LINCOLN WELDERS

IM-316

May, 1990
IM816
Idealarc DC-400 (CV)
8748; 8749; 8750; 8751; 8752; 8753; 8754; 8755; 8762; 8763; 8785; 8807; 8816; 8823; 8974; 8987; 9048; 9049; 9050; 9057; 9121

OPERATING MANUAL

IDEALARC® DC-400

CONSTANT VOLTAGE AND CONSTANT VOLTAGE/VARIABLE VOLTAGE DC ARC WELDING POWER SOURCES

3 PHASE RECTIFIER TYPE

This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and the availability of optional features may have changed.

DC-400 shown with optional undercarriage and meters.

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 arc welding 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 OPERATING MANUAL AND THE ARC WELDING SAFETY PRECAUTIONS ON THE INSIDE FRONT COVER. And, most importantly, think before you act and be careful.

LINCOLN ELECTRIC

THE LINCOLN ELECTRIC COMPANY
World's Largest Manufacturer of Arc Welding Products • Manufacturer of Industrial Motors
Sales and Service Worldwide
Cleveland, Ohio 44117-1199 U.S.A.

ARC WELDING SAFETY PRECAUTIONS

WARNING: PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH.

ELECTRIC SHOCK can kill.

1. 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.

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

   c. Insulate yourself from work and ground using dry insulation. When welding in damp locations, on metal framework such as floors, gratings or scaffolds, and when in positions such as sitting or lying, make certain the insulation is large enough to cover your full area of physical contact with work and ground.

   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.

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

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

   g. Never dip the electrode in water for cooling.

   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.

   i. When working above floor level, protect yourself from a fall should you get a shock.

   j. Also see Items 4c and 6.

ARC RAYS can burn.

2. 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.

   b. Use suitable clothing made from durable flame-resistant material 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.

FUMES AND GASES can be dangerous.

3. 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 on galvanized, lead or cadmium plated steel and other metals which produce toxic fumes, even greater care must be taken.

   b. 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.

   c. 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.

   d. 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.

   e. Also see item 7b.

WELDING SPARKS can cause fire or explosion.

4. 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. Have a fire extinguisher readily available.

   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.

   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.

   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 F4.1-80 from the American Welding Society (see address below).

e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

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.

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.

h. Also see item 7c.

CYLINDER may explode if damaged.

5. 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.

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

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.

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

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

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

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.

6. a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

b. Install equipment in accordance with the National Electrical Code, all local codes and the manufacturer's recommendations.

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

FOR ENGINE powered equipment.

7. a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

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.

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.

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.

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.

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.

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

HAVE ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR WORK performed by qualified people.

For more detailed 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.

PROPER GROUNDING DURING INSTALLATION

The 1985 National Electrical Code does not require this machine to be grounded under normal operating circumstances.

Some State, local or other codes or unusual operating circumstances may require the machine frame to be grounded. It is recommended that you determine the extent to which such requirements may apply to your particular situation and follow them explicity.

In general, if the machine is to be grounded, it should be connected with a #8 or larger copper wire to a solid earth ground such as a metal pipe going into the ground for at least ten feet and having no insulated joints, or to the metal framework of a building which has been effectively grounded. The National Electrical Code lists a number of alternate means of grounding electrical equipment. (If an older portable welder does not have a grounding stud, connect the ground to an unpainted frame screw or bolt.)

INSTALLATION, CONNECTION, AND MAINTENANCE OF BATTERY

To prevent EXPLOSION when:

a) Installing a new battery — disconnect the negative cable from the old battery first and connect the negative cable to the new battery last.

b) Connecting a battery charger — remove the battery from the welder by disconnecting the negative cable first, then the positive cable and battery clamp. When reinstalling, connect the negative cable last.

c) Using a booster — connect the positive lead to the battery first then connect the negative lead to the copper strap on the engine foot.

To prevent ELECTRICAL DAMAGE when:

a) Installing a new battery.

b) Using a booster.

Use correct polarity — Negative Ground.

To prevent BATTERY DISCHARGE, if you have an ignition switch, turn it off when the engine is not running.

To prevent BATTERY BUCKLING, tighten nuts on battery clamp only until snug.

(S-17851)

OPERATION OF ENGINE WELDERS

WARNING: Operate internal combustion engines in open, well ventilated areas or vent engine exhaust fumes outdoors.

OPERATION OF ALL WELDERS

DO NOT TURN THE "CURRENT RANGE SELECTOR" WHILE WELDING because the current may arc between the contacts and damage the switch.

MAINTENANCE AND TROUBLESHOOTING WARNINGS

WARNING: Have qualified personnel do the maintenance and troubleshooting work. Turn the engine (or electrical power at the switchbox) off before working inside the machine. 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.

ATTENTION OWNERS OF ENGINE WELDERS

WARNING: 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. If a problem cannot be corrected by following the instructions, take the machine to the nearest Lincoln Field Service Shop.

CAUTION WHEN INSPECTING THE COMMUTATOR AND BRUSHES

WARNING: Uncovered rotating equipment can be dangerous. Use care so your hands, hair, clothing or tools do not catch in the rotating parts. Protect yourself from particles that may be thrown out by the rotating armature when stoning the commutator.

NAMEPLATES

Whenever routine maintenance is performed on this machine — or at least yearly — inspect all nameplates and labels for legibility. Replace those which are no longer clear. Refer to the parts list for the replacement item number.

PRODUCT DESCRIPTION

The DC-400 is an SCR controlled three phase DC power source. It is designed with a single range potentiometer control.

The DC-400 is supplied in two basic models — a CV model and a CV/VV model.

The CV model is designed for all open arc processes including Innershield®, all solid wire and gas procedures and air carbon arc within the capacity of the machine. Submerged arc welding can be done with the CV model.

The CV/VV model is designed for all of the processes described above plus the capability of stick and TIG welding.

In addition, a CV Sub Arc Mode is provided for improved submerged arc welding in the high deposition, slow travel speed area. A mode switch selects CV Innershield, CV Submerged Arc or VV Stick/TIG.

Either model is designed to be used with the LN-7, LN-8, LN-9, LN-22, LN-23P, or LN-25 semiautomatic wire feeders, the NA-3, NA-5 and NA-5R automatics, and the LT-56 and LT-7 tractors, again within the 400 amp capacity of the machine. The K826 DC-400 Diode Kit option is required to utilize the cold start and cold electrode sensing feature of the NA-3, NA-5 or NA-5R.

There are no provisions on the DC-400 for paralleling.

INSTALLATION

⚠ WARNING

ELECTRIC SHOCK can kill.

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

LOCATION

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

⚠ WARNING

FALLING EQUIPMENT can cause injury.

- **Do not lift this machine using lift bale if it is equipped with a heavy accessory such as trailer or gas cylinder.**
- **Lift only with equipment of adequate lifting capacity.**
- **Be sure machine is stable when lifting.**

STACKING

Three DC-400's may be stacked by observing the following safety precautions:

1. The bottom unit must be placed on a firm, level surface suitable for the total weight [up to 1460 pounds (662 kg)] of the stacked machines.
2. The units must be stacked with their fronts flush, making sure the two holes in the base rails of an upper unit are over the two pins located on the top front corners of the unit below.
3. **WARNING:** Do not stack more than three high. Do not stack the DC-400 on top of any other machine.

INPUT WIRING

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

Dual voltage (e.g. 230/460) models are shipped connected for the higher voltage. To change the connection, see the connection diagram pasted to the inside of the access panel in the case back.

Have a qualified electrician remove the rear 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 welder frame must be grounded. A stud marked with the symbol ⏚ located inside the machine near the input contactor is provided for this purpose. See the National Electrical Code for details on proper grounding methods.

Recommended Input Wire, Grounding Wire and Fuse Sizes Based on National Electrical Code For 60% Hertz, 3 Phase Welders at 100% Duty Cycle Ambient Temperature 30°C or Less

Input Volts	Amps Input	Copper Wire Size Type 75°C in Conduit		Super Lag Fuse Size in Amps
		3 Input Wires	1 Grounding Wire	
230	76	4	6	125
460	38	8	10	60

OUTPUT CONNECTIONS

A. Output Studs

With welder off, connect the output leads to the output terminals marked (+) and (−). They are located at the lower right and lower left corners of the front panel. Strain relief for the electrode and work cables is provided by routing the leads through the rectangular holes in the base before connecting them to the output terminals. Tighten the output stud nuts with a wrench.

Cable Sizes for Combined Lengths of Electrode and Work Cable (Copper) at 100% Duty Cycle

Machine Size	Lengths up to 150 ft. (45 m)	150 to 200 ft. (45 to 60 m)	200 to 250 ft. (60 to 75 m)
400	2/0	3/0	4/0

B. Auxiliary Power

This machine supplies the 115 volt, AC power needed for wire feeding equipment. The power is available from terminals #31 and #32 on the terminal strip. An 8 amp slow blow fuse on the machine control panel protects the auxiliary power from excessive overloads. The circuit has a 1000 volt-ampere rating.

C. Control Cable Connection (Excluding the LN-22)

With the DC-400 turned off, the control cable from the automatic wire feeding equipment is connected to the terminal strips behind the hinged door on the front of the power source. A strain relief box connector is provided for access into the terminal strip section. A chassis grounding screw is also provided below the terminal strip marked with the symbol ⏚ for connecting the wire feeding equipment grounding wire. See the appropriate connection diagram for the exact instructions for the wire feeder being used. A spare hole is provided for an additional box connector if required.

To connect the DC-400 to wire feeders not covered in available connection diagrams, write to the factory for instructions giving complete nameplate information for the DC-400 and wire feeder.

