

Jan. 1985

*Ram*

# OPERATING MANUAL

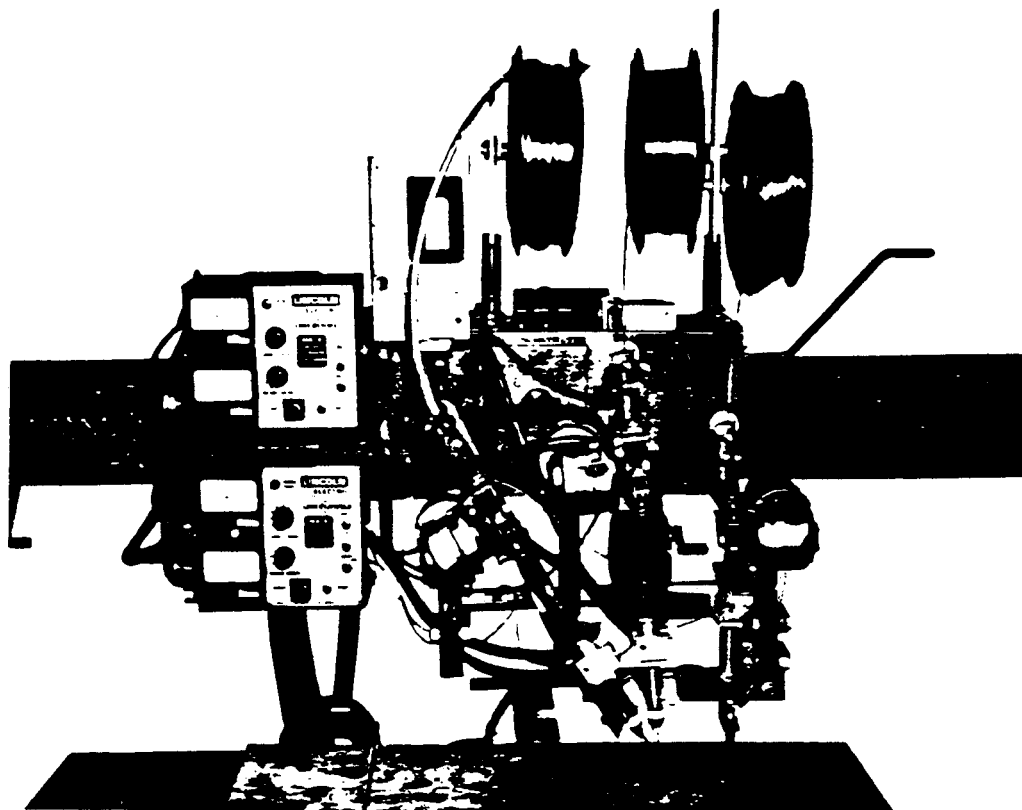


This manual covers equipment which is no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

## NA-4S4

### MODIFIED SERIES ARC WELDER "ONE SIDE WELDING SYSTEM"

IM304  
January 1985  
NA-4S4 Head - Controls  
8182; 8228; 8428; 8429; 8863;  
8864



#### SAFETY DEPENDS ON YOU

Lincoln arc welding equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS OPERATING MANUAL AND THE ARC WELDING SAFETY PRECAUTIONS ON THE INSIDE FRONT COVER.** And, most importantly, think before you act and be careful.

#### SHIPPING DAMAGE CLAIMS

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

# ARC WELDING SAFETY PRECAUTIONS

**PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. READ AND UNDERSTAND BOTH THE SPECIFIC INFORMATION GIVEN IN THE OPERATING MANUAL FOR THE WELDER AND/OR OTHER EQUIPMENT TO BE USED AS WELL AS THE FOLLOWING GENERAL INFORMATION.**

## **1 HAVE ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR WORK performed only by qualified people**

## **2 ELECTRIC SHOCK can kill.**

Protect yourself from possible dangerous electrical shock:

- a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Never permit contact between "hot" parts of the circuits and bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- b. Always insulate yourself from the work and ground by using dry insulation. When welding in damp locations, on metal floors, gratings or scaffolds, and when in positions (such as sitting or lying), make certain the insulation is large enough to cover your full area of physical contact with work and ground.
- c. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition.
- d. Never dip the electrode holder in water for cooling.
- e. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- f. If using the welder as a power source for mechanized welding, the above precautions also apply for the automatic electrode, electrode reel, welding head, nozzle or semiautomatic welding gun.
- g. When working above floor level, protect yourself from a fall should you get a shock.
- h. Ground the work or metal to be welded to a good electrical ground.
- i. Also see Item 7.

## **3 FUMES AND GASES can be dangerous to your health.**

- a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. When welding on galvanized, lead or cadmium plated steel and other metals which produce toxic fumes, even greater care must be taken.
- b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- c. Also see Item 8b.

## **4 ARC RAYS can injure eyes and burn skin.**

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

## **5 FIRE OR EXPLOSION can cause death or property damage.**

- a. Remove fire hazards well away from the area. If this is not possible cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Have fire extinguisher readily available.
- b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.

- c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned." For information purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1-80 from the American Welding Society (see address below).
- e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- f. Also see Items 6c and 8c.

## **Additional Safety Precautions**

### **6 For Welding in General.**

- a. Droplets of molten slag and metal are thrown or fall from the welding arc. Protect yourself with oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses when in a welding area. Use glasses with side shields when near slag chipping operations.
- b. 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.
- c. Be sure the work cable is connected to the work as close to the welding area as practical. Work cables connected to the building framework or other locations some distance from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

### **7 For Electrically Powered Equipment.**

- a. Turn off the input power using the disconnect switch at the fuse box before working on the equipment.
- b. Make the electrical installation in accordance with the National Electrical Code, all local codes and the manufacturer's recommendations.
- c. Properly ground the equipment in accordance with the National Electrical Code and the manufacturer's recommendations.

### **8 For Engine Powered Equipment.**

- a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.
- b. Operate internal combustion engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.
- c. Do not add the fuel near an open flame, welding arc or when the engine is running. Stop the engine and, if possible, allow it to cool to prevent spilled fuel from igniting on contact with hot engine parts or electrical sparks. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.
- d. 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.
- e. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

**For more detailed information it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting" — ANSI Standard Z49.1 from the American Welding Society, P.O. Box 351040 Miami, Florida 33135.**

NA-4S4 Modified Series Arc Equipment  
For Carriage or Gantry Mounting

INDEX

	<u>PAGE</u>
GENERAL DESCRIPTION AND FEATURES	1 - 4
EQUIPMENT REQUIREMENTS FOR MODIFIED SERIES ARC WELDING	5 - 6
INSTALLATION	
<u>Carriage Mounted Equipment:</u>	
Section A	
Mechanical Installation	7 - 13
Electrical Installation	13 - 20
Section C	
Loading and Positioning	25 - 34
<u>Gantry Mounted Equipment:</u>	
Section B	
Mechanical Installation	20 - 21
Electrical Installation	21 - 24
Section C	
Loading and Positioning	25 - 34
OPERATION - WELD TESTING	35 - 38
MAINTENANCE INSTRUCTIONS	39 - 42
SPARE PARTS	43
COMPONENT POSITIONING (All factory set)	45 - 49



## GENERAL DESCRIPTION AND FEATURES

The modified series arc system is a tandem arc unit for submerged arc type operation. This unit has been specifically designed so that the 'modified series type arc concept' could be applied to the one side welding technique of plate thicknesses ranging from 3/16 up to 4.00 inches.

Two units are available; namely, the K-311-B and the K-311-S. The K-311-B has all of the components preset and ready to weld beveled joints of plate thicknesses ranging from 3/8 to 4.00 inches. The K-311-S has all of its components preset for welding square edge (no preparation) plates ranging in thickness from 3/16 to 5/8 of an inch.

With a few changes in the types of nozzles used and head arrangements, either system can be converted for the other type operation (K-311-B to a K-311-S) or a (K-311-S to K-311-B).

The basic unit has two modified NA-4 type solid state controls both having start and crater P.C. boards installed. The A.C. ammeters have been replaced with 'Wire Feed Speed Meters' so actual wire feed rates can be monitored with greater accuracy. The complete wire feeder assembly can be mounted to a standard Lincoln K-325-HC-S travel carriage or some other speed controlled travel unit such as a gantry. It can also be mounted in a fixed position and the work moved. This wire feeder mounting assembly has a built-in 4" vertical adjustment and a built-in 2" horizontal adjustment. Other major changes in electrical stickouts and angular relations can be made in the head mounting supports. \*

IMPORTANT NOTE: This system does not have a sensing system built-in for either the horizontal plane or the vertical plane. For units that are mounted on Lincoln carriages, the user will have to position the plates to be welded so that the seam is parallel to the carriage travel beam in the horizontal plane within  $\pm 1/16$ . The bottom of the plate must also be held within  $\pm 1/16$  in the vertical plane with respect to the travel carriage beam. For units that are to be mounted on a user's gantry, the user will have to supply sensing and guiding mechanisms in both the horizontal and vertical planes unless the above tolerances can be met.

The options that are available with the K-311 units are as follows:

A) K-325 HC-S Carriage (standard)

The unit is designed to ride on a beam constructed of either 8 inch, 10 inch, or 12 inch structural channel. For the construction of the beam, refer to drawing G-1458. This beam is to be supplied by the user.

B) K-313 Wire Reels and Mountings

This package includes three wire reels for 50-60# coils, three brake-type insulated shafts, and all the necessary hardware to mount all of the above to the top of the standard K-325-HC-S carriage.

C) K-312 An Auxiliary Carriage

This package consists of a K-325 type carriage, minus its drive unit, head lift mechanism, lift handle, and its travel control unit. This carriage is mechanically coupled to the above driven carriage and it acts as a trailer.

The control box mounting platform is part of the package and is mounted to the front of the auxiliary carriage. Also included in this package is the flux hopper, its mounting bracket, and the necessary hose and tubes to deliver the flux to the arc zone. The hopper and its bracket mount to the top surface of the carriage. Hopper capacity is 22 pounds. In addition, control cable extension leads and control to head welding cables are included.

D) K-215 Power Source to Control Input Cables

Two cable assemblies are required and the length required should be specified, i.e., K-215-30 for a length of 30 feet.

If the system is to be used on square edge butt welding of plate thicknesses of 5/16 thru 5/8, then an additional 4/0 cable must be added to the input cable assembly of the modified series arc K-215 cable. An additional 4/0 electrode lead from the modified control to the lead arc nozzle will also be required.

## DESCRIPTION OF THE MAIN COMPONENTS

Description and operation of the main components of the modified series arc equipment are as follows:

### A. Controls

1. A modified solid state NA-4 control for controlling the lead arc and the middle arc wire feed speed. Since both feeders are being controlled by the same NA-4 control, it was necessary to add a second wire feed motor field supply to the standard NA-4 control. The ammeter and current transformer have been replaced with a wire feed speed meter.
2. The second control is a NA-4 type and is used to control the trail arc wire feed rates. The ammeter and current transformer have been replaced with a wire feed speed meter.

VERY IMPORTANT - The wire feed speed meters in each control have been accurately adjusted for the respective wire feed units. The control boxes and wire feed units have been identified with corresponding serial numbers, and these must be used as companion units. If a replacement of a control box, motor, or a speed meter has to be made, see instructions in Maintenance Section for recalibration of the equipment.

### B. Wire Feeders

1. Lead arc wire feeder is an NA-4 type unit with an additional gear ratio added so that the total ratio is 254/1.
2. Middle arc wire feeder is the same as above.
3. The trail arc wire feeder is also a NA-4 type unit having a 142/1 ratio.

### C. Nozzles

1. On the K-311-B, the lead and middle arc both use a K-148-B positive contact type nozzle. The trail arc uses a K-148-B with a K-149-3/16 added.
2. On the K-311-S, the lead nozzle is a K-148-B type, the middle nozzle is a K-148-A type, and the trail arc is a K-148-B type.

D. Straighteners

The equipment is equipped with the solid wire straightener, M-13693.

E. Vertical Head Lift

The complete wire feeding assembly can be raised and lowered for a distance of 4.00 inches with the aid of the standard K-29 vertical head lift. All other major electrical stickout changes can be made on the individual wire feeder mounting supports.

F. Horizontal Adjuster

The complete wire feeding assembly can be moved across the seam to be welded in a horizontal direction for a distance of 2.00 inches with the aid of a K-96 cross seam adjuster.



EQUIPMENT REQUIREMENTS FOR MODIFIED SERIES ARC WELDING

(Carriage or gantry mounted)

Items 9 through 11 will provide a travel mechanism to which the wire feeders and reels can be mounted, and an auxiliary carriage for mounting control boxes and the flux hopper.

	<u>REQUIRED</u>
1) Modified Series Arc Heads and Controls	
A. For prepared plates 3/8 to 4" and over (K-311-B)	1
B. For square edge plates 5/8 and under (K-311-S)	1
2) Power Source - AC-1200 (K-1276-C)	2
3) Control and Power Input Cables (K-215-xxx)*	2
4) Electrode leads for the middle head (4/0). (Same length as the K-215 plus 4 feet.)	2
5) Jumper between AC-1200 work studs (4/0 - length as required)	1
6) Work leads size 4/0 (length as necessary from power sources to the connection point on the work piece)	4
7) Voltage pick up lead for the trail arc - size no. 6 rubber covered cable (same length as work leads)	1

\* For square edge butt welding of 5/16 thru 5/8 plate, an additional 4/0 electrode lead the same length as the K-215 power input cable will be required. Also, an additional 4/0 electrode lead from the modified series arc control box to the lead arc nozzle will be required.

REQUIRED

- 8) For installations where the equipment is installed other than the Lincoln carriage type system, the following additional extension cables (a) and (b) may be required if the standard four foot lengths are not long enough. Leads (c) and (d) must be ordered separately:
- (a) Wire feed motor to control box - L-5318-D-L 3
  - (b) If the Lincoln flux hopper (22# capacity) is used - cable extension -- L-5318-B-L 1
  - (c) (Lead arc) - 4/0 electrode leads from control box to nozzle - length as required. For units that are going to be used for welding 5/16 thru 5/8 square edge butts an additional electrode lead will be required. 2
  - (d) (Trail arc) - 4/0 electrode leads from control box to nozzle - length as required. 2

In each of the above (a, b, c, & d), the user is to determine "L" (length) required and order to suit the installation.

- 9) Travel Carriage (K-325-HC-S) 1
- 10) Unpowered auxiliary carriage, control box mountings, control cable extension leads, control to head welding cables, flux hopper, and delivery tubes (K-312) 1
- 11) Wire reels and mountings (K-313) 1
- 12) Digital wire feed speed indicator (K-283) 1

## INSTALLATION OF THE EQUIPMENT

Instructions for the installation of the series arc equipment to a Lincoln K-325-HC carriage are given in Section A (below) and Section C (Pages 25-34). Instructions for mounting series arc equipment to a gantry are in Section B (Pages 20 - 24 ) and Section C (Pages 25 - 34 ).

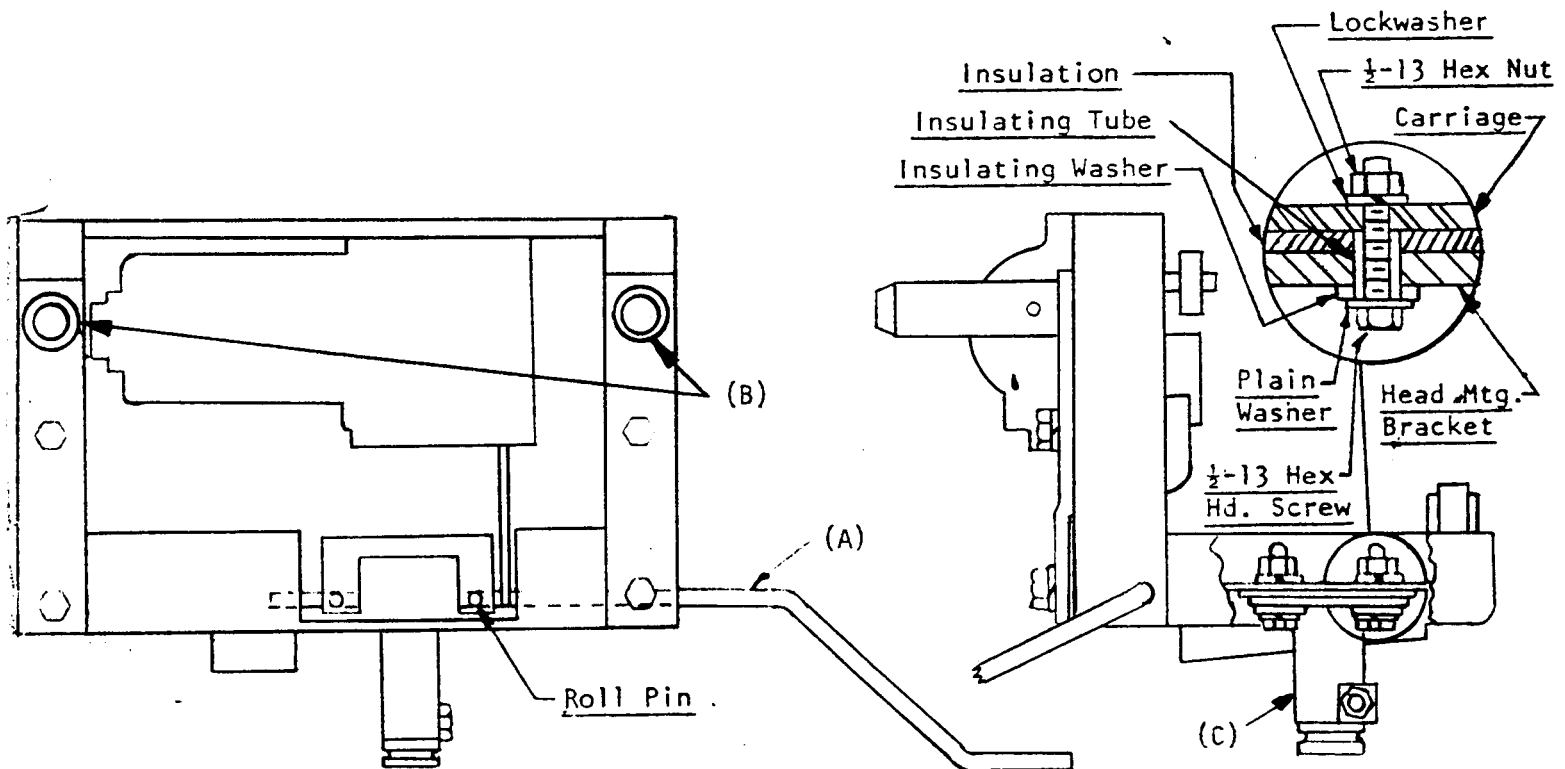
**IMPORTANT** - During the installation of the equipment, it is very important that the respective control boxes are used with their respective wire feeders. Each control has been carefully adjusted for accurate wire feed speed with its wire feed unit and must be used in this fashion. Each control and each of the wire feeders has been identified with a serial number - the control and wire feeder(s) with like serial numbers must be used together.

