



Operator's Manual

NA-3 & NA-4



MODELS:
**NA-3N, NA-3NF, NA-3S, NA3SF,
NA-4**



Register your machine:

www.lincolnelectric.com/register

Authorized Service and Distributor Locator:

www.lincolnelectric.com/locator

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, Claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

SAFETY DEPENDS ON YOU

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part.

DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT. And, most importantly, think before you act and be careful.



WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life.



CAUTION

This statement appears where the information must be followed to avoid minor personal injury or damage to this equipment.



KEEP YOUR HEAD OUT OF THE FUMES.

DON'T get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.

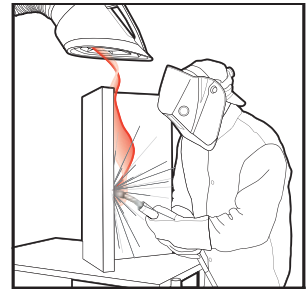
READ and obey the Material Safety Data Sheet (MSDS) and the warning label that appears on all containers of welding materials.

USE ENOUGH VENTILATION or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and the general area.

IN A LARGE ROOM OR OUTDOORS, natural ventilation may be adequate if you keep your head out of the fumes (See below).

USE NATURAL DRAFTS or fans to keep the fumes away from your face.

If you develop unusual symptoms, see your supervisor. Perhaps the welding atmosphere and ventilation system should be checked.



WEAR CORRECT EYE, EAR & BODY PROTECTION



PROTECT your eyes and face with welding helmet properly fitted and with proper grade of filter plate (See ANSI Z49.1).

PROTECT your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.

PROTECT others from splatter, flash, and glare with protective screens or barriers.

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

Also, wear safety glasses in work area AT ALL TIMES.



SPECIAL SITUATIONS

DO NOT WELD OR CUT containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

DO NOT WELD OR CUT painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.

Additional precautionary measures

PROTECT compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.

BE SURE cylinders are never grounded or part of an electrical circuit.

REMOVE all potential fire hazards from welding area.

ALWAYS HAVE FIRE FIGHTING EQUIPMENT READY FOR IMMEDIATE USE AND KNOW HOW TO USE IT.



SECTION A: WARNINGS



CALIFORNIA PROPOSITION 65 WARNINGS

Diesel Engines

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

Gasoline Engines

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

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

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

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

- 1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.



- 1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- 1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- 1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.
- 1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS



- 2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines
- 2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- 2.c. Exposure to EMF fields in welding may have other health effects which are now not known.
- 2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
 - 2.d.1. Route the electrode and work cables together - Secure them with tape when possible.
 - 2.d.2. Never coil the electrode lead around your body.
 - 2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
 - 2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.
 - 2.d.5. Do not work next to welding power source.



FOR ENGINE POWERED EQUIPMENT.

- 1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.
- 1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.



- 1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.





ELECTRIC SHOCK CAN KILL.



- 3.a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- 3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

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

- Semiautomatic DC Constant Voltage (Wire) Welder.
 - DC Manual (Stick) Welder.
 - AC Welder with Reduced Voltage Control.
- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.
 - 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
 - 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
 - 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
 - 3.g. Never dip the electrode in water for cooling.
 - 3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
 - 3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
 - 3.j. Also see Items 6.c. and 8.



ARC RAYS CAN BURN.



- 4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



FUMES AND GASES CAN BE DANGEROUS.



- 5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**
- 5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.
- 5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- 5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 5.e. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer’s safety practices. MSDS forms are available from your welding distributor or from the manufacturer.
- 5.f. Also see item 1.b.



WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



- 6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.
- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.
- 6.i. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.
- 6.j. Do not use a welding power source for pipe thawing.



CYLINDER MAY EXPLODE IF DAMAGED.



- 7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
 - Away from areas where they may be struck or subjected to physical damage.
 - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.



FOR ELECTRICALLY POWERED EQUIPMENT.



- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to
<http://www.lincolnelectric.com/safety>
for additional safety information.



**Welding Safety
Interactive Web Guide
for mobile devices**

Get the free mobile app at
<http://gettag.mobi>

Thank You

for selecting a **QUALITY** product by Lincoln Electric. We want you to take pride in operating this Lincoln Electric Company product ... as much pride as we have in bringing this product to you!

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric is not in a position to warrant or guarantee such advice, and assumes no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

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

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

Please Examine Carton and Equipment For Damage Immediately

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, Claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

Product _____

Model Number _____

Code Number or Date Code _____

Serial Number _____

Date Purchased _____

Where Purchased _____

Whenever you request replacement parts or information on this equipment, always supply the information you have recorded above. The code number is especially important when identifying the correct replacement parts.

On-Line Product Registration

- Register your machine with Lincoln Electric either via fax or over the Internet.
- For faxing: Complete the form on the back of the warranty statement included in the literature packet accompanying this machine and fax the form per the instructions printed on it.
- For On-Line Registration: Go to our **WEB SITE at www.lincolnelectric.com**. Choose "Quick Links" and then "Product Registration". Please complete the form and submit your registration.

Read this Operators Manual completely before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. The level of seriousness to be applied to each is explained below:

WARNING

This statement appears where the information **must** be followed **exactly** to avoid **serious personal injury** or **loss of life**.

CAUTION

This statement appears where the information **must** be followed to avoid **minor personal injury** or **damage to this equipment**.

Sec. L1 — Index

Installation Instructions

- Sec. L2.2 Mechanical Installation
 - Sec. L2.2.6 Submerged Arc Contact Assemblies — K231, K226, K233
 - Sec. L2.2.7 K148 Contact Nozzle and K149 Linc-Fill™ Long Stickout Extension
 - Sec. L2.2.11 K29 Vertical Head Adjuster
 - Sec. L2.2.12 K96 Horizontal Head Adjuster
- Sec. L2.3 Electrical Installation
 - Sec. L2.3.4 Connection Diagrams
 - Sec. L2.3.5 Connection of NA-3 (All) to Non-Lincoln (Not included in Sec. L2.3.4) Power Sources
- Sec. L2.5 Special Mechanical Installation
 - Sec. L2.5.3 K129 Submerged Arc Small Wire Twinarc®
 - Sec. L2.5.3 K225 Submerged Arc Twinarc® Kit
 - Sec. L2.5.3 K239 Twinarc® Kit for Innershield® Electrodes
 - Sec. L2.5.4 K218 Horizontal Fillet/Lap Attachment
 - Sec. L2.5.5 K281 Solid Wire Straightener for Tiny Twinarc®
 - Sec. L2.5.6 K278 Spreadarc™
 - Sec. L2.5.7 K386 Narrow Gap Deep Groove Nozzle
 - Sec. L2.5.8 K391 High Capacity Submerged Arc Nozzle
 - Sec. L2.5.9 K405 Automatic Innershield® Nozzle
 - Sec. L2.5.10-A Speed-Feed® Drums
 - Sec. L2.5.10-B Speed-Feed Reels
- Sec. L2.7 Optional Features Installation
 - Sec. L2.7.1 Contact Assemblies
 - Sec. L2.7.2 Twinarc Installations
 - Sec. L2.7.3 K218 Horizontal Fillet/Lap Attachment
 - Sec. L2.7.4 K29 Vertical Lift Adjuster
 - Sec. L2.7.5 K96 Horizontal Adjuster
 - Sec. L2.7.7 K219 Flux Hopper Kit
 - Sec. L2.7.8 K223 Solenoid Kit
 - Sec. L2.7.9 K221 Start Controls P.C. Board
 - Sec. L2.7.10 K245 Crater Controls P.C. Board
 - Sec. L2.7.11 K237 Linc-Fill Starting Relay
 - Sec. L2.7.12 K224 Solid State Remote Field Control
 - Sec. L2.7.13 K238 High Frequency Unit
 - Sec. L2.7.14 K263 DC Electronic Voltmeter
 - Sec. L2.7.15 K299 Wire Reel Assembly
 - Sec. L2.7.16 K310 Flux Screen
 - Sec. L2.7.17 K58 Magnetic Separator
 - Sec. L2.7.18 Wire Size Conversion Kits — Gun Cable Adapters

Operating Instructions

- Sec. L3.2 Routine Equipment Operation
 - Sec. L3.2.1 Operators Instructions
 - Sec. L3.2.2 Loading the 50-60 Lb. (23-27 Kg) Reel
 - Sec. L3.2.3 Head Position Adjustments
 - Sec. L3.2.4 Controls and Their Functions
- Sec. L3.3 Setup Instructions
 - Sec. L3.3.1 Submerged Arc and Open Arc Welding with DC Constant Voltage (CV) Power Sources Only
 - Sec. L3.3.2 Submerged Arc Welding with DC or AC Constant Current (CC)⁽¹⁾ Power Sources Only
 - Sec. L3.3.4 Special Considerations for Line-Fill Welding
- Sec. L3.4 Starting and Stopping Sequences
 - Sec. L3.4.1 Available Starting Sequences
 - Sec. L3.4.2 Setting Travel Starting and Stopping

⁽¹⁾ Note: Formerly Variable Voltage (VV).

Maintenance Instructions

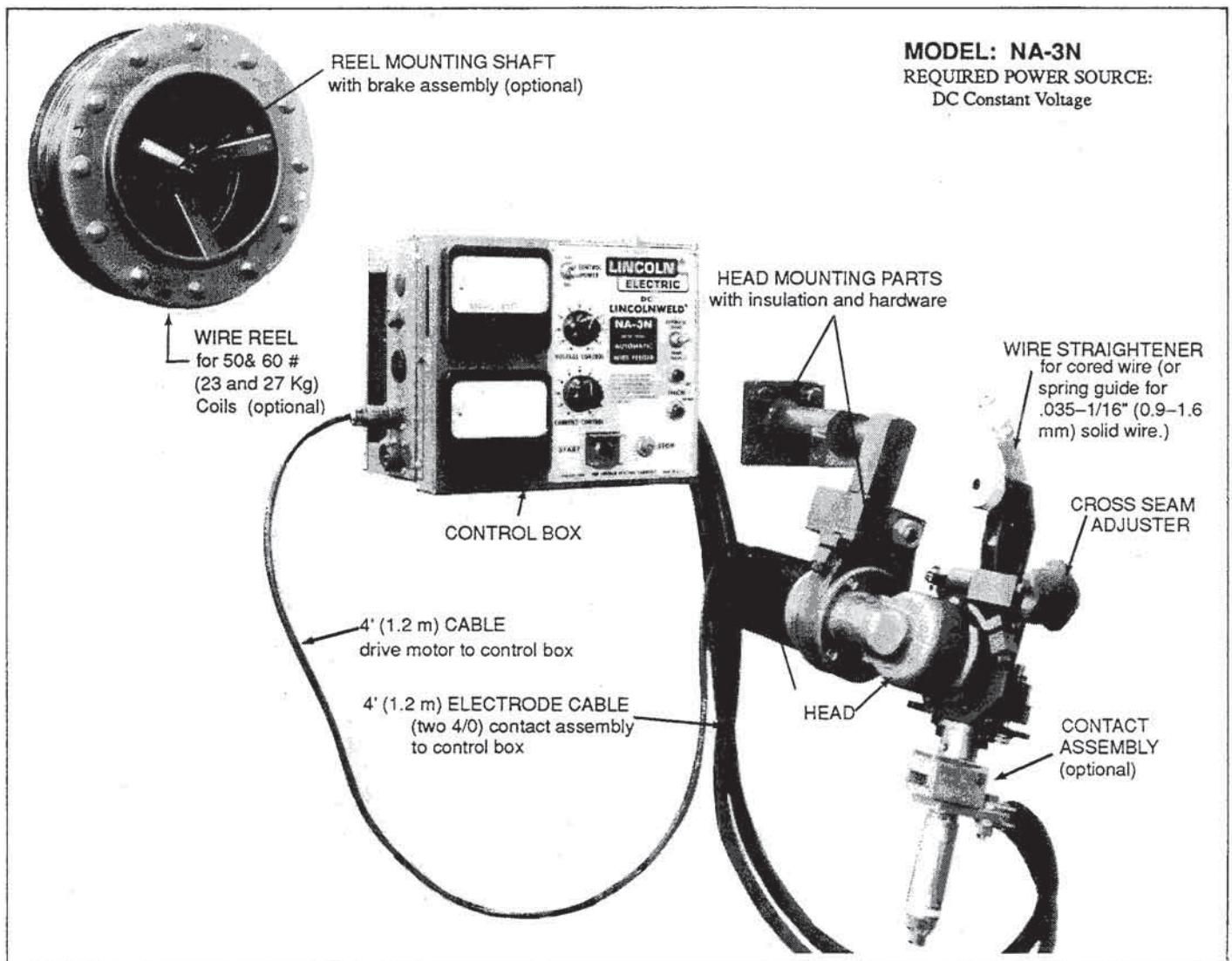
Sec. L6.2	Mechanical Maintenance
Sec. L6.2.1	Wire Drive Gear Box
Sec. L6.2.2	Changing Wire Feed Gear Ratios
Sec. L6.2.3	Wire Drive Mechanism
Sec. L6.2.5	Wire Straighteners
Sec. L6.3	Electrical Maintenance
Sec. L6.3.1	Control Box
Sec. L6.3.2	Circuit Protection
Sec. L6.4	Optional Feature Maintenance
Sec. L6.4.1	Contact Assemblies
Sec. L6.4.2	Wire Reel Mounting for 50 or 60 Lb. (23 or 27 Kg) Coils
Sec. L6.4.4	Travel Carriage
Sec. L6.4.5	Carriage Gear Box Disassembly
Sec. L6.4.6	Vertical Lift Adjuster
Sec. L6.4.7	Horizontal Adjuster

Parts List — At Back of Manual

Wiring Diagrams and Dimension Drawings — At Back of Manual

SEC. L2.2 — MECHANICAL INSTALLATION

Sec. L2.2.1-N Available Models



MODEL: NA-3NF
(For Machinery and Fixture Builders)

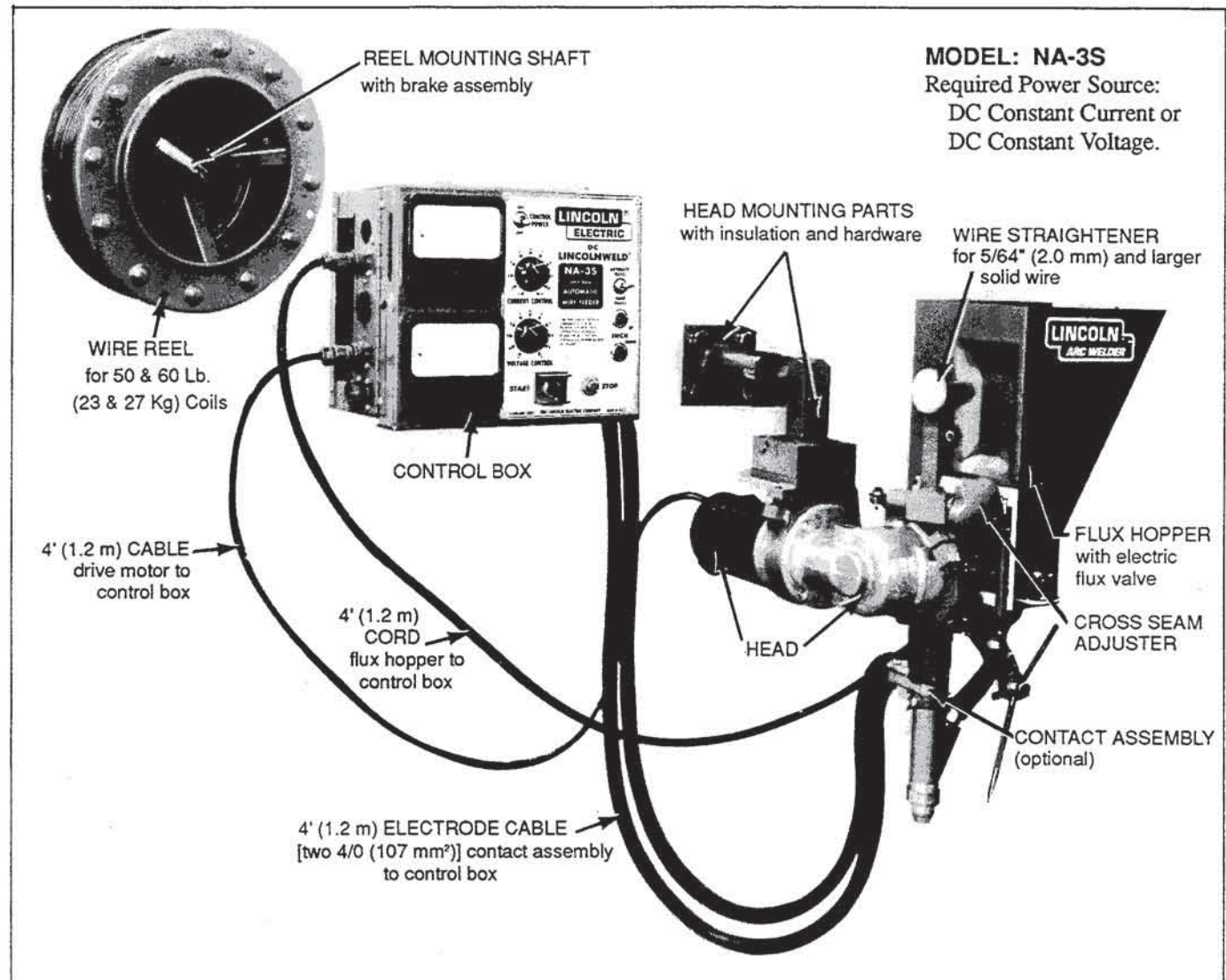
Required Power Source: DC Constant Voltage

Identical to the NA-3N except the following parts are not included:

- Head Mounting Parts
- 4' (1.2 m) Electrode Cable
- Cross Seam Adjuster

Sec. L2.2.1-S

Available Models



MODEL: NA-3SF

(For Machinery and Fixture Builders)

Required Power Source:

DC Constant Current or DC Constant Voltage

Identical to the NA-3S except the following parts are not included:

Head Mounting Parts
4' (1.2 m) Electrode Cable
Cross Seam Adjuster
Flux Hopper and Pointer Assembly

MODEL: NA-4

Required Power Source:
AC Constant Current

Identical to the NA-3S except for the control and wiring differences required for operation with the AC power source.

MODEL: NA-4F

Required Power Source:
AC Constant Current

Identical to the NA-4 except the following parts are not included:
Flux Hopper with Automatic Valve
Cross Seam Adjuster
Head Mounting Parts
Electrode Cable from Control to Wire Contact Assembly

MECHANICAL INSTALLATION — CONT'D

Sec. L2.2.2

Head Installation

CAUTION: A common mistake when installing these automatic wire feeders is to allow an electrically conductive path between the welding head and ground. This can happen accidentally and unknowingly, as for example if a piece of wire or an extra metal washer forms a "bridge" across an insulator or if something gets bent and touches something it should not touch. If this occurs the wire may not inch down. Another common occurrence is for leads #67 or #21 to be misconnected (or broken). In this case the wire will inch up (back up) when the start button is pushed.

To avoid these situations, be sure to use ALL insulators provided. After installation, test per table below and obtain indicated resistances. If the test results are different than the expected resistances consult the Troubleshooting Guide in the appropriate IM manual. Before consulting the manual first examine the installed wirefeeders to see if there is some conducting path between the head and the work fixture.

Test Points	Expected Resistances	Comments and Conditions
Lead #67 (#667 in NA-5 Control Box) to Electrode Wire	Zero or less than 1 ohm	Electrode wire must be in contact with assembly tip
Lead #21 (#621 in NA-5 Control Box) to work piece	Zero or less than 1 ohm	Polarity switches must be in the correct position
Lead #67 (#667 in NA-5 Control Box) to Lead #21 (#621 in NA-5 Control Box)	Greater than 15K ohms Greater than 1K ohms (NA-3, 4, LT-7)	Before testing using a 3/4" wrench disconnect the welding cable(s) from the contact assembly

A. GENERAL REQUIREMENTS (All Models)

Mountings and Fixtures — Design the installation with the adjustability required by the welding application. Include sufficient clearance for the head adjustments described in Sec. L3.2.3.

For best arc striking, use a rigid mounting which prevents the head from moving when the electrode strikes the work.

Insulation — The head and electrode are electrically "hot" when welding. They must be insulated from ground.

B. SPECIFIC REQUIREMENTS FOR NA-3N, NA-3S, NA-4 AND NA-5

Head mounting hardware and insulation is shipped with these heads. If installing an optional vertical lift adjuster or horizontal adjuster, see Sec. L2.2.11 or Sec. L2.2.12 respectively. To mount heads on the standard travel carriage, see Sec. L2.2.4. To mount heads on a separate fixture, provide the mounting holes specified in the dimension print.

C. SPECIFIC REQUIREMENTS FOR THE NA-3NF AND NA-3SF, NA-5NF AND NA-5SF

These models do not include the head mounting parts and cannot be installed on the standard travel carriage. Design the head mounting and insulation parts to fit the fixture.

During 1996 a "Made to Order" K690-1F 95/1 NA-3SF Head (Code 10215) was established equipped for 3/32 Tiny Twinarc with the following parts replacing unneeded parts of the present K209B Head:

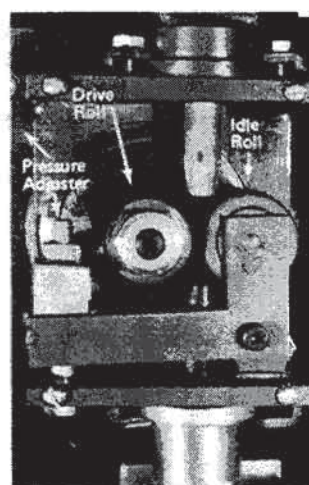
L5761	Tiny Twinarc Straightener (K281)
S14904 (2)	Outer Drive Roll (3/32)
S14905	Center Drive Roll (3/32)
T12146-1	Drive Roll Spacer
M8776-6	Drive Roll Key
S13165	Idle Roll Assembly
S13162-5/64	Outgoing Guide Tube (1/16 thru 3/32)
M11609	Tiny Twinarc Nozzle with:
	(2) T12507-5/64 Guide Tube
	(2) T14050-3/32 Contact Tip
S15954	Tip Holder Assembly

D. WIRE FEED MECHANISM

All heads are shipped with the wire feed speed gear box ratio specified for the model ordered. To change the gear box ratio, see Sec. L6.2.2.

All heads are shipped ready to feed the wire sizes specified on the order. Feeding other sizes may require changing drive rolls and guide tubes (see Parts List P-100-D & P-100-D.1).

Adjust the idle roll pressure adjustment screw for the wire diameter to be used in production. As shown on the indicator, there are two settings — .035-3/32" and .120-7/32" (equal to 0.9-2.4 mm and 3.0-5.6 mm). Make this adjustment only with the appropriate wire size between the drive and idle rolls. On some cored or soft electrodes it may be necessary to set for a lower pressure to prevent crushing.



As Shipped

When shipped, the drive roll rotates clockwise to feed electrode down (see photo). If desired, the faceplate can be rotated 180° and the wire straightener and contact assembly locations switched. The drive roll

rotation direction must be reversed by interchanging leads #626 and #627 from the wire feed motor plug at the terminal strip inside the control box.

Sec. L2.2.2 (Continued)

E. CONTACT ASSEMBLIES

Several different contact assemblies are available. See Sec. L2.2.6 or L2.2.7 for installation instructions.

F. WIRE REEL

If 300 to 1000 pound (136 to 454 Kg) Speed-Feed® reels or Speed-Feed® drums are to be used, see Sec. L2.5.7.

When ordered, the reel for 50 or 60 pound (23 or 27 Kg) coils is shipped with the needed mounting shaft, hardware and insulation. Shaft mounting hole requirements are on the head dimension drawings.

Install the reel mounting shaft on the fixture or travel carriage so the wire goes as directly as possible to the wire straightener without going around any corners or touching grounded metal equipment. If it must be fed long distances, use insulated, friction-free guides rather than long tubes.

G. WIRE STRAIGHTENER

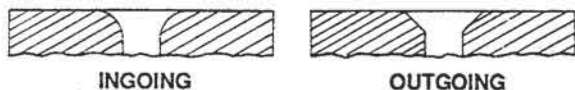
The NA-3S, NA-3SF, NA-4, NA-5S and NA-5SF models are shipped with a solid electrode straightener for 5/64" (2.0 mm) and larger wire.

The NA-3N, NA-3NF, NA-5N and NA-5NF models are shipped with one of the following:

1. A flux-cored wire straightener for .062 thru 5/32" (1.6-4.0 mm) Innershield electrode. It can also be used with 5/64" (2.0 mm) and 3/32" (2.4 mm) solid wire.
2. A tightly wound spring type wire guide for .035 thru 1/16" (0.9-1.6 mm) solid electrodes.

The various optional Twinarc® assemblies also include a twin wire straightener or wire guide as appropriate.

After the head is installed, fit the wire straightener or wire guide over the ingoing guide tube on top of the drive roll box. (The ingoing guide has a radius at the entrance shoulder — the outgoing guide is chamfered.) The ingoing (radius) guide tube **MUST** be used at the wire straightener.



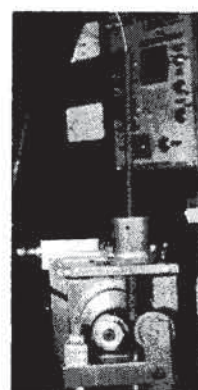
Turn the straightener so it points toward the wire reel. Tighten the two clamps supplied to hold it in position.



For 5/64" (2.0 mm) & Larger Solid Electrode



For Flux Cored Electrode



For .035-1/16" (0.9-1.6 mm) Solid Electrode

December 1998

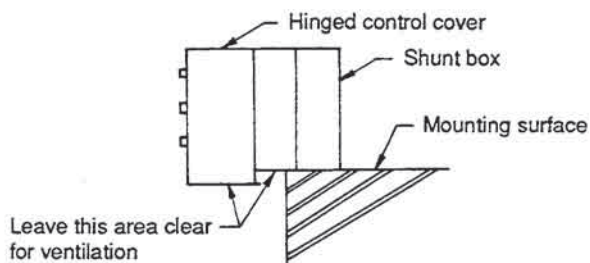
Sec. L2.2.3

Control Box Installation

The control box can be mounted either on the standard travel carriage or a separate fixture. It is electrically grounded by a lead in the input cable assembly.

For mounting on the travel carriage, see Sec. L2.2.4.

If mounting the controls on a fixture, remove the cover from the rear of the control box to provide access to the four mounting holes in the bottom of the box. Provide the holes in the fixture as specified in the dimension drawing filed at the back of this manual. Be sure the area below the front cover has ample clearance allowing free circulation of cooling air per the sketch below. Replace the back cover.



June 1974

Sec. L2.2.4-A

K236 Travel Carriage Installation (Discontinued May '75)

Build the mounting beam per instructions on the dimension drawing at the back of the manual.

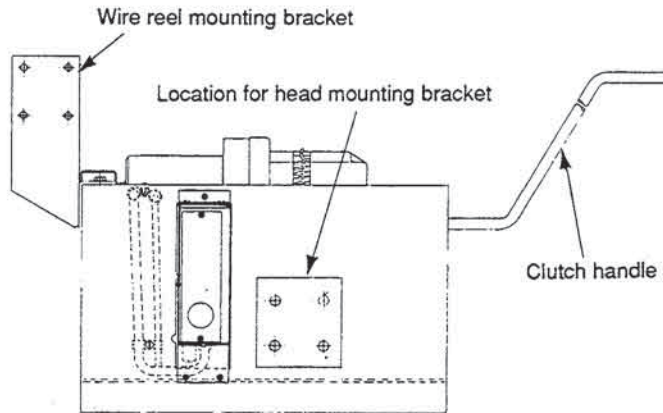
Before placing the carriage on the beam, install the clutch handle on the carriage. Also install the head mounting bracket using the insulation and hardware shipped with the head.

Set the carriage on the beam with the clutch handle all the way down so it rolls freely on the track. Push the handle up and the drive roll should engage the track and hold the car-

MECHANICAL INSTALLATION — CONT'D

Sec. L2.2.4-A (Continued)

riage firmly. If necessary, install shims per the dimension diagram at the rear of this manual.

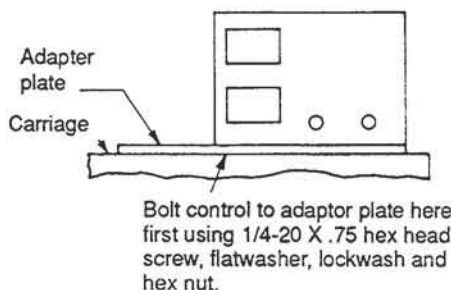


Travel Carriage

The carriage gear box is shipped without oil. With the carriage on the beam, remove the 3/8" (9.5 mm) slotted pipe plug on the top surface of the gear case and remove the oil level screw from the dust cap which faces the rear. Fill the gear case with the oil furnished or with SAE-140 oil until it runs out of the oil level hole. Capacity is about 1/2 pint (0.2 Liters).

Install the wire reel bracket to the left side of the carriage. Install the wire reel mounting shaft using the insulation and hardware shipped with the reel.

To install the control box, remove the cover from the back of the control box. Bolt the adapter plate to the left bottom corner of the box as shown in the following sketch using the hardware shipped with the carriage. Mount the control box and adapter plate to the carriage thru the holes in the bottom right corner of the box and the two holes in the left end of the adapter plate, using hardware shipped with the carriage. Replace the back cover.



Insert the plug of the carriage drive motor cable into the matching receptacle on the side of the control box. The carriage requires 250 volt-amperes of 115 volt, AC, 50 or 60 hertz power.

Keep the load on the carriage as uniform as practical. Install cables so they move smoothly with the carriage. Clamp the 4/0 (107.2 mm²) electrode cables from the power source to

the left rear corner of the carriage using the holes provided for the cable clamp. Suspend all cables off the floor to prevent excessive drag and damage to the cables.

Each carriage is shipped with the gear ratio specified for the model ordered. The travel speed ranges are listed below. Although carriages operate at speeds down to zero, speed variations increase rapidly with uneven loading when travel speeds below the listed minimums are used.

Carriage	Gear Box Ratio	Carriage Speed in	
		in./ min	m/ min
K236S	648 - 1	6.5 - 52	.16 - 1.3
K236M	324 - 1	13 - 104	.33 - 2.6
K236F	144 - 1	27 - 216	.68 - 5.4

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Sec. L2.2.4-C

K325 Travel Carriage Installation (Codes Above 8000)

The carriage is available in two versions: a Standard Carriage for normal loads and a High Capacity (-HC) Carriage for heavy loads.

The units are convertible from standard to high capacity or from high capacity to standard by changing bearings and a few spacers.

The maximum equipment to be used with each type of carriage is shown in the following tables.

K325 STANDARD CARRIAGE [Carriage bearing width .472 (12 mm)]

Single Wire Operation	Twin Wire Operation
<ol style="list-style-type: none"> 1. Single head and control 2. Single wire reel 3. Vertical adjuster 4. Horizontal adjuster 5. Flux hopper 6. 75 lbs. (34 Kg) of auxiliary equipment centrally located over carriage 	<ol style="list-style-type: none"> 1. Single head and control 2. Two wire reels 3. Vertical adjuster 4. Horizontal adjuster 5. Flux hopper 6. No auxiliary equipment

K325HC HIGH CAPACITY CARRIAGE [Carriage bearing width .866 (22 mm)]

Multiple Arc Operation	Tandem Twinarc
<ol style="list-style-type: none"> 1. Two heads and controls 2. Two wire reels 3. Vertical adjuster 4. Horizontal adjuster 5. Flux hopper 6. 150 lbs. (68 Kg) of auxiliary equipment centrally located over carriage 	<ol style="list-style-type: none"> 1. Three heads and controls 2. Three wire reels 3. Vertical adjuster 4. Horizontal adjuster 5. Flux hopper 6. No auxiliary equipment
	<ol style="list-style-type: none"> 1. Two heads and controls 2. Four wire reels centrally located over carriage 3. Vertical adjuster 4. Horizontal adjuster 5. Flux hopper 6. No auxiliary equipment

Sec. L2.2.4-C (Continued)

It is important that the mounting of the heads, control boxes, wire reels and other equipment be done in such a manner that there is a minimum overhung weight. The head mountings are to be such that the heads are within the dimension shown in Figure 1.

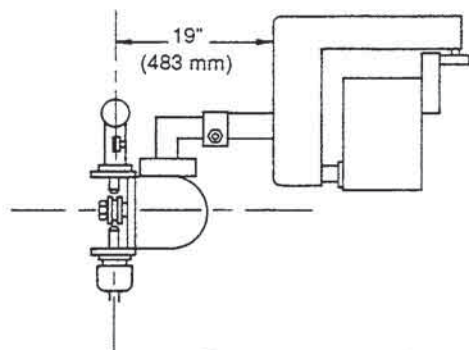


Figure 1

Installation

All carriages are factory assembled to fit an 8" (203 mm) beam; for 10" (254 mm) and 12" (305 mm) beams, see G-1458 (NA-3 and NA-4) for instructions for proper shimming.

The carriage release handle, wire reel support bracket, and the head supporting bracket are not factory mounted. **NOTE:** These carriages (above Code 8427) are equipped with a T13586-1 drive wheel with a helical tooth suitable for driving on a smooth drive rail. If the carriage is to be used with a beam drive rail having a straight cut knurl, it will be necessary to replace the drive roll with a T13586 drive roll (straight tooth) which must be ordered separately. These three items should be mounted to the carriage before it is placed upon the beam (see instruction sheet M13297). After installing the wire reel shaft support and the head support, be sure both of these supports are electrically isolated from the carriage frame.

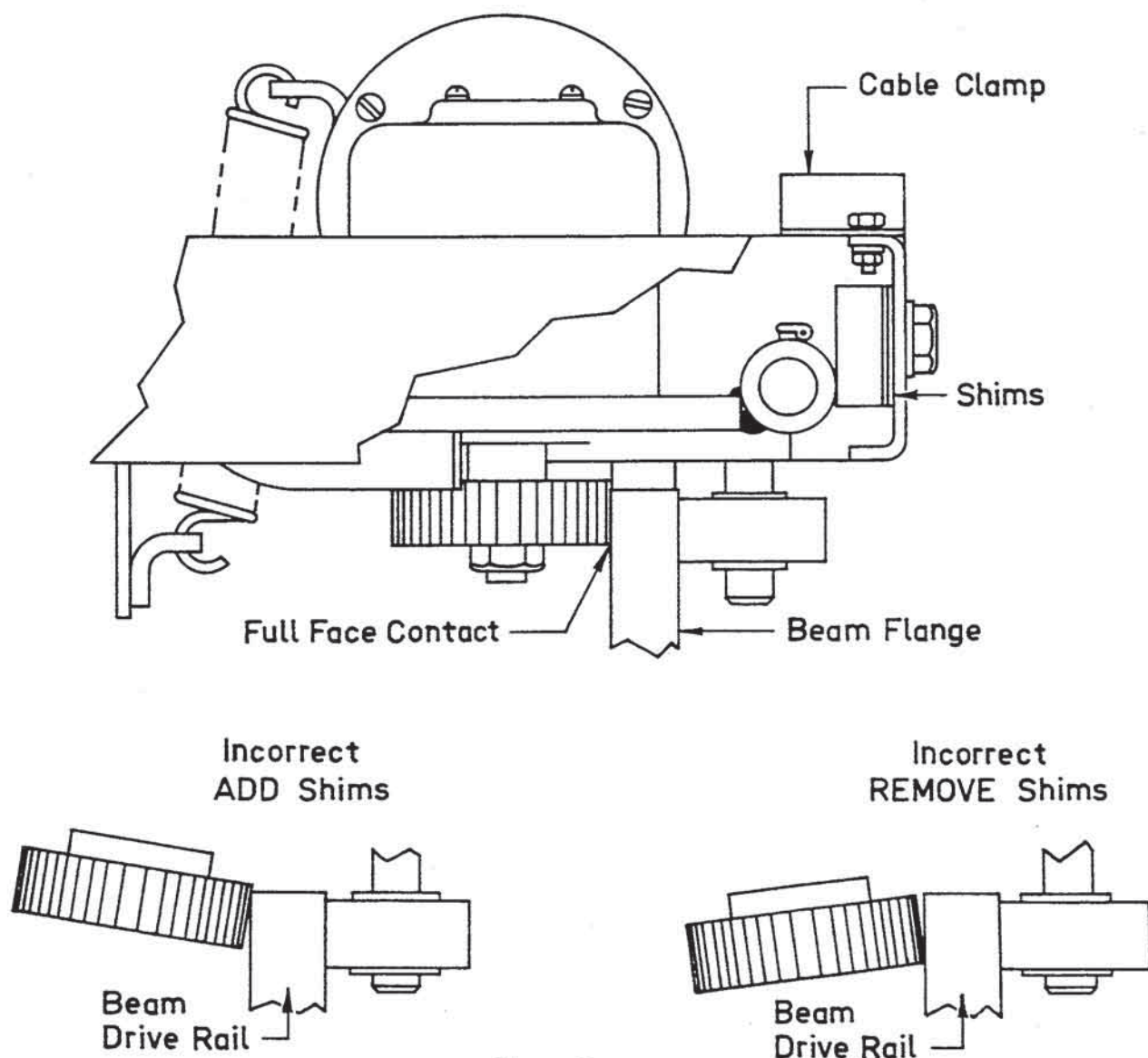


Figure 2

MECHANICAL INSTALLATION — CONT'D

Sec. L2.2.4-C (Continued)

With the carriage release handle all the way down, set the carriage upon the beam. It should run freely along the entire beam length. With the release handle in the up position the drive gear should engage the track and hold the carriage securely in position.

Mount the control box on top of the carriage (see instruction sheet M13297). Parts needed for insulating or mounting the control box are found on each carriage. The NA-3 and NA-4 boxes require no insulation.

Insert the 4-prong plug of the carriage drive circuit control cable into the matching receptacle on the side of the control box. Earlier drive circuit cables had a 3-prong plug. The carriage requires 250 volt-amperes of 115 volt, AC, 50 or 60 hertz power.

Keep the load on the carriage as uniform as practical. Install cables so they move smoothly with the carriage. Clamp the 4/0 (107.2 mm²) electrode cables from the power source to the left rear corner of the carriage using the holes provided for the cable clamp. Suspend all cables off the floor to prevent excessive drag and damage to the cables.

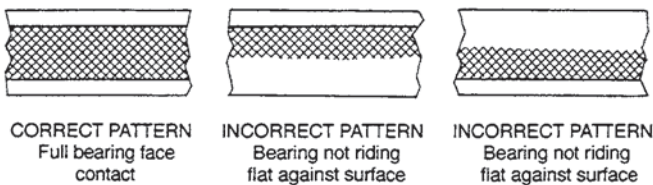
For Twinarc installations, install the second wire reel as specified in the instructions shipped with the Twinarc kit.

After all of the equipment (wire reel shafts, wire reel and wire, and control box) have been installed on the carriage, the tracking of the carriage bearings and the drive gear should be checked.

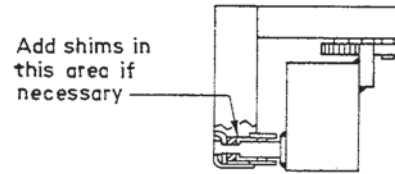
The carriage drive unit is properly shimmed at the factory so that the face of the driving gear is flat against a .88 (22 mm) thick beam flange when the release handle is in the up position. If the flange is other than .88 (22 mm) thick the shims under the gear box mounting brackets will have to be changed per Figure 2.

Carriage Bearing Tracking

The bearing tracking can be checked by placing a strip of white paper along the area over which each set of bearings ride. Disengage the release handle and move the carriage over these paper strips. If the carriage has been properly installed, the trace on each paper should show a uniform trace left by the bearing face.

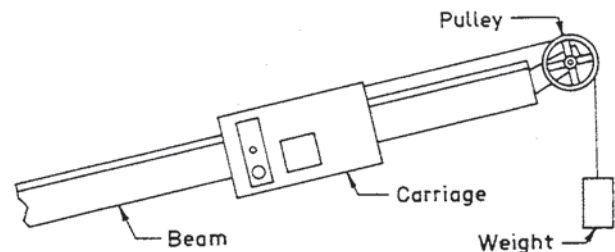


The out-of-squareness between the carriage and the beam can be corrected by shimming the lower bearing assembly bar.



Inclined Operation of Carriage

1. Beam should have knurled type driving flange.
2. When the tilt is 5° or under, no counter weight system is required as far as the loading on the carriage drive motor is concerned. However, see "caution" below.
3. Beam tilt angles of greater than 5° will require a counter weight system as shown.
The amount of counter weight will depend on the tilt angle and carriage loading.



4. Beam tilt angles should be limited to 10° or less.

CAUTION: When the carriage is used in an inclined type of operation, the unit is free to roll whenever the travel release handle is pulled down. This may happen even if a counterbalance is used unless the wire reel and flux hopper (when used) are mounted off the carriage in which case their changing weight does not affect the counterbalance.

Each carriage is shipped with the gear ratio specified for the model ordered. The travel speed ranges are listed below. Although carriages operate at speeds down to zero, speed variations increase rapidly with uneven loading when travel speeds below the listed minimums are used.

(Standard or HC) Carriage	Gear Box Ratio	Carriage Speed in	
		In./ min	m/ min
K325S	952-1	5 - 75	.12 - 1.9
K325F	254-1	15 - 270	.38 - 6.8

Maintenance

Periodically:

1. Disengage the release handle and see that the carriage moves freely along the beam.
2. Add a few drops of machine oil to each of the head lift bearings. This can be done through the front opening in the carriage.
3. Add a few drops of oil to clutch handle bearings.

Sec. L2.2.4-C (Continued)

4. Add a few drops of oil into each of the oil cups at the travel mounting pivot point.
(No change of lubrication is required for cold temperature operation.)

Once a year:

1. Check the motor brushes. If .25 (6.3 mm) or shorter, replace with new.
2. Check the carriage drive gear teeth. If the teeth are badly worn, replace the drive gear.
3. After 5,000 hours of operation, the motor and the first reduction should be removed from the gear box, and all of the gear teeth should be re-coated with a good grade of graphite grease.

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For installation instructions on discontinued K247 Travel Carriage, consult NA-2, IM-245-A and LAF3, IM198 instruction manuals.

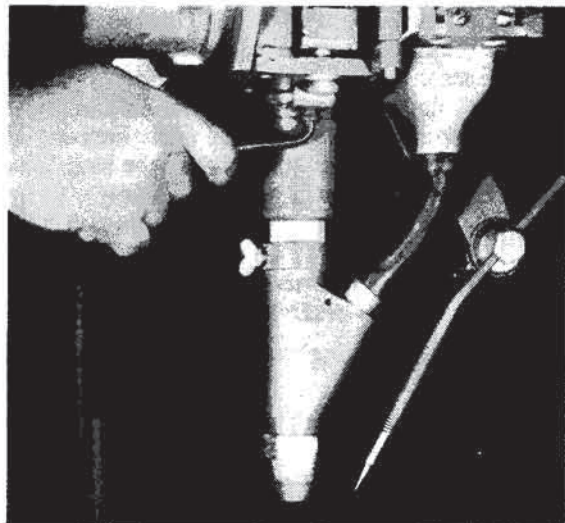
SEC. L2.2.6 SUBMERGED ARC CONTACT ASSEMBLIES

(In IM-305, File as Sec. T2.2.6) (In IM-198, File as Sec. 2.7.1)

(Also See Sec. L2.2.7 for the K148 nozzle when using high currents
or Linc-Fill long stickout procedures.)

A. K231 Contact Nozzle Assembly

(For all NA and LT models.)

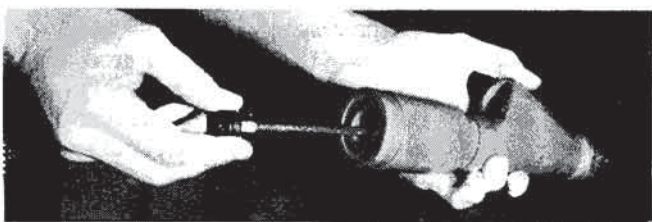


For submerged arc welding using currents generally under 600 amps. Higher currents can be used but result in faster tip wear. The outer flux cone deposits flux right around the arc for full coverage with minimum flux consumption.

Contact tips for the electrode diameter specified on the order [5/64 thru 7/32" (2.0-5.6 mm)] are shipped with each nozzle. A different contact tip is required for each electrode size used. Nozzles ordered for 5/64 and 3/32" (2.0 and 2.4 mm) electrodes also include a contact tip adapter. Screw the adapter into the nozzle and the tip into the adapter.

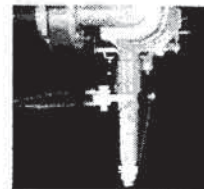
Installation — Nozzles ordered for feeding 5/64" and 3/32" (2.0 and 2.4 mm) electrode diameters include a liner. Insert the liner as shown in the following photo. Do NOT use the liner when the I.D. of the outgoing tube is larger than .125" (3.1 mm). These larger I.D. guide tubes are shipped with some wire feeders built to feed 3/32" (2.4 mm) and all wire feeders built to feed larger electrodes.

NOTE: Changing to a different diameter wire may necessitate changing drive rolls and the ingoing and outgoing guide tubes. See P-100-D for the correct parts.



