LINCOLN WELDERS®

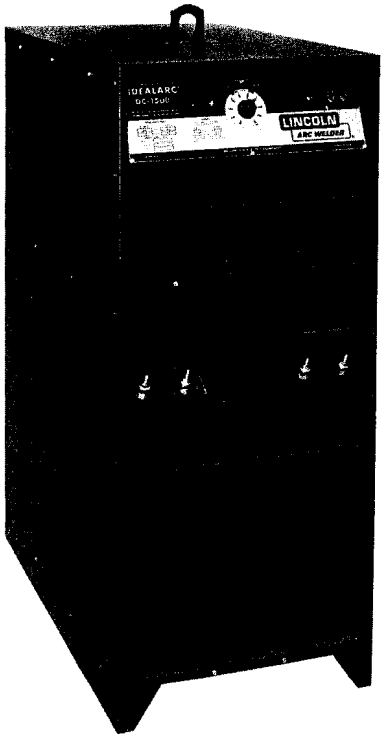
IM-280

IM280
Idealarc DC-1500
7479; 7562; 7636; 7676; 7687; 7748; 7778; 7816; 7828; 7885; 8146; 8147; 8151; 8237; 8238; 8239

OPERATING MANUAL

IDEALARC® DC-1500

Constant and Variable Voltage DC Power Source, 3 Phase Rectifier Type



This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

DAMAGE CLAIMS

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 welders are designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. Read and observe all instructions and specific safety precautions included in this manual as well as the common machine operating and welding safety precautions outlined on the back of this manual. And, most importantly, think before you act and be careful.

PRODUCT PURPOSE

The Idealarc DC-1500 is a transformer-rectifier type DC power source designed for submerged arc and open arc automatic welding.

LINCOLN® ELECTRIC **THE LINCOLN ELECTRIC COMPANY**
World's Largest Manufacturer of Arc Welding Products • Manufacturer of Industrial Motors
Cleveland, Ohio 44117 U.S.A.

INSTALLATION

Location

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

Input Wiring

Be sure the voltage, phase and frequency of the input power is as specified on the welder nameplate.

Have a qualified electrician remove the lower right side case panel and connect 3 phase AC power to terminals L_1, L_2 and L_3 of the input contactor in accordance with the National Electrical Code, all local codes and the wiring diagram located inside the machine.

The frame of the welder must be grounded. A stud marked with the symbol ⏚ located on the fan shroud is provided for this purpose. See the National Electrical Code for details on proper grounding methods.

Recommended Input Wire, Ground Wire and Fuse Sizes Based on National Electrical Code For 60 Hertz, 3 Phase Welders at 100% Duty Cycle

Input Volts	Amps Input	Copper Wire Size Type 75° In Conduit		Super Lag Fuse Size In Amps
		3 Input Wires	Grounding Conductor	
460	184	000	3	300

NOTE: The standard machines are designed to operate on 460 volt-60 Hertz, 440 volt 50-Hertz and 380 volt-50 Hertz input power systems. However, to use the machines on 380 volt-50 Hertz power, reconnect the transformer input leads in accordance with the connection diagram pasted to the inside of the lower right side case panel.

Output Connection (Turn Power Source Off)

a. Output Studs

The 'Positive' and 'Negative' output studs are located on the front panel. Two of each are provided to simplify connecting multiple electrode or work cables as suggested in the table below.

Connect the electrode cables to the 'Positive' studs for electrode positive (DC+) polarity or to the 'Negative' stud for electrode negative (DC–) polarity as required by the welding procedures. Connect the work cables to the other set of studs. Tighten the nuts with a wrench.

Suggested Copper Cable Sizes — 80% Duty Cycle		
Below 1000 amps	Two 4/0	Up to 200'
1000 to 1200 amps	Three 4/0	
1200 to 1500 amps	Four 4/0	

b. Auxiliary Power

This machine supplies the 1000 volt-amperes of 115 volt, AC power needed for the automatic wire feeders. The power is available from terminals #31 and #32 on the terminal strip.

c. "NL Option" (K-783)

Installation of an NL option is *required* when connecting a DC-1500 to LAF-3, NA-2, LT-3 or LT-34 wire feeding systems. See the section on page 4 entitled "NL Option Kit" for full information.

d. Wire Feeder Connection — Without NL Option

Turn the welder off. Remove the screw and lift the hinged door on the front of the control panel to expose the terminal strips. Connect the leads of the wire feeder input control cable to the terminal strip *exactly* as specified in the appropriate connection diagram included in the wire feeder Operating Manual. Attach the control cable to the panel at the right of the terminal strip using the clamp attached to the control cable. Close the door and replace the screw.

To connect the DC-1500 to wire feeders not covered in available connection diagrams, write to the factory for instructions giving complete nameplate information for the DC-1500 and wire feeder.

e. Optional Remote Control (K-775)

This control is included as part of the 'NL Option'. Connect it to the 'NL Option' box per instructions shipped with the option. (Not required with the NA-3, LT-7 or LT-56.)

It can be purchased separately when the DC-1500 is used for other applications.

To install, turn the power off. Remove the screw and lift the hinged door on the front of the control panel to expose the terminal strips. Connect the numbered leads to the appropriate terminals — 75 to 75, etc — on the terminal strip and the green lead to the stud marked with the symbol ⏚. Attach the control cord to the panel at the right of the terminal strip using a suitable clamp. Close the door and replace the screw. The Remote Control cord can be lengthened to any length by properly splicing an appropriate four conductor rubber-covered cable to the standard 25' cord before connecting to the DC-1500 terminal strip.

f. Connecting for Air Carbon Arc

To use the DC-1500 for air carbon arc or other applications, disconnect all wire feeder welding cables and control leads and connect a jumper between #2 and #4 on the terminal strip on the front of the DC-1500. On codes above 8234, also connect a jumper from #82

to #32. With the #2 to #4 jumper connected, the output studs are energized whenever the machine is on. **WARNING:** If the electrode leads to the wire feeder are not disconnected per instructions, the wire feeder nozzle or gun and electrode will be electrically "hot".

g. DC-1500 Paralleling Kit

A kit for field installation only, (order T-14273) is available for paralleling two DC-1500's for currents up to 3000 amperes, 100% duty cycle. Complete installation instructions are shipped with the kit.

h. Connecting for High Frequency Starting

As shipped, these welders can be used with a high frequency unit for improved automatic welding starting characteristics.

OPERATING INSTRUCTIONS

DUTY CYCLE

The DC-1500 is rated for 100% duty cycle at 1500 amps and 60 volts.

To Set Polarity

Connect the electrode cable to the 'Positive' or 'Negative' studs depending upon the electrode polarity desired. Connect the work cable to the other studs.

Set the 'Electrode Negative — Electrode Positive' switch to correspond to the polarity of the electrode cable connection. This switch setting is necessary for proper operation of the Lincoln wire feeder attached to the power source.

To Start the Welder

Press the 'On-Off' pushbuttons to start and stop the welder. The red pilot light near the center of the control panel indicates when the welder is on.

To Set for Machine or Remote Control

The output can be controlled either at the wire feeder or the DC-1500. When the NL Option Kit is installed, however, output is controlled only from the K-775 Remote Control usually mounted at the wire feeder.

To adjust the output from the wire feeder, set the toggle switch on the front of the DC-1500 to 'Output Control Remote'. To adjust the output using the DC-1500 'Output Control' rheostat, set this switch to 'Output Control at DC-1500'.

To Set the Welder Output

With the toggle switch set to 'Output Control at DC-1500', rotating the 'Output Control' rheostat on the DC-1500 from 1 to 10 increases the machine output from minimum to maximum. The same full range control is set from the wire feeder or K-775 when the toggle switch is set to 'Output Control Remote'.

Set the output as required by the welding procedures.

To Set for Constant or Variable Voltage Output

The toggle switch labeled CV Innershield, CV submerged arc, VV submerged arc, is used to select the proper welder characteristics for the process being used.

The CV Innershield Mode permits the DC-1500 to produce essentially a flat output characteristic that can be varied from approximately 20 to 60 volts. In this position the dynamic characteristic of the machine under welding conditions provides optimum welding characteristics for Innershield welding and most other open arc processes.

The CV Submerged Arc Mode also produces an essentially flat output characteristic that can be varied from approximately 20 to 60 volts. The dynamic characteristics of the CV Submerged Arc Mode are such that excellent submerged arc welding can be obtained for most procedures that previously required a variable voltage type power source.

The VV Submerged Arc Mode permits the DC-1500 to produce a variable voltage output characteristic through the range of 200A-28V to 1500A-60V with an open circuit votlage of 98 volts. Although almost all submerged arc welding can now be done in the CV mode, the VV mode is available for those procedures where VV may still be desirable.

Set-up for Various Processes

Selection of mode switch position — There are several general rules to follow in the selection of the mode switch position.

1. Use the CV Innershield mode for all Innershield welding and air carbon arc cutting with 5/8" and smaller carbons. (Limited 3/4" air carbon arc cutting is possible if output control is set at #5 to keep currents below 1300 amps.)
2. Use the CV Submerged Arc mode for most submerged arc welding. However, some high speed welding procedures may perform better on the CV Innershield mode.
3. The VV mode is available for high current, large puddle submerged arc procedures that cannot be done as well with the constant voltage mode.

General Set-Up Procedures When Using DC-1500 and Lincoln Automatic Head NA-3 (Read the following and refer also to the chart on page 5.)

1. *NA-3* — The NA-3 should be set for the mode being used on the power source. If using either of the CV

modes, the NA-3 VV board switch should be set for CV. If the power source is used in the VV mode, then the NA-3 VV board mode switch should be placed in the VV position.

All NA-3's when used with the DC-1500 are capable of cold starting with the variable voltage board mode switch in VV. Cold starting permits the wire to be inched down to the work, automatically stop and automatically energize the flux hopper valve. All NA-3's made after September 1976, are capable of cold starting on either CV or VV settings of the variable voltage board switch when used with the DC-1500.

