

# DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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OPERATOR'S, ORGANIZATIONAL  
DIRECT SUPPORT, GENERAL SUPPORT  
AND  
DEPOT MAINTENANCE MANUAL

WELDING SET  
ARC, INERT GAS SHIELDED: WATER COOLED  
ALUMINUM WELDING, GENERAL PURPOSE  
(AIRCO MODEL 2351 1209)  
FSN 3431-731-4163

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<p>This copy is a reprint which includes current pages from Changes 1</p>
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HEADQUARTERS, DEPARTMENT OF THE ARMY

25 JUNE 1969

#### SAFETY PRECAUTIONS

Trechloroethylene or methylchloroform will have toxic effects unless proper ventilation is provided, or if allowed to have prolonged contact with the skin.

Point the cylinder valve away from your body before opening.

Whenever steps are taken to remove and repair electrical hazards, place all power controls off and disconnect all electrical cabling from power sources.

CHANGE )  
No. 1 )

HEADQUARTERS,  
DEPARTMENT OF THE ARMY  
WASHINGTON, D. C., 28 September 1973

Operator's, Organizational, Direct Support,  
General Support and Depot Maintenance Manual  
WELDING SET, ARC; INERT GAS SHIELDED; WATER COOLED; ALUMINUM WELDING; •  
GENERAL PURPOSE (AIRCO MODEL 2351 1209) FSN 3431-731-4163

TM 5-3431-226-15, 25 June 1969, is changed as follows:

**Page ii** Table of Contents. Appendix B is changed to read, "BASIC ISSUE ITEMS AND ITEMS TROOP INSTALLED OR AUTHORIZED".

**Page 1.** Paragraph 1.1b. The second sentence is changed to read "Appendix B contains the Basic Issue Items and Troop Installed or Authorized Items Lists."

Paragraph 1.2.1 is added.

#### 1.2.1. Reporting of Errors

You can improve this manual by calling attention to errors and by recommending improvements using DA Form 2026 (Recommended Changes to Publications) or by a letter, and mail direct to Commander, U.S. Army Troop Support Command, ATTN: AMSTS-MPP, St. Louis, MO 63120. A reply will be furnished direct to you.

*Following page 74* Page B-2 is rescinded in its entirety.

*Page 76.* Add the following before Section I, "Part 6, HEAVY DUTY WATER CIRCULATOR, 10-GALLON".

*Page A1,* Paragraph 2 add the following.

AR 740-1           Color, Marking, and Preparation of Equipment for Shipment.

AR 746-5           Color and Marking of Army Materiel.

Paragraph 3, add the following.

FM 29-2           Organizational Maintenance Management.

TM 5-764           Electric Motor and Generator Repair.

Paragraph 4. TB 740-93-2, is changed to read, "TB 740-97-2".

Add the following:

TM 38-230-2       Preservation, Packaging and Packing of Military Supplies and Equipment (Packing).

Paragraph 5 is added.

#### 5. Demolition-

TM 750-244-3       Procedures for Destruction of Equipment to Prevent Enemy Use.

Paragraph 6 is added.

#### 6. Lubrication

C9100IL           Fuels, Lubricants, Oils, and Waxes.

Paragraph 7 is added:

#### 7. Cleaning

TM 38-230-1       Preservation, Packaging, and Packing of Military Supplies and Equipment (Cleaning).

Paragraph 8 is added.

#### 8. Operation

TM 9-237           Welding Theory and Operation.

Page B-1. Appendix B is superseded as follows:

# APPENDIX B

## BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

### Section I. INTRODUCTION

**B-1. Scope**

This appendix lists items required by the operator for operation of the welding set.

**B-2. General**

This list is divided into the following sections:

*a. Basic Issue Items List - Section II.* Not applicable.

*b. Items Troop Installed or Authorized List-Section III.* A list of items in alphabetical sequence, which at the discretion (If the unit commander may accompany the welding set. These items are **NOT SUBJECT TO TURN-IN** with the welding set when evacuated.

**B-3. Explanation of Columns**

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

*a. Source, Maintenance and Recoverability Code (SMR).* Not applicable.

*b. Federal Stock Number.* This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

*c. Description* This column indicates the Federal item name and any additional description of the item required.

*d. Unit of Measure (U/M).* A two character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

*e. Quantity Furnished with Equipment (BIIL),* Not applicable.

*f. Quantity Authorized (Items Troop Installed or Authorized).* This column indicates the quantity of the item authorized to be used with the equipment.

### Section III. ITEMS TROOP EN STALLED OR AUTHORIZED LIST

(1) Smr code	(2) Federal stock number	(3) Description  Ref No. & mfr code	Usable on code	(4) Unit of meas	(5) Qty auth
	7520-559-9618	CASE, Maintenance and Operation Manuals		EA	1

**By Order of the Secretary of the Army:**

Official:

**VERNE L. BOWERS**  
Major General, United States Army  
The Adjutant General

CREIGHTON W. ABRAMS  
General United States Army  
chief of Staff

**Distribution:**

To be distributed in accordance with DA Form 12-25A (qty rqr block No. 182) Organizational maintenance requirements for Welding Sets.

TECHNICAL MANUAL

NO. 5-3431-226-15

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 25 JUNE 1969

Operator Is, Organizational, Direct Support,  
General Support, and Depot Maintenance Manual

WELDING SET, ARC, INERT GAS SHIELDED: WATER COOLED;  
ALUMINUM WELDING, GENERAL PURPOSE  
(AIRCO MODEL 2351 1209)  
FSN 3431-731-4163

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PART I  
GENERAL

Section I. INTRODUCTION

1.1 Scope

a. This manual is published for the use of personnel to whom the Arc Welding Set (Airco Model 2351-1209) is issued. The set consists of five end items described in Parts II through VI. Each part furnishes instruction on the installation, operation, and maintenance of a specific end item.

b. Appendix A contains a list of publications applicable to this manual. Appendix B contains a list of basic Issue items authorized the operator of this equipment. Appendix C contains the maintenance allocation chart.

1.2 Forms and Records

Forms and procedures used for equipment maintenance will be only those prescribed in TM 38-750 (Army Equipment Record Procedures).

Section II. DESCRIPTION AND DATA

1.3 Description

The five end items comprising the set are listed below together with their part numbers.

<u>Item</u>	<u>Part Number</u>
Style 8000 Regulator	8068054
Model AHC-1 Gun	2351 1150
Model AHF-E1 Feeder	2351 1100
Model AHC-B Control	2351 0504
Water Circulator Unit	2304 0171

1.4 Tabulated Data

a. Welding Set/

<u>Item</u>	<u>Part Number</u>	<u>Amount</u>
Hose Connection Gland	803-0247	4
Hose Connection Nut (L.H.)	803-0254	2
Hose Connection Nut (R.H.)	803-0255	2

<u>Item</u>	<u>Part Number</u>	<u>Amount</u>
Regulator	806-8054	1
Argon Flow Adapter	830-1976	1
50 Ft. Long Gas Hose	908-2210	1
60 Ft. Long Water Hose	908-3210	1
120 Ft. Long Welding Cable	1322-2000	1
Terminal Lug	1323-0200	5
Ground Clamp	0702-0002	1
Water Circulator Unit	2304-0171	1
10 Lb. Spool 3/64 in. Diameter Magnesium Aluminum Wire	2332-5623	2
10 Lb. Spool 1/16 in. Diameter Magnesium Aluminum Wire	2332-5624	2
Model AHC-B Aircomatic Control	2351-0504	1
Model AHF-E1 Wire Feeder	2351-1100	1
Model AH35C-1 Gun	2351-1150	1
Secondary Contactor	2354-0102	1
Wire Guide Component Kit	2354-0126	1
Wire Guide Component Kit	2354-0127	1
Hose and Cable Kit	2360-2204	
244 Cu. Ft. Cylinder W.P. Technical Argon FSN 8120-282-8077 MIL-A-18455B		4
Scratch Wire Brush, Steel, 1 1/8 to 1 1/4 in. Lg., Clear of Block, 16 Rows Ig., 4 Rows Wide, Shoe Handle, Straight Rectangular Face; 4 3/4 to 5 in. Lg., Brush Parts; 10 1/2 in. Lg.; Federal Specification H-B-178b, Type III, Class 1		2

b. Auxiliary and Accessory Items. The remaining parts of the set consist of auxiliary items required for metal-inert-arc, gas-shielded welding of aluminum, in addition to accessory items required to adapt the major end items for use.

c. Wiring Data

- (1) Refer to figure 1 for the electrical schematic diagram.
- (2) Refer to figure 2 for the wiring diagram control panel.
- (3) Refer to figure 3 for the interconnection schematic.
- (4) Refer to figure 4 for the gun and feeder wiring diagram.



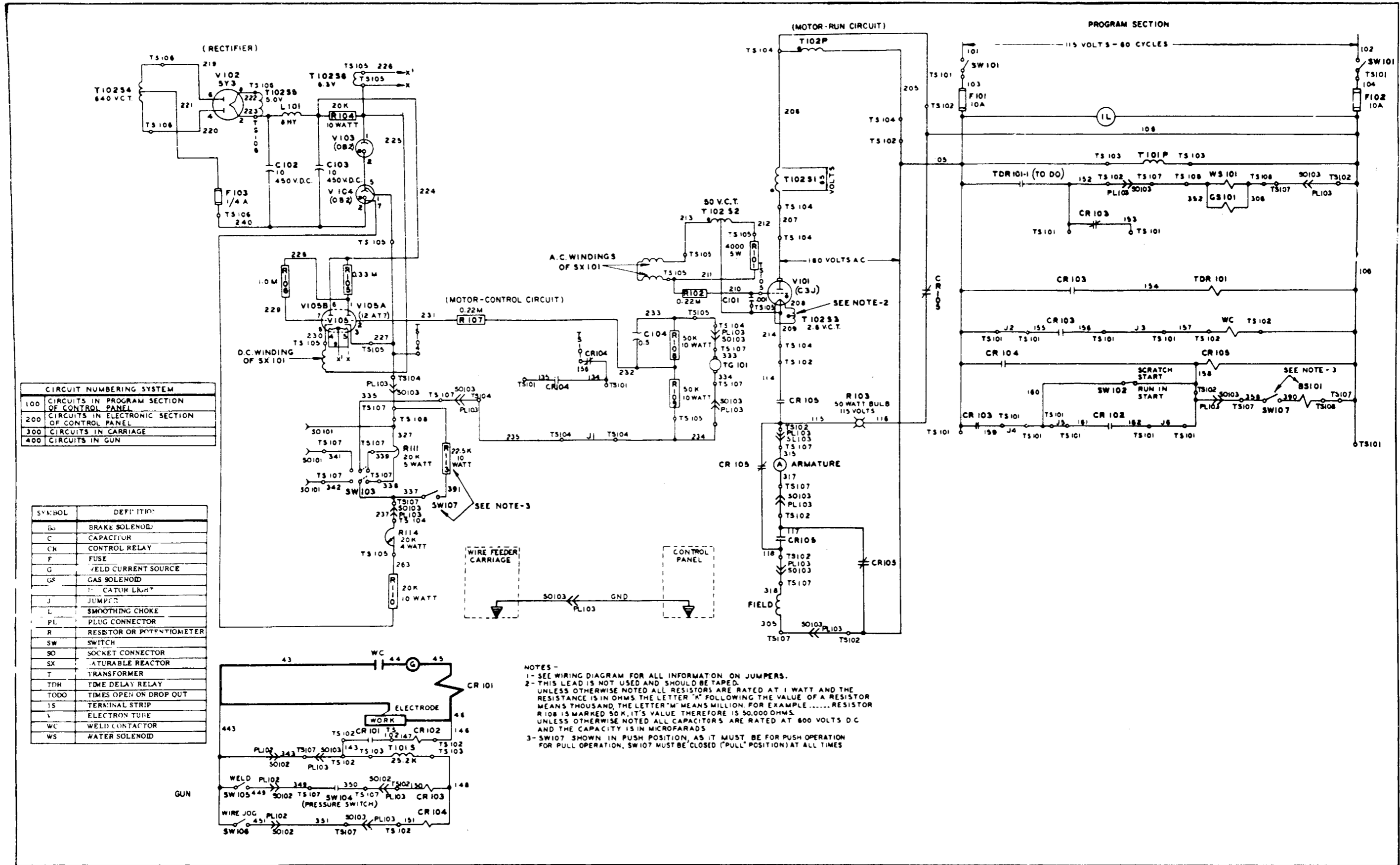


Figure 1. Electrical Schematic Diagram.

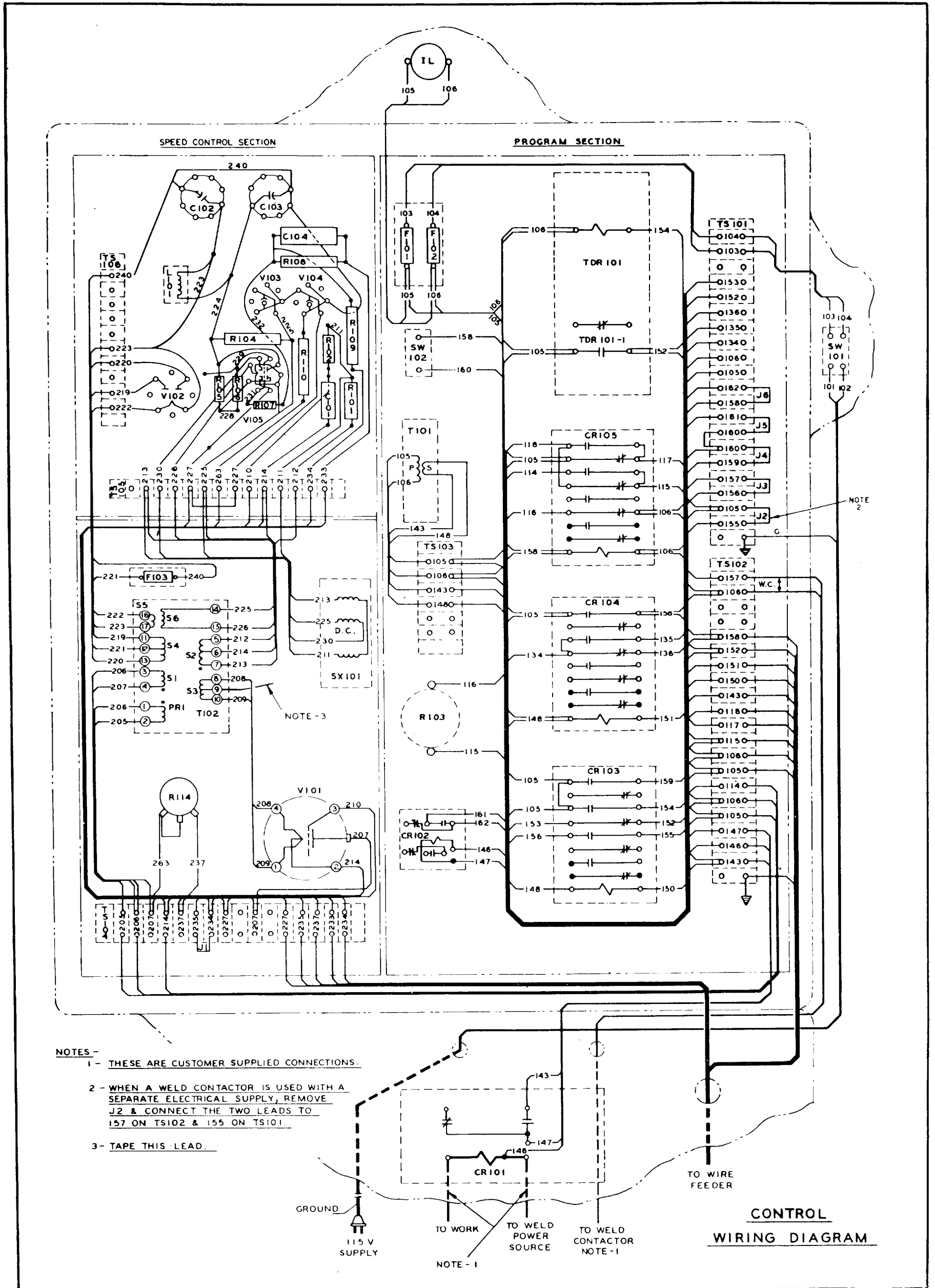


Figure 2. Wiring Diagram Control Panel

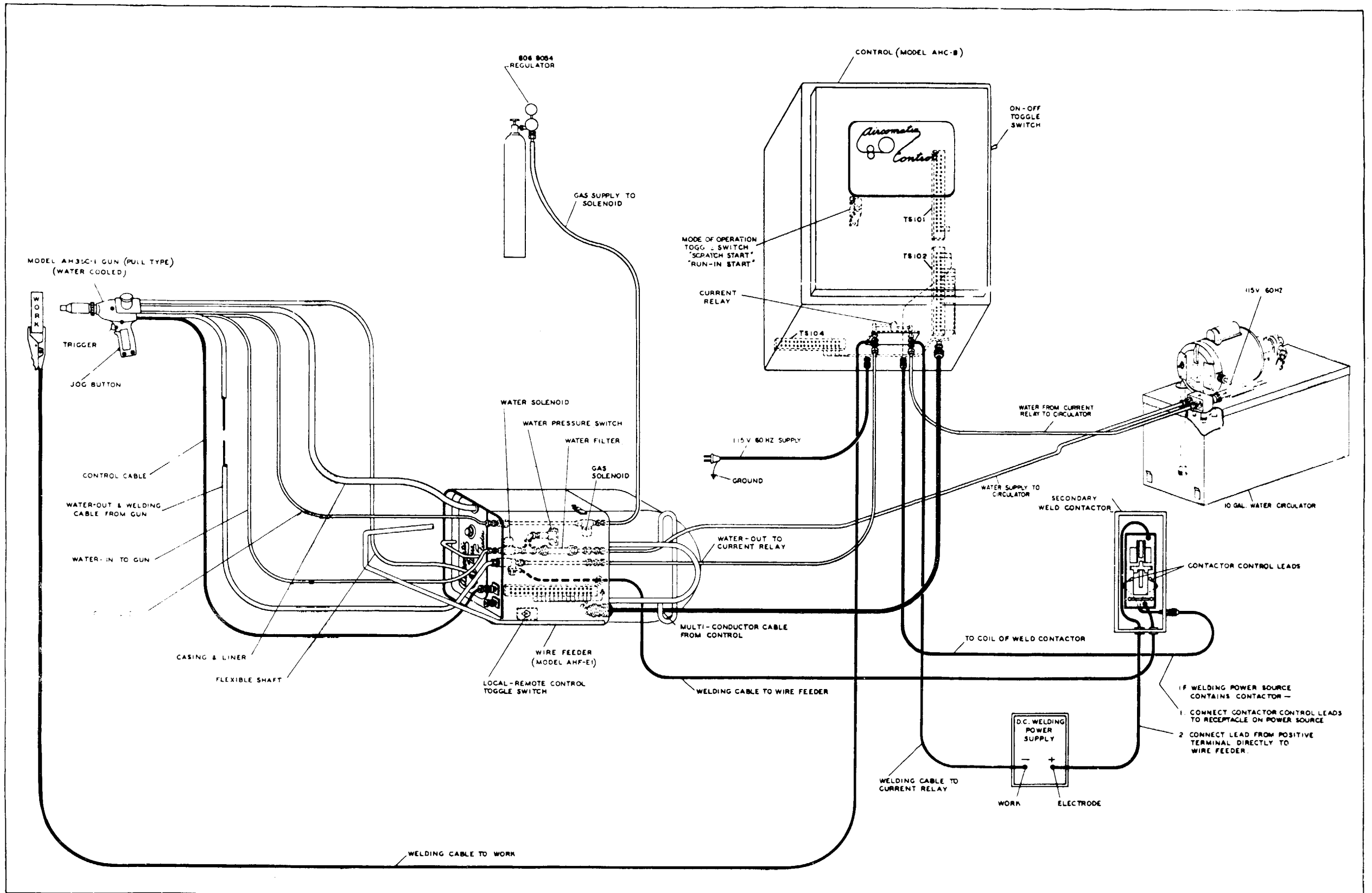


Figure 3. Interconnection schematic.

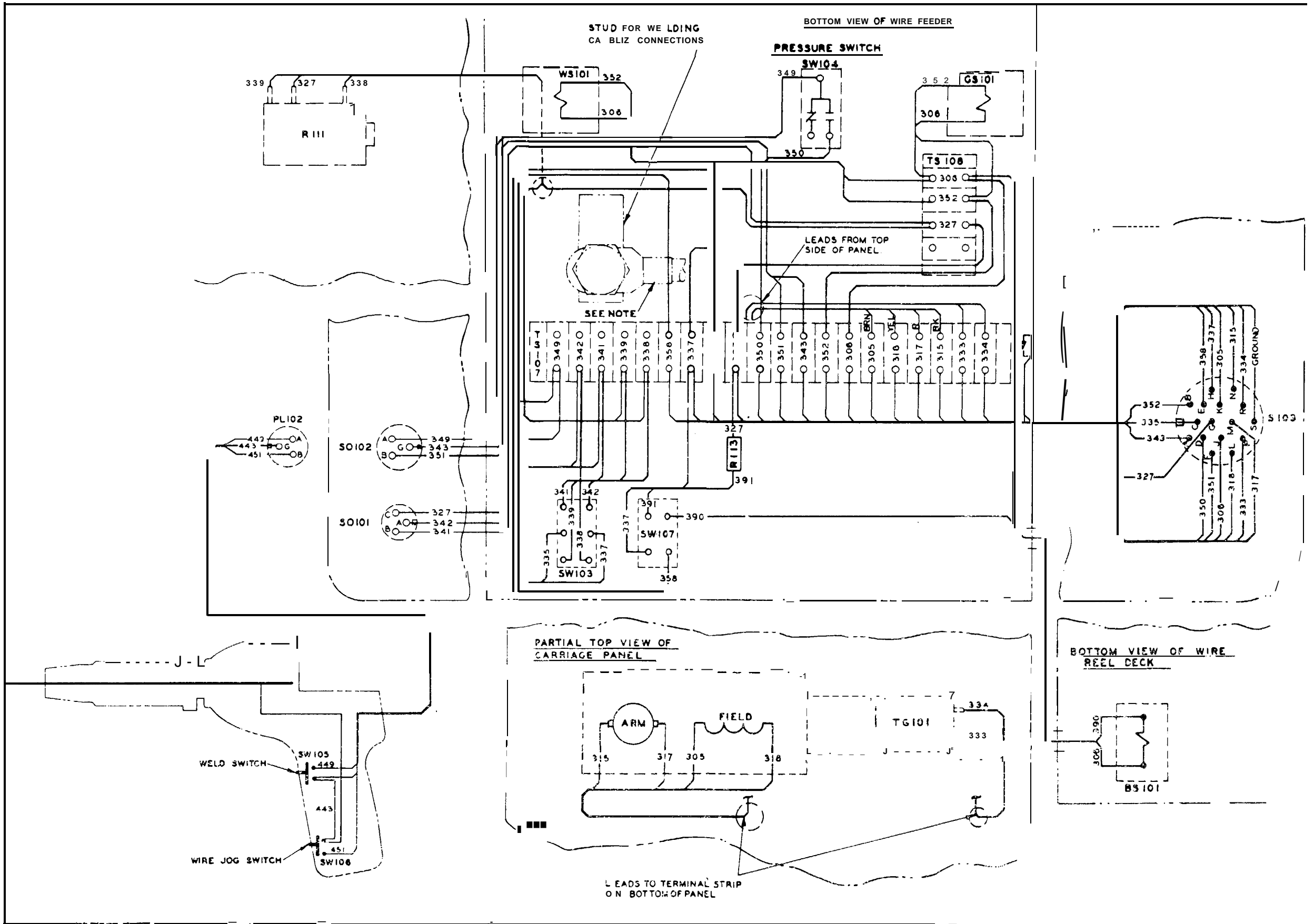


Figure 4. Wiring Diagram - Gun and feeder.

PART 2

8000 SERIES  
FIXED-PRESSURE  
REGULATORS

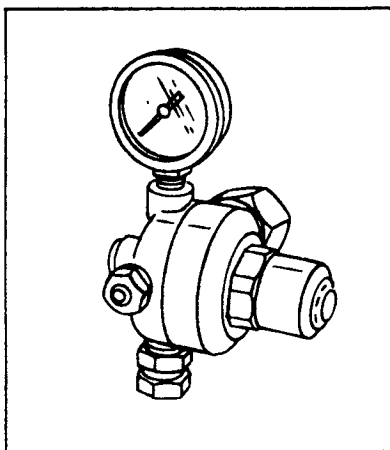


Figure 1. Fixed- Pressure Regulator with Flow Adaptor

## Section 1. INTRODUCTION

### 1.1 DESCRIPTION

The ALRCO 38000 Series Fixed-Pressure Regulators (Fig. 1) are for cylinder service. They are Single-Stage Metering devices designed for gas-shielded arc-welding applications. These regulators will supply a constant reliable flow of gas to meet specific job requirements.

The regulator delivery pressure is preset to 30 psi and sealed during manufacture. Once the outlet of the regulator is fitted with a proper flow adapter, a constant flow of gas will be obtained.

Table I lists the stock numbers of the various Fixed-P ressure Regulators, and the gas for which each is to be used.

TABLE I

Fixed- Pressure Single-Stage Regulator

Gas	Stock Number	Inlet Pressure Gauge - psi	CGA Inlet Connection
Argon	806 8044	4000	580
	806 8054	4000	540
Helium	806 8053	4000	350
CO <sub>2</sub>	806 8055	2000	320
AG 75*	806 8053	4000	350

\* 75 Percent Helium and 25 Percent Argon

NOTE: All outlet connections are 1/4 NPT internal threads.

1.2 ACCESSORIES

Accessories are items needed so the Fixed-Pressure Regulators can be adapted to suit the particular job requirements.

A complete line of Flow Adapters (Table II) are available for the best gas flow for each job. Since gas flow can be "tailored", a considerable savings in gas consumption can be realized.

TABLE II  
Flow Adapters

Gas	Gas Flow-cfh	Stock No	Gas	Gas Flow-cfh	Stock No
Argon	10	830 1971	CO <sub>2</sub>	30	830 1980
	15	830 1972		28	830 2013
	20	830 1973			
	30	830 1974			
	40	830 1975			
	50	830 1976		AG 75	15
Helium	12	830 1977	20		830 1984
	20	830 1978	40		830 1985
	25	830 1979	50		830 1986

Flow Adapters can also be used with an 8010281 station valve for pipeline service. The pipeline must have a pressure of 30 psi.

Figure 2 illustrates the method of connection the Flow Adapters to a pipeline. Use an 8010267 plug and chain assembly to cap-off unused outlets.

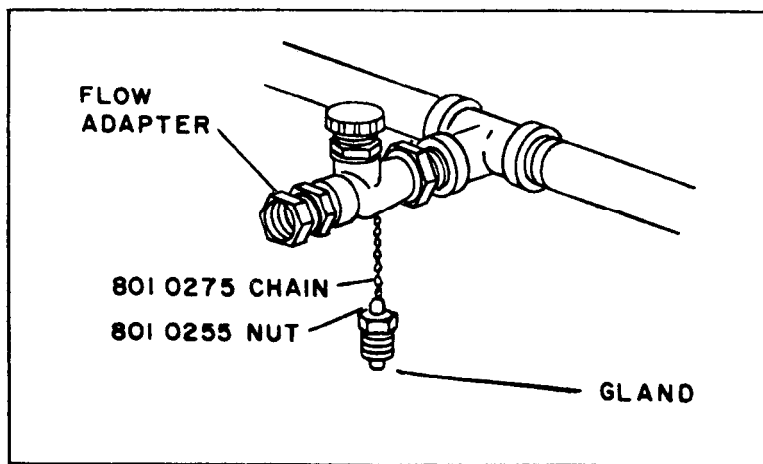


Figure 2. Flow Adapter for Pipeline Service

## Section II. INSTALLATION

### 2.1 PRECAUTIONS

a. These regulators must not be used where rated capacity will be exceeded. The regulator will not maintain the required delivery pressure under this condition.

b. Be sure that all connections to the regulator are clean. To remove dirt or grease on the regulator and surrounding metallic parts, wipe or brush with trichlorethylene.



CAUTION:

TRICHLOROETHYLENE WILL HAVE TOXIC EFFECTS UNLESS PROPER VENTILATION IS PROVIDED, OR IF ALLOWED TO HAVE PROLONGED CONTACT WITH THE SKIN.

c. Never use this regulator for gases other than those for which it has been designed and specified.

d. To clean the cylinder valve outlet, blow-out any foreign matter by rapidly opening and closing the cylinder valve.

