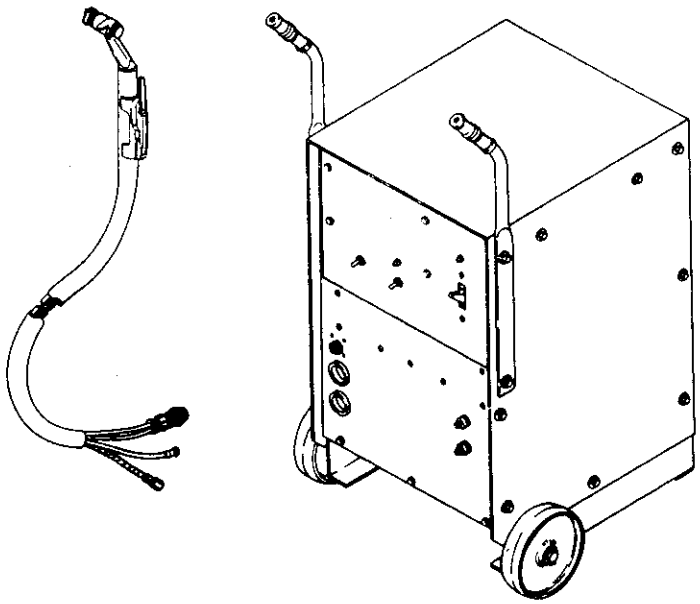
March 1985 FORM: OM-284C

Effective With Serial No. JF858383

WARNING: Read and understand the entire contents of this manual before installing, operating, or maintaining this equipment.

MODEL
ZIP CUT™



OWNER'S MANUAL

MILLER ELECTRIC MFG. CO.
718 S. BOUNDS ST, P.O. Box 1079
APPLETON, WI 54912 USA

NWSA CODE NO. 4679
PRINTED IN U.S.A.

LIMITED WARRANTY

EFFECTIVE: JUNE 1, 1979

This warranty supersedes all previous MILLER warranties and is exclusive with no other guarantees or warranties expressed or implied.

LIMITED WARRANTY - Subject to the terms and conditions hereof, Miller Electric Mfg. Co., Appleton, Wisconsin warrants to its Distributor/Dealer that all new and unused Equipment furnished by Miller is free from defect in workmanship and material as of the time and place of delivery by Miller. No warranty is made by Miller with respect to engines, trade accessories or other items manufactured by others. Such engines, trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any. All engines are warranted by their manufacturer for one year from date of original purchase.

Except as specified below, Miller's warranty does not apply to components having normal useful life of less than one (1) year, such as spot welder tips, relay and contactor points, MILLERMATIC parts that come in contact with the welding wire including nozzles and nozzle insulators where failure does not result from defect in workmanship or material.

Miller shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources and components	1 year
2. Original main power rectifiers (labor - 1 year only)	3 years
3. All welding guns and feeder guns	90 days
4. All other Millermatic Feeders	1 year
5. Replacement or repair parts, exclusive of labor	60 days
6. Batteries	6 months

provided that Miller is notified in writing within thirty (30) days of the date of such failure.

As a matter of general policy only, Miller may honor claims submitted by the original user within the foregoing periods.

In the case of Miller's breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be, at Miller's option (1) repair or (2) replacement or, where authorized in writing by Miller in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized Miller service station or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at Customer's risk and expense. Upon receipt of notice of apparent defect or failure, Miller shall instruct the claimant on the warranty claim procedures to be followed.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.

EXCEPT AS EXPRESSLY PROVIDED BY MILLER IN WRITING, MILLER PRODUCTS ARE INTENDED FOR ULTIMATE PURCHASE BY COMMERCIAL INDUSTRIAL USERS AND FOR OPERATION BY PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT AND *NOT* FOR CONSUMERS OR CONSUMER USE. MILLER' WARRANTIES DO NOT EXTEND TO, AND NO RESELLER IS AUTHORIZED TO EXTEND MILLER'S WARRANTIES TO, ANY CONSUMER.

CERTIFICATE

NAME OF EQUIPMENT:_____ MODEL NO._____

SERIAL NO._____ DATE_____

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.

Date Installed_____ Signed_____

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SECTION 1 - SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE

1-1. INTRODUCTION - We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

Safe practices developed from experience in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used or maintained. The reason for the safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1 - General Precautions, common to arc welding and cutting; and 2 - Arc Welding (and Cutting) (only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

1-2. GENERAL PRECAUTIONS

Different arc welding processes, electrode alloys, and fluxes can produce different fumes, gases, and radiation levels. In addition to the information in this manual, be sure to consult flux and electrode manufacturers for specific technical data and precautionary measures concerning their material.

A. Burn Prevention

Wear protective clothing - gauntlet gloves designed for use in welding, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles or glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a MUST for welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

B. Toxic Fume Prevention

Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed 1 in Standards index. NEVER ventilate with oxygen.

Lead -, cadmium -, zinc -, mercury -, and beryllium - bearing and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated, or the operator wears an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidently opened or left open. Check to be sure that the space is safe before re-entering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a

highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

C. Fire and Explosion Prevention

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

a. appreciable combustibles (including building construction) are within 35 feet
b. appreciable combustibles are further than 35 feet but can be ignited by sparks
c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 3 in Standards index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see paragraph above). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

D. Compressed Gas Equipment

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, PRECAUTIONS FOR SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 6 in Standards index.

