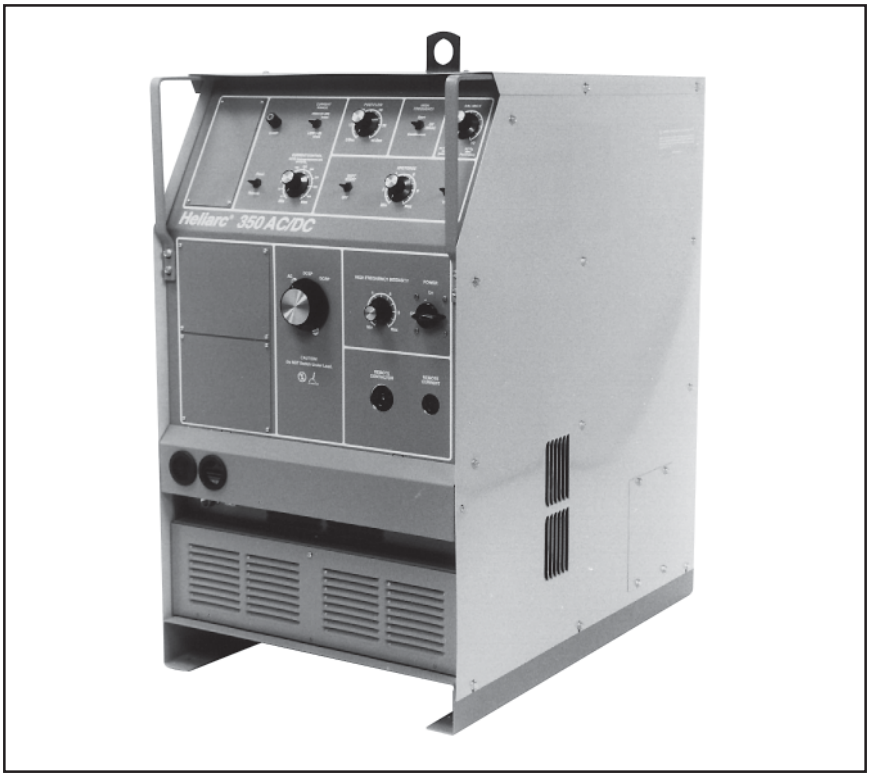
F-14-447-A
April, 1995

INSTRUCTION MANUAL

Heliarc 350 AC/DC
WELDING POWER SOURCE



This manual provides installation and operation instructions for the following Heliarc 350 AC/DC power sources:

ESAB P/N 35588 - 208/230/460 V ac, 1 phase, 60 Hz with power factor
ESAB P/N 35534 - 230/460/575 V ac, 1 phase, 60 Hz with power factor (refer to supplement F-14-453)
ESAB P/N 35597 - 220/380/415 V ac, 1 phase, 50 Hz with power factor (refer to supplement F-14-454)
L-TEC P/N 35600 - 220/380/415 V ac, 1 phase, 50 Hz with power factor (refer to supplement F-14-454)
ESAB P/N 35585 - 208/230/460 V ac, 1 phase, 60 Hz without power factor
ESAB P/N 35591 - 230/460/575 V ac, 1 phase, 60 Hz without power factor (refer to supplement F-14-453)

This manual is also suitable for use with L-TEC Heliarc 306 as made prior to April, 1995.

CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for electric welding equipment, we urge you to read our booklet, "Precautions and Safe Practices for Arc Welding, Cutting, and Gouging," Form 52-529. Do NOT permit untrained persons to install, operate, or maintain this equipment. Do NOT attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions before installing or operating this equipment.

Be sure this information reaches the operator.
You can get extra copies through your supplier.

ESAB®
ESAB Welding & Cutting Products

USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Defective equipment should not be used. Parts that are broken, missing, worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, the manufacturer recommends that a telephone or written request for service advice be made to the Authorized Distributor from whom purchased.

This equipment or any of its parts should not be altered without the prior written approval of the manufacturer. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than the manufacturer or a service facility designated by the manufacturer.

SAFETY PRECAUTIONS

WARNING: These Safety Precautions are for your protection. They summarize precautionary information from the references listed in Additional Safety Information section. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below as well as all other manuals, material safety data sheets, labels, etc. Failure to observe Safety Precautions can result in injury or death.

PROTECT YOURSELF AND OTHERS -- Some welding, cutting, and gouging processes are noisy and require ear protection. The arc, like the sun, emits ultraviolet (UV) and other radiation and can injure skin and eyes. Hot metal can cause burns. Training in the proper use of the processes and equipment is essential to prevent accidents. Therefore:

1. Always wear safety glasses with side shields in any work area, even if welding helmets, face shields, and goggles are also required.
2. Use a face shield fitted with the correct filter and cover plates to protect your eyes, face, neck, and ears from sparks and rays of the arc when operating or observing operations. WARN bystanders not to watch the arc and not to expose themselves to the rays of the electric-arc or hot metal.
3. Wear flameproof gauntlet type gloves, heavy long-sleeve shirt, cuffless trousers, high-topped shoes, and a welding helmet or cap for hair protection, to protect against arc rays and hot sparks or hot metal. A flameproof apron may also be desirable as protection against radiated heat and sparks.
4. Hot sparks or metal can lodge in rolled up sleeves, trouser cuffs, or pockets. Sleeves and collars should be kept buttoned, and open pockets eliminated from the front of clothing
5. Protect other personnel from arc rays and hot sparks with a suitable non-flammable partition or curtains.
6. Use goggles over safety glasses when chipping slag or grinding. Chipped slag may be hot and can fly far. Bystanders should also wear goggles over safety glasses.

FIRES AND EXPLOSIONS -- Heat from flames and arcs can start fires. Hot slag or sparks can also cause fires and explosions. Therefore:

1. Remove all combustible materials well away from the work area or cover the materials with a protective non-flammable covering. Combustible materials include wood, cloth, sawdust, liquid and gas fuels, solvents, paints and coatings, paper, etc.
2. Hot sparks or hot metal can fall through cracks or crevices in floors or wall openings and cause a hidden smoldering fire or fires on the floor below. Make certain that such openings are protected from hot sparks and metal.“
3. Do not weld, cut or perform other hot work until the workpiece has been completely cleaned so that there are no substances on the workpiece which might produce flammable or toxic vapors. Do not do hot work on closed containers. They may explode.
4. Have fire extinguishing equipment handy for instant use, such as a garden hose, water pail, sand bucket, or portable fire extinguisher. Be sure you are trained in its use.
5. Do not use equipment beyond its ratings. For example, overloaded welding cable can overheat and create a fire hazard.
6. After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire. Use fire watchers when necessary.
7. For additional information, refer to NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

ELECTRICAL SHOCK -- Contact can cause severe injury or death. DO NOT use AC output in damp areas, if movement is confined, or if danger of falling exists. Put on dry, hole-free gloves before turning on the power. Also:

1. Be sure the power source frame (chassis) is connected to the ground system of the input power.
2. Connect the workpiece to a good electrical ground.
3. Connect the work cable to the workpiece. A poor or missing connection can expose the operator or others to a fatal shock.
4. Use well-maintained equipment. Replace worn or damaged cables.
5. Keep everything dry, including clothing, work area, cables, torch/electrode holder and power source. Fix water leaks immediately.
6. Make sure that you are well insulated, especially when standing on metal or working in tight quarters or in a damp area. Wear rubber-soled shoes and stand on a dry board or insulating platform.
7. Turn off the power before removing your gloves.
8. Refer to ANSI/ASC Standard Z49.1 (see listing below) for specific grounding recommendations. Do not mistake the work lead for a ground cable.

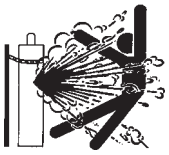
ELECTRIC AND MAGNETIC FIELDS — May be dangerous. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding and cutting current creates EMF around welding cables and welding machines. Therefore:

1. Welders having pacemakers should consult their physician before welding. EMF may interfere with some pacemakers.
2. Exposure to EMF may have other health effects which are unknown.
3. Welders should use the following procedures to minimize exposure to EMF:

A. Route the electrode and work cables together. Secure them with tape when possible.
B. Never coil the torch or work cable around your body.
C. Do not place your body between the torch and work cables. Route cables on the same side of your body.
D. Connect the work cable to the workpiece as close as possible to the area being welded.
E. Keep welding power source and cables as far away from your body as possible.

FUMES AND GASES -- Fumes and gases, can cause discomfort or harm, particularly in confined spaces. Do not breathe fumes and gases. Shielding gases can cause asphyxiation. Therefore:

1. Always provide adequate ventilation in the work area by natural or mechanical means. Do not weld, cut, or gouge on materials such as galvanized steel, stainless steel, copper, zinc, lead, beryllium, or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.
2. Do not operate near degreasing and spraying operations. The heat or arc rays can react with chlorinated hydrocarbon vapors to form phosgene, a highly toxic gas, and other irritant gases.
3. If you develop momentary eye, nose, or throat irritation while operating, this is an indication that ventilation is not adequate. Stop work and take necessary steps to improve ventilation in the work area. Do not continue to operate if physical discomfort persists.
4. Refer to ANSI/ASC Standard Z49.1 (see listing below) for specific ventilation recommendations.



CYLINDER HANDLING -- Cylinders, if mishandled, can rupture and violently release gas. Sudden rupture of cylinder, valve, or relief device can injure or kill. Therefore:

1. Use the proper gas for the process and use the proper pressure reducing regulator designed to operate from the compressed gas cylinder. Do not use adaptors. Maintain hoses and fittings in good condition. Follow manufacturer's operating instructions for mounting regulator to a compressed gas cylinder.
2. Always secure cylinders in an upright position by chain or strap to suitable hand trucks, undercarriages, benches, walls, post, or racks. Never secure cylinders to work tables or fixtures where they may become part of an electrical circuit.
3. When not in use, keep cylinder valves closed. Have valve protection cap in place if regulator is not connected. Secure and move cylinders by using suitable hand trucks. Avoid rough handling of cylinders.
4. Locate cylinders away from heat, sparks, and flames. Never strike an arc on a cylinder.
5. For additional information, refer to CGA Standard P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders", which is available from Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

EQUIPMENT MAINTENANCE -- Faulty or improperly maintained equipment can cause injury or death. Therefore:

1. Always have qualified personnel perform the installation, troubleshooting, and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.
2. Before performing any maintenance work inside a power source, disconnect the power source from the incoming electrical power.
3. Maintain cables, grounding wire, connections, power cord, and power supply in safe working order. Do not operate any equipment in faulty condition.
4. Do not abuse any equipment or accessories. Keep equipment away from heat sources such as furnaces, wet conditions such as water puddles, oil or grease, corrosive atmospheres and inclement weather.
5. Keep all safety devices and cabinet covers in position and in good repair.
6. Use equipment only for its intended purpose. Do not modify it in any manner.

ADDITIONAL SAFETY INFORMATION -- For more information on safe practices for electric arc welding and cutting equipment, ask your supplier for a copy of "Precautions and Safe Practices for Arc Welding, Cutting and Gouging", Form 52-529.

The following publications, which are available from the American Welding Society, 550 N.W. LeJuene Road, Miami, FL 33126, are recommended to you:

1. ANSI/ASC Z49.1 - "Safety in Welding and Cutting"
2. AWS C5.1 - "Recommended Practices for Plasma Arc Welding"
3. AWS C5.2 - "Recommended Practices for Plasma Arc Cutting"
4. AWS C5.3 - "Recommended Practices for Air Carbon Arc Gouging and Cutting"
5. AWS C5.5 - "Recommended Practices for Gas Tungsten Arc Welding"
6. AWS C5.6 - "Recommended Practices for Gas Metal Arc Welding""
7. AWS SP - "Safe Practices" - Reprint, Welding Handbook.
8. ANSI/AWS F4.1, "Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances."

This symbol appearing throughout this manual means **Attention! Be Alert! Your safety is involved.**

The following definitions apply to DANGER, WARNING, CAUTION found throughout this manual:

DANGER Used to call attention to immediate hazards which, if not avoided, will result in immediate, serious personal injury or loss of life.

WARNING Used to call attention to potential hazards which could result in personal injury or loss of life.

CAUTION Used to call attention to hazards which could result in minor personal injury.

1.1 GENERAL

The Heliarc 350 AC/DC Welding Power Source is a constant current AC/DC welding power source designed for high quality tig and stick welding in both the AC and DC mode. The unique characteristics of the magnetic and solid state circuits provide excellent arc conditions for all tig welding as well as high alloy stick electrodes. The non-saturating current limiting reactor and electronic feedback control prohibits high current surges inherent with saturable reactors or solid state SCR control alone, therefore reducing spatter on stick electrodes as well as tungsten spitting when tig welding. The electronic firing circuit utilizes a voltage compensating circuit which compensates for line voltage variations of ±10 percent.