### Section A

#### Step A1

#### Travel Carriage (K-325-HC-S) and the Auxiliary Carriage

The carriages are designed to ride on a beam constructed of either 8 inch, 10 inch, or 12 inch channel. For the construction of the beam, refer to drawing G-1458. The carriage, as it leaves the factory, is properly shimmed and adjusted so that it will fit a beam made with 8 inch channel.

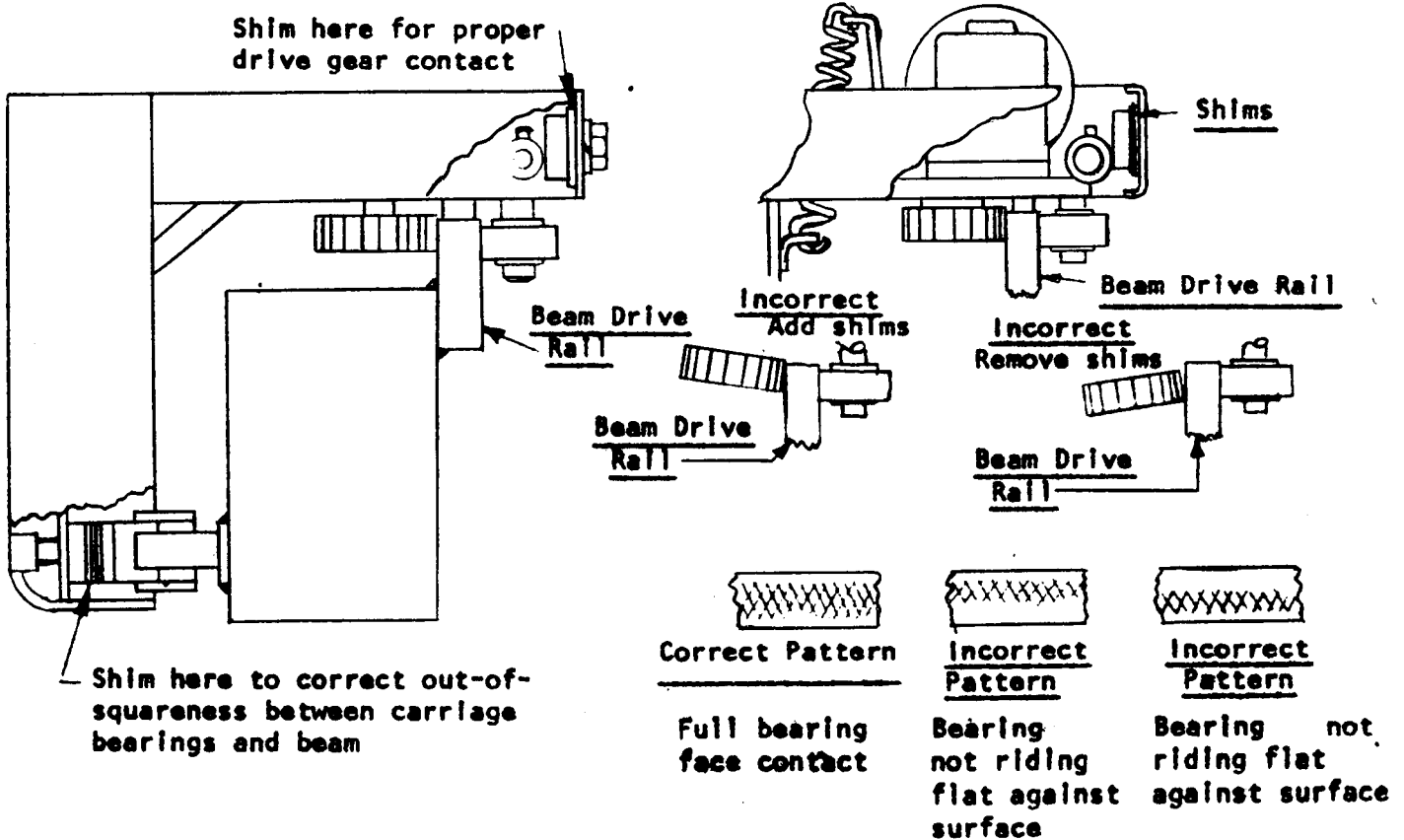


Before the carriage is placed upon the beam:

- a. Insert the clutch handle (A) through the hole in the right-hand side of the carriage. Push the handle through the carriage frame until the end goes into the lift yoke. Line up the roll pin hole in the yoke and 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.

- b. Mount the wire reel pivot shaft brackets (B) on top the left and right rails of the carriage. (Screws, lockwashers, and hex nuts are supplied with each bracket.)
- c. Install the head mounting bracket (M-6769, Item C) to the head lift plate per Figure using the hardware and insulation supplied. The head mount is to be electrically isolated from the carriage frame. Tighten these four bolts securely.
- d. 1) Remove the cable clamp from the top left rear of the carriage. This bracket will not be required.  
2) This standard carriage is shipped with a wire reel mounting bracket, a control box mounting plate, and some insulating hardware. These components will not be required for this application.
- e. With the clutch handle all the way down, set the carriage on the beam.

Check the carriage tracking and its squareness on the beam and, if necessary, install shims per Figure below.

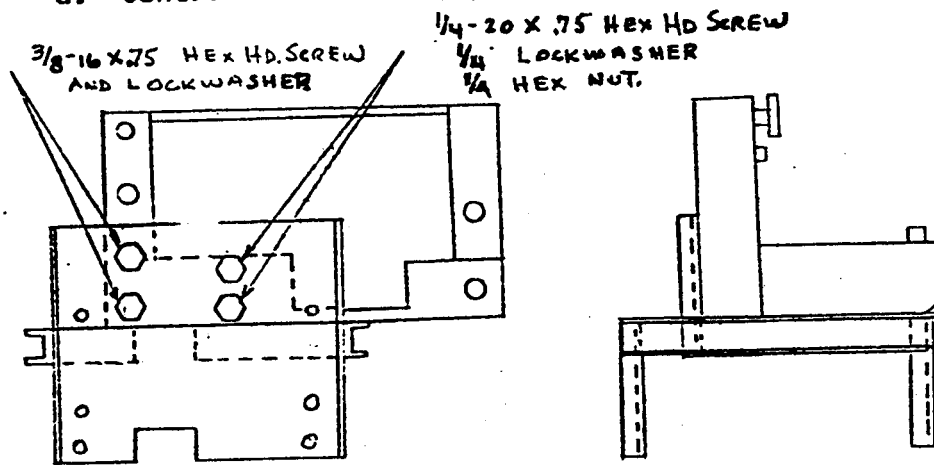


Step A2

Auxiliary Carriage

Before mounting the unit on the beam, install the following:

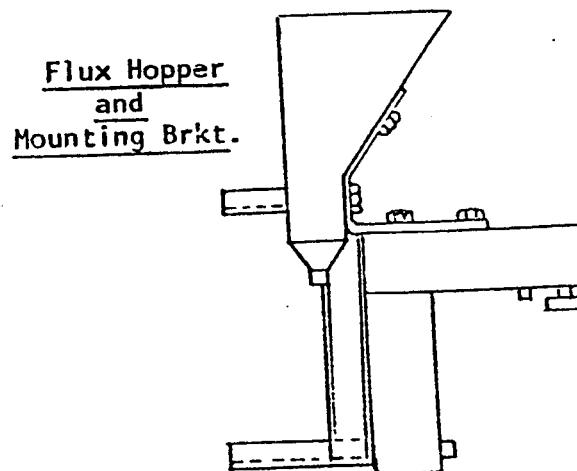
a. Control box mounting platform



Insert the two 3/8-16 x .75 long hex head screws and their respective washers through the platform into the top of the carriage, insert the two 1/4-20 x 3/4 hex head screws through the top of platform and carriage, put lockwashers and nuts on. Fasten platform securely to the carriage.

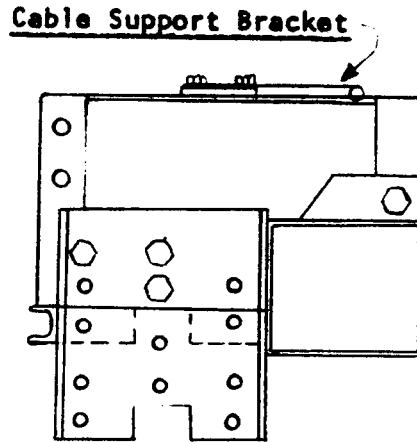
b. Flux Hopper

Fasten the flux hopper bracket to the top right-hand corner of the carriage frame using the 1/2-13 x 1.00 hex head screws supplied.



c. Cable Support Bracket

Fasten the cable support bracket to the back channel of the carriage using the 1/2-13 x 1.00 hex head screw supplied.

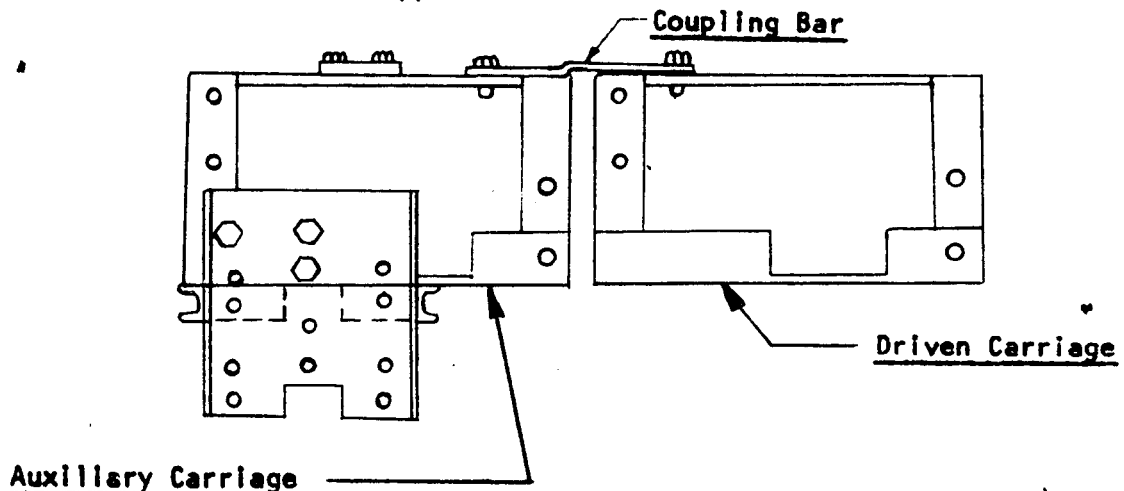


d. Control Box Mounting

Mount the auxiliary carriage onto the beam to the left of the driven carriage.

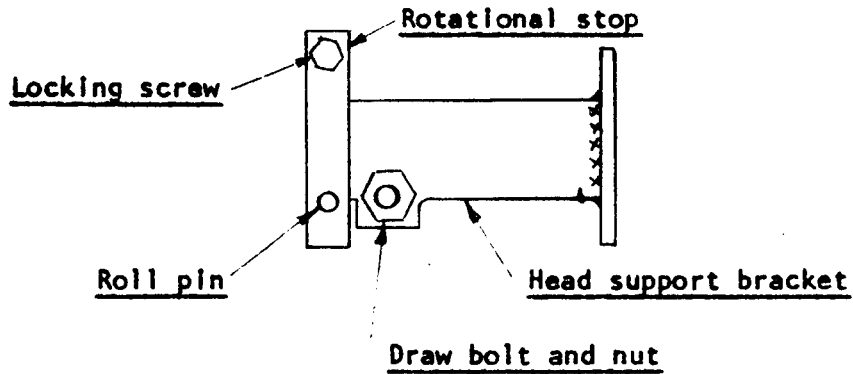
- 1) Mount the trail head control box (unit without the aluminum junction box on rear) to the top shelf of the control box mounting bracket using the hardware supplied.
- 2) Mount the modified series arc control box to the lower shelf of the bracket using the screws supplied.

e. Install the carriage coupling bar between the two carriages with the hardware supplied.



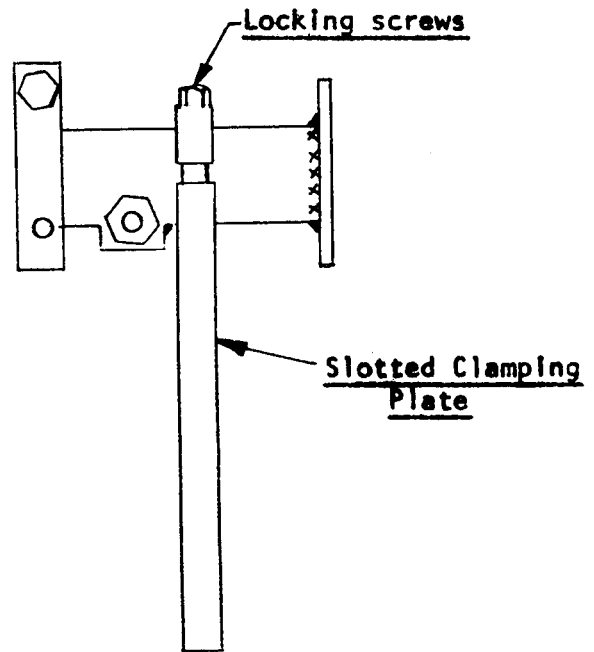
Step A3

Rotational Stops

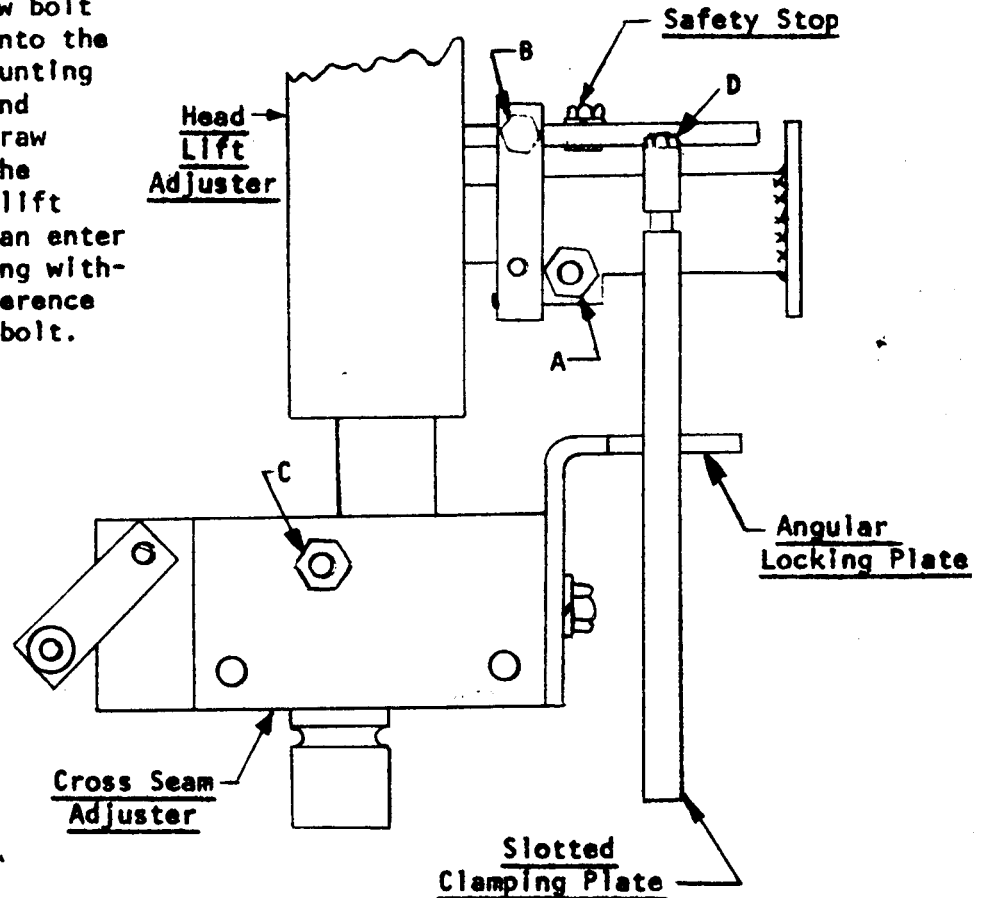


- a. Install the vertical head lift rotational stop to the machined end of the head mounting bracket that was installed in Step A1-c. Drive the supplied roll pin into the hole and insert the locking screw in position shown. Do not tighten screw at this time. Insert the draw bolt and its tightening hexagon nut as shown.

