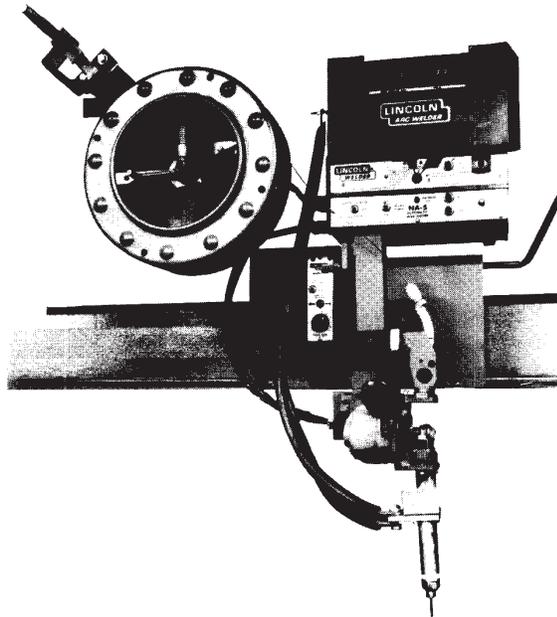




## Operator's Manual

# NA-5 AUTOMATIC WELDING SYSTEM



For use with machines having Code Numbers:

**12430, 12431, 12434,  
12435, 12438**



**Register your machine:**

[www.lincolnelectric.com/register](http://www.lincolnelectric.com/register)

**Authorized Service and Distributor Locator:**

[www.lincolnelectric.com/locator](http://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 Safety Data Sheet (SDS) 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



**WARNING:** Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects, or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an exposed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to [www.P65warnings.ca.gov/diesel](http://www.P65warnings.ca.gov/diesel)

**WARNING:** This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 *et seq.*)



**WARNING:** Cancer and Reproductive Harm  
[www.P65warnings.ca.gov](http://www.P65warnings.ca.gov)

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

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

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



### FOR ENGINE POWERED EQUIPMENT.

- 1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.
- 1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.
- 1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact



with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

- 1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.
- 1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- 1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- 1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.
- 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.



## 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.



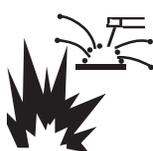
## FUMES AND GASES CAN BE DANGEROUS.



- 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 hardfacing (see instructions on container or SDS) 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 unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also 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 Safety Data Sheet (SDS) and follow your employer’s safety practices. SDS 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, 14501 George Carter Way Chantilly, VA 20151.



## 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.**

# NOTES

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## PRODUCT DESCRIPTION

A new concept in automatic welding – a wire feeder which, when used with an appropriate Lincoln power source, takes the guesswork from procedure setting and procedure control. Designed to achieve higher quality control and weld quality levels more easily. The arc voltage and wire feed speed can be set on digital meters before the arc is struck and the procedure remains precisely set day in and day out on production jobs.

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Travel Carriage Installation . . . . .	Sec. T2.2.4
Submerged Arc Contact Assemblies . . . . .	Sec. T2.2.6
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K219 Flux Hopper Kit . . . . .	Sec. T2.5.9
K337 Weld Timer Module . . . . .	Sec. T2.5.10
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K58 Magnetic Separator . . . . .	Sec. T2.5.17
K310 Flux Screen . . . . .	Sec. T2.5.18
K349 Multi-Procedure Kit . . . . .	Sec. T2.5.19

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**Sec. T7 – Parts Lists**

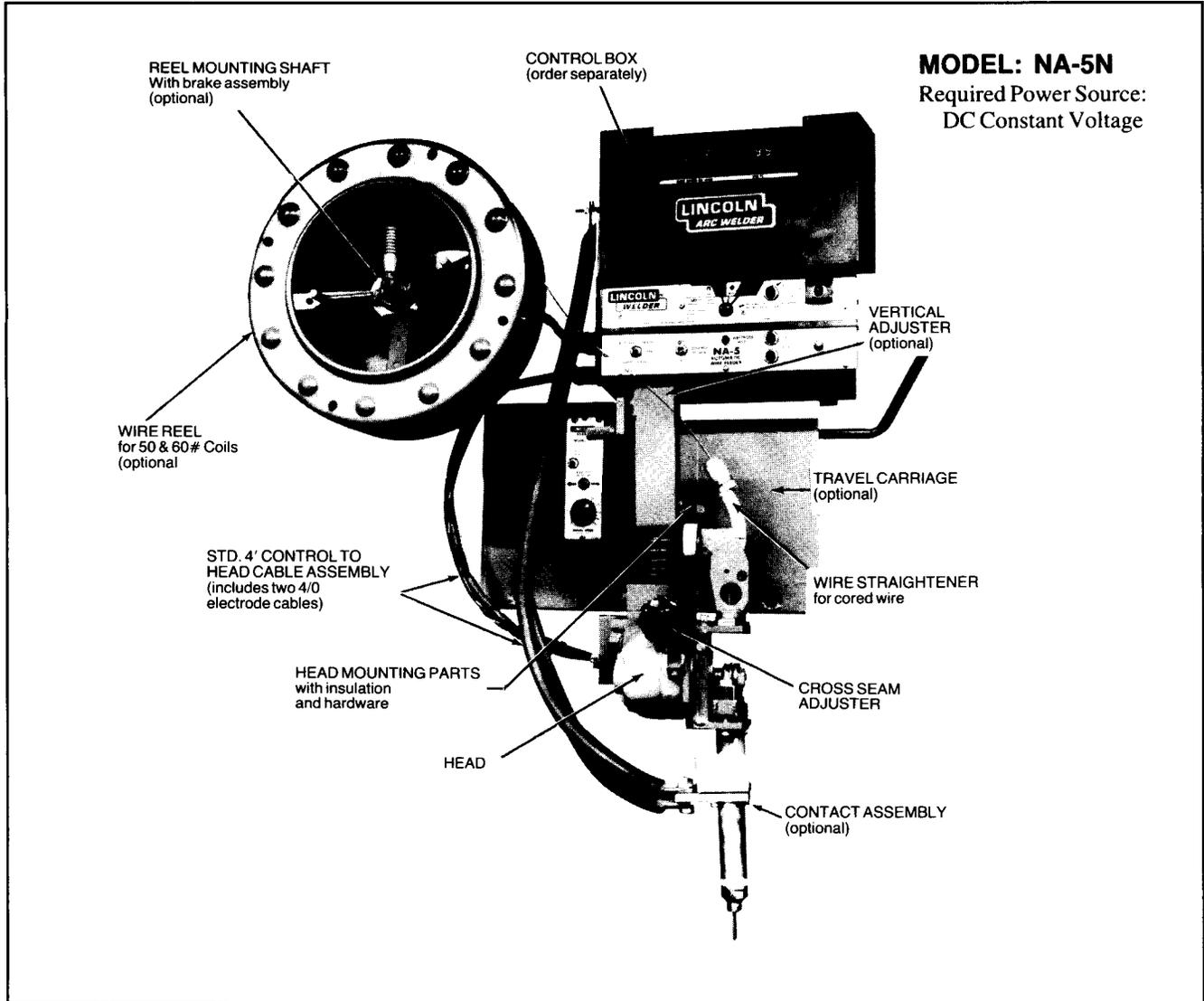
Wiring Diagrams and Dimension Prints – At back of Manual

February 1982

## SEC. T2.2 – MECHANICAL INSTALLATION

Sec. T2.2.1-N

### Available Models



### MODEL: NA-5NF HEAD

(For Machinery and Fixture Builders)

NA-5 Control (order separately)

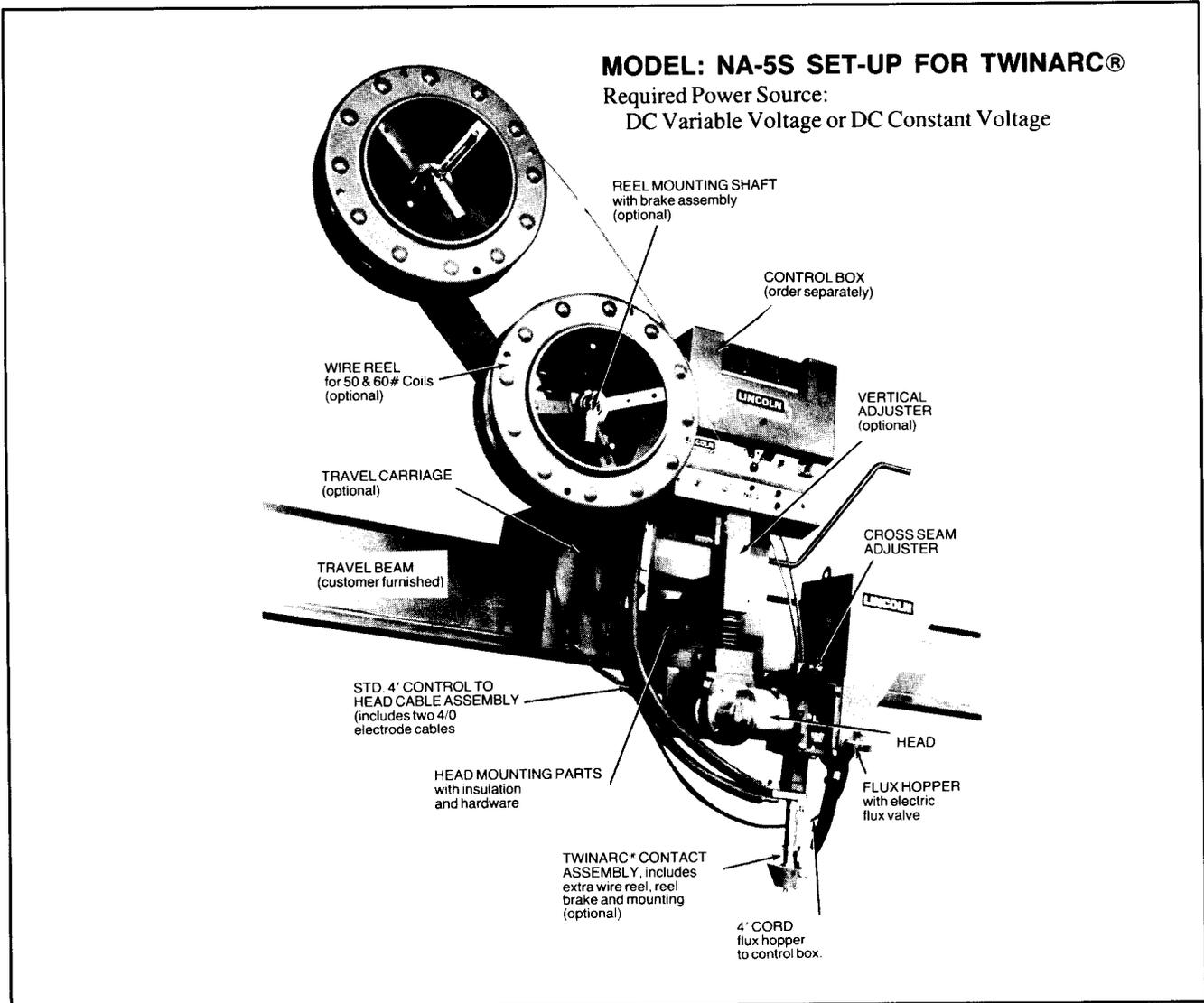
**Required Power Source:** DC Constant Voltage

Identical to the NA-5N except the following parts are not included:

- Head Mounting Parts
- 4' Electrode Cable
- Cross Seam Adjuster

Sec. T2.2.1-S

**Available Models**



**MODEL: NA-5SF HEAD**  
(For Machinery and Fixture Builders)

NA-5 Control (order separately)

**Required Power Source:**  
DC Constant Voltage

Identical to the NA-5S except the following parts are not included:

- Head Mounting Parts
- 4' Electrode Cable
- Cross Seam Adjuster
- Flux Hopper and Pointer Assembly

## MECHANICAL INSTALLATION — CONT'D

Sec. T2.2.2

(File as Sec. L2.2.2 for IM-278)

### Head Installation

#### 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. T3.2.3.

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.

This equipment is for industrial use only and it is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There can be potential difficulties in residential locations due to conducted as well as radiated radio-frequency disturbances. The EMC or RF classification of this equipment is Class A.

Sec. T2.2.1-A

### General Specifications

#### Model: NA-5 Control

Solid wire size range	.045 – 7/32 in (1.1 – 5.6 mm)
Wire feed speed range	23 – 456 ipm (0.6 – 11.6 m/min)
Current capacity	1500 A/100% duty cycle (continuous operation)

#### Environmental Area:

Keep the machine dry at all times. Do not place it on wet ground or in puddles. Never place liquids on top of the machine.

## MECHANICAL INSTALLATION—CONT'D

### 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. T2.2.11 or Sec. T2.2.12 respectively. To mount heads on the standard travel carriage, see Sec. T2.2.4. To mount heads on a separate fixture, provide the mounting holes specified in the dimension print.

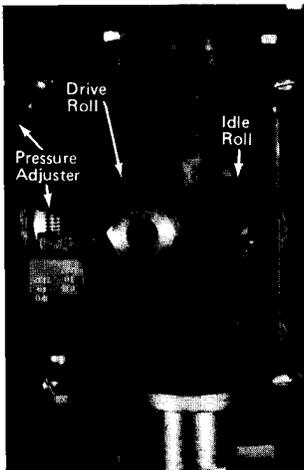
### C. SPECIFIC REQUIREMENTS FOR THE NA-3NF AND NA-3SF, NA-5NF AND NA-5SF

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. Refer to appropriate dimension print.

### 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. T6.2.2.

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).



As Shipped

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". 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.

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.

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### E. CONTACT ASSEMBLIES

Several different contact assemblies are available. See Sec. T2.2.6, T2.2.7, T2.5.3 or T2.5.4 for installation instructions.

### F. WIRE REEL

If 300 to 1000 pound Speed-Feed® reels or Speed-Feed® drums are to be used, see Sec. T2.5.7.

When ordered, the reel for 50 or 60 pound 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

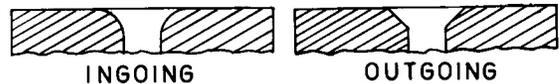
The NA-3S, NA-3SF, NA-4, NA-5S and NA-5SF models are shipped with a solid electrode straightener for 5/64" and larger wire.

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 .045 thru 5/32" Cored electrode. It can also be used with 5/64" and 3/32" solid wire. For solid wires above 3/32", use the M8269-1 Solid Wire Straightener.
2. A tightly wound spring type wire guide for .035 thru 1/16" 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.



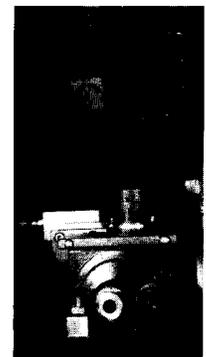
Turn the straightener so it points toward the wire reel. Tighten the two clamps supplied to hold it in position.



For 5/64" & Larger Solid Electrode.



For Flux Cored Electrode.



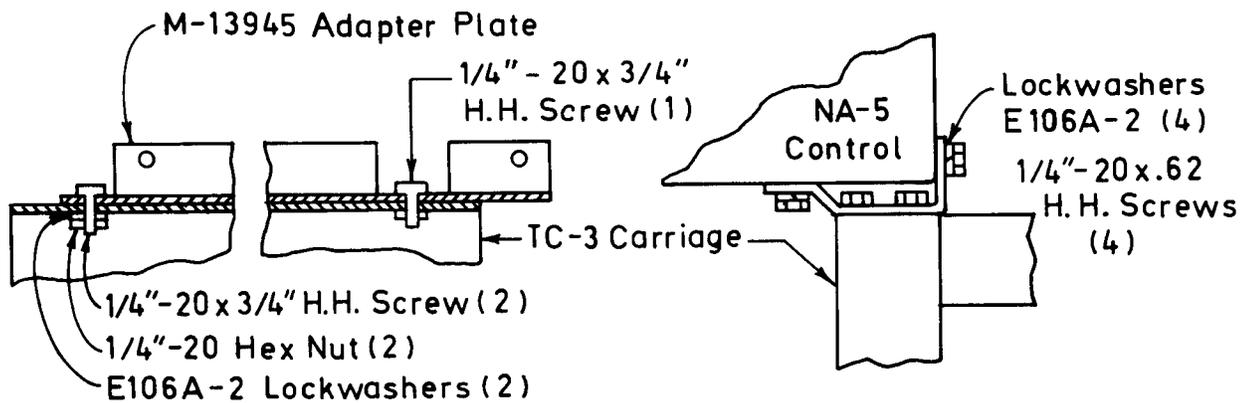
For .035-1/16" Solid Electrode.

## Sec. T2.2.3

**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.

When mounting to the travel carriage, use mounting kit T14469. Bolt the adapter plate to the top of the carriage using the hardware supplied. The NA-5 control box is then mounted to the adapter plate using four bolts and lockwashers, two from the bottom and two on the back.



For complete details on carriage operation, see Sec. T2.2.4.

If mounting the controls on a fixture, use the mounting holes provided in the bottom and/or back of the box. See dimension print S16717. The control box should be mounted so the controls and meters are convenient for the operator.

February 1982

**MECHANICAL INSTALLATION – CONT'D.**

Sec. T2.2.4-C

(File as Sec. L2.2.4-C for IM-278)

**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.

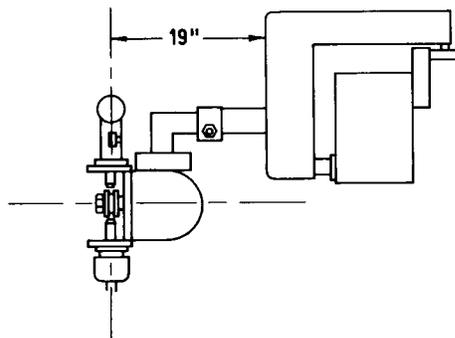
**K325 STANDARD CARRIAGE (Carriage bearing width .472)**

Single Wire Operation	Twin Wire Operation
1. Single head and control	1. Single head and control
2. Single wire reel	2. Two wire reels
3. Vertical adjuster	3. Vertical adjuster
4. Horizontal adjuster	4. Horizontal adjuster
5. Flux hopper	5. Flux hopper
6. 75 lbs. of auxiliary equipment centrally located over carriage	6. No auxiliary equipment

**K325HC HIGH CAPACITY CARRIAGE (Carriage bearing width .866)**

Multiple Arc Operation	Tandem Twinarc
1. Two heads and controls	1. Three heads and controls
2. Two wire reels	2. Three wire reels
3. Vertical adjuster	3. Vertical adjuster
4. Horizontal adjuster	4. Horizontal adjuster
5. Flux hopper	5. Flux hopper
6. 150 lbs. of auxiliary equipment centrally located over carriage	6. No auxiliary equipment

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 dimensions shown in Figure 1.



**Figure 1**

**INSTALLATION**

All carriages are factory assembled to fit an 8" beam; for 10" and 12" beams see G1458 (NA-3, NA-4 and NA-5) for instructions for proper shimming.

**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.

The carriage release handle, wire reel support bracket, and the head supporting bracket are not factory mounted. 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.

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).

Insert the 3-prong plug (codes above 8300 use a 4-prong 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 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 thick beam flange when the release handle is in the up position. If the flange is other than .88 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.

Sec. T2.2.4-C (Continued)

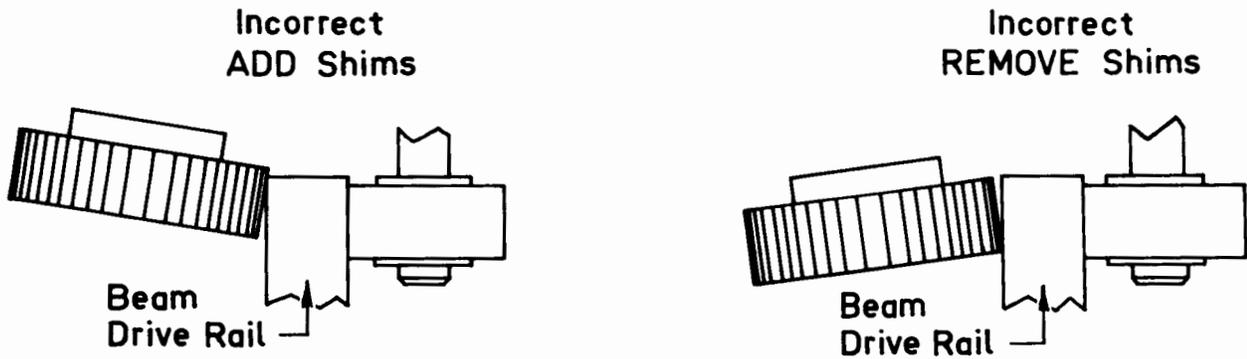
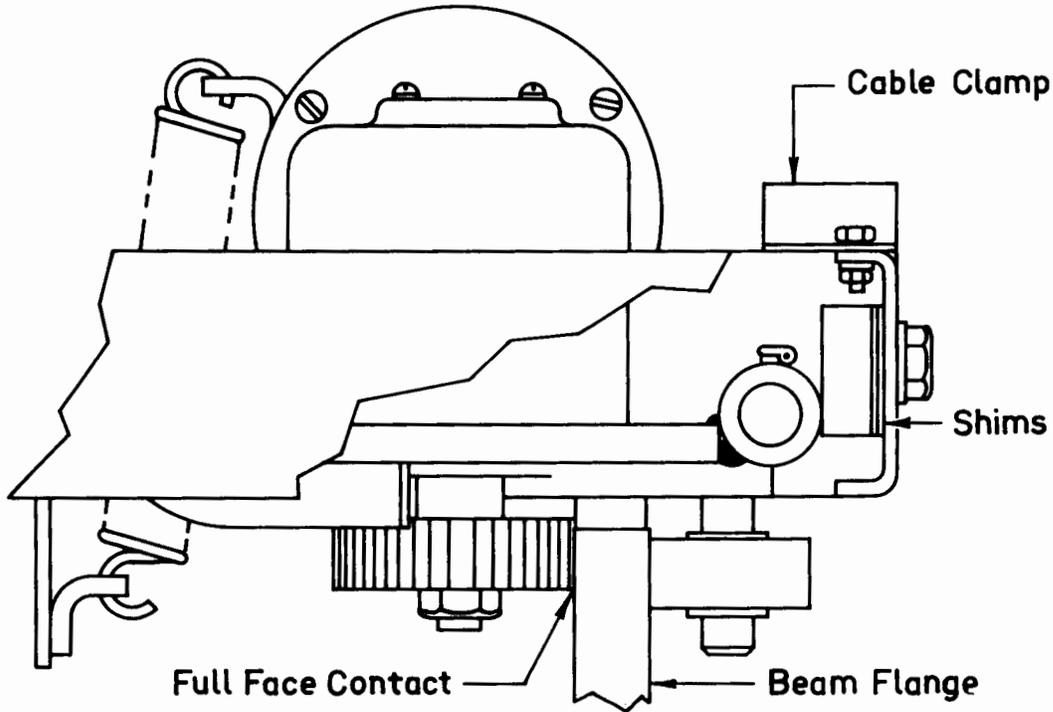
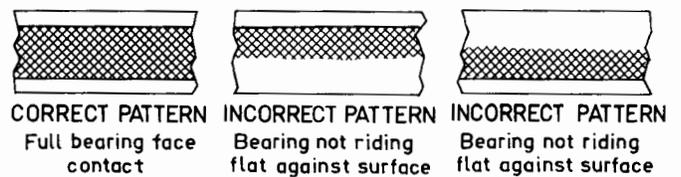
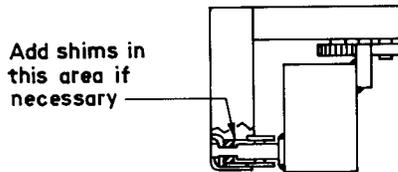


Figure 2



Sec. T2.2.4-C (Continued)  
(File as Sec. L2.2.4-C for IM-278)

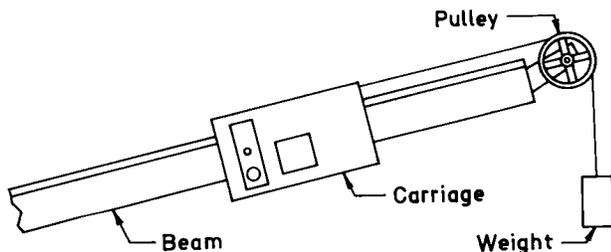
The out-of-squareness between the carriage and the beam can be corrected by shimming the lower bearing assembly bar:



### 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 inches per minute
K325S	952-1	5-75
K325F	254-1	15-270

### 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.
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:*

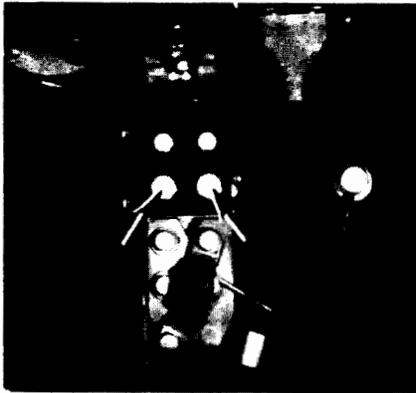
1. Check the motor brushes. If .25 or shorter, replace with new.
2. Check the carriage drive gear teeth. If the teeth are badly worn, replace the drive gear.
3. After 5,000 hours of operation, the motor and the first reduction should be removed from the gear box, and all of the gear teeth should be re-coated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

February 1982



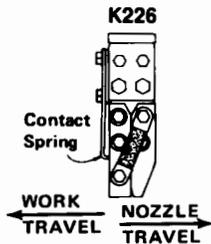
## B. K226 Contact Jaw Assembly

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



For submerged arc welding generally at currents from 600 to 1000 amps. Model K266T with two tapered jaws feeds  $\frac{3}{32}$ " and  $\frac{1}{8}$ " electrodes. K226R with one tapered and one rectangular jaw feeds  $\frac{1}{8}$ " thru  $\frac{7}{32}$ " electrodes. The braided shunt is not included with the K226T.

**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  $90^\circ$  apart.)



Connect two electrode cables coming from the control box to the contact jaws by placing one under each of the  $\frac{1}{2}$ -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" piece of bare  $\frac{5}{32}$ " 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  $\frac{3}{32}$ " diameter electrodes.



Unless a separate K219 Flux hopper kit was ordered, a T10642-11 flux hose must be purchased. A S7748-35 hose tip must also be purchased separately.

**Installation** — Depending upon the electrode size specified when the nozzle was ordered, either a liner for .035 thru .052" electrode or for  $\frac{1}{16}$ " thru  $\frac{3}{32}$ " 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 assure 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  $90^\circ$  apart. When a groove is worn in one direction, remove the shoe, turn it  $90^\circ$  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.

October 1997

## FOR SUBMERGED ARC AND WELDING WITH INNERSHIELD® ELECTRODES

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

#### Sec. T2.2.7

(File as Sec.L2.2.7 for IM-278)

(File as Sec.M2.2.7 for IM-279)

This nozzle can be used with the NA-3, NA-4 and NA-5 wire feeders. K148A is designed for  $\frac{3}{32}$ " and  $\frac{1}{8}$ " wire sizes. K148B is designed for  $\frac{5}{32}$ " and  $\frac{3}{16}$ " wire. K148C is designed for  $.068$ " to  $\frac{5}{64}$ " wire.

#### Current Ratings

##### A. Without Linc-Fill Attachment

Innershield welding:

600 amps, 100% duty, no water cooling

1100 amps, 100% duty, with water cooling

Submerged arc welding:

1100 amps, 100% duty, no water cooling

##### B. With K-149 Linc-Fill Attachment

Innershield or Submerged Arc

1100 amps, 100% duty, no water cooling

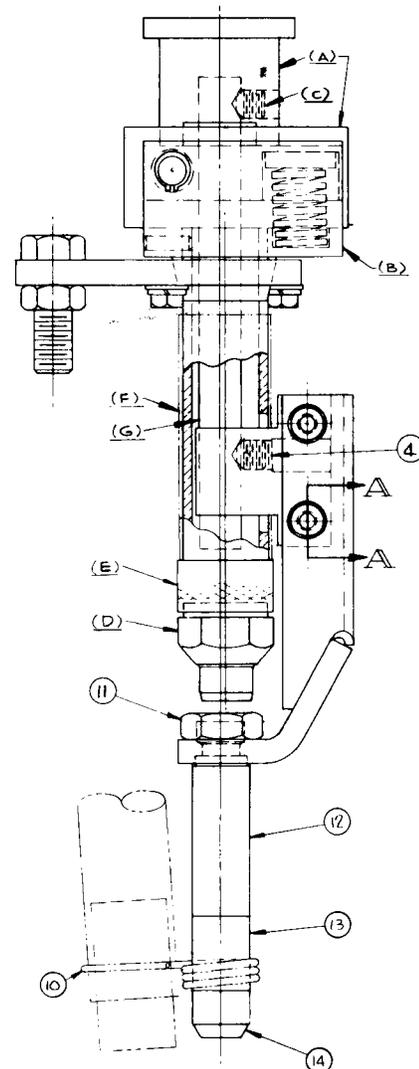
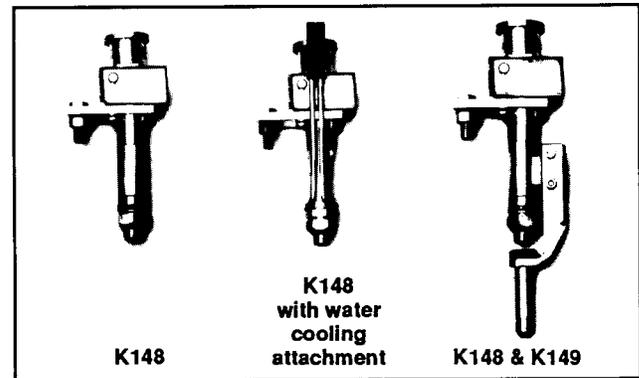
#### Water Cooling Attachment

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.

The Magnum Water Cooler 20 saves water and is recommended for most applications. The other solution is to connect the attachment to the water supply and the drain with rubber tubing obtained locally. Water flow should be between 1/2 – 1 gallon (1.9 – 3.8 L) of tap water per minute.

#### K149 Installation

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  $\frac{3}{8}$ " (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.

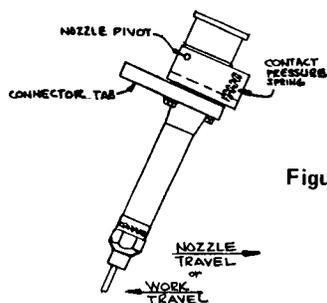


Figure 1

### Operation

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

### Loading of Wire

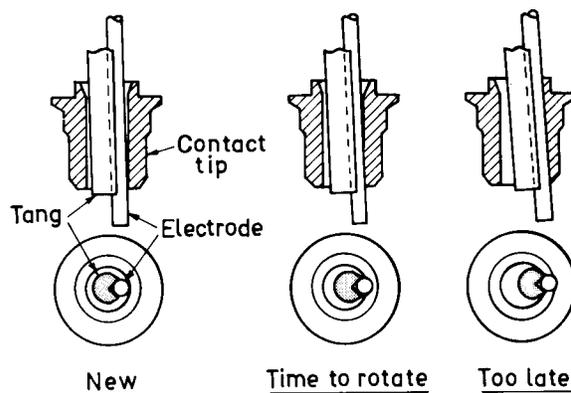
Straighten the start end of the coil for at least eight inches, pass the end down through the appropriate wire straightener. Inch the wire through the wire feeder and the nozzle.

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 I.D. 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" (9.5 mm) hole in the contact tip. Under these conditions the contact tip can be easily removed from the nozzle body.

Sec. T2.2.7 (Continued)

(File as Sec. L2.2.7 for IM-278)

(File as Sec. M2.2.7 for IM-279)

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 insures a longer thread life of the two mating parts. Suggested anti-sieze compounds are Graphite grease per Lincoln specifications E-2067 and "Anti-Sieze and Lub. Compound" made by Never Seez Compound Corporation, 2910A. 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.

April 1988

Sec. T2.2.8

(File as Sec.L2.2.8 for IM-278)

**For Submerged Arc Welding  
K285 Concentric Flux Cone**

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

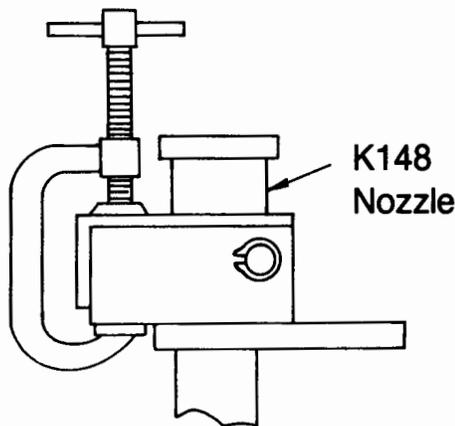
The unit consists of two members that are electrically insulated from each other. One of the members is fastened to the nozzle body with two worm-type hose clamps. The second member is adjusted up and down on the stationary member to the desired height and then locked in position with a wing screw. The moving member supports the flux hose and the concentric copper flux cone.

**NOTE:** The concentric flux cone does *not* have suitable insulation for use with high frequency starting.

**I. INSTALLATION**

**A. K148 Nozzle**

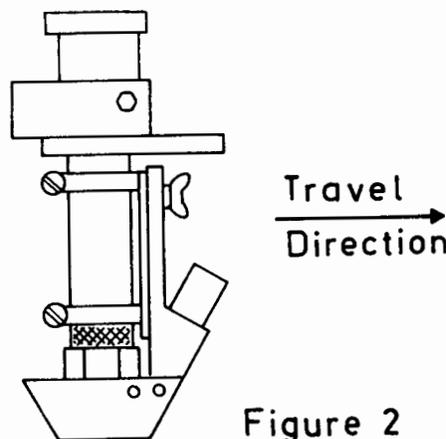
1. Remove spring pressure on center guide tube by applying a "C" clamp as shown in Figure 1. Apply only enough clamping force to relieve the tang pressure from the I. D. of the tip.



**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.

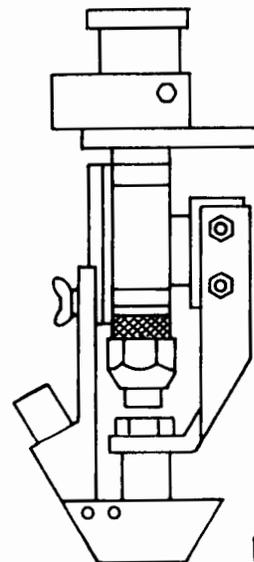


**Figure 2**

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.
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 electrical stickout.
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  $7^\circ$ , 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).

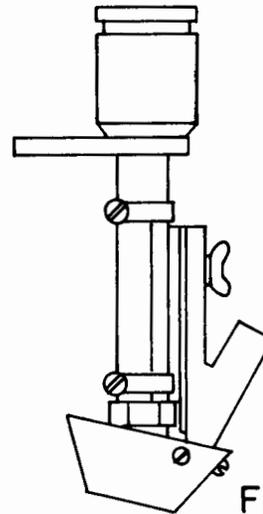


Figure 4

### D. All Nozzles

After the installation to any of the three 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 the ground during the welding operation the cone will be damaged.

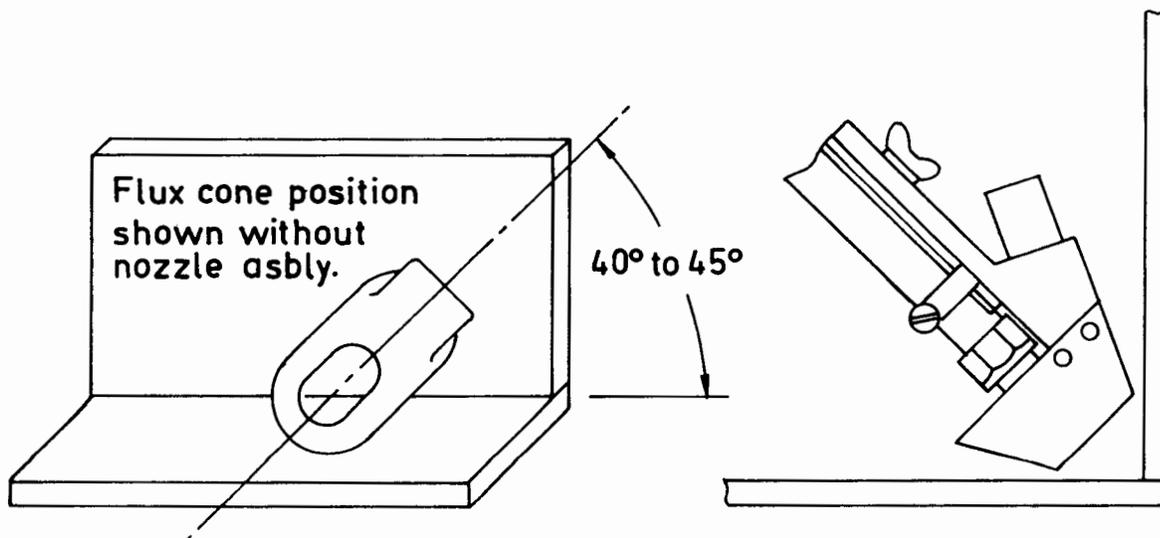


Figure 5

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

## II. GENERAL OPERATING COMMENTS

### A. Nozzle positions for Horizontal Fillets

1. K148 or K148 with K149.

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 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 the clamps.

Loosen wing screw, allowing the cone assembly to slide down within .12 of an inch 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 insure 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.

February 1982

## MECHANICAL INSTALLATION – CONT'D

Sec. T2.2.11

(File as Sec. L2.2.11 for IM-278)

(File as Sec. E2.7.7 for IM-245)

### 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 can be achieved with this attachment.

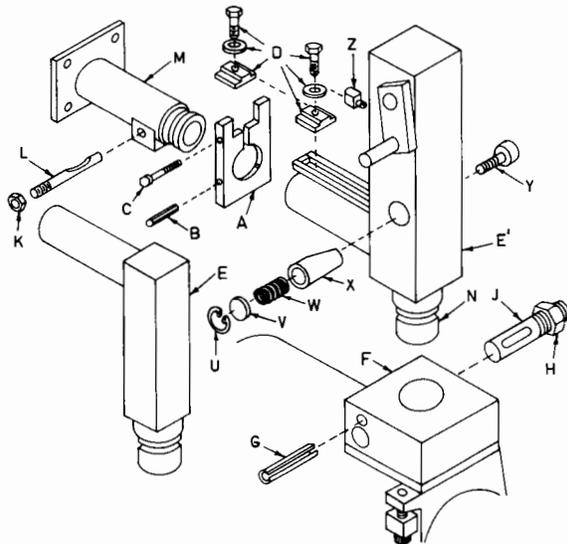


Fig. 1 — NA-2, NA-3, NA-4 and NA-5

#### B. INSTALLATION

Check the carton for the following items:

1. Head adjustment lock (A).
2.  $\frac{1}{4}$ " diameter roll pin (B).
3.  $\frac{1}{2}$ " —  $13 \times 2.75$  hex head lock 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  $\frac{1}{4}$ " 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 the clamp ring (A) with the open slot in the up position, using the  $\frac{1}{2}$ " 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. T2.2.12.
10. Raise the welding head (or horizontal adjuster) back into position on the up and down lift shaft (N). Drive the  $\frac{5}{16}$ " 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.

Sec. T2.2.12

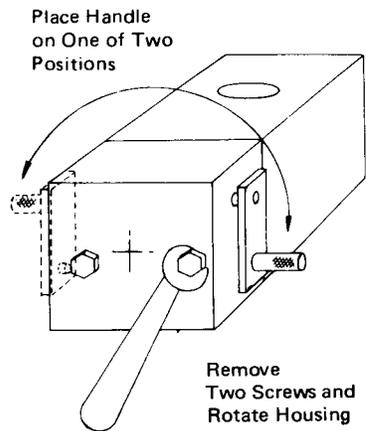
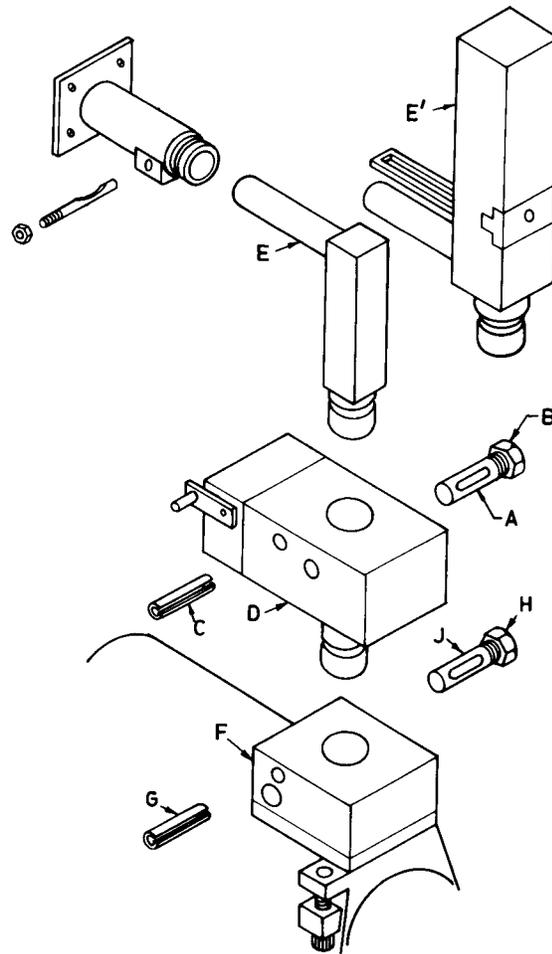
(File as Sec. L2.2.12 for IM-278)

(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. T2.2.11.
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 1982

## SEC. T2.3 – ELECTRICAL INSTALLATION

### Sec. T2.3.1

#### Wiring the Equipment

**⚠ WARNING**



ELECTRIC SHOCK  
can kill.

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

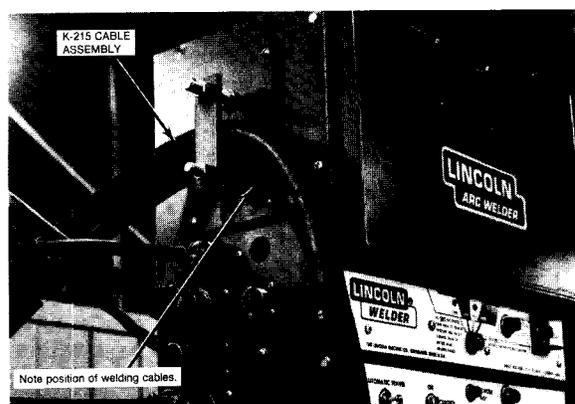


Figure 1

#### A. INPUT POWER REQUIRED

The only power required for operation of the control is 115 volts AC, 50 or 60 Hz.

All power sources covered in Sec. T2.3.4 provide the required power. If there is no connection diagram available for a particular power source, the power source is not suitable for use with the NA-5.

#### B. CONNECTION OF HEAD TO CONTROLS

All heads include a 4-foot motor and motor tachometer 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 mounted so the 4-foot cables are not sufficient, install a K335 or K338 Control to Head Extension cable of the length ordered (up to 30 feet). The K335, for the NA-5S head, includes motor, tachometer and flux hopper lead extensions with polarized plugs on each end and electrode cables. The K338 for the NA-5N, NF, and SF heads, is the same as the K335 *without* the flux hopper lead extension.

The NA-5N and NA-5S also include two 4-foot lengths of electrode cable. Bolt the terminals of one end of the cable pair to the wire contact assembly and the terminals of the other end to the electrode leads to the K215 Power Source to Control cable assembly. Properly insulate the bolted connection. When the K335 or K338 extension cables are used between the controls and heads, the 4-foot lengths of electrode cable are not used. If currents or duty cycle higher than 1000 amperes at 80% duty cycle will be used, add additional electrode cable per Table 1.

The “F” models do not include the 4-foot lengths of electrode cable as standard. If not using a K335 or K338, for the NA-5NF or NA-5SF order an appropriate length of the needed electrode cable. Connect it between the wire contact assembly and the K215 cable assembly 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 CONTROL TO POWER SOURCE CABLE ASSEMBLY

At the NA-5 control, in order to activate the NA-5 weld current sensing switch, the electrode cables of the K215 cable assembly must be placed under the clamp bar on the left hand side of the control box. See Figure 1. (This is necessary for proper operation of the reed switch.) The nuts holding the clamp bar in place need only be pulled up snug. Do not over tighten. If a carriage is used, the electrode cables should also be clamped to it with the cable clamp supplied on the carriage. Do not clamp the control cable under the travel carriage clamp, but route it over its top.

Insert the polarized connector of the control cable in the K215 assembly into the matching receptacle on the side of the control box.

With the power source off, connect the K215 Power Source to Control cable assembly to the power source as follows:

1. If using a multiprocess power source (SAM, SA-800, SAF-600, DC-400, DC-600, DC-1000 or DC-1500 types), be sure it is properly set for the welding process being used per the connection diagram.
2. Connect the K215 control cable leads to the power source terminal strip exactly as specified on the appropriate connection diagram. Include all jumpers on the terminal strips as shown on the diagram. *Do not* put on any other jumpers. If currents or duty cycle higher than 1000 amperes at 80% duty cycle will be used, add additional electrode cables to the K215 assembly per Table 1.
3. Depending on the power source and process to be used, the jumpers on the NA-5 Voltage Board may have to be changed. As shipped, the NA-5 is connected for use with the DC-400, DC-600, DC-1000 or DC-1500 type power sources. For other power sources, refer to the appropriate connection diagram and Sec.T3.6.
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.

Sec. T2.3.1 (Continued)

**D. ELECTRODE POLARITY**

Polarity is changed by operating the polarity switch on the power source if so equipped or by interchanging the welding leads on the power source output studs.

**IMPORTANT: WHEN CHANGING POLARITY ON INSTALLATIONS USING THE DISCONTINUED K224 SOLID-STATE REMOTE CONTROL:**

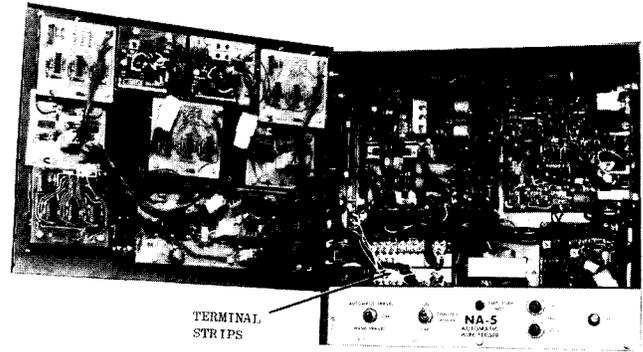
Turn generator off and allow it to come to a *complete stop* before changing polarity. The polarity switch on the solid-state remote field control and the power source polarity must be set to the same polarity. Failure to do so will result in blowing the fuse in the solid-state remote field control and loss of generator output.

The polarity of the NA-5 control circuit is shipped connected for electrode positive. If electrode negative is required, two leads inside the NA-5 control must be reversed. Proceed as follows:

Turn off the input power to the NA-5 control box by turning off the welding power source. Open the control box door and locate the terminal strips mounted on the back of the box in the lower left hand corner. On the right end of the lower terminal strip, interchange the black and white leads going to the terminals marked (+) and (-). The black lead (No. 67) must be connected to the same polarity as the electrode welding lead, i.e. if the electrode is positive, connect the black lead to the (+) terminal on the terminal strip. The white lead (No. 21) is connected to the opposite polarity terminal.

**E. 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. This



is a 4-prong receptacle connected to leads #531, #532, #25, and a grounding lead. Leads 531 and 532 are 115 volts AC. Leads #25 and #531 are 115 volts AC with #25 connected through the wire feeder travel switching circuit for manual or automatic starting and stopping. (See Sec. T2.2.4-C for completed details on the K325 Travel Carriage.)

**F. 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. T3.5.2 for a description of these sequences and the needed reconnection instructions.

**G. SPEEDMETER CALIBRATION**

The jumper on the NA-5 Speedmeter board, located on the backside of the NA-5 door behind the digital speedmeter, is factory shipped connected to Pin "95" which is correct for a 95/1 NA-5 head ratio using the S12514 drive roll.

For NA-5 heads with other ratios or drive rolls, the jumper must be reconnected per chart below:

Speedmeter Pin	NA-5 Head Ratio	Drive Roll Part No.	NA-5 Head "K" No.	Wire Size Range, in (mm)		Rated Speed Range, ipm (m/min)
95S	95/1	S12515 or S19113	K346-1B K347-1B	Single	1/16-3/32 (1.6-2.4) or .045 (1.1)	23-456 (0.6-11.6)
95S	95/1	S13161-.052	K346-1B K347-1B with K129	Twin	.045-.052 (1.1-1.3)	23-456 (0.6-11.6)
		S13161-5/64		Twin	1/16-5/64 (1.6-2.0)	
		S14904 (outer roll) S14905 (inner roll)		Twin	3/32 (2.4)	
142	142/1	S12514	K346-1A K347-1A	Single	3/32-7/32 (2.4-5.6)	15-289 (0.4-7.3)
142T	142/1	S14904 (outer roll) S14905 (inner roll)	K346-1A K347-1A with K225	Twin	5/64-1/8 (2.0-3.2)	15-300 (0.4-7.6)

# ELECTRICAL INSTALLATION – CONT'D

## Sec. T2.3.4-A Connection of NA-5 (All) to a DC-600

**99611-1W**

**CONNECTIONS MUST BE MADE EXACTLY AS SHOWN BELOW.  
FOR ANY OTHER USE OF POWER SOURCE, DISCONNECT ALL NA-5 LEADS AND CABLES.**

**NOTE:** Above diagram shows electrode connected positive. To change polarity, turn power off, reverse the electrode and work cables at the power source and position the switch on power source to proper polarity. Refer to NA-5 operating manual for required NA-5 Control Box polarity connections.

