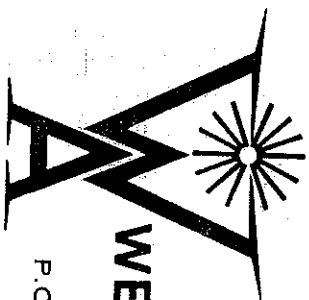


INSTRUCTION MANUAL
FOR
MODEL 435 AC-DC G WELDER



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I. INTRODUCTION TO THE WESTERN ARCTRONICS MODEL 435 AC-DC G WELDER

The Western Arctronics Model 435 Welder provides, in a single unit, the capacity for perfect performance in a variety of welding techniques. Alternating current, straight or reverse polarity direct current are easily selected. Within four overlapping ranges, the welding current is variable from two to over three hundred amperes; moreover, it is continuously variable throughout each range.

The design of circuitry and components guarantees stable current, thus setting a new standard in the field of welding in an inert gas atmosphere. This stability is particularly advantageous when thin materials are being welded.

The foregoing features are integrated within a system containing controls and accessory units which provide the ultimate in flexibility. Whether the user wants outstanding performance for only one application or must be equally well equipped for all types of inert gas and metallic arc welding, the Western Arctronics Model 435 will meet his most exacting requirements.

II. GENERAL INFORMATION

This welder is the result of some unique engineering advancements. Its steel core components, which have been designed to complement one another, form the heart of this machine. These components are the MAIN POWER TRANSFORMER to supply the basic welding current, the REACTOR to control this current, and a DC CHOKE to provide superior characteristics for DC welding.

Choice of type and amount of welding current is easily made from the front panel. Two selector switches are mounted together on the front panel. One selects AC or DC welding current of STRAIGHT or REVERSE polarity, and the other determines which one of the four current ranges is to be used. Both switches are non-shorting, allowing their positions to be changed while the machine is turned on; however, since the full welding current is carried by these switches, they should

not be changed under load (while welding).

A HIGH FREQUENCY UNIT is included as standard equipment and it features freedom from constant attention to the spark-gap points. By resonating the output circuit, the need for critical adjustment of the INTENSITY and PHASE SHIFT controls is eliminated.

The inherent flexibility of the Western Arctronics Welder is derived from its control system. It is this network of components, sub-assemblies and wires which forms the nerve center of the machine. From either the front panel or a remote rheostat, welding current can be controlled continuously and without dead spots throughout each of the four current ranges. One mode of operation provides high frequency only to start the arc and then shuts it off automatically. As required for the particular welding technique employed, water and gas are turned on and off without attention from the operator. A more thorough understanding of these functions will be gained by reading the chapter DESCRIPTIONS OF CONTROL FUNCTIONS.

An unusual feature is the provision for spot welding in an inert gas atmosphere. A SPOT WELD TIMER is available as an accessory and can be installed at any time merely by plugging it into a prewired receptacle and tightening two captive screws. Of course, for spot welding, a spot weld gun is attached to the welder in place of the usual electrode holder. The trigger switch on the spot gun is connected through a cord plugged into the SPOT TIMING RECEPTACLE. Operation of the trigger will initiate a timing cycle controlled by the SPOT TIMER. Water and gas flow will be started and stopped automatically.

III. DESCRIPTIONS OF CONTROL FUNCTIONS

The Western Arctronics Model 435 Welder has been designed for use with both inert gas and metallic arc welding processes. Control functions are built into this unit so that operation of auxiliary equipment, such as a remote foot control, hydromount or coolant source, and flow of inert gas, is fully coordinated with whatever process is being used. The features incorporated into this welder assist the user in making the finest quality welds in metals of almost any type and thickness.

POLARITY SWITCH - ALTERNATING CURRENT, STRAIGHT OR RE-

VERSE POLARITY DIRECT CURRENT may be selected for welding by positioning the left ball knob on the front panel as indicated by the front plate.

CURRENT RANGE SWITCH - FOUR CURRENT RANGES are provided on this welder, with ample overlap between each range. The desired welding current range is selected by positioning the ball knob on the right side of the front panel as indicated by the front plate.

PANEL AMPERAGE CONTROL - WELDING CURRENT IS CONTINUOUSLY ADJUSTABLE THROUGHOUT EACH OF THE FOUR CURRENT RANGES by means of this control.

If a foot or hand operated rheostat is used to control welding current from a remote location, maximum welding current will be limited to the value set by the **PANEL AMPERAGE CONTROL**.

POWER SWITCH - This toggle switch is located at the lower left hand corner of the front plate. Its function is to turn on the cooling fan and activate the control system within the welder. Application of AC power to the primary windings of the welding transformer within the unit is controlled by a contactor as described in the next paragraph.

STANDARD-REMOTE CONTACTOR SWITCH - This toggle switch is located at the lower right hand corner of the front plate. When placed in the **STANDARD** position, the contactor will be activated whenever the **POWER** switch is ON, thus permitting the machine to weld. In the **REMOTE** position, this switch de-energizes the contactor and transfers control of the contactor through the **REMOTE CONTACTOR RECEPTACLE**.

REMOTE CONTACTOR RECEPTACLE - This two-pole receptacle is located on the lower right front portion of the machine behind the access door and is connected to the circuit only when that switch is set on **REMOTE**. The contactor within the welder can then be actuated from some distance by closing the circuit between the two poles of this receptacle. Foot rheostats for remote control of welding current normally include a switch to control the contactor.

STANDARD-REMOTE AMPERAGE SWITCH - This toggle switch is located at the lower right hand corner of the front plate. When this switch is set in the **STANDARD** position, the switch places control of welding current entirely with the **PANEL AMPERAGE CONTROL** within whatever **CURRENT RANGE** has been selected. When this switch is set on **REMOTE**, the **REMOTE AMPERAGE RECEPTACLE** is in the circuit, and a remote amperage device should be attached.

REMOTE AMPERAGE RECEPTACLE - This three-pole receptacle is located at the lower right portion of the machine behind the access door.

from a foot control incorrectly wired. The fuse in the lower holder behind the access door protects the **AUXILIARY POWER RECEPTACLE**.

IV. OPERATION

Place the **POWER SWITCH** in the **ON** position to activate the cooling fan and the control system within the welder.

If desired, the **CONTACTOR CONTROL SWITCH** may be placed in the **REMOTE** position while other adjustments are being made prior to welding. When changed to **STANDARD**, this switch will energize the contactor, and the machine will be ready for welding. If a remote contactor control switch is used, it should be attached to the receptacle marked **REMOTE CONTACTOR**, and the **CONTACTOR CONTROL SWITCH** must then be positioned to **REMOTE**.

Select the type of welding current desired by positioning the **POLARITY SWITCH** to **AC** (alternating current), **DC STRAIGHT** (straight polarity direct current), or **DC REVERSE** (reverse polarity direct current). With respect to the **GROUND** terminal, the **ELECTRODE HOLDER** terminal is negative when the **POLARITY SWITCH** is set on **DC STRAIGHT** and positive when on **DC REVERSE**.

Welding current will be determined by the combined settings of the **CURRENT RANGE SWITCH** and **PANEL AMPERAGE CONTROL**. First, select a **CURRENT RANGE** which includes the particular current value desired. Next, adjust the **PANEL AMPERAGE CONTROL** to a position upon its dial scale that is proportionate to the position of the desired welding current within the current range selected. Greater or lesser welding current can then be attained by further adjustment of the **PANEL AMPERAGE CONTROL**.

If the remote amperage control device (for example, a foot operated rheostat) is not used, the **STANDARD-REMOTE AMPERAGE SWITCH** must be set to **STANDARD**; otherwise, the **PANEL AMPERAGE CONTROL** will be completely ineffective. When such a remote amperage control is used, it is attached to the receptacle marked **REMOTE AMPERAGE**, and the **REMOTE AMPERAGE SWITCH** is set to **REMOTE**. This device will then be a vernier amperage control capable of varying welding current from the minimum for the current range in use to a maximum limited by the setting of the **PANEL AMPERAGE CONTROL**.

With some welding techniques, particularly when a foot amperage control is not used, it may be desirable to limit the initial arc current. The Western Arcronics Welder has a circuit to perform this function; it is activated by setting the START ADJUSTMENT SWITCH to SLOW. The degree to which the starting current is reduced can then be varied by the START ADJUSTMENT CONTROL. Minimum starting current results when this control is in its full clockwise position. To dispense with this function, either position the START ADJUSTMENT CONTROL fully counter clockwise or place the START ADJUSTMENT SWITCH to FAST.

High frequency is needed to start or maintain the arc for many types of welding. If continuous high frequency is required, such as when welding with AC in an inert gas atmosphere, set the HIGH FREQUENCY SWITCH to CONTINUOUS. When high frequency is needed only to initiate the arc, set the switch to START; high frequency will then disappear after the arc has been struck. High frequency is not required for metallic arc AC or DC welding. When the HIGH FREQUENCY SWITCH is placed in the OFF position, neither the high frequency unit nor the gas and water valves will operate. This feature eliminates the possibility of unnecessary gas consumption when doing metallic arc welding.

When high frequency is employed, the operator should adjust the INTENSITY and PHASE SHIFT rheostats for best performance. The INTENSITY rheostat provides control of the amount of high frequency present at the ELECTRODE HOLDER. The PHASE SHIFT RHEOSTAT controls the time of occurrence of maximum high frequency voltage with respect to the AC cycles of welding current. Optimum settings of this control must be determined experimentally since they will vary for different welding jobs and currents.

Water and gas valves operated by a timing circuit are provided to control the flow of coolant and inert gas. Whenever both the contactor is actuated and the HIGH FREQUENCY SWITCH is set on either START or CONTINUOUS, the valve will open. The timer causes the valves to remain open for a pre-determined interval after the contactor is de-energized (at completion of weld). Any time interval from about 0 to 22 seconds can be selected by adjusting the dial on the timer. About fifteen seconds post flow of water and gas is ideal for most operations.

This welder becomes a source of controlled current for spot welding in an inert gas atmosphere when it is equipped with a SPOT WELD TIMER. For spot welding, a spot weld gun is attached to the ELECTRODE HOLDER terminal of the welder, and the materials to be welded are electrically connected to the GROUND terminal. Weld current is determined by the settings of the CURRENT RANGE SWITCH and PANEL AMPERAGE CONTROL, the same as for any other type of weld-

A remote amperage control device, when attached to this receptacle, will be effective only when the STANDARD-REMOTE AMPERAGE SWITCH is in the REMOTE position. Such a device will, in essence, be a vernier control capable of varying welding current from the minimum to the maximum for whatever current range is being used.

HIGH FREQUENCY START-OFF-CONTINUOUS SWITCH - This three position toggle switch is located at the lower right-hand corner of the front plate and controls operation of the high frequency unit within the welder. When switched to the START position, this switch engages a circuit sensing the voltage across the welding arc. High frequency will be present at the electrode holder until an arc has been struck, at which time the high frequency is automatically turned off. High frequency will appear again whenever the welding arc is broken or the voltage across the arc is too great. This is caused by the distance being too great between work and electrode.

When this switch is in the off position, the water and gas valves are turned off as well as the high frequency. This converts the machine to a standard arc welder. Place the switch in the continuous position for welding aluminum and other non-ferrous alloys.

SLOW START ADJUSTMENT CONTROL SWITCH - This switch is located at the lower left hand corner of the front plate. Its function is to place the START ADJUSTMENT CONTROL in or out of slow or fast starting. Setting this switch to FAST keeps the slow or fast start position of the control circuit from having any effect on the control of welding current.

START ADJUSTMENT CONTROL - This rheostat is located above the START ADJUSTMENT CONTROL SWITCH. With its related switch in the SLOW position, this control has the effect of limiting the initial amount of welding current when an arc has been struck. As the arc is maintained, welding current will gradually rise to the level determined by the PANEL CURRENT CONTROL and a REMOTE AMPERAGE CONTROL if in use. The START ADJUSTMENT CONTROL has its maximum effect when rotated fully clockwise.

HIGH FREQUENCY INTENSITY CONTROL - This rheostat is located on the lower right hand side of the front plate. Its function is to control the INTENSITY or amount of high frequency present at the ELECTRODE HOLDER. Maximum INTENSITY results when this control is turned fully clock-wise.

HIGH FREQUENCY PHASE SHIFT CONTROL - This rheostat is located in the lower center of the front plate. Its function is to change the PHASE of the HIGH FREQUENCY in relation to the PHASE OF THE WELDING ARC VOLTAGE. This control also has some effect upon the INTENSITY of the high frequency, although it is not as pronounced as

that of the HIGH FREQUENCY INTENSITY CONTROL. Positioning of the PHASE and INTENSITY controls is left to the discretion of the operator, who will discover the most suitable setting related to each job and his set-up.