Through its unique design, the Heliarc 350 AC/DC combines all of the latest state-of-the-art magnetic and solid state concepts to provide the wide range(s) volt-ampere curve characteristics needed for a constant current AC/DC power source - see Figure 1-1.

Table 1-1. Specifications

NEMA †Rated Output @ 60% Duty Cycle		300 Amps @ 32 Volts AC/DC, Tig/Stick		
Open Circuit Voltage		79 V ac/72 V dc		
Output Current Range In Amperes	Welding Current	AC/DC		
	Low Range High Range	5‡ to 50 Amps 20 to 380 Amps		
Input Voltage		208/230/460 V ac 1 Ph, 60 Hz		
Input Current @ Rated Load in Amperes**	Voltage	208	230	460
	w/o P.F.C.* with P.F.C.*	123 99	112 86	56 43
Power Factor @ Rated Load	w/o P.F.C.* with P.F.C.*	Approx. 71% Approx. 88%		
Auxiliary Power Output		115 V ac, 15 Amp, 60 Hz		
Dimensions:	Width Depth Height	22-3/4 in. 578 mm 32 in. 813 mm 36 in. 914 mm		
Weight Approx.		600 lbs 270 kg		

*P.F.C. (Power Factor Correction)
†Output Rating conforms to NEMA Rating EWI-1971 Class 1 (60).
‡3-amp. minimum with LOW AMP KIT, DC only.
**These are NEMA ratings and in some cases, the input currents will vary --

1.2 DUTY CYCLE

Duty cycle is defined as the ratio of load time to the total time. Standard current ratings are based on a 10-minute cycle. This machine is rated at 60 percent duty cycle which means the rated load (300 amps) is applied for a total of 6 minutes and shut off for a total of 4 minutes in a 10-minute period. However, if the welding current is decreased, the duty cycle can be increased. Conversely, if the welding current is increased, the duty cycle must be decreased. Figure 1-2 enables the operator to determine the safe output of the power source at various duty cycles.

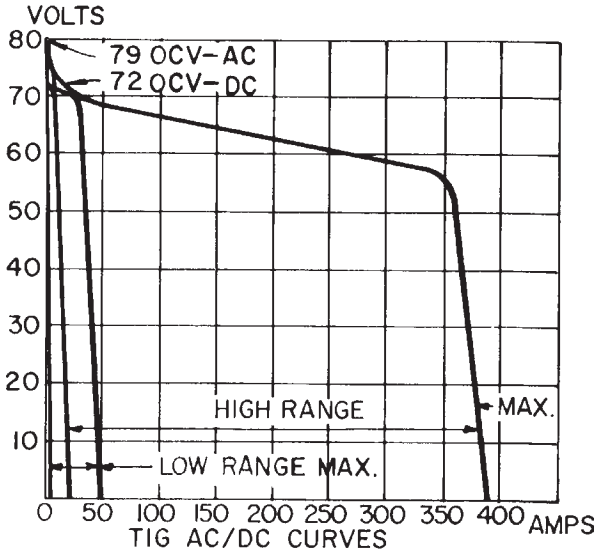


Figure 1-1. Volt-Ampere Curves

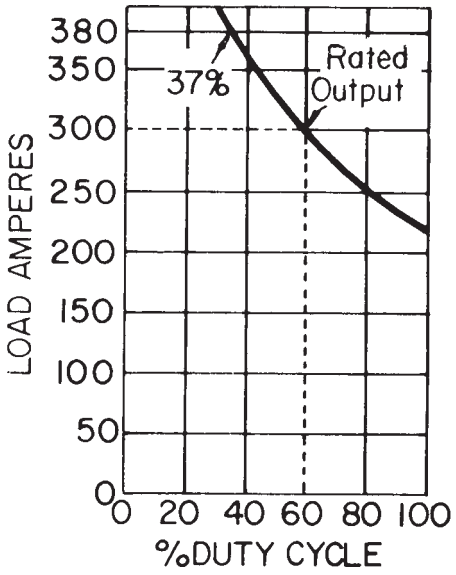


Figure 1-2. Duty Cycle Chart

For DC & AC Balanced Wave Only

2.1 GENERAL

Proper installation can contribute materially to the satisfactory and troublefree operation of the power source. It is suggested that each step in this section be studied carefully and followed as closely as possible.

2.2 UNPACKING AND PLACEMENT

A. Immediately upon receipt of the power source, it should be inspected for damage which may have occurred in transit. Notify the carrier of any defects or damage at once.

B. After removing the power source from the shipping container, check the container for any loose parts. Remove all packing materials.

C. Check air passages at front, bottom and rear of cabinet for any packing materials that may obstruct air flow through the power source.

D. If the machine is not to be installed immediately, store it in a clean, dry, well-ventilated area.

E. The location of the welding machine should be carefully selected to ensure satisfactory and dependable service. Using the lifting eyebolt, or a forklift truck, place the power source in the desired location. Choose a location relatively close to a properly fused source of electrical power. **Never lift the unit with cylinder attached.**

F. The machine components are maintained at proper operating temperatures by forced air which is drawn through the cabinet by the fan unit on the rear panel.

The power source is designed to operate at up to 40 °C (104 °F) ambient temperature. For this reason, locate the machine in an open area where air can circulate freely at front, bottom and rear openings Leave at least 2 feet of clearance between the rear of the power source and wall or other obstruction.

IMPORTANT

Do not use filters on this unit. Output ratings are designed and based on an unobstructed supply of "clean" cooling air drawn over its internal components. If cooling air is dirty (e.g., laden w/conductive dust), the interior should be cleaned using low pressure air (refer to Section 4).

2.3 PRIMARY (INPUT) ELECTRICAL CONNECTIONS

This welding power source is a single-phase unit and must be connected to a single-phase power supply. Although designed with line voltage compensation, it is suggested the unit be operated on a separate circuit to assure that the performance of the machine is not impaired due to an overloaded circuit.

ELECTRIC SHOCK CAN KILL! Do not touch electrically live parts. Be sure that all power is off by opening the line (wall) disconnect switch when primary electrical connections are made to the power source. To be doubly safe, check your input leads with a voltmeter to make sure that all power is OFF.

A. A line (wall) disconnect switch, with fuses or circuit breakers, should be provided at the main power panel (see Figure 2-2). The primary power input must have three insulated copper conductors (two power leads and one ground wire). The wires may be heavy rubber-covered cable, or may be run in a solid or flexible conduit. Refer to table 2-1 for recommended input conductors and line fuse sizes. **Do not connect the input conductors until step C.**

Table 2-1. Recommended Sizes for Input Conductors and Line Fuses

Input Requirements			Input & Gnd. Conductor* CU/AWG	Time-Delay Fuse Size Amps
Volts	Amperes			
	①	②		
Units Without Power Factor Correction.				
208	123	184	No. 1/0	200
230	112	166	No. 1	175
460	56	83	No. 6	100
Units With Power Factor Correction.				
208	99	137	No. 2	150
230	86	124	No. 3	150
460	43	62	No. 6	70

①DC and AC balanced wave input current rating.

②AC unbalanced wave input current rating.

*Sized per National Electric Code for 75 °C rated conductors @ 30 °C ambient using a 60-percent duty cycle based on the AC unbalanced wave ampere ratings. Not more than three conductors in the raceway or cable. Local codes should be followed if they specify sizes other than those listed above.

B. For access to input terminal board, remove the screws which secure the right side panel of the power source. The input terminal board, Figure 2-1, is clearly marked to show the available primary voltage connections which may be used. Set the voltage links on this board to match your actual incoming voltage (208, 230, or 460 volt single-phase). As shipped from the factory, the input terminal board voltage links are set up for 460 volt operation.

C. Thread the input conductor cables from the wall disconnect switch through the strain relief hole in the rear panel (see Fig. 2-2). Secure the cables with the strain relief coupling provided, and then connect conductors to terminals L1 and L2 (on the input terminal board) using UL listed pressure wire connectors. Connect the ground wire to the grounding stud provided on the chassis base near the input terminal board.

CAUTION

It is of the utmost importance that the chassis be connected to an approved electrical ground to prevent accidental shocking. Take care not to connect the ground wire to any of the primary leads.

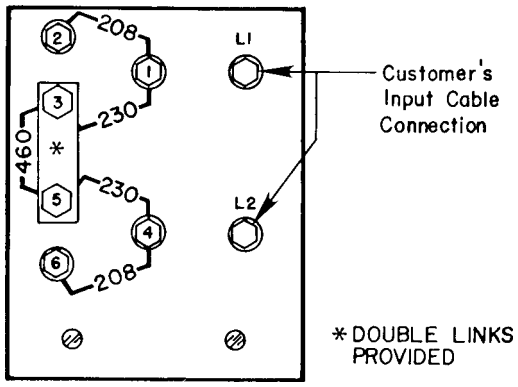


Figure 2-1. Input Terminal Board

D. Recheck all connections to make sure that they are tight, well insulated, and that the proper connection has been made.

2.4 EXTERNAL POWER/CONTROL HOSE CONNECTIONS

CAUTION

Verify that all electrical connections comply with local electrical codes and especially with requirements established in booklet F-11-831 "High Frequency Stabilized Arc Welding Equipment", which is packed with the power source.

Refer to Figure 2-2, for typical primary input, secondary output, process gas and water, and torch connections that are required for this unit's welding applications.

WARNING

Before making any connections to the power source's output terminals, make sure that all primary input power to the power source is deenergized (off) at the customer's disconnect switch.

The proper operation of the power source depends to a great extent on the use of output cables that are insulated copper, adequately sized, in good condition and properly connected to the machine using UL listed pressure wire connectors It is recommended that the output cables be kept short as possible (this is particularly important for tig applications using ACHF) and be of adequate current carrying capacity. The resistance of the output cables and connections cause a voltage drop which is added to the voltage of the arc. Excessive cable resistance may result in overloading as well as reducing the maximum current output of which the power source is capable. The welding output terminals are located on the front panel. Table 2-2 will prove useful for selecting the recommended output cable size.

Table 2-2. Recommended Welding Cable Sizes

Welding Total Length (Feet) of Cable in Weld Circuit*					
Curren	**50**	**100**	**150**	**200**	**250**
200	2	2	1	1	1/0
250	1	1	1	1/0	1/0
300	1/0	1/0	1/0	2/0	3/0

*Total cable length includes work and electrode cables. Cable size is based on direct current, insulated copper conductors, 60-percent duty cycle and a voltage drop of 4 or less volts. The welding cable insulation must have a voltage rating that is high enough to withstand the open circuit voltage of the machine.

2.5 INSTALLATION OF OPTIONAL KITS

For installation of optional kits (if applicable) refer to Section 2.6.

2.6 ACCESSORIES

A. Slope/Spotweld Control Module, P/N 680665. The slope control features provide smoothly controlled welding starts and precise crater-free finishes for critical manual tig welding applications; and the spot-weld control features permit precisely timed full-range spotwelding capability. For additional control function information, refer to operation section. This control module is completely self-contained and is designed for easy plug-in, bolt-on installation on the left-side of the front panel (see parts illustrations and wiring diagrams in this manual, and for installation instructions, see F-14-396A).

B. Analog Meter Module, P/N 680628. The voltmeter and ammeter provide direct accurate indication of AC and DC open-circuit and welding voltage, and welding current The meter module is completely self-contained and is designed for easy plug-in, bolt-on installation in the upper-left corner of the power source front panel (see parts illustrations and wiring diagrams in this manual, and for installation instructions, see F-14-395).

C. Power Factor Correction Kit, P/N 680632. When installed in units without power factor correction, it provides lower input current draw. The kit consists of 3 prewired power factor capacitors that are mounted on the left-rear chassis base of the unit (see parts illustrations and wiring diagram in this manual, and for installation instructions, see F-14-394).

D. Low Amp Kit (For DC Only), P/N 680631. This kit is designed to enhance arc starting and arc stability down to 3 amps for low range DC tig welding of thin-gauge materials. **Even lower weld currents, down to 2 amps and lower, are attainable with this option by readjusting a shunt lead "inside" the power source -- see Section 4 for Shunt Adjustment procedures.** The kit consists of an On-Off switch and provision for a factory-supplied wire harnessed amp-type receptacle (for connecting an external optional "pulse control" and a thermally-protected internal inductor. For installation procedures, see booklet F-14-398.

