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.
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.

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

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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.

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

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

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

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CALIFORNIA PROPOSITION 65 WARNINGS

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

The Above For Diesel Engines

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

The Above For Gasoline Engines

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

The Above For Gasoline Engines

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SAFETY

Mar ‘95
ELECTRIC SHOCK can kill.
3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

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

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.
4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.
5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may 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 material safety data sheet (MSDS) and follow your employer’s safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see Item 1.b.
WELDING 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.

CYLINDER may explode if damaged.
7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:
   • Away from areas where they may be struck or subjected to physical damage.
   • A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

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.

Mar ’95
HOW TO USE THIS GUIDE

1. Locate your general problem from among the CAPITALIZED problems in the index on pages 8 and 9.

2. Locate your specific problem on the list under the appropriate general problem. Be certain you determine in which mode or modes the problem occurs. Following instructions for a problem in the inch mode, for example, when the problem actually occurs in all modes can lead to the wrong conclusion.

3. Turn to the page indicated and follow the step-by-step instructions to find the solution.

4. When a P.C. Board is to be replaced, follow procedure outlined on page 2.

Caution: Before making or breaking any connections inside the control box, turn the input power to the control box off at the power source. Turning the 'Control Power' switch 'Off' removes voltage from the circuitry but 115 volt input power is still present at #31 and #32 on the terminal strip and at the hot side of the 'Power Switch'.

Whenever the 'Start' button is pressed, power source output voltage is present between the head or electrode and the work and between the terminals on the voltmeter until the 'Stop' button is also pressed.
PROCEDURE FOR REPLACING P. C. BOARDS

Before replacing a P. C. board which is suspected of being defective, visually inspect the P. C. board in question for any electrical or mechanical damage to any of its components and conductors on the back of the board.

A. If there is no visible damage to the P. C. board, install a new one and see if this remedies the problem. If the problem is remedied, re-install the old P. C. board to see if the problem still exists. If it no longer exists with the old P. C. board, then:

1. Check the P. C. board harness connector pins for corrosion, contamination, or looseness.

2. Check leads in the plug harness for loose or intermittent connection.

B. If P. C. board is visibly damaged electrically, before possibly subjecting the new P. C. board to the same cause of failure, check the following:

1. Inspect for possible shorts, opens or grounds caused by:
   a. Frayed or pinched lead insulation.
   b. Poor lead termination, such as a poor contact or a short to adjacent lug or surface.
   c. Shorted or open motor or other external leads.
   d. Foreign matter or interference behind the P. C. boards or inside control box.

2. If any special connections or rewiring was done, make certain it was done precisely per factory wiring diagrams and/or instructions.

C. If P. C. board is visibly damaged mechanically, inspect for cause then remedy before installing a replacement P. C. board.
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</table>
NA-3 and NA-4
COMPONENT LOCATIONS

Standard on NA-3S and NA-4
Optional on NA-3N

(Optional)
'Start Controls' Board

(Optional)
'Crater Controls' Board

F2 was 2/10A on superseded L-5244-1 Control Bd.
F3 was not included on superseded L-5244-1 Control Board.