1. Pressure Regulators

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks - if gas leaks externally.
Excessive Creep - if delivery pressure continues to rise with downstream valve closed.
Faulty Gauge - if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

2. Cylinders

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be struck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

Protect cylinders particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

Prohibited use. Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT use tape.

4. Proper Connections

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking agree, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

5. Pressurizing Steps:

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly there-after. Brush with soap solution (capful of Ivory

Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

1-3. ARC WELDING - Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

A. Burn Protection

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. DON'T GET BURNED; COMPLY WITH PRECAUTIONS.

1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outergarments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

2. Eye and Head Protection

Protect eyes from exposure to arc. NEVER look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

*Trademark of Proctor & Gamble.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should NOT be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced IMMEDIATELY. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields MUST be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

B. Toxic Fume Prevention

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture later under rough handling.

D. Compressed Gas Equipment

Comply with precautions in 1-2D.

E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH a wet surface when welding, without suitable protection.

To protect against shock:

Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part - or grounded metal - reduces the body surface electrical resistance, enabling dangerous and possibly lethal currents to flow through the body.

1. Grounding the Equipment

When arc welding equipment is grounded according to the National Electrical Code, and the work is grounded according to ANSI Z49.1 "Safety In Welding And Cutting," a voltage may exist between the electrode and any conducting object. Examples of conducting objects include, but are not limited to, buildings, electrical tools, work benches, welding power source cases, workpieces, etc. **Never touch the electrode and any metal object unless the welding power source is off.**

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made electrically HOT by stray current may shock, possibly fatally. Do NOT GROUND to electrical conduit, or to a pipe carrying ANY gas or a flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirements of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. Do NOT connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT - a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken off ground prong.

2. Electrode Holders

Fully insulated electrode holders should be used. Do NOT use holders with protruding screws.

3. Connectors

Fully insulated lock-type connectors should be used to join welding cable lengths.

4. Cables

Frequently inspect cables for wear, cracks and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly - lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

5. Terminals And Other Exposed Parts

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

6. Electrode

a. Equipment with output on/off control (contactor)

Welding power sources for use with the gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and similar processes normally are equipped with devices that permit on-off control of the welding power output. When so equipped the electrode wire becomes electrically HOT when the power source switch is ON and the welding gun switch is closed. Never touch the electrode wire or any conducting object in contact with the electrode circuit unless the welding power source is off.

b. Equipment without output on/off control (no contactor)

Welding power sources used with shielded metal arc welding (SMAW) and similar processes may not be equipped with welding power output on-off control devices. With such equipment the electrode is electrically HOT when the power switch is turned ON. Never touch the electrode unless the welding power source is off.

7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock

or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing.

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

F. Protection For Wearers Of Electronic Life Support Devices (Pacemakers)

Magnetic fields from high currents can affect pacemaker operation. Persons wearing electronic life support equipment (pacemaker) should consult with their doctor before going near arc welding, gouging, or spot welding operations.

1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 550 Le Jeune Rd, P.O. Box 351040, Miami, FL 33135.

2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the U.S. Government Printing Office, Washington, D.C. 20402.

4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES obtainable from the American Welding Society, 550 Le Jeune Rd. P.O. Box 351040, Miami FL 33135.

8. NFPA Standard 51, OXYGEN - FUEL GAS SYSTEMS FOR WELDING AND CUTTING obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

9. NFPA Standard 70-1978, NATIONAL ELECTRICAL CODE obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS obtainable from the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.

12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.

14. American Welding Society Standard AWSF4.1 "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", obtainable from the American Welding Society, 550 Le Jeune Rd. P.O. Box 351040, Miami, FL 33135.

15. ANSI Standard Z88.2 "Practice for Respiratory Protection" obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

ZIP UT	Rated Output Amperes/ Duty Cycle	Maximum Open-Circuit Voltage	Amperes Input At Rated Load Output 50 or 60 Hz Single-Phase 200V	220V	230V	380V	460V	575V	KVA	KW	Electrode Type/Duration	Plasma/ Secondary Gas Air	Dimension	Weight Net*	Ship
Low Range	20 amperes @ 100 volts 100% duty cycle	270	34	31	30	18	15	12	6.9	4.4	zirconium long cutting cycle 10 hrs. short cutting cycle 2 hrs.	3.5 CFM (98.5 L/min.) @ 75 PSI (503 kPa)	Height 28 in. (711 mm) w/handles 38 in. (965 mm) Width 15 in. (381 mm) Depth 17-1/4 in. (438 mm)	195 lbs. (88 kg)	235 lbs. (107 kg)
High Range	40 amperes @ 143 volts 40% duty cycle		60	54	52	31	26	21	12	6.9					

