5 and B6 of the 115 VAC inverter board. See ***Figure F.1***. See Wiring Diagram.
6. Label and disconnect leads 411, 412, 413 and 414 from the 115 VAC inverter board thermostat terminals. See ***Figure F.1***. See Wiring Diagram.
7. Using a Philips screwdriver, remove the screw, lock washer and flat washer securing the ground lead to the cooler base. See Wiring Diagram.
8. Using a 3/8” nutdriver, remove the four nuts securing the 115 VAC inverter board to its mounting posts. See ***Figure F.2***.
9. The 115 VAC inverter board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 115 VAC inverter board into the machine.
2. Using a 3/8” nutdriver, attach the four nuts securing the 115 VAC inverter board to its mounting posts.
3. Using a Philips screwdriver, attach the screw, lock washer and flat washer securing the ground lead to the cooler base. See Wiring Diagram.
4. Connect leads 411, 412, 413 and 414 to the 115 VAC inverter board thermostat terminals. See Wiring Diagram.

5. Connect leads 730 and 729 to terminals B5 and B6 of the 115 VAC inverter board. See Wiring Diagram.
6. Connect plugs J61, J62 and J63 to the 115 VAC inverter board. See Wiring Diagram.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – 115 VAC inverter board plug and lead locations

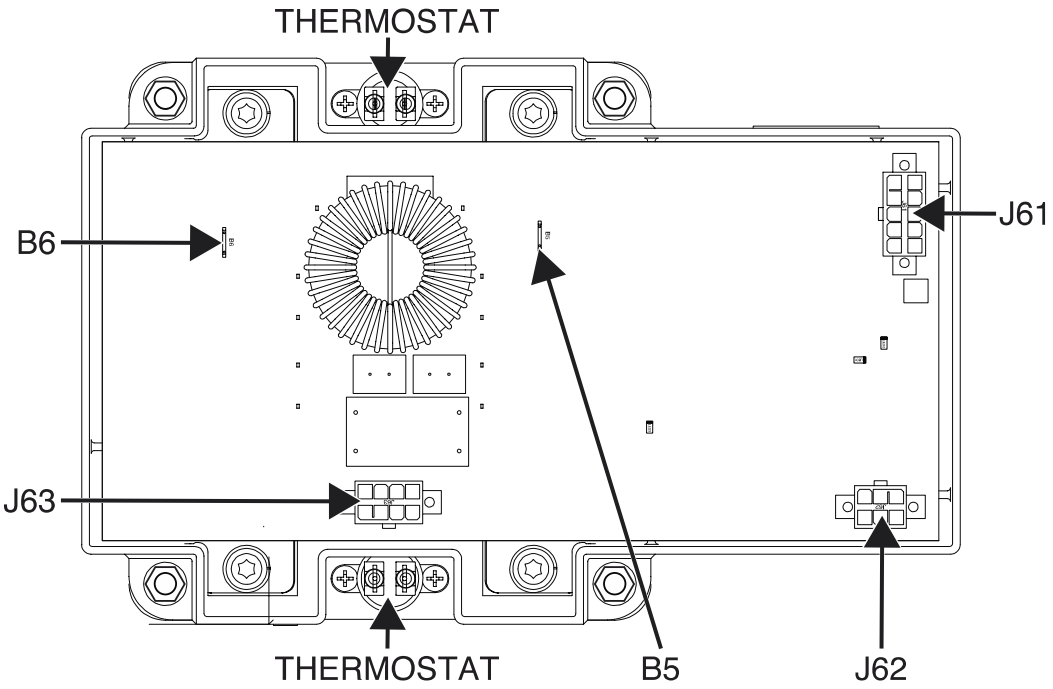
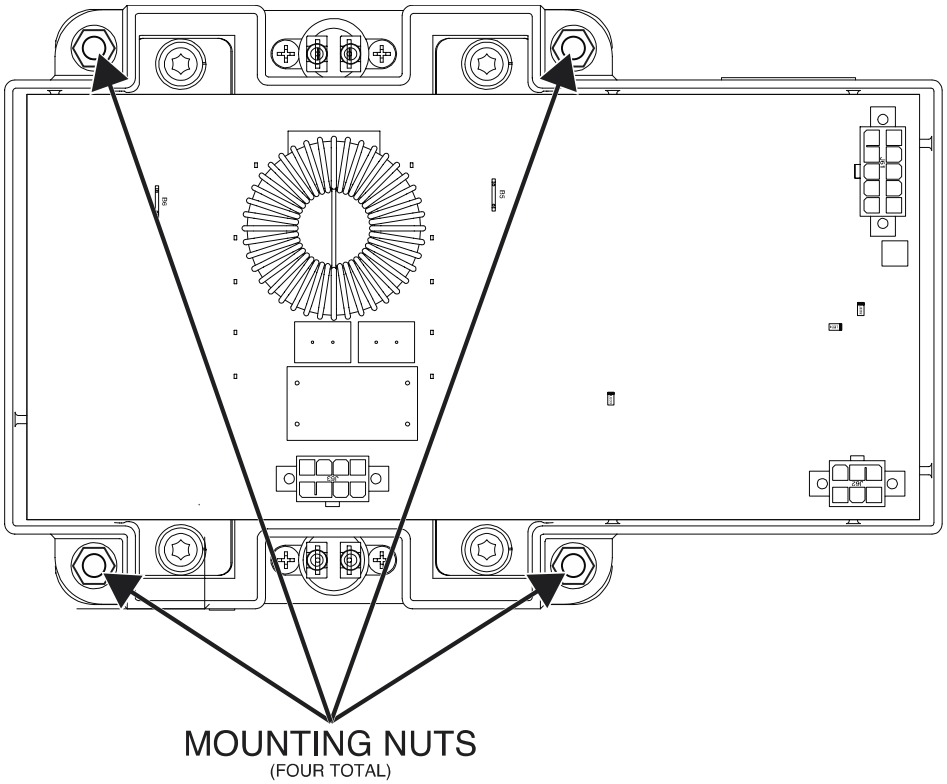