**N.A.** On earlier DC-600's, #67 terminal was 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 S-16586-□ remote voltage sensing work lead is available for this purpose. Connect it directly to the work piece keeping it separate from the welding work cable connection to the work piece. For convenience, this extended #21 lead should be taped along the welding work cable.

**N.D.** Tape up bolted connection.

**N.E.** Connect the NA-5 control cable grounding lead to the frame terminal marked #77 near the power source terminal strip. The power source must be properly grounded.

**N.F.** If using an older K-215 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.G.** The jumpers on the NA-5 Voltage Board must be connected as follows:  
Connect red jumper to pin '15'.  
Connect white jumper to pin '19'.

**N.H.** Connect a jumper from '19' to '19'. There is no NPS terminal strip on DC-600 codes above 8200.

**N.I.** For proper NA-5 operation, the electrode cables must be snugged under the clamp bar on the left side of the NA-5 Control Box.

**DC-600 POWER SOURCE SETTINGS**

**ALL CODES:**  
TURN OFF INPUT POWER  
Adjust the Power Source: DC-600:

1. Connect electrode cables to terminal of desired polarity.
2. Set toggle switch to same polarity as the electrode cable connection.
3. Set toggle switch to "Remote".
4. Set mode switch to the desired position for the process to be used.

**DC-600 CODES 8000 - 8045:**  
For Sub Arc:

1. Set mode switch to CV Sub Arc.
2. White lead on Control P.C. Board is connected to Pin '19' and blue lead is connected to '19'.

For all Open Arc Processes Except NR-203 Electrodes:

1. Set mode switch to CV Innershield.
2. White lead on Control P.C. Board is connected to Pin '19' and blue lead is connected to '19'.

**DC-600 CODES 8046 - 8200:**  
For Sub Arc:

1. Set mode switch to CV Sub Arc.
2. White lead on Control P.C. Board is connected to Pin '19'.

For all Open Arc Processes Except NR-203 Electrodes:

1. Set mode switch to CV Innershield.
2. White lead on Control P.C. Board is connected to Pin '19'.

**DC-600 CODES ABOVE 8200:**  
For Sub Arc:

1. Set mode switch to CV Sub Arc.

For all Open Arc Processes:

1. Set mode switch to CV Innershield.

**FOR OPTIMUM PERFORMANCE WITH THE NA-5, DC-600'S WITH CODES 8200 AND ABOVE ARE PREFERRED.**

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

Sec. T2.3.4-B

**Connection of NA-5 (All) to a SAF-600 or SA-800, Types "-O" or "-OF" and M.G. Solid-State Field Control (Obsolete)**

**CONNECTIONS MUST BE MADE EXACTLY AS SHOWN BELOW. FOR ANY OTHER USE OF POWER SOURCE, DISCONNECT ALL NA-5 LEADS AND CABLES.**

**TURN POWER SOURCE OFF.**

Set the Electrode Polarity switch for the desired polarity. Set the Voltage Control to maximum for higher voltage applications (above 25 volts), and to mid-range for low voltage applications.

For Sub Arc:

1. Set the Voltage Range switch to High.
2. Connect the cable from the contactor box to the appropriate Sub Arc tap for the current being used.

For all Open Arc Processes:

1. Set the Voltage Range switch to Low.
2. Connect the cable from the contactor box to the Innershield tap.

**SAF-600 or SA-800 POWER SOURCE SETTINGS**

For Sub Arc:

1. Red lead on Voltage P.C. Board is connected to Pin "5".
2. White lead on Voltage P.C. Board is connected to Pin "A".

For all Open Arc Processes:

1. Red lead on Voltage P.C. Board is connected to Pin "5".
2. White lead on Voltage P.C. Board is connected to Pin "A".

**NA-5 SETTINGS**

For Sub Arc:

1. Red lead on Voltage P.C. Board is connected to Pin "5".
2. White lead on Voltage P.C. Board is connected to Pin "A".

For all Open Arc Processes:

1. Red lead on Voltage P.C. Board is connected to Pin "5".
2. White lead on Voltage P.C. Board is connected to Pin "A".

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

N.F. If using an older K-215 control cable: Connect lead #76 to Lead #76 of Field Control, connect leads #75 and #77 to Lead #77 of Field Control.

F.G. For proper NA-5 operation, the electrode cables must be snugged under the clamp bar on the left side of the NA-5 Control Box.

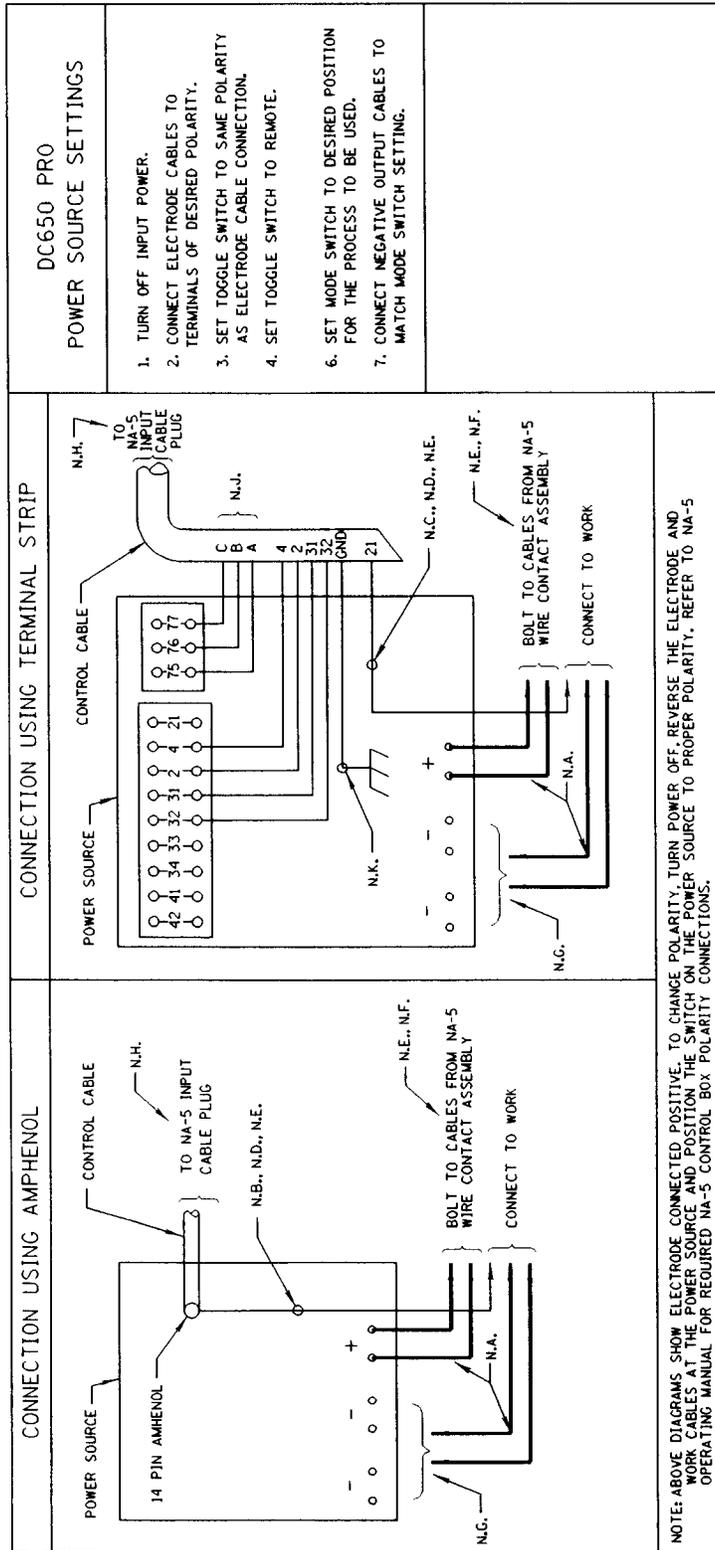
**IMPORTANT WHEN CHANGING POLARITY:** Turn generator off and allow it to come to a complete stop before changing polarity. The polarity switch on the Solid-State Remote Field Control and the polarity switch on the power source must be set to the same polarity. Failure to do so, will result in blowing the fuse in the Solid-State Field Control - and loss of generator output. Refer to NA-5 operating manual for required NA-5 control box polarity connections.

1. Bolt and tape connections separately. Tape up lead #75 from field control.
2. Welding cables must be of proper capacity for the current and duty cycle of immediate and future applications.
3. Extend lead #21 using #14 or larger insulated wire, physically suitable for the installation. An S-16586-C remote voltage-sensing work lead is available for this purpose. Connect it directly to the work lead, keeping it separate from the welding work cable connection to the work piece. For convenience, this extended #21 lead should be taped along the welding work cable.
4. Tape up bolted connection.
5. Connect the NA-5 control cable grounding lead to the frame terminal marked **RT**, near the power source terminal strip. The power source must be properly grounded.

Sec. T2.3.4-B-1

**Connection of NA-5 (All) to a DC-650  
 With No Line voltage Compensator (Obsolete)**

CONNECTION DIAGRAM DC-650 PRO/DC-750 TO NA-5 & NA-5R



NOTE: ABOVE DIAGRAMS SHOW ELECTRODE CONNECTED POSITIVE. TO CHANGE POLARITY, TURN POWER OFF, REVERSE THE ELECTRODE AND WORK CABLES AT THE POWER SOURCE AND POSITION THE SWITCH ON THE POWER SOURCE TO PROPER POLARITY. REFER TO NA-5 OPERATING MANUAL FOR REQUIRED NA-5 CONTROL BOX POLARITY CONNECTIONS.

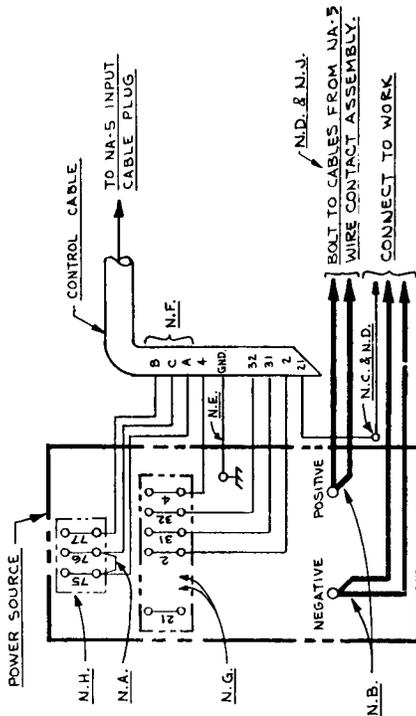
N.A. WELDING CABLES MUST BE SIZED FOR CURRENT AND DUTY CYCLE OF APPLICATION.  
 N.B. EXTEND LEAD #21A BY REMOVING LEAD #21A FROM THE TERMINAL STRIP AND CONNECTING IT TO A #14 OR LARGER INSULATED WIRE PHYSICALLY SUITABLE FOR THE INSTALLATION.  
 N.C. EXTEND LEAD #21 USING A #14 OR LARGER INSULATED WIRE PHYSICALLY SUITABLE FOR INSTALLATION.  
 N.D. CONNECT EXTENDED LEAD DIRECTLY TO THE WORK PIECE KEEPING IT SEPARATE FROM THE WELDING WORK CABLE CONNECTION TO THE WORK PIECE. FOR CONVENIENCE, THIS EXTENDED LEAD SHOULD BE TAPED ALONG THE WELDING WORK CABLE.  
 N.E. TAPE UP CONNECTION.  
 N.F. FOR PROPER NA-5 OPERATION, THE ELECTRODE CABLES MUST BE SNUGGED UNDER THE CLAMP BAR ON THE LEFT SIDE OF THE NA-5 CONTROL BOX.  
 N.G. CONNECT NEGATIVE OUTPUT CABLES TO STUDS TO MATCH DC650 PRO MODE SWITCH SETTING.  
 N.H. THE JUMPERS ON THE NA-5 VOLTAGE BOARD MUST BE CONNECTED AS FOLLOWS: CONNECT RED JUMPER TO PIN 'S'.  
 N.J. IF USING AN OLDER K-215 CONTROL CABLE; CONNECT LEAD #75 TO #75 ON TERMINAL STRIP, CONNECT LEAD #76 TO #76 ON THE TERMINAL STRIP, CONNECT LEAD #77 TO #77 ON THE TERMINAL STRIP.  
 N.K. CONNECT THE NA-5 CONTROL CABLE GROUNDING LEAD TO THE FRAME TERMINAL MARKED  $\overline{77}$  NEAR THE POWER SOURCE TERMINAL STRIP.

Sec. T2.3.4-C

**Connection of NA-5 (All) to R3S-400, -600 or -800  
With No Line voltage Compensator (Obsolete)**

585C1-1W

**CONNECTIONS MUST BE MADE EXACTLY AS SHOW BELOW.  
FOR ANY OTHER USE OF POWER SOURCE, DISCONNECT ALL NA-5 LEADS AND CABLES.**



**NOTE:**

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

- N.A. Add jumper from #75 to #76, using insulated copper wire.
- 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 S-16586-C remote voltage-sensing work lead is available for this purpose. Connect it directly to the work piece, keeping it separate from the welding work cable connection to the work piece. For convenience, this extended #21 lead should be taped along the welding work cable.
- N.D. Tape up bolted connection.
- N.E. Connect the NA-5 control cable grounding lead to the frame terminal marked #77, near the power source terminal strip. The power source must be properly grounded.

R3S POWER SOURCE SETTINGS	NA-5 SETTINGS
<p>TURN POWER SOURCE OFF.</p> <p><u>For all processes:</u></p> <ol style="list-style-type: none"> <li>1. Connect electrode cable to terminal of desired polarity.</li> <li>2. Set the Polarity Switch to the same polarity as the electrode cable connection.</li> <li>3. Set toggle switch to Remote.</li> <li>4. Install voltage triangle in a position as close as possible to the desired arc voltage.</li> </ol>	<p><u>For Sub Arc:</u></p> <ol style="list-style-type: none"> <li>1. Red lead on Voltage P.C. Board is connected to Pin "S".</li> <li>2. White lead on Voltage P.C. Board is connected to Pin "A".</li> </ol> <p><u>For all Open Arc Processes:</u></p> <ol style="list-style-type: none"> <li>1. Red lead on Voltage P.C. Board is connected to Pin "P".</li> <li>2. White lead on Voltage P.C. Board is connected to Pin "A".</li> </ol>

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

- N.F. If using an older K-215 control cable: Connect lead #75 to #75 on terminal strip, connect lead #76 to #77 on terminal strip, connect lead #77 to #76 on terminal strip, and add jumper per N.A.
- M.G. On earlier R3S machines, #67 and #1 terminals were also on the terminal strip. The upper terminal strip (#75, #76, #77) was not present on early R3S machines. These machines are not compatible with the NA-5, since there can be no adjustment of voltage by the NA-5.
- M.J. For proper NA-5 operation, the electrode cables must be snugged under the clamp bar on the left side of the NA-5 Control Box.

Sec. T2.3.4-D

**Connection of NA-5 (All) to a SAM-400  
Motor Generator or Engine Welder**

**386E1-M**

**CONNECTIONS MUST BE MADE EXACTLY AS SHOWN BELOW.  
FOR ANY OTHER USE OF POWER SOURCE, DISCONNECT ALL NA-5 LEADS AND CABLES.**

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

**NOTE:** To change polarity, turn power off, and position the switch on power source to proper polarity. Refer to NA-5 operating manual for required NA-5 Control Box polarity connections.

**N.A.** Remove SAM Portable Field Control and connect NA-5 Control Cable.

**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 S-16586-C-3 remote voltage-sensing work lead is available for this purpose. Connect it directly to the work piece, keeping it separate from the welding work cable connection to work piece. For convenience, this extended #21 lead should be taped along the welding work cable.

**N.D.** Tape up bolted connection.

**N.E.** Connect the NA-5 control cable grounding lead to the frame terminal marked **N.E.** near the power source terminal strip. The power source must be properly grounded.

**N.F.** If using an older K-215 control cable: Connect lead #76 to #75 on terminal strip, connect leads #75 and #77 to #76 on terminal strip.

**N.G.** On earlier SAM machines, #1 terminal was also on the terminal strip.

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

SAM POWER SOURCE SETTINGS	NA-5 SETTINGS
<p><b>TURN POWER SOURCE OFF.</b></p> <p><b>For Sub Arc:</b></p> <ol style="list-style-type: none"> <li>1. Set the Electrode Polarity Switch to the Variable Voltage position of the polarity desired for the process being used.</li> <li>2. Set the toggle switch to Constant Voltage.</li> <li>3. Set the Constant Voltage Control to Number 7 and the Current Control to 500.</li> </ol> <p><b>For all Open Arc Processes:</b></p> <ol style="list-style-type: none"> <li>1. Set the Electrode Polarity Switch to the Constant Voltage position of the polarity desired for the process being used.</li> <li>2. Set the toggle switch to Constant Voltage.</li> <li>3. Set the Constant Voltage Control to Number 5.</li> </ol>	<p><b>For Sub Arc:</b></p> <ol style="list-style-type: none"> <li>1. Red Lead on Voltage P.C. Board is connected to Pin #1.</li> <li>2. White Lead on Voltage P.C. Board is connected to Pin #4.</li> </ol> <p><b>For all Open Arc Processes:</b></p> <ol style="list-style-type: none"> <li>1. Red Lead on Voltage P.C. Board is connected to Pin #1.</li> <li>2. White Lead on Voltage P.C. Board is connected to Pin #4.</li> </ol>

Sec. T2.3.4-E

**Connection of NA-5 (All) to a SAM-650 Engine Welder**

**18661-1M**

**CONNECTIONS MUST BE MADE EXACTLY AS SHOWN BELOW.  
FOR ANY OTHER USE OF POWER SOURCE, DISCONNECT ALL NA-5 LEADS AND CABLES**

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

**SAM POWER SOURCE SETTINGS**

TURN POWER SOURCE OFF.

For Sub Arc:

1. Set the Electrode Polarity Switch to the polarity desired for the process being used.
2. Set the toggle switch to Constant Voltage.
3. Set the Constant Voltage Control to Number 7.
4. Connect the TAP cable to the "300-575, Max. Slope" stud.

For all Open Arc Processes:

1. Set the Electrode Polarity Switch to the polarity desired for the process being used.
2. Set the toggle switch to Constant Voltage.
3. Set the Constant Voltage Control to Number 5.
4. Connect the TAP cable to the "450-Max, Med Slope" stud.

**NA-5 SETTINGS**

For Sub Arc:

1. Red lead on Voltage P.C. Board is connected to Pin "5".
- White lead on Voltage P.C. Board is connected to Pin "A".

For all Open Arc Processes:

1. Red lead on Voltage P.C. Board is connected to Pin "5".
- White lead on Voltage P.C. Board is connected to Pin "A".

**NOTE:** To change polarity, turn power off, and position the switch on power source to proper polarity. Refer to NA-5 operating manual for required NA-5 Control Box polarity connections.

**M.A.** Remove SAM Portable Field Control and connect NA-5 Control Cable.

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

**M.C.** Extend lead #21 using #14 or larger insulated wire physically suitable for the installation. An S-16586-□ remote voltage-sensing work lead is available for this purpose. Connect it directly to the work piece, keeping it separate from the welding work cable connection to the work piece. For convenience, this extended #21 lead should be taped along the welding work cable.

**M.D.** Tape up bolted connection.

**M.E.** Connect the NA-5 control cable grounding lead to the frame terminal marked #77 near the power source terminal strip. The power source must be properly grounded.

**M.F.** If using an older K-215 control cable: Connect lead #76 to #75 on terminal strip, connect leads #75 and #77 to #76 on terminal strip.

**M.G.** On earlier SAM machines, #1 terminal was also on the terminal strip.

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



Sec. T2.3.4-G

Connection of NA5 to DC400 or CV400

S17375

WARNING

- Do not operate with covers removed.
- Disconnect power source before servicing.
- Do not touch electrically live parts.
- Only qualified persons should install, use or service this machine.

ELECTRIC SHOCK CAN KILL

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-[LENGTH] 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 NA-5 voltmeter reading.)

N. C. Tape up bolted connection.

N. D. Connect the control cable ground lead to the frame terminal marked 77 near the power source terminal strip. The power source grounding terminal (marked  $\equiv$  and located near the power source input power connections) must be properly connected to electrical ground per the power source operating manual.

N. E. The jumpers on the NA-5 voltage board must be connected as follows: Connect red jumper to pin 'S'. Connect white jumper to pin 'B'.

N. G. When using NA-5 controls above Code 8300 without the optional DC-400 diode kit or CV-400, CVI-500 diode option: The NA-5 Inch Down button will not operate unless a jumper is connected between the two tab terminals, labeled 'AUTO' located above the transformer on the NA-5 Voltage P.C. board. This jumper, however, will disable the Cold Starting/Auto-Stop feature of the NA-5, permitting only Hot Starting techniques to be used.

N. H. For proper NA-5 operation, the electrode cables must be snugged under the clamp bar on the left side of the NA-5 control box. If lead #21 is to be connected to the terminal strip, this connection must be changed whenever the electrode polarity is changed.

\* 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. Refer to NA-5 Operating Manual for required NA-5 control box polarity connections. Also refer to note N.H.

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

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

## SEC. T2.5 – OPTIONAL FEATURE INSTALLATION

### Sec. T2.5.3 (K129)

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

(File as Sec. E2.7.5 (K129) for IM-245)

### K129 Submerged Arc Small Wire Twinarc®

In "Twinarc" welding two small diameter (.045,  $\frac{1}{16}$ ,  $\frac{5}{64}$  or  $\frac{3}{32}$ ") 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,  $\frac{1}{16}$ ,  $\frac{5}{64}$  and  $\frac{3}{32}$ ". Converting to a different wire size is accomplished by changing a few parts. See Parts List P-101-G.

An S17728 side-by-side tip holder is available for Lincore overlay welding procedures employing the same 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.

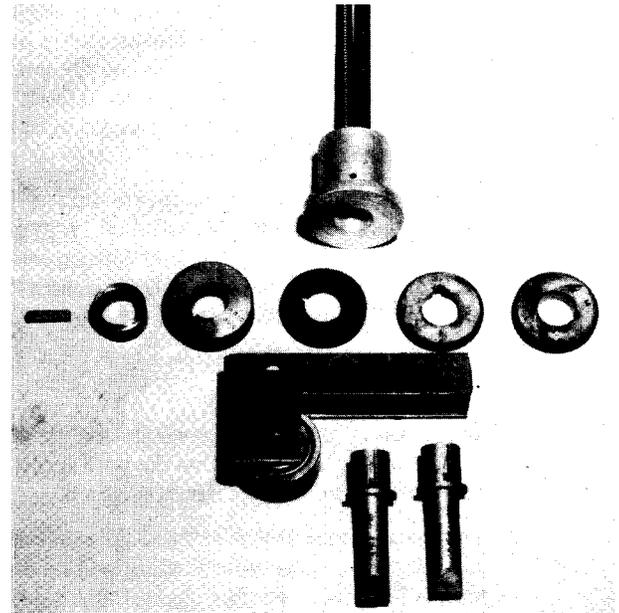
#### B. INITIAL PREPARATION (For .045, $\frac{1}{16}$ or $\frac{5}{64}$ " wire)

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.<sup>(1)</sup>
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 $\frac{3}{32}$ " 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.<sup>(1)</sup>
  - 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.

<sup>(1)</sup> On later models, the shoulder bolt pivot replaced by a pin secured by a set screw located on the mounting surface of the face plate.



4. Place an outer, center and outer drive roll on the shaft and tighten the hex nut securely.

#### D. NOZZLE INSTALLATION

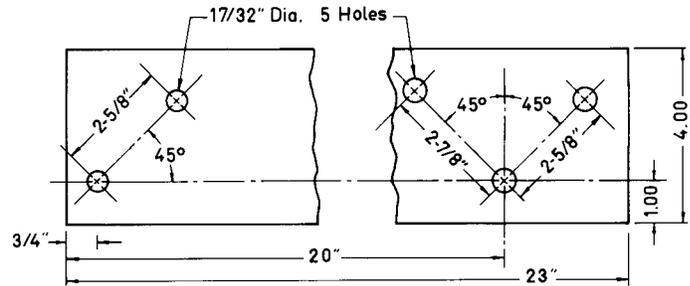
1. Place the new swivel type idle roll into position, tighten the pivot screw and then assemble the tension spring and screw.
  - a. On the NA-2 and NA-2F, tighten the tension screw until the nut bottoms against the shoulder of the screw.
  - b. On the NA-3, NA-4 or NA-5, with wire in the system, tighten the tension screw to the  $\frac{.045}{32}$ " 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 they are parallel with outside diameter of the drive 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 being 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.

Sec. T2.5.3 (K129), L2.5.3 and E2.7.5 (Continued)

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 insure proper line up of the holes. Insert and tighten the two socket head screws and fasten the nozzle securely.
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 cables for currents up to 1000 amperes at 80% duty cycle. Use three 4/0 cables for 1000 – 1300 amperes, use four 4/0 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.



BRACKET SUPPORT DETAIL  
Materials - 3/8 x 4.00 x 23 H.R.S.

**F. MAINTENANCE** (For .045 wire)

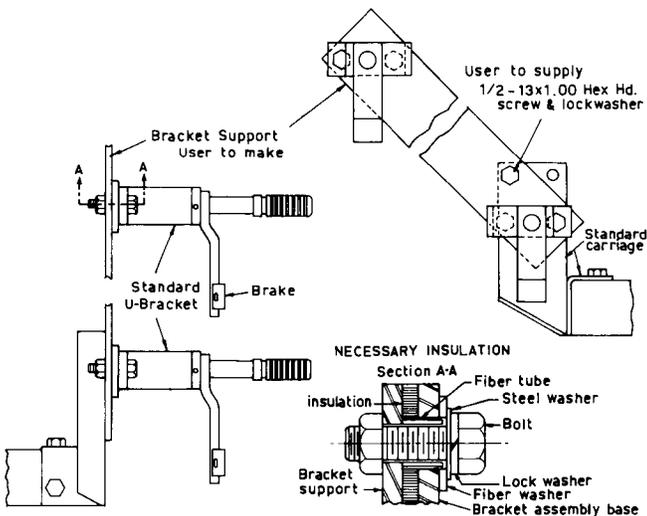
Unscrew the locking collar and replace the contact tip when it no longer provides accurate wire placement or good electrical contact. Keep replacement tips in stock. For 1/16, 5/64 and 3/32" wire the tips can be replaced directly. Before installing the new tip or contact tip holder:

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-sieze compound on the threads insures a longer life of the two mating parts. Suggested anti-sieze compounds are Graphite grease per Lincoln specification E-2067.
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 wire. 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.

**Tip Holder Ceramic Replacement** (1/16 thru 3/32" wire)

Should the ceramic inserts in the tip holder break, they may be replaced as follows:

- Remove nozzle tips
- Remove hollow-lok screws with a 5/32 Allen wrench
- Exchange broken ceramics with the new ones
- Screw hollow-lok screws in
- Replace nozzle tips



METHOD FOR MOUNTING SECOND ELECTRODE REEL

## K225 SUBMERGED ARC TWINARC® KIT

Sec. T2.5.3 (K225)

(File as Sec.L2.5.3 (K225) for IM-278)

### K225 Submerged Arc Twinarc® Kit

In "Twinarc" submerged arc welding, two ( $\frac{3}{64}$ ,  $\frac{3}{32}$  or  $\frac{1}{8}$ ") 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 required for maximum usable currents and wire feed speeds, especially with  $\frac{3}{64}$ " electrode.

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 block.

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 drawing below 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.

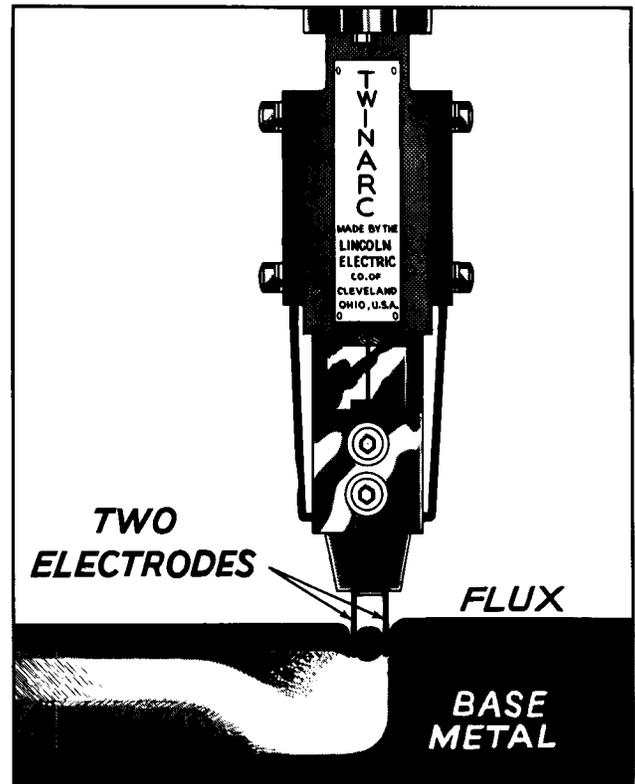
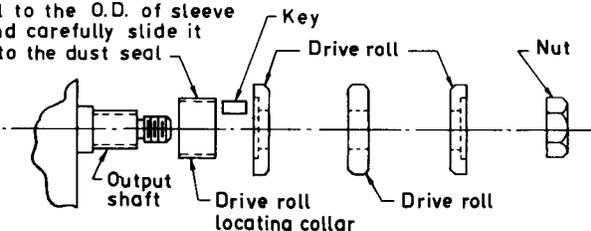
#### B. INITIAL PREPARATION

1. Remove the following parts from the wire 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. [See Sec. T2.5.3 (K129).]

#### 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 the tension spring and screw. Adjust the idle roll

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



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 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.

Sec. T2.5.3 (K225) and L2.5.3 (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  $\frac{3}{8}$ ,  $\frac{1}{2}$ , and  $\frac{5}{8}$  inch spacing are available.

To change the blocks loosen the two pressure springs. Then remove the two  $\frac{1}{4}$ -20 socket head screws that hold the contact block. Before installing the new block, use graphite grease on the  $\frac{1}{4}$ -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.

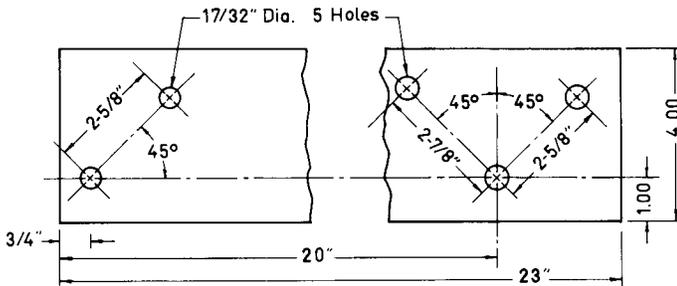
**Nozzle Rotation:** The nozzle can be set so the electrodes are in line with the joint for highest speed and

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  $\frac{1}{4}$ -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.

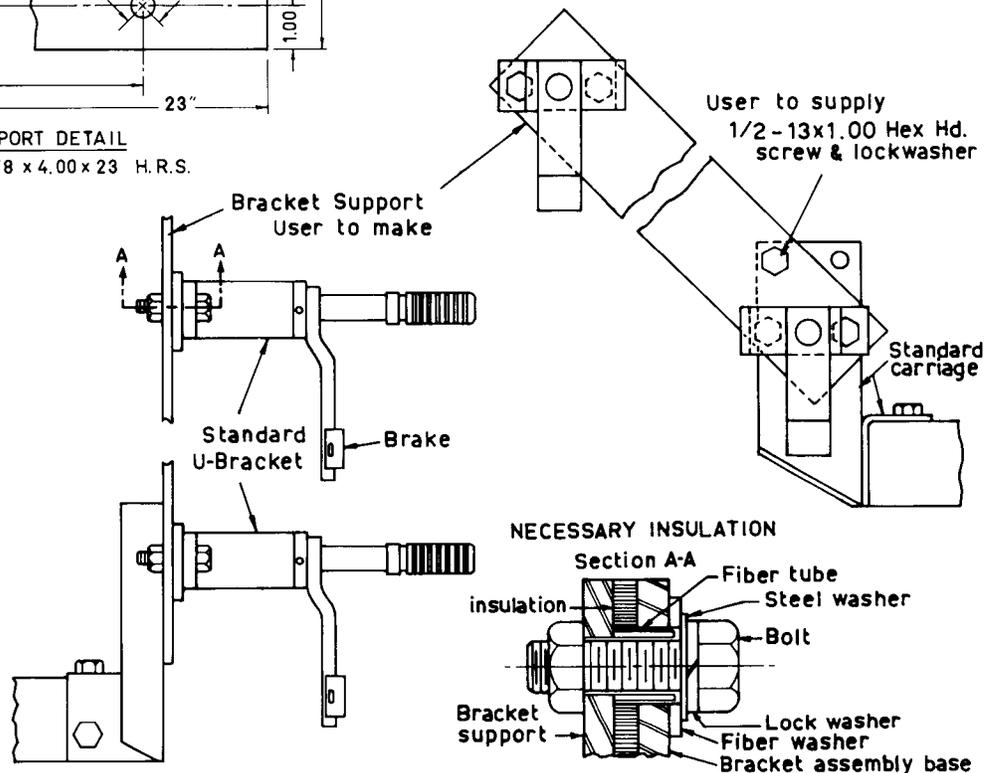
**E. MAINTENANCE**

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.



**BRACKET SUPPORT DETAIL**  
Materials -  $\frac{3}{8}$  x 4.00 x 23 H.R.S.



**METHOD FOR MOUNTING SECOND ELECTRODE REEL**

## K239 INNERSHIELD® TWINARC® KIT

Sec. T2.5.3 (K239)  
(File as Sec. L2.5.3 (K239) for IM-278)  
**K239 Innershield® Twinarc® Kit**

In Innershield 'Twinarc' welding, two  $\frac{3}{32}$ " 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 a 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.

### A. REEL INSTALLATION

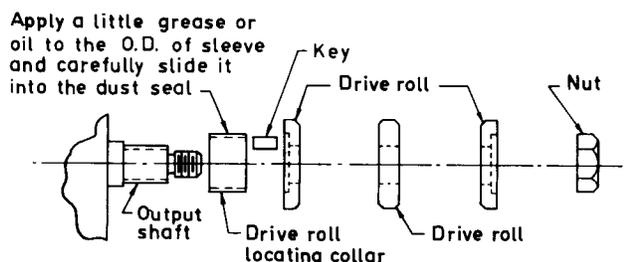
1. See K129 for mounting suggestions for the second electrode reel. The reel support bracket must be made by the fixture builder to fit the particular installation.
2. For optimum operation, the two wire reels should be mounted in the same plane as the drive rolls. The distance between the wire reels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

### B. 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. [See Sec. T2.5.3 (K129).]
  - e. All the parts on the output shaft including the drive roll locating collar which is held on by a small set screw.

### C. INSTALLATION (Refer to Parts List P-100-D)

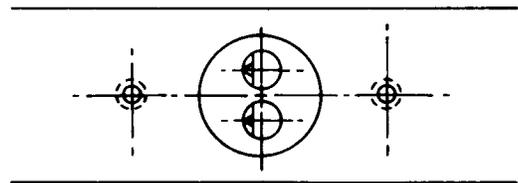
1. Install the new idle roll assembly and hold it in place with the pivot bolt, (Item 18) and nut (Item 17). Do not install the idle roll spring screw (Item 6) yet.
2. Install the drive rolls as shown.



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  $.035\text{-}\frac{3}{32}$ " 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  $\frac{1}{2}$ -13 bolt and the nut provided.
7. Water cooling is required for Innershield 'Twinarc' welding. Connect the tubes included on the nozzle to the water supply and drain using rubber tubing obtained locally. Water flow should be about  $\frac{1}{3}$  gallon 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.

### D. 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  $\frac{1}{3}$  gallon per minute level.

1. **For the NA-5** — Install a K336 Remote 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

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

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 FS6  
3500 N. Spaulding Avenue                      SPDT  
Chicago, Illinois 60618

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

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.

**E. ADJUSTMENTS**

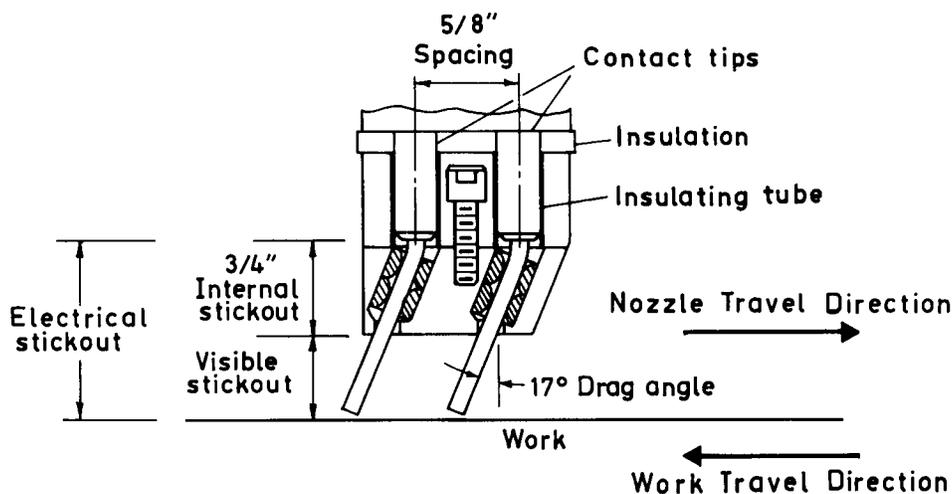
1. When using an NA-5, connect the calibration jumper lead to pin "95S" on the wire speed meter board per the table on the wiring diagram.
2. **Nozzle Rotation:** The proper lineup of the electrodes with the seam should be specified by the pro-

cedures. 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.

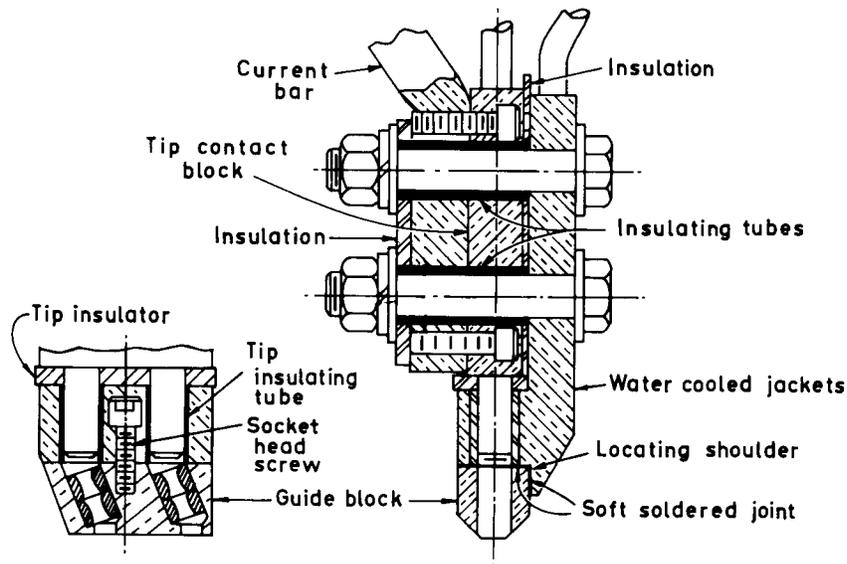
3. **Electrode Spacing, Drag Angle and Electrode Stickout:** As shown in the following sketch, the electrode spacing, drag angle as the electrode leaves the guide block and the internal electrical stickout is fixed. The electrical stickout is 3/4" greater than the visible stickout. Set the stickout as specified by the procedures.

**F. 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. T3.2.2. For "Speed Feed" drums and reels see Sec. T2.5.7-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.
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 are properly installed as described under "Reel Installation".



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



### G. 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 of 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 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 insure a good soldered 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.

February 1982

## K218 HORIZONTAL FILLET/LAP ATTACHMENT

Sec. T2.5.4

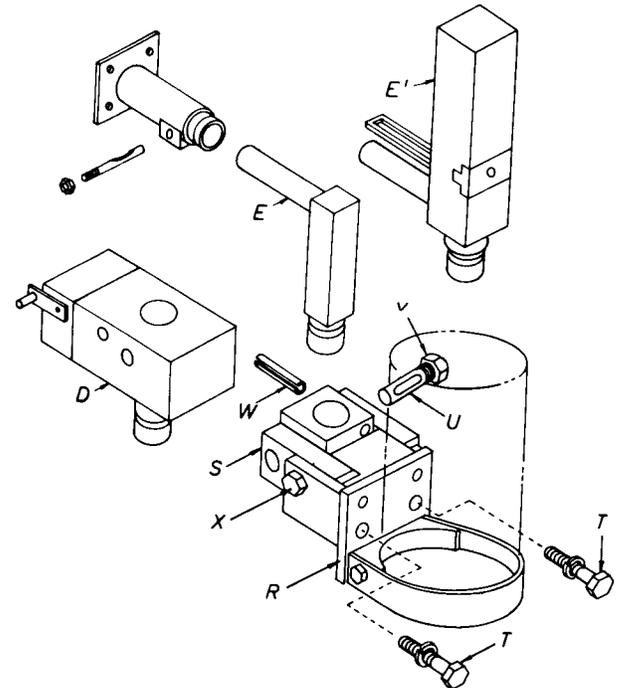
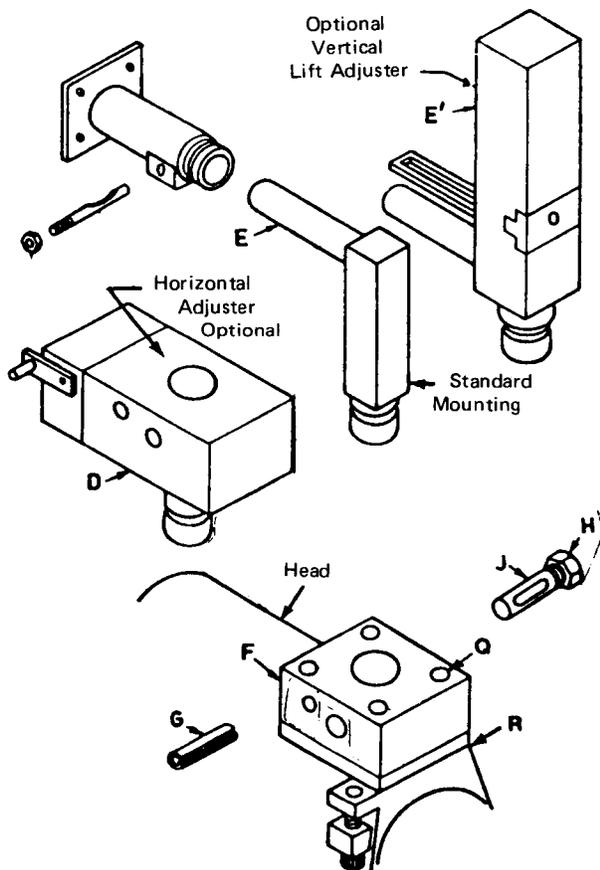
(File as Sec. L2.5.4 for IM-278)

### K218 Horizontal Fillet/Lap Attachment

This special contact assembly is recommended for submerged arc welding horizontal fillet and lap joints on  $\frac{3}{16}$ " 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  $\frac{1}{2}$ -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 adjuster (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 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.

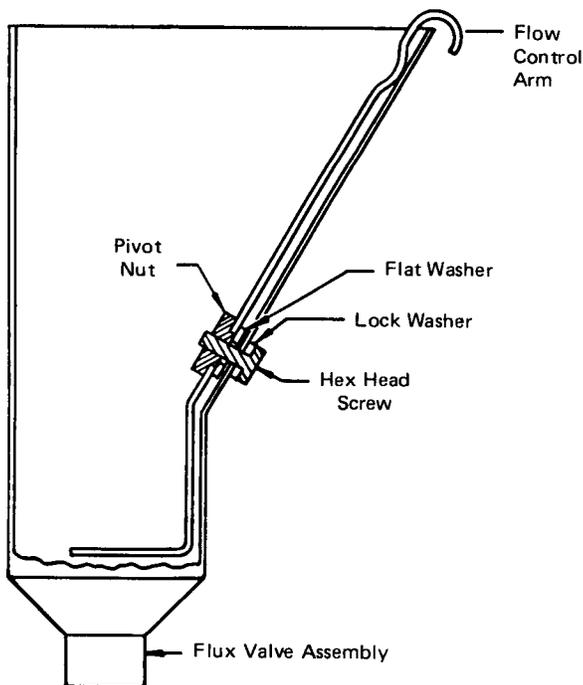
Sec. T2.5.4 and L2.5.4 (Continued)

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 or NA-5N, 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 (T-14861)**

This 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" 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" 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" 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. T2.5.5

(File as Sec. L2.5.5 for IM-278)

The K281 Tiny Twinarc wire straightener will straighten .045 through  $\frac{3}{32}$ " 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	When Using Standard K129 Spring Ingoing Guides	When Using Optional K281 Straightener
.045	$\frac{3}{8}$ "	$\frac{5}{8}$ "
.052	$\frac{1}{2}$ "	$\frac{3}{4}$ "
1/16	$\frac{3}{4}$ "	1 $\frac{1}{4}$ "
5/64	1"	1 $\frac{3}{4}$ "
3/32	1 $\frac{1}{4}$ "	2"

### 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, NA-4 or NA-5 head can usually be positioned to meet the requirements.

### B. INSTALLATION PROCEDURE

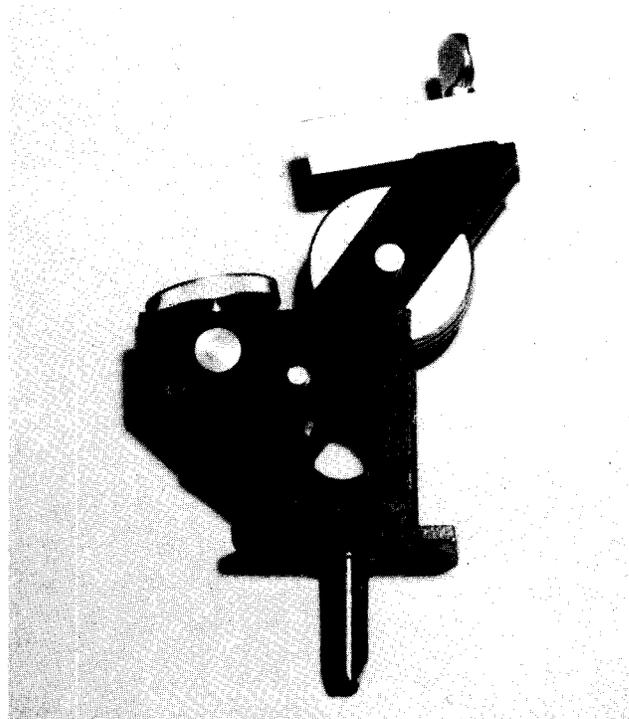
1. Remove ingoing spring wire guide.
2. Remove ingoing wire guide tube.
3. Insert the new ingoing wire guide tube (ceramic inserts).
4. Place the wire straightener over the guide, positioned as outlined in "A" above, and tighten the two hex head screws.

### C. REELS AND SPEED FEED DRUMS

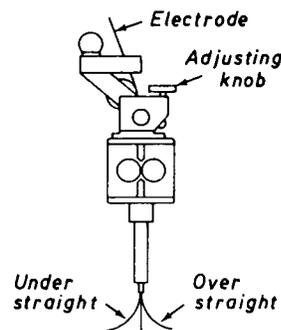
(See Sec. T2.5.7 for detailed instructions on wire feeding from Speed Feed Drums and Reels.)

### 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" – 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 of 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.

February 1982

## K278 SPREADARC™

Sec. T2.5.6

(File as Sec. L2.5.6 for IM-278)

### 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 (without head).

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

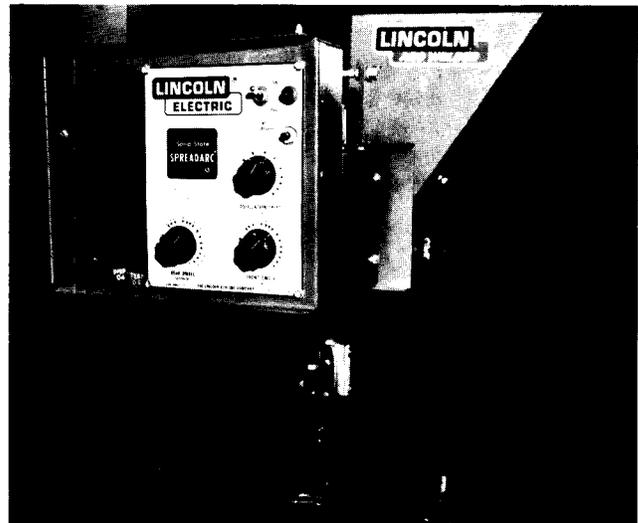
Oscillation track – 0.25 to 4.0 inches.

Oscillation speed – 10-120 in/min.