IMPORTANT

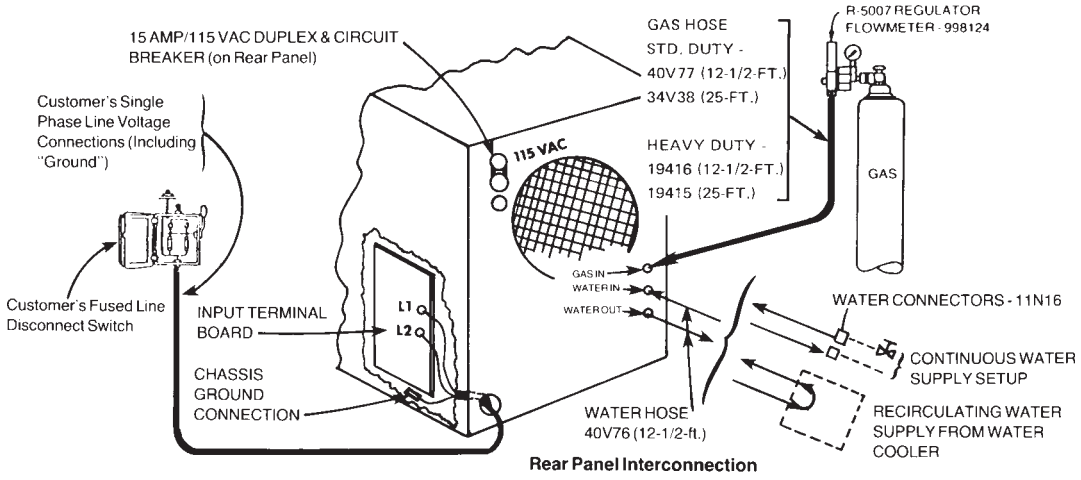
This option (Item D.) cannot be installed if a panel-mounted Pulse option (Item E.1.) is installed because they both use the same front-panel mounting location; however, it can be installed if the external Pulse Control option (Item E.2.) is used.

E. Pulse Control Module, P/N 680693. The Pulse Control module "pulses" the power source output, giving the operator more precise control over penetration, heat input and bead shape. This pulsing output current results in high quality tig or tig/spot welds requiring less operator skill. This module is completely self-contained and is designed for easy plug-in (to an internal receptacle provided in the wiring harness), bolt-on installation in the same front-panel location as, but in place of the Low-Amp Kit option. For installation instructions, see F-14-397; for replacement parts, see this manual.

F. FC-4EHD Foot Switch Current and Contactor Control, P/N 679662. This device provides the operator with remote control of current and contactor operation at the welding station. Interconnection of these functions to the main unit is provided by a pair of mating 25-foot cable/plug assemblies. By depressing the foot pedal, the weld-start sequence circuit will energize, and the welding current will increase or decrease within the range preset on the power source Current Control potentiometer.

G. TC-1A Torch Current and Contactor Control, P/N 34718 (25-Ft Lg.). This remote fingertip control is designed to be taped to any tig torch handle and it allows the operator complete contactor control and variable control of the welding current. The TC-1A includes prewired current and contactor control plugs which are compatible for use on ESAB solid-state type, constant current power sources. The control knob of this torch handle potentiometer/switch is designed for right- and left-handed accessibility. By simply rotating the knob clockwise (off of zero) the intergral switch will energize the contactor, and further regulation (clockwise) will increase the output current up to the limit preset on the power source main control.

H. Torch Switch Assembly, P/N 674038. This device is designed to be attached to any tig welding torch, and provides the operator with remote contactor operation at the welding station. Interconnection to the power source is provided by its 12-1/2-ft cable/plug assembly.



Rear Panel Interconnection

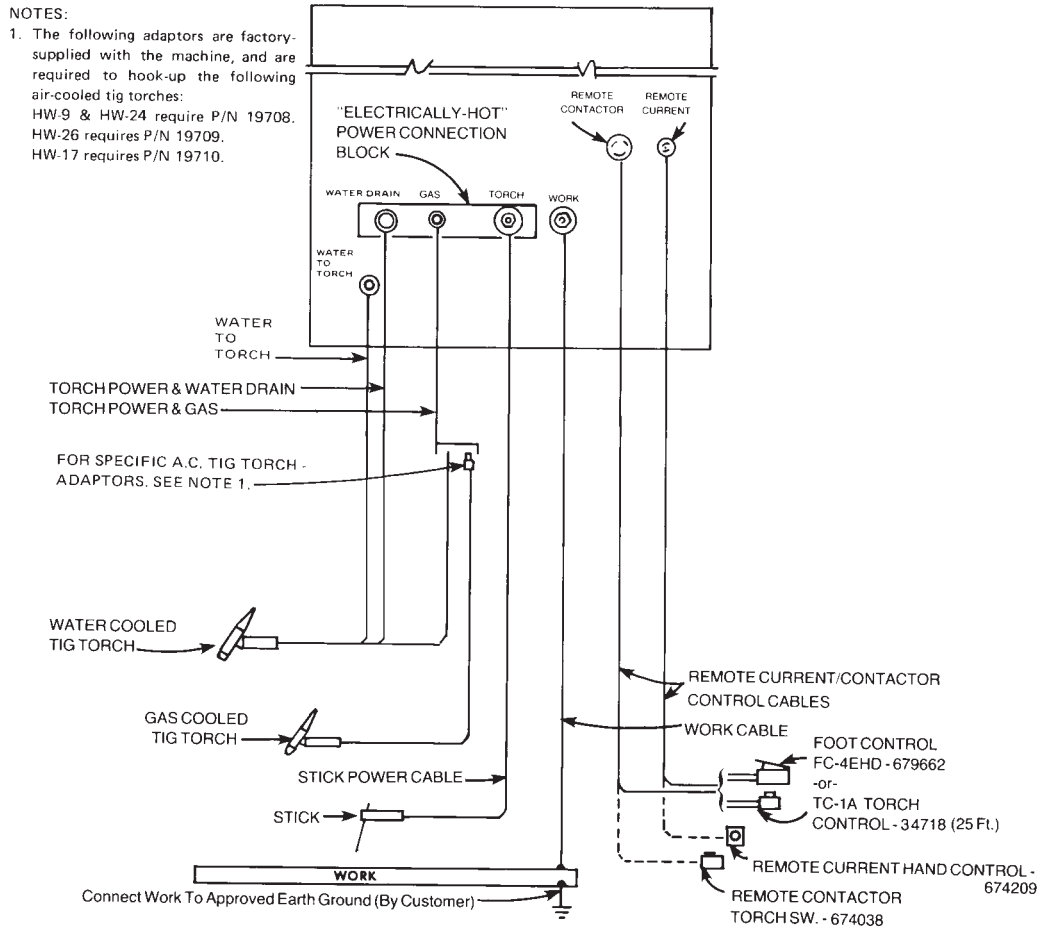


Figure 2-2. Interconnection Diagram

I. Current Hand Control, P/N 674209. This accessory operates in series with the power source's 'main current control' potentiometer to provide remote (up to 25-ft) current regulation. The hand control potentiometer's current adjustment is always controlled by and limited to the range that is preset on the main current control.

J. WC-9 Coolant Circulator, P/N 33540, is used for water cooled torch operation and is designed to be "free standing" in a convenient location near the torch. A four-gallon capacity tank provides 1.0 gal/min @ 50 psi, using 6 amps, 115 volts, 60 Hertz, 1-phase input. Since the circulator is designed to run continuously during a welding operation, never connect it to a power source that uses a solenoid controlled water supply that opens and closes with each operation of the welding contactor -- the cooling efficiency of the unit will be hampered and the starting winding in the pump motor may burn out. Refer to Figure 2-2 for suggested hose hookup.

K. WC-8C Coolant Circulator, P/N 33739, is used for water cooled torch operation and is designed to fit in a cylinder rack of a power source truck (item M). A 1.5 gallon capacity tank provides 1 gal/min @ 50 psi, using 6 amps, 115 volts, 60 Hertz, 1-phase input. Since the cooler is designed to run continuously during a welding operation, never connect it to a power source that uses a solenoid controlled water supply that opens or closes with each operation of the welding contactor -- the cooling efficiency of the unit will be hampered and the starting winding in the pump motor may burn out. Refer to Figure 2-2 for suggested water hose hookup.

L. TR-21 Truck, P/N 680794. Provides complete mobility for power source or welding outfit and includes a bracket for two gas cylinders or one gas cylinder and a WC-8C water cooler.

M. Water Solenoid Valve Kit, P/N 30570. This kit comes completely assembled and ready for mounting in place of the existing bulkhead fittings provided for the WATER IN service on the rear panel of the power source. It is identical to the gas assembly, except that its hose adaptor connection is a left-hand fitting (58V75). To install the solenoid assembly, refer to instruction sheet F-14-452.

3.1 CONTROL FUNCTIONS

A. Power On-Off Switch (ROS). In the OFF position, the power source is electrically shut down; however, input voltage is still present in the unit (at the input terminal board and the Power On-Off switch) -- unless the customer's line switch is off. In the ON position, this switch provides power to the fan motor, the primary and secondary of the main transformer and its 115-volt and 24-volt windings to energize the control circuitry by preparing the ready-to-weld status of the unit, as determined by the positioning of the Tig-Stick switch SW1 (see Item B. following).

B. Tig-Stick Mode Switch (SW1). This two-position toggle switch sets the operational modes which can be used. **In the STICK position** (and the ROS toggle is ON), the solid-state contactor and arc-force circuits immediately energize and welding power is continuously present at the output terminals. **In the TIG position**, the solid-state contactor and other tig sequencing circuits are controlled by a remote device (foot or torch switch) through the Remote Contactor Receptacle J4 (see Item C. following).

NOTE

In the Tig Mode, the Arc Force control/circuitry is inoperable.

C. Remote Contactor Receptacle (J4). The cable connector from the remote Foot Control or Torch Switch accessories plugs into this low-voltage receptacle to control the conducting sequence of the bridge SCRs to make or break the tig welding output power.

D. Current Selector Switch (CSS). A 3-position switch offers a choice of AC, DCSP, or DCRP output current to suit your particular welding applications. Placing the switch in its DCSP mode causes the output terminals to assume the following polarities; work is positive, and torch/electrode is negative. Conversely, when the switch is in DCRP: work is negative and torch/electrode is positive. **Do not change the position of this switch while welding or under load.**

E. Current Range Selector Switch (SW1). This 2-position switch (an integral part of the SCR Control p.c. bd.) permits quick coarse selection of the output current ranges which can be used. The current ranges are marked Low 3-50 Amps and High 20-380 Amps. The Low Range provides exceptional cleaning action for all low current tig AC applications. For higher current tig welding, always try to select the appropriate minimum current range that adequately covers your welding requirements. For stick electrode welding, position the switch to the desired current output range. **Do not change the position of this switch while welding or under load.**

NOTE

The Min/Max current values for the Low/High ranges can be shifted even lower by readjusting the shunt -- see Section 4 for procedures.

F. Current Control Potentiometer (R44). This potentiometer (an integral part of SCR Control p.c. bd.) provides fine adjustment of welding current within the range selected on the Current Range Switch (SW1). The panel-faced dial provides an accurate reference for resetting and/or adjusting the potentiometer.

G. Current Panel-Remote Switch (SW2), and Remote Current Control Receptacle (J3). This two-position toggle switch determines the location from which welding current will be operated either from the power source potentiometer -- PANEL position, or, from REMOTE location by plugging an optional FC-4EHD Foot or TC-1A Torch Control into Receptacle J3. When the Remote position is selected, the remote control options will vary the welding current, but only within the range preset on the power source Current Control Potentiometer (R44).

H. Post Flow Control (PFP). This potentiometer (an integral part of the Logic p.c. bd.) provides a time (from 3 to 45 seconds) post-flow of shielding gas and cooling water after the contactor signal is opened.

I. High Frequency (and Gas Water Solenoids) Selector Switch (HFS). A three position toggle switch (an integral part of the Logic p.c. bd.) controls high frequency and, shielding gas and cooling water in the welding operation.

The functional positions are: **Off** -- no high frequency and, gas and water solenoid valves are deenergized (this is the normal position for all stick welding); **Continuous** -- high frequency and, shielding gas and cooling water (if used) are provided throughout the entire welding cycle (this is the normal position for all AC tig welding); and, **Start** -- high frequency

initiates immediately and cuts off when the arc is established, gas and water solenoids energize and remain on throughout the welding cycle (this last position is normal for most DC tig welding applications).

J. High Frequency Intensity Control (HFI). This rheostat, with panel-faced dial, allows you to regulate the output intensity of the high frequency oscillator circuit. For most applications the control should be set at maximum.