Figure F.2 – 115 VAC inverter board mounting nut locations

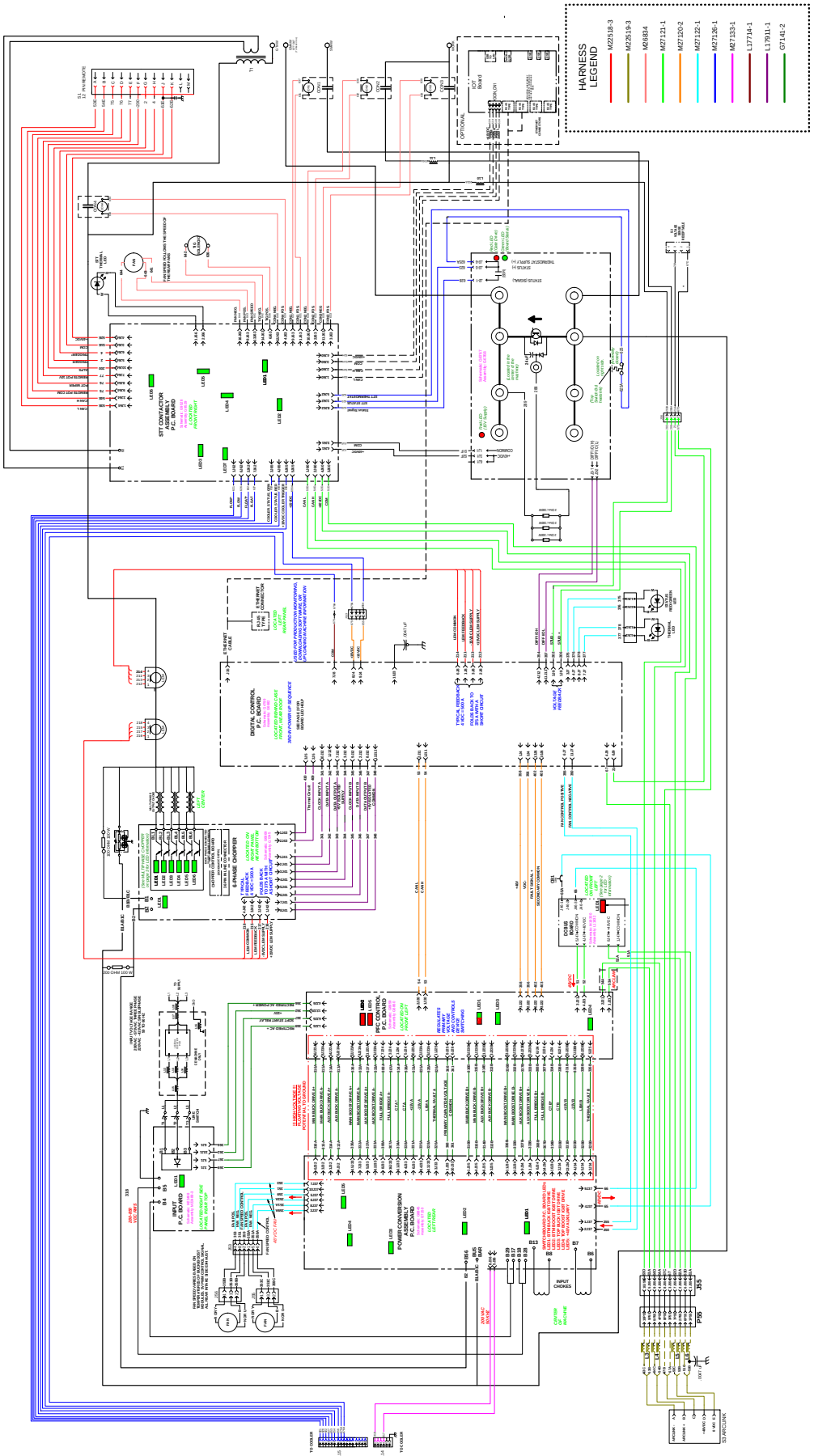


RETEST AFTER REPAIR

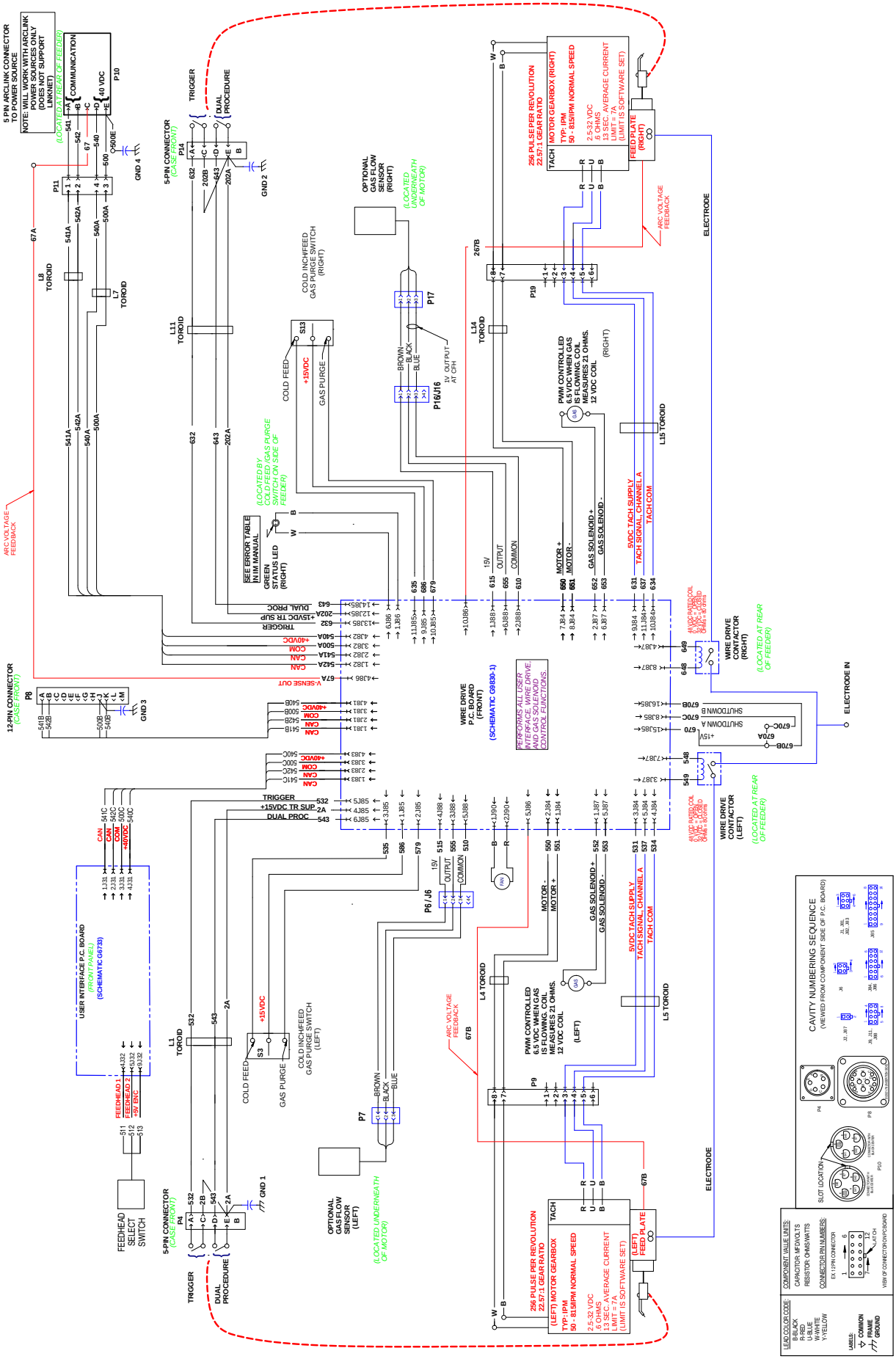
Testing is required after the removal of any component that could affect the machine's electrical characteristics or if any electrical components are repaired or replaced.