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

### B. INSTALLATION

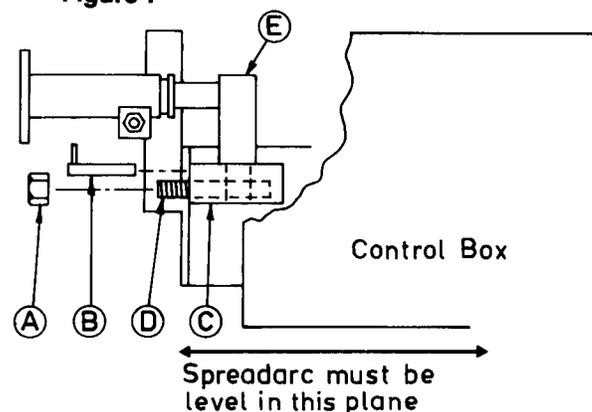
1. The Spreadarc can be mounted on a K325 travel carriage or on a stationary head mount in which case the work must be moved. When the Twinarc process



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



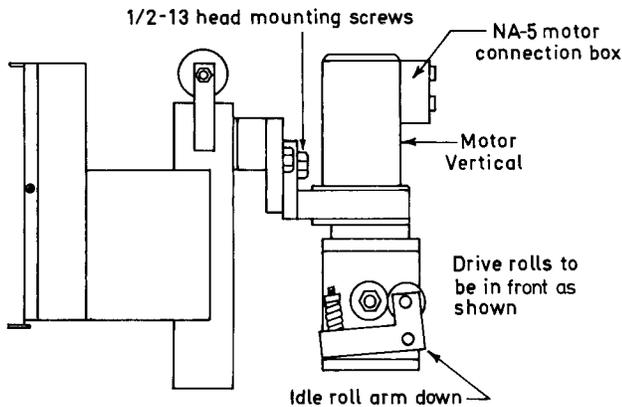
3. Remove the head mounting block from the NA-3, NA-4 or NA-5 head by removing the four allen head cap screws. This part is not used. Mount the head to the Spreadarc using the two  $\frac{1}{2}$ -13  $\times$  1 hex head screws, washers and lockwashers supplied with the Spreadarc through the two large holes in the head mounting pad.

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

**NOTE:** Before mounting an NA-5 head to the Spreadarc, to assure adequate clearance between the motor connection box and the Spreadarc head mounting surface, the motor mounting to the gearbox should be rotated per the instructions below.:

1. Remove the four screws mounting the gearbox assembly to the motor adapter plate, and remove the gearbox.
2. Remove the three screws mounting the adapter plate to the motor, rotate the adapter plate 90° clockwise, and replace the three mounting screws.
3. Remount the gearbox assembly with the four mounting screws.

The drive motor is to be in the vertical position and the drive rolls are to face the front. Loosen the head face plate clamp screw 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).



**Figure 2**

When using a K225 Twinarc nozzle, a K219 flux hopper and a standard head mounting on a travel carriage, and when welding from left to right, a special 12" flux tube is required. The tube, which is included with the Spreadarc, may be trimmed in length to fit the installation. In addition, it is necessary to reposition the steel plate on the nozzle to which the flux hose retainer ring is attached. Remove the two screws holding this plate and rotate the plate 180° so the ring is closer to the bottom of the nozzle. Replace the screws.

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.**

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 au-

xiliary 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 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 speed 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

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

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, 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 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.
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 B. Do *not* loosen the motor mounting screws for the reason stated in Step B. 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**

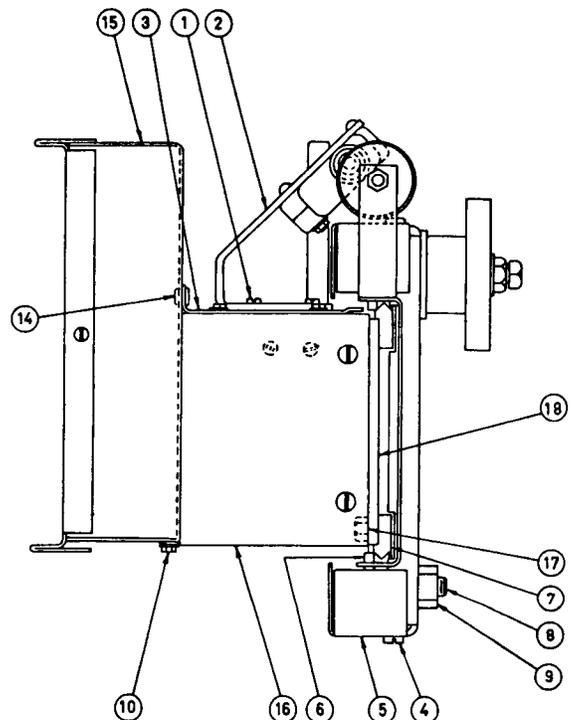
1. *Circuit Protection* – The 0.8 circuit breaker mounted on the control box door protects the control circuit and motor from short circuit conditions. It also protects from severe overload conditions such as an obstacle restricting carriage movement. If it opens, determine and correct the cause of the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

"The motor may or may not have an automatic thermostat mounted within the motor case.

If the motor has a thermostat and operated under server conditions, the thermostat may or may not open before the circuit breaker opens. The thermostat will close when the motor has cooled down.

If the motor does not have a thermostat; a jumper (T13962) must be installed on the terminal strip at positions #732 and #732A. See wiring diagram (M13447), on next page.

October 1997



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

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 — indicate 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).

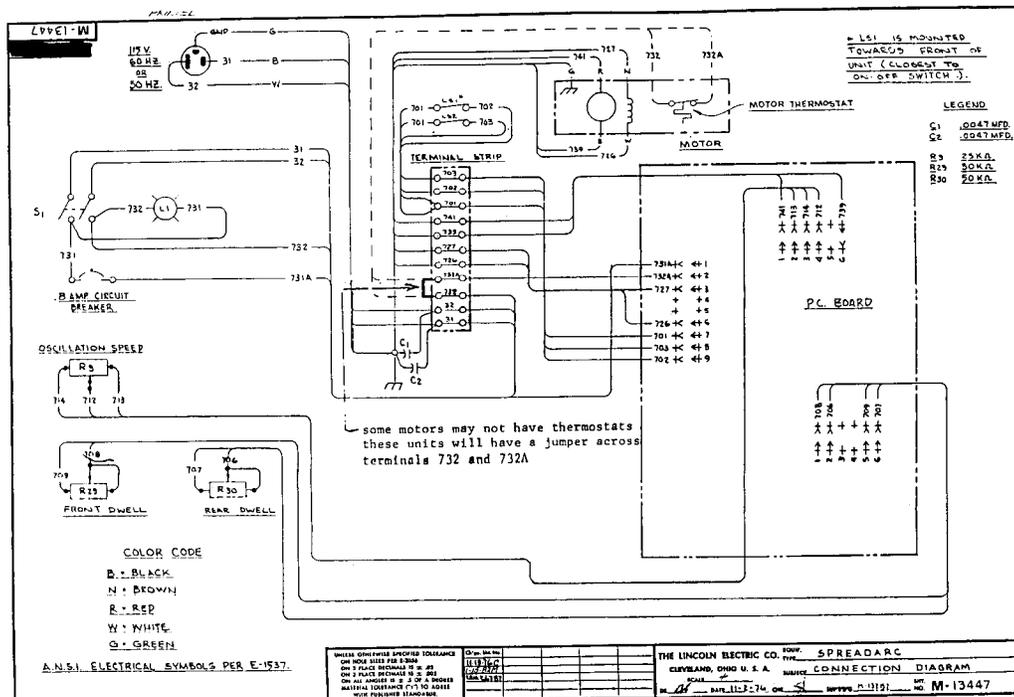
3. **Voltage Measurements** — All voltages are  $\pm 10\%$ .

- 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.

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.

October 1997



## SPEED-FEED® DRUMS

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

Sec. T2.5.7-A  
(File as Sec. L2.5.10-A for IM-278)

### 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.)

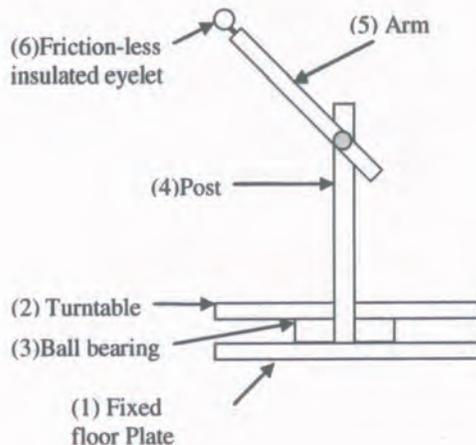


Figure 1

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)

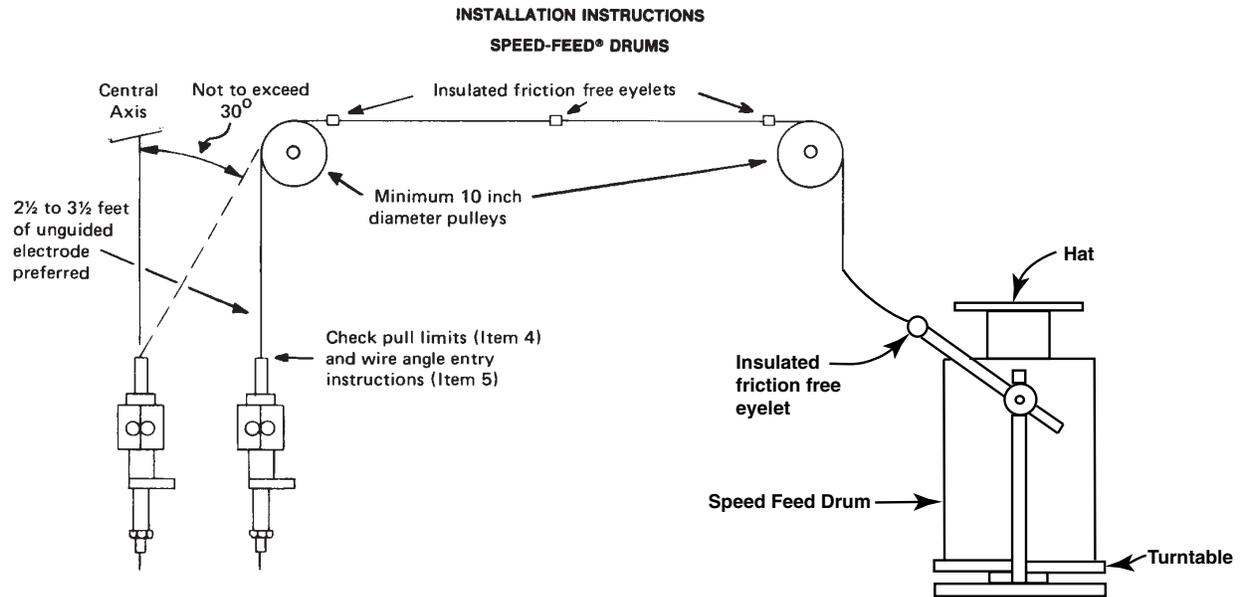
600 lb & 1000 lb Drum	Dimensions
Outside Diameter (in)	23 3/8 ± 1/16 (56.8 cm ± 0.16 cm)
Height (in) (without cover)	34 3/4 +1/8 -1/4 (88.3 cm + 0.32 cm -0.64cm)

#### 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. T2.5.7-A (Continued)  
File as Sec. L2.5.10-A for IM278)



### 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

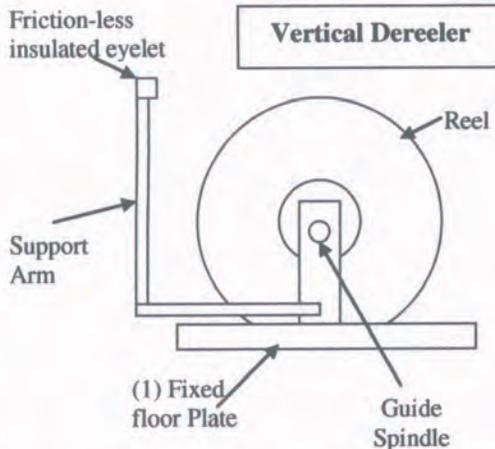
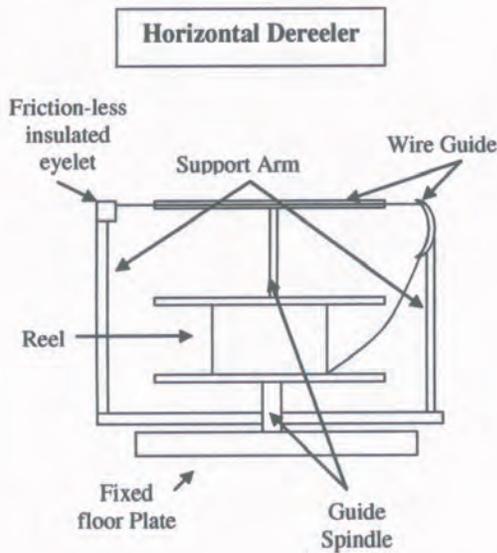
<http://www.lincolnelectric.com/knowledge/articles/content/speedfeeddrums.asp>

Sec. T2.5.7-B (FOR IM305)  
 (File as Sec.L2.5.10-B for IM278)

## SPEED-FEED® REELS

### General Installation

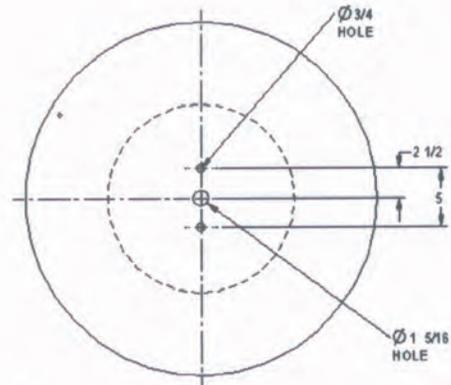
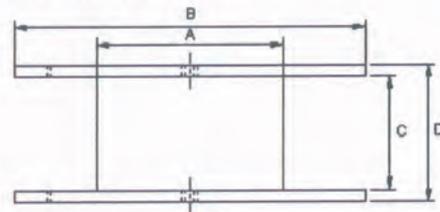
The Reels require dereeling equipment that permits them to rotate freely as the electrode is used. Dereelers can hold the reels in vertical or horizontal position, depending on the application. The dereeler needs to include at least one low friction insulated eyelet.



### 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

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

Sec. T2.5.7-B (Continued)  
(File as Sec. L2.5.10-B for IM278)

**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**

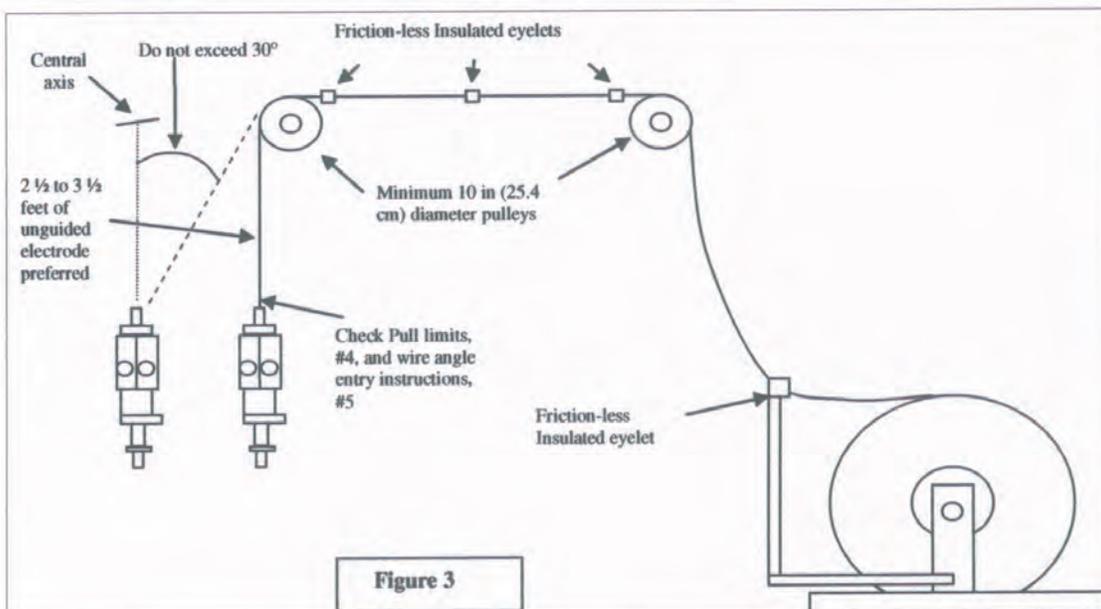
A. Improper installation can:

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.

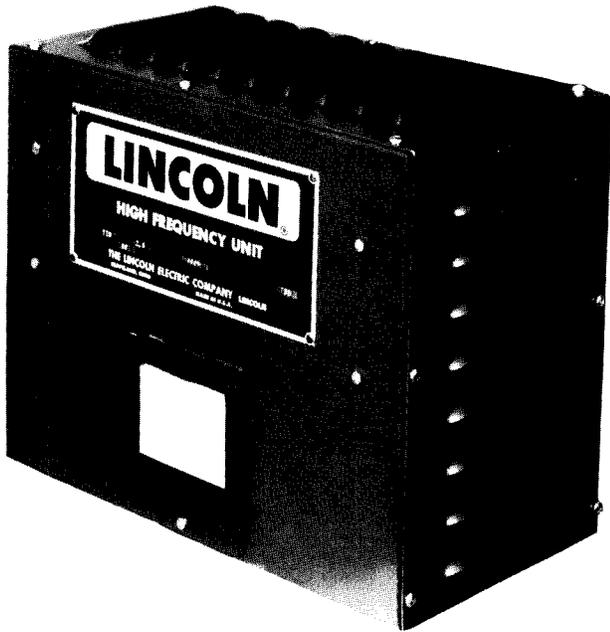


**Figure 3**

## SEC. T2.5 – OPTIONAL FEATURES INSTALLATION – CONT'D

Sec. T2.5.8

### K238 High Frequency Generator



**NOTE:** When using the K238 HF unit, the NA-5 control must have a code above 8300 and the equipment being used must have the following special high frequency insulation:

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.\*\*

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

#### A. GENERAL

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-5. 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 or the Spreadarc options. It is to be used only with the "hot starting" start sequence.

#### B. HIGH FREQUENCY INTERFERENCE PROTECTION

It is important that the energy from the High frequency unit be utilized at the arc and the amount radiated kept at a minimum. The following instructions *must* be followed to minimize the amount of RF radiation as required by the FCC, to prevent malfunctioning of the NA-5 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 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. Tape the leads together where practical.
3. Be sure the rubber covering the electrode and work cables is free of cuts and cracks that allow high frequency leaking. Use cables with high natural rubber content, such as Lincoln Stable-Arc®, which more effectively resists high frequency leakage than neoprene and other synthetic rubber insulated cables.
4. The control leads from the high frequency unit to the NA-5 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 antenna, radiating energy into space. Make certain the electrode cannot touch the NA-5 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 antennas.
8. Route the wire feed motor leads, flux hopper leads and any other remote control leads so they are no closer than 6" to the High Frequency unit, head mounting parts, wire reel, wire reel mounting, welding cables, etc. Use lead clamps as necessary.

#### C. ELECTRICAL CONNECTION

While observing all the points made in above Section (B), make the electrical connections as follows:

1. Turn off all input power to the power source and NA-5. Mount the High Frequency Unit as near to the head as possible but at least two feet away from the NA-5 control box.
2. Connect electrode welding cables from the High Frequency Unit to the automatic head and to the K215 input cable assembly at the NA-5 control box 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 screws holding the NA-5 control box cover closed and open the the door to gain access to the terminal strip.

## Sec. T2.5.8 (Continued)

6. Remove the plastic hole plug from the hole on the left side of the NA-5 control box. Install the appropriate connector for the control lead conduit.
7. Install a shielded five conductor control cable, having #18 AWG or larger control leads, from the High Frequency Unit to the NA-5 control box. The shielding must be grounded to the control boxes. Connect the leads as follows:
  - a. High-Freq terminal strip #31 to NA-5 control terminal strip #31.
  - b. High-Freq terminal strip #87 to NA-5 control terminal strip #87.
  - c. High-Freq terminal strip #681 to NA-5 control terminal strip #681.
  - d. High-Freq terminal strip #510 to NA-5 control terminal strip #610.
  - e. High-Freq grounding stud to NA-5 control box grounding stud.
8. Remove the #67 black lead from the NA-5 terminal strip electrode polarity connection and tape the terminal of the removed lead.
9. Connect a #18 AWG, or larger, electrode sensing lead from the bolted electrode lead connection (per M-14156) to the appropriate NA-5 terminal strip polarity connection (replacing the #67 black lead referred to in 'Electrode Polarity', Sec. T2.3.1).

**D. OPERATION**

When the NA-5 "Start" button is pushed, 115 volts AC is applied to leads #31 and #87, energizing the High Frequency Unit. When the welding arc is established, 110 volts DC is applied to #610 and #681 which energizes 1CR in the High Frequency Unit. This opens the 1CR normally closed contact – which is in series with the 115 volt AC input power circuit – and de-energizes the High Frequency Unit.

**WARNING:** When using the High Frequency Unit, the "hot starting" start sequence is to be used (see "Means of Arc Striking", Sec. T3.5.1). "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 when the electrode touches the work.

**E. 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:** Use extreme caution when this adjustment is made. The voltage in this part of the circuit is dangerously high when the unit is energized. Turn off the NA-5 control, turn off the power source, and disconnect the input power to the power source before removing the screw that holds the access door in place.

Replace the screw holding the access door closed after the adjustment is made. Only a qualified electrician is to do the maintenance work.

## SEC. T2.5 – OPTIONAL FEATURES INSTALLATION – CONT'D

### Sec. T2.5.9

#### **K219 Flux Hopper Kit** (Standard on the NA-5S)

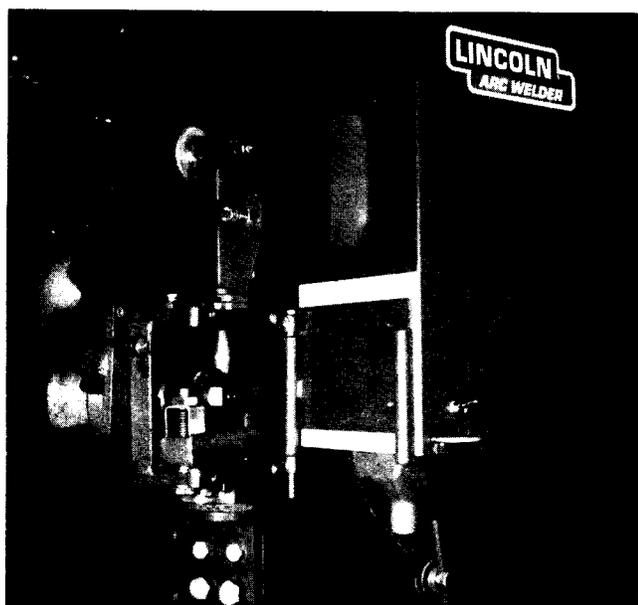
The flux hopper can be mounted on the NA-5N or NA-5NF heads for submerged arc welding. Installation instructions are shipped with each kit. Operation is as follows:

1. Flux valve switch on "off". The flux valve is then on manual operation and must be held open. It will close when released.
2. Flux valve switch on "on".

When starting "cold", the valve automatically opens when the electrode makes electrical contact with the work while the inch down pushbutton is pressed.

When starting "hot" or "cold", the flux valve automatically opens when the "Start" button is pushed. It remains open until the Burnback timer times out, or the flux valve switch is turned "off".

February 1982



### Sec. T2.5.10

#### **K337 (-10 or -100) Weld Timer Module**

Permits setting of weld time for an adjustable period. Eliminates need to press stop button. Instructions are included with kit. The Timer units are adjustable by means of thumb-wheel switches over the following ranges:

K337-10	0.00 to 9.99 sec.
K337-100	00.0 to 99.9 sec.

February 1982

### Sec. T2.5.11

#### **K336 Remote Interface Module**

Permits connection of customer-furnished remote start-stop and inch momentary contact closure or momentary 24 volt signals. Also used when a single remote signal is desired to start or stop multiple heads. Installation and application instructions are included with the kit.

**NOTE:** This Module replaces the earlier K336 Remote Pushbutton Interface Module.

February 1982

#### **K373 Analog Interface Procedure Control**

This kit mounts on the right side of the NA5 control box with three screws and connects to the NA5 procedure kit receptacle and terminal strip.

This control provides circuit isolated interface for 0 to 10 volts DC analog signal levels, linearly representing 0 to 100% of the rated range of the wire speed and voltage control of the NA5 system. Comprehensive installation and operation instructions are included with the control.

April 1988

### Sec. T2.5.12 (Cont.)

#### **Linc-Fill™ Starting Relay (K237)**

When using the Linc-Fill Starting Relay Kit, it is also necessary to use a K334 Optional Start Control. *Do not* use the starting relay circuit when using high frequency. Install the kit following the instructions supplied with the kit.

The Linc-Fill Starting Circuit was designed for especially difficult long stickout procedures for which the NA-5 adjustments of acceleration, strike, or start controls do not give satisfactory starting. It bypasses the normal path for the welding current and puts the current into the wire at the long stickout extension guide. This permits starting with a short electrical stickout and then switching to a long electrical stickout once the arc is established. Only a portion of the current is actually bypassed to the extension guide. The remainder of the current follows the normal path in through the contact tip. This heats up the wire while the arc is being established. Then about one second after the arc is struck, the Linc-Fill Starting Relay drops out and all of the current passes through the normal path through the nozzle contact tip.

#### **Linc-Fill Starting Relay Circuit Operating Instructions:**

1. Set the start control timer for about one second delay. The start wire speed is set for about 50% to 75% of the Weld speed and the Start voltage control is set about the same as the Weld voltage.
2. Cut the end of the electrode to a sharp point and make a test weld. Make certain that the starting relay drops out after the start time has expired.

If stubbing occurs when the arc first strikes, the 'Inch Wire Speed' may be set too high or the strike or start voltage may be set too low.

If stubbing occurs when the start time expires, the start wire speed may be set too low or the start voltage is set too high.

The lead from the Starting Relay and the nozzle contact assembly which accompanies the kit is 15 ft. of #12 wire. This has been found to give the proper amount of bypass current. If the length of lead sent with the kit is not the desired length for the relay to guide assembly lead, a new lead can be made per the table below. Any of these leads should give the same amount of bypass current.

Sec. T2.5.12 (Cont.)

If Length of Cable from Starting Relay to Extension on Nozzle is:	Use Wire size
8-11 feet	14
10-14 feet	13
13-17 feet	12
16-22 feet	11
20-28 feet	10
32-45 feet	8
51-71 feet	6

February 1982

Sec. T2.5.13

**K334 Start and Crater Controls**

Easily installed procedure and timer boards to permit adjustment of wire speed and voltage. Can be installed to function at either the start of the weld or at the end for crater filling. Instructions are included with the kit.

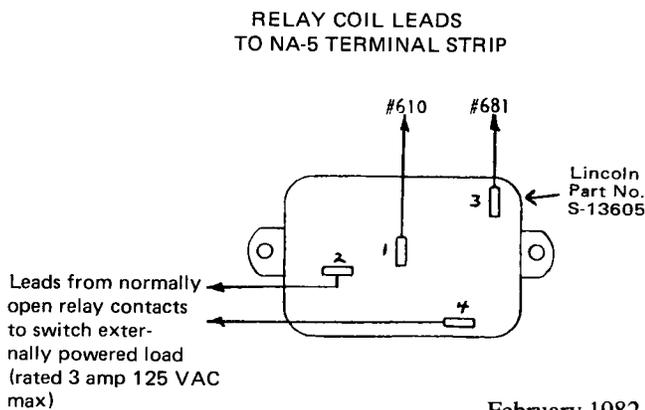
February 1982

Sec. T2.5.14

**Current Relay (S13605)**

Useful for fixture builders and others who need a signal indicating that welding current is flowing. Relay contacts (#2 and #4) will close and remain closed when welding. Mounts inside the NA-5 control box using the two holes provided on the bottom left side with #6 screws and nuts (not provided).

The electrical connections of the current relay (leads and terminals are not provided) to be made per diagram below:



February 1982

Sec. T2.5.15

**K224 Solid-State Remote Field Control**

(Discontinued)

Required when using a SAF-600 or SA-800 motor generator type power source. Mounting instructions are shipped with each kit. Electrical connections are included in the appropriate connection diagram, Sec. T2.3.4-A.

July 1983

Sec. T2.5.16

**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 closes when the Burnback timer times out. Installation instructions are shipped with each kit.

February 1982

Sec. T2.5.17

**K58 Magnetic Separator**

The K58 is a permanent magnet type separator designed to fit the top of the standard fill funnel of the continuous flux feed system or the top of the K219 flux hopper of a full automatic head.

The purpose of the separator is to remove magnetic materials such as mill scale and any other extraneous magnetic materials which may have been recovered along with the flux to be processed.

It is important to remove these magnetic particles from the flux which is to be reused in the continuous flux feeding system. If the magnetic material is not removed it will gather around the nozzle of the gun and impede or shut off the flux flow when making relatively long welds or welding continuously. The magnetic particles can also cause porosity in the weld.

Fit the magnetic separator into the funnel or hopper. Pour the flux to be reclaimed into the top pan of the separator. The separator is designed so the flux flows around three permanent magnets. The magnets remove all magnetic particles. When the magnets become covered with their full load, they automatically stop the flux flow. When the flux flow stops, remove the separator from the funnel or hopper. Turn it over and open the panel that covers the magnets. Remove the magnetic particles with brushing or an air blast. Be careful to protect yourself and others in the area from flying particles.

The magnetic separator is used with all Lincoln mild steel fluxes - 760, 761, 780, 781, 860, and 880. Do not use the magnetic separator with any stainless steel, alloy, or hardsurfacing flux except H-535. The magnetic separator removes some of the alloying elements from these fluxes thus changing their characteristics.

July 1983

Sec. T2.5.18

**K310 Flux Screen**

The unit was designed to fit the top of either the standard fill funnel of a continuous flux feed system of a K58 magnetic separator. The unit has a steel screen with .065 to .075 openings and an air vibrator attached to the frame. The vibrator can be used with air line pressures ranging from 20 psi thru 100 psi.

For ease of handling, the user should connect the incoming air line to the 1/8" pipe elbow with the aid of a fast disconnect type air coupling.

July 1983

### K349 MULTI-PROCEDURE KIT

Discontinued--Available by special order only  
For installation to older NA-5 models, refer to IM 305

Sec. T2.5.19

#### A. GENERAL

The Multi-Procedure Kit is an optional control box designed to mount and connect to NA-5 automatic controls. The kit provides three additional Weld mode procedure settings of wire feed speed and voltage, allowing the choice of four NA-5 Weld mode procedures. Weld Procedure 1 is set with the standard NA-5 Weld Controls and Weld Procedures 2, 3, and 4 are set with the weld controls provided under the kit's lockable security panel. Any one of the four weld procedures may be selected by the operator before or during welding using the kit's panel selector switch, or by connection of customer-furnished remote signals. Lights on the front panel of the kit indicate the selected weld procedure, and the NA-5 meters show that procedure when the NA-5 Weld mode light is on.

Maximum versatility is obtained when the NA-5 is connected to a DC-400 through DC-1500 type power source or SAF-600 and SA-800 with the Solid-State Remote Field Control. When used with a SAM or R3S power source, the voltage range of the required procedures may exceed the range covered by the power source remote control, and it would, therefore, be impossible to obtain the range of set procedures without readjustments at the power source.

#### B. INSTALLATION TO THE NA-5

1. Turn off all input power to the NA-5 *at the power source*.
2. Remove the button plug from the bottom right side of the NA-5 control box to expose the round access hole.
3. Remove the top-most screw from the right side of the NA-5 control box and save for use in Step 4 below.
4. Route the Multi-Procedure kit plug harness into the NA-5 control box through the round access hole. Then align the Multi-Procedure Kit's top and two bottom mounting holes with the holes in the NA-5 box side and secure with the removed top screw and the two screws provided with the kit.
5. Open the NA-5 control box door and locate the 12-cavity harness receptacle lying near the lower right rear corner of the box. Remove the receptacle's jumper plug (T13498-1) and save for future re-use.
6. Remove the jumper leads from the Multi-Procedure Kit harness plug and connect the plug to the NA-5 harness receptacle.



Figure 2

Sec. T2.5.19 (Continued)

**NOTE:**

1. If the Multi-Procedure Kit is removed from the NA-5, both the button plug and the jumper plug (removed in Steps 2 and 5 above) must be replaced on the NA-5.
2. Access to the circuit board mounting screws located between the NA-5 and kit control boxes is obtained by removing the kit's top mounting screw and hinging the box down.

If weld procedure selection is to be done *only* with the kit's panel selector switch, the Multi-Procedure Kit installation is now complete. If it is desired to employ remote signals for weld procedure selection, refer to Section C below.

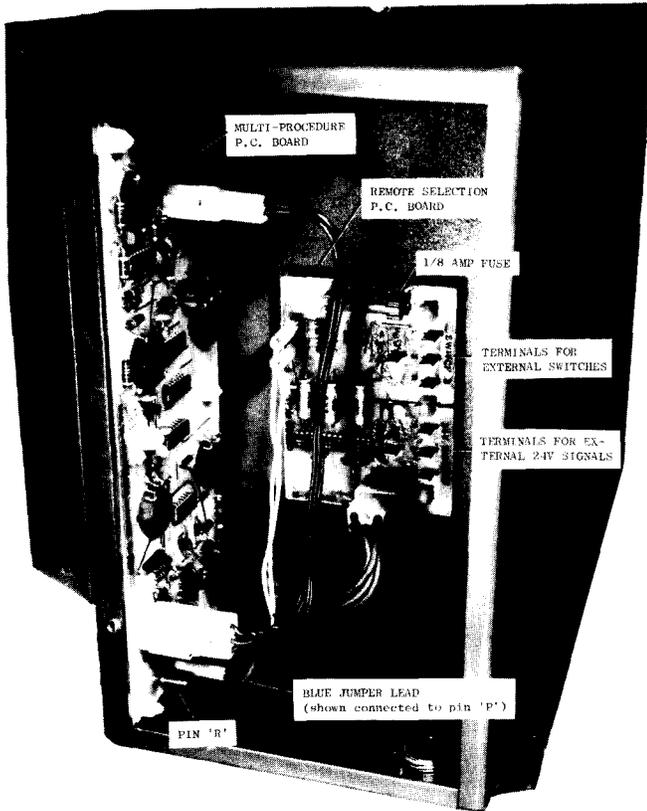


Figure 3

**C. PROCEDURE SELECTION WITH REMOTE SIGNALS**

1. Procedure Selection

The Multi-Procedure Kit circuitry is such that the procedure selection is performed on a priority basis, in which the selection of a higher weld procedure number overrides the selection of any lower weld procedure number. Therefore, selection of Weld Procedure 3 overrides the selection of Weld Procedure 2, and Weld Procedure 4 overrides the selection of any other weld procedure(s). The circuit also provides that if Weld Procedure 2, 3, or 4 is *not* selected, then Weld Procedure 1 is automatically selected.

2. Remote Selection Signals

The Remote Selection Board of the Multi-Procedure Kit permits remote selection of Weld Procedures 2, 3, and 4 by user-supplied external signals and provides protective isolation of the kit's control circuitry from these signals.

The external signals can be switch closure or 24 volt signals per the following:

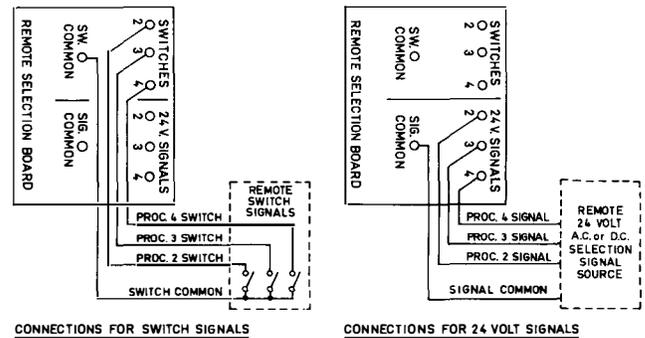
**SWITCHES** – Maintained closure of contacts rated for 24 volts, 10 milliamperes DC service.

**24 VOLT SIGNALS** – Application of a 24 volt  $\pm 10\%$  AC or DC signal capable of 10 milliamperes per input.

3. Remote Signal Connections

- a. Turn off the input power to the NA-5 and remove the Multi-Procedure Kit side cover panel by removing the two lower panel screws.
- b. Route leads from the external selection signals into the Multi-Procedure box through the cable clamp provided, or appropriate user-provided replacement box connector. **NOTE:** A plug buttoned hole cluster is also provided on later units to accept mounting of an MS-3102A-18 type box receptacle.\*
- c. Using .250 x .032 quick-connect female lead terminals, connect the remote leads to the proper Remote Selection Board terminals per the appropriate connection diagram shown below:

\* Such as L.E. Part No. S12021-11 (4-socket) receptacle for S12020-3 (4-pin) plug with S12024-1 cable clamp.



**CAUTION:** The switch common and the 24 volt signal common terminals are *not* electrically common with each other and are, therefore, not interconnectable. Although the kit's Remote Selection Board is fuse protected, improper signals or connections may possibly cause damage to the circuit.

4. Exclusive Remote Selection While Welding

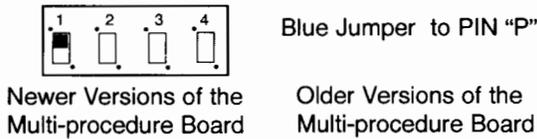
The Multi-procedure board inside the kit control box can be configured to permit the kit's panel selector switch to be fully functional while welding, or it can be configured to disable the panel selector switch thus permitting remote selection of weld procedures. (See Figure 3.)

The panel selector switch is fully functional in either configuration when not welding.

Sec. T2.5.19 (Continued)

a. Configuring the Multi-Procedure Board for weld procedure selection from the panel (non remote).

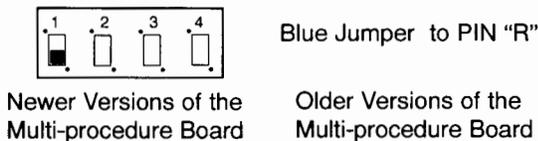
On older models when the blue jumper is connected to pin "P" the kit's panel selector switch is fully functional. This corresponds to setting the DIP switch to the UP position on newer versions of the Multi-procedure board.



This configuration must be used if remote procedure selection is not used, or if it is desired to permit panel selector switch override of remotely selected procedures while welding. However, remote procedure selection will be disabled if the panel selector switch is not set to the REMOTE position.

b. Configuring the Multi-Procedure Board for Remote weld procedure selection.

On older models when the blue jumper is connected to pin "R" the kit's panel selector switch is disabled allowing for weld procedure selection from a remote source. This corresponds to setting the DIP switch to the DOWN position on newer versions of the Multi-procedure board.



This configuration provides exclusive remote selection of weld procedures while welding, regardless of the position of the kit's panel selector switch. This prevents selector switch override of the remotely selected weld procedure. If the selector switch is not set to the REMOTE position, the weld procedure will automatically alter to that selected by a remote signal when the weld is started and return to the selector switch procedure when the weld cycle has ended.

**D. OPERATION**

1. Panel Controls

- a. **Panel Lights** – The Multi-Procedure Kit panel lights always indicate the weld procedure number which is presently selected. However, the selected weld procedure is not functional nor displayed on the NA-5 meters unless the NA-5 WELD mode light is on.\*
- b. **Panel Selector Switch** – The Multi-Procedure Kit panel selector switch allows the selection of any of the four weld procedures by rotating the knob to the positions for Weld Procedure 1, 2, 3 or 4.

By rotating the selector switch knob to the REMOTE position, the weld procedure is selected by a remote signal connected to the kit as described in Section C. The kit's panel lights will indicate the selected weld procedure.

- c. **Procedure Controls** – The standard NA-5 Weld Controls are used to set the Wire Speed and Volts for Weld Procedure 1. Weld Procedures 2, 3, and 4 are set using the appropriate Wire Speed and Volts controls located under the lockable security panel of the Multi-Procedure Kit. The weld procedure control settings are functional and displayed on the NA-5 meters only when the NA-5 WELD mode light is on and the specific Weld Procedure number has been selected, as indicated by the kit's panel lights.\*

2. Presetting the Weld Procedures

- a. Set the NA-5 mode selector switch to WELD position.\*
- b. Select Weld Procedure 1 using the Multi-Procedure Kit panel selector switch.
- c. Adjust Weld Procedure 1 controls (on NA-5 panel) so the NA-5 meters display the desired values of wire feed speed and arc voltage.
- d. Repeat Steps b and c above for Weld Procedures 2, 3, and 4 as required for the application.

3. Welding *Without* Remote Selection of Weld Procedures

- a. The Multi-Procedure board must be configured to "weld procedure selection from the panel", as originally shipped. (See Section C.4.)
- b. Select the desired Weld Procedure number using the Multi-Procedure Kit panel selector switch.
- c. Start the weld, and the selected weld procedure will become operative when the NA-5 WELD mode light turns on, indicating that the weld mode of the welding cycle is in progress.\*
- d. The selected weld procedure will remain operative as long as the NA-5 weld mode is operative, or until another weld procedure is selected during the weld mode.

4. Welding *With* Remote Selection of Weld Procedures

- a. Set the Multi-Procedure Kit panel selector switch to the REMOTE position.
- b. Select the desired Weld Procedure number using the appropriate remote selection signal. (Refer to Section C.)
- c. Start the weld, and the remotely selected weld procedure will become operative when the NA-5 WELD mode light turns on, indicating that the weld mode of the welding cycle is in progress.\*
- d. The remotely selected weld procedure will remain operative as long as the NA-5 weld mode is operative, or until another weld procedure is selected during the weld mode.\*

Sec. T2.5.19 (Continued)

### **E. SECURITY OF WELD PROCEDURE SETTINGS**

There are two means provided to prevent or limit unauthorized readjustments of the Multi-Procedure Kit voltage and wire feed speed controls once set to the desired procedure.

1. Once the procedure is set, the security panel of the Kit can be locked to prevent access to the control knobs.
2. The control range of the procedure control knobs can be limited to either about 3% or about 15% of the full range control by installing a knob rotation stop-screw to any or all of the control knobs. This stop-screw is installed in the same manner as described for the NA-5 Control (see Sec. T3.9.)

### **F. MAINTENANCE**

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

\* Except when used with NA-5R Controls — see “Note” in Section A.

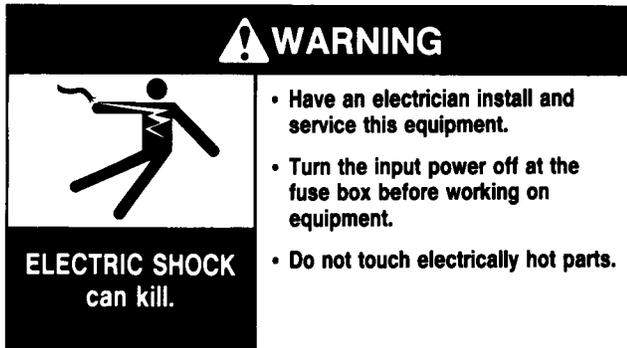
February 1996

## SEC. T3.2 — ROUTINE EQUIPMENT OPERATION

Sec. T3.2.1

(File as Sec. L3.2 for IM-278)

### Operator's Instructions



Once properly set up (per Sec. T3.4), 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 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" or less 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

February 1982

## Sec. T3.2.2

**Loading the 50 – 60 Pound 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 flat 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 .035 and .045" 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

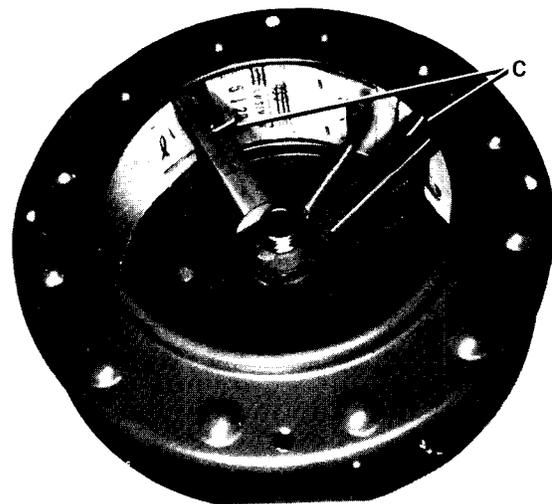
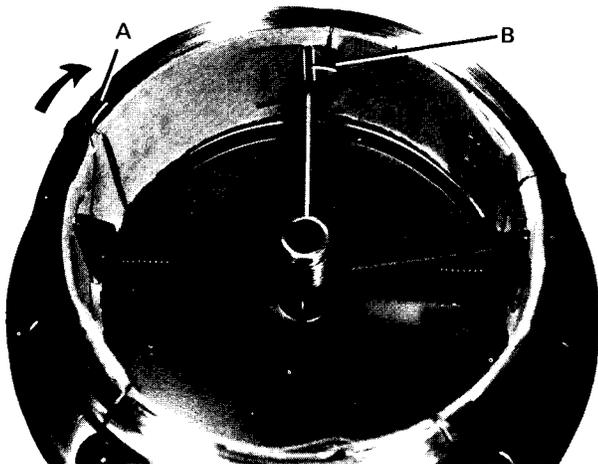
the cover and secure it by bending it back. Cut and remove the remaining tie wires.

**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 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.

February 1982



## ROUTINE EQUIPMENT OPERATION – CONT'D

Sec. T3.2.3

(File as Sec. L3.2.3 for IM-278)

### Head Position Adjustments

The NA-3N, NA-3S, NA-4, NA-5N and NA-5S heads can be easily adjusted to any welding position. These adjustments are illustrated below. The most frequently used adjustments, Fig. T3.2.3-1 and Fig. T3.2.3-2, are also available on the -NF and -SF units. The other -NF or -SF adjustments depend upon the fixture design.

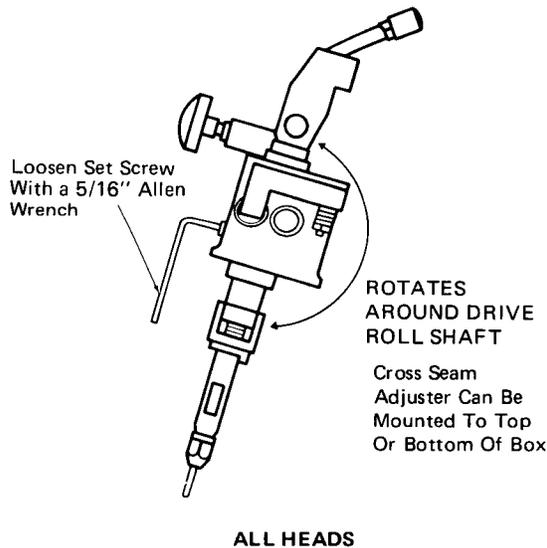


Fig. T3.2.3-1

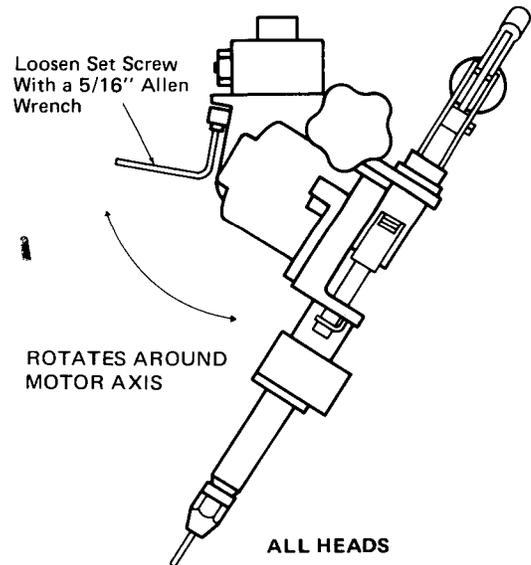
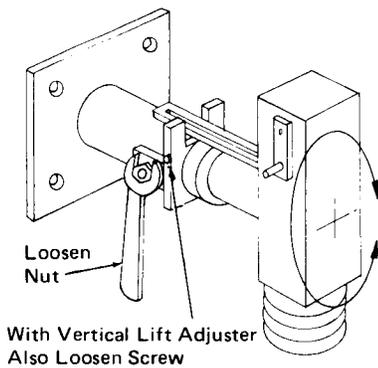


Fig. T3.2.3-2

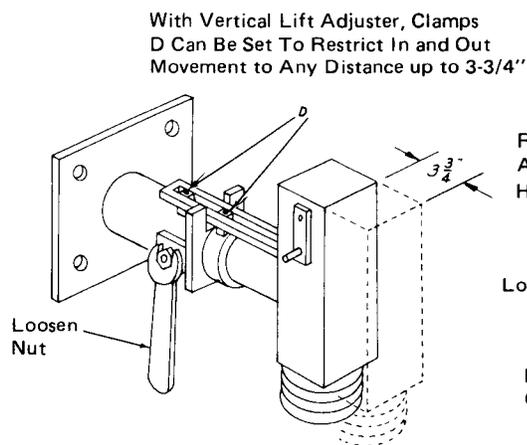
**NOTE:** If the head is positioned so the wire feed roll box is placed upside down, the wire straightener and nozzle positions must be interchanged. Then, to feed the electrode down through the nozzle, the wire feed motor direction of rotation must be reversed. To do this interchange leads #626 and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



ENTIRE HEAD ROTATES ABOUT MOUNTING BAR, USUALLY KEPT WITHIN 22° OF VERTICAL

WITH STANDARD HEAD MOUNTING OR VERTICAL LIFT ADJUSTER

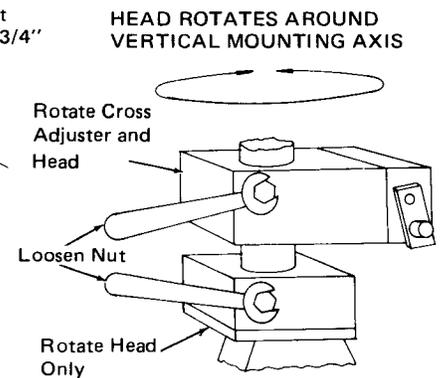
Fig. T3.2.3-3



HEAD SLIDES IN AND OUT

WITH STANDARD HEAD MOUNTING OR VERTICAL LIFT ADJUSTER

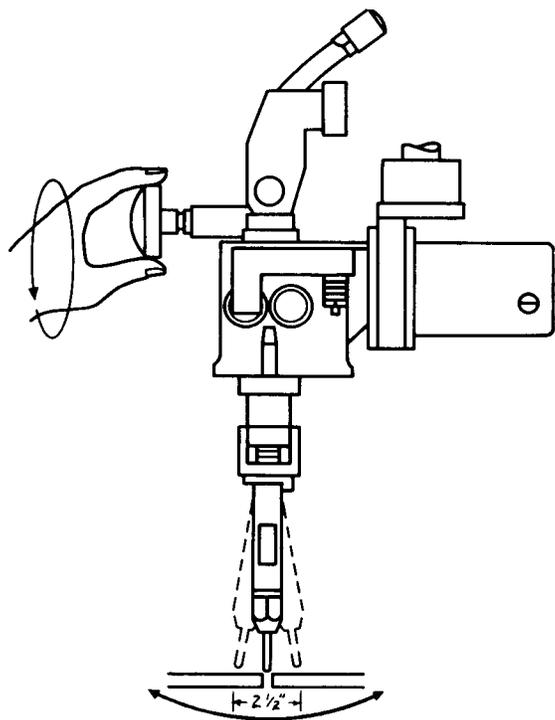
Fig. T3.2.3-4



WITH STANDARD HEAD MOUNTING OR HORIZONTAL HEAD ADJUSTER

Fig. T3.2.3-5

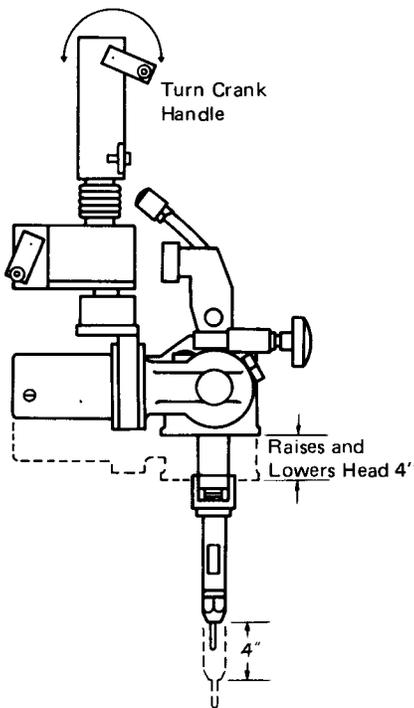
Sec. T3.2.3 and L3.2.3 (Continued)



CROSS SEAM ADJUSTER

Fig. T3.2.3-9

Operation of the hand screw of the cross adjustment assembly permits a 2½ inch cross seam adjustment. This adjustment can be done while welding.