2.2 TO CONNECT THE REGULATOR

a. Observe the precautions listed in the previous paragraph.

b. Select the flow adapter best suited for your specific needs from Table II. It is recommended that a series of adapters be kept on hand so that all job requirements can be met. Flow adapter markings are shown in Figure 3.

c. Apply a small amount of pipe compound onto the threads of the flow adapter, screw the adapter into the regulator outlet, and wrench-tighten. Use the mixture sparingly and apply it to the male threads only; take care to prevent the mixture from flowing past the end of the first thread.

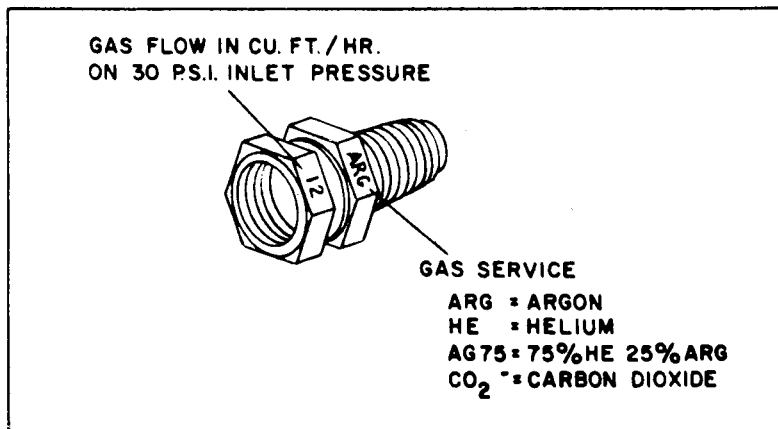


Figure 3. Flow Adapter Markings

- d. Tighten the regulator 1/8-inch inlet connection nut in place with a suitable wrench.
- e. Connect the gas hose to the flow adapter.
- f. Slowly open the cylinder valve. Cylinder pressure is shown on the cylinder pressure gauge.
- g. Test all connections for leaks.
- h. Close the cylinder valve.

### Section III. OPERATION

#### 3.1 TO ADJUST WORKING PRESSURE

Open the cylinder valve slowly. Sudden changes in pressure may damage the internal parts of the regulator. When the cylinder valve is completely opened, the required gas flow and delivery pressure will be established.

#### CAUTION:

POINT THE CYLINDER VALVE AWAY FROM YOUR  
BODY BEFORE OPENING.

#### 3.2 TO SHUT DOWN

NOTE : Perform the following steps when the regulator is to be out of use for more than one-half hour.

- a. Close the cylinder valve tightly.
- b. Open the down-stream valve to drain the line.

NOTE : When in transit (unless the cylinders are mounted on a special truck which holds them securely in place) remove the regulator, recap the cylinder, and protect the regulator cylinder connection.

## Section IV. MAINTENANCE

### 4.1 GENERAL

Regulators are precision-built instruments and should be handled as such. Minor, repairs such as seat or diaphragm replacement may be made on the spot by qualified personnel.

The following are hints for good maintenance practice.

- a. Test the regulator periodically with soapy water to locate leaks.
- b. For replacement, use only those AIRCO parts designed for your regulator.

NOTE: Do not, at any time, disturb the sealed-in pressure setting screw of the regulator. If this screw is tampered with, gas flow may not be accurate.

- c. When using a vise or wrench on the regulator, use only enough pressure to hold the part. Be careful not to score or distort the body, threads, or other parts.

- d. Failure to replace any of the parts may cause a hazardous condition.

- e. If it is necessary to replace the pressure gauge, the inlet nut, and the gland, tin the gauge threads or wrap them with teflon tape. Use them sparingly and take care to prevent them from going past the end of the first thread.

- f. Before reassembly, always remove dirt or grease, which is not readily removable with a lint-free cloth, from the body and parts with a cloth dampened with trichloroethylene or methylchloroform. Do not allow rubber parts to be exposed to either of these solvents for longer than a few seconds.

### CAUTION

TRICHLOROETHYLENE OR METHYLCHLOROFORM (1, 1, 1-TRICHLOROETHANE) MAY HAVE TOXIC EFFECTS. AVOID BREATHING THE FUMES. AVOID PROLONGED CONTACT WITH THE SKIN. PROVIDE PROPER VENTILATION.

## 4.2 SYMPTOMS OF FAULTY OPERATION

The following signs indicate faulty operation: the necessary repairs should be made immediately.

- a. With no flow through the hose, working pressure increases steadily above set pressure - indicates a leak across the seats.
- b. Continuous discharge of gas from relief valve - indicates a relief valve failure or seat failure.
- c. Gas leakage from spring case - indicates loose or damaged diaphragms.
- d. Gas leakage from pressure gauge - indicates a damaged gauge or a loose connection. If the gauge leaks, it must be replaced immediately with a new gauge free of oil and grease.
- e. Gas leakage from inlet connection - indicates a damaged gland or a loose connection.
- f. An excessive drop in indicated cylinder pressure as the flow is increased - indicates a dirty inlet filter or that the cylinder valve is not fully open. If the inlet filter cannot be cleaned with compressed nitrogen, replace the gland.

## 4.3 DIAPHRAGM REPLACEMENT

- a. Disconnect the regulator from the cylinder.
- b. Mount the regulator vertically with the spring case assembly UP. If it is more convenient, brace the regulator by holding the forged body section with an 11/16-inch wrench, and the spring case with a 1 1/4-inch wrench.
- c. Remove the spring case and screw assembly carefully by unscrewing it from the regulator body. The adjusting screw is preset in the spring case and tension on the adjusting spring cannot be relieved.
- d. Lift off the spring button, adjusting spring, diaphragm plate, and slip ring.
- e. Lift the diaphragm and thrust plate assembly out of the regulator body by gripping it by the raised center section.
- f. Replace the diaphragm. Before discarding the old diaphragm, pop out the thrust plate by doubling the diaphragm over.
- g. Reinsert the thrust plate by pushing the edge of the plate under the retaining lip on one side and gradually working the lip around over the thrust plate.

h. Reinstall the diaphragm and thrust plate assembly on the regulator body so that the thrust plate is down and the sealing surface fits into the groove in the body.

i. Place the slip ring, diaphragm plate, adjusting spring, and spring button (concave side up) on the diaphragm in the order named.

j. Place the spring case on the body and thread together carefully. Tighten the spring case with a torque of approximately 150 inch-pounds.

k. Connect the regulator to the cylinder.

#### 4.4 SEAT ASSEMBLY REPLACEMENT

a. Perform steps a through e, paragraph 4.3.

b. Remove the seat and retainer assembly with an 11/16 - inch wrench. Replace the retainer seat.

c. Remove the thrust pin and seat assembly.

d. Replace the seat assembly and thrust pin.

e. Put the small end of the thrust pin in the seat assembly carefully. Do not damage the seating surface.

f. Insert the thrust pin and seat assembly in the marginal spring.

g. Slide the seat and retainer assembly over the thrust pin carefully and tighten it in the body with a torque of approximately 120 inch-pounds.

h. Perform steps h through k, paragraph 4.3.

#### 4.5 RELIEF VALVE SEAT REPLACEMENT

a. Disconnect the regulator from the cylinder.

b. Mount the regulator body securely in a vise or other suitable holding device with the relief valve facing UP.

c. Remove the relief-valve cap by unscrewing it from the body.

d. Lift out the relief-valve spring and the relief-valve stem and seat assembly. Replace the seat.

e. Reinsert the relief-valve stem and seat assembly, relief-valve spring, and relief-valve cap in the regulator body.

f. Connect the regulator to the cylinder.

PART 3

# AIRCOMATIC GUN

MODEL AH35-C1

## Section I. INTRODUCTION

### 1.1 SCOPE

This manual provides installation, operation, and maintenance information, for the Model AH35-C1 AIRCOMATIC Pull Gun (Fig. 1). Additional information is available in manuals covering equipment with which the Gun is used.

### 1.2 DESCRIPTION

The Gun is a compact, well balanced welding tool with pistol grip, featuring, heavy-duty construction and simplicity of design. The complete package includes a stripped gun, drive roll housing assembly, flexible shaft, guide bushing, casing, and liner. With drive roll housing in place, the Gun weighs approximately 3-3/4 pounds. The nozzle provides adequate gas shielding at low flow rates and is chrome-plated to minimize spatter buildup. Wire sizes that can be used with the Gun may range from .030 to 1/16-inch aluminum, .020 to 1/16-inch hard, and 5/64-inch stranded wire. Figure 2 provides dimensions, and Table I pertinent characteristics, of the Gun.

### 1.3 ACCESSORY EQUIPMENT

Items required to adapt the Gun for any particular job are called accessories. These include contact tubes, inlet and outlet guide bushings, and drive rolls to suit the type and size of welding wire used, as shown in Figure 8 of Section II.

### 1.4 AUXILIARY EQUIPMENT

Auxiliary equipment comprises items, in addition to accessories, required to complete a typical welding installation. Such equipment includes: goggles,

Table L Gun Characteristics and Specifications

Characteristics	specifications
Continuous duty rating	<b>400</b> amps Argon
DC reverse polarity	550 amps CO <sub>2</sub>
Wire types and diameters (inches)	
Aluminum and Magnesium	<b>.030, 3/64, 1/16</b>
Stranded	<b>5/64</b>
Hard	<b>.020, .025, .030, .035, .045, 1/16</b>
Cooling medium	Water
Cooling water flow rate	<b>2</b> pints per minute at <b>30</b> psi ( <b>75</b> psi max. )
Hose and cable lengths (nominal)	10 feet

Table II. Optional Equipment

Table II not applicable.



Figure 1. Model AH35-C1 Pull Gun

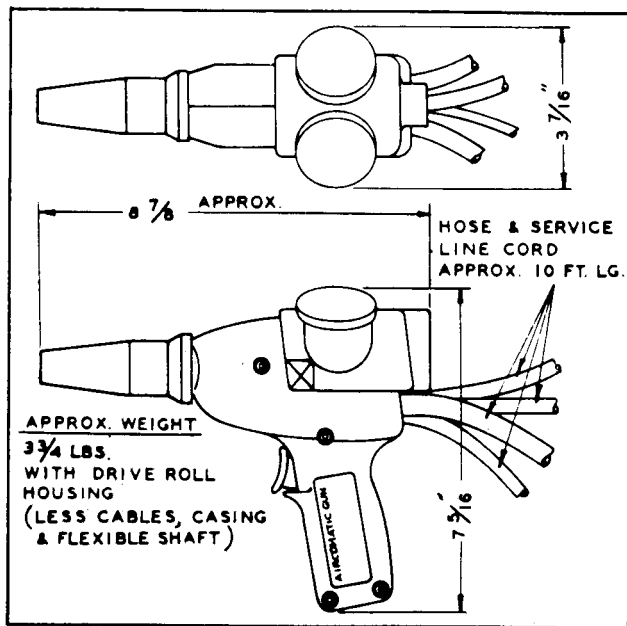


Figure 2. Dimensions

helmet, gloves, welding cables, gas supply hose fittings regulator and flowmeter, shielding gas, welding wire a power source, and a secondary contactor if the power source does not contain a primary contactor.

## Section II. INSTALLATION

### 2.1 GENERAL

This section covers installation of the Gun only. For additional instructions refer to the applicable feeder, control, and power source manuals.

### 2.2 UNPACKING AND INSPECTION

Unpack the Gun carefully. Inspect the unit, cables, and hoses. Operate the Gun trigger to make sure that it is free. Inspect visible surfaces of the drive roll housing for damage. Place the housing on the stripped Gun. Inspect the casing assembly, liner, and outlet guide bushing.

### 2.3 INSTALLING JOG SWITCH

**NOTE:** The Model AHF-E1 Feeder includes a jog switch which may be installed in the Gun handle as follows (Fig. 3):

- Press down lock button (Fig. 4) on right side of Gun and slide off drive roll housing.
- Unscrew and remove nozzle from Gun.
- Unscrew barrel lock nut.
- Remove left screws from backplate and drive roll housing retainer.
- Lay Gun on its right side. Remove the four hex-socket head cap screws which hold the left-hand handle.

- Lift left-hand handle off carefully.
- Remove plug near the handle bottom.
- Connect lead of jog switch to terminal on trigger switch which has two leads.

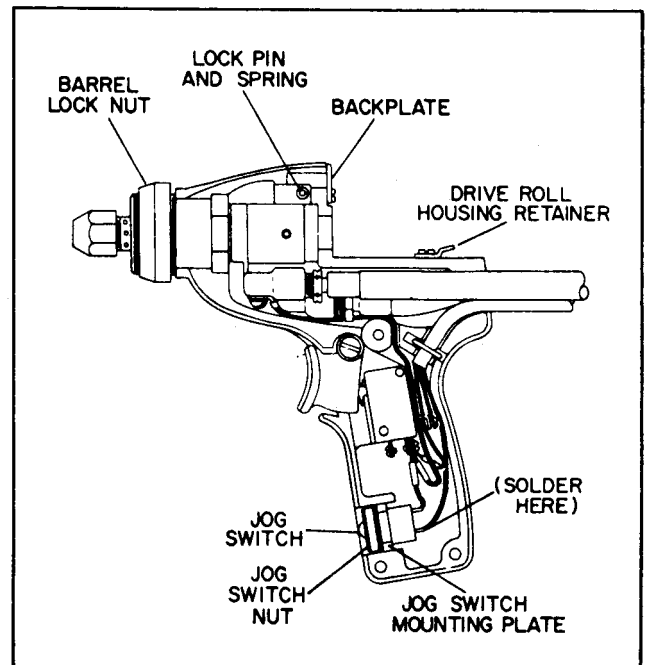


Figure 3. Installing Jog Button



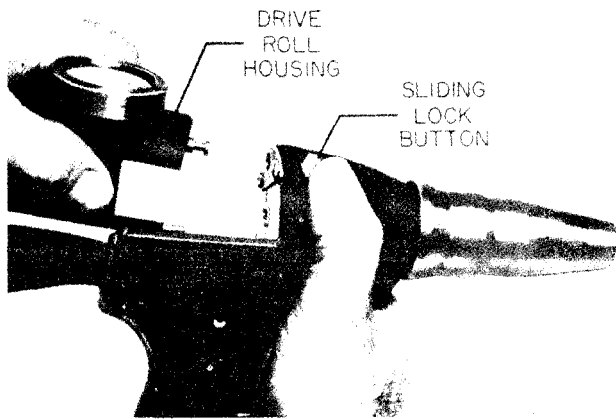


Figure 4. Removing Drive Roll Housing

- i. Solder black wire control cable assembly (taped when not used) to open terminal of jog switch.
- j. Check action of the jog switch.
- k. Fit mounting plate of jog switch into its retaining groove at base of right-hand handle assembly.
- l. Check the trigger and its switch for proper operation.
- m. Make sure spring on drive roll housing lock and springs in trigger have not slipped out of position.
- n. Fit left-hand handle over end of lock pin and spring and onto right-hand handle assembly. Align mounting holes.
- o. Secure these assemblies with hardware removed in step e.
- p. Tighten jog switch nut.
- q. Screw on barrel lock nut and tighten.
- r. Screw on nozzle and tighten.
- s. Slide and lock drive roll housing onto Gun. Adjust position of drive roll housing retainer if necessary.

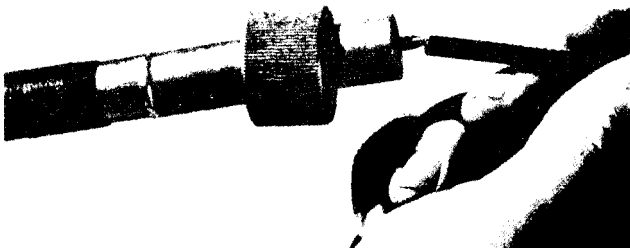


Figure 5. Pushing Flexible Shaft into Casing

## 2.4 FLEXIBLE SHAFT

Connect the flexible shaft to the Gun as follows:

- a. Press down lock button (Fig. 4) on right side of Gun. Slide off drive roll housing.
- b. Remove screw on right side of drive roll housing (Fig. 5).
- c. Remove protective caps from the flexible shaft and push square shank-end into casing (Fig. 6) to expose the tapped fitting at the other end.

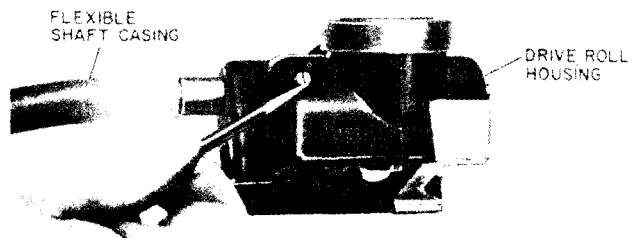


Figure 6. Removing Anchoring Screw for Flexible Shaft Casing

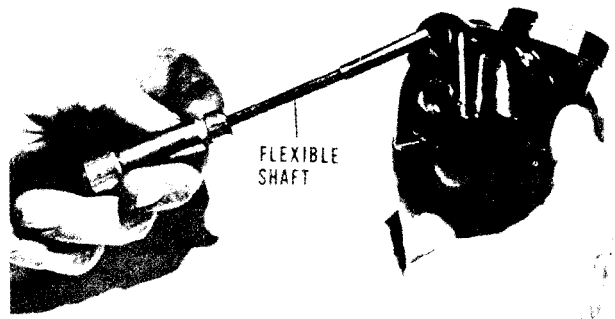


Figure 7. Inserting Tapped End of Flexible Shaft into Drive Roll Housing

- d. Insert left-hand tapped end of flexible shaft into top hole of drive roll housing (Fig. 7) to engage end of worm shaft within housing.
- e. Turn housing counterclockwise so that worm will screw into left-hand thread of flexible shaft. Hand tight en.
- f. Slide casing of flexible shaft into housing hole as far as it 'will go.
- g. Secure casing with screw removed in step b.
- h. Straighten flexible shaft.

*NOTE:* Do not lock drive roll housing on Gun until wire and wire guide fittings are installed.

**2.5 CONNECTING GAS AND WATER HOSES AND CONTROL CABLE**

**CAUTION**

MAKE SURE ALL POWER IS OFF.

Connect water-out and cable assembly, water-in hose, gas hose, and control cable of the Gun to feeder according to instructions in feeder manual.

**2.6 WIRE GUIDE FITTINGS IN DRIVE ROLL HOUSING**

Install wire guide fittings (Fig. 8) in drive roll housing as follows:

a. Press down lock button (Fig. 4) on right side of Gun. Slide off drive roll housing,

b. Back off adjusting set screw (Fig. 9) on right-hand disc of drive roll housing to relieve pressure on conical roll shaft.

c. Insert conical roll into end of conical roll shaft (Fig. 10).

d. Hold conical roll depressed. Insert grooved roll into end of grooved roll shaft. Release conical roll,

e. Lift casing catch and install inlet guide bushing in bottom hole of drive roll housing (Fig. 11). Release catch.

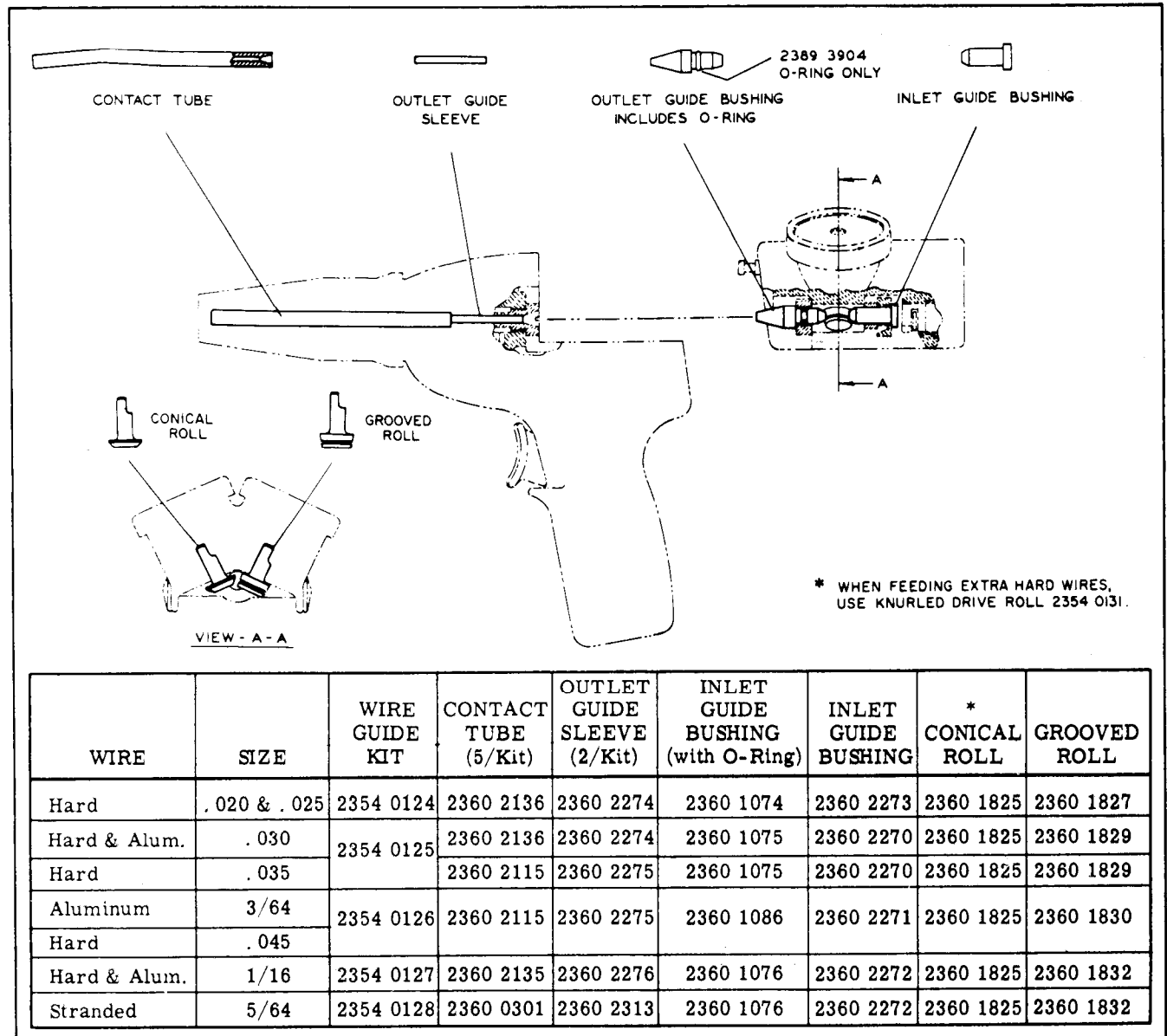


Figure 8. Wire Guide Fittings

ADJUSTING  
SET SCREW ON  
SPRING-BACKED  
ROLL SHAFT

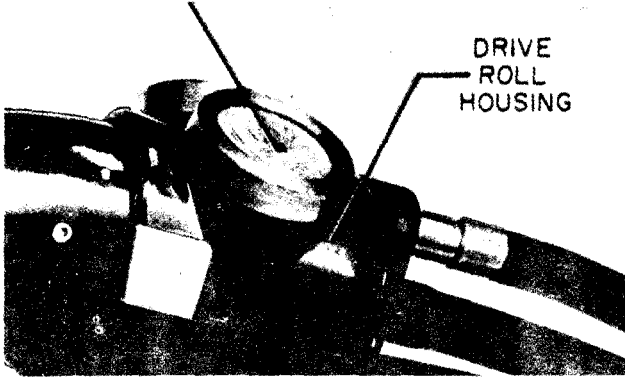


Figure 9. Adjusting Setscrew for Conical Roll Shaft

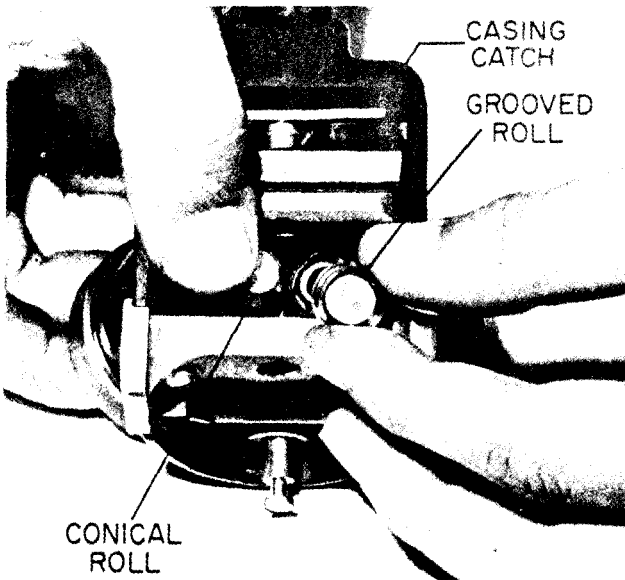


Figure 10. Inserting Drive Rolls in Shaft

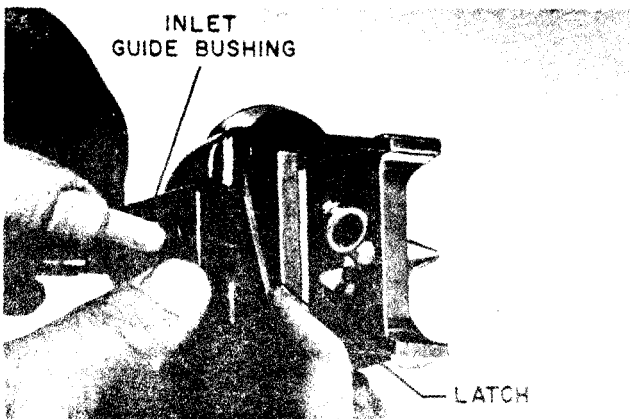


Figure 11, Installing Inlet Guide Bushing

## 2.7 INSTALLING CASING ASSEMBLY AND THREADING WIRE

### CAUTION

MAKE SURE ALL POWER IS OFF.

Install the casing assembly as follows:

a. Insert liner (Fig. 12) into casing assembly when aluminum wire is to be used.

**NOTE:** Liner may also be used with hard wire.

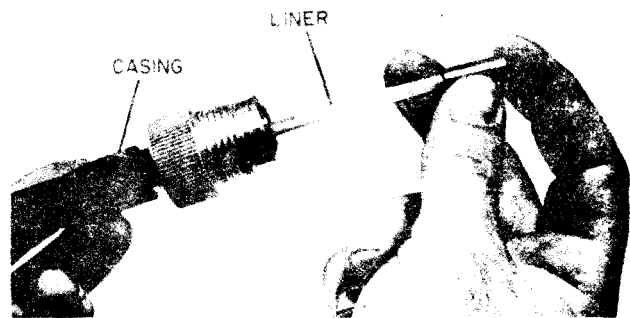


Figure 12. Installing Casing Liner

b. Insert casing outlet guide bushing into the feeder as explained in the feeder manual.

c. Arrange casing so it is reasonably straight. Slowly ease welding wire from feeder spool into and through casing until about 8 inches emerges at front end of casing.

d. Thread nut end of casing into feeder.

e. Turn drive roll housing of Gun upside down. Insert wire protruding from casing into drive roll housing hole, through inlet bushing, and up to conical and grooved rolls (Fig. 13).

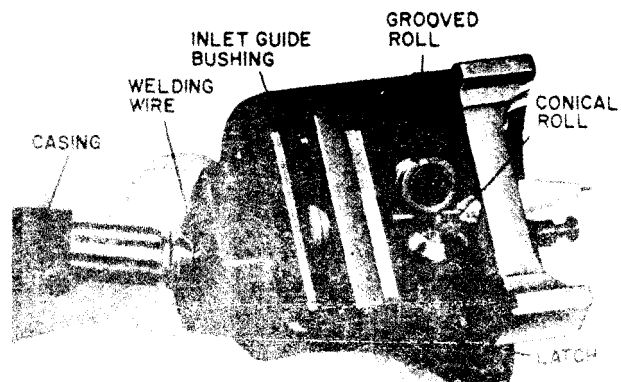


Figure 13. Latching Casing to Drive Roll Housing

f. Hold conical roll depressed and ease casing with wire further into housing so that wire passes through groove of grooved roll, and through the crossbar opening for the outlet guide bushing.

g. Push casing into housing until latch engages in casing groove.

h. Release conical roll after making sure that wire is properly seated in grooved roll.

i. Slip drive roll outlet guide bushing (Fig. 8) over protruding wire and seat in crossbar opening.

j. Turn adjusting setscrew (Fig. 9) slowly clockwise until conical roll presses on wire within grooved roll. Compression should be just enough for positive wire drive.

## 2.8 INSTALLING WIRE GUIDE FITTINGS IN GUN BARREL

Install wire guide fittings selected in paragraph 2.6 into the Gun barrel as follows:

a. Insert a 1-3/16-inch long outlet guide sleeve (Fig. 14) into liner retainer of Gun. Push sleeve all the way in until end is at base of retainer counterbore (Fig. 15). (Slots in retainer hold the sleeve in place.)