2. *Arc striking with DC-1500 mode switch on CV sub-arc or CV Innershield* — There are a number of basic techniques for good arc striking that apply to all processes and power sources. It may not be necessary in every application to follow these guidelines, but when striking problems do occur, following the suggestions below should provide trouble-free starting. These procedures apply to all single solid wire, Innershield wire, and Twinarc 1/8 and 3/32 solid wire.
   a. Except for long stickout Innershield procedures and Tiny Twinarc 1/16 procedures, an NA-3 start board is *not* needed. If a start board is *not* needed, *it should be removed* from the machine, or at least disconnected and the logic board jumper plug replaced. Leaving it connected makes the setup for arc striking more difficult. Also, if a crater board is *not* needed, it should be removed from the NA-3 or at least electrically disconnected and the jumper plug replaced.
   b. Cut electrode to a sharp point.
   c. For cold starts, make certain work piece is clean and electrode makes positive contact with plate.
   d. For hot starts, travel should be started before wire contacts the work ("on the fly" starting).
   e. *DC-1500, Codes Below 8146:*
   Set NA-3 open circuit voltage control to 4 and the inch control to 2.

   DC-1500, Codes 8146 and Higher:
   Set NA-3 open circuit voltage control to approximately the same setting as the weld setting. For initial test welds, choose the voltage setting based on the table below. Set the inch control to 2.

Approximate Voltage	Voltage Control Setting
22-24	2
34-36	4
46-48	6
56-60	8

   All Codes:
   These are approximate settings only until the welding procedure has been set.

   It should be noted that with the DC-1500 the OCV required for optimum starting is lower than that required with other type power sources.

   f. Run a test weld, setting the proper current, voltage and travel speed.

   g. Once the proper welding procedure is established and if the start is poor — wire blast-off, stub, etc., adjust the OCV and inch speed for optimum starting. In general, a low inch speed will provide the best starting.

   Adjust the OCV by making repeated starts and observing the voltmeter action.

   With proper adjustment of the OCV control, the voltmeter needle will swing smoothly up to the desired arc voltage and thus provide repeatable starts.

   If the voltmeter swings *above* then back to the desired welding voltage, the OCV setting is *too high.* This usually results in a bad start where the wire tends to "blast-off".

   If the voltmeter needle *hesitates* before coming up to the desired voltage, the OCV is set *too low.* This will cause the electrode to stub.

   h. For Twinarc welding, clipping both wires to equal lengths will be beneficial to make consistently good starts.

3. *Single Innershield Wire* — Procedures and techniques are the same as above, except starting is generally better "hot" than "cold". For electrical stickouts above 1¾ an NA-3 start board is required.

4. *Twinarc Innershield* — Procedures and techniques are the same as above, except starting is generally better "hot" than "cold". Use of an NA-3 start board improves starting.

5. *Twinarc Submerged Arc 1/16* — Procedures and techniques are the same as above, except starting is best when using CV Innershield and the NA-3 start board.

6. *Use of the NA-3 Start Board* — For those processes above that recommend use of the NA-3 start board, the following method should be used to set up the procedure.
   a. Set start time at 0 and start current and voltage at mid-range. Start the weld and set the proper current and voltage for the welding procedure.
   b. Turn the start board timer to maximum.
   c. Set start board current one to one-and-a-half dial numbers below NA-3 front control settings.
   d. Place start board's voltage control approximately equal to NA-3 voltage control setting.

   When set per c and d, above, the starting only procedure will provide a current setting lower than the NA-3 current setting and a voltage setting nearly equal to the desired welding procedure.

   e. With the start board time delay set at maximum, establish the correct arc striking procedure as described previously by changing OCV and inch speed.
   f. Now increase the start board current and voltage to bring the start current and voltage closer to the welding procedure. The start board current and voltage should be as close to the welding proce-

RECOMMENDED SETUP PROCEDURES FOR NA-3 — DC-1500

Equipment and Control Setting	INNERSHIELD (1)			SUBMERGED ARC (2)				AIR CARBON ARC CUTTING
	Single Innershield Stickout Under 1¾"	Single Innershield Stickout Over 1¾"	Twinarc Innershield	Single Solid Wire	Tiny Twinarc 1/16 (3)	Tiny Twinarc Over 1/16	High Current Very Large Puddle	(7) Carbon Rods 5/16" and Smaller
Wire Feed Type Control	NA-3S or NA-3N	NA-3S or NA-3N	NA-3S or NA-3N	NA-3S	NA-3S	NA-3S	NA-3S	—
NA-3S VV Board Mode Switch	CV	CV	CV	CV	CV	CV	VV	—
NA-3 Inch Speed Dial Setting	2	2	2	2	2	2	2	—
NA-3 OCV Control	(8)	(8)	(8)	(8)	(8)	(8)	6.5 — 7.0	—
NA-3 Start Board	(6)	Req'd. (4)	Req'd. (4)	(6)	(6)	(6)	(6)	—
DC-1500 Output Control Switch — Machine or Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Machine
DC-1500 Mode Switch	CV Inner-shield	CV Inner-shield	CV Inner-shield	CV Submerged arc (5)	CV Inner-shield	CV Submerged arc (5)	VV	CV
DC-1500 Output Control	Inoperative	Inoperative	Inoperative	Inoperative	Inoperative	Inoperative	Inoperative	5-6

(1) Innershield welding is normally started "hot." Start button is pressed with wire above the work.
(2) Most submerged arc welding is normally started "cold." Wire is inched down and stops automatically when it makes electrical contact with the work. (The wire should be cut to a point, and the work surface clean, for best striking.) Pressing the start button initiates welding.
(3) Starting is best with "hot" starting.
(4) If a start board is called for, refer to "Use of the NA-3 Start Board" for details on how to set the controls.
(5) Some high speed welding procedures may perform better on the CV Innershield mode. Merely change the switch between CV Submerged arc position and select the best welding.
(6) Start board is not required. It should be electrically disconnected and the jumper plug replaced.
(7) Limited ¾" air carbon arc cutting is possible if output control is set at about #5 to keep currents below 1300 amps. Above this value the fault protection and current limiting circuitry will operate and prevent proper operation due to shorting pulses up to 2400 amps.
(8) Set the OCV control to the same dial setting as the NA-3 voltage control. For initial test welds choose a setting from the table under 2e on page 4.

dure as possible while still getting satisfactory starts.

g. Now decrease the start time as low as possible for optimum starts.

7. Arc striking with the DC-1500 mode switch in VV.

a. NA-3 — The NA-3 variable voltage board mode switch should be set to the VV position.

b. *DC-1500, Codes Below 8146:*
The OCV control should be at minimum.

DC-1500, Codes 8146 and Higher:
Set OCV control at 6.5 to 7.0.

c. Other techniques recommended in the previous sections for good arc striking apply here also.

NL Option Kit (Not Required With NA-3, LT-7 or LT-56.)

The K-783 NL option kit (for field installation) is designed to permit use of the NA-2, LAF-3, LT-3 and the LT-3 section of the LT-34 tractor with DC-1500's assigned code 7687 and above. It provides the necessary DC control power for the operation of the equipment and the necessary circuitry for proper inching, cold starting and arc striking. **In using the NL option kit, a K-775 remote field control is required and is included as part of the option kit.** (See page 2, paragraph e.)

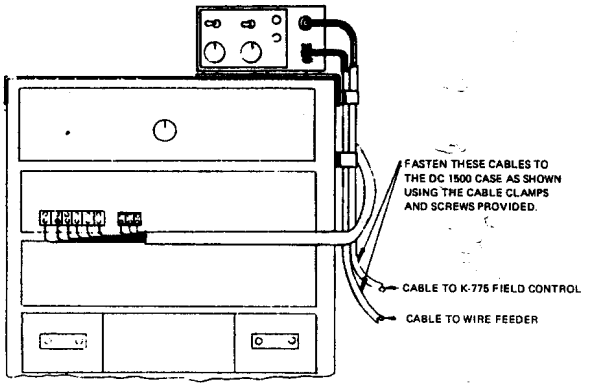
The NL option kit consists of a sheet metal box, 12.5" long, 11.5" deep and 5.7" high. This box mounts on top of the DC-1500 and the following controls are located on the front of the box:

1. Inch speed control — used for LT tractor only.
2. Hot start control — used to obtain optimum arc striking.
3. Polarity switch — changes polarity of control circuit to correspond with electrode polarity.
4. Contactor dropout delay switch — switches in or out a slight contactor dropout delay to prevent sticking of the wire in the crater at the end of welding.

The terminal strip for connection to the automatic equipment is located under the front cover. All necessary control leads for connection to the DC-1500 are wired into the NL kit for easy connection to the DC-1500 terminal strip.

Before proceeding with any installation, be certain the DC-1500 is turned off.

1. Mount the NL option box to the top of the DC-1500 with the screws used to fasten the roof and sides.
2. Remove the cover of the NL option for access to the terminal strips.



3. Feed the control cable from the automatic wire feed control unit through the grommet on the front of the NL box. Connect the control leads per the appropriate connection diagram included at the back of this manual. Secure the cables to the case with the clamps and screws provided.
4. Using the same diagram, connect the leads from the option kit to the DC-1500 terminal strip.
5. Feed the K-775 control cable through the clamp on the front of the NL option box and connect the leads to terminals 75, 76 and 77 per the connection diagram.
6. Replace the cover. This completes the installation.

NOTE: An NL Option was **factory installed** inside DC-1500's built to codes 7562-NL, 7636-NL and 7676-NL. The instructions for the K-783 apply except as follows:

1. The factory-installed NL Option does not have a separate 'POS — NEG' switch.
2. The factory-installed NL Option does not have an 'Inch Speed' control.
3. It cannot be used with LT-3 or LT-34 wire feeders.
4. The fuse protecting the 115 volt DC circuit is a 2 amp fuse located on the NL Option panel inside the welder.

Operation When Connected to the NA-2

1. Set the 'POS — NEG' switch (on both NL Option & DC-1500) to correspond to the polarity of the electrode cable connection.
2. Set the mode switch on the front of the DC-1500 to 'Constant Voltage — Innershield' or 'Constant Voltage — Submerged Arc'.
3. Set the toggle switch on the front of the DC-1500 to 'Output Control Remote'.
4. Set the output as required for the procedures using the K-775 Remote Output Control shipped with the NL Option.
5. Set the NA-2 inch speed to a speed lower than welding feed speed for good starting using the control on the NA-2. The NL Option 'Inch Speed' control is not in the circuit.
6. Set the 'Hot Start Control' on the NL Option to 4.
7. Set the 'Contactor Drop-Out Delay' switch to 'Off.' Refer to the NA-2 Operating Manual for Instructions for setting the contactor drop-out delay and crater filling features built into the NA-2 circuit.