K. Gas and Water Torch Connections.

1. Three service connectors are located on the lower-right side of the rear panel. The upper fitting is equipped with a solenoid valve and provides GAS IN service that is threaded to accept a standard CGA "B" size "right-hand" inert gas hose connection nut. The remaining two fittings provide torch cooling water IN and OUT service that are threaded to accept standard CGA "B" size "left-hand" water hose connection nuts. As shipped from the factory, the WATER IN fitting is not equipped with a solenoid valve (available as a field-installed option, see II-D-13); and therefore if water-cooled torch operation is required, the water service should only be used with a coolant circulator or a continuous water supply (see Fig. 4).

2. The three torch service connectors (from K-1) are located on the lower left-hand side of the front panel (behind the protective cover). Two of these connectors, WATER DRAIN and shielding GAS fittings, are electrically connected to the TORCH output block -- which makes these fittings "power" as well as "service" connections to the torch (see Fig. 4). The remaining connector, WATER-TO-TORCH, provides this service when water cooled torch operation is used.

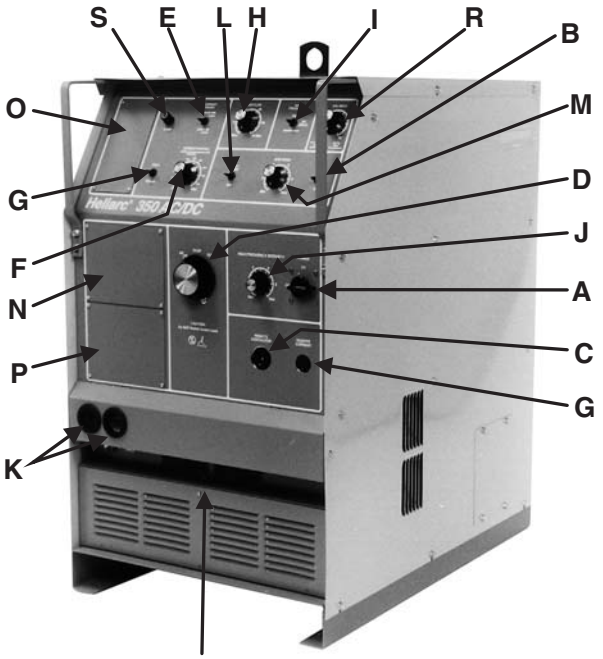
I. Soft Start Switch (SW1). This two-position switch (an integral part of the soft start p.c. bd.) allows you to reduce the initial high current overshoot when starting a welding arc **above 30 amperes** -- below 30 amperes, the unit is inherently soft-starting. In the OFF position, full current is applied the instant the arc is struck and this is the normal position for all stick, tig-slope and tig-spot welding. In the SOFT START position, initial welding current is less than that set by the power source Current Control potentiometer. Once the arc is established, it has no effect on the full-load current setting.

M. Arc Force Potentiometer (AFP). This control is only functional in the Stick mode, and is marked MIN, 1-9, MAX. The lower settings provide less short circuit current and a softer, more stable arc. The higher settings provide more short circuit current and a forceful, more penetrating arc. For most stick welding, set the knob at 3 or 4 and readjust up (forceful) or down (softer) as desired. Note that with the knob in the MIN. position a longer arc length can be maintained, and at MAX., the arc will extinguish much easier when drawing away from the work.

N. Slope/Spotweld Control Module. This module operates as follows:

1. The Slope features consist of the following functional controls:

a. On-Off Slope Switch places the slope control features in or out of the conventional tig welding circuit.



b. Up Slope Potentiometer allows you to set a timed period which provides a gradual current increase (upslope) at the beginning of a weld for smoother starts and elimination of blow holes. The up slope time control can be adjusted to provide an upslope time from 0 to 10 seconds (Min to Max). With the pot set at Min, the current will rapidly rise from the minimum of the selected "current range" up to the actual setting established on the "current control" potentiometer. As the upslope

pot is increased toward Max, the current will take longer to rise (in direct proportion to its time setting) until the desired weld current is reached.

c. Down Slope Potentiometer allows you to set a timed period which provides a gradual current decrease (downslope) at the end of the weld cycle for crater-free finishes. The Down Slope time control can be adjusted to provide a downslope time of 0-10 seconds (Min to Max). The setting of this control is similar to that of the Up Slope feature, except the Down Slope setting determines the rate at which welding current will gradually decrease down to the **minimum** of the selected "current range" **or** as determined by the Final Current "cut off level."

d. Set the 3-position "Spotweld-Off-Final Current" switch to the FINAL CURRENT position when slope control is used. This mode enables the Final Current time potentiometer to set the current cut-off-level during a downslope period.

When the "Final Current" switch position is selected ("on"), the solid state contactor and welding output will remain "on" for the length of time set on the Final Current potentiometer -- after the torch switch has been released/deenergized (to initiate the downslope sequence).

e. Final Current Potentiometer allows you to set a timed period from 0 to 10 seconds (HI to LOW) that determines the "cut-off-level" of welding current at which the contactor will drop out, after the torch switch is released, during downslope. The pot can be set to drop out slightly below the welding current level (HI setting), or at the minimum output of the selected current range (LOW setting).

2. The Spotweld features consist of the following functional controls:

a. The 3-position "Spotweld-Off-Final Current" switch determines whether or not the spotwelding sequence will be functional in the Tig welding mode. Placing the switch in the SPOTWELD position actuates the spotweld timer for use in the Tig welding sequence. With the switch in its OFF position, the "timed-welding" feature is deenergized and welding action is conventionally controlled from the torch switch.

b. Spotweld Timer Potentiometer is provided to control the period of time weld power is available during tig Spotwelding operations. The spotweld pot can be adjusted to provide arc duration periods from 0 to 10 seconds (Min to Max). The operating sequence begins when the torch switch is closed and the arc is initiated. As soon as the arc is established, the timer begins timing out. **The torch switch must be held closed throughout the entire welding interval.** After the spotweld time cycle is completed, the welding current cuts off and when the torch switch is released, the time will recycle and the post flow sequence will begin. If for any reason you wish to prematurely terminate the spot weld, simply release the torch switch and all welding action will stop except post flow.

NOTE

If the High Frequency switch is in its CONTINUOUS position, the high frequency will remain "on" after the spotweld (time) cycle is completed and until the torch switch is released. If this is a problem, simply change the High Frequency switch from "Continuous" to "Start" only -- even for AC welding operations.

O. AC/DC Analog Meter Module. The optional meters provide direct accurate reading of AC and DC open-circuit and welding voltages, and welding current.

P. This module location is designed to accept either of two optional kits as follows:

1. Low-Amp Kit. This module is optional and consists of a front panel On-Off switch and an amp receptacle (for connecting an external Pulse Control), and an internal thermally protected inductor. It is designed to enhance arc starting and stability for "low range" DC tig welding down to 3 amperes. The duty cycle range of this feature runs from 3 to 20 amperes @ 100% to a maximum of 50 amperes @ 16%.

2. **Pulse Control.** This module is optional and consists of a front panel On-Off switch, a Background Current pot, a pulse Frequency (cycles/second) pot, and a pulse On Time (percent) pot. It is designed to "pulse" the welding current to provide greater control over penetration, heat input and bead shape during the welding operation.

R. Balance Control Feature. This component, a potentiometer for the units, allows you to change the "wave balance" characteristics of the Heliarc 350 as follows:

These units incorporate a potentiometer to effect a wave BALANCE change. **With the potentiometer set in its extreme counterclockwise or "Max. Cleaning" position**, the machine is set up for "balanced" wave operation (equal portions of reverse and straight polarity -- 50/50) for use in the following applications; DC tig, DC Stick, AC Stick, and AC tig w/Maximum Cleaning (and minimum penetration)—this will be the normal (counterclockwise) position for most applications. As the potentiometer is turned clockwise toward "Max. Penetration," cleaning action will lessen and penetration will increase until you reach Maximum Penetration and this "unbalanced" wave output (more straight than reverse polarity) should only be used for AC tig applications when needed.

IMPORTANT

Please note that when using "Maximum Penetration in AC tig," the machine will have a reduced duty cycle. Also, when using DC tig or stick welding, the controls should always be set to the Maximum Cleaning or "balanced" wave position.

S. Front Panel 3-Amps Fuse (F1). This fuse provides protection to the 24-volt control circuit and the printed circuit boards.

T. Rear Panel Auxiliary 115-V. Receptacle (J2). This duplex receptacle can be utilized to supply 115-volt power for other equipment (water cooler, grinder, etc.) and is protected by a 15-ampere circuit breaker.

3.2 SEQUENCE OF OPERATION

CAUTION

Never, under any circumstances, operate the power source without its panels in place. In addition to the safety hazard, improper cooling may cause overheating which will damage the internal components. Also, make sure you are adequately protected before you start welding -- welding helmet, gloves and ear protection should always be worn.

A. STICK ELECTRODE WELDING

1. Connect all welding cables to workpiece and electrode holder as shown on the Interconnection Diagram, Figure 2-2.

2. Place the power source's Power On-Off, Soft Start, Slope, Spotweld, Low Amp, and High Frequency switches to their OFF positions. Set the Balance control to its Maximum Cleaning (or balanced wave) position and leave it there.

3. Close the main (wall) disconnect switch or circuit breaker to provide input voltage to the power source.

4. Place the Current Selector switch to either AC, DCSP, or DCRP depending on your welding application.

CAUTION

Do not change the position of this switch while welding.

5. Place the Tig-Stick toggle switch to its STICK position.

6. Place the Current Range Selector to one of the two Current Range positions to suit your welding applications.

CAUTION

Do not change the position of this switch while welding.

7. Adjust the Current Control potentiometer for the approximate desired welding current.

8. Set the Arc Force control at Minimum on the dial and readjust as necessary to provide a more forceful welding arc.

9. Place the Current Panel-Remote switch in its PANEL position.

10. Place the Power On-Off switch to its ON position. This will immediately energize the power source up to the output terminals and the electrode holder. Commence welding by touch or scratch starting.

11. If necessary, readjust the Current Control potentiometer to obtain the exact welding condition required.

B. TIG WELDING

1. General Procedures For Tig and Tig-Spot Welding

a. Make the necessary welding power and service connections as shown on the Interconnection Diagram, Figure 2-2.

b. Depending on the control model purchased (Deluxe or Basic) and options installed, set the following switches in their OFF positions; High Frequency, Slope, Spotweld, Soft-Start and Low-Amp Option.

c. Place the Tig/Stick Mode selector switch in TIG position. Remember this mode requires that a torch switch or foot control be plugged into the Remote Contactor receptacle in order to make and break the welding sequence.

NOTE

The Arc Force potentiometer is only used in the stick mode, and is functionally out-of-the-circuit in the Tig mode.

d. Close the main (wall) disconnect switch to provide single-phase power to the welding unit.

e. Set the Power On-Off switch to On position. This will start the fan motor and immediately energize the unit up to its solid state contactor.

f. Set the Current Range Selector switch for the desired output current -- LOW or HIGH. The current limits within each range are printed on the front panel. Always try to operate in the lowest range which will adequately do the job.

g. Place the Current Selector switch in either AC, DCSP, or DCRP position. The AC position is primarily used for welding of aluminum and magnesium. The DCSP position will normally be used to cover all of the remaining metals (steel, copper, refractory, etc.) and alloys. The DCRP position produces a shallow weld, which makes it suitable for joining thin sheets of metal (e.g., aluminum, magnesium, foil, etc.).

Do not change the position of this switch while welding.

h. Set the Balance control (potentiometer) to the position which best suits your "AC-Tig" welding condition -- Remember that when using "Maximum Penetration" mode, your duty cycle (AC welding arc time) must be reduced. Also remember that for DC welding applications, this control should always be set for "Maximum Cleaning."

i. Set the High Frequency selector switch to either Continuous (AC) or START (DC). (If AC welding at 50 amps or more, it may be placed in START position.) Also see section III-I.

If high frequency is to be used, set the intensity control as desired. If you have had no experience on a particular application, set this control at Maximum and readjust later to secure the intensity which gives the best results.

j. Adjust the Current Control potentiometer for the approximate welding current desired. Remember that the setting placed on this control will be the maximum usable current which can be regulated from a "remote" foot or hand control accessory, if used.

k. Select the proper tungsten electrode from Table 3-1 following:

Table 3-1.
Typical Current Ranges For Tungsten Electrodes

Electrode Diameter Inches	Welding Currents, Amps			
	ACHF		DCSP	DCRP
	Using pure tungsten electrodes	Using thoriated electrode	Using pure or thoriated tungsten electrodes	
0.020	5-15	5-20	5-20	---
0.040	10-60	15-80	15-80	---
1/16	50-100	70-150	70-150	10-20
3/32	100-160	140-235	150-250	15-30
1/8	150-210	225-325	250-400	25-40
5/32	200-275	300-400	---	40-55
3/16	250-350	---	---	55-80
1/4	---	---	---	80-125

l. Depending on the type of current regulation desired, place the "Panel-Remote" Current Control switch as follows:

(1) PANEL position -- only permits current regulation to be made locally from the main Current Control potentiometer and is the normal position for all stick, all tig-spot, and many conventional tig welding applications which do not normally utilize the optional Foot or Hand Control accessories.