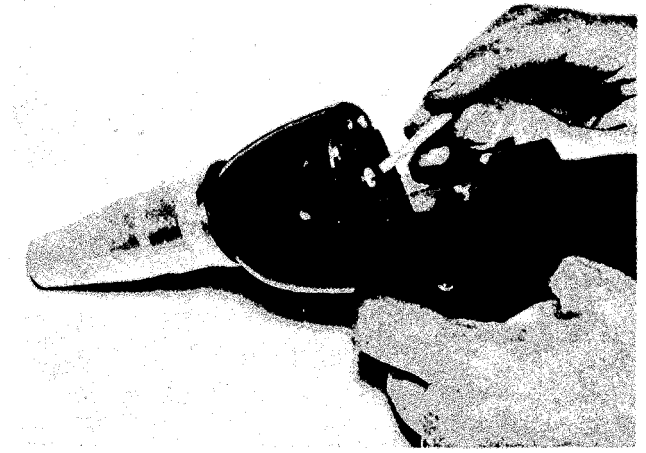


Figure 14. Installing Outlet Guide Sleeve in Gun

b. Unscrew and remove nozzle from Gun.

c. Pass end of wire protruding from drive roll housing (Fig. 16) into liner retainer and outlet guide sleeve. Slide drive roll housing onto stripped Gun until housing is locked.

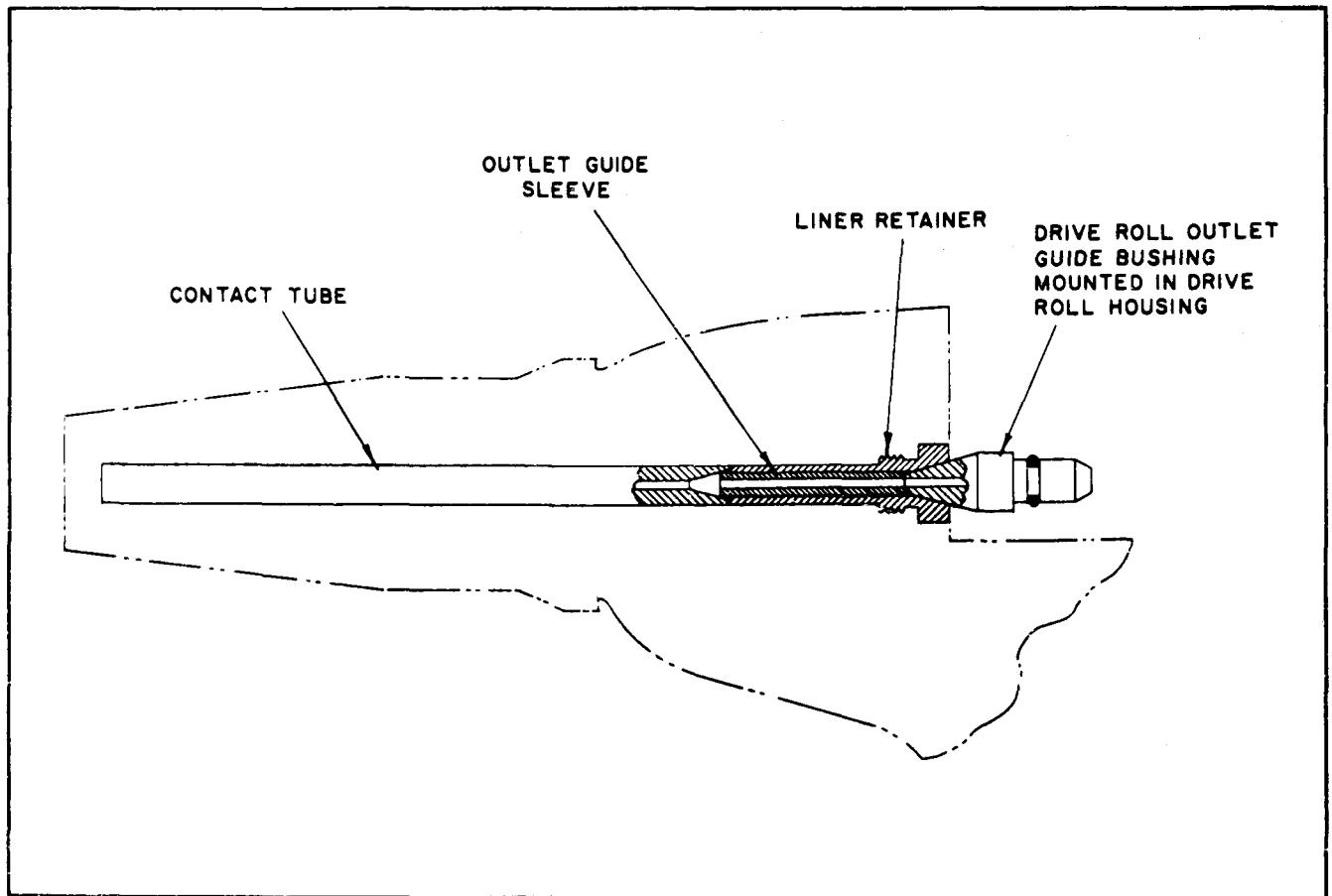


Figure 15. Final Position of Wire Guide Fittings in Gun Barrel

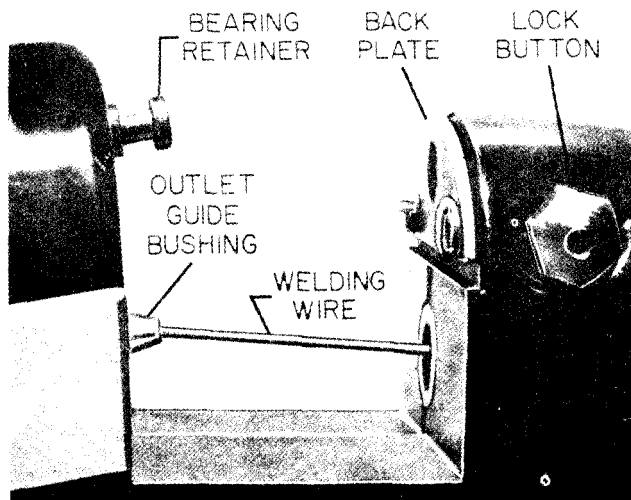


Figure 16. Sliding Drive Roll Housing with Wire onto Gun

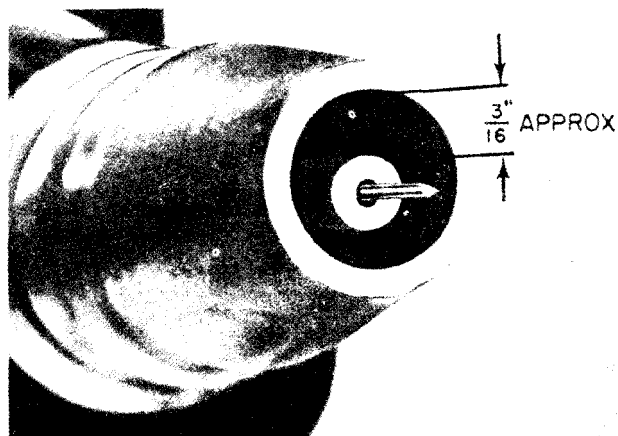


Figure 18. Nozzle-to-Contact Tube Distance

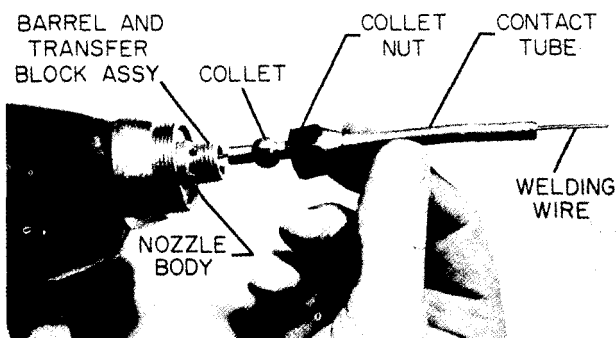


Figure 17. Installing Contact Tube

d. Remove collet nut from Gun barrel (Fig. 17).

*NOTE:* Do not let collet roll away

e. Slide collet, then collet nut onto contact tube.

f. Slide contact tube with collet and nut onto wire protruding from Gun. Push contact tube into barrel until it touches liner retainer (Fig. 15).

g. Screw collet nut over collet onto barrel end. Use wrench supplied with Gun to tighten.

h. Screw nozzle onto barrel and tighten. The nozzle-to-contact-tube distance should be approximately 3/16-inch (Fig. 18), if all fittings have been properly installed.

## Section III. OPERATION

### 3.1 SAFETY REQUIREMENTS

Comply with all ventilation, fire, and other safety requirements for welding as established for industrial applications. Reference as applicable: Safety in Electric and Gas Welding and Cutting Operation, American Standard Association Bulletin 249.1, 1958, and Recommended Safe Practices for Inert-Gas Metal-Arc welding, American Welding Society Bulletin A6.1, 1958.

Because of infrared radiation emitted by the high-intensity arc in AIRCOMATIC welding methods, flash goggles (medium shade 1306 2101) are recommended in addition to helmet for the operator and nearby personnel.

Do not weld in the presence of even minute amounts of vapors from chlorinated solvents (such as carbon tetrachloride or trichlorethylene). Ultraviolet light from the electric arc can break down the vapors to form phosgene, a poisonous gas.

The welding wire (electrode) and all metal parts in contact with it are electrically energized while welding. Periodic inspection of Gun and cables for broken insulation, water leakage and other electrical hazards is essential.

### CAUTION

WHENEVER STEPS ARE TAKEN TO REMOVE AND REPAIR SUCH HAZARDS, PLACE ALL POWER CONTROLS OFF. DISCONNECT ALL ELECTRICAL CABLING FROM POWER SOURCES.

### 3.2 PRE-WELD CHECKLIST

Check the Gun as follows:

- a. Drive roll housing assembly locked on stripped Gun.
- b. All hose and cable assemblies tight.

- c. Flexible cable assembly locked to drive roll housing.
- d. Nozzle tight.
- e. Welding wire protrudes from Gun nozzle.

### 3.3 PRELIMINARY PROCEDURES FOR GUN OPERATION

**NOTE:** If equipment has not been in recent use, point Gun toward floor and press trigger for a short interval to purge the gas and water lines.

Preset controls on equipment in the system as instructed in equipment manuals.

Whenever a new welding operation begins, perform a trial weld on metal similar to the workpiece. Proceed as follows:

- a. Clamp welding power source cable (negative) to trial piece.
- b. Aim Gun at trial piece to be welded, holding nozzle a few inches away.
- c. If operation is set for SCRATCH START, rub the sharp end of welding wire against trial piece until arc is started; if set for RUN-IN START, arc should start as soon as welding wire contacts trial piece.
- d. When arc starts and gas flows, vary distance of Gun nozzle from trial piece to determine approximately how far from trial piece Gun operation produces the best results.
- e. Release trigger but hold Gun over weld puddle until post-weld gas flow stops.
- f. Set Gun aside where protruding wire electrode cannot touch any metallic surface.

### 3.4 WELDING OPERATION

To perform a welding operation with the Gun, proceed as follows:

- a. Aim Gun at workpiece. Keep nozzle at distance found satisfactory during trial weld.
- b. Pull back and hold trigger to keep wire feeding continuously into arc. (Weld puddle will be protected by shielding gas as puddle solidifies. )
- c. Release trigger to stop welding, but hold Gun in same position for short interval until post-weld gas stops flowing.

d. Remove Gun when gas flow stops. Use a wood stick to scrape inside of nozzle clean of any spatter accumulation. Do not bang nozzle.

e. Place Gun aside where protruding wire electrode cannot touch any metallic surface.

### 3.5 SHUTDOWN PROCEDURES

Environmental conditions and safety requirements will determine the extent of equipment shutdown between operations. If temperature may fall below the, freezing point, perform ALL the following steps, otherwise begin with step e.

- a. Turn OFF welding power source.
- b. Turn OFF water and disconnect water supply hose.
- c. Press Gun trigger to open water solenoid.
- d. Disconnect water-in hose and blow out water lines with compressed air.
- e. Place all (remaining) power controls OFF.
- f. Disconnect power cable from the 115 volt ac source.
- g. Turn OFF gas.
- h. Place Gun in safe location. Coil or drape hose and cables without sharp bends.

### 3.6 PRINCIPLES OF OPERATION

When the Gun trigger switch is closed, it operates a main control relay which, through other relays, completes the circuits to the weld current, gas and water solenoids, water pressure switch, and time-delay relay (which provides a timed interval of post-weld gas flow). Simultaneously, a motor-drive relay circuit is energized to run the feeder motor. This motor, drives a wormshaft through the flexible shaft within the drive roll housing locked to the Gun.

The wormshaft, in turn, drives a geared shaft on each side, which turn in opposite directions. One shaft end contains a grooved roll fitting in which the welding wire is seated; the other contains a conical roll which provides pressure against the wire in the grooved roll. Hence, the welding wire is pulled through the Gun casing from a spool in the feeder.

Welding current from the welding power source is applied to the system through a reverse polarity circuit. This consists of a secondary weld contactor (if needed), a welding current cable attached to the Gun barrel, the welding wire (consumable electrode) within the barrel, the workpiece, and the cable from the power source clamped to the workpiece.

## Section IV. MAINTENANCE

### 4.1 GENERAL

This section covers preventive maintenance, inspection and service and repairs required to keep the Gun at minimum standards for efficient operation.

Preventive maintenance consists of cleaning, tightening, and minor repairing designed to prevent down-time of equipment for major service and parts replacement. At 30 day intervals and, whenever the wire guide fittings are replaced, inspect and service the Gun as follows:

*CAUTION*

MAKE SURE ALL POWER IS OFF.

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>a. Clean Gun exterior.</li> <li>b. Unscrew and remove nozzle.</li> <li>c. Remove accumulated spatter from nozzle. Be sure threads are clean and in good condition.</li> </ul> | <ul style="list-style-type: none"> <li>d. Push down lock button on right side of Gun. Carefully slide off drive roll housing including welding wire.</li> <li>e. Make sure mating surfaces of Gun and housing are clean. If necessary, use compressed air to remove any dust or dirt.</li> <li>f. Make sure gas orifices at front of Gun barrel are not clogged.</li> <li>g. Check for damage on all hoses and cables. Make sure all connections are tight.</li> <li>h. Insert protruding wire of drive roll housing into liner retainer of Gun barrel. Slowly slide housing into place on Gun until it locks in.</li> <li>i. Screw nozzle onto Gun, Hand tighten.</li> <li>j. Turn power ON. Operate Gun with trigger for a short interval to ascertain satisfactory operation. Use jog button, if attached, to test wire feed mechanism.</li> </ul> |
|--|---|

Table III. Welding System Troubleshooting

SYMPTOM	PROBABLE CAUSE	REMEDY
No welding arc with power ON and Gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Welding power source OFF.</li> <li>b. Contactor trouble.</li> <li>c. Defective cable.</li> <li>d. Malfunction in Gun.</li> <li>e. Malfunction in feeder.</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Check and repair.</li> <li>c. Repair or replace.</li> <li>d. See Table IV.</li> <li>e. See feeder manual</li> </ul>
No gas flow with power ON and Gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Gas source OFF.</li> <li>b. Clogged line.</li> <li>c. Malfunction in Gun.</li> <li>d. Malfunction in feeder.</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Repair or replace</li> <li>c. See Table IV.</li> <li>d. See feeder manual.</li> </ul>
No water flow with power ON and Gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Water source OFF.</li> <li>b. Clogged line.</li> <li>c. Malfunction in Gun.</li> <li>d. Malfunction in control.</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Repair or replace.</li> <li>c. See Table IV.</li> <li>d. See Control Manual.</li> </ul>

Table IV. Gun Troubleshooting

SYMPTOM	PROBABLE CAUSE	REMEDY
No welding arc with power ON and Gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Defective trigger switch.</li> <li>b. Defect in cable of water-out and cable assembly.</li> <li>c. Wire within Gun disconnected.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace.</li> <li>b. Check continuity and replace if necessary.</li> <li>c. Disassemble Gun and repair.</li> </ul>
No gas flow with power ON and Gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Clogged or pinched gas line on Gun.</li> <li>b. Gas orifices on Gun barrel stopped up.</li> </ul>	<ul style="list-style-type: none"> <li>a. Repair or replace.</li> <li>b. Remove nozzle and clean.</li> </ul>
No water flow with power ON and Gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Clogged water hoses.</li> <li>b. Blockage within barrel and transfer block assembly.</li> </ul>	<ul style="list-style-type: none"> <li>a. Repair or replace.</li> <li>b. Disconnect water hoses and blow out with compressed air.</li> </ul>
Improper or no wire feed with power ON and Gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Break in welding wire.</li> <li>b. Flexible shaft malfunction.</li> <li>c. Defective wire guide fitting in drive roll housing assembly or Gun barrel.</li> <li>d. Defective trigger wire or connection within Gun.</li> <li>e. Defective trigger switch.</li> <li>f. Defective trigger switch compression spring.</li> </ul>	<ul style="list-style-type: none"> <li>a. Check and repair.</li> <li>b. Check for proper coupling at each end, or replace.</li> <li>c. Check, repair or replace.</li> <li>d. Check, repair or replace.</li> <li>e. Replace.</li> <li>f. Replace.</li> </ul>
Improper or no wire feed with power ON and jog button depressed.	<ul style="list-style-type: none"> <li>a. Check causes (a) thru (d), above, for no wire feed with trigger depressed.</li> <li>b. Defective jog button.</li> <li>c. Defective switch or switch wiring.</li> </ul>	<ul style="list-style-type: none"> <li>a. Perform remedies (a) thru (d), above for no wire feed with trigger depressed.</li> <li>b. Replace.</li> <li>c. Repair or replace.</li> </ul>
Drive roll housing does not lock on Gun.	<ul style="list-style-type: none"> <li>a. Defective compression spring.</li> <li>b. Defective drive roll housing lock.</li> <li>c. Shifted or damaged drive roll housing retainer.</li> <li>d. Defective backplate or screws project.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace.</li> <li>b. Replace.</li> <li>c. Reposition or replace.</li> <li>d. Adjust or replace.</li> </ul>



## 4.2 RETHREADING BROKEN WELD WIRE

Rethread wire as follows:

### **CAUTION**

MAKE SURE ALL POWER IS OFF.

- a. Push in lock button on right side of Gun. Slide off drive roll housing.
- b. Unscrew and remove nozzle from Gun barrel.
- c. Pull length of wire out of Gun barrel.
- d. Actuate casing latch. Pull casing out of drive roll housing.
- e. Remove casing from feeder,

f. Rethread wire from spool through feeder. (Refer to feeder manual. )

g. Refer to paragraph 2.7 for rethreading wire.

h. Insert protruding wire of drive roll housing assembly at Gun into liner retainer. Slowly slide housing into place on Gun until it locks in.

i. Screw nozzle onto Gun. Hand tighten.

j. Turn power ON. Operate Gun with trigger (and jog button, if installed) for a short interval to ascertain that it operates satisfactorily.

## 4.3 TROUBLESHOOTING

When a malfunction occurs in the welding system, refer to Table III to determine whether the trouble can be confined to the Gun. Then troubleshoot the Gun in accordance with Table IV.

PART 4

**AIRCOMATIC  
PUSH-PULL WIRE FEEDER**

**MODEL AHF-E1**



Figure 1. Model AHF - EI Push-Pull Wire Feeder

## Section I. INTRODUCTION

### 1.1 GENERAL

This manual covers the description, installation, operation, and maintenance of, the Model AHF-EI AIRCOMATIC Push-Full Wire Feeder (Fig. 1) used in MIG welding.

### 1.2 DESCRIPTION

This versatile unit feeds welding wire and monitors welding current, cooling water, and shielding gas to

an AIRCOMATIC gun. It can be used with either a push or pull type. The carriage supports all the feeder components. The motor drives the welding wire through the gun. The drive rolls drive wire when a push gun is used. The reel deck supports the hub, brake, and brake adjustment device. The strain relief relieves the strain on hoses, casing, and flexible shaft. The cover protects the mechanisms. See Figure 2 for dimensions.

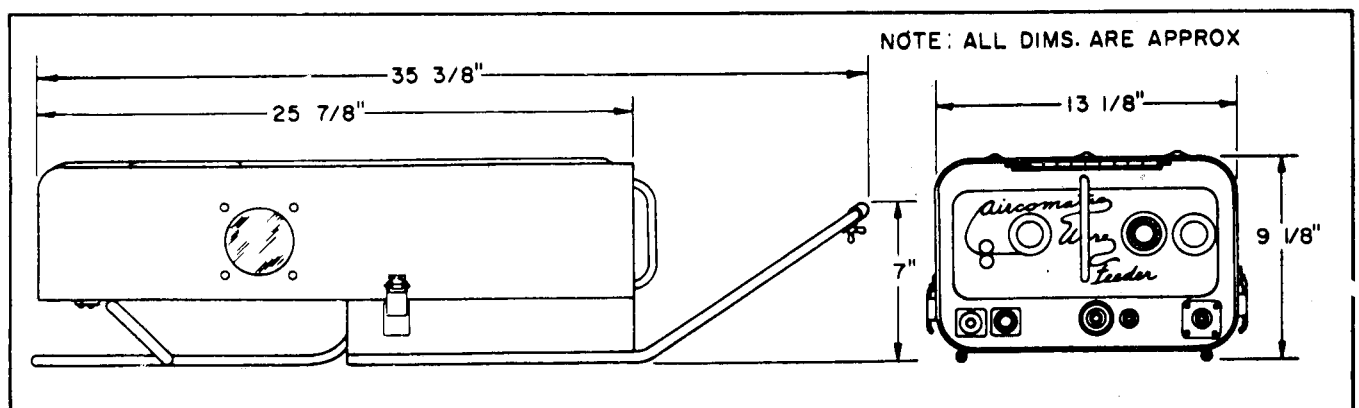


Figure 2. Dimensions

### 1.3 ACCESSORY EQUIPMENT

Items required to adapt the Feeder for use under particular job conditions are accessories. These include inlet guide bushings and drive rolls associated with the type and size of welding wire to be used. See Table I in Section II.

### 1.4 AUXILIARY EQUIPMENT

Auxiliary equipment comprises items, in addition to accessories, required to complete a typical welding installation. Such equipment includes: goggles, helmet, gloves, welding cables, gas and water hoses and fittings, regulator and flowmeter, shielding gas, welding wire, a push or pull type welding gun, a Model AHC-B Control, a power source, and a secondary

contactor if the power source does not contain a primary contactor. In most cases auxiliary items include instruction books which describe their function and operation. To simplify the procurement of necessary hoses and cables, kits are available. These are explained in Table II in Section II. In addition, Table III in Section II is included to aid in the local procurement or fabrication of needed welding cables.

## Section II. INSTALLATION

### 2.1 GENERAL

This section covers installation of the Feeder and its interconnection with the components needed to operate MIG welding system.

### 2.2 UNPACKING, INSPECTION, AND ASSEMBLY

Unpack the Feeder carefully. Inspect the unit

*NOTE:* A jog button is supplied with the Feeder for attachment to water-cooled guns. Refer to the water-cooled gun manual for installation instructions.

### 2.3 STRAIN RELIEF KIT INSTALLATION

If the strain relief (Fig. 3) is to be used, screw the frame onto the bottom of the carriage with the four screws provided in the kit.

### 2.4 SITE SELECTION

Select a location for the Feeder so that it will be easy to adjust the wire feed speed dial (Fig. 3). Position the Feeder to avoid kinks or sharp bends in the hoses and cables. If practical, allow room for full opening of the hinged cover (Fig. 3) and turning the unit on its side for removal of the bottom cover and inspection of the under-carriage components.

### 2.5 INSTALLING WIRE GUIDE FITTINGS

Select the inlet guide bushing, knurled or conical drive roll, and grooved drive roll suitable for the wire type and size to be used as indicated in Table I.

*NOTE:* If the Feeder is to be used with a pull gun, do not install drive rolls, but perform steps a and e.

- a. Unlock and open hinged cover.
- b. Insert the conical drive roll into the upper roll shaft.
- c. Hold cam handle (Fig. 4) depressed to raise conical drive roll in upper roll shaft.
- d. Insert the grooved drive roll into the lower roll shaft. Release cam handle.
- e. Insert inlet guide bushing into drive roll housing (Fig. 4).

TABLE I

Wire Guide Fittings

Wire Size	Inlet Guide Bushing Assy. with "O" Rmg	Drive Roll	
		Conical	Grooved
Hard .035	23600883	2360 1700	2360 1702
Hard .045	23600883	2360 1700	2360 1702
Hard 1/16	23600884	2360 1700	2360 1703
Hard 5/64	23601714	2360 1700	2360 1704
Hard 3/32	23600885	2360 1700	2360 1705
Al. 3/64	23600883	23601701	2360 1702
Al. 1/16	23600884	2360 1701	2360 1703
Al, 3/32	23600885	23601701	2360 1705
Al, 1/8	23600886	2360 1701	23601706
Stranded 5/64	23601714	2360 1701	2360 1704

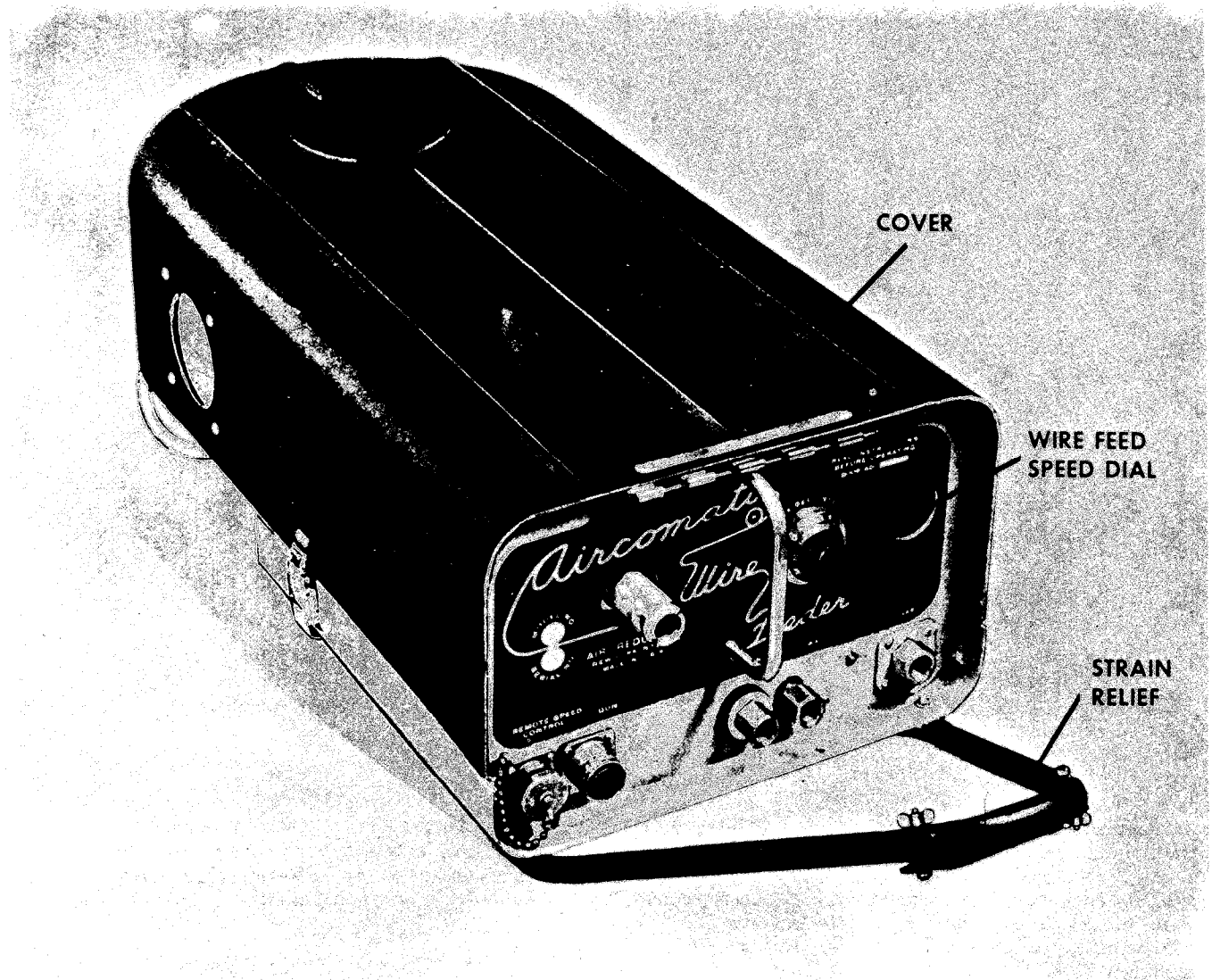


Figure 3. Wire Feeder, Front View

## 2.6 INSTALLING AND THREADING WIRE

Install and thread the welding wire in the Feeder as follows :

- a. Unlock and open hinged cover.
- b. Select wire size and type.
- c. Place lever of hub assembly (Fig. 5) in vertical position.
- d. Slip wire spool onto hub. Position it so that spool turns clockwise as wire pays out.
- e. Engage hub flange pin with hole in spool. Place the lever in horizontal position.
- f. If installing a pull gun, refer to the gun manual for wire installation. Be sure PUSH-PULL switch is in PULL position after wire is installed between pull-gun drive rolls.

g. If installing a push gun, place the PUSH-PULL switch in PULL position and perform the following steps.

h. Back off adjustment knob on drive roll housing (Fig. 4) a few turns counterclockwise.