LOGIC BOARD

* Jumper lead present on boards made after last quarter of 1976.
<table>
<thead>
<tr>
<th>PROBLEM NUMBER</th>
<th>DESCRIPTION</th>
<th>SEE PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>CONTINUOUS WIRE FEED</strong> (whenever 'Power Switch' is 'On')</td>
<td>10</td>
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<tr>
<td>B</td>
<td><strong>NO WIRE FEED</strong> or <strong>WROUNG WIRE FEED DIRECTION:</strong> When pressing 'Inch Up', 'Inch Down' or 'Start' buttons:</td>
<td>11</td>
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<tr>
<td></td>
<td>B1 No wire feed at all.</td>
<td>12</td>
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<tr>
<td></td>
<td>B2 Wire won't feed and circuit breaker trips</td>
<td>12</td>
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<tr>
<td></td>
<td>B3 Wire won't feed and no reading on voltmeter when the 'Start' button is pressed. Wire inches up and down OK</td>
<td>12</td>
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<tr>
<td></td>
<td>B4 Wire feeds up when it should feed down and vice versa</td>
<td>12</td>
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<td></td>
<td>B5 If the wire feeds down, see page</td>
<td>13</td>
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<td></td>
<td>B6 If the wire does not feed, see page</td>
<td>13</td>
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<tr>
<td></td>
<td>B7 If the wire feeds up instead of down, see page</td>
<td>14</td>
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<tr>
<td></td>
<td>B8 Wire feeds up instead of down when the 'Start' button is pressed. Inches OK with 'Inch Down' button (with VV boards only)</td>
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<td></td>
<td>B9 Wire doesn't stop when it touches the work with cold starting</td>
<td>14</td>
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<td></td>
<td>B10 Wire won't inch up but inches down and welds OK</td>
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<td></td>
<td>B11 Wire feeds only up with both 'Inch' buttons</td>
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<td></td>
<td>B12 Wire feeds only down with both 'Inch' buttons</td>
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<tr>
<td>C</td>
<td><strong>WIRE FEEDS AT FULL SPEED</strong> (no control) or <strong>POOR CONTROL OF FEED SPEED</strong> (minimum speed, limited or erratic control):</td>
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<tr>
<td></td>
<td>Wire Feeds at Full Speed (no control):</td>
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<td></td>
<td>C1 during inch mode only</td>
<td>16</td>
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<td></td>
<td>C2 during weld mode only</td>
<td>27</td>
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<td></td>
<td>C3 during inch and weld modes</td>
<td>16</td>
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<td></td>
<td>C4 during start mode only (optional 'Start Controls')</td>
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<td></td>
<td>C5 during crater mode only (optional 'Crater Controls')</td>
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<td></td>
<td>C6 Limited wire feed speed in more than one mode</td>
<td>16</td>
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<td></td>
<td>C7 Minimum speed, limited speed control or erratic speed control in one or more modes</td>
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<td>C8 No control of voltage and current in weld mode only</td>
<td>19</td>
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<td>D</td>
<td><strong>NO POWER SOURCE OUTPUT</strong> (no voltmeter reading):</td>
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<td>D1 Power source contactor not pulling in. Check contactor operation. If OK, see Problem D2.</td>
<td>20</td>
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<td></td>
<td>D2 No output (voltmeter reading) when pressing 'Start' button</td>
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<tr>
<td>E</td>
<td><strong>POOR CONTROL OF POWER SOURCE OUTPUT</strong> with 'Voltage Control', 'Current Control' or optional 'Start Controls' and 'Crater Controls':</td>
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<td></td>
<td>No output control (usually full output or very low output):</td>
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<td></td>
<td>E1 in all modes</td>
<td>21</td>
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<td>E2 in start mode only (optional 'Start Controls')</td>
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<td>E3 in weld mode only</td>
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<td>E4 in crater mode only (optional 'Crater Controls')</td>
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<td></td>
<td>E5 in start mode only (optional 'Start Controls')</td>
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<td></td>
<td>E6 in weld mode only</td>
<td>21</td>
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<tr>
<td></td>
<td>E7 in crater mode only (optional 'Crater Controls')</td>
<td>17</td>
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<tr>
<td></td>
<td>E8 in more than one mode</td>
<td>16</td>
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</table>
F  POOR ARC STARTING:
F1 Wire does not feed when 'Start' button is pressed — see Problem B
F2 No power source output — see Problem D
F3 Poor control of power source output — see Problem E
F4 No control of motor-generator power source OCV with 'Open Circuit Voltage' control ........................................ 21
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F7 Poor control of wire feed speed — see Problem C
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G3 Poor control of power source output — see Problem E
G4 No control of voltage and current in weld mode only ................... 19

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H3 Runs continuously with switch on 'Automatic Travel' ....................... 23
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J2 while pressing the 'Inch' or 'Start' buttons ....................................... 12
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    With optional 'Crater Controls' board:
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K2 poor control of power source output — see Problem E
K3 Power source contactor does not drop out ....................................... 24
K4 Welding does not stop ..................................................................... 24
K5 Burnback time cannot be properly set ............................................ 24

L  FLUX VALVE OR OPTIONAL GAS/WATER SOLENOID:
L1 does not open at all ........................................................................ 25
L2 remains open continuously ............................................................. 25
L3 Flux valve does not open when 'Start' button is pressed but
    does open when electrode touches work ......................................... 25
L4 (When cold starting) flux valve does not open when wire touches
    the work while pressing 'Inch Down' button .................................... 25

M  OPTIONAL USER INSTALLED CURRENT ACTUATED RELAY (5CR):
M1 will not operate ............................................................................... 26
M2 remains pulled in continuously ....................................................... 26
PROBLEM A  CONTINUOUS WIRE FEED (WHENEVER THE 'CONTROL POWER' SWITCH IS ON)

Observe light 1B

Is light 1B OFF?  YES  Replace Control Board

NO

Observe lights 1A, 2B and 2J

Are all lights OFF?  YES

Refer to wiring diagram for the model and code (see IM-27B). Check pigtail lead #693 on logic board for proper connection. If lead is OK, replace logic board.