- b. Install the slotted clamping plate to the outside diameter of head mounting tube as shown. Slide the plate as far forward as possible, but do not tighten locking screws securely at this time.



- c. Loosen the draw bolt nut A. Look into the I.D. of the mounting tube, rotate and position the draw bolt so that the vertical head lift mounting bar can enter into the housing without any interference from the draw bolt.



#### Step A4

#### Complete Wire Feed Assembly to Head Mounting Bracket

With the aid of an overhead crane or some other lifting mechanism, pick up the entire wire feeder package so the nozzles are hanging down and the mounting bar of the vertical head lift is in a horizontal position. It is important that this mounting bar is in a horizontal position for ease of insertion into the head mounting bracket. Raise the entire unit so that the vertical head lift mounting bar can be inserted into the mounting bracket. During the insertion the safety tongue of the vertical head lift will slide through the upper rotational stop, and at the same time the tongue of the angular locking plate will slide into the slot of the slotted clamping plate. Push the entire unit into almost full engagement. Install one safety stop inside of the upper rotational stop plate.

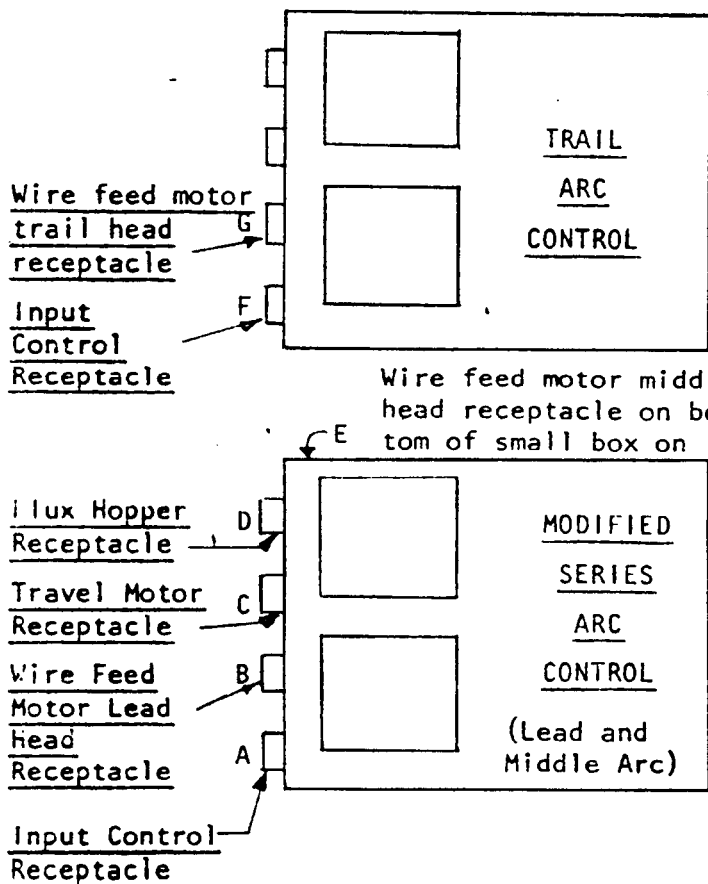


Snug up the draw bolt nut which is on the head mounting bracket so that the entire wire feed assembly can still be rotated with some effort. The unit should be oriented so the long hexagonal bar upon which all three of the wire feeders are mounted is horizontal. Tighten screw "B" in the upper rotational stop and the two screws "D" which clamp the lower rotational stop to the head mounting bracket. Tighten the draw bolt nut "A" securely.

Check to see if the hex bar is parallel to the surface on which the lower carriage bearings are riding. When the equipment is installed on a gantry, the hex bar must be parallel to the gantry track. If the bar is not parallel, loosen the draw bolt nut "C" which fastens the cross seam adjuster to the vertical head lift and the locking screws "D". Rotate the entire wire feed assembly until the hex bar is parallel and then tighten the hex draw bolt nut "C" and locking screws securely.

Step A5

Control Box Connections



- a. Connect the lead arc motor plug to receptacle (B).
- b. Connect the middle head motor plug to receptacle (E) which is on the bottom of the aluminum junction box that is mounted on the rear of the lower control box (not shown).
- c. Using the extension cord supplied, connect the travel carriage plug to the travel receptacle (C) on the lower control box.
- d. Connect the flux hopper plug to the control box receptacle (D).
- e. Using the extension cord supplied, connect the trail head motor plug to the wire feed receptacle (G) of the upper control box.

Step A6

Connection of welding leads and control cables from power source to the NA-4S4 controls

Carefully follow these instructions while referring to M-13523.

VERY IMPORTANT - Leads must be routed and connected as shown, otherwise erroneous meter readings may result from extraneous induced voltages.

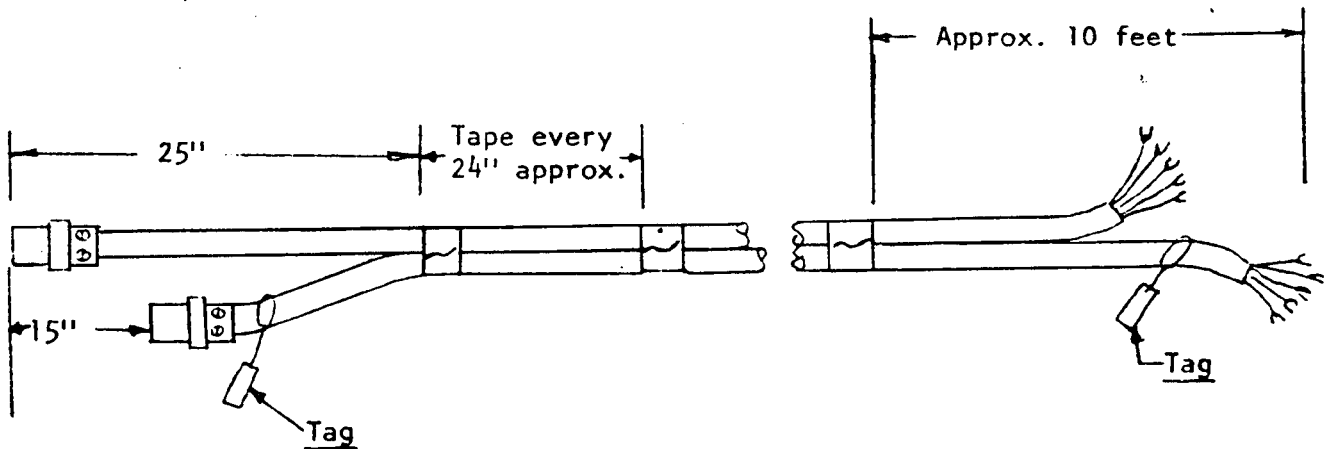
a. Power Source

Refer to M-13523 - NOTE NB in regard to phase relationship of the two power sources.

b. Input Cable

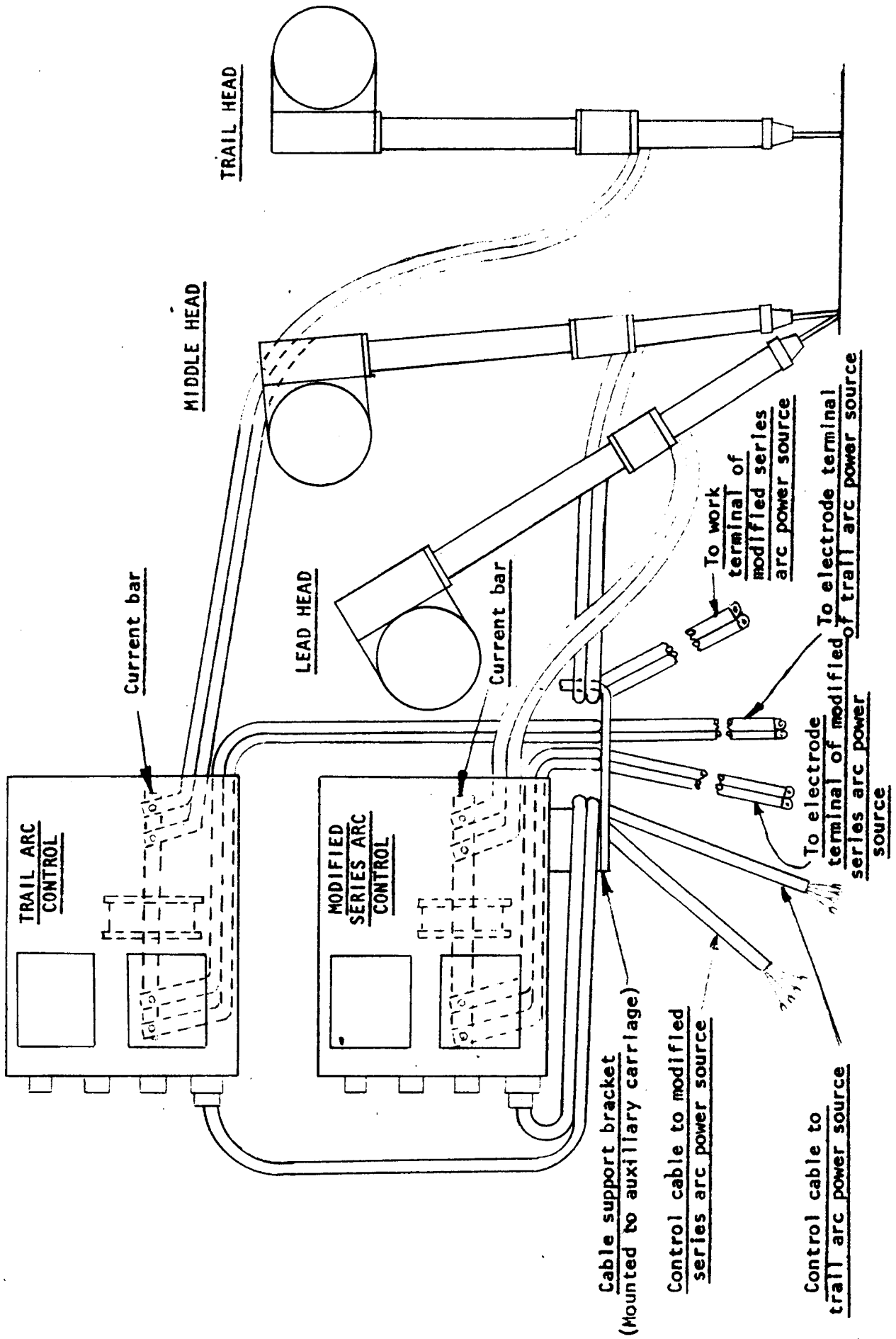
Proceed as follows:

- 1) Uncoil the cable assemblies and lay them out in a straight line. Remove the control cable from each assembly by cutting the tape at each of the tie points along the cable.
- 2) Take one of the control cables and identify as "trail arc control" at each end using a tag.
- 3) Lay both control cables side by side with a 15" stagger as shown and then friction tape the two cables together every 24 inches (approximately) to within 10 feet of the lugged end.



- 4.) Route the amphenol end of the cable assembly under the auxiliary carriage, lay the cables into the support hook which is fastened to the rear of the carriage. (Refer to Figure on Page 16 .) Connect the amphenol of the cable which has a tag to the trail arc control box (upper box). Connect the second control cable to the modified series arc control box.
- 5.) With the power sources off, hook up each control cable to their respective AC-1200's per drawing M-13523. (Tagged control cable should go to the power source to be used for the trail arc.) There is a clamp taped to each control cable. Remove the tape and fasten each control cable to the front of each of the AC-1200's. Leave a little cable slack between the terminal strip and the clamp so that there will be no strain on the lugs at the terminal strip. Do not connect lead #21 to either machine terminal strip. See instructions on M-13523 for the connection and extension of lead #21.
- 6.) Take two of the electrode lead\* which were disassembled in (1) above. Route the end of each electrode lead under the auxiliary carriage, lay the cables into the cable support, and then up into the back lower right hand corner of the modified series arc control box. Feed the cables under the insulating plates which support the current bar. Connect each of the leads to the left end of the current bar using the hardware provided. Make sure that the flat side of the lugs are against the current bar when making the connection. Tag the other end of these electrode leads as "Series Arc Electrode". (See Figure on Page 16.)
- 7.) Take the other two electrode leads that are left from (1) above. Route the leads under the auxiliary carriage, lay the cables into the cable support and then up into the back lower right hand corner of the trail arc control box. Feed the cables under the insulating plates which support the current bar. Connect each of the leads to the left end of the current bar using the hardware provided. Make sure that the flat side of the lugs are against the current bar when making the connection. Tag the other end of these electrode leads as "Trail Arc Electrode". (See Figure on Page 16.)

\* If the welding is to be done on square edge plate 5/16 through 5/8, an additional 4/0 lead from the series arc power source to the modified control box will be required.



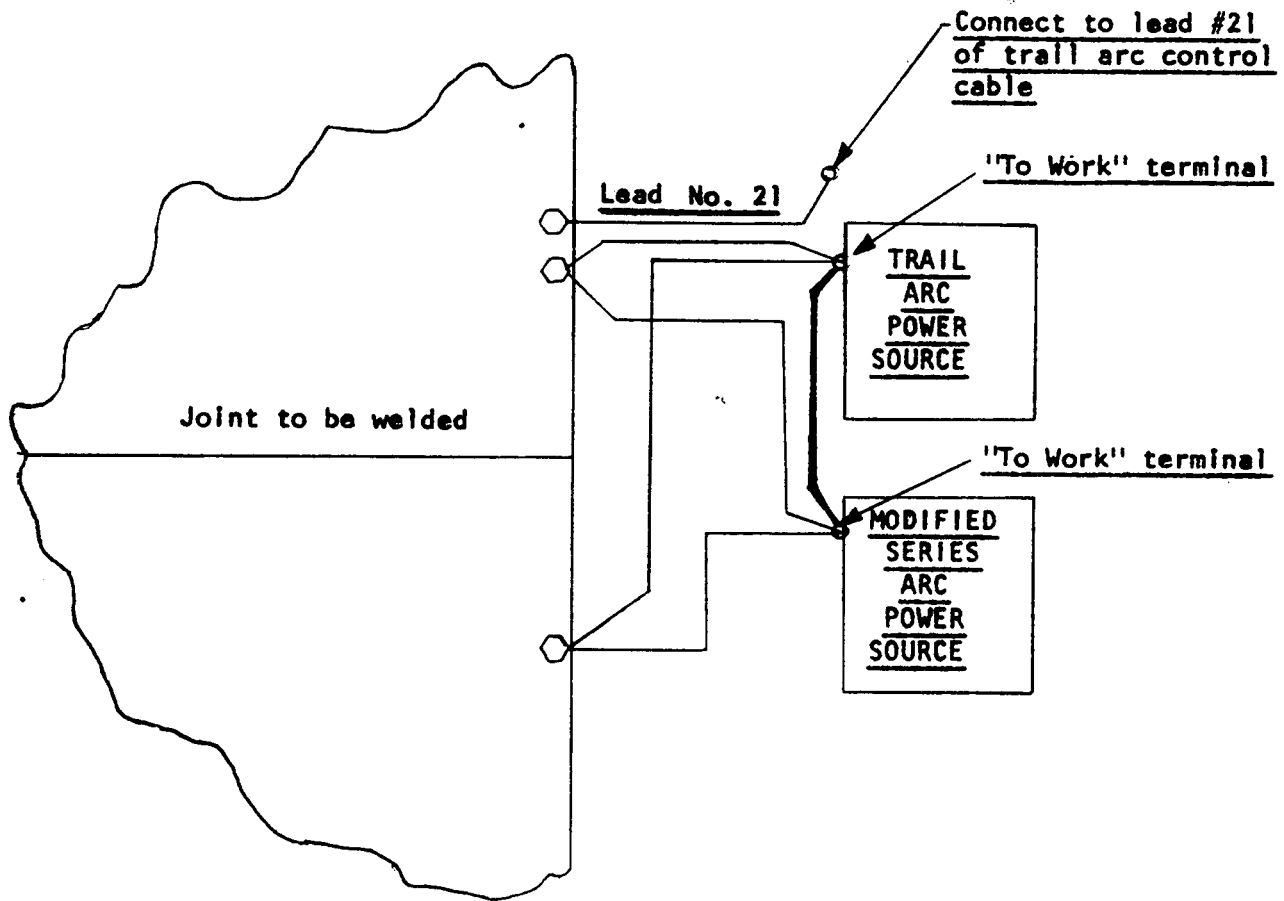
- 8.) Two 4/0 electrode leads to the middle nozzle will be required; the length of which should be the same as the K-215's which are being used plus 4 feet. Route the ends of these two electrodes under the auxiliary carriage, lay them into the cable support, and then over to the middle nozzle flag. Place one lead on top of flag; the other on the bottom with the flat side of the lugs against the flag. A lead #21 is also connected at this junction. See M-13523 for installation instructions.