*NOTE:* Never turn the adjusting set-screw of the grooved roll shaft, This is factory-set, and any disturbance may cause misalignment of the shaft and roll, requiring special gauges for correction.

i. Lift end of wire from spool. Clip the wire to remove the sharp bend. Smooth the cut end to prevent snagging. Straighten the wire, but keep it taut so that it cannot loosen on spool,

j. Holding cam handle depressed, pass wire through inlet guide bushing, between conical and grooved rolls,

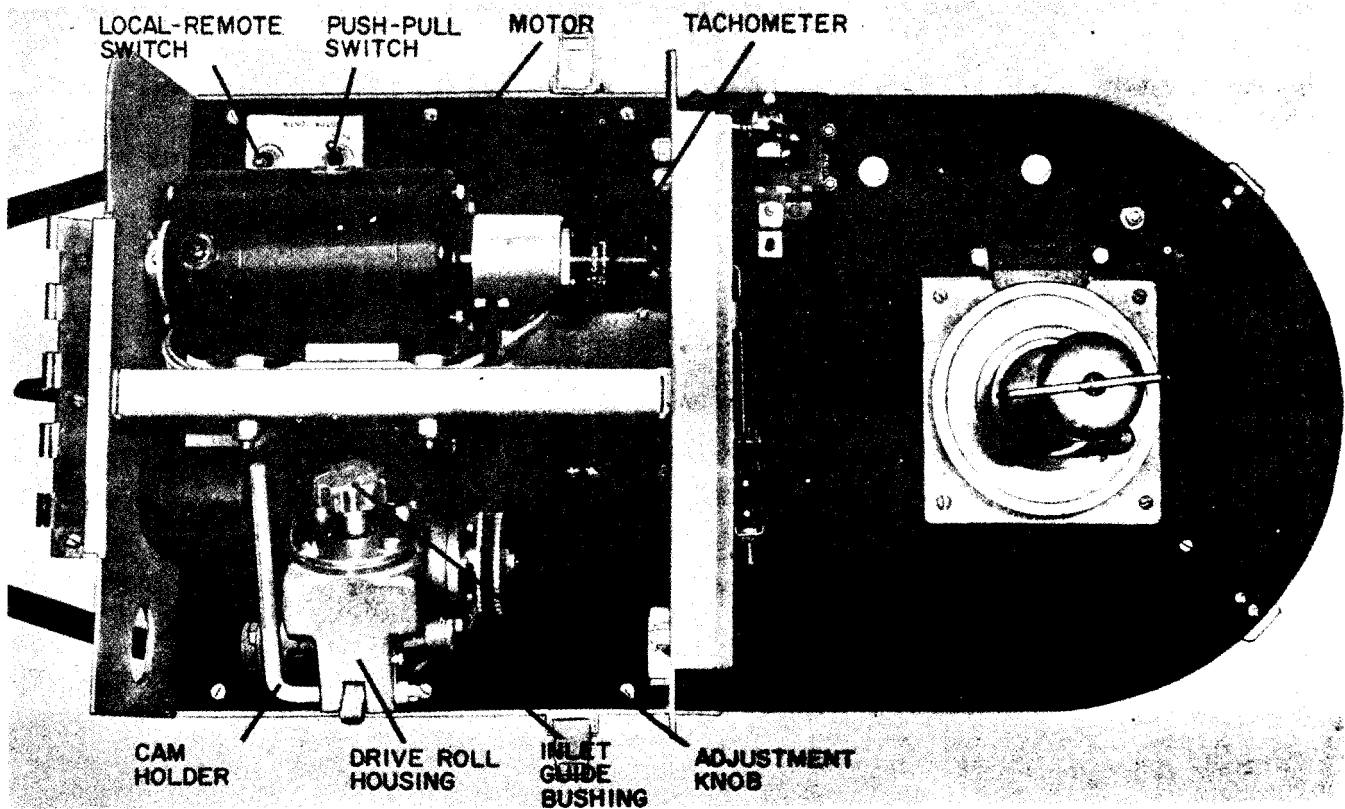


Figure 4. Wire Feeder, Inside View

and out about an inch through the casing inlet guide bushing housing (Fig. 6).

k. Release cam handle and gently turn adjustment knob clockwise to add only sufficient pressure of conical roll against wire to allow rolling friction for feeding without deforming.

*NOTE:* The adjustment knob, once properly set, need not be readjusted unless wire of different size or quality is to be threaded.

1. Wind the spool counterclockwise to take up slack between the spool and drive rolls.

*IMPORTANT:*

1. Do not push wire back through the drive rolls. The wire may kink.

2. If the wire end is not straight, cut off the bent part and remove burrs to prevent jamming in the casing.

m. Pass the end of the gun casing through the casing retainer (Fig. 6).

n. Fit the casing through the drive roll housing near the drive rolls so welding wire enters the end of the casing inlet bushing.

o. Screw the retaining nut of the casing firmly into the casing retainer.

p. Check that the casing inlet bushing is as close to the drive rolls as possible without touching and centered so wire cannot scrape against it. Align-

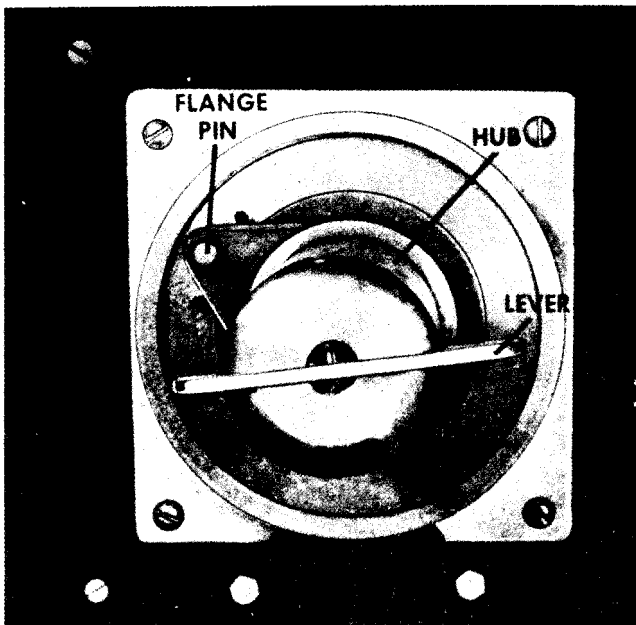


Figure 5. Hub Assembly

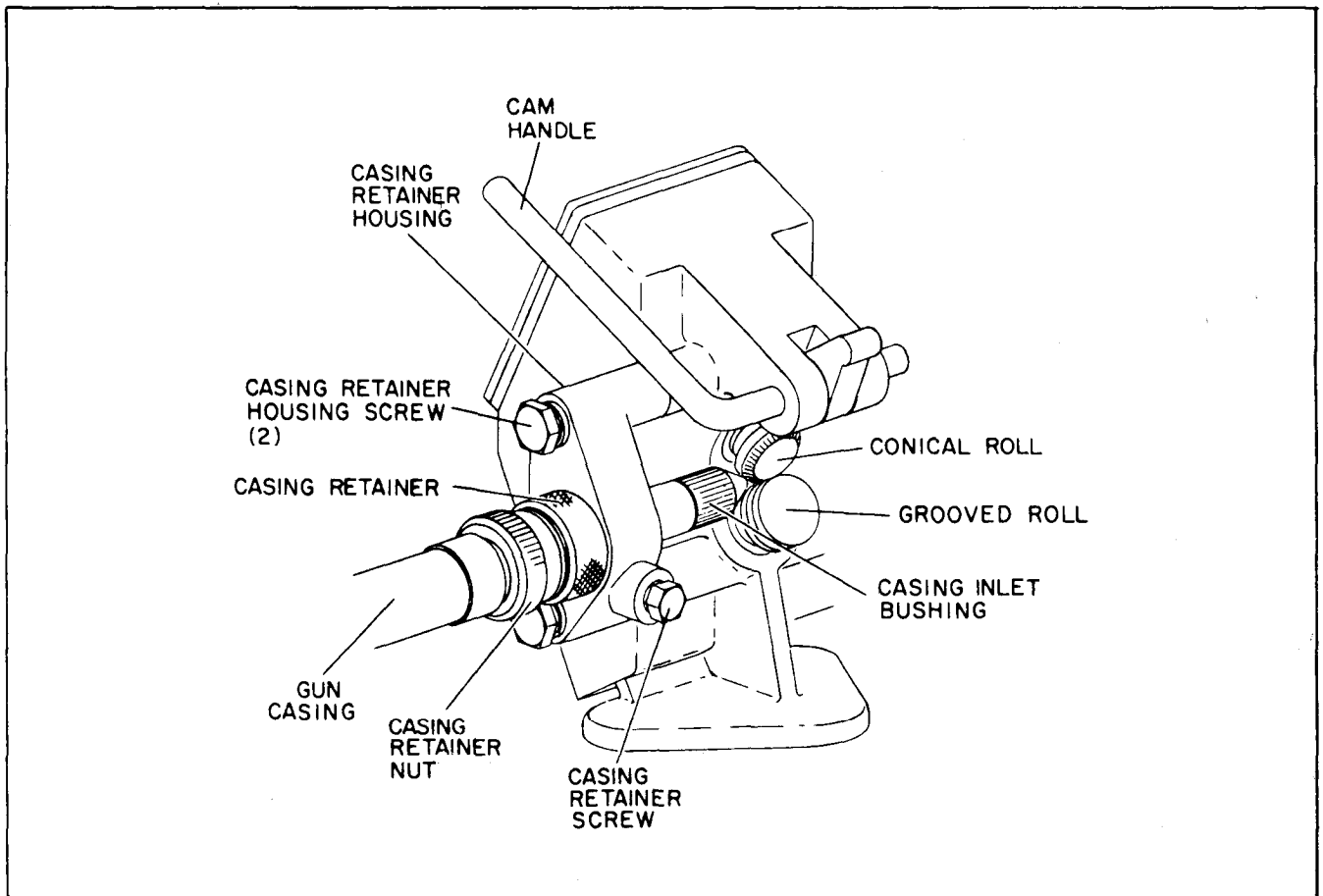


Figure 6. Drive Roll Housing

ment of the bushing with the drive rolls may require moving the end of the casing assembly horizontally toward or away from the drive rolls and/or shifting the casing retainer housing. If any of these adjustments are necessary, proceed as follows:

q. Back out the casing retainer screw sufficiently to allow the casing to slide forward or backward. Bring the casing inlet bushing close to the drive rolls and retighten the screw.

r. Loosen the casing retainer housing screws, if required, sufficiently to allow movement of the housing.

s. Observing the drive rolls from the side of the housing, the top of the casing inlet bushing should be evenly spaced between the upper and lower drive rolls. Retighten the screws.

## 2.7 CONNECTING FEEDER IN SYSTEM

a. The Feeder is interconnected (Fig. 7) with a Control, welding power source, gun, and (if power source does not contain a primary contactor) a secondary contactor. This requires two water hoses (water-cooled guns only), a gas hose, a multi-conductor cable, and a contactor-to-feeder cable (or power source to feeder). One of the water hoses (water-out-to-relay) and the multi-conductor cable are supplied in a hose and cable kit available in three sizes as shown in Table II. The other water hose is a customer-furnished,

5/16-inch hose that connects the Feecier to the water supply. The gas hose is a customer-furnished, 5/16-inch hose that connects the Feeder to the gas supply.

b. If supply water pressure exceeds 75 psi, install a water pressure regulator at inlet end of water hose.

c. If continuous water cooling for severe service conditions is required, refer to control manual for necessary re-connection of the control cable leads.

*NOTE:* For adequate cooling, water must flow at the rate of at least two pints per minute requiring a pressure of about 30 psi. The gun will not operate unless the water pressure switch (factory-set at 25 psi) is closed. However, in unusual cases, a clogged or pinched water line might generate enough back pressure to close this switch even with insufficient cooling water in the system. For this reason keep end of water drain hose visible at all times.

## 2.8 CONNECTING GUN TO FEEDER

a. Attach the gun casing as explained in paragraph 2.6 of the gun manual.

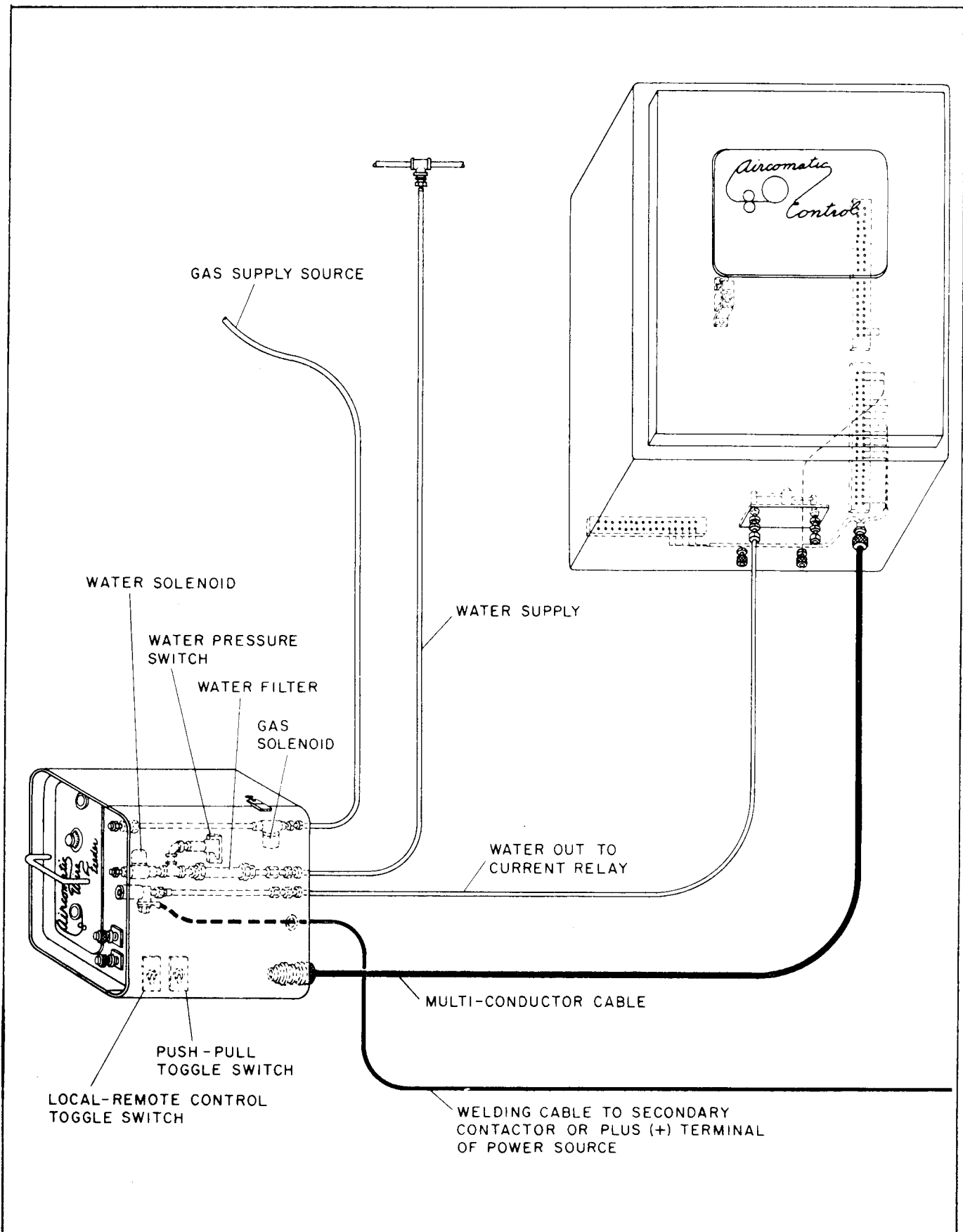


Figure 7. Interconnection Diagram



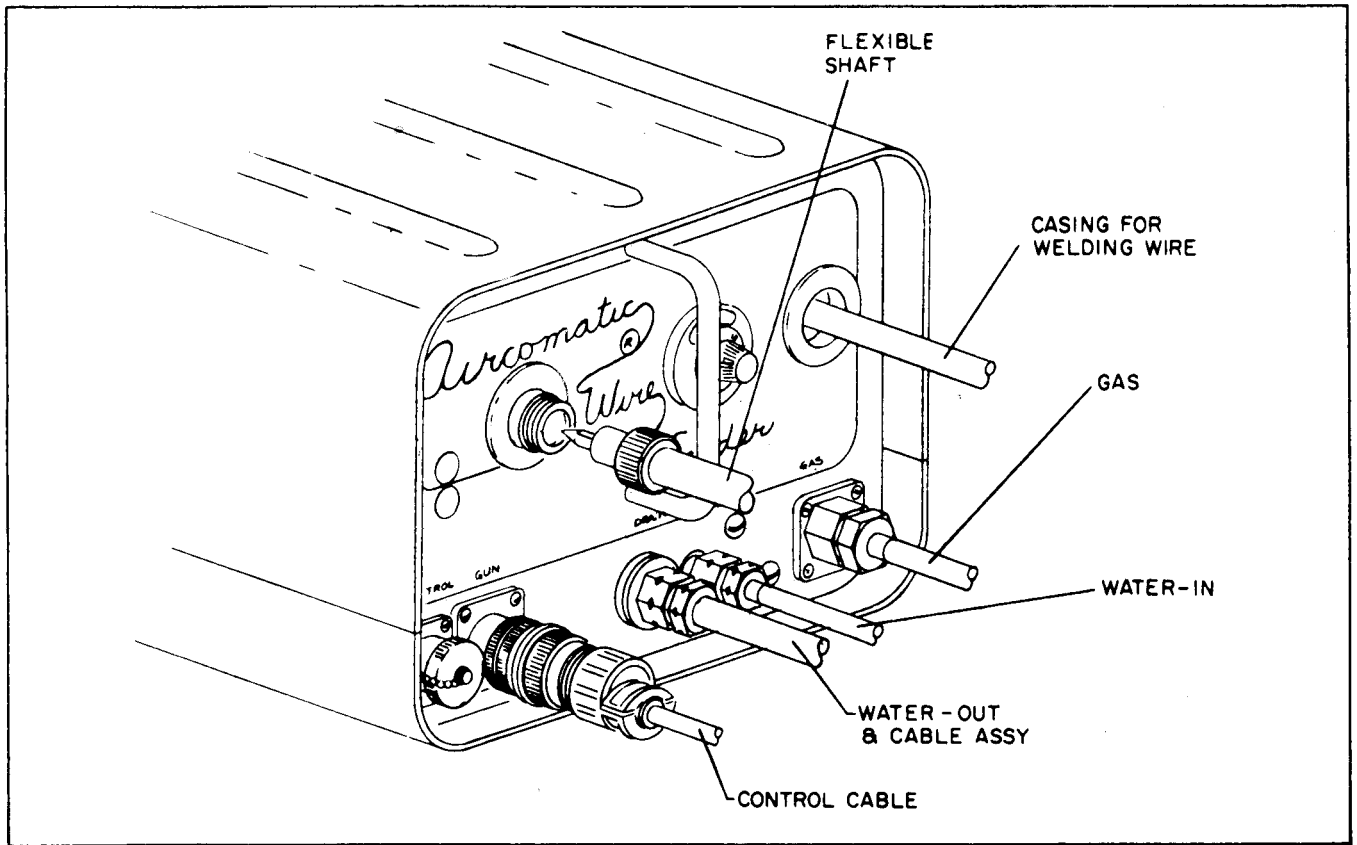


Figure 8. Connecting Gun

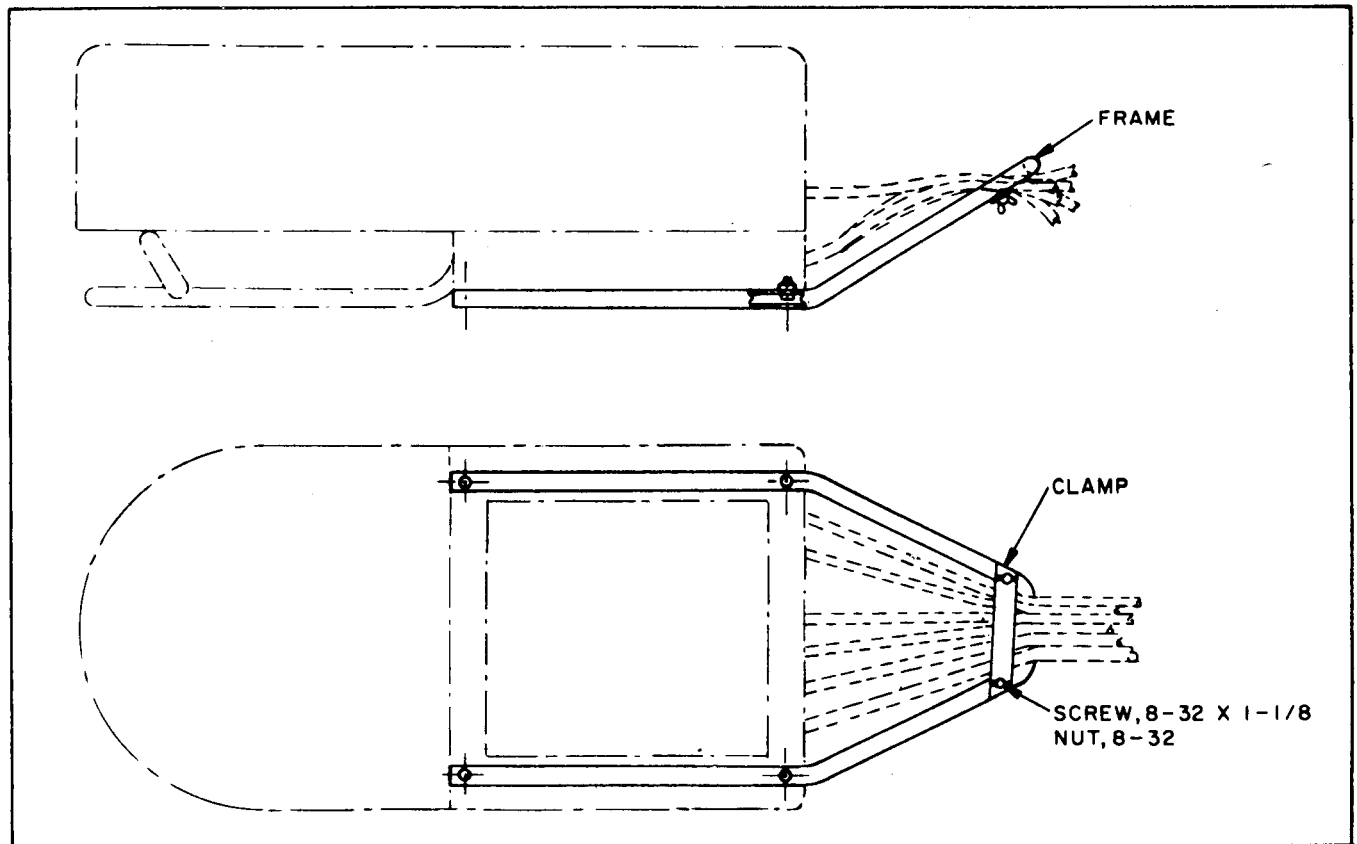


Figure 9. Anchoring Cable and Hoses on Strain Relief

TABLE II

Hose and Cable Kits

Hose and Cable Length (ft. )	Hose and Cable Kit Stock No.	Wire Hose Stock No.	Wire Hose Stock No.
15	23602203	23602205	23601196
50	23602203	23602206	23600979
100	23602257	23602284	23601301

TABLE III

Cable Size Selector Guide

Amps.	Feet											
	50	75	100	125	150	175	200	225	250	300	350	400
100	2	2	2	2	1	1/0	1/0	2/0	2/0	3/0	4/0	4/0
150	2	2	1	1/0	2/0	3/0	3/0	4/0				
200	2	1	1/0	2/0	3/0	4/0	4/0					
250	2	1/0	2/0	3/0	4/0							
300	1	2/0	3/0	4/0								
350	1/0	2/0	4/0									
400	1/0	3/0	4/0									
450	2/0	3/0										
500	2/0	4/0										

b. Make all other gun connections as shown in Figure 8.

c. Anchor cables and hoses and flexible shaft on strain relief (Fig. 9) to prevent straining at connection points to the Feeder 'as follows:

1. Fasten hoses, casing and flexible shaft, if any, side-by-side in order of decreasing hose diameter under nose of frame. Leave a small amount of slack.

2. Place clamping bar under this cluster. Apply screws and wing nuts.

3. Tighten screws only sufficiently to hold the cluster into place.

IMPORTANT: Be careful not to flatten the hoses excessively. Excessive clamping may hinder flow through the hoses.

Section III. OPERATION

3.1 SAFETY REQUIREMENTS

Comply with all ventilation, fire and other safety requirements for welding as established for industrial applications. Reference as applicable:

a. "Safety in Electric and Gas Welding and Cutting Operation", . . . American Standards Association: Bulletin 249.1, 1958.

b. "Recommended Safe Practices for Inert- Gas Metal-Arc Welding". . . American Welding Society: Bulletin A6.1, 1958,

Because of infrared radiation emitted by the high-intensity arc in AIRCOMATIC welding methods, flash

goggles (medium-shade 1306 2101) are recommended in addition to helmet for the operator and near-by personnel. The welding wire (electrode) and all metal parts in contact with it are electrically energized while welding, requiring periodic inspection of cables for broken insulation, water leakage, and other electrical hazards.

CAUTION

WHENEVER STEPS ARE TAKEN TO REMOVE AND REPAIR SUCH HAZARDS, PLACE ALL POWER coNTRoLsoFF AND DISCONNECT ALL ELECTRICAL CABLING FROM POWER SOURCES.

### 3.2 GENERAL

The Feeder should only be operated when connected within an AIRCOMATIC welding system. This section covers only pre-weld requirements such as setting the wire feed speed dial, a pre-weld checklist, an operating sequence (Fig. 10) and inspection during and after operation. As additional aids toward understanding this system, a schematic diagram (Fig. 11) and wiring diagram (Fig. 12) are included at the end of this section.

The location and function of the controls used in the operation of the Feeder are listed in Table IV. Also listed are components closely related to Feeder operation.

### 3.3 SETTING WIRE SPEED DIAL

Manually set the desired wire feed speed on the dial of the wire feed speed dial (Fig. 3), as follows:

TABLE IV  
Functions of Controls and Selected Electrical Components

Control or Component	Symbol	Function
Wire Feed Speed Potentiometer Dial (Fig. 3)	R111	For manual setting of desired wire feed speed. Rated: 0-20, 000 ohms, 5W, continuously variable.
	R113	Functions in parallel with R111 when PUSH-PULL switch SW107 is in PULL position to adapt R111 for pull operation.
PUSH- PULL Switch (Fig. 4)	SW107	PUSH position (for push guns) opens brake solenoid circuit to apply drag on wire reel, PULL position (for pull guns) closes brake solenoid circuit to retract brake and remove drag.
LOCAL-REMOTE Switch (Fig. 4)	SW103	LOCAL position switches Wire Feed Speed Potentiometer (R111) into motor control circuit so that speed can be hand-set at panel dial,  REMOTE position switches R111 out of and Remote Control (R112) into motor circuit so that speed can be set on the remote control.
Tachometer-Generator (Fig. 4)	TG101	Produces electrical equivalent of existing motor speed for motor control circuit in control unit.
Solenoid: Brake (Fig. 11)	BS101	Retracts brake during pull operation of Feeder when energized by pull gun trigger, Upon release of trigger, brake engages.
Gas (Fig. 12)	GS101	Allows gas flow during push or pull operation of Feeder when energized by gun trigger,
Water (Fig. 12)	WS101	Allows water to flow during push or pull operation of Feeder when energized by gun trigger.