WATER AND GAS TIMER - An automatic timer is incorporated as a plug-in unit occupying a recessed area behind the access door at the lower front portion of the welder. Its purpose is to control the operation of the water and gas valves. Whenever the contactor is actuated and the HIGH FREQUENCY SWITCH is set on either START or CONTINUOUS, the water and gas valves will be opened. Upon completing a weld, the operator will usually turn off the welding current (by de-energizing the contactor) and thus start the timing interval for the post flow of water and gas. This post flow of coolant and inert gas dissipates the heat stored in the torch and protects the tungsten electrode while it cools. The timing interval is adjustable from about two to thirty seconds.

The sequence of operations described above applies when the welder is used in an inert gas shielded welding process. The automatic timer is designed to conserve gas and coolant. For metallic arc welding where neither gas nor coolant are required, if the HIGH FREQUENCY SWITCH is positioned to OFF, this timing function is not in the circuit, and therefore water and gas valves will remain in their CLOSED positions.

SPOT WELD TIMER - A spot weld timer is available as an accessory, and provision has been made for it at the right of the WATER AND GAS TIMING CONTROL. Since the welder is pretired to accommodate this timer, installation consists of merely plugging it into the receptacle provided and tightening two captive screws.

SPOT TIMER RECEPTACLE - This two-pole receptacle is located adjacent to the SPOT WELD TIMER position. It is inactive unless the welder is equipped with a timer. Its function is to provide a means of initiating the spot weld cycle.

AUXILIARY POWER RECEPTACLE - This two-pole receptacle is located near the center of the lower front portion of the machine behind the access door. Whenever the POWER SWITCH is ON, 115 volts AC is present at this receptacle. Its purpose is to provide power for a coolant pump such as is incorporated in a hydromount. Motors up to one-quarter horsepower may be powered from this source, which has a nominal rating of 500 VA.

FUSES - Two fuse holders are mounted on the front of the welder. Both use the same size fuse, namely, a 10 ampere slow blow type (Buss MDL-10). The fuse in the upper holder protects the welding amperage control circuit. If the fuse goes out, there is no longer any amperage control from the main rheostat. This fuse protects the main amperage control

the ELECTRODE HOLDER will depend upon its length and the welding currents to be used.

Both the ELECTRODE HOLDER and GROUND terminals are electrically isolated from the case of the welder. Be careful that lugs, brackets or frayed cable ends do not cause a connection between one of the output terminals and the case. This is particularly important at the ELECTRODE HOLDER terminal because high frequency can be lost (shorted to the case) even though welding current is normal.

CAUTION - BE SURE CONNECTIONS AT ELECTRODE HOLDER AND GROUND TERMINALS ARE CLEAN AND TIGHT.

WATER and GAS CONNECTIONS should be made to the valves which are mounted on the output panel. Be sure to observe direction of flow as indicated on the valves by arrows.

115 volts AC to power a coolant pump is available at the receptacle on the output panel. Its nominal rating is 500 VA, which will power a one-quarter horsepower motor.

MOUNTING HOLES are provided in the bottom sides of the frame rails. They are convenient for attaching the welder to a hydromount or dolly.

VI. MAINTENANCE

CAUTION - DISCONNECT PRIMARY POWER BEFORE ENTERING THE INSIDE OF THE WELDER FOR INSPECTION OR MAINTENANCE. DANGEROUS VOLTAGES ARE PRESENT WITHIN WELDER, EVEN WHEN THE POWER SWITCH IS OFF, UNLESS PRIMARY POWER HAS BEEN REMOVED.

Routine maintenance will be limited to the several requirements covered below.

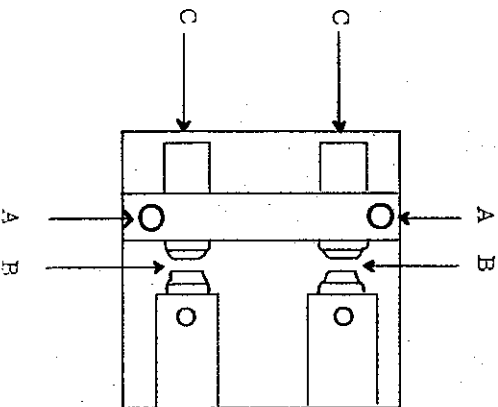
The dust filter should be replaced periodically. If the red light located on the front panel is lighted, it is an indication that the welder is warmer than normal. The duty cycle may be exceeded or the air flow is being restricted. Check the filter to see if a replacement is needed. Particular attention should be given to keeping the rectifier stacks and the high frequency unit clean. In most cases this can be done effectively if only the top is removed.

Lubricate the fan motor occasionally with a good grade of light oil. It is accessible when the top is removed.

Clean or replace and readjust the tungsten spark gap points as required for satisfactory operation of the high frequency unit. The spark gap assembly is accessible when the access cover on the front of the welder is removed. Generally, high frequency output varies directly with spark gap spacing. The nominal spacing is .008 inch, but this can be increased to as much as .013 inch to obtain maximum high frequency output. High frequency radiation (radio interference) will increase with greater output, so it is suggested that minimum spark gap spacing consistent with the welding operation be maintained.

TO ADJUST SPARK GAPS

1. Loosen screw - A
2. Place feeler gauge between points - B
3. Apply pressure to spark electrode so feeler gauge is held firmly between gap - B
4. Tighten screw - A



ing. Set the POLARITY SWITCH for STRAIGHT POLARITY DIRECT CURRENT. Other switches are positioned as follows: POWER - ON, CONTACTOR SWITCH - REMOTE, AMPERAGE SWITCH - STANDARD, HIGH FREQUENCY - START, START ADJUSTMENT CONTROL - FAST, and INTENSITY and PHASE SHIFT CONTROLS - fully clockwise. Duration of each weld is determined by the SPOT WELD TIMER which can be set for any period up to 120 cycles (two seconds). Each spot weld cycle is initiated by operating the trigger switch on the spot weld gun, which should be connected, through a cord, to the SPOT TIMING RECEPTACLE. The trigger switch must be held in the closed position until the weld cycle is complete. Water and gas flow will be started and stopped automatically.

Duty cycle is the ratio of ON-time to ON-time plus OFF-time, over a specified duration of time. Duty cycle for Western Arctronics welders is specified for ten minutes of ON plus OFF-time. Ratings are based on a 60% duty cycle. According to definition, a 60% duty cycle would allow six minutes of ON-time during any ten minute period. That is, $\text{duty cycle} = \frac{\text{ON}}{\text{ON} + \text{OFF}}$ during a ten minute period, or $60\% = \frac{6}{6+4}$. If the total ON-time during any ten minute period exceeds six minutes, the welder should not be used at maximum output without exceeding its rating.

V. INSTALLATION

LOCATION - The welder should be located so that air passage is not restricted from moving in through the screen and air filter at the bottom nor out and away from the back at the fan location. Air drawn through the welder should be dry and as free from metal dust and oil as possible.

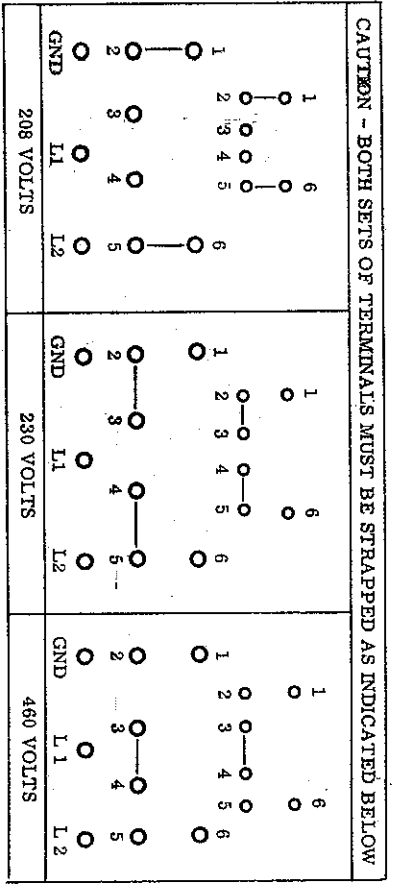
CAUTION - TO MOVE THIS WELDER USE THE LIFT EYE ON TOP OF THE MACHINE. DO NOT PICK UP WITH FORK LIFT BETWEEN FRAME RAILS.

PRIMARY POWER REQUIREMENTS - The Western Arctronics Model 435 Welder can be operated from a 208, 230, or 460 volt, 50-60 cycle AC line. The power lines to the welder should be fused at 100 amperes for 208 or 230 volt operation and 50 amperes for 460 volt operation. Wire size requirements will depend largely upon how far the welder is located from its source of primary power. The main consid-

eration is that input voltage at the welder does not drop appreciably under full load conditions. An electrician can best determine requirements of the power source after studying all conditions related to the installation.

POWER CONNECTIONS TO THE WELDER are made at a terminal board accessible through a hinged door on the back of the welder. Incoming power lines are attached to the terminals marked L 1 and L 2. The line neutral or ground should be attached to the terminal marked GND. It is recommended that power lines to the welder be enclosed in flexible or rigid metal conduit and that the conduit be properly grounded as a means of reducing electrical radiation.

STRAPPING FOR LINE VOLTAGE OPTIONS - Western Arc-tronics welders are strapped for 460 volt operation when they leave the factory. Even if 460 volt operation is planned, it would be wise to check the strapping of your welder by referring to the chart on the inside of the access door. Restrap BOTH SETS OF TERMINALS for the line voltage to be used and make certain that all connections are tight. Do not use steel hardware (nuts, bolts, or washers) for connections to the terminal panel if any of the brass hardware supplied with the welder becomes lost. The strong magnetic fields surrounding these terminals would cause the steel hardware to become hot causing damage to the panel.



OUTPUT CONNECTIONS are made at the bottom panel on the front of the welder. Connect the torch or electrode holder to the terminal marked **ELECTRODE HOLDER**, and the work or material to be welded to terminal marked **GROUND**. A number two cable will be sufficiently large for the **GROUND** connection in most applications. If a torch for inert gas welding is used, it will be supplied with its own cable of the proper size. For metallic arc welding, the size of the cable to

NOTE: Widening the spark gap spacing will increase the loading on the two mica capacitors in the high frequency unit and thus can contribute to their premature failure. If one of the capacitors should fail, operation can be continued on the other capacitor if the spark gap spacing is reduced about .004 inch.

The main rectifier stacks are protected by a thermostat. If the rectifiers are overloaded, the thermostat will open the contactor control circuit, causing loss of welding current. If this should happen, leave the **POWER SWITCH ON** so that the fan will continue to operate. After several minutes welding may be resumed.

This welder is equipped with power factor correction capacitors. If one of the capacitors fails, primary line current will increase, but operation of the welder may be continued.

A thorough visual inspection of the inside of the welder whenever the top or sides are removed is advisable in order to detect the start of trouble. Cable and wire terminations should be inspected for signs of heating or arcing which would indicate loose connections. It is important that all electrical connections are kept tight.

Trouble shooting and parts replacement may be necessary at times. Note that all of the wires in the control system are color coded and that the wire color codes are shown on the schematic wiring diagram. The direction of rotation of each rheostat is also shown. With the above information, no difficulty should be experienced when replacing parts. The **WATER** and **GAS** and **SPOT WELD TIMERS** are plug-in units which can be removed when servicing is required.

A complete stock of replacement parts is maintained by the Western Arctronics Company. For assistance in servicing your welder or for securing replacement parts, contact your dealer; he may have the parts you need in stock, or he will obtain them for you.

VII. ELECTRICAL INTERFERENCE

Although electrical interference may be experienced in some installations, it can be minimized or entirely eliminated by following these recommendations:

1. Be sure the power cables to the welder are enclosed in rigid

NOTES

- or flexible steel conduit which is properly grounded to the welder frame at one end and to the service ground at the switch box end.
2. Ground the work to an adequate ground (A water pipe or 8-ft. ground rod driven into the earth).
 3. Keep spark gap setting to a minimum. This can be as low as .003", depending upon the application.
 4. Reduce length of welding leads where feasible.
 5. If phone or lighting wires are open and in close proximity to the welder, enclose them in conduit and ground conduit. Capacitors across and between each wire and ground may assist in blocking interference in phone circuits. These capacitors should be the mica type of approximately .001 mfd. capacity, and should be installed by the telephone company. In general, very little direct radiation extends beyond approximately 50 ft. Within this 50-ft. radius all conductors should either be shielded with conduit or relocated outside the area.
 6. Wave traps may be installed across the welding terminals of the welder. A wave trap will be most effective for only the one frequency to which it is adjusted.