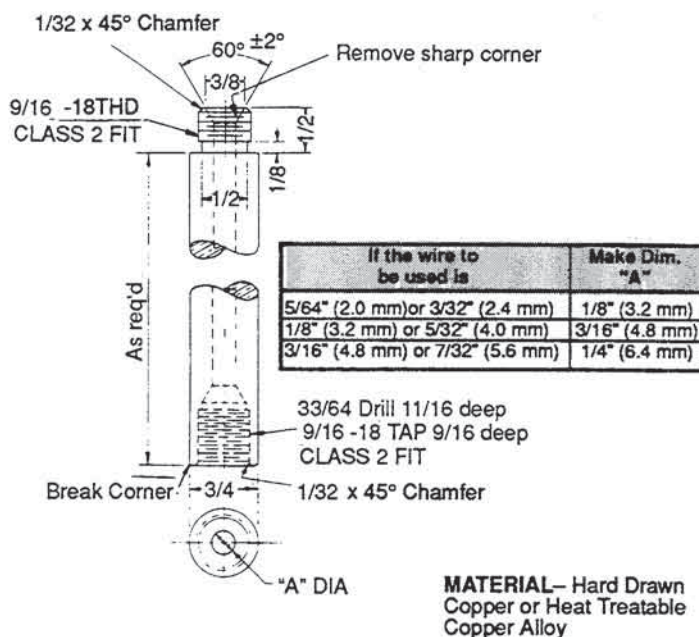
Connect the rubber flux hose that is shipped loose between the flux hopper and the flux cone body. Slide the rubber tube onto the nipple on the bottom of the flux hopper and insert the end with the insulating tube into the hole in the flux cone body.

Connect the electrode cable from the control box to the contact nozzle. Place one cable on top and one below the connection tab with the lugs flat against the tab and tighten the bolt and nut.



Operation — Do NOT completely straighten the electrode. A slight curvature is required in the electrode to ensure good electrical contact inside the contact tip.

Extensions — When required the nozzle can be lengthened by making extensions per the following drawing. Screw the extensions into the nozzle body and screw the contact tip or small wire adapter into the extension. A flux tube of the appropriate length must be made for the installation.



Maintenance — Replace the contact tip when it no longer provides accurate wire location or good electrical contact. Rusty and dirty wire or high currents increase tip wear. Always keep replacement tips in stock.

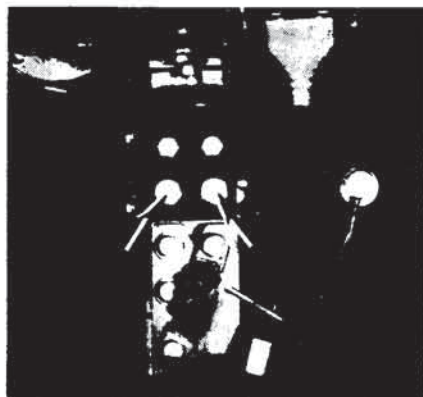
To replace the contact tip, first loosen the retaining wing screw and remove the flux cone. Then unscrew the tip and replace it.

The special socket head screw (Item 118 of P-101-M) holds the nozzle body to the insulator. If the nozzle body becomes loose, remove the nozzle from the head, tighten the screw and reassemble the nozzle.

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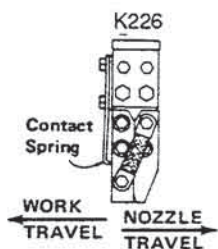
B. K226 Contact Jaw Assembly

(For Models NA-3, NA-4 and NA-5)



For submerged arc welding generally at currents from 600 to 1000 amps. Model K226-T with two tapered jaws feeds 3/32" and 1/8" (2.4 and 3.2 mm) electrodes. K226-R with one tapered and one rectangular jaw feeds 1/8" thru 7/32" (3.2-5.6 mm) electrodes. The braided shunt is not included with the K226-T.

Installation — Insert the outgoing wire guide from the wire feed mechanism into the top of the contact assembly body. Install the assembly in position on the bottom of the wire feed mechanism with the pressure spring as shown in the following sketch and lock it in position with the two screws provided with the assembly. (NOTE: By removing the four screws which hold the body to the mounting block, the jaws can be rotated to the appropriate one of four positions 90° apart.)



Connect two electrode cables coming from the control box to the contact jaws by placing one under each of the 1/2-13 nuts on the assembly (see arrows in photograph) with the cable lugs flat against the copper and tighten the nuts.

Slip the rubber tube shipped with the contact assembly onto the valve below the flux hopper. (If installing other rubber tubing, be sure it is non-conductive.) Fit the copper tube in the other end through the clip on the jaw assembly.

Maintenance — Rusty or dirty wire and excessively high currents increase jaw wear. When arcing occurs in the jaws or the wire becomes loose in the jaws, remove the jaws and dress them down by filing. When an excessive amount of material is worn off, replace the jaws. Contact jaws

manufactured after April, 1979 have replaceable contact inserts (refer to P-101-N).

The contact jaws must be kept in line with the wire guides. To align the contact jaws, loosen the stationary contact jaw (Item 25 of P-101-N). Release the tension on the movable contact jaw (Item 21) by loosening the screws holding the strap spring (Item 18). Place a straight 14" (356 mm) piece of bare 5/32" (4.0 mm) wire up through the wire guide and into the drive rolls. Adjust the stationary contact jaw so the electrode touches the jaw at the center of the groove for the entire length of the jaw. Tighten the screws. Remove the piece of bare wire. Apply the tension to the movable contact jaw by tightening the screws holding the strap spring. Be certain the movable contact jaw moves freely after these screws are tightened.

C. K233 Small Wire Contact Nozzle

(For Models NA-3, NA-4 and NA-5)

For submerged arc welding with .035" thru 3/32" (0.9-2.4 mm) diameter electrodes.



K233

A separate S7748-35 hose tip must be purchased and unless a separate K219 flux hopper kit was ordered, a T10642-11 flux hose must be purchased.

Installation — Depending upon the electrode size specified when the nozzle was ordered, either a liner for .035 thru .052" (0.9-1.3 mm) electrode or for 1/16" thru 3/32" (1.6-2.4 mm) electrode is shipped with the assembly. Insert the appropriate liner into the nozzle body with the adapter ring on top.

Insert the outgoing wire guide from the wire feed mechanism into the top of the nozzle body and place the nozzle in position on the bottom of the wire drive mechanism.

Operation — A pressure shoe and contact tips for the electrode diameter specified on the order are shipped with each assembly. A different contact tip is required for each electrode size used.

The electrode is automatically held against the nozzle contact tip with a preset pressure to ensure good electrical contact. Because the electrode is held against the tip, it tends to wear a groove in the tip. When the groove becomes too deep to maintain good electrical contact, the tip must be replaced.

A groove is also worn in the contact pressure shoe. This shoe has two chamfered edges 90° apart. When a groove is worn in one direction, remove the shoe, turn it 90° and replace it so the second chamfered edge fits into the contact tip. This provides a new wearing surface. When both wearing surfaces are grooved, replace the shoe.

K148 Contact Nozzle and K149 Linc-Fill™ Long Stickout Extension

File as Sec. 2.7.2 for IM-198 or IM-239

This nozzle can be used with the NA-1, NA-2, NA-3, NA-4, NA-5, LAF-3, LAF-4, LAF-5 and LT-3 wire feeders. K148-A is designed for 3/32" (2.4 mm) and 1/8" (3.2 mm) wire sizes. K148-B is designed for 5/32" (4.0 mm) and 3/16" (4.8 mm) wire. K148-C is designed for .062" (1.6 mm) to 5/64" (2.0 mm) wire.

A. Without Linc-Fill Attachment

1100 amps, 100% duty, with water cooling

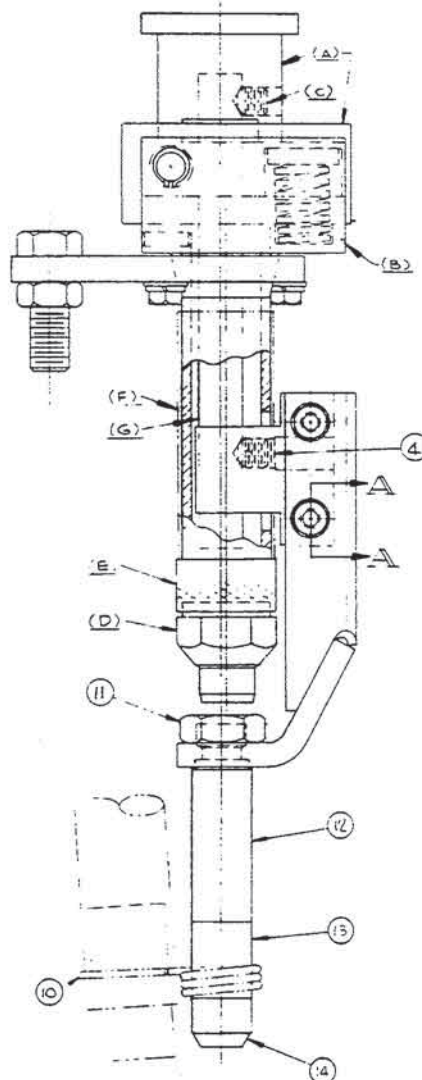
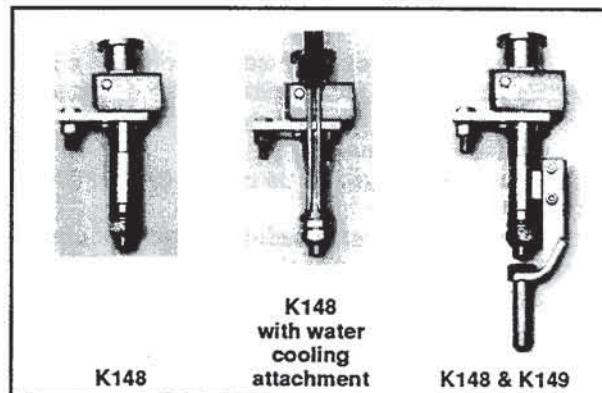
1100 amps, 100% duty, no water cooling

1100 amps, 100% duty, no water cooling

When using currents over 600 amperes at high duty cycles water cooling always increases contact tip life. The cooling attachment is ordered as a separate item, Part No. T12928. Installation instructions are included in the kit.

Connect the attachment to the water supply and the drain with rubber tubing obtained locally. Water flow should be between 1/2 (1.9 l) and 1 gallon (3.8 l) of tap water per minute.

1. Install the K149 attachment before mounting the K148 nozzle on the welder.
2. Place a small C-clamp on the spring supporting members (A) and (B) in such a manner that the spring can be compressed. Look up the hole in the end of contact tip and tighten the C-clamp until the backup tang lifts off the surface.
3. Remove the 3/8" (9.5 mm) set screw (C) in the body (A).
4. Remove the contact tip clamping nut (D) and the contact tip.
5. Remove the brass thread protecting collar (E).
6. Remove the window cover (F) from unit.
7. Slide the center guide (G) up out of the pivot body until the tang is above the window.
8. Place the Linc Fill guide assembly into the nozzle window, and then lower the center guide tube (G) back down to its original position.



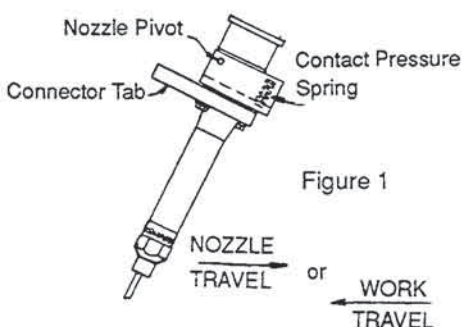
9. Line up the spot at the top of the center guide tube (G) with the 3/8" (9.5 mm) tapped hole in the upper pivot block (A) and put the 3/8" (9.5 mm) set screw (C) back into the hole and tighten securely.
10. Line up the lower spot in the center guide tube (G) with the 3/8" (9.5 mm) set screw (Item 4) and tighten this securely.
11. Replace the brass thread protecting collar (E). It is important that this protecting collar be pulled up against its locating shoulder, otherwise the tip locking nut will not clamp the tip securely.
12. Replace the contact tip and its clamping nut (D) and tighten securely.
13. Assemble the proper combination of extension guides (Items 12, 13 and 14) with locking nut (Item 11) for the welding procedure to be used.
14. If Submerged Arc welding is being used, screw the flux hose clamp (Item 10) onto the extension housing.

K148 Nozzle Installation

To install the nozzle on the head, insert the outgoing wire guide from the head into the nozzle assembly. Place the combined assembly in position on the bottom of the wire feed roll box. Clamp it in place using the two clamps supplied with the head.

Before pulling the clamps up tight the nozzle must be positioned relative to the travel direction as shown in Figure 1. This position is set so accidental contact between the work and the nozzle will not compress the contact pressure spring. If positioned otherwise, such accidental contact may cause arcing inside the contact tip.

After the nozzle is positioned in the proper relationship with the travel direction, the connector tab for the electrode cables can be moved to any of four positions 90° apart. To change the tab, remove the two 1/4-20 hex head screws. Tap the connector tab to loosen it from the tapered collar on the nozzle body. Turn the tab to the desired position. Replace and tighten the 1/4-20 screws.



Operation

The same contact tip, S13763, is used for 3/32 through 3/16" (2.4–4.8 mm) diameter electrodes. S16388 is used for .062 and 5/64" (1.6–2.0 mm) electrode.

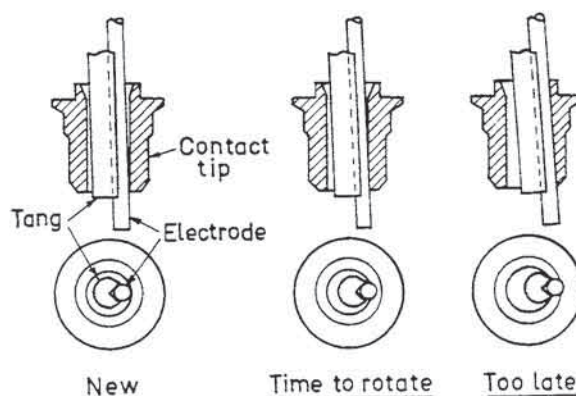
Loading of Wire

Straighten the start end of the coil for at least eight inches (203 mm) pass the end down through the appropriate wire straightener. Inch the wire through the wire feeder and the nozzle. When using .062 (1.6 mm) or 5/64 (2.0 mm) Innershield electrode with a K148-C nozzle, make sure that the wire is in the "vee" groove of the pressure tang. Idle roll pressure settings should be made per marks on the idle roll arm, except for the smaller diameter electrodes. For the .062 (1.6 mm) and 5/64" (2.0 mm) wire sizes, back off on the idle roll pressure so that there is little or no flattening of the wire.

Because the electrode is held against one point of the contact tip, it wears a groove at that point. When the groove is about one half the diameter of the electrode, rotate the contact tip to a new position per the instructions below. Careful positioning of the contact tip will provide four to six wear spots depending upon the electrode size.

When welding with the small diameter electrodes, it will be necessary to change contact position more frequently since the amount of tip wear that can be tolerated is much less. The tang should never be allowed to touch the I.D. of the contact tip. To do so will allow welding current to go through the tang, causing electrical wear and overheating of the tang and contact tip.

If the groove is allowed to wear until the tang touches the ID of the contact tip, welding current passes through the tang. This causes electrical wear and overheating of the tang and contact tip.



To rotate the tip, clip the end of the electrode and inch it up until it is free of the contact tip. Loosen the locking nut about one-half turn and pull the nozzle body to relieve the pressure of the tang against the inside of the contact tip hole. At this moment rotate the tip the proper amount and then retighten the locking nut.

File as Sec. L2.2.7 for IM-278

File as Sec. T2.2.7 for IM-305

File as Sec. M2.2.7 for IM-279

To install a new contact tip proceed as follows:

1. Clip the end of the electrode and inch it up until it is free of the tip.
2. Remove the contact tip locking nut.
3. Relieve the spring pressure of the contact tip against the steel tang in the hole of the contact tip. To do this, push the nozzle body so the steel tang is approximately centered in the 3/8" (9.5 mm) hole in the contact tip. Under these conditions the contact tip can be easily removed from the nozzle body.
4. a. Before installing the new tip, make sure the threads and the bottom surface of the nozzle are clean and bright. These surfaces are current carrying areas and must be clean.
b. Push the nozzle body to one side and insert the new contact tip.
5. a. Check the locking ring threads making sure they are free of any foreign material. A small application of high temperature anti-seize compound on these threads ensure a longer thread life of the two mating parts. Suggested anti-seize compounds are Graphite grease per Lincoln Spec E2067, and "Anti-Seize and Lub. Compound" made by Never Seiz Compound Corporation, 2910 A. 18th Ave., Broadview, Illinois.
b. Replace the locking ring and tighten securely.
6. Check the contact tip to be certain it is tight in the nozzle body. If the tip is not tight, arcing will take place between the tip contact surface and the nozzle contact surface which will damage the nozzle body.

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File as Sec. L2.2.8 for IM-278
File as Sec. T2.2.7 for IM-305

FOR SUBMERGED ARC WELDING K285 Concentric Flux Cone

The concentric flux cone was designed to fit on the K148 alone, K148 with a K149, K129 and the K391 nozzles. [The maximum electrical stickout when using the K149 will be four inches (102 mm).] Use of this attachment results in the flux being fed concentrically around the electrodes.

The unit consists of two members that are electrically insulated from each other. One of the members is fastened to the nozzle body with two worm-type hose clamps. The second member is adjusted up and down on the stationary member to the desired height and then locked in position with a wing screw. The moving member supports the flux hose and the concentric copper flux cone. **NOTE:** The K285 does not have suitable insulation for use with "Hi-Frequency" starting.

I. INSTALLATION

A. K148 Nozzle

1. Remove spring pressure on center guide tube by applying a "C" clamp as shown in Figure 1. Apply only enough clamping force to relieve the tang pressure from the I.D. of the tip.

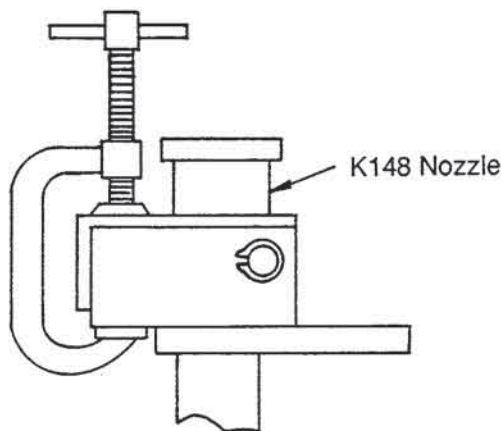


Figure 1

2. Remove the nut holding the contact tip in place. Remove the contact tip.
3. Remove the secondary threaded collar which will allow the dirt shield to come off the barrel of the nozzle.
4. Make sure that all threads and contact surfaces are clean and bright, then replace the threaded collar, contact tip and the tip locking nut. Tighten both the collar and the tip locking nut securely.
5. Remove the "C" clamp, releasing the internal guide.
6. Unscrew the hose clamps entirely so that the open ends may be placed around the body of the nozzle. Put the hose clamps back together and tighten the

clamps with the stationary part of the cone mounting covering up the opening in the nozzle body.

7. Position the moving member to the desired height of flux coverage and tighten the wing screw into the top tapped hole. See Figure 2.

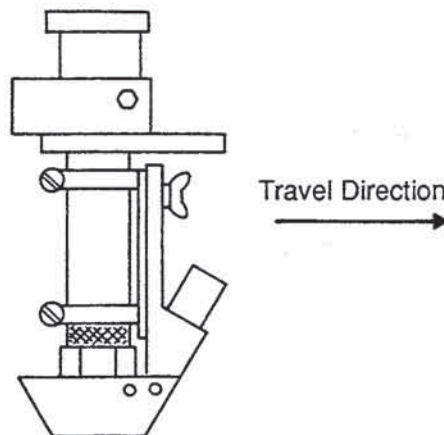


Figure 2

8. Connect flux hose from hopper to the flux entry port on the concentric flux cone arm (cut the hose length to suit).

B. K149 Linc-Fill Nozzle

1. Unscrew the hose clamps entirely so that the open ends may be placed around the body of the nozzle. Place the stationary member of the unit directly opposite the arm coming out of the window of the nozzle, put the hose clamps back together and tighten. The stationary member should be positioned as shown in Figure 3.

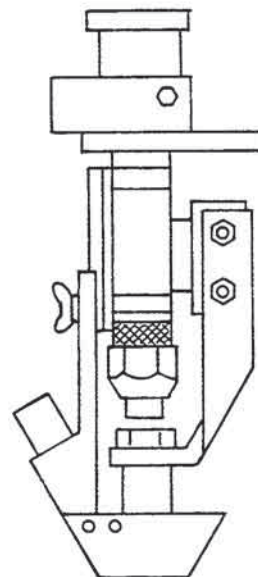


Figure 3

2. The lower hose clamp must be placed and tightened in a position where it does not touch the outboard long stickout arm of the K149 nozzle.

Sec. L2.2.8 (Continued)

3. Position the moving member to the desired flux coverage and then tighten the wing screw. (Use middle or lower tapped hole — depending upon E.S.O.) The arm can be lowered to cover 4.00 inch (102 mm) electrical stickouts.
4. Connect flux hose from hopper to the flux entry port on the concentric flux cone arm (cut the hose length to suit).

C. K129 Type Twinarc Nozzle

1. Unscrew the hose clamps far enough so that they can be slipped up over the tip holder clamping nut.
2. Position the stationary member as shown in Figure 4 and then tighten the hose clamps.
3. Position the moving member to the desired height and tighten the wing screw.
4. Since the tips and the wire come out of the nozzle at 7°, there will be some occasions where the cone will have to be tilted as shown. Provisions have been made to accomplish this by removing the furthestmost screw from the tip on each side of the cone, then tilting the cone and putting the two screws back into the rear holes of the cone. Retighten all four screws. See Figure 4.
5. Connect the flux hose from the hopper to the flux entry port of the concentric cone arm (cut the hose length to suit).

D. K391 High Capacity Nozzle

1. Remove the flux tube hanger bolted to the nozzle body.
2. Unscrew the hose clamps far enough so that they can be slipped over the body of the nozzle.
3. Position the stationary member so that the "ears" engage with the two parallel slots in one side of the nozzle body. Then tighten the hose clamps.
4. Position the moving member to the desired height and tighten the wing screw.

5. Connect one end of the rubber flux hose to the bottom of the flux hopper, determine the length of hose required, cut the hose to length. Insert the flux tube tip into this cut end, and insert the flux tube tip into the large hole provided in the aluminum arm.

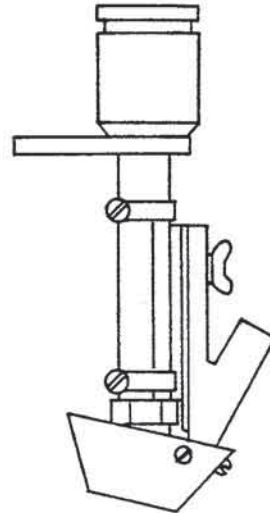


Figure 4

E. All Nozzles

After the installation to any of the above nozzles has been completed, a continuity check should be made between the copper flux cone and the nozzle body. This can be done by using an ohmmeter or test light. If meter reads zero, determine where the "short" is and correct the situation, otherwise the copper cone will be at electrode potential and if it should touch ground during the welding operation the cone will be damaged.

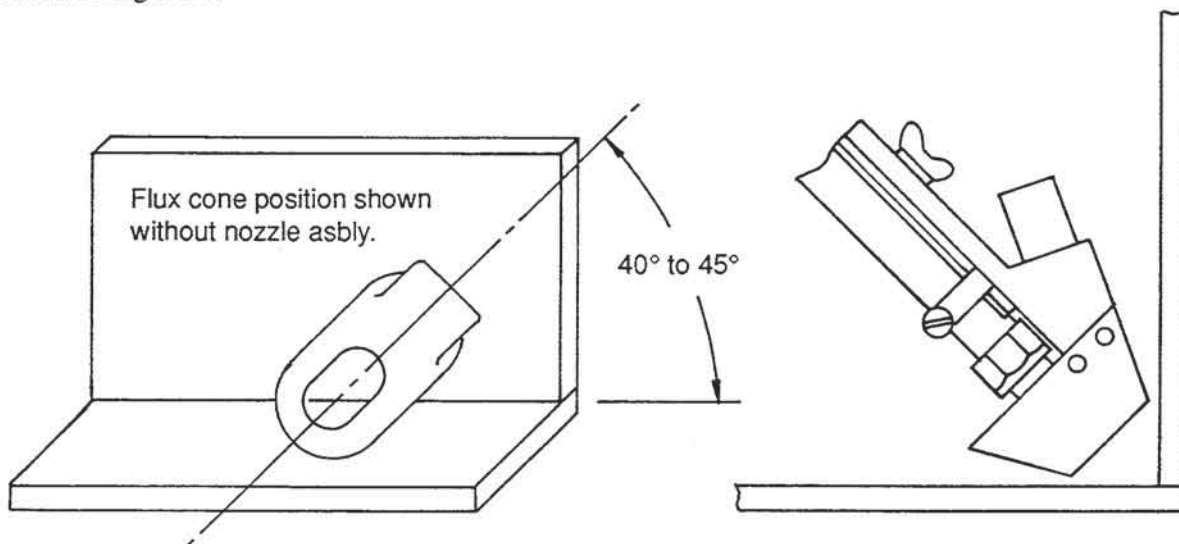


Figure 5

Sec. L2.2.8, T2.2.7 and 2.7.8 (Continued)

II. GENERAL OPERATING COMMENTS

A. Nozzle Positions for Horizontal Fillets

1. K148, K148 with K149 or K391

After the concentric flux unit has been fastened to the nozzle body (per Section I, A or B), set the nozzle to the proper electrode angle dictated by the procedure. Loosen the two hold down clamps which fasten the nozzle to the face plate, rotate the entire nozzle assembly approximately 40 to 45° and then retighten the clamps. Inch the electrode out of the nozzle to the proper E.S.O. Position the wire into the joint configuration, then slide the concentric cone down so that it is approximately .12 of an inch (3.0 mm) away from the vertical and the horizontal surfaces to be welded. Tighten the wing screw. See Figure 5.

2. K129

After mounting the concentric cone to the nozzle (per Section I, C) set the head and nozzle for the proper electrode angle per procedural requirements. Inch the electrode out of the tips to the proper E.S.O. Place the nozzle into the welding position. Loosen the clamps and rotate the concentric flux cone unit approximately 40 to 45°. Retighten clamps.

Loosen wing screw, allowing the cone assembly to slide down within .12 of an inch (3.0 mm) of touching the piece to be welded. See Figure 5.

B. Flux Hopper Mounting for Horizontal Fillets

For horizontal fillet welding the flux hopper will not function properly if it is fastened to the face plate of the NA-3 or NA-5. The hopper should be mounted directly above the flux entry of the concentric flux cone unit. Flux hose angles should be no greater than 35° from the vertical plane to ensure good flux flow from hopper to cone.

C. Usage On Deep Narrow Grooved Welds

For narrow deep groove welding it may be necessary to remove the copper cone from the moving arm.

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MECHANICAL INSTALLATION

File as Sec. L2.2.11 for IM-278
File as Sec. T2.2.11 for IM-305

K29 Vertical Head Adjuster

A. ASSEMBLY

Automatic welding applications frequently require raising and lowering the head assembly. The Vertical Head Adjustment provides a quick, simple and easy method of doing this. A height variation of four inches (102 mm) can be achieved with this attachment.

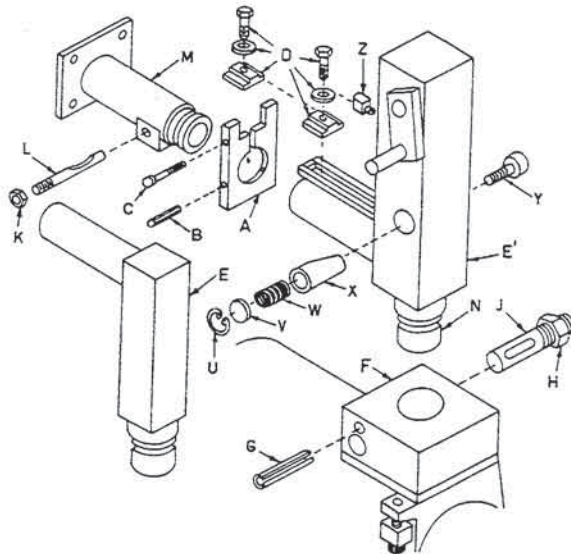


Fig. 1 — NA-2, NA-3, NA-4 and NA-5

B. INSTALLATION

Check the carton for the following items:

1. Head adjustment lock (A).
2. 1/4" (6.3 mm) diameter roll pin (B).
3. 1/2 — 13 x 2.75 hex head locking screw (C).
4. Two adjustable clamps and their respective screws and washers (D).
5. Vertical head lift adjuster (E').

To install proceed as follows:

1. Be sure nut (H) is tight. Drive out roll pin (G).
2. While holding the head, loosen nut (H) and lower the head (F) from the head support (E).
3. Loosen the nut (K) on the draw bolt (L); now remove the stationary mount (E), (not shown in Fig. 2).
4. Slide the clamp ring (A) over the end of the mounting bracket (M).
5. Drive the 1/4" (6.3 mm) roll pin (B) into clamp ring (A) when the hole in the ring lines up with the groove in the mounting bracket (M).
6. Tighten clamp ring (A) with the open slot in the up position, using the 1/2" (12.7 mm) clamping bolt (C).
7. Slide the vertical head adjustment unit (E') into the mounting bracket (M). Tighten the draw bolt nut (K).
8. Install one adjustable clamp (D) on each side of the clamp ring (A).

9. If a horizontal adjuster is to be used, install it now per instructions in Sec. L2.2.12.
10. Raise the welding head (or horizontal adjuster) back into position on the up and down lift shaft (N). Drive the 5/16" (7.9 mm) roll pin (G) back into its original position.
11. Tighten draw bolt nut (H).

C. ADJUSTMENT AND LOCKING ARRANGEMENT

The rotational movement of the lift mechanism is kept to a near zero level at all times because the spring loaded wedge shaped pin is always in intimate contact with the vertical slide. The socket head screw on the right side of the lift housing is used as a locking screw. Its function is to pull the wedge tight against the vertical slide and thus lock the unit at a desired height. This screw should always be a half turn loose unless a locked condition is wanted. *Extreme* tightening of the locking screw may lock the wedge so that the lift cannot be moved in either direction. If this should occur, loosen the locking screw a turn or two and tap the screw into the head lift body. This will loosen the locking wedge.

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MECHANICAL INSTALLATION — CONT'D

File as Sec. L2.2.12 for IM-278

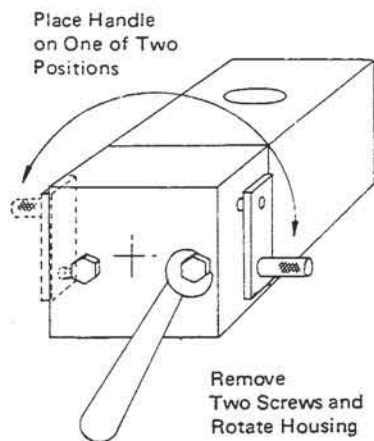
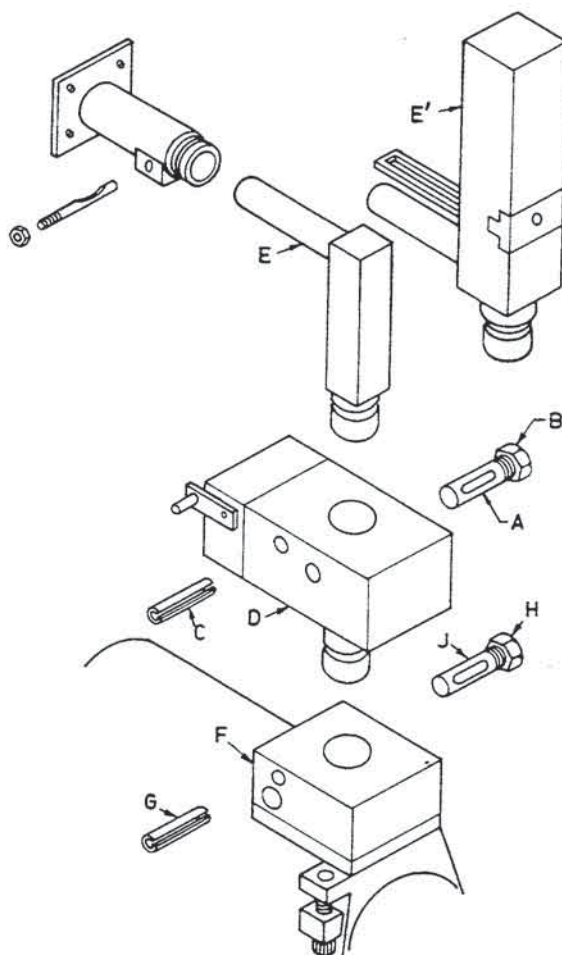
File as Sec. T2.2.12 for IM-305

File as Sec. E2.7.8 for IM-245

K96 Horizontal Head Adjuster

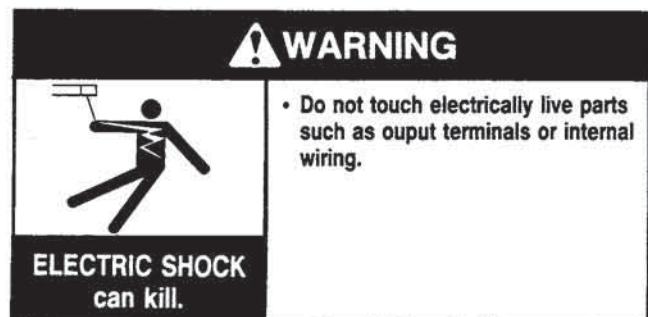
This accessory provides an easy means of moving the head in a horizontal direction by simply turning a crank handle. Install per the following:

1. Be sure nut (H) is tight. Drive out roll pin (G).
2. While holding the head, loosen nut (H) and lower the head (F) from the head support (E) or (E').
3. If a vertical lift adjuster is to be used, install it now per instructions in Sec. L2.2.11.
4. With draw bolt (A) and nut (B) in place, fit the horizontal adjuster (D) to the stub shaft of (E) [or the vertical lift adjuster (E') if it is installed].
5. Drive in the roll pin (C) which comes with the adjuster (D).
6. With the draw bolt (J) and hex nut (H) in place, fit the head (F) to the stub shaft on the bottom of the horizontal adjuster (D). Tighten nut (H).
7. Drive in the roll pin (G) removed in step 1.
8. Place the crank housing on the adjuster (D) in the more convenient of the two positions indicated in the sketch by removing the two screws, rotating the housing 180° and tightening the screws.



February 1980

SEC. L2.3 — ELECTRICAL INSTALLATION



Sec. L2.3.1

WIRING THE EQUIPMENT

A. Input Power Required

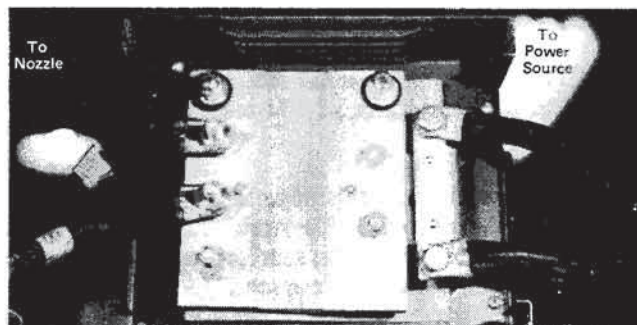
350 volt-amperes of 115 volt 60 or 50 hertz AC power is required for the wire feed motor and controls. Another 250 volt-amperes may be required depending upon the travel circuit (See "D. Travel Mechanism" below).

All power sources covered in Sec. L2.3.4 provide the 600 volt-amperes of 115 volt AC power. (Exception: Only 350 volt-amperes is available from discontinued SAN-900, SAN-1100 and SAN-600 machines built to codes below 5300. For 600 volt-amperes output, write to the factory for instructions giving full nameplate information.)

B. Connection of Head to Controls

NOTE: All electrode cables that are connected to the rear

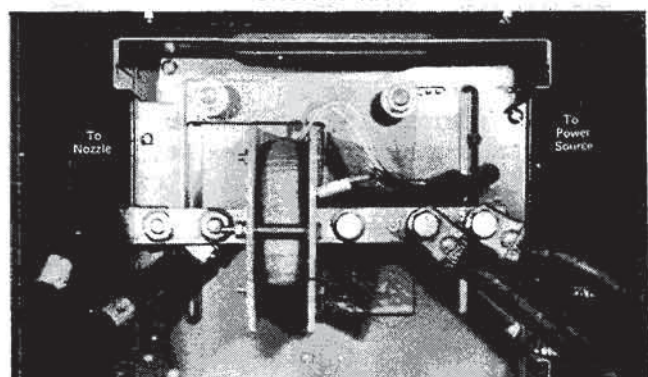
BACK OF NA-3



If necessary attach third (or fourth) cable to extra stud.

If necessary, attach third or fourth cable to underside of connection bar.

BACK OF NA-4



If necessary, attach third (or fourth) cable to underside of connection bar.

90No



of the control box must be manufactured by Lincoln Electric Co. to ensure that the termination complies with applicable U.L. standards for safety.

All heads include a 4' (1.2 m) motor cable and, when appropriate, a 4' (1.2 m) flux hopper cable. Insert the plugs on these cables into the matching receptacles on the side of the control box.

If the control box is to be located so the 4' (1.2 m) cables are not sufficient, install the separate extensions cable assembly of the length ordered [up to 75' (22.8 m)]. The motor and flux hopper extension cables have plugs on both ends for easy installation.

The NA-3N, NA-3S and NA-4 also include two 4' (1.2 m) lengths of electrode cable. Bolt one end to the contact assembly and the other end to the right side (when facing the front of the control box) of the shunt (or NA-4 current transformer). When the K234 or K235 extension cables are used between the controls and heads the 4' (1.2 m) lengths of electrode cable are not used. If currents or duty cycles higher than 1000 amps at 80% duty cycle will be used, add additional electrode cables per Table 1.

For the NA-3NF or NA-3SF, order an appropriate length of the needed electrode cable. Connect it between the contact assembly and shunt as described above.

Table 1

	80% Duty Cycle
Below 1000 amps	Two 4/0
1000 to 1300 amps	Three 4/0
1300 to 1500 amps	Four 4/0

C. Connection of Input Cable Between Power Source and Control Box

NOTE: All electrode cables that are connected to the rear of the control box must be manufactured by Lincoln Electric Co. to ensure that the termination complies with applicable U.L. standards for safety.

Sec. L2.3.1 (Continued)

NA-3N and NA-3NF

1. Use a constant voltage type power source.
2. If using a multiprocess power source (SAM, SA-800, SAF-600, DC-400, DC-600, DC-1500), be sure it is properly set for constant voltage welding per instructions in the power source operating manual.
3. Connect the input cable to the power source exactly as specified on the appropriate connection diagram in Sec. L2.3.4. Include all jumpers on the terminal strips as shown on the diagrams.

For instructions to connect to Lincoln power sources not included in Sec. L2.3.4, write to the factory; if it is not a Lincoln power source see Sec. L2.3.5.

NOTE: Paralleling two power sources of the same model may be practical. Request bulletin E133 for instructions.

4. Connect work leads of sufficient size and length (per Table 1) between the "To Work" stud on the power source and the work. Be sure the connection to the work makes a tight and clean metal-to-metal contact.
5. Connect the two electrode cables of the input cable assembly to the left side (when facing the front of the control box) of the shunt-current relay assembly located on the rear of the control box. If currents or duty cycle higher than 1000 amps at 80% duty cycle will be used, add additional electrode cables per Table 1. If a travel carriage is used, clamp the electrode cables to the carriage using the clamps supplied with the carriage. Do not hold the control cable with this clamp.
6. Insert the polarized connector of the control cable into the matching receptacle on the side of the control box.

NA-3S and NA-3SF (and NA-3N or NA-3NF with constant current board added)

1. Use either a constant current or constant voltage power source as required for the application. Be sure the power source is set for constant current or constant voltage welding as appropriate per instructions in the power source operating manual.
2. Set the wire feeder for constant current or constant voltage as appropriate per instructions in Sec. L2.3.4.
3. Connect the input cable to the power source exactly as specified on the appropriate wiring diagram in Sec. L2.3.4. Include all jumpers on the terminal strips as shown on the wiring diagram. To connect to power sources not included in Sec. L2.3.4, consult the factory giving full nameplate information on the power source.

NOTE: Paralleling two power sources of the same model may be practical. Request bulletin E133 for instructions.

4. Connect work leads of sufficient size and length (per Table 1) between the "To Work" stud on the power source and the work. Be sure the connection to the work makes a tight and clean metal-to-metal contact.

5. Connect the two electrode cables of the input cable assembly to the left side (when facing the front of the control box) of the shunt-current relay assembly located on the rear of the control box. If currents or duty cycle higher than 1000 amps at 80% duty cycle will be used, add additional electrode cables per Table 1. If a travel carriage is used, clamp the electrode cables to the carriage using the clamps supplied with the carriage. Do not hold the control cable with this clamp.
6. Insert the polarized connector on the control cable into the matching receptacle on the side of the control box.

NA-4

1. Present NA-4's with a potentiometer type current control (K248 above code 7560) are designed for use with the AC-1200 power source. They may be used with the discontinued AC-1000's or AC-750's but will require an external switch to control transformer output. See Connection Diagram S15865 in Sec. L2.3.4-H.
2. Discontinued NA-4's equipped with a toggle switch type current control (K211 below code 7560) may be connected directly to the discontinued AC-1000's or AC-750's provided the proper control cable is available (K216). Contact factory for Connection Diagram S15269. These units may also be used with AC-1200's but will require an external rheostat for current control (K775). Refer to Connection Diagram S15667 in IM-283.
3. Connect the input cable to the power source exactly as specified in Sec. L2.3.4. Include all jumpers on the terminal strips exactly as specified in the diagram.

NOTE: Paralleling two power sources of the same model may be practical. Request bulletin E133 for instructions.

4. Connect work leads of sufficient size and length (per Table 1) between the "To Work" stud on the power source and the work. Be sure the connection to the work makes a tight and clean metal-to-metal contact.
5. Connect the two electrode cables of the input cable assembly to the left side (when facing the front of the control box) of the current transformer located at the rear of the control box. If currents or duty cycle higher than 1000 amps at 80% will be used, add additional electrode cables per Table 1. If a travel carriage is used, clamp the electrode cables to the carriage using the clamps supplied with the carriage. Do not hold the control cable with this clamp.
6. Insert the polarized connector of the input cable into the matching receptacle on the side of the control box.

NOTE: Special cable routing precautions should be taken to avoid possible erroneous meter readings due to induced voltages or magnetic fields caused by the current flowing in the weld cables.

- a. Separate the K215 input control cable assembly so the control cable is kept spaced from the weld cables by at least 12" (305 mm) to avoid induced voltages.

Sec. L2.3.1 (Continued)

- b. Route and connect the cables to the control box as illustrated below to avoid magnetic field influence on the control box meters.

When welding with more than one AC arc, all control cables should be spaced at least 12 inches (305 mm) from all weld cables.

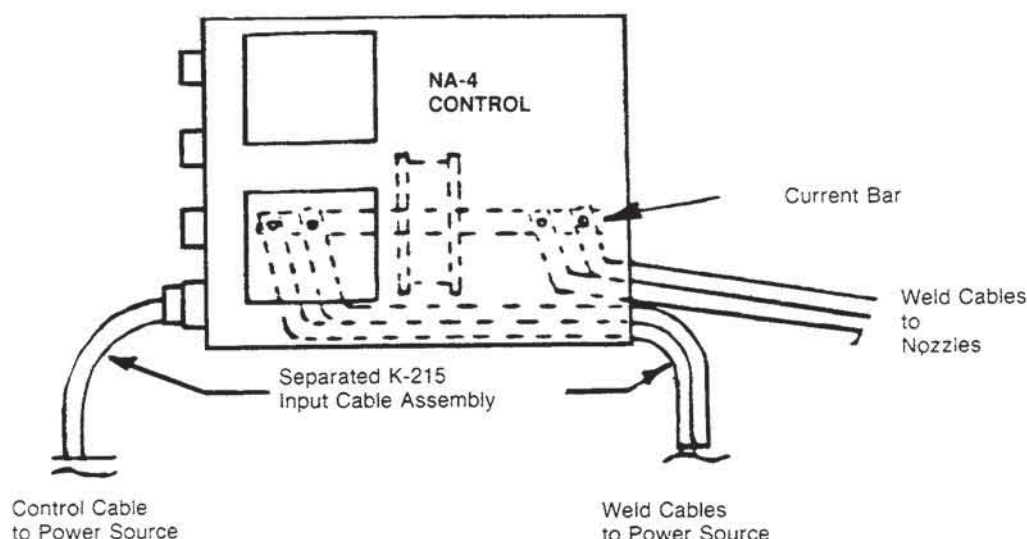
On critical applications, to reduce arc voltage change and meter discrepancy to a minimum, the #21 lead on the NA control cable should be disconnected from the power source terminal strip and extended so it can be connected directly to the work piece. The #67 lead should be removed from the NA-4 connection bar, extended and

connected directly to the electrode contact assembly on the head. #16 AWG conductors should be used and these #21 and #67 leads should be kept as far as possible from electrode and work leads.

D. Travel Mechanism

115 volt AC power to drive the standard Lincoln travel carriage or for starting and stopping other travel mechanisms is obtained from a receptacle on the control box. The travel receptacle has been changed on NA-3 and NA-4 controls above code 8300. The 3-slot receptacle has been replaced with a 4-slot receptacle which provides a grounding lead connection for TC-3 carriage travel controls.

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ELECTRICAL INSTALLATION — CONT'D

Sec. L2.3.3

Special Electrical Connections

A. ARC AND TRAVEL STARTING AND STOPPING

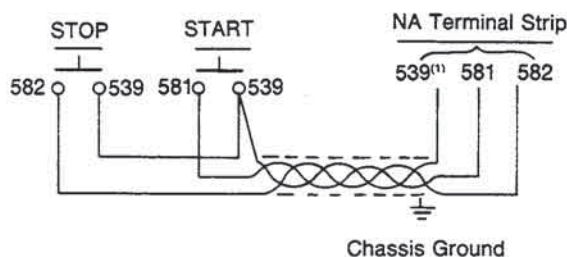
Various sequences for starting and stopping the arc and travel are possible with standard machines or optional features. The choice of sequences depends upon the specific requirements of the procedures and application. See Sec. L3.4 for a description of these sequences and the needed reconnection instructions.