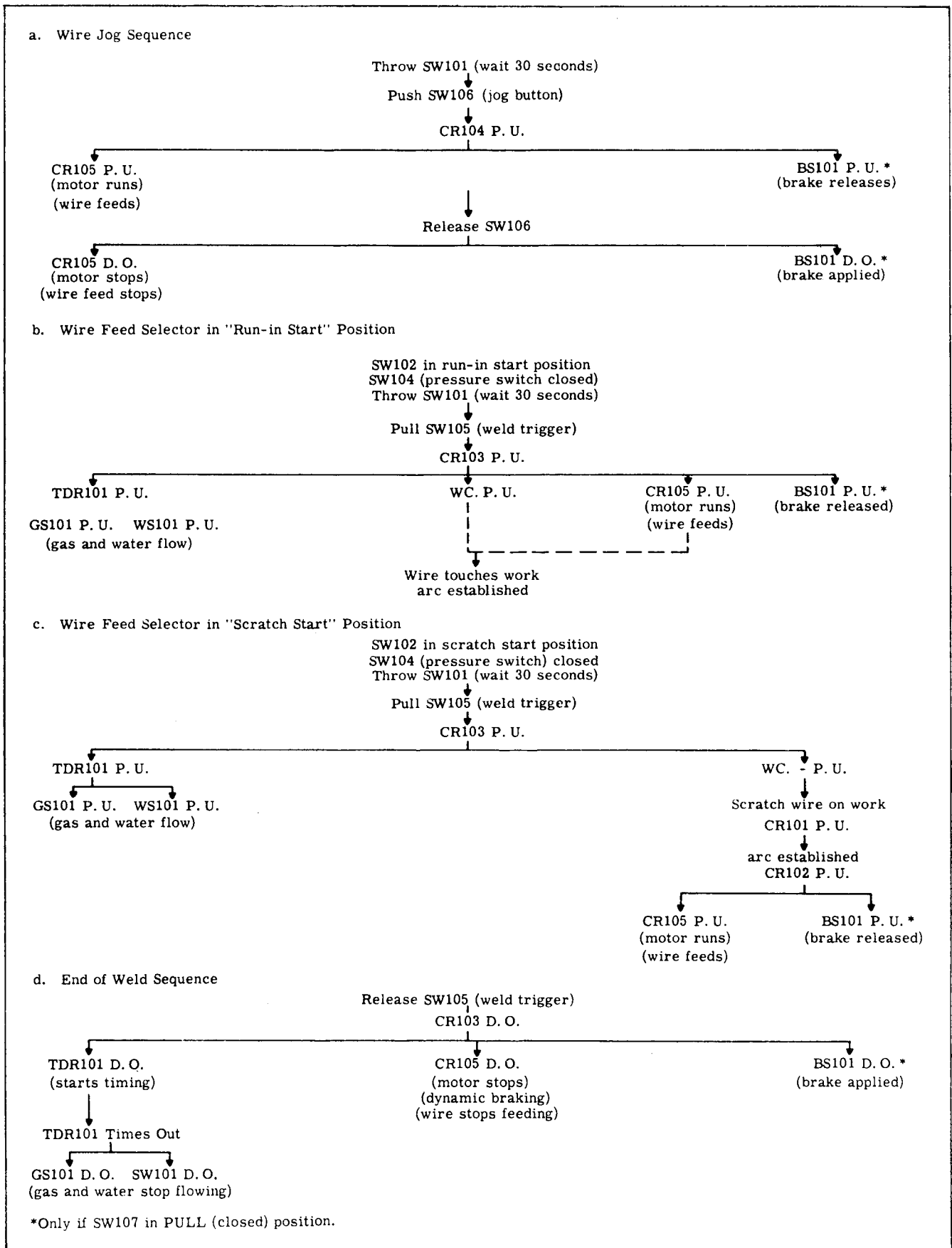


Figure 10. Sequence Chart, Wire Feeder Operation

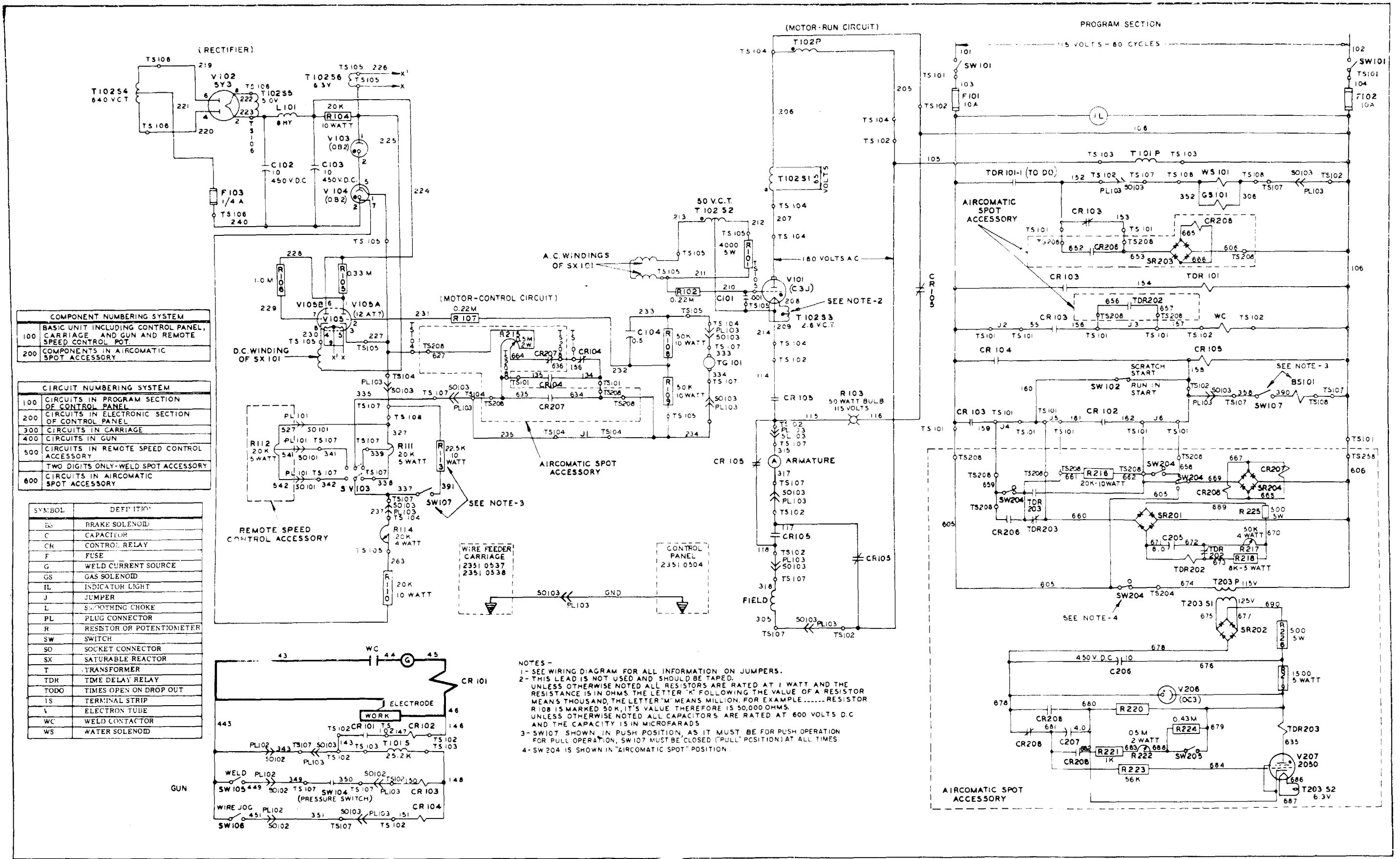


Figure 11. Schematic Diagram

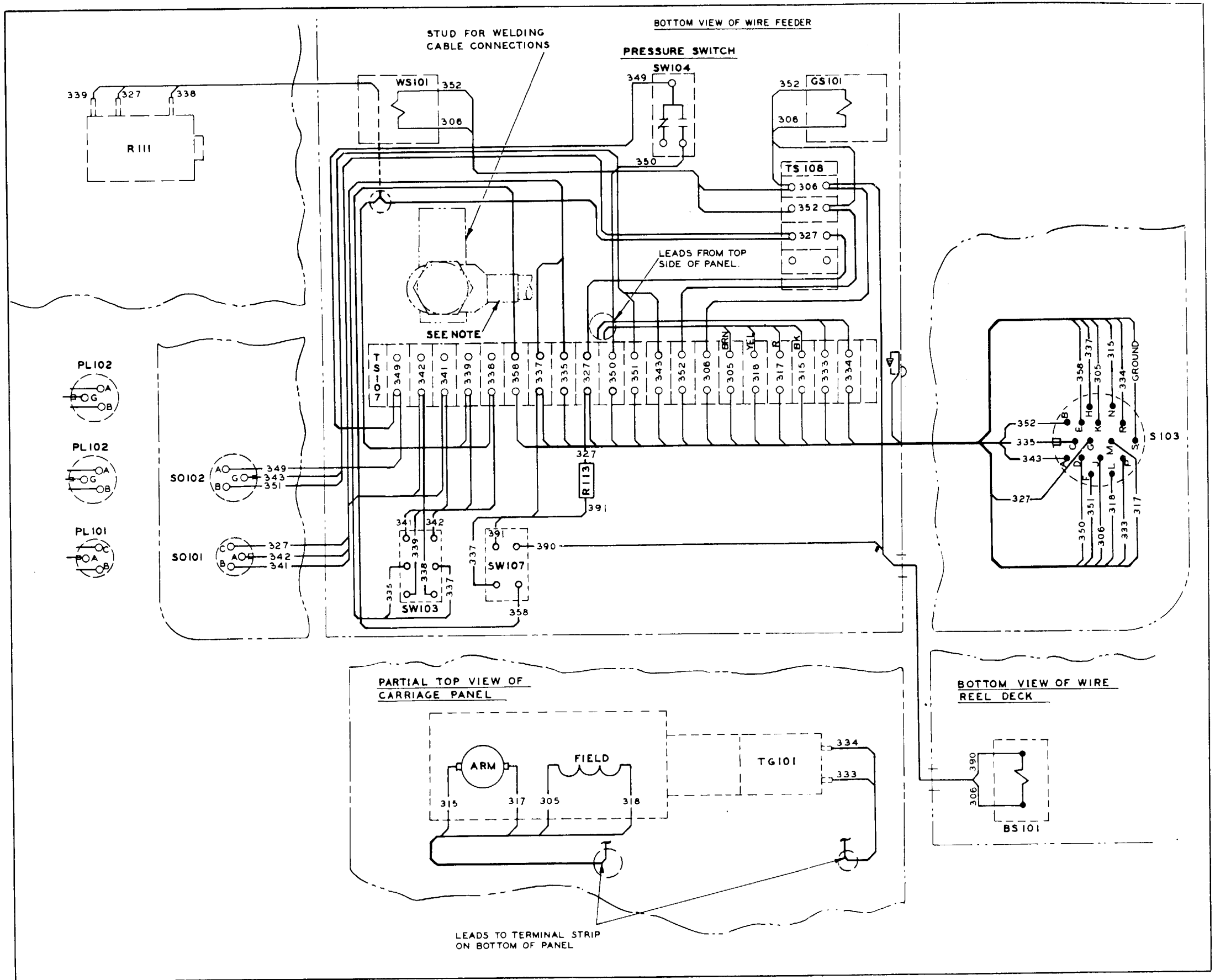


Figure 12. Wiring Diagram

- a. Take reading of dial when set at a minimum (zero) position,
- b. Add desired wire feed speed to this reading in inches-per-minute,
- c. Set dial to sum of steps a and b above,

Example: If minimum is 55, and the desired wire feed speed is to be 185 ipm, set dial at 240.

### 3.4 PRE-OPERATION CHECKS

- a. Turn main power switch ON at control.
- b. Actuate gun trigger.
- c. Look for leaks at hose connections and around equipment, and tighten or repair.
- d. Look for signs of overheating and burning at electrical points, as evidenced by brownish discoloration, smoke, or odor.
- e. Hold gun trigger or jog button depressed for an interval of 15, 30, or 60 seconds. Measure the amount of wire output at gun to ascertain actual wire feed speed.
- f. Compare actual wire feed speed with desired speed set on dial of panel to determine whether calibration of dial potentiometer is necessary. If so, refer to the Model AHC-B Control manual for calibration instructions.
- g. Turn OFF main power switch at Control.

### 3.5 PRE-WELD CHECKLIST

Before operating the Feeder make sure of the following:

- a. All connections tight.
- b. Wire in drive rolls properly seated for push gun operation, or drive rolls removed for pull gun operation.
- c. Adjustment knob (Fig. 4) properly set.
- d. Lever on hub reel (Fig. 5) locked,
- e. Proper drag on wire reel (push gun only).
- f. Proper belt tension (push gun only).
- g. PUSH- PULL switch (Fig. 4) in proper position for the gun being used.
- h. LOCAL-REMOTE switch (Fig. 4) in proper position.
- i. Cover locked.
- j. Wire feed speed dial (Fig. 3) properly set.
- k. Water supply ON and end of drain hose visible.
- l. Gas supply ON.

### 3.6 CHECKS DURING AND AFTER OPERATION

During operation of the Feeder, check for signs of leaks, and any unusual operating noises. If present, turn main power switch at control OFF immediately. After an operation, repeat the pre-operation checks.

### 3.7 SHUTTING DOWN SYSTEM

When operating during temperature above freezing, shut down the system by turning main power switch at the control OFF. Turn OFF gas and water supplies. Disconnect the power cord of the control. When operating during temperatures below freezing with a water-cooled gun, shut down the system as follows:

- a. Turn water supply OFF. Disconnect water supply hose.
- b. Place main switch of power source OFF.
- c. Set selector switch in control to SCRATCH START,
- d. Depress gun trigger to open water solenoid.
- e. Use compressed air to blow out water lines.
- f. Turn main power switch at control OFF,
- g. Disconnect power cord of control.
- h. Turn shielding gas supply OFF.

### 3.8 PRINCIPLES OF OPERATION

This AIRCOMATIC welding system needs only two simple hand operations for welding after power is turned on: (1) setting the wire feed speed dial on the Feeder, and (2) pulling the gun trigger to energize the circuit. The welding operation is programmed and electronically controlled by the Model AHC-B Control. Welding wire is power fed, and cooling water and gas are routed through the Feeder.

Feeding of the wire is accomplished by a motor and drive rolls (Fig. 4). The motor drives the drive rolls through a pulley and timing belt arrangement within the Feeder for pushing wire through a push gun, or it drives a flexible shaft connected to drive rolls within a pull gun which pulls the wire from the reel in the Feeder. The drive roll housing within the Feeder includes a worm gear on an integral bearing-mounted shaft to which a belt pulley is keyed. This worm drives two worm gears, each keyed to a bearing-mounted roll shaft. One shaft end holds a removable conical roll wire guide fitting. The other holds a grooved roll fitting. As the motor drives the belt pulley on the worm shaft, the worm drives a worm gear and roll shaft on either side of it. The welding wire, gripped between the conical and grooved drive rolls, is thus pushed toward the push gun. An inlet guide bushing admits the wire to the drive roll housing, and after it has passed through the drive rolls, the wire leaves through an outlet guide bushing. It reaches the push gun through a liner within a casing coupled to the outlet guide bushing and connected to the gun. An adjustment

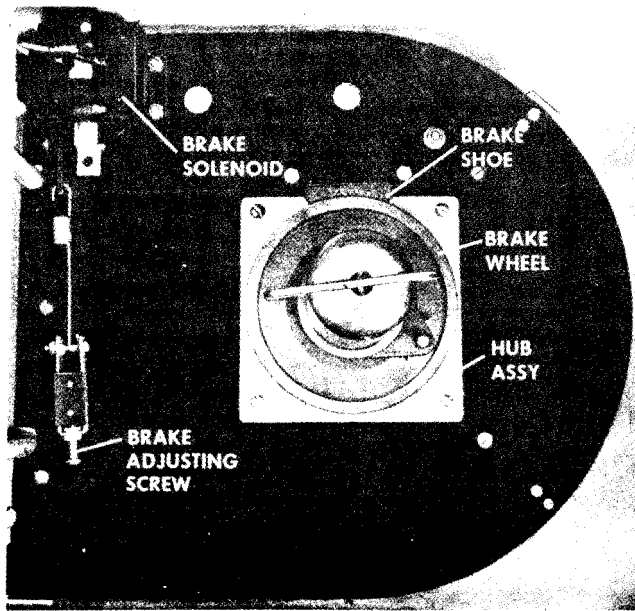


Figure 13. Brake Mechanism

knob is provided for adjusting the pressure of the conical roll shaft and fitting against the wire. An adjustment setscrew (factory-set) aligns the grooved roll shaft. A cam handle on the assembly, when depressed, actuates a spring-cam which moves the conical roll shaft away from the welding wire to facilitate wire-threading.

The wire reel mounts and locks on a hub assembly (Fig. 13) which also provides a braking surface (wheel) for the shoe of the drag brake. The operation of the brake is determined by the position of the PUSH-PULL switch. In PUSH position, the brake remains engaged and the brake shoe drags on the brake wheel of the hub to control overrun of wire from the reel. In PULL position, the brake is electrically released when the trigger switch is pulled to eliminate drag so that the reel is free as the wire is pulled by the gun. As soon as the trigger is released, the spring loaded brake re-engages with the brake wheel of the hub to stop wire pay-out.

A brake adjustment device permits the adjustment of the degree of friction between the brake shoe and the hub brake wheel to increase or decrease the amount of drag and to compensate for brake wear.

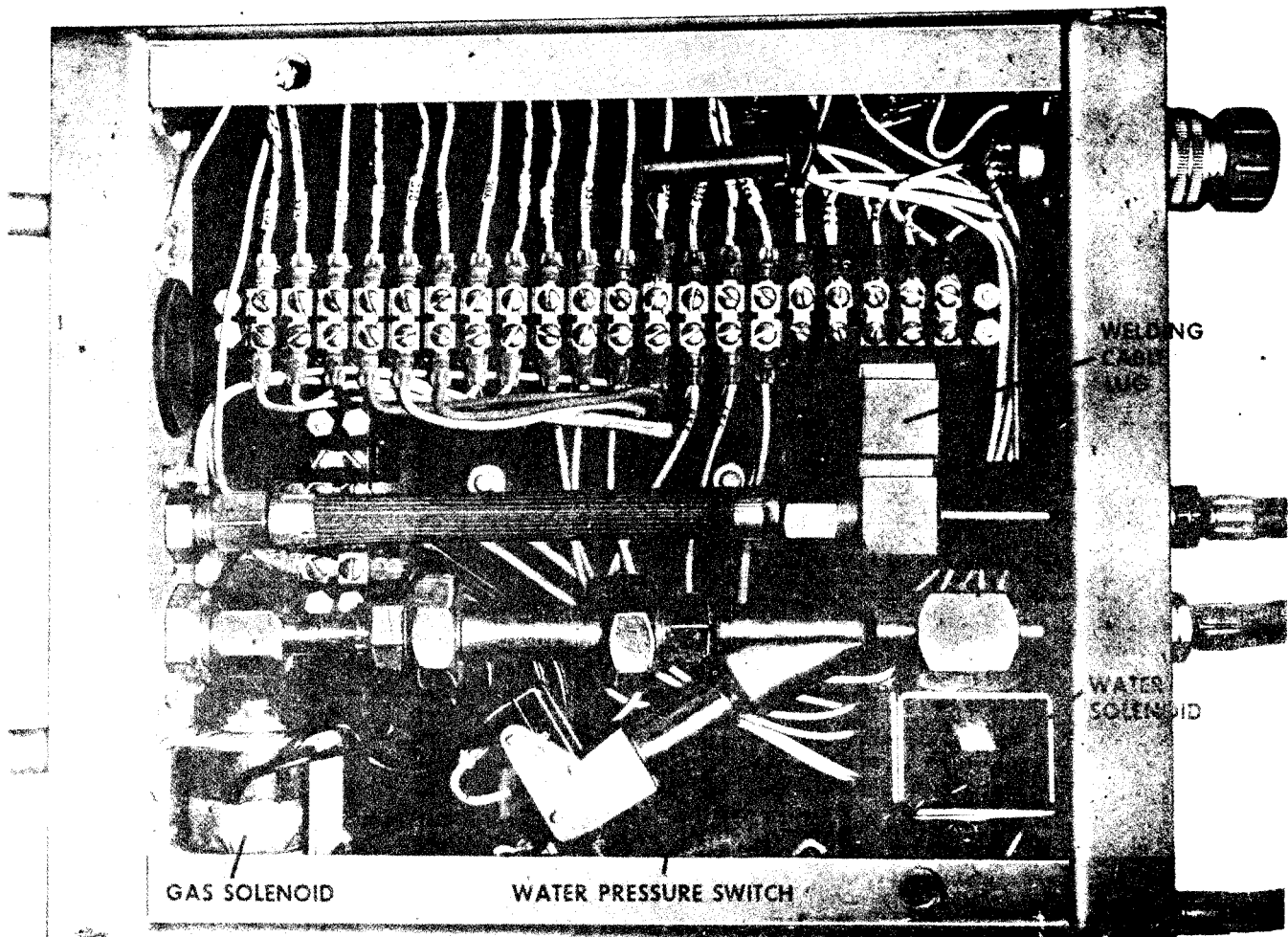


Figure 14. Feeder Service Connections



Flows of gas and water are routed through the Feeder by the operation of a gas solenoid, a water solenoid, and a water pressure switch (Fig. 14). The gas solenoid admits shielding gas from the gas source to the gun nozzle. The water solenoid admits cooling water from a source to the gun (water-cooled) and to the current relay in the control. These services are provided upon closing the trigger switch and a short time after the trigger switch is released. A time delay relay within the control provides for setting the post flow time.

The water pressure switch is factory-set to close at a water pressure of 25 psi. It keeps the system in-operative unless inlet water pressure is at least 25 psi

The circuits of the Feeder are part of the circuitry of the Control and gun, and include: a motor, a wire feed speed potentiometer in the motor control circuit, a gas solenoid, a water-solenoid, a water pressure switch, and a brake solenoid. For details on the functioning of these circuits, refer to the control manual.

The operating sequence of the Feeder components is listed in Figure 11.

## Section IV. MAINTENANCE

### 4.1 GENERAL

This section covers inspection, preventive maintenance and service, and repairs required to keep the Feeder operating efficiently,

### 4.2 PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, tightening, and making minor repairs designed to prevent lay-up time of equipment for major service and parts replacement.

### CAUTION

**BEFORE MAKING REPAIRS TO THE FEEDER MAKE SURE POWER SWITCH AT CONTROLS IS OFF.**

At least every 30 days check the Feeder as follows:

- a. Look for signs of overheating of wires and components.

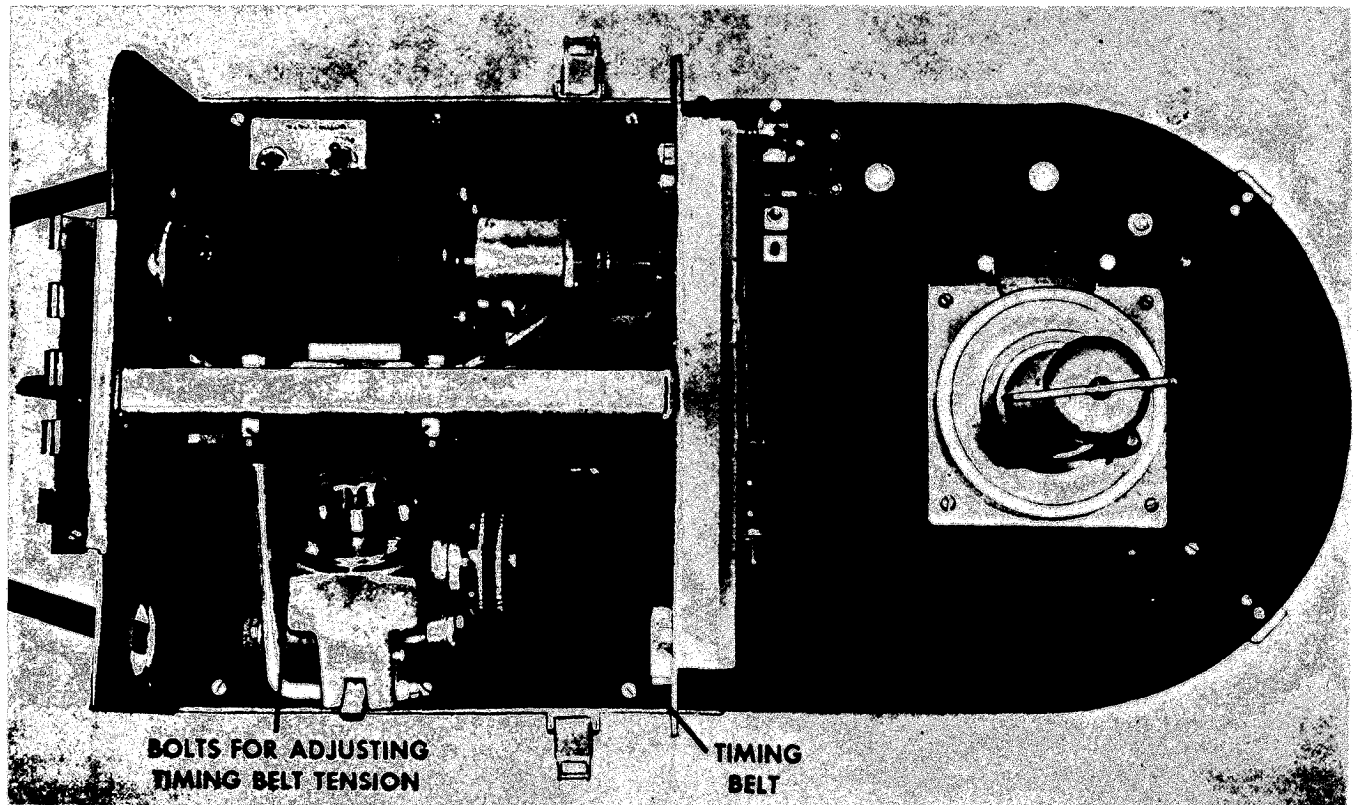


Figure 15. Timing Belt Adjustment

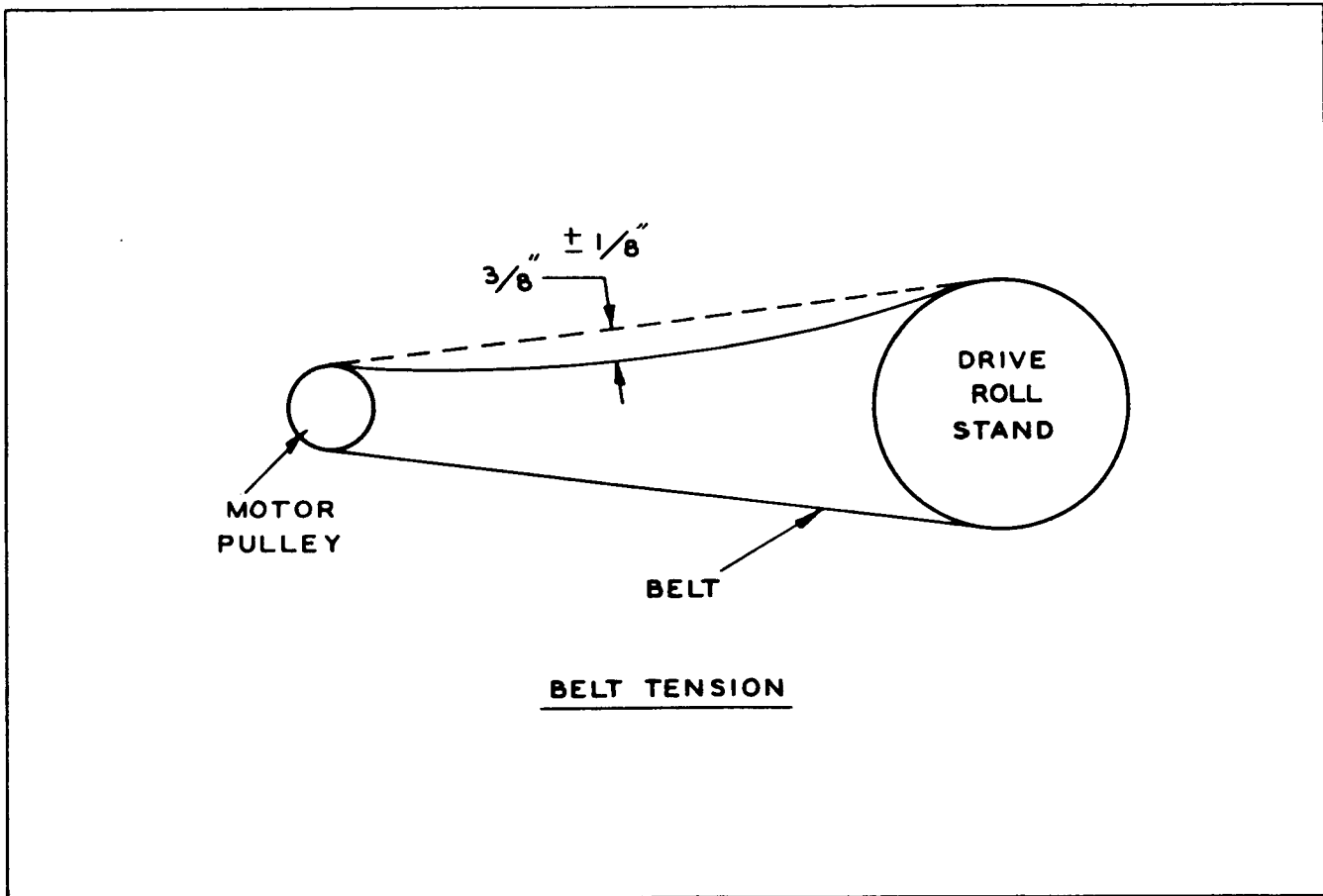


Figure 16. Adjustment Point for Timing Belt

b. Check timing belt for proper tension.

c. Check hose connections for leaks. Make sure cables are secure.