NO

If light 1A is ON

Remove lead #593 from 'Inch Up' switch. If light 1A is still ON, replace control board. If light goes OFF replace 'Inch Up' switch.

If light 2B is ON

Remove lead #581 from 'Start' switch. If light 2B is still ON, replace logic board. If light goes OFF, replace 'Start' switch.

If light 2J is ON

Remove lead #592 from 'Inch Down' switch. If light 2J is still ON replace logic board. If light goes OFF replace 'Inch Down' switch.
Problem B1: Wire does not feed at all - up or down

Make sure 'Control Power' switch is 'ON'.

Check circuit breaker on left side of cover to see if it is tripped.

Is breaker tripped? YES

Reset breaker. See Problem J on Page 9

NO

Open the sub panel and see if any of the lights on the P.C. boards are ON

Are any lights ON? YES

NO

Check 3/10 A amp fuse F2 on control board. A F2 was 2/10 A on superseded L-5224-1 control board.

Is fuse OK? YES

No A.C. input to control box. Check #31 and 32 connections and continuity.

NO

Check wire feed motor for worn brushes, bad connections, etc. Check continuity of motor leads back to control board.

Turn off 'Control Power' switch on door and replace fuse F2. Check #510 on the terminal strip for possible ground to case, short to adjacent leads, or external voltage or short between 510 and 581, 582, 585 or 589. If no faults are found, unplug all P.C. boards, except the Control Board. Turn on 'Control Power' switch and check fuse F2:

Is fuse OK? YES

NO

Replace control board

Turn off 'Control Power' switch. Continue to plug the P.C. boards back into the lead harness until the one is found which causes fuse F2 to blow. Replace that particular board. Connect boards back in this order: 1) Logic board 2) V.V. Board 3) Optional start and crater boards
PROBLEM B2 & J2  WIRE WON'T FEED
AND CIRCUIT BREAKER
TRIPS WHILE PRESSING 'INCH'
OR 'START' BUTTONS

Reset circuit breaker and observe
lights 1C & 1D with unit at idle.

Both lights are ON or
both lights are OFF.

Light 1C is OFF
Light 1D is ON

Check 1/2 amp field fuse
"Line 3".

Is fuse OK?

YES Replace
Control board

NO

Disconnect motor amphenol from control box. Check motor field for an open
condition and check the armature for
a short. Also check for broken shaft,
gears or any other obstructions which
might cause the motor not to run.
The normal field resistance is about
700 \( \Omega \) and the normal armature
resistance is 0.85 \( \Omega \).

The following conditions could cause the field fuse to open:
1. Complete or partial wire feed motor field short. Normal field
resistance is about 700 \( \Omega \).
2. A welding procedure with a lot of electrode to puddle shorting.
(Lights 1C and 1D will both be flickering while welding.) The
rapid arc shorting may cause the field voltage polarity to change
frequently and blow the fuse.
3. Too low an impedance across 21-67 (See "Impedance Requirements" under
4. A defective control board.  

Problem B5 on Page 13

PROBLEM B3  WIRE WON'T FEED AND NO
VOLTMETER READING WHEN 'START'
BUTTON PRESESSED. WIRE INCHES UP
AND DOWN OK.

While pressing 'Start' button, observe
light 2B.

Is light 2B ON?

YES Replace
logic board

NO Remove electrode from drive rolls. Place
a jumper across the terminals of the start
switch and observe light 2B.

Is light 2B ON?

YES Replace
'Start switch'

NO

Check leads #581 and 539 to 'Start' switch

PROBLEM B4  WIRE FEEDS UP WHEN IT SHOULD FEED
DOWN & FEEDS DOWN WHEN IT SHOULD
FEED UP

The welding head is designed to feed
wire in the proper direction when it is
installed as shipped from the factory.
If the nozzle and wire straightener are
rotated about the axis of the gear box
output shaft, the wire may feed in the
opposite direction.

To remedy this situation, interchange
the #626 and #627 leads from the wire feed
motor receptacle to the terminal strip in
the control box.
PROBLEM B5  WIRE WON'T INCH DOWN BUT INCHES UP O.K.
PRESS THE 'START' BUTTON AND THE WIRE FEEDS DOWN.