SET THE PACE IN WELDING

#1500 4
with this

AC • AC-DC INERT ARC WELDER

A complete and self-contained welder that can be operated manually, automatically or remotely. This series of welders is designed for use in both inert gas shielded tungsten arc welding and coated electrode metallic arc welding. Maximum versatility of usage is gained by the simple electrical control to provide current output, timing functions and built-in automatic protection supervision. They are built in accordance with NEMA standards and are made of the highest quality material and equipped with the latest design components available. There is little or no maintenance required as a result of the patented transformer design which eliminates moving parts. Many additional optional features and accessories go with the basic unit to gain the optimum in welding.

All Models are equipped with built-in power factor correction, for lower primary line draw and economical operation. These welders are rated for industrial duty cycles in accordance with NEMA specification. Exclusive innovations provide rapid and effortless dialing of heat selection and genuine versatility of application. Compact machines that offer welding efficiency never before provided in electrical welding equipment. Welding process changeover adjustment, is also rapid and simple—by selection of the proper switch positions.

WELDING PROCESSES

- Metallic Arc
- Tungsten Inert Gas
- Automatic Arc
- Inert Gas Spot
- Sigma

MATERIALS

- Copper
- Aluminum
- Magnesium
- Alloy Steels
- Stainless Steel



The machines have adjustable timing devices that plug-in like radio tubes, giving a variety and different combinations to handle the widest range of welding tasks. A real time saver in production welding.

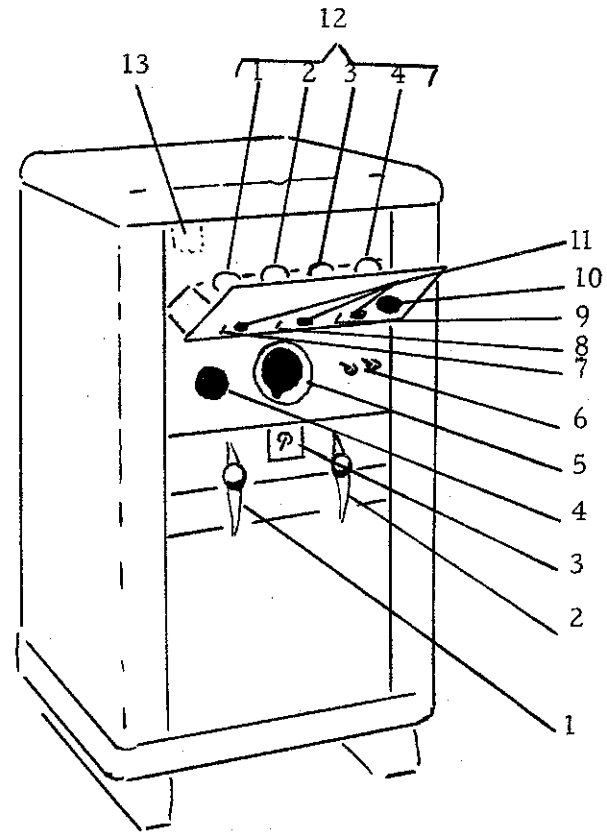
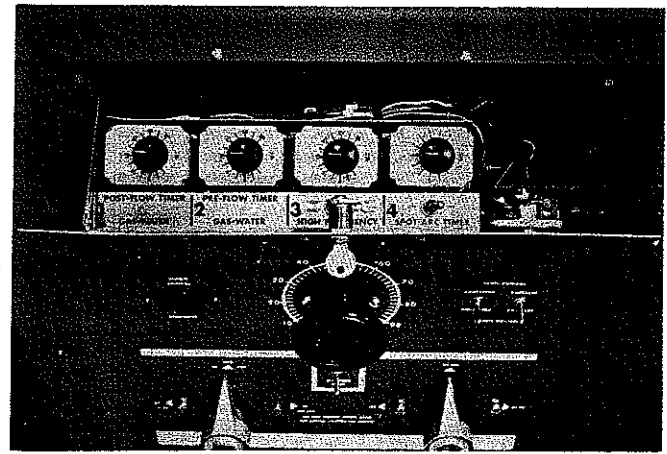
Ease of maintenance was a major factor for consideration in the case design of these units. A rugged steel cabinet assures successful operation in all weather conditions. Baked-on enamel cabinet finish assures lasting beauty and case longevity. All controlling switches, dials, and connections are clearly marked with a long lasting silk screen process. Every component that could ever require attention has been located for easy accessibility. The entire high frequency and control assembly is mounted on a removable drawer type plug-in chassis. There are two lifting eyes mounted on each side of the case halfway between the front and the rear. The front panel of the case is recessed and all controls and switches are behind the clearance of the front part of the case, giving additional protection.

AMAZING CONTROL SYSTEM

Simplicity of operation is stressed in these units' comprehensive design and engineering. All controls and adjustments are readily accessible and are clearly marked; lighted red indicating pilots show the operator exactly how the machine is functioning at all times during the operation.

Inherent arc stability of our units produce an extremely smooth and unvarying performance in all arc welding operations.

SKETCH DETAIL



TRANSFORMER

A patented saturable shunt transformer design eliminates the need for a separate saturable reactor normally used in electrically controlled welding machines. The resulting space economy allows for a smaller and more compact welder. The transformer dual coil windings are designed for balanced operation and superior cooling. Constructed from die-punched silicon laminations with fixed primary and secondary windings. Coils are double impregnated with baked varnish for protection. The cooling fan motor has lifetime lubrication and the fan exhaust requires no more clearance than 18" from the wall. The cooling fan is mounted to the top rear of the case, therefore providing a complete cooling draft throughout the case and over the transformer. The full range output produced in the basic power unit is done through a patented, magnetically controlled transformer.

1. RANGE SWITCH — selected precise range for a particular welding job and with generous overlap; marked with "HIGH", "MEDIUM" and "LOW" settings.
2. POLARITY SWITCH — furnished on AC-DC models to connect output for either AC or DC straight polarity or DC reversed polarity.
3. START SWITCH — soft start begins at approximately 1/2 normal current for a 2 second delay, then increases to normal value. Standard start begins at normal value immediately.
4. REMOTE CONTROL RECEPTACLE — a single receptacle that accommodates both remote controls for amperage and for "OFF-ON" operation.
5. WELDING AMPERAGE — just dial the amperage you need. Makes it very simple to get the particular heat you want for any particular welding job.
6. PANEL REMOTE SWITCHES — (Contactor & Amperage: toggle switches to select control at the panel or at the remote position.
7. POWER SWITCH — energizes both the cooling fan and the control transformer for welding procedure.
8. GAS-WATER SWITCH — for inert gas welding should be in "ON" position; for metallic arc welding should be in "OFF" position.
9. HIGH FREQUENCY SWITCH — turns high frequency "ON" for inert gas welding; operates in conjunction with high frequency drop-out timer.
10. HIGH FREQUENCY INTENSITY SELECTOR — rotating knob selects proper high frequency for arc starting. Controls increase or decrease spark jump.
11. PILOT LIGHTS — are illuminated when the function which each represents is operating; individual lights are labeled to show their function.
12. PLUG-IN TIMERS — (1) Post-Flow timer (0 to 30 seconds); (2) Pre-Flow timer (0 to 30 seconds); (3) High Frequency drop-out timer (0 to 30 seconds); (4) Spot Gun timer (0 to 3 seconds).
13. INTERLOCK SWITCH — safety device to cut main power automatically whenever timer control panel is opened.

POST-FLOW TIMER

This timer continues the flow of shielding gas and water **after** the welding arc is broken in order to provide protection to the hot tungsten electrode and TIG torch. This timer is adjusted from 1-30 seconds, depending upon the size of the electrode, the current used and the time required for the tungsten electrode to cool down without oxidizing. The post-flow function should always be used when TIG welding. When stick electrode welding, this function is not needed and can be deactivated by placing the gas-water switch on the "Off" position without disturbing the setting on the timer. Hi-frequency adjustment is on the front panel.

PRE-FLOW TIMER

This timer provides a shielding arc gas purge of the gas lines and work area **before** the arc is struck. When this timer is used, there is a delay of 1 to 30 seconds after the start switch is activated, during which time gas and water flow. At the end of the time delay, Hi-Frequency starts (if used), the arc is struck and main welding power flows. By setting this timer on "zero" (or if no timer is furnished) this time delay in starting will be minimized.

THE HI-FREQUENCY DROP-OUT TIMER

This timer is used most often in the DC TIG welding and stick electrode applications. It is designed to shut off the Hi-Frequency oscillator at a pre-set time (1-30 seconds) after the arc is stabilized. In AC TIG welding, the Hi-Frequency stabilizer must operate **continuously** in order to maintain the arc and the drop-out timer then is NOT used. The Hi-Frequency drop-out switch should be set on "continuous". (Instantaneous Hi-Frequency drop-out timer is provided as standard with the machine even though no timer is used. A dummy plug must be in position in the socket and the Hi-Frequency drop-out switch inside must be set on "Start-only" in order to obtain this function.)

HI-FREQUENCY SPARK GAP

The tungsten spark gaps are factory set at .008 and this assembly is mounted on the righthand side behind the upper front door panel. The spark gap can be adjusted by screwing the contacts in or out and have a range of .003 to .012. The Hi-Frequency intensity selector increases or decreases the amount of spark jump. The distance the spark jumps will increase as the tungsten becomes heated and will vary with the cable length, base metal, etc.

CONTACTOR

AC/DC units are equipped with hermetically sealed silicon diode rectifier cells. They give superior welding performance on DC applications due to their high efficiency and non-aging characteristics. They require no maintenance.

START SWITCH

When the switch is set for soft start, the welding begins at approximately half of the welding current. Then after a delay of about 2 seconds, the current increases to the normal value. This feature minimizes the possibility of tungsten erosion and inclusions created by high starting currents. When the switch is set for standard start, the welding begins at the normal current level immediately. (The soft start isn't used when a remote foot switch is being used.)

GAS-WATER CONNECTIONS

These connections are easily accessible on the front part of the lower side panel. The brass fittings are clearly marked. The water inlet fitting is a 5/8 - 18 LH female fitting. The gas inlet to torch is a 5/8 - 18 RH female fitting in accordance with International Acetylene Association Standards. The entire valve panel can be removed for ease of servicing and are immediately behind this panel. Electrical connections unplug readily.

PRIMARY POWER CONNECTIONS

Standard models are provided with a triple voltage primary for operation on 208, 230, or 460 volt AC power lines. For safety, all welders leave the factory connected for 460 volts. Should reconnection of the machine for 208, or 230 volts be required, rear door access panel readily exposes the primary terminal. Simply rearrange the copper voltage change bars as pointed out in the Operating Instructions, or via the diagram attached to the inside of the panel door. Fuses should be selected in sizes of approximately 1½ to 2 times the rated primary ampere. These units will operate from a single phase power line, or from any one phase of a three phase power line. Any three combinations of optional voltages may be received through special order.

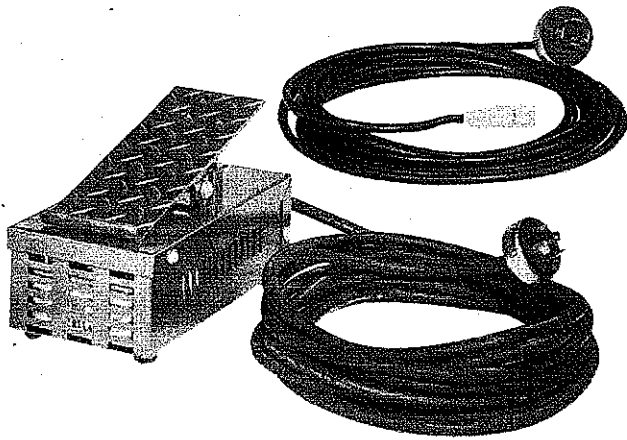
SECONDARY POWER CONNECTIONS

The terminal studs are located behind the bottom front panel door. The lug of the TIG torch power lead bolts to the stude marked "electrode" and the lug of the ground clamp cable is bolted to the stud marked "ground". For metallic arc welding, replace the TIG torch power lead with a stick electrode cable and holder lead to the stud marked "electrode".

When a water recirculating pump system is used, the incoming water hose and torch water hose is connected directly to the recirculator.

A water-flow safety switch (torch saver) can easily be connected to this machine by connecting this switch in the contactor circuit. A bolted connection of two black wires is located behind the gas-water panel.