Identify the above two electrode leads at the machine end as "Series Arc Work" leads.

- 9.) Group all six electrode leads into a neat bundle and tie them together using 1-1/2 inch wide friction tape, tie this group of cables together every 24 inches (approximately) to within 10 feet of the other end of the cables. Do not include control cables in this bundle. Control leads must always be separated from the electrode leads by at least two feet.
- 10.) At the two power sources, connect the tagged electrode leads, "Trail Arc Electrode" and "Series Arc Electrode", to the proper terminals. See Page 19<sup>4</sup> for proper "Current Tap Range".

The two leads which are tagged "Series Arc Work Leads" should be connected to the work terminal of the series arc power source.

11.) From each of the power sources, connect two 4/0 leads to each of the work terminals and then fasten the other four ends to the work piece as shown. It is recommended that the welding be done in a direction away from the work lead connections. *Also, add a 4/0 jumper between the work terminals of each power source.*



Separately connect the #21 voltage sensing lead for the trail arc control to the work piece per Installation Instructions on M-13523.

c. Power Source Electrode Connections

- 1) For square edged butt joints on plate thicknesses of 5/16 or less (trail arc not used):
  - a. At the series arc power source, connect the two electrode leads to the medium range 385-895 ampere tap.
  - b. Trail arc power source not used.
  
- 2) For square edged butt joints on plate thicknesses of 3/8 through 5/8:
  - a. At the series arc power source, connect the two electrode leads to the maximum range 735-1500 ampere tap.
  - b. At the trail arc power source, connect the two electrodes to the medium range 385-895 ampere tap.
  
- 3) For prepared beveled plates 3/8 and above:
  - a. At the series arc power source, connect the two electrode leads to the medium range 385-895 ampere tap.
  - b. At the trail arc power source, connect the electrode leads to the medium range 385-895 ampere tap.

Step A7

Electrode leads - control box to nozzle

- a. Install the two 52" long electrode leads from the trail arc control box to the trail arc nozzle flag. Connect each of the leads to the right end of current bar using the hardware provided. Make sure that the flat side of the lugs are against the current bar. Run the leads down and over the middle arc motor and then down to the trail arc nozzle flag. Fasten one lead on top of the flag and the other to the bottom side making sure that the flat side of lug is against the flag surface. The #67 voltage sensing lead is also part of this junction. Refer to M-13523 for installation instructions, *also figure on page 16.*

- b. Install the two\* 38" long electrode leads from the series arc control box to the lead arc nozzle flag. Fasten the ends to right hand end of the current bar, run the leads down along the right side of the control box and over to the lead arc nozzle flag. A #67 voltage sensing lead is part of this junction. Refer to M-13523 for installation instructions.

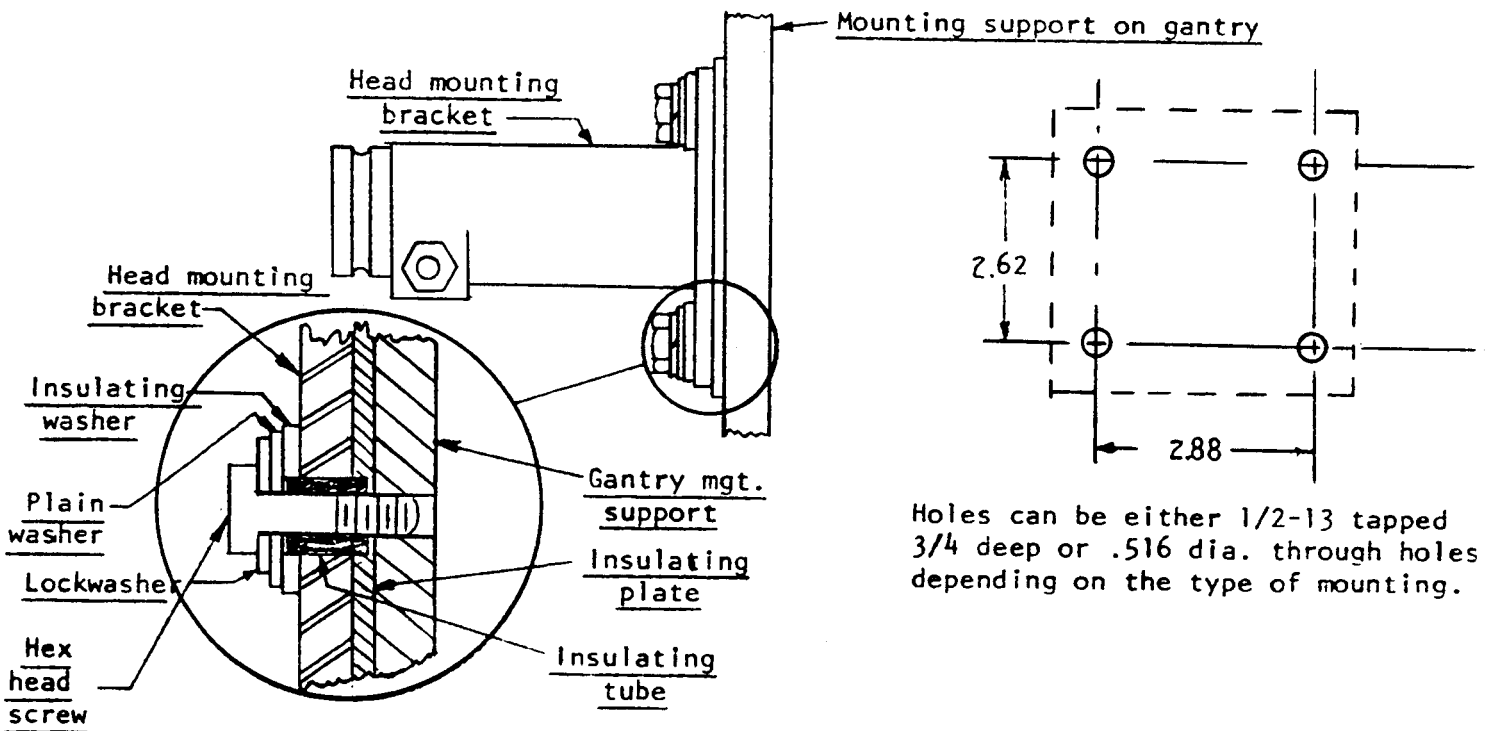
\* A third 4/0 electrode lead the same length as the above must be added when welding square edge plates 5/16 thru 5/8 in thickness.

CONTINUE WITH SECTION C ON PAGE 25.

Section B - The following instructions are for the installation of the series arc equipment to a gantry.

**Step B1**

Install the Head Mounting Bracket M-6769 to the designated position on the gantry plate per figure using the hardware and insulation supplied. Tighten all bolts securely.



The head mounting bracket is to be electrically isolated from the gantry frame.

**Step B2**

Rotational Stops - See Section A, Step A3. (Page 11)

**Step B3**

Complete wire feed assembly to head mounting bracket. See Section A, Step A4. (Page 12)



#### Step B4

Mount the wire feeder controls so that they are convenient for the operator to manipulate. See dimensional print L-5311 for control box size and dimensions for the mounting holes. The control boxes should be mounted away from any magnetic influence such as electromagnets, power lines, welding electrode cables or work cables.

The control units depend upon convection air cooling. Allow a minimum of 2.00 inches air space above each box for proper operation.

#### Step B5

##### Wire Feeders to Control Box Connections

Extension cables may be required.

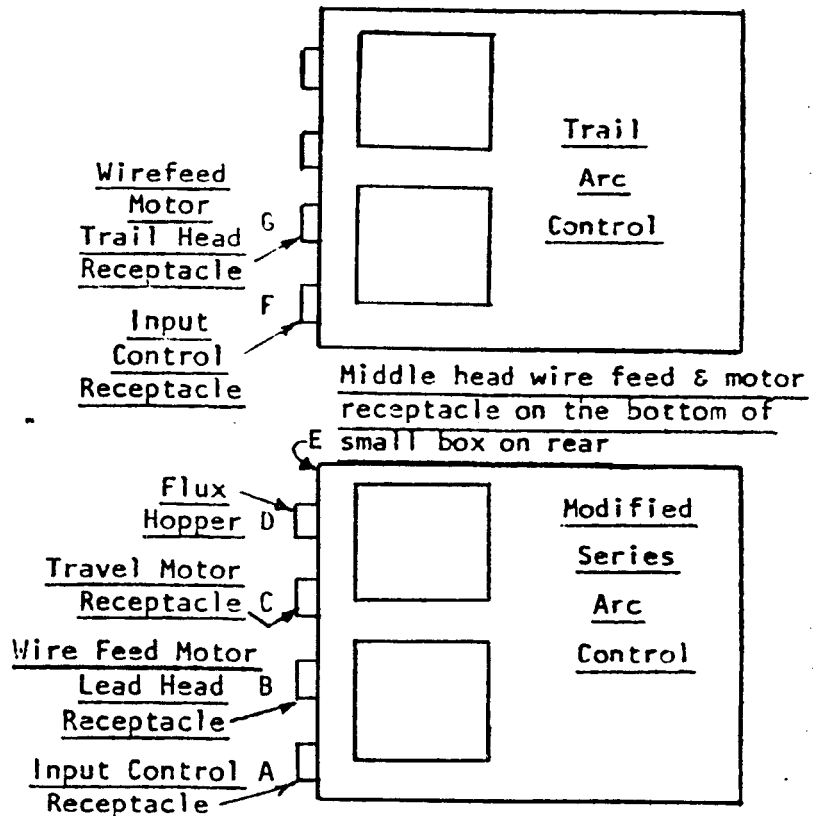
- Wire feed motor to control box - 3 required - L-5318-D-"L"
- Lincoln flux hopper to control box - 1 required if Lincoln flux hopper is used - L-5318-B-"L"
- 4/0 electrode leads from control box to nozzle - 2 required\* - length as required - (Lead arc).  
\* A third electrode lead is required when welding square edge plates 5/16 thru 5/8 thick.
- 4/0 electrode leads from control box to nozzle - 2 required - length as required - (Trail arc).

The user to determine "L" (length) required and order to suit the installation.

#### Step B6

##### Control Box Connections

- Connect lead arc motor plug to receptacle (B).
- Connect the middle head motor plug to receptacle (E) which is on the bottom of the aluminum box that is mounted on the rear of the modified control box.
- Connect the travel circuit plug to the travel receptacle (C).
- Connect the flux hopper circuit plug to the control box receptacle (D).
- Connect the trail head motor plug to receptacle (G).



## Step B7

Connection of welding leads and control cables from the power source to the NA-4S4 controls.

Carefully follow these instructions while referring to drawing M-13523.

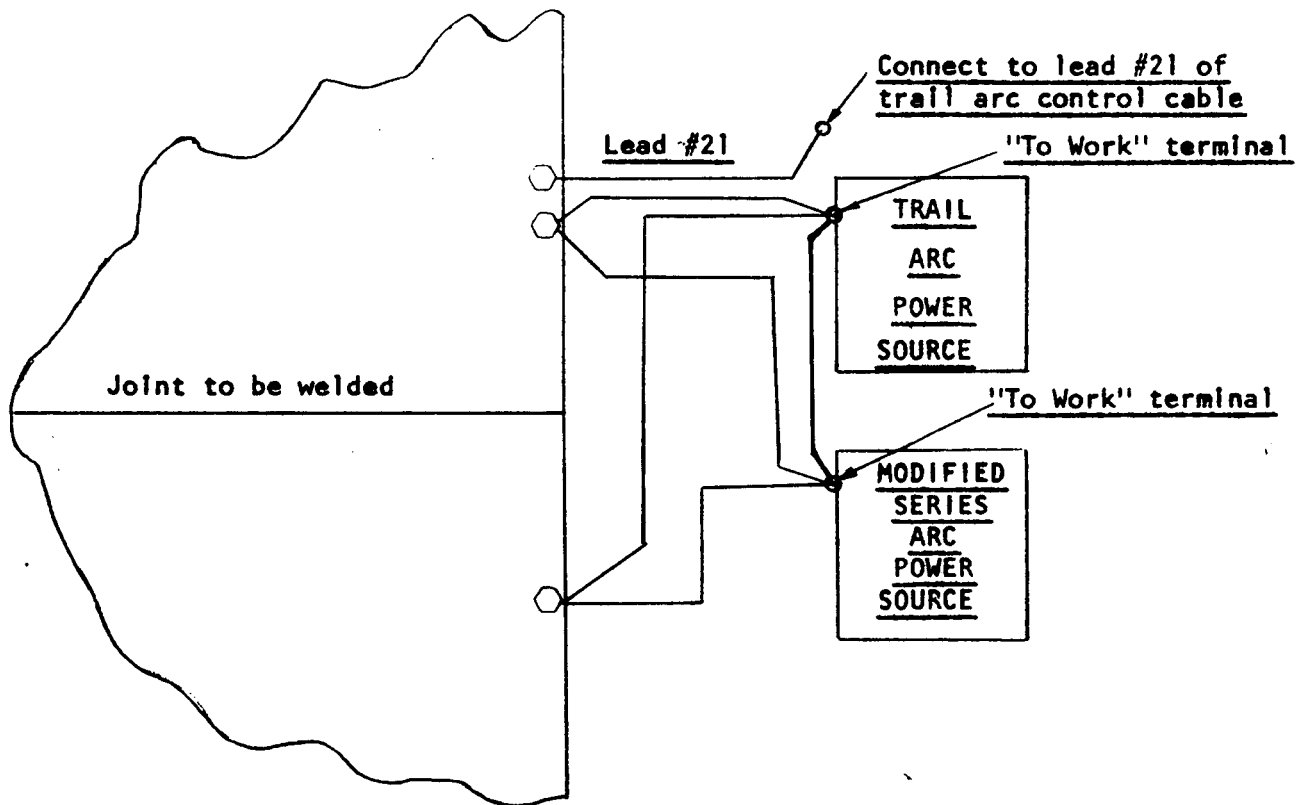
VERY IMPORTANT - Leads must be routed and connected as recommended. Otherwise erroneous meter readings may result from extraneous induced voltages. (See Figure on Page 16. Use as a reference of a typical installation.)

### Power Source Connections

- a. Refer to M-13525 diagram - Note NB in regard to the phase relationship of the two power sources.
- b. Uncoil the two K-215 input cable assemblies, lay them out in a straight line. Remove the control cable from each assembly by cutting the tape at each of the tie points along the assembly.
- c. With the welding power sources turned "off", connect the amphenol of one control cable to the input receptacle of the 'trail arc control box'.
- d. Connect the amphenol of the second control cable to the input receptacle of the modified series arc control box.
- e. At the welding power source, hook up each control cable to their respective AC-1200's per M-13523. There is a clamp taped to each of the control cables. Remove the tape and fasten each control cable to the front of each of the AC-1200's. Leave a little cable slack between the terminal strip and the clamp so that there will be no strain on the lugs at the terminal strip. Do not connect lead #21 to either machine terminal strip. See instructions on M-13523 for the connection and extension of lead #21.
- f. Install two of the 4/0 cables which were part of the K-215 assemblies from the electrode terminals of the trail arc power source (see page 19 for proper current range terminals) to the current bar of the trail arc control box. Route the two leads into the back right hand side of the control box and under the insulating supports of the current bar. Fasten each electrode lead to the left end of the current bar securely with the hardware provided making sure that the flat side of lugs are against the bar.
- g. Install the two remaining 4/0 electrode leads which were part of the K-215 assemblies from the electrode terminals of the lead arc power source (see page 19 for proper current range terminals) to the current bar of the modified series arc control box. For an installation that is to be used for the welding of 5/16 thru 5/8 square edge plate, a third 4/0 electrode lead will have to be installed along

with the two above electrode leads. Route all the above electrode leads into the lower right rear of the modified series control box and under the insulating supports of the current bar. Fasten the leads to the current bar using the hardware supplied making sure that the flat side of each of the lugs is against the bar surface. Tighten securely.

- h. Connect a set of two 4/0 leads from the work terminal of the modified series arc power source to the flag of the middle head nozzle. The #21 lead is part of this junction at the nozzle (see M-13523 installation instructions of lead #21). All six of these electrode leads may be grouped together but should be kept separate and at least 2 feet from the control cables to avoid stray magnetic fields that could cause erroneous meter readings.
- i. From each of the power sources, connect two 4/0 leads to each of the work terminals and then fasten the other four ends to the work piece as shown. It is recommended that the welding be done in a direction away from the work lead connections. *Also, add a 4/0 jumper between the work terminals of each power source.*



Separately connect the #21-voltage sensing lead for the trail arc control to the work piece per installation instructions on M-13523.

J. Electrode leads - Control box to nozzle (See figure on Page 16)

1) Install two 4/0 electrode leads from the trail arc control box to the trail arc nozzle flag. Connect each of the leads to the right end of current bar using the hardware provided. Make sure that the flat side of the lugs are against the current bar. Run the leads directly to the trail arc nozzle flag. Fasten one lead on top of the flag and the other to the bottom side making sure that the flat side of lug is against the flag surface. The #67 voltage sensing lead is also part of this junction. Refer to M-13523 for installation instructions.

2) Install two\* 4/0 electrode leads from the series arc control box to the lead arc nozzle flag. Fasten the ends to right hand end of the current bar, run the leads directly to the lead arc nozzle flag. A #67 voltage sensing lead is part of this junction. Refer to M-13523 for installation instructions.