*Power Source Only

Figure 2 - 1. Specifications

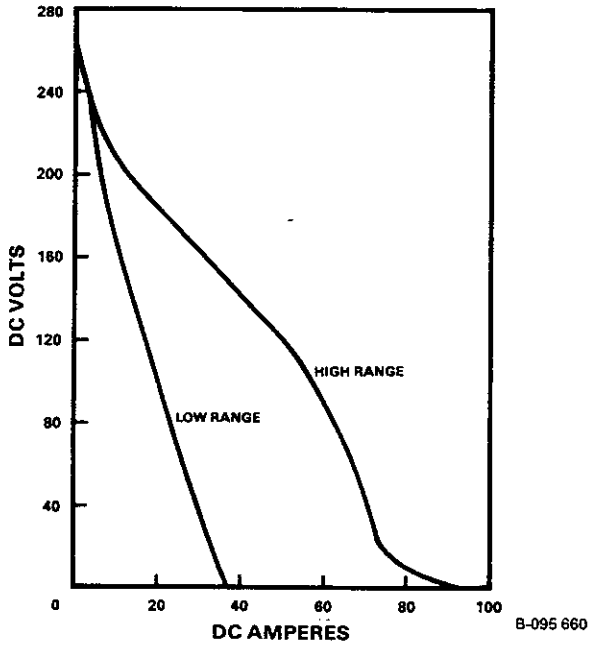


Figure 2 - 2. Volt-Ampere Curve

Metal	Thickness	Approx. Torch Speed (IPM)	Output Range	Torch Standoff
Mild Steel	28 ga - 16 ga	175	Low	Contact
	11 ga - 3/16	65	High	1/16
	1/4	35		
	3/8	20		
Stainless Steel	22 ga	130	Low	Contact
	16 ga	150	High	1/16
	10 ga - 3/16	50		
	1/4	30		
	3/8	10		
Aluminum	.040	190	Low	Contact
	1/16	250	High	1/16
	.100	120		
	1/4	40		
	3/8	20		

Ref: TC-095 028

Figure 2 - 3. Recommended Plasma-Arc Cutting Parameters

2 - 1. VOLT-AMPERE CURVES (Figure 2-2) - The Volt-Ampere curves show the output voltage and current of the power source available in either the HI or LOW range.

With the use of the Volt-Ampere curves, it is possible to determine what the current will be at a particular voltage. The Volt-Ampere curves show the minimum and maximum curves of each current range.

2 - 2. RECOMMENDED PLASMA-ARC CUTTING PARAMETERS (Figure 2-3) - The Recommended Plasma-Arc Cutting Parameters chart shows the recommended travel speed, range selection, and torch standoff for various metals of various thicknesses.

2 - 3. DUTY CYCLE - This power source is rated at 40 percent duty cycle when operated in the HIGH range. The duty cycle is the percentage of a ten minute period that the unit can be operated at a given output without causing overheating and damage to the unit. Since this unit is rated at 40% duty cycle when operated in the HIGH range, it can be operated at rated load for four minutes out of ten. During the remaining six minutes, the unit should sit idle to permit proper cooling. When operated in the LOW range, this power source is rated at 100 percent duty cycle. This means that the power source can be operated at rated load continuously.

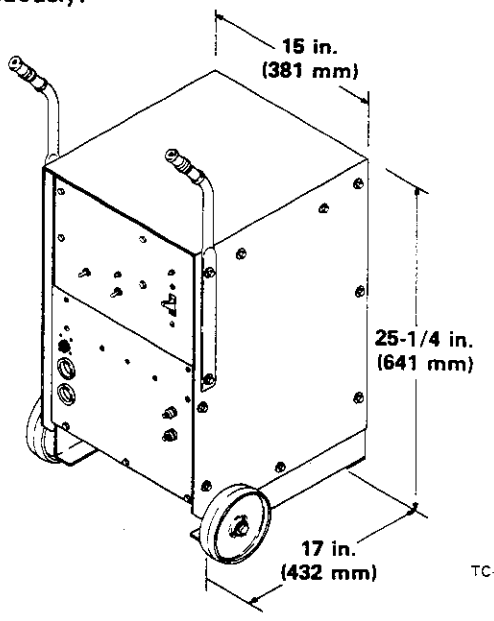


Figure 2 - 4. Dimensional Drawing

2 - 4. GENERAL INFORMATION AND SAFETY

A. General

Information presented in this manual and on various labels, tags, and plates provided on this unit pertains to equipment design, installation, operation, maintenance and troubleshooting which should be read, understood and followed for the safe and effective use of this equipment.

B. Safety

The installation, operation, maintenance, and troubleshooting of this equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated and maintained only by qualified persons in accordance with this manual and all applicable codes such as, but not limited to, those listed at the end of Section 1 - Safety Rules For Operation Of Arc Welding Power Source.

Safety instructions specifically pertaining to this unit appear throughout this manual highlighted by the signal words **WARNING** and **CAUTION** which identify different levels of hazard.

WARNING statements include installation, operating, and maintenance procedures or practices which if not carefully followed could result in serious personal injury or loss of life.

CAUTION statements include installation, operating and maintenance procedures or practices which if not carefully followed could result in minor personal injury or damage to this equipment.

A third signal word, **IMPORTANT**, highlights instructions which need special emphasis to obtain the most efficient operation of this equipment.

2 - 5. RECEIVING-HANDLING - Prior to installing this equipment, clean all packing material from around the unit and carefully inspect for any damage that may have occurred during shipment. Any claims for loss or damage that may have occurred in transit must be filed **by the purchaser with the carrier.** A copy of the bill of lading will be furnished by the manufacturer on request if occasion to file claim arises.

When requesting information concerning this equipment, it is essential that Model Description and Serial (or Style) Number of the equipment be supplied.

2 - 6. DESCRIPTION - This unit is a direct current, straight polarity power source designed for use with clean, dry compressed air as a cutting agent. It will cut metals up to 3/8 in. (9.5 mm) thickness using the plasma arc cutting process.