(2) REMOTE position -- this permits current regulation from a remote location (e.g., a Foot or Hand Control), **but only within the range preset on the main current control potentiometer.**

m. Set the Post Flow potentiometer (PFP) to provide the desired time interval (from 4 to 45 seconds) of shielding gas and cooling water after the welding arc has cut off.

2. Specific Procedures For Tig Welding

In addition to the general procedures covered in Section IV-B-1 preceding (depending on the model purchased), two additional operating features, Slope/Spotweld and/or Low Amp Option, can also be used in this sequence.

a. Remote Contactor and/or Current Control functions are provided using one or more of the following options. *(Note that contactor operation thru a remote control device is absolutely essential in the Tig mode; whereas, current control can be provided either remote or locally from the power source.)*

(1) If combined current and contactor control is desired, connect the optional FC-4EHD Foot Control or TC-1A Torch Control to the appropriate receptacles on the power source and make sure the Current Panel/Remote switch is positioned for REMOTE operation. (Set the main Current Control potentiometer to the highest current to be used. Current can now be regulated up to the preset limit by depressing the foot pedal on the FC-4EHD or turning the pot on the TC-1A and this action will also energize the solid state contactor.)

If you wish to use the FC-4EHD or TC-1A for remote contactor operation only, make sure the Current Panel/Remote switch is repositioned to PANEL setting.

(2) If separate current control is desired, connect the optional Current Hand Control to its power source current receptacle and make sure the Current Panel/Remote switch is in REMOTE position. (The Hand Control will vary welding current, but only within the range preset on the main Current Control potentiometer.)

(3) If remote contactor control only is desired, use the optional Torch Switch accessory, P/N 674038. (The torch switch must be held closed during the entire welding cycle.)

b. The Soft Start switch can be set as desired. It is intended to provide soft-starts for tig applications about 30-amperes (below 30-amperes, the unit is inherently soft starting); however, if hot starts are desirable (above 30 amps), leave the switch in its "off" position. **This switch should generally be left in its OFF position for all tig-slope and/or tig-spot welding.**

c. If Slope Control is provided and is to be used, do the following:

IMPORTANT

This "slope" feature should not be used with Soft Start (Item b) "on." Make sure the Soft Start switch is "off." Also, Current Control should be set and controlled from the power source current control pot; therefore, always set the Current Panel/Remote switch in its PANEL position. Remote Contactor

Control is normally provided using the optional "torch switch" accessory; however, this can also be accomplished using the FC-4EHD foot or TC-1A torch control so long as their current control features are deenergized.

(1) Place the Slope On-Off switch in the On position.

(2) Set the three-position "Spotweld-Off-Final Current" switch to its FINAL CURRENT position.

(3) Set the Up Slope to provide the timed current rise desired (from 0 to 10 seconds). The lower the setting, the more rapid the current rise, conversely, the higher the setting, the more gradual the rise to the selected weld current setting.

(4) The Down Slope Control can be set to provide a timed interval (0 to 10 seconds) at which welding current will gradually decrease to the minimum of the preselected ranges, or to the setting determined by the Final Current "cut-off-level" control following.

(5) The Final Current control potentiometer sets the timed period (0 to 10 seconds) that determines the "cut-off-level" of welding current at which the contactor will drop out, after the torch switch is released, during downslope. This control can be slightly below the welding current level, (HI setting) or at any level including that of the minimum output of the preselected current range (LOW setting).

When the "Final Current" switch position (item C-2) is selected, the solid-state contactor and welding output will remain "on" for the length of time set on the Final Current potentiometer -- after the torch switch has been released/deenergized (to initiate the downslope sequence) or unless the Tig/Stick switch is inadvertently placed in Stick.

d. If the optional Pulse Control is provided and used, do the following:

IMPORTANT

In pulse welding operations, the Peak current is always set and normally controlled from the power source's main Current Control potentiometer, and the Background current (on the module) is selected as a percentage of the "peak" setting. This operation can be setup for Panel or Remote current control; however, if Remote Control is used, remember that current regulation can only be varied within the current range (and percentage) preset on the power source. You must also be careful when varying the pulsed welding current, that the background current level does not drop below the recommended minimum for your specific electrode size, since this may result in arc outages.

Contactor control is normally provided using the remote torch switch accessory; however, this can also be accomplished using the FC-4EHD foot or TC-1A torch control accessories when the appropriate cables are connected to the power source.

(1) Set the Pulse module On-Off switch to its ON position to activate the pulsing features.

(2) Set the power source Current Control potentiometer to provide the desired "peak" current desired for your operation -- **be careful that this setting does not exceed the maximum current rating of your electrode.**

(3) Set the Pulse module Background Current potentiometer to provide the percentage of "background" current desired. This pot is calibrated in approximate percentages from Minimum current output of the power source, up to Max. (100%) of the power source's "peak" current setting -- **be careful that this approximated setting does not drop below the minimum current rating of your electrode, particularly if you're varying the pulsed welding current from a remote control It may result in arc outages.**

(4) Set the frequency control to provide the number of pulses per second desired from 0.5 to 10 Hz.

(5) Set the On Time control to provide the percent of time (5% to 95%) that the peak current level will be "on," as compared to its background current level. This setting, which essentially sets the pulse width, is independent of the frequency control.

e. The Low Amp option, if provided and used, is designed to enhance arc starting and arc stabil-

ity for "low-range, d.c. tig" welding down to 3 amperes. This feature can be very beneficial for welding very thin gauge materials. This option would not normally be used in conjunction with "slope" or "soft-start." **Remember that this switch also has a duty cycle which runs from 3 to 20 amperes @ 100%, to a maximum of 50 amperes @ 16%.**

If you wish to lower this current range even further (down to 2 amps and below), simply readjust the shunt lead "inside" the power source as described in Section V, Shunt Adjustment.

f. To establish the welding arc, position the torch electrode near the workpiece (e.g., 1/8" typical) and close the Remote Torch or Foot Control. This will energize the solid state contactor and provide high frequency to initiate the arc, and upslope sequence (if provided).

g. If necessary, readjust the panel or remote Current Control until you secure the exact condition desired.

h. When welding is completed, release the remote Torch Switch to initiate downslope sequence (if provided and used) and weld finish After the arc has extinguished, shielding gas and water will continue for the time left in the Post Flow mode. Since postflow is initiated when the torch switch is released, it is necessary to set a high enough Postflow time to cover downslope and the time required to protect the cooling weldment.

3. Specific Procedures For Tig Spotweld - If provided.

In addition to the general procedures covered in Section IV-B-1 preceding, do the following for Tig Spotwelding.

NOTE

Remote Current regulation is not recommended for use in Tig Spotweld operation. Remote Contactor control will normally be provided using the optional Torch Switch.

a. Set the Current Control switch to its PANEL position.

b. Soft Start would not normally be used for tig-spot; therefore, place this switch in OFF position.

c. Low-Amp option (if provided) would not normally be used for tig-spot; however, if desired, remember, it can only be used in "low-range-d.c." applications and it also has a duty cycle which must be maintained -- see Section III-P.

d. The Slope mode selector switch should be placed in the OFF position for Spotwelding.

e. If the optional Pulse Control is provided and is to be used, set the controls in the same manner as described in Section IV-B-2-d.

f. Set the Spotweld Selector switch to the ON position.

g. Set the Spotweld Timer control for the desired arc time interval (variable from 0 to 10 seconds).

h. Connect the optional Torch Switch to the Remote Contactor receptacle.

i. Place the torch in position to spot weld and then close the torch switch/trigger. (The switch must be held closed during the welding cycle.) This action initiates all programmed circuitry to energize contactor and high frequency, start and cut-off the arc after the preselected time, and initiate postflow service.

j. When the weld is completed, release the torch switch and the Spotweld Timer will recycle and ready the machine for another weld sequence. (If or any reason you wish to prematurely terminate the spot weld, simply release the Torch Switch and all welding action will stop.)

NOTE

If the High Frequency switch is in its CONTINUOUS position, the high frequency will remain "on" after the spotweld (time) cycle is completed and until the torch switch is released. If this is a problem, simply change the High Frequency switch from "Continuous" to "Start" only -- even for AC welding operations.

4.1 GENERAL

If this equipment does not operate properly, stop work immediately and investigate the cause of the malfunction.

WARNING

Be sure that the wall disconnect switch or circuit breaker is open before attempting any inspection or work on the inside of the power source. Always wear safety goggles with side shields when blowing out the unit with the low pressure air.

4.2 CLEANING

Since there are no moving parts (other than the fan) in the power source, maintenance consists mainly of keeping the interior of the cabinet clean. Periodically remove the cover from the cabinet and blow accumulated dust and dirt from the air passages and the interior components, using clean low pressure air. It is imperative that the air passages, to the interior of the unit, be kept free of dirt accumulation to ensure adequate circulation of cooling air, especially over the rectifier bridge plates and magnetics. The length of time between cleaning will depend on the location of the unit, and the amount of dust in the atmosphere.

4.3 LUBRICATION

Fan motors with oil tubes require lubrication after 1 year of service. Motors without oil tubes are permanently lubricated and do not require any attention.

4.4 SHUNT ADJUSTMENT

The 350's internal shunt lead can be readjusted to provide additional benefits as follows:

A. Lowering Current Range With Opt. Low Amp Kit Installed. The Low Amp Kit will allow you to weld down to 3 amps for DC applications. However, if you wish to weld even lower (down to 2 amps and below), a simple wire adjustment on the internal brass shunt can be made as follows:

To shift the current range down (meaning the minimum and maximum current range will shift lower than the original specification), adjust the green wire on the brass shunt upward in the slot and retighten. In some cases, you may need to remove the green wire from the slot and replace it on the other side of the brown wire to complete the modification. **Under no circumstances should this machine be operated "without" the green wire attached to the shunt -- this would cause the machine to weld at maximum output with no control.**

B. Raising The Current Range without Low Amp Kit Installed. In some cases you wish to raise the specified maximum output above 380 amps for higher range welding applications. This can be done as follows:

To shift the current range upwards (meaning the minimum and maximum current range will shift higher than the original specification), simply move the green wire in the shunt slot downward, and retighten. **If this is done, remember that the original duty cycle of the machine does not change and must not be exceeded -- see duty cycle chart in front of booklet for approximate percentages.**

4.5 SPARK GAP SERVICING & ADJUSTMENT

The spark gap, which is part of the high frequency generator, is factory set at 0.030-in. ($\pm$0.002-in.). After extended operation or if erratic operation is noted, it may be necessary to readjust or replace the electrodes (673578). Use a feeler gauge when readjusting the gap. (See Form 11-831, "Recommended Installation and Test Procedures for High Frequency Stabilized Arc Welding Machines," packed with the unit.) Cleaning or dressing of the spark gap electrodes is not recommended. When replacement is necessary, both electrodes should be replaced.

Remember that high frequency radiation increases as the gap increases and this can cause interference in other electronic equipment.

A. Loosen retaining screw "A" only enough to free electrode point "C" for adjustment.

B. Place feeler gauge of proper thickness between gap "B."

C. Apply slight pressure against loosened electrode point "C" so the feeler gauge is held firmly in the gap. Tighten retaining screw "A."

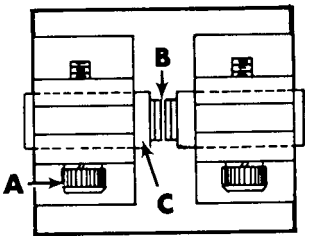


Figure 4-1. Spark Gap Adjustment

4.6 TESTING AND REPLACING BRIDGE ASSY. COMPONENTS

SCRs and silicon diodes are devices which allow current to flow in only one direction, and block current in the other direction. The SCRs and silicon diodes used in this power source are designed to provide long troublefree operation; however, should a failure occur, they may require replacement. The testing procedures to determine defective components follow:

A. Silicon Diode Rectifier, D1-D2.
Disconnect the power lead to the diode, to provide an open circuit across the component to be tested. Using an ohmmeter set to the Rx1 scale, check the resistance in the forward and reverse direction. A good diode will read high in reverse and low in the forward direction.