\* A third 4/0 electrode lead the same length as the above must be added when welding square edge plates 5/16 thru 5/8 inches in thickness.

k. Install the wire reels so that the wires can be fed into each respective wire feeder without any unnecessary bending or kinking. The mounting of the reel supports must be electrically isolated from its support and each reel must be isolated from the other two.

## Section C

### Step C1

#### Loading and Straightening of the Electrode

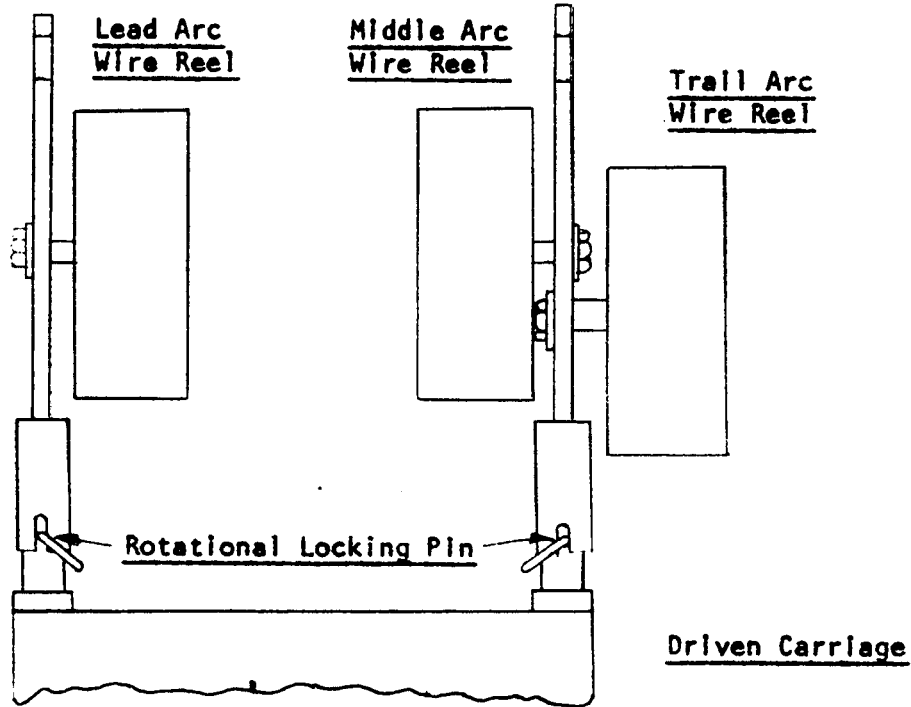
The following information shows the installation for Lincoln carriage mounted equipment. Installation of wire mountings for a gantry mounted equipment should follow the same general pattern.

The straightener knobs should be pointed toward the wire reels. Back off each of the wire straightener knobs to the minimum straightening position.

a. Load the electrode as follows:

- 1) Load the "lead head" reel so that the wire pay off is in the counter clockwise direction.
- 2) Load the "middle head" reel so that the wire pay off is in the clockwise direction.
- 3) Load the "trail head" reel so that the pay off is in the counter clockwise direction.
- 4) Cut and remove all tie wires on each coil. The tie wire which holds the start end of coil should be cut last and the start end of the coil should be held at the time the tie wire is cut, otherwise the coil will tend to unwind and also may produce a cross-over tangle. Insert the start end of coil into one of the holes in the reel cover and bend it so that it is secure.

- b. The loaded wire reels can be mounted either by leaving the spindle on the carriage or by removing the complete spindle assembly from the carriage by a hoist or crane and mounting the reels onto their respective shafts at a more convenient level.



- 1) Mounting reels - without removing the spindles from the carriage

By removing the locking pin at the base of the spindle reel support, it can be rotated to a  $90^\circ$  position and thereby enable changing the reels. There is a set of holes  $90^\circ$  apart for the locking pin so that the spindle is held in position during the mounting of the reels onto the wire reel shafts.

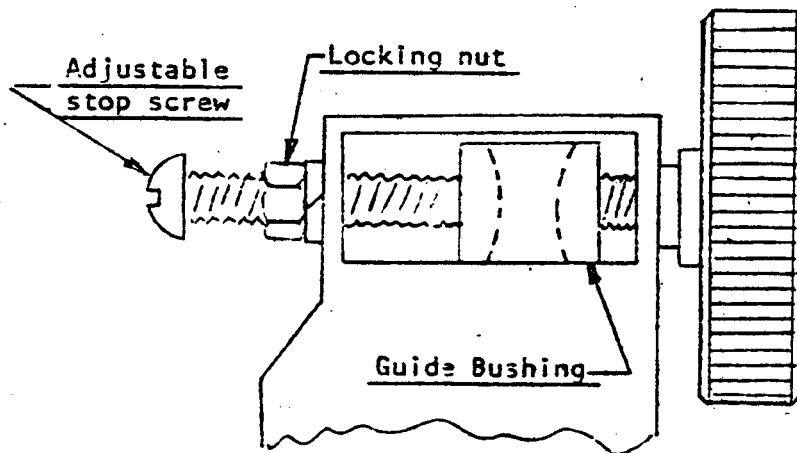
- 2) Mounting reels - by removing the spindle assembly from the carriage.

Lift the spindle from the carriage with the aid of a hoist and mount the full reels onto their respective wire reel shafts. Lift the loaded spindle assemblies and place them onto their respective spindle shafts.

c. Wire Straightening

Turn power sources on, turn the power switch to the on position on both the control boxes. Open the front door on each control box and set the inch speed to maximum.

Each of the wire straighteners have an adjustable "stop" built into the frame. This allows the operator to return the straightener to the proper position so that it will feed straight wire. These positions are factory set. The "stop" position may have to be moved periodically due to the wear in the upper guide or the ingoing guide tube or a change in wire size. See figure below for adjusting.



To set - loosen the locking nut and back the stop screw out. Set the straightener guide for straight wire and then turn the stop screw in until it just touches the guide bushing. Hold the stop screw and tighten the locking nut.

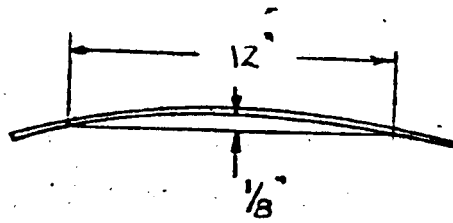
### 1) Lead Arc Head

Cut the start end of the lead arc so that there are no kinks or bends in the wire, make no attempt to straighten the wire. Push the end of the wire through the nylon sheath, shove the sheath back along the wire until it touches the coil on the reel.

By hand, straighten the first 10 to 15 inches of the start end of the coil. Turn the straightener knob back to the minimum position. (The adjusting knob of each straightener must be toward the reels.) Pass the straightened coil end through the straightener into the wire feeder until it touches the drive roll. Push the inch button and inch the wire through the system.

Turn the straightener knob back until it is back against its preset stop, these stops are factory set to give straight wire when using specified wire diameters. If other type or size is to be used, the stops will have to be re-set.

Inch several lengths (approximately 15" long) of wire and check it for straightness. The wire should have no more than an 1/8" of bow in a 12" length.



If the wire is not within this limit, then reset the stop position on the wire straightener.

## 2) Middle Head

a) Since both the lead head and the middle head are controlled by the same inch button, it will be necessary to either relieve the idle roll spring pressure or block open the lead arc drive rolls so that the lead head will not feed wire.

b) The middle head does not need the nylon tube - load and straighten the same as the lead head.

c) Unblock or reset idle pressure of the lead head. Clip the wire just below each nozzle tip and then inch the wire down until the wires do not quite touch.

## 3) Trail head

Repeat loading and straightening procedure as in c-1 for the lead arc except that no nylon tube is used.

4) All 3 electrode leads must be electrically isolated from each other and from any structural member of the installation.

5) Reset Inch speed controls per information on Pages 35 and 36.

## Step C2

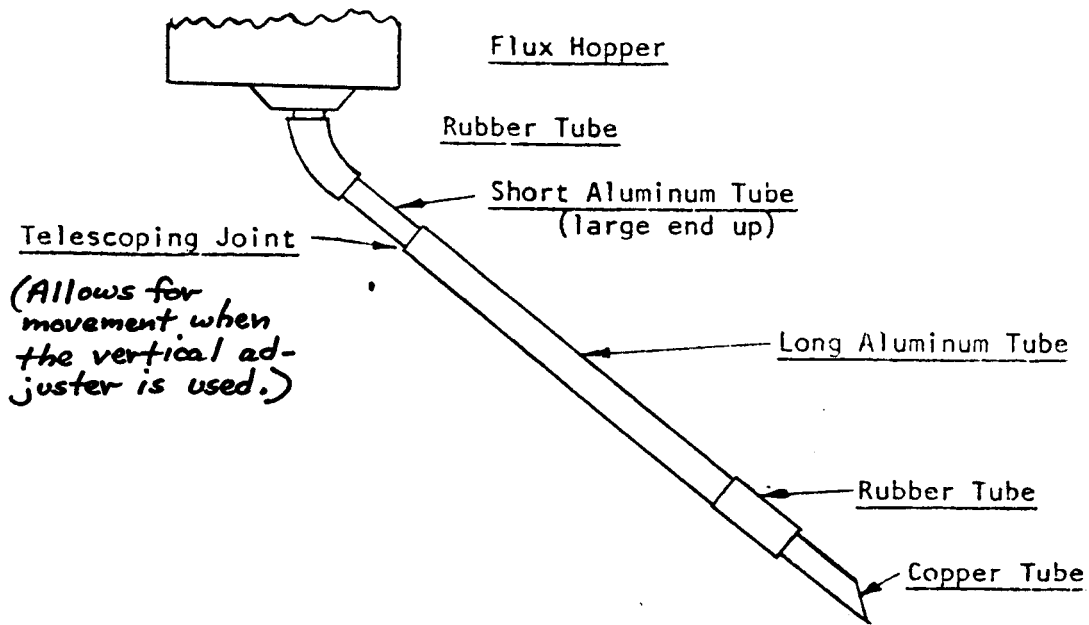
### Flux Tube

The following information shows the installation for Lincoln carriage mounted equipment. Installation of a flux delivery system for gantry mounted equipment should follow the same general pattern.

#### a. For beveled plates

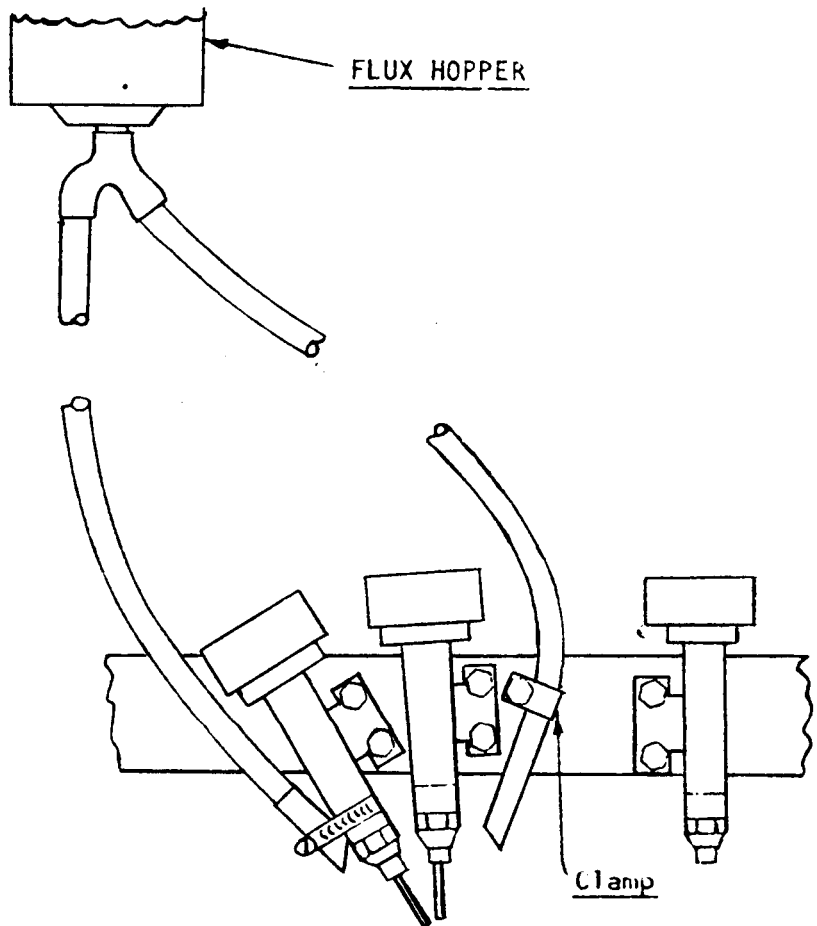
Install flux tube from the hopper down to the lead arc nozzle, per figure at top of next page.





The flux hose copper tube should be fastened to the lower end of the lead nozzle using the hose clamp provided. The height at which the discharge tube is set with respect to the top of the plate determines the height of the flux pile. See welding procedures for recommended flux height for procedure being used.

b. For Square Edge Plate Welding



A double flux delivery system is required for the welding of square edge plates. The lead arc flux tube is installed as shown in the figure. Here again, the height at which the discharge tube is fastened will determine the flux height. The second flux delivery system is fastened to the nozzle line up bar and it is set to discharge a small amount of flux just behind the middle arc electrode to prevent excessive arc flash thru.

### Step C3

#### Instructions for Setting Head Height

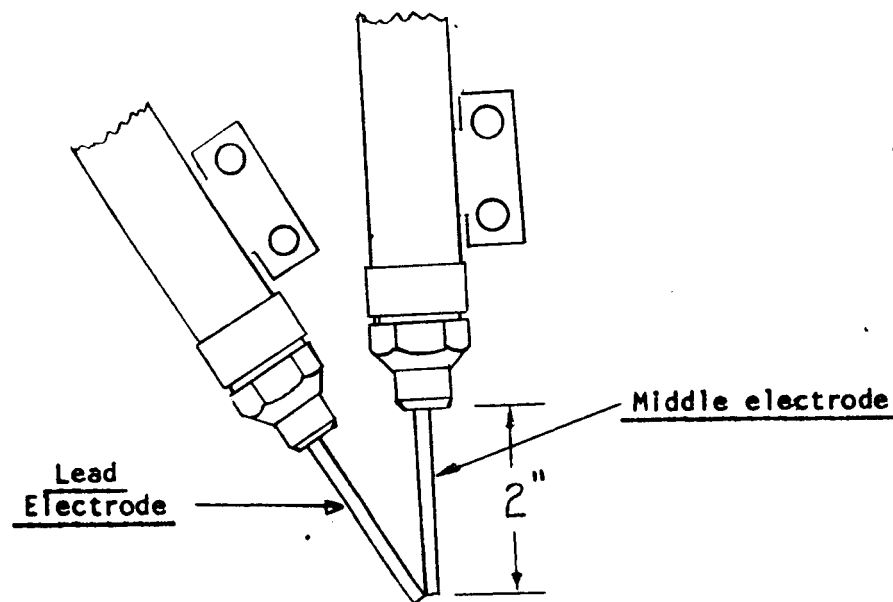
The nozzle angles, electrical stickouts, and electrode spacings have been correctly set and all units completely locked into their respective positions at the factory. The correct positioning, stickout, and spacing are shown in Figure on Page 32 (for beveled plates) or Page 33 (for squared edge plates).

The only time a major change in the height of the entire wire feed assembly is required is when the unit is to be used on a different plate thickness. Minor height adjustments may have to be made depending upon the accuracy of the joint preparation.

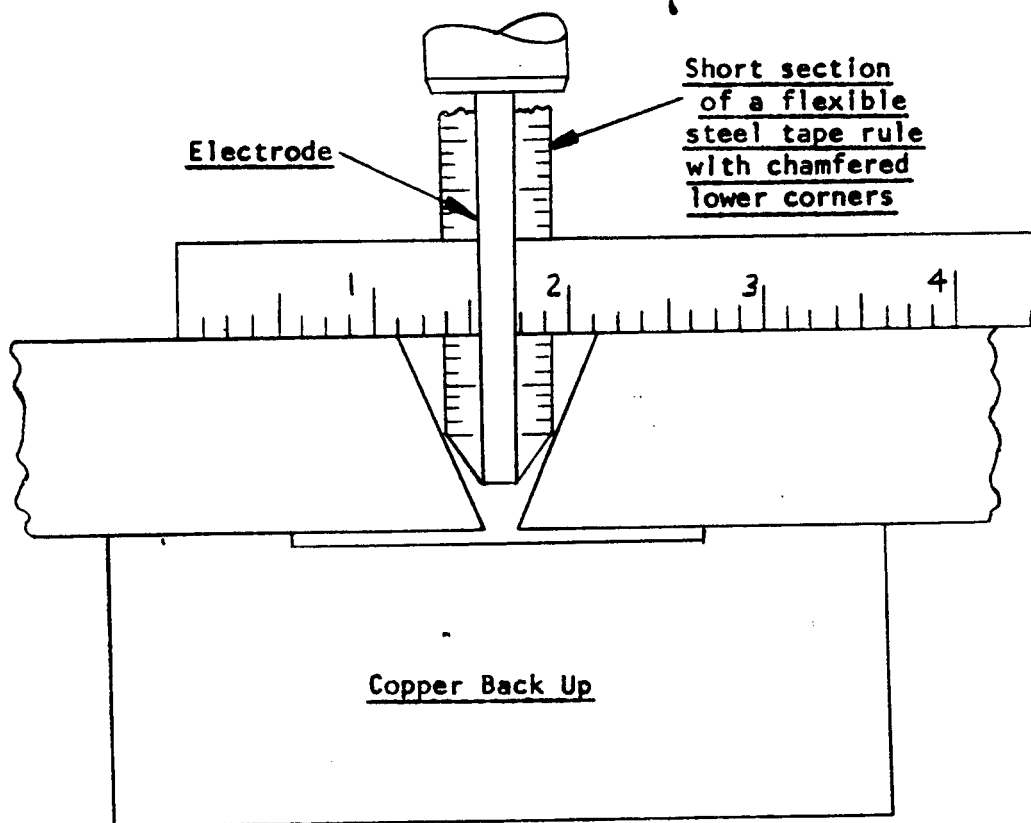
Before making any height adjustments, it is important that all the wires are coming out of their respective nozzle and are straight.