Operation When Connected to the LAF-3 and the K-783 NL Option Kit

For proper arc striking and welding when using the LAF-3 with the DC-1500 and K-783 NL Option Kit, follow the instructions below (Turn the input power off at the fuse box before working inside the machine.):

1. Connect the DC-1500, NL option, and LAF-3 per the connection diagram M-13321.
2. Remove the cover from the LAF-3 control box.
3. Remove the blue jumper lead connected between #1 on the coil of the main relay and #7 on the coil of the transfer relay. (The main relay is the upper right relay when facing the left end of the control box. The transfer relay is just to the left of the main relay.)
4. Replace the LAF-3 control cover.
5. Set the 'POS — NEG' switch (on both the NL Option and the DC-1500) to correspond to the polarity of the electrode cable connection.
6. Set the mode switch on the front of the DC-1500 to 'Variable Voltage.'
7. Set the toggle switch on the front of the DC-1500 to 'Output Control Remote.'
8. Set the DC-1500 welding current as required by the procedures using the K-775 Remote Output Control shipped with the NL Option.
9. Set the LAF-3 'Inch Speed' control near minimum so the electrode touches the work lightly before starting the arc. The NL Option 'Inch Speed' control is not in the circuit.
10. Set the 'Hot Start Control' on the NL Option at #2. This setting does not change the open circuit voltage, but it will improve starting, particularly at low currents. Adjust the control for optimum starting.

    (**NOTE:** The "Hot Start Control" does not affect the starting method of the LAF-3, i.e., "cold" start, "hot" start, etc. See IM-198-B, Sec. 2.4.9).
11. Set the NL Option 'Contactor Drop-Out Delay' switch to 'On.' This circuit delays opening of the output contactor for a fixed length of time after wire feeding stops to prevent sticking.

Operation When Connected to the LT-3 or LT-34

Follow the same instructions as above except in Step 1, connect per M-13322. Omit Steps 2, 3 and 4. Set the 'Inch Speed' control on the NL Option as low as possible so the electrode touches the work piece lightly before starting the arc.

Overload Protection

The NL Option kit includes two fuses on the front panel. The upper fuse (2 amp slow blow) protects the inching circuit when the option is used with LT-3 and LT-34 wire feeders. The lower fuse (2.8 amp slow blow) protects the 115 volt DC circuit (#1 and #2). If replacing either fuse use the same size and type.

MAINTENANCE

Have a qualified electrician do all installation, maintenance and trouble shooting work. Turn the power off at the fuse box before working inside the machine.

General Maintenance

1. The fan motors have sealed bearings which require no service.
2. In extremely dusty locations, dirt may clog the air channels causing the welder to run hot. Blow out the welder with low pressure air at regular intervals. Also blow dirt out of the NL Option box.

Overload Protection

The DC-1500 has built-in protective thermostats. If the rectifier or transformer reaches the maximum safe operating temperature because of frequent overload or high room temperature plus overload, the contactor drops out stopping the welder. The thermostats automatically reset when the temperature reaches a safe operating level. Press the 'On' button to start the welder.

The power rectifiers are also protected by a special solid state circuit. With the occurrence of a short circuit or excessively high overloads, the input contactor opens. When the overload is removed, press the 'On' button to start the welder.

An 8 amp fuse located on the front of the machine protects the 115 volt auxiliary AC circuit (#31 and #32) from overload. If replacing, use the same type and size fuse.

TROUBLE SHOOTING GUIDE

NOTE: To locate the "Firing Circuit" and "Control/Fault Protection Circuit" P.C. boards, remove the upper case panel on the left side of the machine. The names are printed on the boards.

TROUBLE	CAUSE	WHAT TO DO
Input contactor (CR1) chatters.	1. Faulty input contactor (1CR). 2. Low line voltage. 3. Faulty pilot relay (2CR).	1. Repair or replace. 2. Check with power company. 3. Replace relay.
Machine input contactor does not operate.	1. Supply line fuse blown. 2. Contactor power circuit dead. 3. Broken power lead. 4. Wrong input voltage. 5. Primary or power SCR thermostats open. 6. Open input contactor coil. 7. Faulty on-off switch. 8. Faulty pilot relay (2CR).	1. Replace if blown. Look for reason first. 2. Check pilot transformer T_1 and associated leads. 3. Check input voltage at contactor. 4. Check voltage against nameplate. 5. Check for overheating. Make sure both fans are operating and there is no obstruction to free air flow. Faulty thermostats — replace. 6. Replace coil. 7. Replace switch. 8. Replace relay.
Machine input contactor operates but no output when trying to weld.	1. Electrode or work lead loose or broken. 2. Open main transformer (T_5) primary or secondary circuit. 3. 'Firing Circuit' P.C. board not connected or is faulty. 4. Output pilot relay (6CR) not operating or faulty.	1. Repair connection. 2. Repair. 3. All nine light emitting diodes (101 thru 109) must be lit. (See 'P.C. Board Trouble Shooting Guide".) 4. Check relay by connecting a jumper across terminals 2 and 4 on DC-1500 terminal strip. Replace if faulty.
Machine has maximum output but no control.	1. 'Output Control' switch (SW_4) in wrong position. 2. 'Output Control' switch faulty. 3. Open in feed back circuitry. 4. Faulty 'Control/Fault Protection' or 'Firing Circuit' P.C. boards. 5. Output control potentiometer open (lead no. 75).	1. Check position of swtich. 2. Check switch and replace if faulty. 3. Check wiring and control and 'Firing Circuit.' P.C. board wiring harness plugs. 4. All light emitting diodes must be lit, except 104 on 'Control/Fault Protection' board. (See "P.C. Board Trouble Shooting Guide.") 5. Check and replace if faulty.

TROUBLE	CAUSE	WHAT TO DO
Machine does not have maximum output.	1. One input fuse blown.	1. Check and replace if blown after checking for reason for blown fuse.
	2. One phase of main transformer open.	2. Check for open and repair.
	3. Faulty "Control/Fault Protection" or "Firing Circuit" P.C. boards.	3. All light emitting diodes must be lit on both P.C. boards, except 104 on "Control/Fault Protection" board. (See "P.C. Board Trouble Shooting Guide.")
	4. Output control potentiometer defective.	4. Check and replace if faulty.
	5. Output control potentiometer leads open 226, 237, 236, 76, 77.	5. Check and repair broken leads.
Machine has output but trips off immediately.	1. Machine has either an internal or external short circuit on the output.	1. Check internally and externally for any shorts and remove or repair.
	2. Faulty 'Control/Fault Protection' P.C. board.	2. If no short circuits, LED 104 must be lit (See "P.C. Board Trouble Shooting Guide.")
Variable or sluggish welding arc.	1. Poor work or electrode connection.	1. Check and clean all connections.
	2. Welding leads too small.	2. Check table on page 2.
	3. Welding current or voltage too low.	3. Check procedures for recommended settings.
Machine will not shut off.	1. Input contacts frozen.	1. Check for approximately .13 inch over travel of contacts.
	2. Pilot relay contacts stuck closed.	2. Check and replace if necessary.
Output control not functioning on the machine.	1. 'Output Control' switch in the wrong position.	1. Place switch in 'Output Control at DC-1500.'
	2. Faulty output control switch.	2. Check and replace if found faulty.
	3. Faulty 'Output Control' rheostat.	3. Check and replace if found faulty.
	4. Leads or connections open in 'Control Circuit.'	4. Check lead continuity and connections for an open and repair if necessary.
	5. Faulty 'Firing Circuit' or 'Control/Fault Protection' P.C. board.	5. All light emitting diodes must be lit on both P.C. boards, except 104 on "Control/Fault Protection" board. (See "P.C. Board Trouble Shooting Guide.")
Output control not functioning on remote control.	1. 'Output Control' switch in the wrong position.	1. Place switch in 'Output Control Remote.'
	2. Faulty output control switch.	2. Check and replace if found faulty.
	3. Faulty remote control rheostat.	3. Check and replace if found faulty.
	4. Leads or connections open in 'Control Circuit.'	4. Check all leads and connections, internal and remote, for continuity and repair if necessary.
	5. Faulty 'Firing' or 'Control/Fault Protection' P.C. board.	5. All light emitting diodes must be lit on both P.C. boards, except 104 on "Control/Fault Protection" board. (See "P.C. Board Trouble Shooting Guide.")
Poor starting	1. 7CR not operating properly.	1. Check LED L2. It should be off until welding current flows. If not, check 7CR for proper operation.
		2. 3CR reed switch not operating properly.
		3. Possible defective control board.
Output stays at minimum — will not start (VV mode)	1. Open connection between control board and mode switch through 7CR.	1. Check 7CR relay.
		2. Check 3CR reed switch if 7CR relay is not pulling in.
Machine trips off with High Current Procedures on starting	1. OCV setting too high.	1. Reduce OCV setting.
	2. Defective control board.	2. Replace control board.
Machine trips off with High Current Air Carbon Arc Procedure.	1. Carbon rod arc length too short.	1. Hold longer arc without shorting rod to work.
	2. Machine output setting too high.	2. Reduce output control setting.
Blast at end of weld.	1. Defective 7CR starting relay assembly.	1. Check by hooking machine to load of at least 200 amps. Remove load and watch LED L2 on control board. L2 must dim gradually. If L2 dims immediately, 7CR starting relay assembly is defective.

P.C. BOARD TROUBLE SHOOTING GUIDE

WARNING: Have a qualified electrician do the trouble shooting work. When the sides are off and the power on, take special care to avoid contact with electrically "hot" terminals while using the following guide.