When replacing defective diodes, make sure mounting surfaces are clean. Coat mounting surfaces with Dow Corning No. 340 silicon heat sink compound, or equivalent. Replaced diode (nuts) should be tightened only until firm, and then torque tight (recommended range is 275 inch lbs. min. to 325 inch lbs. max.).

B. Silicon Controlled Rectifier - SCR.
Disconnect the SCR wiring (but do not unclamp) to break continuity and provide an open-circuit across the component to be tested. Using an ohmmeter set to the Rx1 scale, check the resistance across the SCR in both directions. A good SCR will read high in both directions. If the reading is low or zero in either direction, the SCR is defective.

When replacing defective SCRs, make sure the mounting surfaces are clean. Coat the mounting surfaces with Alcoa No. 2 electrical joint compound, available from ESAB in 8 oz. containers under P/N 73585002. Make certain that the polarity on the replacement SCR is the same as on the unit being replaced. Place the top clamp piece over the bolts and tighten each nut **hard finger tight**. The clamp piece should be parallel to the top plate. Then tighten each nut approx. 1/4 turn at a time (alternately), for two complete revolutions until the force indicator on the clamp assembly reads 1.0 kilo pounds (1000 lbs).

5.1 GENERAL

If power source is operating improperly, the following troubleshooting information may be used to locate the source of the trouble.

Check the problem against the symptoms in the following troubleshooting guide. The remedy may be quite simple. If the cause cannot be quickly located, open up the unit and perform a simple visual inspection of all the components and wiring. Check for secure terminal connections, loose or burned wiring or components, bulged or leaking capacitors, or any other sign of damage or discoloration.

5.2 TROUBLESHOOTING GUIDE

WARNING

Be sure that all primary power to the machine has been externally disconnected. Open wall disconnect switch or circuit breaker before attempting inspection or work inside of the power source.

A. Unit Completely inoperative. Fan does not run.

1. Open line fuses -- check the line fuses for continuity and replace if necessary. If the fuses continue to open, the jumper links may not be in proper position. See primary electrical connections in section 2.3.

2. No power input -- check position of line disconnect switch.

3. Improper jumper link placement on input terminal board. See primary electrical connections in section 2.3.

4. Defective ROS and/or wiring -- check continuity of ROS and replace if necessary.

B. No welding output. Fan operative.

1. Improper jumper link placement on input terminal board -- See primary electrical connections in section 2.3.

2. Power source magnetics overheating -- thermal switch (TS) tripped due to restricted cooling air flow, or overextended duty cycle. Allow unit to cool down for at least 5 minutes with fan running to let TS reset.

3. Tig/Stick switch TSS in the TIG position without a remote contactor control connected to the remote torch receptacle RTR. Place TSS in the STICK position or make remote torch connection at RTR.

4. Defective TSS and/or wiring. Check continuity and replace if necessary.

5. Defective SCR p/c board.

6. Defective Current Range Switch SW1 (located on SCR p/c board). Check continuity of SW1 and ensure that all connections are secure and correct. Replace SW1 if defective.

7. Defective current selector switch CSS and/or wiring. Check continuity of CSS and ensure that all connections are secure and correct. Replace CSS if defective.

8. Defective Current Control Potentiometer R44 (located on SCR p/c board). To check continuity of R44, put Panel-Remote switch (PRS) in REMOTE position. Disconnect TC-1 or FC-4 Remote control. Check resistance between terminals "X" and "W" of Remote Current Control receptacle (RCC) by rotating Current Control potentiometer (R44). Resistance should vary between "0" and 13.3 K to 16.7 K ohms. If pot checks good, replace SCR p/c board.

9. The 3-amp control fuse may be blown -- check and/or replace.

C. Low or unstable open circuit voltage.

1. Current control pot set too low for welding application. Increase setting of CCP.

2. Defective SCR in main bridge. Check the resistance across the SCR on the Rx1 scale. If the reading is high the SCR is working. If the resistance is low or zero the SCR is defective. To check the gate, connect the gate lead to the anode of the SCR and read the forward resistance across the SCR anode to cathode. If the internal voltage of the meter is high enough, the meter should read a low resistance.

3. Defective diode in main bridge. Place the current selector switch between position so as to provide an open circuit across the diodes. On the Rx1 scale check the resistance in the forward and reverse directions. A good diode will read

high in the reverse direction and low in the forward direction. Replace defective parts.

4. Defective CSS and/or wiring. See troubleshooting 2-g.

5. Defective SCR p/c board.

D. Erratic output welding current.

1. Intermittent shunt connections. Check connections to shunt.

2. Defective SCR and/or diode in main bridge. See troubleshooting 3-b and 3-c.

3. Defective SCR p/c board. Replace SCR p/c board.

4. Excessive high frequency. Check spark gaps and adjust if necessary (see Maintenance Section). Check all connections and components in high frequency bypass circuit and replace any defective components.

E. Erratic output at welding currents above 200 amps (approx.).

Input voltage falling below 10% of rated voltage while machine is under load. May have to increase input power conductor size or decrease length.

F. Low Welding output in High range.

Current Range Switch SW1 (located on SCR p/c board) may not be closing when positioned in HIGH range. Check continuity of SW1 on SCR p/c board -- replace if defective.

G. Minimum welding output in both current ranges.

1. Check for defective Current Control Potentiometer R44 (located on SCR p/c board) using procedure outlined in Step 2-h.

2. Faulty wiring to Panel/Remote switch, or switch itself may be defective.

H. High weld output, current control does not vary the output.

1. Open shunt connection. Check connections on shunt.

2. Defective SCR p/c board. Replace if defective.

I. Absence of High Frequency while selector switch (HFS) is in START mode only.

1. Open circuit voltage low -- check remote contactor switch or Tig/Stick Mode Switch TSS.

2. CCP or remote current control not set high enough.

3. SCR p/c board may be defective.

J. Insufficient or Absence of H.F.

1. High frequency switch in the OFF position. Check HFS and place in START or CONTINUOUS position.

2. Improper spark gap Clean and adjust spark gaps, if necessary. See spark Gap servicing.

3. Defective wiring to High Frequency Intensity pot, or pot itself may be defective.

4. Defective HFS and/or wiring. Make continuity check and replace if necessary.

5. Defective Logic p/c board.

K. No gas and/or water flow.

1. High Frequency Switch (HFS) in OFF (Stick) position -- place in Start or Continuous Mode(s). Make continuity check, if necessary, and replace if defective.

2. GS and/or WS solenoid defective. Check 24 V ac across solenoid coil. If present, and solenoid does not energize, replace it.

L. No remote contactor control.

TIG/STICK switch in the STICK position. Place TSS switch in the TIG position.

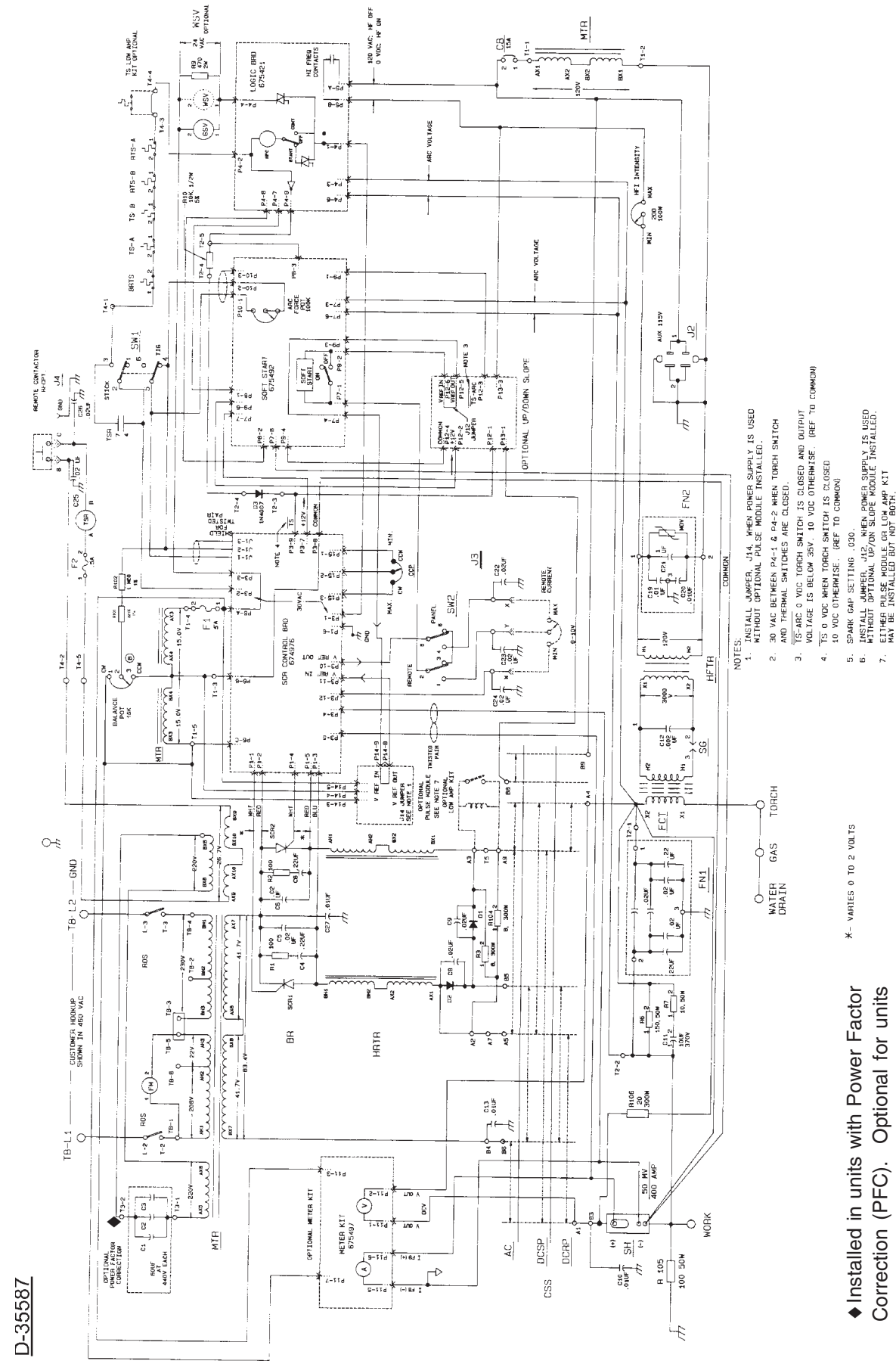


Figure 5-1. Heliarc 350 AC/DC Schematic Diagram - 208/230/460 V ac, 1 Phase, 60 Hz