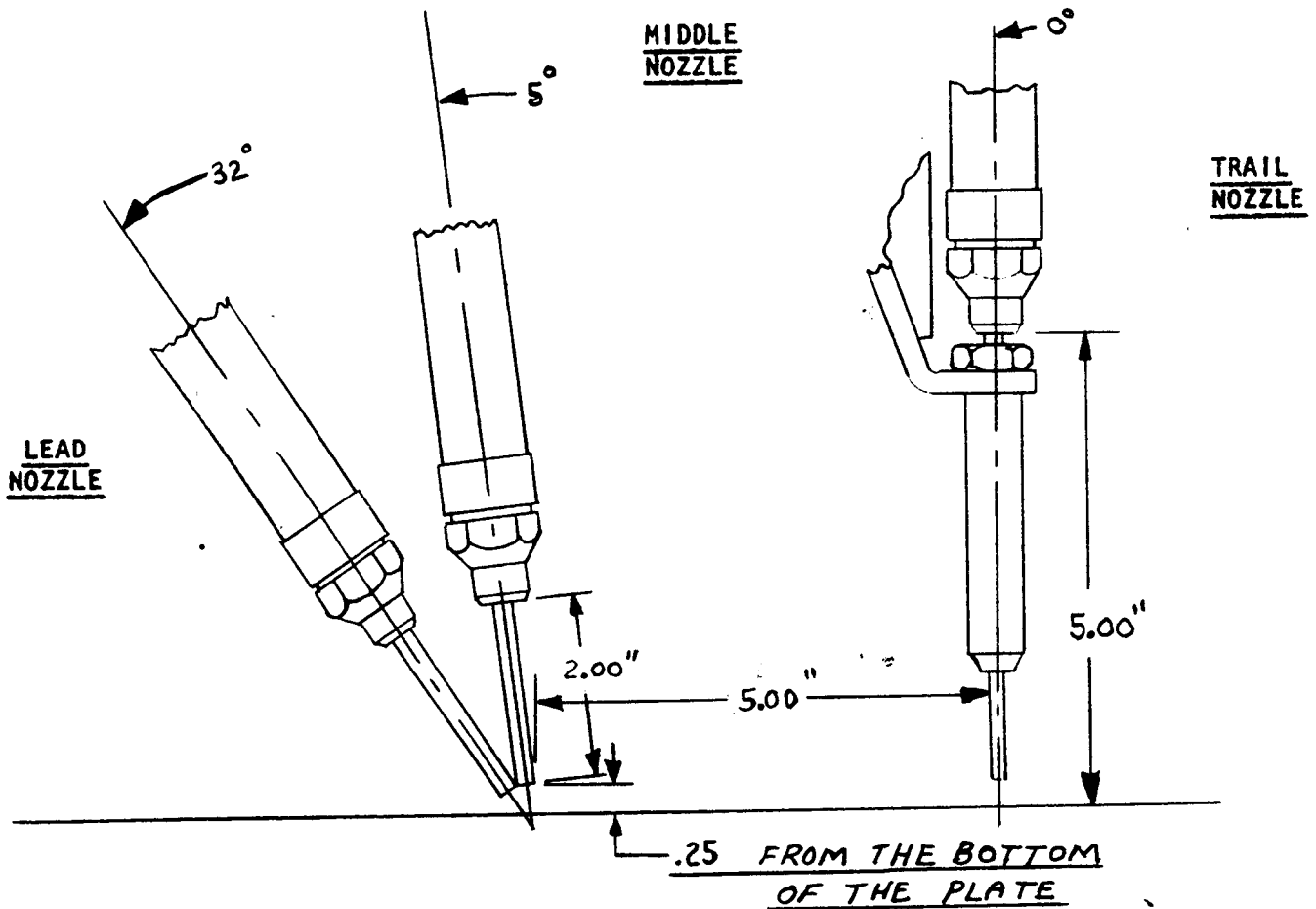
The vertex height above the plate bottom is a very important parameter to the welding procedure and care should be taken to measure it accurately. A method of checking this value is as follows:

- a. Cut the ends of the lead and middle arc electrodes to the appropriate length so that when the two electrodes come together the middle arc electrical stickout is 2.00".

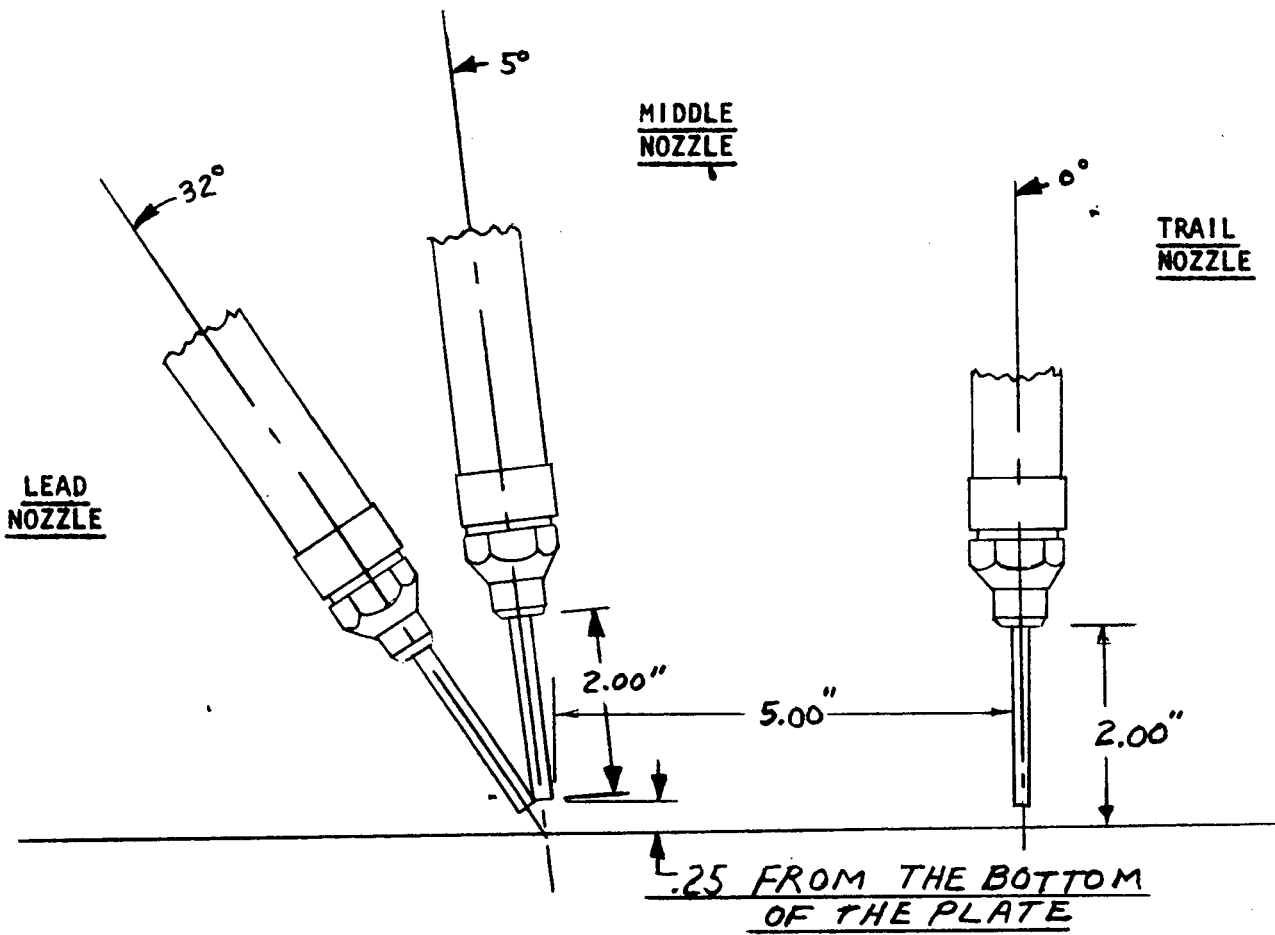


- b.. Lower the wires down into the groove to be welded and measure the distance from the vertex to the top of the plate. By sticking the short thin section of a rule into the vertex point and by holding it against the middle electrode with a six inch scale, read the dimension on the thin rule which is on the bottom edge of the six inch scale. Subtract this value from the actual measurement of plate thickness and this will be the distance that the vertex is above the bottom of the plate.



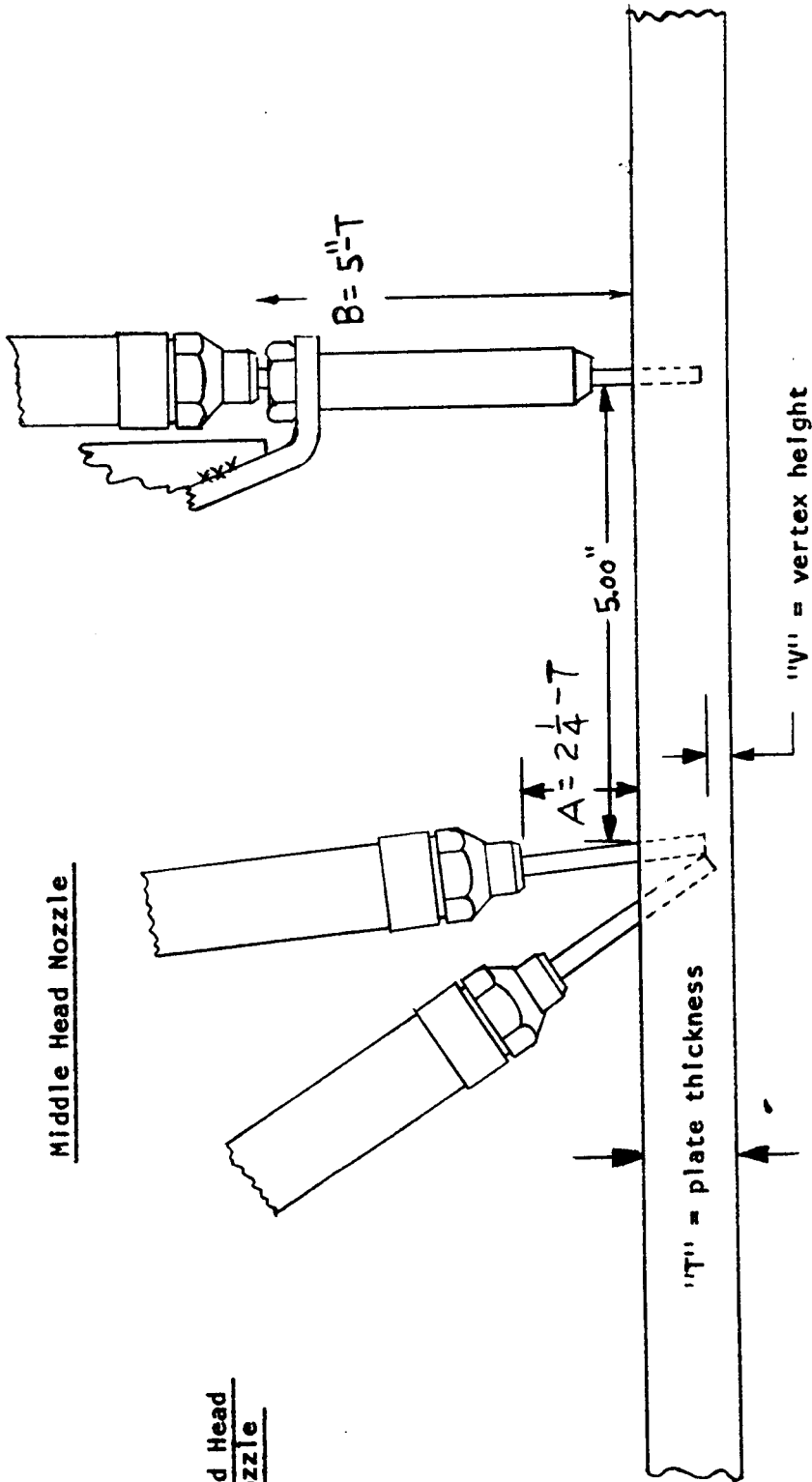


PROPER ELECTRODE SETTINGS FOR WELDING BEVELED PLATES



PROPER ELECTRODE SETTINGS FOR WELDING SQUARE EDGE PLATES

Trail Head Nozzle



Middle Head Nozzle

Lead Head Nozzle

For Beveled Plates Only

T	A	B	V
1/2	1-3/4	4-1/2	1/4
5/8	1-5/8	4-3/8	1/4
3/4	1-1/2	4-1/4	1/4
1	1-1/4	4	1/4
1-1/4	1	3-3/4	1/4
1-1/2	3/4	3-1/2	1/4
1-3/4	1/2	3-1/4	1/4
2	1/4	3	1/4

\* Dimensions in the table do not account for plate thickness variations which do have to be considered.

OPERATION - WELD TESTING

- A. Set the wire feed unit nozzles into the position where the weld is to start.
- B. Turn both the AC-1200 power sources on and set the toggle switch to the 'remote control' position on each power source.
- C. At the NA-4S4 control boxes - all control knob settings are at a preset condition but may have to be changed slightly to meet actual procedural values required *(or if changed during installation)*.
  1. Travel control
    - a. See procedure sheet for proper travel speed and set the travel speed knob accordingly.
    - b. Set the direction of travel switch to the proper direction.
  2. Modified series arc control box (lower control box)

	SQ. EDGE 5/16 PLATE & UNDER	EQ. EDGE 3/8 PLATE THRU 5/8	FOR BEVELED PLATE 3/8 & OVER
a. Set "Wire Feed" Speed control to:	8 (50"/min.)	5 (75"/min.) <sup>*</sup>	7 (45"/min.)
b. Set Voltage control to:	6 (35 volts)	3 (36 volts)	5 (32 volts)
c. Set travel switch to "off" position. This switch is used to control travel. Open the door of the control box and set the knobs to the numbers shown in the sketch.			

	<u>Beveled</u>	<u>Sq. Edge</u>	
			Start Control
	(3)	(6)	Start Current
	(7.5)	(5)	Start Voltage
	(.75)	(1)	Time in Seconds
			Crater Control
	(6)	(4)	Crater Current
	(9)	(8)	Crater Voltage
	(.5)	(1.5)	Time in Seconds
Open Circuit Voltage	(8)	(8)	
Inch Speed set for 8 to 10"/min. on speed meter	(3)	(2)	
Contactors and Electrode Backup Time Delay	(6)	(6)	

\* Shift wire feed speed meter switch to the high range.

- d. Close and secure the door.
3. Trail arc control box (upper control box)

	SQ. EDGE 5/16 THRU 5/8 PLATE	FOR BEVELED PLATE 3/4 & OVER
a. Set Wire Feed Speed control to:	4 (35"/min.)	4.5 (35"/min.)
b. Set Voltage control to:	8 (41 volts)	6 (32 volts)

- c. Travel switch (position of this switch has no effect on travel). Open the door of the control box. Set the knobs to the number shown in the sketch.

	Beveled	Sq. Edge	
			Start Control
	(4.5)	(4)	Start Current
	(9)	(9)	Start Voltage
	(.75)	(1)	Time In Seconds
			Crater Control
	(5)	(5)	Crater Current
	(8)	(8)	Crater Voltage
	(1)	(2)	Time In Seconds

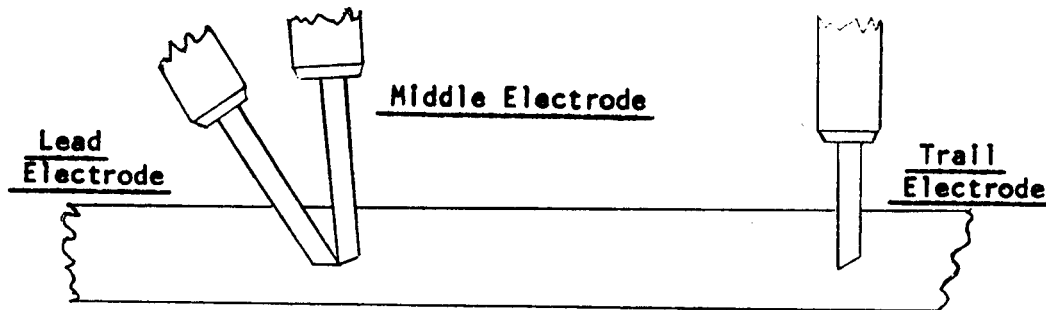
- d. Close and secure the door.