B. REMOTE LOCATION OF PUSHBUTTONS

The "Start", "Stop", "Inch Up" and "Inch Down" pushbuttons can be mounted in locations up to 50' (15.2 m) away from the standard control box using either of the following methods:

1. Remove the pushbuttons from the control box and mount them where desired. Extend the leads.
2. Connect SPNO pushbuttons capable of switching 15 volts at 4 milliamps in parallel with the existing pushbuttons. The "Inch Up" and "Inch Down" extension leads must be connected to the pushbuttons in the control box. The leads for the "Start" and "Stop" extension leads can be connected to the terminal strip in the control box.

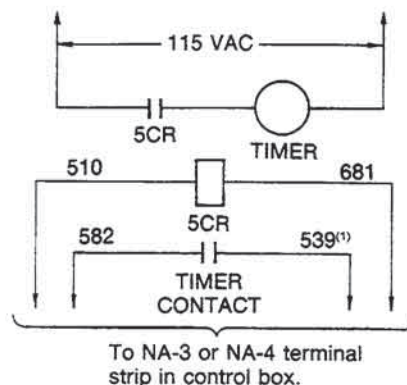
To minimize electronic circuit interference the leads between the switches and control box must be twisted together and electrically shielded from parallel conductors carrying other circuits. Be certain the connections are properly made and insulated from each other and the case.



⁽¹⁾ Use 539S on later models.

C. CONNECTING FOR TIMED WELDS

1. Use a SPNO 115 volt DC relay (part number S13605) with a maximum coil current of 15 milliamps. This relay is shown as 5CR on the connection schematic.
2. Mount the relay at a convenient location near the control box. Connect the coil leads to #510 and #681 on the control box terminal strip.
3. Connect one side of a suitable reset timer motor to one side on the AC line and the other side of the timer to one side of the 5CR relay contact. Connect the other side of the contact to the other side of the AC line. Connect the normally open contacts of the reset timer to #582 and #539⁽¹⁾ on the control box terminal strip. The timer contacts must be capable of switching 15 volts at 4 milliamps.



To NA-3 or NA-4 terminal strip in control box.

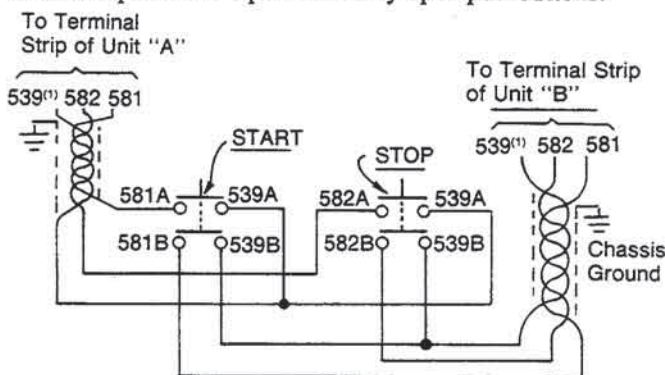
⁽¹⁾ Use 539S on later models.

With this connection the timer starts operating when the arc is established. When it times out the timer closes contact #582 to #539⁽¹⁾ just as if the "Stop" button were pressed to initiate the stopping sequence. The control is then ready for the next weld.

⁽¹⁾ Use 539S on later models.

D. CONNECTION FOR OPERATING TWO HEADS FROM ONE LOCATION

To operate two heads with only one start and one stop button, use double pole normally open pushbutton switches capable of switching low voltages of 15 volts, 4 milliamps. Mount the switches where convenient and connect them to the control box terminal strips per the diagram below. Keep the leads from each control completely isolated from the leads to the other unit. To minimize circuit interference, the leads from each button to each control box should be twisted together and electrically shielded from parallel conductors carrying other circuits. If three heads are to be controlled with one set of switches, follow the same instructions except use three pole normally open pushbuttons.



⁽¹⁾ Use 539S on later models.

E. HIGH FREQUENCY GENERATOR (K238) FOR DIFFICULT STARTING APPLICATIONS

NOTE: When using the K238 HF unit, the automatic welding equipment being used must have the following special high frequency insulation:

Sec. L2.3.3 (Continued)

1. Factory installed between head motor and gearbox.
2. Factory provided for head mounted flux hopper.
3. Factory provided for wire reel mounting bracket.
4. Factory provided for head mounting⁽²⁾

⁽²⁾ Fixture builder ("F") models which do not have head mounting insulation must be mounted with a minimum of one inch (25.4 mm) thick polyester laminate providing the head with no less than one inch (25.4 mm) exposed and 1/2 inch (12.7 mm) unexposed electrical clearance between the head mounting bracket and mounting surface (including electrically common mounting hardware).

The K238 High Frequency Unit supplies high frequency power to the welding leads for more positive starting on some jobs. It operates on 115 volts, 50 or 60 hertz power supplied from the NA-3 or NA-4 control. The welding circuit of the K238 is rated at 750 amps, 100% duty cycle, welding current. It cannot be used with the Linc-Fill Starting Relay option. It is to be used only with the "hot starting" start sequence.

High Frequency Interference Protection

It is important that as much of the energy from the high frequency unit as possible is utilized at the arc and that the amount radiated is kept at a minimum. The following instructions *must* be completely followed to minimize the amount of RF radiation as required by the FCC, to prevent malfunctioning of the NA-3 or NA-4 control and for safety.

1. The work terminal at power source *must* be connected to a driven ground at the welder, or to a water pipe that enters the ground within 10 feet (3.0 m) of the power source. The ground connection should be securely made and as short as possible using cable of the same size as the work cable or larger. Grounding to the building frame or a long pipe system can result in re-radiation, effectively making these members radiating antennas.
2. Keep the work and electrode leads between the high frequency unit and the arc as close together as possible. Lengths should be as short as possible but never exceed 25 feet (7.6 m). Tape the leads together where practical.
3. Be sure the rubber covering the electrode and work cable is free of cuts and cracks that allow high frequency leaking. Cables with high natural rubber content, such as Lincoln Stable-Arc, better resist high frequency leakage than neoprene and other synthetic rubber insulated cables.
4. The control leads from the high frequency unit to the NA-3 or NA-4 must be shielded as specified in the "Electrical Connections" section.
5. Keep the covers on the High Frequency Unit.
6. Mount the wire reel as close to the head as possible. The electrode and reel become an aerial radiating energy into space. Make certain the electrode cannot touch the NA-3 or NA-4 control box.
7. Make sure all parts carrying high frequency are insulated from all other parts. Even though the parts are not grounded, they might become radiating aersials.
8. Route the wire feed motor and flux hopper leads so they are no closer than 6" (152 mm) to the High Frequency unit, head mounting parts, wire reel, wire reel mounting, welding cables, etc. Use lead clamps as necessary.

Electrical Connections


While observing all of the points made above, make the electrical connections as follows:

1. Turn off all input power to the power source and NA-3 or NA-4. Mount the High Frequency Unit as near to the head as possible but at least two feet (.6 m) away from the NA-3 or NA-4 control box.
2. Connect electrode welding cables from the High Frequency Unit to the automatic head and to the NA-3 shunt or NA-4 current transformer per M14156.
3. Connect work welding cables from the High Frequency Unit to the power source and to the work per M14156.
4. Remove the cover from the High Frequency Unit. Install the appropriate connector for the control lead conduit in the hole provided to the right of the terminal strip.
5. Loosen the screw holding the NA-3 or NA-4 control box cover closed and open the door. Remove the screw securing the inner panel and open the inner panel to gain access to the terminal strip.
6. Remove the plastic hole plug from the hole on the left side of the NA-3 or NA-4 control box. Install the appropriate connector for the control lead conduit.
7. Install shielded and twisted #18 AWG or larger control leads from the High Frequency Unit to the NA-3 or NA-4 control box per M14156. The shielding must be grounded to the control box.

Operation: When the NA-3 or NA-4 "Start" button is pushed the High Frequency Unit is energized. When the welding arc is established the High Frequency Unit is deenergized.

CAUTION: When using the High Frequency Unit, the "hot starting" start sequence is to be used (see "Routine Equipment Operation," Sec. L3.2). If using an NA-3S or NA-4, "cold starting" is *not* to be used; do not allow the electrode to touch the work when inching down because this results in the High Frequency Unit becoming energized.

Maintenance: The only routine maintenance required on the High Frequency Unit is to inspect the spark gaps monthly and to maintain the setting specified on the spark gap cover plate.

⚠ WARNING	
	<p>• Do not touch electrically live parts such as output terminals or internal wiring.</p>
<p>ELECTRIC SHOCK can kill.</p>	

The voltage at the spark gap is dangerously high when the unit is energized. Turn off the NA-3 or NA-4 control, turn off the power source, and disconnect the input power to the power source before removing the spark gap access door. Replace the access door after the adjustment is made.

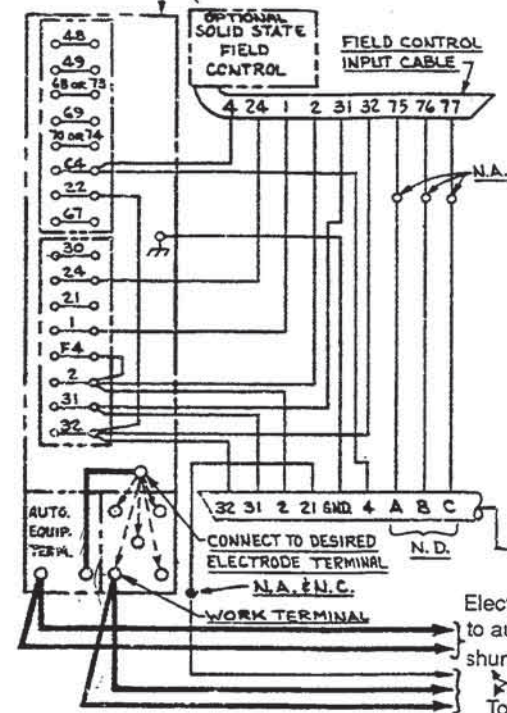
ELECTRICAL INSTALLATION — CONT'D

Sec. L2.3.4-A

Connection of NA-3 (All) to a SAF-600 or SA-800, Types "-O" or "-OF" and M.G. Solid State Field Control

SAF-600 OR SA-800
"O" OR "OF"
CONTROL BOX

NOTE: Electrode polarity switches on power source and field control must be set for same polarity. Power source must be off when changing polarity.



Connect the control cable ground lead to the frame terminal marked near the power source terminal strip or to an unpainted frame screw. The power source must be properly grounded.

If optional solid state motor generator field control is not used, tape up separately the A, B & C leads from the control cable. Also connect a jumper from #2-#24 on the power source terminal strip.

- N.A. Bolt and tape connection.
- N.B. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.
- N.C. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] 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. (This extended #21 lead connection replaces the need to employ the remote work lead accessory on LN-8 meter kits which have a direct work lead jack.)
- N.D. If using an older control cable: connect lead #75 to lead #75 of field control, connect lead #76 to lead #76 of field control, connect lead #77 to lead #77 of field control.

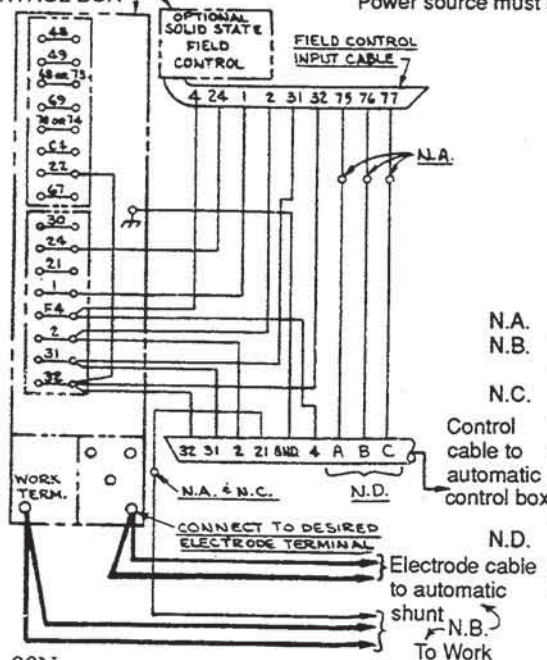
S15268
1-25-80

Sec. L2.3.4-B

Connection of NA-3 (Set for Constant Current Welding) to a SAF-600 or SA-800, Type "-F" and M.G. Solid State Field Control

SAF-600 or
SA-800 "F"
CONTROL BOX

NOTE: Electrode polarity switches on power source, and field control must be set for same polarity. Power source must be off when changing polarity.



Connect the control cable ground lead to the frame terminal marked near the power source terminal strip or to an unpainted frame screw. The power source must be properly grounded.

If optional solid state motor generator field control is not used, tape up separately the A, B and C leads from the control cable. Also connect a jumper from #2-#24 on the power source terminal strip.

- N.A. Bolt and tape connection.
- N.B. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.
- N.C. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] 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.
- N.D. If using an older K215 control cable: connect lead #75 to lead #75 of field control, connect lead #76 to lead #76 of field control, connect lead #77 to lead #77 of field control.

S15377
1-25-80

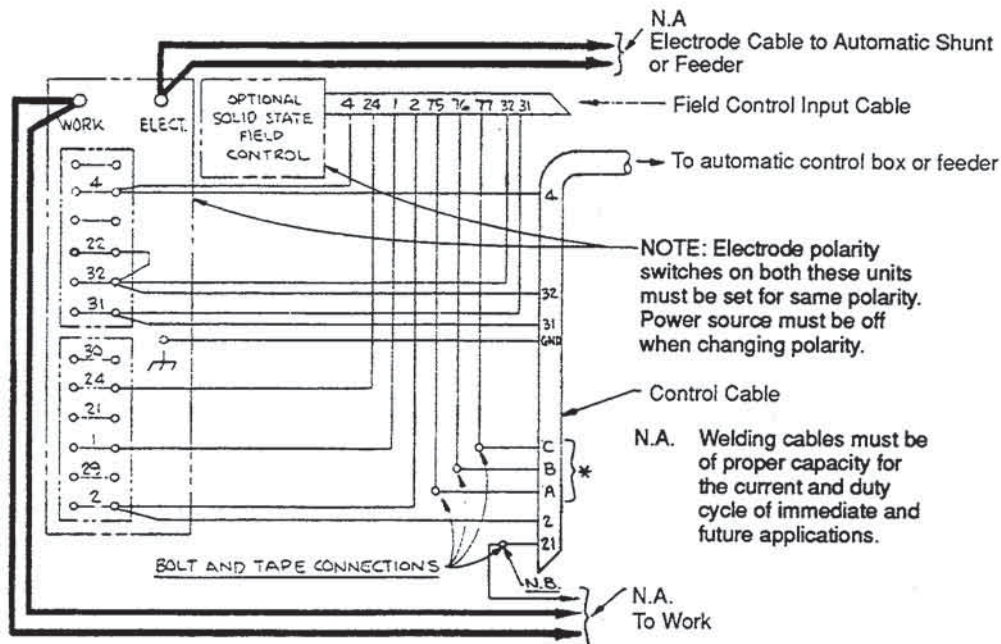
Sec. L2.3.4-C

Connection of NA-3 (All) to a SAN

Connect the control cable ground lead to the frame terminal marked /// near the power source terminal strip or to an unpainted frame screw. The power source must be properly grounded

If optional solid state motor generator field control is not used, tape up separately the A, B and C leads from the control cable. Also connect a jumper from #2-#24 on the power source terminal strip.

* If using an older control cable: connect lead #75 to lead #75 of field control, connect lead #76 to lead #76 of field control, connect lead #77 to lead #77 of field control.



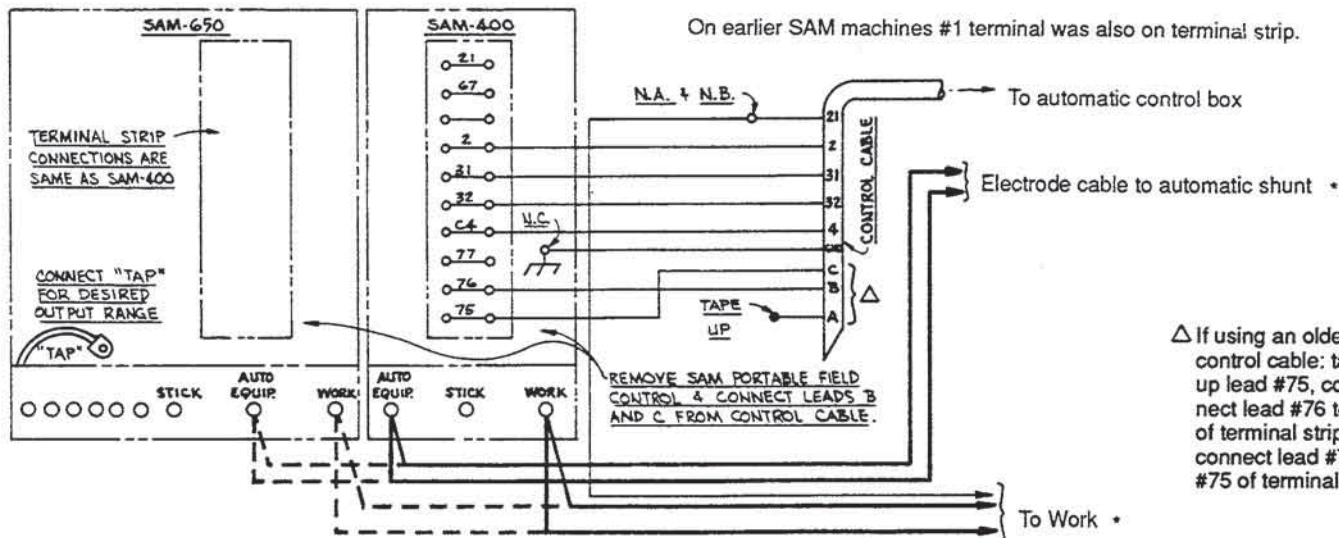
N.B. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] remote voltage sensing work lead is available for this purpose. Connect it directly to the work piece keeping it electrically separate from the welding work lead circuit and connection. For convenience, this extended #21 lead should be taped to the welding work lead.

S15266
1-25-80

Sec. L2.3.4-D

Connection of NA-3 (All) to a SAM Motor-Generator or Engine Driven Welder

Power Source



△ If using an older control cable: tape up lead #75, connect lead #76 to #76 of terminal strip, connect lead #77 to #75 of terminal strip.

N.C. Connect the control cable ground lead to the frame terminal marked /// near the power source terminal strip or to an unpainted frame screw. The power source must be properly grounded.

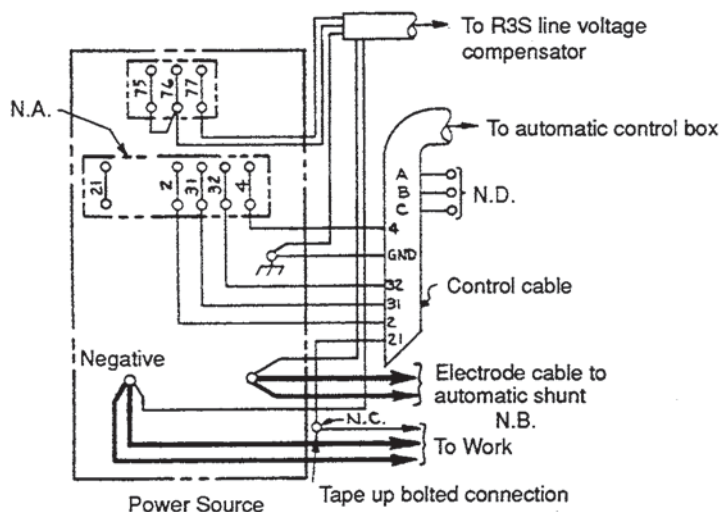
*Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.

S15265
3-28-80J

N.B. Tape up bolted connection.

Sec. L2.3.4-E

Connection of NA-3 or LT-7 to R3S-400, 600 or 800 With Line Voltage Compensator



- N.A. On earlier R3S-400, -600 & -800 machines, #67 & #1 terminals were also on the terminal strip.
- N.B. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.
- N.C. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] 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.
- N.D. NA-3 or LT-7 leads A, B and C (#75, #76 and #77 on older K215 control cable) are taped up when R3S line voltage compensator is connected. Arc voltage is controlled by the line voltage compensator rheostat. There will be no adjustments of voltage by automatic control box controls.
- N.E. If a variable voltage board is present in the automatic controls the jumper lead on the V.V. board must be connected to pin "L".

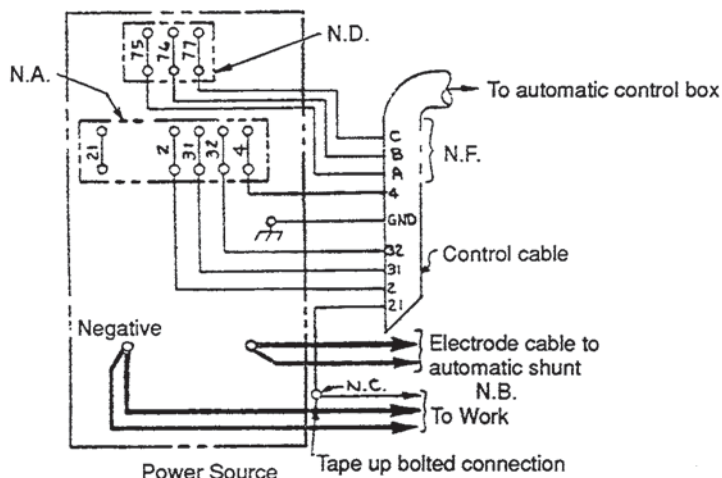
Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work leads at the power source and reverse the "Control Switch" at the power source.

Connect the control cable ground lead to the frame terminal marked GND near the power source terminal strip or to an unpainted frame screw. The power source must be grounded properly.

S15990
1-25-80

Sec. L2.3.4-E.1

Connection of NA-3 or LT-7 to R3S-400, 600 or 800 With No Line Voltage Compensator



- N.A. On earlier R3S-400, -600 & 800 machines, #67 & #1 terminals were also on the terminal strip.
- N.B. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.
- N.C. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] 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.
- N.D. Upper terminal strip does not appear on older R3S machines. Leads A, B and C should then be taped up. There will be no adjustment of voltage by the automatic control box voltage controls.
- N.E. If a variable voltage board is present in the automatic controls, the jumper lead on the V.V. board must be connected to pin "L".
- N.F. If using an older control cable: connect lead #75 to #75 on terminal strip, connect lead #76 to #76 on terminal strip, connect lead #77 to #77 on terminal strip.

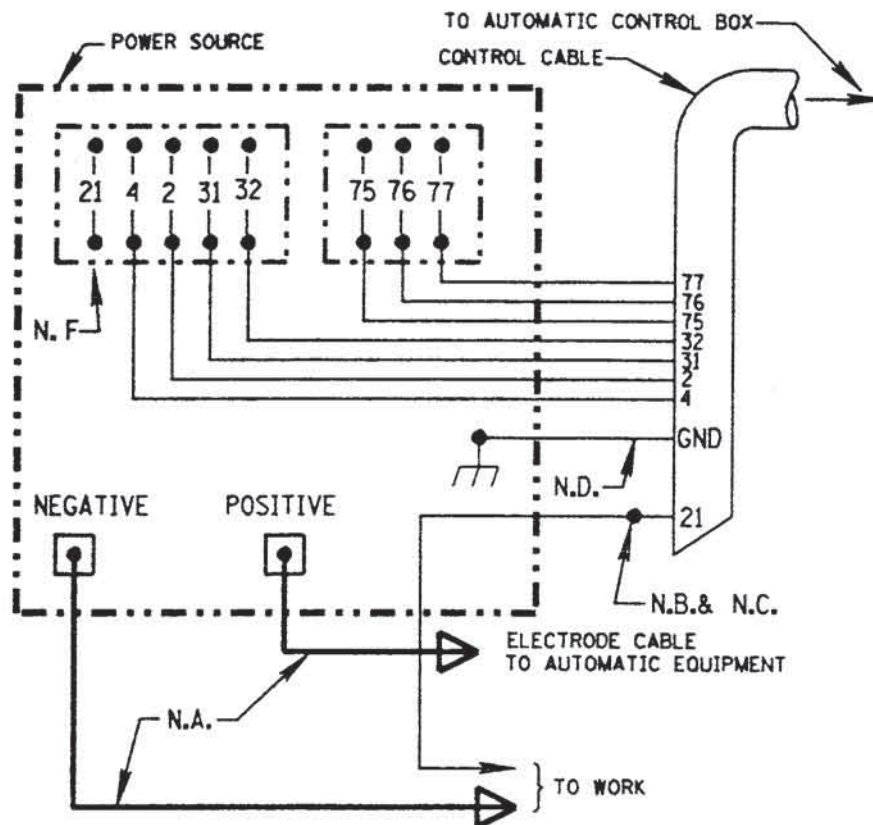
Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work leads at the power source and reverse the "Control Switch" at the power source.

Connect the control cable ground lead to the frame terminal marked GND near the power source terminal strip or to an unpainted frame screw. The power source must be grounded properly.

S15991
1-25-80

Sec. L2.3.4-F

Connection of NA-3, LT-5 or LT-7 to Idealarc DC-400 and NA-3 to CV/CVI Power Sources



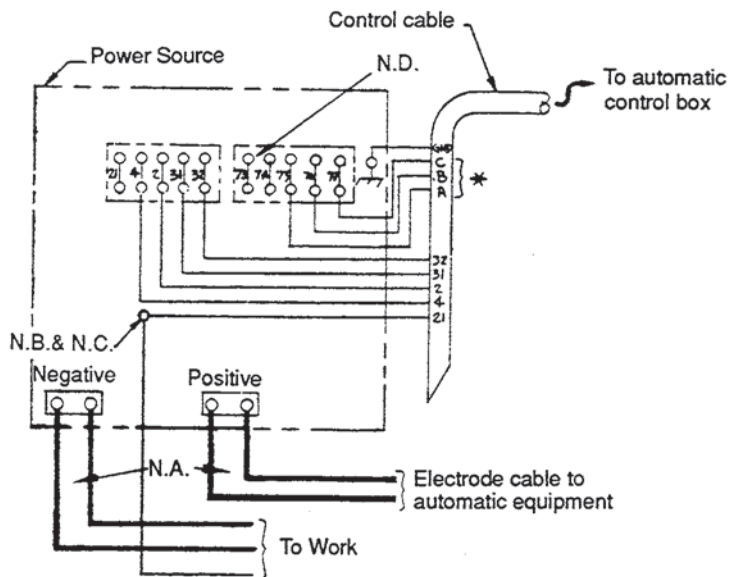
Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work leads at the power source and position the switch on power source (if equipped) to proper polarity. Reverse the leads on the back of the ammeter and voltmeter in the automatic control box. Also refer to note N.F.

- 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 AWG or larger insulated wire physically suitable for the installation. An S16586-[] 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, then control cable lead #21 does not need to be extended and can be directly connected to terminal #21 on the terminal strip. Note that this is not the preferred connection because it adds error to the wire feeder voltmeter reading.)
- 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 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 a variable voltage board is present in the automatic controls and the DC-400 diode kit or CV-400 or CVI-500 diode option 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/autostop feature of the automatic controls, permitting only hot starting techniques to be used.
- N.F.* If lead #21 is to be connected to the terminal strip, connect to the #21 terminal that matches work polarity. This connection must be changed whenever the electrode polarity is changed.

* Does not apply to DC-400 below code 9200 with polarity switch.

Sec. L2.3.4-G

Connection of NA-3, LT-5 or LT-7 to Idealarc DC-1000 and DC-1500



Connect the control cable ground lead to the frame terminal marked \nearrow near the power source terminal strip. The power source must be properly grounded.

* If using an older control cable: connect lead #75 to #75 on terminal strip, connect lead #76 to #76 on terminal strip, connect #77 to #77 on terminal strip.

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 S16586-[] 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.

N.C. Tape up bolted connection.

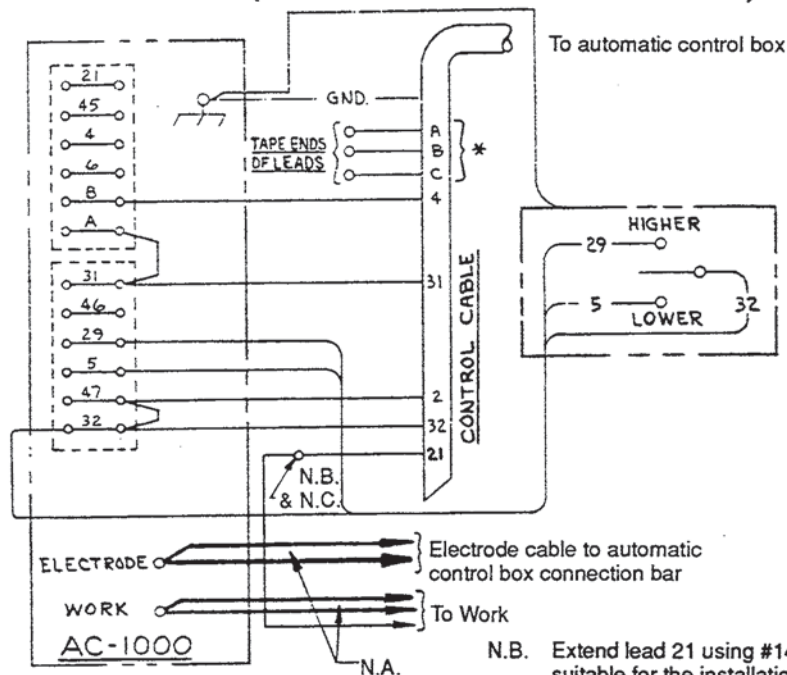
N.D. Terminals 73 & 74 not present on earlier DC-1500.

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.

S15534
2-26-82B

Sec. L2.3.4-H

Connection of NA-4 (which has rheostat for current control) to an AC-1000



All the current control rheostats on the control box will be inoperative. To avoid operator confusion the knobs should be removed.

* If using an older control cable tape ends of leads #75, #76 and #77.

CURRENT CONTROL SWITCH
SPDT, center off, momentary contact toggle switch 10 amp, 250 VAC rating. (Lincoln part No. S9826)

Switch to be located in suitable grounded enclosure at automatic control box. Leads to power source to be 18GA. or larger.

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

N.B. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] 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.

N.C. Tape up bolted connection.



Connect the control cable ground lead to the frame terminal marked \nearrow near the power source terminal strip or to an unpainted frame screw. The power source must be grounded properly

S15865
1-25-80

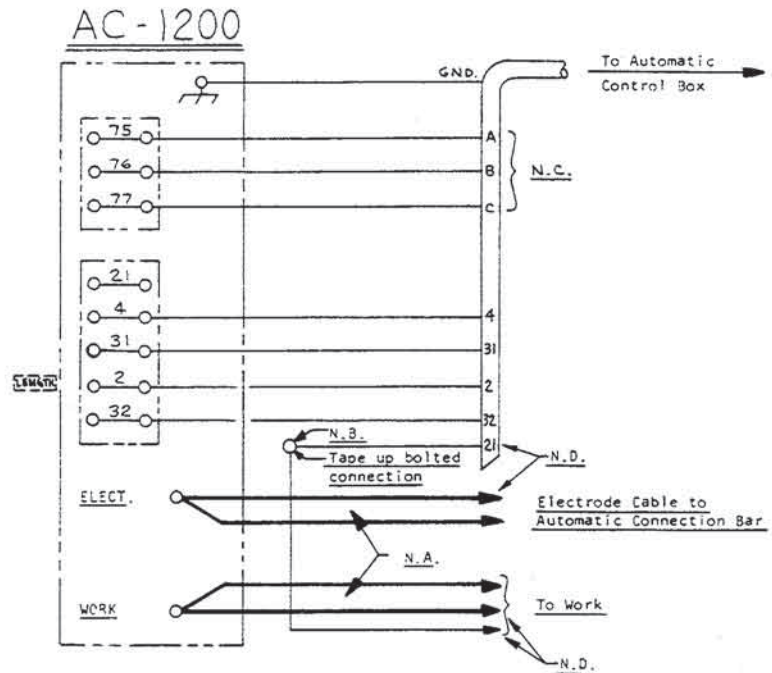
Sec. L2.3.4-J

Connection of NA-4 (which has rheostat for current control or LT-6) to an AC-1200

WARNING: Turn power off before making these connections.

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 also be connected to electrical ground per the power source Operating Manual.

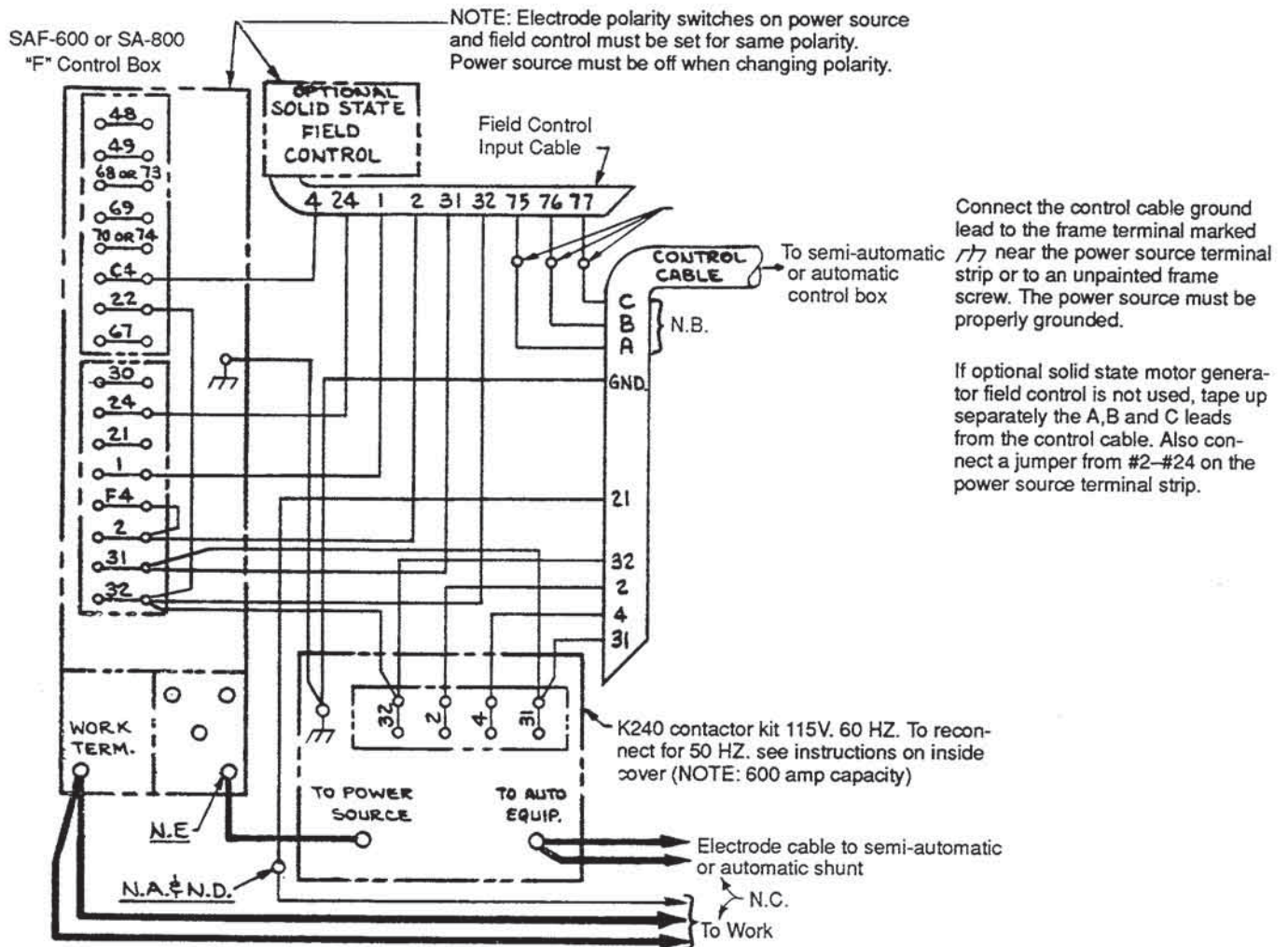
- N.A. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications. See the Operating Manual for proper sizes.
- N.B. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] remote voltage sensing work 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.
- N.C. If using an older control cable: connect lead #75 to #75 on terminal strip, connect lead #76 to #76 on terminal strip, connect lead #77 to #77 on terminal strip.
- N.D. To avoid possible induced NA-4 or LT-6 meter reading error; keep the control leads, including the extended #21 lead separated from the AC welding cables by at least 12 inches.



S15602
6-22-84H

Sec. L2.3.4-K

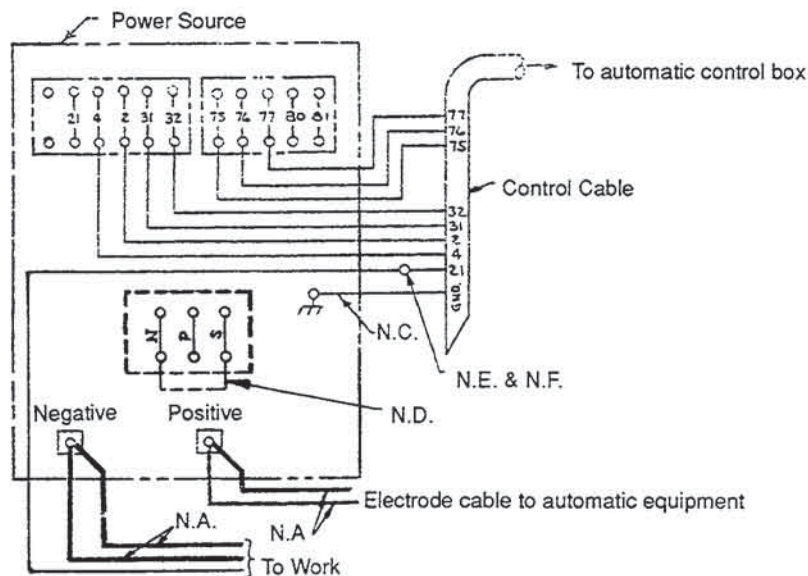
Connection of NA-3 to SAF-600 "F" or SA-800 "F" and M.G. Solid State Field Control and K240 Contactor Kit



- N.A. Bolt and tape connection.
- N.B. If using an older control cable: connect lead #75 to lead #75 of field control, connect lead #76 to lead #76 of field control, connect lead #77 to lead #77 of field control.
- N.C. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.
- N.D. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] 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. (This extended #21 lead connection replaces the need to employ the remote work lead accessory on LN-8 meter kits which have a direct work lead jack.)
- N.E. Connect to desired electrode terminal.


Sec. L2.3.4-L

Connection of NA-3, LT-5 or LT-7 to Idealarc DC-600



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. Also reverse the leads on the back of the ammeter and voltmeter in the automatic control box.

Notes

- N.A. Welding cable must be of proper capacity for the current and duty cycle of immediate and future applications.
- N.C. Connect the control cable ground lead to the frame terminal marked  near the power source terminal strip. The power source must be properly grounded.
- N.D. For DC-600 codes below 8200, connect a jumper from "N" to "S". There is no NPS terminal strip on codes above 8200.
- N.E. Extend lead 21 using #14 or larger insulated wire physically suitable for the installation. An S16586-[] 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.
- N.F. Tape up bolted connection.

S16366
7-24-81X

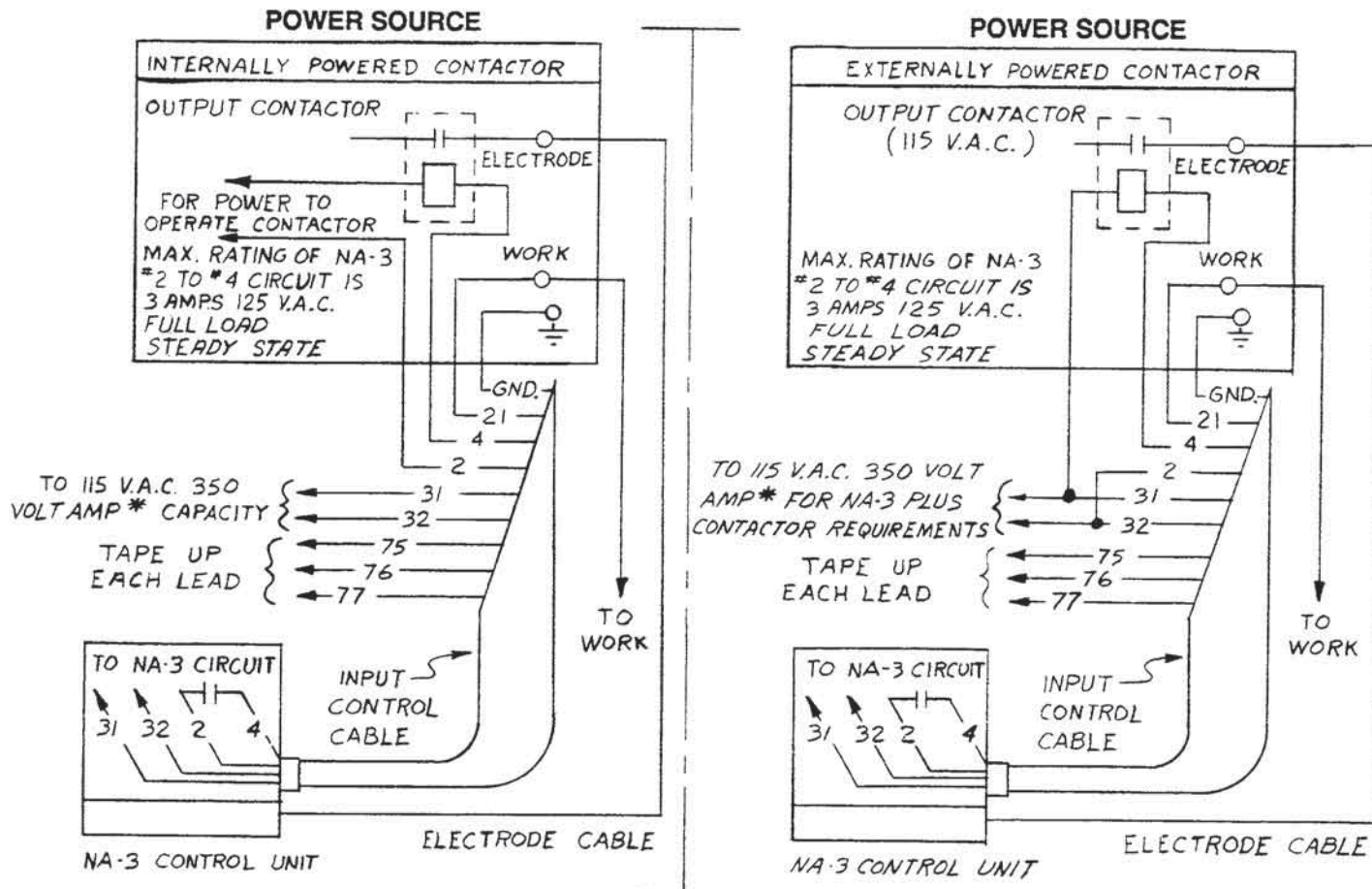
ELECTRICAL INSTALLATION — CONT'D

Sec. L2.3.5

Connection of NA-3 (All) to Non-Lincoln (not included in Sec. L2.3.4) Power Sources

NON-LINCOLN DC POWER SOURCES

Refer to wiring diagram of power source to be used to find the type of contactor circuit



*600 VA if Lincoln Travel Carriage is connected to NA-3.
There will be no output control of the power source at the NA-3.

K129 SUBMERGED ARC SMALL WIRE TWINARC®

File as Sec. L2.5.3 (K129) for IM-278

File as Sec. T2.5.3 (K129) for IM-305

In "Twinarc" welding two small diameter [.045, 1/16, 5/64 or 3/32" (1.1, 1.6, 2.0, or 2.4 mm)] solid wires are fed through a single wire feeder. Both wires must be the same size. Any standard NA-2, NA-2F, NA-3, NA-4, or NA-5 can be used. Gear ratio of the head must be 95:1. (The jumper on the NA-5 wire speed meter board must be in the proper position per Item E "Adjustments.")

The "Twinarc" assembly includes a wire reel, reel brake, shaft and mounting bracket, drive roll, idle roll assembly and the needed dual wire guides, nozzle and contact tip or contact tip holder. Spacing between the wires is fixed by the holes in the contact tip or contact tip holder.

A "Twinarc" assembly is available for each wire size — .045, 1/16, 5/64 and 3/32" (1.1, 1.6, 2.0 and 2.4 mm). Converting to a different wire size is accomplished by changing a few parts. See Parts List P-101-G.

For overlay work with 1/16 thru 3/32" (1.1 — 2.4 mm) Lincore® electrodes, a special side-by-side tip holder (part number S17728) is available that uses standard tips.

A. Reel Installation

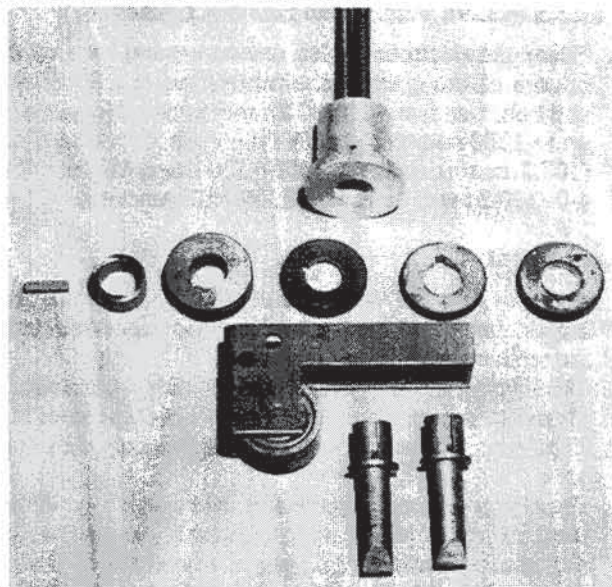
1. See drawing on next page for mounting suggestions for the second electrode reel. The reel support bracket must be made by the fixture builder to fit the particular installation.