D. Connection of DC-400 to LN-22

1. Turn off all power.
2. Connect a jumper from 2-4 on terminal strip.
3. Connect the electrode cable to the output terminal of polarity required by electrode. Connect the work lead to the other terminal.
4. Place electrode negative-electrode positive switch to the same polarity as the electrode cable.
5. Place the Output Control Switch "at DC-400" position unless a K775 remote control is connected to 75, 76, 77 on the DC-400 terminal strip.
6. Place Mode Switch (CV-VV unit only) in CV.

See LN-22 operating manual (IM-282) for further operating information.

WARNING: The electrode is always electrically hot when the power source is connected to the LN-22 and turned on. It will arc if it touches the work or any metals touching the work. When not welding, store the gun in the insulated tube on the wire reel housing.

E. Stick, TIG or Air/Carbon Arc (CV-VV units only)*

1. Turn off all power.
2. Disconnect all wire feed unit control, electrode, and work leads.
3. Place mode switch in the VV position for stick or TIG and CV Innershield for air carbon arc.
4. For stick, TIG, or air carbon arc, connect a jumper from 2-4 on terminal strip. With the DC-400 connected for stick, TIG, or air carbon arc welding, the output terminals will be energized at all times.

* **WARNING: If stick welding, TIG welding or air carbon arc cutting is to be done on the DC-400 along with semiautomatic/automatic welding, then a K804 Multi-Process Switch is required. If the Multi-Process Switch is not used, then all control, electrode, and work leads to wire feed equipment *must* be disconnected from the DC-400 *before* connecting the DC-400 for stick or air carbon arc cutting.**

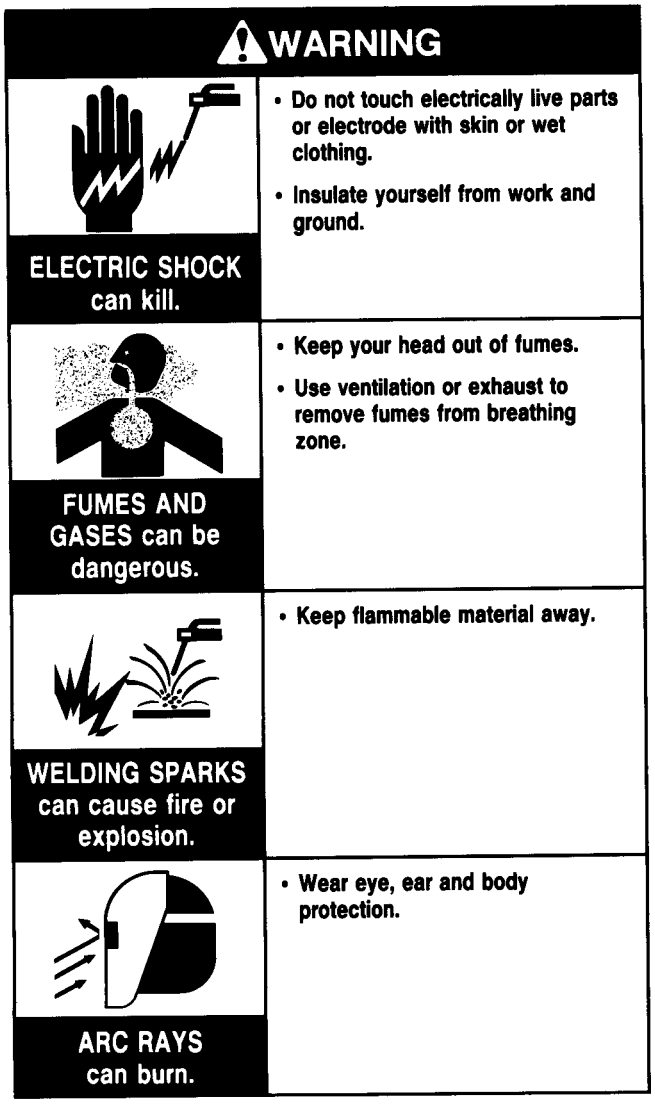
All P.C. boards are protected by a moisture resistant coating. When the welder is operated, this coating will "bake off" of certain power resistors that normally operate at high temperatures emitting some smoke and odor for a short time. These resistors and the P.C. board beneath them may become blackened. This is a normal occurrence and does not damage the component or affect the machine performance.

OPERATING INSTRUCTIONS

WARNING: Applies to DC-400's *without* the Capacitor Discharge Option (Option Q)

When using this power source with wire feeders which do not have an electrical interlock (or with wire feeders with the electrical interlock in the OFF position), there will be a small spark if the electrode contacts the work or ground within several seconds after releasing the trigger.

When used with wire feeders with the electrical interlock in the ON position, the arc can restart if the electrode touches the work or ground during these several seconds.



DUTY CYCLE

The DC-400 is NEMA rated 100% duty cycle at 400 amps, 36 volts for either 60 or 50 Hertz.

TO SET POLARITY

Turn off the DC-400 and connect the electrode cable to the "Positive" or "Negative" studs depending upon the electrode polarity desired. Connect the work cable to the other stud. (See "Output Connections".)

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 some Lincoln wire feeders and does not change the welding polarity.

STARTING THE MACHINE

The toggle switch at the extreme right side of the control panel energizes and closes the three phase input contactor from a 115 volt auxiliary transformer. This in turn energizes the main power transformer.

The red light below the stop-start toggle switch indicates when the input contactor is energized.

OUTPUT CONTROL

The output control to the right of the center of the control panel is a continuous control of the machine output. The control may be rotated from min. to max. while under load to adjust the machine output.

The machine is equipped with line voltage compen-

sation as a standard feature. This will hold the output essentially constant except at maximum outputs of the machine, through a fluctuation of ±10% input line voltage.

OUTPUT CONTROL AT DC-400 OR OUTPUT CONTROL REMOTE

The toggle switch on the control panel labeled "Output Control at DC-400" — "Output Control Remote" gives the operator the option of controlling the output at the machine control panel or at a remote station. For remote control, the toggle switch is set in the "Output Control Remote" position and controlled at the wire feed unit control or by connecting a K775 control to terminals 75, 76 and 77 on the terminal strip at the front of the machine. For control at the machine control panel, the toggle switch is set in the "Output Control at DC-400". (Exception: When used with an LN-9 or NA-5 wire feeder, the toggle switch must be in the "Output Control Remote" position or automatic shutdown of the wire feeder may occur.)

MODE SWITCH — FOR CONSTANT VOLTAGE OR CONSTANT CURRENT OUTPUT (CV/VV MODELS ONLY)

The large mode switch on the left side of the machine, labeled "Constant Voltage Submerged Arc, Constant Voltage Innershield and Variable Voltage Stick/TIG", is used to select the proper welder characteristics for the process being used.

The CV Innsershield mode permits the DC-400 to produce essentially a flat output characteristic that can be varied from approximately 12 to 40 volts. In this position the dynamic characteristic of the machine under welding conditions provides optimum welding characteristics for Innershield welding. Other open arc processes including short arc MIG welding and air carbon arc are also done using the CV Innershield mode. Most submerged arc welding can also be done in this mode.

The CV Submerged Arc mode also produces an essentially flat output characteristic that can be varied from approximately 12 to 40 volts. The dynamic characteristics of the CV Submerged Arc mode make possible improved submerged arc welding over that possible using the Constant Voltage Innershield mode. The improvement is most noticeable on high deposition, slow travel speed welds.

The VV mode permits the DC-400 to produce a variable voltage (Constant Current) output characteristic through the range of 60 to 500 amps with an open circuit voltage of approximately 57 volts (54V on 50 Hz). Stick and TIG welding are done with this position of the Mode Switch.

CAUTION: There are no means provided to switch modes remotely. Do not change the position of the mode switch if output voltage or current is present as this may damage the switch.

ARC FORCE SELECTOR [CV/VV MODEL, EFFECTIVE ONLY IN VV (CONSTANT CURRENT) MODE]

The arc force control is calibrated from one to ten. Lower settings will provide less short circuit currrent and a softer arc. Higher settings will provide a higher short circuit current and a more forceful arc. For most stick welding, the dial should be set at approximately mid-range, 5-6. Adjustment up or down can then be made depending on the electrode, procedures and operator preferences. TIG welding should be done with the arc force control at or near minimum.

ARC CONTROL [EFFECTIVE ONLY IN CV INNERSHIELD (CONSTANT VOLTAGE) MODE]

The Arc Control is a tapped switch numbered from 1 to 11; it changes the pinch effect of the arc. This control, most useful for processes that utilize a "shorting" metal transfer, controls the spatter, fluidity and bead shape. The pinch effect is increased by turning the control clockwise.

For all applications, a good starting point for the arc control is a dial setting of 6. The control can be increased or decreased as desired.

OPERATION OF OPTIONAL EQUIPMENT

REMOTE OUTPUT CONTROL

An optional "remote output control" (K775) is available. This is the same remote control that is used on the Lincoln R3S, R3R, and DC-600 power sources. The K775 consists of a control box with 25 feet (7.6 m) of four conductor cable. This connects to terminals 75, 76, 77 on the terminal strip and the case grounding screw so marked with the symbol ⏚ on the machine. These terminals are made available by opening the terminal access cover on the left side of the case front. This control will give the same control as the output control on the machine.

DIODE KIT (K826)

This field installed option mounts to the front of the DC-400. It allows the use of the cold start and cold electrode sensing features of the NA-3, NA-5, or NA-5R.

The Diode Kit is connected to the positive output terminal of the DC-400. Consult the Diode Kit nameplate for work and electrode lead connections. Connect the wire feeder voltage sensing lead (#21) directly to the workpiece when using the Diode Kit.