Plasma is air which has been heated to an extremely high temperature and ionized so that the air becomes electrically conductive. The tip of the electrode is located within the nozzle of the torch. The torch nozzle has a small opening (orifice) which constricts the arc. The compressed air flows through the arc where it is heated to the plasma temperature range. Since the air cannot expand due to the constriction of the nozzle, it is forced through the orifice and emerges in the form of a highly compressed air stream. The heat formed by the arc and the plasma melts the metal, and the air stream forces the molten metal from the cut.

SECTION 3 - INSTALLATION

IMPORTANT: *Read entire Section 7 regarding high-frequency equipment location and installation requirements.*

3 - 1. INSTALLATION OF HANDLE AND RUNNING GEAR

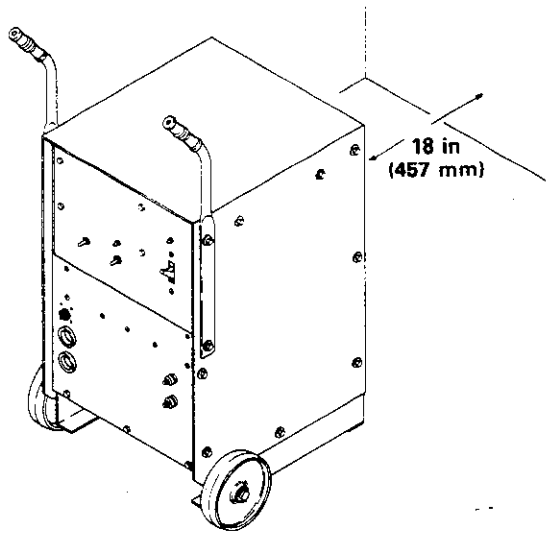
CAUTION: UNCONTROLLED TILTING OR TIPPING of unit can result in personal injury or equipment damage.

- *Use equipment of adequate capacity to lift the unit.*
- *If using lift forks to handle this unit, be sure the lift forks are long enough to extend out of the opposite side of the base.*
- *Do not place any part of the body under the unit while it is suspended.*

Place blocks under frame of unit before attaching running gear.

1. Block unit securly in middle to ease installation of front wheels and rear support bracket.

2. Install rear support bracket using 1/4-20 screws, flat washers and nuts provided.



TC-096 135-B

Figure 3 - 1. Location

3. Slide axle through holes provided in front sides of base.

4. Install two 1/2 in. (12.7 mm) flat washers to each end of axle.

5. Install wheels and 1/2 in. (12.7 mm) flat washers for outside wheel hub onto axle and secure in place with cotter pins. Install cotter pins by bending both legs around axle in one direction or by bending one leg clockwise and the other leg counterclockwise. Legs of cotter pins should conform to contour of axle as tightly as possible.

6. Install handles to power source using 1/4-20 self-tapping screws provided.

3 - 2. LOCATION (Figure 3-1) - A proper installation site should be selected for the power source if the unit is to provide dependable service and remain relatively maintenance free.

A proper installation site permits freedom of air movement into and out of the power source, and also least subjects the units to dust, dirt, moisture, and corrosive vapors. A minimum of 18 inches (457 mm) of unrestricted space must be maintained between the power source front and rear panels and the nearest obstruction. Also, the underside of the power source must be kept completely free of obstructions. The installation site should also permit easy removal of the power source outer enclosure for maintenance functions.

CAUTION: RESTRICTED AIR FLOW causes overheating and possible damage to internal parts.

- *Maintain at least 18 inches (457 mm) of unrestricted space on all sides of unit and keep underside free of obstruction.*
- *Do not place any filtering device over the intake air passages.*

Warranty is void if any type of filtering device is used.

CAUTION: IMPROPER LIFTING EQUIPMENT can result in personal injury and equipment damage.

- *Use equipment of adequate capacity to lift the unit.*
- *If using lift forks to handle this unit, be sure the lift forks are long enough to extend out of the opposite side of the base.*

Using lift forks too short will expose internal components to damage should the tips of the lift forks penetrate the bottom of the unit.

3 - 3. ELECTRICAL INPUT CONNECTIONS

IMPORTANT: *Read and comply with entire Section 7 regarding high-frequency equipment location and installation requirements before making electrical input connections.*

A. Electrical Input Requirements

This power source is designed to be operated from single-phase, 60 Hertz, ac input power which has a voltage rating that corresponds with one of the electrical input voltages shown on the nameplate. Consult the local electric utility if there is any question about the type of electrical system available at the installation site or how proper connections to the power source are to be made.

B. Reconnection For Operation From Lower Input Voltage (Figure 3-2)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down power source and disconnect line power employing "lockout/tagging procedures" before making reconnection.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

INCORRECT INPUT VOLTAGE CHANGEOVER can damage unit.