POWER SOURCE RATED OUTPUT			
PROCESS	DUTY CYCLE	VOLTS (AT RATED AMPS)	AMPS
GMAW /FCAW	100%	34	400
SMAW	100%	36	400
GTAW-DC	100%	26	400

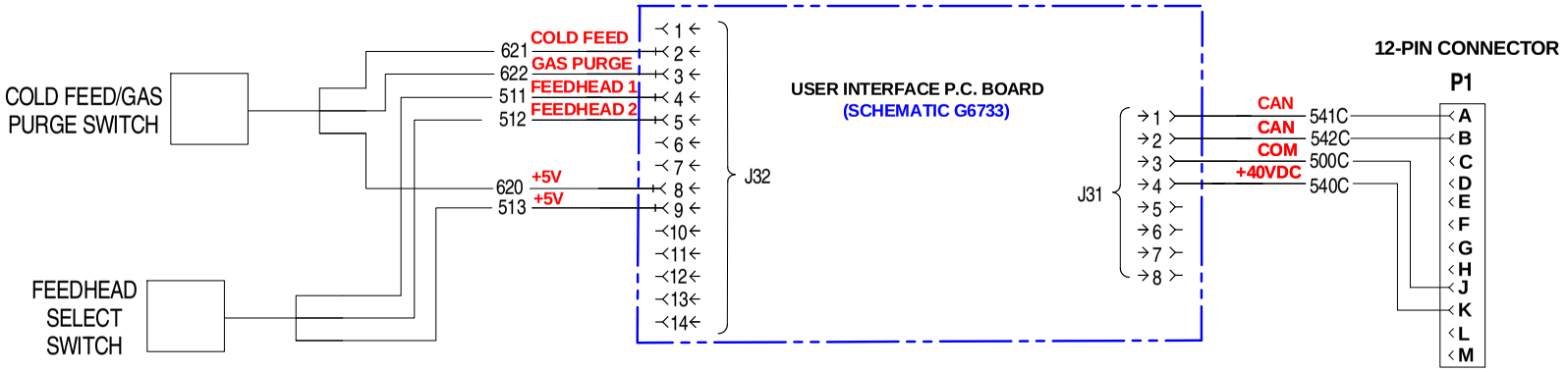
WIRE FEEDER RATED OUTPUT		
DUTY CYCLE	AMPS	WIRE FEED SPEED
60%	450	50 – 800 IN/MIN 1.3 – 20.3 M/MIN

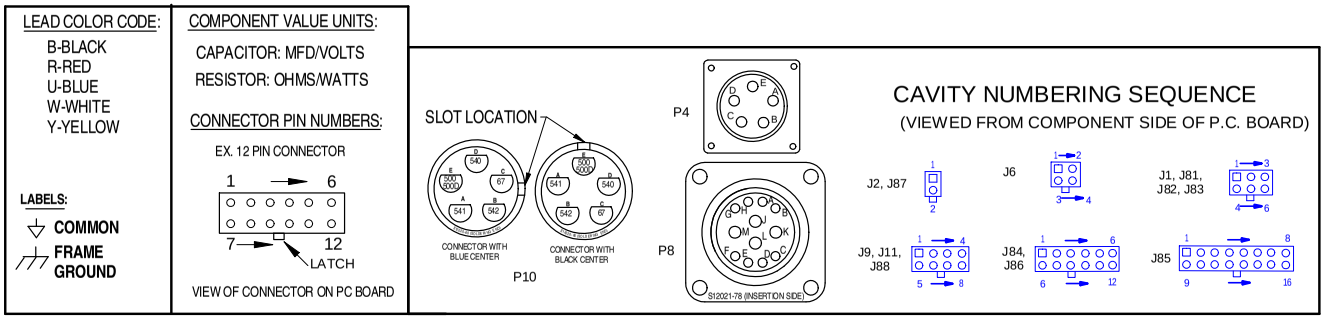


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.