MULTI-PROCESS SWITCH

Purpose

A Multi-Process Switch has been designed for use with the DC-400 or DC-600. With this switch installed on the DC-400, it permits easy changing of the polarity of the wire feed unit connected and also provides separate terminals for connection of stick or air carbon arc. (Stick is available only on DC-400 CV/VV machines.) The Multi-Process Switch is available as either a factory installed or field installed option.

NOTE: IF THE DC-400 IS TO BE USED FOR *BOTH* SEMIAUTOMATIC/AUTOMATIC AND STICK/AIR CARBON ARC, THEN A MULTI-PROCESS SWITCH IS REQUIRED.

Design

The Multi-Process Switch consists of a 3-position switch assembly that is mounted in a sheet metal enclosure, with two output terminals on each end of the box. The two terminals on the left side of the box are for connection of wire feed electrode and work leads. The two terminals on the right side of the box are for connection of work and electrode for stick or air carbon arc.

The switch mounts to the front of the DC-400 by means of a bracket that fastens to the case sides. Two 4/0 leads connect the switch assembly to each output stud.

Connections

1. Connect wire feed unit electrode and work cables through the rectangular strain relief holes in the base of the DC-400 to the output studs on the left side of the box.
2. Connect wire feeder control cable and make other terminal strip connections as specified on the connection diagram for the Lincoln wire feeder being used. "Electrode" and "Work" are connected to the left side of the Multi-Process Switch.
3. Connect stick or air carbon arc electrode and work cables through the rectangular strain relief holes in the base of the DC-400 to the output studs on the right side of the box.

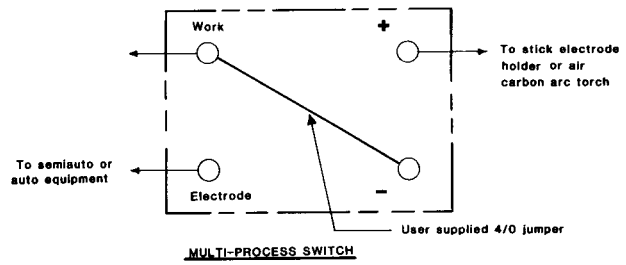
Operation

The operation of the switch is as follows:

A semiautomatic or automatic wire feed unit electrode and work cables are connected to the terminals on the left side of the box. Stick or air carbon arc electrode and work leads are connected to the terminals on the right side of the box. There are three positions on the switch. With the switch in the left position, the wire feed terminals are electrode positive. In the center position, the wire feeder terminals are electrode negative. In both the left and center switch positions, the right side stick terminals are disconnected. In the right switch position, the wire feed terminals are disconnected from the DC-400 and the stick terminals connected. The polarity of the stick terminals is as marked on the end of the box. To change polarity, the electrode and work leads must be interchanged. In the stick position, the stick terminals are energized at all times.

IMPORTANT: When switching from *VV* to *CV* change the multi-process switch first then change the DC-400 mode switch. When switching from *CV* to *VV* change the DC-400 mode switch to VV first, then change the multi-process switch. Failure to follow these procedures will result in damage to the DC-400 mode switch.

Connections (For those applications where it is *not* necessary to have separate work cables for stick and semiautomatic welding.)



MULTI-PROCESS SWITCH

If both stick and semiautomatic welding is done on the same workpiece, only one work lead is required. To do this, connect a 4/0 jumper from the work terminal on the semiautomatic side to the terminal to be used for work on the stick side. The work lead from the semiautomatic side then serves as the work lead for both semiautomatic and stick welding.

To change stick polarity, reverse the leads at the (+) and (−) terminals on the right side of the Multi-Process Switch.

NOTE: When a DC-400 equipped with a Multi-Process Switch is mounted on an undercarriage, the undercarriage handle in the resting position can hit the case of the Multi-Process Switch. This does no harm, but if the user desires, a ¼ or ⅜" (6.4 or 9.5 mm) bolt and nut may be placed in the hole in the undercarriage tow bar to limit the travel of the undercarriage handle.

AMPTROL™ ADAPTER CABLE

A 3-wire cable, 12″ (305 mm) long, is available to connect a standard K771 (Hand) or K772 (Foot) Amptrol in place of the K775 Remote Current Control. The Amptrol arc-start switch is non-functional in this application.

HI-FREQ™ (K799, Codes 8634 and Above Only)

Field installed kit that supplies the high frequency plus gas valve for DC TIG welding. The DC-400 is shipped with proper R.F. by-pass circuitry installed to protect the control circuit when welding with a Hi-Freq unit.

MAINTENANCE

⚠ WARNING

ELECTRIC SHOCK can kill.

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

GENERAL MAINTENANCE

1. The fan motor has 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 to eliminate excessive dirt and dust build-up on internal parts.
3. In extremely dusty locations, dirt may accumulate on the control cable connection terminal strips. Wipe or blow these terminal strips off at regular intervals. This is particularly important in damp locations.

MACHINE AND CIRCUIT PROTECTION

The power source is thermostatically protected with proximity thermostats against overload or insufficient cooling. One thermostat is located on the nose of the center bottom primary coil and a second thermostat is attached to the lead connecting the secondaries. The primary thermostat is connected in series with the output circuit (2-4). If the machine is overloaded, the thermostat will open and the output will be zero. The fan will continue to run. The secondary thermostat is in series with the input contactor and will open either with an excessive overload or insufficient cooling, opening the input contactor. The input contactor will remain open until the machine cools, at which time the contactor will close. The fan motor does not run when the secondary thermostat opens.

The power source is also protected against overloads on the SCR bridge assembly through an electronic protection circuit. This circuit senses an overload on the power source and limits the output by phasing back the SCR's.

Protection is provided to protect the circuitry from accidental grounds. If the customer accidentally "grounds" 75, 76 or 77 to the positive output lead, the DC-400 output will be reduced to a low value, thus preventing any damage to the machine. If the ground occurs between 75, 76 or 77 and the negative output lead, one of the P.C. board fuses will blow, preventing any machine damage.

TROUBLESHOOTING GUIDE

WARNING: Have qualified personnel do the maintenance and troubleshooting work. Turn the input power off using the disconnect switch at the fuse box before working inside the machine.

TROUBLE	CAUSE	WHAT TO DO
Input Contactor (CR1 chatters)	1. Faulty input contactor (CR1). 2. Low line voltage.	1. Repair or replace. 2. Check input power.
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 secondary thermostats open. 6. Open input contactor coil. 7. Power "on/off" switch (S1) not closing.	1. Replace if blown — look for reason first. 2. Check pilot transformer T2 and assocated leads. 3. Check input voltage at contactor. 4. Check voltage against instructions. 5. Check for overheating; make sure fan is operating and there is no obstruction to free air flow. Replace faulty thermostats. 6. Replace coil. 7. Replace switch.
Machine input contactor operates but no output when trying to weld	1. Electrode or work lead loose or broken. 2. Open main transformer (T1) primary or secondary circuit. 3. Output pilot relay CR2 not operating or faulty. 4. Defective power[1] or control board.	1. Repair connection. 2. Repair. 3. Check CR2 relay pull in by connecting a jumper across terminals 2 and 4 on DC-400 terminal strip. Replace if faulty. 4. Replace defective P.C. board. See the following procedure for replacing P.C. Boards.
Machine has minimum output and no control	1. Terminals 75, 76, or 77 grounded to *positive* output.	1. Check 75, 76, or 77 for ground to positive output circuit. Nearly zero ohms to ground indicates a grounded circuit. A value greater than a few thousand ohms is normal.
Machine has low output and no control	1. Output control Machine/Remote Switch (S4) in wrong position. 2. Output control Machine/Remote Switch faulty. 3. Open in feedback circuitry. 4. Faulty control or power[1] circuit P.C. boards. 5. Output control potentiometer circuit open (lead 75).	1. Check position of switch. 2. Check switch and replace if faulty. 3. Check wiring and control and firing circuit P.C. board wiring harness plugs. 4. Replace. See procedure for replacing P.C. Boards. 5. Check and replace potentiometer if faulty. Check wiring of lead #75.
Machine does not have maximum output	1. One input fuse blown. 2. One phase of main transformer open. 3. Faulty control or power[1] circuit P.C. boards. 4. Output control potentiometer defective. 5. Output control potentiometer leads 210, 211, 212, 213 open.	1. Check and replace if blown after checking for reason for blown fuse. 2. Check for open and repair. 3. Replace. See procedure for replacing P.C. Boards. 4. Check and replace if faulty. 5. Check and repair broken leads.
Machine will not shut off	1. Input contactor contacts frozen. 2. Defective on/off switch S-1.	1. Check and replace if necessary. 2. Replace.
Variable or sluggish welding arc	1. Poor work or electrode connection. 2. Welding leads too small. 3. Welding current or voltage too low. 4. Defective main SCR bridge. 5. Micro switch S4D or S4D actuator defective.	1. Check and clean all connections. 2. Check table in instruction manual. 3. Check procedures for recommended settings. 4. Check and replace if defective. 5. Check and replace if defective. (If S4D actuator is found defective, replace mode switch cam also.)
Output control not functioning on the machine	1. Machine/Remote switch in wrong position. 2. Faulty Machine/Remote Switch. 3. Faulty output control potentiometer. 4. Leads or connections open in control circuit. 5. Faulty control circuit P.C. board.	1. Place switch in "Output Control at DC-400". 2. Check and replace if found faulty. 3. Check and replace if found faulty. 4. Check lead continuity and connections for an open and repair if necessary. 5. Replace. See procedure for replacing P.C. Boards.

[1] Power P.C. Board used in machines below code 9200.