Control/Fault Protection P.C. Board

1. LED 101 indicates AC input voltage is present at pins 255-256. If not lit, check the voltage across the secondary winding of the control transformer T7. The voltage should be approximately 115 volts. If not, the problem is in the power supply and not the P.C. board.
2. LED 102 indicates welder output voltage is being supplied to the control circuit. If not lit, check to make certain 222 from pin 2 of the 12-pin control circuit P.C. board connector is connected to the power source negative output stud, and is not broken.
3. LED 103 indicates power is being applied to fault protection relay 2CR. Input contactor should be

closed.

4. LED 104 indicates when fault protection circuit is being activated.
5. LED 105 indicates a control signal is being supplied to the firing circuit. As the output control is varied, LED 105 should change brilliancy.

Firing Circuit P.C. Board

With a jumper between 2 and 4, all nine light emitting diodes must be lit when the power source is turned on. If not, follow the following procedure:

1. *Light 307* indicates AC power being supplied to P.C. board from control transformer T2. If not lit, check voltage across terminals 203 and 204 on the terminal strip located on the left side of the bottom fan baffle. Voltage should be approximately 115 volts. If no voltage indicates a supply problem, check wiring and transformer. If voltage is present, turn the machine off, remove the 12-pin harness plug from the P.C. board, turn the machine back on and check the voltage across pins 2 and 3 on the plug. This should be approximately 115 volts. If no voltage and there is voltage at terminals 203 and 204 on terminal strip TS_1, this indicates a broken lead or loose terminal on either lead 203 or 204. If voltage is present and light 307 is not lit, replace P.C. board.
2. *Light 308* indicates AC power being supplied to P.C. board from control transformer T3. If not, follow the same procedure as above in (1) for terminals 205 and 206 on terminal strip TS_1 and pins 5 and 6 on the connector.
3. *Light 309* indicates AC power being supplied to P.C. board from control transformer T4. If not, follow the same procedure as above in (1) for terminals 207 and 208 on terminal strip TS_1 and pins 9 and 12 on the connector.
4. *Lights 301 through 306* indicate gate signals are being supplied to the main power SCR's 301 through 306 respectively. If light 205 on the "Control/Fault Protection" circuit P.C. board and lights 307 through 309 on the "Firing" circuit P.C. board are lit and lights 301 through 306 are not lit, check lead 231 between the "Firing" P.C. board and the "Control/Fault Protection" P.C. board that it is not broken and is connected to each connector. If the lead shows continuity and lights 301 through 306 are not lit, replace the "Firing Circuit" P.C. board. If any one of the lights 301 through 306 is not lit and lights 307 through 309 are lit, replace the "Firing Circuit" P.C. board.

   If trouble shooting guide indicates a possible P.C. board problem, the guide on page 10 can be used to locate the problem.

NL OPTION KIT TROUBLE SHOOTING GUIDE

NOTE: Referenced Relays are in the NL Option Kit.

TROUBLE	CAUSE	WHAT TO DO
A. Wire will not inch down.	Polarity switches on NL option or DC-1500 not in proper position.	Set polarity switch on DC-1500 and NL option to same polarity as electrode polarity.
	Loss of voltage to motor.	Check voltage from lead 67 to lead 290. It should be 17 to 20V DC.
B. Wire inches down but will not stop when it hits the work.	Leads improperly connected to DC-1500 terminal strip, or to NL option terminal strip.	Check for good tight connections, connected per connection diagram for automatic equipment being used.
	Work lead not connected.	Connect work lead to work.
	Automatic stop relay (4CR) not operating.	Check Fuse F2. Check for loose connection. Check for defective 4CR relay.
C. Arc will not strike.	Output circuit of DC-1500 not being turned on.	Fuse F1 blown — replace after first checking reason for blown fuse.
		Check operation of relays 1CR and 2CR when automatic start button is pressed. If 1CR is OK but 2CR does not operate, check voltage across terminals 294, 295 on P.C. board.
		Voltage should be 115V. If voltage is present, check relay 2CR for open coil, loose leads, etc.
		If voltage is not present, check terminals 1 and 4 on P.C. board. If voltage is present, P.C. board is defective.
		If no voltage is present at pins 1 and 4, check circuitry supplying terminals 1 and 4 on P.C. board.
D. No control with control potentiometer.	Machine-remote switch on DC-1500 in machine position.	Place machine-remote switch on DC-1500 in remote position.
E. Welding is controlled by hot start control instead of remote field control (or automatic control unit potentiometer.)	3CR is not operating.	Check lead no. 22 on terminal strip in NL option for proper connection per connecting diagram for equipment being used.
		Check 3CR for loose leads or open coil.

OUTLINE FOR DC-1500 TROUBLE SHOOTING GUIDE

NO WELDER OUTPUT
(INPUT CONTACTOR "ON", TERMINALS 2 AND 4 CLOSED)

CHECK CONTROL BOARD LED 105

- IF OFF → CHECK LED 101
  - IF OFF → CHECK AC INPUT TO "CONTROL/ FAULT PROTECTION" BOARD POSSIBLE DEFECTIVE T7 TRANSFORMER
  - IF ON → REPLACE "CONTROL/ FAULT PROTECTION" BOARD
- IF ON → CHECK "FIRING" BOARD LED'S ALL NINE LIGHTS SHOULD BE ON
  - IF YES → CHECK GATE LEAD CONNECTIONS TO SCR'S
  - IF NO → CHECK LIGHTS 307, 308, 309
    - IF ONE OR MORE ARE OUT → CHECK AC INPUT TO BOARD, 203-204, 205-206, 207-208 POSSIBLE DEFECTIVE TRANSFORMERS T2, T3, OR T4
    - IF ON AND OTHER LIGHTS ARE OUT → REPLACE FIRING BOARD

MACHINE HAS OUTPUT BUT TRIPS OFF IMMEDIATELY

CHECK FOR SHORT BETWEEN ELECTRODE AND WORK LEADS. REMOVE EXTERNAL LEADS FROM THE OUTPUT TERMINALS

IF TROUBLE STILL PERSISTS, CHECK LED 103 ON "CONTROL/FAULT PROTECTION" BOARD

IF LIGHT GOES ON, THEN QUICKLY OUT WHEN START BUTTON IS PRESSED, "CONTROL/FAULT PROTECTION" BOARD IS DEFECTIVE AND SHOULD BE REPLACED

ERRATIC WELDING

CHECK PROCEDURE

CHECK MODE SWITCH FOR PROPER POSITION FOR PROCESS BEING USED

CHECK LED'S 304, 305, 306 FOR EQUAL BRILLIANCY

IF LIGHTS ARE NOT ALL APPROXIMATELY EQUALLY BRIGHT, REPLACE FIRING P.C. BOARD

POOR STARTING

ENERGIZE OUTPUT (JUMPER 2-4)
NO LOAD

L2 MUST BE OFF

- IF ON → CHECK 7CR AND STARTING RELAY ASEMBLY AND WIRING TO CONTROL BOARD
- IF OFF → APPLY LOAD
  L2 MUST INCREASE AS OUTPUT VOLTAGE IS INCREASED AND L5 MUST HAVE THE SAME BRIGHTNESS WITH 2-4 OPEN
  - IF NOT → CHECK 7CR
  - IF OK CHECK VV MODE OCV. ADJUST POWER SOURCE OUTPUT CONTROL
    OCV MUST STAY LOW UNIT POT IS INCREASED TO #5 OR #6 ON THE DIAL OCV SHOULD REACH MAX AT #9
    IF NOT REPLACE CONTROL BOARD

CANNOT START WELD
OUTPUT STAYS LOW — V.V. MODE
OUTPUT STAYS HIGH — C.V. MODE

CHECK 7CR CONTACTS

CONTACTS MUST CLOSE AND CONNECTION MADE FROM CONTROL BOARD TO MODE SWITCH AND NEG. OUTPUT STUD WHEN OUTPUT CURRENT FLOWS

MACHINE TRIPS OFF WITH HIGH CURRENT PROCEDURES

REDUCE OCV SETTING

IF MACHINE STILL SHUTS DOWN REPLACE CONTROL BOARD

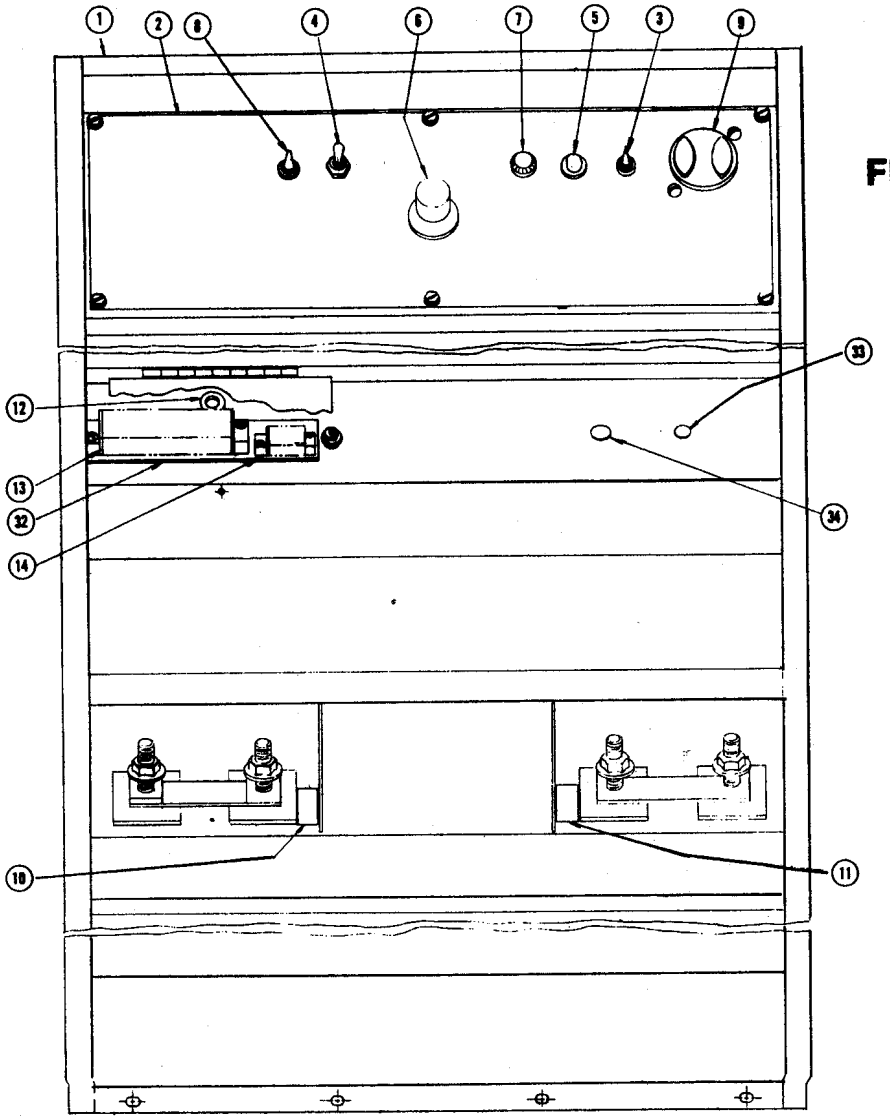
BLAST AT END OF WELD

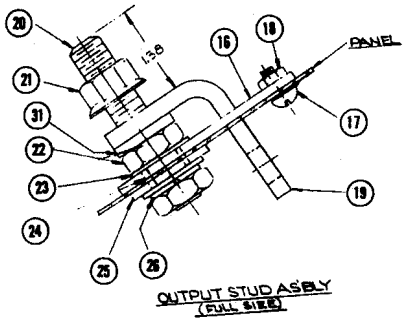
LOAD MACHINE TO 200A (OVER 40V) AND REMOVE LOAD