REMOTE CONTROLS



Both hand or foot operated rheostats are available for remote control operation complete with cable and plug assembly. A single receptacle that accommodates both remote controls for amperage and for "Off-On" operation is located on the front panel of the machine. The "contactor" switch and the "amperage" switch, located on the front panel, both have a remote position. When the contactor switch is in the remote position, it passes the "start" and "stop" control on to whatever device is plugged into the remote control receptacle. When the amperage switch is in the remote position, the amperage adjustment is accomplished by the foot operated remote control plugged into the remote control receptacle.

SILICON RECTIFIERS

The heart of any DC Rectifier welder is the rectifier bank which converts AC alternating energy into steady DC welding current. Silicon Rectifiers are the most perfect static converter elements known to man. Here are the facts: Silicon diodes are 98% efficient compared to approximately 85% for selenium rectifiers. Silicon diodes do not age or deteriorate in service. Silicon diodes are the only hermetically sealed rectifiers in the industry. Selenium can be semi-sealed only by painting. Silicon diodes are small rugged low cost units comparable in size to a spark plug with 6 cells required per machine. Selenium necessitates a large bulky bank of 40 or more plates 6" x 12" in size. Silicon has negligible reverse leakage currents compared to other rectifier materials. Here are some of the benefits: Savings in power; delivers same maximum output over the entire life of the equipment. Metallic dust, moisture and corrosive fumes cannot attack silicon and deteriorate it; produces an exceptionally smooth stable welding arc free from capacitive crackle.

Distributed By:

SPECIFICATIONS — (200 - 300 Amps)

RATED SEC. AMPS: 300 at 32 Load Volts - 200 at 28 Load Volts

Rated Duty Cycle: 60%

Open Circuit Volts: 80 AC - 72 DC

Current Range: 300 Amp AC 5-80, 30-230, 165-400-DC 5-75, 25-220, 125-400 - 200 Amp AC 5-80, 30-200, 160-300 - DC 5-75, 25-185, 120-300

Type Control: Saturable Transformer with 3 position Range Switch and Rheostat

Rated Primary: 208/230/460 Volts, 1 Ph. 50/60 Hz, 300 - 110/100/50 Amps, 200 - 77/70/35 Amps; Optional 380, 575, etc.

Power Factor Correction: 75%

Start Control: Standard and Soft Start Switch

DC Inductor: Included

Overload Protection: Thermostatic; Fused Control Circuit

Rectifier Type: Silicon Diode, Straight Polarity Type

Panel Controls: Hi-Freq. Start / Off/ Cont. Switch; H. F. Intensity Rheostat; Power, Gas/Water & Hi-Freq. On/Off Switches and Pilot Lights; Switches for Panel or Remote Control of Primary Contactor and Output Amperage; Plug-in Post Flow Timer (Standard); **Optional** Plug-in Timers for Pre-Flow, Hi-Freq. Delay and Spot Arc Timer; Remote Control Receptacle; AC, DC Str., DC Rev. Polarity Switch; 3 Position Range Switch; Amperage Control Rheostat; Soft Start Switch.

Connections: 1/2" Secondary Studs behind hinged door; Primary Terminal Panel and Voltage Links

Remote Control: 20" Cable and Momentary Contact Switch included.

Construction: Skid Mounted, Lift Eyes, 16 Ga. Baked Enamel Cabinet, Upright Style: Removable Plug-In Hi-Freq. Control Drawer Assembly and Gas/Water Solenoid Panel.

Size and Weight: 22" Wide x 24" Deep x 41 1/2" High, Approximately 575 lbs. net 300 Amp., 535 lbs. 200 Amp.

RUNNING GEAR

A heavy-duty four-wheeled truck with towing bar is available at a nominal extra cost. Because of the minimum weight of the units, a towing truck is highly desirable in many cases to gain rapid portability from station to station within the manufacturing plant or can be easily moved to where overhead conveyance can be used to lift and move to a dock or truck bed. Running gears come in two types, with or without a gas bottle platform.

ACCESSORY KIT

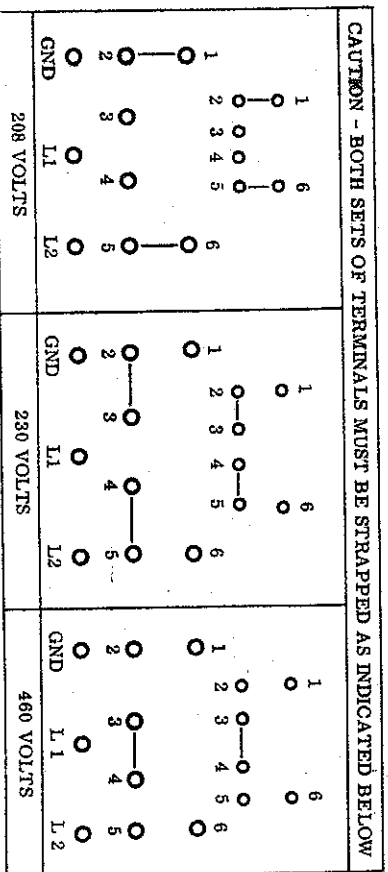
Accessory packages consisting of a welding helmet with lens, 35' of welding cable with electrode holder and lugs, 30' of ground cable with ground clamp and lug are optional. The cable lug-ends are standard; however, CAM-LOK plug-ins are special order but are at additional cost. Note: Space lugs are standard with the welder. Cam-Lok connections on the welder are special order and at additional cost.

Inert gas torches may be ordered to meet any requirement or welding need.

eration is that input voltage at the welder does not drop appreciably under full load conditions. An electrician can best determine requirements of the power source after studying all conditions related to the installation.

POWER CONNECTIONS TO THE WELDER are made at a terminal board accessible through a hinged door on the back of the welder. Incoming power lines are attached to the terminals marked L 1 and L 2. The line neutral or ground should be attached to the terminal marked GND. It is recommended that power lines to the welder be enclosed in flexible or rigid metal conduit and that the conduit be properly grounded as a means of reducing electrical radiation.

STRAPPING FOR LINE VOLTAGE OPTIONS - Western Arc-tronics welders are strapped for 460 volt operation when they leave the factory. Even if 460 volt operation is planned, it would be wise to check the strapping of your welder by referring to the chart on the inside of the access door. Restrap BOTH SETS OF TERMINALS for the line voltage to be used and make certain that all connections are tight. Do not use steel hardware (nuts, bolts, or washers) for connections to the terminal panel if any of the brass hardware supplied with the welder becomes lost. The strong magnetic fields surrounding these terminals would cause the steel hardware to become hot causing damage to the panel.



OUTPUT CONNECTIONS are made at the bottom panel on the front of the welder. Connect the torch or electrode holder to the terminal marked ELECTRODE HOLDER, and the work or material to be welded to terminal marked GROUND. A number two cable will be sufficiently large for the GROUND connection in most applications. If a torch for inert gas welding is used, it will be supplied with its own cable of the proper size. For metallic arc welding, the size of the cable to

NOTE: Widening the spark gap spacing will increase the loading on the two mica capacitors in the high frequency unit and thus can contribute to their premature failure. If one of the capacitors should fail, operation can be continued on the other capacitor if the spark gap spacing is reduced about .004 inch.

The main rectifier stacks are protected by a thermostat. If the rectifiers are overloaded, the thermostat will open the contactor control circuit, causing loss of welding current. If this should happen, leave the POWER SWITCH ON so that the fan will continue to operate. After several minutes welding may be resumed.

This welder is equipped with power factor correction capacitors. If one of the capacitors fails, primary line current will increase, but operation of the welder may be continued.

A thorough visual inspection of the inside of the welder whenever the top or sides are removed is advisable in order to detect the start of trouble. Cable and wire terminations should be inspected for signs of heating or arcing which would indicate loose connections. It is important that all electrical connections are kept tight.

Trouble shooting and parts replacement may be necessary at times. Note that all of the wires in the control system are color coded and that the wire color codes are shown on the schematic wiring diagram. The direction of rotation of each rheostat is also shown. With the above information, no difficulty should be experienced when replacing parts. The WATER and GAS and SPOT WELD TIMERS are plug-in units which can be removed when servicing is required.

A complete stock of replacement parts is maintained by the Western Arctronics Company. For assistance in servicing your welder or for securing replacement parts, contact your dealer; he may have the parts you need in stock, or he will obtain them for you.

VII. ELECTRICAL INTERFERENCE

Although electrical interference may be experienced in some installations, it can be minimized or entirely eliminated by following these recommendations:

1. Be sure the power cables to the welder are enclosed in rigid

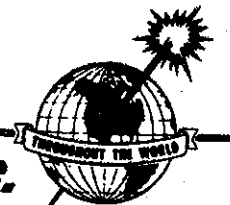
Forney

HIGH FREQUENCY INERT GAS WELDING

**INSTALLATION
MAINTENANCE
and OPERATING
INSTRUCTIONS**

**INCLUDING GENERAL
WELDING INSTRUCTIONS**

**Forney
INDUSTRIES, INC.**



BOX 563, FORT COLLINS, COLORADO 80521

SECTION I

HIGH FREQUENCY UNIT

INSTRUCTIONS INSTALLATION AND OPERATION OF HIGH FREQUENCY
ARC STABILIZERS

GENERAL DESCRIPTION

The High Frequency Arc Stabilizer is designed to convert standard AC or DC welding machines for the tungsten inert gas shielded (TIG) arc welding process. These units are also often used to improve the ease of metallic arc welding, particularly when low currents and special, hard-to-handle electrodes are involved.

In inert gas welding the high frequency allows the welding arc to be started without touching the tungsten electrode to the work, thereby eliminating contamination of the tungsten. This is accomplished by holding the tungsten electrode approximately 1/16" to 1/8" away from the work piece. The high frequency then jumps this gap and creates an ionized path through the air over which the main welding current can flow.

In addition, the high frequency oscillator continues to stabilize and maintain the welding arc after it has been started. It is absolutely essential to use high frequency for starting and stabilizing when welding with an AC welder on aluminum or magnesium, otherwise the arc will go out. When using a DC welder on stainless or carbon steel the arc can be struck without contamination by touching the electrode and the arc will normally be maintained, however, the use of high frequency greatly simplifies the starting process, especially in tight corners.

High Frequency also performs another important function when welding aluminum or magnesium. It tends to break down the surface oxide and thereby gives a cleaning action to the weld puddle.

For stock electrode work with low hydrogen and lime coated rods, it is frequently difficult to maintain a steady arc, particularly with welders having low open circuit voltage. By using a high frequency oscillator this arc - out problem is easily solved and production speed is greatly increased.

A Gas-Water Control is available which works in conjunction with the arc stabilizer to control the flow of gas and water for TIG welding.

SPECIFICATIONS OF HIGH FREQUENCY ARC STABILIZER

Through Put Rating @ 100% Duty Cycle	Input			Dimensions (Inches)			Net Wt.
	Volts	Amps	HZ	W	H	D	lbs.
400 A	115/230	1/.5	50-60	15	7-1/4	14-3/4	27

INSTALLATION

RADIO FREQUENCY INTERFERENCE

This equipment has been type-tested under standardized field test conditions as recommended by the Joint Industry Committee on High Frequency Stabilized Arc Welders and found to radiate radio frequency energy within the maximum allowable limit established by the Federal Communications Commission for this type of equipment.

On the basis on these tests, installations of this equipment made in accordance with the instructions herein may reasonably be expected to meet the radiation limits established by the Federal Communications Commission.

The operator of this equipment should execute the certificate on the following page and attach it to the equipment.

For additional information refer to:

1. Federal Communications Commission
"Rules and Regulations" Part 18
2. "Recommended Installation and Test Procedures for High-Frequency Stabilized Arc Welding machines"
Published by the National Electric Manufacturers' Association

G U A R A N T E E

The manufacturer guarantees to the original purchaser that this equipment has been thoroughly checked and tested before shipment and is free of mechanical and electrical defects.

Should defects due to faulty material or workmanship develop within one year from date of sale, the equipment will be repaired and put in workable condition free of charge, providing it is returned to our factory, or authorized service station, TRANSPORTATION PREPAID, after issuance of return goods tags have been made by the factory, or authorized service station, authorizing such a return.

This guarantee does not cover helmet, cables, plugs, receptacles, switches, electrode holder or ground clamp, nor is it valid if the item has been misused, abused, or tampered with.

CERTIFICATE

NAME OF EQUIPMENT HIGH FREQUENCY ARC STABILIZER

This equipment has been type-tested under standardized field test conditions as recommended by the Joint Industry Committee on High Frequency Stabilized Arc Welding Machines found to radiate less than 10 microvolts per meter at a distance of one mile, the maximum allowable limit established by the Federal Communications Commission for equipment of this type.