At least every 60 days check the Feeder as follows:

a. Wipe away any dust, dirt and grime from Feeder. Use an air hose, if necessary, to blow it out.

b. Tighten all loose wire connections. Repair or replace any wiring with damaged insulation.

c. Tighten all mounting hardware.

d. Replace timing belt (Fig. 15) if worn or frayed. Check for proper belt tension.

e. Check brake (Fig. 13) for proper adjustment.

f. Lubricate gear chamber of drive roll housing (Fig. 4). Use a good grade of oil.

g. Make sure all switches are serviceable and wire feed speed dial and potentiometer function properly.

#### 4.3 REPLACING AND ADJUSTING TIMING BELT

The motor is mounted on a spring-loaded plate held on a support of the carriage. This arrangement enables

adjustment of the timing belt tension. To replace the belt, it is not necessary to disturb this adjustment. The belt is eased off the pulleys and removed when the adapter is taken off the motor. Belt adjustment, however, is necessary whenever a motor is replaced. Adjust the timing belt (Fig. 15) by turning the motor mounting bolts until the tension on the belt is as shown in Figure 16. Make sure the motor is approximately parallel to the motor support, or the belt may run off the drive roll pulley.

#### 4.4 BRAKE ADJUSTMENT

To adjust the brake to increase or decrease the amount of friction between the brake shoe and the hub brake wheel or to compensate for brake shoe wear, proceed as follows:

a. Unlock and open hinged cover.

b. Place lock lever of hub in vertical position. Remove wire reel.

c. Turn the brake adjusting screw (Fig. 13) until brake shoe makes light contact with the wheel.

d. Replace wire reel and lock it.

4.5 TROUBLESHOOTING

e. Close and lock hinged cover.

f. Test for proper brake adjustment by measuring the amount of wire overrun from a full spool of wire in the PUSH mode. The overrun should be approximately 1/2-5/8-inch.

Whenever a malfunction occurs in the welding system, refer to Table V to determine whether the trouble can be isolated to the Feeder. Then troubleshoot the Feeder in accordance with Table VI to repair the trouble. Reference to the sequence of operations (Fig. 8), schematic diagram (Fig. 9), and the wiring diagram (Fig. 10) may be desirable.

TABLE V  
Welding System Troubleshooting

Symptom	Probable Cause	Remedy
No welding arc with power on and gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Welding power source OFF.</li> <li>b. Contactor trouble.</li> <li>c. Defective cable.</li> <li>d. Malfunction in Control</li> <li>e. Malfunction in gun.</li> <li>f. Malfunction in Feeder.</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Check and repair</li> <li>c. Repair or replace,</li> <li>d. See Control manual.</li> <li>e. See gun manual.</li> <li>f. See Table VI.</li> </ul>
No gas flow with power on and gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Gas source OFF.</li> <li>b. Clogged line.</li> <li>c. Malfunction in gun.</li> <li>d. Malfunction in Control.</li> <li>e. Malfunction in Feeder.</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Repair or replace.</li> <li>c. See gun manual.</li> <li>d. See Control manual.</li> <li>e. See Table VI</li> </ul>
No water flow with power on and gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Water source OFF.</li> <li>b. Clogged line.</li> <li>c. Malfunction in gun.</li> <li>d. Malfunction in Control.</li> <li>e. Malfunction in Feeder.</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Repair or replace.</li> <li>c. See gun manual.</li> <li>d. See Control manual.</li> <li>e. See Table VI.</li> </ul>
No wire feed with power on and gun trigger or wire jog depressed.	<ul style="list-style-type: none"> <li>a. Malfunction in Control.</li> <li>b. Malfunction in Feeder.</li> <li>c. Malfunction in gun.</li> </ul>	<ul style="list-style-type: none"> <li>a. See Control manual.</li> <li>b. See Table VI.</li> <li>c. See gun manual.</li> </ul>

TABLE VI  
Feeder Troubleshooting

Symptom	Probable Cause	Remedy
No welding arc with power ON and gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Clogged or pinched water line.</li> <li>b. Clogged water filter.</li> <li>c. Low water pressure</li> <li>d. Defective water pressure switch SW104.</li> </ul>	<ul style="list-style-type: none"> <li>a. Repair or replace.</li> <li>b. Clean.</li> <li>c. Check pressure and remedy.</li> <li>d. Replace.</li> </ul>
No gas flow with power ON and gun trigger depressed.	<ul style="list-style-type: none"> <li>a. Clogged or pinched gas line.</li> <li>b. Defective gas solenoid GS101.</li> </ul>	<ul style="list-style-type: none"> <li>a. Repair or replace.</li> <li>b. Replace.</li> </ul>
No wire feed with power ON, gun trigger depressed, or gun wire jog depressed.	<ul style="list-style-type: none"> <li>a. Empty spool or wire broken near spool.</li> <li>b. Spool locked by brake.</li> <li>c. Wire jam up within drive roll assembly.</li> <li>d. Broken drive belt.</li> <li>e. Belt slipping.</li> <li>f. Defective motor wiring or motor.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replenish or re-thread wire.</li> <li>b. Adjust brake.</li> <li>c. Loosen adjustment knob and correct.</li> <li>d. Replace.</li> <li>e. Adjust.</li> <li>f. Repair or replace.</li> </ul>
Excessive wire payout in push operation.	<ul style="list-style-type: none"> <li>a. Insufficient drag on reel.</li> <li>b. Defective brake spring.</li> <li>c. Faulty brake solenoid.</li> </ul>	<ul style="list-style-type: none"> <li>a. Adjust brake.</li> <li>b. Replace brake spring.</li> <li>c. Replace.</li> </ul>
Wire slips in drive rolls (push operation).	<ul style="list-style-type: none"> <li>a. Improper conical roll adjustment.</li> <li>b. Defective spring within either roll shaft .</li> </ul>	<ul style="list-style-type: none"> <li>a. Correct with adjustment.</li> <li>b. Replace.</li> </ul>
Timing belt slips off, drive roll pulley.	<ul style="list-style-type: none"> <li>a. Improper belt tension.</li> <li>b. Motor misalignment.</li> </ul>	<ul style="list-style-type: none"> <li>a. Adjust.</li> <li>b. Adjust.</li> </ul>

PART 5

# AIRCOMATIC CONTROL

MODEL AHC-B

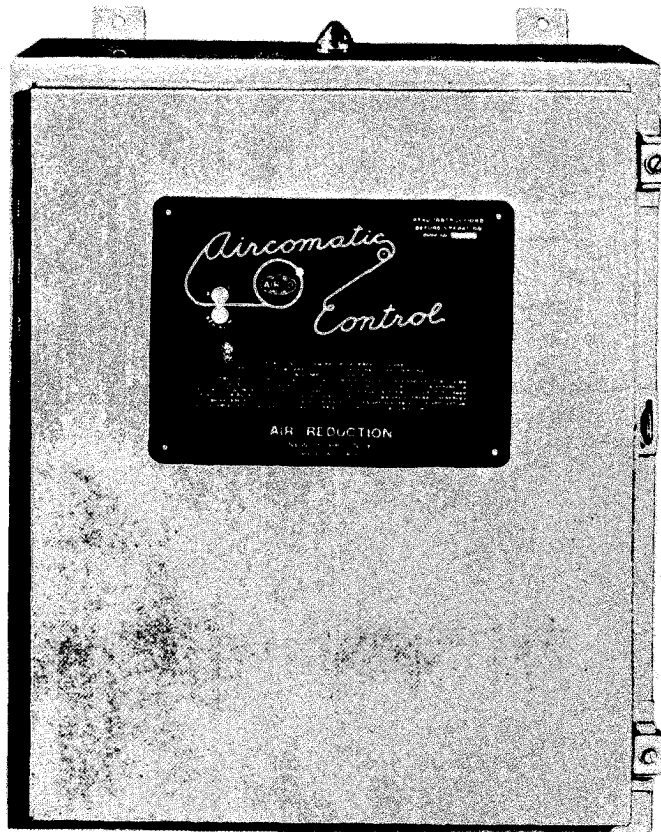


Fig. 1 Model AH C- B Cent rol

## Section I. INTRODUCTION

### 1.1 SCOPE

This manual covers the description, installation, operation, maintenance, and parts replacement for the AIRCOMATIC Control, Model AHC-B (Fig. 1), which is used in manual Aircomatic welding.

### 1.2 DESCRIPTION

The Model AHC-B Control is an electronic panel used in manual and semiautomatic AIRCOMATIC welding operations to program the welding operation. It can only be operated when connected within a system containing an AIRCOMATIC welding gun, Model AHF-E Push-Pull Wire Feeder, and a welding power source. Such a system needs only two hand operations for welding after the power is turned on: a pre-setting of wire feed speed on a dial of the Wire Feeder, and a pull of the gun trigger. The Control automatically programs the operation by timing and sequencing the gas flow, water flow, wire feeding, and weld current. At the end of the weld, it provides dynamic motor braking, and, with pull-type guns, an electric brake for wire-reel drag.

The Control is a compact steel enclosure with a hinged door.

It contains an electro-mechanical weld programming section, an electronic speed control section, a water-

cooled weld current relay. This 90-pound unit operates with an input of 115 VAC, 60 cps, and its power lines are fused at 10 amperes. Dimensions are shown in Fig. 2. All interconnecting cables and hoses for gas and water are brought into the enclosure through the bottom.

#### 1.2.1 CONTROL COMPONENTS

A current relay applies welding current from the power source. It contains two welding cable lugs and a water connection gland.

Three fuses protect the Control circuitry: two power line fuses and a 1/4 amp fuse for a full-wave rectifier in the speed control section.

The weld programming section receives the input power, energizes the speed control section, and uses a time-delay relay and a number of control relays. These sequence the integrated welding steps such as feeding weld current, wire, and gas and water flow once the gun trigger is pulled.

The speed control section electronically regulates the motor to produce the desired wire feed rate set manually on the wire feed speed dial of the feeder. It

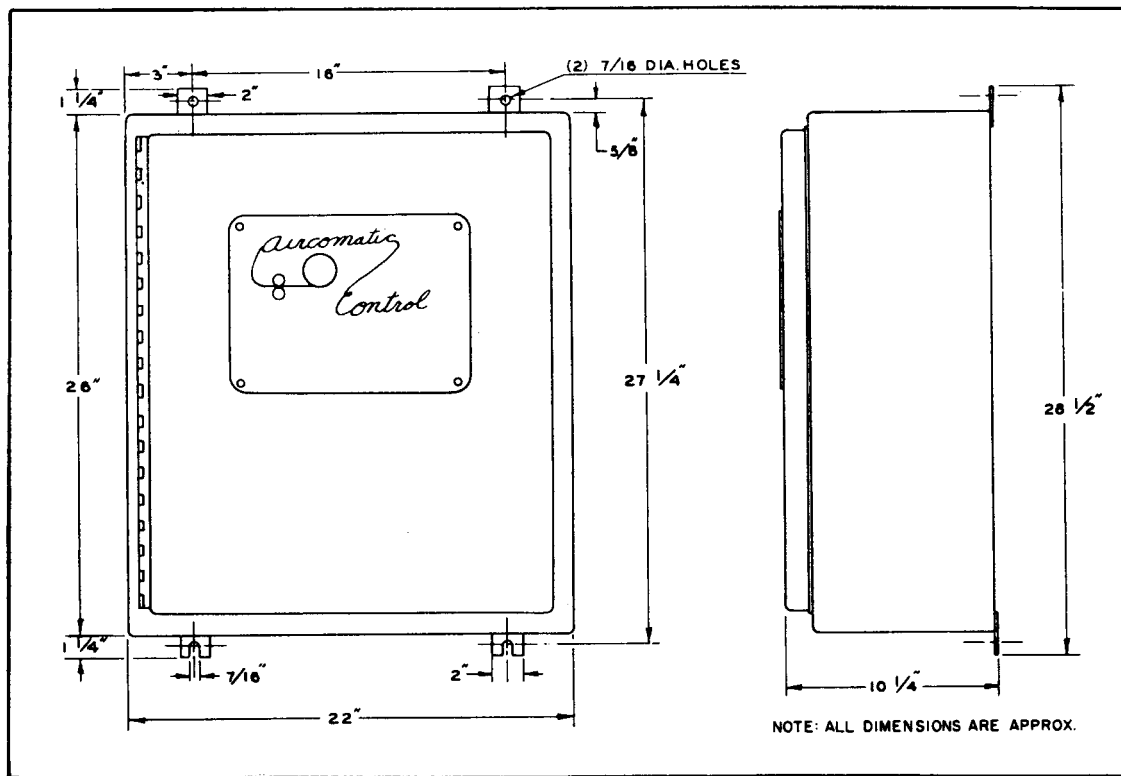


Fig. 2 Dimensions

contains a printed circuit board with a rectifier, amplifiers, voltage regulators, resistors, capacitors, and a saturable reactor. These comprise a full-wave rectifier, a motor control circuit, and a motor-run circuit.

### 1.2.2 OPERATING CONTROLS AND INDICATORS

The controls and indicators used for operation of the Control are a main power switch, a power-ON indicator lamp, a wire feed selector switch, a wire feed calibration rheostat, and a rough-service lamp resistor.

### 1.3 SUPPORTING EQUIPMENT

Supporting equipment includes other basic components which must be used in a system with the Control such as an AIRCOMATIC push or pull welding gun and a Model AHF-E Push-Pull Wire Feeder.

## Section II. INSTALLATION

This section covers installation of the Control and interconnection with all basic components needed for the operation of an AIRCOMATIC welding system.

### 2.1 UNPACKING, INSPECTION AND ASSEMBLY

Unpack the Control carefully so as not to damage any parts or mar any finished surfaces. Check the enclosure, both inside and out, for any signs of damage. Unwrap the tubes and capacitors, and install these on the Control chassis (Fig. 3). Report any damage immediately to your nearest AIRCO representative.

### 2.2 LOCATION AND MOUNTING

Choose a location for the Control that will have free and easy access. Allow for complete opening of the tinged door. Make certain there will be sufficient space for connecting cables and hoses at the base,

Secure the Control to a wood panel. Place it so that the Power-ON lamp atop the Control will be at average eye-line height.

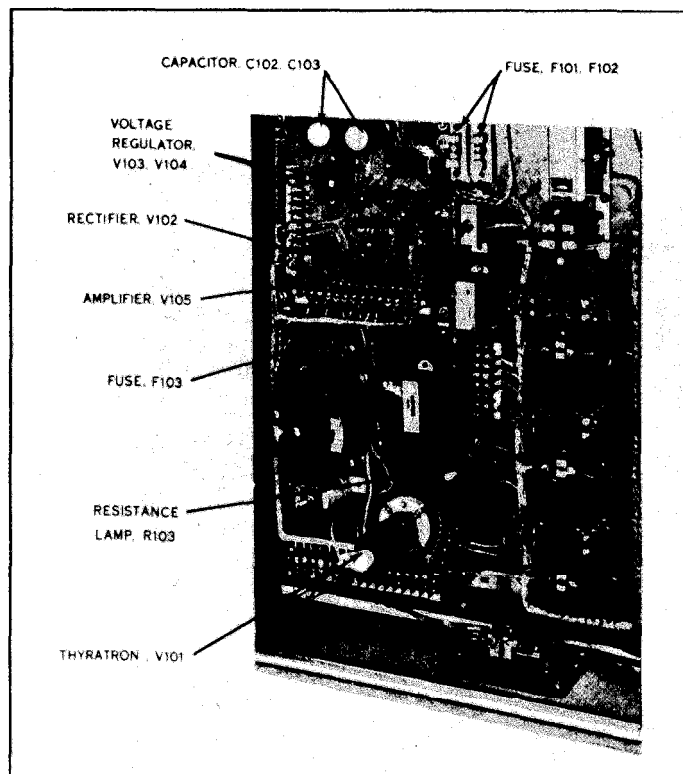


Fig. 3 Tube and Fuse Location

### 2.3 CONNECTING CONTROL

After making sure that the main power switch (Fig. 4) is OFF, connect Control in accordance with interconnection diagram (Fig. 5) as follows:

- a. Plug the power cord into a 115 VAC supply,
- b. Insert the two groups of leads of the multi-conductor cable (part of the hose and cable kit described in the feeder manual) through the cord grip in the bottom of the Control. Connect the group containing the larger number of leads to the proper terminals on terminal strip TS101. (The numbers on the leads correspond to the points on the terminal strip to which they attach, ) Connect the other group of leads to the proper terminals on terminal strip TS104. Secure the cord grip.
- c. If a secondary weld contactor is used, bring the cable from the contactor coil through the rear cord

grip of the Control. Attach the leads to points 157 and 106 on TS102.

d. If a water-cooled gun is to be used, attach a 5/16 ID hose from the drain to the right hose connector.

e. If a water-cooled gun is to be used, attach the water hose (part of the hose and cable kit described in the feeder manual) from the feeder to the left hose connector.

f. Connect a welding cable from the left hose connector to the workpiece. See Table I for the correct size,

g. Connect a welding cable from the right hose connector to the negative (-) terminal of the power source. See Table I for the correct size.

TABLE 1. Cable Size Selector Guide

Amps	Feet											
	50	75	100	125	150	175	200	225	250	300	350	400
100	2	2	2	2	1	1/0	1/0	2/0	2/0	3/0	4/0	4/0
150	2	2	1	1/0	2/0	3/0	3/0	4/0				
200	2	1	1/0	2/0	3/0	4/0						
250	2	1/0	2/0	3/0	4/0							
300	1	2/0	3/0	4/0								
350	1/0	2/0	4/0									
400	1/0	3/0	4/0									
450	2/0	3/0										
500	2/0	4/0										



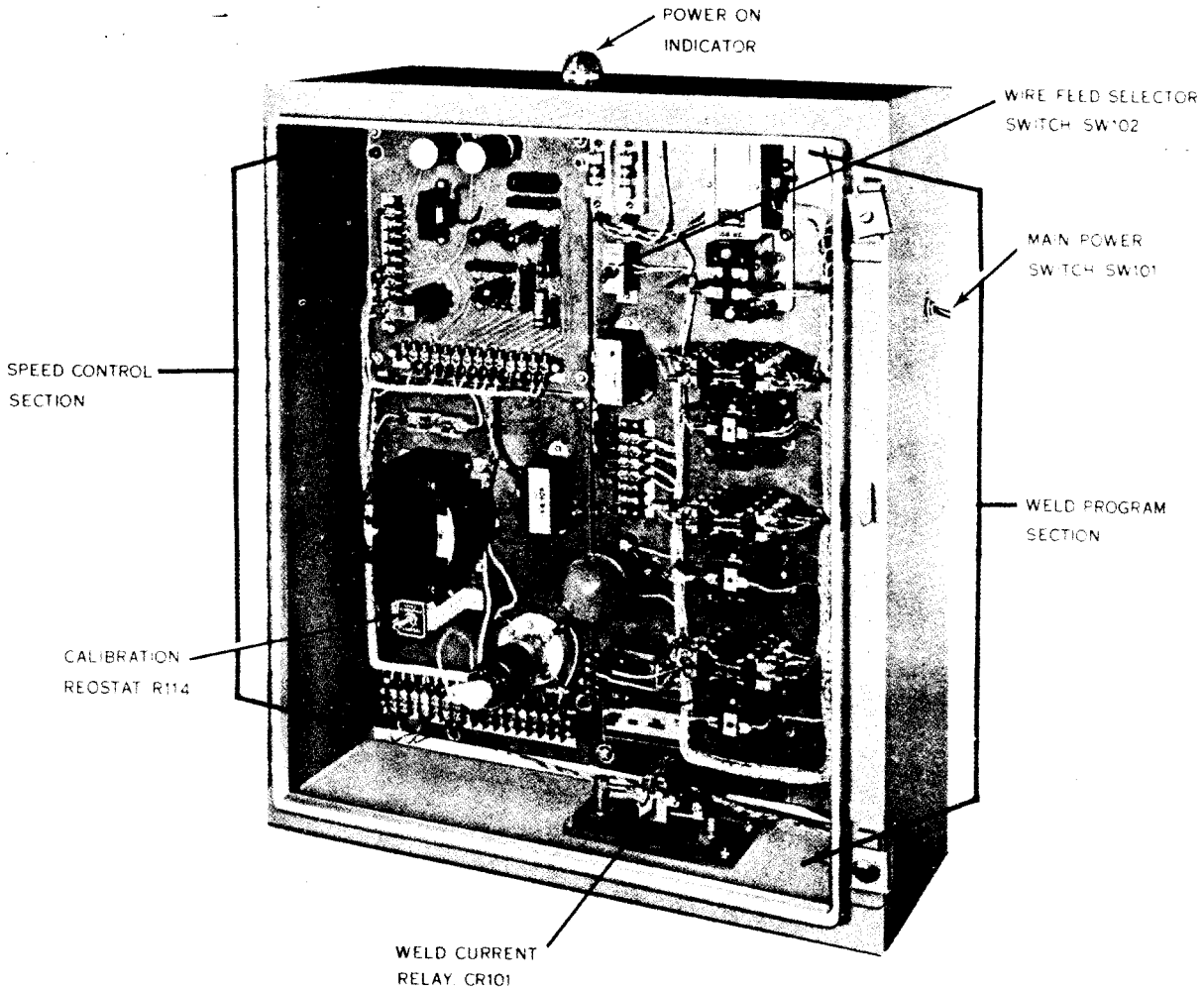


Fig. 4 Model AHC-B Control (Inside View)

#### 2.4 RUN-IN OR SCRATCH-START MODES

Selection of the starting mode, RUN-IN or SCRATCH-START, depends upon the type of wire and welding power source to be used. Refer to Table II.

#### 2.5 SETTING POST-WELD GAS AND WATER FLOW

a. Adjust the timer on the time-delay relay (TDR101).

*NOTE:* The timer is factory-set for 5 seconds of post-weld gas and water flow. The adjusting screw has a calibrated range of 0 to 99.

- b. Turn main power switch (Fig. 4) OFF.  
 c. Open Control door. Check reading of adjusting screw.  
 d. Turn adjusting screw counterclockwise to INCREASE time flow interval, and clockwise to decrease.

TABLE II. Selection of Wire- Feed Starting Method

Wire Type	Power Source Type	
	Drooping Characteristic	CAV or RAV
Aluminum, Magnesium, Copper, and Copper Base Alloys	Scratch-Start	Run-In Start or Scratch Start
Others	Run-In Start or Scratch Start	Run-In Start or Scratch Start

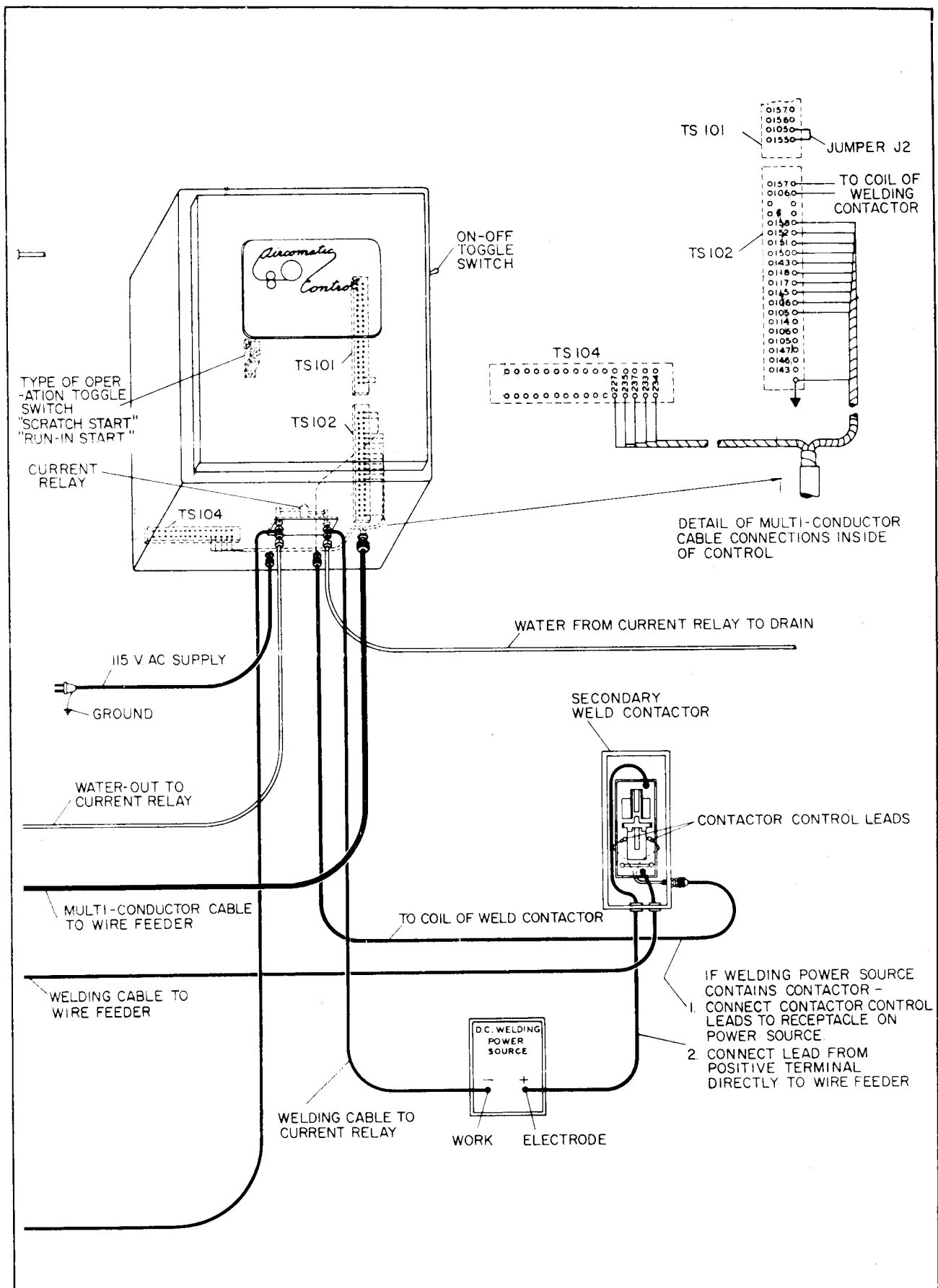


Fig. 5 Interconnection Diagram

## Section III. OPERATION

### 3.1 SAFETY REQUIREMENTS

Comply with all ventilation, fire, and other safety requirements for welding as established for industrial applications. Reference as applicable:

a. "Safety in Electric and Gas Welding and Cutting Operations", American Standards Association: Bulletin Z49.4 4958

b. "Recommended Safe Practices for Inert-Gas Metal-Arc Welding", American Welding Society: Bulletin A6. 1, 1958.

Because of infrared radiation emitted by the high-intensity arc in Aircomatic welding methods, flash goggles (medium-shade 1306 2101) are recommended in addition to helmet for the operator and near-by personnel. The welding wire (electrode) and all metal parts in contact with it are electrically energized while welding, requiring periodic inspection of cables for broken insulation, water leakage, and other electrical hazards.

#### CAUTION

WHENEVER STEPS ARE TAKEN TO REMOVE AND REPAIR ELECTRICAL HAZARDS, PLACE ALL POWER CONTROLS OFF AND DISCONNECT ALL ELECTRICAL CABLING FROM POWER SOURCES.

### 3.2 GENERAL

The Control can only be operated when connected within a welding system. This section covers only pre-weld requirements, and operation sequence, calibration, and checks during and after operation.

### 3.3 PRE-WELD REQUIREMENTS

Before operating the Control in a welding system:

- a. Turn main power switch (SW101) (Fig. 4) OFF.
- b. Make sure all connections of hoses and cables are tight.
- c. Set wire feed selector switch (SW102) in SCRATCH-START or RUN-IN position,
- d. Check for proper adjustment of time-delay relay.
- e. Close control door.
- f. Turn main power switch (SW101) ON. Allow at least a 30-second warm-up interval for equipment before welding.

### 3.4 OPERATION

Operation of the Control in an energized welding system is remotely controlled by the trigger or wire jog on the gun.

### 3.5 OPERATION CHECKS

During operation of the Control to insure proper operation.

- a. Carefully open Control door. Make sure lamp glows when power switch is ON.

*NOTE:* This lamp goes out when guntrigger or wire jog is depressed.

- b. Check for leaky hoses. Shut down system before making any repairs.