B. Initial Preparation [For .045, 1/16 or 5/64" (1.1, 1.6 or 2.0 mm) wire]

1. Remove the following parts from the wire feed unit.
 - a. The wire straightener.
 - b. The complete nozzle.
 - c. Both the upper and lower guide tubes.
 - d. The drive rolls.
 - e. The idle roll assembly. ⁽¹⁾
2. Place the double grooved drive roll on the shaft and insert the key. Place the clamping washer back on the shaft and tighten the hex locking nut.

C. Initial Preparation [For 3/32" (2.4 mm) wire]

1. Remove the following parts from the wire feed unit.
 - a. The wire straightener.
 - b. The complete nozzle.
 - c. Both the upper and lower guide tubes.
 - d. The drive rolls.
 - e. The idle roll assembly. ⁽¹⁾
 - f. The drive roll key.
 - g. The output shaft drive roll spacer.
2. Oil or grease the new, shorter drive roll spacer, place it on the output shaft and push it back as far as it will go.
3. Place the key in the keyway of the shaft.
4. Place the outer, center and another outer drive roll on the shaft and tighten the hex nut securely.



Twinarc incoming and outgoing guide tubes, drive rolls, and idle roll assembly.

D. Nozzle Installation

1. Place the new swivel type idle roll into position, tighten the pivot screw then assemble the tension spring and screw.
 - a. On the NA-2 and NA-2F, tighten the tension screw until the nut bottoms against the shoulder of the screw.
 - b. On the NA-3, NA-4 or NA-5, with wire in the system, tighten the tension screw to the .045-3/32" position on the indicator plate.
2. Insert one of the guide tubes in the top hole of the face plate (use either one of the guide tubes supplied, both are identical). Place the dual ingoing wire guide over this guide tube. The two parts are keyed together so hole line up is automatic. Then place the two "L" shaped locking clamps (T8400) into position, line up the two flat surfaces of the guide tube so that they are parallel with outside diameter of the drive roll and tighten the two locking screws.
3. Turn the nozzle upside down. Insert the two long wire guide tubes that were shipped loose into the nozzle body so they fit into the internal recessed holes in the mounting block. Place the contact tip (or the contact tip holder) into position at the end of the nozzle making sure the guide tubes fit into the recessed holes in the contact tip. Line up the holes in the contact tip or holder with the holes in the incoming end and lock it in position with the clamping nut.
4. Insert the other guide tube in the outgoing side of the face plate. Place the nozzle assembly over the guide tube. Here again the tube and the nozzle assembly are keyed to ensure proper line up of the holes. Insert and tighten the two socket head screws and fasten the nozzle securely.

⁽¹⁾ On later models, the shoulder bolt pivot was replaced by a pin secured by a set screw located on the mounting surface of the faceplate.

Sec. L2.5.3 (K129), T2.2.12 and E2.7.8 (Continued)

5. Fasten the electrode cables, one on top and one on the bottom of the electrode terminal, with a 1/2-13 nut and bolt. Use two 4/0 (107.2 mm²) cables for currents up to 1000 amperes at 80% duty cycle. Use three 4/0 (107.2 mm²) cables for 1000-1300 amperes, use four 4/0 (107.2 mm²) cables for 1300-1500 amperes.

E. Adjustments

1. When using an NA-5, connect the calibration jumper lead to pin "95S" on the wire speed meter board per the table on the wiring diagram.
2. The ingoing tubes must be lined up with the drive roll grooves or poor wire feeding will be encountered. Therefore, do not change this adjustment once it is set.
3. There may be occasions where the two wires will be used other than in line with the seam to be welded. To adjust the nozzle for staggered or cross seam wire position, loosen the contact tip clamping nut. Rotate the nozzle tip until the desired wire position is set, then retighten the nut. Readjust the head position to get proper angle of wire to work.

F. Maintenance [For .045 (1.1 mm) wire]

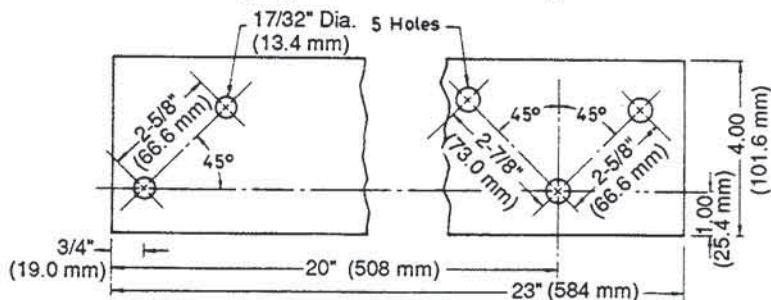
Unscrew the locking collar and replace the contact tip when it no longer provides accurate wire placement or

good electrical contact. Keep replacement tips in stock. For 1/16, 5/64 and 3/32" (1.6, 2.0 and 2.4 mm) wire the tips can be replaced directly. Before installing the new tip or contact tip holder:

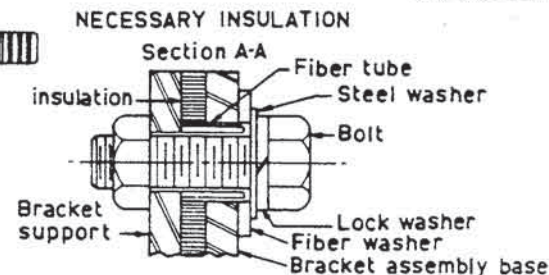
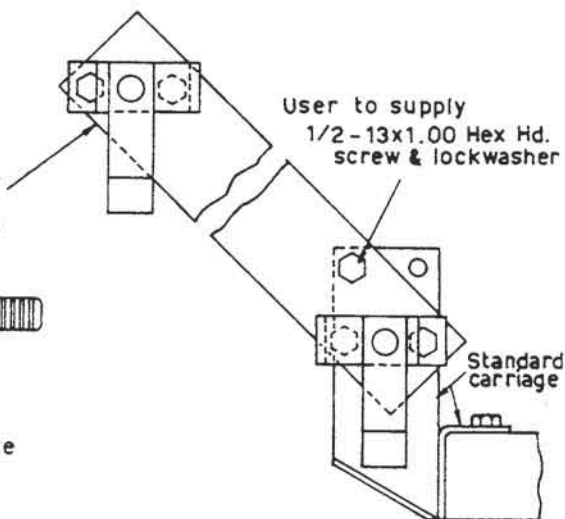
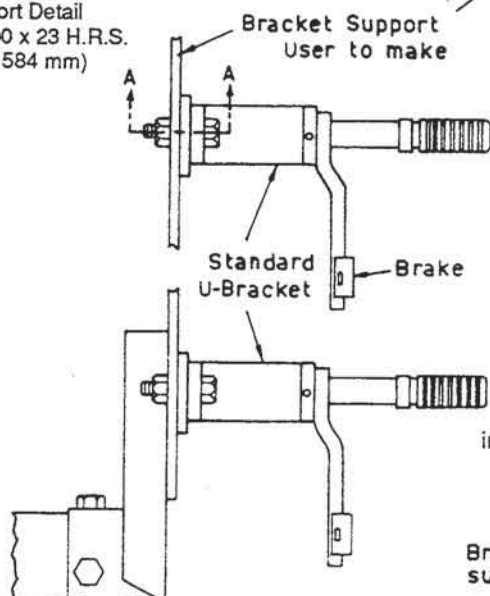
1. Make sure the threads and the bottom surface of the nozzle are clean and bright. These surfaces are current carrying areas and must be clean.
2. Check the locking ring threads making sure they are free of any foreign material. A small application of high temperature anti-seize compound on these threads ensures a longer life of the two mating parts. Suggested anti-seize compounds are Graphite grease, per Lincoln spec E2067 and "Anti-Seize and Lub. Compound" made by Never-Seiz Compound Corporation, 2910 S. 18th Ave., Broadview, Illinois 60153.
3. Inch electrode out of end of nozzle. If the long steel guide tubes came out with the old contact tip, slide the guide tubes over the wires. Then insert the wire through the holes in the new contact tip or contact tip holder. This procedure simplifies the assembly and line-up of the component parts.
4. Replace the locking ring and tighten securely.

Other replacement parts that should be kept on hand include: drive rolls, tip holders, inserts and the locking nut.

November 1990



Bracket Support Detail
Materials - 3/8 x 4.00 x 23 H.R.S.
(2.0 x 101.6 x 584 mm)



METHOD FOR MOUNTING SECOND ELECTRODE REEL

K225 SUBMERGED ARC TWINARC® KIT

Sec. L2.5.3 (K225)

K225 SUBMERGED ARC TWINARC® KIT

In "Twinarc" submerged arc welding, two 5/64, 3/32 or 1/8" (2.0, 2.4, or 3.2 mm) solid wires are fed through a single wire feeder. Both wires must be the same size.

An NA-3S, NA-4 or NA-5 with a 142:1 gear ratio should be used. The 95:1 gear ratio may be used with the NA-3 for maximum usable currents and wire feed speeds, especially with 5/64" (2.0 mm) electrode. Do not use the 95:1 gear ratio for K225 Twinarc with the NA-5 since wire speed calibration will not be correct.

The "Twinarc" assembly includes a wire reel, insulated reel mounting bracket, drive rolls, drive roll locating collar, an idle roll assembly, wire straightener, dual wire guides, nozzle and contact blocks.

The contact assembly has two spring loaded jaws. These press the electrode against the center spacer block for good electrical contact to keep the nozzle cool and to maintain contact at a given point so electrical stickout remains constant during welding. Spacing between the wires is fixed by the size of the center contact block.

A. Reel Installation

1. See Sec. L2.5.3 for mounting suggestions for the second electrode reel. The reel support bracket must be made by the fixture builder to fit the particular installation. The wire reels should be located so the wire straightener knob points toward the wire reels.

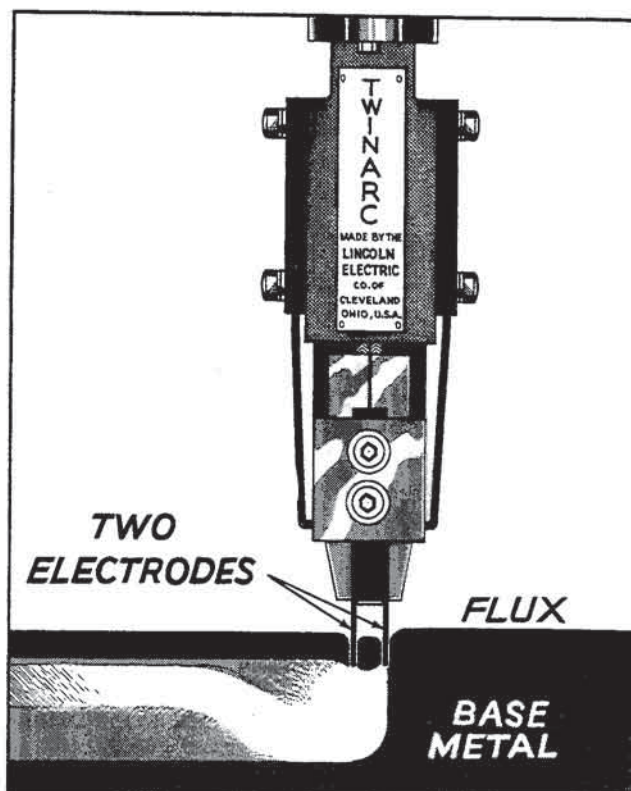
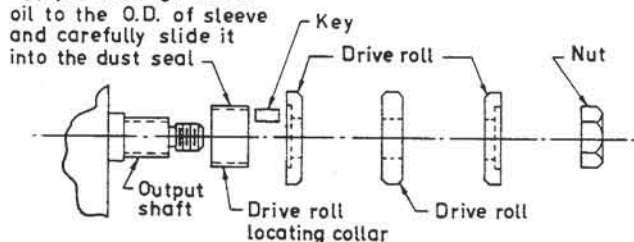
B. Initial Preparation

1. Remove the following parts from the feed unit:
 - a. The wire straightener.
 - b. The complete nozzle.
 - c. Both the upper and lower guide tubes.
 - d. The drive roll assembly including the drive roll locating collar.
 - e. The idle roll assembly.⁽¹⁾

C. "Twinarc" Assembly (Parts listed on P-101-L)

1. Place the drive rolls on the shaft per the following sketch and tighten the hex locking nut.
2. Place the new swivel type idle roll assembly into position, tighten the pivot screw, and then assemble

Apply a little grease or oil to the O.D. of sleeve and carefully slide it into the dust seal



- the tension spring and screw. Adjust the idle roll pressure adjustment screw for the wire diameter to be used while welding.
3. Insert one of the guide tubes into the top hole of the face plate (both guide tubes supplied are identical). Place the dual wire straightener over this guide tube. The two parts are keyed together so hole line up is automatic. Then place the two "L" shaped locking clamps into position, line up the two flat surfaces of the guide tube so that they are parallel with outside diameter of the drive roll, and tighten the two locking screws.
4. Fit the other electrode guide into the top of the "Twinarc" nozzle. Install the nozzle to the head by first sliding the guide tube into the faceplate until the mounting screws supplied with the nozzle can be started into their respective tapped holes. Tighten these two screws. The lineup of the outgoing guide is automatic.
5. Fasten the electrode cables of the proper size to the copper bar on the nozzle. Use two 4/0 (107.2 mm²) cables for currents up to 1,000 amps at 80% duty cycle. Split the cables so they will be on both sides of the copper bar.
6. Install the rubber flux tube provided onto the metal discharge tube at the bottom of the flux hopper. Slip the end of the rubber tube with the copper tip through the clip to the "Twinarc" nozzle assembly.

⁽¹⁾ On later models, the shoulder bolt pivot was replaced by a pin secured by a set screw located on the mounting surface of the faceplate.

Sec. L2.5.3 (K225) (Continued)

D. Adjustments

Electrode Spacing: The wires are held against a center contact block by the two pressure springs on the jaws. The center block controls the distance between the wires. Center blocks for 3/8, 1/2, and 5/8 inch (9.5, 12.7, and 15.8 mm) spacing are available.

To change the blocks loosen the two pressure springs. Then remove the two 1/4-20 socket head screws that hold the contact block. Before installing the new block, use graphite grease on the 1/4-20 screw threads and be sure the mating surfaces between the center contact block and the mating surface on the copper current bar are bright, clean and flat. This junction carries the full welding current. After the contact block is in place and the two socket head screws are retightened, tighten the screws holding the pressure springs.

Nozzle Rotation: The nozzle can be set so the electrodes are in line with the joint for highest speed and penetration; straddle the joint for a wide bead and shallow penetration; or skewed across the joint for special conditions. To rotate the nozzle, loosen the two 1/4-20 socket head screws that hold the body of the nozzle to the mounting

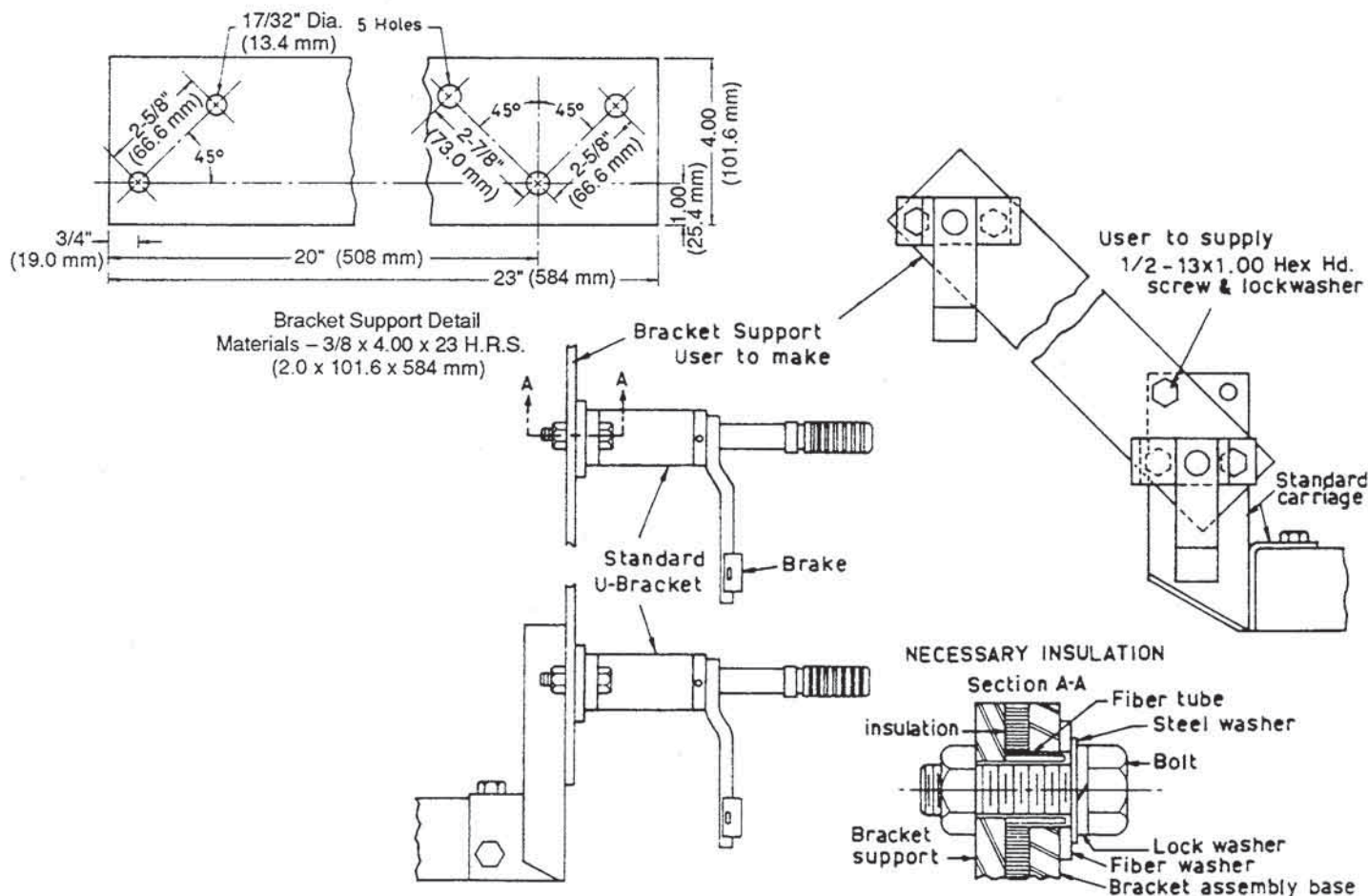
base and rotate the nozzle to the desired angle. If the desired angle is not readily obtained, remove the socket head screws entirely and relocate them in alternate holes provided. Any desired angle can be obtained in this manner. Retighten the screws when properly adjusted.

E. Maintenance

The greatest contact jaw wear takes place on the center contact block. The side pressure jaws are made from a special long wearing material. Replace the center contact block when it has such a groove worn that there is no pressure on the electrode from the side pressure jaws.

When replacing the center contact block, be certain the surface between it and the copper bar is bright, smooth and clean. This joint must carry up to 1,500 amperes.

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METHOD FOR MOUNTING SECOND ELECTRODE REEL

K239 TWINARC® KIT FOR INNERSHIELD® ELECTRODES

File as Sec. L2.5.3 (K239) for IM-278

File as Sec. T2.5.3 (K239) for IM-305

K239 TWINARC® KIT FOR INNERSHIELD® ELECTRODES

In "Twinarc" welding with Innershield electrodes, two 3/32" (2.4 mm) flux-cored electrodes are fed through a single wire feeder. Both wires must be the same size. Any standard model of the NA-2, NA-3 or NA-5 with 95:1 wire feed gear ratio can be converted for "Twinarc" welding.

The K239 kit includes the nozzle equipped for water cooling, drive rolls, drive roll locating collar, idle roll assembly, ingoing and outgoing guide tubes, wire straightener, wire reel and wire reel mounting shaft and insulation. Spacing between the electrodes is fixed.

Reel Installation

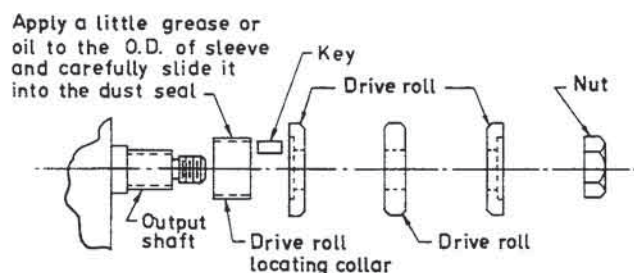
1. See K129 for mounting suggestions for the second electrode reel. The reel support bracket must be made by the fixture builder to fit the particular installation.
2. For optimum operation, the two wire reels should be mounted in the same plane as the drive rolls. The distance between the wire reels and the head should be far enough [3 to 4 ft. (.9 to 1.2 m)] to allow the Innershield electrode to orient itself before entering the wire straightener.

Initial Preparation

1. Remove the following items from the head. Save the parts so the head can be reconverted to single wire operation if required.
 - a. The wire straightener assembly.
 - b. Single wire nozzle assembly.
 - c. Upper and lower wire guide tubes.
 - d. The idle roll assembly.⁽¹⁾
 - e. All the parts on the output shaft including the drive roll locating collar which is held on by a small set screw.

Installation (Refer to Parts List P-100-D)

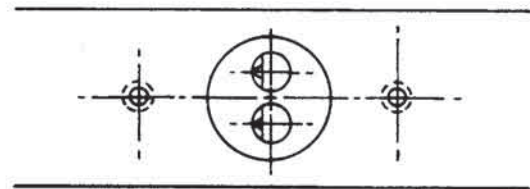
1. Install the new idle roll assembly and hold it in place with the pivot bolt, (Item 18) and nut (Item 17). Do not install the idle roll spring screw (Item 6) yet.
2. Install the drive rolls as shown.



3. (NA-3 or NA-5) Install the idle roll spring (Item 8), spring screw (Item 6), washer (Item 7) and yoke indicator assembly (Item 10). Tighten the idle roll spring screw to the .035-3/32" (equal to 0.9-2.4 mm) setting on the yoke indicator assembly.

(NA-2) Install the idle roll spring (Item 8) and spring screw (Item 6) with its washers and the square nut (Item 10). Tighten the spring screw until the nut hits the shoulder on the screw.

4. Insert one wire guide into the top of the faceplate (Item 1) and slip the wire straightener down over the top of it. The holes in the wire guide should be lined up squarely with the grooves in the drive roll as shown. Point the bent arm of the wire straightener either to the right or the left depending upon the location of the wire reels. When properly set, clamp straightener in position using the two L-shaped clamps (Item 5).



5. Fit the other electrode guide into the top of the "Twinarc" nozzle. Install the nozzle to the head by first sliding the guide tube into the faceplate until the mounting screws supplied with the nozzle can be started into their respective tapped holes. Tighten these two screws. The lineup of the outgoing guide is automatic.
6. Fasten the electrode cables to the nozzle. Use two 4/0 cables for currents up to 1,000 amperes at 80% duty cycle. Place one on the top and one on the bottom of the electrode terminal and tighten the 1/2-13 bolt and the nut provided.
7. Water cooling is required for "Twinarc" welding with Innershield electrodes. Connect the tubes included on the nozzle to the water supply and drain using rubber tubing obtained locally. Water flow should be about 1/3 gallon (1.25 liters) of tap water per minute. Installation of a solenoid valve assembly (K223 for the NA-3 and NA-5; M10502 for the NA-2) is recommended to control cooling water flow. Installation instructions are included in the kits.

Water Flow Switch Installation

Installation of a switch which permits welding *only* when cooling water is flowing in the nozzle is highly recommended. The switch must operate at the 1/3 gallon (1.25 liters) per minute level.

⁽¹⁾ On later models, the shoulder bolt pivot was replaced by a pin secured by a set screw located on the mounting surface of the faceplate.

Sec. L2.5.3 (K239) and Sec. T2.5.3 (K239) (Continued)

1. **For the NA-5** — Install a K336 Remote Pushbutton Interface Module. Then connect a flow switch with normally closed contacts between the "Common Terminal" and the "Weld Stop Terminal" of the interface module. If water is not flowing, the weld cannot be started. The switch should be suitable for a low level voltage of 24 volts and 10 milliamps. Two suitable switches are as follows:

Delaval	Switch Number FS925
Gems Sensor Division	SPDT — N.C.
Farmington, Connecticut 06302	

Hoban Engineering Corp.	Switch Number
1074 N.W. 1st Avenue	200-B-2-A
Boca Raton, Florida 33432	SPST — N.C.

2. **For the NA-3** — Use a switch with normally closed contacts. The two switches listed under the NA-5 are suitable.

Connect the switch to terminals #528 and #582 on the NA-3 terminal strip. If welding starts (current flows) when no water is flowing, the NA-3 shuts down.

3. **For the NA-2** — use a switch with normally open contacts. Two suitable switches are as follows:

McDonnell & Miller ITT	Switch Number FS 6
3500 N. Spaulding Avenue	SPDT
Chicago, Illinois 60618	

Hays Manufacturing Co.	Switch Number 2600-0811
Division of Zurn Industries	SPDT
Erie, Pennsylvania 16512	

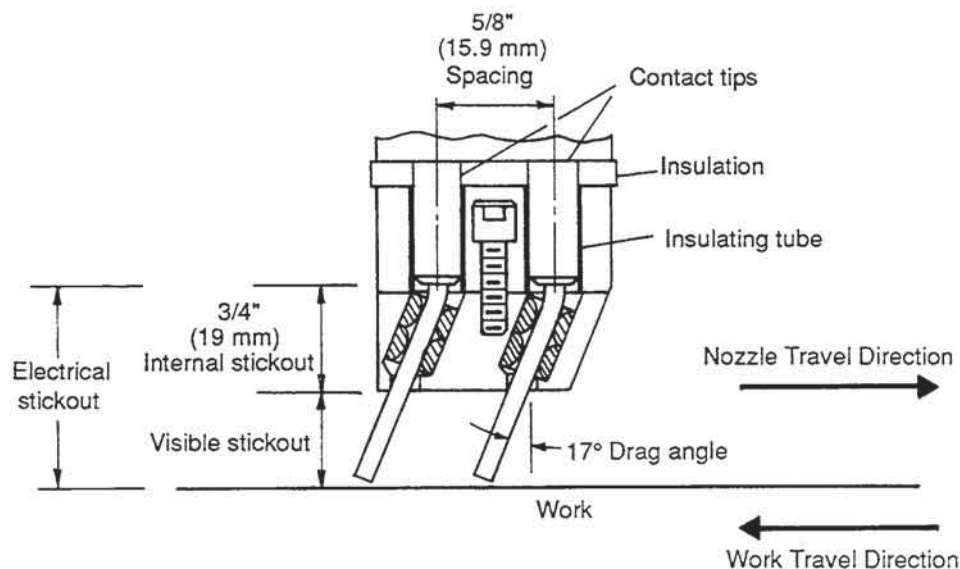
Remove the jumper from 20 to 26 on the terminal strip in the NA-2 control box. Connect the normally open contacts of the switch to these terminals. The switch will prevent ICR from pulling in if no water is flowing.

Adjustments

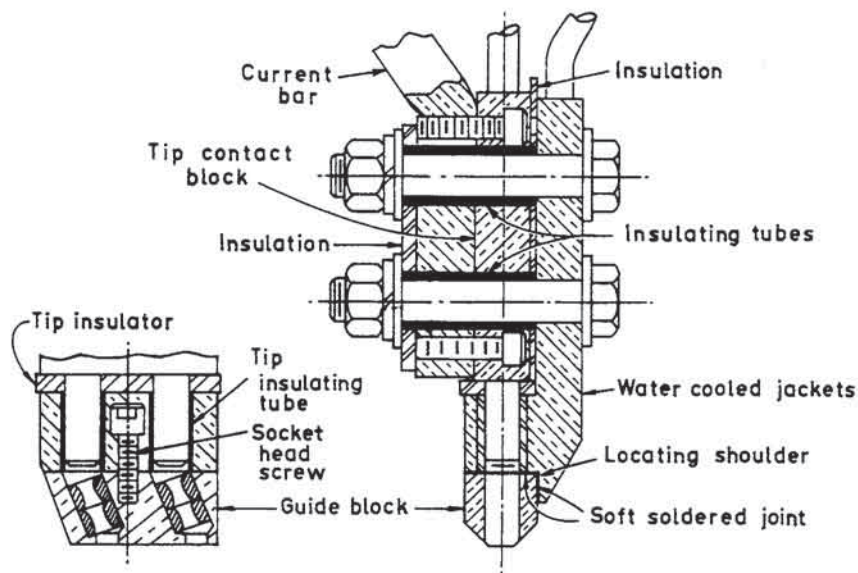
1. When using an NA-5, connect the calibration jumper lead to pin "95S" on the wire speed meter board per the table on the wiring diagram.
2. **Nozzle Rotation:** The proper lineup of the electrodes with the seam should be specified by the procedures. To rotate the nozzle, loosen the two 1/4"-20 socket head screws which hold the body of the nozzle to the mounting base and rotate the nozzle to the desired angle. If a greater angle is required, remove the socket head screws entirely and relocate them in the alternate holes provided. Any desired angle can be obtained in this manner. Tighten the screws when properly adjusted.
3. **Electrode Spacing, Drag Angle and Electrode Stickout:** As shown in the following sketch, the electrode spacing, drag angle as the electrode leaves the guide block and the internal electrical stickout is fixed. The electrical stickout is 3/4" (19 mm) greater than the visible stickout. Set the stickout as specified by the procedures.

Loading the Electrode

1. Remove either the nozzle or the guide block at the end of the nozzle.
2. Load the wire reels with Innershield electrode per instructions in Sec. L3.2.2. For "Speed Feed" drums and reels see Sec. L2.5.7-A and B.
3. Remove the U-shaped ingoing guide from the top of the wire straightener. Turn the straightener adjusting knob for minimum straightening. Straighten the first 10" of electrode and insert the ends through their respective holes and down through the straightener and ingoing guides to the drive rolls. Press the "Inch Down" button until both wires start to feed through the rolls.
4. Turn the straightener knob away from minimum straightening and slide the U-shaped guide along the wires to its original position. Lock the thumb screw.



Sec. L2.5.3 (K239) and Sec. T2.5.3 (K239) (Continued)



5. Inch the electrode through the drive rolls and adjust the straightener until the wire is straight. Mark this position so it can be quickly reset after the next loading of the reels. The straightener will do a good straightening job if the reels were properly installed as described under "Reel Installation".

Maintenance

1. Replace the contact tips when the output current and voltage become unstable. For access to the tips, remove the two screws holding the guide block assembly.
2. Holes worn in the guide block assembly allow the wire to wander. When replacing the assembly, it is absolutely essential to follow these replacement instructions:
 - a. Shut the welding power source off.
 - b. Shut water flow off.
 - c. Disconnect water lines from the water cooled jacket.
 - d. Remove the two hex head screws which mount the water cooled jacket to the tip contact block and current bar. Slide the jacket down off the tips.
 - e. With the use of a small propane torch, apply just enough heat to melt the soft joint between the guide block and the water jacket. *Do not* overheat [600°F, (316°C) max.]

- f. Remove the socket head screw while the joint is still hot, then remove the guide block.
- g. Remove the two tip insulating tubes from the two holes in the water cooled jacket.
- h. Re-tin the mating surfaces of the water cooled jacket using an acid core 50-50 solder. Avoid getting solder into the holes.
- i. The new guide block is tinned at the factory and only a light amount of sanding of the mating surfaces will be necessary.
- j. Assemble the guide block to the water jacket using the socket head screw removed previously.
- k. Make sure the guide block is back against the locating shoulder. Stand the unit up vertically with the guide block at the bottom, then heat the assembly again until the solder melts between the joints; tighten the screw during the time the solder is in a liquid state. Add a little solder to the mating edges to ensure a good solder joint. Do not overheat. Improper soldering will cause the joint to overheat and fail while welding.
- l. Allow piece to cool and insert new tip insulating tubes into the water cooled jacket.
- m. Reassemble the unit.

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K218 HORIZONTAL FILLET/ LAP ATTACHMENT

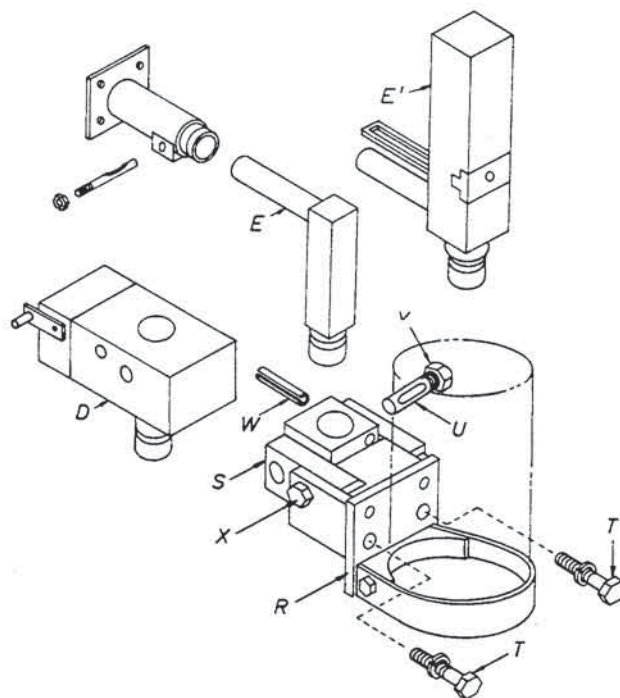
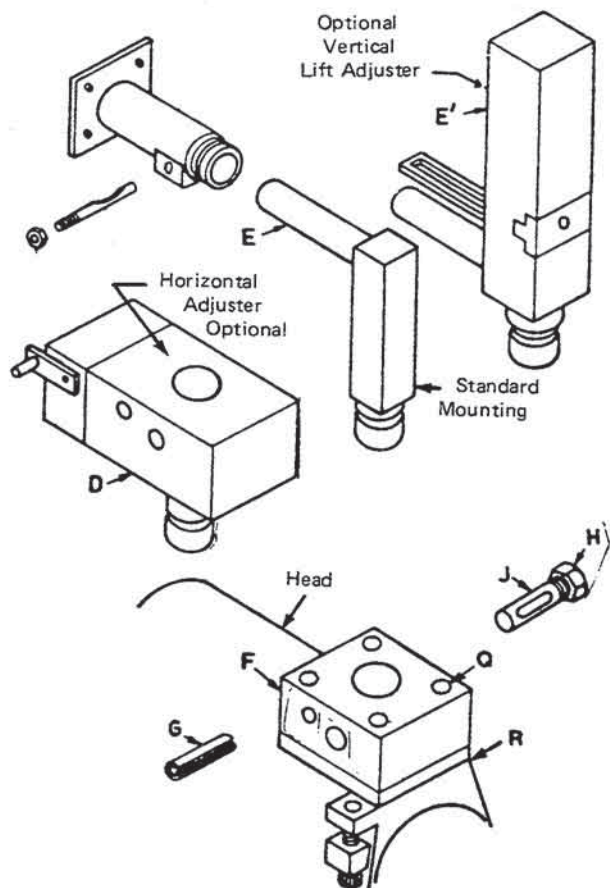
Sec. L2.5.4

K218 Horizontal Fillet/ Lap Attachment

This special contact assembly is recommended for submerged arc welding horizontal fillet and lap joints on 3/16" (4.8 mm) and thicker plate. With the special head pivot assembly loose, the guide wheels ride in the joint for accurate bead placement often eliminating the need for expensive fixtures and clamps.

INSTALLATION OF HEAD PIVOT ASSEMBLY

1. If already installed, remove the straight contact assembly from the head. Remove the electrode cables from the contact assembly.
2. Unplug the wire feed motor and flux hopper cords from the control box.
3. Remove the flux hopper. Be sure the draw bolt nut (H) is tight and remove the roll pin (G) from the head mounting block (F).
4. Support the head so it cannot fall, loosen the draw bolt nut (H) and lower the head from the mounting (E) [or optional horizontal adjuster (D) or vertical lift adjuster (E')].



5. Remove the four Allen screws (Q) which hold the mounting block (F) to the gear box mounting plate (R). (Save items G, H, J, Q and F for reassembly if the K218 is to be removed.)
6. Attach the pivot assembly (S) included in the kit to the gear box mounting plate (R) using the two 1/2-13 hex head screws (T) and lockwashers included in the kit.
7. Put the draw bolt (U) shipped with the kit into the pivot assembly (S) with the cut in the bolt in proper position to allow the assembly to slide onto the head mounting.
8. With the wire feed motor vertical, slide the entire assembly onto the post of the head mounting (E) [or optional horizontal (D) or vertical lift adjusters (E')] and tighten the nut (V). Drive the safety roll pin (W) shipped with the kit into the pivot assembly. This pin holds the head on the mounting but allows it to pivot about the axis of the mounting post when the nut (V) is loose.
9. Loosen the lock nut (V) and position the pivot shaft of the pivot assembly (S) parallel to the weld travel direction. Tighten the lock nut (V).

INSTALL THE CONTACT ASSEMBLY AND FLUX TUBE

1. Rotate the drive roll box to position the wire straightener on top.
2. Put the outgoing wire guide from the drive roll mechanism into the hole in the top of the fillet/ lap

Sec. L2.5.4 (Continued)

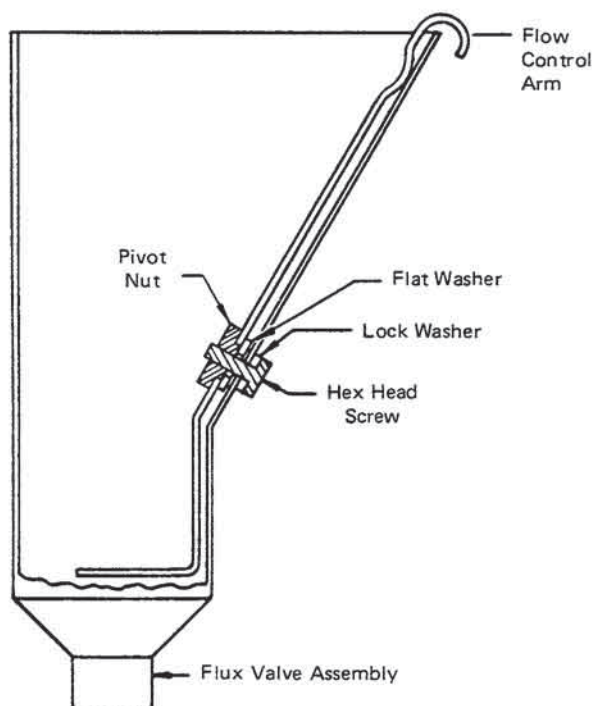
attachment contact assembly. Place the contact assembly in position on the bottom of the drive roll box and tighten the two screws which hold it to the head.

3. Connect the electrode cable from the control box to the contact assembly. Place one cable on each side of the connection tab with the lugs flat against the tab and tighten the bolt and nut.
4. Install the flux hopper. (If adding a flux hopper kit to an NA-3N, install per instructions shipped with the kit.)
5. Attach the flux tube included in the kit to the flux hopper and tighten the wing screw.
6. Plug the wire feed motor and flux hopper cords into the appropriate receptacles on the side of the control box.

INSTALL THE FLUX CONTROL KIT (T14861)

The kit includes a mechanical flux flow control arm which is installed as follows:

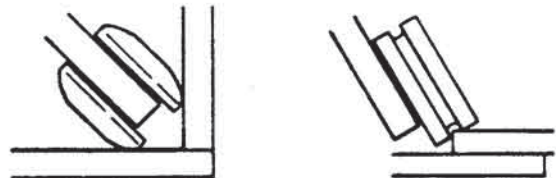
1. Remove the 3/8" hex head screw from the sloping surface of the flux hopper. Replace this screw with the longer screw and lockwasher included in the kit and tighten the screw.
2. Put the flat washer from the kit over the screw. Place the control arm inside the hopper with the bent section straddling the top edge of the hopper and the hole over the screw installed in paragraph 1.



3. Screw the special pivot nut from the kit onto the screw so the shoulder of the pivot area enters into the hole in the control arm. Tighten the nut against the flat washer. The arm must be free to rotate about the pivot nut.

OPERATION

1. If making lap welds on 3/16" thru 3/8" (4.8 thru 9.5 mm) plate, install the grooved guide roll shipped with the kit. This guide roll is designed to ride along the top corner of the upper plate. Use the fillet guide roll for lap welds on plate over 3/8" (4.8 mm) thick.



2. If making fillet welds, install the double guide rolls which are designed to ride against both the vertical and horizontal members of the joint with sufficient clearance between the rolls to clear tack welds.
3. Obtain the proper position of the electrode with respect to the joint by adjusting the hex screw above either guide roll.
4. Adjust the flux hose to deposit flux directly onto the wire at the joint. Do not allow flux to fall ahead of the guide roll.
5. Loosen the lock screw (X) on the pivot assembly (S) allowing the head to swing freely about the pivot shaft.
6. The combination of the off-center weight of the head and the downward pressure of the spring on the contact assembly holds the guide rolls in contact with the joint. This system automatically compensates for misalignment between the work and the head up to 1/4" (6.4 mm) either vertically or horizontally.

MAINTENANCE

1. Periodically grease the contact assembly pivot point through the grease fitting on the assembly.
2. Rusty or dirty wire and excessively high currents increase jaw wear. When arcing occurs in the jaws or the wire becomes loose in the jaws, remove the jaws and dress them down by filing. When an excessive amount of material is worn off, replace the jaws. Contact jaws manufactured after April, 1979 have replaceable contact inserts (refer to P-101-N).

K281 SOLID WIRE STRAIGHTENER FOR TINY TWINARC®

Sec. L2.5.5

The K281 Tiny Twinarc wire straightener will straighten .045 through 3/32" (1.1 through 2.4 mm) wire diameters. It is recommended for welding procedures requiring long stickout and where wire position accuracy is essential. The maximum recommended electrical stickouts are as follows:

Wire Size (mm)	When Using Standard K129 Spring Ingoing Guides (mm)	When Using Optional K281 Straightener (mm)
.045 (1.1)	3/8" (9.5)	5/8" (16.0)
.052 (1.3)	1/2" (12.5)	3/4" (19.0)
1/16 (1.6)	3/4" (19.0)	1-1/4" (32.0)
5/64 (2.0)	1.00" (25.0)	1-3/4" (44.5)
3/32 (2.4)	1-1/4" (32.0)	2.0" (51.0)

A. General Installation

1. For best wire straightening the plane of the straightener rolls should be as close as possible to the same plane as the wire reels.
2. The straightener moving arm should be pointing toward the reels and the adjusting knob should be away from the reels.
3. The wire straightener can be mounted in two positions and the NA-3 or NA-4 head can usually be positioned to meet the requirements.

B. Installation Procedure

1. Remove ingoing spring wire guide.
2. Remove ingoing wire guide tube.
3. Insert the new ingoing wire guide tube (ceramic inserts).
4. Place the wire straightener over the guide, positioned as outlined in "A" above, and tighten the two hex head screws.

C. Reels and Speed Feed Drums

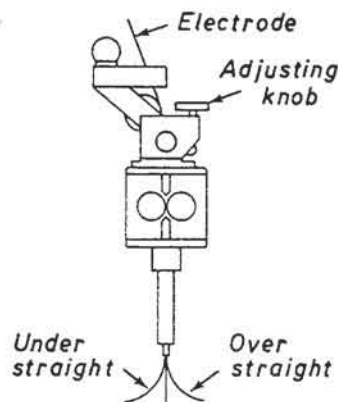
(See Sec. L2.5.7 of IM-278 for detailed instructions on wire feeding from Speed Feed Drums and Reels.)

D. Wire Loading and Straightener Adjustment

1. Turn the straightener knob to the maximum open position.
2. Remove the top ingoing guide block by loosening the thumb screw.
3. Straighten each coil end for a distance of approximately 10" (254 mm) — the straighter the wire the easier to load.
4. Insert one wire in each of the guide block holes.
5. Enter both wires down through and between the rollers, then through the upper wire guide tube until the wires touch the drive roll. Push the inch button and start the wires through the wire feeder.
6. Replace the upper ingoing guide block which is keyed with two roll pins. Make sure that each wire is in its respective groove in each of the rolls. Tighten the thumb screw.



7. Turn the adjusting knob until the moving arm is approximately in the mid position of its total movement.



The tips should be in line with the O.D. of the drive roll for initial straightening adjustment. If the wires are bowing to the right, it is being over-straightened. If the wire is bowing to the left, then the wire is not being straightened enough. Adjust the knob until the wire comes out parallel and uniform. Depending on how the electrode enters the straightener, there may be some side bend to the electrode.

After the wire is coming out the nozzle with satisfactory straightness, the tip orientation can be changed to whatever angle between "in line" or "cross seam" is required. This is accomplished by loosening the hexagon clamping nut and then rotating the tip or tip holder to whatever wire orientation is required.

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NOTE: For overlay work with 1/16 thru 3/32" (1.6 thru 2.4 mm) Lincore® electrodes a special side-by-side tip holder (part S17728) is available that uses standard tips.

K278 SPREADARC™

File as Sec. L2.5.6 for IM-278

File as Sec. T2.5.6 for IM-305

A. GENERAL INFORMATION

The K278 Spreadarc oscillator has been designed for use with the NA-3N, NA-3S, NA-4, NA-5N or NA-5S head and control. The primary application for this accessory piece of equipment is for hardfacing buildup using a Twinarc® nozzle. The "Spreadarc-Twinarc" covers large areas quickly with smooth beads of minimum admixture with the base metal. Flux cored electrode, open arc and submerged arc procedures can be used.