Installations using this equipment on the basis of these tests, may reasonably be expected to meet the radiation limitations established by the Federal Communications Commission, only when installed, operated, and maintained as specified in the instruction book provided.

USER'S CERTIFICATION

The Welding equipment identified above has been installed in accordance with the specific instructions applicable to this model as outlined in the instruction book furnished. It is being used only for the purpose for which it was intended and is being maintained and operated in accordance with the manufacturer's instructions.

SERIAL NO. _____

DATE INSTALLED _____

SIGNED _____

WARNING

It is inadvisable that individuals who wear the "Heart Pace-Maker" type of apparatus operate this equipment, or be in the vicinity where it is in operation, due to the Radio Frequencies generated. Some Radio Frequencies have been found to adversely affect the "Pace-Maker".

RECEIVING - HANDLING

Carefully unpack the unit and inspect for damage which may have occurred in shipping. Any claim for loss or damage should be filed with the freight carrier.

LOCATION

It is recommended that the High Frequency Arc Stabilizer be located as close to the welding operation as possible. This will permit short welding leads which will reduce radio frequency emission and provide for better welding operation. Rubber feet on the bottom of the unit permit mounting on top of a welder. The feet may be removed if desired and the unit screwed in place.

SAFETY

Before making primary or secondary connections, changing parts, or making repairs, be sure the incoming power is disconnected. Repairs or troubleshooting should only be done by qualified personnel.

NOTE: VOLTAGES AS HIGH AS 5000 VOLTS ARE PRESENT IN THIS EQUIPMENT.
USE EXTREME CAUTION IN SERVICING THIS UNIT.

Before operating this equipment all safety precautions relating to welding operations should be observed. Consult the safety section of the welding machine instruction manual or the safety standards published by the American Welding Society.

INPUT POWER CONNECTIONS

The standard voltage units are connected at the factory for 115 volts and are supplied with a standard 115 volt plug. By reconnecting the unit internally in accordance with the instructions on the case, and changing the incoming power plug, the stabilizer can be adapted to 230 volt operation. On either voltage the unit should be grounded through the third wire of the input cord.

In order to minimize radio interference all lighting, power, telephone, and other wires within 50 feet of the welding operation should be enclosed in rigid metallic conduit which is grounded at the point close to the welder.

THROUGH-PUT (WELDING) CONNECTIONS

Four studs are provided on the front for connection of the welding leads and machine leads. Connect appropriately sized welding cables from the output terminals of the welding machine to the two studs on the stabilizer identified as "TO WELDING MACHINE". See Figure (1)

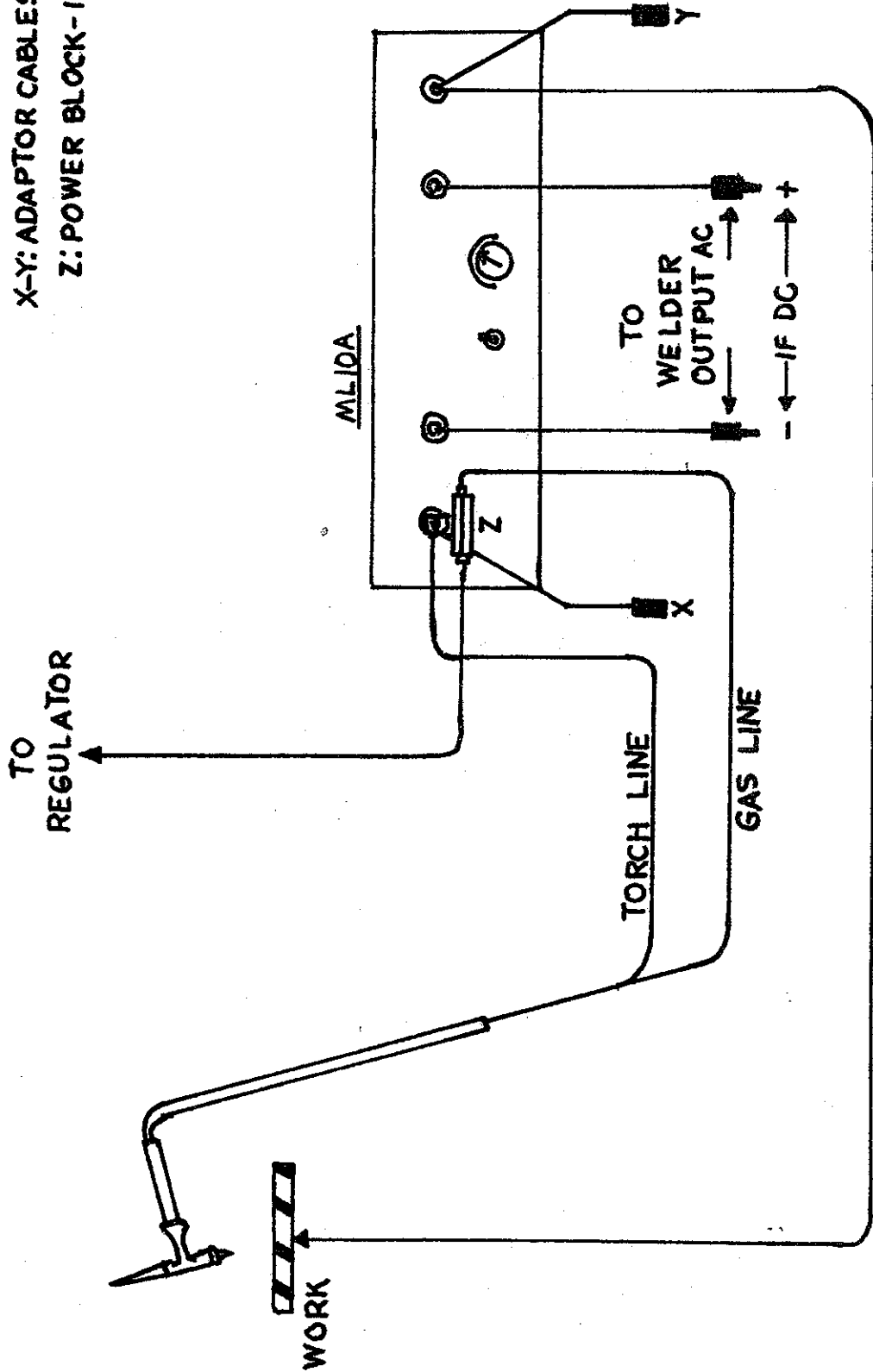
Connect a welding cable between the stabilizer stud identified as "TO WORK" and the work piece. Connect the electrode holder to the stud identified as "TO ELECTRODE HOLDER".

Keep the electrode holder cable and the work cable as short as possible. Do not coil. Do not tape the leads together, but space about 1 inch apart. For longest life of these cables, do not run over a metallic surface and use "HYPALON" insulated cable instead of rubber.

In order to minimize radio interference it is recommended that a grounding cable, the same size as the work lead, be connected between the "TO WORK" terminal of the stabilizer and a water pipe which enters the earth within 10 feet of the Stabilizer or a driven ground rod at the arc stabilizer. In addition a heavy lead should be connected from the "TO WORK" stud and the stabilizer case.

For inert gas welding it is necessary to connect gas and water hoses to TIG welding torch. Consult torch manufacturers' literature for proper installation. Since this model contains a high frequency oscillator only and does not control gas and water, separate manual shut off valves must be used in the gas and water lines. It is possible to add a Gas - Water Control to the High Frequency at a later date if desired. (Model ML-10A).

X-Y: ADAPTOR CABLES
Z: POWER BLOCK - IF USED-



WORK - GND.

AIR COOLED TIG KIT CAT. NO. 252-O

FIG. 1

OPERATION

Current settings, tungsten electrode size and gas size and gas flow are all dependent on the nature and size of material being welded, the specific type of welds, (butt, lap, etc.) and the rate of heat dissipation into surrounding jigs and fixtures. A rough guide of current required for different sizes of pure tungsten is shown below. More detailed information is normally supplied by manufacturers of TIG torches.

TABLE 2

Metal Thickness	Electrode Dia.	Nozzle Sizes Orifice Diameter	Amp. Settings	Argon Gas Flow	Filler Rod Diam.	No. Passes
Less Than 1/16	0.04	1/4 inch	10-60	5CFH	3/32	1
1/16	1/16	1/4 inch	40-120	7CFH	3/32	1
1/8	3/32	5/16 inch	100-160	10CFH	1/8	1
1/4	1/8	3/8 inch	150-210	15CFH	3/16	2
5/16 up	5/32	1/2 inch	200-300	up to 20CFH	1/4	3

Higher amperages can be used when welding with 1 or 2 percent thoriated tungsten.

1. Turn on the primary toggle switch located on the front panel. High Frequency will operate continuously.
2. Adjust setting of panel intensity rheostat knob; clockwise for high and counter clockwise for low. This setting changes the amount of high frequency spark jump and is best determined from experience. For metallic arc welding the setting can be turned down to reduce any "bite" experienced in any changing electrodes.

In general use the lowest settings which gives satisfactory results.

3. Turn on gas and water sources manually and proceed to strike the arc. To break the arc on completion of the weld, lift torch away from the work piece. If gas and water control unit is being used, refer to that section starting on Page 8.

MAINTENANCE

This arc Starter requires very little maintenance. A periodic check of various points will insure a long and efficient operating life. After approximately 300 hours of operation the high frequency spark gap should be inspected and reset if necessary. These tungsten spark gaps are factory set at .008 inches. However, since the gaps are subject to constant arcing they will wear slightly in time. Failure to make this adjustment will result in intermittent operation of the high frequency oscillator and will also cause overloading of the high voltage condensers, resulting in premature failure. The brass high frequency spark assembly is accessible by removing the cabinet cover.

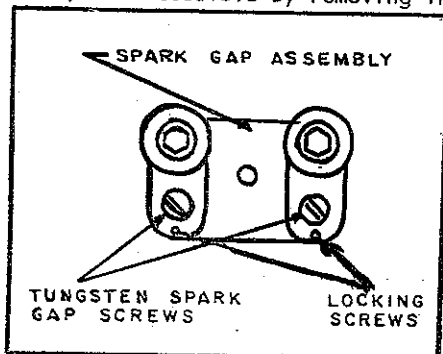


Fig. 4 - Spark Gap Assembly Adjustment

To adjust the gaps, first loosen the small locking machine screws located directly in front of the large (3/8") slotted contact screws. (See Fig. 4). The main gaps are then set by screwing these contacts in or out until a feeler gauge approximately .008" thick will just slide between each pair of points. This setting can vary from .003" to .012"; however, since widening the gap produces more high frequency energy it is recommended that the setting be kept as small as practicable.

After proper distance is determined remove feeler gauge and tighten locking screws. The screws have a very fine 48 pitch thread and can be set with fair accuracy simply by closing each screw down against its mate and then backing off approximately 1/3 to 1/2 turn.