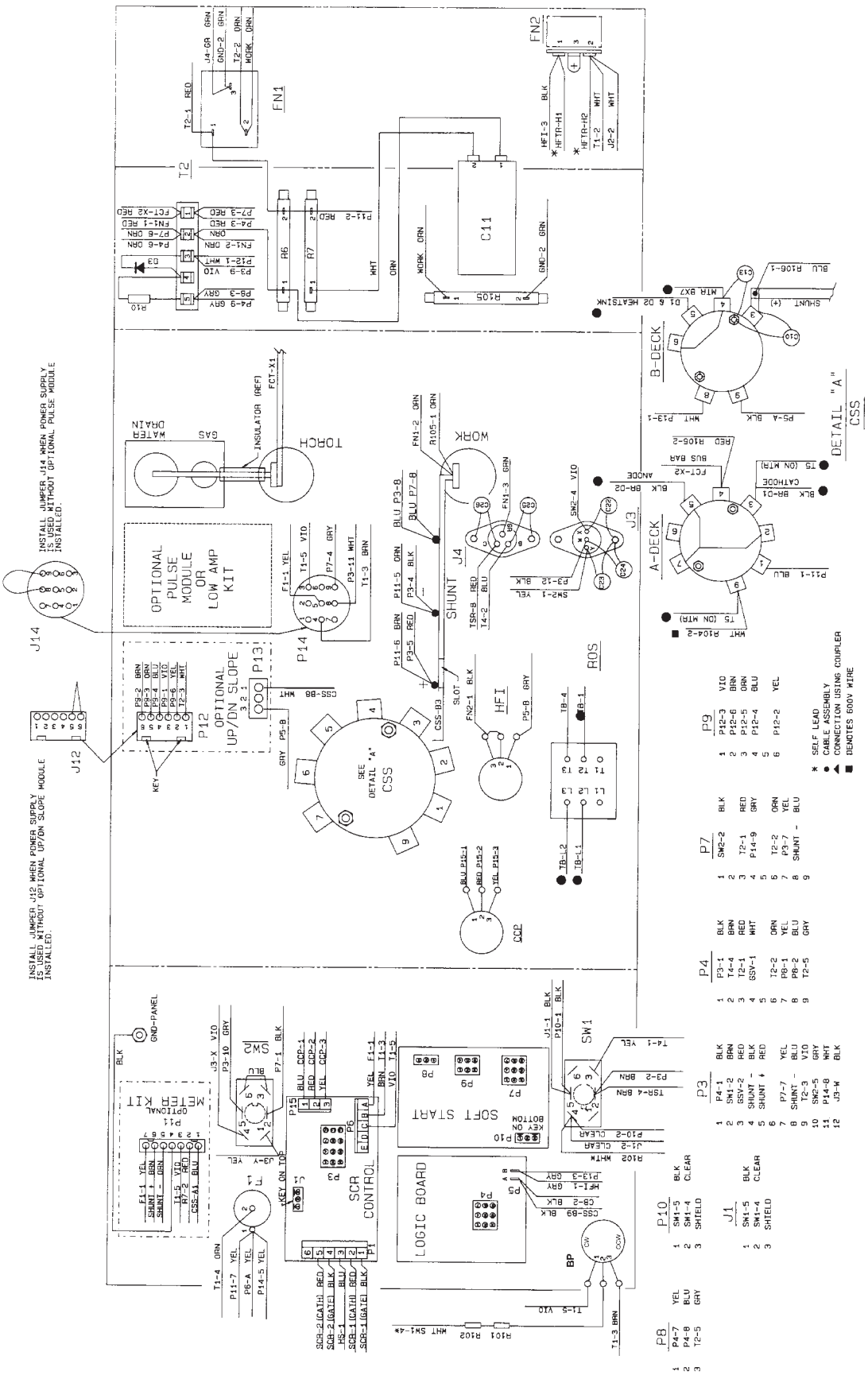


Figure 5-2. Heliarc 350 AC/DC Wiring Diagram - 208/230/460 V ac, 1 Phase, 60 Hz (Sheet 1 of 2)

D-35586

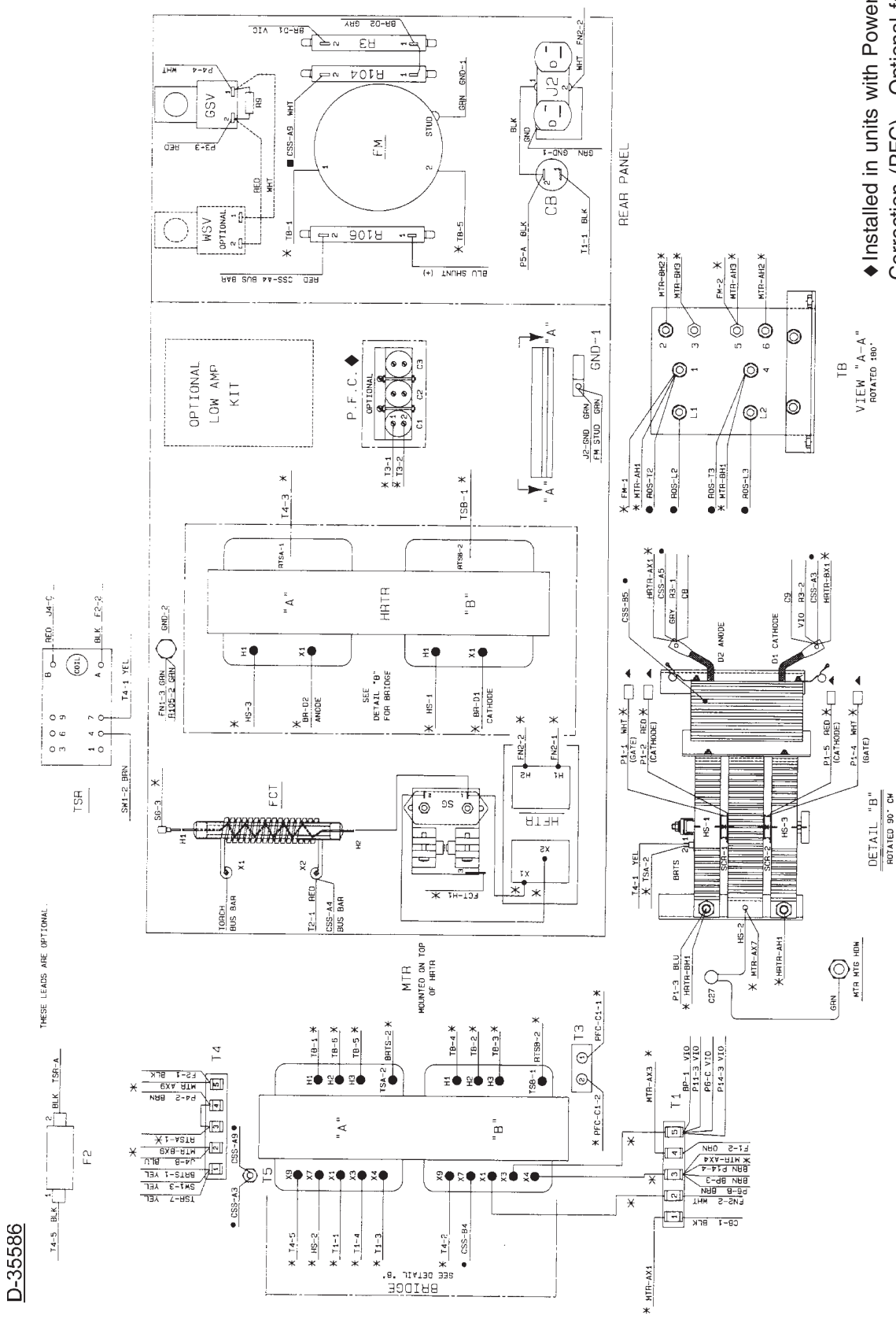


Figure 5-2. Heliarc 350 AC/DC Wiring Diagram - 208/230/460 V ac, 1 Phase, 60 Hz (Sheet 2 of 2)

6.1 GENERAL

Replacement Parts are illustrated on the following figures. When ordering replacement parts, order by part number and part name, as illustrated on the figure. DO NOT ORDER BY PART NUMBER ALONE.

Always provide the series or serial number of the unit on which the parts will be used. The serial number is stamped on the unit nameplate.

6.2 ORDERING

To assure proper operation, it is recommended that only genuine ESAB parts and products be used with this equipment. The use of non-ESAB parts may void your warranty.

Replacement parts may be ordered from your ESAB distributor or from:

ESAB Welding & Cutting Products
Attn: Customer Service Dept.
PO Box 100545, Ebenezer Road
Florence, SC, 29501-0545

Be sure to indicate any special shipping instructions when ordering replacement parts.

To order parts by phone, contact ESAB at 1-803-664-5540 or 4460. Orders may also be faxed to 1-800-634-7548. Be sure to indicate any special shipping instructions when ordering replacement parts.

Refer to the Communication Guide located on the last page of this manual for a list of customer service phone numbers.

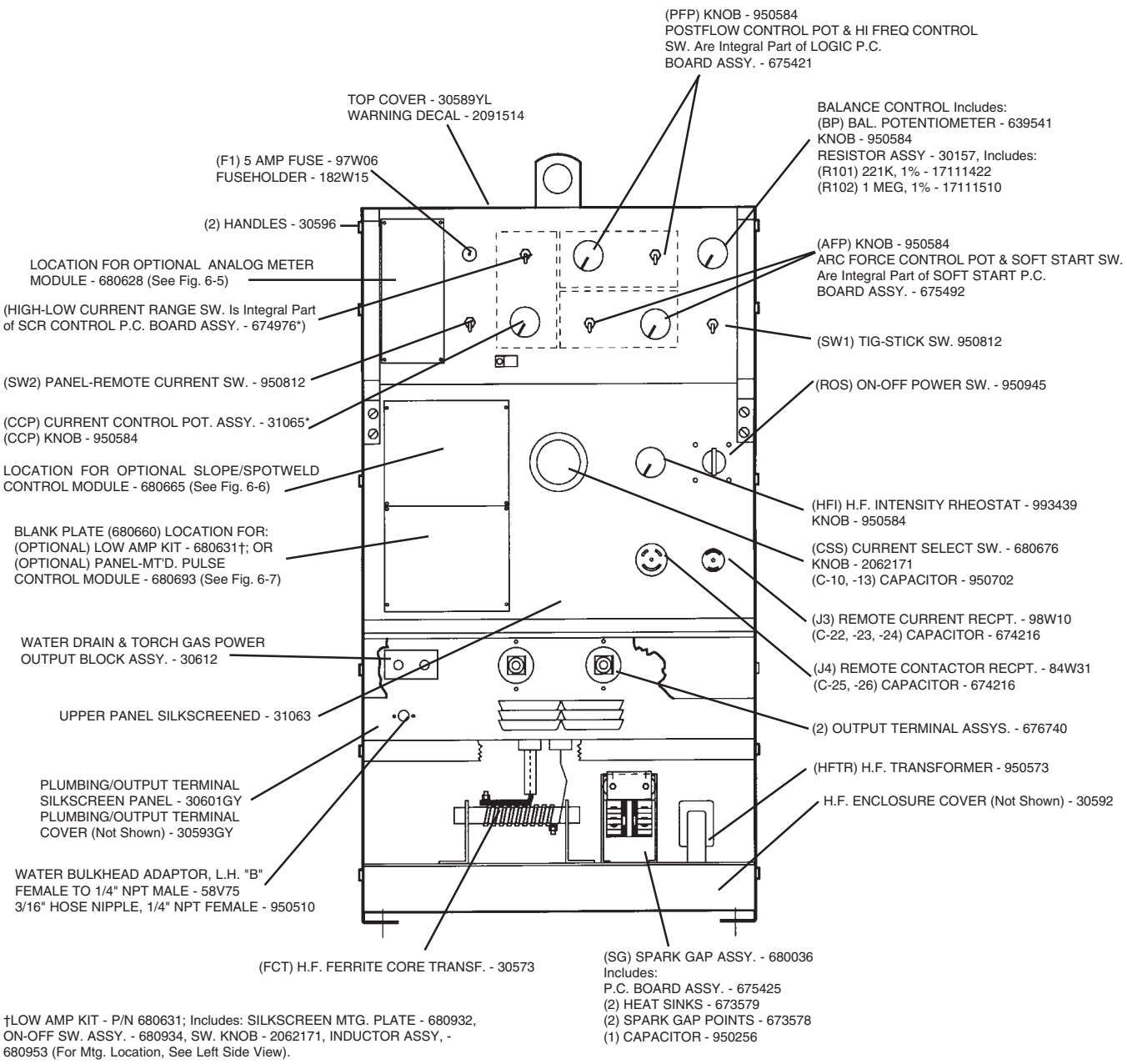


Figure 6-1. Heliarc 350 AC/DC (Front View)

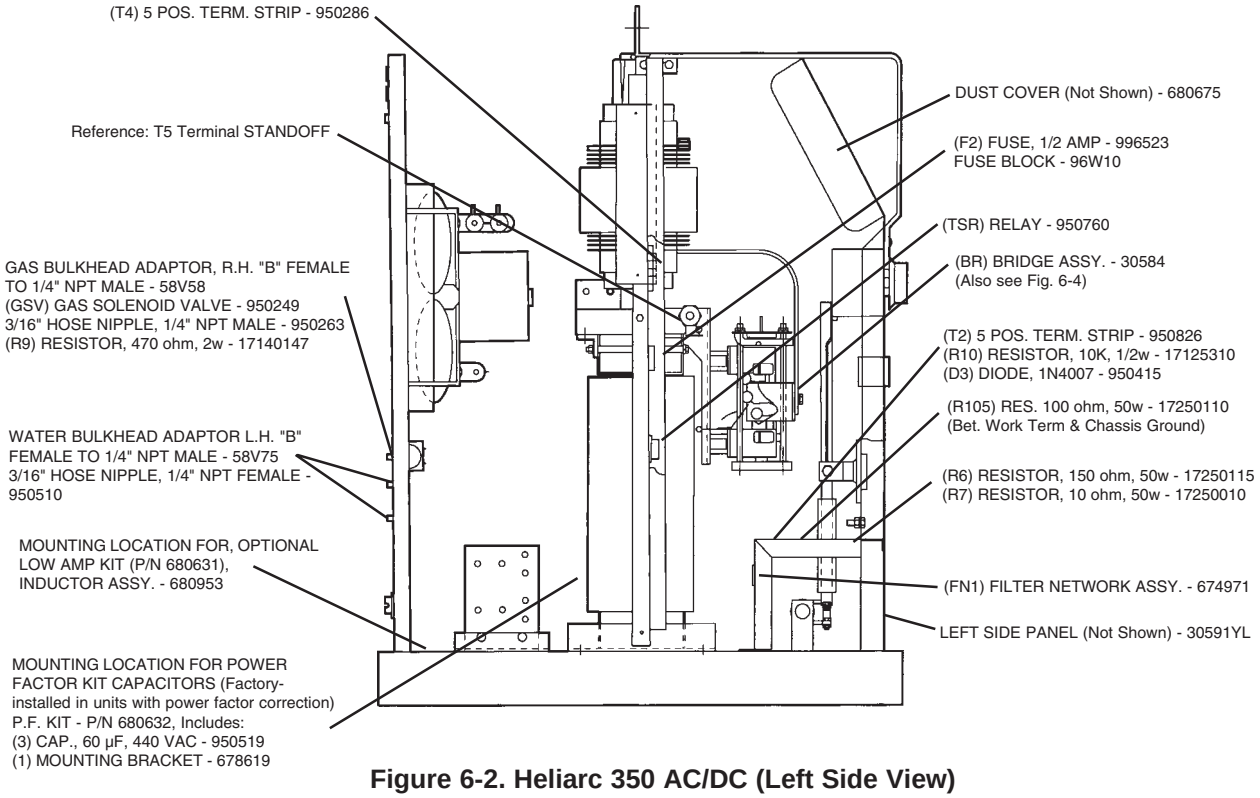


Figure 6-2. Heliarc 350 AC/DC (Left Side View)