After operation of the Control, check for leaks and look for signs of overheating at electrical points as evidenced by brownish discoloration, smoke or odor. Recheck interconnections, or troubleshoot as necessary.

### 3.6 OPERATING SEQUENCE

During a system operation, the Control performs four sequences (Figs. 6, 7, and 8):

- a. Wire jog sequence for advancing wire without gas and water flow.
- b. Run-In Start sequence for feeding wire with gas and water supplies.
- c. Scratch-Start sequence for supplying gas and water, but feeding wire only after wire electrode is scratched against workpiece.
- d. End of weld sequence,

### 3.7 SHUTTING DOWN CONTROL

To shut down Control, turn power switch (Fig. 4) OFF.

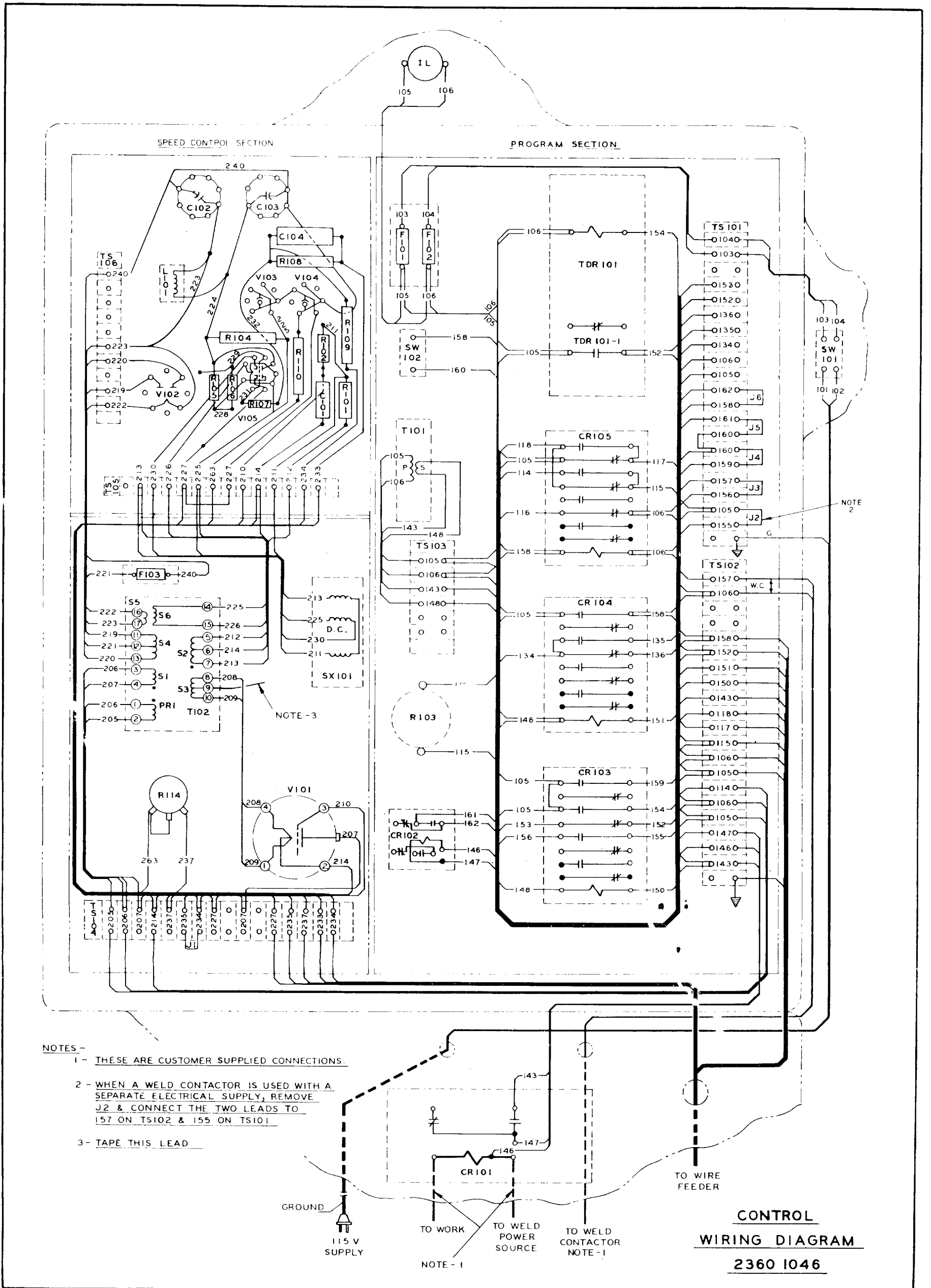
*NOTE:* At freezing temperatures, purge water lines before turning off the Control.

### 3.8 PRINCIPLES OF OPERATION

#### 3.8.1 PROGRAM SECTION

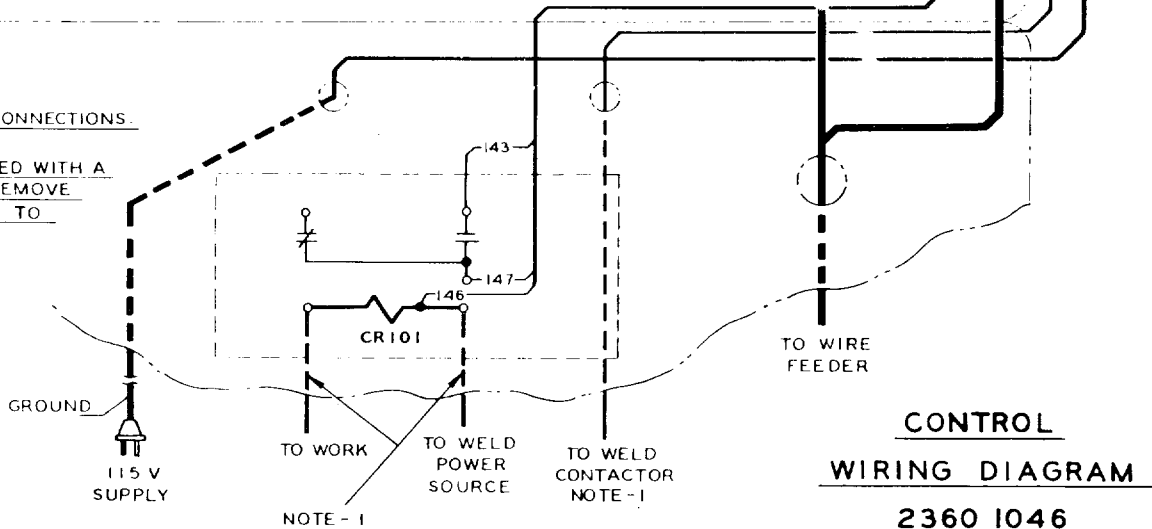
After the gun trigger is pulled, the program section receives the input power, energizes the speed control section, and uses a time-delay relay and control relays to sequence the weld current, wire, gas, and water flow.

When the input voltage is impressed across the secondary of transformer T101S and the gun trigger is pulled, control relay CR103 is energized. It operates the time-delay relay TDR101 which in turn energizes the gas and water solenoids. The time-delay relay also governs the time interval during which gas and water flow after the gun trigger is released. This



**NOTES -**

- 1 - THESE ARE CUSTOMER SUPPLIED CONNECTIONS.
- 2 - WHEN A WELD CONTACTOR IS USED WITH A SEPARATE ELECTRICAL SUPPLY, REMOVE J2 & CONNECT THE TWO LEADS TO 157 ON TS102 & 155 ON TS101
- 3 - TAPE THIS LEAD



**CONTROL  
WIRING DIAGRAM  
2360 1046**

**Fig. 6 Wiring Diagram**

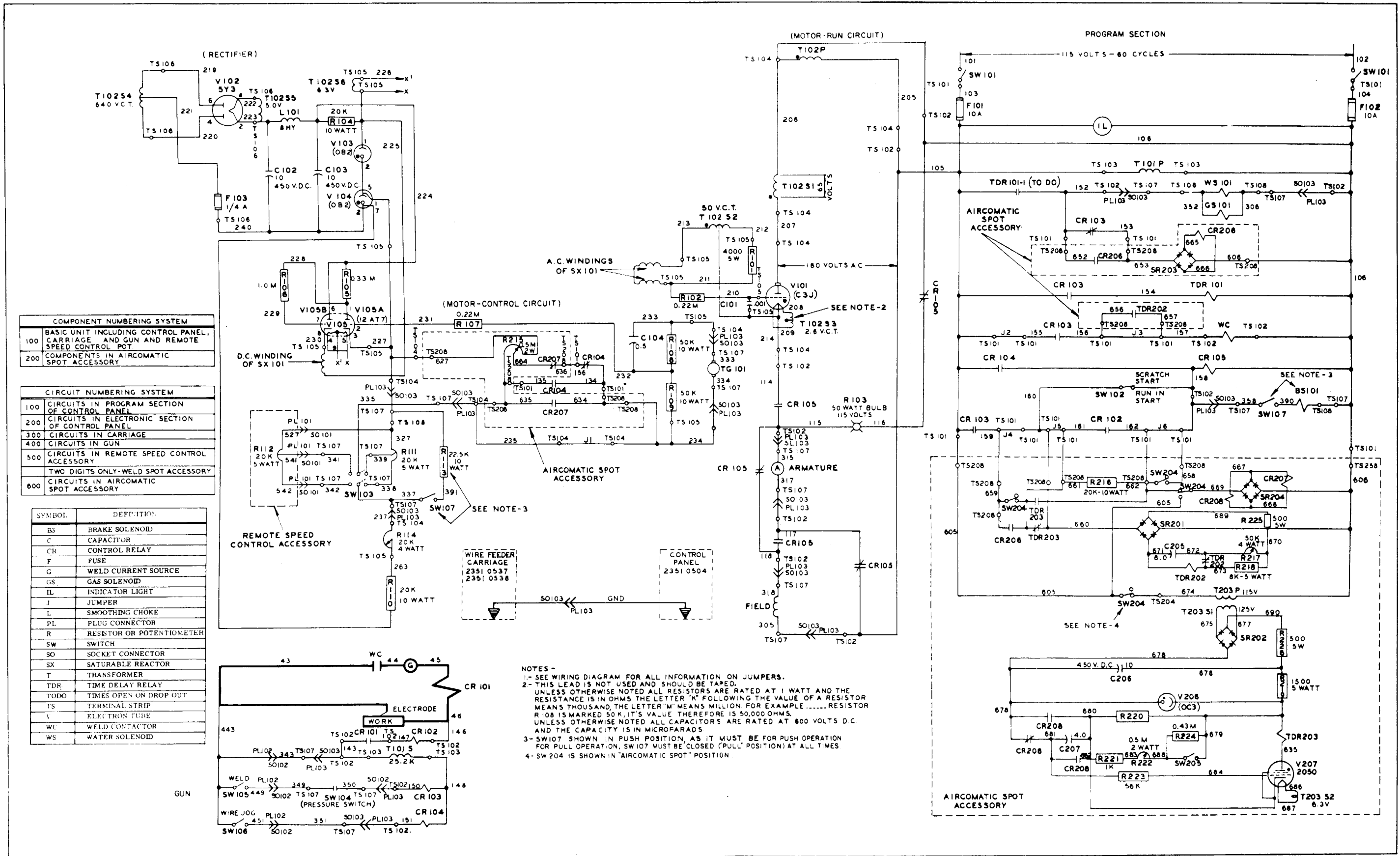
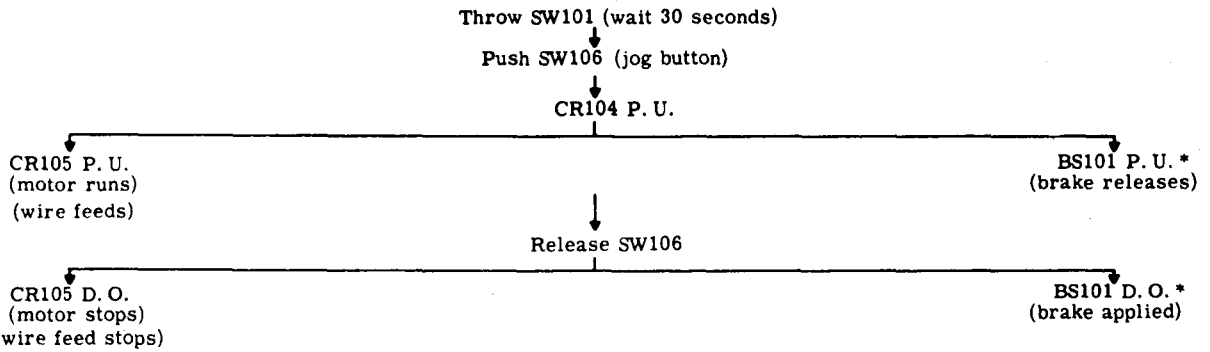
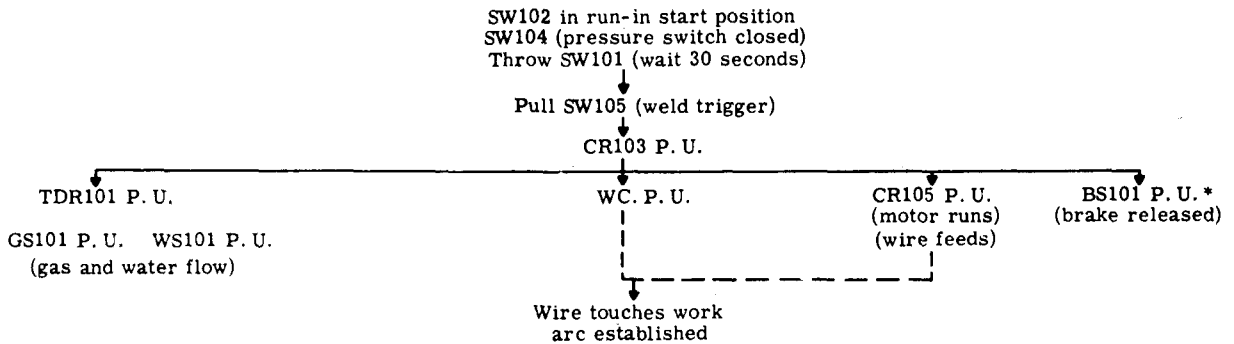


Fig. 7 Schematic Diagram

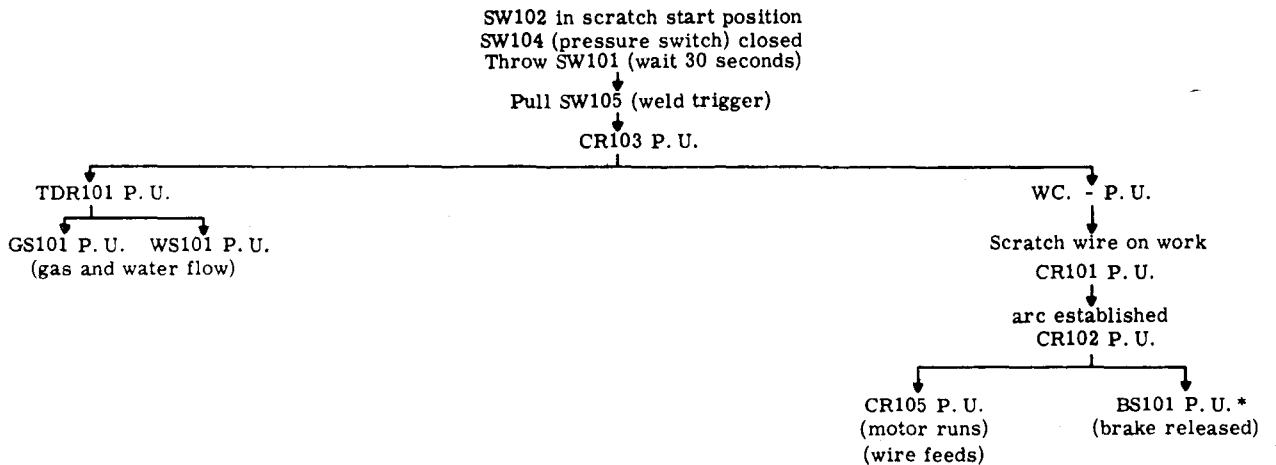
a. Wire Jog Sequence



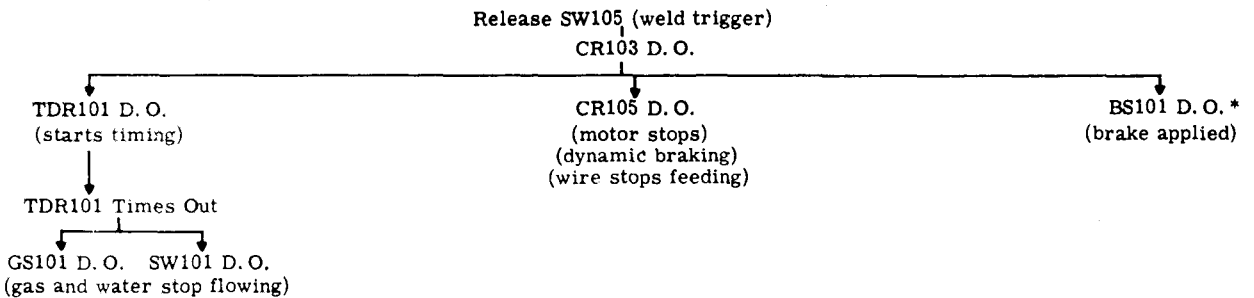
b. Wire Feed Selector in "Run-in Start" Position



c. Wire Feed Selector in "Scratch Start" Position



d. End of Weld Sequence



\*Only if SW107 in PULL (closed) position.

Fig. 8 Sequence Chart

relay contains an adjustable timer calibrated from 0 to 99. The program-section contains a circuit for a brake solenoid (BD101) located in the feeder. This releases an electro-mechanical brake on the wire reel for pull guns. This section is also provided with an input receptacle for an AIR SOMATIC spot accessory used for spot-welding. The power input of the section passes through the gun trigger and a water pressure switch (SW104) factory-set at 25 psi, so that even though the gun trigger is depressed, the Control remains inoperative if there is insufficient cooling water in the system.

### 3.8.2 SPEED CONTROL SECTION

The speed control section electronically regulates the speed of the wire feed motor to produce the required wire feed speed. It contains a printed circuit board with a rectifier, amplifiers, voltage regulators, resistors, capacitors, and a saturable reactor. These comprise a full-wave rectifier, a motor control circuit, and a motor-run circuit. The rectifier converts input AC to filtered, regulated DC for the control circuit. The control circuit uses a dual triode to amplify the electrical equivalent of the motor speed from a tachometer-generator on the wire feed motor. Onto

this voltage, it superimposes the electrical equivalent of wire feed speed. The resultant voltage is applied, through the saturable reactor, to the motor-run circuit which uses a thyatron to regulate the speed of the wire feed motor. Thus, the motor speeds up or slows down, depending on the relation of its speed to that set on the dial. When the gun trigger switch is energized, the motor-run circuit is in a relay condition. This places the motor armature in series with the motor field. Release of the trigger sets up a relay condition which places the armature in parallel with the field, and in series with a 50-watt lamp so that dynamic braking occurs, and the lamp glows. Hence, the lamp, when lit, indicates a stand-by condition of the motor (no wire feed). This is the same condition that exists when only the main power switch (SW101) is turned ON.

### 3.8.3 ELECTRIC BRAKE FOR WIRE REEL

In pull-type gun systems, the Control electrically releases a brake in the Wire Feeder to prevent drag on the wire reel. When the gun trigger or jog switch is energized, control relay CR103 or 104 in the Control (Fig. 9) energizes brake-solenoid (BS101) in the feeder to release the brake on the wire reel hub.

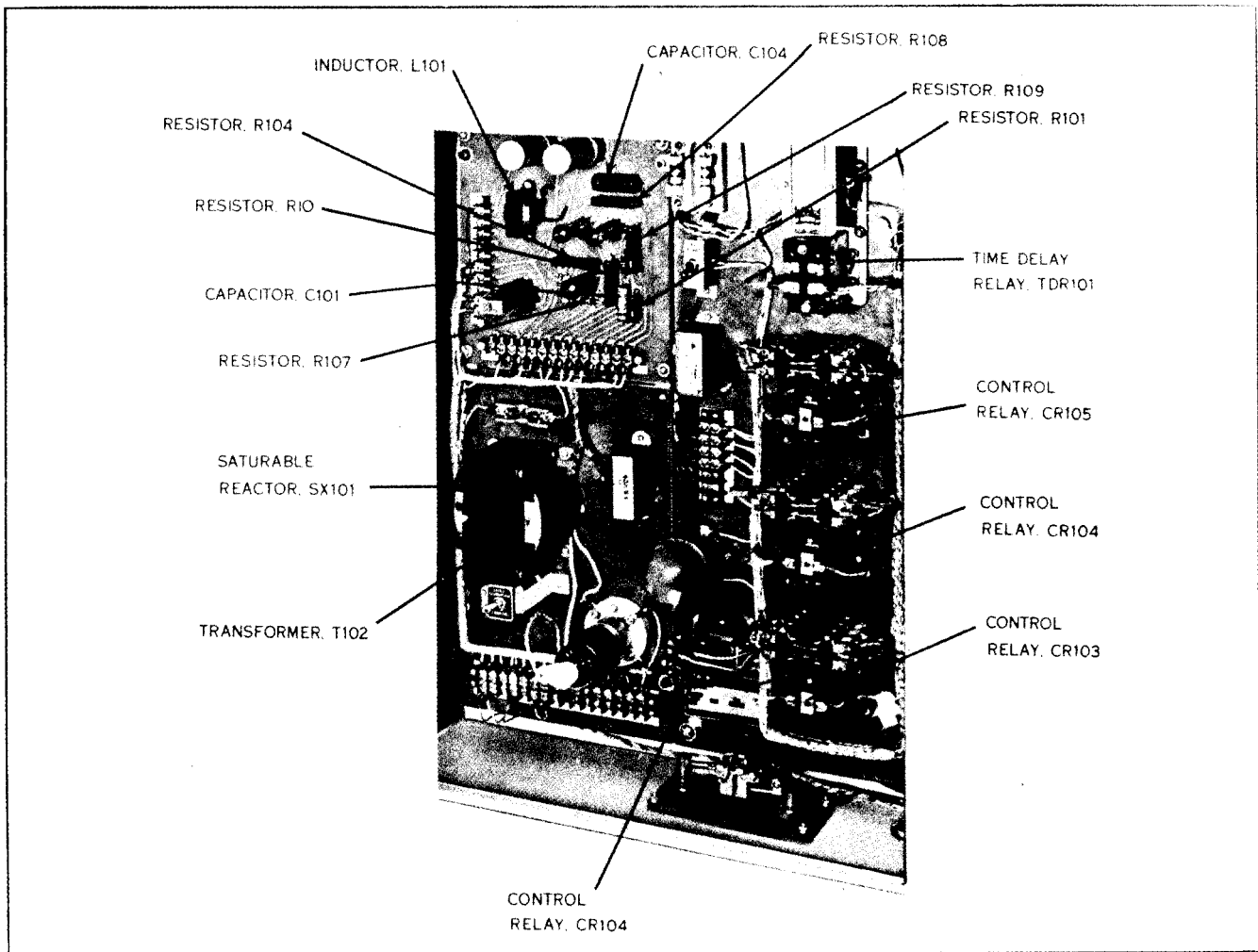


Fig. 9 Control Components

## Section IV. MAINTENANCE

### 4.1 GENERAL

This section covers inspection, preventive maintenance, and service and repairs required to keep the Control at minimum standards for efficient operation.

### 4.2 PREVENTIVE MAINTENANCE

#### 4.2.1 EVERY 30 DAYS

At least every 30 days, check the Control:

- Turn main power switch (Fig. 4) OFF.
- Open Control door. Look for signs of overheating or burning of wiring or components.
- Make sure tube and other plug-in parts are secure.
- Check that all cable and hose assemblies are tight.
- Look for signs of physical damage inside or outside of Control.

#### 4.2.2 EVERY 60 DAYS

At least every 60 days, perform the following:

- Turn main power switch (Fig. 4) OFF. Open Control door.
- Wipe away dust, dirt, and grime. Use an air hose, if necessary, to blow it out of Unit.
- Tighten all loose wire connections. Repair or replace any wiring with damaged insulation.
- Tighten all mounting hardware.

### 4.3 CALIBRATING PROCEDURE

A calibration rheostat (Fig. 4) is provided in the Control for calibrating the front-panel dial of the wire feed

speed potentiometer on the feeder. Use this rheostat to calibrate the dial as follows:

- Choose an interval of time (15, 30, or 60 seconds) for testing a wire feed operation. (The greater the interval, the more accurate the test.)
- Set dial on feeder for desired rate of wire feed.
- Operate system (jog or trigger on gun depressed) to feed wire only for interval of time selected.
- Measure output of wire fed from gun. Convert this to inches-per-minute.
- Check this output in inches-per-minute with optimum suggested by appropriate chart of Figure 10 for dial setting used in test.
- If output is less than optimum suggested, turn rheostat clockwise slightly. Repeat steps a through e. If it is more, turn rheostat counterclockwise and repeat operation.

**NOTE:** Calibration is complete when the actual wire output speed matches the optimum suggested by the charts.

### 4.4 TROUBLESHOOTING

Whenever a malfunction occurs in the welding system, refer to Table III to determine whether the trouble can be isolated to the Control. Troubleshoot the Control in accordance with Table IV.

**NOTE:** Before troubleshooting make sure system has adequate inlet water pressure.

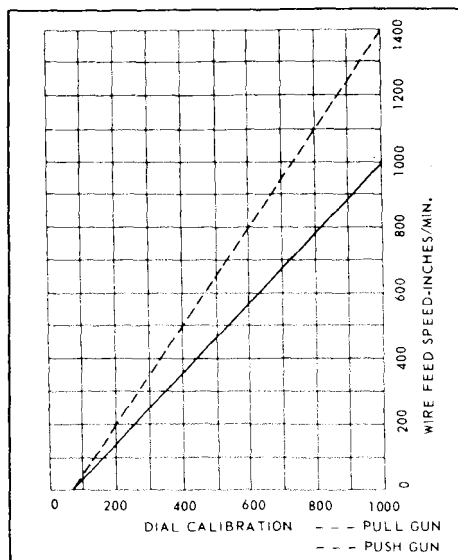


Fig. 10 Calibration Charts



TABLE III. Troubleshooting System

Symptom	Probable Cause	Remedy
No welding arc with power ON and gun trigger depressed	<ul style="list-style-type: none"> <li>a. Welding power source OFF</li> <li>b. Contactor trouble</li> <li>c. Defective cable</li> <li>d. Malfunction in Control</li> <li>e. Malfunction in gun</li> <li>f. Malfunction in Wire Feeder</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Check and repair.</li> <li>c. Repair or replace.</li> <li>d. See Table IV.</li> <li>e. See gun manual.</li> <li>f. See Wire Feeder manual.</li> </ul>
No gas flow with power ON and gun trigger depressed	<ul style="list-style-type: none"> <li>a. Gas source OFF</li> <li>b. Clogged line</li> <li>c. Malfunction in gun</li> <li>d. Malfunction in Control</li> <li>e. Malfunction in Wire Feeder</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Repair or replace.</li> <li>c. See gun manual.</li> <li>d. See Table IV.</li> <li>e. See Wire Feeder manual.</li> </ul>
No water flow with power ON and gun trigger depressed	<ul style="list-style-type: none"> <li>a. Water source OFF</li> <li>b. Clogged line</li> <li>c. Malfunction in gun</li> <li>d. Malfunction in Control</li> <li>e. Malfunction in Wire Feeder</li> </ul>	<ul style="list-style-type: none"> <li>a. Turn ON.</li> <li>b. Repair or replace.</li> <li>c. See gun manual.</li> <li>d. See Table IV.</li> <li>e. See Wire Feeder manual.</li> </ul>
No wire feed with power ON and gun trigger or jog depressed	<ul style="list-style-type: none"> <li>a. Malfunction in Control</li> <li>b. Malfunction in Wire</li> <li>c. Malfunction in gun</li> </ul>	<ul style="list-style-type: none"> <li>a. See Table IV,</li> <li>b. See Wire Feeder manual.</li> <li>c. See gun manual.</li> </ul>

#### 4.5 CIRCUIT REPAIRS

The circuits within the Control are designed for long-life and trouble-free operation. The speed control section consists of a printed circuit board, a replace-

able unit. Hence, troubleshooting and repairs by the user should be limited to replacement of plug-in parts. Components such as transformers, resistors, capacitors, etc. should be checked and replaced by skilled personnel only. Use Table IV as a guide.