- *Do not use 230 volts fan motor lead as a primary voltage input conductor on 460/575 volts power sources.*

Several different power sources are manufactured for operation from different input voltages. Power sources are manufactured to be operated from 200/230 volts and 460/575 volts in 60 Hz models, or from 220/380 volts and 380/415 volts in 50 Hz models. The power source is shipped from the factory wired for the highest input voltage. If the unit is to be operated from a lower primary power supply, the primary power cable must be reconnected to the lower voltage winding. To reconect to the lower voltage winding, see Figure 3-2 and proceed as follows:

1. Remove wrapper from power source.

2. Locate lower and higher voltage windings.

IMPORTANT: *On all models except the 460/575 volts model, there are three leads protruding from the coil of the primary voltage transformer. The inside lead (first lead) is the common winding. The middle lead is the lower voltage winding and the outside lead is the higher voltage winding. On the 460/575 volts model, there are four leads protruding from the coil of the primary voltage transformer. The inside lead (first lead) is the common winding. The second lead is the 230 volts fan motor lead. The 230 volts fan motor lead cannot be used as a primary voltage conductor! The third lead is the 460 volts winding and the fourth (outside) lead is the 575 volts winding.*

3. Cut plastic ties from lower and higher voltage windings and remove insulating material.

4. Trace lead 8 that goes from higher voltage winding to POWER switch.

5. Disconnect POWER switch lead 8 from higher voltage winding and connect to lower voltage winding.

6. Reconnect all leads. Reinstall insulating material and tie with plastic ties or tape.

7. Reinstall and secure wrapper.

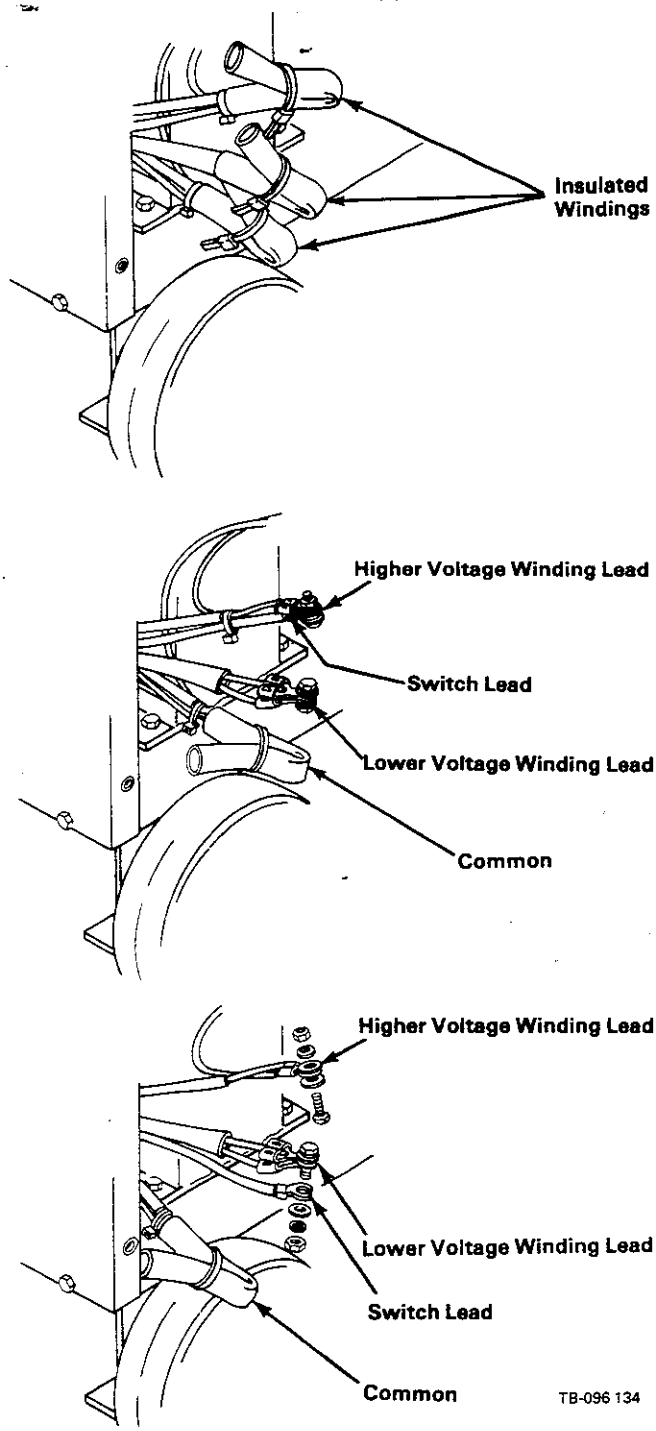


Figure 3 - 2. Primary Winding Connections

C. Input Conductor Connections (Figure 3-3)

WARNING: ELECTRIC SHOCK can kill.

- *It is recommended that a fusible line disconnect switch be installed in the input circuit to the power source.*

This would provide a safe and convenient means to completely remove all electrical power from the power source whenever it is necessary to internally inspect or service the unit.

- *Employ "lockout/tagging procedures" on input line before making input connections to the power source.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

Input at rated load output for this unit is in excess of 50 amperes. Therefore this unit is shipped with a six gauge, three-conductor power cable equipped with 1/4 in. (6.3 mm)lug terminals. The black and white conductors must be connected to the line terminals and the green conductor to a proper ground. Use a grounding method that is acceptacle to the local electrical inspection authority.

Table 3-1 provides guidelines for selecting the proper size input conductors and line fuses. The input conductors should be covered with an insulating material that complies with national, state, and local electrical codes.

Table 3 - 1. Input Conductor And Fuse Sizes

Input Conductor Size - AWG*					
200V	220V	230V	380V	460V	575V
6(8)	8(8)	8(8)	10(10)	12(12)	12(12)

Fuse Size In Amperes					
200V	220V	230V	380V	460V	575V
100A	80A	80A	70A	40A	35A

*Input conductor sizes are based on National Electrical Code specifications for allowable ampacities of insulated copper conductors, having a temperature rating of 75°C, with not more than three conductors in a raceway or cable. Numbers in ( ) are equipment ground conductor sizes.