NOTE: If using a DC-400, CV-400 or PP-500 power source, the Diode Option must be used. (See NA-3 to power source connection diagram for further details).

While pressing the 'Inch Down' button observe light 2J

Is light 2J on?  YES
Is VV board present?  YES
Does VV board have a pigtail lead alongside switch? NO
Is switch in VV? NO
Replace logic board

Is light 2J on?  NO
Replace logic board

Is VV board present?  NO
Replace logic board

Is pigtail on pin L? NO
Turn off all input power and disconnect lead #21 between input amphenol and terminal strip. Disconnect lead at terminal strip and insulate lug on this lead. Turn on input power, Press 'Inch Down' button and observe light 3A.

Replace VV board and reconnect lead #21

Is light 3A on?  YES

Impedance Requirements: Turn off all input power, reconnect lead #21 and turn the input power on. Connect a voltmeter across the voltmeter studs and press the 'Inch Down' button. The voltage should be above 5V. If this is not the case, the external impedance across 21-67 (electrode to work) is too low. This impedance must be above 500Ω for the circuit to operate properly. Low impedance can be caused by (1) a circuit, lead or object external to the power source or automatic controls causing low resistance between 21-67, (2) a non-Lincoln power source not built with the required impedance, or (3) a defective Lincoln power source (see Operating Manual or Trouble Shooting Guide for power source). *Use an AC voltmeter for units with early L-5394 VV boards & a DC voltmeter for L-5394-1 and higher part number boards (positive to #67).

Check the lead connections to the inch down switch. If OK, place a jumper across the switch terminals and observe light 2J.

Is light 2J on?  YES
Replace 'Inch Down' Switch

The problem is in the leads going to the switch. Check leads #592 and #539 from switch to logic board.

PROBLEM B6  WIRE WON'T INCH DOWN BUT INCHES UP OK. PRESS THE 'START' BUTTON AND THE WIRE DOES NOT FEED

Press 'Inch Down' button and observe light 1B

Is light 1B on?  YES
Replace control board

Is light 1B on?  NO
Replace control board

Is voltage 12-15V DC? NO
Replace logic board

Measure DC voltage from lead #586 to #539 while pressing 'Inch Down' button. Lead #586 is at upper left corner of connection E (see photo on Page 1). 539 is at right hand terminal of upper terminal strip.
PROBLEM B7  WIRE WON'T INCH DOWN BUT INCHES UP OK. PRESS THE 'START' BUTTON AND THE WIRE FEEDS UP INSTEAD OF DOWN.

Refer to connection diagram of control unit to power source. Check all leads for proper connection.

- **is V.V. board present**
  - **YES**
    - While pressing 'Inch Down' button, observe light 3A.
  - **NO**
    - Check continuity of leads #21 and 67 to V.V. board. If defective, repair. If OK, replace V.V. board.

Check jumper plug in harness. Make sure plug is securely in place and is making good connections. If connections are bad, remedy. If connections are OK, check light 2E while pressing 'Inch Down' button.

- **is light 2E ON?**
  - **YES**
    - While pressing 'Inch Down' button, check light 2E.
  - **NO**
    - Replace logic board

PROBLEM B8 & B8  WIRE DOESN'T STOP WHEN IT TOUCHES THE WORK WITH COLD STARTING.

The wire feed will stop only when a V.V. board is present and the CV/VV switch is in V.V. position. (See footnote N.A.)

Check to insure proper connection of electrode leads to control box, head and work. Check connection and continuity of lead #21 from control box to power source via control cable and lead #67 from shunt to V.V. board.

Turn OFF all input power. Locate lead #21 from the input receptacle in the control box and disconnect it from the terminal strip. Insulate the terminal on this lead.

Place a jumper across the voltmeter studs. Turn ON input power and inch the electrode up from the work. Press the 'Inch Down' button.

- **does the wire feed?**
  - **YES**
    - While pressing 'Inch Down' button, observe light 3A.
  - **NO**
    - Problem is external to control box. Re-check for proper connections.

- **Replace logic board**
  - **YES**
    - Replace V.V. board
  - **NO**

N.A.  On older V.V. boards only. On V.V. boards made after last quarter of 1976 the wire will stop in either C.V. or V.V. mode as long as the jumper lead on the V.V. board is on pin H. If jumper lead is on pin L, the wire will not stop no matter where switch is set.
**PROBLEM B10** WIRE WON'T INCH UP BUT INCHES DOWN AND WELDS OK.