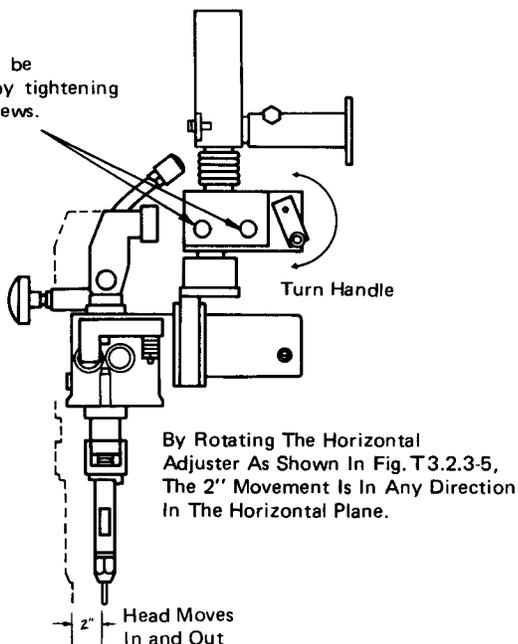


VERTICAL HEAD LIFT ADJUSTER ONLY

Fig. T3.2.3-6

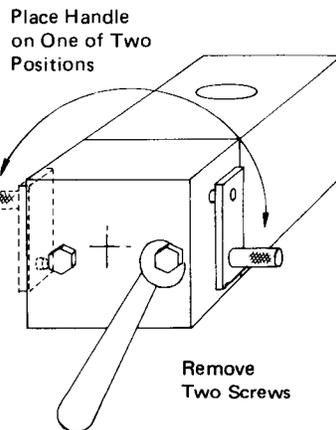
This adjustment can be used during setup or while welding. To control the rotational movement of (N) as it moves up and down, the key is made in two parts (U) and (W). These parts are spaced by the shims (Y) to allow vertical movement of (N) with the minimum amount of rotational movement when screws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

This adjustment can be locked in position by tightening two socket head screws.



HORIZONTAL HEAD ADJUSTER ONLY

Fig. T3.2.6-7



HORIZONTAL HEAD ADJUSTER ONLY

Fig. T3.2.3-8

## ROUTINE EQUIPMENT OPERATION – CONT'D

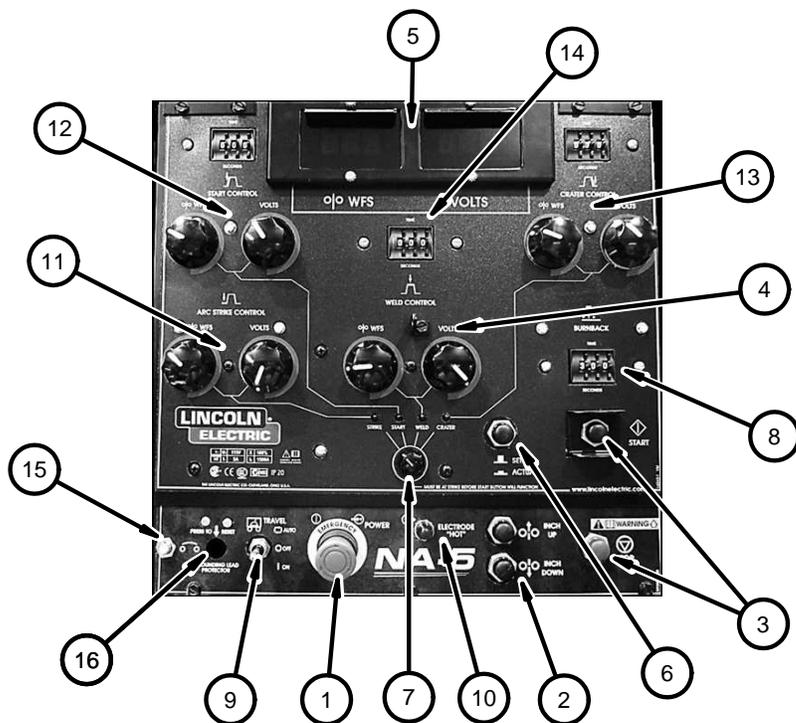
Sec. T3.3.1

### Controls and Their Functions

#### CONTROLS ON THE FRONT OF THE NA-5 CONTROL BOX

##### A. Exposed Controls (lockable cover down)

1. **Wire Speed Meter (5)** – Reads the SET or ACTUAL wire speed (in inches/minute). The jumper on the meter P.C. board must be properly positioned for the gear ratio and drive rolls being used (see table on wiring diagram).
2. **Volts Meter (5)** – Reads the SET or ACTUAL welding voltage.
3. **Inch-Up Button (2)** – Pushing this button will inch the electrode up.
4. **Inch-Down Button (2)** – Pushing this will inch the electrode down. With NA-5 controls above Code 8300, the electrode will automatically stop when it makes electrical contact with the work, and the flux solenoid (if used) will activate until the inch-down button is released. Units below Code 8300 do not have this automatic stop feature.
5. **Start Button (3)** – When this is pushed, the electrode will feed down with the wire speed and voltage controlled by the Arc Striking Controls.



(Under the conditions noted in Sec. T3.8 (B) under “Electrode Backup”, NA-5 Controls above Code 8300 – with “Cold Starting” – may feed in the wrong direction when the start button is pressed.) When the electrode contacts the work, the arc will be established and the circuit will automatically switch from the Arc Striking Controls to the Weld Controls. If the optional Start Control is installed, however, the circuit will switch from the Arc Striking Controls to the Arc Start Controls and then, after the Start Controls time out, will switch to the Weld Controls.

If the circuit is connected (see table on wiring diagram) for starting “on-the-fly”, the travel circuit will be energized when the start button is pushed. If the circuit is connected for starting from a standstill, the travel will be energized when the arc is established. (See Sec. T3.5.1.)

6. **Stop Button (3)** – Pressing this begins the stopping cycle. As shipped from the factory, the wire feed motor will stop immediately and there will be a burnback as set by the Burnback and Electrode Backup Time control. However, if the Crater Control option is installed, the unit will first switch from the Weld Control to Crater Control and after the Crater Control Time ends will then go into the stop sequence.
7. **Travel Switch (9)** – When in the Hand Travel position, the travel circuit will be energized. When in the Off position, the travel will not operate and when the switch is in Automatic Travel position the travel will be automatically controlled by the NA-5 control circuit during the welding operation.
8. **Control Power Switch (1)** – This switch opens both sides of the AC input power to the control circuit. In the event of circuit malfunction, this switch can be thrown to the OFF position which will turn the entire circuit off. However, if it is necessary to service the inside of the control box, the power to the box should be disconnected at the power source. Although this switch turns off both sides of the AC line power to the control unit, the power lines and power source control leads are still brought into the control box and, therefore, this power switch should not be relied upon to protect maintenance personnel.
9. **SET-ACTUAL Pushbutton (6)** – After the weld has been started, the ACTUAL wire speed and volts can be read by pressing the pushbutton to the left of the START button. When the pushbutton is not being pressed, the meters read the SET value.
10. **Mode Selector Switch and Lights (7)** – When the NA-5 is at idle, the knob can be set to point to the STRIKE, START, WELD, or CRATER controls for presetting purposes. For example, by turning the knob to WELD, the WIRE SPEED and VOLTS rheostats for the Weld Controls will

## Sec. T3.3.1 (Continued)

be operative. With this setting, the WELD light will be on. If the knob is set for optional controls which are not installed, the STRIKE light will be on. After the various controls are set, the knob must be positioned at STRIKE before the start but-ton will function. The important thing to re-member is that regardless of the setting of the knob, the light which is on shows the set of con-trols which are functioning. When welding, the NA-5 control will disable the selector switch and automatically switch the various sets of controls into the circuit and the lights will show which set of controls are operative.

This control can be useful for loading new coils of wire. Usually the Arc Striking inch wire speed is set rather slow. By turning the Mode Selector to one of the other modes, such as Weld, the wire speed is set to the higher speed as set by the Weld wire speed. After wire is loaded, the Mode Switch is set back to Strike.

11. **Electrode 'HOT' Light (10)** – This light comes on when the start button is pressed and the elec-trode circuit is electrically hot. It will stay on until the control signals the power source output to be off.
12. **Circuit Breaker (15)** – Protects the circuit from severe wire feed overloads or short circuit condi-tions.
13. **Grounding Lead Protector (16)** – Protects the control box grounding lead (in the input cable) from welding current in case of a short from the welding circuit to the frame. It shuts off the power source welding voltage and makes the drive rolls turn in reverse.

**B. Controls Under the Lockable Security Cover**

1. **Arc Striking Controls (11)** – There are two con-trols in this mode. The Inch Wire Speed rheostat sets the wire speed during idle and after the NA-5 is energized by the Start circuit until welding cur-rent begins to flow. The Volts potentiometer con-trols the power source output voltage before the arc strikes. (The Volts potentiometer is not effec-tive on R3S machines.) Proper setting of both of these controls is very important in order to have the best arc striking.
2. **Weld Controls (4)** – The Wire Speed and Volts potentiometers control the welding procedure.
3. **Burnback and Electrode Back Up Time (8)** – This control determines the length of time of burnback delay after the stop circuit is energized. Depending on the connections on the logic board, it may also determine the length of time the wire feed motor reverses after the stop button is pushed before it stops. The NA-5 as shipped from the factory is connected to stop the wire feed motor immediately with adjustable burnback delay when the stop button is pushed. The time delay control, therefore, should be adjusted to just the point where there is no sticking of the electrode in the crater at the end of the weld. If the circuit is con-nected so the wire reverses at the end of the weld, the distance the wire reverses after the welding

arc goes out is controlled by the time setting and the Inch Wire Speed. The higher the Inch Wire Speed setting, the faster the wire reverses. If the wire does not back up far enough at the end of the weld, increase the time setting and/or turn the Inch Wire Speed to a higher setting. However, the inch speed should be set for best arc striking and the backup distance controlled by the time setting. If other modes of burnback and electrode backup are desired, refer to Sec. T3.5.2.

Burnback voltage and wire speed will be at the settings of the previous mode until the arc goes out.

4. **Start Controls (12) (Optional)** – On some appli-cations and procedures it is desirable to weld at a different wire speed and voltage at the start of a weld for a short period of time before swiching to the weld wire speed and volts. When the optional Start Controls are installed this can be done. The start wire speed and voltage can be higher or lower than the weld values and are completely independent of other control settings. Setting the start time to 0.00 seconds will bypass the start mode controls during the welding cycle.

Install the optional Start Controls per the instruc-tions included with the kit. Note that the same kit can be used for either Start Controls or Crater Controls and proper function depends on correct installation.

Although the timer can be set for 9.99 seconds, the majority of applications will require only 0.25 to 2.00 seconds. A good rule to follow for the initial settings of the Start Controls is to set them at the same settings as the Weld Controls wire speed and voltage. The time delay can be set for about one second. After the first test weld, the controls can be re-adjusted as desired.

5. **Weld Timer (14) (Optional)** – With this option, the weld duration is set by the Weld Time control. The control starts timing when the Weld Controls become operative and energizes the stop circuit when it reaches its set time. Install the optional Weld Timer module per the instructions included with the kit. Setting the weld time for zero seconds will bypass the weld mode control settings during the welding cycle.
6. **Crater Controls (13) (Optional)** – On some appli-cations and procedures it is desirable to weld at a different wire speed and voltage at the finish of a weld for a short period of time for crater filling purposes. The optional Crater Controls has been designed for this purpose and allows higher or lower values than when welding. Setting the Crater time to 0.00 seconds will give zero crater-fill time; however, the crater settings will be active during Burnback time until the arc goes out.

Install the optional Crater Controls per the instruc-tions included with the kit. Note that the same

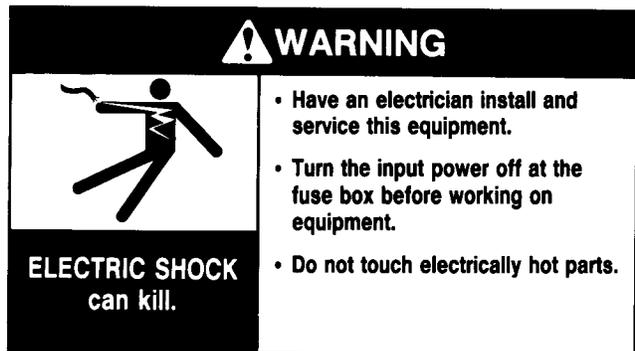
Sec. T3.3.1 (Continued)

kit can be used for either Start Controls or Crater Controls and proper function depends on correct installation.

Although the timer can be set for 9.99 seconds, the majority of applications will require only 0.25 to 2.00 seconds. A good rule to follow for the initial settings of the Crater Controls is to set them at the same settings as the Weld Controls wire speed and voltage. The time delay can be set for about one second. After the first test weld, the controls can then be readjusted as desired.

February 1982

## SEC. T3.4 — SET-UP INSTRUCTIONS



1. If using a multiprocess power source (SAM, SAF, SA, DC-400, DC-600, DC-1000 or DC-1500 type), make connections and settings per the power source connection diagram for the process being used. See Sec. T2.3.4.

### AUTO TAB

When using the NA-5 with a DC-400 power source, the "Auto Tab" jumper on the NA5 voltage P.C. board must be connected in order for the inch down circuit to function. When the "Auto Tab" jumper is connected, the Cold Starting feature of the NA5 is disabled, and only the Hot Starting technique can be used. If the Cold Starting technique is to be used, the optional K826 Diode Kit must be installed on the DC-400.

2. Set the power source and NA-5 circuit polarity per information on Electrode Polarity in Sec. T2.3.
3. Depending upon the procedures and applications, decide:
  - a. The means of arc striking and whether to start the travel with the 'Start' button or the arc.
  - b. Whether the initial bead size or penetration requires use of the optional Start Controls.See Sec. T3.5 for descriptions of these various starting sequences and the rewiring needed to accomplish them.
4. Depending upon the procedures and applications:
  - a. Select the arc and travel stopping sequence. See Sec. T3.5.2 for a description of these various stopping sequences and the rewiring needed to accomplish them.
  - b. Decide if control of the ending bead size or crater filling requires use of optional Crater Controls. See Sec. T3.5.2.
5. Set the head position relative to the work as required for the fixture, application, and procedures. See Sec. T3.2.3.
6. 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.

7. Refer to the instructions for the wire contact assembly being used. See Sec. T2.2.6, T2.2.7, T2.5.3 or T2.5.4.
8. The mount for standard 50 and 60 pound 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. 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.
9. Load the wire reel per Section T3.2.2 or install the Speed-Feed drum or reel per Section T2.5.7-A or -B.
10. Straighten the first six inches of electrode and push it through the wire straightener to the drive rolls. To use the cored wire straightener, remove the knurled nut at the top, feed the wire through the nut, down into the straightener, and into the drive rolls. Screw the nut back onto the straightener. Feed wire through the nozzle tip and adjust the straightener for optimum straightness. With wire contact assemblies, 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.
11. 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 measurement 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.
12. Connect the work lead to the work or a suitable piece of scrap. Clip the end of the electrode to a sharp point.
13. Preset the Start (if used), Weld, and Crater (if used) Controls to the wire speed and voltage specified in the procedure.
14. Make several test welds, readjusting the controls in the following order:
  - a. Set the Arc Striking, Inch Wire Speed, and Volts Controls for optimum arc striking. The optimum strike control settings for most processes will be typically 4 - 5 volts higher than the Weld Mode Voltage Setting and 40 - 50% of the Weld Mode Wire Feed Speed Setting (possibly lower if cold starting is used).
  - b. If striking is still not satisfactory, refer to Sec. T3.5.2 for information on wire feed motor acceleration.
  - c. If installed, adjust the "Start Controls" to set the welding procedures for the time set on the timer to provide the bead size, penetration, or other factor as needed for the application (refer to Sec. T3.5.1).

Sec.T3.4 (Continued)  
**Setup Instructions**

- d. If installed, adjust the "Crater Controls" to set the welding procedures for the set time after the stop button is pressed to provide the bead size or fill the crater as needed for the application (refer to Sec. T3.2.2).
- e. Set the "Burnback Time" to provide the stopping characteristics needed.

April 1988

## SEC. T3.5 – STARTING AND STOPPING SEQUENCES

### Sec. T3.5.1

#### Means of Arc Striking

##### A. All NA-5 codes utilize “hot start” arc striking which operates as follows:

1. With the electrode not touching the work, press the ‘Start’ button.
2. The electrically “hot” electrode inches down as set by the ‘Inch Wire Speed’ control.
3. When it makes electrical contact with the work, the arc strikes and the circuit automatically switches from ‘Strike’ settings to ‘Weld’ (or Start, if used) settings.

##### B. NA-5 models above Code 8300 offer both “hot start” arc striking, as described above, or “cold start” arc striking which operates as follows:

1. Press the Inch Down button until the tip of the electrode touches the work, automatically stops, and the flux (if used) is automatically dispensed. **NOTE:** If Inch Speed is set too high, the electrode may stop with too much force on its tip resulting in possibly poor starting.
2. The arc establishes when the ‘Start’ button is pressed and the circuit automatically switches to Weld (or start, if used) settings. Should the arc not start immediately, the wire will retract slightly until the arc is established and then feed down in the normal manner.

Use either the standard “on-the-fly” travel starting or rewire the controls for “standstill” travel starting per Sec. T3.5.2 below.

##### C. Optional ‘Start Controls’

Recommended for applications where penetration, bead size, and other weld characteristics must be carefully controlled at the start.

The starting sequence is as described above except, when the arc strikes, the machine welds at the wire speed and voltage set by the ‘Start Controls’ panel until the time set on the thumbwheel switch elapses. The circuit then automatically switches to ‘Weld Controls’ wire speed and voltage. Actual settings depend upon the application requirements.

Setting the start time to 0.00 seconds will bypass the Start Mode controls during the weld cycle.

##### D. Available options for applications with particularly difficult starting

1. K238 High Frequency Generator – See Sec. T2.5.8.
2. K237 Linc-Fill Starting Relay – See Sec. T2.5.12.

### Sec. T3.5.2

#### Setting Travel Starting and Stopping

Standard machines can be connected for a variety of starting and stopping sequences.

#### STARTING 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 K337 Weld Timer Module to control the welding cycle duration can be installed.
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. Stopping Sequences

As shipped, the travel stops when the ‘Stop’ button is pressed producing a smaller crater area.

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

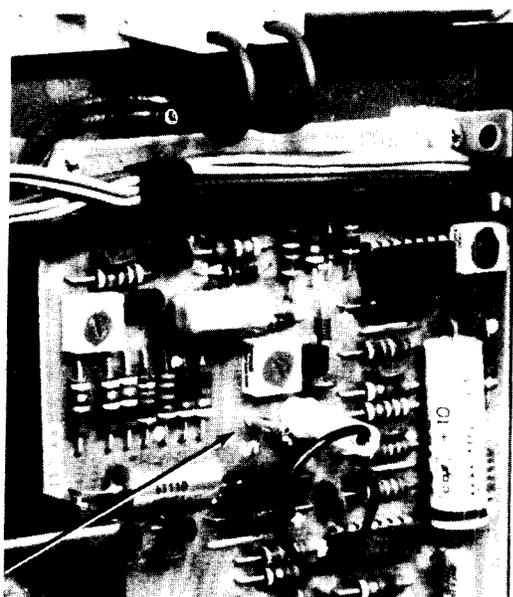
##### D. Reconnecting the Travel Starting and/or Stopping Sequence

To change the travel sequence, turn off all input power to the NA-5 control box. Open the control box. The logic board is mounted on the back of the box in the upper right hand corner. To change the travel circuit for the various modes of starting and stopping, follow the information on the table of the wiring diagram for the NA-5 being used. Table T3.5 at the end of this section also shows information on reconfiguring the travel sequences.

##### E. Wire Feed Motor Acceleration

The NA-5 has two different speeds of controlled wire feed motor acceleration. As shipped, the unit is connected for fast acceleration which is best for most ap-

Sec. T3.5.2 (Continued)



plications. To change to the slower acceleration, turn off all input power to the NA-5 control box. Open the control box. Locate the 'Control' P.C. Board mounted on the back of the box in the lower right hand corner and change the jumper plug from the 'F' pin to the 'S' pin.

**F. Burnback and Electrode Back-Up**

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 when the optional 'Crater Controls' are not used follows:

1. Press the 'Stop' button.
2. The wire feed motor stops and the Burnback time delay starts.
3. The arc continues to burn the electrode back from the puddle until the arc goes out or the time set on the thumbwheel switch elapses. This control should be set for just enough burnback time to prevent crater sticking.

There are two other ways this circuit can be connected. One will cause the wire to retract\* with a contactor drop out delay at the end of the weld, and the second will cause the wire to retract\* during burnback time and there will be no contactor drop out delay at the end of the weld. If either one of these alternate methods of stopping the weld is desired, the connections on the logic board can be easily changed.

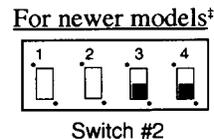
To change the stopping sequence, turn the input AC power off at the power source, remove the screw hold-

ing 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:**

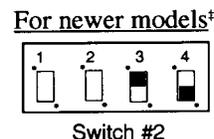
1. Feed motor stops and electrode burns back with contactor delay (standard)

For older models  
lead 693 to pin 3  
lead 690 to pin 4



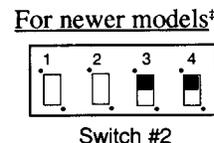
2. Feed motor inches up and electrode burns back with contactor delay

For older models  
lead 693 to pin 1  
lead 690 to pin 4



3. Feed motor inches up and contactor opens (no burnback)

For older models  
lead 693 to pin 1  
lead 690 to pin 2



**G. Optional 'Crater Controls'**

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.

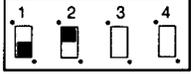
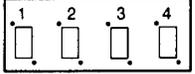
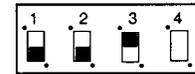
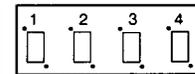
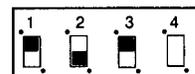
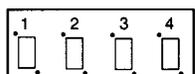
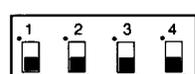
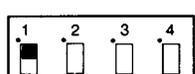
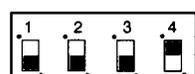
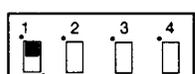
When the 'Stop' button is pressed, the machine welds at the wire speed and voltage set by the 'Crater Controls' until the time set on the thumbwheel switch elapses. The circuit then automatically switches to the arc stopping sequence described above.

**NOTE:** Setting crater time to 0.00 seconds will give zero crater fill time; however, the crater settings will be active during burnback time until the arc goes out.

\* Wire will retract at Weld Mode Speed (or Crater Mode Speed, if installed) until the arc goes out, then retract at Strike Mode Speed for remainder of burnback time.

Sec. T3.5.2 (Continued)

**Table T.3.5 RECONNECTING THE TRAVEL SEQUENCE**

Travel Starts	Travel Stops	Older Models	Newer Models <sup>1</sup>
With the "Start" Button	With the "Stop" Button	Lead 691 to Pin 6 Lead 692 to Pin 5	  <p>Switch #1                  Switch #2</p>
With Arc Striking	With Arc Stopping	Lead 691 to Pin 6 Lead 692 to Pin 7	  <p>Switch #1                  Switch #2</p>
With Arc Striking	With "Stop" Button	Lead 691 to Pin 5 Lead 692 to Pin 7	  <p>Switch #1                  Switch #2</p>
With "Start" Button	With End Crater Fill Time (with Optional procedure module installed in crater receptacle <sup>1</sup> )	Lead 691 to Pin 6 Lead 692 to Pin 9	  <p>Switch #1                  Switch #2</p>
With "Start" Button	After Bumpback Time (with Optional procedure module installed in crater receptacle <sup>1</sup> )	Lead 691 to Pin 6 Lead 692 to Pin 8	  <p>Switch #1                  Switch #2</p>

**NOTE:**

-  Indicates switch in up position
-  Indicates switch in down position
-  Indicates switch position does not matter

<sup>1</sup> If the Optional Procedure Module is installed in the crater receptacle, DIP switch position 1 on Switch #2 should be in the UP position as shown. Additionally, remove 583C to 584C Jumper Plug from the Procedure Board. If the Procedure Module is not installed the switch should be in the down position and the 583C to 584C Jumper Plug should be re-installed on the Procedure Board.

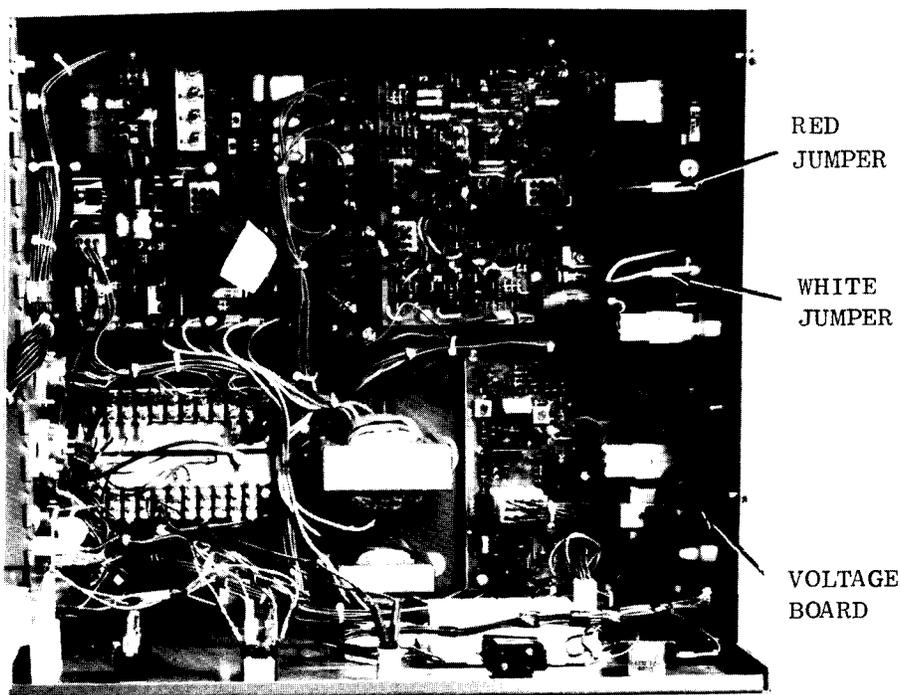
February 1996

## SEC. T3.6 – VOLTAGE CONTROL RESPONSE

The NA-5 is provided with selectable voltage control response. Proper setting depends on the power source and process being used. Refer to the appropriate power source connection diagram for the proper connection of the jumpers located on the NA-5 Voltage Board.

To change the voltage control response:

1. Turn off all input power to the NA-5 control.
2. Open the control box.
3. Locate the Voltage P.C. board mounted on the right side of the box. Position the jumper plugs on the Voltage Board per the appropriate power source connection diagram.



February 1982

## SEC. T3.7 – AUTOMATIC SHUTDOWN

If the NA-5 voltage control is unable to supply the 'SET' value of arc voltage while welding, the automatic shutdown circuit will activate. This protection circuit immediately returns the NA-5 control to idle state within a few seconds after the arc voltage discrepancy occurs.

Typical causes for the activation of this protective shutdown circuit are as follows:

1. 'SET' value of arc voltage is outside the power source range.
2. Power source voltage control not set for 'REMOTE'.
3. Misconnection of NA-5 control cable leads to power source.
4. Incorrect weld polarity connections, or settings, at NA-5 or power source.
5. Lost connection of NA-5 voltage sensing leads (#67 and #21) between arc and voltage control, or a blown 1/8 amp fuse on voltage P.C. boards built since 1983.

With NA-5 units above Code 8300, the conditions of (4) and (5) above would result in the wrong wire feed direction when the weld is started. (See Sec. T3.8.)

In the case of full range control power sources, such as the DC-600, this protective shutdown circuit could prevent welding under the conditions of (3), (4) and (5) above by holding the power source output at minimum, possibly providing too low of a power source output to even establish an arc, or causing the field fuse to blow because of rapid field reversals with NA-5 controls above Code 8300. (See Sec. T3.8.)

Although out of range shutdown can occur with all power sources when working with very low or very high arc voltages, it is most likely to occur when using the R3S models with the somewhat limited voltage range of the various taps. For instance, if the R3S-400 triangle tap setting is for 31 volts, the range of control from the remote circuit is approximately 7 volts, i.e., 27½ to 34½ volts at nominal input voltage. If the NA-5 controls are set for 29 volts and the input voltage to the R3S goes up, it may not be possible for the NA-5 control circuit to hold the 29 volts so the welding will shut down. By changing to the 27 volt triangle setting, the range will be approximately 23½ to 30½ volts and at high input voltage there will be sufficient control to hold the SET arc voltage. On these machines, if the NA-5 stops welding, follow this procedure:

- A. Move the NA-5 voltage set point 2 volts lower than the desired procedure and make a test weld.
  1. If the NA-5 still shuts down, go to Step (B) below.
  2. If the NA-5 keeps welding, change the R3S triangle setting to the next *higher* voltage and reset the NA-5 set point to the desired procedure. The R3S is now set properly unless there is a significant change in input voltage. Skip the following step.

- B. Move the NA-5 voltage set point 2 volts higher than the desired procedure and make a test weld.

1. If the NA-5 now keeps welding, change the R3S triangle setting to the next *lower* voltage and reset the NA-5 set point to the desired procedure. The R3S is now set properly unless there is a significant change in input voltage.
2. If the NA-5 still shuts down, refer to the following paragraph and the other possible causes previously listed.

In some cases, it is also possible to hold the 'ACTUAL' button pressed while starting the arc. Before the NA-5 shuts down, the actual arc voltage can be read on the digital meter. Comparing this reading to the 'SET' reading will tell what change in the range controls of the power source are required so it can supply the desired voltage. Should the meter read zero, check the NA-5 sensing leads (#21 and #67) connections. Should the meter read a minus (–) voltage, the polarity connections or settings at the NA-5 or power source are wrong.

This same general procedure can be used on other power sources. For example, if the NA-5 keeps shutting down and the other possible causes have been checked, adjust the SET voltage higher and/or lower than the desired voltage. If the NA-5 continues to weld at one of these voltages, it can then be determined what change in the range controls of the power source are required so it can supply the desired voltage.

July 1983

## SEC. T3.8 – COLD START CIRCUITRY

NA-5 controls above Code 8300 contain circuitry added to the Voltage P.C. board to facilitate the "cold starting" features of these units.\* This circuitry senses the voltage present between the electrode and work, via leads #67 and #21, and permits normal wire feed if this voltage exceeds typically about 6.5 volts DC. However, if this voltage level is not exceeded, or drops below typically about 3.5 volts DC, the Auto Stop activates while inching down or electrode backup occurs if the arc start circuit has been initiated.

\* Units below Code 8300 can be provided with the cold start circuitry by replacing the old code L-6257 Voltage board with the new G-1556 Voltage board. This new board will mount and connect in the same manner as the old board, except the third harness connector (previously connected to a jumper plug) must be connected to the lower receptacle of the new Voltage board.

**NOTE:** HI-FREQ starting cannot be used with converted units *below* Code 8300.

### A. Auto Stop

When the inch down button is pressed, a low level DC voltage signal is applied between the electrode and work which permits the wire to inch down normally. When the electrode makes electrical contact with the work, it shorts out this signal causing the wire feed to automatically stop and the flux solenoid to activate until the inch down button is released. Inch up will not be affected by this circuit.

This voltage signal is supplied by the 24 volt transformer on the NA-5 Voltage P.C. board only when the inch down button is pressed. The level of the signal appearing between the electrode and work will be dependent on the impedance present across these points, including the power source output stud impedance. If this impedance is less than 500 ohms the applied signal level may be too low to permit the electrode to inch down.

### B. Electrode Backup

If while starting or welding the electrode stubs or shorts to work, the resulting loss of arc voltage will cause the electrode to momentarily back up until the arc voltage is re-established, then change back to normal feed direction.

**NOTE:** The "cold starting" circuitry will cause the NA-5 to feed in the wrong direction when the start button is pressed if the 'ACTUAL' arc voltage, as read on the NA-5 voltmeter, does not exceed typically about 6.5 volts. Usual causes for this situation are:

1. No wire loaded through the NA-5 head and nozzle assembly (*except* when using the K148 nozzle).
2. No power source weld cable connection to the NA-5 head or work.
3. Incorrect electrode polarity connections at the NA-5 or power source.
4. Little or no output voltage from the power source.

5. An open #67 or #21 voltage sensing lead to the NA-5 control box, or a blown 1/8 amp fuse on voltage P.C. boards built since 1983.

July 1983

## SEC. T3.9 – SECURITY OF WELD PROCEDURE SETTINGS

There are two means provided to prevent or limit unauthorized readjustment of the NA-5 voltage and wire feed speed controls once set to the desired procedure.

1. The security panel of the NA-5 can be locked to prevent access to the control knobs.
2. The control range of the procedure control knobs can be limited to either about 3% or about 15% of the full range control by installing a knob rotation stop screw to any or all of the control knobs. This stop screw is installed in the following manner:
  - a. Turn off the input power to the NA-5.
  - b. Loosen each knob set screw and remove all knobs, including the rotary selector switch knob.
  - c. Remove the felt seal and square spacer tube mounted behind each control knob.
  - d. Open the control box and disconnect, then remove, the procedure control P.C. board assembly and its panel insulation.
  - e. Install a 1/2" long, pan or round head, #4 sheet metal screw into the .10" dia. hole, located beneath each square hole, so the head is on the back side of the panel (inside the control box).
  - f. Remount the P.C. board assembly and its panel insulation, then reconnect the P.C. board and close and secure the control box.
  - g. Remount the rotary selector switch knob, and replace each square spacer tube and felt seal so the #4 screw protrudes between the tube and the felt seal.
  - h. Turn on the NA-5 input power and set the desired procedure by rotating the shafts of the controls.
  - i. Carefully replace each control knob so the #4 screw inserts into the center of the shorter length channel on the back of the knob for about 3% of the total range of control or into the center of the longer length channel for about 15% of the total range of control.
  - j. With finger pressure on the knob against the felt seal, carefully retighten the set screw of each knob.

**NOTE:** Steps (h) thru (j) will have to be repeated if it is desired to change the procedure settings to values outside the selected 3% or 15% control range limit.

February 1982

## SEC. T6 – MAINTENANCE

### Sec. T6.2 – Mechanical Maintenance

<b>⚠ WARNING</b>	
	<ul style="list-style-type: none"> <li>• Have an electrician install and service this equipment.</li> <li>• Turn the input power off at the fuse box before working on equipment.</li> <li>• Do not touch electrically hot parts.</li> </ul>
<b>ELECTRIC SHOCK can kill.</b>	

#### Sec. T6.2.1

#### Wire Drive Gearbox

Once a year recoat all gears with a non-fluid type lubricant (Lincoln Spec. E2322). 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 until all teeth are lubricated.

February 1982

#### Sec. T6.2.2

#### Changing Wire Size and Wire Feed Gear Ratios

Gear Ratio	Feed Speed Range (in/mm)	Max. Wire Size	
		Cored Wire	Solid Wire
21:1	100 – 2070	.052	.052
57:1	38 – 762	3/32	1/16
95:1	22 – 428	5/32	1/8
142:1	15 – 289	5/32	7/32

Four wire size conversion kits are available to convert wire feeder for different size or type electrodes. The kits include drive rolls and guide tubes for the wire specified:

3/32 – 7/32 Solid or Cored	T13724-A
1/16 – 3/32 Solid or Cored	T13724-B
.035 – .052 Solid	T13724-C
.045 – .052 Cored	T13724-D

To have proper wire speed calibration, the proper combinations must be used. See section F.5, or NA-5 wiring diagram for proper pin settings on the wire speed meter PC board.

Four gear ratios are available — 21:1, 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-135-C.)

1. Remove the four round head screws which mount the motor adapter plate to the gearbox. Remove the motor and adapter plate from the gearbox.
2. Take the two longer screws removed in Step (a) 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 type lubricant (Lincoln Spec. E2322). This can be scooped from the cavity of the gear case.
7. Reassemble the motor on the gearbox being certain the gears mesh properly and the adapter plate locating bead is in its cavity. Replace and tighten the four screws and the lockwashers removed in Step (1).
8. Jumper on wire speed meter P.C. board must be properly positioned for the gear ratio and drive rolls being used. (See table on wiring diagram.)

July 1983

#### Sec. T6.2.3

#### Wire Drive Mechanism

Drive mechanisms for three wire size ranges are available - .035 thru .052", 1/16 thru 3/32" and 3/32 thru 7/32". 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. T6.2.2) 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 .045 – .052 cored electrode 1/16" and larger diameter electrodes have two sets of teeth so they can be reversed once before they must be replaced.

February 1982

#### Sec. T6.2.4

#### Wire Straighteners

##### 1. 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.

Sec.T6.2.4 (Continued)

**2. 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.

February 1982

## SEC. T6.3 - ELECTRICAL MAINTENANCE

### Sec. T6.3.1 **Control Box**

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

February 1982

### Sec. T6.3.2 **Circuit Protection**

The circuit breaker mounted at the bottom left hand corner 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 button.

If a complete or partial short occurs in the field circuit or if there is a defect on the Power P.C. board, a 1/2 amp slow-blow type fuse will blow on early model machines, or a PTC Resettable Fuse will open on later model machines. This field circuit protection is mounted on the Power P.C. board inside the control box. Before replacing the fuse or allowing the PTC Resettable Fuse to reset and restoring power to the machine, check the motor field for a shorted condition. Normal field resistance is approximately 700 ohms.

With NA-5 controls above Code 8300, the field circuit protection may also open due to frequent motor field reversals from application problems affecting the "cold" starting circuit, such as the power source output being too low to establish an arc, or the welding procedure causing frequent electrode-to-puddle shorting. (Refer to Sec. T3.7.)

The power supply for the electronic circuitry is protected by a 1/2 ampere slow-blow type fuse. It is located on the Power P.C. board inside the control box.

The 1/8 amp fast-blow fuse, on the Voltage P.C. boards built since 1983, protects the NA-5 circuitry from damage which may result from a ground, or case, faulted control lead. If this fuse blows, the NA-5 arc voltage sensing lead circuit will be opened (see Section T3.7), and the NA-5 Troubleshooting Guide should be consulted to detect and clear the fault.

September 1998

### Sec. T6.3.3 **Ground Fault Fuse Protection**

A 1/8 amp fast-blow fuse is located on the NA-5 Voltage board. This fuse will protect the NA-5 circuitry from damage resulting from a ground, or case faulted control lead when arc voltage potential exists between ground and the NA-5 circuit common (#510). Such a condition typically exists when the NA-5 polarity connections are set for electrode negative.

April 1988

### Sec. T6.3.4 **Grounding Lead Protection**

The wire feeder enclosure is grounded through the control cable to the power source. If there is a fault from welding power to ground, the grounding lead protector (GLP) will trip and shut off the power source output. The drive rolls will also back the wire away from the work. Check that the electrode or other live parts are isolated from the frame and enclosures, and reset the GLP. The GLP may be reset by pressing the small button recessed on the front switch panel with a pen or other small, blunt tool.

Oct 2015

## SEC. T6.4 – OPTIONAL FEATURE MAINTENANCE

Sec. T6.4.1

### Wire 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. T2.2.6, T2.2.7, T2.5.3 and T2.5.4 for specific instructions for replacing contact tips and other maintenance of the various contact assemblies.

February 1982

Sec. T6.4.2

### Wire Reel Mounting for 50 or 60# 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.

February 1982

Sec. T6.4.3

### Travel Carriage

See maintenance information in Sec. T2.2.4-C.

February 1982

Sec. T6.4.4

### 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 with grease.

February 1982

Sec. T6.4.5

### 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.

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Sec. T6.4.6

### High Frequency Generator (K238)

See maintenance information in Sec. T2.5.8.

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Sec. T6.4.7

### Spreadarc (K278)

See maintenance information in Sec. T2.5.6.

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## SEC. T6.6 — NA-5 GENERAL TROUBLESHOOTING GUIDE

### INTRODUCTION: How To Use This Guide

#### Sec. T6.6

1. Problems incurred with the NA-5 do not necessarily involve failures in the circuitry. More often, problems are caused by misapplication, misconnection, or shutdown of the NA-5 protective features. Therefore, when a problem is experienced, *first* refer to the GENERAL APPLICATION TROUBLESHOOTING GUIDE below. The instructions in this guide should solve most problems.
2. If the problem being experienced cannot be solved by using the GENERAL APPLICATION TROUBLESHOOTING GUIDE, the problem may be due to a fault in the control circuitry. To detect and correct this fault, refer to the COMPREHENSIVE TROUBLESHOOTING GUIDE, IM-305TS.

### TABLE OF CONTENTS

#### SUBJECT

#### GENERAL APPLICATION TROUBLESHOOTING GUIDE

For general maintenance, connection, and mechanical problems

- A. Application Problems
- B. Out-of-Range Shutdown
- C. Accuracy Checks
- D. Preliminary Power Supply Checks

Sec. T6.6 (Continued)

**IA. APPLICATION PROBLEMS**

1. Drive rolls turn, but wire will not feed or wire feeding is rough or uneven.

CAUSE	WHAT TO DO
a. Wire jammed or kinked on route through head.	a. Remove wire from head, then feed in new wire. Note any obstruction.
b. Incorrect drive rolls and guide tubes, or incorrect pressure setting.	b. Be sure that the drive rolls and guide tubes are stamped with the wire diameter being used. Replace if necessary. Check for proper pressure setting.
c. Worn drive rolls.	c. Replace, or reverse, if split-type.
d. Partially flashed or melted contact tip.	d. Replace contact tip.

2. Variable or "hunting" arc.

CAUSE	WHAT TO DO
a. Contact tip worn or incorrect size.	a. Replace contact tip.
b. Worn or undersized work cables or poor connections to work.	b. Inspect and repair or replace as necessary.
c. Loose electrode connections.	c. The following connections must be tight: Electrode cable to wire feeder and power source, work cable to power source and work, contact tip to nozzle.
d. Rusty electrode.	d. Replace electrode.

3. Unit will not feed wire. Digital meters are not lit.

CAUSE	WHAT TO DO
a. CONTROL POWER switch OFF.	a. Turn switch ON.
b. Circuit breaker is tripped.	b. Reset breaker.
c. Power Fuse blown.	c. Replace fuse.
d. No 115 V AC supply from power source.	d. Check that the power source is ON. If so, check power source AC fuse.

4. Arc can be struck, but unit then shuts down while welding, or power source output is too low to establish an arc. (ACTUAL VOLTS meter reading is low, or zero, when start is pressed.)

CAUSE	WHAT TO DO
a. Leads 21 and 67 may not be connected for the correct polarity at the terminal strip inside the control box, or not connected to work and electrode.	a. Check the white (work) and black (electrode) leads at the (+) and (-) terminals (per NA-5 wiring diagram).
b. Control leads may be improperly connected at the power source.	b. Check the appropriate power source connection diagram.
c. Welding power source is unable to supply the SET voltage.	c. Reset the output range controls of the power source so that it can supply the desired voltage. See "Out-of-Range Shutdown", Section IB.
d. Power source voltage control switch not set to REMOTE.	d. Voltage control switch of R3S, DC-600 or DC-1500 type power sources must be set to REMOTE.
e. 1/8 A fuse on voltage P.C. board is blown.*	e. Refer to Section II, Problem T6 to determine cause of fuse blowing.

\* Voltage P.C. boards built prior to 1983 did not have fuse protection.

Sec. T6.6 (Continued)

5. Poor arc striking with sticking or “blast-offs”, weld porosity, narrow and ropy looking bead, or electrode stubbing into plate while welding.

**CAUSE**

---

- a. Improper procedures or techniques.
- b. Improper wire feed acceleration setting for the process in use.
- c. Voltage Control response not set properly for the power source and/or process in use.

**WHAT TO DO**

---

- a. See “How to Make Submerged Arc Welds” (S604) or “Innershield Production Welding Guide” (N675).
- b. See IM10227 manual.
- c. See IM10227 and the appropriate power source connection diagram.

6. Speedmeter readings and/or wire feed speed are not accurate.

**CAUSE**

---

- a. The Speedmeter Calibration Jumper is connected to the wrong pin.
- b. Improper drive rolls.

**WHAT TO DO**

---

- a. Select the correct pin to match the drive roll and head ratio being used. See Section IC2.
- b. Drive rolls must match wire size.

7. Travel, Burnback, or other modes do not sequence properly.

**CAUSE**

---

- a. Jumpers on the Logic Board may be connected incorrectly.

**WHAT TO DO**

---

- a. Consult the manual or wiring diagram for the various alternate pin connections.

8. When “START” is pressed, the drive rolls back the electrode away from the work and there is no welding power.

**CAUSE**

---

- a. Parts at welding voltage may have made contact with the wire feeder enclosure or frame, causing grounding lead protector to trip.

**WHAT TO DO**

---

- a. Ensure live parts are isolated from wire feeder enclosure and frame. Reset the grounding lead protector.

Sec. T6.6 (Continued)

### IB. OUT-OF-RANGE SHUTDOWN

If the NA-5 voltage control is unable to supply the SET value of arc voltage while welding, the automatic shutdown circuit will activate. This protection circuit immediately returns the NA-5 control to idle state within a few seconds after the arc voltage discrepancy occurs.

Typical causes for the activation of this protective shutdown circuit are as follows (See Sec. IA.4 for remedies.):

- a. SET value of arc voltage is outside the power source range.
- b. Power source voltage control not set for "REMOTE".
- c. Misconnection of NA-5 control cable leads to power source.
- d. Incorrect weld polarity connections, or settings, at NA-5 or power source.
- e. Lost connection of NA-5 voltage-sensing leads (67 and 21) between arc and voltage control, or blown 1/8 A fuse on voltage P.C. boards built since early 1983.

With NA-5 units above Code 8300, the conditions of (d) and (e) above would result in the wrong wire feed direction when the weld is started.

In the case of full-range-control power sources, such as the DC-600, this protective shutdown circuit could prevent welding under the conditions of (c), (d), and (e), above, by holding the power source output at minimum, possibly providing too low of a power source output to even establish an arc. With NA-5 units above Code 8300, condition (c) could cause repeated feed direction reversals which may blow the Field fuse in the NA-5 Power P.C. Board.