LED L2 MUST DIM GRADUALLY

IF NOT 7CR STARTING RELAY OR ASSEMBLY IS DEFECTIVE

FRONT PANEL ASSEMBLY



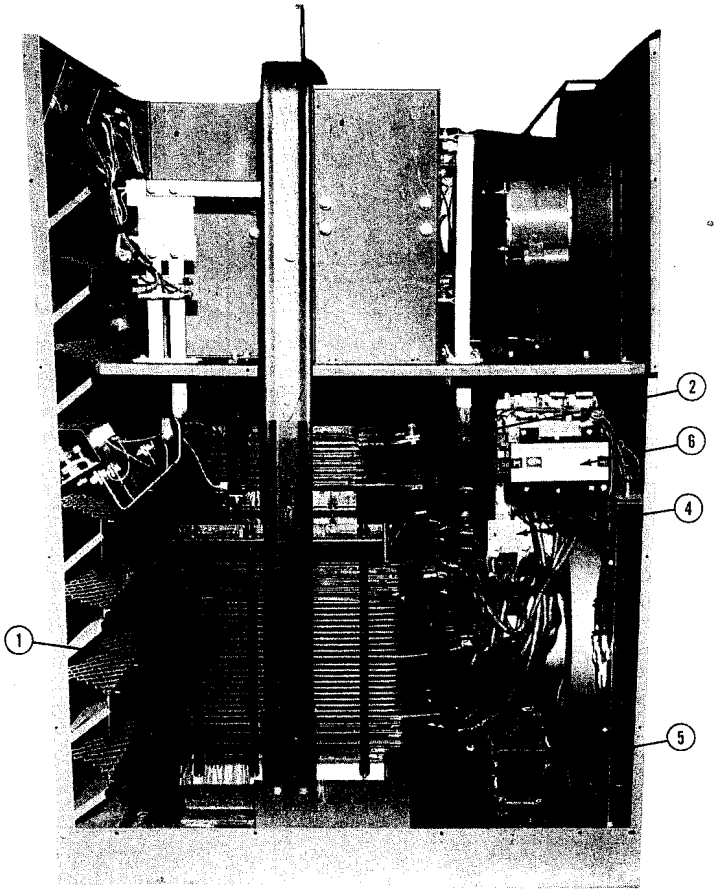


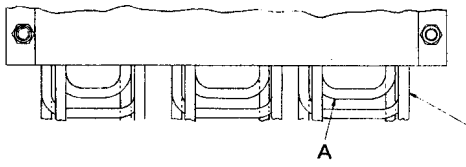
Parts List P-118-C

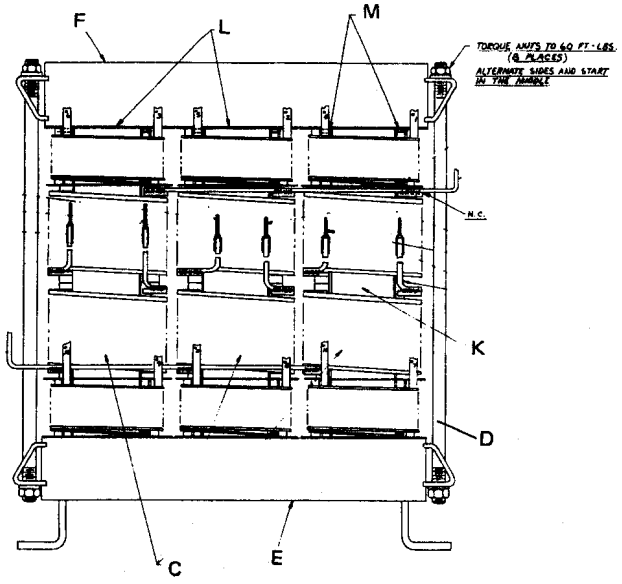
ITEM	PART NAME AND DESCRIPTION	NO. REQ'D.
1	Front Panel	1
2	Nameplate	1
3	Polarity Control Switch	1
4	Current Control Switch	1
5	Pilot Light	1
6	Output Control Potentiometer	1
	Potentiometer Insulation	1
	Knob	1
7	Fuse Holder	1
	Fuse	1
8	Voltage Control Switch	1
9	Push Button	1
10	Decal (Negative)	1
11	Decal (Positive)	1
12	Grommet	1
13	Terminal Strip	1
14	Terminal Strip	1
16	Stud Insulation	4
17	Sems Screw	4
18	Hex Nut	4
19	Connection Strap	4
20	Stud	4
21	Flanged Nut	4

ITEM	PART NAME AND DESCRIPTION	NO. REQ'D.
22	Hex Jam Nut	8
23	Plainwasher	8
24	Insulating Bushing	4
25	Insulating Washer	4
26	Lockwasher	4
31	Jumper	2
32	Number Plate	1
	Parts Not Illustrated:	
R	Roof	1
US	Upper Case Side	2
LS	Lower Case Side	2
UB	Upper Case Back	1
LB	Lower Case Back	1
	For Codes 7562-NL and 7637-NL only:	
	Hot Start Dial Plate	1
	Contactor Drop Out Delay Switch	1
	Hot Start Potentiometer	1
	Potentiometer Knob	1

INTERNAL PARTS

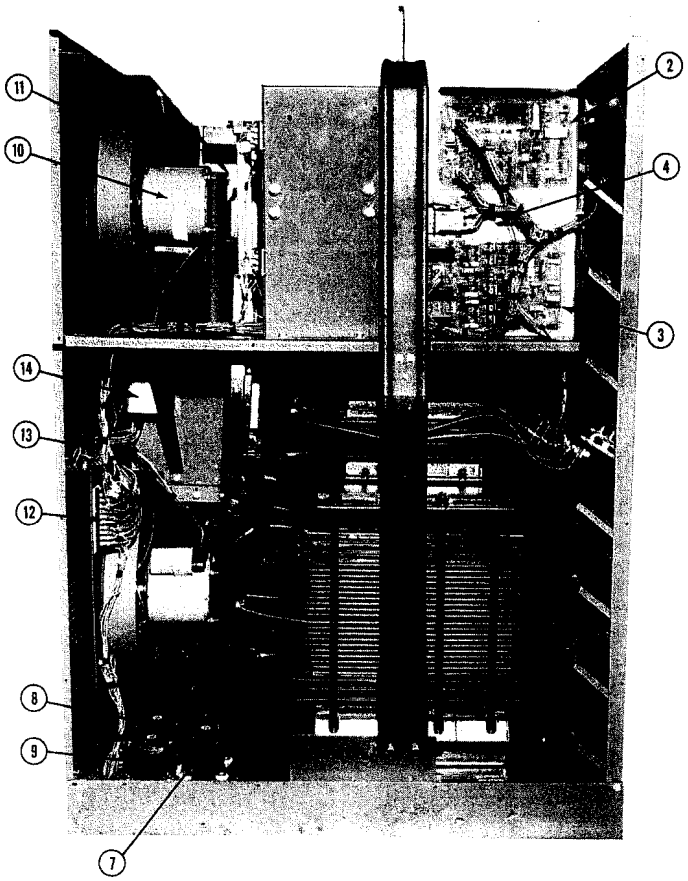






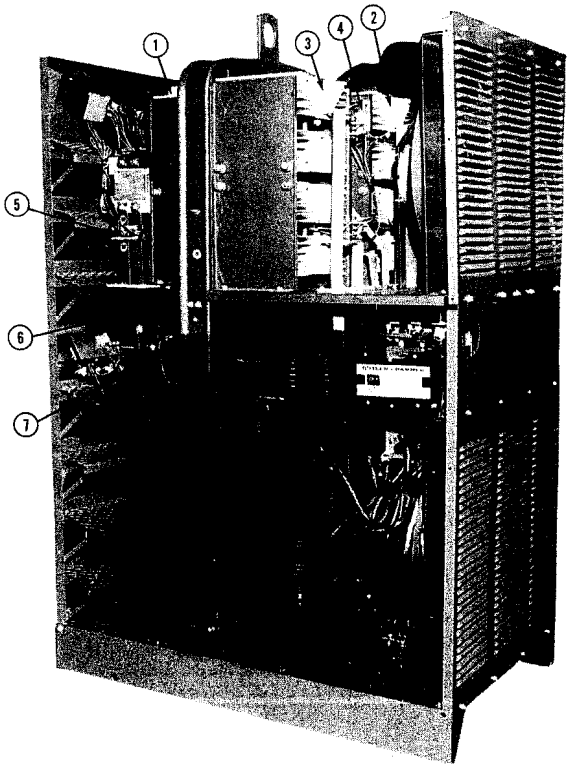
Parts List P-118-D		
ITEM	**PART NAME AND DESCRIPTION**	**NO. REQ'D.**
1	Transformer Assembly, Includes:	1
A	Inner Primary Coils	6
B	Outer Primary Coils	6
C	Secondary Coils	6
D	Studs	8
E	Lower Lamination Assembly	1
F	Upper Lamination Assembly	1
K	Middle Lamination Assembly	3
L	Insulating Barrier	12
M	Molding Compound Insert	6
2	Interphase Coil & Lamination Assembly, Includes:	1
	Interphase Coil	1
3	Primary Coil Thermostat-Not Shown	1
4	Reconnect Panel Assembly	1
5	Auxiliary Power Transformer (T1)	1
6	Line Contactor Assembly	1