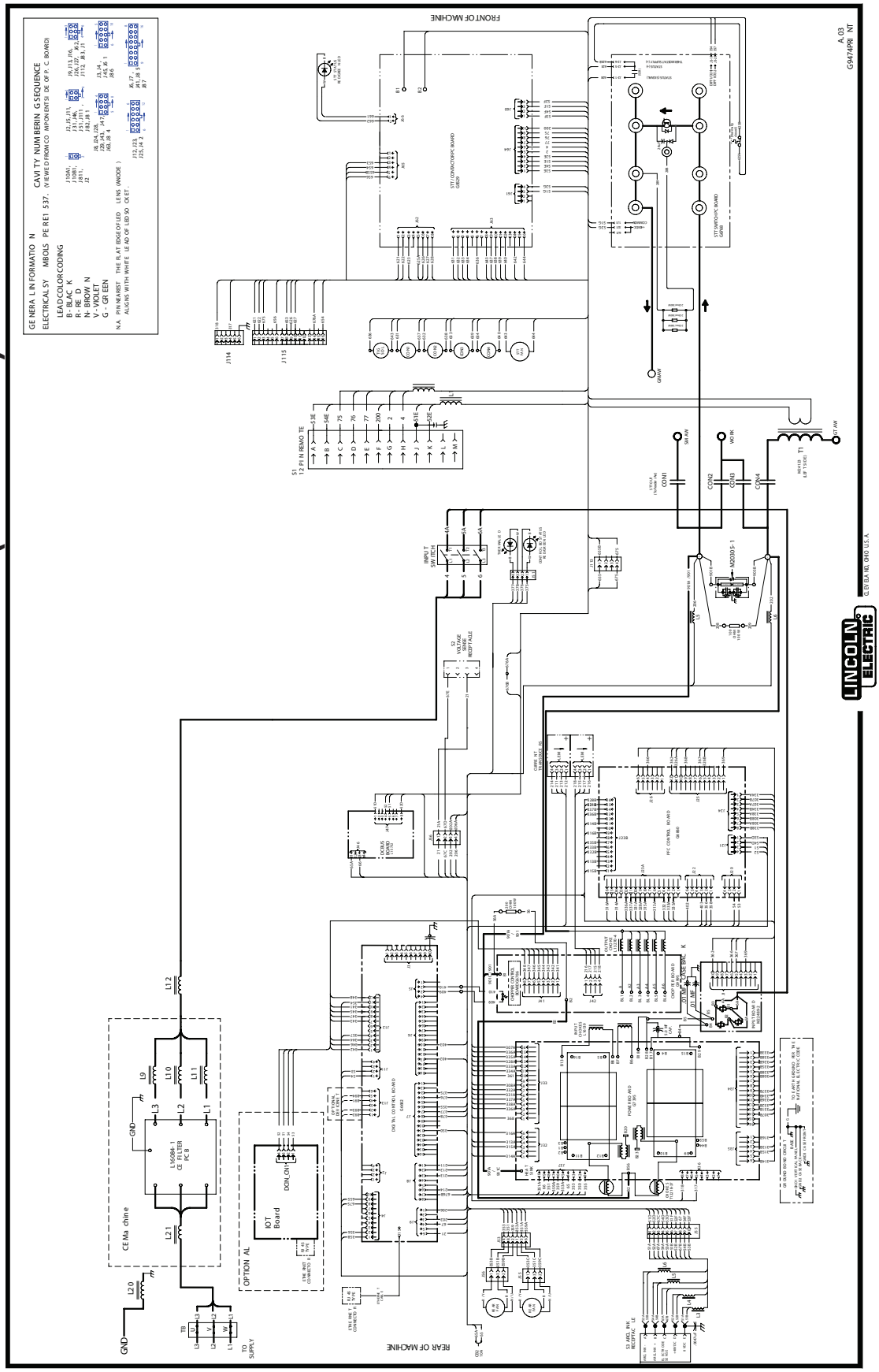
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.