Although out of range shutdown can occur with all power sources when working with very low or very high arc voltages, it is most likely to occur when using the R3S models with the somewhat limited voltage range of the various taps. For instance, if the R3S-400 triangle tap setting is for 31 volts, the range of control from the remote circuit is approximately 7 volts; i.e., 27½ to 34½ volts at nominal input voltage. If the NA-5 controls are set for 29 volts and the input voltage to the R3S goes up, it may not be possible for the NA-5 control circuit to hold the 29 volts, so the welding will shut down. By changing to the 27 volt triangle setting, the range will be approximately 23½ to 30½ volts and at high input voltage there will be sufficient control to hold the SET arc voltage. On these machines, if the NA-5 stops welding, follow this procedure:

- A. Move the NA-5 voltage set point 2 volts lower than the desired procedure and make a test weld.
  1. If the NA-5 still shuts down, go to Step B. below.
  2. If the NA-5 keeps welding, change the R3S triangle setting to the next *higher* voltage and reset the NA-5 set point to the desired procedure. R3S is now set properly unless there is a significant change in input voltage. Skip the following step.

- B. Move the NA-5 voltage set point 2 volts higher than the desired procedure and make a test weld.

1. If the NA-5 now keeps welding, change the R3S triangle setting to the next *lower* voltage and reset the NA-5 set point to the desired procedure. R3S is now set properly unless there is a significant change in input voltage.
2. If the NA-5 still shuts down, refer to paragraph below and the other possible causes previously listed.

This same general procedure can be used on other power sources. For example, if the NA-5 keeps shutting down and the other possible causes have been checked, adjust the SET voltage higher and/or lower than the desired voltage. If the NA-5 continues to weld at one of these voltages, it can then be determined what change in the range controls of the power source are required so it can supply the desired voltage.

In some cases, it is also possible to hold the ACTUAL button pressed while starting the arc. Before the NA-5 shuts down, the actual arc voltage can be read on the digital meter. Comparing this reading to SET reading will tell what change in the range controls of the power source are required so it can supply the desired voltage. Should the meter read zero, check NA-5 sensing leads (67 and 21) connections. Should the meter read a negative (-) voltage, the polarity connections or settings at the NA-5 or power source are wrong.

### IC. NA-5 ACCURACY CHECKS

#### 1. Voltmeter Accuracy

Perform the following checks with the automatic equipment connected to the welding power source per the proper connection diagram. The power source is to be ON and both the power source and automatic equipment properly set up for welding.

- a. Connect a test voltmeter (with at least 3 digits and ±0.5% accuracy, see box below) between work and the electrode cable connection at the welding head.
- b. While welding the test voltmeter reading should match the ACTUAL VOLTS meter reading within ±0.5 V (typically ±0.2 V). If it does not, refer to COMPREHENSIVE TROUBLESHOOTING GUIDE.
- c. Remove the test voltmeter and, while welding, compare the SET VOLTS and ACTUAL VOLTS meter readings. Depending upon the arc voltage characteristics of the process being welded, the ACTUAL reading may vary somewhat about an average value. The "average" ACTUAL reading should match the SET reading within ±0.5 V (typically ±0.2 V). If it does not, refer to Section II, COMPREHENSIVE TROUBLESHOOTING GUIDE.

The following is a list of digital meters which would meet or exceed the required 0.5% accuracy. To perform the meter accuracy check, you must have a meter as accurate as these, (0.5%) or better.

Sec. T6.6 (Continued)

1. Fluke #8022A

John Fluke Mfg. Co.  
P.O. Box 43210  
Mountlake Terrace, WA 98043

2. Triplet #3400

Triplet Corp.  
286 Harmon Road  
Bluffton, OH 45817

3. Data Precision #935

Data Precision Corp.  
Electronics Avenue  
Danvers, MA 01923

4. Keithley Model # 169

Keithley Instruments, Inc.  
28775 Aurora Road  
Cleveland, OH 44139-1891

**IC2. Wire Speed Accuracy**

a. Check that the Speedmeter Calibration Jumper is connected to the proper calibration pin for the head and drive roll system employed, per the table below.

Speedmeter Calibration	Head Ratio	Drive Roll Part Number	Wire Size Range	Rated Speed Range (in/min)
21 <sup>(3)</sup>	21/1	S12778	Single .035-.052 Solid	100-2070
57F <sup>(1)</sup>	57/1	S12778	Single .035-.052 Solid	40-778
		S19113	Single .045-.052 Cored	
57 <sup>(1)</sup>	57/1	S12515	Single 1/16-3/32	38-762
95	95/1	S12514	Single 3/32-5/32	22-428
95S <sup>(2)</sup>	95/1	S12515	Single 1/16-3/32	23-456
		S19113	Single .045-.052 Cored	
		S13161-.052	Twin .045-.052	
		S13161-5/64	Twin 1/16-5/64	
		S14904 (outer) S14905 (inner)	Twin 3/32	
142	142/1	S12514	Single 3/32-7/32	15-289
142T <sup>(2)</sup>	142/1	S14904 (outer) S14905 (inner)	Twin 5/64-1/8	15-300

<sup>(1)</sup> Early Speedmeter pins were labeled 55F and 55, respectively.

<sup>(2)</sup> Early Speedmeter P.C. Boards did not include these calibration pins.

<sup>(3)</sup> Present on Hi-Speed NA-5 Speedmeter board (L8575-1) only.

b. Check for proper inches of wire fed per revolution of drive roll (IPR):

1. Set the STRIKE Speed Control to any setting between 50 and 125 in/min. Measure the precise length of wire fed by exactly 10 revolutions of the drive roll, while pressing the INCH DOWN button.
2. The measured length should be within the range specified by the table below for the drive roll and wire size employed.

Drive Roll Part Number	Wire Size Range	Inches of Wire Fed per 10 Revolutions of Drive Roll
S12778	Single .035-.052 Solid	53 — 54
S19113	Single .045-.052 Cored	53 — 54
S12515	Single 1/16-3/32	51 — 53
S12514	Single 3/32-5/32	49 — 51
S12515	Single 1/16-3/32	51 — 53
S13161-.052	Twin .045-.052	53 — 55
S13161-5/64	Twin 1/16-5/64	53 — 55
S14904 (outer) S14905 (inner)	Twin 3/32	51 — 52
S12514	Single 3/32-7/32	49 — 52
S14904 (outer) S14905 (inner)	Twin 5/64-1/8	51 — 53

Sec. T6.6 (Continued)

3. If the measured length is not within the specified lengths, refer to Section IA.1 and IA.6.
- c. Check for proper drive roll revolutions per minute (RPM):
  1. Set the STRIKE Speed Control to obtain the SET Speedmeter reading specified for the Speedmeter Calibration Pin and head ratio employed per the

table below.

2. While pressing the INCH DOWN button, the Drive Roll RPM (revolutions counted in 60 seconds) and the ACTUAL Speedmeter reading (ACTUAL button pressed) should be as per table and correspond to the SET Speedmeter reading. If accuracy checks do not match per table, refer to COMPREHENSIVE TROUBLESHOOTING GUIDE.

Speedmeter Calibration Pin	Head Ratio	Set Speedmeter Reading (IPM)	Drive Roll RPM	Actual Speedmeter Reading (IPM)
21 <sup>(1)</sup>	21/1	0.27 (IPM × 1000)	50 ± 2	0.27 ± 0.01 (IPM × 1000)
57F	57/1	268	50 ± 1	268 ± 2
57	57/1	262	50 ± 1	262 ± 2
95	95/1	249	50 ± 1	249 ± 2
95S	95/1	265	50 ± 1	265 ± 2
142	142/1	250	50 ± 1	250 ± 2
142T	142/1	260	50 ± 1	260 ± 2

<sup>(1)</sup> Present on Hi-Speed NA-5 Speedmeter board only.

**ID. PRELIMINARY POWER SUPPLY CHECKS**

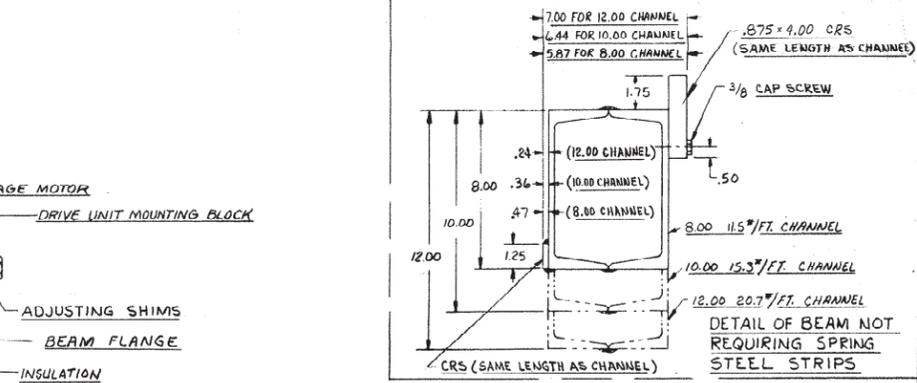
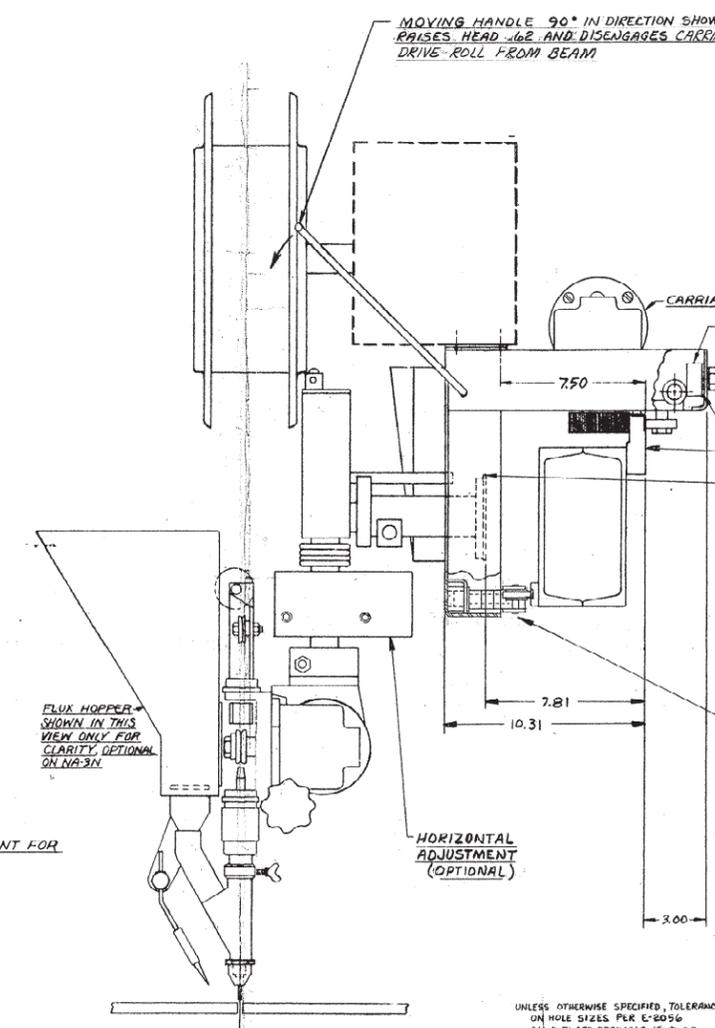
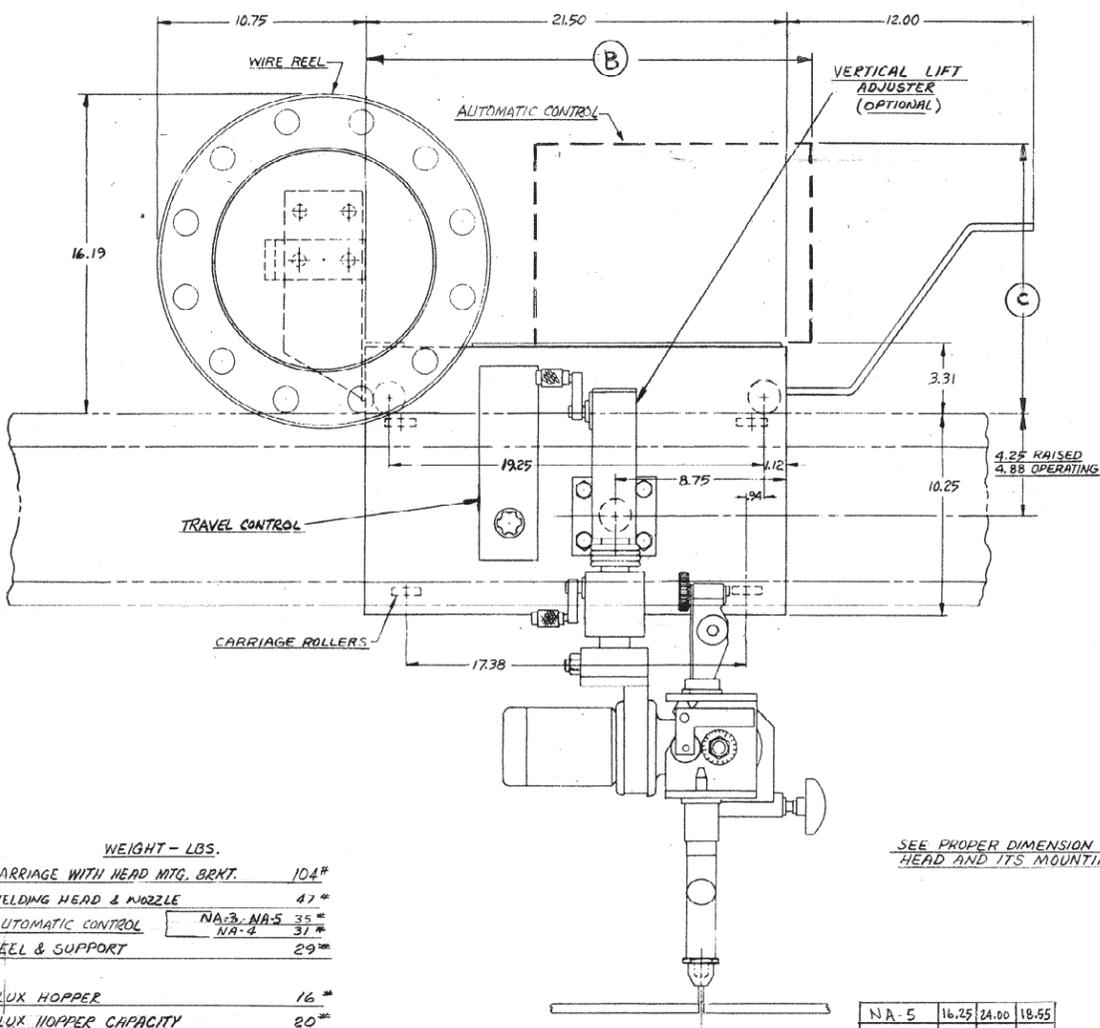
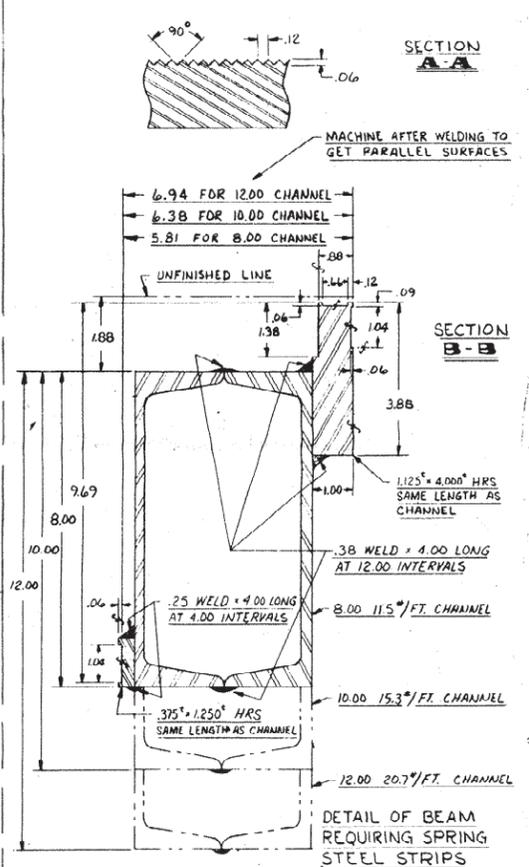
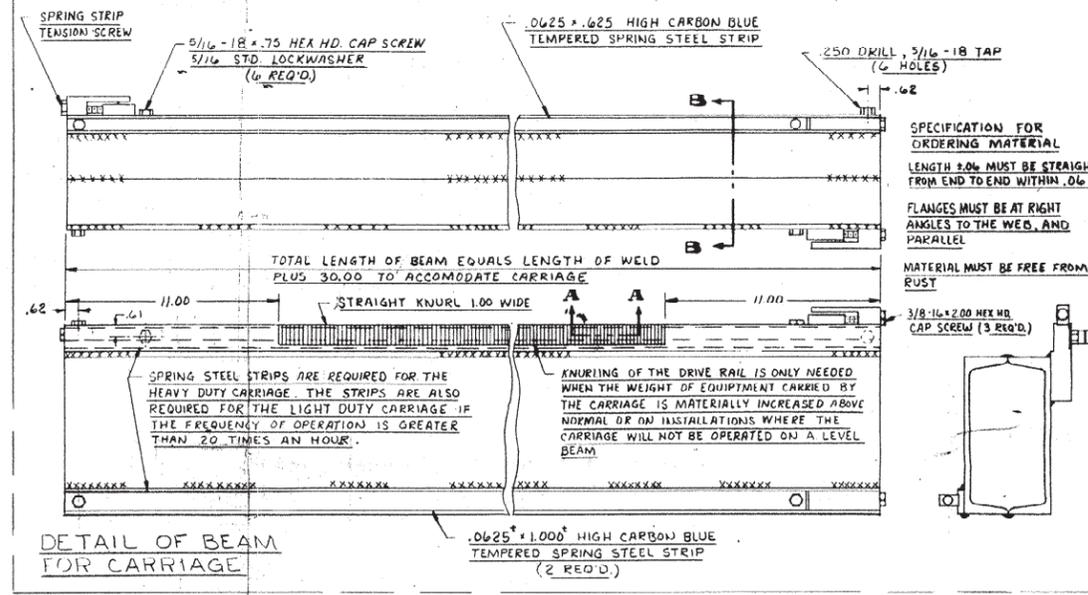
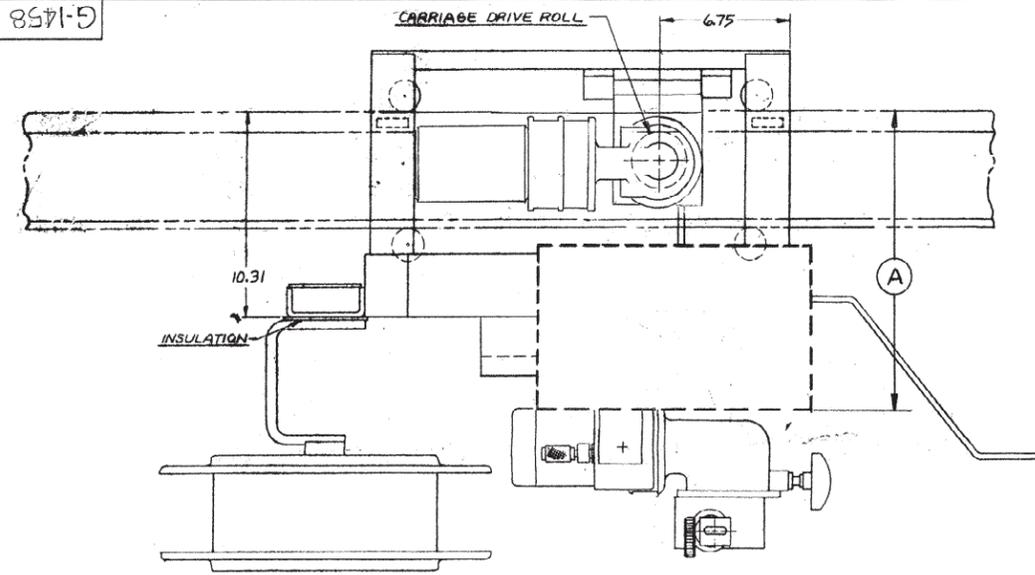
Due to the unpredictable behavior that may result from faulty power supply outputs, the NA-5 Power Supply Lights should be checked before further troubleshooting is attempted.

Be sure that the power source is ON, and CONTROL POWER switch is ON at the NA-5.

Check each light listed in the table below on the P.C. Boards):

Light	Light Location	Supply Presence Indicated By Light ON
1A	Power Board	+ 15 V Analog
1B	Power Board	- 10 V Analog
1F	Power Board	+ 115 V Relay
7A	Logic Board	+ 15 V Logic
Speedmeter Display	Front Panel	+ 5 V Speedmeter
Voltmeter Display	Front Panel	+ 5 V Voltmeter

1. If the lights in the table are *all* ON, then the power supplies are probably OK. If any lights are OFF or are very dim, refer to COMPREHENSIVE TROUBLESHOOTING GUIDE.
2. If power supplies check OK, locate the problem being experienced in the COMPREHENSIVE TROUBLESHOOTING GUIDE INDEX and refer to the section specified by the Index.
3. Locate the ADDITIONAL SYMPTOM best describing the problem being experienced and proceed step-by-step through the troubleshooting instructions given for the specific symptom.



**CARRIAGE LEVELING & ADJUSTMENT INSTRUCTIONS**

CARRIAGE AS SHIPPED IS ASSEMBLED SUCH THAT IT WILL FIT PROPERLY ON AN 8.00 BEAM HAVING A .88 WIDE FLANGE WITH NO KNURL.

BEAMS WITH KNURLED OR NON-STANDARD FLANGES:

TO OBTAIN THE BEST BEAM AND DRIVE ROLL LIFE ON BEAMS WHICH HAVE .88 WIDE KNURLED FLANGES, REMOVE THE .06 SHIM FROM BEHIND EACH DRIVE UNIT MOUNTING BLOCK.

TO OBTAIN THE BEST BEAM AND DRIVE ROLL LIFE ON BEAMS WHOSE FLANGES ARE SOME OTHER DIMENSION, ADD OR REMOVE SHIMS BEHIND THE DRIVE UNIT MOUNTING BLOCKS UNTIL THE FACE OF THE KNURLED DRIVE ROLL IS FULLY SEATED ON THE BEAM FLANGE.

	STANDARD CARRIAGE FRONT BEARING MOUNTINGS			HIGH CAPACITY CARRIAGE FRONT BEARING MOUNTINGS		
8.00 BEAM						
10.00 BEAM						
12.00 BEAM						

FOR USE WITH NON-STANDARD TRAVEL BEAMS:

USE SPACERS AND STANDARD FLATWASHERS TO SHIM UNTIL THE CARRIAGE IS SQUARE WITH THE BEAM AND ALL BEARINGS MAKE FULL FACE CONTACT WITH BEAM. CHECK THIS BY RUNNING THE BEARING OVER A PIECE OF PAPER.

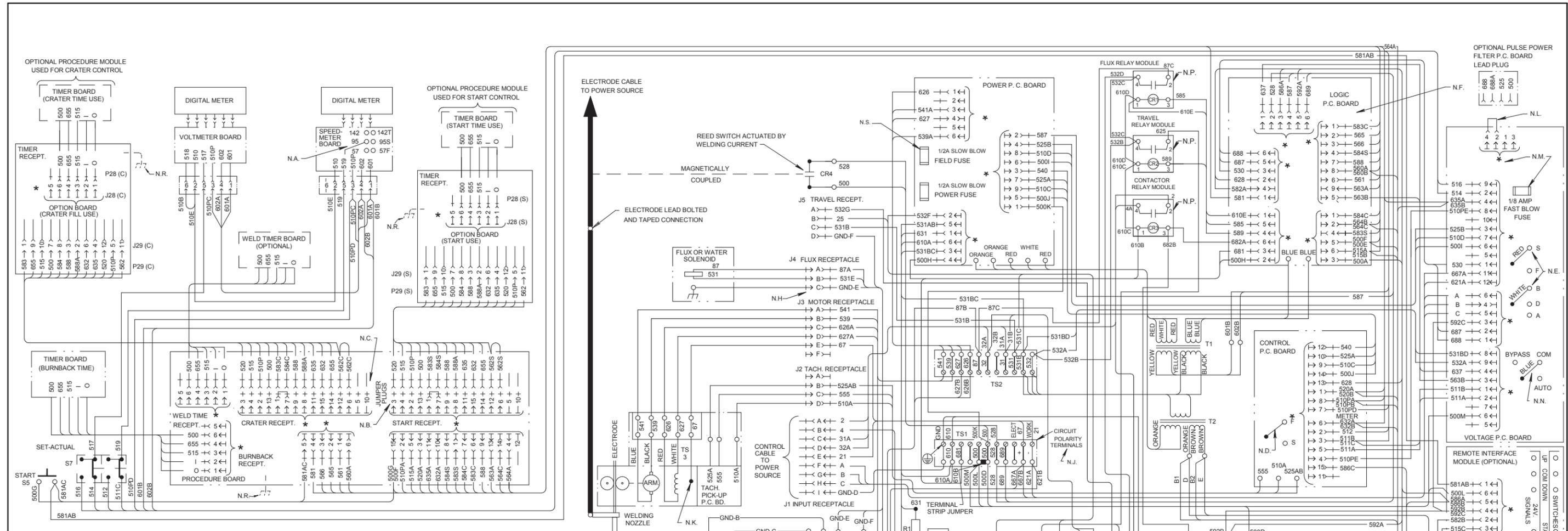
WEIGHT - LBS.

CARRIAGE WITH HEAD MTG. BRKT.	104#
WELDING HEAD & NOZZLE	47#
AUTOMATIC CONTROL	NA-3, NA-5 35# NA-4 37#
REEL & SUPPORT	29#
FLUX HOPPER	16#
FLUX HOPPER CAPACITY	20#
VERTICAL LIFT ADJUSTER	18#
HORIZONTAL ADJUSTMENT	18#

SEE PROPER DIMENSION PRINT FOR HEAD AND ITS MOUNTINGS

NA-5	16.25	24.00	18.85
NA-4	16.15	21.50	14.00
NA-3	16.15	21.50	14.00
CONTROLS	A	B	C

UNLESS OTHERWISE SPECIFIED, TOLERANCE ON HOLE SIZES PER E-2050 ON 2 PLACE DECIMALS IS ±.002 ON 3 PLACE DECIMALS IS ±.002 ON ALL ANGLES IS ±.5 OF A DEGREE MATERIAL TOLERANCE "C" TO AGREE WITH PUBLISHED STANDARDS.



**ELECTRICAL SYMBOLS PER E1537**

N.A. SPEEDMETER BOARD CALIBRATION JUMPER IS TO BE CONNECTED FOR NA-5 HEAD AND DRIVE ROLL EMPLOYED PER CHART BELOW: (CONNECTED TO PIN "95" OR "21" Δ WHEN SHIPPED.)

SPEEDMETER PIN	NA-5 HEAD RATIO	DRIVE ROLL PART NUMBER	WIRE SIZE RANGE	RATED SPEED RANGE
57F	57/1	S12778	SINGLE .035-.052	40-778 I.P.M.
57	57/1	S12515	SINGLE 1/16-3/32	38-762 I.P.M.
95	95/1	S12514	SINGLE 3/32-5/32	22-428 I.P.M.
95S	95/1	S12515	SINGLE 1/16-3/32	23-456 I.P.M.
142	142/1	S13161-052	TWIN .045-.052	15-289 I.P.M.
		S13161-5/64	TWIN 1/16-5/64	
		S14904(OUTER)	TWIN 3 32	
142T	142/1	S12514	SINGLE 3/32-7/32	15-300 I.P.M.
		S14904(OUTER)	TWIN 5/64-1/8	
21Δ	21/1	S12778	SINGLE .035-.052	100-2070 I.P.M.

⊗ = EARLIER SPEEDMETER BOARDS DID NOT HAVE THESE PINS.  
 Δ = SINGLE "21" PIN ON HIGH SPEED BOARD ONLY.

- N.B. REMOVE START RECEPTACLE JUMPER PLUG FROM PROCEDURE BOARD TO INSTALL OPTIONAL PROCEDURE MODULE AS START PROCEDURE CONTROL. IF MODULE IS REMOVED, REPLACE JUMPER PLUG.
- N.C. REMOVE CRATER RECEPTACLE JUMPER PLUG FROM PROCEDURE BOARD TO INSTALL OPTIONAL PROCEDURE MODULE AS CRATER PROCEDURE CONTROL AND CONNECT LOGIC BOARD LEAD #694 TO PIN #10. IF MODULE IS REMOVED, REPLACE JUMPER PLUG AND LOGIC BOARD LEAD #694 TO PIN #8.
- N.D. CONTROL BOARD JUMPER LEAD CONNECTED TO PIN "F" WHEN SHIPPED. SEE OPERATING MANUAL FOR USE OF PIN "S" JUMPER CONNECTION.
- N.E. VOLTAGE BOARD RED JUMPER LEAD CONNECTED TO PIN "S" AND WHITE JUMPER LEAD CONNECTED TO PIN "B" WHEN SHIPPED, FOR USE TYPICALLY WITH DC [ ] TYPE POWER SOURCES. REFER TO CONNECTION DIAGRAM FOR ALTERNATE CONNECTIONS, AND JUMPER CONNECTIONS FOR R3S, SAM AND SAF OR SA POWER SOURCES WITH K224. EARLIER VOLTAGE BOARDS DO NOT CONTAIN PIN "D".
- N.F. LOGIC BOARD DIP SWITCHES OR JUMPERS TO BE SET TO SUIT DESIRED APPLICATIONS PER CHARTS BELOW:
- ▲ NA-5 SHIPPED CONNECTED FOR INDICATED METHODS OF TRAVEL & BURNBACK.

METHODS OF TRAVEL		FOR EARLIER LOGIC P.C. BOARDS WITH JUMPERS	FOR LOGIC P.C. BOARDS WITH DIP SWITCHES
START/STOP WITH SWITCHES ▲	CONNECT LEAD #691 TO P6 LEAD #692 TO P5		
START/STOP WITH WELD CURRENT	CONNECT LEAD #691 TO P6 LEAD #692 TO P7		
START WITH WELD CURRENT STOP WITH STOP SWITCH	CONNECT LEAD #691 TO P5 LEAD #692 TO P7		
START WITH START SWITCH STOP AFTER CRATER TIME (OPTIONAL PROCEDURE MODULE INSTALLED IN CRATER RECEPTACLE)	CONNECT LEAD #691 TO P6 LEAD #692 TO P9		
START WITH START SWITCH STOP AFTER BURN-BACK TIME (OPTIONAL PROCEDURE MODULE INSTALLED IN CRATER RECEPTACLE)	CONNECT LEAD #691 TO P6 LEAD #692 TO P8		

METHODS OF BURNBACK		FOR EARLIER LOGIC P.C. BOARDS WITH JUMPERS	FOR LOGIC P.C. BOARDS WITH DIP SWITCHES
WIRE FEED STOP WITH CONTACTOR DELAY ▲	CONNECT LEAD #690 TO P4 LEAD #693 TO P3		
INCH UP WITH CONTACTOR DELAY	CONNECT LEAD #690 TO P4 LEAD #693 TO P1		
INCH UP WITH NO CONTACTOR DELAY	CONNECT LEAD #690 TO P2 LEAD #693 TO P1		

USE OF OPTIONAL CRATER MODULE		
CRATER BOARD INSTALLED?	FOR EARLIER LOGIC P.C. BOARDS WITH JUMPERS	FOR LOGIC P.C. BOARDS WITH DIP SWITCHES
YES	CONNECT LEAD #694 TO P10	
NO ▲	CONNECT LEAD #694 TO P8	

WORK CABLE TO POWER SOURCE

N.G. 531-532 115VAC  
 531-25 115VAC (SWITCHED) } 250 VA

N.H. 531-87 115 VAC (SWITCHED) 1/2 AMP.

N.J. CONNECT #67 BLACK (ELECTRODE) LEAD AND #21 WHITE (WORK) LEAD TO APPROPRIATE TERMINAL STRIP POLARITY CONNECTIONS WHICH MATCH ELECTRODE AND WORK CABLE POLARITY CONNECTIONS TO POWER SOURCE.

N.K. LEAD CONNECTED TO MOTOR FRAME WHICH IS ELECTRICALLY COMMON WITH ELECTRODE DRIVE ROLL AND DRIVEN ELECTRODE.

NOTE: NA-5 MOTORS INSULATED FOR HIGH FREQUENCY STARTING DO NOT HAVE THIS CONNECTION. REFER TO HI-FREQUENCY INSTALLATION INSTRUCTIONS FOR REQUIRED #67 ELECTRODE VOLTAGE SENSING LEAD CONNECTION.

N.L. REMOVE JUMPER PLUG TO INSTALL OPTIONAL KIT. IF KIT IS REMOVED, REPLACE JUMPER PLUG.

N.M. NOT PRESENT ON EARLIER VOLTAGE P.C. BOARDS.

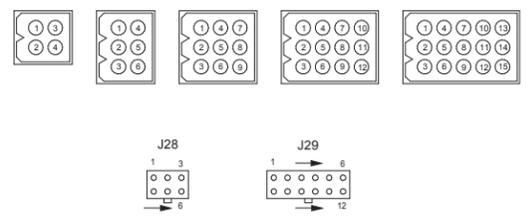
N.N. BLUE JUMPER LEAD NOT PRESENT ON EARLIER VOLTAGE P.C. BOARDS. THE JUMPER IS TO BE CONNECTED TO THE "COM" TAB, UNLESS SPECIFIED ON THE POWER SOURCE CONNECTION DIAGRAM TO BE CONNECTED TO THE "AUTO" TAB TO DISABLE THE "COLD" STARTING FEATURE.

N.P. EARLIER RELAYS HAD SAME TERMINAL NUMBERS BUT IN A DIFFERENT ORIENTATION.

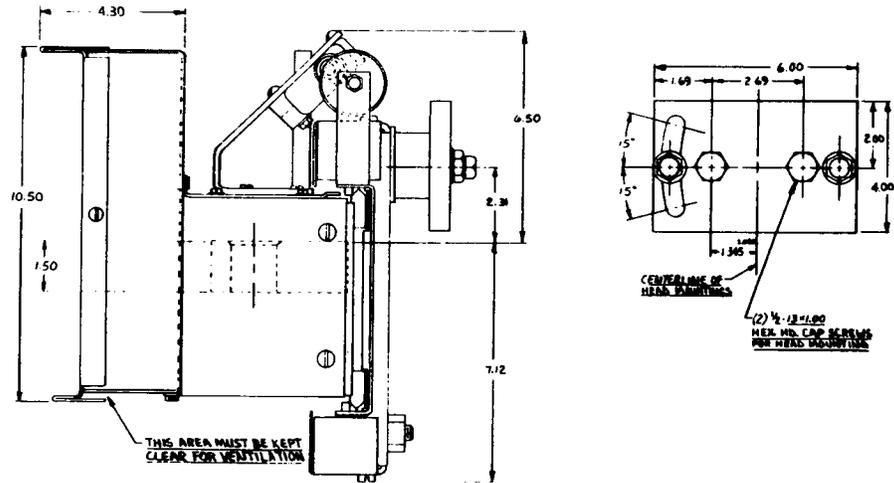
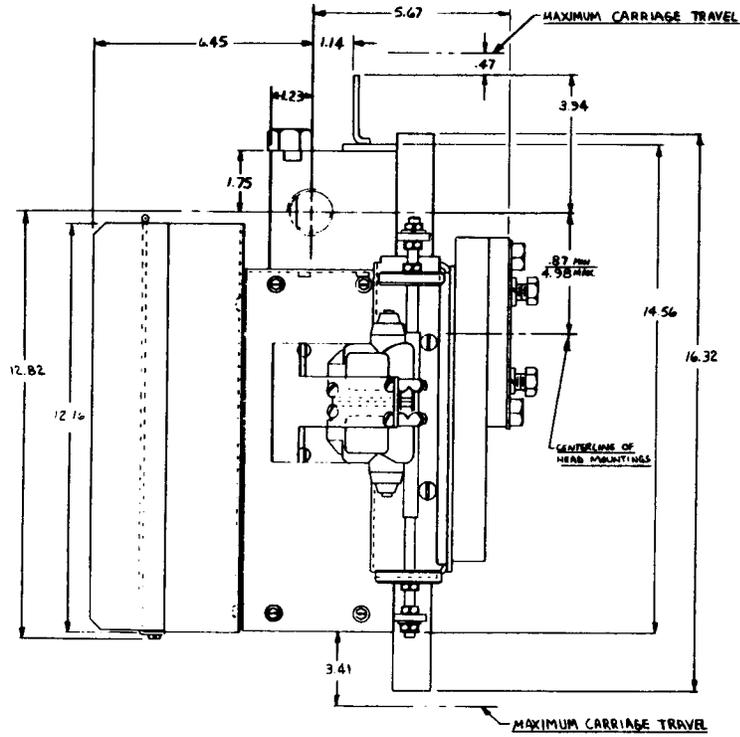
N.R. POTENTIOMETERS AND SWITCHES MOUNTED ON P.C. BOARD ARE CONNECTED TO FRAME, FOR ESD. (NOT PRESENT ON EARLIER BOARDS)

N.S. THE FIELD FUSE WAS REPLACED WITH A PTC RESETTABLE FUSE ON LATER MODEL POWER BOARDS.

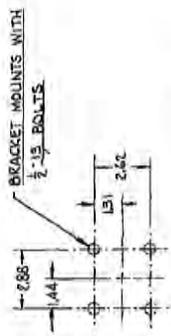
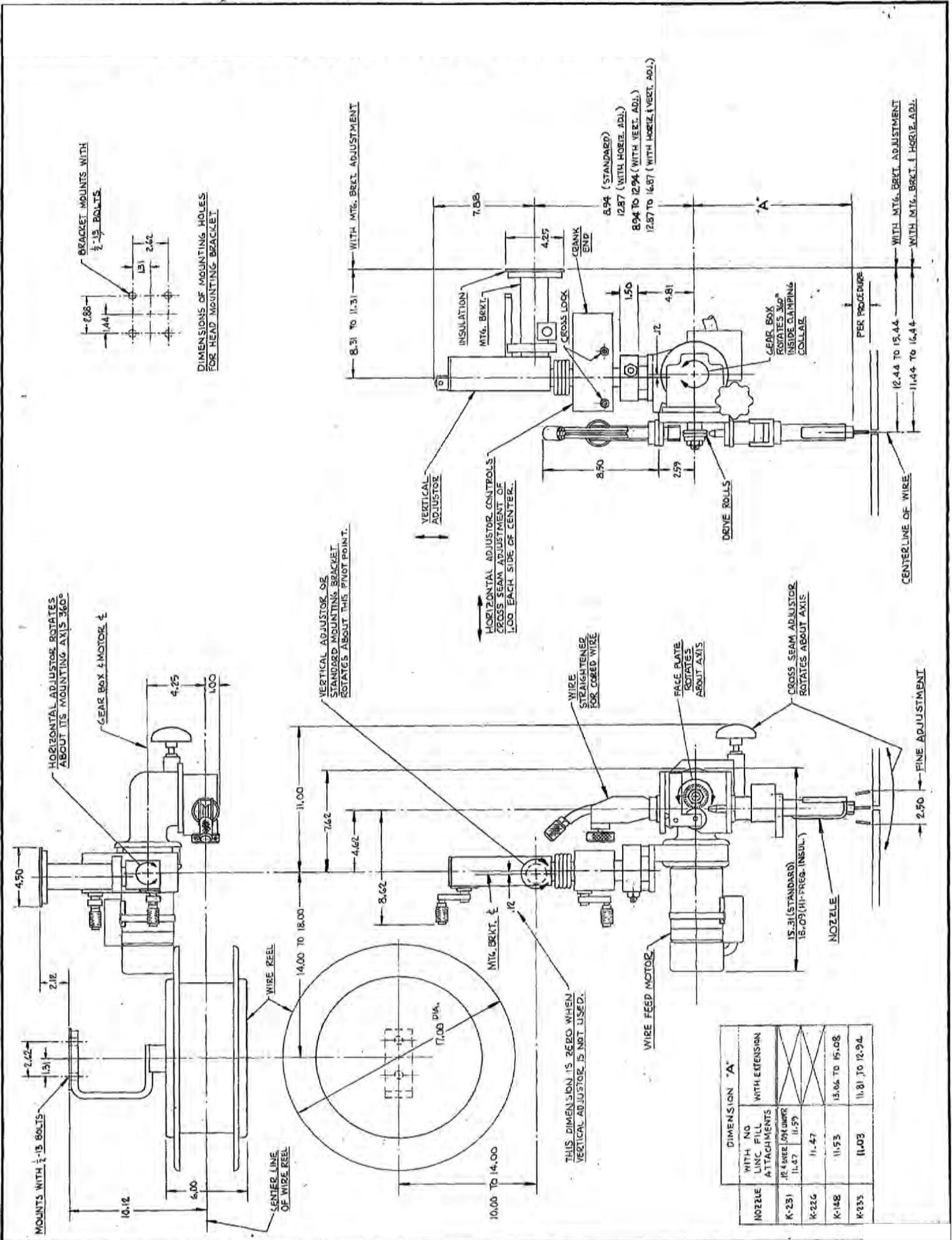
**\* CAVITY NUMBERING SEQUENCE (COMPONENT SIDE OF P.C. BOARD)**



### K278 SPREADARC DIMENSIONS



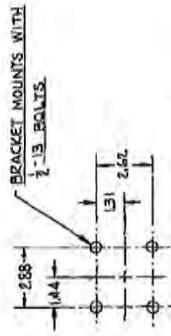
# DIMENSION PRINT



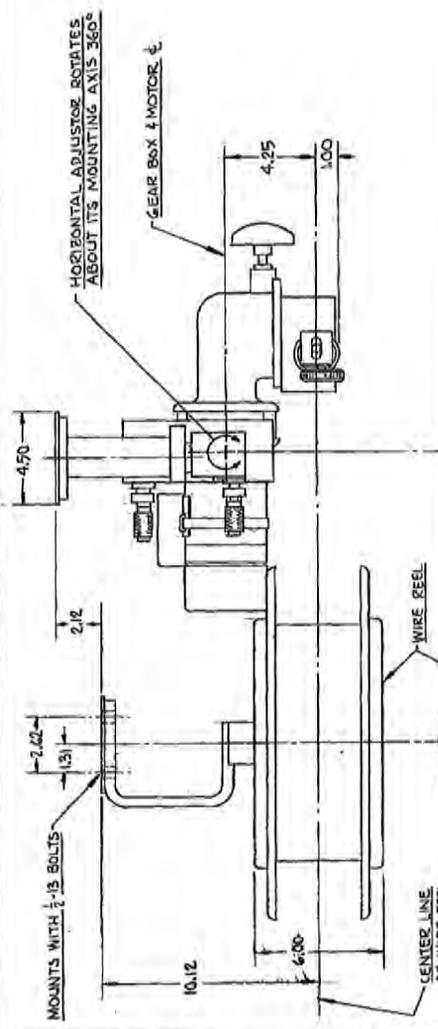
DIMENSIONS OF MOUNTING HOLES FOR HEAD MOUNTING BRACKET

NOZZLE	DIMENSION "A"	
	WITH NO LINC. FILL ATTACHMENTS	WITH EXTENSION
K-231	11.47	11.59
K-236	11.47	11.53
K-148	11.47	15.04 TO 15.08
K-235	11.03	11.81 TO 12.94

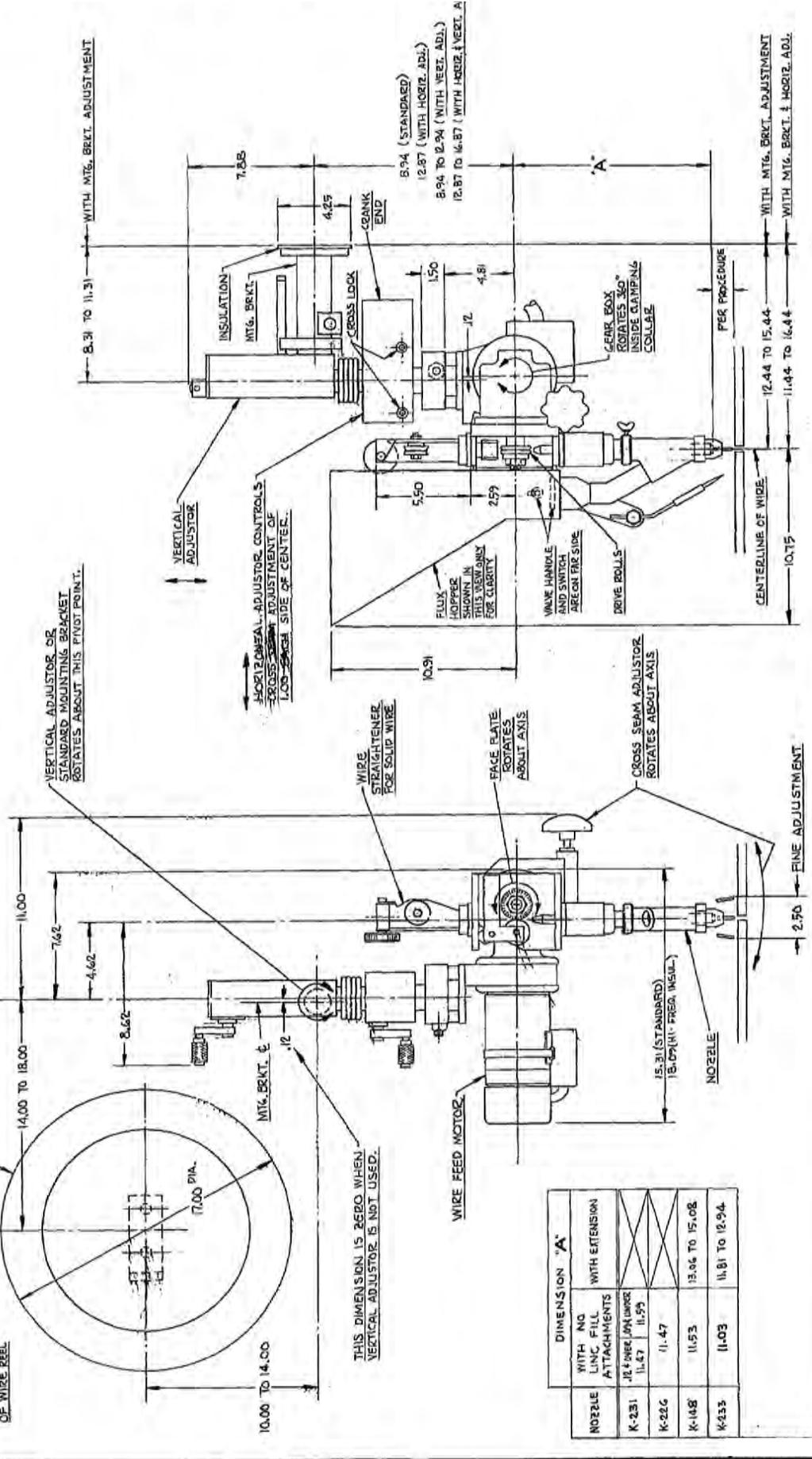
# DIMENSION PRINT



DIMENSIONS OF MOUNTING HOLES FOR HEAD MOUNTING BRACKET

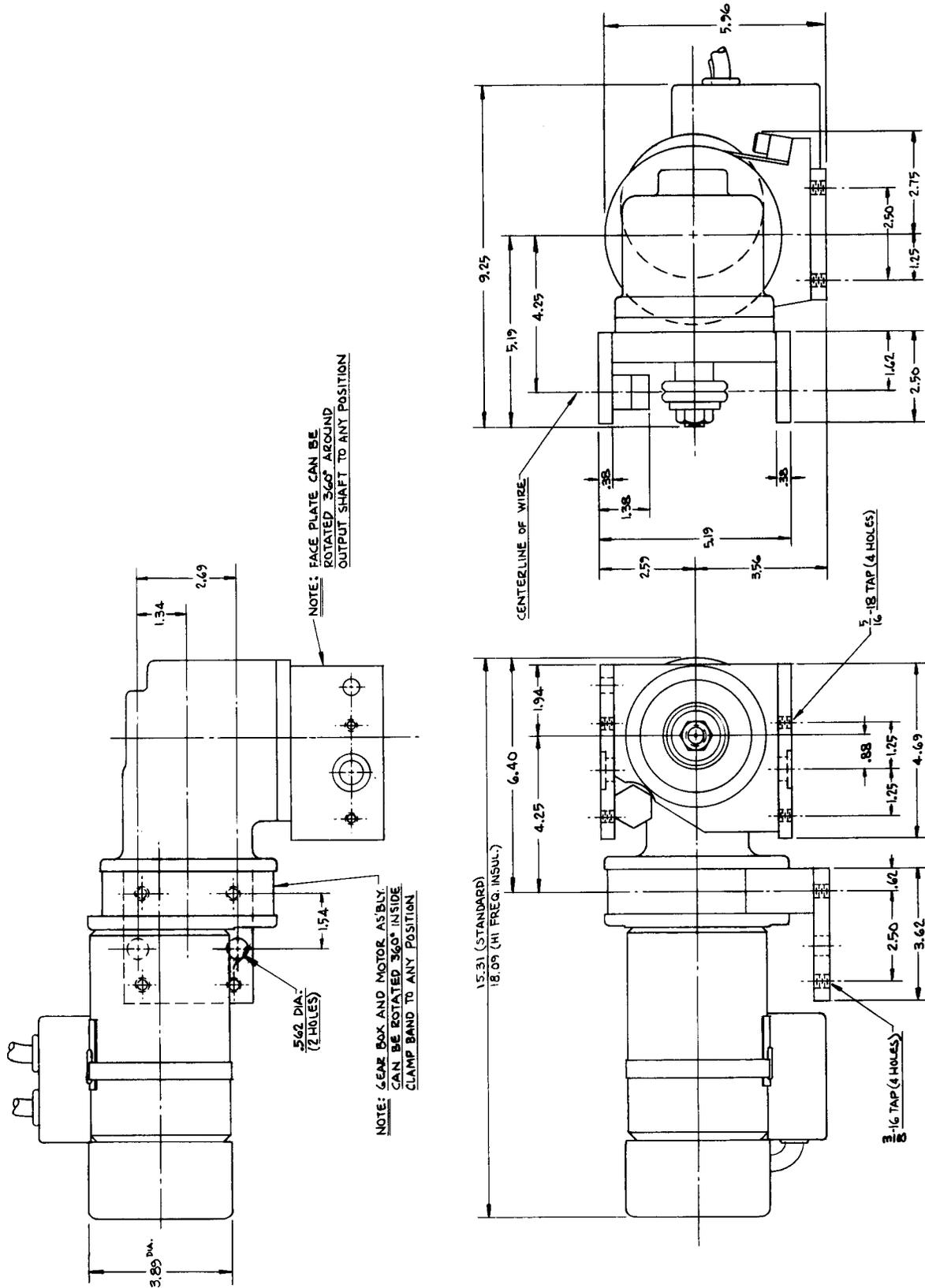


VERTICAL ADJUSTOR OR STANDARD MOUNTING BRACKET ROTATES ABOUT THIS PIVOT POINT.