INTERNAL PARTS



Parts List P-118-E		
ITEM	PART NAME AND DESCRIPTION	NO. REQ'D.
1	Fault Protection P.C. Board	1
2	Control Circuit P.C. Board	1
3	Firing Circuit P.C. Board	1
4	Relay (2 CR)	1
5	Resistor (R7)	1
6	Relay (7 CR)	1
7	Transformer (T2)	1
8	Transformer (T3)	1
9	Transformer (T4)	1
10	Fan Motor	2
11	Fan	2
12	Terminal Strip	1
	Number Plate	1
13	Control Circuit Transformer (T7)	1
14	Relay (6 CR)	1
	Relay Dust Cover	1

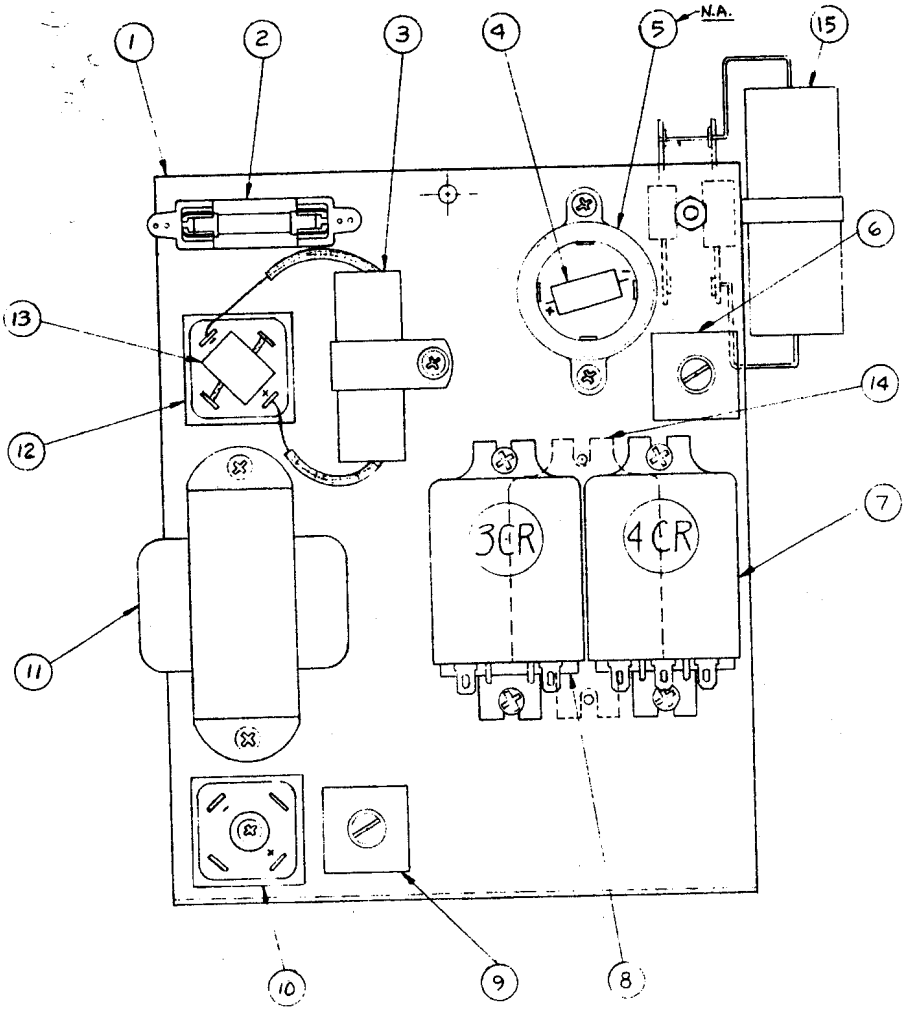
RECTIFIER ASSEMBLY

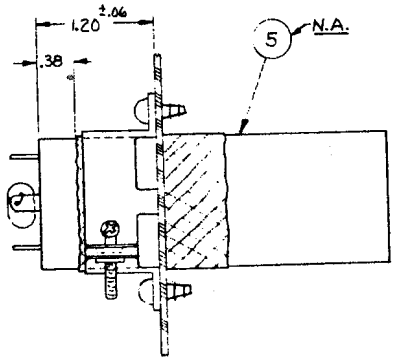


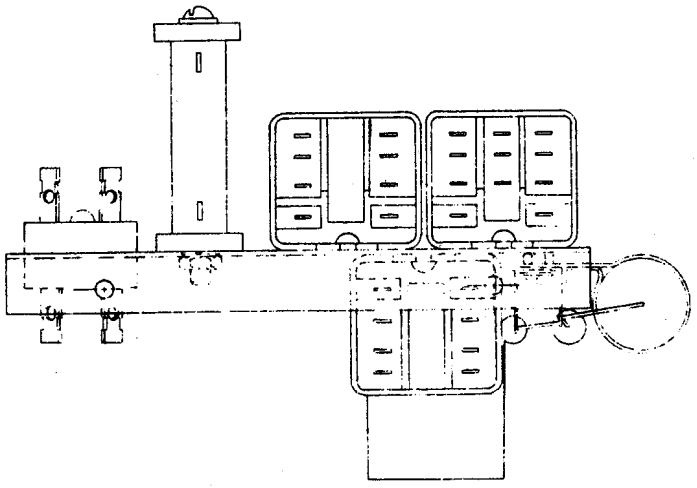
Parts List P-118-G		
ITEM	PART NAME AND DESCRIPTION	NO. REQ'D.
1	Rectifier Assembly - Front Center	1
2	Rectifier Assembly - Rear Left	1
3	Rectifier Assembly - Rear Right	1
4	Snubber P.C. Board	1
5	Shunt Assembly	1
	Reed Switch Assembly (3 CR) (Above Code 8100 Only)	1
	Reed Switch Assembly (4 CR)	1
6	Diode Heatsink Assembly	1
7	Resistor (R2) (Hidden Behind Vertical Member)	1
	Resistor Mounting Stud	1
	Resistor Insulating Washers	1

AUXILIARY POWER MTG. PANEL ASSY.

(Codes 7562-NL, 7636-NL and 7676-NL Only)



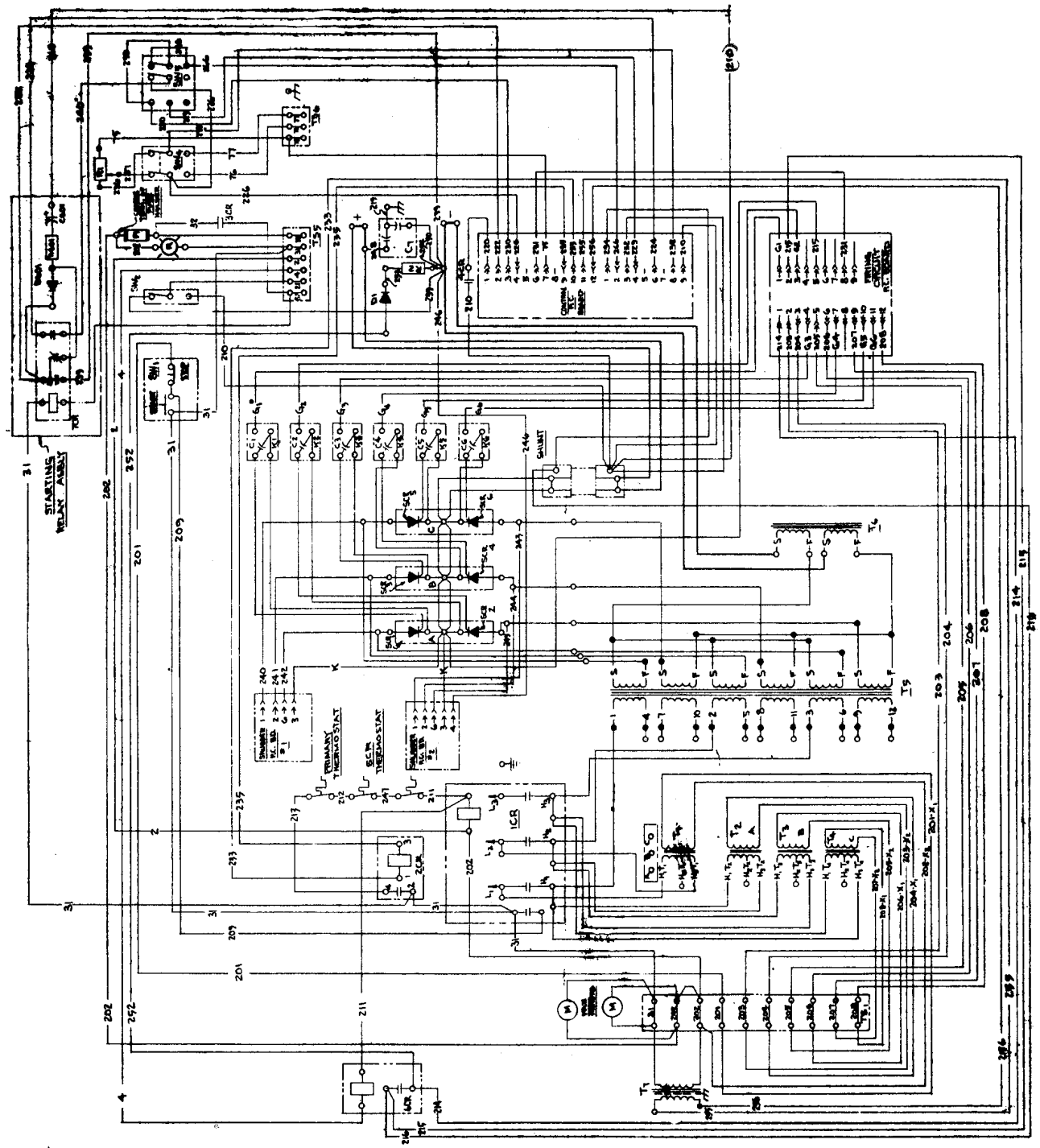




Parts List P-118-F		
ITEM	PART NAME AND DESCRIPTION	NO. REQ'D.
	Auxiliary Power Panel Assembly-Includes All Below:	1
1	Mounting Panel	1
2	Fuse Block	1
	Fuse (F1)	1
3	Capacitor Assembly (C8)	1
4	Resistor (R4)	1
5	Capacitor (C9)	1
6	Resistor (R3)	1
	Insulating Washer	2
7	AC Relay Assembly (4 CR)	1
8	Current Relay (3 CR)	1
9	Resistor (R5)	1
	Insulating Washer	2
10	Rectifier (Rect. 2)	1
11	Transformer (T8)	1
12	Rectifier (Rect. 1 & 3)	2
13	Thyrector Diode Assembly (TP1)	1
14	Auxiliary DC Relay Assembly (5 CR)	1
15	Time Delay Assembly	1