The K278 Spreadarc produces a linear oscillation of the automatic head and nozzle. The advantages of the K278 Spreadarc are as follows:

1. The arc length remains constant during oscillation to give more uniform penetration.
2. There are controls for dwell periods at the end of the stroke to provide smoother bead edges.
3. The travel speed of the arc is uniform across the bead.

The control circuitry of the new Spreadarc uses solid state electronics. The dwell time and oscillation speed controls are calibrated for easy setting. The length of the oscillation travel distance is easily adjustable from four inches to one-quarter inch by repositioning stops which activate sealed, snap action limit switches.

A control box containing the electrical controls is mounted on the side of the unit opposite the head mounting. The operating controls consist of:

1. "On-off" switch.
2. "On" pilot light.
3. Circuit breaker (protects control circuit and motor from short circuit conditions).
4. Oscillation speed. The nameplate dial is calibrated directly in "inches per minute".
5. Front and rear dwell controls. Each has the nameplate dial calibrated directly in seconds.

Specifications:

Input voltage — 115 volts, 50 or 60 hertz.

Input current — 1.0 ampere maximum.

Weight — 62 pounds (28 Kg) (without head).

Maximum allowable additional weight to be mounted on Spreadarc — 70 pounds (32 Kg) (one NA-3, NA-4 or NA-5 head with flux hopper.)

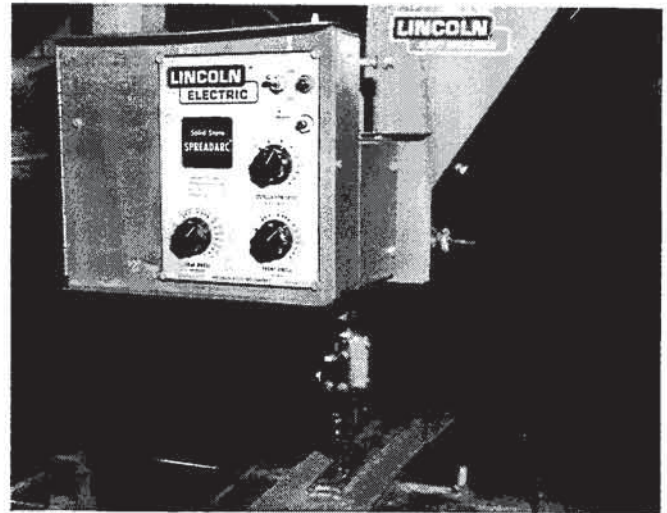
Oscillation track — 0.25 to 4.0 inches (6.4 to 102 mm).

Oscillation speed — 10-120 in./min. (.25-3 m/min)

Dwell at either end of travel — .10 to 2 seconds.

B. INSTALLATION

1. The Spreadarc can be mounted on a K325 travel carriage or on a stationary head mount in which case the work must be moved. When the Twinarc process is used with the wire reels mounted on the carriage, the



- K325HC heavy duty carriage is recommended. In many applications it may be desirable to use the K29 vertical lift adjuster. The Spreadarc *cannot* be used with a K96 horizontal head adjuster or with high frequency starting.
2. Remove the hex nut (A) and the support pin (B) from the Spreadarc mounting block (C). With the draw bolt (D) properly in place, mount the Spreadarc to the head support or vertical lift (E). Maintain support until the support pin (B) is inserted into the mounting block (C), and install hex nut (A) on draw bolt (D). Rotate the Spreadarc until it is perpendicular to the travel carriage beam and tighten hex nut (A). Make certain that travel carriage beam or stationary mounting is properly squared up. The Spreadarc must be level in the horizontal plane within $\pm 2^\circ$ (see Figure 1).

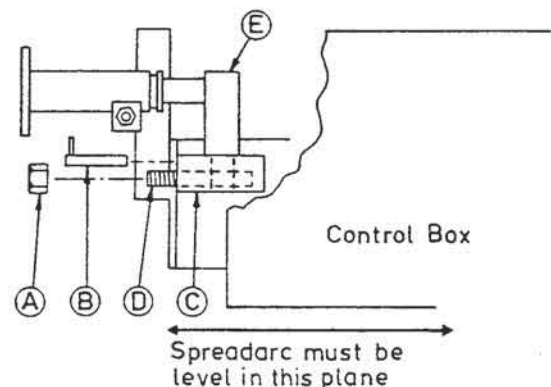


Figure 1

Sec. L2.5.6 and Sec. T2.5.6 (Continued)

3. Remove the head mounting block from the NA-3, NA-4 or NA-5 head by removing the four allen head cap screws. This part is not used. Mount the head to the Spreadarc using the two 1/2-13 x 1 hex head screws, washers and lockwashers supplied with the Spreadarc through the two large holes in the head mounting pad. The drive motor is to be in the vertical position and the drive rolls are to face the front. Loosen the head face plate and rotate the face plate so that the idle roll arm is *down*. Install the nozzle, wire straightener and flux hopper (if used) per the NA-3, NA-4 or NA-5 operating manual (see Figure 2).

Insert the three prong line cord plug into a 115 volt 60 or 50 hertz outlet. The Spreadarc unit is grounded through the line cord, but the head mounting is insulated from the Spreadarc carriage. **Do not allow any conducting element to bridge from the Spreadarc to the head since the head, including the motor and gear box case, is at welding potential.**

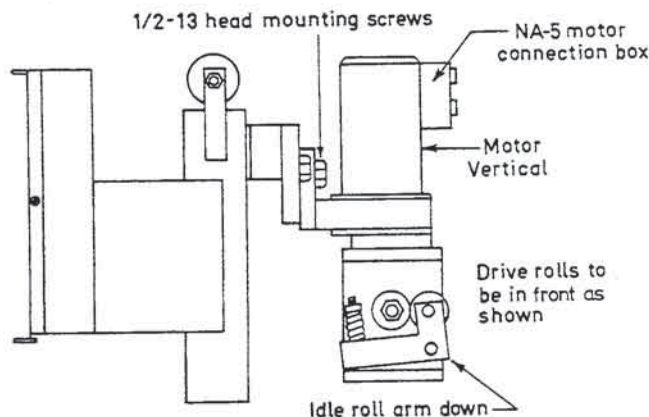


Figure 2

4. The Spreadarc can also be powered by an NA-3, NA-4, or NA-5 unit providing the welding power source supplying #31 and #32 has sufficient auxiliary power capacity. Instructions are as follows:
 - a. Turn off the input power to the NA-3, NA-4 or NA-5 control box.
 - b. Remove the three prong plug from the Spreadarc power cord and remove the rubber jacket 10 inches (254 mm) from the end of the cord.
 - c. Install a terminal for a #10 screw on the green lead and terminals for #6 screws on the white and black leads.
 - d. Install the power cord through the access hole in the left side of the control box using a strain relief cable clamp.

- e. Remove the nut from the grounding stud located on the same side as the access hole. Install the terminal of the green lead on the grounding stud, keeping the other terminals in place. Replace and securely tighten the nut on the grounding stud.
- f. Install the white lead on terminal 32 on the terminal strip.
- g. Install the black lead on terminal 31 on the terminal strip.

C. OPERATION

1. Set the oscillation speed control and the rear and front dwell controls as called for in the welding procedure. The front dwell control controls the dwell when the nozzle is farthest from the Spreadarc mounting bracket. Turn the power switch on. After the dwell period and oscillation starts, adjust the oscillation travel distance by rotating either or both of the limit switch stops as required to give proper front and rear electrode position. After the desired oscillation track is obtained, lock the stops in place by tightening the hex nuts against the stops.
2. If there is a major change in the control setting, the oscillation track will change, requiring readjustment of the limit switch stops.

D. MAINTENANCE

Before doing any of the following maintenance work, remove the line cord plug from its receptacle or turn the input power off at the power source if powered by an NA-3, NA-4 or NA-5. Remove the head from the Spreadarc for Steps 2,3 and 4.

1. *Limit switches* — Twice a year, check the limit switch plungers by rotating them. They should turn freely. If they are "stiff", pull back the rubber boot and clean the plunger with a cleaning solvent. Apply a dry lubricant such as moly or graphite and put the rubber boot back in place.
2. *"V" tracks and bearings* — Clean, inspect and re-lubricate twice a year (more often under severe duty applications) as follows (see Figure 3):
Remove the four screws (1) holding the limit switch bracket (2) to the top cover (3). Remove the four screws (4) holding the top and bottom track covers (5) in place and remove track covers. Clean the four "V" groove bearings (6) and the top and bottom "V" tracks (7) and inspect for wear.

Providing the tracks are not severely worn, re-lubricate the contact surface of the bearings and tracks with a graphite or moly filled grease, such as automotive chassis grease, and reassemble.

If the wear on the inside edge of the top track has reached .040 (1.0 mm) either interchange the top and bottom tracks if the bottom track is not severely worn, or replace both tracks. To remove the tracks, loosen the 1/2-13 hex head screws (8) which hold the bottom "V" bearings in place by rotating the screws (8) and holding the eccentric nuts (9) from turning. Rotate the eccentric nuts (9) to give maximum clearance of the bearings to the track. Remove the four screws (10) and (14) holding the

Sec. L2.5.6 and T2.5.6 (Continued)

control box (15) in place. Maintain support on the control box to prevent straining the leads from the motor.

While supporting the moving carriage, remove the eight hex head screws (17) holding the top and bottom tracks in place and remove the tracks by sliding them off the track support (18). Allow the top "V" bearing to rest on the track support. Do *not* loosen the screws holding the motor in place because it has been factory set to give the proper clearance between the rack and pinion. Inspect the four "V" bearings to see that they rotate freely and are not excessively worn.

Install the new tracks, or switched tracks, on the track support making certain that they are seated on the edges of the track support. Re-assemble all parts except for the top and bottom track shields and limit switch bracket.

To adjust the eccentrics on the bottom "V" bearings, tighten the 1/2-13 screws until snug. Rotate eccentric nuts to bring bottom bearings snug against the track. Hold eccentric nuts from turning and tighten 1/2-13 screws. Check for proper pressure by turning outer race of bottom bearings by hand. They must slip but there must be no vertical play in the carriage assembly. Readjust eccentrics if necessary. Lubricate tracks and bearings and install top and bottom track shields and limit switch bracket.

3. **Motor brushes** — With normal service, these brushes should last for many years. Check brushes every two years or whenever the unit is disassembled for changing tracks. Replace the brushes before the length is reduced to less than .25 inch (6.4 mm).
4. **Motor gear reducer** — When the motor brushes are checked, also inspect the grease in the gear box. If it appears hardened or dirty, it should be changed as follows:
Disassemble the unit as described in Step #2. Do *not* loosen the motor mounting screws for the reason stated in Step #2. Remove the four screws holding the gear case to the motor frame at the large flange. Remove the gear case from the motor. Remove as much as possible of the old grease from the gear case. Do not wash in solvent. Repack with Plastilube #2, Warren Refining Company, Cleveland, Ohio, or an equivalent grease, and reassemble.
5. **Control box** — Every six months inspect the control box. If needed, blow dirt out using low pressure air. Replace screw holding cover in place.

E. TROUBLESHOOTING

1. **Circuit Protection** — The 0.8 amp circuit breaker mounted on the control box door protects the control circuit and motor from short circuit conditions. It also protects from severe overload conditions such as an obstacle restricting carriage movement. If it opens, determine and correct the cause of the overload. To reset the circuit breaker, push the red button.

2. **Printed Circuit Board** — The P.C. board has light emitting diodes mounted at various locations to aid in troubleshooting a problem. The lights and their "on" functions are as follows:
A — indicates front limit switch LS1 is activated.
B — indicates rear limit switch LS2 is activated.
C — indicates positive field voltage.
D — indicates negative field voltage.
E — indicates voltage to motor armature.
(will be dim when speed control is set at minimum).
3. **Voltage Measurements** — All voltages are $\pm 10\%$.
a. 31 — 32 terminal strip — 115 volts AC.
b. 32 — 731A terminal strip — 115 volts AC (0 if motor thermostat or circuit is open).
c. 726 — 727 terminal strip — 105 to 120 volts DC (polarity depending on travel direction).
d. 739 — 741 terminal strip — 90 to 100 volts DC, oscillation speed at maximum; 12 to 25 volts DC, oscillation speed at minimum.
e. 701 — 702 terminal strip — 13 to 15 volts DC — limit switches not activated.
f. 701 — 703 terminal strip — 13 to 15 volts DC — limit switches not activated.

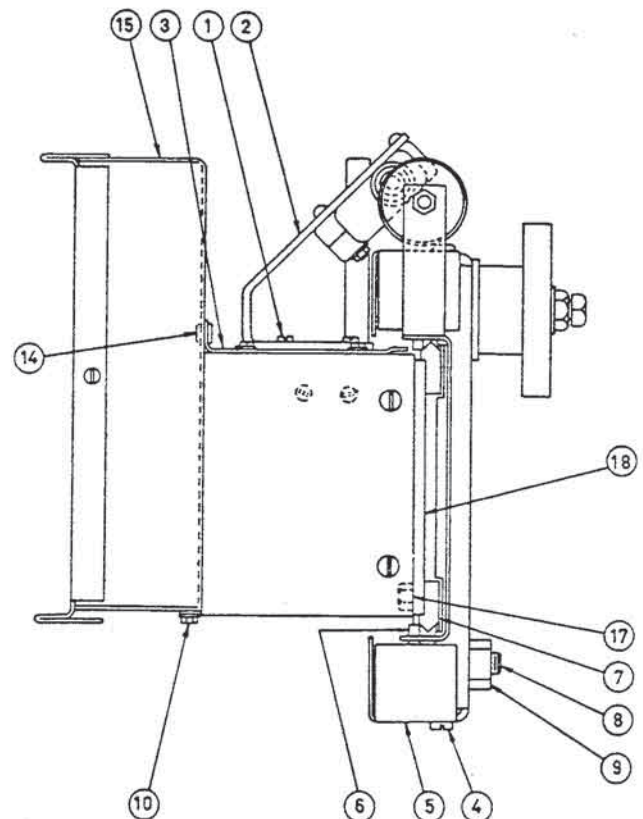


Figure 3

Sec. L2.5.6 and Sec. T2.5.6 (Continued)

4. *Resistance Measurements*

- a. 726 — 727 terminal strip — Motor field, should be 1200 to 1500 ohms.
- b. 739 — 741 terminal strip — Motor armature, should be 120 to 160 ohms.

November 1990

Sec. L2.5.7

K386 NARROW GAP, DEEP GROOVE NOZZLE

The 750 amp water-cooled automatic nozzle is designed for narrow gap, deep groove, submerged arc welding procedures using a single 3/32" (2.4 mm) diameter LC-72 or 3/32" (2.4 mm) solid electrode fed by a standard NA-4 head. IM-335 describes its installation and operation.

November 1990

Sec. L2.5.8

K391 HIGH CAPACITY SUBMERGED ARC NOZZLE

The K391 Submerged Arc Nozzle is an extremely rugged assembly designed to meet the high amperage, duty cycle, and heat input requirements of heavy automatic submerged arc welding. This nozzle is intended for use with the Lincoln NA-3, NA-4 & NA-5 Automatic Wire Drives configured for single or multiple arc applications, such as with the K387 Tandem Arc Fixture.

The K391 nozzle is rated for welding with 1/8 — 7/32" (3.2 — 5.6 mm) diameter solid wire electrode for heavy duty submerged arc applications. Included is a contact tip for the wire size specified and a flux tube hanger (see Figure 1).

The K391 nozzle may also be used with the optional K285 concentric flux cone for complete flux coverage deposited concentrically about the electrode (see Figure 2).

November 1990



Figure 1

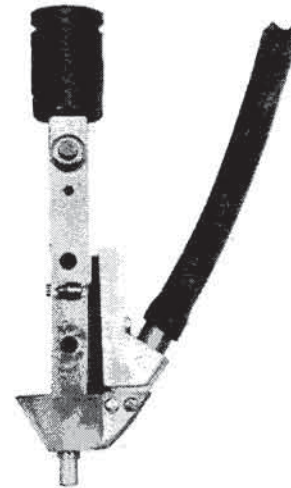


Figure 2 — Shown with optional K285 concentric flux cone attached

Sec. L2.5.9

K405 AUTOMATIC INNERSHIELD NOZZLE

The K405 Automatic Innershield Nozzle offers a more slender and lower cost alternative to the K148 Positive Contact Nozzle, for use with NA-3 or NA-5 Automatic Heads⁽¹⁾, and features "quick-change" threadless contact tips.


K405 Nozzle Assemblies are available for welding with .062" (1.6 mm) through .120" (3.0 mm) diameter Innershield sizes, and are rated for procedures up to 600 amps, 80% duty cycle, using up to 1.25" (3.2 mm) electrical stickout.

For additional information on the K405, consult IM-344.

⁽¹⁾ K405-3/32 must be used with a head equipped with drive roll and guide tubes for 1/16 — 3/32 (1.6 — 2.4 mm) electrodes [not 3/32 — 7/32 (2.4 — 5.6 mm)].

November 1990

SPEED-FEED® DRUMS

<p>WARNING</p> 	<p>FALLING EQUIPMENT can cause injury</p>	<ul style="list-style-type: none"> • Use equipment rated to lift weight of this drum. • if possible, lift from bottom. • For top lifting: <ul style="list-style-type: none"> – Lift only when cover locked in place. – Lifting device contact with underside of closing ring must be at least 38 inches. • Never stand under a lifted load.
---	--	--

Sec. L2.5.10-A

General Installation

The drum must be set on a turntable which permits it to turn freely, allowing the wire to be paid off without tangling. Turntables can be purchased from a manufacturer or made by the user. (See Figure 1) A turntable consists of a stationary plate on the floor (1), a rotating plate (turntable) (2) centered on a large bearing (3), and a post (4) and arm(s) (5) for the eyelet(s) (6). At least one low friction insulated eyelet is required to guide the electrode. This is to help guide the wire out of the drum and prevent tangles or accidental grounding, which can cause personal harm and/or damage to the equipment (See Figure 1 below for labeled illustration.)

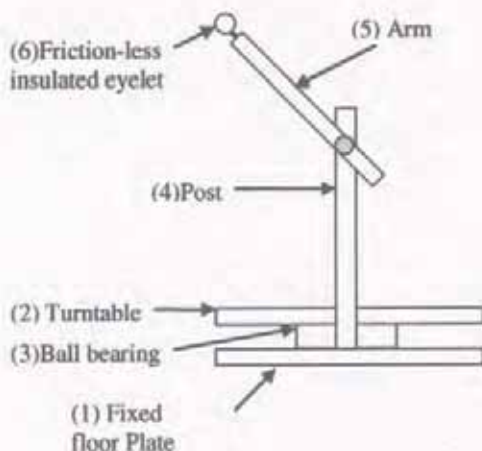


Figure 1

Hats which fit inside the drum core are necessary to prevent the electrode from flipping over the top of the drum core and becoming tangled.

Please visit the "Steel Hat Construction" document at <http://www.lincolnelectric.com/knowledge/articles/content/steelhatconstruction.asp> for specifications on how to construct permanent steel hats. Reusable fiber hats are available from the Lincoln Electric Company. (The Lincoln Electric product number for the reusable fiber hats is ED020219).

Drum Dimensions

1. Dimensions of SPEED FEED DRUMS

300 lb Drum	Dimensions
Outside Diameter (in)	23 3/8 ± 1/16 (56.8 cm ± 0.16 cm)
Height (in) (without cover)	17 3/4 +1/8 -1/4 (45.1 cm + 0.32cm -0.64 cm)

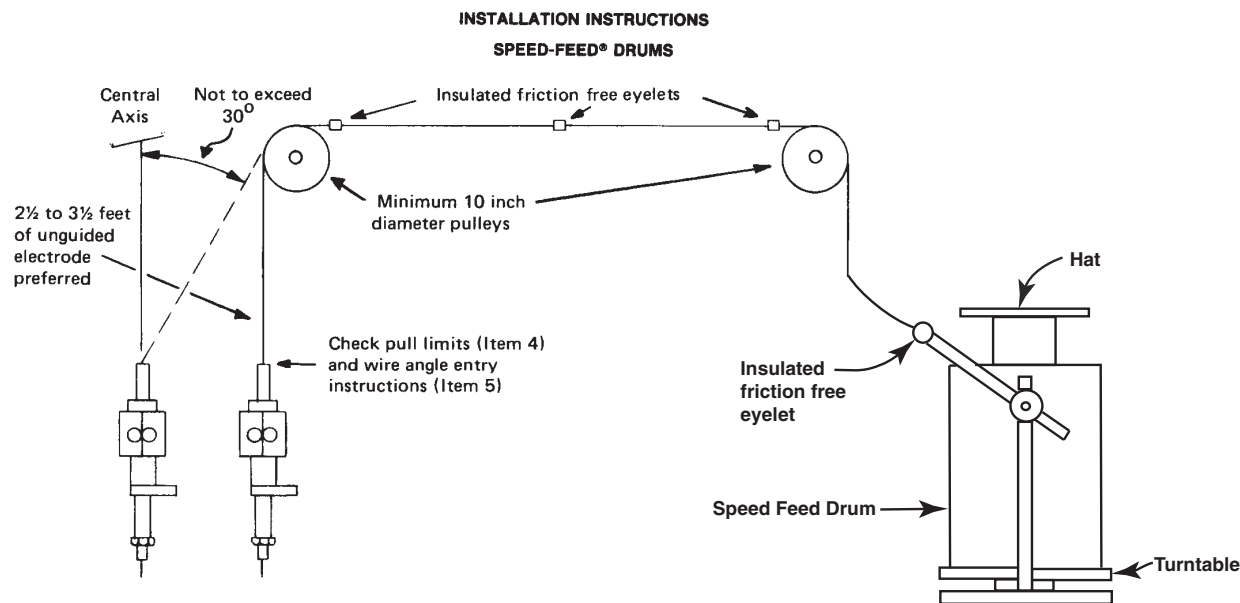
600 lb & 1000 lb Drum	Dimensions
Outside Diameter (in)	23 3/8 ± 1/16 (56.8 cm ± 0.16 cm)
Height (in) (without cover)	34 3/4 +1/8 -1/4 (88.3 cm + 0.32 cm -0.64cm)

2. Dimensions of Drum CORE

300 lb Drum	Dimensions
Inside Diameter (in)	16.0 ± 1/2 (40.6 cm ± 1.3 cm)
Inside height of core (in)	17 1/16 +1/8 -1/4 (43.3 cm + 0.32 cm -0.64 cm)

600 lb & 1000 lb Drum	Dimensions
Inside Diameter (in)	16.0 ± 1/2 (40.6 cm ± 1.3 cm)
Inside height of core (in)	34 3/8 +1/8 -3/8 (87.3 cm + 0.32 cm -0.95 cm)

Sec. L2.5.10-A (Continued)



Drum Setup

***ALWAYS** use caution, proper equipment and appropriate procedures when moving the drums. Improper handling may cause personal injury and/or damage to the product. For more information on safe drum handling please visit:

<http://www.lincolnelectric.com/knowledge/articles/content/drumhandling.asp>

Drum Hat Installation

1. Before removing the lid, set the drum on an appropriate dereeler. Remove the drum lid used for shipping but DO NOT remove the center cardboard core. (Figure 2).



Figure 2

2. Place the drum hat on the drum core (Figure 3).



Figure 3

3. Load the wire from the drum past the hat (Figure 4) and into the low friction insulated eyelet(s) (Figure 5). The eyelet(s) must be between a 20 and 40 degree angle with respect to the vertical axis of the drum.



Figure 4



Figure 5

From this point load the wire according to the process which you are using. Appropriate wire conduit or insulated guides should be used to prevent wire from making contact with objects at welding ground potential.

Installation of automatic Drum Brakes

High electrode feed speeds (generally >300 inches per minute) may require the use of a turntable with an automatic brake to stop the drum rotation from overrun at the end of the weld. For more information on drum brakes and for instructions on how to install the brake into the turntable visit:

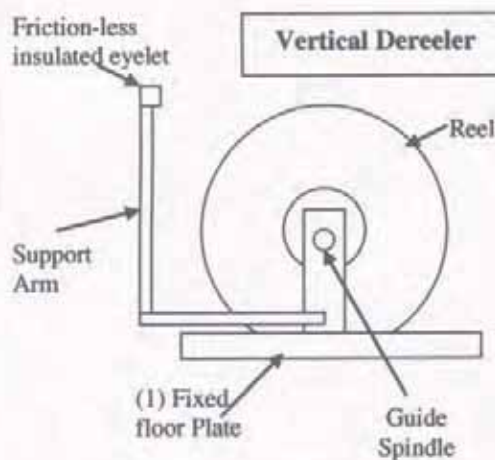
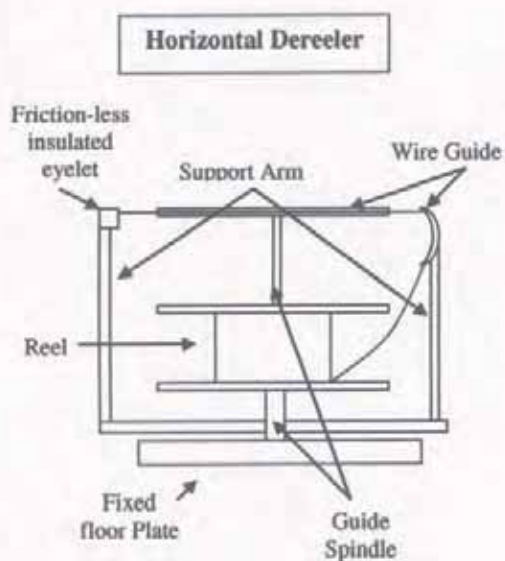
<http://www.lincolnelectric.com/knowledge/articles/content/speedfeeddrums.asp>

SPEED-FEED® REELS

Sec. L2.5.10-B

General Installation

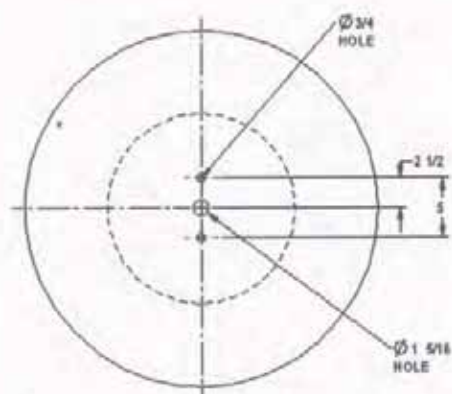
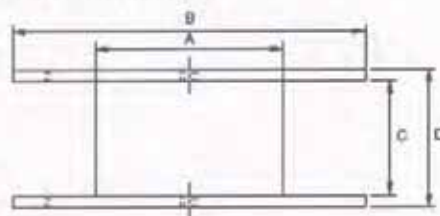
The Reels require dereeling equipment that permits them to rotate freely as the electrode is used. Dereelers can hold the reels in vertical or horizontal position, depending on the application. The dereeler needs to include at least one low friction insulated eyelet.



Reel Setup

***ALWAYS** use caution, proper equipment and, appropriate procedures when moving the reels. Improper handling can cause personal injury and/or damage to the product. *

Reel Dimensions



(lbs. Wire)	A (in.)	B (in.)	C (in.)	D (in.)
Solid Wire				
300	12	23 3/4	6	7 1/4
600&750	16	30	9 5/8	11 5/8
1000	12	30	9 5/8	9 5/8
Cored Wire				
300	15	23 3/4	9 1/4	10 1/4
600&750	16	30	9 5/8	9 5/8

Solid Wire

(lbs. Wire)	A (in.)	B (in.)	C (in.)	D (in.)
300	12	23 3/4	6	7 1/4
600&750	16	30	9 5/8	11 5/8
1000	12	30	9 5/8	9 5/8

Cored Wire

(lbs. Wire)	A (in.)	B (in.)	C (in.)	D (in.)
300	15	23 3/4	9 1/4	10 1/4
600&750	16	30	9 5/8	9 5/8

*A spacer may be needed on the dereeler shaft for smaller reels to prevent instability.

INSTALLATION INSTRUCTIONS SPEED-FEED® REELS

Installation of Automatic Reel Brakes

The high electrode feed speeds (generally >300 inches per minute) may require the use of a turntable with an automatic brake to stop the reel rotation from overrun at the end of the weld. For more information on brakes and for instructions on how to install them visit the Lincoln Electric website at

<http://www.lincolnelectric.com/knowledge/articles/content/speedfeeddrum.asp> and view the Speed Feed document.

Wire Feeding

The position of the reel with respect to the wire feeder will vary from job to job. Proper placement of the wire is important to minimize the complications during wire feeding.

Improper Installation

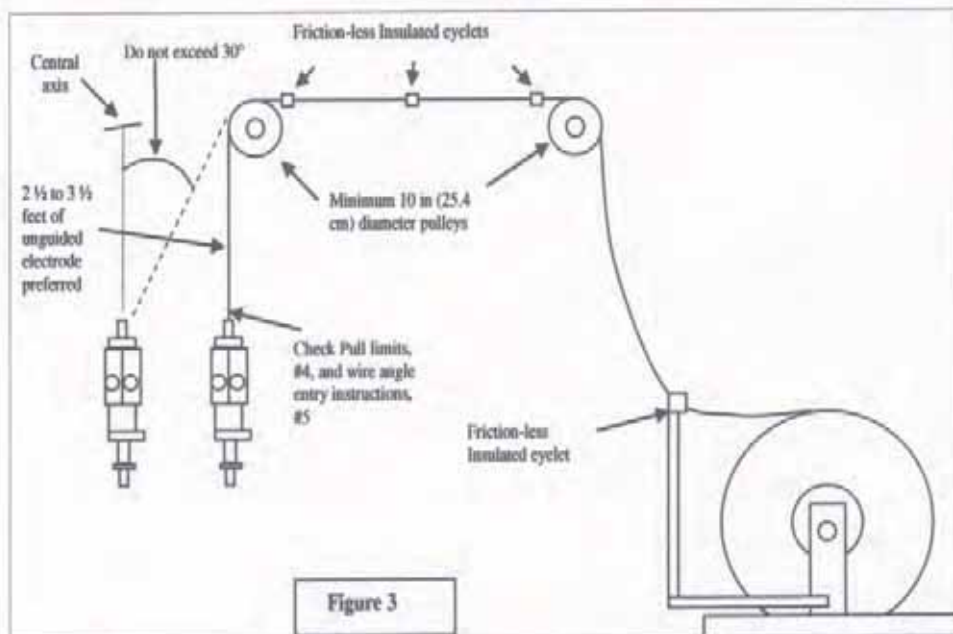
A. Improper installation can:

1. Pull kinks into the wire feeder which can not be straightened.
2. Cause milling of the electrode resulting in clogged guide tubes and liners.
3. Overload the wire feed drive motor.

Precautions

B. To prevent installation complications observe the following precautions: (See Figure 3)

1. Pull the electrode as short a distance as possible.
2. Guide the electrode through friction free insulated eyelets which are properly spaced. Do not pull the wire through small diameter tubes.
3. Minimize sharp bends in the electrode. When a change in direction is required use free-wheeling idler rolls of at least 10 inches (25.4 centimeters) in diameter.
4. Position the eyelets and idler rolls so there is as little loading on the feed motor as possible. Ideally the total force at the head to move the electrode (or electrodes in Twinarc welding) should not exceed 20 pounds (89 newtons).
5. Be certain the electrode enters the straightener or ingoing guide at an angle no greater than 30° from its central axis.
6. Load Speed-Feed reels on the turntables so they are centered and balanced.
7. Do not over tighten the electrode in the drive rolls.



SEC. L2.7 — OPTIONAL FEATURES INSTALLATION

Sec. L2.7.1

Contact Assemblies

The various Innershield and submerged arc contact assemblies available for single electrode (and tandem arc) welding are described in current Lincoln specification literature. See Sec. L2.2.6 and L2.2.7 for installation, operating and maintenance instructions.

June 1974

Sec. L2.7.2

Twinarc® Installations

In Twinarc welding, two electrodes are fed through one head for generally faster welding. The various Innershield and submerged arc kits — containing a contact assembly, wire straightener or spring guide, drive roll parts and second wire reel and reel mounting — are described in current Lincoln specification literature. Installation, operating and maintenance instructions are shipped with each kit or can be ordered as "Sec. L2.5.3 (K-appropriate)."

June 1974

Sec. L2.7.3

K218 Horizontal Fillet/Lap Attachment

This special contact assembly automatically guides the electrode when making submerged arc horizontal fillet and lap welds for accurate bead placement without expensive fixturing and clamps. Installation, operating and maintenance instructions are shipped with each kit and can be ordered as "Sec. L2.2.9."

June 1974

Sec. L2.7.4

K29 Vertical Lift Adjuster

When mounted in the NA-3N, NA-3S or NA-4 head mounting system, it provides quick hand crank adjustment of the vertical head position as shown in the drawing to the right, and some horizontal adjustability as described in Sec. L3.2.3. Installation instructions are shipped with each kit and can be ordered as "Sec. L2.2.11."

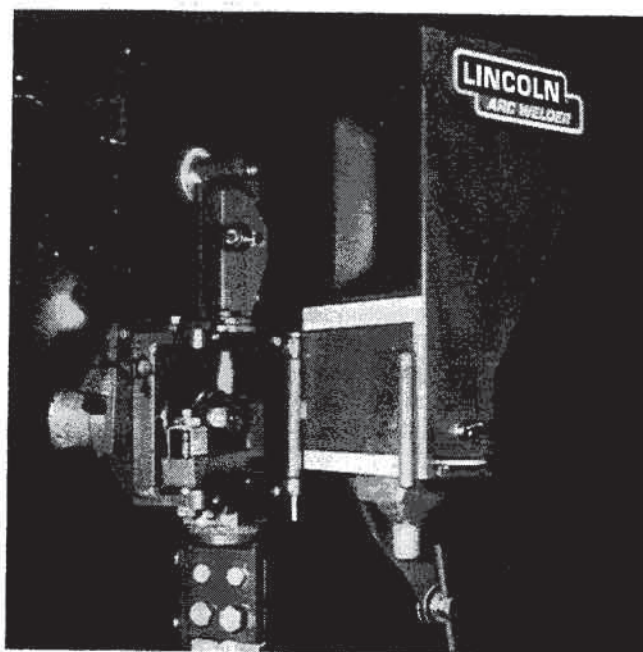
June 1974

Sec. L2.7.5

K96 Horizontal Adjuster

When installed in the head mounting system, it provides quick hand crank adjustment of the horizontal head position as in the drawing to the right. Installation instructions are shipped with each kit and can be ordered as "Sec. L2.2.12."

June 1974



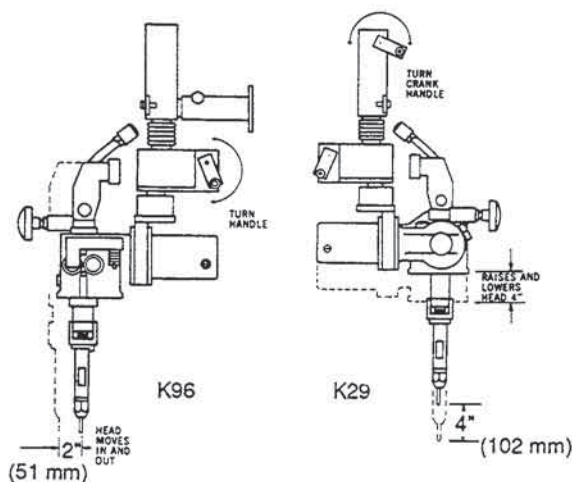
Sec. L2.7.7

K219 Flux Hopper Kit

The flux hopper can be mounted on an NA-3N and NA-3NF heads for submerged arc welding. Installation instructions are shipped with each kit. Follow the operating and maintenance instructions for the NA-3S flux hopper throughout this manual.

The flux hopper assembly should not be mounted on heads using high frequency starting. Mount to a separate part of the fixture. The standard mounting insulation is not sufficient to protect the electrical circuit of the solenoid from the high frequency. This only applies to the K219 kit. The NA-3S HF flux hopper does have the necessary extra insulation for mounting onto the head face plate.

June 1974



Sec. L2.7.8 **K223 Solenoid Kit**

The solenoid includes a valve for control of the water flow when using the cooling attachment on the K148 or K239 contact nozzle assembly. It opens when the "Start" button is pressed and can be wired to close either when the "Stop" button is pressed or the arc goes out. Installation instructions are shipped with each kit.

August 1975

Sec. L2.7.9 **K221 Start Controls PC Board**

When installed on the inner panel of the control box, this circuit adjusts starting current and voltage^{o)} for an adjustable period of time as needed to control penetration, bead size or other factors at the start. Must be used when using the K237 Linc-Fill starting relay. Installation instructions are shipped with each kit.

June 1974

Sec. L2.7.10 **K245 Crater Controls PC Board**

When installed on the inner panel of the control box, this circuit adjusts ending current and voltage^{o)} for an adjustable period of time as needed to control bead size or fill craters at the end. Installation instructions are shipped with each kit.

August 1975

Sec. L2.7.11 **K237 Linc-Fill™ Starting Relay**

This relay improves starting characteristics when using the K149 or K104 Linc-Fill long stickout nozzle extension assembly as described in Sec. L3.3.4-D. It can be mounted either on the standard travel carriage or in a convenient location near the head in accordance with instructions shipped with each kit. Requires installation of the optional K221 "Start Controls" P.C. Board.

January 1978

Sec. L2.7.12 (Discontinued) **K224 Solid State Remote Field Control**

Required for proper control of the output when using an SAN, SA or SAF motor-generator type power source. Mounting instructions are shipped with each kit. Electrical connections are included in Sec. L2.3.4.

June 1974

Sec. L2.7.13 **K238 High Frequency Unit**

When required for difficult starting applications the High Frequency Unit can be connected to new heads equipped with the required factory installed insulation. Installation instructions are included in Sec. L2.3.3.

June 1974

^{o)} With NA-4 and AC-1000 combination, controls voltage only.

Sec. L2.7.14 **K263 DC Electronic Voltmeter**

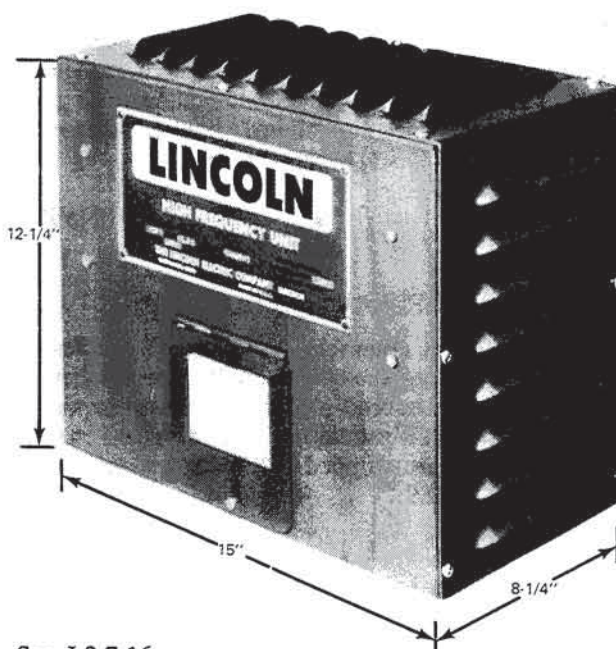
Replaces the standard analog type voltmeter shipped with the NA-3 when precise monitoring of voltage is required. Includes red lights to show high or low voltage and a green light to show when the arc voltage matches the desired voltage pre-set on the dial. Installation instructions are shipped with the kit.

August 1975

Sec. L2.7.15 **K299 Wire Reel Assembly**

For the NA-3 and NA-4. Includes wire reel for 50-60 pound (22.7-27.2 Kg) coils, wire reel mounting and brake. Mounting instructions included with kit. K299-HF same as above but with high frequency mounting insulation.

November 1990



Sec. L2.7.16 **K310 Flux Screen**

For any submerged arc equipment. Removes large particles from reused submerged arc welding flux. Includes air driven vibrator. Operating instructions included with kit.

September 1987

Sec. L2.7.17 **K58 Magnetic Separator**

For any submerged arc equipment. Removes foreign magnetic particles from reused submerged arc welding flux. Operating instructions included with kit.

September 1987

Sec. L2.7.18 **Wire Size Conversion Kits Gun Cable Adapters**



Contact your local Lincoln district office for additional information on available sizes or adaptability.

September 1987

SEC. L3.2 — ROUTINE EQUIPMENT OPERATION

Sec. L3.2.1

OPERATOR'S INSTRUCTIONS

 WARNING	
	<ul style="list-style-type: none">• The head, electrode and wire reel are electrically "hot" during the entire welding cycle (including hot start and contactor delay time). Do not touch or allow these parts to touch other equipment when welding.
ELECTRIC SHOCK can kill.	

Once properly setup (per Sec. L3.3.1 thru L3.3.6), the operator can make production welds *without readjusting controls* using the following simple instructions.

1. Be sure there is enough electrode in the machine to complete the weld.
2. If submerged arc welding, fill the flux hopper with new or freshly screened flux. All reused flux must be screened 100% through an 8 mesh screen [a .065-.075 (1.6 to 1.9 mm) opening]. Turn the switch on the hopper to "On".
3. Start the power source.
4. Turn the "Power Control" switch on the wire feeder control to "On".
5. Position the welding head at the start of the weld. Be sure the travel carriage or other travel mechanism is set to move in the proper direction.
6. Set the travel switch to "Automatic Travel." When set to "Hand Travel" the travel system operates without welding.
7. For best starts, cut the electrode to a sharp point.

8. Press the "Inch Down" button to feed the electrode out of the nozzle:
 - a. For most applications, when using "hot starting," leave the electrode 1/4" (6.4 mm) or more away from the work.
 - b. When using "cold starting" for some submerged arc welding, inch the electrode down until it touches the work and the flux valve opens.
9. Press the "Start" button.
10. While welding turn the cross seam adjuster hand wheel as needed to keep the arc in the joint.
11. At the end of the weld, press the "Stop" button.
12. If needed, press the "Inch Up" button to get the electrode up out of the way. Remove the work and reload the fixture.

NOTE: When the contact tip in the end of the nozzle wears during repetitive welding, it must be replaced. Check the contact tip for wear if weld quality seems to be deteriorating.

Sec. L3.2.2

Loading the 50-60 Pound (22.7-27.2 Kg) Reel

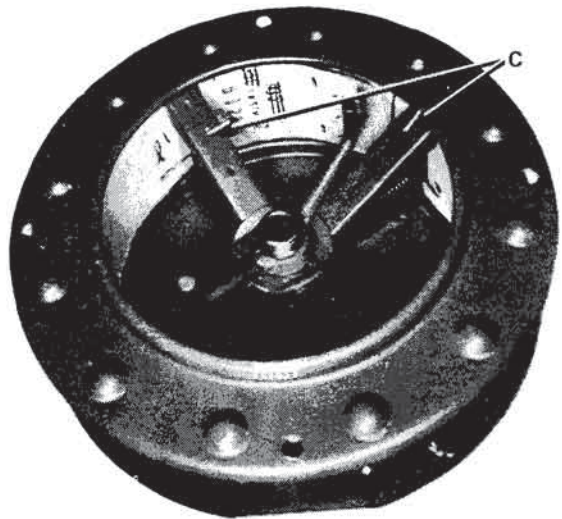
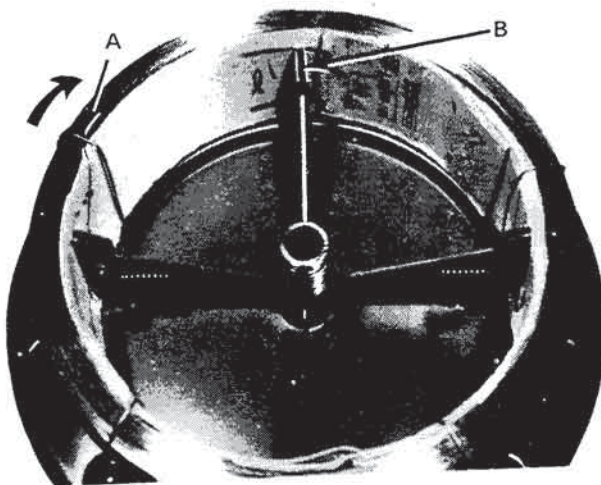
1. To remove the wire reel from its shaft, grasp the spring loaded knob and pull it out. This straightens the knob so it seats into the shaft when released.
2. Lay the reel on the floor and remove the cover plate.
3. Place a coil of wire on the reel so it unwinds properly as the reel rotates:
 - a. Be sure the coil is placed so the spring loaded arms will not interfere with the later removal of the coil tie wires.
 - b. When loading .030, .035 and .045" (0.8, .09, 1.1 mm) L-50 wire, be certain the coil is placed on the reel so the spring loaded arms are at the center of the slots in the cardboard coil liner. This provides the positive compression of the coil needed for trouble free wire feeding.
 - c. Put the cover plate on the reel so the four arms of the cover straddle the spring loaded arms of the reel proper.
4. Tighten the cover as much as possible by hand. Do NOT hammer on the spinner nut arms.
5. Cut and remove the tie wire holding the free end of the coil. Insert the free end into one of the holes in the cover and secure it by bending it back. Cut and remove the remaining tie wires.

NOTE: Always be sure the free end of the coil is securely held while the tie wires are being cut and until the wire is feeding through the drive rolls. Failure to do this will result in "back lashing" of the coil, which may tangle the wire. A tangled coil will not feed so it must either be untangled or discarded.

6. Replace the reel on the wire feeder. Grasp the shaft knob, pull it out and swing it across the reel hub.
7. Turn the reel until the free end of the electrode is accessible. While tightly holding the electrode, cut off the bent end. **Straighten the first six inches (152 mm)** and insert it through the wire straightener (or small wire spring guides) to the drive rolls. Press the "Inch Down" button until the rolls pick up the wire and feed it through the nozzle.