With unit at idle check light 1D

- Is light 1D ON? NO → Replace Control board
  - YES → While pressing the 'Inch Up' button observe light 1A.
    - Is light 1A ON? YES → Replace Control board
    - NO → Place a jumper across the terminals of the 'Inch Up' switch. Observe light 1A.
      - Is light 1A ON? YES → Replace 'Inch Up' switch
        - NO → Check leads #593 and 539 for continuity between switch and control board

---

**PROBLEM B11** WIRE FEEDS UP WITH BOTH 'INCH' BUTTONS.

While pressing the 'Inch Down' button observe light 2E.

- Is light 2E ON? YES → Replace Control board
  - NO → Replace logic board

**PROBLEM B12** WIRE FEEDS DOWN WITH BOTH 'INCH' BUTTONS.

With unit at idle, observe light 2E.

- Is light 2E OFF? YES → NO
PROBLEM C1  WIRE FEEDS AT FULL SPEED DURING INCH MODE ONLY

With unit at idle, check light 2A.

If light 2A is ON? NO Replace logic board

YES

If control box is an NA-3, replace reed switch 4CR. If it is an NA-4, replace the current sensor P.C. board.

(1) To check weld mode, remove electrode from drive rolls and place a jumper across #528 and #539 on the terminal strip in the control box. Press 'Start' button. CAUTION: Power source output voltage is across head and work. Press 'Stop' button. If wire also feeds full speed in weld mode with no control, see Problem C3.

PROBLEM C3  WIRE FEEDS AT FULL SPEED IN INCH AND WELD MODE.

With unit at idle, observe light 2A.

With optional boards present?

YES

Set 'Start Current' and/or 'Crater Current' controls to min. Setting. Check speed in 'Start' and/or Crater mode.

Does wire feed at min. speed?

YES Replace logic board

NO

Replace control board

YES

Is light 2A ON?

PROBLEM C6 & C8  LIMITED WIRE FEED SPEED AND/OR LIMITED POWER SOURCE OUTPUT CONTROL IN MORE THAN ONE MODE (INCH, START, WELD OR CRATER).

If V.V. board is present, place CV/VV switch in CV position. (See Note N.A.)

Place a jumper across #528 and #539 on terminal strip in control box. Observe lights 2A, 2L and 4A on the start or crater fill board, if present.

are all these lights OFF?

YES

Whatever light is ON, replace the board on which it is located.

If wire feed speed control(2) is the problem, see Problem C7 on Page 18. If power source output control is the problem, see trouble shooting for the power source or optional K224 'Solid State Remote Field Control'

(2) For CV applications, the current control adjusts the wire feed speed. For VV applications, the wire feed speed is determined by the voltage control.

N.A. On V.V. boards made after last quarter of 1976, place the pigtail jumper lead alongside the CV/VV switch on pin L. After testing is completed, return lead to original position.

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PROBLEM C4 & E2  WIRE FEEDS AT FULL SPEED AND/OR NO POWER SOURCE OUTPUT CONTROL IN START MODE ONLY (1)

Remove electrode from drive rolls. Place a jumper across #528 and #539 on the terminal strip in the control box. Set start time to max. Press 'Start' button while observing light 4B on start board. CAUTION: When 'Start' button is pressed full power source voltage is across head and work.

does light 4B go OFF?

YES

Press 'Stop' button. Replace 'Start Controls' board.

NO

Press 'Stop' button. Replace logic board.

(1) Applies only to units with optional 'Start Controls' board installed

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PROBLEM C5 & E4  WIRE FEEDS AT FULL SPEED AND/OR NO POWER SOURCE OUTPUT CONTROL IN CRATER MODE ONLY (2)

Remove electrode from drive rolls. Push 'Start' button. CAUTION: Full power source output voltage is across head and work.

Set crater time to max. Press 'Stop' button while observing light 4B on crater board.

does light 4B go OFF?

YES

Press 'Stop' button. Replace crater board

NO

Replace logic board

(2) Applies only to units with optional 'Crater Controls' boards installed.
PROBLEM C7  MINIMUM FEED SPEED, LIMITED SPEED CONTROL OR ERRATIC SPEED CONTROL IN ONE OR MORE MODES.