DC-1500 WIRING DIAGRAM

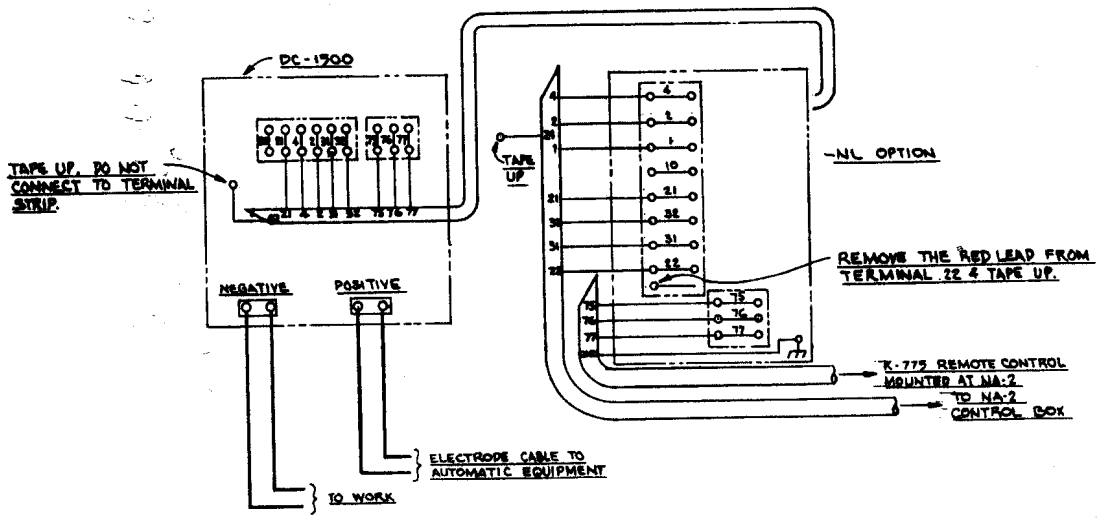
NOTE: This diagram is for reference only. It is not accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the welder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



L-6262
9-21-79B

Connection of DC-1500 With NL Option Kit (K-783) to NA-2

M-13318
9-21-79B



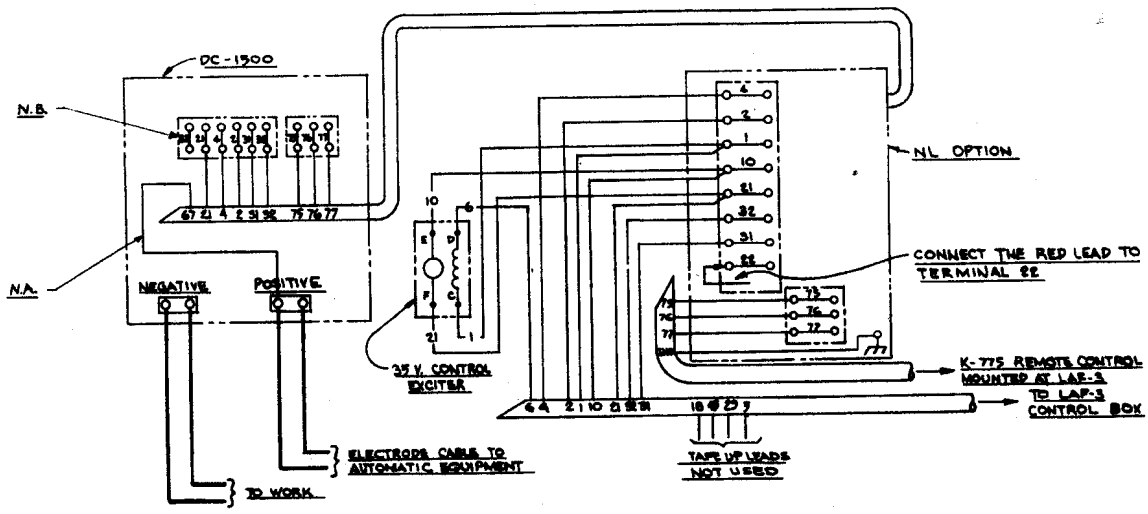
THIS DIAGRAM SHOWS THE ELECTRODE CONNECTED POSITIVE. TO CHANGE POLARITY, TURN POWER SOURCE OFF, REVERSE THE ELECTRODE AND WORK LEADS AT THE POWER SOURCE AND POSITION THE SWITCH ON THE POWER SOURCE AND NL OPTION KIT TO THE PROPER POLARITY. ALSO REVERSE THE LEADS ON THE BACK OF THE AMMETER AND VOLTMETER IN THE NA-2 CONTROL BOX.

CONTACTOR DROP OUT DELAY SWITCH ON THE NL OPTION KIT MUST BE IN THE "OFF" POSITION.

THE 4/0 CABLES SHOWN WILL HANDLE UP TO 1000 AMPS AT 80% DUTY CYCLE. FOR HIGHER CURRENTS OR DUTY CYCLE ADD ADDITIONAL CABLES TO THE POWER SOURCE OUTPUT STUDS.

Connection of DC-1500 With NL Option Kit (K-783) to LAF-3

M-13321
9-21-79B



N.A. - ON CODES ABOVE 8234 EXTEND LEAD 67 AND CONNECT IT TO THE ELECTRODE CABLE GOING TO THE AUTOMATIC EQUIPMENT.

N.B. - ON CODES BELOW 8234 THIS IS #67 AND THE LAF-3 #67 LEAD CAN BE CONNECTED EITHER TO THE #67 TERMINAL OR THE ELECTRODE CABLE TERMINAL AS SHOWN.

THIS DIAGRAM SHOWS THE ELECTRODE CONNECTED POSITIVE. TO CHANGE POLARITY, TURN POWER SOURCE OFF, REVERSE THE ELECTRODE AND WORK LEADS AT THE POWER SOURCE AND POSITION THE SWITCH ON THE POWER SOURCE AND NL OPTION KIT TO THE PROPER POLARITY. ALSO REVERSE THE LEADS ON THE BACK OF THE AMMETER AND VOLTMETER IN THE LAF-3 CONTROL BOX.

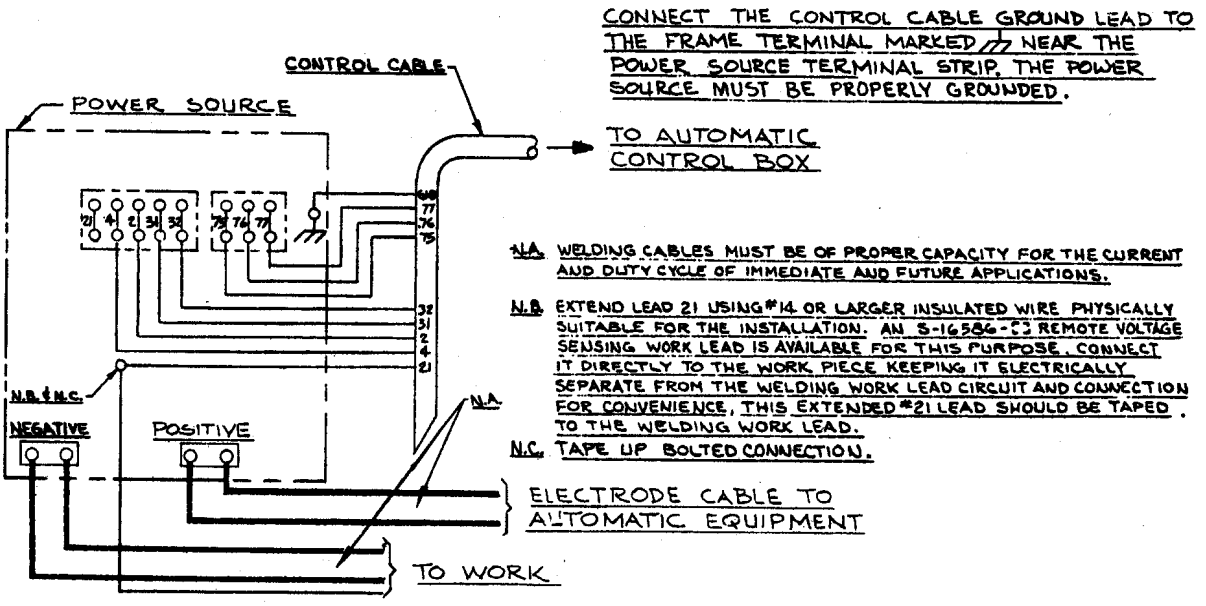
CONTACTOR DROP OUT DELAY SWITCH ON THE NL OPTION KIT MUST BE IN THE "ON" POSITION.

THE 4/0 CABLES SHOWN WILL HANDLE UP TO 1000 AMPS AT 80% DUTY CYCLE. FOR HIGHER CURRENTS OR DUTY CYCLE ADD ADDITIONAL CABLES TO THE POWER SOURCE OUTPUT STUDS.