NOTE: When using the flux-cored electrode wire straightener, remove the bushing from the top of the straightener. Then insert end of the electrode through the bushing and down through the straightener. When the drive rolls start feeding wire, stop and reinstall the bushing.

November 1990



ROUTINE EQUIPMENT OPERATION — CONT'D

Sec. L3.2.3

Head Position Adjustments

The NA-3N, NA-3S and NA-4 heads can be easily adjusted to any welding position. These adjustments are illustrated below. The most frequently used adjustments, Fig. L3.2.3-1 and Fig. L3.2.3-2, are also available on the NA-3NF and NA-3SF. The other NA-3NF or 3SF adjustments depend upon the fixture design.

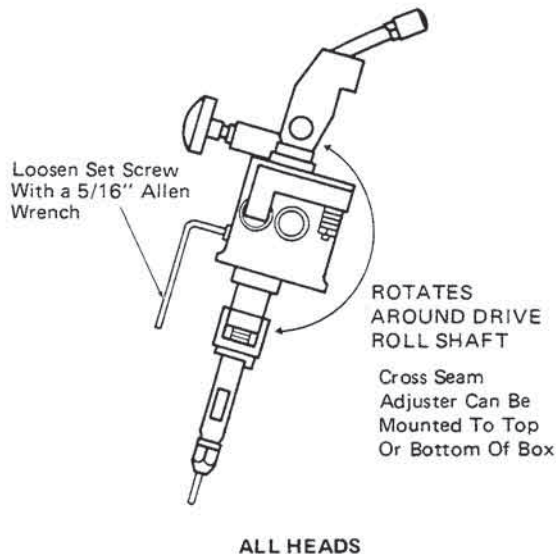


Fig. L3.2.3-1

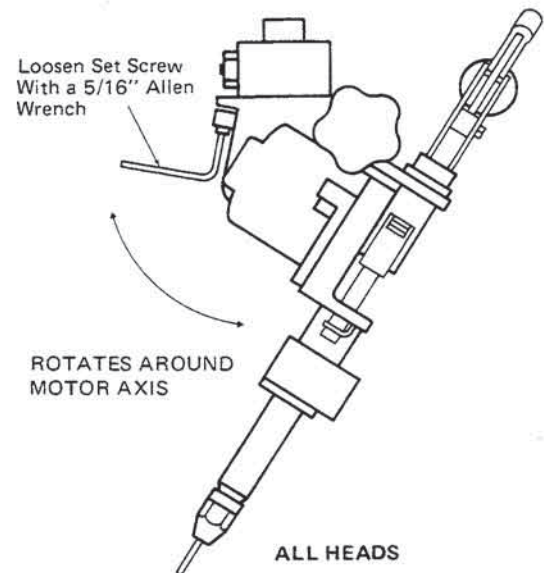
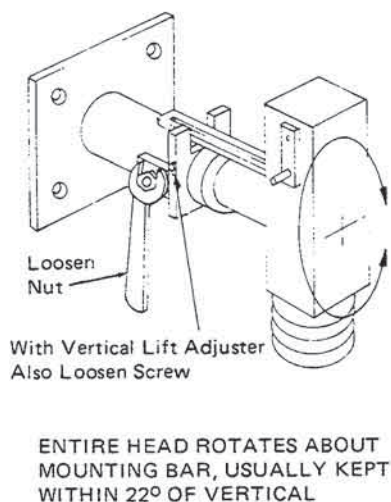


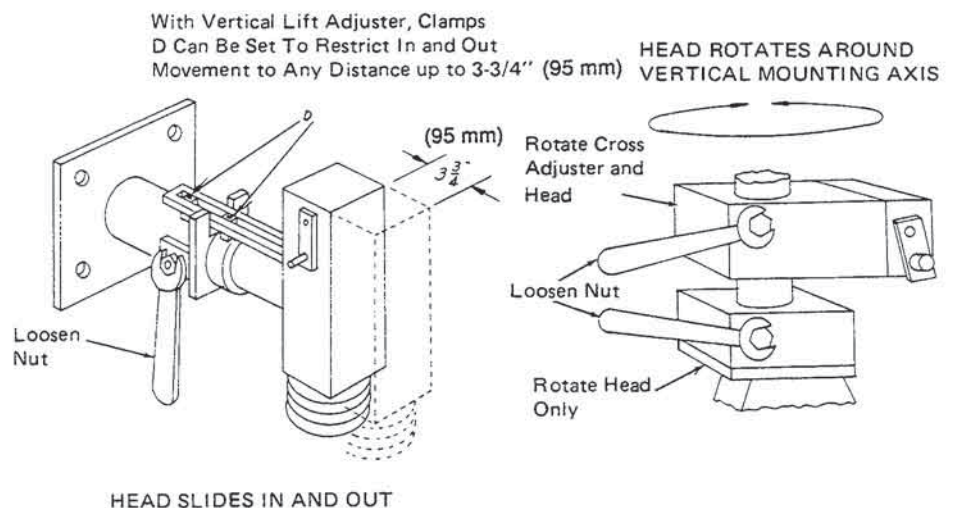
Fig. L3.2.3-2

NOTE: If the head is positioned so the wire feed roll box is placed upside down, the wire straightener and nozzle positions must be interchanged. Then, to feed the electrode down through the nozzle, the wire feed motor direction of rotation must be reversed. To do this interchange leads #626 and #627 from the feed motor plug at the terminal strip inside the control box.



WITH STANDARD HEAD MOUNTING
OR VERTICAL LIFT ADJUSTER

Fig. L3.2.3-3



WITH STANDARD HEAD MOUNTING
OR VERTICAL LIFT ADJUSTER

Fig. L3.2.3-4

WITH STANDARD HEAD MOUNTING
OR HORIZONTAL HEAD ADJUSTER

Fig. L3.2.3-5

Sec. L3.2.3 (Continued)

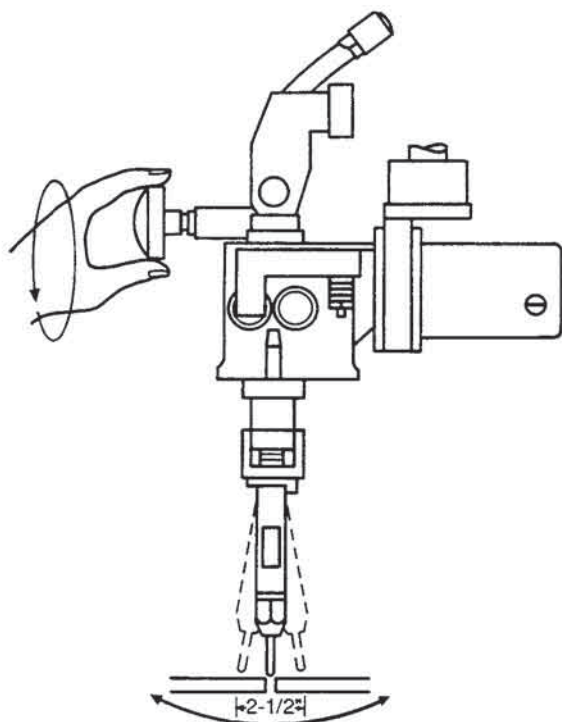
**CROSS SEAM ADJUSTER**

Fig. L3.2.3-9

Operation of the hand screw of the cross adjustment assembly on the NA-3N, NA-3S and NA-4 permits a 2-1/2 inch (64 mm) cross seam adjustment. This adjustment can be done while welding.

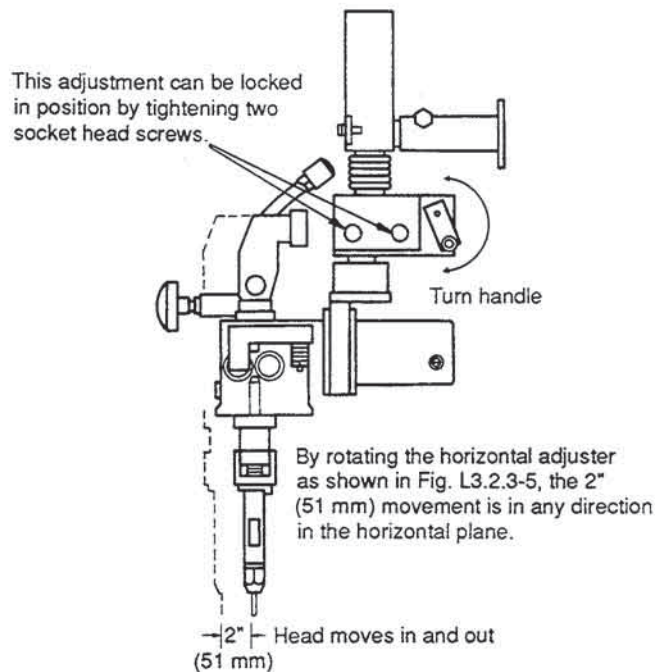
**HORIZONTAL HEAD ADJUSTER**

Fig. L3.2.6-7

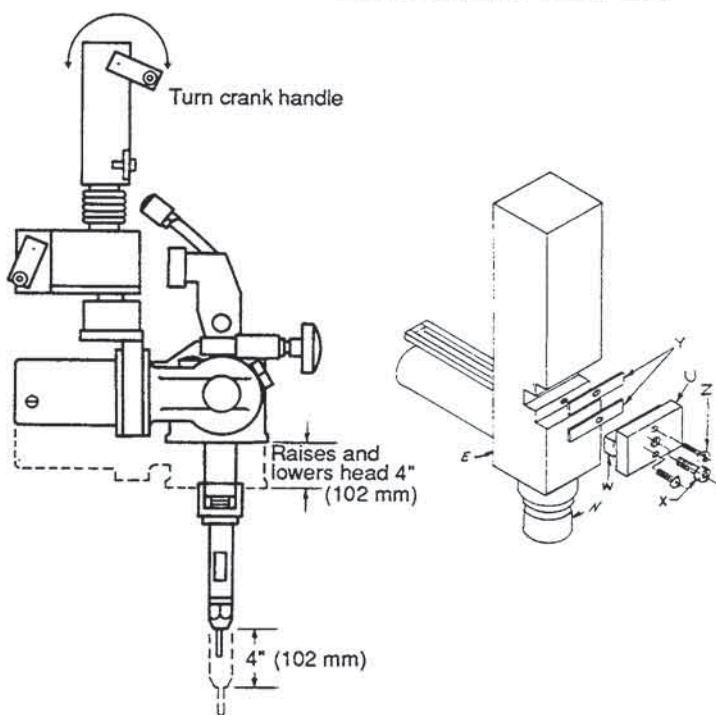
**VERTICAL HEAD LIFT ADJUSTER ONLY**

Fig. L3.2.3-6

This adjustment can be used during setup or while welding. To control the rotational movement of (N) as it moves up and down, the key is made in two parts (U) and (W). These parts are spaced by the shims (Y) to allow vertical movement of (N) with the minimum amount of rotational movement when screws (Z) are tight and socket head screw (X) is loose. To lock (N) so there is no movement, tighten socket head screw (X).

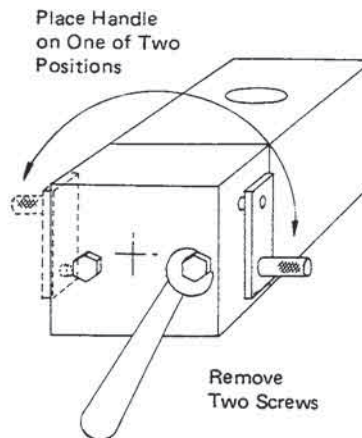
**HORIZONTAL HEAD ADJUSTER ONLY**

Fig. L3.2.3-8

ROUTINE EQUIPMENT OPERATION — CONT'D

Sec. L3.2.4

Controls and Their Functions

A. NA-3N AND NA-3NF

(Also NA-3S and NA-3SF when connected to a Constant Voltage power source.)

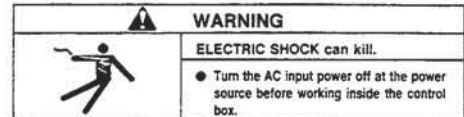
AMMETER — Indicates current only while welding.

CIRCUIT BREAKER — Protects the circuit from severe wire feed motor overloads and short circuits. Press to reset. Locate and correct the cause for overloading.

VOLTMETER (Standard) — Indicates welding voltage only while welding. Also indicates OCV below 60 volts.

ELECTRONIC VOLTMETER (Optional) — Replaces the standard meter when precise monitoring of the arc voltage is required. See section F on the back of this sheet for operating information.

CONTROL POWER — Turns input control power "On" and "Off". Also used as an emergency "Off" in case of malfunction



VOLTAGE CONTROL — Adjusts arc volts by controlling power source output voltage.

TRAVEL — Turn to "Off" for no travel; "Hand Travel" for travel without welding; "Automatic Travel" for welding operations. Speed and direction of travel are controlled by the travel mechanism controls.

INCH UP & INCH DOWN — Press to inch electrode at the speed set by "Inch Speed" control on inner panel.

CURRENT CONTROL — Adjusts wire feed speed to control welding current.

START — Pushbutton begins welding cycle.

STOP — Pushbutton initiates the stopping cycle at the end of the weld.



B. NA-3S AND NA-3SF

(When connected to a Constant Current power source)

CURRENT CONTROL — Adjusts welding current by controlling power source output.

VOLTAGE CONTROL — Adjusts arc voltage.
(All other controls same as NA-3N.)



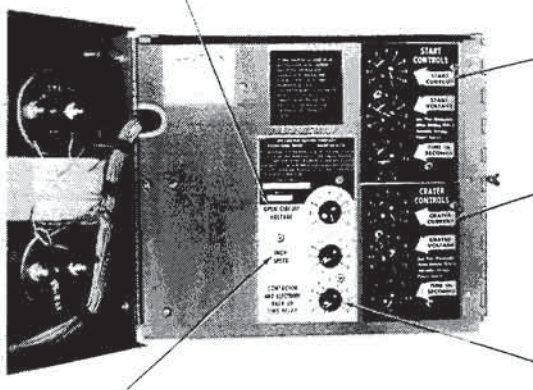
C. NA-4

CURRENT CONTROL — Adjusts welding current by controlling power source output.

(All other controls same as NA-3S connected to constant current power source.)

Older NA-4's used with AC-1000 power sources used a toggle switch instead of a rheostat for Current Control.

OPEN CIRCUIT VOLTAGE — Adjusts OCV of motor-generator, DC-600 and DC-1500 power sources to control starting characteristics.



INCH SPEED — Sets speed of electrode feeding when not welding. It is independent of the other feed speed controls permitting inch speeds faster or slower than welding feed speeds.

FUSES — Located on the control P.C. board located behind the inner panel door (see Sec. L6.3.2).

⁽⁴⁾ With NA-4 and AC-1000 combination, adjusts only voltage.

E. SETTING FOR CV OR CC POWER SOURCES

The NA-3N and NA-3NF weld only with a constant voltage power source. These machines can be converted for constant current welding by installation of the proper parts.

The NA-3S and NA-3SF weld with either a constant voltage (CV) or constant current (CC)⁽¹⁾ power source. Set the equipment for either CV or CC as appropriate per the following:

1. If using a multiprocess power source, set it per the instructions in the Operating Manual shipped with the power source.
2. Turn the input power off, and open the inner panel. Set the "CV-CC" switch located on the constant current P.C. board inside the control box. When using an R3S power source with the triangle plate (for major voltage adjustments) the constant current board jumper must be on Pin L.
3. There are two nameplates on top of each other on the front of the wire feeder control box. Be sure the nameplate for the appropriate type power source is on top.
4. Similarly, if the optional "Start Controls" or "Crater Controls" P.C. boards are installed, be sure the nameplates for the appropriate type power sources are on top.

F. OPTIONAL ELECTRONIC VOLTMETER OPERATION

Set the desired arc voltage on the meter dial and start to weld. The green light glows when actual voltage matches the preset voltage. Either red light glows when welding voltage is higher or lower than the preset voltage. Adjust

(1) NOTE: Some machines are labeled "CV-VV". CC for constant current and VV for variable voltage have the same meaning.

D. INNER CONTROL PANEL

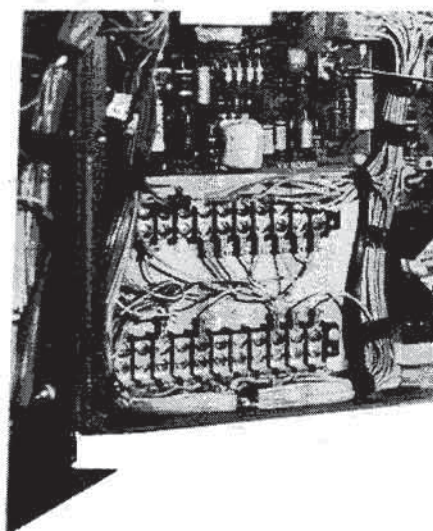
OPTIONAL START CONTROLS — Set starting current⁽⁴⁾ and voltage for an adjustable time.

OPTIONAL CRATER CONTROLS — Set ending current⁽⁴⁾ and voltage for an adjustable time.

TIME DELAY — Prevents crater sticking by adjusting the time for electrode burnback and/ or retract in from the puddle.

the "Voltage Control" in the appropriate direction until the green light glows.


The NA-4 only welds with a constant current AC power source. Be sure the "CV-CC" switch on the constant current P.C. board inside the control box is always set on "CC" and the constant current board jumper is on the correct Pin.



CV-CC Switch

When Innershield welding connect the jumper on the back of the meter between A & B and the red lights will glow when welding voltage is 1/2 volt above or below the preset voltage. When submerged arc welding connect the jumper between B & C and the red lights glow whenever the welding voltage is 1 volt above or below the preset voltage.

SEC. L3.3 — SETUP INSTRUCTIONS

⚠ WARNING	
	<ul style="list-style-type: none">• The head, electrode and wire reel are electrically "hot" during the entire welding cycle (including hot start and contactor delay time). Do not touch or allow these parts to touch other equipment when welding.
ELECTRIC SHOCK can kill.	

Sec. L3.3.1

WELDING WITH INNERSHIELD® ELECTRODES

Also Submerged Arc and Open Arc Welding with DC Constant Voltage (CV) Power Sources Only

(See Sec. L3.3.2 for Welding with Constant Current Power Sources)

The following instructions assume that the needed equipment — including the appropriate wire straightener or small wire spring guide and contact nozzle — are properly installed. Choose the electrode and basic procedures depending upon the application.

Single Electrode — The following setup instructions are written for single electrode welding.

Twinarc® — The following setup instructions also apply

for Twinarc welding in which two electrodes are fed through a single wire feeder modified by the installation of a Twinarc kit. See Sec. L2.5.3 (KXXX) for installation instructions.

A. Electrical Setup

1. If using a multiprocess power source (SAM, SAF, SA-800, DC-600 or DC-1500), set the power source for constant voltage (CV) welding per instructions in the power source manual.
2. Set the wire feeder for constant voltage (CV) welding per Sec. L3.2.4.
3. Set the power source for the electrode polarity [DC(+) or DC(-)] specified by the procedures. Interchange the NA-3 voltmeter and ammeter leads if the polarity was changed. If using the discontinued "Solid-State Remote Field Control" with a motor-generator power source, be sure to set the power source *and* field control to the same polarity *before* starting the power source. Opposite polarity settings blow the fuse in the field control.
4. Depending upon the procedures and application, decide:
 - a. Whether to use "hot" or "cold" starting (cold starting cannot be used when connected to an R3S and requires the use of the constant voltage board).
 - b. Whether to start the travel with the "Start" button or the arc.
 - c. If control of initial bead size or penetration requires use of the optional "Start Controls" P.C. board.

See Sec. L3.4.1 for descriptions of these various starting sequences and the rewiring needed to accomplish them.

See Sec. L3.3.4 for Linc-Fill long stickout starting considerations.

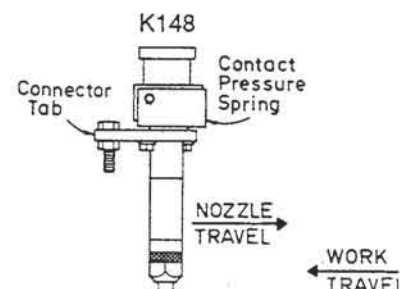
5. Depending upon the procedures and applications:

- a. Select the arc and travel stopping sequence.
- b. Decide if control of the ending bead size or crater filling requires use of the optional "Crater Controls" P.C. board.

See Sec. L3.4.2 for descriptions of these various stopping sequences and the rewiring needed to accomplish them.

B. Mechanical Setup

1. Set the head position relative to the work as required for the fixture, application and procedures (see Sec. L3.2.3).
2. Rotate the wire straightener, if used, until the top of the straightener faces the wire reel. This is required for smooth feeding of the electrode into the straightener.
3. If using a K148 contact assembly, rotate the assembly relative to the direction of travel as shown in the following sketch:



Sec. L3.3.1 (Continued)

4. The mount for standard 50 and 60 pound (22.7 and 27.2 Kg) electrode coils includes a two position brake assembly. Generally the brake should be at the inner position (nearest to the wire reel shaft) for wire feed speeds below 400"/min (10.0 m/min). It should be at the outer position for faster wire speeds. To adjust the brake position, remove the wire reel. Pull the cotter pin that holds the brake shoe to the arm, move the shoe and replace the cotter pin. Do not bend the cotter pin — it is held in place by a friction fit.
5. Load the wire reel per Sec. L3.2.2 or install the Speed-Feed drum or reel per Sec. L2.5.7.

C. Control Adjustments and Test Welding

1. Set the wire feed speed (WFS) specified by the procedures using the NA-3 "Current Control." For initial test welds, choose the setting from the following table:

Gear Ratio 142-1 ^(a)		Gear Ratio 95-1 ^(a)		Gear Ratio 55-1 ^(a)	
Approx. WFS ipm m/min	Setting	Approx. WFS ipm m/min	Setting	Approx. WFS ipm m/min	Setting
50-(1.25)	1-3/4	100-(2.5)	2-1/2	200-(5.0)	3
100-(2.5)	3-1/2	200-(5.0)	5	400-(10.0)	6
150-(3.8)	5-1/4	300-(7.6)	7-1/2	600-(15.0)	8
200-(5.0)	7	400-(10)	10		
250-(6.4)	8-3/4				

^(a) Stamped on the gear box.

2. Set the power source and wire feeder for the voltage specified by the procedures as follows:

Idealarc® R3S

- a. Set the power source for the voltage range desired per instructions in the R3S operating manual. The OCV is fixed.
- b. Make the final voltage adjustments using the "Voltage Control" on the NA-3. This control varies the voltage over the range set by the power source.

Idealarc DC-600 and DC-1500

- a. Set the toggle switch on the front of the DC-600 or DC-1500 to "Output Control Remote."
- b. Set the "Electrode Negative — Electrode Positive" switch to correspond to the polarity of the electrode cable connection.
- c. Set the 3-position toggle switch to "CV Innershield" or "CV Submerged Arc" as appropriate for the process and procedure.
- d. Set the NA-3 inch speed at #2.
- e. DC-600 — Set the NA-3 OCV control at approximately the same dial setting as the NA-3 voltage control for the procedure being used.
- f. DC-1500 — Set the NA-3 OCV control at #4.
- g. Set the arc voltage using the NA-3 "Voltage Control." For initial test welds, choose a setting from the following table:

	Approx. Voltage	NA-3 Voltage Control Setting
DC-600	18 — 22	4
	28 — 32	6
	38 — 42	8
DC-1500	22 — 24	2
	34 — 36	4
	46 — 48	6
	56 — 60	8

For further information on the use of these two power sources with NA-3, refer to the DC-600 or DC-1500 operating manuals.

Idealarc DC-400 and DC-1000

Consult the operating manual for these machines.

SAF-600 and SA-800 with discontinued "Solid-State Remote Field Control"

- a. Set the "Voltage Range" switch on the power source to "Low".
- b. Set the power source "Voltage" rheostat to maximum.
- c. Connect the cable from the power source contactor box to the power source "Innershield" stud.
- d. Set the arc voltage using the NA-3 "Voltage Control." For initial test welds, choose a setting from the following table:

Approx. Voltage	Voltage Control Setting
18 — 22	1
28 — 32	3
38 — 42	6

SAM Motor-Generator or Engine Welder

- a. Set the power source "Constant Voltage Control" to "High."
- b. Set the arc voltage using the "Voltage Control" on the NA-3. For initial test welds, choose a setting from the following table:

Approx. Voltage	Setting
18 — 22	1
28 — 32	5
38 — 42	10

SAN with the discontinued "Solid-State Remote Field Control"

- a. Set the power source "Voltage" rheostat to maximum.
- b. Set the arc voltage using the "Voltage Control" on the NA-3. For initial test welds, use the table at the top of this column.
3. Unless otherwise instructed in C-2, set the "Inch Speed" for good arc striking. For an inch speed slower than welding feed speed, usually required for good striking, set the "Inch Speed" control on the inner panel one or two dial numbers below the setting of the "Current Control" on the front control panel.

Sec. L3.3.1 (Continued)

4. If using a motor-generator type power source with the recommended (discontinued) "Solid-State Remote Field Control" installed, the power source OCV is controlled by the "Open Circuit Voltage" control on the inner panel of the NA-3. (Set the OCV control to 4 and the inch control to 2. To read OCV's under 60 volts on the NA-3 voltmeter, inch the electrode up from the work and press the "Start" button. Press the "Stop" button before the electrode reaches the work.
5. If installed, set the "Start Controls" and "Crater Controls" on the inner panel. For initial test welds, set the "Time In Seconds" to 1 second and the "Current" and "Voltage" controls to the same dial numbers (to produce about the same output) as the "Current Control" and "Voltage Control" on the front panel.
6. Set the "Contactor-Time Delay" on the inner control panel to prevent crater sticking and provide the stopping characteristics required by the application. For initial test welds, set it to about 5.
7. Straighten the first six inches of electrode and push it through the wire straightener to the drive rolls. Press the "Inch Down" button and feed the electrode down through the nozzle. Adjust the wire straightener hand wheel. With contact nozzles, except the K231, adjust until the electrode is straight as it comes out of the nozzle. Do not *completely* straighten the wire when using a K231 contact nozzle because the nozzle relies on a small curvature of the electrode for proper electrical contact within the contact tip.
8. Set the travel speed as specified by the procedures. With the wire feeder travel switch set to "Hand Travel", the travel runs without welding, permitting accurate measurements of travel speed. When using a Lincoln travel carriage, adjust the speed with the rheostat and the direction with the toggle switch on the carriage control panel.
9. Connect the work lead to the work or a suitable piece of scrap. Clip the end of the electrode to a sharp point.
10. Make a test weld and adjust the wire feeder "Voltage Control" and "Current Control" until the meters indicate the output specified by the procedures.
11. Make several test welds, readjusting the starting and stopping controls in the following order:
 - a. Set the "Inch Speed" control for optimum arc striking. See Sec. L3.3.4 if using "Linc-Fill" long stick-out techniques.
 - b. If installed, adjust the "Start Controls" to set the welding procedures during the first 0-3 seconds of welding to provide the bead size, penetration or other factor as needed for the application.
 - c. If installed, adjust the "Crater Controls" to set the welding procedures for the 0-3 seconds after the stop button is pressed to provide the bead size or to fill the crater as needed for the application.
 - d. Set the "Contactor-Time Delay" to provide the stopping characteristics needed.

November 1990

SETUP INSTRUCTIONS — CONT'D

Sec. L3.3.2

Submerged Arc Welding with DC or AC Constant Current (CC) Power Sources Only

(See Sec. L3.3.1 for Welding with Constant Voltage Power Sources)

The following instructions assume that the needed equipment — including flux hopper, solid electrode wire straightener and appropriate contact nozzle — are properly installed. Choose the flux, electrode and basic procedures depending upon the application.

Single Electrode — The following setup instructions are written for single electrode welding.

Twinarc® — The following setup instructions also apply for Twinarc welding in which two electrodes are fed through a single wire feeder modified by the installation of a Twinarc kit. See Sec. L2.5.3 (KXXX) for installation instructions.

Tandem Arc — The following setup instructions also apply for tandem arc welding in which 2 or 3 electrodes are fed through 2 or 3 wire feeders. The arc can be controlled either by pressing the "Start" or "Stop" buttons of each wire feeder or by interconnecting them per Sec. L2.3.3 for control using only one start and one stop button.

A. ELECTRICAL SETUP

1. If using a multiprocess power source (SAM, discontinued SAF or SA-800, DC-600 or DC-1500), set the power source for constant current (CC) welding per instructions in the power source manual.
2. Set the wire feeder for constant current (CC) welding per Sec. L3.2.4.
3. Set the power source for the electrode polarity [DC(+) or DC(-)] specified by the procedures. Reverse the NA-3 or NA-4 voltmeter and ammeter leads if the polarity was changed. If using the discontinued "Solid-State Remote Field Control" with a motor-generator power source, be sure to set the power source *and* field control to the same polarity *before* starting the power source. Opposite polarity settings blow the fuse in the field control.
4. Depending upon the procedures and application, decide whether to:
 - a. Use "hot" or "cold" starting.
 - b. Start the travel with the arc or the "Start" button.
 - c. Control initial bead size and penetration by using the optional "Start Control" P.C. board.

See Sec. L3.4.1 for descriptions of these various starting sequences and the rewiring needed to accomplish them.

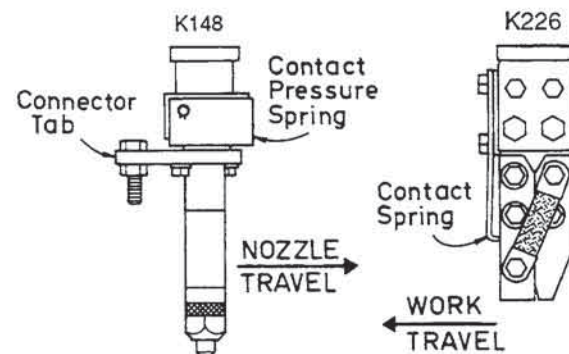
See Sec. L3.3.4 for Linc-Fill long stickout starting considerations.

5. Depending upon the procedures and application:
 - a. Select the arc and travel stopping sequence.
 - b. Decide if control of the ending bead size or crater filling requires use of the "Crater Controls" P.C. board.

See Sec. L3.4.2 for descriptions of these various stopping sequences and the rewiring needed to accomplish them.

B. MECHANICAL SETUP

1. Set the head position relative to the work as required for the fixture, application and procedures (see Sec. L3.2.3).
2. Rotate the wire straightener until the hand wheel faces the wire reel. This is required for smooth feeding of the electrode into the straightener.
3. If using a K148 or a K226 contact assembly, rotate the assembly relative to the direction of travel as shown in the following sketches:



4. The mounting for the standard 60# (27.2 Kg) electrode coils, includes a two-position brake assembly. Generally, when submerged arc welding, leave the brake at the inner position (nearest to the wire reel shaft).
5. Load the wire reel per Sec. L3.2.2 or install the Speed-Feed drum or reel per Sec. L2.5.7.
6. Fill the flux hopper with new or freshly screened flux.

Sec. L3.3.2 (Continued)

C. CONTROL ADJUSTMENTS AND TEST WELDING

1. Set the power source and the wire feeder current and voltage controls for the outputs specified by the procedure as follows:

Discontinued SAF-600 or SA-800 with discontinued "Solid-State Remote Field Control"

- a. Set the "Voltage Range" switch on the power source to "High".
- b. Set the power source "Voltage" rheostat to maximum.
- c. Set the arc voltage with the "Voltage Control" on the NA-3. For initial test welds, set it at about 6.
- d. Connect the cable from the power source contactor box⁽⁶⁾ to the power source sub-arc stud with the lowest current range that still permits welding at the current specified in procedures. For example, if you want 500 amperes welding current, use the "300-575" stud and not the "450-Max" stud.
- e. Make final current adjustments with the NA-3 "Current Control." This control varies the current over the entire range controlled by the stud connection. For initial test welds set it at about 6.

Discontinued SA-750 — Follow the instructions for the SA-800 except the SA-750 does not have a Voltage Range Switch or Contactor.⁽⁶⁾

Idealarc DC-600 and DC-1500

- a. Set the toggle switch on the front of the DC-600 or DC-1500 to "Output Control Remote."
- b. Set the "Electrode Negative — Electrode Positive" switch to correspond to the polarity of the electrode cable connection.
- c. Set the 3-position toggle switch to "VV Submerged Arc."
- d. Set the NA-3 inch speed at #2.
- e. Set the NA-3 OCV control near minimum.

NOTE: Most submerged arc welding can be done with the DC-600 and DC-1500 power sources set for CV sub arc and the NA-3S for constant wire feed. Constant current would normally only be required for high current-large puddle type applications. Refer to the DC-600 or DC-1500 operating manuals for further information.

AC-1200 (or Discontinued AC-1000 or AC-750)

- a. Set the current with the "Current Control" on the NA-4. For initial test welds with the AC-1200, set it at about 5. Be sure to choose the correct current range stud on the AC-1200. The discontinued AC-1000 or AC-750 output is indicated on the dial on the front of the power source.
- b. Set the voltage with the "Voltage Control" on the NA-4. For initial test welds, set to about 6. The power source OCV is fixed.

2. Unless otherwise instructed in C-1, set the "Inch Speed" for good arc striking as follows:
 - a. When "hot" starting, usually set it to one or two dial numbers lower than the setting on the "Voltage Control" on the front panel. This provides the inch speed slower than welding feed speed usually recommended.
 - b. When "cold" starting, usually set it to about 2 for a slow inching speed to prevent jamming the electrode against the work before striking.
3. If using a motor-generator type power source, set the "Voltage Range" switch on the power source to "High." If using a motor-generator power source with the discontinued "Solid-State Remote Field Control" installed, the OCV is controlled by the "Open Circuit Voltage" control on the inner panel of the NA-3. Set the OCV for good arc striking at about 3 to 8 volts higher than the welding voltage. To read OCV's under 50 volts on the NA-3 voltmeter, inch the electrode up from the work and press the "Start" button. Press the "Stop" button before the electrode reaches the work.
4. If installed, set the "Start Controls" and "Crater Controls" on the inner panel. For initial test welds, set the "Time In Seconds" to 1 second and the "Current" and "Voltage" controls to the same dial numbers (to produce about the same output) as the "Current Control" and "Voltage Control" on the front panel.
5. The setting on the "Contactor-Time Delay" on the inner control panel is not generally critical to the submerged arc welding. For initial test welds, set it to about 5.
6. Straighten the first six inches of electrode and push it through the wire straightener to the drive rolls. Press the "Inch Down" button and feed the electrode down through the nozzle. Adjust the wire straightener hand wheel. With contact nozzles, except the K231, adjust until the electrode is straight as it comes out of the nozzle. Do not *completely* straighten the wire when using a K231 contact nozzle because this nozzle relies on a small curvature of the electrode for proper electrical contact within the contact tip.
7. Set the travel speed as specified by the procedures. With the wire feeder travel switch set to "Hand Travel," the travel runs without welding, permitting accurate measurements of travel speed. When using a Lincoln travel carriage, adjust the speed with the rheostat and the direction with the toggle switch on the carriage control panel.
8. Mount and properly connect the work lead to the work or a suitable piece of scrap. Clip the end of the electrode to a sharp point.
9. Make a test weld and adjust the wire feeder "Voltage Control" and "Current Control" until the meters indicate the output specified by the procedures.
10. Make several test welds readjusting the starting and stopping controls in the following order:
 - a. Set the "Inch Speed" control for optimum arc striking. See Sec. L3.3.4 if using "Linc-Fill" long stick-out techniques.
 - b. If installed, adjust the "Start Controls" to set the

⁽⁶⁾ For power sources without a contactor box, connect the electrode cable from the NA-3 input cable assembly to the appropriate stud.

SETUP INSTRUCTIONS — CONT'D

Sec. L3.3.2 (Continued)

welding procedures during the first 0-3 seconds of welding to provide the bead size, penetration or other factor as needed for the application.

- c. If installed, adjust the "Crater Controls" to set the welding procedures for the 0-3 seconds after the stop button is pressed to provide the bead size or fill the crater as needed for the applications.
- d. Set the "Contactor-Time Delay" to provide the stopping characteristics needed.

September 1987

Sec. L3.3.4

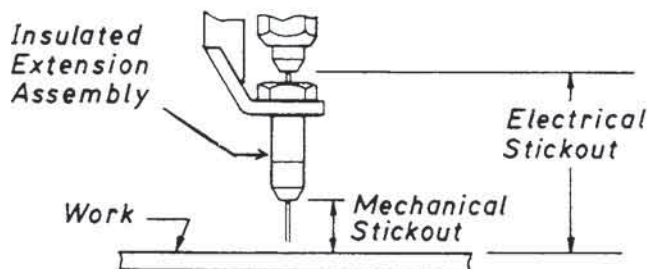
Special Considerations for Linc-Fill™ Welding

The setup and operating instructions in Sec. L3.3.1 and L3.3.2 also apply when using Linc-Fill procedures except for the additional starting and test welding requirements described below.

A. DEFINITION

Electrical stickout is the distance between the point of electrical contact in the nozzle tip and the work. Most automatic welding procedures specify standard stickouts between 5/8 and 2" (16 and 50 mm).

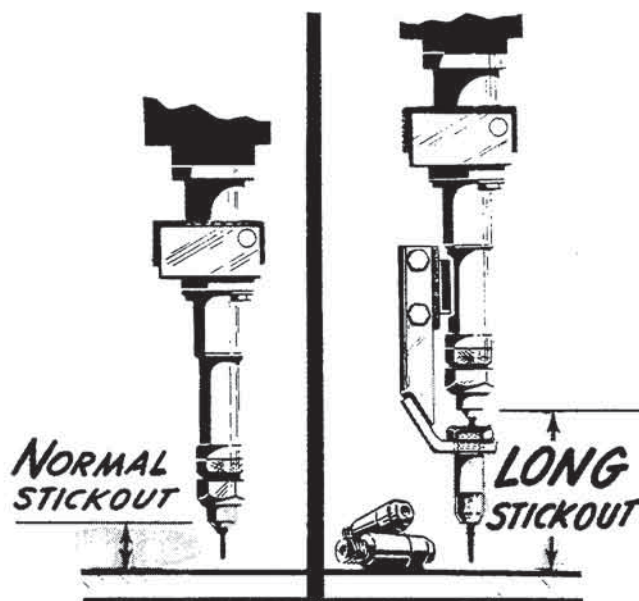
Installing the K149 Linc-Fill extension guide on the K148 nozzle increases the electrical stickout. Passing the welding current through the longer length of electrode preheats the electrode so it melts more quickly in the arc. Long stickouts from 2-1/2 to 5" (65 to 125 mm) are practical for welding groove joints, flat fillet joints and other production "Fast-Fill" applications.



B. STARTING REQUIREMENTS

1. Install the K221 "Start Controls" P.C. board per instructions shipped with the kit.
2. Install the extension tubes from the K149 kit required for the stickout desired allowing for a 3/4 to 1-1/2" (19 to 38 mm) mechanical stickout. Use the tip in the end of the K149 extension for the electrode diameter to be used.
3. Be certain the work cable connection to the work is clean and bright.
4. Use clean rust-free electrode. Remove dirt and rust from the starting area of the work.

5. Always clip the electrode to a sharp point. As an alternative, reconnect the contactor dropout and back-up circuits (see Sec. L3.4.2) to retract the wire from the work at the end of the weld to inch up through the extension tip knocking the slag ball off.
6. If using a motor-generator power source with adjustable OCV, set the "Open Circuit Voltage" control to over 50 volts for CC power sources or near maximum for CV power sources.
7. If using a DC-600 or DC-1500, set the NA-3 OCV control at Min. when the power source is set on CC, and set it on number 4 when in the "CV Innershield" or "CV Submerged Arc" mode.
8. Set the starting sequence to start "hot" and "on-the-fly" per instructions in Sec. L3.4.1.



9. Use the appropriate one of the following two starting methods:
 - a. **Reduced Output Starting** suitable for most applications.
 - b. **By-Pass Relay Starting** for especially difficult starting.

C. REDUCED OUTPUT STARTING METHOD — SETUP AND TEST WELDING

1. The optional K221 "Start Controls" P.C. board must be installed.
2. Remove the tip from the extension nozzle guide to prevent arc damage during setup.
3. Set the *welding* current and voltage specified by the procedures using the methods outlined in Sec. L3.3.1 for CV power sources or Sec. L3.3.2 for CC power sources. Ignore the starting characteristics.
4. Set the "Time in Seconds" on the "Start Controls" board to 1 second and "Start Current" and "Start Voltage" to the same dial settings as the "Current Control" and "Voltage Control" on the front panel.

Sec. L3.3.4 (Continued)

5. Start several welds adjusting the "Inch Speed" Control, usually to a slow speed, for the best starting that can be obtained. If inch speed is too fast, the electrode end jams into the work or "blasts off." If too slow, the arc flutters and goes out.
6. Set the "Time in Seconds" on the optional "Start Controls" board for 3 seconds and the "Start Current" and "Start Voltage" to the same dial settings as the "Current Control" and "Voltage Control" on the front panel. Start several welds adjusting the "Start Current" and "Start Voltage", usually to a lower setting, to obtain optimum starting characteristics. Re-adjusting the "Inch Speed" during these adjustments may be necessary.
7. Reduce the "Time in Seconds" setting to provide only enough time for good striking.
8. If the backup circuit is to be used to knock the ball of slag off the end of the electrode at the end of each weld, make several test welds adjusting the "Contactor — Time Delay" on the inner panel to provide sufficient electrode retraction to pull it up through the tip of the extension. If using a short visible stickout, reconnecting to eliminate burnback (Sec. L3.4.2) may be needed to prevent arc damage to the tip.
9. When setup is complete, reinstall the tip in the extension guide.

D. BY-PASS RELAY STARTING METHOD — SETUP AND TEST WELDING

1. The optional K237 By-Pass Relay and K221 "Start Controls" P.C. board must be installed.
2. Remove the tip from the nozzle extension guide to prevent arc damage during setup.
3. Set the *welding* current and voltage specified by the procedures using the methods outlined in Sec. L3.3.1 for CV power sources or Sec. L3.3.2 for CC power sources. Ignore the starting characteristics.
4. Re-install the extension guide tip.
5. Set the "Time In Seconds" on the "Start Controls" to one second and set the "Start Current" and "Start Voltage" to the same dial settings as the "Current Control" and the "Voltage Control" on the front panel. Part of the current⁷⁾ will then flow through the extension guide and into the electrode during the first one second of welding.
6. Start several welds adjusting the "Inch Speed" control, usually to a slow speed, until good starting is obtained. If inch speed is too fast, the electrode end jams into the work or "blasts off." If too slow, the arc flutters and goes out.
7. If necessary, start several test welds adjusting the "Start Current" and "Start Voltage" to a lower setting to obtain optimum starting. Re-adjusting the "Inch Speed" may be necessary during these adjustments.
8. If the backup circuit is to be used to knock the ball of slag off the end of the electrode at the end of each weld, make several test welds adjusting the "Contactor — Time Delay" on the inner panel to provide sufficient electrode retraction to pull it up through the extension

guide tip. If using a short visible stickout, reconnecting to eliminate burnback (see Sec. L3.4.2) may be needed to prevent arc damage to the tip.

- ⁷⁾ The amount of the current diverted thru the extension guide depends upon the procedures and the relative resistance of the electrode stickout and the lead between the by-pass relay and the extension guide. Using the 15 foot (4.5 m) of #12 wire shipped with the by-pass relay about 100-150 amps goes into the wire at the extension guide tip when welding with Innershield .120" (3.0 mm) NS-3M flux-cored electrode at 700 amps, DC, 37 volts and 3-3/4" (95 mm) electrical stickout. Higher welding currents, lower lead resistance and higher electrode stickout resistance increases the amount of by-pass current.

If the 15 foot (4.5 m) lead shipped with the by-pass relay must be changed to fit the installation, the same amount of by-pass current is obtained with any one of the following lead sizes:

Length ft. (m)	Wire Size AWG (IEC mm ²)
8-11 (2.4-3.3)	14 (2.50)
10-14 (3.0-4.3)	13 (2.50)
13-17 (4.0-5.2)	12 (4.0)
16-22 (4.9-6.7)	11 (4.0)
20-28 (6.1-8.5)	10 (6.0)
32-45 (9.7-13.7)	8 (10.0)
51-71 (15.5-21.6)	6 (16.0)

November 1990



SEC. L3.4 — STARTING AND STOPPING SEQUENCES

Sec. L3.4.1

Available Starting Sequences

The NA-3N and NA-3NF utilize “hot start” arc striking.

The NA-3S, NA-3SF and NA-4 can use either “hot start” or “cold start” arc striking without any rewiring.

 WARNING	
	<ul style="list-style-type: none">• The head, electrode and wire reel are electrically “hot” during the entire welding cycle (including hot start and contactor delay time). Do not touch or allow these parts to touch other equipment when welding.• Use “Hot Starting” only where required.
ELECTRIC SHOCK can kill.	

A. “HOT STARTING”

1. With the electrode not touching the work, press the “Start” button.
2. The electrically “hot” electrode inches down at the pre-set inching speed.
3. When it touches the work, the arc strikes and the circuit automatically switches from inching to welding wire feed speed.

Use either the standard “on-the-fly” travel starting or rewire the controls for “standstill” travel starting (see Sec. L3.4.2).

B. “COLD STARTING”

Recommended primarily for submerged arc welding with a constant current power source when the weld must start at a precise location. Can be used on DC-600 and DC-1500 power sources.

1. Inch the electrode down with the “Inch Down” button. When it touches the work, inching automatically stops and the flux valve opens (switch on flux hopper must be “On”).
2. Press the “Start” button to start the weld.

C. OPTIONAL “START CONTROLS” P.C. BOARD

Recommended for applications where penetration, bead size and other characteristics must be carefully controlled at the start. It is required when using Linc-Fill long stickout procedures.