In what mode does the problem occur

- Inch mode (1)
- Optional start mode
- Weld mode
- Optional crater mode
- All modes

Replace logic board
Replace 'Start Controls' board
Replace R3 in cover
Replace 'Crater Controls' board
Check brushes and commutator in wire feed motor.

(1) Max. inch speed armature voltage (#541-539) was decreased from 86-97 VDC to 21-26 VDC on logic P.C. Boards built after December 1976. (Logic P.C. Board date codes higher than 612)

Is motor OK? NO → Replace motor

YES → Arc controls being used in WV mode

NO → Replace control board

YES → Turn OFF all input power to controls at the terminal strip in the control box, remove lead #21 and insulate lug. Place a jumper across #528-#539. Connect a DC voltmeter across #541-#539. Turn weld voltage control to min. Make sure CV/VV switch is in VV.

Turn ON the input power and press the start button. Caution: Power source output voltage will be across head and work. Press inch down button while observing voltmeter reading.

If unit is an NA-3S, voltmeter reading should be 20-30 volts. If unit is an NA-4, voltmeter reading should be 14-20 volts.

Is voltage OK? NO → Press stop button, turn off power and replace WV board

YES → Press stop button, turn off power and replace control board

Remove all jumpers and connect leads back per standard unit
PROBLEM C8 and G4
NO CONTROL OF VOLTAGE
AND CURRENT IN WELD MODE ONLY.

Turn OFF 'Control Power' switch and place a jumper across 528-539 on terminal strip.

Turn ON 'Control Power' switch, press 'Start' button and observe light 2D.

Is light 2D ON bright?  NO

Is Start P. C. Board present?  YES

Is light 2L ON?  NO

Trouble is in reed switch of NA-3 or Current Sensor P. C. Board of NA-4 or in leads from either of these units to terminal strip. Press 'Stop' button.

Check continuity of lead #528 from terminal strip to logic board, if OK replace logic board.

Turn start time to Min. Is light 4A on start board ON continuously?  NO

Replace Start Board

YES

Replace Logic Board
PROBLEM D2  NO POWER SOURCE OUTPUT (NO VOLTMETER READING) WHEN PRESSING 'START' BUTTON.

1) Check for proper connection of electrode leads and for proper connection of control cable leads to power source. (See connection diagram of control unit to appropriate power source.

2) Check pigtail lead #690 on logic board for proper connection (See wiring diagram for the model and code - see IM-278.)

Remove electrode from drive rolls and press 'Start' button. Observe light 2K. CAUTION: When 'Start' button is pressed, full power source voltage is across head and work.

Is light 2K ON? NO

YES

Turn OFF 'Control Power' switch on cover. Remove lead #682 from 3CR. Check resistance of relay coil between this relay terminal and #510. Resistance should be 10K±10%.

Is coil resistance OK?

YES Replace logic board

NO

Replace relay 3CR

Is reading zero? NO Replace relay 3CR in control box

YES

Turn OFF input power to control box. Reconnect lead #2 to terminal strip.

Is 'Solid State Remote Field Control' being used with an MG set?

YES

Place a jumper across #2 and 24 at MG terminal strip. Turn ON input power. Press 'Start' button and observe voltmeter reading on the NA control box. Press 'Stop' button.

NO

Problem is in power source or in control cable leads from control box to power source. Check continuity of leads 75, 76 and 77 from Logic Board and lead #21 from V.V. Board to power source. Also check lead connections at power source.

Was voltage present?

YES

Problem is in solid state field control. Consult troubleshooting guide for the unit.

NO
PROBLEM E1  NO CONTROL OF POWER SOURCE OUTPUT IN ALL MODES (POWER SOURCE OUTPUT IS PRESENT.)

Refer to connection diagram of control unit to power source. Check all leads for proper connections.

Turn off all power. Disconnect leads 75, 76, and 77 at power source. Connect an ohmeter across 76 and 77 of control cable and then turn control power back on. At the NA control box, turn the 'Open Circuit Voltage' through its full range. Repeat with ohmeter connected between 75 and 76.

Does resistance vary from 0 to 10kΩ in both cases?

YES

If a 'Solid State Remote Field Control' is being used, consult troubleshooting guide for the unit.

If solid state field control is not being used consult troubleshooting guide for the power source.

NO

Replace rheostat R2 in control box cover

If problem still occurs, replace logic board.

Trouble is in:
1) Control cable
2) Leads from connector on control to rheostat.

PROBLEM E6  LIMITED OR ERRATIC CONTROL OF POWER SOURCE OUTPUT IN WELD MODE ONLY.