WARNING: ELECTRIC SHOCK can kill.

- *Do not connect an input (white or black) conductor to the ground terminal.*
- *Do not connect the ground (green) conductor to an input line terminal.*

Incorrect input connections can result in an electrically energized power source chassis. The ground terminal is connected to the power source chassis and is for grounding purposes only.

3 - 4. WORK CABLE ASSEMBLY - A 10 foot (3 m) work cable with a lug on one end is included with this unit.

A. Installation Of Work Clamp (Figure 3-4)

Install the work clamp onto the work cable as follows:

1. Insert the end of the work clamp with the terminal lug on it through one of the two supplied insulating sleeves.

2. Lay the work cable inside the half of the work clamp which has the flatest inner surface.

3. Align the smaller hole in the work clamp with the hole in the work cable terminal lug. Secure the terminal lug to the work clamp with the supplied nut and bolt.

4. Bend the tabs on the end of the work clamp around the work cable.

5. Slide the insulating sleeve on the work cable over the work clamp handle.

6. Slide the remaining insulating sleeve over the other work clamp handle.

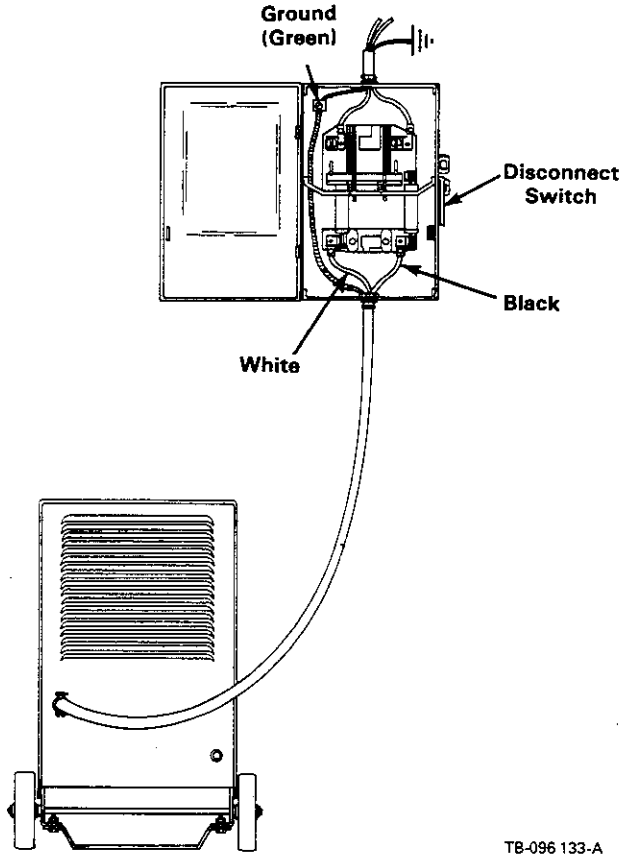


Figure 3 - 3. Input Conductor Connections

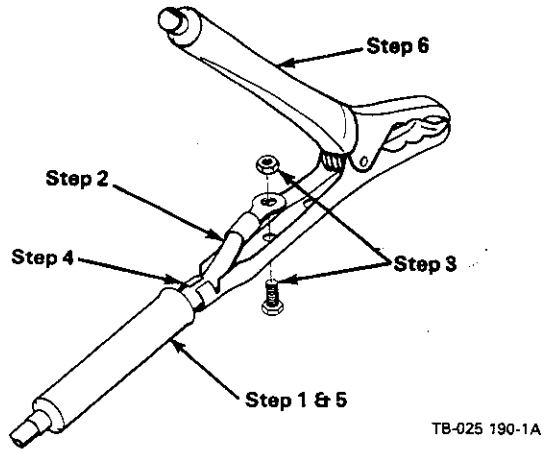


Figure 3 - 4. Work Clamp Installation

3 - 5. INSTALLATION OF TORCH AND WORK CABLE (Figure 3-5)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Disconnect input power and employ "lockout/tagging procedures" before internally inspecting, servicing or making connections.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open positon, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

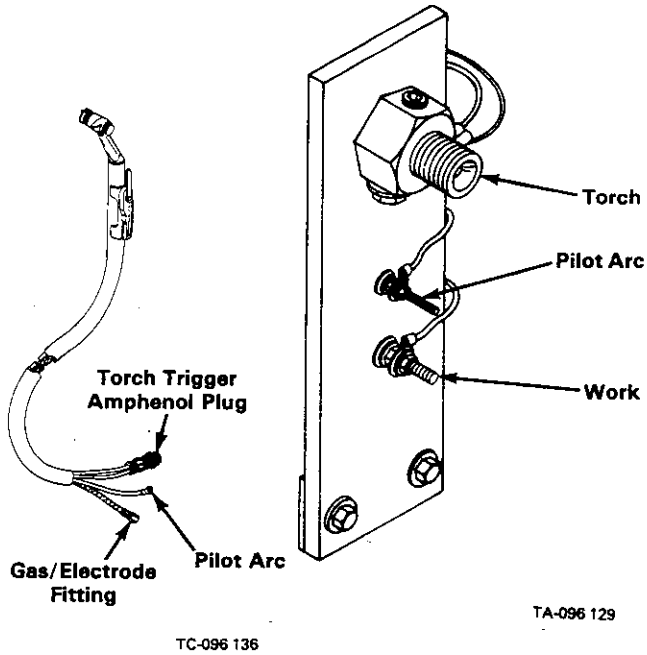


Figure 3 - 5. Torch and Work Cable Terminal Board

1. Remove wrapper.

2. Install strain relief clamp onto torch cables.

3. Insert torch cables through upper hole on front panel.

4. Connect Gas/Electrode fitting to upper gas fitting labeled TORCH on terminal connection board.

5. Connect black Pilot Arc cable to center terminal labeled PILOT ARC on terminal connection board.

6. Insert Work cable through bottom hole on front panel and connect to bottom terminal labeled WORK on terminal connection board.