TROUBLE	CAUSE	WHAT TO DO
Output control not functioning on remote control	1. Machine/Remote switch in wrong position. 2. Faulty Machine/Remote Switch. 3. Faulty remote control potentiometer. 4. Leads or connections open in control circuit. 5. Faulty control circuit P.C. board.	1. Place switch in "Output Control Remote". 2. Check and replace if found faulty. 3. Check and replace if found faulty. 4. Check all leads and connections, internal or remote, for continuity; repair if necessary. 5. Replace. See procedure for replacing P.C. Boards.
Poor arc striking with semiautomatic or automatic wire feeders	1. Defective start circuit. 2. Poor work connection. 3. Improper procedures. 4. Defective control board.	1. Check start board and reed switch CR3. 2. Work connection must be adequate for application. 3. Adjust procedures for improved starting. 4. Replace. See procedure for replacing P.C. Boards.
Poor arc characteristics	1. Start circuit energized at all times (reed switch not closing). 2. Start board defective. 3. Defective control board. 4. Capacitor(s) in output circuit failed. A failure is indicated if the small vent plug on top of a capacitor is raised or blown out.	1. Short reed switch leads together. If welding improves, replace reed switch. 2. If problem is still present with reed switch shorted, unplug start board. If problem disappears, replace start board. See procedure for replacing P.C. Boards. 3. Replace. See procedure for replacing P.C. Boards. 4. Replace entire bank of capacitors. Do *not* replace individual capacitors. **WARNING:** The liquid electrolyte in these capacitors is toxic. Avoid contact with any portion of your body. Clean up vented electrolyte using rubber gloves and a water dampened cloth. Any electrolyte which gets on skin, clean with soap and water.
Arc control has no effect in CVI mode with short circuit transfer processes	1. Defective R1, L1, S4D, S4D actuator or S5.	1. Check and replace if found defective. (If S4D actuator is found defective, replace mode switch cam also.)

TROUBLESHOOTING PROCEDURES

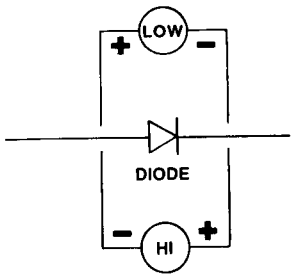
A. Procedure for Replacing P.C. Boards

When a P.C. Board is suspected to be defective, the following procedure must be followed:

1. Visually inspect the P.C. board. If the board has fuses, check to see if any are blown. Are any of the components damaged? Is a conductor on the back side of the board damaged? If electrical damage is visible on the P.C. board, inspect the machine wiring for grounds or shorts to avoid damaging a new P.C. board. Install a new P.C. board only after a visual inspection of the P.C. board and machine wiring is satisfactory.
2. If the problem is remedied by a new P.C. board, install the old P.C. board (if it has no electrical damage) and determine if the problem still exists. If the problem does not return with the old board:
   a. Check the P.C. board harness plug and P.C. board plug for contamination, corrosion, or oversize.
   b. Check leads in the harness for loose connections.

B. Procedure for Checking Diodes

1. Isolate the diode in question. (Electrically disconnect from other circuits.)
2. Use an ohmmeter X10 scale. Connect the meter across the diode and note the resistance value. Reverse the ohmmeter leads and note the resistance value.
   Shorted diode — Low resistance readings in both directions.
   Open diode — High or infinite resistance in both directions.
   Good diode — One reading will be high or infinite and the other reading will be low.



C. Connecting the Remote Control to the Machine

Extreme caution must be observed when installing or extending the wiring of a remote control. Improper connection of this unit can lead to failure of the output control rheostat or the control circuit. Only the green lead can and should be grounded to the machine case. When extending the standard remote control make sure the leads are the same and the splice is waterproof. Be very careful not to ground the cable when in use and don't let the lugs touch against the case.

D. Output Voltage

The open circuit voltage of the machine should be adjustable from 10 to 42 volts in CV. In the VV (Constant Current) mode of CV/VV models, the open circuit voltage should be approximately 57 volts (54 volts on 50 Hz) except at near minimum settings of the output control where it may be lower. If any other condition exists, refer to the Troubleshooting Guide.

E. Fault Protection Operation

The overload protection circuit, in the control board, will limit the welding current (heat) to 550 amps if a short or overload is applied to the machine.

F. Checking Snubber Circuit

In case of an SCR malfunction or failure, the snubber assembly should be checked. Turn the machine off and remove the sides of the machine. (See the instruction manual parts list for the exact location.)

1. Visually inspect the snubber assembly for overheated components or damaged components.

G. Checking Output Control Rheostat on Machine

Turn machine off. Remove the arc control switch knob.

Remove the control panel and screws and open the front cover. (If machine has a mode switch, the switch knob must also be removed.)

Turn the output control switch to remote.

Disconnect the harness plug from the control board.

With an ohmmeter on X1K, connect it to lead 210 and 211 on S2.

Rotate the output control rheostat. The resistance reading should be from around zero to 10K Ω. Check the resistance reading between 75 on the terminal strip and 211 on S2. The reading must be 10K Ω. No reading will indicate an open rheostat and a low reading will indicate a shorted or partially shorted rheostat; in either case, replace.

H. Input Contactor Toggle Switch Check

1. Turn off the machine power input. S-1 has 110 volts across it when the input power is connected.
2. Isolate the switch to be tested by removing all connecting leads.
3. Check to make sure the switch is making connections with a V.O.M. meter. The meter should read zero resistance.
4. Put the ohmmeter on X1K scale and measure the resistance between the terminal and the case of the machine (touch a self-tapping screw). Reading should be infinite.
5. If either step (3) or step (4) fails, replace the switch.

I. Remote Control Check

Disconnect the remote output control and connect an ohmmeter across 75 and 76 and rotate the rheostat in the remote control. The resistance reading should go from zero to 10K ohms. Repeat with triplett across 77 and 76 with same results. Connect ohmmeter across 75 and 77. The reading should be 10K ohms. A lower reading will indicate a shorted or partially shorted rheostat. A very high reading will indicate an open rheostat. In either of the last two cases, replace rheostat. Check cable for any physical damage.

J. Power Rectifier Bridge Assembly Checking Procedure

CAUTION: The rectifier bridge tests outlined below will identify the most common defects found in power diodes or power silicon controlled rectifiers. If a bridge problem still exists after test, call a Lincoln Field Service Shop. Further evaluation of diodes or silicon controlled rectifiers may require laboratory equipment.

1. **Device Isolation** (See the instruction manual parts list for the exact location.)

Disconnect the following leads from the bridge shown in Diagram 2:

a. Wiring harness gate leads (G1, G2, G3) from the gate lead terminals on the P.C. board.
b. AC leads X1, X2, and X3 from the anodes of the SCR's and cathodes of the diodes.
c. One lead from each snubber assembly.
d. The flex lead 220 on the DC(−) common heat sink. This lead connects to the latching resistor (R2).
e. The cathode of each diode (4 total).

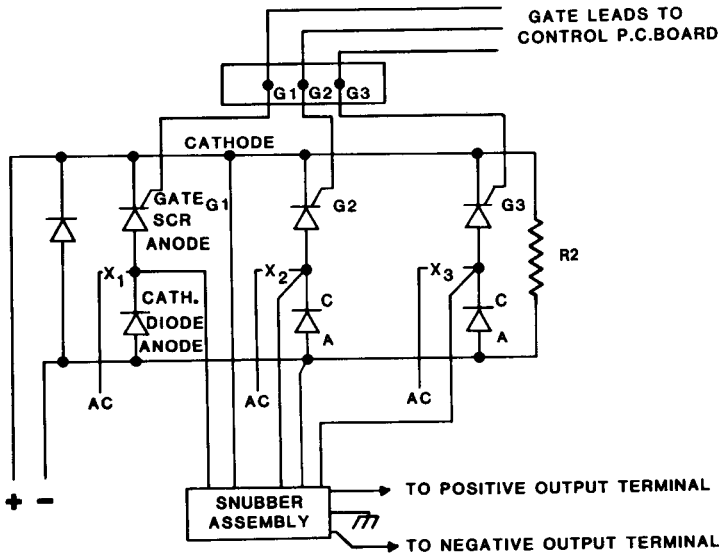
2. **Power Diode Test**

a. Establish the polarity of the ohmmeter leads and set to X10 scale.
b. Connect the ohmmeter positive lead to the anode and negative lead to the cathode.
c. Reverse the leads of the ohmmeter from Step b.
d. A shorted diode will indicate zero or an equally low resistance in both directions. An open diode will have an infinite or high resistance in both directions; and a good diode will have a low resistance in Step b and a much higher resistance in Step c.