The starting sequence is as described above for “hot starting” except, when the arc strikes, the machine welds at the current^(*) and voltage set by the “Start Controls” panel until the time set on the “Time In Seconds” control elapses. The circuit then automatically switches to welding current and voltage. Actual settings depend upon the application requirements.

^(*) With the NA-4 and discontinued AC-1000 or AC-750 combination, the current is not adjustable.

D. OPTIONAL K237 BY-PASS RELAY

Recommended for especially difficult starting applications when using the Linc-Fill long stickout nozzle extension assemblies.

This option requires use of “hot starting” and the optional “Start Controls” kit. It cannot be used with high frequency starting.

The starting sequence is as described above for “hot starting” except, when the arc strikes, a portion of the starting current goes through the Linc-Fill extension guide entering the electrode near the arc. This, in effect, provides short stickout starting. When the time set on the “Time In Seconds” timer elapses, all of the welding current flows through the regular nozzle contact tip and the extension guide is electrically “cold.”

See Sec. L3.3.4 for specific operating instructions.

Sec. L3.4.2

Setting Travel Starting and Stopping

When shipped, all models are connected so the travel starts when the “Start” button is pressed and stops when the “Stop” button is pressed. Standard machines can be connected for a variety of starting and stopping sequences.

A. “ON-THE-FLY” TRAVEL STARTING

When shipped, all models are connected for “On-The-Fly” travel starting. The sequence follows:

1. With the electrode NOT touching the work, press the “Start” button. This starts both the wire feed and travel motors.
2. When the electrically “hot” electrode touches the work to start the arc, there is relative motion between the end of the electrode and the work. This “scratching” type contact helps assure consistent arc striking.

This sequence is recommended for most welding including:

1. Roundabouts and any other weld which ends at its starting point. A timer to control the welding cycle can be installed per Sec. L2.3.3.
2. Welds started on a run-out tab.
3. For improved arc striking on any application.

B. “STANDSTILL” TRAVEL STARTING

All models can be reconnected so the travel remains at a standstill until the arc starts. “Standstill” travel starting is used when the electrode *must* be started at a precise location.

For consistent arc striking with “Standstill” travel starting always clip the end of the electrode to a sharp point before starting.

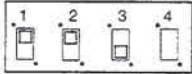
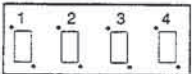
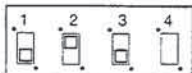
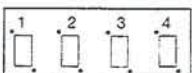
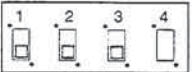
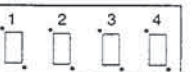
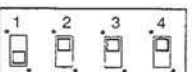
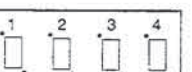
C. SETTING STOPPING SEQUENCES

As shipped, the travel stops when the "Stop" button is pressed, producing a small crater area.

When the end overlaps the beginning of the weld, reconnecting to stop the travel later in the sequence spreads the crater over a longer area.


D. RECONNECTING THE TRAVEL SEQUENCE


To change the travel sequence, turn the input AC power off at the power source, remove the screw holding the inner panel and swing the panel open. Change the connections (older models) or switch positions (newer models) on the logic board as follows:

Travel Starts	Travel Stops	Older Models	Newer Models†
With the "Start" Button	With the "Stop" Button	Lead 691 to Pin 6 ⁽⁹⁾ Lead 692 to Pin 5	  Switch #1 Switch #2
With Arc Striking	With Arc Stopping	Lead 691 to Pin 6 ⁽⁹⁾ Lead 692 to Pin 7	  Switch #1 Switch #2
With Arc Striking	With "Stop" Button	Lead 691 to Pin 5 Lead 692 to Pin 7	  Switch #1 Switch #2
With "Start" Button	With End Crater Fill Time ⁽¹⁰⁾	Lead 691 to Pin 8 Lead 692 to Pin 9	  Switch #1 Switch #2

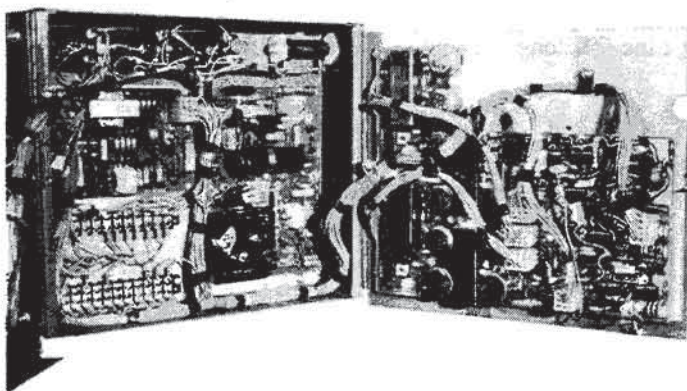
(9) On machines below code 7432, connect 691 to pin 8.
(10) Crater fill Board installed.

NOTE:

 Indicates switch in up position

 Indicates switch in down position

 Indicates switch position does not matter



Logic Board

Sec. L3.4.2 (Continued)

E. SETTING THE ARC STOPPING SEQUENCE

The primary consideration in setting the arc stopping sequence is to prevent the electrode from sticking in the puddle. This is easily done with the machine as shipped.

The standard sequence follows:

1. Press the "Stop" button.
2. The wire feed motor stops and the "Contactor-Time Delay" starts.
3. The arc continues to burn the electrode back from the puddle until the time set on the "Contactor-Time Delay" located on the inner panel elapses. This control should be set for the minimum burnback time that still prevents crater sticking.

⚠ WARNING



ELECTRIC SHOCK can kill.

- The head, electrode and wire reel are electrically "hot" during the entire welding cycle (*including* hot start and contactor delay time). Do not touch or allow these parts to touch other equipment when welding

- Use minimum contactor delay time required.

When it is necessary to retract the electrode for easy fixture unloading or to assure restriking with Linc-Fill long stickout procedures, the standard machines can be reconnected so that, when the "Stop" button is pressed, the wire feed motor reverses to inch the electrode away from the crater. This can be done with or without burnback. The distance the electrode retracts depends primarily upon the time set on the "Contactor And Electrode Back Up Time Delay". The "Inch Speed" set for good arc striking also affects the distance the wire is retracted.

F. RECONNECTING THE STOPPING SEQUENCE

To change the stopping sequence, turn the input AC power off at the power source, remove the screw holding the inner panel and swing the panel open. Change the connections (older models) or switch positions (newer models) on the logic board as follows:

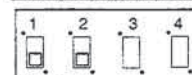
WHEN THE "STOP" BUTTON IS PRESSED:

1. Feed motor stops and electrode burns back (standard)

For older models

lead 693 to pin 3
lead 690 to pin 4

For newer models[†]



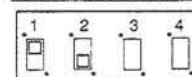
Switch #2

2. Feed motor inches up and electrode burns back

For older models

lead 693 to pin 1
lead 690 to pin 4

For newer models[†]



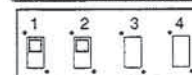
Switch #2

3. Feed motor inches up and contactor opens (no burn-back)

For older models

lead 693 to pin 1
lead 690 to pin 2

For newer models[†]



Switch #2

*NOTE:

Indicates switch in up position

Indicates switch in down position

Indicates switch position does not matter

The positions of switch #1 do not affect the stopping sequence.


G. OPTIONAL "CRATER CONTROLS" PC BOARD

Recommended for applications where the ending bead size must be controlled, the crater must be filled including roundabouts and other welds where the end overlaps the start.

When the "Stop" button is pressed, the machine welds at the current⁽¹⁾ and voltage set by the "Crater Controls" until the time set on the "Time In Seconds" control elapses. The circuit then automatically switches to the arc stopping sequence described above.

⁽¹⁾ With the NA-4 and discontinued AC-1000 or AC-750 combination the current is not adjustable.

SEC. L6.2 — MECHANICAL MAINTENANCE



! WARNING

- Turn off input power to the welding power source using the disconnect switch before working on this equipment.

**ELECTRIC SHOCK
can kill.**

Sec.L6.2.1

Wire Drive Gear Box

Once a year recoat all gear teeth with a non-fluid moly-disulfide grease such as Non-Fluid Oil Corp's A-29 Special/ MS lubricant. For access to the gears in one chamber, remove the adapter plate and motor assembly. To lubricate the gears in the other chamber, remove one of the pipe plugs and feed grease in contact with the bevel gear teeth while rotating the output shaft by hand until all teeth are lubricated.

November 1990

Sec. L6.2.2

Changing Wire Feed Gear Ratios (NA-3 only)

Gear Ratio	Feed Speed ⁽¹²⁾ in./min (m/min)	Max Wire Size (mm)	
		Cored Wire	Solid Wire
57:1	40-650 (12-198)	.120 (3.0)	3/32 (2.4)
95:1	25-400 (7.5-122)	5/32 (4.0)	1/8 (3.2)
142:1	17-268 (5.2-82)		7/32 (5.6)

⁽¹²⁾ Using constant wire feed speed (CV mode).

Three gear ratios are available — 57:1, 95:1 and 142:1. To change the gear ratio, replace the motor pinion and the first reduction gear per the following instructions: (Refer to P-100-C and P-100-E.)

1. Remove the four round head screws which mount the motor adapter plate to the gear box. Remove the motor and adapter plate from the gear box.
2. Take the two longer screws removed in Step (1) and screw one into each of the tapped holes located in the face of the fiber input gear (Item 13). Insert the screws through the full thickness of the gear and, using a screwdriver wedged between the screws to prevent rotation, remove the hex nut (Item 10) which holds the gear to the shaft. Remove the flat washer (Item 11).
3. Pull the gear from the shaft using the screws as a pulling device.
4. Be certain the woodruff key (Item 5) is properly located on the shaft. Turn the adapter plate mounting screws into the new fiber gear from the stenciled side and place the gear on the shaft. Replace the flat washer, tighten the hex nut and remove the adapter plate mounting screws from the gear.
5. After noting the relation of the adapter plate with the motor leads, remove the adapter plate from the motor. Support the pinion properly and, with the proper size punch, drive the roll pin which holds the pinion out of

the shaft. Pull the pinion off. Install the new pinion and replace the roll pin. Replace the adapter plate in its original location.

6. Cover the teeth of the motor pinion and the input gear with a non-fluid moly-disulfide grease such as Non-Fluid Oil Corp's A-29 Special / MS lubricant. This can be scooped from the cavity of the gear case.
7. Reassemble the motor on the gear box being certain the gears mesh properly and the adapter plate locating bead is in its cavity. Replace and tighten the four screws and the lock washers removed in Step 1.

November 1990

Sec. L6.2.3

Wire Drive Mechanism

Drive Mechanisms for three wire size ranges are available — .035 thru .052" (0.9 thru 1.3 mm), 1/16 thru 3/32" (1.6 thru 2.4 mm) and 3/32" thru 7/32" (2.4 thru 5.6 mm). If changing to wire sizes outside the range, change the drive rolls and the incoming and outgoing guide tubes. Also change the gear ratio (Sec. L6.2.2) if necessary.

The electrode is driven by gripping between the grooved drive rolls and a spring loaded idle roll. Replace the drive rolls when they become worn. The drive rolls for 1/16" (1.6 mm) and larger diameter electrodes have two sets of teeth so they can be reversed once before they must be replaced.

November 1990

Sec. L6.2.5

Wire Straighteners

A. FOR SOLID ELECTRODE

Periodically inspect the slide bushing at the top of the straightener and the ingoing wire guide at the bottom of the straightener for signs of wire milling. If necessary, rotate the guide to present an unworn surface. To reverse the slide bushing for a fresh wear surface, remove the cross adjustment screw and turn the bushing over.

B. FOR FLUX-CORED ELECTRODE

Severe wear to the "V" groove in the curved arm of the straightener can result in wire wander at the arc. Periodically check the groove and replace the arm when badly worn. Also replace the ingoing guide at the top of the straightener if it shows signs of milling the wire.

June 1974

SEC. L6.3 - ELECTRICAL MAINTENANCE

Sec. L6.3.1

Control Box

Every three months inspect the control box. If needed, blow dirt out using **low** pressure air. No other maintenance should be required.

June 1974

Sec. L6.3.2

Circuit Protection

The circuit breaker mounted on the left side of the control box protects the control circuit from short circuit conditions and from severe wire feed overloads. If it opens, determine and correct the cause of the overload. To reset the circuit breaker, push the red button.

Field Circuit Fuses (Early models only) - On the control P.C. board there is a 1/2 amp slo-blo fuse to protect the field circuit. The following conditions could cause this field fuse to open:

- a. Complete or partial wire feed motor field short.

Normal field resistance is approximately 700 ohms.

- b. A welding procedure where there is a lot of electrode to puddle shorting. This rapid arc shorting may cause the field voltage polarity to change frequency and blow the fuse. (1C and 1D will **both** be flickering when welding.)

- c. Too low an impedance when idle across 21-67, caused by the following:

1. Something external to the NA controls and power source, causing a partial short across 21-67.
2. Use of a non-Lincoln power source.
3. A defective Lincoln Electric power source.

- d. A defective control board.

The control P.C. board is located behind the inner panel door. P.C. Board Power Supply Fuse - On the early model control P.C. board there is a 3/10 amp fuse to protect the DC regulated power supply from overload. This fuse will blow if a P.C. board component fails and overloads the 24 volt DC power supply. A second 3/10 amp fuse had been added to the control board on later models to protect the board against faulted remote switches.

September 1987

On the latest models all fuses on the control board have been replaced with PTC Resettable Fuses. These devices will shutdown the circuit if overloaded, but will automatically reset after the overload condition has been removed. Should one of these devices trip, turn off the power to the unit and remove the source of the overload (See possible suggestions above for fuse blowing). Allow a few minutes for the device to cool down before restoring power.

September 1998

SEC. L6.4 — OPTIONAL FEATURE MAINTENANCE

Sec. L6.4.1

Contact Assemblies

Dirty or rusty electrode and excessively high currents cause rapid wear of the contact tips. The nozzle contact tip must be replaced when it no longer provides accurate wire location or good electrical contact. See Sec. L2.2.6, Sec. L2.2.7 or Sec. L2.5.3 for specific instructions for replacing contact tips and other maintenance of the various contact assemblies.

June 1974

Sec. L6.4.2

Wire Reel Mounting for 50 or 60# (22.7 or 27.2 Kg) Coils

Periodically coat the reel shaft with a thin layer of grease. No maintenance of the two position adjustable brake is needed except to replace the shoe assembly if it wears through.

November 1990

Sec. L6.4.4

Travel Carriage

Periodically oil the following parts with a light machine oil:

1. Clutch handle bearings
2. Travel gear box pivot points
3. Pins and bearings on the mechanism which raises and lowers the welding head.

Every three months clean and inspect the control box. No further maintenance should be required.

May 1985

Sec. L6.4.6

Vertical Lift Adjuster

Every month add a few drops of SAE-140 oil or equivalent to the oil cup on the back of the vertical lift housing.

Every year replace the grease in the top section gear cavity with a medium grease.

If the unit is disassembled for cleaning, apply a layer of medium grease to the screw threads of the head lift tube (Item 2 of P-101-S) and head lift screw (8). Apply a thin layer of grease to the OD of the head lift tube and the ID of the long hole in the head lift body (1). Slide the head lift tube into the head lift body and screw in the head lift screw. Fill the upper section gear cavity one-half full of grease. Be sure the needle bearings are packed in grease.

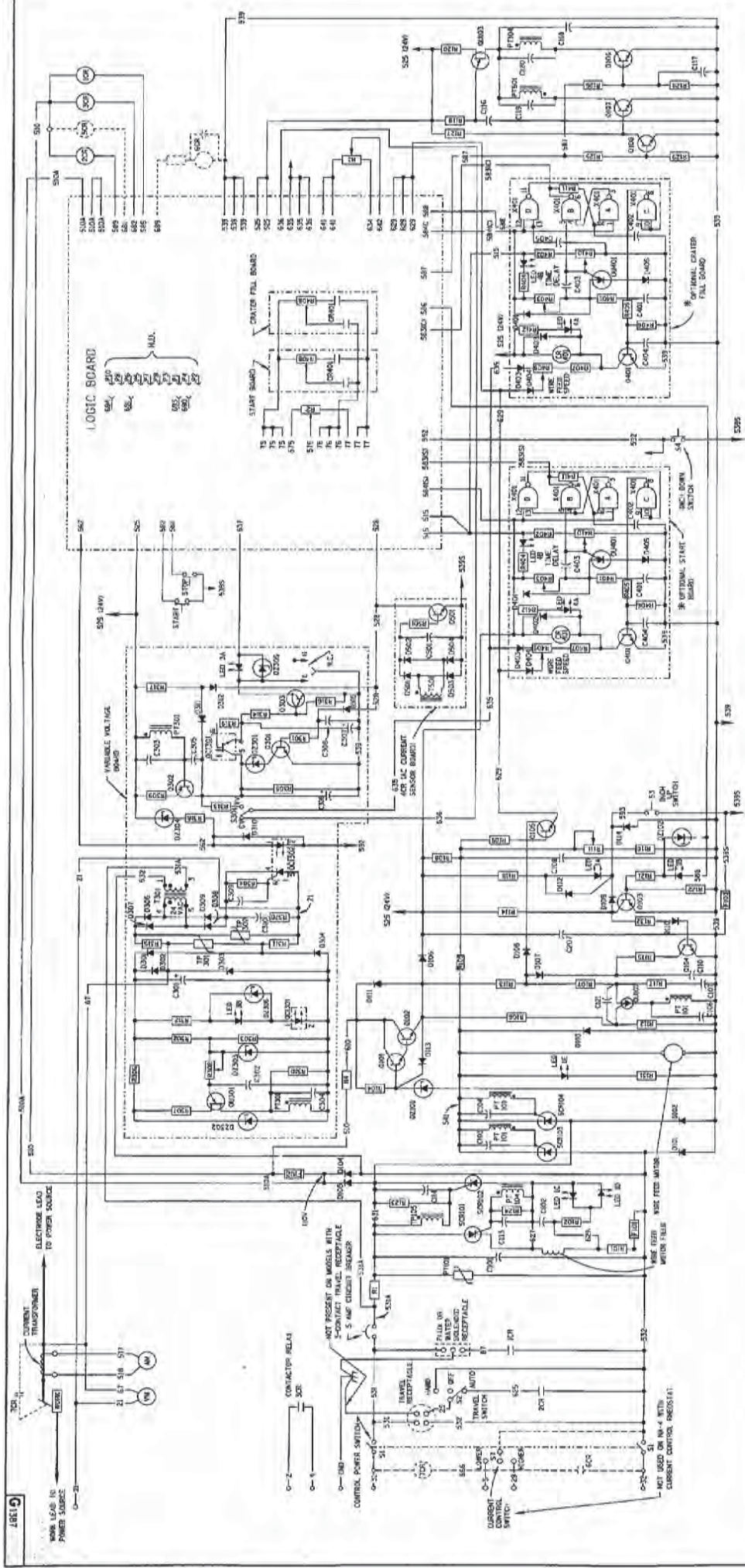
June 1974

Sec. L6.4.7

Horizontal Adjuster

Twice a year apply a thin coat of grease to all sliding surfaces. Every year replace the grease in the gear cavity with a medium grease.

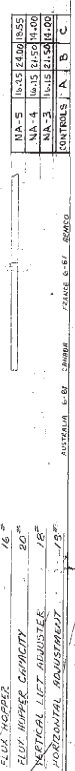
June 1974



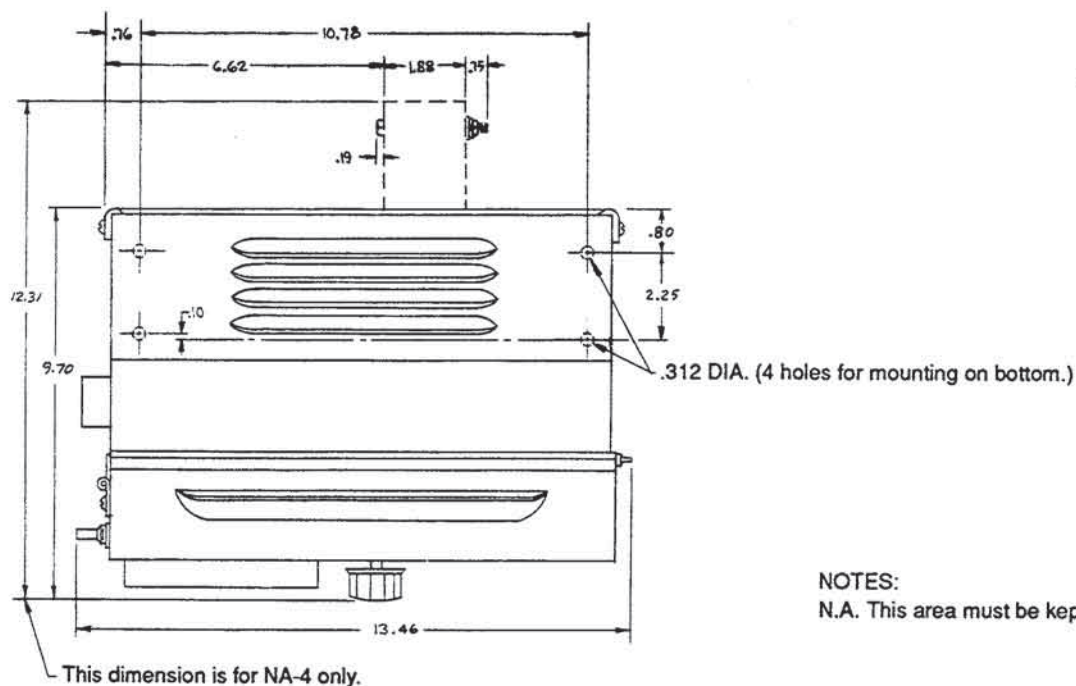
FOR CONTROL P.C. JAMERS, LEX-100, OR JAMER USE LEX-100 SCHEMATIC FOR COMPONENT VALUES AND CIRCUIT CONNECTIONS.

CONTROL CIRCUIT

C101	47 MFD	C102	200K	C103	100K	C104	100K	C105	100K	C106	100K	C107	100K	C108	100K	C109	100K	C110	100K	C111	100K	C112	100K	C113	100K	C114	100K	C115	100K	C116	100K	C117	100K	C118	100K	C119	100K	C120	100K	C121	100K	C122	100K	C123	100K	C124	100K	C125	100K	C126	100K	C127	100K	C128	100K	C129	100K	C130	100K	C131	100K	C132	100K	C133	100K	C134	100K	C135	100K	C136	100K	C137	100K	C138	100K	C139	100K	C140	100K	C141	100K	C142	100K	C143	100K	C144	100K	C145	100K	C146	100K	C147	100K	C148	100K	C149	100K	C150	100K	C151	100K	C152	100K	C153	100K	C154	100K	C155	100K	C156	100K	C157	100K	C158	100K	C159	100K	C160	100K	C161	100K	C162	100K	C163	100K	C164	100K	C165	100K	C166	100K	C167	100K	C168	100K	C169	100K	C170	100K	C171	100K	C172	100K	C173	100K	C174	100K	C175	100K	C176	100K	C177	100K	C178	100K	C179	100K	C180	100K	C181	100K	C182	100K	C183	100K	C184	100K	C185	100K	C186	100K	C187	100K	C188	100K	C189	100K	C190	100K	C191	100K	C192	100K	C193	100K	C194	100K	C195	100K	C196	100K	C197	100K	C198	100K	C199	100K	C200	100K	C201	100K	C202	100K	C203	100K	C204	100K	C205	100K	C206	100K	C207	100K	C208	100K	C209	100K	C210	100K	C211	100K	C212	100K	C213	100K	C214	100K	C215	100K	C216	100K	C217	100K	C218	100K	C219	100K	C220	100K	C221	100K	C222	100K	C223	100K	C224	100K	C225	100K	C226	100K	C227	100K	C228	100K	C229	100K	C230	100K	C231	100K	C232	100K	C233	100K	C234	100K	C235	100K	C236	100K	C237	100K	C238	100K	C239	100K	C240	100K	C241	100K	C242	100K	C243	100K	C244	100K	C245	100K	C246	100K	C247	100K	C248	100K	C249	100K	C250	100K	C251	100K	C252	100K	C253	100K	C254	100K	C255	100K	C256	100K	C257	100K	C258	100K	C259	100K	C260	100K	C261	100K	C262	100K	C263	100K	C264	100K	C265	100K	C266	100K	C267	100K	C268	100K	C269	100K	C270	100K	C271	100K	C272	100K	C273	100K	C274	100K	C275	100K	C276	100K	C277	100K	C278	100K	C279	100K	C280	100K	C281	100K	C282	100K	C283	100K	C284	100K	C285	100K	C286	100K	C287	100K	C288	100K	C289	100K	C290	100K	C291	100K	C292	100K	C293	100K	C294	100K	C295	100K	C296	100K	C297	100K	C298	100K	C299	100K	C300	100K	C301	100K	C302	100K	C303	100K	C304	100K	C305	100K	C306	100K	C307	100K	C308	100K	C309	100K	C310	100K	C311	100K	C312	100K	C313	100K	C314	100K	C315	100K	C316	100K	C317	100K	C318	100K	C319	100K	C320	100K	C321	100K	C322	100K	C323	100K	C324	100K	C325	100K	C326	100K	C327	100K	C328	100K	C329	100K	C330	100K	C331	100K	C332	100K	C333	100K	C334	100K	C335	100K	C336	100K	C337	100K	C338	100K	C339	100K	C340	100K	C341	100K	C342	100K	C343	100K	C344	100K	C345	100K	C346	100K	C347	100K	C348	100K	C349	100K	C350	100K	C351	100K	C352	100K	C353	100K	C354	100K	C355	100K	C356	100K	C357	100K	C358	100K	C359	100K	C360	100K	C361	100K	C362	100K	C363	100K	C364	100K	C365	100K	C366	100K	C367	100K	C368	100K	C369	100K	C370	100K	C371	100K	C372	100K	C373	100K	C374	100K	C375	100K	C376	100K	C377	100K	C378	100K	C379	100K	C380	100K	C381	100K	C382	100K	C383	100K	C384	100K	C385	100K	C386	100K	C387	100K	C388	100K	C389	100K	C390	100K	C391	100K	C392	100K	C393	100K	C394	100K	C395	100K	C396	100K	C397	100K	C398	100K	C399	100K	C400	100K	C401	100K	C402	100K	C403	100K	C404	100K	C405	100K	C406	100K	C407	100K	C408	100K	C409	100K	C410	100K	C411	100K	C412	100K	C413	100K	C414	100K	C415	100K	C416	100K	C417	100K	C418	100K	C419	100K	C420	100K	C421	100K	C422	100K	C423	100K	C424	100K	C425	100K	C426	100K	C427	100K	C428	100K	C429	100K	C430	100K	C431	100K	C432	100K	C433	100K	C434	100K	C435	100K	C436	100K	C437	100K	C438	100K	C439	100K	C440	100K	C441	100K	C442	100K	C443	100K	C444	100K	C445	100K	C446	100K	C447	100K	C448	100K	C449	100K	C450	100K	C451	100K	C452	100K	C453	100K	C454	100K	C455	100K	C456	100K	C457	100K	C458	100K	C459	100K	C460	100K	C461	100K	C462	100K	C463	100K	C464	100K	C465	100K	C466	100K	C467	100K	C468	100K	C469	100K	C470	100K	C471	100K	C472	100K	C473	100K	C474	100K	C475	100K	C476	100K	C477	100K	C478	100K	C479	100K	C480	100K	C481	100K	C482	100K	C483	100K	C484	100K	C485	100K	C486	100K	C487	100K	C488	100K	C489	100K	C490	100K	C491	100K	C492	100K	C493	100K	C494	100K	C495	100K	C496	100K	C497	100K	C498	100K
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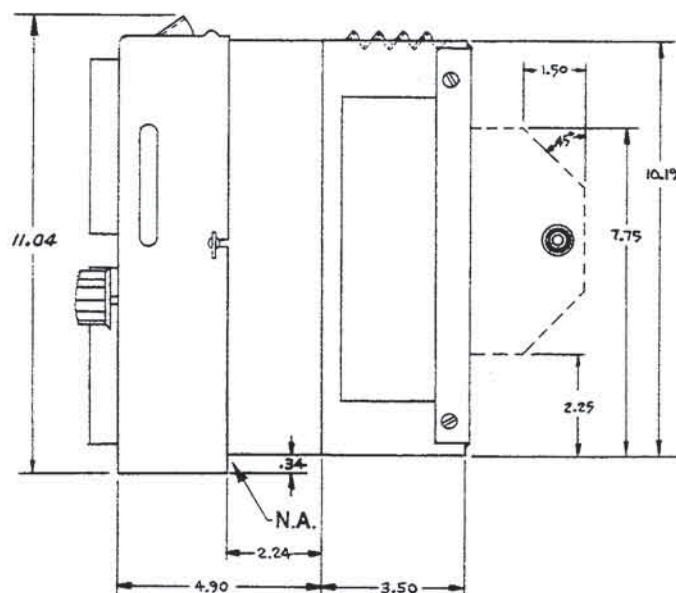
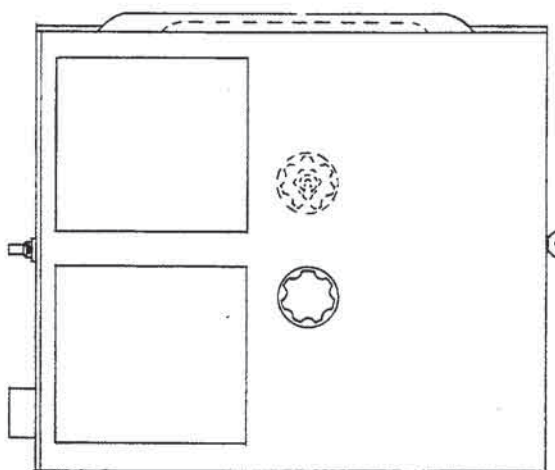
NA-3 (All Models) and NA-4 CONTROL BOX DIMENSIONS



All Dimensions in Inches

NOTES:

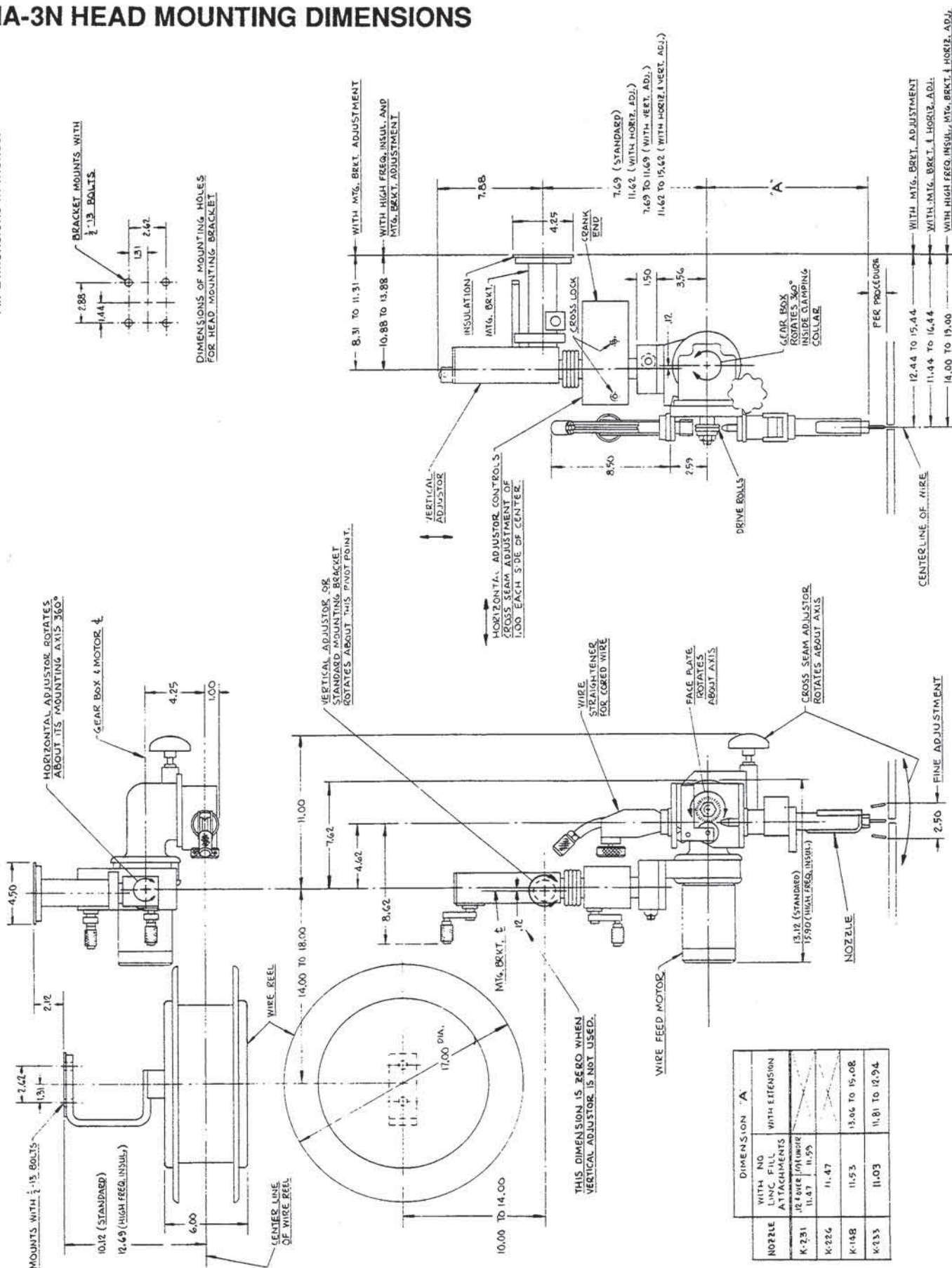
N.A. This area must be kept clear for ventilation.



Drawing: L5311

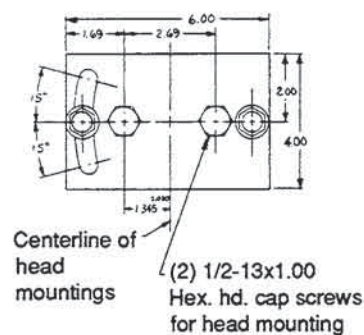
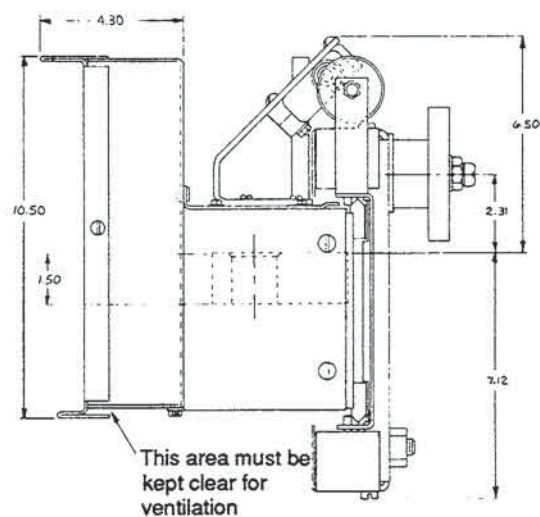
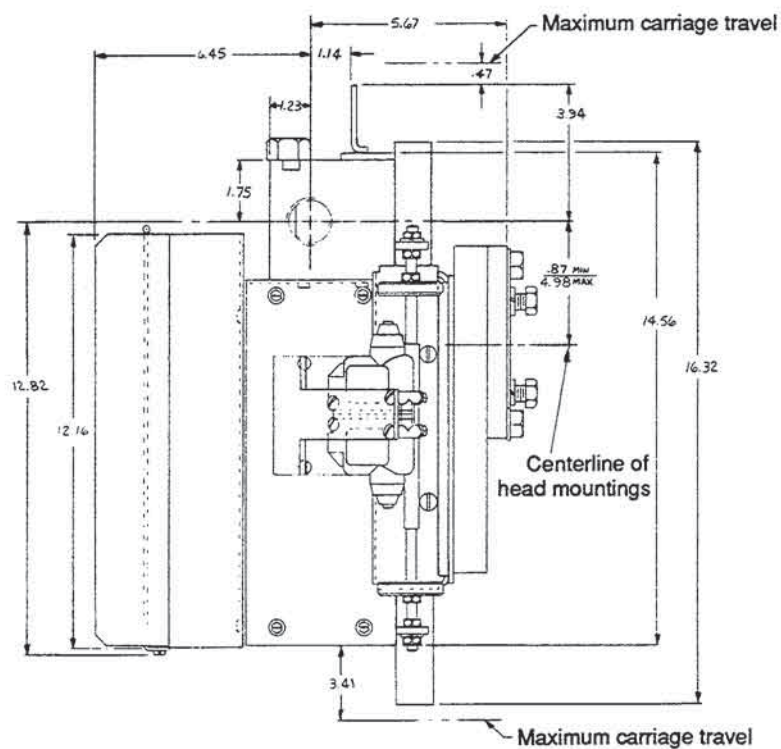
NA-3N HEAD MOUNTING DIMENSIONS

All Dimensions in Inches.



NOZZLE	DIMENSION "A"		
	WITH NO. LINC. FILL ATTACHMENTS	WITH EXTENSION	
K-231	11.47	11.53	
K-226	11.47	11.53	
K-148	11.53	13.86 TO 15.08	
K-133	11.03	11.81 TO 12.94	

K278 SPREADARC DIMENSIONS



NA-3N AND NA-3S WIRING DIAGRAM

Methods of Burnback		For earlier Logic P.C. Boards with dip switches
Wire feed stop & contactor delay	Connect Lead #633 to P3	SWITCH #1
Inch up & contactor delay	Connect Lead #633 to P1	SWITCH #1
Inch up & no contactor delay	Connect Lead #633 to P1	SWITCH #1

Methods of Travel		For earlier Logic P.C. Boards with dip switches
Start/stop with switches	Connect Lead #691 to P6	SWITCH #1
Start/stop with current	Connect Lead #691 to P6	SWITCH #1
Start with current	Connect Lead #691 to P6	SWITCH #1
Start with start switch	Connect Lead #691 to P6	SWITCH #1
Stop on start switch	Connect Lead #691 to P6	SWITCH #1
Stop on start switch	Connect Lead #691 to P6	SWITCH #1

N.A. WHEN START P.C. BOARD IS INSTALLED, JUMPER CONNECTOR 'A' IS REMOVED.
N.B. THESE LEADS ARE NOT PRESENT ON LOGIC P.C. BOARDS WITH DIP SWITCHES.
N.C. WHEN VARIABLE VOLTAGE P.C. BOARD IS INSTALLED, JUMPER CONNECTOR 'C' IS REMOVED.
N.D. 531-532 115VAC
N.E. 531-532 115VAC (SWITCHED) 250VA
N.F. 87-531 115VAC - 1/2A SWITCHED.
N.G. ON EARLIER UNITS, LEAD #689 WAS LOCATED BETWEEN *31 AND *67 FORMERLY *51 LEAD #510 WAS LOCATED BETWEEN *87 AND *32 AND LEAD #51 WAS LOCATED NEXT TO *68. CAREFULLY NOTE LEAD POSITIONS BEFORE MAKING ANY CONNECTIONS TO TERMINAL STRIP.
N.H. THIS LEAD IS PRESENT ON CODES 10311 AND HIGHER.
N.I. THESE LEADS ARE NOT PRESENT ON EARLIER START AND CRATER FILL P.C. BOARDS.
N.J. ALL FUSES WERE REPLACED WITH PTC RESETTABLE FUSES ON LATER CONTROL P.C. BOARDS.

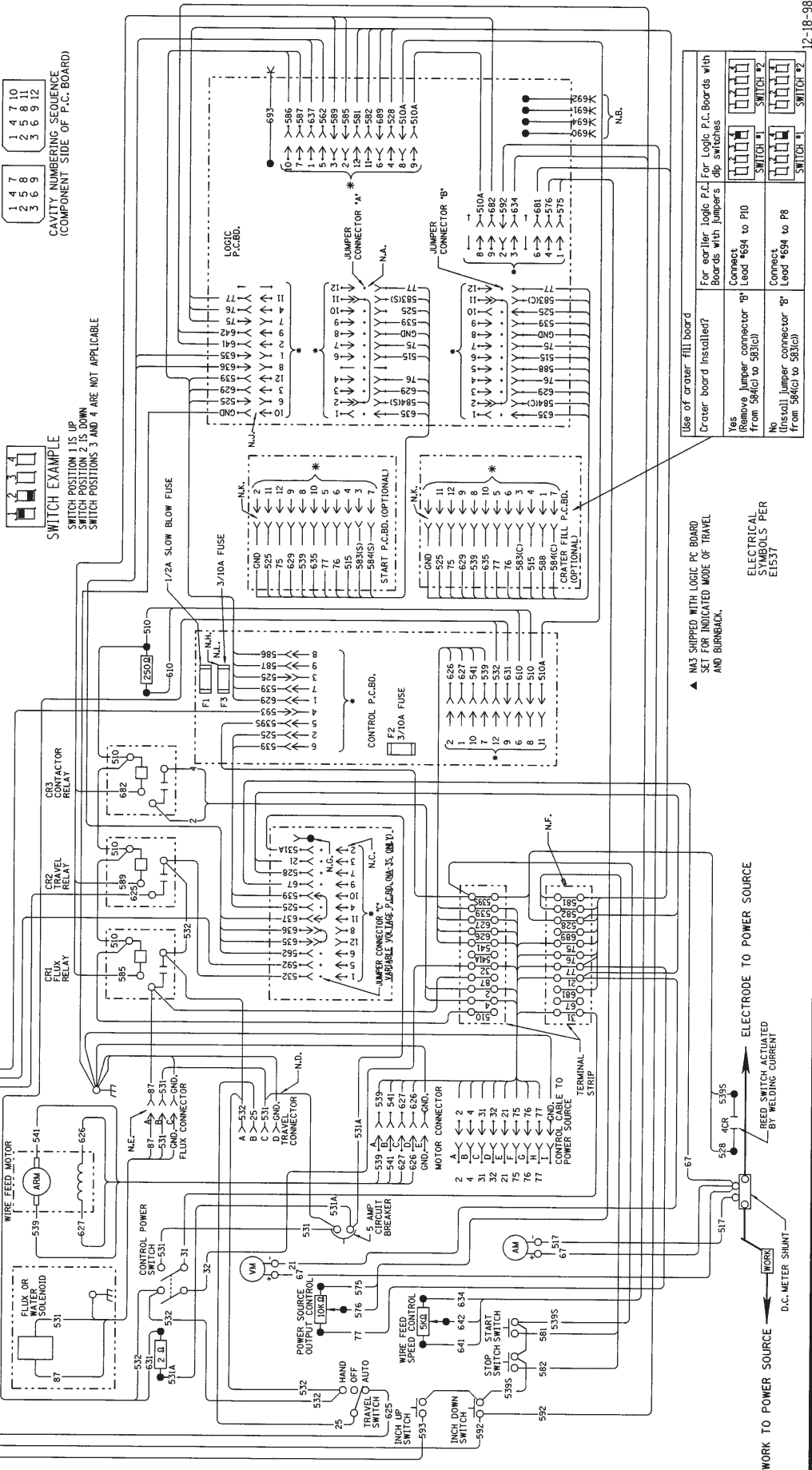
* INDICATES CONNECTOR CAVITY NUMBERS

1 4 7	1 4 7 10
2 5 8	2 5 8 11
3 6 9	3 6 9 12

CAVITY NUMBERING SEQUENCE (COMPONENT SIDE OF P.C. BOARD)

SWITCH EXAMPLE

SWITCH POSITION 1 IS UP
SWITCH POSITION 2 IS DOWN
SWITCH POSITIONS 3 AND 4 ARE NOT APPLICABLE



Use of crater fill board		For earlier Logic P.C. Boards with dip switches
Yes (Remove jumper connector 'B' from 584(c) to 583(c))	Connect Lead #634 to P10	SWITCH #1
No (Install jumper connector 'B' from 584(c) to 583(c))	Connect Lead #634 to P8	SWITCH #2

ELECTRICAL SYMBOLS PER E1557

NA-4 WITH CURRENT CONTROL RHEOSTAT

N.A. WHEN START P.C. BOARD IS INSTALLED, JUMPER CONNECTOR 'A' IS REMOVED.
 N.B. THESE LEADS ARE NOT PRESENT ON LOGIC P.C. BOARDS WITH DIP SWITCHES.
 N.C. 531-532 115VAC-531-25 115VAC (SWITCHED) - 250 VA
 N.D. 87-531 115VAC - 1/2A SWITCHED.
 N.E. ON EARLIER UNITS LEAD #689 WAS LOCATED BETWEEN #31 AND #67. FORMERLY LEAD #689 WAS LOCATED NEXT TO #689. NOTE LEAD POSITIONS BEFORE MAKING ANY CONNECTIONS TO TERMINAL STRIP.
 N.F. JUMPER LEAD TO BE CONNECTED TO PIN 'H' AT ALL TIMES.
 N.G. UNIT SHIPPED WITH LEAD IN THIS POSITION.
 N.H. THIS LEAD PRESENT ON CODE 10318 AND HIGHER. THESE LEADS ARE NOT PRESENT ON EARLIER START AND CRATER FILL P.C. BOARDS.
 N.K. ALL FUSES WERE REPLACED WITH PTC RESETTABLE FUSES ON LATER CONTROL P.C. BOARDS.
 ELECTRICAL SYMBOLS PER E137.
 * INDICATES CONNECTOR CAVITY NUMBERS
 CAVITY NUMBERING SEQUENCE (COMPONENT SIDE OF P.C. BOARD)

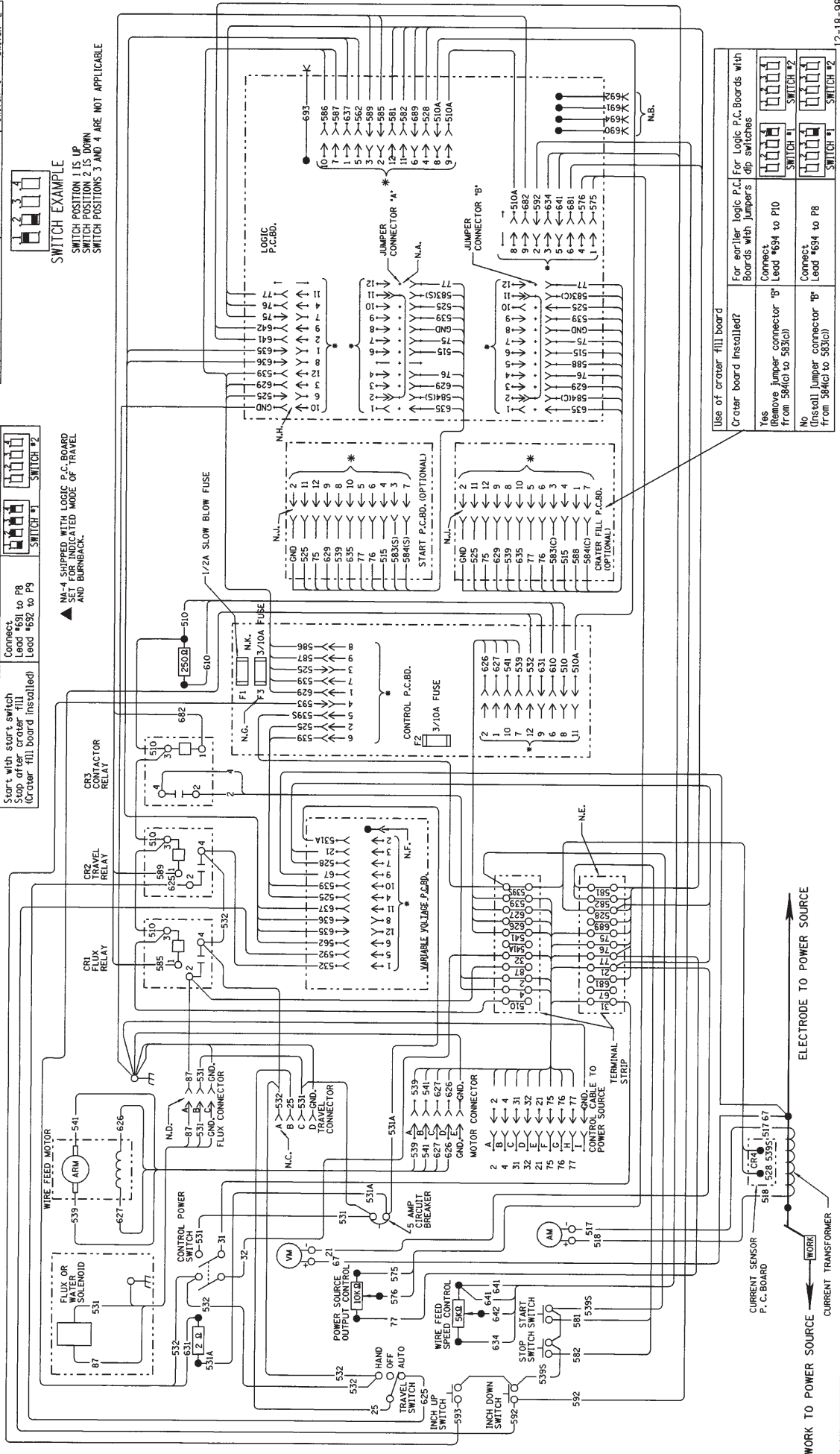
Methods of Travel	For earlier logic P.C. Boards with Boards with jumpers	For Logic P.C. Boards with dip switches
Start/stop with switches	Connect Lead #591 to P6	Connect Lead #591 to P6
Start/stop with current	Connect Lead #591 to P6	Connect Lead #591 to P6
Start with current	Connect Lead #591 to P6	Connect Lead #591 to P6
Stop with stop switch	Connect Lead #591 to P6	Connect Lead #591 to P6
Start with start switch	Connect Lead #591 to P6	Connect Lead #591 to P6
Stop with stop switch	Connect Lead #591 to P6	Connect Lead #591 to P6
Start with start switch	Connect Lead #591 to P6	Connect Lead #591 to P6
Stop with stop switch	Connect Lead #591 to P6	Connect Lead #591 to P6

Methods of Burnback	For earlier logic P.C. Boards with Boards with jumpers	For Logic P.C. Boards with dip switches
Wire feed stop & contactor delay	Connect Lead #633 to P3	Connect Lead #633 to P3
Inch up & contactor delay	Connect Lead #633 to P4	Connect Lead #633 to P4
Inch up & no contactor delay	Connect Lead #633 to P1	Connect Lead #633 to P1
Inch up & no contactor delay	Connect Lead #633 to P2	Connect Lead #633 to P2



SWITCH POSITION 1 IS UP
 SWITCH POSITION 2 IS DOWN
 SWITCH POSITIONS 3 AND 4 ARE NOT APPLICABLE

▲ N.A.4 SUPPLIED WITH LOGIC P.C. BOARD SET FOR INDICATED MODE OF TRAVEL AND BURNBACK.