NOZZLE	DIMENSION 'A'	
	WITH NO LINC FILL ATTACHMENTS	WITH EXTENSION
K-231	11.47	11.59
K-226	11.47	11.53
K-148	11.53	13.06 TO 15.08
K-255	11.03	11.81 TO 12.94

# NA-5 MOTOR, GEAR BOX AND FACE PLATE ASSEMBLY



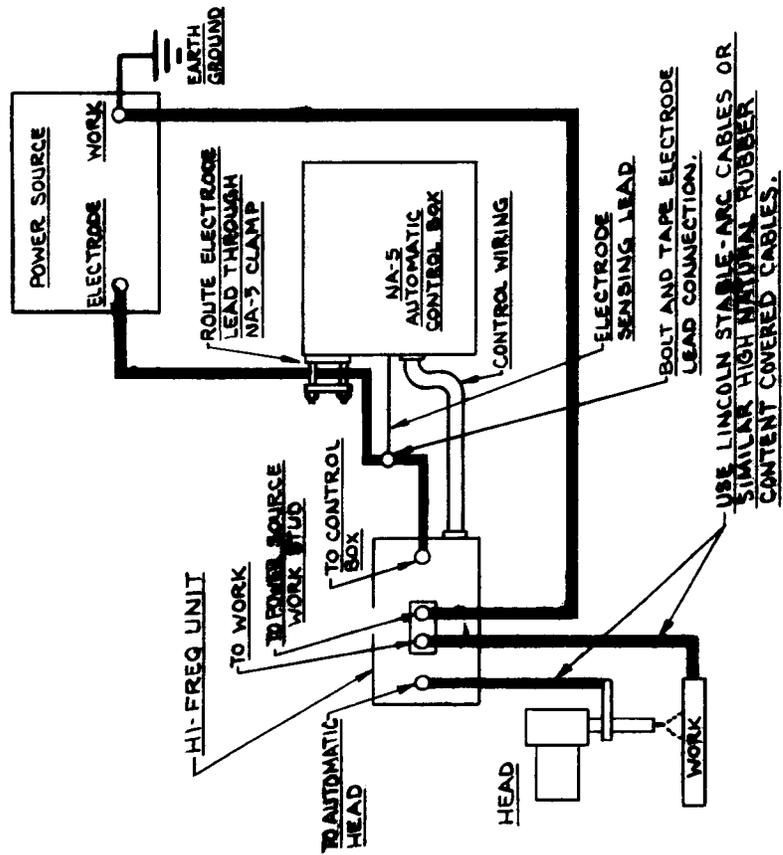
## CONNECTION OF HI-FREQ (K238) TO NA-5 (NA-5 Head AND Controls Must Be Above Code 8300)

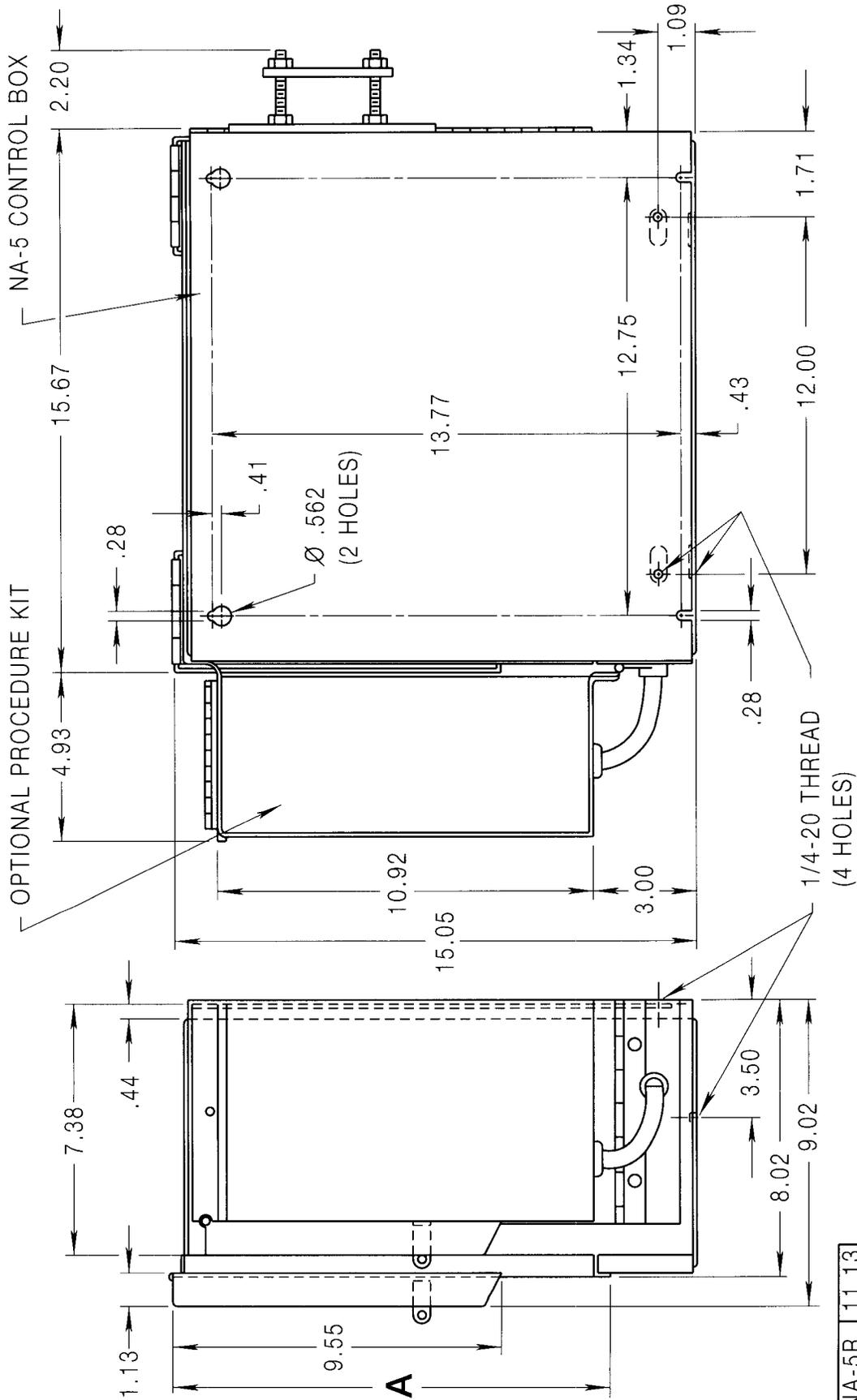
**PRECAUTION! BEFORE CONNECTING THE HIGH FREQUENCY UNIT.**

- A. REFER TO THE HIGH FREQUENCY INSTRUCTIONS INCLUDED IN THE HI-FREQ UNIT LITERATURE PACKAGE, WHICH IS ALSO IN THE MANUAL FOR THE AUTOMATIC WELDING EQUIPMENT BEING USE.
- B. BE SURE THE AUTOMATIC WELDING EQUIPMENT BEING USED HAS THE FOLLOWING PROTECTION.
  - 1. FACTORY INSTALLED HI-FREQ INSULATION BETWEEN HEAD MOTOR AND GEAR BOX.
  - 2. FACTORY PROVIDED HI-FREQ INSULATION FOR WIRE REEL MOUNTING.
  - 3. FACTORY PROVIDED HI-FREQ INSULATION FOR HEAD MOUNTED FLUX HOPPER.
  - 4. HI-FREQ INSULATION FOR HEAD MOUNTING. MODELS WITHOUT FACTORY PROVIDED INSULATION MUST BE INSULATED WITH A MINIMUM OF ONE INCH THICK POLYESTER LAMINATE PROVIDING THE HEAD WITH NO LESS THAN ONE INCH EXPOSED AND 1/2 INCH UNEXPOSED ELECTRICAL CLEARANCE BETWEEN HEAD MOUNTING BRACKET AND MOUNTING SURFACE (INCLUDING ELECTRICALLY COMMON MOUNTING HARDWARE).
- C. WELDING CABLES MUST BE OF PROPER CAPACITY FOR CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS.

**CONTROL WIRING INSTRUCTIONS**

1. REMOVE PLASTIC BUTTON PLUG FROM SIDE OF AUTOMATIC EQUIPMENT. INSTALL A BOX CONNECTOR OR PROVIDE OTHER APPROPRIATE STRAIN RELIEF FOR CONTROL LEADS. USE AT LEAST #18 AWG 300V. STRANDED COPPER LEADS.
2. CONNECT A LEAD FROM HI-FREQ TERMINAL STRIP #81 TO AUTOMATIC TERMINAL STRIP # 51.
3. CONNECT A LEAD FROM HI-FREQ TERMINAL STRIP # 87 TO AUTOMATIC TERMINAL STRIP # 87.
4. CONNECT A LEAD FROM HI-FREQ TERMINAL STRIP # 68 TO AUTOMATIC TERMINAL STRIP # 68.
5. CONNECT A LEAD FROM HI-FREQ TERMINAL STRIP # 510 TO AUTOMATIC TERMINAL STRIP # 610.
6. CONNECT A LEAD FROM HI-FREQ GROUNDING STUD TO AUTOMATIC GROUNDING STUD.
7. ALL OF THE ABOVE LEADS MUST BE TWISTED TOGETHER AND ELECTRICALLY SHIELDED. THE SHIELDING MUST BE GROUND TO THE AUTOMATIC CONTROL BOX AND KEPT AT LEAST SIX INCHES AWAY FROM ANY LEADS CARRYING HIGH FREQUENCY.
8. REMOVE THE #67 BLACK LEAD FROM THE NA-5 TERMINAL STRIP POLARITY CONNECTION AND TAPE THE TERMINAL OF THE REMOVED LEAD.
9. CONNECT AN ELECTRODE SENSING LEAD FROM THE BOLTED ELECTRODE LEAD CONNECTION TO THE APPROPRIATE NA-5 TERMINAL STRIP POLARITY CONNECTION (REFER TO NA-5 WIRING DIAGRAM).





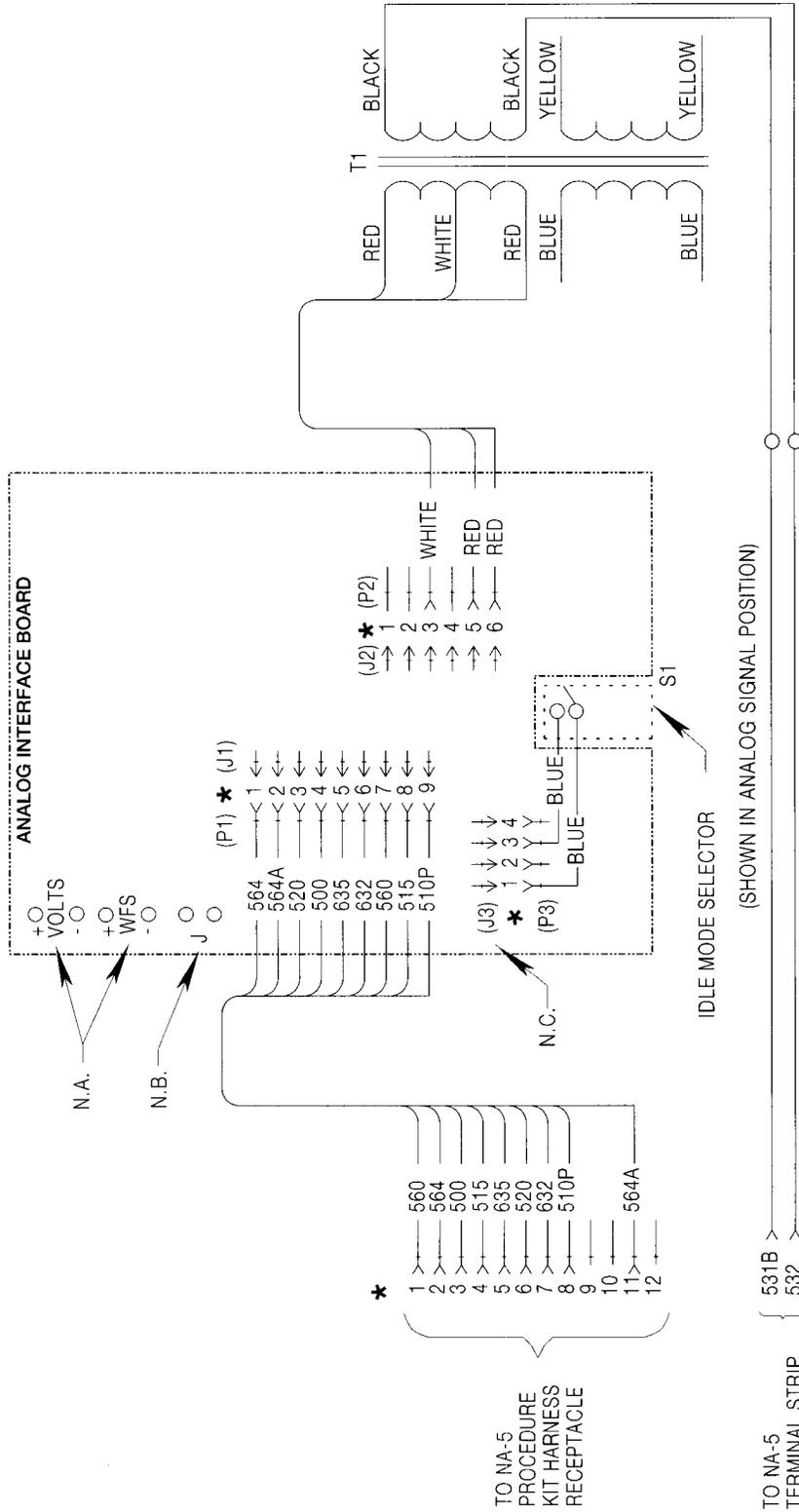
NA-5 AND NA-5R CONTROL BOX  
DIMENSION PRINT

2-20-87G  
**S** 16717



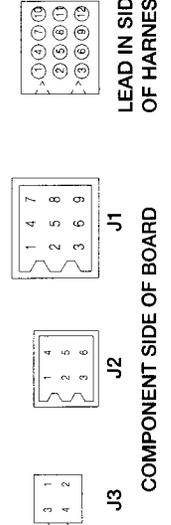
Sec.T2.5.20 (Continued)

**ANALOG INTERFACE KIT WIRING DIAGRAM**



\* =CONNECTOR CAVITY NUMBERING SEQUENCE.

- NOTES**
- N.A. EXTERNAL LEAD CONNECTION TERMINALS FOR ANALOG CONTROL SIGNAL LEVELS FOR ARC VOLTS AND WFS.
  - N.B. SEE OPERATING INSTRUCTIONS FOR PROPER USE OF "J" PINS.
  - N.C. ON OLDER BOARDS, LEADS ARE SOLDERED DIRECTLY TO BOARD.



1-19-96J  
 S17306



Service Navigator 2.0

# NA-5SF Auto Head - 12430

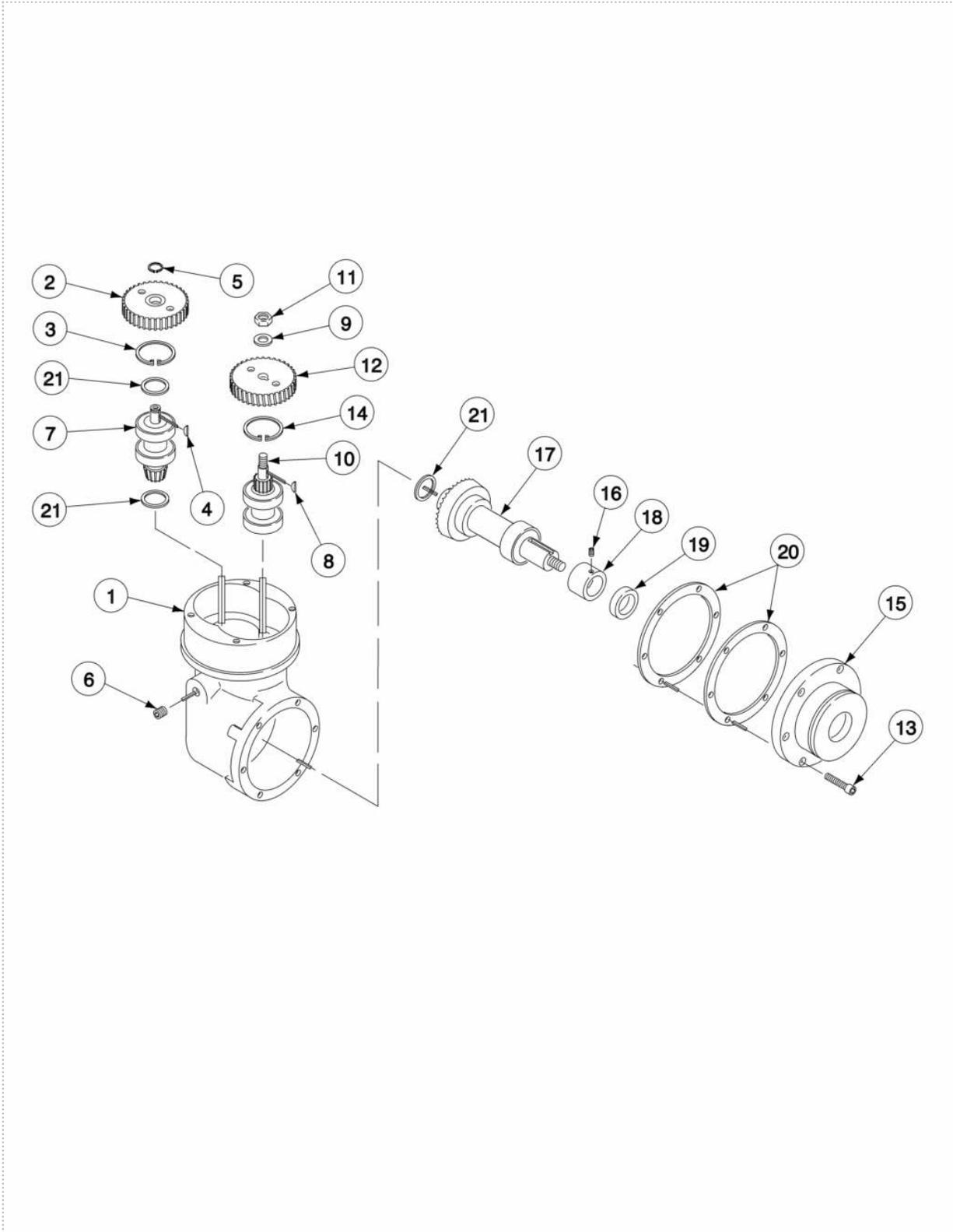
## Index of Sub Assemblies - 12430

KEY	PART NUMBER	DESCRIPTION	QTY
	P-135-A	Index of Sub Assemblies	AR
	P-100-C	Wire Feed Gear Box	AR
	P-100-D_2	Wire Feed Drive Roll Box	AR
	P-135-C	Wire Feed Drive Motor	AR
	P-100-M	Solid Wire Straightener	AR

## Wire Feed Gear Box

KEY	PART NUMBER	DESCRIPTION	QTY
	9SL5199-1	GEAR BOX ASBLY 142/1	1
1	9SG1328	GEAR BOX	1
2	9SS12504	GEAR	1
14	9SS9776-23	RETAINING RING	1
8	9S#304	WOODRUFF KEY	1
5	9SS9776-16	RETAINING RING	1
6	9SS11604-26	SET SCREW	2
7	9SS12511	BEVEL SHAFT ASBLY	1
8	9S#304	WOODRUFF KEY	1
9	9SS9262-121	PLAIN WASHER	1
10	9SS12510	SPUR SHAFT ASBLY	1
11	9SCF000029	5/16-18HN	1
12	9SS12882	HELICAL GEAR (142/1)	1
13	9ST9447-28	SOCKET HEAD CAP SCREW	6
14	9SS9776-23	RETAINING RING	1
15	9SM10256	GEAR CASE COLLAR	1
16	9SS11604-13	SET SCREW	1
17	9SS12509	OUTPUT SHAFT ASBLY	1
18	9ST12146	DRIVE ROLL SPACER	1
19	9SS7611-15	OIL SEAL	1
20	9ST12119-1	GASKET (.0125)	As Req
20	9ST12119-2	GASKET (.004)	As Req
21	9SS9262-110	PLAIN WASHER	As Req
21	9SS9262-111	PLAIN WASHER	As Req

# Wire Feed Gear Box

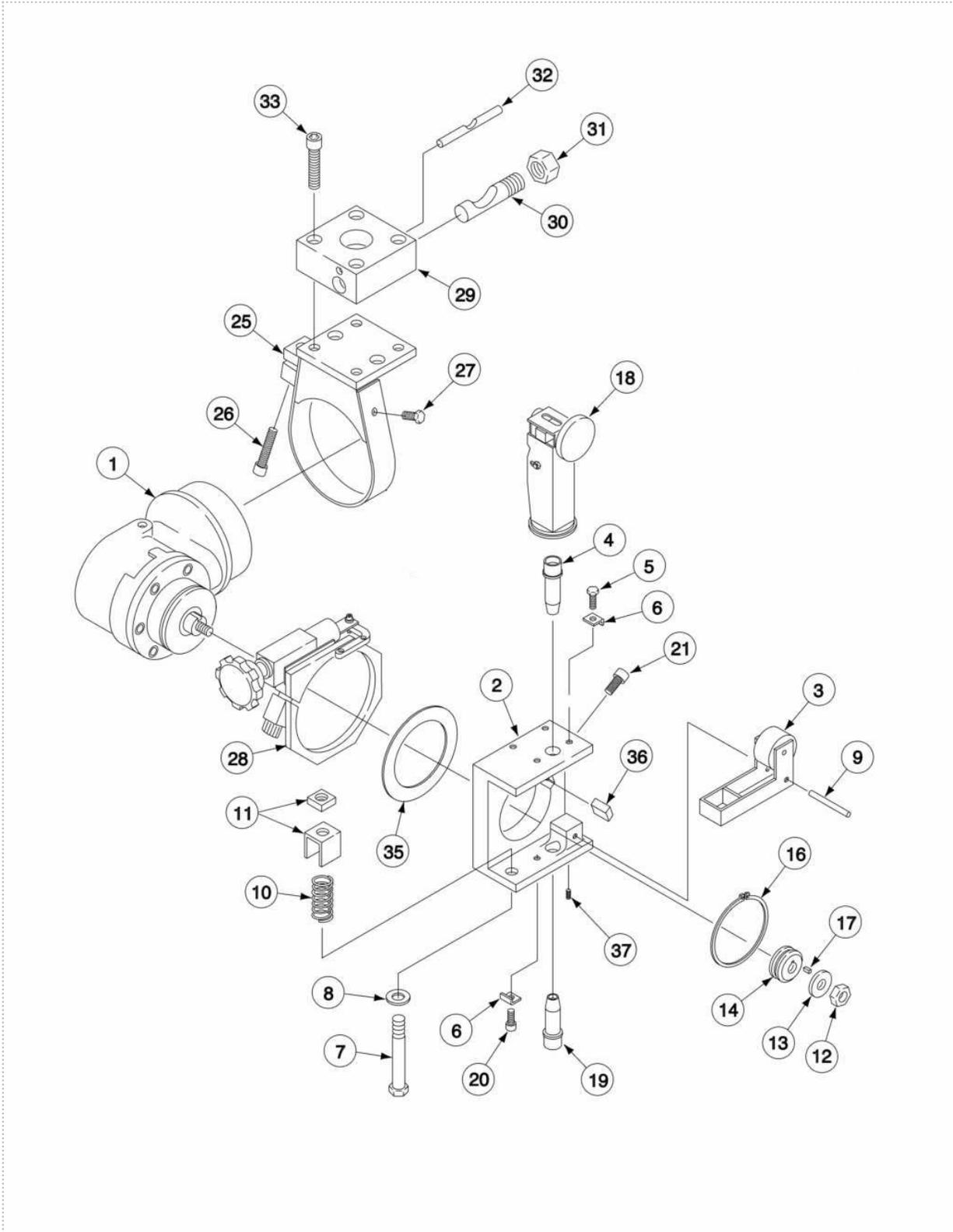


P-100-C.jpg

## Wire Feed Drive Roll Box

KEY	PART NUMBER	DESCRIPTION	QTY
1	9SL5199-1	GEAR BOX ASBLY 142/1	1
2	9SL6987	FACE PLATE MACHINING	1
3	9SS12475	IDLE ROLL ASBLY	1
4	KP2116-2	GUIDE TUBE 3/32 THRU 7/32 INCOMING	1
5	9SCF000040	5/16-18X.75HHCS	2
6	9ST8400	MOUNTING CLIP	4
7	9SCF000039	3/8-16X3.00HHCS	1
8	9SS9262-120	PLAIN WASHER	1
9	9ST12206-4	PIVOT PIN	1
10	9ST10247-7	SPRING	1
11	9ST13610-1	YOKE INDICATOR ASBLY	1
12	9ST10552-1	DRIVE ROLL NUT	1
13	9SS9262-44	PLAIN WASHER	1
14	KP1885-1	DRIVE ROLL KNURLED 3/32-7/32	2
16	9SS11910-2	SNAP RING	1
17	9SM8776-5	KEY	1
18	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
19	KP1963-1	GUIDE TUBE 3/32-7/32 OUTGOING	1
20	9ST9447-12	SOCKET HEAD CAP SCREW	2
21	9ST9447-32	SOCKET HEAD CAP SCREW	1
35	9SS9262-131	PLAIN WASHER	1
36	9ST14896-1	LOCKING KEY	1
37	9SS11604-8	SET SCREW	1
	9SS24727-3	DECAL	1
	9SS31444-5	RATING PLATE	1
	9SS25815-3	WARNING DECAL	1

# Wire Feed Drive Roll Box

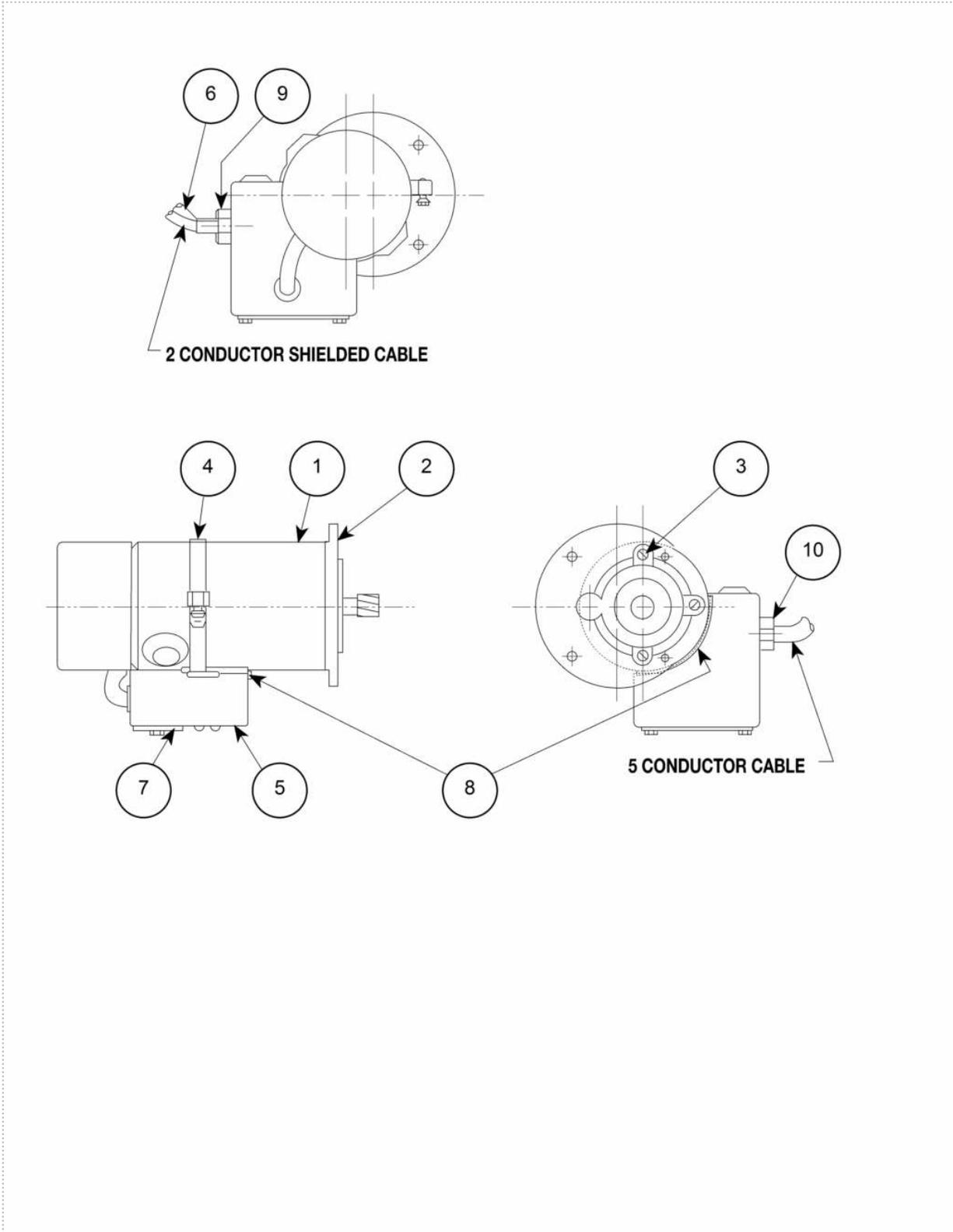


P-100-D\_2.jpg

## Wire Feed Drive Motor

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM13902-9	Drive Motor & Connection Box Assembly	1
1	9SL6440-3	MOTOR ASBLY 142/1	1
	9SS16979-1	DRIVE MOTOR LEAD PREPARATION	1
	9SM13312-12	BRUSH & SPRING ASBLY	2
	9SM13312-13	BRUSH CAP	2
	9SS15013-3	PINION GEAR	1
	9SM14701-2	TACHOMETER PICK-UP PC BDASBLY	1
	9SS16180	SLOTTED DISC	1
	9SM13629	TACH SHIELD MTG PLATE	1
	9SM13578	PICKUP HOUSING ASBLY	1
	9ST14326	COVER ASBLY	1
2	9SM10255-1	MOTOR ADAPTER PLATE	1
3	9SCF000036	#8-32X.75FHS	3
4	9SS10888-20	HOSE CLAMP	1
5	9SM13901	CONNECTION BOX ASBLY	1
6	9SL6209	CONTROL BOX TO HEAD CABLE ASBLY	1
	9SS12020-17	CONNECTOR	1
	9SS12024-4	CABLE CLAMP	1
	9SS12020-27	CONNECTOR	1
	9SS12024-1	CABLE CLAMP	1
7	9ST13193-1	CONNECTION BOX COVER	1
	9SS8025-70	SELF TAPPING SCREW	2
8	9ST12823-18	GROMMET STRIP	1
9	9ST9274-3	GROMMET	1
10	9ST9274-4	GROMMET	1
	9SS16718	MOTOR END COVER	1

# Wire Feed Drive Motor

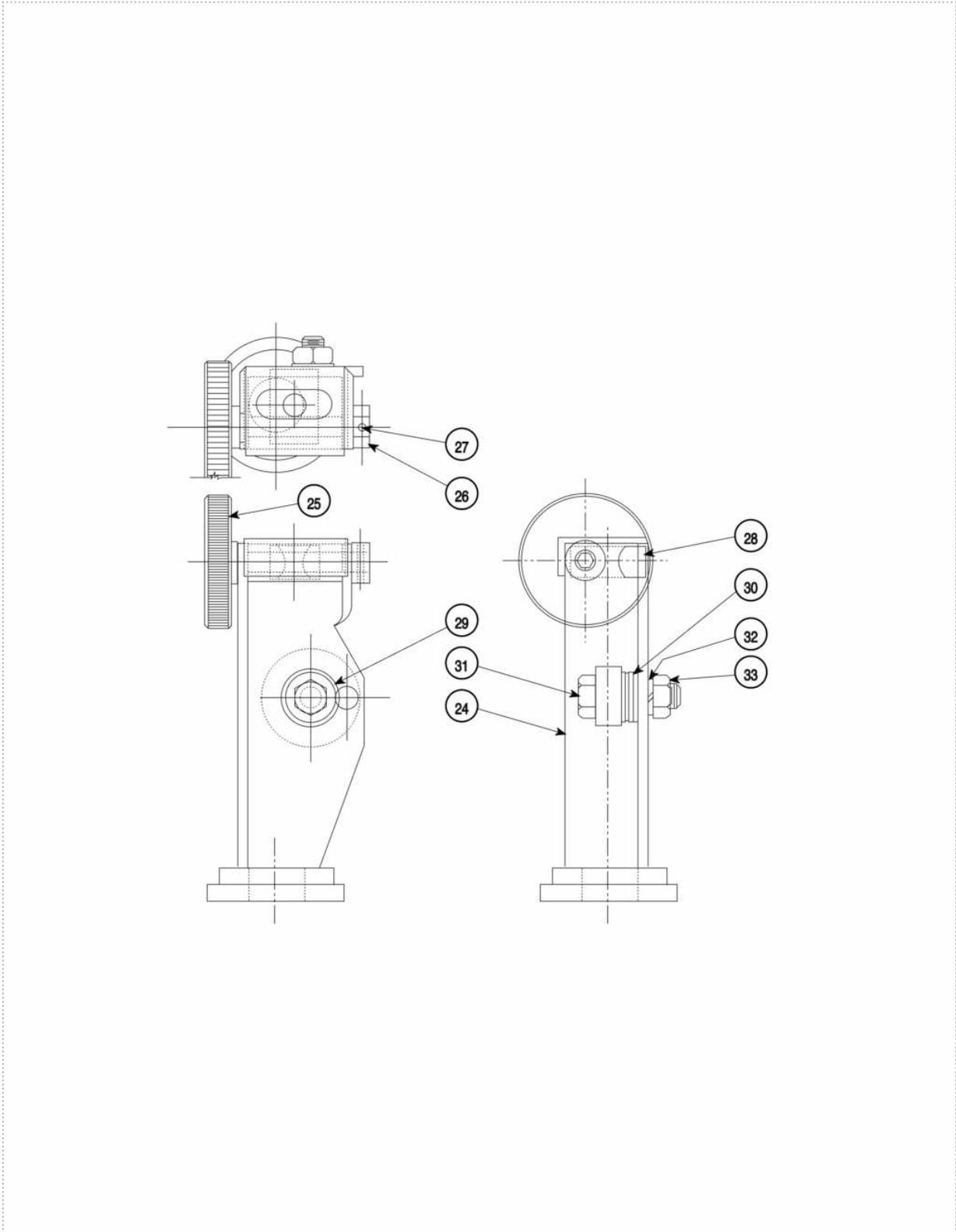


P-135-C.jpg

## Solid Wire Straightener

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
24	9SM8268	WIRE STRAIGHTENER BODY ASBLY	1
25	9SS10159	CROSS SLIDE SCREW ASBLY	1
26	9ST10585	BUSHING	1
27	9ST9967-5	PINS	1
28	9ST10584	SLIDE BUSHING	1
29	9SM9300-55	BEARING	2
30	9SS9262-140	PLAIN WASHER	2
31	9SCF000028	5/16-18X1.25HHCS	1
32	9SE106A-3	LOCKWASHER	1
33	9SCF000029	5/16-18HN	1

# Solid Wire Straightener



P-100-M.jpg



Service Navigator 2.0

# NA-5SF Auto Head - 12431

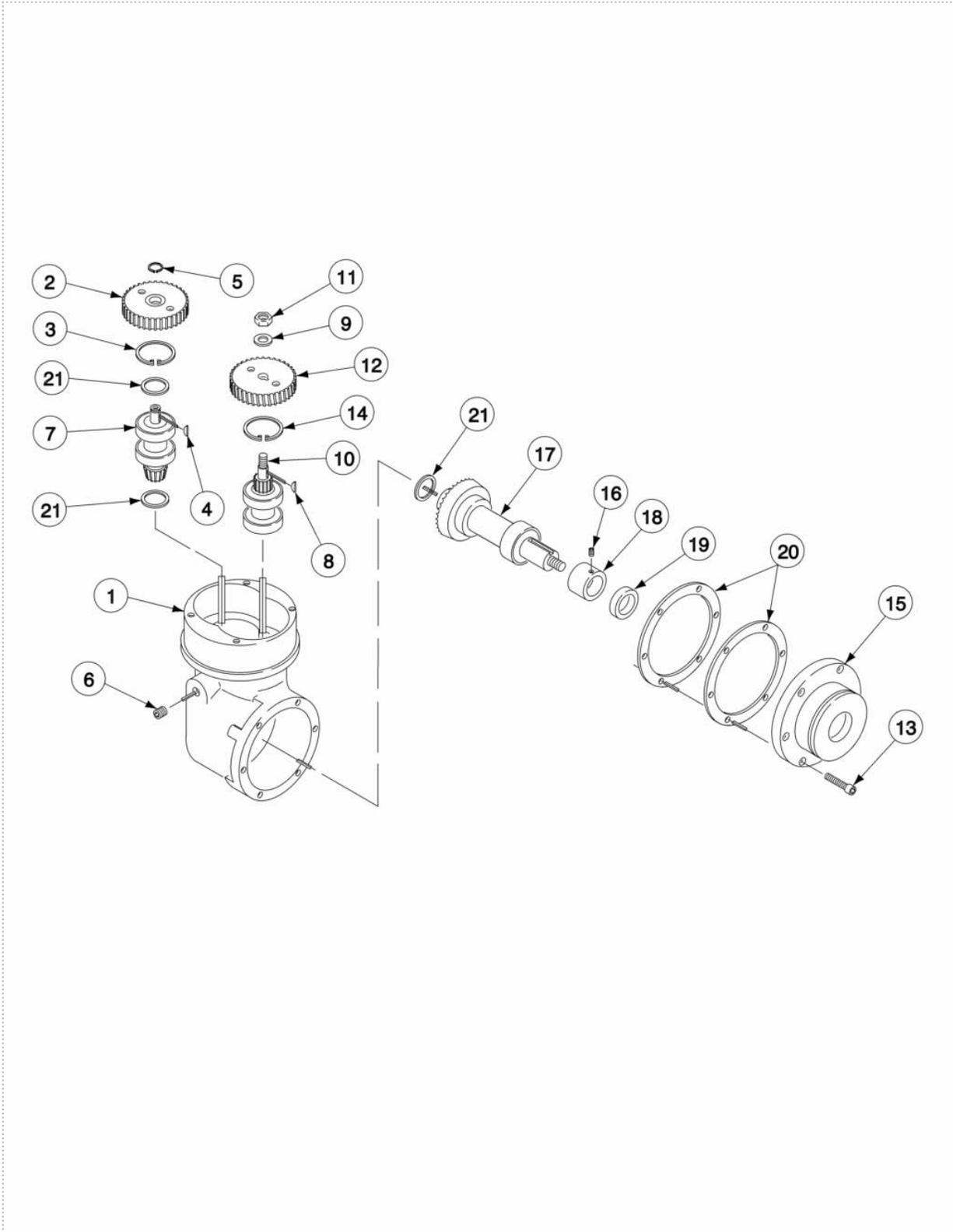
## Index of Sub Assemblies - 12431

KEY	PART NUMBER	DESCRIPTION	QTY
	P-135-A	Index of Sub Assemblies	AR
	P-100-C	Wire Feed Gear Box	AR
	P-100-D_2	Wire Feed Drive Roll Box	AR
	P-135-C	Wire Feed Drive Motor	AR
	P-100-M	Solid Wire Straightener	AR

## Wire Feed Gear Box

KEY	PART NUMBER	DESCRIPTION	QTY
	9SL5199-3	GEAR BOX ASBLY 95/1	1
1	9SG1328	GEAR BOX	1
2	9SS12504	GEAR	1
14	9SS9776-23	RETAINING RING	1
8	9S#304	WOODRUFF KEY	1
5	9SS9776-16	RETAINING RING	1
6	9SS11604-26	SET SCREW	2
7	9SS12511	BEVEL SHAFT ASBLY	1
8	9S#304	WOODRUFF KEY	1
9	9SS9262-121	PLAIN WASHER	1
10	9SS12510	SPUR SHAFT ASBLY	1
11	9SCF000029	5/16-18HN	1
12	9SS12503	HELICAL GEAR (95/1)	1
13	9ST9447-28	SOCKET HEAD CAP SCREW	6
14	9SS9776-23	RETAINING RING	1
15	9SM10256	GEAR CASE COLLAR	1
16	9SS11604-13	SET SCREW	1
17	9SS12509	OUTPUT SHAFT ASBLY	1
18	9ST12146	DRIVE ROLL SPACER	1
19	9SS7611-15	OIL SEAL	1
20	9ST12119-1	GASKET (.0125)	As Req
20	9ST12119-2	GASKET (.004)	As Req
21	9SS9262-110	PLAIN WASHER	As Req
21	9SS9262-111	PLAIN WASHER	As Req

# Wire Feed Gear Box

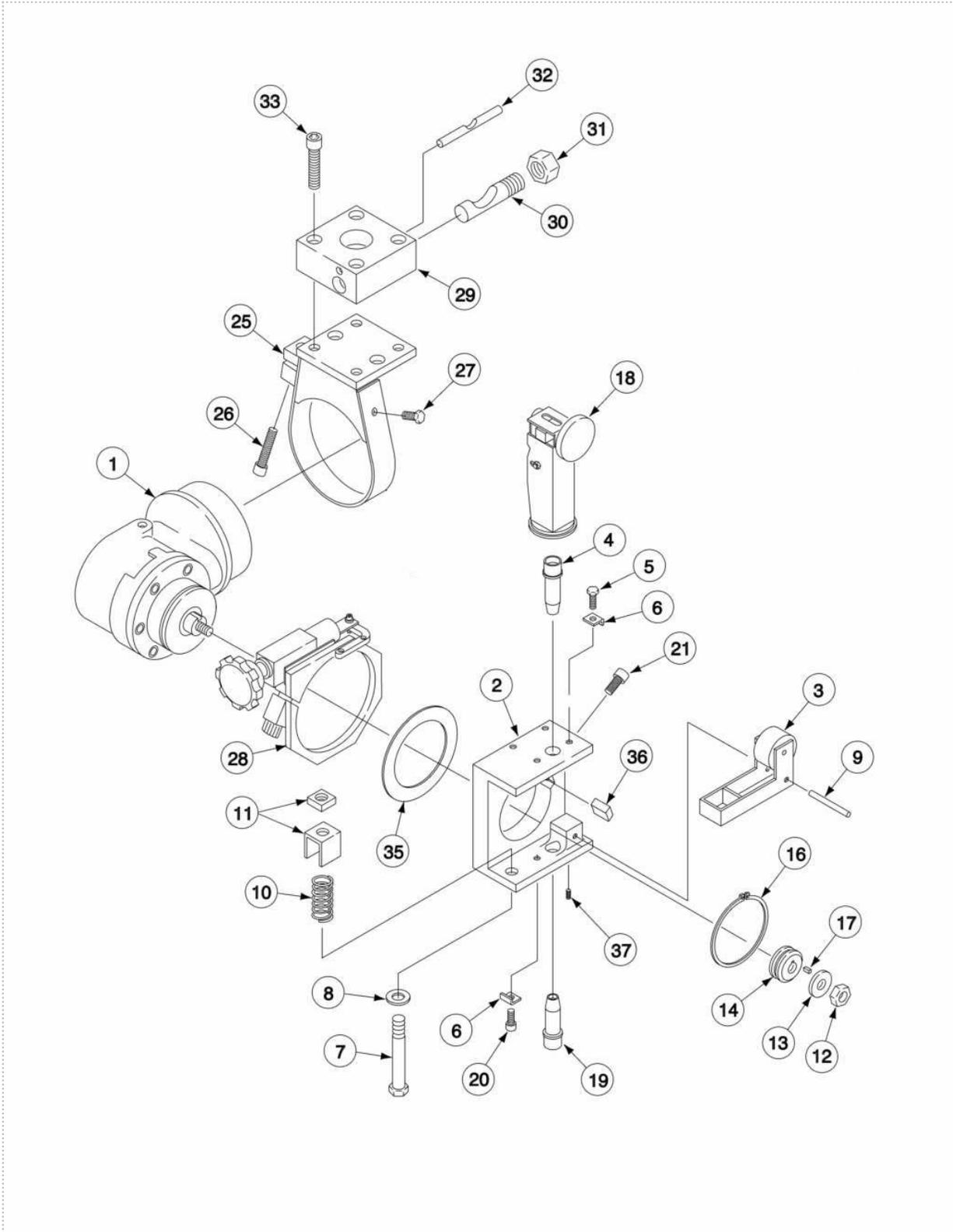


P-100-C.jpg

## Wire Feed Drive Roll Box

KEY	PART NUMBER	DESCRIPTION	QTY
1	9SL5199-3	GEAR BOX ASBLY 95/1	1
2	9SL6987	FACE PLATE MACHINING	1
3	9SS12475	IDLE ROLL ASBLY	1
4	KP2116-1	GUIDE TUBE 1/16 THRU 3/32 INCOMING	1
5	9SCF000040	5/16-18X.75HHCS	2
6	9ST8400	MOUNTING CLIP	4
7	9SCF000039	3/8-16X3.00HHCS	1
8	9SS9262-120	PLAIN WASHER	1
9	9ST12206-4	PIVOT PIN	1
10	9ST10247-7	SPRING	1
11	9ST13610-1	YOKE INDICATOR ASBLY	1
12	9ST10552-1	DRIVE ROLL NUT	1
13	9SS9262-44	PLAIN WASHER	1
14	KP1886-1	DRIVE ROLL KNURLED 1/16-3/32	2
16	9SS11910-2	SNAP RING	1
17	9SM8776-5	KEY	1
18	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
19	KP2097-2	GUIDE TUBE & SLEEVE ASBLY 3/32OUTGOING	1
20	9ST9447-12	SOCKET HEAD CAP SCREW	2
21	9ST9447-32	SOCKET HEAD CAP SCREW	1
35	9SS9262-131	PLAIN WASHER	1
36	9ST14896-1	LOCKING KEY	1
37	9SS11604-8	SET SCREW	1
40	9SS24727-1	DECALCOUNTRY OF ORIGIN	1
	9SS31444-5	RATING PLATE	1
	9SS25815-3	WARNING DECAL	1