3. **Power Silicon Rectifier Test**

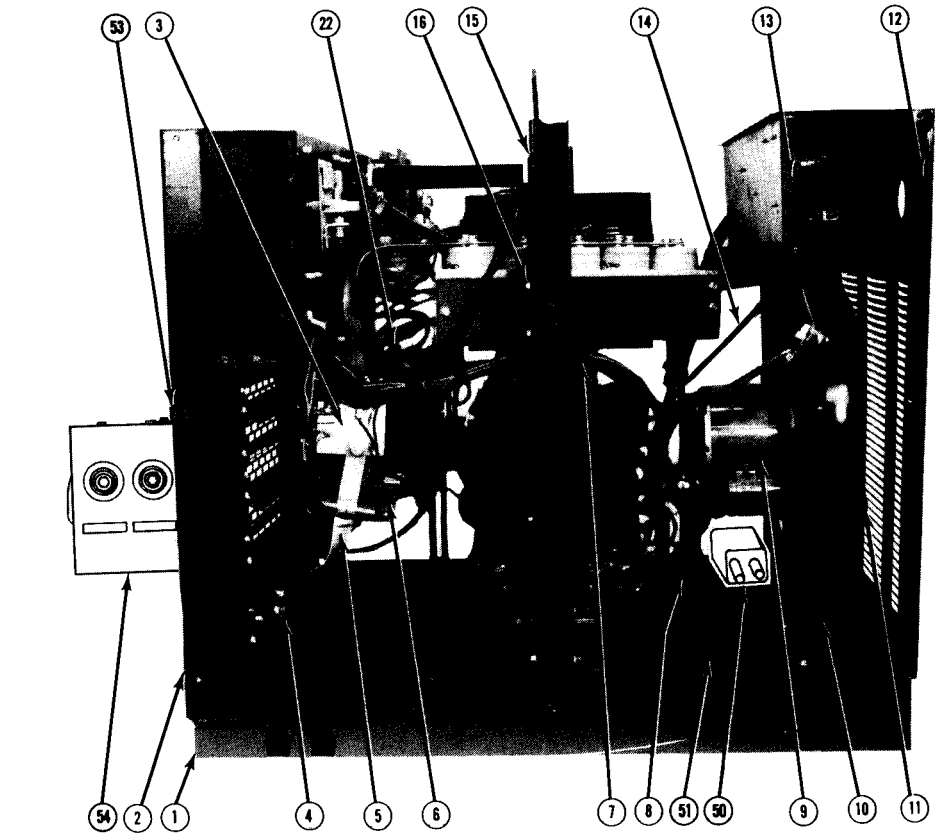
The SCR must be mounted in the heat sink when making the test.

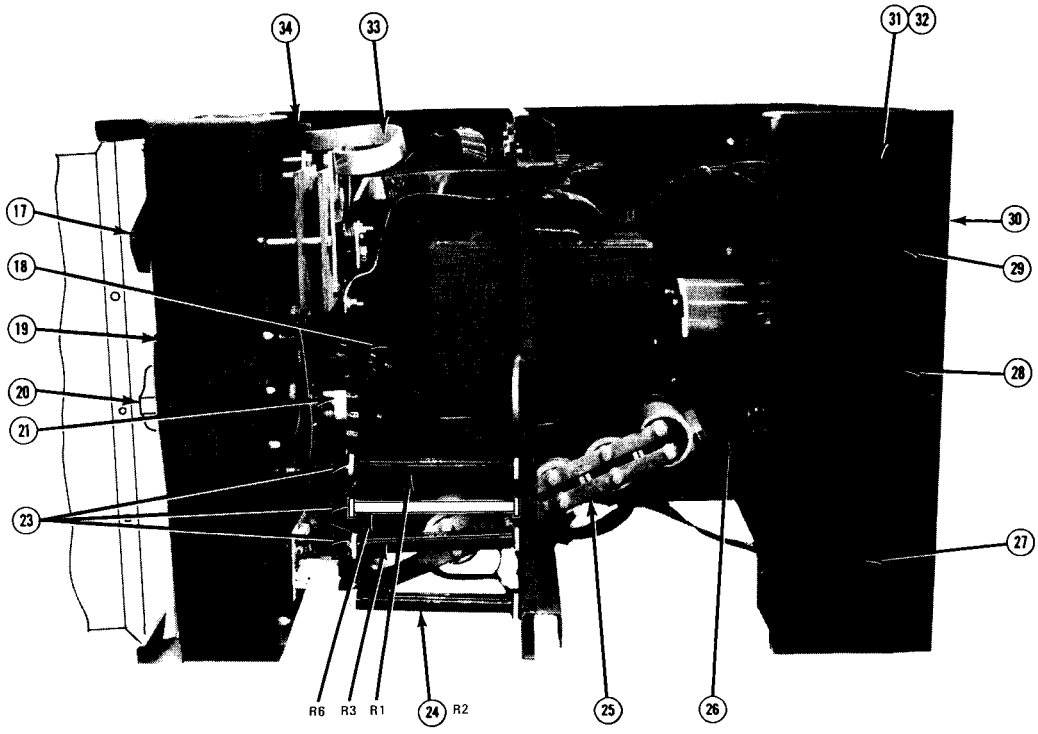
a. Connect the ohmmeter (set to the X10 scale) leads to the anode and cathode.
b. Reverse the leads of the ohmmeter from step a.
c. A shorted SCR will indicate zero or an equally low resistance in one or both directions. A good SCR will indicate an infinite or very high resistance in both directions.
d. Establish the polarity of the ohmmeter. Connect the positive lead to the gate and the negative lead to the cathode.
e. An open gate circuit will have an infinite — or high — resistance. A good gate circuit will read a low resistance, but not zero ohms.



POWER RECTIFER BRIDGE
DIAGRAM 2

GENERAL ASSEMBLY





G-1626
8-30-85C

Parts List P-151-C

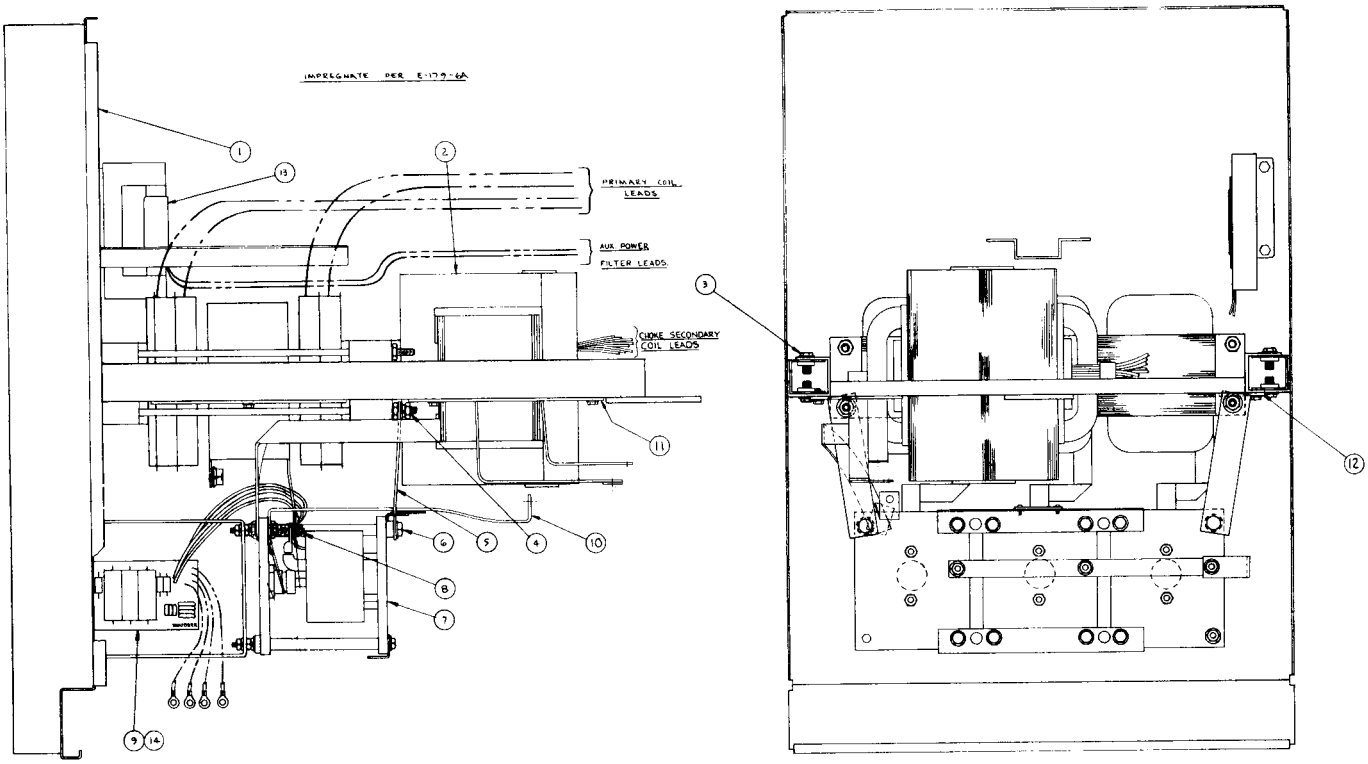
ITEM	PART NAME & DESCRIPTION	NO. REQ'D
1	Transformer, Lift Bail Base, Rectifier & Choke Assembly See P-151-D	
2	Case Front Assembly See P-151-E	
3	Shunt	1
6	Reed Switch (CR3)	1
7	Loom	1
8	Bushing	1
9	Fan Motor	1
10	Fan Baffle	1
11	Fan	1
12	Rear Panel	1
13	Input Box	1
14	Fan Motor Bracket Stiffener	1
15	Capacitor Baffle	1
16	Capacitor Mounting Bracket	1
17	Mode Switch Handle (CV-VV Machines Only)	1
	Set Screw-Handle Mounting	1
18	Grommet Strip	1
19	Control Box Cover Assembly See P-151-F	
20	Arc Control Handle	1
	Self Tapping Screw-Handle Mounting	1
	Shaft Extension	1
	Thread Cutting Screw-Extension Mounting	1
21	Arc Control Switch	1
	Switch Mounting Spacer	2
22	Air Deflector	1
23	Resistor (R1, R3 & R6)	3
	Round Head Screw	3
	Insulating Washer	6
	Lock Washer	3
	Plain Washer	3
	Hex Nut	3
24	Resistor (R2)	1
	Mounting Hardware — Same as item 23	
25	Capacitor Bank, Includes:	1
	Capacitor	5
	Insulation	1
26	Capacitor Brace	1
27	Control Transformer	1
28	Contactor	1
29	Reconnector Panel (Moveable) (Specify Voltage)	1
30	Input Access Door	1
31	Reconnect Panel (Stationary) (Specify Voltage) Includes:	1