7. Connect torch trigger amphenol plug to torch trigger amphenol receptacle.

8. Remove lower left screw from lower front panel. Secure strain relief clamp to lower front panel by reinstalling screw.

9. Replace and secure wrapper.

3 - 6. TORCH ASSEMBLY (Figure 3-6)

1. Screw plunger tube into lower torch body and tighten with supplied 6mm wrench.

2. Screw in electrode using supplied 10mm wrench.

3. Screw on nozzle. Ensure that nozzle is screwed on fully and hand tighten.

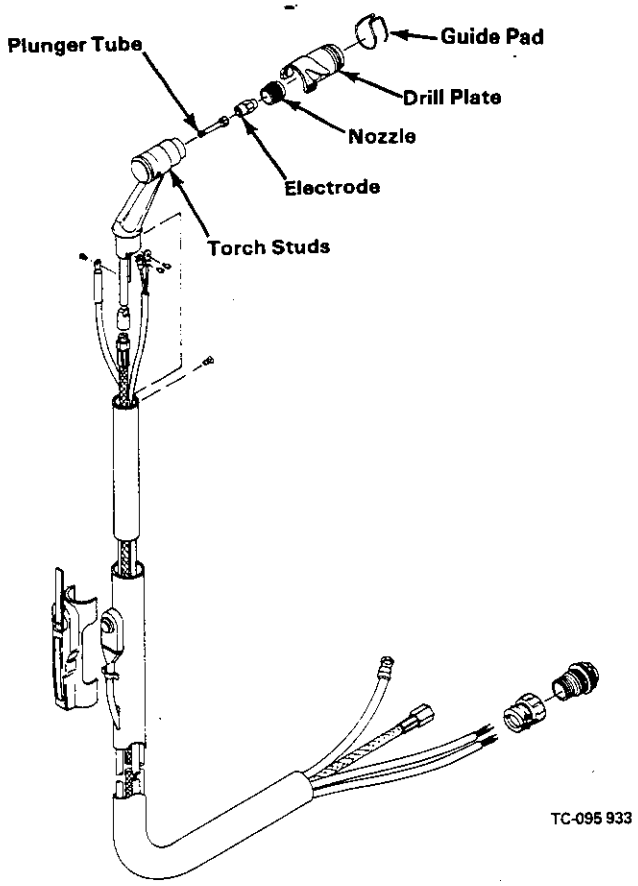


Figure 3 - 6. Exploded View Of Torch

WARNING: ELECTRIC SHOCK can kill.
- *Do not touch live electrical parts.*
- *Shut down power source before cleaning slag from nozzle and/or guide pad.*

HOT EQUIPMENT can cause burns.
- *Allow equipment to cool before inspecting or servicing.*

4. Install guide pad so that loop end faces the direction of travel. Position guide pad in upper groove of drill-plate skirt for cutting in LOW range or in lower groove for cutting in HI range.

5. Place the pad/drill-plate assembly on the torch.

6. Grasp the notched, hinged section of the drill-plate between thumb and forefinger.

7. Snap notched, hinged section of drill-plate over torch studs. Ensure that hinged section pivots correctly on torch studs.

3 - 7. INSTALLATION OF FILTER/REGULATOR AND BRACKET (Figure 3-7)

1. Install air Filter/Regulator support bracket using supplied hex-head sheet metal screws to holes provided in rear panel directly above input conductor access hole.