PROBLEM F4  NO CONTROL OF MOTOR-GENERATOR POWER SOURCE OCV WITH 'OPEN CIRCUIT VOLTAGE' CONTROL.

With unit at idle check light 2D.

is light 2D ON?

YES

If unit is an NA-3, replace reed switch, 4CR. If it is an NA-4, replace circuit sensor P.C. board.

NO

Replace logic board

PROBLEM F5  LIMITED OR ERRATIC CONTROL OF MOTOR-GENERATOR POWER SOURCE OCV WITH 'OPEN CIRCUIT VOLTAGE' CONTROL ONLY.
PROBLEM G1 & J1  CIRCUIT BREAKER TRIPS WHILE FEEDING WIRE

Set 'Inch Speed' approximately the same as weld speed. While inching down, check the motor armature current in lead #541 at the terminal strip in the control box. This current should not exceed 2 amps D.C. average.

If this current is too high, check for possible external loading such as bent electrode, dirty electrode, milling guide tubes, clogged nozzle, etc.

If there is no indication of external loading, check motor field voltage across #626 and 627 on terminal strip in control box. While inching down this voltage should be 98 - 130 volts D.C.

If Voltage OK? YES Replace wire feed motor

NO Replace control board

PROBLEM J3  CIRCUIT BREAKER TRIPS WITH WIRE FEEDER AT IDLE.

Turn OFF 'Control Power' switch on control box cover. Unplug three harness plugs to logic board and one harness plug from V.V. board (if installed). Harness lead plugs from optional 'Start Controls' or 'Crater Controls' boards, if installed, can remain plugged into logic board. Turn on 'Control Power' switch.

If breaker trip does YES

NO

Turn OFF 'Control Power' switch and unplug 2 harness plugs from control P.C. board. Turn ON 'Control Power' switch.

If breaker trip does YES

NO Replace Control board

Replace V.V. board

Problem is in leads. When checking leave all P.C. boards disconnected from harness.
PROBLEM H1  TRAVEL CIRCUIT WON'T RUN AT ALL.
1. Faulty travel switch.
2. Wiring between travel switch and travel unit.
3. Travel unit is defective

PROBLEM H2  TRAVEL CIRCUIT WON'T RUN WITH SWITCH SET ON 'AUTOMATIC TRAVEL'.
Check light 2H when travel should normally be running in auto position.

- Is light 2H ON?
  - Yes: Check voltage between leads #532 & 625 at 2CR.
  - No: Remove lead #589 from 2CR. Check resistance of 2CR coil.
  - Is coil resistance 10KΩ ± 10%?
    - Yes: Replace travel switch, S2
    - No: Replace 2CR

PROBLEM H3  TRAVEL CIRCUIT RUNS CONTINUOUSLY WITH SWITCH SET ON 'AUTOMATIC TRAVEL'.
Check light 2H when travel should normally be OFF.

- Is light 2H OFF?
  - Yes: Replace 2CR
  - No: Check voltage zero volts AC

PROBLEM H4  TRAVEL CIRCUIT WON'T RUN WITH SWITCH ON 'HAND TRAVEL'. RUNS OK WITH SWITCH SET TO 'AUTOMATIC TRAVEL'.
Replace travel switch, S2.
PROBLEM K3  POWER SOURCE CONTACTOR DOES NOT DROP OUT

When contactor should normally be open, observe light 2K.

- light 2K OFF? NO Replace logic board
  YES

- Locate lead #2 going from terminal strip to input receptacle. Remove lead at terminal strip.
  - contactor out? NO
  YES Replace relay 3CR

- Problem is with power source pilot relay or contactor

PROBLEM K4  WELDING DOES NOT STOP WHEN ‘STOP’ BUTTON IS PRESSED.

- Momentarily shut OFF ‘Control Power’ switch and then turn it back ON.

- While pressing ‘Stop’ button, observe light 2C.
  - light 2C ON? YES Replace logic board
    NO
    - Place a jumper across the terminals of the ‘Stop’ switch and observe light 2C.
      - light 2C ON? YES Replace ‘Stop’ switch
        NO
        Problem is in leads to ‘Stop’ switch.

PROBLEM K5  BURNBACK TIME CANNOT BE SET PROPERLY.

Replace logic board
**Problem L1**  FLUX VALVE OR WATER/GAS SOLENOID DOES NOT OPEN AT ALL.