TROUBLE SHOOTING

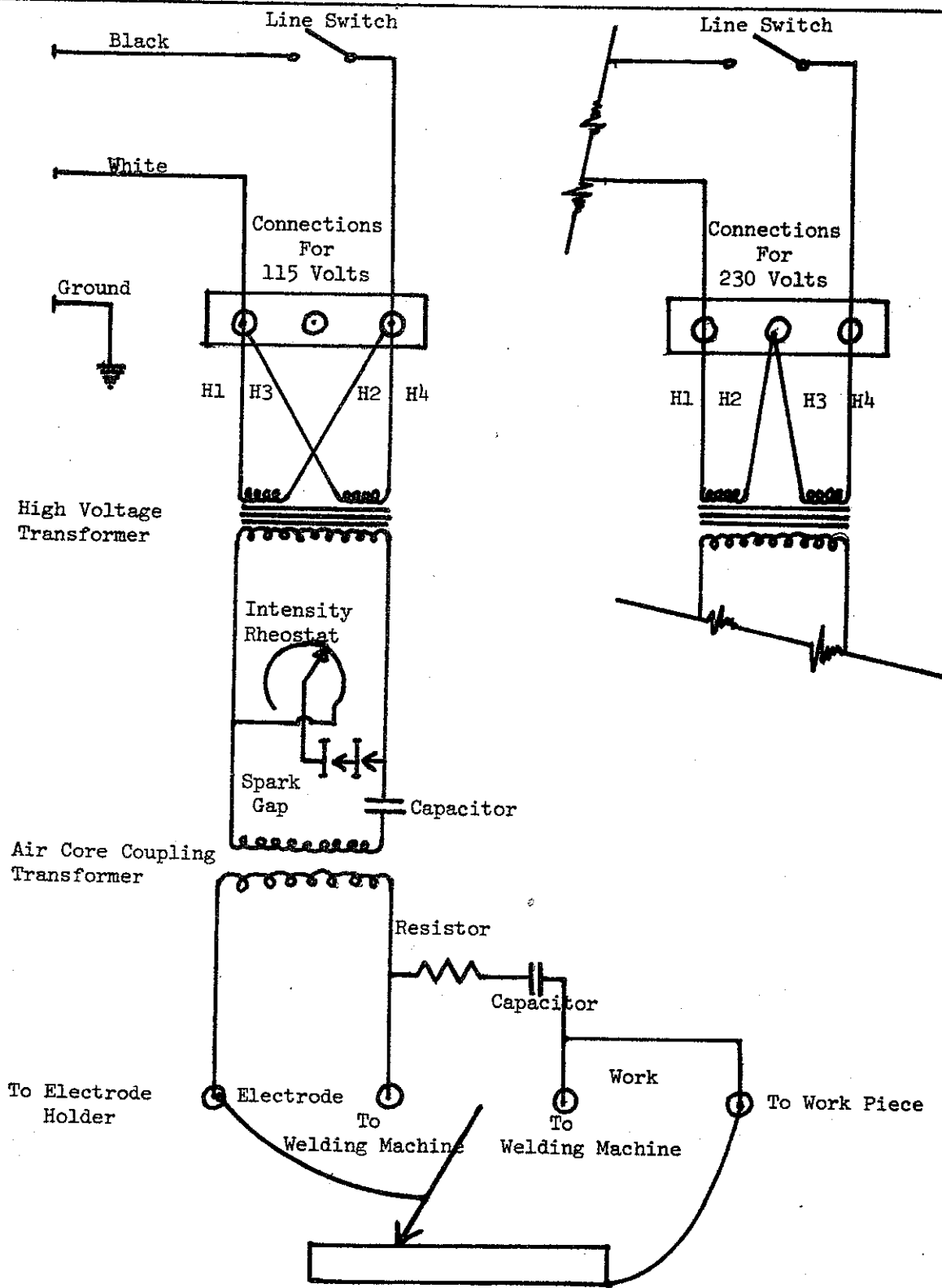
DIFFICULTY

POSSIBLE CAUSES AND REMEDY

- | | |
|--|--|
| 1. No high frequency, spark gap does not run. | 1. Defective on-off switch - Replace. |
| | 2. Defective Hi Voltage Capacitor Disconnect. If spark gap starts capacitor is defective. Replace. |
| | 3. Broken leads. Repair. |
| | 4. Spark gap setting is too great. Re-Set. |
| | 5. Defective high voltage transformer. Replace. |
| 2. Difficulty in establishing the arc, spark gap runs. | 1. High Frequency Intensity Control setting too low. Increase setting. |
| | 2. Using too large a tungsten. Use smaller. |
| | 3. Defective Cables. Replace. |

PARTS LIST

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QTY</u>	<u>PART NUMBER</u>
1	Line Switch SPST 250 Volts, 3 Amperes	1	24R220
2	High Voltage Transformer 115/230 Volts	1	27R1232A
3	High Voltage Capacitor .002 MFD 6000 Volts	1	4R1220
4	Spark Gap Assembly Complete	1	11G2243
5	Intensity Rheostat 50 Watts 2 - Ohms	1	19R1744
6	By-Pass Capacitor 4 MFD 236 Volts	1	4R120A
7	By-Pass Resistor Non-Inductive 50 Watts 25 Ohms	1	19R1746
8	Air Core Coupling Transformer	1	26G2285-2
9	Knob for Rheostat	1	19R387
10	Primary Cord with 115 Volt Plug	1	29R1102
11	Terminal Studs (Cam Lok Male)	4	9R1620
12	Cabinet -- less Cover	1	3G2338
13	Cover	1	3G2341
14	Cabinet Feet	4	3R2197



SCHMATIC DIAGRAM: High Frequency Arc Stabilizer

SECTION II

GAS - WATER CONTROL

INSTRUCTIONS FOR INSTALLATION, MAINTENANCE, AND OPERATION OF GAS-WATER CONTROL

GENERAL DESCRIPTION

The Gas-Water control is designed for use in conjunction with the compatible model of High Frequency Arc Stabilizer. The control is equipped with gas and water solenoid valves, electronic postflow timing, circuits to control flow of water and gas, and operation of the High Frequency Arc Stabilizer. A remote control cable and switch is provided.

SPECIFICATIONS

INPUT		DIMENSIONS (Inches)			NET WEIGHT
Single Phase 50/60 HZ		Width	Depth	Height	
Volts	Amps	16	14	4-1/2	14
115	1.0				
230	.5				

RECEIVING AND HANDLING

Carefully inspect the unit for damage that may have occurred in shipping. Any claims for loss or damage that may have occurred in transit must be filed by the buyer with the freight carrier.

INSTALLATION

LOCATION

The Gas-Water Control is designed to mount underneath the High Frequency Arc Stabilizer. The four feet on the bottom of the Stabilizer fit into four holes in the top of the Control.

INPUT POWER

Be sure the Stabilizer is connected for the input voltage which corresponds to the input voltage of Gas-Water Control. Make sure that this voltage is the correct one for the input power available.

See stabilizer instruction manual.

Be sure the power switches on the Stabilizer and Control are both in the OFF position.

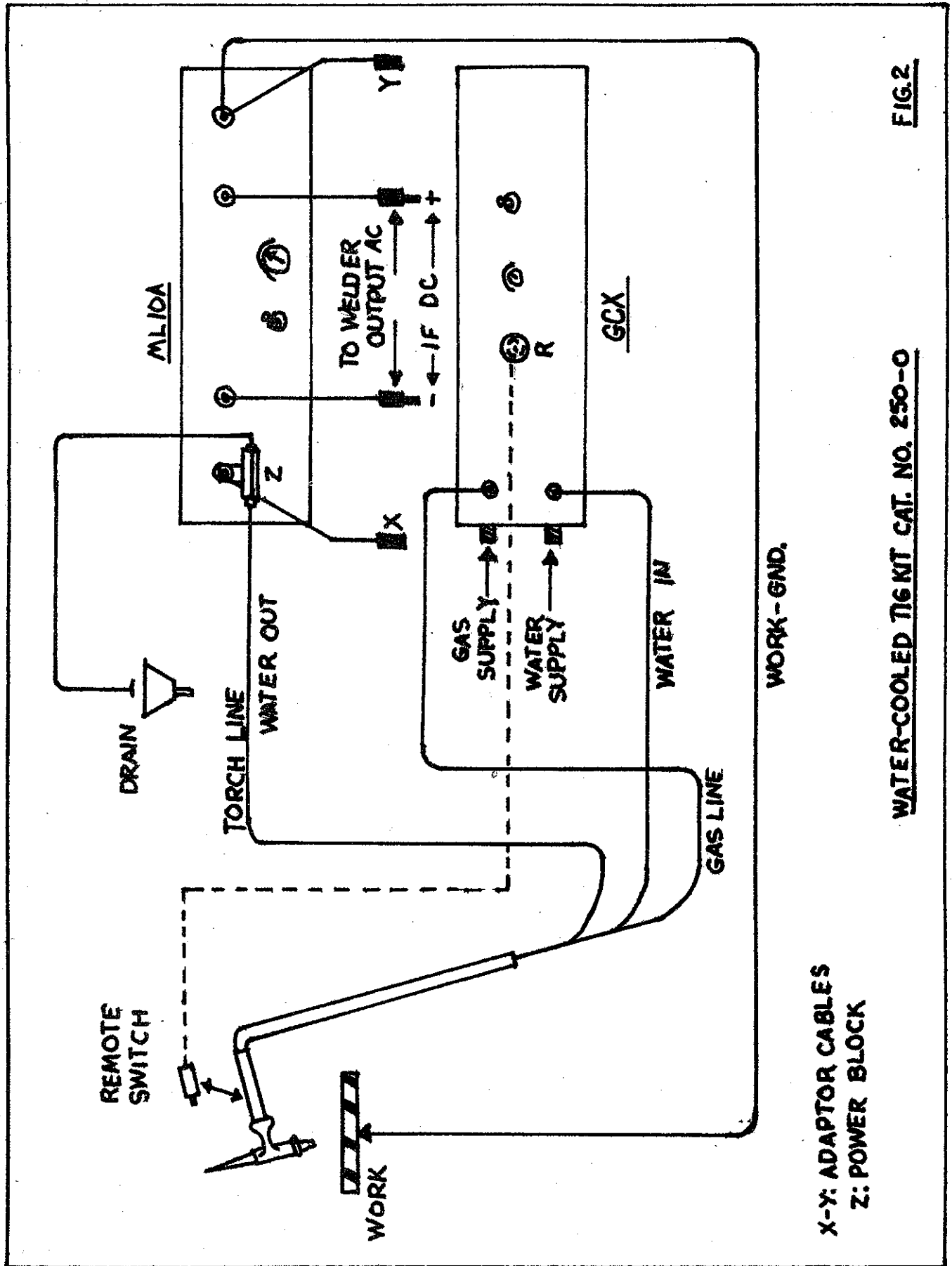
Plug the Stabilizer's primary line cord into the matching receptacle in the rear of the Control. For 230 Volt operation, this also necessitates a change in the plug on the Stabilizer. The required plug is furnished with the 230 Volt Gas-Water Control.

Plug the primary line cord of the Control into a receptacle of the proper AC voltage. Check the nameplate on the Control for the correct primary input voltage and frequency.

REMOTE CONTROL CONNECTIONS

Plug the remote control cable and switch assembly into the three pole receptacle on the front of the Gas-Water Control. Attach the switch to the TIG Torch in position for convenient operation.

The remote control switch has three positions and controls high frequency and gas and water. The rearmost position (toward the cable) is OFF. The center position is GAS AND WATER only. The forwardmost position (away from the cable) is GAS, WATER, AND HIGH FREQUENCY.



X-Y: ADAPTOR CABLES
 Z: POWER BLOCK

WORK - GND.

WATER-COOLED TIG KIT CAT. NO. 250-0

FIG. 2

GAS-WATER CONNECTIONS

Connect a hose from the gas supply flowmeter - regulator to the gas connection (upper fitting) on the side of the Control.

The gas fittings have a 5/8-18 right hand thread and water fittings have a 5/8-18 left hand thread.

Connect the incoming water to the water connection (lower fitting) on the side of the Control.

Connect the gas and water inlet hoses of the TIG Torch to the gas and water fittings on the front of the Control.

If a water recirculator is used, do not connect the water hose to the Gas-Water Control, but connect them directly to the TIG Torch.

The drain water from the TIG Torch usually returns through the power cable and should go to a drain through a rubber or plastic hose. The TIG Torch power cable/drain water fitting usually attaches to the High Frequency Arc Stabilizer electrode stud. See Stabilizer instructions for proper power connections.

OPERATION

Use in conjunction with High Frequency Arc Stabilizer.

Set the power switches on the welding machine, High Frequency Arc Stabilizer, and Gas-Water Control to ON.

Slide the remote switch to the forward position. Gas and Water flow and high frequency are now on. Place the electrode close to the work, but do not touch the work. High Frequency will jump the gap between the electrode and the work and the arc will be established.

When welding with AC, the high frequency must be left on continuously. Leave the remote switch in the forward position until the weld is complete, then return the remote switch to the rear position. The high frequency will shut off and the arc will be extinguished. The postflow timer will maintain the flow of gas and water for the pre-set time.

When welding with DC continuous high frequency is not required. As soon as the arc is established, slide the remote switch back to the center position and continue welding. In this position, gas and water continue to flow even though the high frequency is off. When the weld is complete, break the arc by removing the TIG Torch from the work and slide the remote switch to the rear position. The post-flow timer will maintain the flow of gas and water for the pre-set time.

If gas pre-flow is required, hold the remote switch in the center position for the desired pre-flow time before moving it to the forward position to turn on the high frequency.

The high frequency may be stopped or restarted at any time during welding by operating the remote switch.

CAUTION

ALWAYS RETURN THE REMOTE SWITCH TO THE REAR (OFF) POSITION AFTER WELDING TO PREVENT LOSS OF GAS AND WATER.

TROUBLE SHOOTING

TROUBLE

PROBABLE CAUSE

- | | |
|--|---|
| 1. No gas or water flow and no high frequency. | 1. Remote cable not plugged in or defective.
2. Remote Switch defective.
3. No primary input power. |
| 2. High frequency but no gas or water. | 1. Defective remote cable.
2. Defective remote switch.
3. Defective relay.
4. Defective timer.
5. Defective solenoids.
6. Water or gas flow not turned on. |
| 3. Gas and water but no high frequency. | 1. Defective remote cable.
2. Defective remote switch.
3. High Frequency Arc Stabilizer not plugged in or defective. |

(See Stabilizer Instruction Manual.)