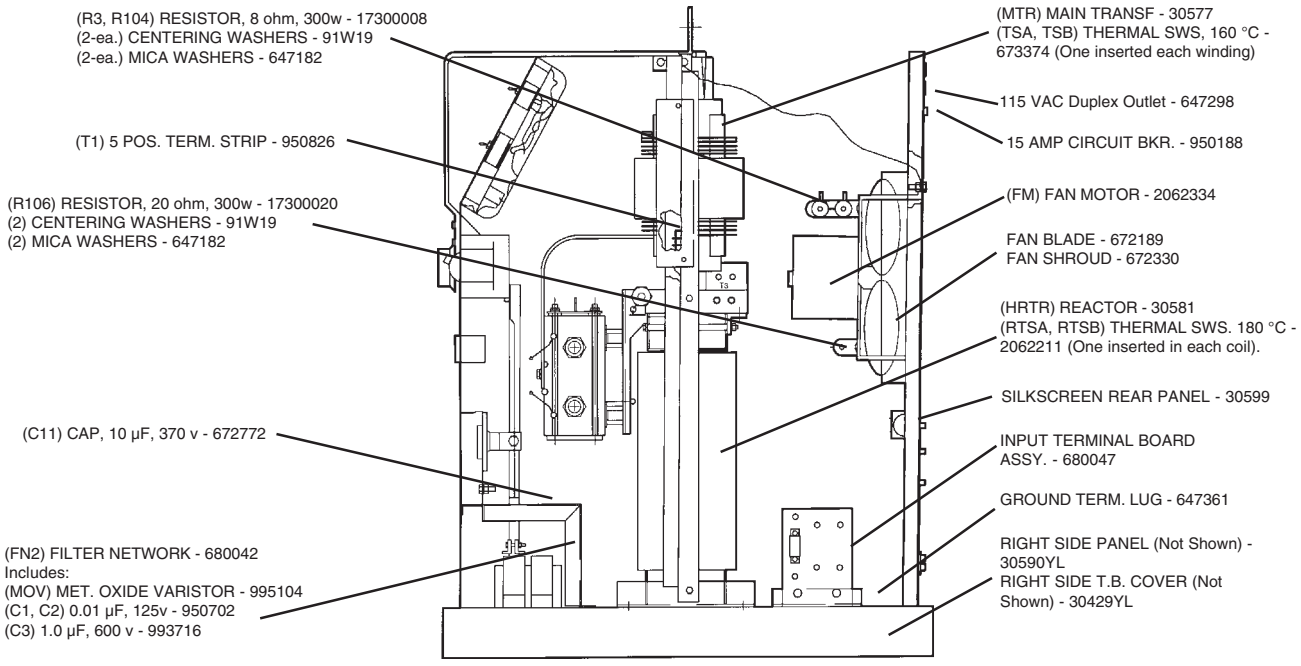


Figure 6-3. Heliarc 350 AC/DC (Right Side View)

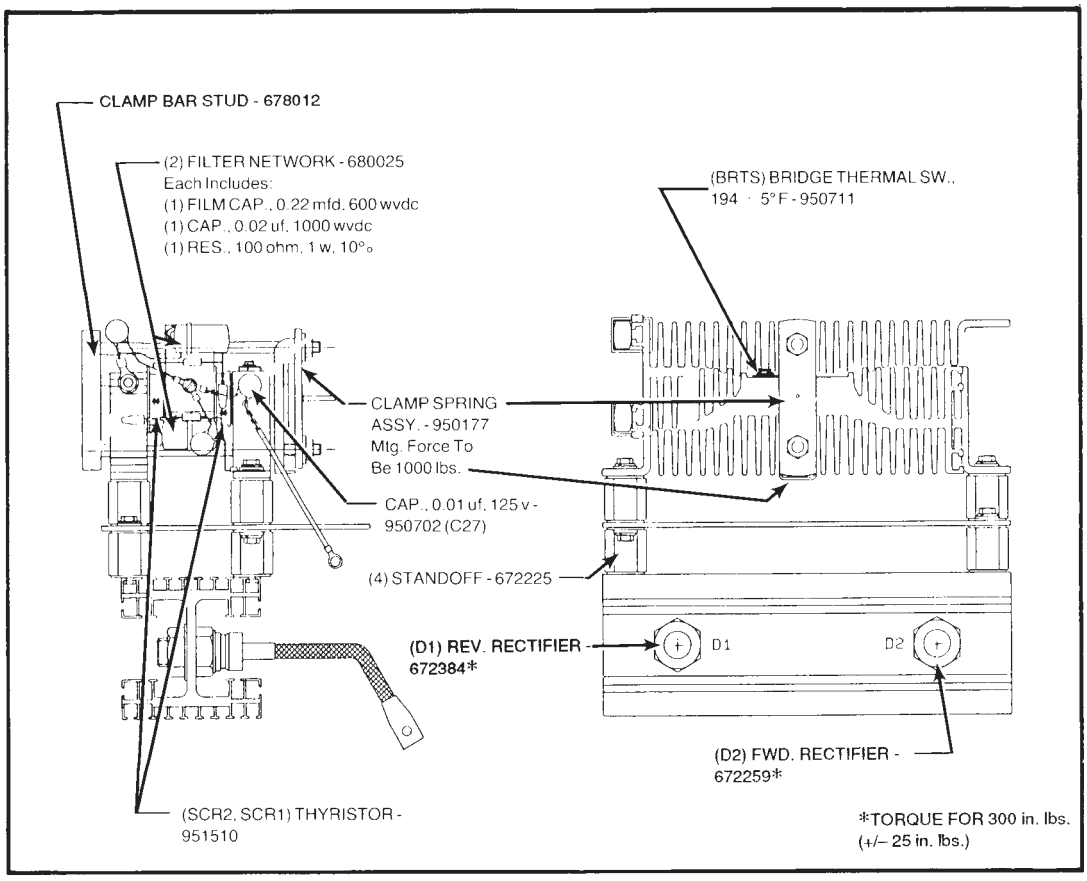


Figure 6-4. Bridge Assembly (P/N 30584)

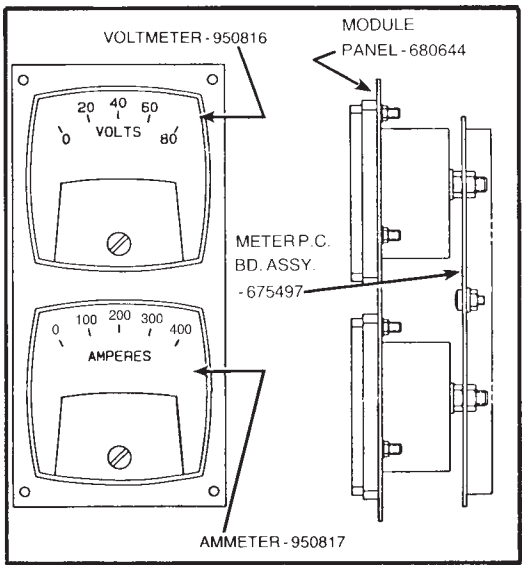


Figure 6-5. Analog Meter Module (P/N 680628)

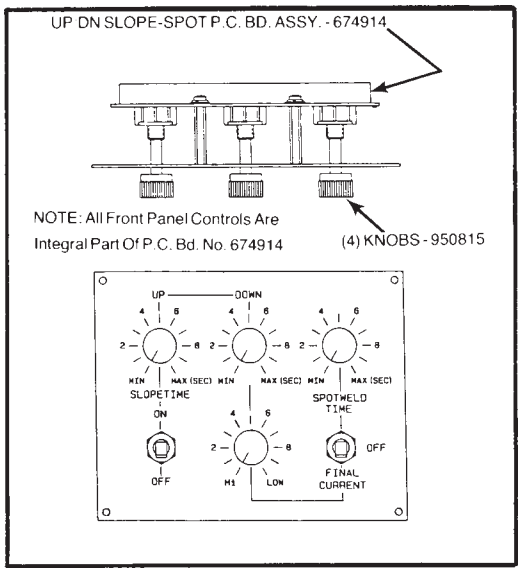


Figure 6-6. Slope/Spotweld Control Module (P/N 680665)

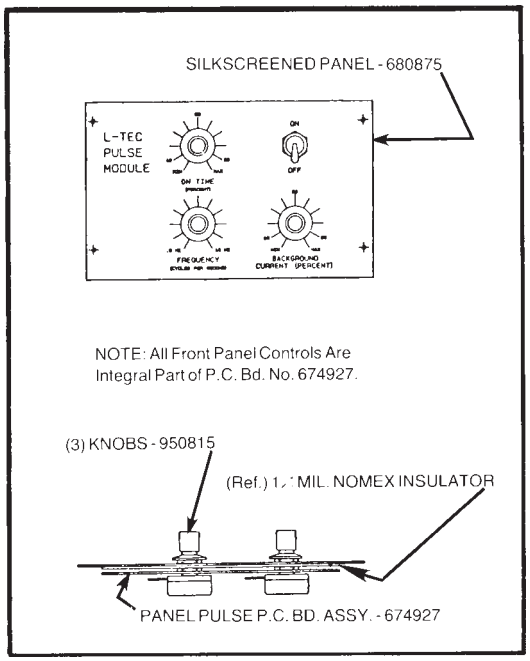


Figure 6-7. Panel Pulse Control Assembly (P/N 680693)

Notes

COMMUNICATIONS GUIDE

A. CUSTOMER SERVICE QUESTIONS: Telephone: (803) 664-5540 / FAX: (800) 634-7548
Order Entry Product Availability Pricing Order Changes Hours: 8:30 AM to 5:00 PM EST

B. ENGINEERING SERVICE: Telephone: (803) 664-4416 or -5550 / FAX: (800) 446-5693
Welding Equipment Troubleshooting Warranty Returns Hours: 7:30 AM to 5:00 PM EST

C. TECHNICAL SERVICE: Telephone: (803) 664-5547 / FAX: (803) 664-5575
Part Numbers Technical Applications Hours: 7:30 AM to 5:00 PM EST
Performance Features Technical Specifications

D. LITERATURE REQUESTS: Telephone: (803) 664-5501 / FAX: (803) 664-5575
Hours: 7:30 AM to 4:00 PM EST

E. WELDING EQUIPMENT REPAIRS: Telephone: (803) 664-4487 / FAX: (803) 664-5557
Repair Estimates Repair Status Hours: 7:30 AM to 3:30 PM EST

F. WELDING EQUIPMENT TRAINING: Telephone: (803) 664-5524 / FAX: (803) 664-5575
Training School Information and Registrations Hours: 7:30 AM to 4:00 PM EST

G. WELDING PROCESS ASSISTANCE: Telephone: (803) 664-4248 / FAX: (803) 664-4454
Hours: 7:30 AM to 4:00 PM EST

H. TECHNICAL ASST. CONSUMABLES: Telephone: (800) 934-9353
Hours: 7:30 AM to 5:00 PM EST

IF YOU DO NOT KNOW WHOM TO CALL

Telephone: (803) 664-5540 and (803) 664-4460

Hours: 7:30 AM to 5:00 PM EST

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