TABLE IV. Troubleshooting Control (Figs. 7 and 8)

Symptom	Probable Cause	Remedy
Power-On Lamp atop Control does not glow with main power switch ON	<ul style="list-style-type: none"> <li>a. No primary power</li> <li>b. Defective fuse F101 or F102</li> <li>c. Defective lamp</li> <li>d. Defective switch</li> </ul>	<ul style="list-style-type: none"> <li>a. Connect power cord to primary source.</li> <li>b. Replace.</li> <li>c. Replace.</li> <li>d. Replace,</li> </ul>
No welding arc with power on and gun trigger depressed	<ul style="list-style-type: none"> <li>a. Defective control relay CR103</li> <li>b. Defective control relay CR101</li> <li>c. Defective wiring associated with steps a, b, or c, above</li> <li>d. Defective transformer T101</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace.</li> <li>b. Replace.</li> <li>c. Check continuity and repair or replace.</li> <li>d. Replace.</li> </ul>
No wire feed with power on and gun trigger or jog depressed	<ul style="list-style-type: none"> <li>a. Defective control relay CR104</li> <li>b. Defective control relay CR105</li> <li>c. Defective thyatron V101</li> <li>d. Defective amplifier V105</li> <li>e. Defective regulator V103, V104</li> <li>f. Defective rectifier V102</li> <li>g. Defective transformer T102</li> <li>h. Defective reactor SX101</li> <li>i. Defective transformer T101</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace.</li> <li>b. Replace.</li> <li>c. Replace</li> <li>d. Replace.</li> <li>e. Replace.</li> <li>f. Replace.</li> <li>g. Replace.</li> <li>h. Replace.</li> <li>i. Replace,</li> </ul>
No wire feed with power on, wire selector switch SW102 in RUN-IN position, gun trigger depressed	<ul style="list-style-type: none"> <li>a. Defective control relay CR103</li> <li>b. Check steps b through i above for wire jog condition</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace.</li> <li>b. Replace necessary parts.</li> </ul>
No wire feed with power on, wire selector switch SW102 in SCRATCH-START position, gun trigger depressed, and wire electrode scratched on work	<ul style="list-style-type: none"> <li>a. Defective control relay CR103</li> <li>b. Defective control relay CR102</li> <li>c. Check steps b through i above for wire jog condition</li> <li>d. Defective control relay CR101</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace,</li> <li>b. Replace</li> <li>c. Replace necessary parts.</li> <li>d. Replace.</li> </ul>
No gas or water flows with power on, and gun trigger depressed	<ul style="list-style-type: none"> <li>a. Defective control relay CR103</li> <li>b. Defective time-delay relay TDR101</li> <li>c. Defective wiring to gas or water solenoid in Wire Feeder</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace.</li> <li>b. Replace.</li> <li>c. Repair or replace.</li> </ul>

TABLE V. Functions of Electronic Components (Figs. 7 & 9)

Components	Symbol	Function
Capacitors	C101	(.001 mf, 600 WVDC) thyatron g-rid capacitor prevents thyatron from firing due to undesirable voltages in thyatron grid circuit.
	C102 C103	(10 mf, 450 WVDC) filter capacitor for output of full-wave rectifier V102.
	C104	(0.5 mf, 600 WVDC) used with resistors R108 and R109 to improve response of motor to sudden changes in load or wire feed speed.
Fuses	F101 F102	(10-amp) in 115 V, 60 cps input lines to protect Control circuits against overloading.
	F103	(1/4-amp) protects full-wave rectifier V102.
	Indicator	IL
Inductor	L101	(8 henrys) filters AC ripple from rectifier V102 output.
Relays	CR101	(Single-pole, double-throw) current relay, picks up at approximately 100 amperes when weld power source current flows in welding circuit; energizes CR102 for "scratch-start".
	CR102	(Double-pole, double-throw) picks up at about 11 volts to energize CR105 during "scratch-start" operation.
	CR103	(Four-pole, double-throw) weld relay, energized when gun trigger is depressed; energizes TDR101 for gas and water flow, WC relay for weld current, and CR105 for operation of wire feed motor.
	CR104	(Four-pole, double-throw) picks up when wire jog on gun is depressed to energize CR105 to enable wire feed without gas and water flow.
	CR105	(Four-pole, double-throw) picks up when gun trigger or wire jog is depressed to operate wire feed motor by placing motor armature in series with field; when trigger or jog is released, places armature in parallel with field for dynamic braking.
	TDR101	(Single-pole, double-throw) pneumatic off-relay; energizes gas and water solenoids in Wire Feeder to apply shielding gas and cooling water at gun; also times and limits post-weld flow of gas and water.
	Resistors	R101
R102		(220, 000 ohms, 1 watt, fixed) Limits current to grid of thyatron V101.
R103		(50 watts, 125 volt, lamp bulb) Used in dynamic braking at end of weld cycle when gun trigger is released.

TABLE V. Functions of Electronic Components (Figs. 7 & 9) (Continued)

Components	Symbol	Function
Resistors (cont)	R104	(20, 000 ohms, 10 watts, fixed) Used with voltage regulators V103 and V104 to regulate voltage to amplifier V105 and wire feed speed potentiometer R111 in Wire Feeder.
	R105	(330, 000 ohms, 1 watt, fixed) Voltage dropping resistor in plate circuit of V105A which limits voltage to grid of V105B.
	R106	(1 megohm, 1 watt, fixed) Prevents current flow to grid of V105B.
	R107	(220,000 ohms, 1 watt, fixed) Prevents current flow to grid of V105A.
	R108 R109	(50,000 ohms, 10 watts, fixed) Voltage divider across output of tachometer-generator on motor shaft. Voltage across R108 with that of capacitor C104 improves response of motor to sudden changes in load. Voltage across R109 is added to that of wire feed speed potentiometer R111 in Wire Feeder (hand-set for desired speed), and amplified by V105. The result is then applied through saturable reactor SX101 to thyatron V101 to alter motor speed.
	R110	(30,000 ohms, 10 watts, fixed) Supplies necessary reference voltage to wire feed speed potentiometer in Wire Feeder.
	R114	(20,000 ohms, 4 watts, variable) Used for fine calibration of wire feed speed potentiometer R111 in Wire Feeder.
	Saturable Reactor	SX101
Switches	SW101	(Double-pole, double-throw) Control circuit switch connects Control components to 115 VAC supply.
	SW102	In SCRATCH START position, only gas and water are supplied to gun when gun trigger is depressed, and wire must be scratched on work-piece to supply weld current and wire. In RUN-IN position, wire, weld current, gas, and water are supplied at gun when gun trigger is depressed.
Transformers	T101	Supplies 25.2 VAC to gun controls and coils of CR103 and CR104.
	T102	Power transformer, supplies the following AC voltages: 180 V to thyatron V101 plate; 50 V to phase-shift windings in motor-run circuit; 2.6 V to thyatron filament; 640 V to rectifier V102; 5 V to rectifier filament; and 6.3 V to amplifier V105 heaters.
Tubes	V101	Thyatron C3J controls speed of wire feed motor by regulating voltage in motor-run circuit.
	V102	5Y3 full-wave rectifier rectifies input AC for use by motor control circuit.
	V103 V104	0B3 voltage regulators keep output voltage of thyatron V101 constant for motor control circuit.
	V105	12AT7 dual triode combines output voltage of tachometer-generator on Wire Feeder motor (voltage equivalent of motor speed) with voltage equivalent of desired wire feed speed (hand-set on wire feed speed potentiometer) for use by motor control circuit.

# INSTALLATION, OPERATION, AND MAINTENANCE

for

## WATER CIRCULATING UNIT

### Section 1. INTRODUCTION

#### 1.1 SCOPE

This manual provides instructions for installation, operation, and maintenance, for the AIRCO heavyduty Water Circulating Unit. This Unit recirculates water or other fluid to cool welding equipment.

#### 1.2 DESCRIPTION

The Unit consists of a sturdy rectangular steel tank and cover on top of which is mounted a heavy-duty motor coupled to a rotary pump. A toggle switch on the motor starts and stops the 115/230 volt ac motor. The Unit can supply sufficient coolant up to a 40-foot head, The approximate dimensions (in inches) for the Unit are shown in Figure 1 .

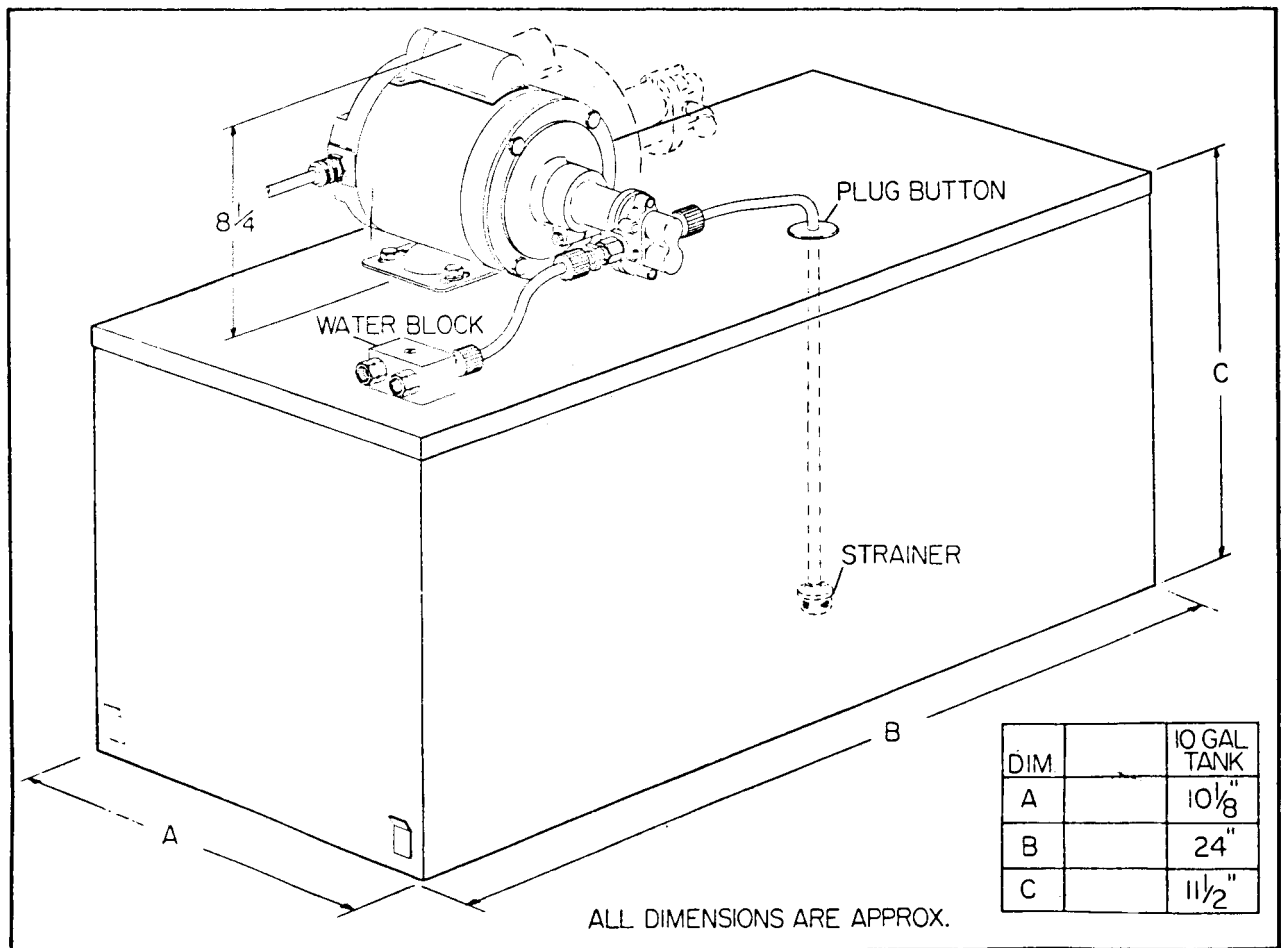


Figure 1. Dimensions (40 Gall Unit Shown)

The discharge line of the Unit has a safety relief valve which bypasses the equipment and allows coolant to go directly to the tank when discharge back pressure exceeds the relief-valve pressure setting.

The tank is supplied with four hold-down clamps intended to keep it from shifting in service. The interior of the tank is coated with a rust-resisting paint.

The bronze water pump is a rotary-gear type with a stainless steel shaft. Carbon shaft bearings are lubricated by the liquid being pumped. A positive mechanical-type lip seal on the pump-coupling shaft needs no mechanical adjustment.

## Section II. INSTALLATION

### 2.1 MOUNTING AND CONNECTIONS

- a. If the Water Circulating Unit is used in a moving vehicle, use the four hold-down clamps supplied as shown in Figure 2.
- b. Attach the coolant inlet hose of the welding device to the connection on the water block marked WATER IN.
- c. Attach the coolant outlet hose of the welding device to the connection on the water block, marked WATER OUT.
- d. The motor comes equipped with wire and plug for 115-volt ac operation. For 230-volt operation, change the wire and plug and refer to Figure 3 to convert the motor.
- e. Plug the circulator motor line cord into a suitable power outlet and attach the ground wire to a suitable ground connection.

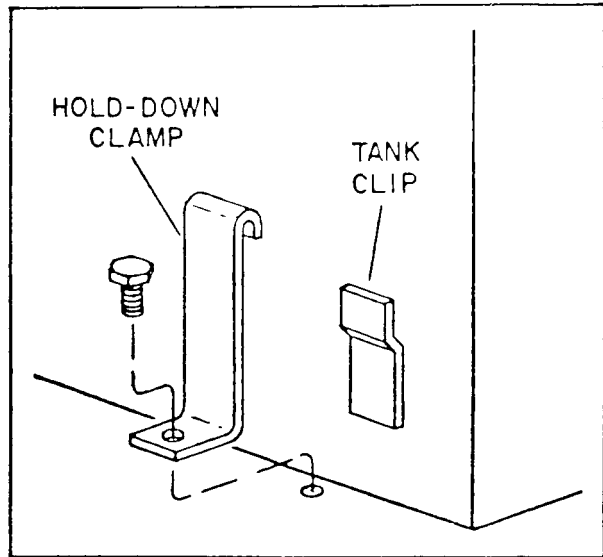


Figure 2. Circulator Mounting

#### IMPORTANT

The motor must run continuously. Never connect the Water Circulating Unit so its motor starts and stops with each operation of a welding contactor. The cooling efficiency of the unit will be hampered and the starting winding in the motor may burn out.

### 2.2 LUBRICANT

The life of the Water Circulating Unit pump increases if a lubricant is added to the water in the tank. A quart of Socony-Vacuum, Solval No. 1535, stock no. 23900404 is supplied with each Unit. A quart should be added to every 10 gallons of water.

Where freezing conditions may be encountered, permanent type anti-freeze must be added. The proper quantity of anti-freeze to be added will depend on the lowest expected temperature in the area and quantity of water. Anti-freeze may be used as a substitute for the lubricant.

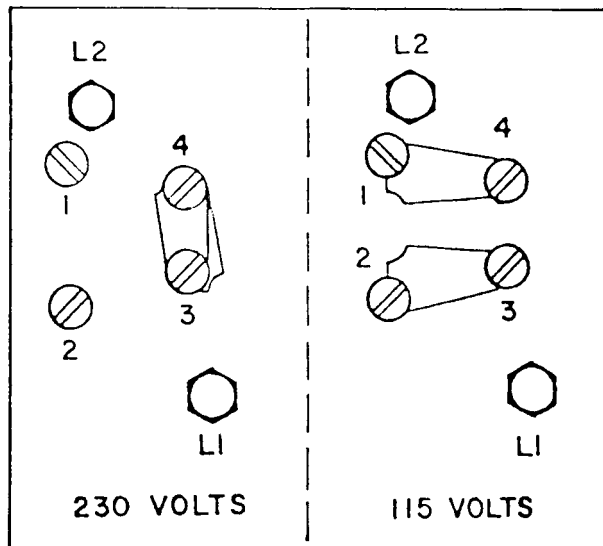


Figure 3. Motor Jumper Location

## Section III. OPERATION

HELIWELD and AIRCOMATIC equipment may be operated at their full rated current for at least three hours continuously. This duty cycle is based on a 40°F (22.3°C) coolant temperature rise above an 80° F (26.7°C) ambient when used with arc-welding devices.

#### IMPORTANT

Coolant temperature should never exceed 120°F (49°C).

## IMPORTANT

A maximum relief valve setting of 40 psi must be maintained. Higher pressure may overload the motor or cause damage to the hoses. At least a 30 psi relief valve setting must be maintained to assure an adequate coolant supply to equipment.

## Section IV. MAINTENANCE

### 4.1 GENERAL

The water circulating tank should be cleaned periodically and replenished with fresh water and lubricant. Oil the motor shaft bearings several times a year with a good grade of light motor oil. The pump bearings require no lubrication other than that provided by the coolant.

### CAUTION

**Unplug motor from power before making any motor repairs or replacements.**

### 4.2 CARBON BEARING REPLACEMENT

### NOTE

It is generally advisable not to replace carbon bearings in the field. This operation requires tools and experience. If done improperly it can ruin the pump and/or burn out the motor. Usually, when carbon bearings are worn out, body and cover casting are equally worn, and replacement of the whole assembly is indicated. However, if field replacement becomes necessary, the following procedure is applicable.

To remove old bearing, heat pump body (or cover) to about 300 to 400 degrees F. Since thermal expansion rate of metal is much higher than that of carbon, carbon bearings will drop out readily.

### IMPORTANT

Do not heat casting over 400 degrees F to prevent warping it.

To install new bearing, make up a proper arbor that slips with at least 0.005-inch clearance into bearing bore, with a shoulder slightly larger than the outside diameter of bearing (Figure 4.)

### NOTE

Carbon bearings are made several thousandths oversize to housing bore to assure press fit.

Use a hand press or bench vise (rather than a hammer) for pressing bearing in. Make sure face of casting is at right angles to movement of arbor. *Press bearing in flush with casting face, machine flush if necessary.* Use reamer of finished bore size (501-.502 in/dial) to ream bearing to proper inside diameter. There is approximately 1/64-inch stock (inside diameter) to be removed.

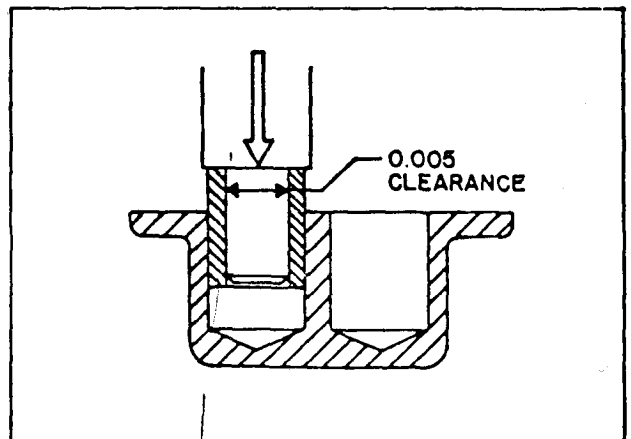


Figure 4. Bearing Installation

## **APPENDIX A**

### **REFERENCES**

#### **1. FIRE PROTECTION**

**TM 5-4200-200-10**

**Hand Portable Fire Extinguishers  
For Army Users**

#### **2. PAINTING**

**TM 9-213**

**Painting Instructions for Field  
Use**

#### **3. MAINTENANCE**

**TM 38-750**

**Army Equipment Record Procedures**

#### **4. SHIPMENT AND STORAGE**

**TB 740-93-2**

**Preservation of USAMEC Mechanical  
Equipment for Shipment and Storage**

**TM 740-90-1**

**Administrative Storage of Equipment**

**TM 38-230**

**Preservation, Packaging, and Packing  
of Military Supplies and Equipment**



## APPENDIX B

### BASIC ISSUE ITEMS LIST

#### Section 1. INTRODUCTION

##### **B-1. Scope.**

This appendix lists items which accompany the welding set or are required for installation, operation, or operator's maintenance.

##### **B-2. General.**

This Basic Issue Items List is divided into the following sections:

a. Basic Issue Items - Section II. A list of items which accompany the welding set and are required by the operator/crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies - Section III. A listing of maintenance and operating supplies required for initial operation.

##### **B-3. Explanation of Columns.**

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

##### a. Source, Maintenance, and Recoverability Codes (SMR):

(1) Source code, indicates the selection status and source for the listed item. Source codes are:

Code	Explanation
P	Repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
M	Repair parts which are not procured or stocked, but are to be manufactured in indicated maintenance levels.

Code	Explanation
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
x	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement of such items will be filled by use of the next higher assembly or component.
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain them through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
C	Repair parts authorized for local procurement. Where such repair parts are not obtainable from local procurement, requirements will be requisitioned through normal supply channels accompanied by a supporting statement of non-availability from local procurement.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above GS and DS level or returned to depot supply levels.

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
c	Operator/crew.

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable, Recoverability codes are:

Code	Explanation
R	Repair parts and assemblies which are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable casings or castings.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e", when used as a part of the nomenclature, indicates the Federal stock number includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parenthesis. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.

d. Unit of Measure (U/M). A 2 character alphabetic abbreviation antes are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g., shims, spacers, etc.).

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) Figure Number. Indicates the figure number of the illustration in which the item is shown.

(2) Item Number. Indicates the callout number used to reference the item in the illustration.

#### B-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies - Section III.

a. Component Application. This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

#### B-5. Abbreviations.

Abbreviation	Explanation
cu .	cubic
ea.	each
ft .	feet
w/o	without

Section II. BASIC ISSUE ITEM

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION		(4) JNIT OF MEA: EA:	(5) QTY INC IN UNIT	(6) QTY FURT WITH QUIF	(7) ILLUSTRATION	
		REF NO. & MFR CODE	USABLE ON CODE				(A) FIG NO.	(B) ITEM NO.
PC	7520-559-9618	GROUP 31 - BASIC ISSUE ITEMS, MANUFACTURER INSTALLE						
			3100 - Basic Issue Items, Manufacturer or Depot Installed					
		Department of the Army, Operator, Organizational, Direct and General Support and Depot Maintenance Manual TM5-3431-226-15		EA		1		
		Case, Maintenance and Operational Manuals: Cotton duck, water repellent mildew resistant		EA		1		

**SECTION III. MAINTENANCE AND OPERATING SUPPLIES**

(1) COMPONENT APPLICATION	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) QUANTITY REQUIRED F/ INITIAL OPERATION	(5) QUANTITY REQUIRED F/8 HRS OPERATION	(6) NOTES
Gun, Welding	6830-290-4291	Argon, Technical: 243 cu. ft.; w/o cylinder	1	As required	

## APPENDIX C

### MAINTENANCE ALLOCATION CHART

#### Section I. INTRODUCTION

##### C-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

##### C-2. Explanation of Columns In Section II

a. Group Number, Column 1. The assembly group is a numerical group assigned to each assembly in a top down breakdown sequence. The applicable assembly groups are listed on the MAC in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.

b. Assembly Group, Column 2. This column contains a brief description of the components of each assembly group.

c. Maintenance Functions, Column 3. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

- C - Operator or crew
- O - Organizational maintenance
- F - Direct support maintenance
- H - General support maintenance
- D - Depot maintenance

The maintenance functions are defined as follows:

- A - INSPECT. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.
- B - TEST. To verify serviceability and to detect electrical mechanical failure by use of test equipment.
- C - SERVICE. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.
- D - ADJUST. To rectify to the extent necessary to bring into proper operating range.
- E - ALIGN. To adjust specified variable elements of an item to bring to optimum performance.
- F - CALIBRATE. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.
- G - INSTALL. To set up for use in an operational environment such as an emplacement, site, or vehicle.
- H - REPLACE. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.
- I - REPAIR. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.
- J - OVERHAUL. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.
- K - REBUILD. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.



d. Tools and Equipment, Column 4. This column is provided for referencing by code the special tools and test equipment, (Section III) required to perform the maintenance functions (Section II).

e. Remarks. Column 5. This column is provided for referencing by code the remarks (Section IV) pertinent to the maintenance functions.

#### C-3. Explanation of Columns in Section III

a. Reference Code. This column consists of a number and a letter separated by a dash. The number references the T&TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. Maintenance Category. This column shows the lowest level of maintenance authorized to use the special tool or test equipment.

c. Nomenclature. This column lists the name or identification of the tool or test equipment.

d. Tool Number. This column lists the manufacturer code and part number, or Federal Stock Number of tools and test equipment.

#### C-4. Explanation of Columns in Section IV

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to Section II. The first letter references column 5 and the second letter references a maintenance function, column 3, A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, Section II.

SECTION II - MAINTENANCE ALLOCATION CHART

FOR

Welding Set, ARC, Inert Gas Shielded:  
 Water Cooled; Aluminum Welding, General Purpose  
 (Airco Model: 2351 1209)  
 FSN 3431-731-4163

(1) GROUP NO.	(2) <del>FUNCTIONAL</del> ASSEMBLY GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS	
		A	B	C	D	E	F	G	H	I	J	K			
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD			
	Welding Set, ARC	C	O	C					O	O	F				
	Control Assy:	O	F	O	O				O	O					A
	Terminal Strips								F	F					
	Reactor, saturable		F						F						
	Transformers		F						F						
	Sockets, tube		F						F						
	Printed wiring board assy								F	F					
	Capacitors		F						F						
	Resistors		F						F						
	Potentiometer		F		C				F						
	Fuse Holder								O						
	Fuse, Cartridge								C						

C-4

SECTION II - MAINTENANCE ALLOCATION CHART

FOR

(1) GROUP NO.	(2) <del>FUNCTIONAL</del> ASSEMBLY GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
02	Continued													
	Relays		F						F					
	Switches		O						O					
	Electron Tubes								O					
	Wiring								F	F				B
	Cabinet								F					
03	Wire Feeder, Push-Pull:	C	O	C					O	O				C
	Switches								O					
	Motor								O					
	Tachometer								O					
	Hub Assembly								O					
	Belt, Drive				O				O					

C-5

SECTION II - MAINTENANCE ALLOCATION CHART

FOR

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
C-9	Continued													
	Drive Roll Housing Assy				C				O					D
	Valves Solenoid:													
	Gas & Water								O					
	Water Filter			C					O					E
	Cable, multi conductor								O					
	Hoses & fittings								O					
	Potentiometer					C			F					
	Resistors		F						F					
	Brake					O			O					
	Water pressure switch		O						O					
	Plugs, connector								O					

SECTION: II - MAINTENANCE ALLOCATION CHART

FCR

	(2) <u>ASSEMBLY</u> FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS										(4) TOOLS AND EQUIPMENT	(5) REPAIRS	
		1	2	3	4	5	6	7	8	9	10			
		REMOVE	TEST	REWORK	ADJUST	ALIGN	OPERATE	INSTALL	REPLACE	REPAIR	REBUILD			
04	Gun:								0	0				
	Contact tubes								C					
	Guides, inlet-outlet								C					
	Drive rolls								C					
	Jog switch								0					
	Flexible shaft								C					
	Nozzle								C					
	Trigger switch								0					
	Casing								0					
05	Water Circulator:								0	0				
	Pipe & fittings								0					
	Valve, relief								0					

SECTION II - MAINTENANCE ALLOCATION CHART

FCR

	(2) <del>FUNCTIONAL GROUP</del> ASSEMBLY	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS	
		A	B	C	D	E	F	G	H	I	J	K			
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	CLEAN/PAINT	REBUILD			
	Continued														
	Tank, water								0	0					
	Motor								0	0					
	Cable assy, power								0	0					
	Pump								0	0					
	Gages:														
	Regulator, argon								0						
	Adapter, flo								0						
	Contact, secondary								0	0					
	Miscellaneous components:														
	Hose, gas & water								C	0					F

C-8



APPROPRIATE ALLOCATION SYMBOL

FOR: Welding Set, ARC:

DATE \_\_\_\_\_

Airco Model 2351 1209

PAGE \_\_\_\_\_ OF \_\_\_\_\_

SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

REFERENCE CODE	MAINTENANCE LEVEL	NOMENCLATURE	TOOL NUMBER
		No special tools or test equipment required.	



## SECTION IV

## MAINTENANCE ALLOCATION CHART

FOR: Welding Set, ARC:

DATE \_\_\_\_\_

Airco Model 2351 1209

PAGE \_\_\_\_\_ OF \_\_\_\_\_

REFERENCE CODE	REMARKS
A - C	Remove dust and dirt with clean, dry air stream.
B - I	Fabricate
C - C	Remove dust and dirt with clean, dry air stream.
D - C	Lubricate gear chamber with good grade oil.
E - C	Clean sediment from filter with clean water spray.
F - I	Fabricate
G - I	Fabricate
H - I	Fabricate

By Order of the Secretary of the Army:

Official:

KENNETH G. WICKHAM,  
Major General, United States Army,  
The Adjutant General.

W. C. WESTMORELAND,  
General, United States Army,  
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To be distributed in accordance with DA Form 12-25, Section I, (qty  
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# The Metric System and Equivalents

## Linear Measure

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

## Weights

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 dekagram = 10 grams = .35 ounce  
 1 hectogram = 10 dekagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

## Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

## Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

## Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit	5/9 (after	Celsius	°C
	temperature	subtracting 32)	temperature	