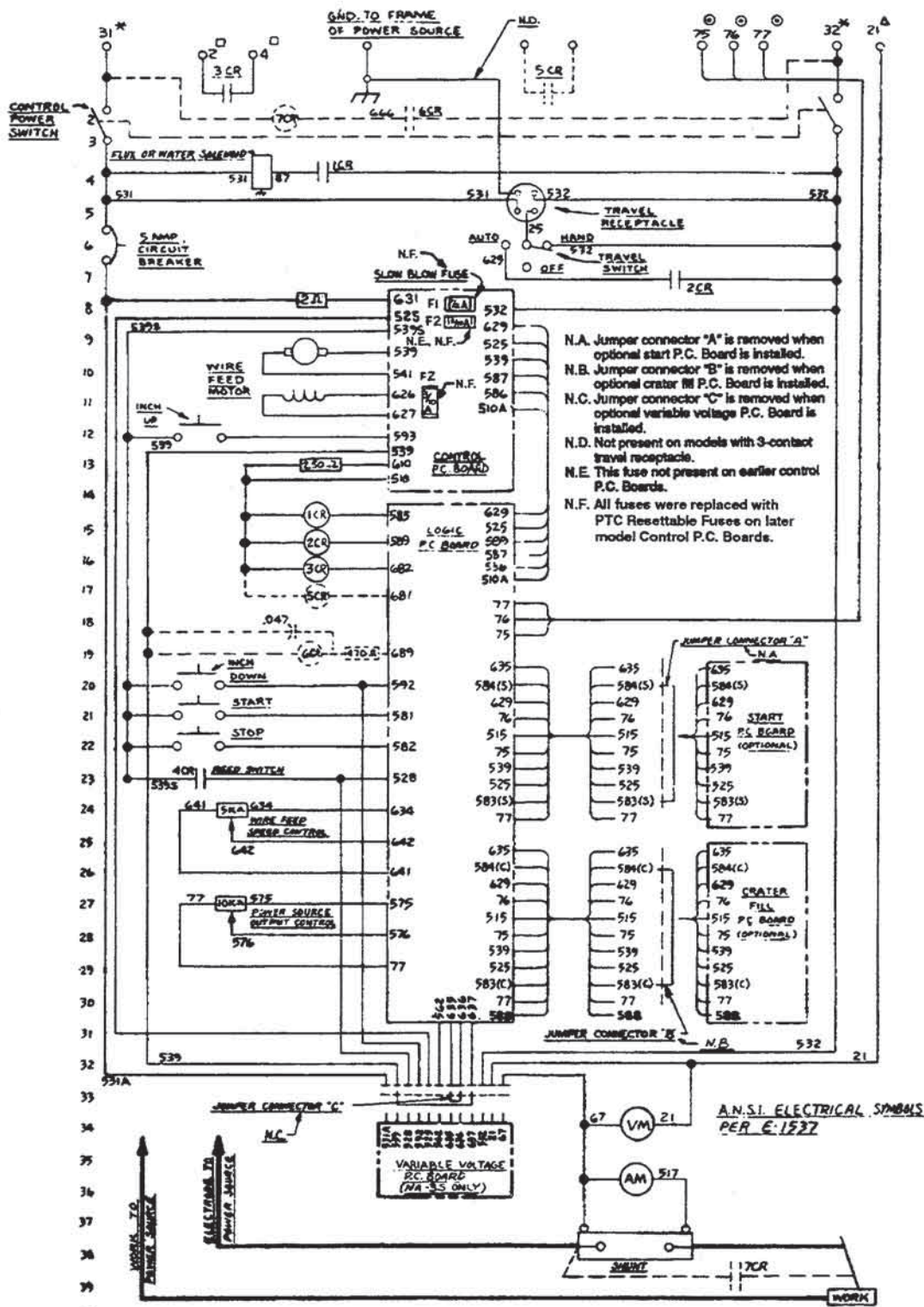
Use of crater fill board	For earlier logic P.C. Boards with Boards with jumpers	For Logic P.C. Boards with dip switches
Crater board installed?	Connect Lead #594 to P10	Connect Lead #594 to P10
Yes (Remove jumper connector 'B' from 584(c) to 583(c))	Connect Lead #594 to P8	Connect Lead #594 to P8
No (Install Jumper connector 'B' from 584(c) to 583(c))	Connect Lead #594 to P8	Connect Lead #594 to P8

* TRANSIENT PROTECTION
CAPACITORS ADDED WHEN
RECTIFIERS WERE CHANGED
FROM SELENIUM TO SILICON
IN 1967.

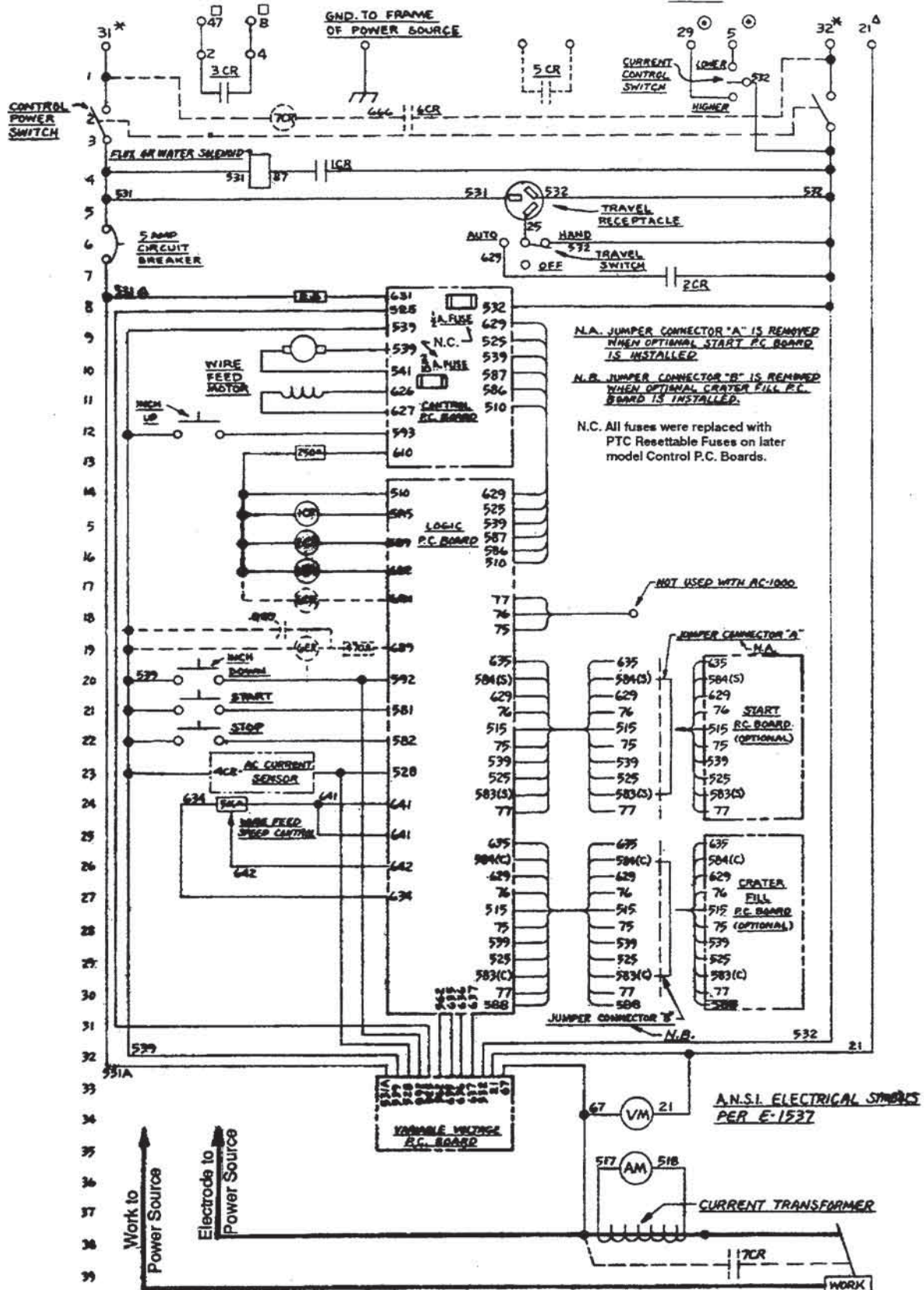


NA-3 (All Models) CONNECTION SCHEMATIC

(For Codes Below 7432, Request M-12610)

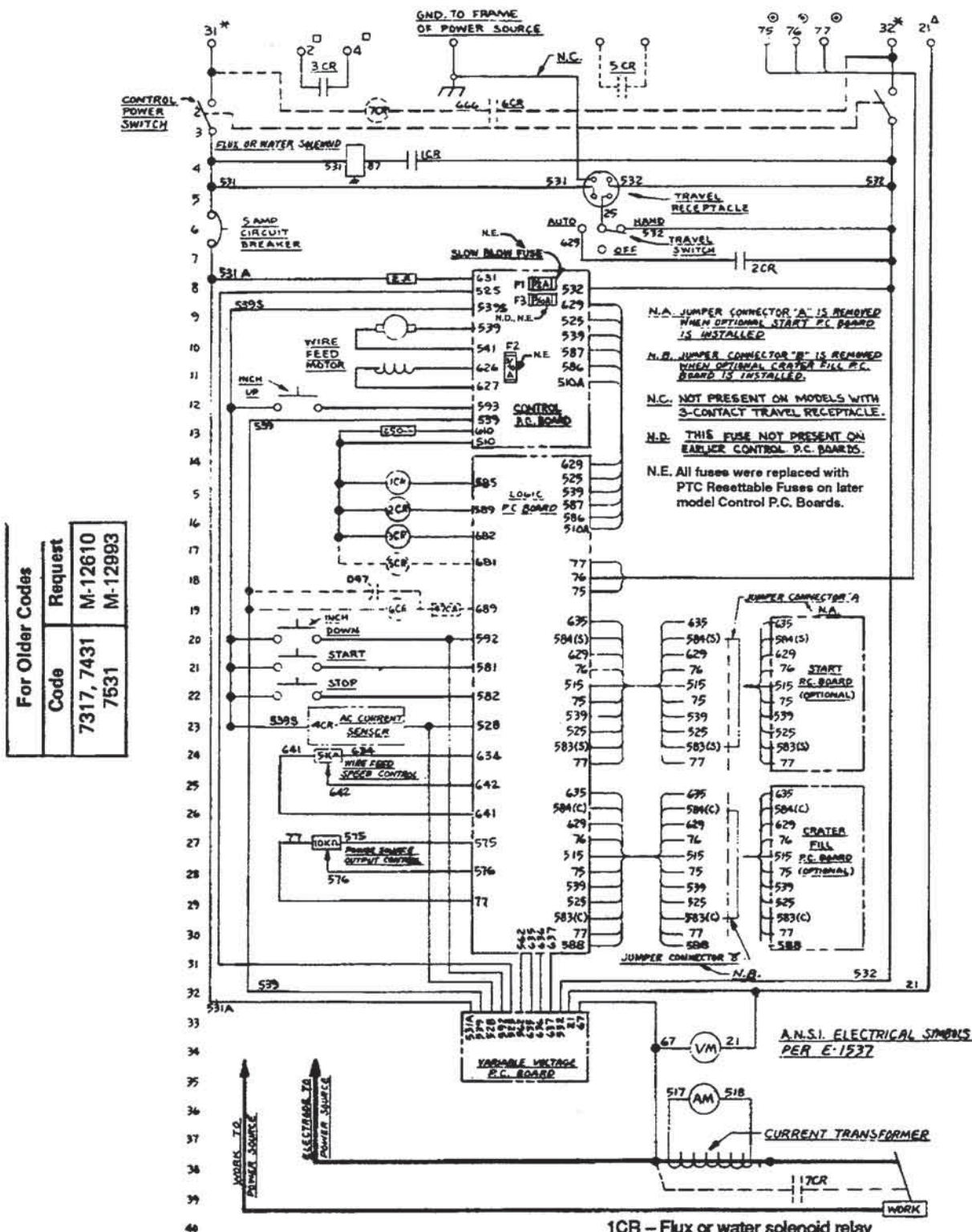


NA-4 CONNECTION SCHEMATIC TO AC-1000



NA-4 CONNECTION SCHEMATIC

(For K-248 Controls with Current Control Rheostat Only)



For Older Codes	
Code	Request
7317, 7431	M-12610
7531	M-12893

- * 31-32 11 VAC, 50-60 HZ.
- 2-4 operates power source contactor
- Δ 21 to #21 terminal (or work stud) on power source
- ⊙ 75-76-77 to Lincoln power source output control circuit

Optional Linc-Fill starting relay kit

- 1CR - Flux or water solenoid relay
- 2CR - Travel relay
- 3CR - Contactor relay
- 4CR - Reed switch actuated by welding current
- 5CR - Optional relay actuated by 4CR circuit
- 6CR - Solid-state relay for Linc-Fill starting relay operation
- 7CR - Linc-Fill starting relay

AUTOMATICS AND CARRIAGE INSTALLATION INSTRUCTIONS

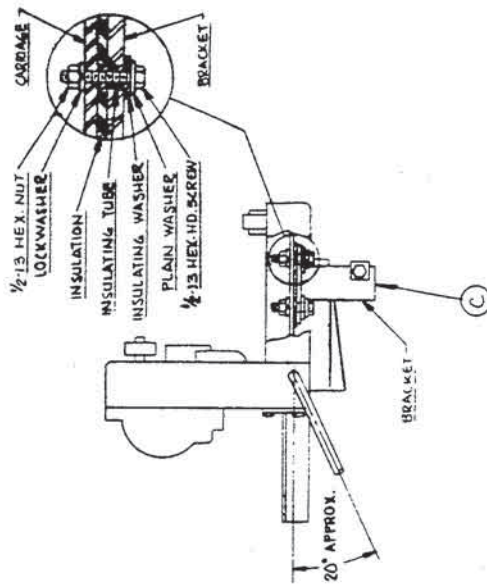


FIG. 3

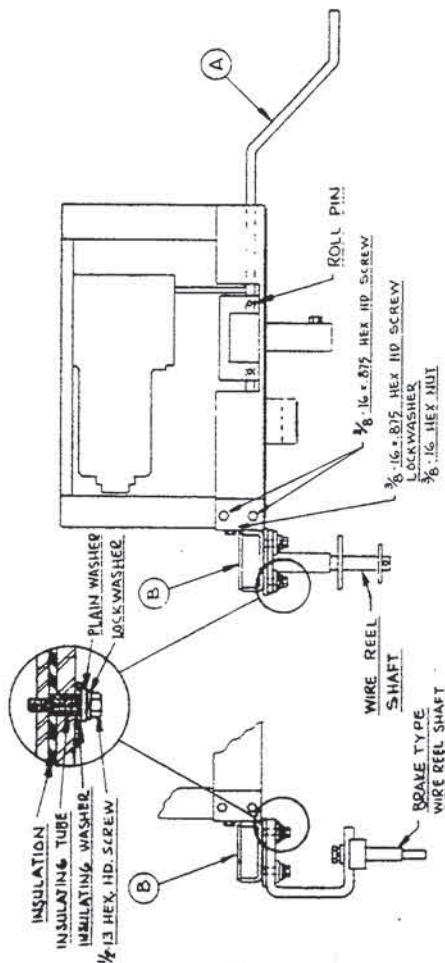


FIG. 1

FIG. 2

INSTALLATION INSTRUCTIONS

Before the carriage is placed upon the beam:

- Insert the clutch handle (A) thru the hole in the right hand side of the carriage. Push the handle thru the carriage frame until the end goes into the lift yoke. Line up the roll pin hole in the yoke & crank and then insert the roll pin, which is shipped taped to the crank handle. Drive the roll pin until it is flush with yoke arm surface.
- Install the wire reel mounting bracket (B) to the upper left front corner of the carriage using the hardware supplied. For LAF-3, -4, -5, install wire reel shaft, supplied with the head, per Fig. 1. For NA-3 & NA-4, install wire reel shaft, supplied with the head, per Fig. 2. In either case, wire reel shaft must be electrically isolated from carriage frame.
- Install the head mounting bracket (C), which is supplied with the wire feeder, to the head lift plate per Fig. 3 using the hardware and insulation supplied. The head mount is to be electrically isolated from the carriage frame.
- Install the control box (D) to the upper right front corner of the carriage using the hardware supplied. For LAF-3, -4, -5, install control box per Fig. 5. The LAF control box must be electrically isolated from the carriage frame. For NA-3 & NA-4, install control box mounting plate to the bottom of the control box and then mount the assembly to the carriage per Fig. 4.

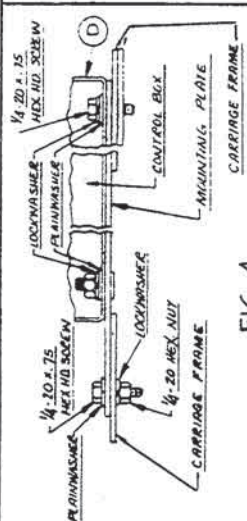


FIG. 4

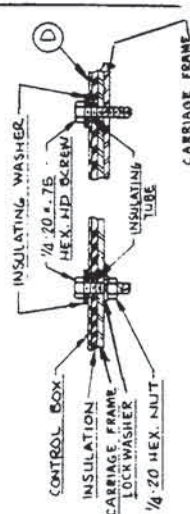
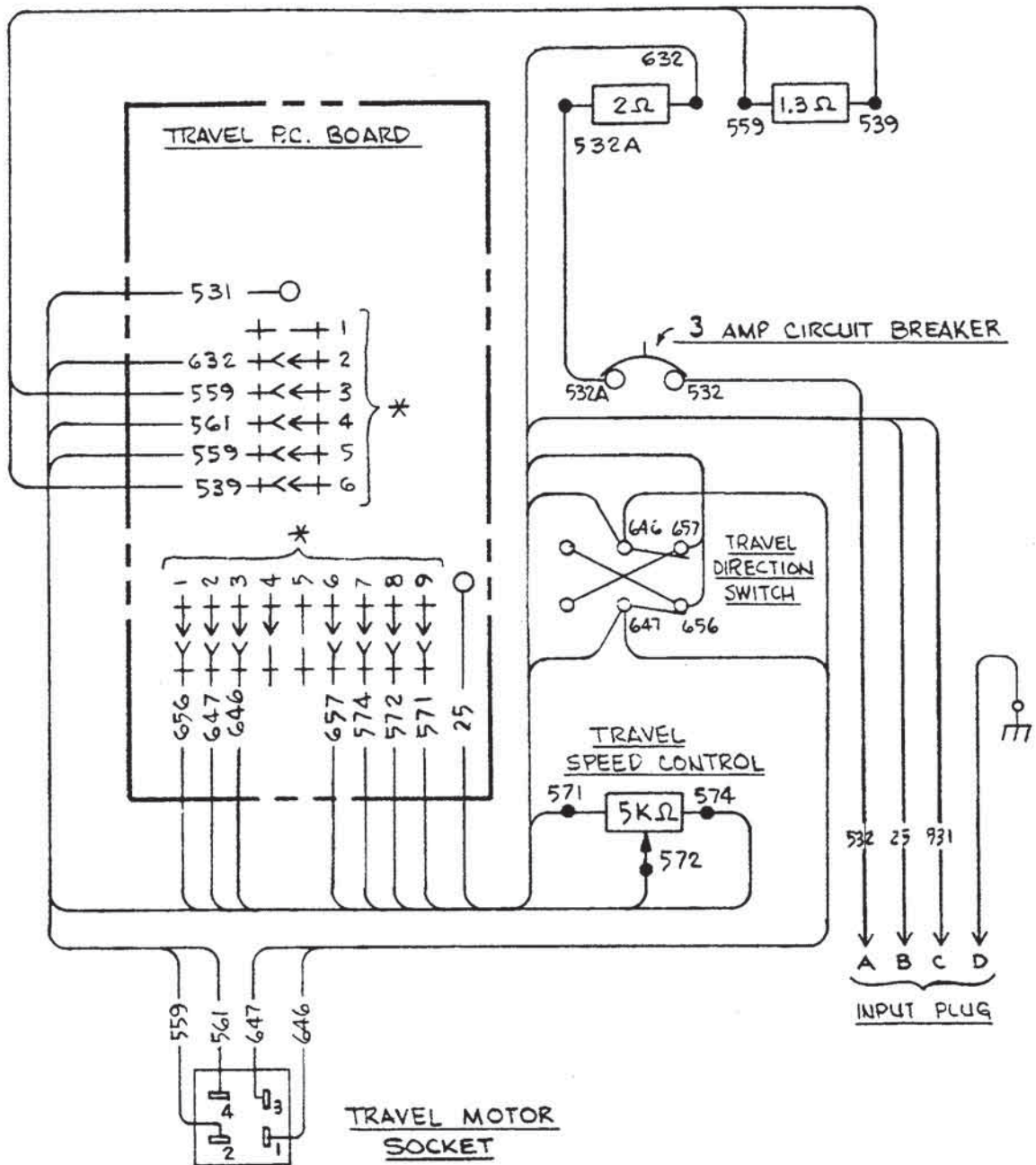
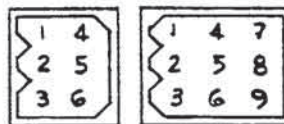


FIG. 5

TC-3 CARRIAGE



* INDICATES CONNECTOR CAVITY NUMBERS

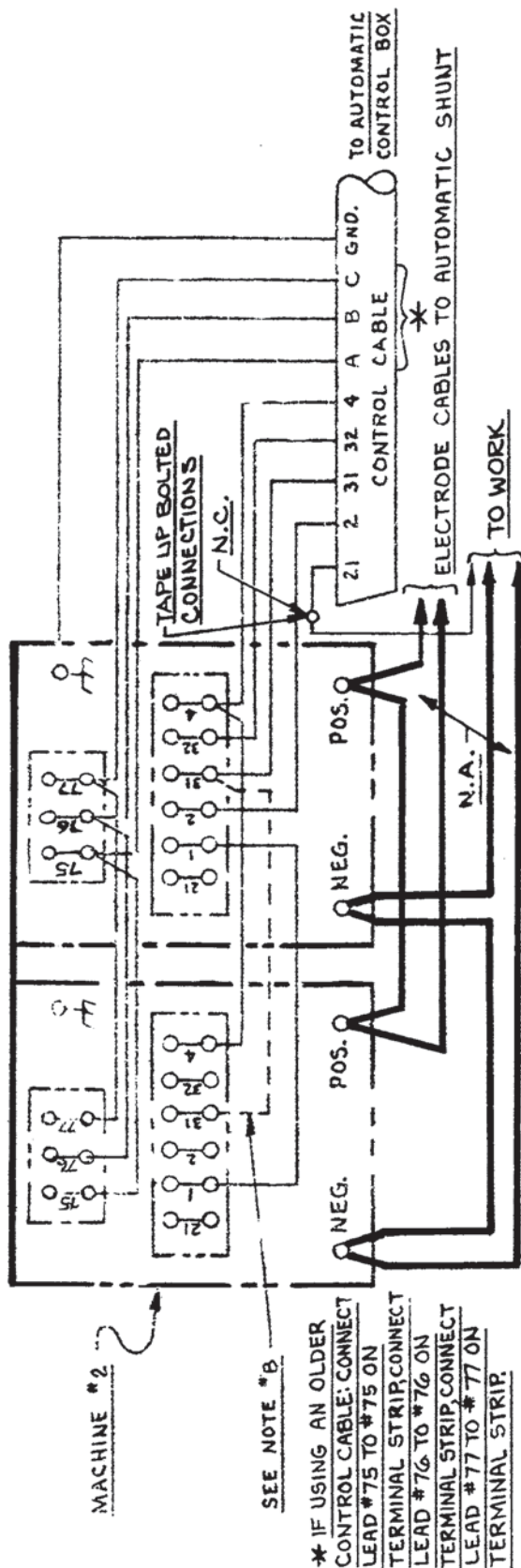


CAVITY NUMBERING SEQUENCE
(COMPONENT SIDE OF P.C. BOARD)

ELECTRICAL SYMBOLS PER E-1537

PARALLELING DIAGRAM-R3S WELDER WITH MAG-AMP VOLTAGE CONTROL

Connected to NA-3, LT-5 or LT-7



1. Welders to be paralleled must be of the same size and model.
2. Connect the two machines to same set of input lines. Connect each phase to a "like" line terminal on reconnect panel. Failure to do so may result in damage to the R3S printed circuit boards.
3. Connect "like" output terminals together, using equal lengths of #4/0 welding cable.
4. The "Fine Voltage Control" and "Voltage Selector" must be at the same setting on both machines.
5. The "Fine Voltage Control Switch" on both machines must be in the "Remote" position. Amount of control will be limited to about 3 volts compared to the normal range of 7 volts.
6. The "Control Circuit Switch" of both machines must be at the same setting.
7. Connect the control cable ground lead to the frame terminal marked near the power source terminal strip or to an unpainted frame screw. The power source, must be properly grounded.
8. On machines without terminal #1 on terminal strip. Add a jumper between the #31 terminals, both machines must have same type of terminal strips.

- N.A.** Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.
- N.B.** If a variable voltage board is present in the automatic controls the jumper lead on the V.V. board must be connected to Pin "1".
- N.C.** Extend lead #2 using #14 or larger insulated wire physically suitable for the installation. An S16586-1 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.

NA-3N AND NA-3S WIRING DIAGRAM

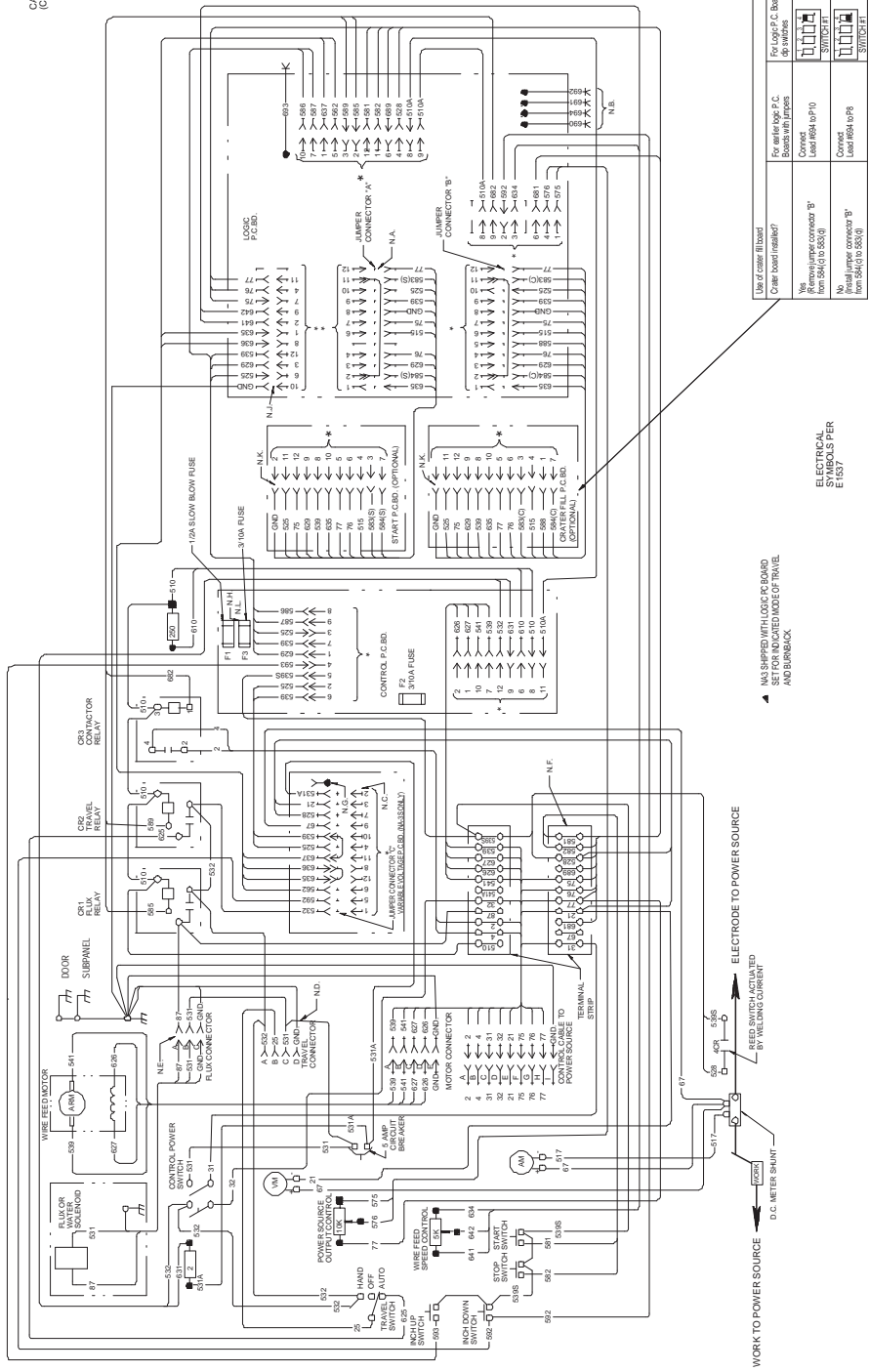
Methods of Travel	For Logic P.C. Boards with dip switches
Wire headstop & connector delay	30T0CHZ
W/O up & connector delay	30T0CHZ
W/O up & no connector delay	30T0CHZ

Methods of Travel	For Logic P.C. Boards with dip switches
Startstop with wireweld	30T0CHZ
Startstop with wireweld	30T0CHZ
Start with wireweld	30T0CHZ
Start with wireweld	30T0CHZ
Start with wireweld	30T0CHZ
Start with wireweld	30T0CHZ



N.A. WHEN START P.C. BOARD IS INSTALLED, JUMPER CONNECTOR "A" IS REMOVED.
N.B. THESE LEADS ARE NOT PRESENT ON LOGIC P.C. BOARDS.
N.C. JUMPER VARIABLE VOLTAGE P.C. BOARD UNINSTALLED.
N.D. JUMPER CONNECTOR "C" IS REMOVED.
N.E. 50/51 15VAC - 10A SWITCHED.
N.F. 50/51 15VAC - 10A SWITCHED.
N.G. WHEN VARIABLE VOLTAGE P.C. BOARD UNINSTALLED.
N.H. THIS LEAD IS NOT PRESENT ON EARLIER CONTROL P.C. BOARD.
N.I. THESE LEADS ARE NOT PRESENT ON EARLIER START AND STOP P.C. BOARDS.
N.J. THESE LEADS ARE NOT PRESENT ON EARLIER START AND STOP P.C. BOARDS.
N.K. THESE LEADS ARE NOT PRESENT ON EARLIER START AND STOP P.C. BOARDS.
N.L. THESE LEADS ARE NOT PRESENT ON EARLIER START AND STOP P.C. BOARDS.

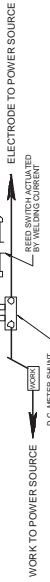
* INDICATES CONNECTOR CAVITY NUMBERS
CAVITY NUMBERING SEQUENCE
(COMPONENT SIDE OF P.C. BOARD)



Use of Logic P.C. Board	For Logic P.C. Boards with dip switches
Yes (reference jumper connector "B" from 50/51 to 50/52)	30T0CHZ
No (reference jumper connector "B" from 50/51 to 50/53)	30T0CHZ

ELECTRICAL SYMBOLS PER E1637

▲ N/A SHIPPED WITH LOGIC P.C. BOARD SET FOR NO CONNECT MODE OF TRAVEL AND TURNBACK

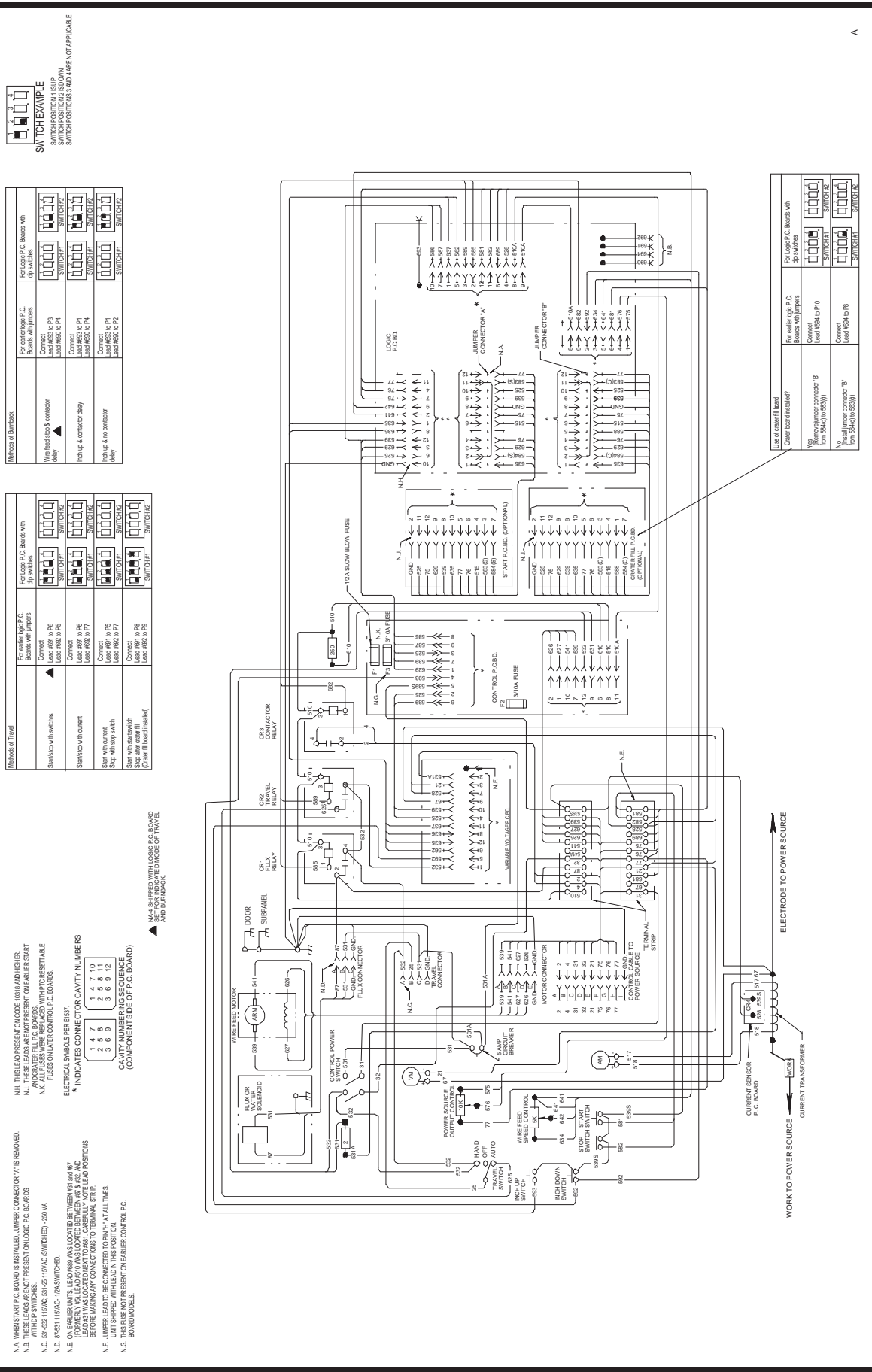


A

L6488-1

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

NA-4 WITH CURRENT CONTROL RHEOSTAT



L6489-1

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

WARNING	<ul style="list-style-type: none"> Do not touch electrically live parts or electrode with skin or wet clothing. Insulate yourself from work and ground. 	<ul style="list-style-type: none"> Keep flammable materials away. 	<ul style="list-style-type: none"> Wear eye, ear and body protection.
Spanish AVISO DE PRECAUCION	<ul style="list-style-type: none"> No toque las partes o los electrodos bajo carga con la piel o ropa mojada. Aislese del trabajo y de la tierra. 	<ul style="list-style-type: none"> Mantenga el material combustible fuera del área de trabajo. 	<ul style="list-style-type: none"> Protégase los ojos, los oídos y el cuerpo.
French ATTENTION	<ul style="list-style-type: none"> Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. Isolez-vous du travail et de la terre. 	<ul style="list-style-type: none"> Gardez à l'écart de tout matériel inflammable. 	<ul style="list-style-type: none"> Protégez vos yeux, vos oreilles et votre corps.
German WARNUNG	<ul style="list-style-type: none"> Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! Isolieren Sie sich von den Elektroden und dem Erdboden! 	<ul style="list-style-type: none"> Entfernen Sie brennbares Material! 	<ul style="list-style-type: none"> Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese ATENÇÃO	<ul style="list-style-type: none"> Não toque partes elétricas e electrodos com a pele ou roupa molhada. Isole-se da peça e terra. 	<ul style="list-style-type: none"> Mantenha inflamáveis bem guardados. 	<ul style="list-style-type: none"> Use proteção para a vista, ouvido e corpo.
Japanese 注意事項	<ul style="list-style-type: none"> 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 施工物やアースから身体が絶縁されている様にして下さい。 	<ul style="list-style-type: none"> 燃えやすいものの側での溶接作業は絶対にしてはなりません。 	<ul style="list-style-type: none"> 目、耳及び身体に保護具をして下さい。
Chinese 警告	<ul style="list-style-type: none"> 皮肤或湿衣物切勿接触带电部件及焊条。 使你自已与地面和工件绝缘。 	<ul style="list-style-type: none"> 把一切易燃物品移離工作場所。 	<ul style="list-style-type: none"> 佩戴眼、耳及身體勞動保護用具。
Korean 위험	<ul style="list-style-type: none"> 전도체나 용접봉을 젖은 형갑 또는 피부로 절대 접촉치 마십시오. 모재와 접지를 접촉치 마십시오. 	<ul style="list-style-type: none"> 인화성 물질을 접근 시키지 마시오. 	<ul style="list-style-type: none"> 눈, 귀와 몸에 보호장구를 착용하십시오.
Arabic تحذير	<ul style="list-style-type: none"> لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الألكترود بجلد الجسم أو بالملابس المبللة بالماء. ضع عازلا على جسمك خلال العمل. 	<ul style="list-style-type: none"> ضع المواد القابلة للاشتعال في مكان بعيد. 	<ul style="list-style-type: none"> ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

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

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

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

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

			
<ul style="list-style-type: none"> ● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone. 	<ul style="list-style-type: none"> ● Turn power off before servicing. 	<ul style="list-style-type: none"> ● Do not operate with panel open or guards off. 	WARNING
<ul style="list-style-type: none"> ● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases. 	<ul style="list-style-type: none"> ● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio. 	<ul style="list-style-type: none"> ● No operar con panel abierto o guardas quitadas. 	Spanish AVISO DE PRECAUCION
<ul style="list-style-type: none"> ● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail. 	<ul style="list-style-type: none"> ● Débranchez le courant avant l'entretien. 	<ul style="list-style-type: none"> ● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés. 	French ATTENTION
<ul style="list-style-type: none"> ● Vermeiden Sie das Einatmen von Schweißrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes! 	<ul style="list-style-type: none"> ● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!) 	<ul style="list-style-type: none"> ● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen! 	German WARNUNG
<ul style="list-style-type: none"> ● Mantenha seu rosto da fumaça. ● Use ventilação e exaustão para remover fumo da zona respiratória. 	<ul style="list-style-type: none"> ● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas. 	<ul style="list-style-type: none"> ● Mantenha-se afastado das partes moventes. ● Não opere com os painéis abertos ou guardas removidas. 	Portuguese ATENÇÃO
<ul style="list-style-type: none"> ● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。 	<ul style="list-style-type: none"> ● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切して下さい。 	<ul style="list-style-type: none"> ● パネルやカバーを取り外したまま機械操作をしないで下さい。 	Japanese 注意事項
<ul style="list-style-type: none"> ● 頭部遠離煙霧。 ● 在呼吸區使用通風或排風器除煙。 	<ul style="list-style-type: none"> ● 維修前切斷電源。 	<ul style="list-style-type: none"> ● 儀表板打開或沒有安全罩時不準作業。 	Chinese 警告
<ul style="list-style-type: none"> ● 얼굴로부터 용접가스를 멀리하십시오. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시오. 	<ul style="list-style-type: none"> ● 보수전에 전원을 차단하십시오. 	<ul style="list-style-type: none"> ● 판넬이 열린 상태로 작동치 마십시오. 	Korean 위험
<ul style="list-style-type: none"> ● ابتعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها. 	<ul style="list-style-type: none"> ● اقطع التيار الكهربائي قبل القيام بأية صيانة. 	<ul style="list-style-type: none"> ● لا تشغيل هذا الجهاز إذا كانت الاغطية الحديدية الواقية ليست عليه. 	Arabic تحذير

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

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

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

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

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

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric is not in a position to warrant or guarantee such advice, and assumes no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

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THE LINCOLN ELECTRIC COMPANY

22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com