# Wire Feed Drive Roll Box

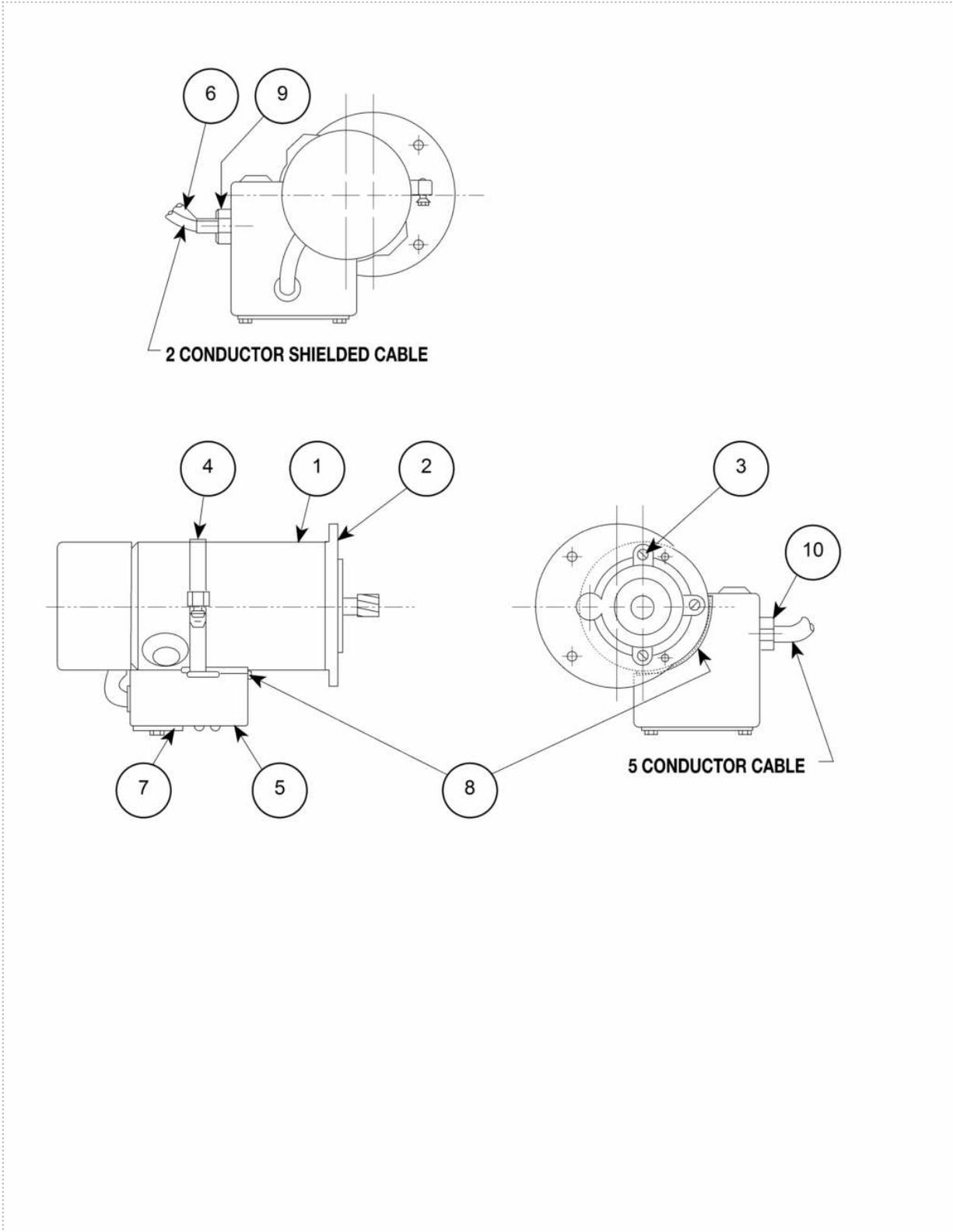


P-100-D\_2.jpg

## Wire Feed Drive Motor

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM13902-8	Drive Motor & Connection Box Assembly	1
1	9SL6440-2	MOTOR ASBLY 95/1	1
	9SS16979-1	DRIVE MOTOR LEAD PREPARATION	1
	9SM13312-12	BRUSH & SPRING ASBLY	2
	9SM13312-13	BRUSH CAP	2
	9SS15013-2	PINION GEAR	1
	9ST9967-33	ROLL PIN	1
	9SM14701-2	TACHOMETER PICK-UP PC BDASBLY	1
	9SS16180	SLOTTED DISC	1
	9SM13629	TACH SHIELD MTG PLATE	1
	9SM13578	PICKUP HOUSING ASBLY	1
	9ST14326	COVER ASBLY	1
2	9SM10255-1	MOTOR ADAPTER PLATE	1
3	9SCF000036	#8-32X.75FHS	3
4	9SS10888-20	HOSE CLAMP	1
5	9SM13901	CONNECTION BOX ASBLY	1
6	9SL6209	CONTROL BOX TO HEAD CABLE ASBLY	1
	9SS12020-17	CONNECTOR	1
	9SS12024-4	CABLE CLAMP	1
	9SS12020-27	CONNECTOR	1
	9SS12024-1	CABLE CLAMP	1
7	9ST13193-1	CONNECTION BOX COVER	1
	9SS8025-70	SELF TAPPING SCREW	2
8	9ST12823-18	GROMMET STRIP	1
9	9ST9274-3	GROMMET	1
10	9ST9274-4	GROMMET	1
	9SS16718	MOTOR END COVER	1

# Wire Feed Drive Motor

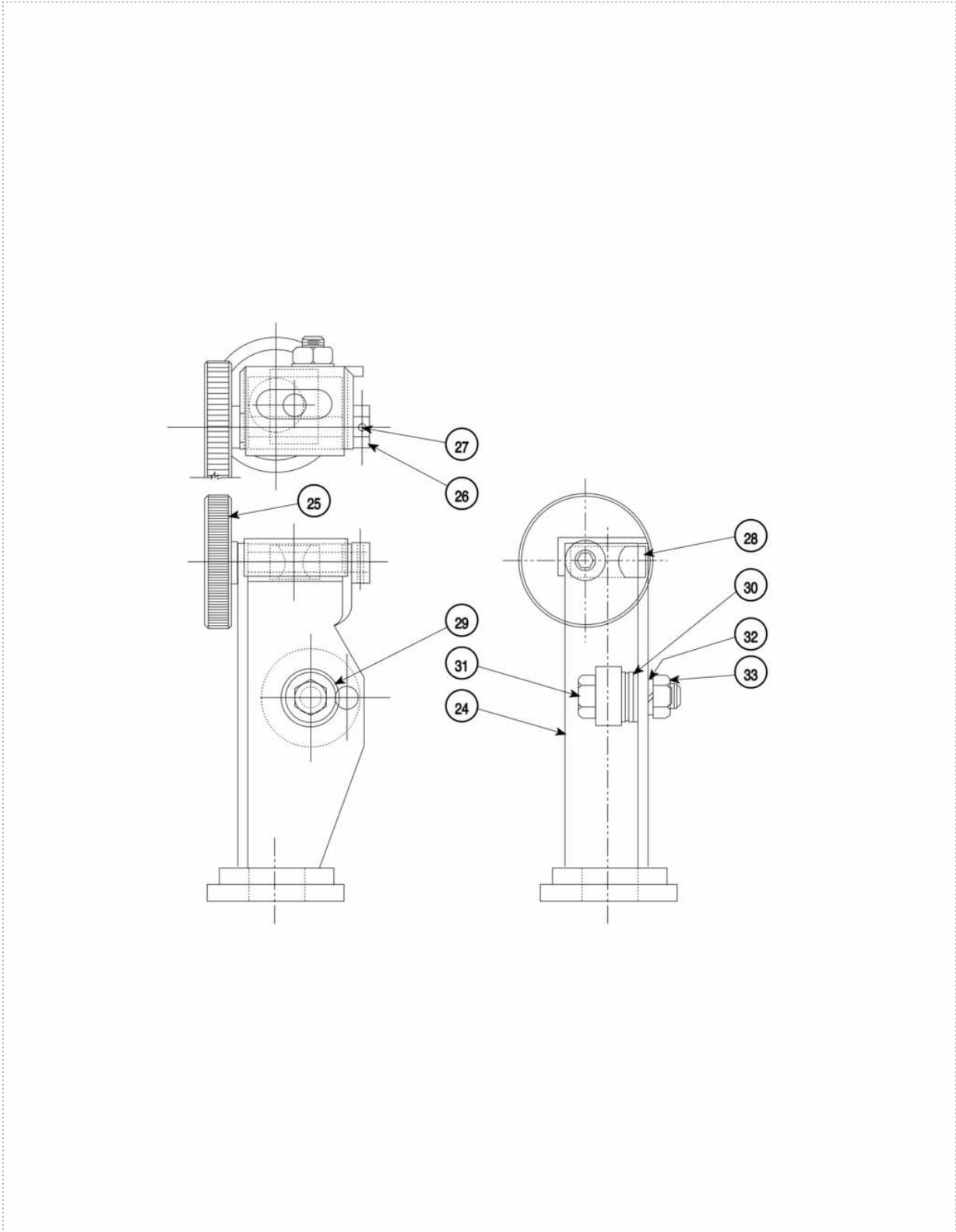


P-135-C.jpg

## Solid Wire Straightener

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
24	9SM8268	WIRE STRAIGHTENER BODY ASBLY	1
25	9SS10159	CROSS SLIDE SCREW ASBLY	1
26	9ST10585	BUSHING	1
27	9ST9967-5	PINS	1
28	9ST10584	SLIDE BUSHING	1
29	9SM9300-55	BEARING	2
30	9SS9262-140	PLAIN WASHER	2
31	9SCF000028	5/16-18X1.25HHCS	1
32	9SE106A-3	LOCKWASHER	1
33	9SCF000029	5/16-18HN	1

# Solid Wire Straightener



P-100-M.jpg



Service Navigator 2.0

# NA-5S Auto Head - 12434

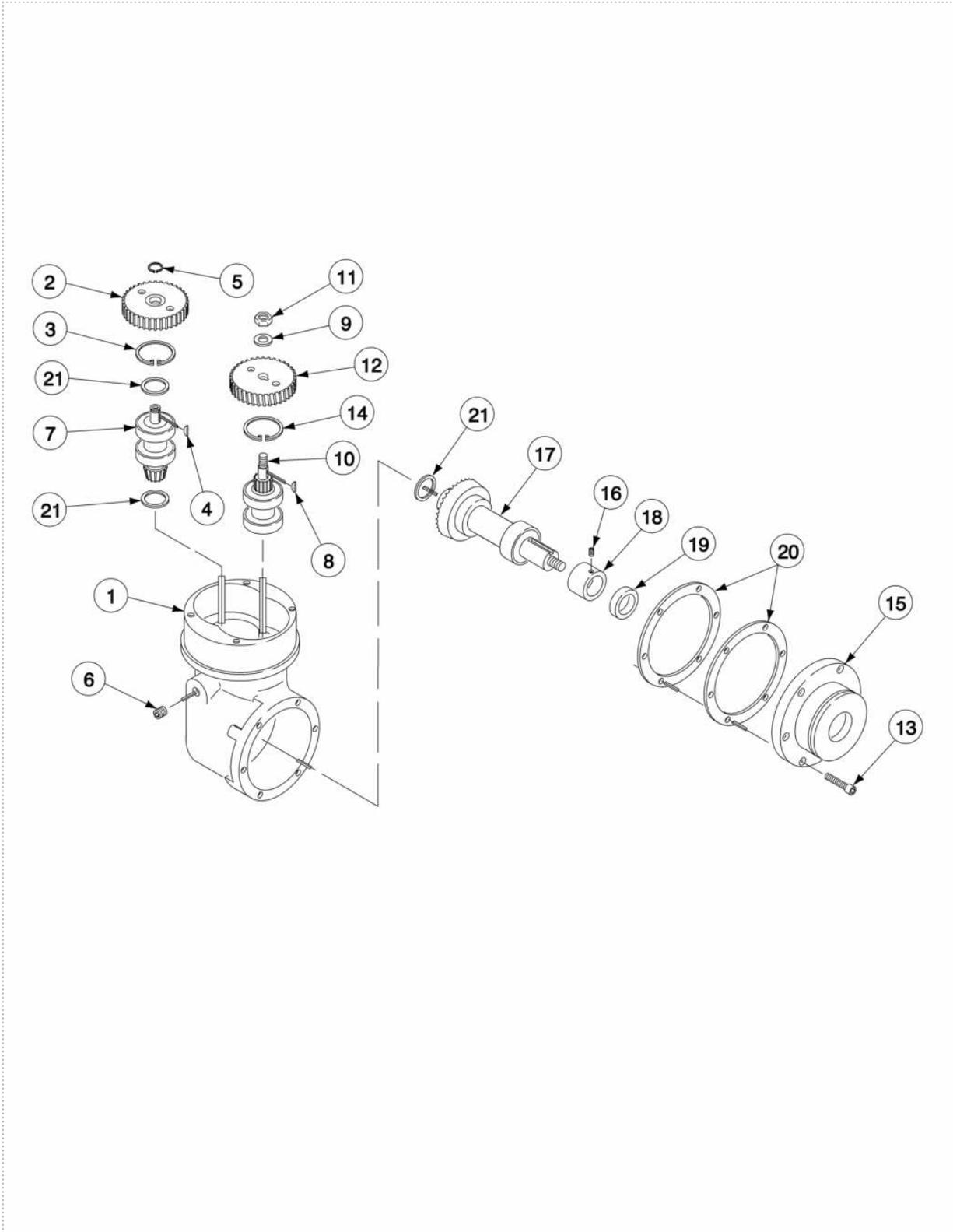
## Index of Sub Assemblies - 12434

KEY	PART NUMBER	DESCRIPTION	QTY
	P-135-A	Index of Sub Assemblies	AR
	P-100-C	Wire Feed Gear Box	AR
	P-100-D_2	Wire Feed Drive Roll Box	AR
	P-135-C	Wire Feed Drive Motor	AR
	P-100-F	Head Mounting	AR
	P-100-L	Cross Seam Adjuster	AR
	P-100-M	Solid Wire Straightener	AR

## Wire Feed Gear Box

KEY	PART NUMBER	DESCRIPTION	QTY
	9SL5199-1	GEAR BOX ASBLY 142/1	1
1	9SG1328	GEAR BOX	1
2	9SS12504	GEAR	1
14	9SS9776-23	RETAINING RING	1
8	9S#304	WOODRUFF KEY	1
5	9SS9776-16	RETAINING RING	1
6	9SS11604-26	SET SCREW	2
7	9SS12511	BEVEL SHAFT ASBLY	1
8	9S#304	WOODRUFF KEY	1
9	9SS9262-121	PLAIN WASHER	1
10	9SS12510	SPUR SHAFT ASBLY	1
11	9SCF000029	5/16-18HN	1
12	9SS12882	HELICAL GEAR (142/1)	1
13	9ST9447-28	SOCKET HEAD CAP SCREW	6
14	9SS9776-23	RETAINING RING	1
15	9SM10256	GEAR CASE COLLAR	1
16	9SS11604-13	SET SCREW	1
17	9SS12509	OUTPUT SHAFT ASBLY	1
18	9ST12146	DRIVE ROLL SPACER	1
19	9SS7611-15	OIL SEAL	1
20	9ST12119-1	GASKET (.0125)	As Req
20	9ST12119-2	GASKET (.004)	As Req
21	9SS9262-110	PLAIN WASHER	As Req
21	9SS9262-111	PLAIN WASHER	As Req

# Wire Feed Gear Box

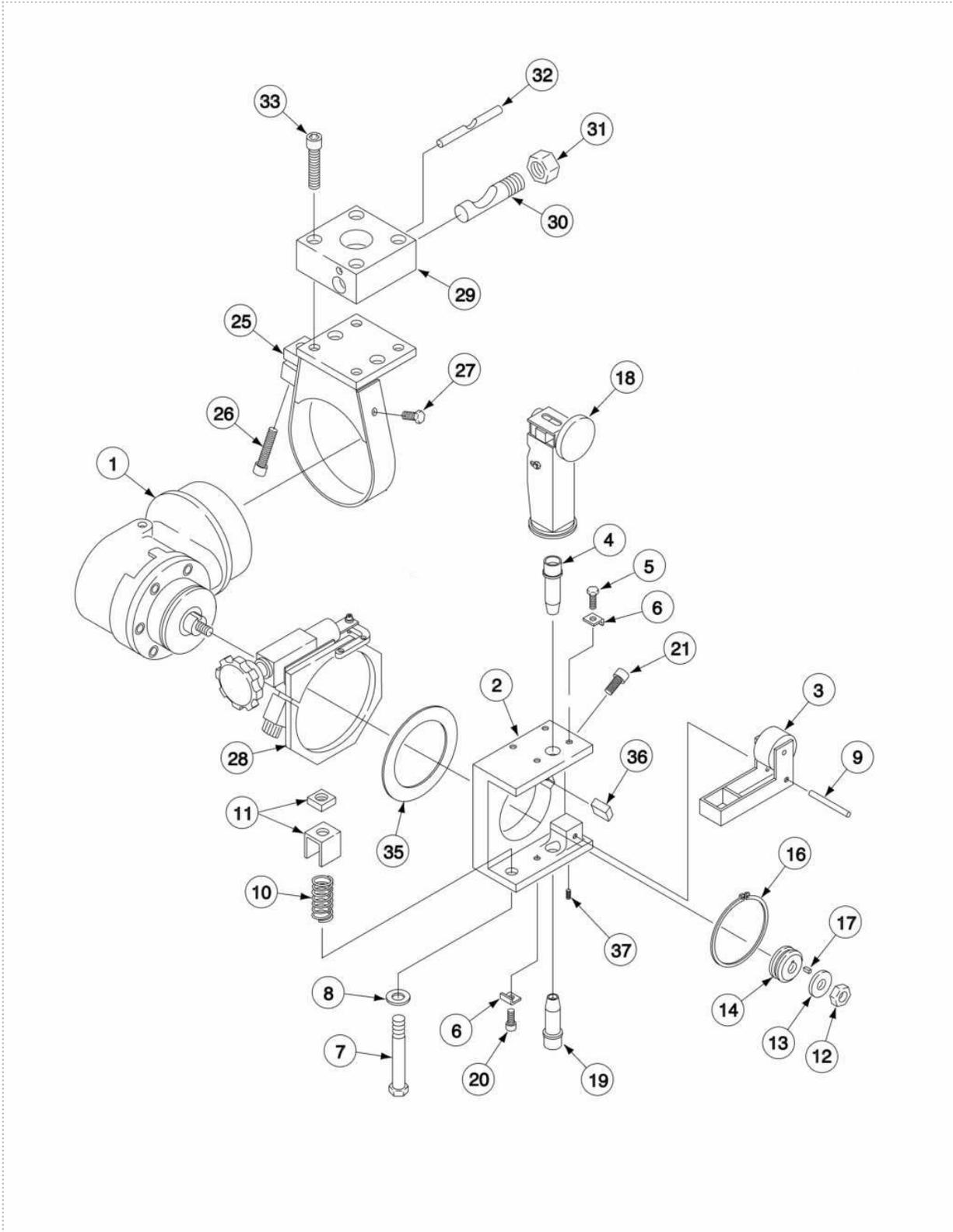


P-100-C.jpg

## Wire Feed Drive Roll Box

KEY	PART NUMBER	DESCRIPTION	QTY
1	9SL5199-1	GEAR BOX ASBLY 142/1	1
2	9SL6987	FACE PLATE MACHINING	1
3	9SS12475	IDLE ROLL ASBLY	1
4	KP2116-2	GUIDE TUBE 3/32 THRU 7/32 INCOMING	1
5	9SCF000040	5/16-18X.75HHCS	2
6	9ST8400	MOUNTING CLIP	4
7	9SCF000039	3/8-16X3.00HHCS	1
8	9SS9262-120	PLAIN WASHER	1
9	9ST12206-4	PIVOT PIN	1
10	9ST10247-7	SPRING	1
11	9ST13610-1	YOKE INDICATOR ASBLY	1
12	9ST10552-1	DRIVE ROLL NUT	1
13	9SS9262-44	PLAIN WASHER	1
14	KP1885-1	DRIVE ROLL KNURLED 3/32-7/32	2
16	9SS11910-2	SNAP RING	1
17	9SM8776-5	KEY	1
18	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
19	KP1963-1	GUIDE TUBE 3/32-7/32 OUTGOING	1
20	9ST9447-12	SOCKET HEAD CAP SCREW	2
21	9ST9447-32	SOCKET HEAD CAP SCREW	1
24	9SM8232	HEAD SUPPORT	1
28	9SM10802	CROSS SEAM ADJUSTER	1
29	9SM10215	PIVOT BLOCK	1
35	9SS9262-131	PLAIN WASHER	1
36	9ST14896-1	LOCKING KEY	1
37	9SS11604-8	SET SCREW	1
	9SS24727-3	DECAL	1
	9SS31444-5	RATING PLATE	1
	9SS25815-3	WARNING DECAL	1

# Wire Feed Drive Roll Box

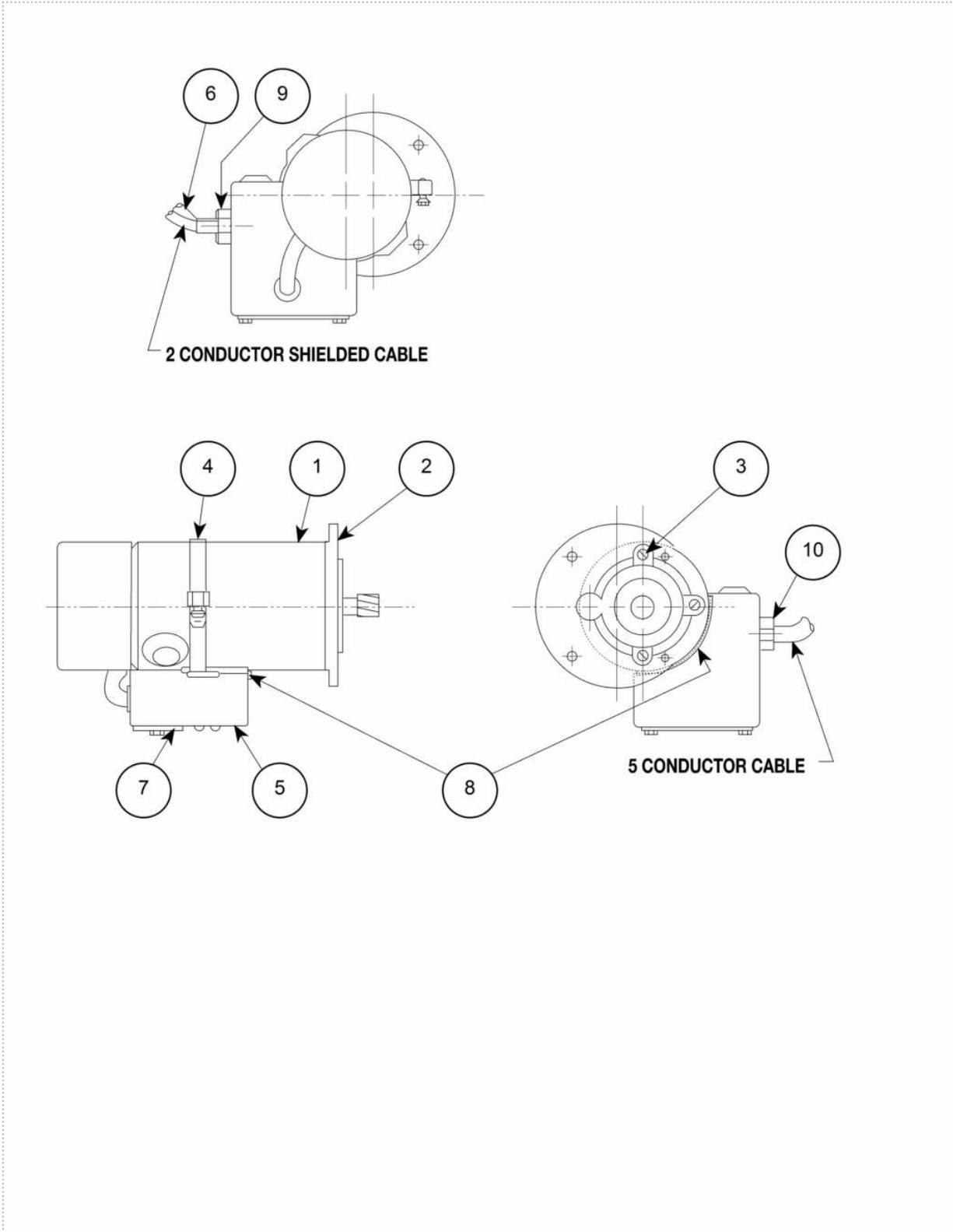


P-100-D\_2.jpg

## Wire Feed Drive Motor

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM13902-9	Drive Motor & Connection Box Assembly	1
1	9SL6440-3	MOTOR ASBLY 142/1	1
	9SS16979-1	DRIVE MOTOR LEAD PREPARATION	1
	9SM13312-12	BRUSH & SPRING ASBLY	2
	9SM13312-13	BRUSH CAP	2
	9SS15013-3	PINION GEAR	1
	9ST9967-33	ROLL PIN	1
	9SM14701-2	TACHOMETER PICK-UP PC BDASBLY	1
	9SS16180	SLOTTED DISC	1
	9SM13629	TACH SHIELD MTG PLATE	1
	9SM13578	PICKUP HOUSING ASBLY	1
	9ST14326	COVER ASBLY	1
2	9SM10255-1	MOTOR ADAPTER PLATE	1
3	9SCF000036	#8-32X.75FHS	3
4	9SS10888-20	HOSE CLAMP	1
5	9SM13901	CONNECTION BOX ASBLY	1
6	9SL6209	CONTROL BOX TO HEAD CABLE ASBLY	1
	9SS12020-17	CONNECTOR	1
	9SS12024-4	CABLE CLAMP	1
	9SS12020-27	CONNECTOR	1
	9SS12024-1	CABLE CLAMP	1
7	9ST13193-1	CONNECTION BOX COVER	1
	9SS8025-70	SELF TAPPING SCREW	2
8	9ST12823-18	GROMMET STRIP	1
9	9ST9274-3	GROMMET	1
10	9ST9274-4	GROMMET	1
	9SS16718	MOTOR END COVER	1

# Wire Feed Drive Motor

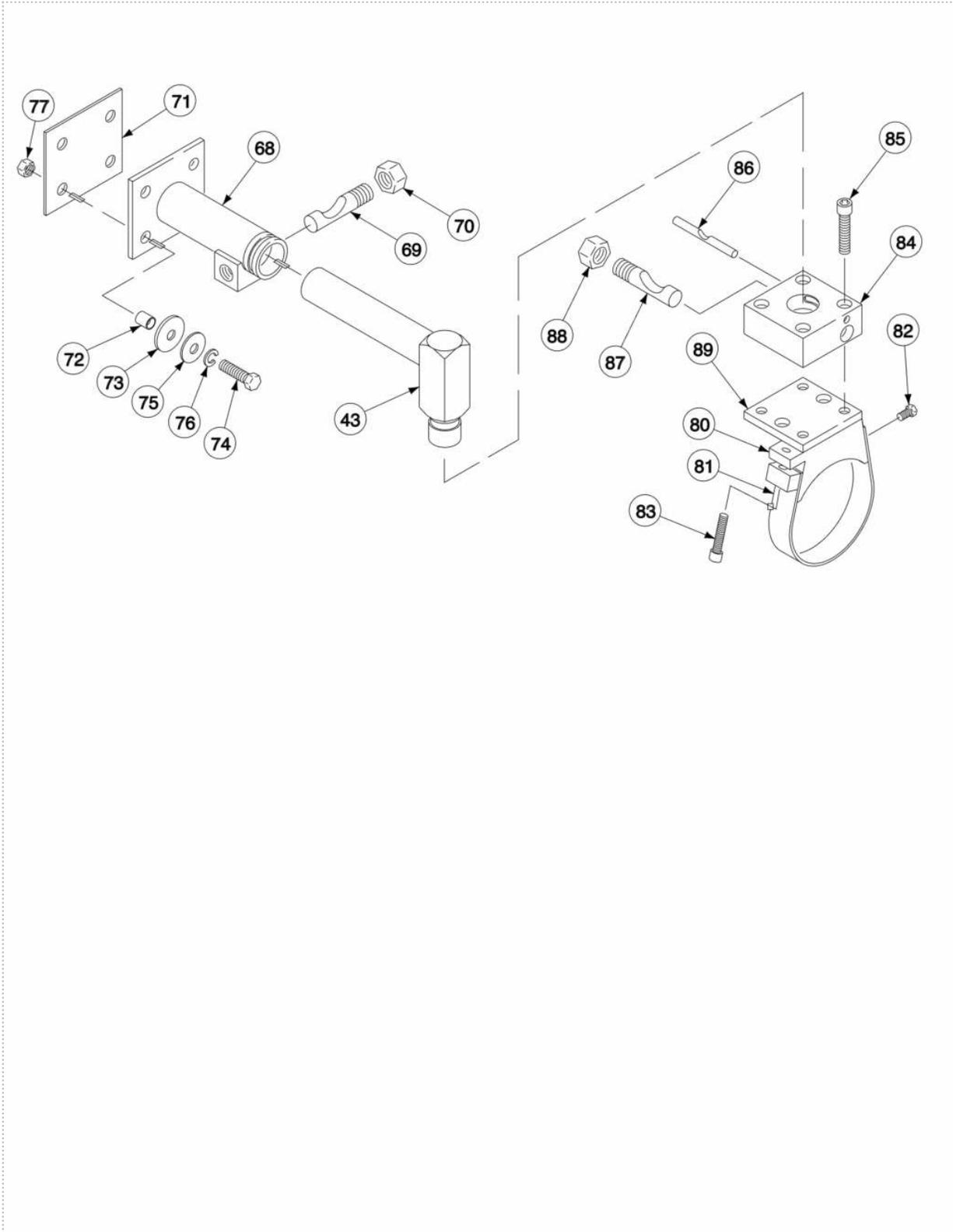


P-135-C.jpg

## Head Mounting

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM8232	HEAD SUPPORT	1
	9SM6769	MOUNTING BRACKET ASBLY	1
68	9SM4016	BRACKET	1
69	9ST4893	DRAW BOLT	1
88	9SCF000025	3/4-10HN	1
71	9SS4322	INSULATION	1
72	9ST7305-18	INSULATING TUBE	4
73	9SS10773-9	INSULATING WASHER	4
74	9SCF000026	1/2-13X1.75HHB	4
75	9SS9262-1	PLAIN WASHER	4
76	9SE106A-5	LOCKWASHER	4
77	9SCF000027	1/2-13HN	4
80	9SM10213	CLAMPING BRACKET ASBLY	1
81	9SS12472	CLAMPING BAND ASBLY	1
82	9SCF000034	3/8-16X.75HHCS	1
85	9ST9447-18	SOCKET HEAD CAP SCREW	4
84	9SM10215	PIVOT BLOCK	1
85	9ST9447-18	SOCKET HEAD CAP SCREW	4
85	9ST9447-31	SOCKET HEAD CAP SCREW	4
86	9ST9967-29	ROLL PIN	1
87	9ST4893-3	DRAW BOLT	1
88	9SCF000025	3/4-10HN	1
89	9SS10262-6	SPACER	4

# Head Mounting

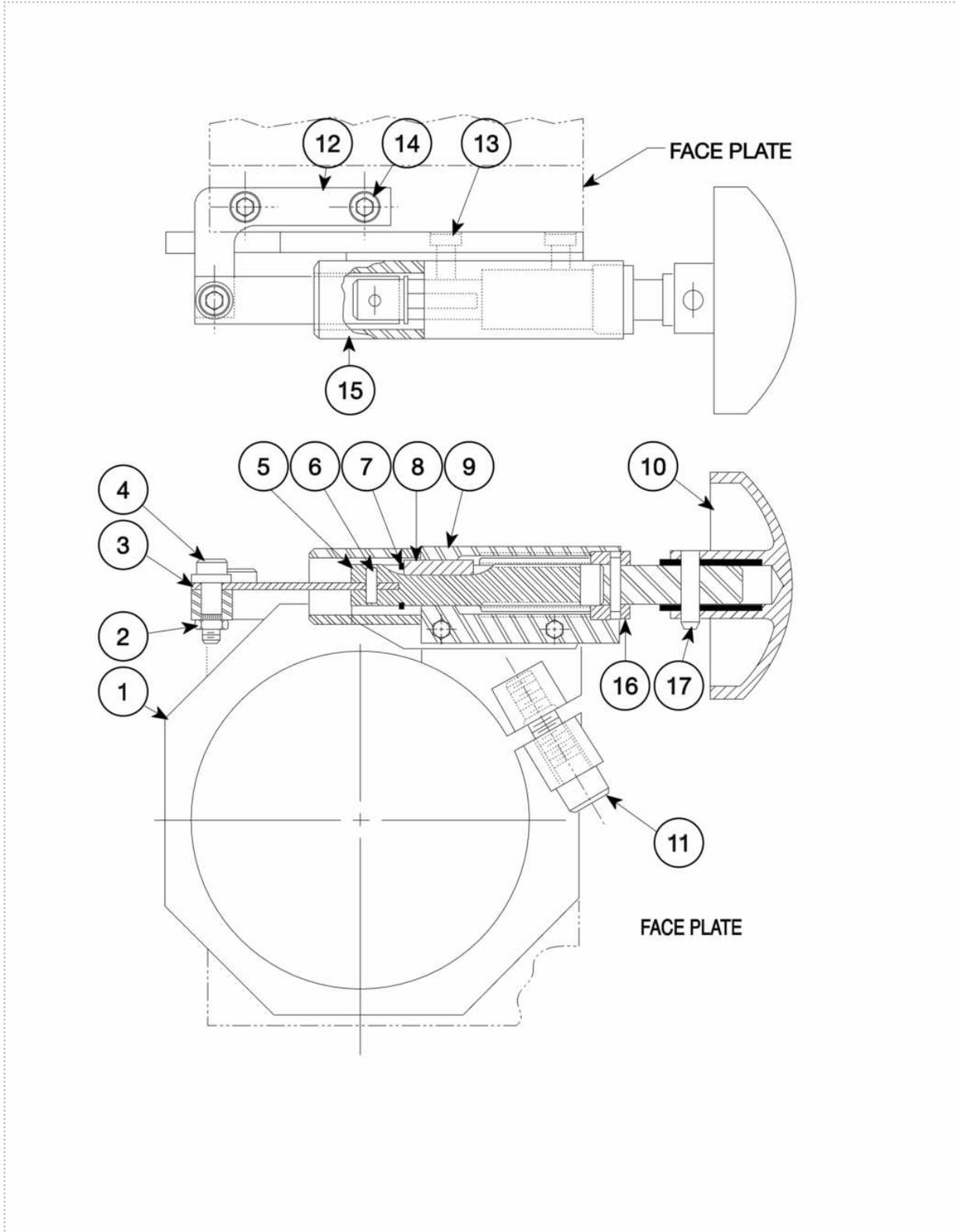


P-100-F.jpg

## Cross Seam Adjuster

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM10802	CROSS SEAM ADJUSTER	1
1	9SM10787	CLAMPING RING ASBLY	1
2	9SCF000010	#10-24HN	1
3	9ST8701-1	SPRING	1
4	9ST12535	SHOULDER SCREW ASBLY	1
5	9SS13202	ADJUSTING SCREW	1
6	9ST9967-8	ROLL PIN	1
7	9SS9776-3	RETAINING RING	1
8	9SM8776-6	KEY	1
9	9SS13203	ADJUSTING BLOCK	1
10	9ST8312	KNOB	1
11	9ST9447-18	SOCKET HEAD CAP SCREW	1
12	9SS13204	MOUNTING ARM	1
13	9SS25930-6	TORX BUTTON HEAD SCREW 1/4-20X.62	2
14	9SS25930-1	142TORX BUTTON HEAD SCREW 1/4-20X.88	2
15	9SS13233	SPATTER GUARD ASBLY	1
16	9ST12537	CROSS SEAM SLEEVE ASBLY	1
17	9ST8433	DRIVE PIN	1

# Cross Seam Adjuster

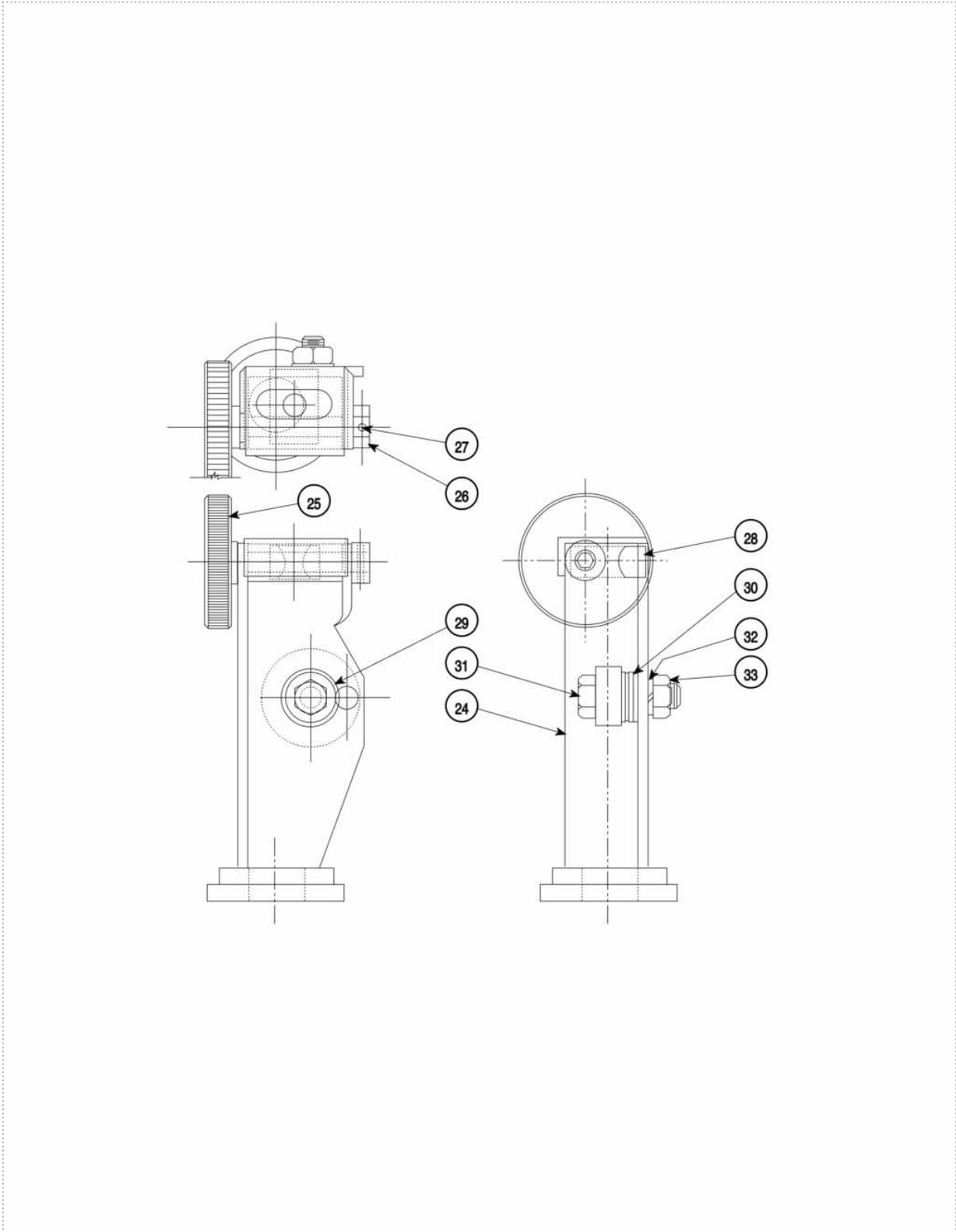


P-100-L.jpg

## Solid Wire Straightener

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
24	9SM8268	WIRE STRAIGHTENER BODY ASBLY	1
25	9SS10159	CROSS SLIDE SCREW ASBLY	1
26	9ST10585	BUSHING	1
27	9ST9967-5	PINS	1
28	9ST10584	SLIDE BUSHING	1
29	9SM9300-55	BEARING	2
30	9SS9262-140	PLAIN WASHER	2
31	9SCF000028	5/16-18X1.25HHCS	1
32	9SE106A-3	LOCKWASHER	1
33	9SCF000029	5/16-18HN	1

# Solid Wire Straightener



P-100-M.jpg



Service Navigator 2.0

# NA-5S Auto Head - 12435

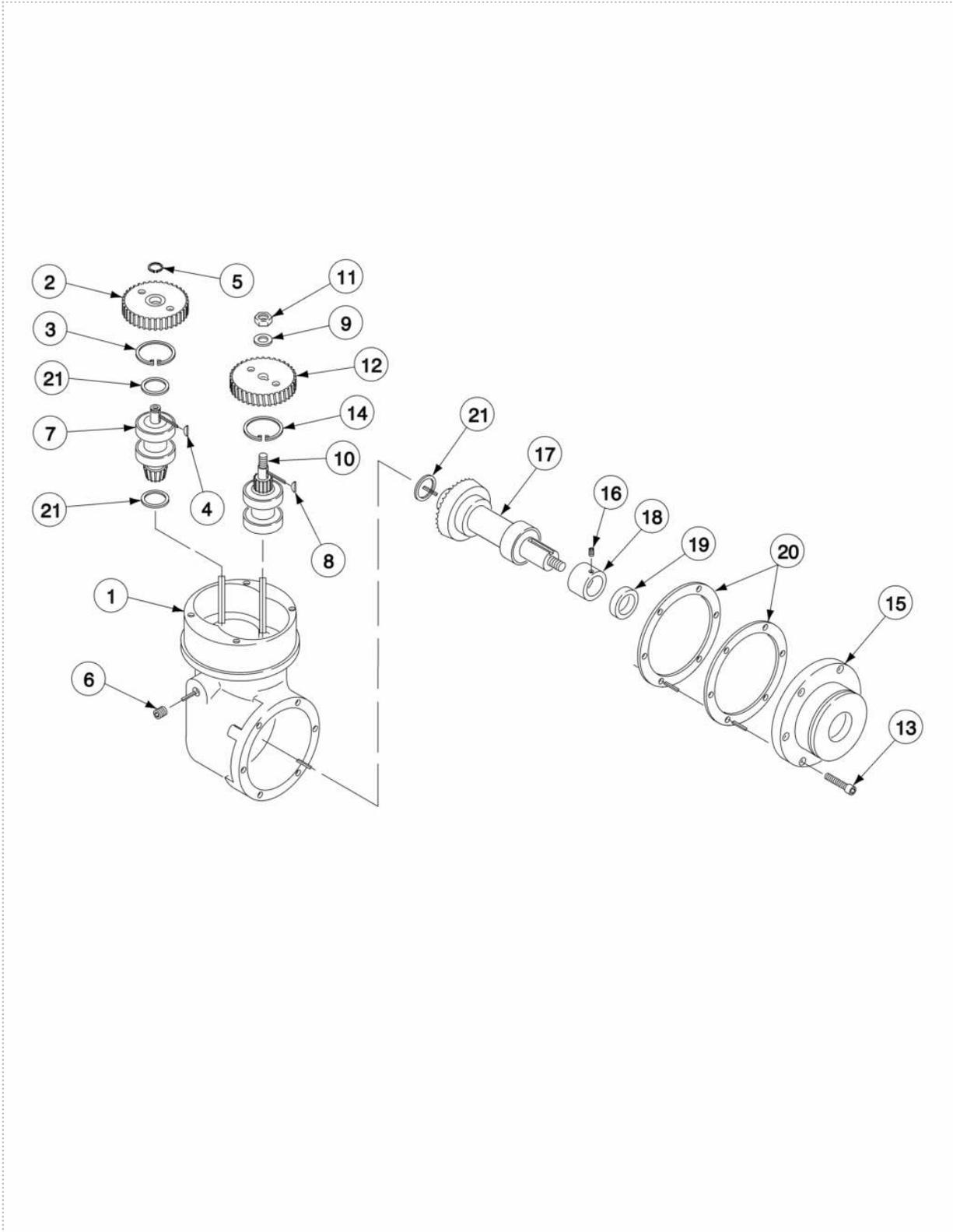
## Index of Sub Assemblies - 12435

KEY	PART NUMBER	DESCRIPTION	QTY
	P-135-A	Index of Sub Assemblies	AR
	P-100-C	Wire Feed Gear Box	AR
	P-100-D_2	Wire Feed Drive Roll Box	AR
	P-135-C	Wire Feed Drive Motor	AR
	P-100-F	Head Mounting	AR
	P-100-L	Cross Seam Adjuster	AR
	P-100-M	Solid Wire Straightener	AR

## Wire Feed Gear Box

KEY	PART NUMBER	DESCRIPTION	QTY
	9SL5199-1	GEAR BOX ASBLY 142/1	1
1	9SG1328	GEAR BOX	1
2	9SS12504	GEAR	1
14	9SS9776-23	RETAINING RING	1
8	9S#304	WOODRUFF KEY	1
5	9SS9776-16	RETAINING RING	1
6	9SS11604-26	SET SCREW	2
7	9SS12511	BEVEL SHAFT ASBLY	1
8	9S#304	WOODRUFF KEY	1
9	9SS9262-121	PLAIN WASHER	1
10	9SS12510	SPUR SHAFT ASBLY	1
11	9SCF000029	5/16-18HN	1
12	9SS12882	HELICAL GEAR (142/1)	1
13	9ST9447-28	SOCKET HEAD CAP SCREW	6
14	9SS9776-23	RETAINING RING	1
15	9SM10256	GEAR CASE COLLAR	1
16	9SS11604-13	SET SCREW	1
17	9SS12509	OUTPUT SHAFT ASBLY	1
18	9ST12146	DRIVE ROLL SPACER	1
19	9SS7611-15	OIL SEAL	1
20	9ST12119-1	GASKET (.0125)	As Req
20	9ST12119-2	GASKET (.004)	As Req
21	9SS9262-110	PLAIN WASHER	As Req
21	9SS9262-111	PLAIN WASHER	As Req

# Wire Feed Gear Box

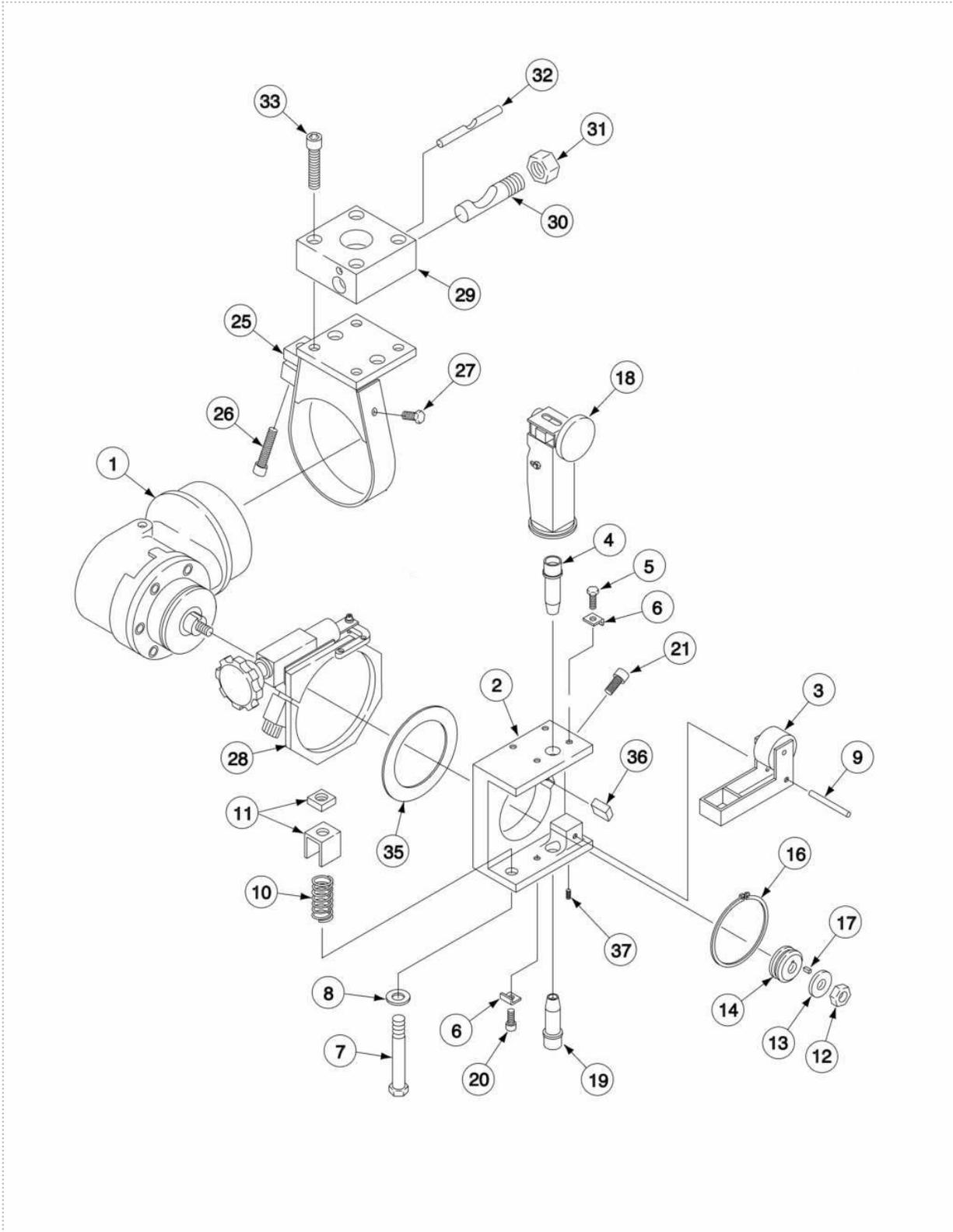


P-100-C.jpg

## Wire Feed Drive Roll Box

KEY	PART NUMBER	DESCRIPTION	QTY
1	9SL5199-1	GEAR BOX ASBLY 142/1	1
2	9SL6987	FACE PLATE MACHINING	1
3	9SS12475	IDLE ROLL ASBLY	1
4	KP2116-2	GUIDE TUBE 3/32 THRU 7/32 INCOMING	1
5	9SCF000040	5/16-18X.75HHCS	2
6	9ST8400	MOUNTING CLIP	4
7	9SCF000039	3/8-16X3.00HHCS	1
8	9SS9262-120	PLAIN WASHER	1
9	9ST12206-4	PIVOT PIN	1
10	9ST10247-7	SPRING	1
11	9ST13610-1	YOKE INDICATOR ASBLY	1
12	9ST10552-1	DRIVE ROLL NUT	1
13	9SS9262-44	PLAIN WASHER	1
14	KP1885-1	DRIVE ROLL KNURLED 3/32-7/32	2
16	9SS11910-2	SNAP RING	1
17	9SM8776-5	KEY	1
18	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
19	KP1963-1	GUIDE TUBE 3/32-7/32 OUTGOING	1
20	9ST9447-12	SOCKET HEAD CAP SCREW	2
21	9ST9447-32	SOCKET HEAD CAP SCREW	1
24	9SM8232	HEAD SUPPORT	1
28	9SM10802	CROSS SEAM ADJUSTER	1
29	9SM10215	PIVOT BLOCK	1
35	9SS9262-131	PLAIN WASHER	1
36	9ST14896-1	LOCKING KEY	1
37	9SS11604-8	SET SCREW	1
	9SS24727-3	DECAL	1
	9SS31444-5	RATING PLATE	1
	9SS25815-3	WARNING DECAL	1