PARTS LIST

ITEM	DIA MKG.	DESCRIPTION	PART NO
1	SI	Line Switch	24R220
2		Pilot Light	115 Volt Model 11R2189 230 Volt Model 11R2198
3		Solenoid Valve	115 Volt Model 22R1836 230 Volt Model 22R1835
4		Gas Connector	22R1818
5		Water Connector	22R1817
6		Stabilizer Receptacle	115 Volt Model 9R1632 230 Volt Model 9R1663
7	TI	Transformer	115 Volt Model 27R2279 230 Volt Model 27R2245
8	TD	Time Delay Relay	18R1869
9	RI	Potentiometer	19R1783
10	K1, K2	Relay	18R1600
11		Input Cord	115 Volt Model 29R1102 230 Volt Model 29G2096
12		Case	3G2236
13		Case Top	3G2226-1
14		Rubber Feet	3R2197
15		Spare Plug for	230 Volt Model 9R1662

PARTS LIST CONT.

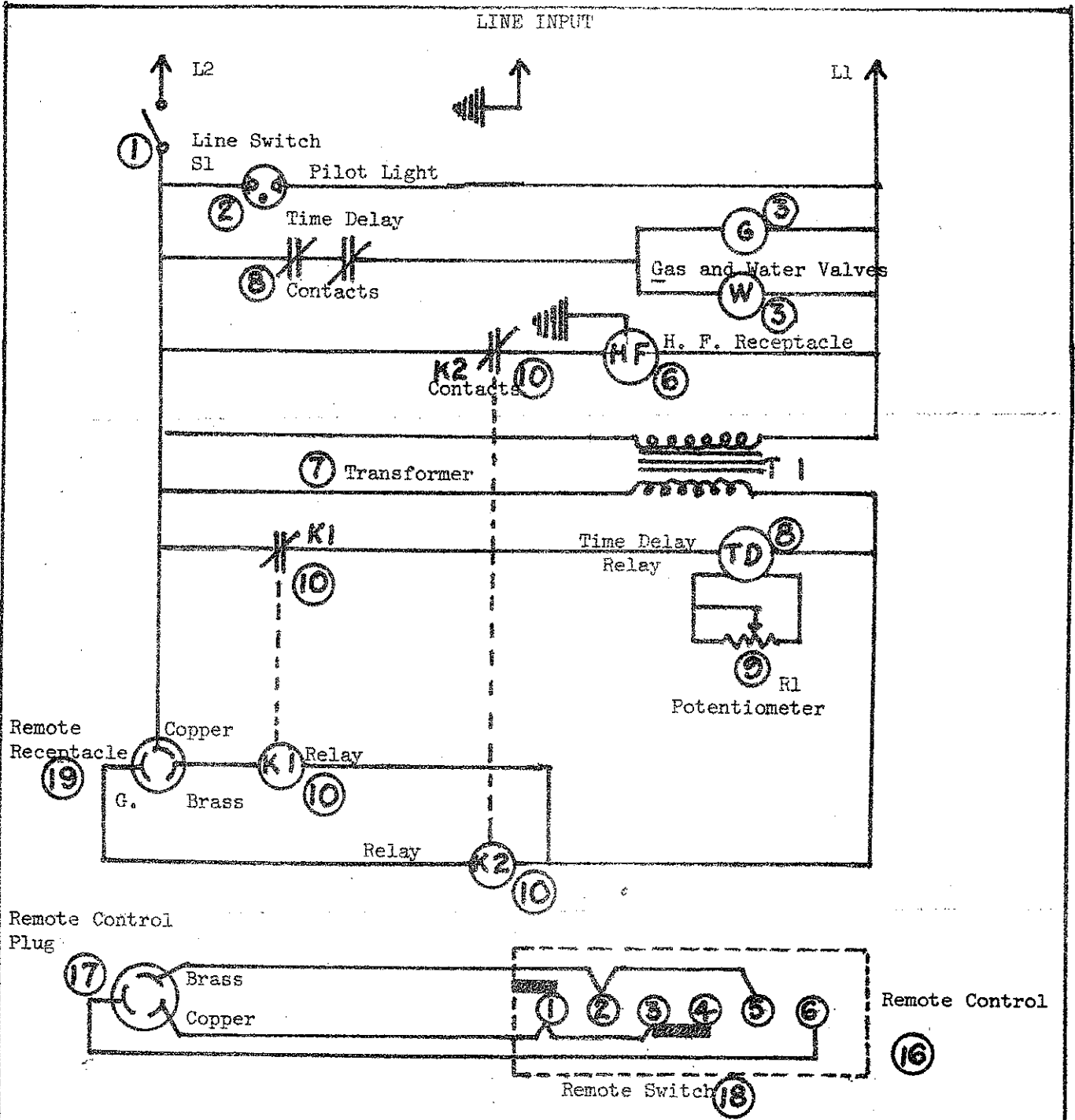
ITEM	DIA MKG.	DESCRIPTION	PART NO
16		Remote Control Cable Assembly Complete	29G2025
17		Remote Control Plug	9R1633
18		Remote Control Switch	24R1993
19		Remote Control Receptacle	9R1631

G U A R A N T E E

The manufacturer guarantees to the original purchaser that this equipment has been thoroughly checked and tested before shipment and is free of mechanical and electrical defects.

Should defects due to faulty material or workmanship develop within one year from date of sale, the equipment will be repaired and put in workable condition free of charge, providing it is returned to our factory, or authorized service station, TRANSPORTATION PREPAID, after issuance of return goods tags have been made by the factory, or authorized service station, authorizing such a return.

This guarantee does not cover helmet, cables, plugs, receptacles, switches, electrode holder or ground clamp, nor is it valid if the items has been misused, abused, or tampered with.



SCHEMATIC: Gas and Water Control and Remote Switch

Switch Position	Function
3-4 (AS Shown)	Off
1-2 and 4-5	Gas and Water
2-3 and 5-6	Gas and Water High Frequency

SECTION III

GENERAL OPERATING INSTRUCTIONS AND INFORMATION

TUNGSTEN-INERT GAS WELDING
AND
GENERAL OPERATING INSTRUCTIONS

GENERAL

Tungsten-inert gas welding, commonly referred to as the TIG process is ideal for welding aluminum, especially thin sheet and plate, and some other non-ferrous metals.

The process makes use of a non-consumable tungsten electrode which is used to produce the arc and to heat the base metal. In most cases the welding is done with a filler rod which is inserted in the molten pool created by the arc. Inert gas is used in the welding to shield the molten metal from oxidation. Usually this gas is argon, or helium or a mixture of both. Argon is generally preferred. It eliminates the need for welding flux, and because it is transparent, the operator can see the bead and fusion zone at all times and thus produce a neater, sounder weld.

Because the TIG process is so highly popular for welding aluminum, there are some considerations about the metal that should be covered here.

Weldable commercial aluminum alloys start to melt at 1050°F. Pure aluminum melts at 1220°F. Steel melts at about 2800°F. Copper melts at about 1980°F. In all these metals except aluminum it is possible to detect the melting point by appearances. Not so with aluminum, except with the TIG process. While using TIG, aluminum will develop a glossy, liquid pool or spot under the arc when it is approaching the melting point or has reached the temperature for welding.

There are two types of aluminum alloys:

1. The work hardenable alloys such as EC (Electrical Conductor grade), 1100, 3003, 5052, 5083, and 5086.
2. The heat treatable alloys such as 6061, 6062, and 6063.

The 2000 and the 7000 series are also heat-treatable aluminum alloys but they are not normally recommended for arc welding.

Aluminum alloys will lose individual characteristics of strength and hardness when reheated to high temperatures. Above 900°F the aluminum will revert to the annealed state. Most welding is done above 1050°F so it is easy to see the change that will take place under these conditions.

These considerations are not intended to discourage the repair of aluminum but to provide basic information for those in the business of fabricating new articles of aluminum.

For those engaged in repairing aluminum articles most of the above technical data can be ignored because the measures taken to repair the part will change appearance, shape, or function to some degree anyway.

Oxides quickly form on aluminum. They melt at considerably higher temperatures than do the alloys or pure aluminum. A skin of aluminum oxide gives the appearance that the base metal is under the welding temperature while actually such is not the case. When trying to weld through these oxides without first removing them, a collapse of the base metal usually occurs.

Aluminum oxides should be removed before the welding begins. This can be done by using a clean stainless steel wire brush. Cleaning with alcohol or acetone is highly recommended. Any oil or dirt on the base metal near the fusion zone will cause unsound welds (porosity caused by gas, dross inclusions, skips, etc.). Cleanliness in joint preparation and welding procedures is important.

Moisture on the tungsten electrode, in the gas line, or along the edges of the base metal can release hydrogen that could be trapped in the weld causing porosity which in turn could impair its strength and ductility. An inspection of base metal parts and welding equipment before the welding starts can prevent this.

The thermal expansion of aluminum is about twice that of steel, so speed of welding is important in controlling the possible distortion. Root openings on butt joints can be closed quite quickly by too much heat and/or too slow a welding process.

Large pieces or shapes of aluminum to be welded should be well tacked and the tack welds should be close together. Mechanical clamps or devices should not be used to hold the base metal parts too securely as the contraction forces could crack the weld.

Sometimes preheating is advisable, especially if the base parts are of such mass or size as to conduct the heat away too fast from the fusion zone. It also helps in preventing distortion and speeds up the welding time.

Joint design is quite simple. On base parts 1/16" to 3/16" thick, a square butt joint is satisfactory. For thicker metals, a single or double vee joint is preferred. Root openings are determined by the thickness of the base metal. Allowances for expansion of base metal in the joint should be made to prevent distortion, and to provide for complete penetration.

FUNDAMENTALS

Alternating (AC) current is recommended for TIG welding of aluminum. This kind of current is produced by your Welder and transmitted through the High Frequency Unit.

To get a better understanding of the advantages of the alternating current in this case it is well to consider the effects of direct current using straight and reverse polarity.

In direct current straight polarity the electrode is negative and the work is positive so that the electrons (current) flow from the electrode to the work. In direct current reverse polarity the electrons (current) flow from the work to the electrode.

The use of direct current straight polarity causes considerable heating of the work, while the electrode stays relatively cool. Direct current reverse polarity is just the opposite in which the electrode receives the heat from the electron transfer, and is frequently overheated at low current settings. Reverse polarity thus causes tungsten burn-off and contamination of the weld.

Alternating current has the decided advantage because theoretically it is a combination of the two types of polarity in direct current.

The term "alternating" describes the changing of direction of the flow of the current. For one half the time (cycles) the current is straight polarity, and for the other half it is reverse polarity.

EQUIPMENT AND SUPPLIES

In addition to the Welder which supplies the power for the High Frequency Unit, a water supply with a regular garden hose with sufficient length to reach the welding area will be necessary. A drain for the water outlet will be necessary. In field work, where water must be conserved, a tank with pump can be used to recirculate the water. Its capacity should be great enough to allow for cooling of the water used and, of course, this would be in proportion to the amount of welding done at any one time.

OPERATION OF EQUIPMENT

The High Frequency Unit and the Gas and Water Control should be located near the operator in the welding area, and as close to the Welder as required.

The High Frequency Unit and Gas and Water Control is provided with a 115 volt power cord, which activates the high frequency unit and the gas-water control. This power cord is to be plugged into a regular 115 volt wall outlet.

The selection of amperage and thus the hook-up to the Welder is dependent on the metal thickness and electrode diameter. See Table 2, page 5.

The maximum gas pressure on this hose and torch is 25 pounds. (Regulators supplied by Forney are preset for this pressure.) See instructions on operation of regulator.

The water, circulating through the torch head, keeps the torch from overheating. It is therefore important to keep the small openings in the torch head from becoming plugged by small particles of dirt brought in by the water supply. A screen is placed in the water line. It should be inspected and cleaned frequently. If the water hose is ever disconnected the opening should be kept clean and free of dirt. The recommended water pressure on this hose and torch is 18 pounds. If the water pressure is not known, the water tap can be turned on easily until water is exhausted through the drain hose in a fast drip or small stream.

An electrode of the proper diameter (as selected from the Chart on page 5) with the proper size chuck can be inserted in torch head. The length of the electrode protruding beyond the end of the nozzle should be approximately 1/8".

The Gas and Water Control can be supplied with either hand or foot operated switches for remote control of gas and/or high frequency.