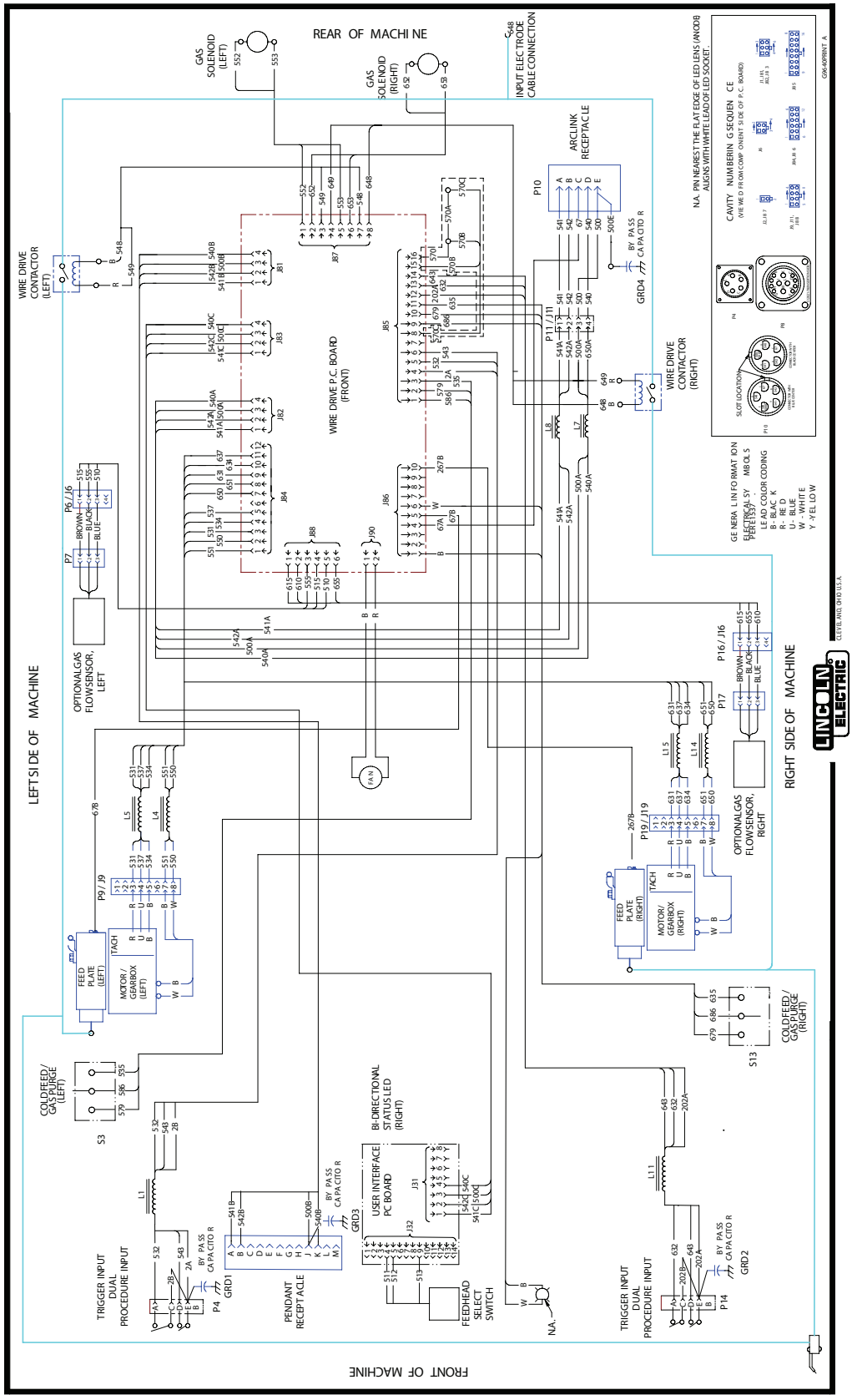
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.

PIPEFAB POWER SOURCE (Code 12858)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.

PIPEFAB WIRE FEEDER (Code 12929)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.

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.

			
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**	● 皮肤或湿衣物切勿接触帶電部件及焊條。 ● 使你自己與地面和工件絶緣。	● 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說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.

Lincoln Electric is a responsive manufacturer, but the definition of specifications, and the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

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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