# Wire Feed Drive Roll Box

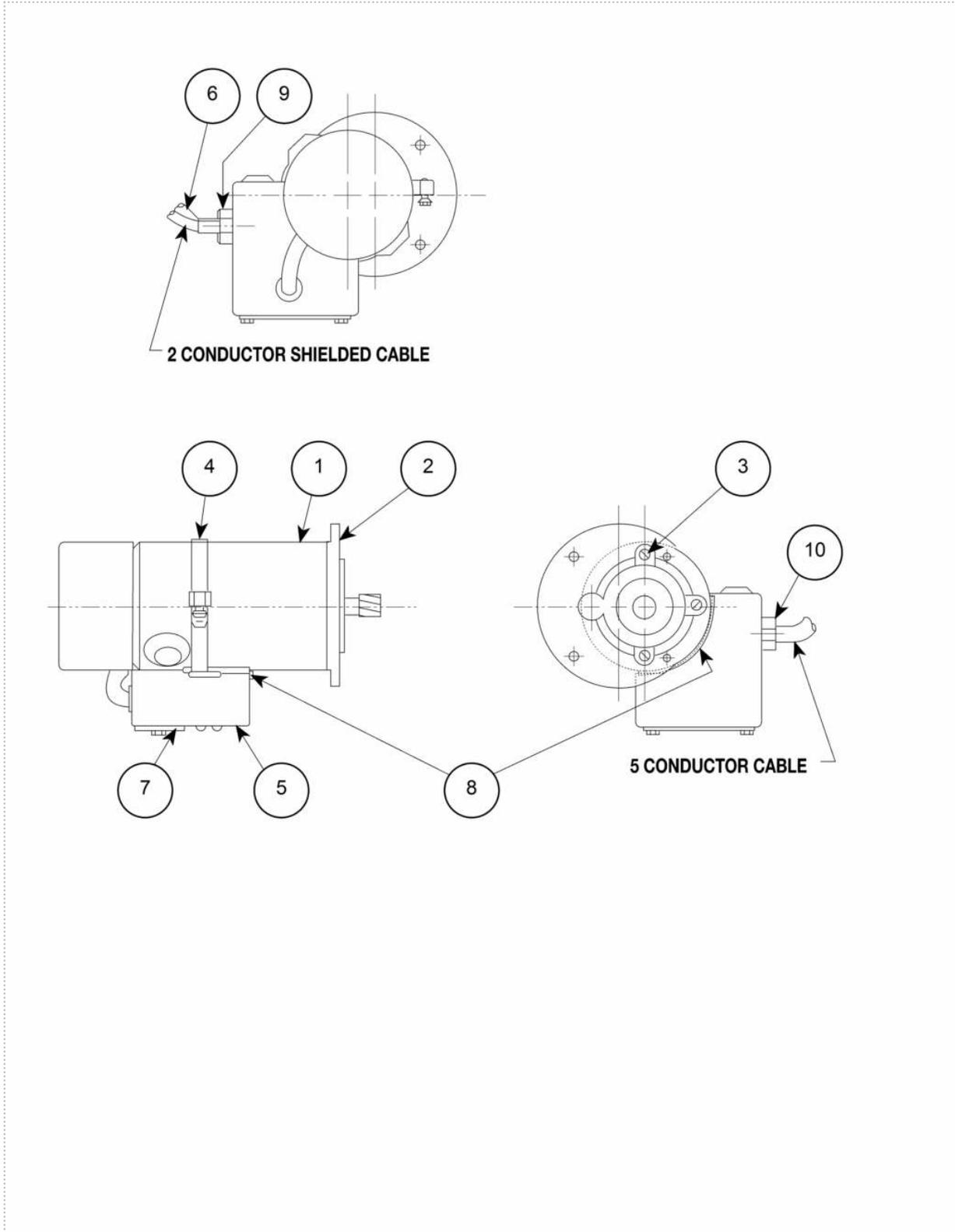


P-100-D\_2.jpg

## Wire Feed Drive Motor

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM13902-9	Drive Motor & Connection Box Assembly	1
1	9SL6440-3	MOTOR ASBLY 142/1	1
	9SS16979-1	DRIVE MOTOR LEAD PREPARATION	1
	9SM13312-12	BRUSH & SPRING ASBLY	2
	9SM13312-13	BRUSH CAP	2
	9SS15013-3	PINION GEAR	1
	9ST9967-33	ROLL PIN	1
	9SM14701-2	TACHOMETER PICK-UP PC BDASBLY	1
	9SS16180	SLOTTED DISC	1
	9SM13629	TACH SHIELD MTG PLATE	1
	9SM13578	PICKUP HOUSING ASBLY	1
	9ST14326	COVER ASBLY	1
2	9SM10255-1	MOTOR ADAPTER PLATE	1
3	9SCF000036	#8-32X.75FHS	3
4	9SS10888-20	HOSE CLAMP	1
5	9SM13901	CONNECTION BOX ASBLY	1
6	9SL6209	CONTROL BOX TO HEAD CABLE ASBLY	1
	9SS12020-17	CONNECTOR	1
	9SS12024-4	CABLE CLAMP	1
	9SS12020-27	CONNECTOR	1
	9SS12024-1	CABLE CLAMP	1
7	9ST13193-1	CONNECTION BOX COVER	1
	9SS8025-70	SELF TAPPING SCREW	2
8	9ST12823-18	GROMMET STRIP	1
9	9ST9274-3	GROMMET	1
10	9ST9274-4	GROMMET	1
	9SS16718	MOTOR END COVER	1

# Wire Feed Drive Motor

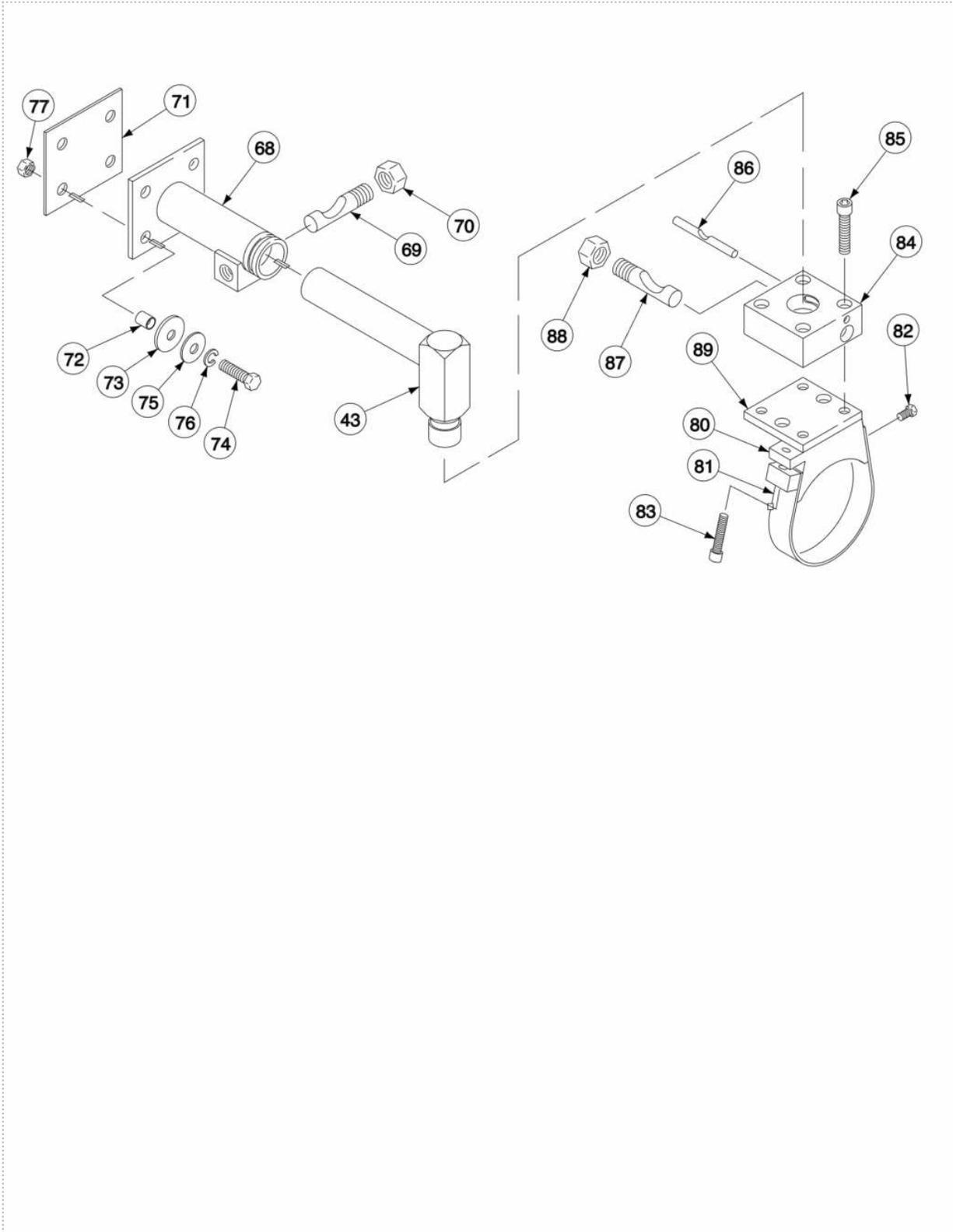


P-135-C.jpg

## Head Mounting

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM8232	HEAD SUPPORT	1
	9SM6769	MOUNTING BRACKET ASBLY	1
68	9SM4016	BRACKET	1
69	9ST4893	DRAW BOLT	1
88	9SCF000025	3/4-10HN	1
71	9SS4322	INSULATION	1
72	9ST7305-18	INSULATING TUBE	4
73	9SS10773-9	INSULATING WASHER	4
74	9SCF000026	1/2-13X1.75HHB	4
75	9SS9262-1	PLAIN WASHER	4
76	9SE106A-5	LOCKWASHER	4
77	9SCF000027	1/2-13HN	4
80	9SM10213	CLAMPING BRACKET ASBLY	1
81	9SS12472	CLAMPING BAND ASBLY	1
82	9SCF000034	3/8-16X.75HHCS	1
85	9ST9447-18	SOCKET HEAD CAP SCREW	4
84	9SM10215	PIVOT BLOCK	1
85	9ST9447-18	SOCKET HEAD CAP SCREW	4
85	9ST9447-31	SOCKET HEAD CAP SCREW	4
86	9ST9967-29	ROLL PIN	1
87	9ST4893-3	DRAW BOLT	1
88	9SCF000025	3/4-10HN	1
89	9SS10262-6	SPACER	4

# Head Mounting

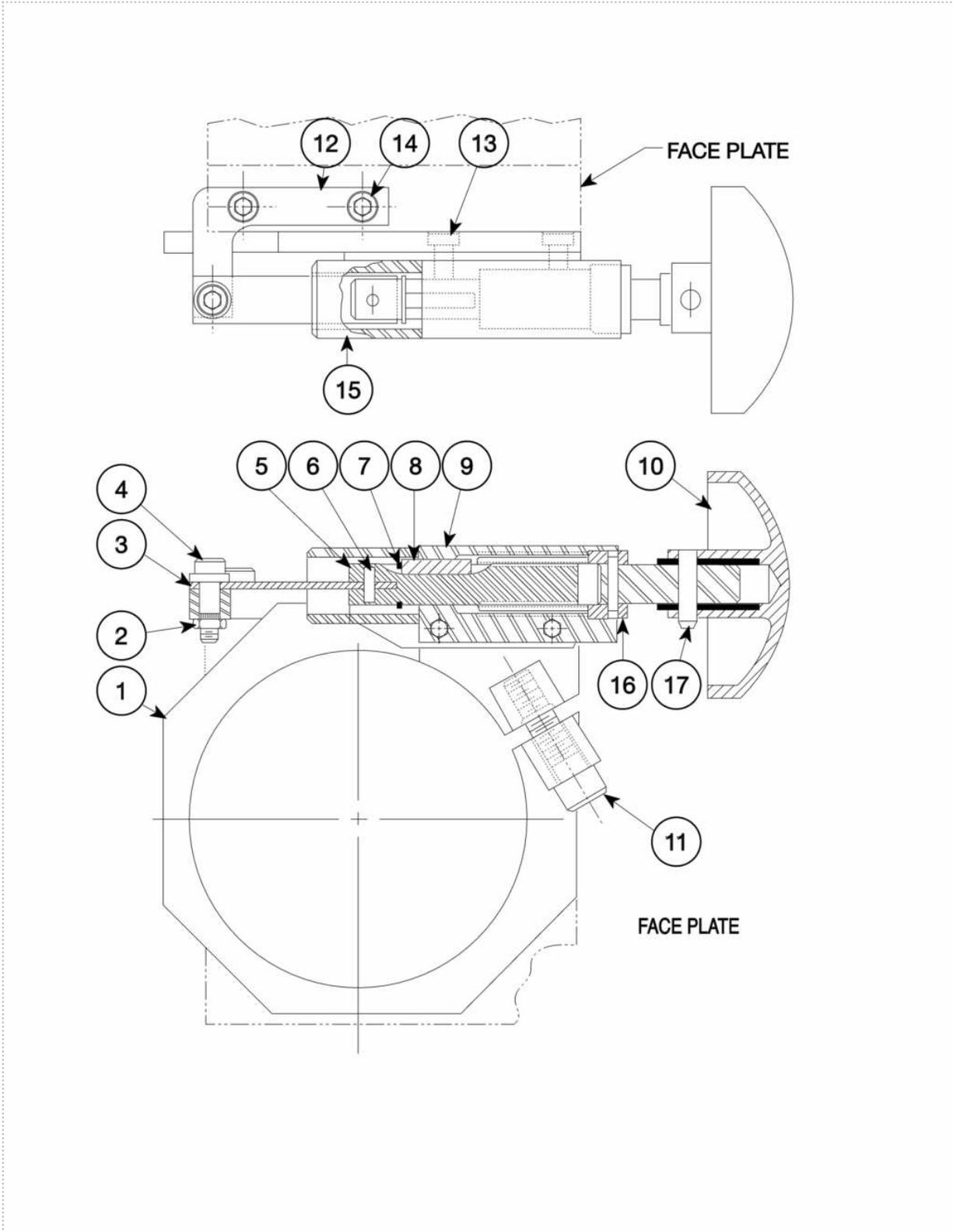


P-100-F.jpg

## Cross Seam Adjuster

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM10802	CROSS SEAM ADJUSTER	1
1	9SM10787	CLAMPING RING ASBLY	1
2	9SCF000010	#10-24HN	1
3	9ST8701-1	SPRING	1
4	9ST12535	SHOULDER SCREW ASBLY	1
5	9SS13202	ADJUSTING SCREW	1
6	9ST9967-8	ROLL PIN	1
7	9SS9776-3	RETAINING RING	1
8	9SM8776-6	KEY	1
9	9SS13203	ADJUSTING BLOCK	1
10	9ST8312	KNOB	1
11	9ST9447-18	SOCKET HEAD CAP SCREW	1
12	9SS13204	MOUNTING ARM	1
13	9SS25930-6	TORX BUTTON HEAD SCREW 1/4-20X.62	2
14	9SS25930-1	142TORX BUTTON HEAD SCREW 1/4-20X.88	2
15	9SS13233	SPATTER GUARD ASBLY	1
16	9ST12537	CROSS SEAM SLEEVE ASBLY	1
17	9ST8433	DRIVE PIN	1

# Cross Seam Adjuster

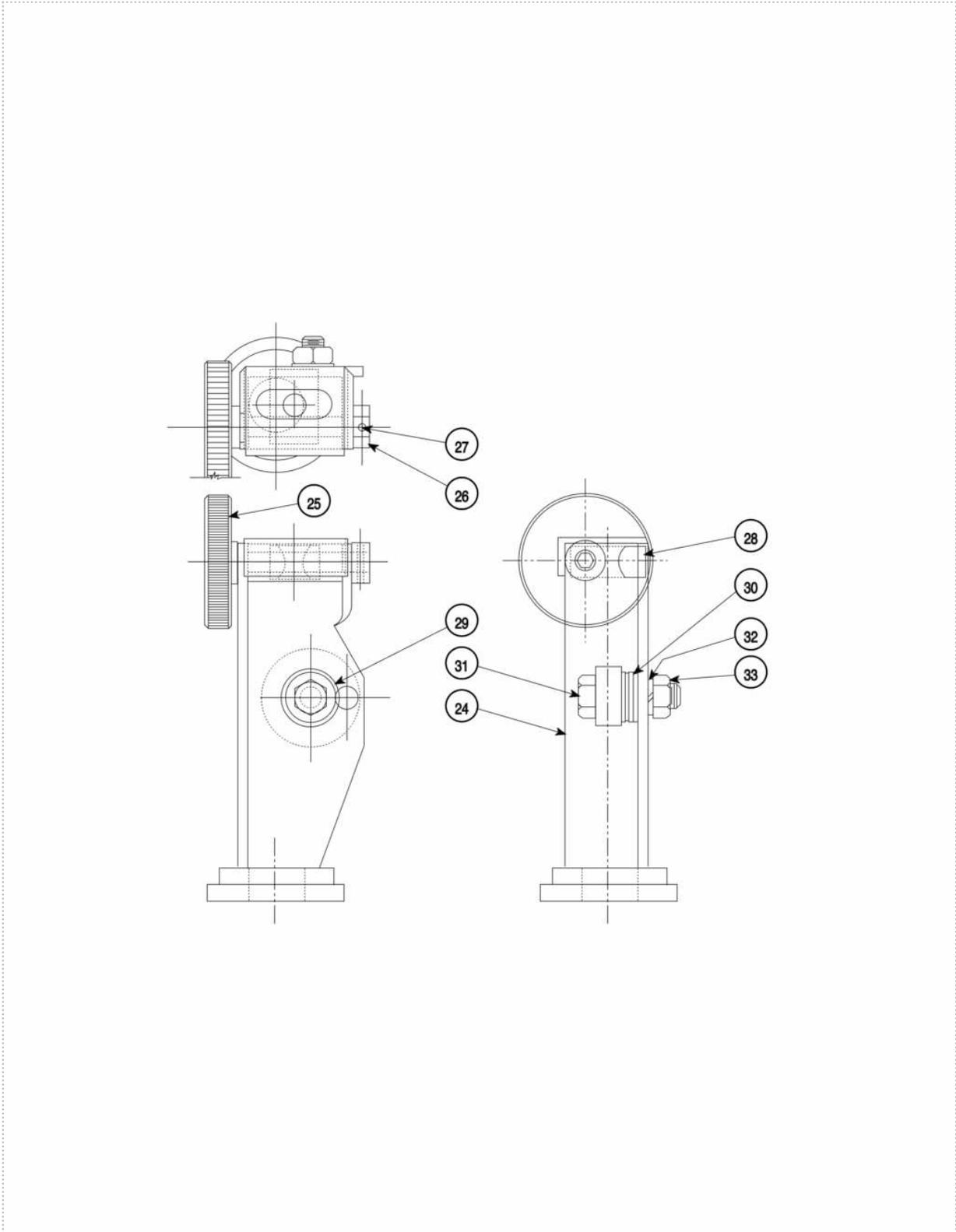


P-100-L.jpg

## Solid Wire Straightener

KEY	PART NUMBER	DESCRIPTION	QTY
	9SM8269-1	WIRE STRAIGHTENER ASBLY	1
24	9SM8268	WIRE STRAIGHTENER BODY ASBLY	1
25	9SS10159	CROSS SLIDE SCREW ASBLY	1
26	9ST10585	BUSHING	1
27	9ST9967-5	PINS	1
28	9ST10584	SLIDE BUSHING	1
29	9SM9300-55	BEARING	2
30	9SS9262-140	PLAIN WASHER	2
31	9SCF000028	5/16-18X1.25HHCS	1
32	9SE106A-3	LOCKWASHER	1
33	9SCF000029	5/16-18HN	1

# Solid Wire Straightener



P-100-M.jpg



Service Navigator 2.0

**NA-5 - 12438**

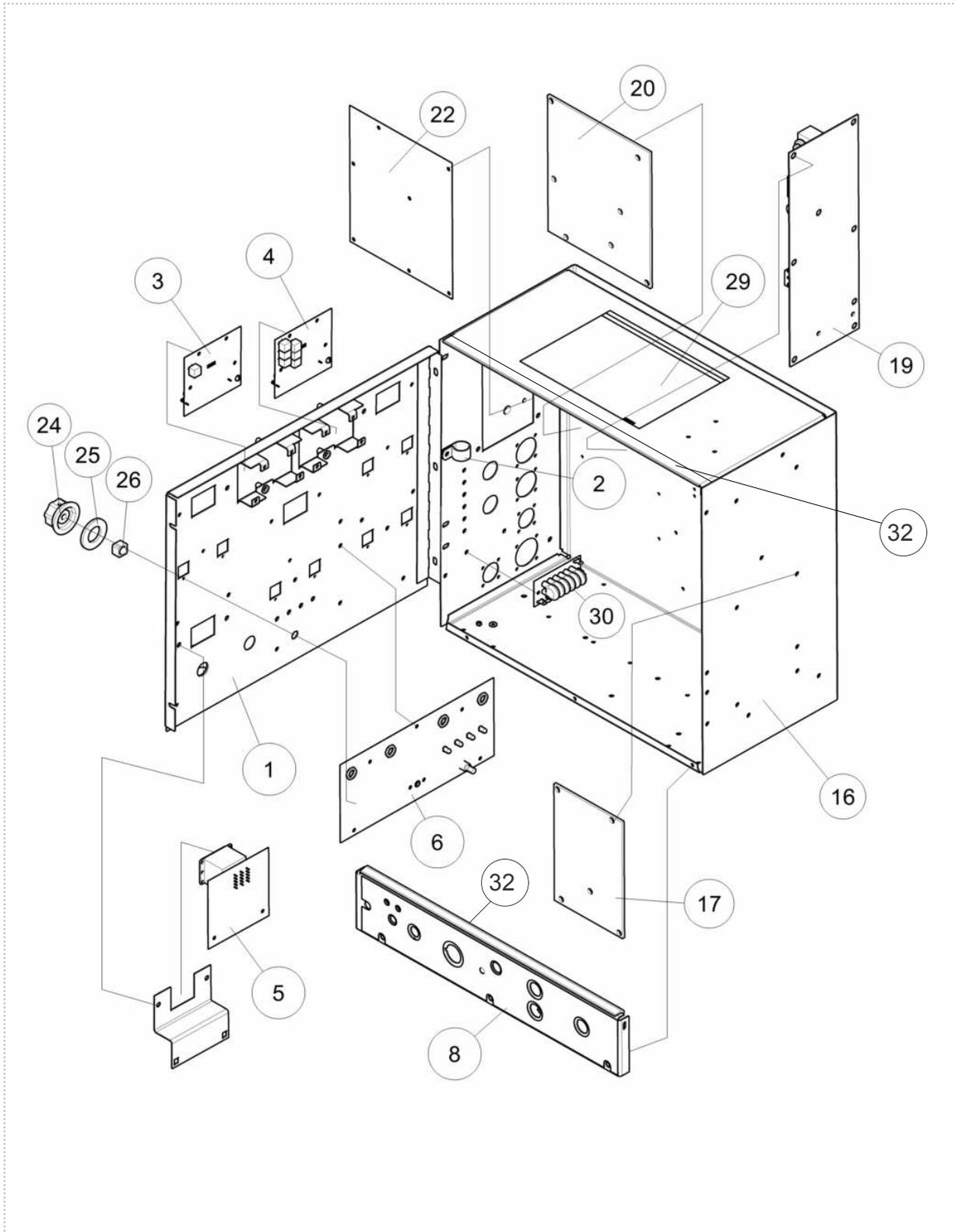
## Index of Sub Assemblies - 12438

KEY	PART NUMBER	DESCRIPTION	QTY
	P-932-A	Index of Sub Assemblies	AR
	P-932-C	Control Box Assembly	AR
	P-932-D	Control Box Door Assembly	AR
	P-932-E	Control Box	AR

## Control Box Assembly

KEY	PART NUMBER	DESCRIPTION	QTY
1	9SS16706-1	CONTROL BOX DOOR ASBLY	1
2	9ST12563-8	LEAD CLAMP	1
3	9SL6685-1	METER PC BD ASBLY	1
4	9SL6233	SPEED METER PC BD ASBLY	1
5	K337-10	Burnback Timer Printed Circuit Board	1
6	9SG1566-3	PROCEDURE PC BD ASBLY	1
	9SS16695	PROCEDURE BD INSULATION	1
8	9SS16713-2	SWITCH PANEL ASSEMBLY	1
	9ST12287-10	CIRCUIT BREAKER	1
	9ST10800-23	SWITCH-TOGGLE	1
	9SM20853	E-STOP SWITCH	1
	9ST13486	PILOT LIGHT	1
	9ST13541-2	SWITCH	2
	9ST13541-1	SWITCH	1
	9SM13935-2	NAMEPLATE	1
	9SS31559-1	GLP SOLDERING	1
	9SS8025-80	SELF TAPPING SCREW	2
16	9SS16991-1	CONTROL BOX WELDED ASBLY	1
17	9SL6445	CONTROL PC BD ASBLY	1
	9SS14020-3	PLASTIC EXPANSION NUT	7
19	9SG1556-5	VOLTAGE PC BD ASBLY	1
20	9SL6242-2	LOGIC PC BD ASBLY	1
	9SS14020-3	PLASTIC EXPANSION NUT	7
22	9SL6252-3	POWER PC BD ASBLY	1
	9SS14020-3	PLASTIC EXPANSION NUT	7
24	9ST10491	KNOB	4
25	9ST14034	SEAL	4
26	9ST14767	SQUARE INSULATING TUBE	4
	9ST13498-10	JUMPER PLUG ASBLY	2
	9ST13498-1	JUMPER PLUG	1
29	9SS20601-8	WARNING DECAL	1
30	9SM14133-1	R.F. BYPASS PC BD ASBLY	1
	9ST13639	ROTARY SWITCH KNOB	1
32	9ST11019-14	EDGE GUARD	2

# Control Box Assembly

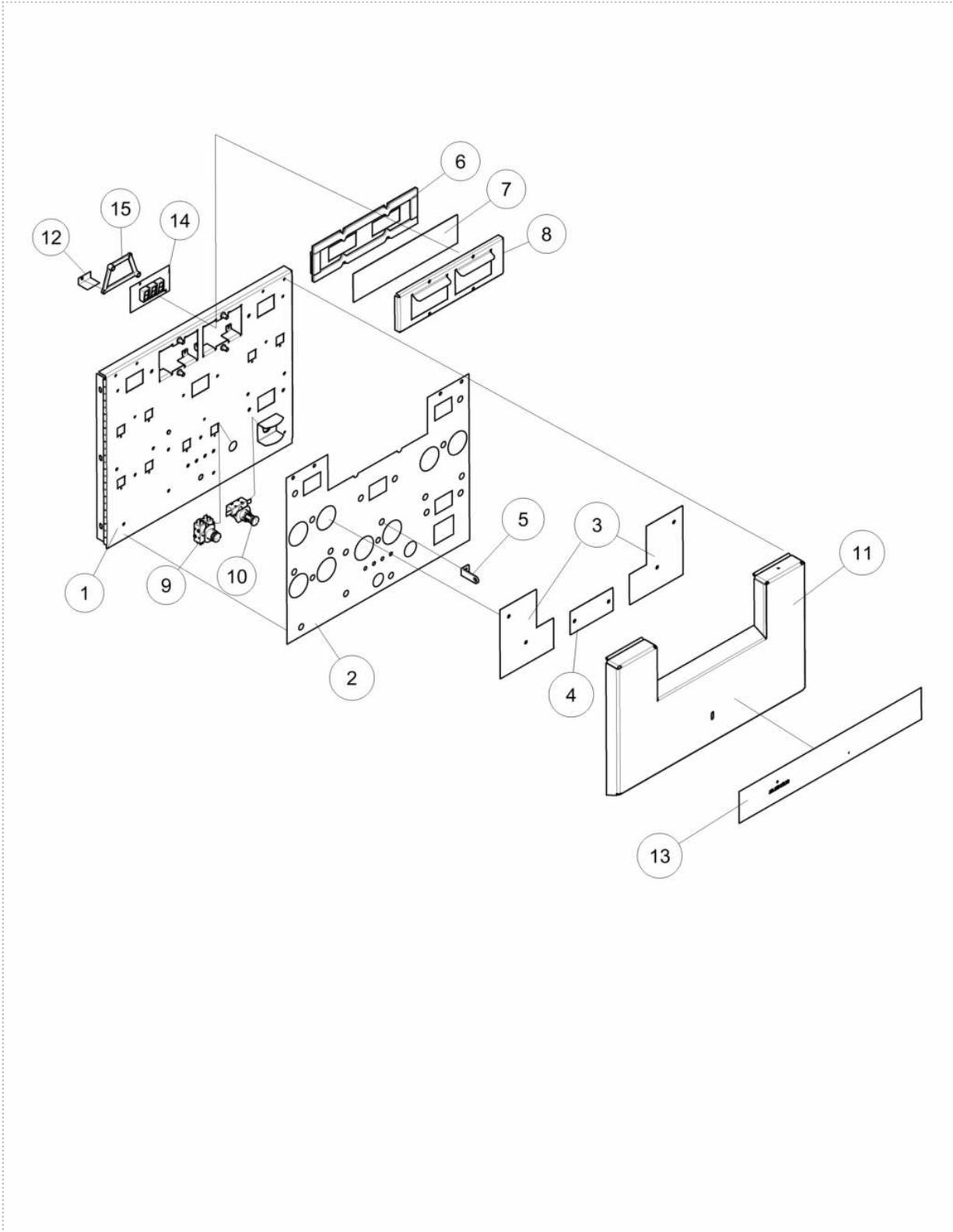


P-932-C.jpg

## Control Box Door Assembly

KEY	PART NUMBER	DESCRIPTION	QTY
1	9SS16706-1	CONTROL BOX DOOR ASBLY	1
2	9SL6243-2	NAMEPLATE	1
3	9SS16696	NAMEPLATE COVER	2
4	9SS10509-108	NAMEPLATE COVER	1
5	9ST10045-40	LOCK TAB	1
6	9SS17720	BEZEL ASBLY	1
7	9ST14807-2	FILTER LENS	1
8	9SM13934	METER SHIELD FRAME	1
9	9ST14751-1	ACTUATOR & SWITCH ASBLY	1
10	9ST13541-2	SWITCH	1
11	9SM13936	SECURITY PANEL ASBLY	1
12	9ST14468	INSULATION	2
13	9SL12800	NAMEPLATE	1
14	9SM14490-2	DIGITAL VOLTMETER PC BD ASBLY	2
15	9SM14537	PC BD SPACER	2

# Control Box Door Assembly

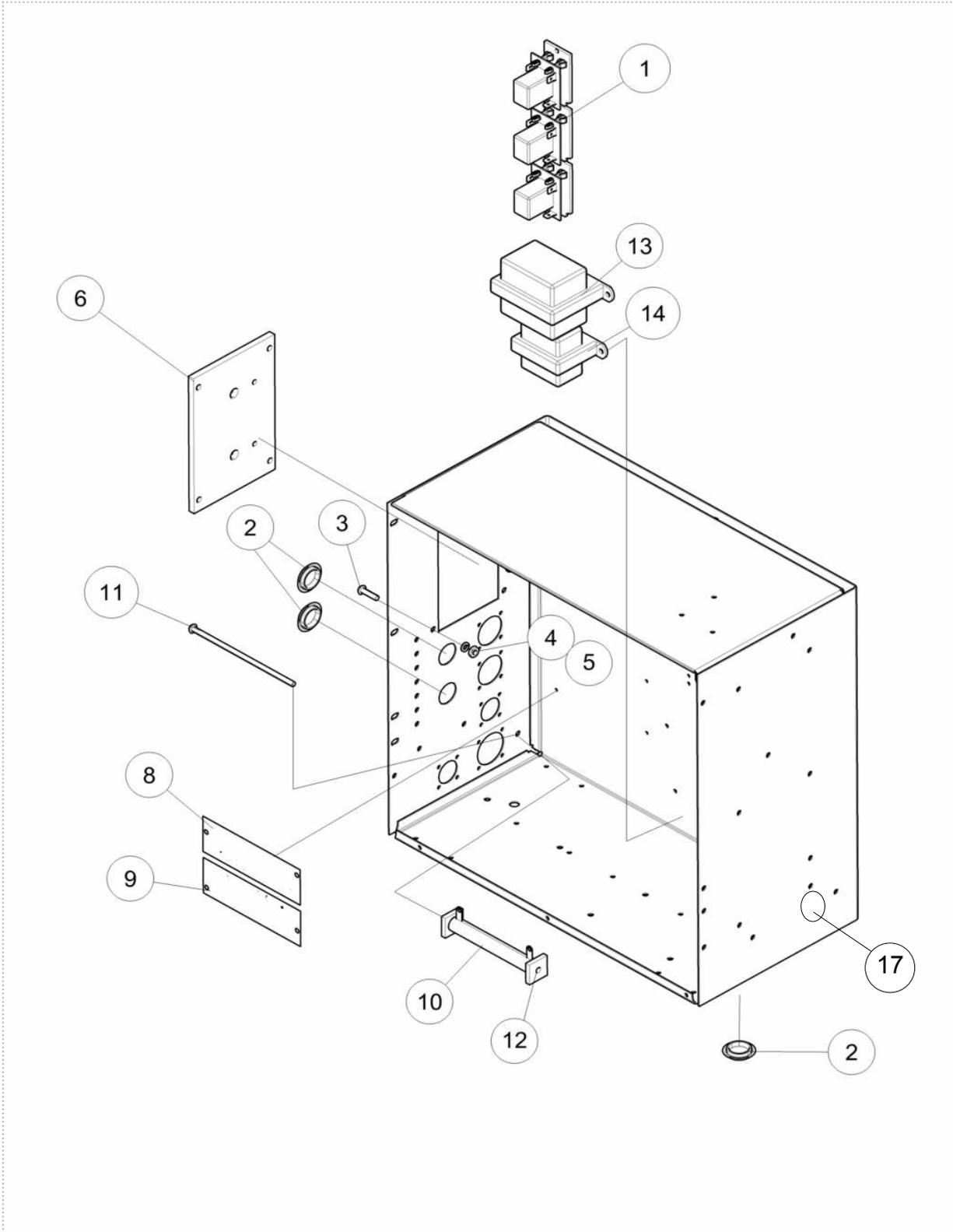


P-932-D.jpg

## Control Box

KEY	PART NUMBER	DESCRIPTION	QTY
	9SS16991-1	CONTROL BOX WELDED ASBLY	1
1	9SS22182	RELAY MODULE ASBLY	3
2	9ST13597-1	PLUG BUTTON	3
3	9SS9225-36	THREAD FORMING SCREW (CUTTING)	1
4	9ST9695-1	LOCKWASHER	1
5	9SCF000010	#10-24HN	2
6	9SS16705	REED SWITCH	1
	9SS12334-35	REED SWITCH ASBLY	1
8	9ST10726-139	NUMBER PLATE	1
9	9ST10726-138	NUMBER PLATE	1
10	9SS10404-75	RESISTOR	1
11	9SCF000045	#10-24X5.00RHS	1
12	9ST4479-A	INSULATING WASHER	2
13	9SS16711	TRANSFORMER ASBLY	1
14	9SS17101	TRANSFORMER & LEAD ASBLY	1
	9ST13941	CABLE TIE MOUNT	2
	9SG8549	HARNESS ASSEMBLY	1
17	9ST10397-10	PLUG BUTTON	1
	9SS14530-5	TERMINAL STRIP	2
	9ST13962	SLOTTED JUMPER	1
	9ST10728-14	FUSE	1

# Control Box



P-932-E.jpg

# Recommended Accessories



**Solenoid Assembly**  
Valve to automatically control water flow when using cooling attachment on K148 contact assemblies. Can also be used to control gas.  
**Order K223**



**Starting or Crater Module**  
Permits additional settings of wire feed speed and voltage for an adjustable period of time (10 seconds max). Can be used for either a starting procedure or a crater fill procedure. If both are required, two assemblies must be ordered.  
**Order K334**



**Remote Interface Module**  
Permits remote operation of the NA-5 Inch Up, Inch Down, Start and Stop Functions by either of the following user-supplied external signals and provides electrical isolation of the NA-5 control circuitry from these signals:

- **Switches**  
Momentary closure of contacts rated for 24 volts, 5 milliamperes, DC.
- **24 Volt Signals**  
Momentary application of 24 volt  $\pm 10\%$  AC or DC signal capable of 5 milliamperes steady state. (15 amp peak capacitive in rush) per input. This module can be used with all codes of NA-5 Controls and replaces the earlier K336 Remote Pushbutton Interface Module, which provided for only external switch closure signals.  
**Order K336**



**Weld Timer Module**  
Permits setting of weld time for an adjustable period of time. Eliminates need to press stop pushbutton. The timer unit is adjustable from 0.00 - 9.99 seconds.  
**Order K337-10**

**Control To Head Extension Cable Assembly**

The standard head is equipped with cables which permit the head to be mounted up to four feet from the controls. "F" models, however, do not include electrode cables. When the head is mounted further away from the control, extension cable assemblies must be purchased. For the NA-5S head: Includes motor, tachometer, and flux valve lead extensions with polarized plugs and electrode. 26 ft. length.  
**Order K335-26**



Recommended for the NA-5N, and SF heads. It is the same as the K335 without the flux valve lead extension. Available in 46 ft. lengths.  
**Order K338-46**

**Mounting Kit**  
For use if the NA-5 control box is to be mounted on the carriage.  
**Order T14469**



**SINGLE ELECTRODE**  
**Submerged Arc Contact Nozzle Assembly for 3/32 in. (2.4 mm), 1/8 in. (3.2 mm) and 5/32 in. (4.0 mm) electrodes.**  
For 5/64 in. (2.0 mm), 3/16 in. (4.8 mm) or 7/32 in. (5.6 mm) sizes, order additional appropriate KP1962 tips. Outer flux cone gives full flux coverage with minimum consumption.  
(Rated up to 650 amps.)  
**Order K231-1**



**K231 Nozzle Contact Tips**  
**Order Severe Duty KP2082-2B1**  
for 5/64 in. (2.0 mm) wire  
**KP1962-3B1**  
for 3/32 in. (2.4 mm) wire  
**KP1962-1B1**  
for 1/8 in. (3.2mm) wire  
**KP1962-4B1**  
for 5/32 in. (4.0 mm) wire  
**KP1962-2B1**  
for 3/16 in. (4.8 mm) wire  
**KP1962-5B1**  
for 7/32 in. (5.6 mm) wire

**Extended Life**  
**KP3162-3B1**  
for 3/32 in. (2.4 mm) wire  
**KP3162-1B1**  
for 1/8 in. (3.2 mm) wire  
**KP3162-4B1**  
for 5/32 in. (4.0 mm) wire  
**KP3162-2B1**  
for 3/16 in. (4.8 mm) wire  
**KP3162-5B1**  
for 7/32 in. (5.6 mm) wire



**Narrow Gap Deep Groove Nozzle**  
For single arc 3/32 in. (2.4 mm) diameter wire welding on thick walled steel plate with nearly parallel-sided, narrow gap joint preparations.  
**Order K386**



**Contact Jaw Assembly**  
Single arc contact jaw assembly for 1/8-7/32 in. (3.2-5.6 mm) diameter wire. Rugged contact jaws for maximum life at currents over 600 amps.  
**Order K226R**



**TWINARC®**  
**Tiny Twinarc® Wire Straightener**  
Straightens wire diameters .045 thru 3/32 in. (1.2 thru 2.4 mm). Particularly valuable on longer electrical stickout procedures.  
**Order K281**



**Tiny Twinarc®**  
Feeds two 1/16, 5/64, or 3/32 in. (1.6, 2.0, or 2.4 mm) electrodes for high speed submerged arc welds on thin gauge (1.89 mm) to heavy plate. Includes contact nozzle, wire guides, drive rolls and guides, and a second wire reel and mounting bracket.  
**Order K129-1/16**  
**K129-5/64**  
**K129-3/32**



**Large Wire Twinarc® Contact Assemblies**  
Feeds two 5/64 in. (2.0 mm), 3/32 in. (2.4 mm) or 1/8 in. (3.2 mm) wires for submerged arc welding on "Fast-Fill" joints or hardfacing beads.  
**Order K225**



**GENERAL OPTIONS**  
**Concentric Flux Cone Assembly**  
For use with K148B, Positive Contact Nozzle Assembly. Gives concentric flux coverage around the electrode.  
**Order K285**



**Positive Contact Assembly**  
For single arc welding at high currents (optional T12928 water cooling attachment recommended when welding over 600 amps).  
**Order K148A**  
(for 3/32 to 1/8 in. wire)  
**Order K148B**  
(for 5/32 to 3/16 in. wire)



**ESO (Extended Stick-Out) Extension**  
Linc-Fill long stickout extension for K148A Single Arc Positive Contact Nozzle Assembly. Required for long stickout technique.  
**Order K149-5/32**



**5 in. Nozzle Extension**  
Extends the wire for subarc nozzles by 5 inches (up to 1/4 in. (6.4 mm) diameter wire).  
**Order KP2721-1**



**Horizontal Head Adjuster**  
Provides crank adjustment of head position. Has 2 in. (51 mm) horizontal travel.  
**Order K96**



**Vertical Lift Adjuster**  
Provides 4 in. (102 mm) hand crank adjustment of vertical head position. It also includes up to 3-3/4 in. (95.2 mm) in-and-out horizontal adjustment with stops that can be preset for simple repetition of the same adjustment.  
**Order K29**



**SpreadArc Oscillator**  
Oscillates head across the line of travel. Calibrated dwell time and oscillation speed controls permit the SpreadArc to cover large areas quickly with smooth beads of minimum admixture.  
**Order K278-1**



**TC-3 Self-Propelled Travel Carriage**  
The TC-3 travel carriage allows the mounting of up to two feed heads/controllers and wire reels to a beam for basic hard automation installations.  
**Order K325 HCS**  
(for 5-75 ipm)

# Recommended Accessories



**Automatic Flux Hopper Assembly**  
Flux Hopper for MAXsa™ 29 Heads (included standard on the MAXsa™ 22 Heads).  
**Order K219**



**Tandem Reels**  
Two Wire Reel Mounting for TC-3.  
**Order K390**



**Flux Hopper**  
Tandem Arc Flux Hopper for K387 mountings.  
**Order K389**



**Wire Reel Assembly for 50-60 lb. Coils**  
Accommodates 50 lb. (22.7 kg) or 60 lb. (27.2 kg) coils of wire on automatic wire feeders. The unit includes a wire reel mounting spindle and braking system. Cannot be used with K2462-1.  
**Order K299**



**Tandem Arc Framework**  
Provides mountings with desired positioning adjustments for two standard Automatic Wire Feed Heads. Includes insulation and hardware to permit direct mounting to a high capacity TC-3 Carriage, or to the user's gantry or fixture for either direction of travel.  
**Order K387**



**Wire Straightener (Subarc) up to 7/32 in. (5.6 mm)**  
Includes a three roll wire straightener with adjustable pressure. (1 included with each tractor and MAXsa™ Feed Head.)  
**Order K1733-5**

## WELD POWER CABLES

Product Number	Description
K2163-35	Lug to Lug, 4/0, 35 ft. (10.7 m) (Two cables per package)
K2163-60	Lug to Lug, 4/0, 60 ft. (18.3 m) (Two cables per package)
K1842-110	Lug to Lug, 4/0, 600A, 60% duty cycle, 110 ft. (33.5 m)

## DRIVE ROLL / GUIDE TUBE KITS

Product Number	Wire Size in. (mm)	Gear Ratio Head
KP1899-1 KP1899-2	3/32 – 7/32 (2.4 – 5.6) 1/16, 5/64, 3/32 (1.6, 2.0, 2.4)	142:1 and 95:1
KP1899-2 KP1899-3 KP1899-4	1/16, 5/64, 3/32 (1.6, 2.0, 2.4) .035, .045, .052 (0.9, 1.1, 1.3) .045 – .052 Cored (1.1 – 1.3)	57:1

## NA-5S and NA-5SF

Product Name	Product Number	Wire Size in. (mm)	Gear Ratio	Wire Feed Speed ipm (m/min)	Max. Solid Wire Size <sup>(2)</sup> in. (mm)
NA-5S	K346A	3/32-7/32 (2.4-5.6)	142:1	15-290 (0.4-7.4)	7/32 (5.6)
NA-5S	K346B	1/16-3/32 (1.6-2.4)	95:1	22-425 (0.6-10.8)	1/8 (3.2)
NA-5SF	K347A <sup>(1)</sup>	3/32-7/32 (2.4-5.6)	142:1	15-290 (0.4-7.4)	7/32 (5.6)
NA-5SF	K347B <sup>(1)</sup>	1/16-3/32 (1.6-2.4)	95:1	22-425 (0.6-10.8)	1/8 (3.2)

<sup>(1)</sup> For the K347 Head, order the K338 extension.

<sup>(2)</sup> For gear ratios shown.

## CONTROL CABLE, EXTENSIONS AND ADAPTER

Product Number	Description
K1820-10	Control Cable Female 9 pin to Male 14 pin, 10 ft. (3.1 m)
K1797-10*	Control Cable Extension, Male 14 pin to female 14 pin, 10 ft. (3.1 m)
K1797-25*	Control Cable Extension, Male 14 pin to female 14 pin, 25 ft. (7.6 m)
K1797-50*	Control Cable Extension, Male 14 pin to female 14 pin, 50 ft. (15.2 m)
K1798	Control Cable Adapter Female 14 pin to terminal strip

\* Requires K1820-10

## WIRE SIZE CONVERSION KITS

Kit No.	Wire Size in. (mm)	Gearbox
T13724B	1/16 – 3/32 (1.6 – 2.4)	142:1
T13724B	1/16 – 3/32 (1.6 – 2.4)	95:1
T13724B T13724C T13724D	1/16 – 3/32 (1.6 – 2.4) .035 – .052 (0.9 – 1.3) .045 – .052 (1.1 – 1.3) Cored	57:1

<b>WARNING</b>	<ul style="list-style-type: none"> <li>● Do not touch electrically live parts or electrode with skin or wet clothing.</li> <li>● Insulate yourself from work and ground.</li> </ul>	<ul style="list-style-type: none"> <li>● Keep flammable materials away.</li> </ul>	<ul style="list-style-type: none"> <li>● Wear eye, ear and body protection.</li> </ul>
Spanish <b>AVISO DE PRECAUCION</b>	<ul style="list-style-type: none"> <li>● No toque las partes o los electrodos bajo carga con la piel o ropa mojada.</li> <li>● Aislese del trabajo y de la tierra.</li> </ul>	<ul style="list-style-type: none"> <li>● Mantenga el material combustible fuera del área de trabajo.</li> </ul>	<ul style="list-style-type: none"> <li>● Protéjase los ojos, los oídos y el cuerpo.</li> </ul>
French <b>ATTENTION</b>	<ul style="list-style-type: none"> <li>● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension.</li> <li>● Isolez-vous du travail et de la terre.</li> </ul>	<ul style="list-style-type: none"> <li>● Gardez à l'écart de tout matériel inflammable.</li> </ul>	<ul style="list-style-type: none"> <li>● Protégez vos yeux, vos oreilles et votre corps.</li> </ul>
German <b>WARNUNG</b>	<ul style="list-style-type: none"> <li>● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung!</li> <li>● Isolieren Sie sich von den Elektroden und dem Erdboden!</li> </ul>	<ul style="list-style-type: none"> <li>● Entfernen Sie brennbares Material!</li> </ul>	<ul style="list-style-type: none"> <li>● Tragen Sie Augen-, Ohren- und Körperschutz!</li> </ul>
Portuguese <b>ATENÇÃO</b>	<ul style="list-style-type: none"> <li>● Não toque partes elétricas e electrodos com a pele ou roupa molhada.</li> <li>● Isole-se da peça e terra.</li> </ul>	<ul style="list-style-type: none"> <li>● Mantenha inflamáveis bem guardados.</li> </ul>	<ul style="list-style-type: none"> <li>● Use proteção para a vista, ouvido e corpo.</li> </ul>
Japanese <b>注意事項</b>	<ul style="list-style-type: none"> <li>● 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。</li> <li>● 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。</li> </ul>	<ul style="list-style-type: none"> <li>● 燃えやすいものの側での溶接作業は絶対にはなりません。</li> </ul>	<ul style="list-style-type: none"> <li>● 目、耳及び身体に保護具をして下さい。</li> </ul>
Chinese <b>警告</b>	<ul style="list-style-type: none"> <li>● 皮肤或湿衣物切勿接觸帶電部件及鋸條。</li> <li>● 使你自已與地面和工件絕緣。</li> </ul>	<ul style="list-style-type: none"> <li>● 把一切易燃物品移離工作場所。</li> </ul>	<ul style="list-style-type: none"> <li>● 佩戴眼、耳及身體勞動保護用具。</li> </ul>
Korean <b>위험</b>	<ul style="list-style-type: none"> <li>● 전도체나 용접봉을 젖은 헝겊 또는 피부로 절대 접촉치 마십시오.</li> <li>● 모재와 접지를 접촉치 마십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 인화성 물질을 접근시키지 마십시오.</li> </ul>	<ul style="list-style-type: none"> <li>● 눈, 귀와 몸에 보호장구를 착용하십시오.</li> </ul>
Arabic <b>تحذير</b>	<ul style="list-style-type: none"> <li>● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الإلكترود بجلد الجسم أو بالملايس المبللة بالماء.</li> <li>● ضع عازلا على جسمك خلال العمل.</li> </ul>	<ul style="list-style-type: none"> <li>● ضع المواد القابلة للاشتعال في مكان بعيد.</li> </ul>	<ul style="list-style-type: none"> <li>● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.</li> </ul>

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

**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 للمنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

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