ITEM	PART NAME & DESCRIPTION	NO. REQ'D
	Terminal Board	1
	Terminal Board Mounting Screws	2
	Carraige Bolt	6
	Hex Nut (Heavy)	6
	Hex Nut (Brass)	6
	Hex Nut (Std.)	6
31	Reconnect Panel (Triple Voltage & 380 Volt Machines)	1
	Panel Mounting Screws	2
	Panel Connection Links	9
31	Input Panel (380/500 V and 460/575 V	
	Units) Include:	
	Terminal Board	1
	Terminal Board Mounting Screws	2
	Carriage Bolt	3
	Hex Nut	9
34	Lead Insulating Panel	1
50	Capacitor Discharge Assembly (Optional) Includes:	1
	Resistor (R6 & R7)	2
	Round Head Screw	2
	Insulating Washer	4
	Plain Washer	2
	Lock Washer	2
	Hex Nut	2
	Relay (CR 4)	1
	Fuse Holder	1
	Fuse	1
53	Bracket, Multi-Process Switch (Optional)	1
54	Multi-Process Switch (Optional)	1
	Multi-Process Switch Parts See P-126-F	
	Multi-Process Switch Brackets	2
		2
	Parts Not Illustrated:	
	Roof	1
	Side Panel	2
	Life Bail Cover Seal	1
	Ground Decal	1
	Instruction Decal — Inside Terminal Strip Access Door	1
	Caution Decal — Back of Control Box Above Rectifier	1

12-13-83

WHEN ORDERING GIVE: Item No., Part Name, Parts List No., and Welder Code.

TRANSFORMER, LIFT BAIL, BASE, RECTIFIER AND CHOKE ASSEMBLY



WHEN ORDERING GIVE: Item No., Part Name, Parts List No., and Welder Code.

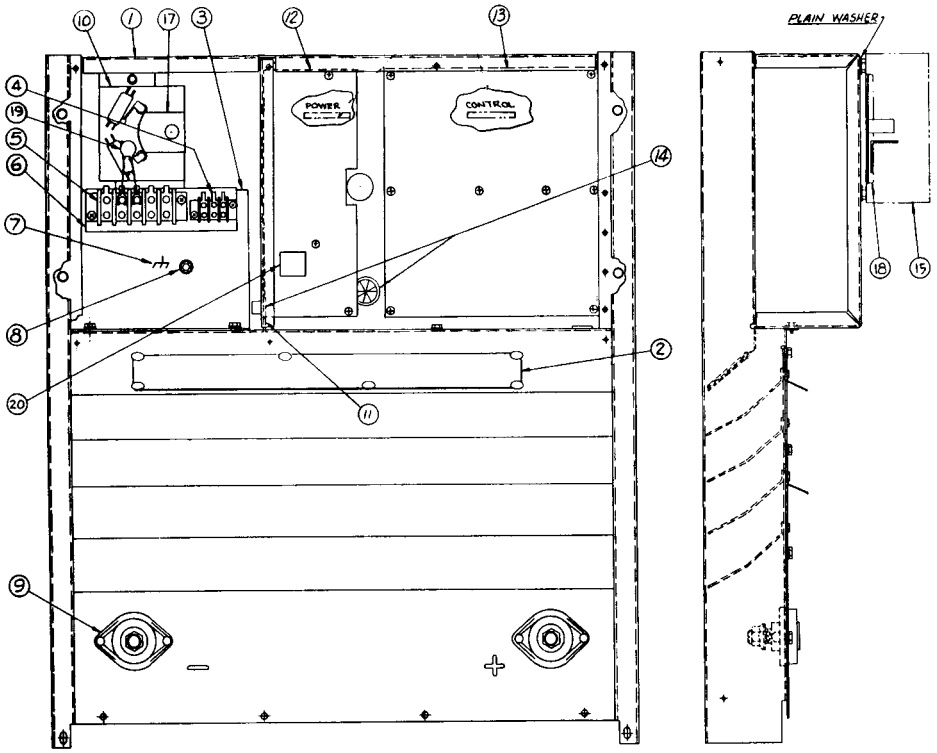
G-1613
10-4-85F

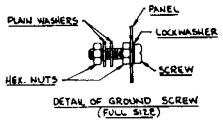
Parts List P-151-D

ITEM	PART NAME & DESCRIPTION	NO. REQ'D
1	Base Assembly	1
2	Transformer, Choke & Lift Bail,	
	Includes:	
	Transformer (Specify Voltage) Includes:	1
	Lamination Assembly	1
	Primary Insulation	6
	Primary Coils	6
	Auxiliary Coils	5
	Auxiliary Coil Insulation	10
	Secondary Coils	3
	Primary Thermostat	1
	Secondary Thermostat	1
	Choke Coil Assembly, Includes:	1
	Choke Primary Coil	1
	Choke Secondary Coil	1
	Lift Bail Assembly	1
3	Hex Head Screw	4
	Lock Washer	4
	Plain Washer	4
4	Plain Washer	2
	Lock Washer	2
	Hex Nut	2
5	Brace	2
6	Thread Cutting Screw	2
	Spacer	2
7	Rectifier Assembly, Includes:	1
	Stud Diodes	4
	SCR Heat Sink Assembly (4 Corner Holes — .290 Dia.)	2
	SCR Heat Sink Assembly (3 Corner Holes — .290 Dia., 1 — .344 Dia.)	1
	Lock Washer	4
	Hex Nut	4
8	Plain Washer	3
	Lock Washer	3
	Hex Nut	3
9	Snubber P.C. Board	1
10	Lead	1
	Hex Head Screw	1
	Plain Washer	2
	Lock Washer	1
	Hex Nut	1
11	Choke Baffle	1
	Thread Rolling Screw	2
12	Insulation (Baffle)	2
	Thread Rolling Screw	2
13	Auxiliary Power Filter	1
	Thread Cutting Screw	2

6-25-84

CASE FRONT ASSEMBLY





L-6808
10-12-84J

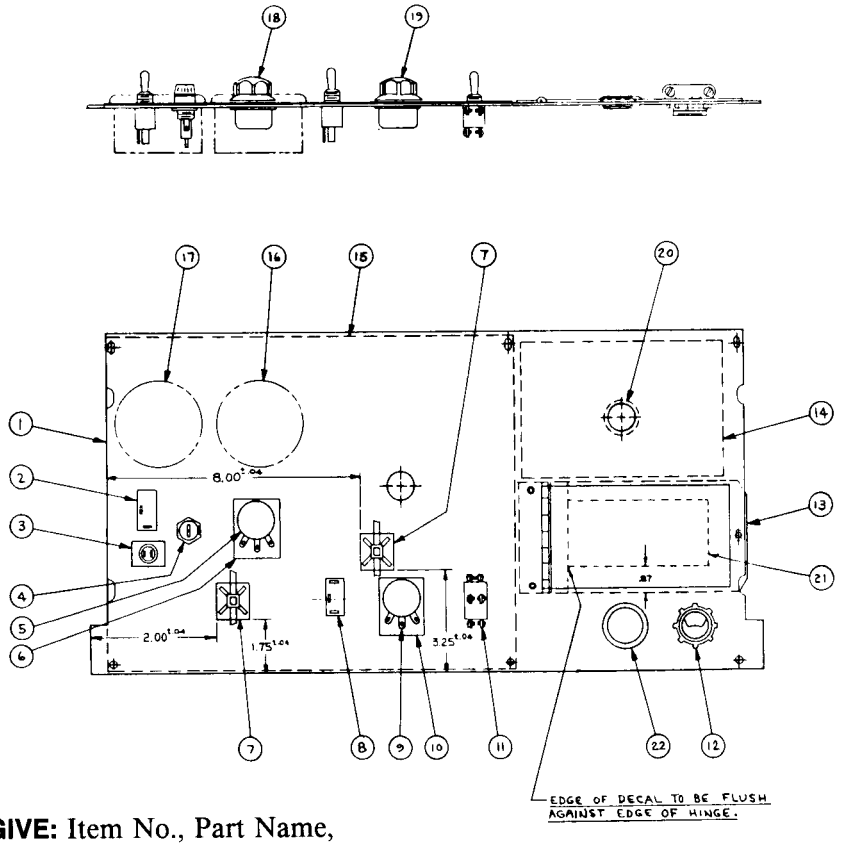
WHEN ORDERING GIVE: Item No., Part Name, Parts List No., and Welder Code.

Parts List P-151-E

ITEM	PART NAME & DESCRIPTION	NO. REQ'D
1	Case Front, Support Louvers & Control Box	1
2	Warning Button	1
	Fastener Button	6
3	Terminal Strip Bracket	1
	Lock Washer	2
	Self Tapping Screw	2
4	Terminal Strip	1
	Self Tapping Screw	2
5	Terminal Strip	1
	Self Tapping Screw	2
6	Number Plate	1
7	Ground Decal	1
8	Thread Cutting Screw	1
	Lock Washer	1
	Plain Washer	2
	Hex Nut	1
9	Output Terminal Kit, Includes:	2
	Output Terminal	1
	Self Tapping Screw	2
	Output Stud Nut	1
10	Micro Switch Assembly (CV/VV Units Only) Includes:	1
	Micro Switch	2
	Switch Actuator	2
11	Insulation	1
12	Power P.C. Board	1
	Expansion Nut	6
	Self Tapping Screw	6
13	Control P.C. Board	1
	Expansion Nut	8
	Self Tapping Screw	8
14	Bushing	2
15	Mode Switch (CV/VV Units Only)	1
	Plain Washer	3
	Lock Washer	3
	Hex Nut	3
17	Cam-Mode Switch (CV/VV Units Only)	1
18	Set Screw	1
	Starting P.C. Board	1
	Expansion Nut	2
	Self Tapping Screw	2
19	Capacitor Assembly (C6)	1
20	Relay (CR2)	1

10-15-84

CONTROL BOX COVER ASSEMBLY



WHEN ORDERING GIVE: Item No., Part Name, Parts List No., and Welder Code.