- D. Flux Hopper - Fill the hopper with the appropriate flux. Turn the toggle switch into the "on" position. Clamp the lower end of the flux tube so the lead arc nozzle at the proper height so that the flux depth meets the procedural requirements. When welding square edge butts, the second flux discharge tube is clamped to the nozzle line up bar so that it will dump flux just behind the middle electrode. See Page 29.



E. Electrode preparation for arc starting (two conditions)

1. Condition (A) Starting in a beveled edge plate.



Cut all electrodes to a sharp point.

Inch the lead and middle arc electrodes down until they touch each other.

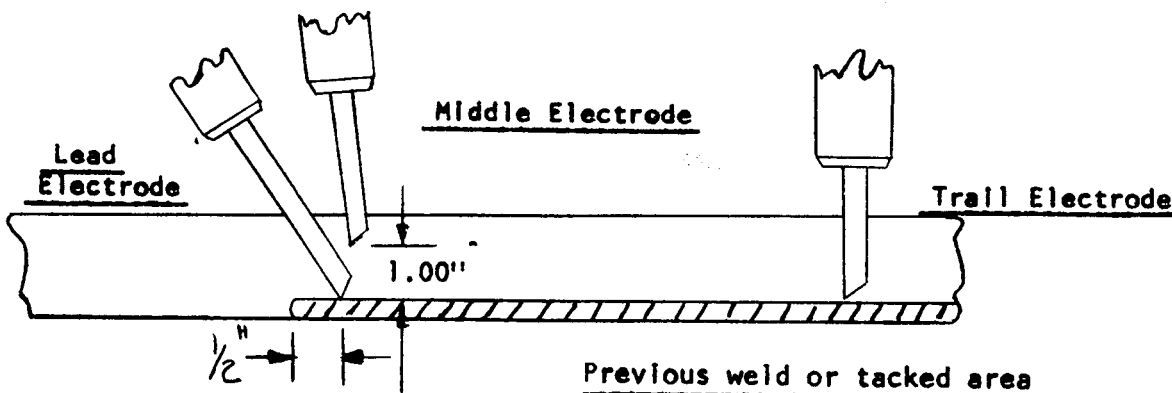
When the wires touch, the Lincoln flux valve will activate and dump flux around the lead arc.

Inch the trail arc wire down until it is approximately 3/4 inch above the bottom of the plate.

With the above condition existing, switch the lower control box travel switch to the 'Automatic' position and press the 'start' button on the lower control box. When the welding has traveled far enough so that the trail electrode is over the spot where the lead arc started, the start button of the trail arc (upper control) can be depressed.

2. Condition (B) Starting on a tack or restarting in a joint that has been partially welded.

Position the equipment so the lead arc electrode is in the position shown in the figure.



The middle arc electrode should be cut shorter than the lead arc electrode by approximately 1.00 inch. All electrodes should be cut to a sharp point.

When the lead arc electrode touches the work, the flux valve will activate and dump flux around the lead arc; flux for the trail arc will have to be supplied by hand at the start of the weld.

With the above conditions existing, switch lower control travel switch to 'Automatic' position and **press start button on both controls.**

- F. After both arcs have started, observe the meter readings, make any minor adjustments in the control settings to meet the procedural requirements. During the welding cycle, the wire feed speeds and the rate of travel speed may be checked periodically with the aid of a Lincoln K-283 Digital Speed Indicator. Wire feed rates should be checked at the top of the wire straighteners.

At the end of the weld, shut off the lead arc first. Allow the equipment to travel approximately 5" or more, and then shut off the trail arc. If a run off tab is used, then both arcs can be shut off at the same time.

### IMPORTANT

During the welding operation, the input cables should be so positioned that they do not affect travel speed. The control cable bundle (two cables) should be kept away from the electrode bundle (six cables) by at least 2 feet. This will prevent stray pickup and erroneous meter readings.

## MAINTENANCE INSTRUCTIONS

### A. Wire Feed Motors and Gearboxes

Once a year, recoat all the gear teeth with a non-fluid moly grease, such as a "Non Fluid Oil Corp." lubricant A29 Special/MS. Check the motor brushes every six months. Replace the brushes if they are less than 1/4" long. For high usage applications, check the motor brushes more often.

### B. Wire Drive Rolls

Check the sharpness of the driving teeth on the drive rolls periodically. When the rolls no longer put indentations into the wire surface, it is time to reverse them. Each drive roll has two driving surfaces so that maximum life can be obtained from each roll. After both sets of teeth are worn then replace the set. The wire guide tubes should be periodically inspected for signs of milling in which case they should be rotated or replaced.

### C. Control Boxes

Every three months, inspect and blow out the control boxes with "dry" low pressure air. No other maintenance is required.

### D. Wire Straightener

The top slide bushing and the incoming guide should be inspected periodically for signs of milling. The slide bushing can be reversed. Remove the cross adjustment screw, flip the slide bushing over and reassemble the adjustment screw. Add a drop of machine oil to each of the adjustment screw threads.

### E. Vertical Head Lift

Periodically add several drops of SAE 90 grade oil into the oil cup which is on the back side of the vertical adjuster.

### F. Wire Reel Mounting

To prolong the life of the wire reel shafts, periodically coat them with a thin layer of grease.

### G. Carriage Travel Motor - Gear Box

Check the brushes periodically and replace them when 3/16 of an inch or shorter.

The gearbox gear teeth should be recoated with a non-fluid moly grease, such as a "Non Fluid Oil Corp." lubricant A29 Special/MS, after each 2000 hours of operation.

### H. Contact Nozzle

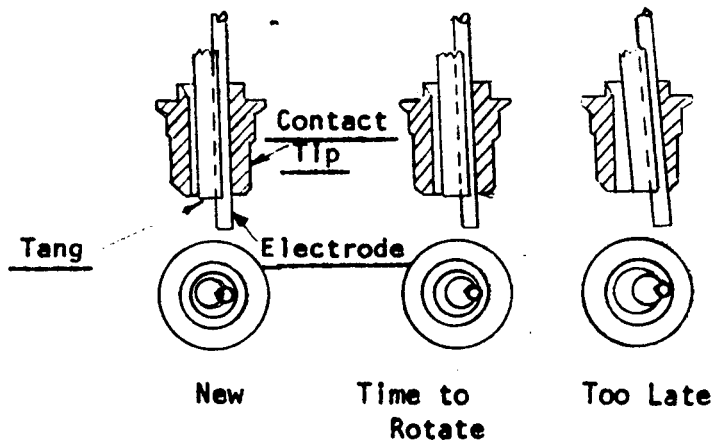
The life of the contact nozzle tips depends largely on the size, surface condition of the wire, and the welding current. The wire straightener should be set so the electrode is completely straight. Rusty or dirty wire is especially bad for contact wear.

The same contact tip is used for 3/32" through 3/16" diameter electrodes.

Feed the electrode into the nozzle. When the electrode enters the contact tip, it is automatically held against the contact tip with a preset pressure to assure a good electrical contact.

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.

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.

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" 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-sieze compound on these threads insure a longer thread life of the two mating parts. Suggested anti-sieze compounds are Graphite grease, "Go-go No-Lok" made by Gojer Corporation, Akron, Ohio, and "Anti-Sieze and Lub. Compound" made by Never Seez Compound Corporation, 2910 S. 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.

## 1. Wire Feed Speed Meter Calibration

Whenever a replacement of a control unit, wire feed motor, or a wire feed speed meter must be done, it will be necessary to re-trim the wire feed speed meter so that the meter is reading accurately. After the replacement of the component has been made, turn on the power source and the "Power On" switch of the NA-4 control. Allow at least 20 minutes for the wire feed motor to warm up before proceeding. The "Modified Series Arc Control" should be trimmed with both the lead arc wire feed motor and the middle arc wire feed motor plugged into the control unit. At the lead and the middle arc wire feeder, block open or reduce the idle roll pressure so that no wire will feed when the inch down button is depressed. Mark a line on the face of the drive roll so that the RPM can be counted. Set the "HI-Lo" switch, which is just under the speed meter, to the "Lo" position. Open the control box door, press the inch down button, and set the "Inch Speed Control" so that the wire drive output shaft is rotating exactly 6 RPM. Leave the "Inch Speed Control" at this setting. Press the inch down button and set the "Lo" trimmer which is on the back side of the wire feed speed meter so that the meter reads 30 inches per minute on the low scale of the meter. Set the "HI-Lo" switch to the "HI" position, press the inch button and set the "HI" trimmer so that the meter reads 30 on the upper scale of the meter.

### To Calibrate the "Trail Arc System"

Block open or reduce the idle roll pressure so that no wire will feed when the inch down button is depressed. Mark a line on the face of the drive roll so that the RPM can be counted. Set the "HI-Lo" switch, which is just under the speed meter, to the "Lo" position. Open the control box door, press the inch down button, and set the "Inch Speed Control" so that the wire drive output shaft is rotating exactly 10 RPM. Leave the "Inch Speed Control" at this setting. Press the inch down button and set the "Lo" trimmer which is in the back of the meter so that the meter reads 50 inches per minute on the low scale of the meter. Set the "HI-Lo" switch into the "HI" position, press the inch button, and set the "HI" trimmer on back of the meter so that the meter reads 50 inches per minute on the high scale of the meter.

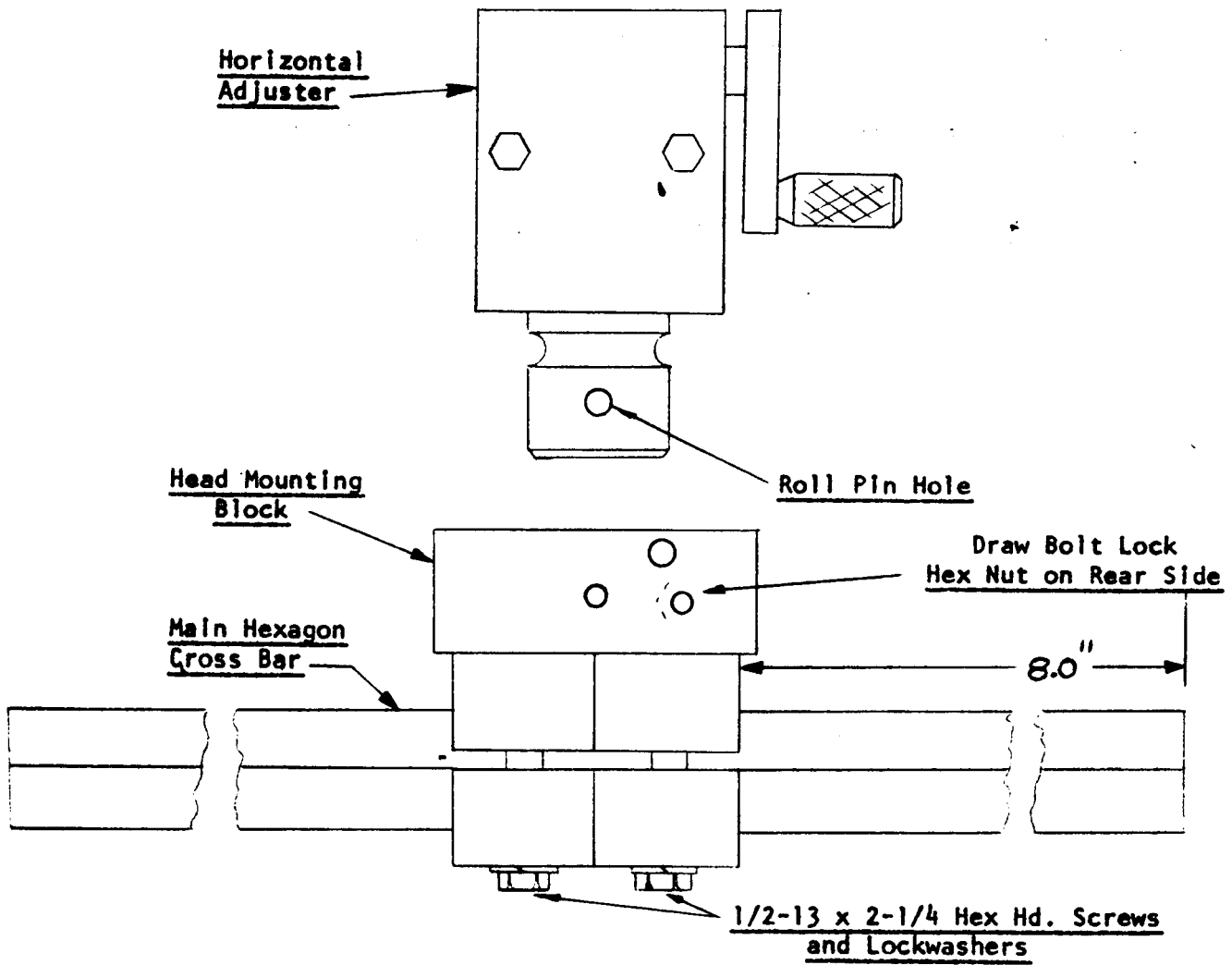
After calibration in either wire feed system, release or apply proper idle pressure to the wire for feeding.

Trimming of the speed meters must be done in this sequence (low speed trimmer first).

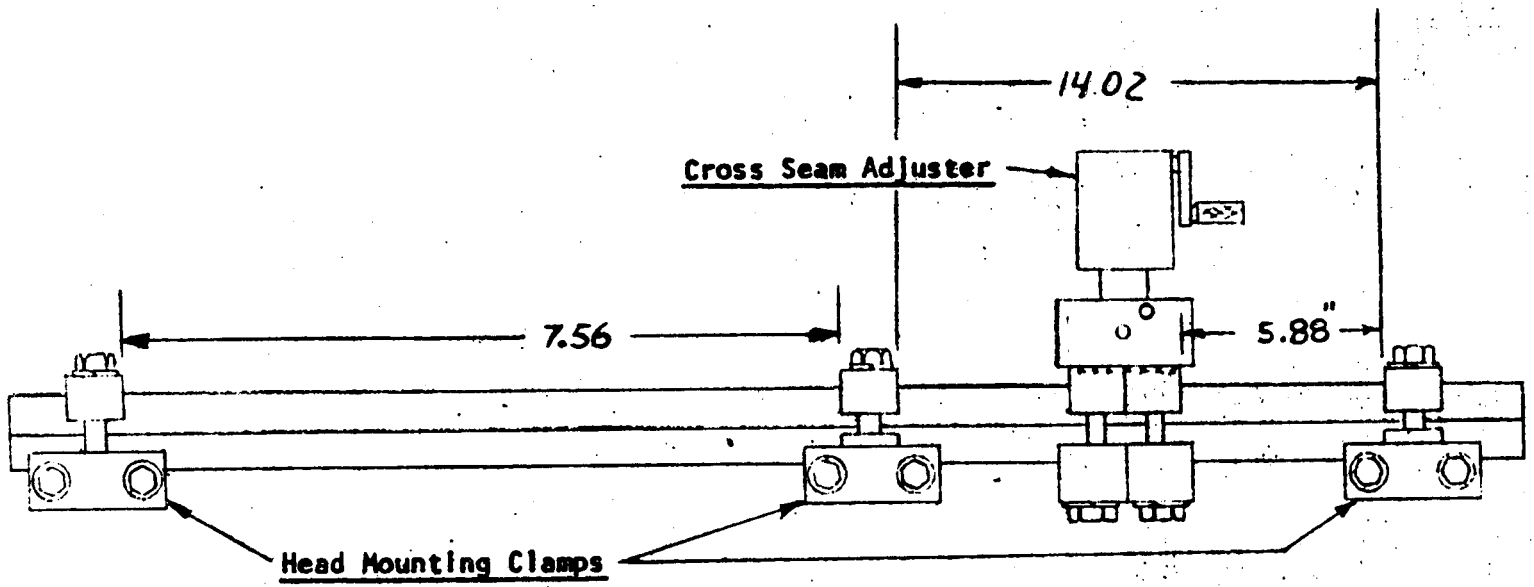
SPARE PARTS

		<u>Required</u>
A. Nozzle center guide	(5/32 - 3/16 dia. electrodes)	S-13769-2 3
	(3/32 - 1/8 dia. electrodes)	S-13769-1 ..
B. Contact tips		S-13763 6
C. Extension guide		S-13786-3/16 2
D. Extension guide support		S-13785-1 2