The gas flowmeter is one of the finest quality and should be attached to the tank by means of the standard fittings which is wrench tightened. Be sure the correct orifice is installed in regulator. Because this regulator is supplied with several orifices, there is no pressure valve handle on the regulator itself. Attach the gas hose to the fitting at the bottom of the flowmeter and wrench tighten.

When the welding is to be stopped for any length of time, close gas tank valve.

OPERATION CHECK LIST

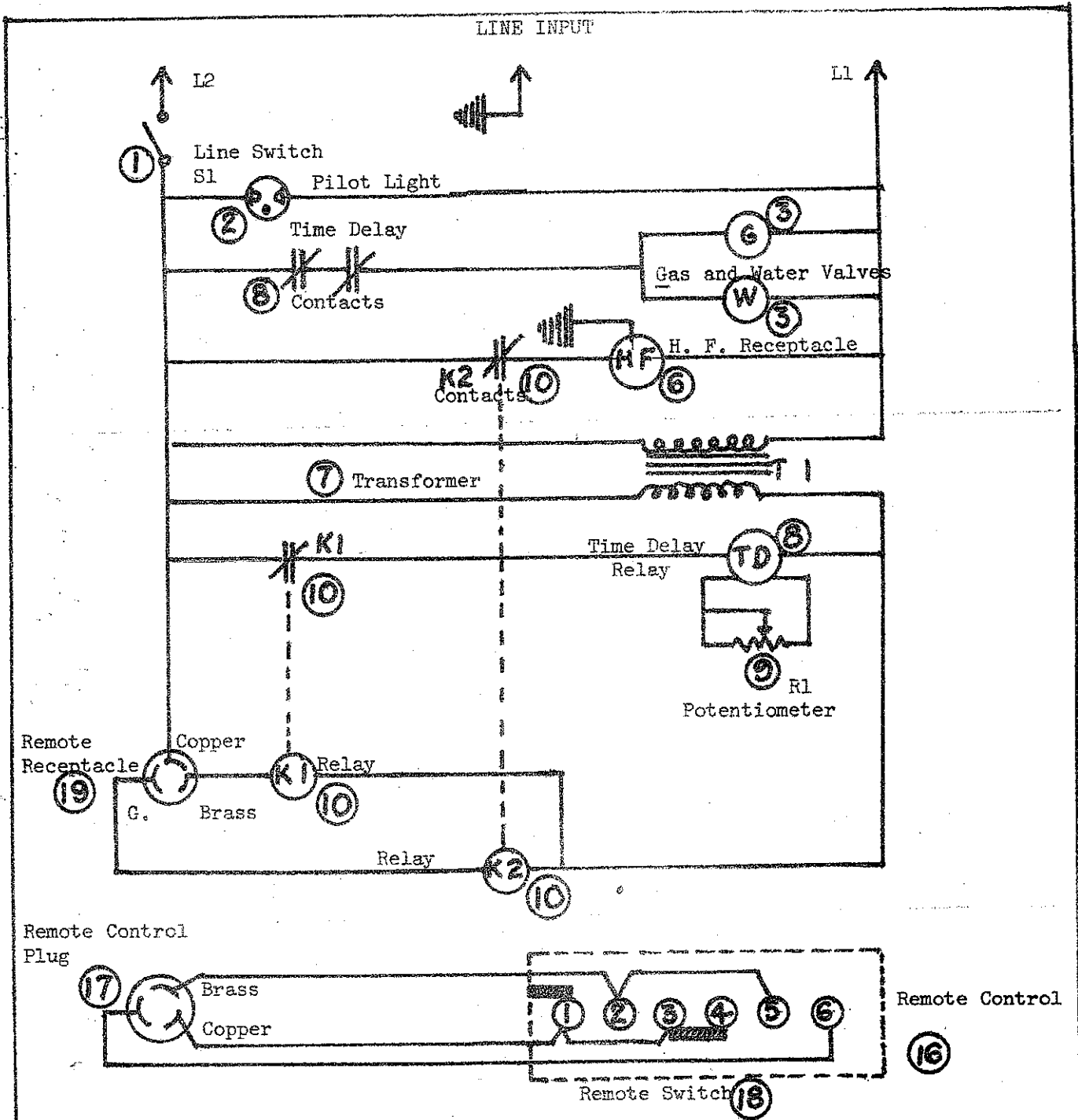
1. Connect the High Frequency Unit/Gas-Water Control to Welder for power as well as amperage setting.
2. Connect the torch cable and switch wires.
3. Connect and check Water-in supply.
Recommend 18 psi water flow.
4. Connect Inert Gas Line.
 - A. Check for gas leak by blocking end of torch and use soapy water on all connections.
 - B. Check gas line for condensation. Blow line out thoroughly. Moisture in gas line causes black pitted welds and porosity. Torch reaction is a violent sputtering.
5. Material to be welded must be clean, especially free from oil.
6. Select proper tungsten electrode and nozzle size for type of work being welded. (See Chart, page 5)
7. Use either pure or thoriated tungsten electrodes in your Torch.
 - A. Tungsten that is too small for the amount of amperage will disintegrate.
 - B. Tungsten that is too large for the amount of amperage will cause a wavering arc.
 - C. Tungsten off center will cause a wavering arc. Check for bent tungsten electrode.
 - D. Touching tungsten electrode with filler rod will contaminate the electrode and cause oxidation and black welds.
 - E. Tungsten protruding too far beyond the tip of nozzle will cause discoloration and porosity of weld.
 - F. Tungsten not protruding far enough beyond tip of nozzle will result in short nozzle life, due to the reflected heat or touching the weld puddle.
 - G. Recommend tungsten electrode on AC welding protrude approximately 1/8" beyond nozzle end.

8. Inert gas shield.

- A. Improper nozzle size will give poor shielding and result in black welds.
- B. Wind drafts cause a break in the gas shield and result in oxidation, i.e. black welds.
- C. Magnetic attraction will also cause a wavering arc.

9. Secure gas tank.

- A. Chain it to post if possible, so it will not fall.
- B. Never force connections which do not fit.
- C. Do Not drop or abuse cylinder.
- D. Protect hose from oil and grease. Prevent kinking. Do not leave in way of someone to trip over.
- E. Never strike an arc on cylinder.
- F. If regulator connection suspected of leaking, test only with soapy water.
- G. Do Not force tank valve with wrench. Hand tighten or loosen only.



SCHMATIC: Gas and Water Control and Remote Switch

Switch Position	Function
3-4 (AS Shown)	Off
1-2 and 4-5	Gas and Water
2-3 and 5-6	Gas and Water High Frequency

SET THE PACE IN WELDING

with this

AC • AC-DC INERT ARC WELDER

A complete and self-contained welder that can be operated manually, automatically or remotely. This series of welders is designed for use in both inert gas shielded tungsten arc welding and coated electrode metallic arc welding. Maximum versatility of usage is gained by the simple electrical control to provide current output, timing functions and built-in automatic protection supervision. They are built in accordance with NEMA standards and are made of the highest quality material and equipped with the latest design components available. There is little or no maintenance required as a result of the patented transformer design which eliminates moving parts. Many additional optional features and accessories go with the basic unit to gain the optimum in welding.

All Models are equipped with built-in power factor correction, for lower primary line draw and economical operation. These welders are rated for industrial duty cycles in accordance with NEMA specification. Exclusive innovations provide rapid and effortless dialing of heat selection and genuine versatility of application. Compact machines that offer welding efficiency never before provided in electrical welding equipment. Welding process changeover adjustment, is also rapid and simple—by selection of the proper switch positions.

WELDING PROCESSES

- Metallic Arc
- Tungsten Inert Gas
- Automatic Arc
- Inert Gas Spot
- Sigma

MATERIALS

- Copper
- Aluminum
- Magnesium
- Alloy Steels
- Stainless Steel



The machines have adjustable timing devices that plug-in like radio tubes, giving a variety and different combinations to handle the widest range of welding tasks. A real time saver in production welding.

Ease of maintenance was a major factor for consideration in the case design of these units. A rugged steel cabinet assures successful operation in all weather conditions. Baked-on enamel cabinet finish assures lasting beauty and case longevity. All controlling switches, dials, and connections are clearly marked with a long lasting silk screen process. Every component that could ever require attention has been located for easy accessibility. The entire high frequency and control assembly is mounted on a removable drawer type plug-in chassis. There are two lifting eyes mounted on each side of the case halfway between the front and the rear. The front panel of the case is recessed and all controls and switches are behind the clearance of the front part of the case, giving additional protection.

POST-FLOW TIMER

This timer continues the flow of shielding gas and water **after** the welding arc is broken in order to provide protection to the hot tungsten electrode and TIG torch. This timer is adjusted from 1-30 seconds, depending upon the size of the electrode, the current used and the time required for the tungsten electrode to cool down without oxidizing. The post-flow function should always be used when TIG welding. When stick electrode welding, this function is not needed and can be deactivated by placing the gas-water switch on the "Off" position without disturbing the setting on the timer. Hi-frequency adjustment is on the front panel.

PRE-FLOW TIMER

This timer provides a shielding arc gas purge of the gas lines and work area **before** the arc is struck. When this timer is used, there is a delay of 1 to 30 seconds after the start switch is activated, during which time gas and water flow. At the end of the time delay, Hi-Frequency starts (if used), the arc is struck and main welding power flows. By setting this timer on "zero" (or if no timer is furnished) this time delay in starting will be minimized.

THE HI-FREQUENCY DROP-OUT TIMER

This timer is used most often in the DC TIG welding and stick electrode applications. It is designed to shut off the Hi-Frequency oscillator at a pre-set time (1-30 seconds) after the arc is stabilized. In AC TIG welding, the Hi-Frequency stabilizer must operate **continuously** in order to maintain the arc and the drop-out timer then is NOT used. The Hi-Frequency drop-out switch should be set on "continuous". (Instantaneous Hi-Frequency drop-out timer is provided as standard with the machine even though no timer is used. A dummy plug must be in position in the socket and the Hi-Frequency drop-out switch inside must be set on "Start-only" in order to obtain this function.)

HI-FREQUENCY SPARK GAP

The tungsten spark gaps are factory set at .008 and this assembly is mounted on the righthand side behind the upper front door panel. The spark gap can be adjusted by screwing the contacts in or out and have a range of .003 to .012. The Hi-Frequency intensity selector increases or decreases the amount of spark jump. The distance the spark jumps will increase as the tungsten becomes heated and will vary with the cable length, base metal, etc.

CONTACTOR

AC/DC units are equipped with hermetically sealed silicon diode rectifier cells. They give superior welding performance on DC applications due to their high efficiency and non-aging characteristics. They require no maintenance.

START SWITCH

When the switch is set for soft start, the welding begins at approximately half of the welding current. Then after a delay of about 2 seconds, the current increases to the normal value. This feature minimizes the possibility of tungsten erosion and inclusions created by high starting currents. When the switch is set for standard start, the welding begins at the normal current level immediately. (The soft start isn't used when a remote foot switch is being used.)

GAS-WATER CONNECTIONS

These connections are easily accessible on the front part of the lower side panel. The brass fittings are clearly marked. The water inlet fitting is a 5/8 - 18 LH female fitting. The gas inlet to torch is a 5/8 - 18 RH female fitting in accordance with International Acetylene Association Standards. The entire valve panel can be removed for ease of servicing and are immediately behind this panel. Electrical connections unplug readily.

PRIMARY POWER CONNECTIONS

Standard models are provided with a triple voltage primary for operation on 208, 230, or 460 volt AC power lines. For safety, all welders leave the factory connected for 460 volts. Should reconnection of the machine for 208, or 230 volts be required, rear door access panel readily exposes the primary terminal. Simply rearrange the copper voltage change bars as pointed out in the Operating Instructions, or via the diagram attached to the inside of the panel door. Fuses should be selected in sizes of approximately 1½ to 2 times the rated primary ampere. These units will operate from a single phase power line, or from any one phase of a three phase power line. Any three combinations of optional voltages may be received through special order.

SECONDARY POWER CONNECTIONS

The terminal studs are located behind the bottom front panel door. The lug of the TIG torch power lead bolts to the stude marked "electrode" and the lug of the ground clamp cable is bolted to the stud marked "ground". For metallic arc welding, replace the TIG torch power lead with a stick electrode cable and holder lead to the stud marked "electrode".

When a water recirculating pump system is used, the incoming water hose and torch water hose is connected directly to the recirculator.

A water-flow safety switch (torch saver) can easily be connected to this machine by connecting this switch in the contactor circuit. A bolted connection of two black wires is located behind the gas-water panel.