L-6816
3-16-84H

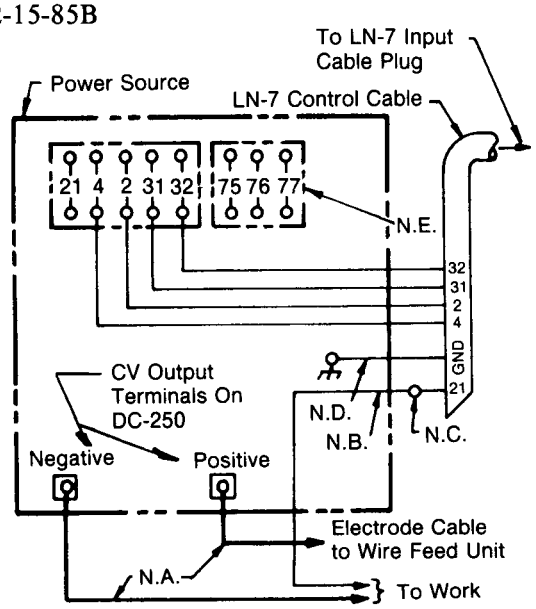
Parts List P-151-F

ITEM	PART NAME & DESCRIPTION	NO. REQ'D
1	Control Box Cover	1
2	Power Switch (S1)	1
3	Pilot Light	1
4	Fuse Holder	1
	Fuse (F1)	1
5	Potentiometer (R4)	1
6	Insulation	1
7	Cable Tie Mount	2
	Cable Tie	2
8	Current Control Polarity Switch (S3)	1
9	Potentiometer (R5) (CV/VV Units Only)	1
10	Insulation (CV/VV Units Only)	1
11	Outputs Control Switch (S2)	1
12	Box Connector	1
13	Access Door Assembly	1
	Self Tapping Screw	2
14	Mode Switch Nameplate (CV/VV Units Only)	1
15	Nameplate	1
16	Ammeter (Optional)	1
17	Voltmeter (Optional)	1
18	Knob	1
19	Knob (CV/VV Units Only)	1
20	Plug Button (CV Units Only)	1
21	Warning Decal	1

2-21-83

Connection of DC-400 to LN-7

S-17372
Wiring Diagram
2-15-85B



Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work leads at the power source.

WARNING: Turn input power to power source off before connecting the LN-7 wire feeder.

N.A. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications. See LN-7 Operating Manual for proper sizes.

N.B. If LN-7 is equipped with a meter kit, extend LN-7 control cable lead #21 using 14 AWG or larger insulated wire physically suitable for the installation. An S-16586-[LENGTH] remote voltage sensing work lead may be ordered for this purpose. Connect it directly to the work piece independent of the welding work cable connection. For convenience, this extended #21 lead should be taped to the welding work lead. (If the length of welding work cable is short, less than 25 feet, and connections can be expected to be reliable, then control cable lead #21 does not need to be extended and can be directly connected to terminal #21 on the terminal strip.)

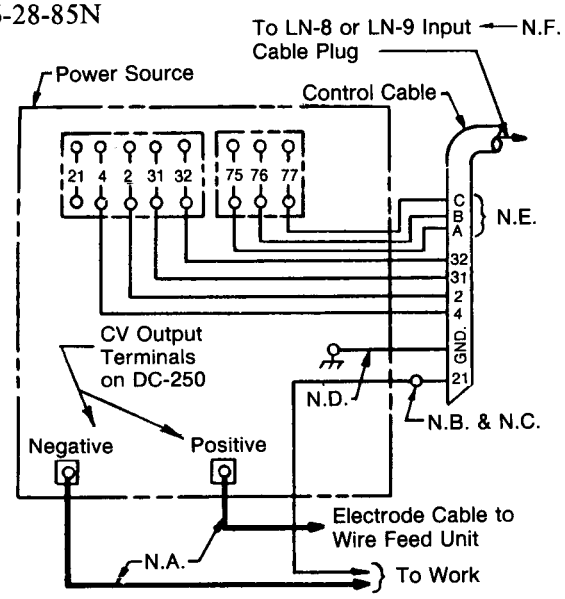
N.C. Tape up bolted connection if lead #21 is extended.

N.D. Connect the control cable ground lead to the frame terminal marked ⏚ near the power source terminal strip. The power source grounding terminal (marked ⏚ and located near the power source input power connections) must be properly connected to electrical ground per the power source operating manual.

N.E. If an optional remote voltage control is used, connect it to this terminal strip.

Connection of DC-400 to LN-8 and LN-9

S-17373
Wiring Diagram
6-28-85N



Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work leads at the power source and position the switch on power source to proper polarity.

N.A. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.

N.B. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S-16586-[ ] remote voltage sensing work lead is available for this purpose. Connect it directly to the work piece keeping it electrically separate from the welding work lead circuit and connection. For convenience, this extended #21 lead should be taped to the welding work lead. (If the length of work lead circuit is short, and connections can be expected to be reliable, the control cable lead #21 does not need to be extended and can be directly connected to terminal #21 on the terminal strip.)

N.C. Tape up bolted connection.

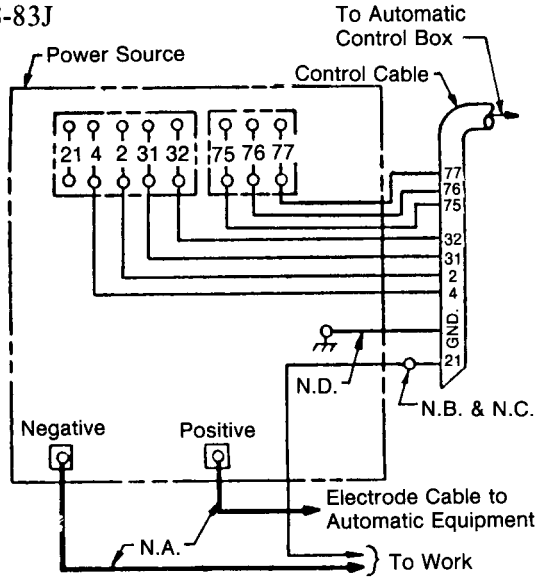
N.D. Connect the LN-8 or LN-9 control cable gound lead to the frame terminal marked ⏚ near the power source terminal strip. The power source must be proprely grounded.

N.E. If using an older LN-8 control cable; connect lead #75 to #75 on the terminal strip, connect lead #76 to #76 on the terminal strip, connect lead #77 to #77 on the terminal strip.

N.F. The LN-9 voltage control jumpers must be connected as follows (refer to LN-9 Operating Manual):
White jumper on voltage board to pin "S".
Blue jumper on voltage board (later units only), or on start board (earlier units), to pin "B".

Connection of NA-3, LT-5 or LT-7

S-17374
Wiring Diagram
7-28-83J



Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work leads at the power source and position the switch on power source to proper polarity. Reverse the leads on the back of the ammeter and voltmeter in the automatic control box.

N.A. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.

N.B. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S-16586-[ ] remote voltage sensing work lead is available for this purpose. Connect it directly to the work piece keeping it electrically separate from the welding work lead circuit and connection. For convenience, this extended #21 lead should be taped to the welding work lead. (If the length of work lead circuit is short, and connections can be expected to be reliable, the control cable lead #21 does not need to be extended and can be directly connected to terminal #21 on the terminal strip.)

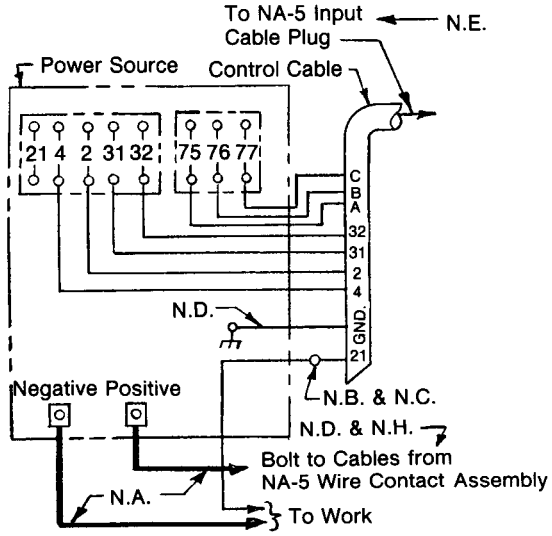
N.C. Tape up bolted connection.

N.D. Connect the control cable ground lead to the frame terminal marked ⏚ near the power source terminal strip. The power source must be proprely grounded.

N.E. If a variable voltage board is present in the automatic controls and the DC-400 diode kit is not used, the jumper lead on the VV board must be connected to pin "L" to permit the inch down button to operate. This jumper, however, will disable the cold starting/ auto-stop feature of the automatic controls, permitting only hot starting techniques to be used.

Connection of DC-400 to NA-5 or NA-5R

S-17375
Wiring Diagram
7-28-83J



Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work leads at the power source, and position the switch on power source to proper polarity. Refer to NA-5 operating manual for required NA-5 control box polarity connections.

NOTE: Although directions always say NA-5, this diagram is also used for NA-5R.

N.A. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.

N.B. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S-16586-[ ] remote voltage sensing work lead is available for this purpose. Connect it directly to the work piece keeping it electrically separate from the welding work lead circuit and connection. For convenience, this extended #21 lead should be taped to the welding work lead. (If the length of work lead circuit is short, and connections can be expected to be reliable, the control cable lead #21 does not need to be extended and can be directly connected to terminal #21 on the terminal strip.)