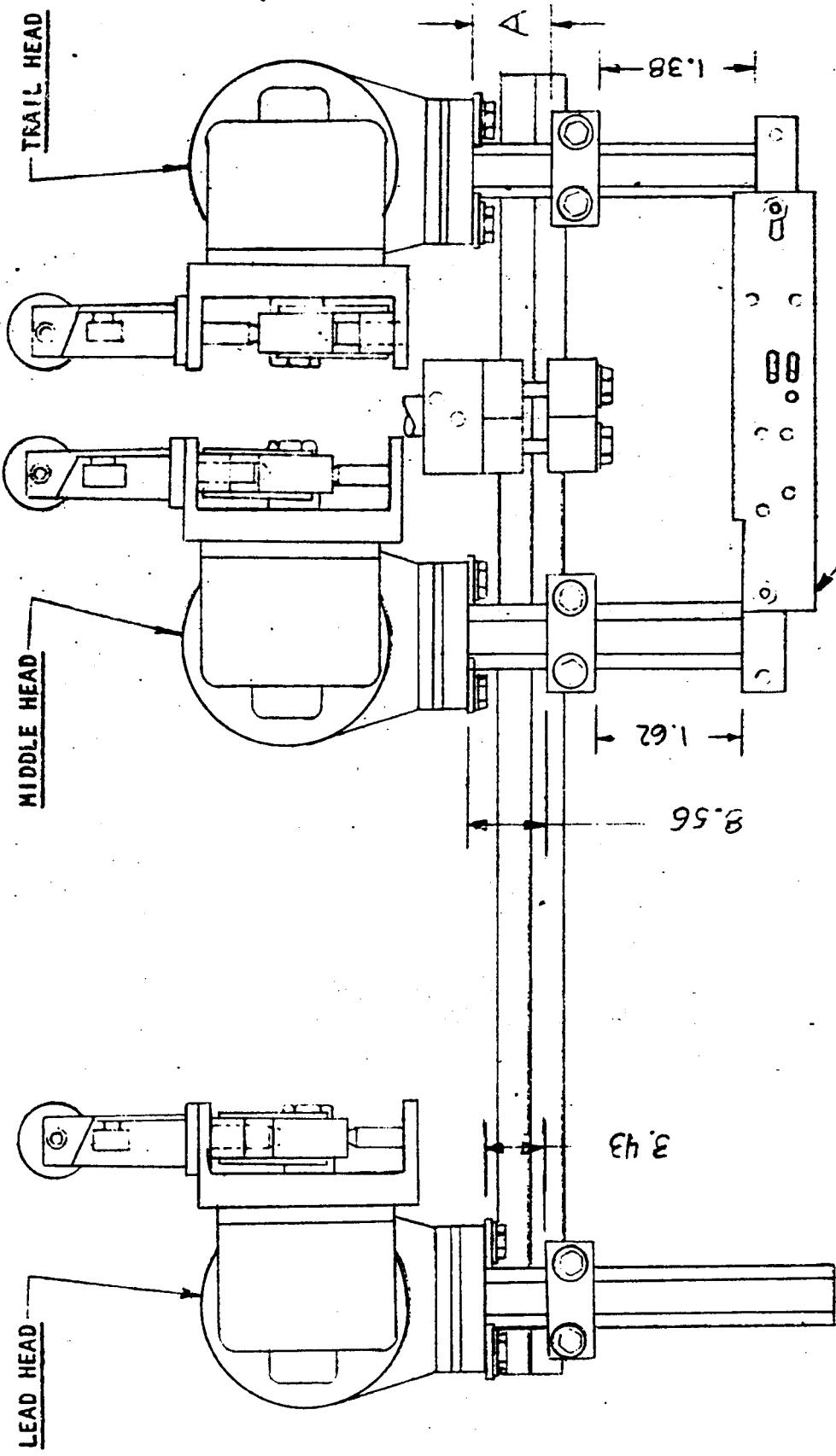
CROSS BAR POSITION WITH RESPECT TO HEAD LIFT







HORIZONTAL POSITIONING OF  
HEAD MOUNTING CLAMPS

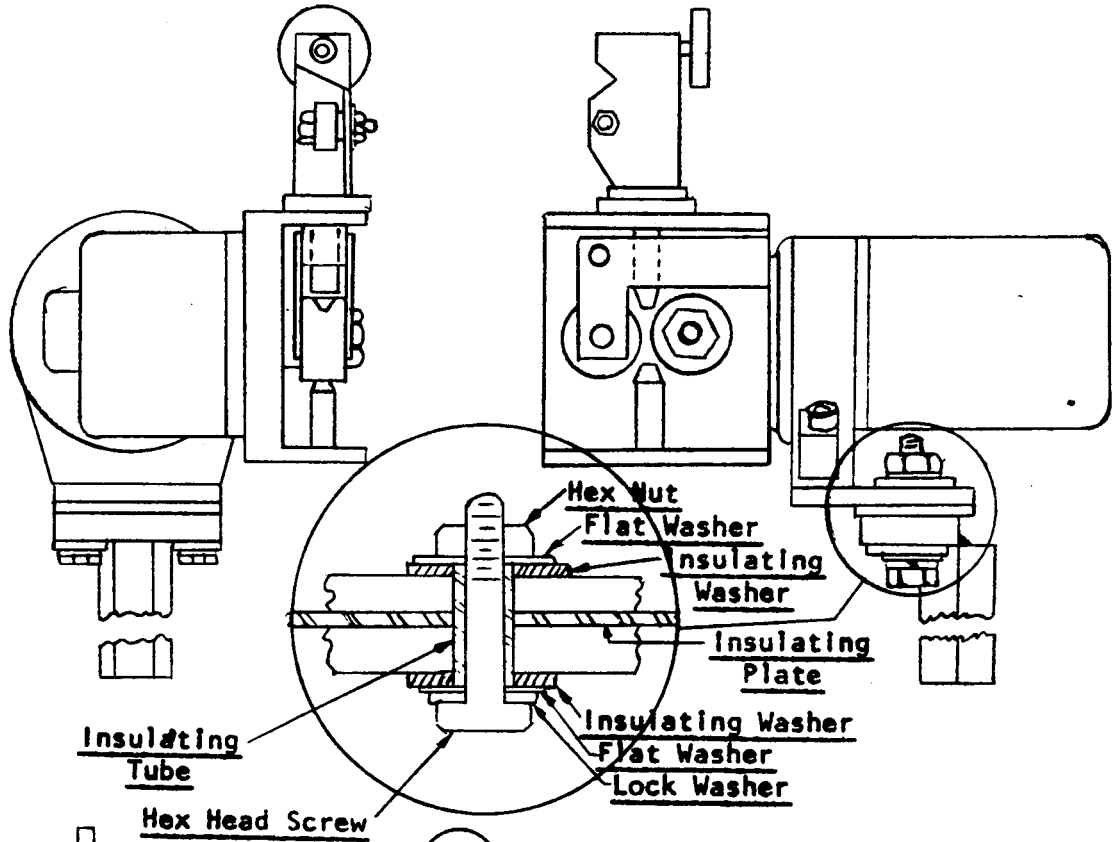


**VERTICAL POSITIONING OF HEAD MOUNTING ARMS**

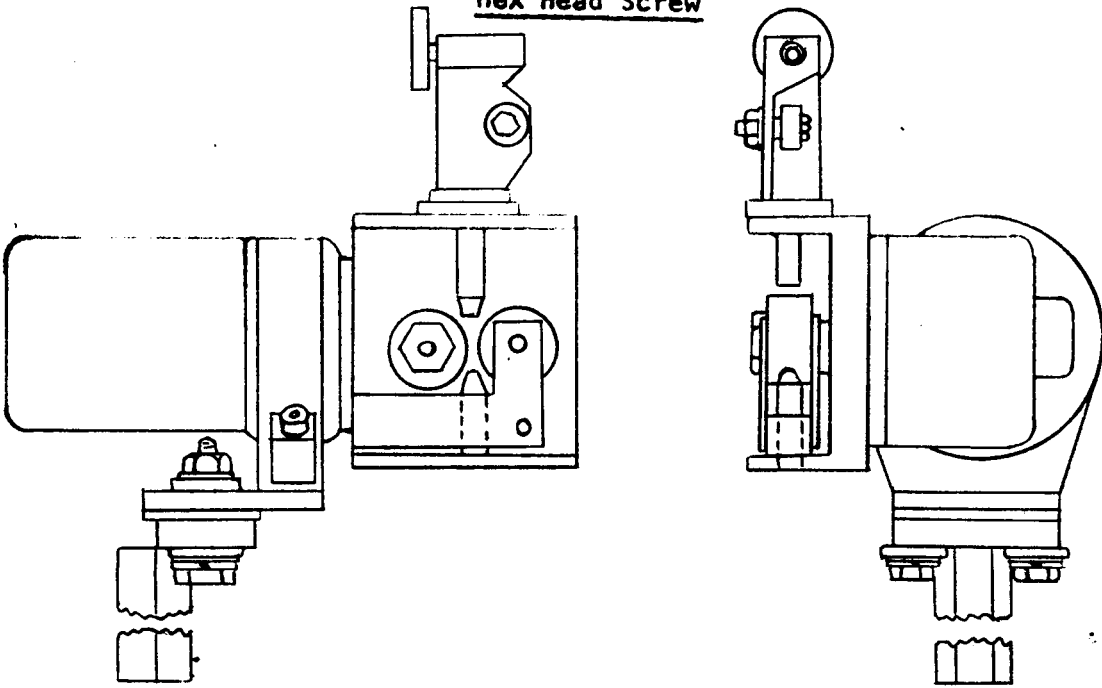
For beveled plate 3/8 and over	3-3/4"
For sq. edge butts 5/8 and under	3.00

WIRE DRIVE ARRANGEMENT  
AND HEAD INSULATION

LEAD HEAD  
and  
MIDDLE HEAD



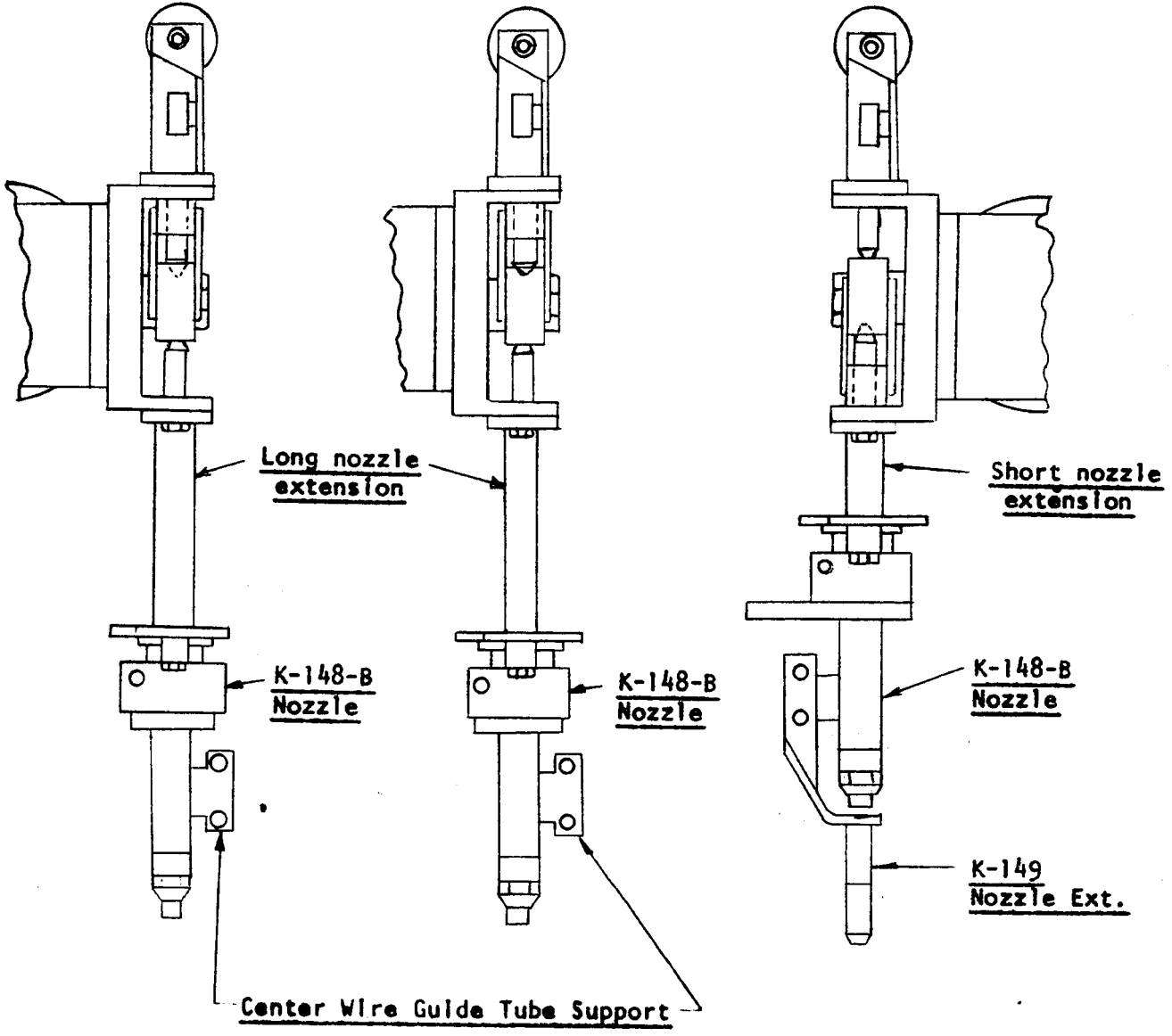
TRAIL HEAD



LEAD HEAD

MIDDLE HEAD

TRAIL HEAD

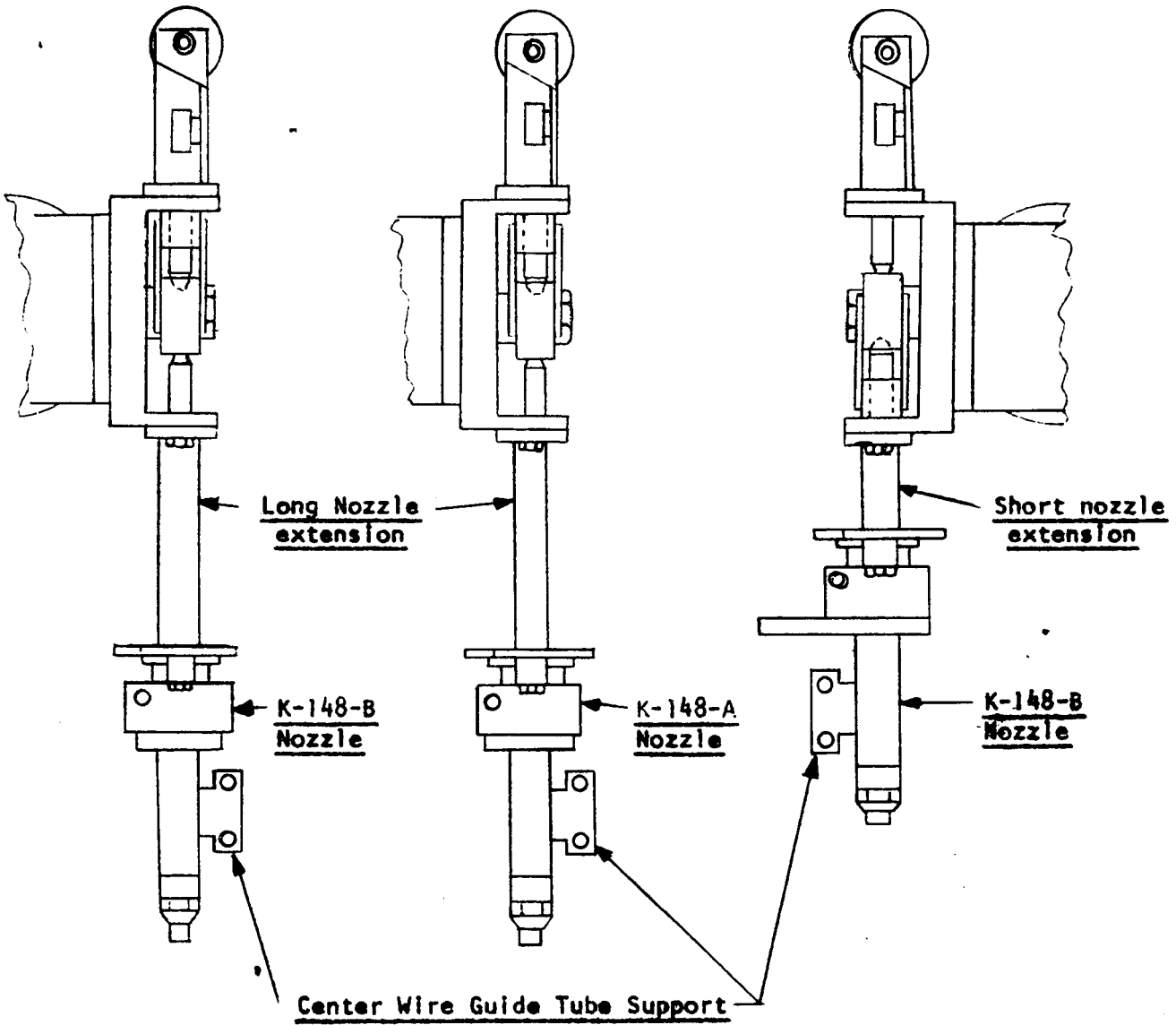


NOZZLE MOUNTING FOR  
BEVELED PLATES 3/8 AND OVER

LEAD HEAD

MIDDLE HEAD

TRAIL HEAD



Nozzle Mounting For  
Square Edge Plates 3/4 and Under



## HOW TO ORDER REPLACEMENT PARTS

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

- (a) From the nameplate — machine model, code and serial numbers.
- (b) From this manual — part name, item number, quantity required and the

number of the list used to get this information.

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

## GUARANTEE

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

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

No expense, liability or responsibility will be assumed by the Seller for repairs

made outside of the Seller's factory without written authority from the Seller. The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of any warranty. The liability of the Seller arising out of the supplying of said equipment or electrode or its use by the Buyer, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment or replacing defective electrode in accordance with the above guarantee. Upon the expiration of any period of warranty, all such liability shall terminate.

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



## THE LINCOLN ELECTRIC COMPANY

World's Largest Manufacturer of Arc Welding Products • Manufacturer of Industrial Motors

Sales and Service Worldwide

Cleveland, Ohio 44117-1199 U.S.A.

Toronto M4G 2B9 - Canada

Sydney 2211 - Australia

Rouen 76120 - France

Litho in U.S.A.