FOR BEST ARC STRIKING WHEN CONNECTED TO AN LAF-3 MAKE THE FOLLOWING CHANGE INSIDE THE LAF-3 CONTROL UNIT. REMOVE THE BLUE JUMPER LEAD CONNECTED BETWEEN #1 ON THE COIL OF THE MAIN RELAY AND #7 ON THE COIL OF THE TRANSFER RELAY. (THE MAIN RELAY IS THE UPPER RIGHT RELAY WHEN FACING THE LEFT END OF THE CONTROL BOX. THE TRANSFER RELAY IS JUST TO THE LEFT OF THE MAIN RELAY.)

Connection of DC-1500 to NA-3 (All), LT-5 or LT-7

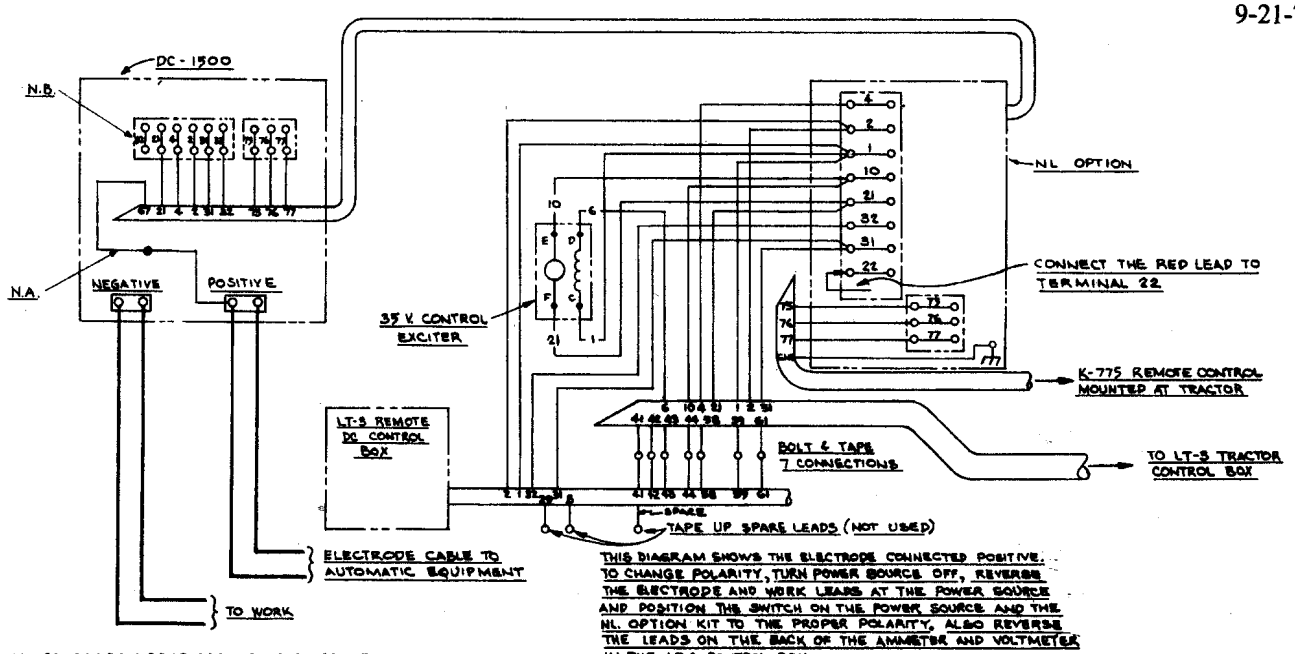
S-15534
2-24-78



ABOVE DIAGRAM SHOWS ELECTRODE CONNECTED POSITIVE. TO CHANGE POLARITY, TURN POWER SOURCE OFF, REVERSE THE ELECTRODE AND WORK LEADS AT THE POWER SOURCE AND POSITION THE SWITCH ON POWER SOURCE TO PROPER POLARITY. ALSO REVERSE THE LEADS ON THE BACK OF THE AMMETER AND VOLTMETER IN THE AUTOMATIC CONTROL BOX.

Connection of DC-1500 With NL Option Kit (K-783) to LT-3 or LT-34

M-13322
9-21-79B



NA - ON CODES ABOVE 8234 EXTEND LEAD 67 AND CONNECT IT TO THE ELECTRODE CABLE GOING TO THE AUTOMATIC EQUIPMENT

N.B. - ON CODES BELOW 8234 THIS IS #67 AND THE LT-3 OR LT-34 #67 LEAD CAN BE CONNECTED EITHER TO #67 OR TO THE ELECTRODE CABLE TERMINAL AS SHOWN.

THIS DIAGRAM SHOWS THE ELECTRODE CONNECTED POSITIVE. TO CHANGE POLARITY, TURN POWER SOURCE OFF, REVERSE THE ELECTRODE AND WORK LEADS AT THE POWER SOURCE AND POSITION THE SWITCH ON THE POWER SOURCE AND THE NL OPTION KIT TO THE PROPER POLARITY, ALSO REVERSE THE LEADS ON THE BACK OF THE AMMETER AND VOLTMETER IN THE LT-3 CONTROL BOX.

CONTACTOR DROP OUT DELAY SWITCH ON THE NL OPTION KIT MUST BE IN THE "ON" POSITION.

THE 4/0 CABLES SHOWN WILL HANDLE UP TO 1000 AMPS AT 80% DUTY CYCLE. FOR HIGHER CURRENTS OR DUTY CYCLE ADD ADDITIONAL CABLES TO THE POWER SOURCE OUTPUT STUDS.

SAFETY PRECAUTIONS

In order to protect yourself and others from possible serious injury read and observe all instructions and specific safety precautions included in this manual as well as the following general safety precautions.

1. Protect yourself from possible dangerous electrical shock:
   a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Never permit contact between "hot" parts of the circuits and bare skin or wet clothing, wear dry, hole-free gloves to insulate hands.
   b. Always insulate yourself from the work and ground using dry insulation when welding in damp locations, on metal floors, gratings or scaffolds, and particularly when in positions (such as sitting or lying) where large areas of your body can be in contact with a conductive surface.
   c. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition.
   d. Never dip the electrode holder in water for cooling.
   e. 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.
   f. If using the welder as a power source for mechanized welding, these precautions for the electrode holder also apply for the automatic electrode, electrode reel, welding head, nozzle or semiautomatic welding gun.
2. When working above floor level, protect yourself from a fall should you get a shock. Never wrap the electrode cable around any part of your body.
3. Arcburn may be more severe than sunburn. Therefore:
   a. Use a shield with the proper filter and over plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Filter lens should conform to ANSI Z87.1 standards.
   b. Use suitable clothing to protect your skin and that of your helpers from the arc rays.
   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.
4. Droplets of molten slag and metal are thrown or fall from the welding arc. Protect yourself with oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and caps over your hair. Wear ear plugs when welding out of position or in confined places.
5. Always wear safety glasses when in a welding area. Use glasses with side shields when near slag chipping operations.
6. Remove fire hazards well away from the area. If this is not possible cover them to prevent the welding sparks from starting a fire. Remember that when welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
7. When not welding place the holder where it is insulated from the work (or ground) system. Accidental contact can cause overheating and create a fire hazard.
8. Be sure the work cable is connected to the work as close to the welding area as practical. Work cables connected to the building framework or other locations some distance 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.
9. 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 on galvanized, lead or cadmium plated steel and other metals which produce toxic fumes, even greater care must be taken.
10. 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.
11. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedure will not cause flammable or toxic vapors from substances inside.
12. Vent hollow castings or containers before heating, cutting or welding. They may explode.
13. For more detailed safety information it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting — ANSI Standard Z49.1" for $5.00 from the American Welding Society, Miami, Florida 33125.

Additional Safety Precautions

The high voltage and rotating parts associated with this type of equipment require observance of these additional precautions:

1. Have all installation, maintenance and repair work performed only by qualified people.
2. Disconnect and lock out all power sources before doing any work on the equipment.
3. Make the electrical installation in accordance with the National Electrical Code and all local codes.
4. Properly ground the equipment in accordance with the National Electrical Code and the manufacturer's recommendations. The work or metal to be welded must also be connected to a good electrical ground.
5. Keep all covers and safety devices in position.
6. Keep hands, hair, clothing and tools away from all moving parts when operating or repairing equipment.

HOW TO ORDER REPLACEMENT PARTS

Order parts only from Lincoln offices or from the Authorized Field Service Shops listed in the "Service Directory". Give the following information:

(a) From the nameplate — machine model, code and serial numbers.
(b) From this manual — part name, item number, quantity required and the number of the list used to get this information.

Any items indented in the "Parts Name" column are included in the assembly under which they are listed. The indented items may be ordered separately. If the entire assembly is needed, do ***not*** order the indented parts.

GUARANTEE

The Lincoln Electric Company, the Seller, warrants all new equipment except engines and accessories thereof against defects in workmanship and material for a period of one year from date of shipment, provided the equipment has been properly cared for, and operated under normal conditions. Engines and engine accessories are warranted free from defects for a period of ninety days from the date of shipment.

If the Buyer gives the Seller written notice of any defects in equipment or electrode or flux within any period of warranty and the Seller's inspection confirms the existence of such defects, then the Seller shall correct the defect or defects at its option, either by repair or replacement F.O.B. its own factory or other place as designated by the Seller. The remedy provided Buyer herein for breach of Seller's warranty shall be exclusive.

No expense, liability or responsibility will be assumed by the Seller for repairs made outside of the Seller's factory without written authority from the Seller.

The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of any warranty. The liability of the Seller arising out of the supplying of said equipment or electrode or its use by the Buyer, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment or replacing defective electrode in accordance with the above guarantee. Upon the expiration of any period of warranty, all such liability shall terminate.

The foregoing guarantees and remedies are exclusive and except as above set forth. There are no guarantees or warranties with respect to engines, accessories, equipment, electrodes, or flux, either express or arising by operation of law or trade usage or otherwise implied, including without limitation the warranty of merchantability, all such warranties being waived by the Buyer.

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