N.C. Tape up bolted connection.

N.D. Connect the NA-5 control cable gound lead to the frame terminal marked ⏚ near the power source terminal strip. The power source must be proprely grounded.

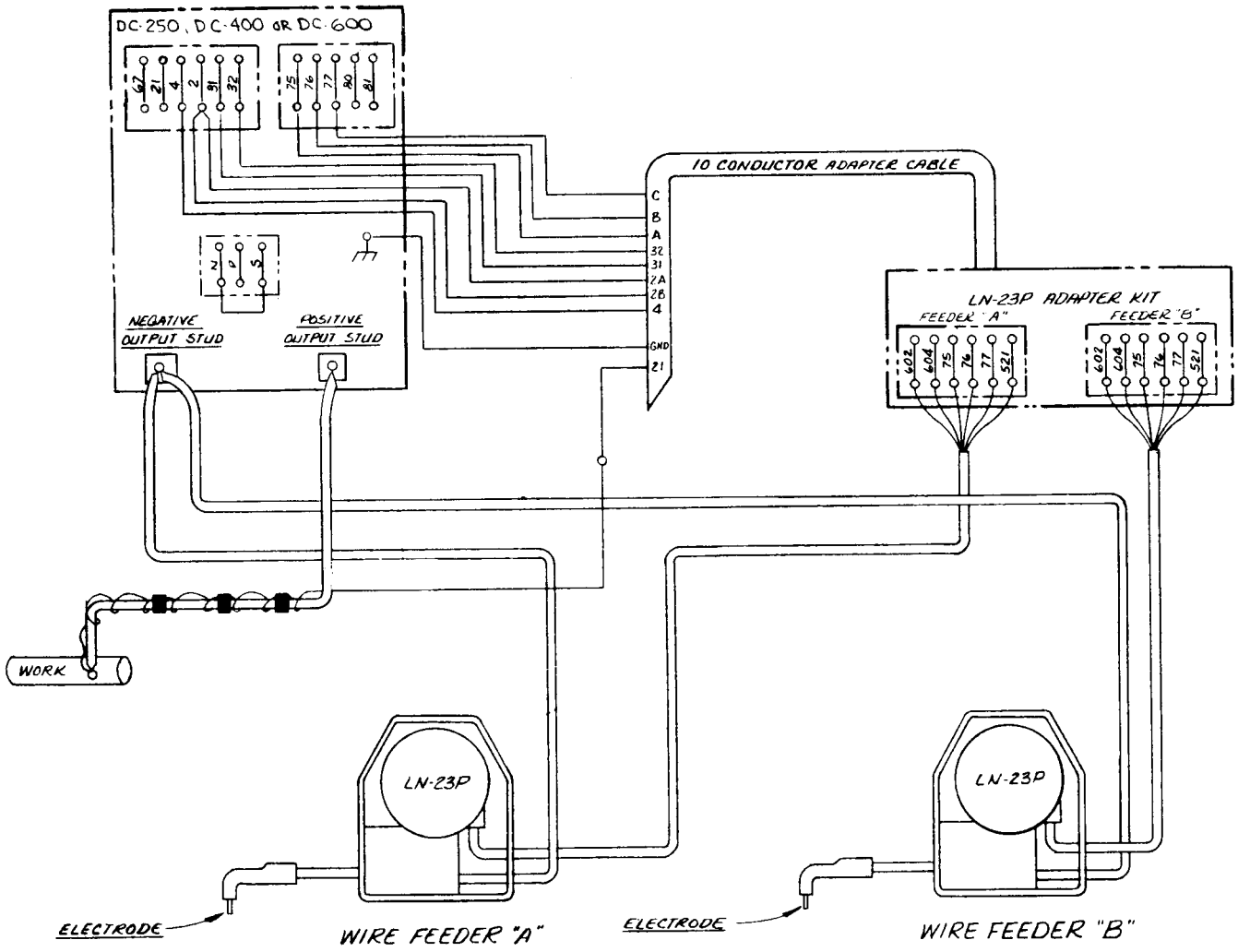
N.E. The jumpers on the NA-5 voltage board must be connected as follows:
Connect red jumper to pin "S"
Connect white jumper to pin "B"
When using NA-5 controls above Code 8300 without the optional DC-400 diode kit:
The NA-5 Inch Down button will not operate unless a jumper is connected between the two tab terminals, labled "AUTO", located above the transformer on the NA-5 Voltage P.C. board. This jumper, however, will disable the Cold Starting/Auto-Stop feature of the NA-5, permitting only Hot Starting techniques to be used.

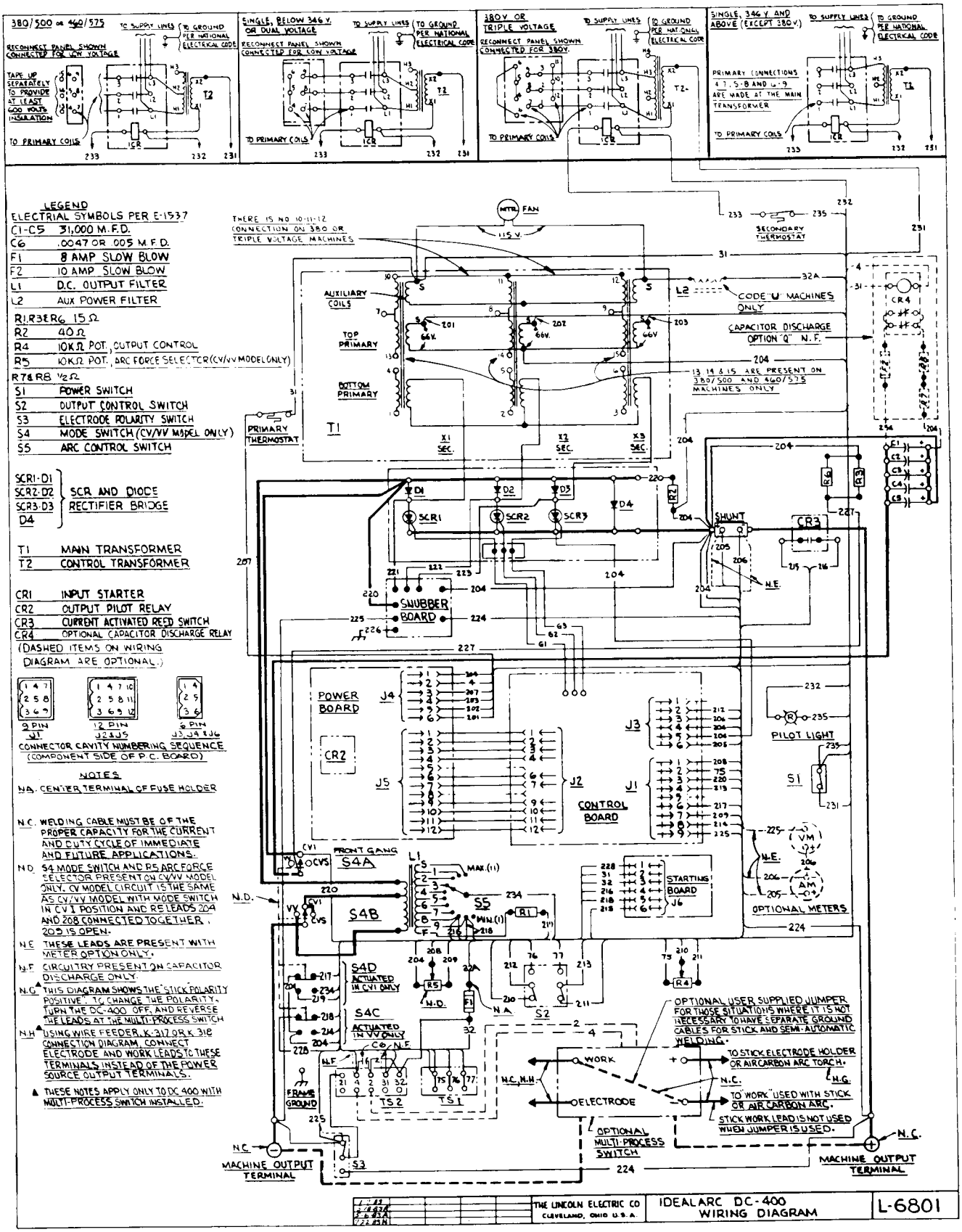
N.G. For proper NA-5 operation, the electrode cables must be snugged under the clamp bar on the left side of the NA-5 control box.

FOR ADDITIONAL INSTALLATION INSTRUCTIONS, SEE NA-5 OPERATING MANUAL.

Connection of LN-23P's and Adapter Kit to DC-400

M-14272
Wiring Diagram
2-15-85B





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-6801
7-22-83N

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 — complete part name and description, 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.

SPECIAL GUARANTEE ON RECTIFIER STACKS

The Lincoln Electric Company guarantees the main power rectifiers on transformer-rectifier type welders against defects in material or workmanship for a period of five years from date of welder shipment. When an individual diode or diode assembly is replaced, the original diode or diode assembly must be returned to Cleveland for examination and credit if judged defective. If a replacement diode or diode assembly is installed by an Authorized Field Service Shop within twelve months of the date of shipment of the original part, the labor expense will be paid by The Lincoln Electric Company. After 12 months any labor expense will be the owner's responsibility.

LINCOLN® ELECTRIC

THE LINCOLN ELECTRIC COMPANY
World's Largest Manufacturer of Arc Welding Products • Manufacturer of Industrial Motors
Sales and Service Worldwide
Cleveland, Ohio 44117-1199 U.S.A.
Toronto M4G 2B9 – Canada • Sydney 2211 – Australia • Rouen 76120 – France

Eff. May '90 Ram
5-84
Litho in U.S.A.