- Check position of switch on flux hopper to see if it is ON.
  - When the flux valve or solenoid should normally be OPEN, observe light 2G.
    - Is light 2G ON?
      - NO
        - Remove lead #585 from relay 2CR. Check the coil resistance from this relay terminal to lead #510.
      - YES
        - Check voltage between #31 & 87 on terminal strip in control box when valve should be open. This voltage should be 102-130 AC.
          - Is voltage OK?
            - YES
              - Trouble is in flux valve or solenoid or in leads going to unit.
            - NO
              - Replace relay 1CR.
  - Replace logic board.

**Problem L2**  FLUX VALVE OR WATER/GAS SOLENOID REMAINS OPEN CONTINUOUSLY.

- When flux valve or solenoid should normally be OFF, observe light 2G.
  - Is light 2G OFF?
    - NO
      - Replace ICR relay.
    - YES
      - Is coil resistance 0OKΩ ± 10%?
        - NO
          - Replace relay 1CR.
        - YES
          - Replace logic board.

**Problem L3**  FLUX VALVE DOES NOT OPEN WHEN 'START' BUTTON IS PRESSED. OPENS WHEN ELECTRODE TOUCHES WORK.

**Problem L4**  (WHEN 'COLD' STARTING ONLY) FLUX VALVE DOES NOT OPEN WHEN WIRE TOUCHES THE WORK WHILE PRESSING 'INCH DOWN' BUTTON. WORKS OK WHEN 'START' BUTTON IS PRESSED.

- Check wire feed when electrode touches work.
  - Replace logic board.
    - YES
      - Refer to problem 89, page 14.
    - NO
      - Wire feed STOP?
        - YES
          - Refer to problem 89, page 14.
        - NO
          - Refer to problem 89, page 14.
**PROBLEM M1** OPTIONAL USER INSTALLED CURRENT ACTUATED RELAY (5CR) DOES NOT OPERATE AT ALL

Place a jumper across #528 & #539 on the terminal strip in control box. Check voltage across #510 & 681 on the terminal strip.

- **is voltage 90-120 volts DC**
  - NO → Replace logic board
  - YES → Problem is in current actuated relay itself or in leads from terminal strip to relay

**PROBLEM M2** OPTIONAL USER INSTALLED CURRENT ACTUATED RELAY (5CR) REMAINS PULLED IN CONTINUOUSLY.

With unit at idle, check voltage across #510 & #681 on terminal strip in control box.

- **is voltage 90-120 volts DC**
  - NO → Problem is in optional relay
  - YES → Observe light 2D

- **is light 2D ON?**
  - NO → Replace logic board
  - YES → If unit is an NA-3, replace reed switch 4CR. If it is an NA-4, replace the current sensor P.C. board.
PROBLEM C2 & E3  WIRE FEEDS FULL SPEED AND/OR NO POWER SOURCE OUTPUT CONTROL
DURING WELD MODE ONLY

Remove electrode from drive rolls and place a jumper across #20-#30 on terminal strip on control box. Press start button. Caution: power source output is across head and work. Observe light 2D.

- Is light 2D on bright? NO
- Press stop button and turn off power before working on unit. Check continuity of leads #539 and #528 from terminal strip to logic board. If OK, replace logic board.

- Is start P.C. board present? YES
- With start time to min. is light 4A on start board on continuously?
  - YES
  - Press stop button and turn off power before working on unit. Replace start board.
  - NO
  - Is light 2L on? NO
  - Press stop button, turn off power and replace logic board.
  - YES
  - Arc controls used in VV mode
    - Turn OFF input power switch. Locate lead #21 on the terminal strip. Remove this lead from the terminal strip and insulate the lug. Connect a DC voltmeter across #541-539 on the terminal strip. Turn ON input power switch and press start button. Caution: power source output is across head and work. Make sure CV/VV switch is in VV.

- Press stop button and turn off power. Check continuity of leads #634, #641, and #542 between wire feed speed control and logic board. Check continuity of leads #75, #78, and #77 between NA power source output control and connections at power source. Check for proper resistance of wire feed speed control (5k ~) or power source output control (10k ~).

- Is voltage OK? YES
- TROUBLE IS IN REED SWITCH IF UNIT IS AN NA-3 OR IN THE CURRENT SENSOR IF NA-4, OR IN LEADS FROM THESE UNITS TO THE TERMINAL STRIP.
- ALL
- Only
- Press stop button and turn off power before working on unit.