2. Remove retaining ring from Filter/Regulator and insert top of Filter/Regulator through bottom of support bracket.

3. Secure Filter/Regulator to support bracket by reinstalling retaining ring and tightening.

4. Connect nipple end of supplied air hose to OUT port of Filter/Regulator.

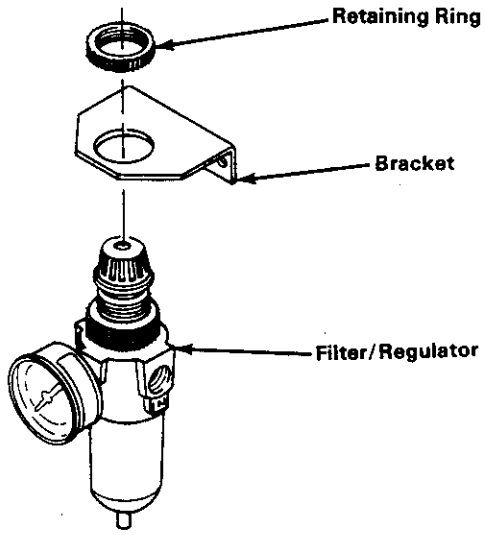


Figure 3 - 7. Installation Of Filter/Regulator & Bracket

5. Connect other end of air hose to air fitting in lower left corner of rear panel and tighten securely.

6. Connect incoming air line hose to IN port of Filter/Regulator.

IMPORTANT: *Ensure that this unit is supplied by a clean and dry air source.*

SECTION 4 - OPERATOR CONTROLS

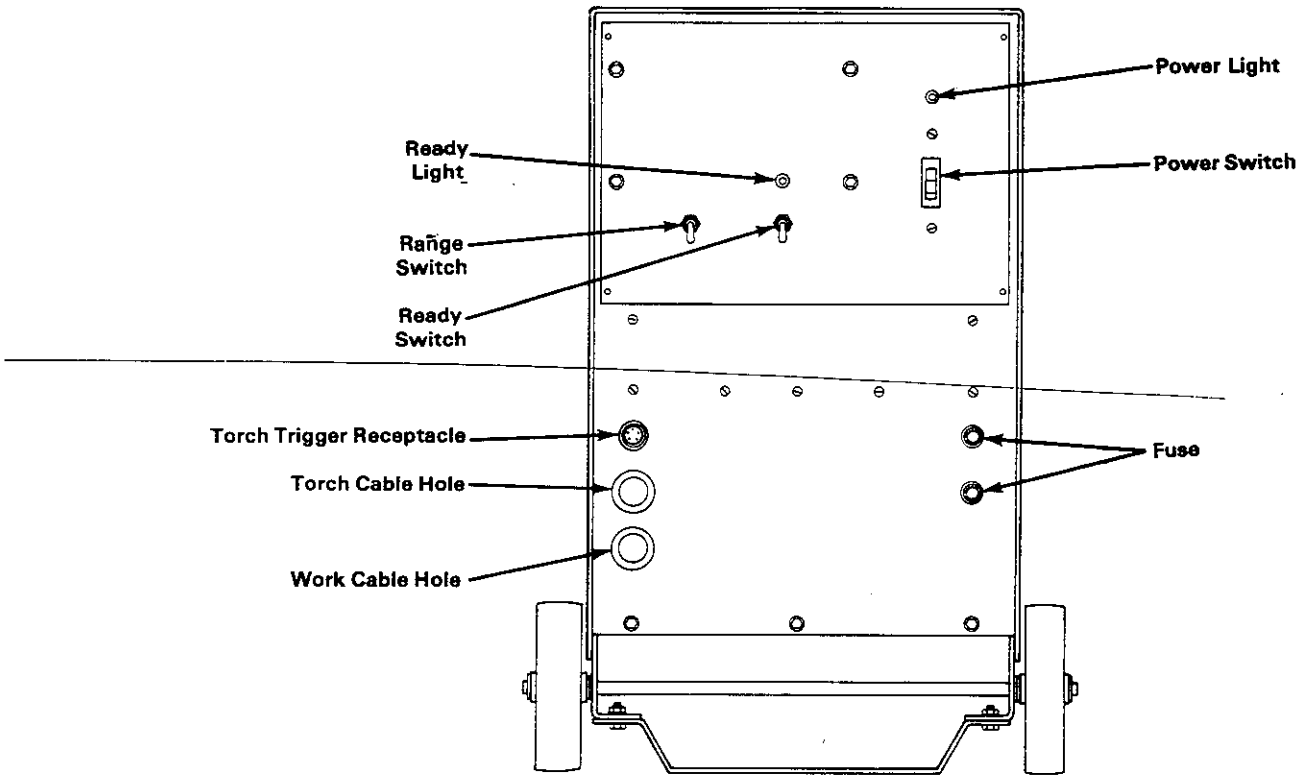


Figure 4 - 1. Front Panel View

4 - 1. POWER SWITCH (Figure 4-1) - Place the POWER switch in the ON position to energize power source. Place POWER switch in OFF position to shut power source down.

4 - 2. POWER LIGHT (Figure 4-1) - The POWER light indicates that the power source is energized. The POWER light will light whenever the POWER switch is in the ON position.

4 - 3. READY SWITCH (Figure 4-1) - The READY switch is a spring-loaded toggle switch which, when held in the ON position, will energize the control circuitry and place the torch in a ready to cut status. READY switch returns to the normally open position when released.

4 - 4. READY LIGHT (Figure 4-1) - When the READY light is lighted all of the safety devices within the control circuitry have been energized and the torch is in a ready to cut status. If the READY light does not light after the READY switch is placed in the ON position, check the safety devices to ensure proper working order. (See Section 6-6 Troubleshooting.)

4 - 5. RANGE SWITCH (Figure 4-1) - The RANGE SWITCH provides the means of selecting between the two amperage ranges. Select the LOW range when cutting thin gage material where the torch comes into direct contact with the work surface. Select the HI range when cutting thicker material where the standoff distance must be 1/16 in. (1.6 mm) or more.

SECTION 5 - SEQUENCE OF OPERATION

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury; IMPROPER AIR FLOW AND EXPOSURE TO ENVIRONMENT can damage internal parts.

- *Do not use cables or torch with damaged insulation.*
- *Shut down power source before cleaning slag from nozzle and/or guide post.*
- *Maintain at least 18 inches (457 mm) of unrestricted space on all sides of unit and keep underside free of obstructions.*
- *Do not place any filtering device over the intake air passages of this power source.*
- *Keep all covers and panels in place while operating.*

Warranty is void if any type of filtering device is used or if the power source is operated with any portion of the outer enclosure removed.

ARC RAYS, SPARKS, AND HOT METAL can burn eyes and skin.

- *Wear correct eye and body protection.*
- *Wear welding lens No. 4 when operating this unit in the low range; wear welding lens No. 8 when operating in high range.*
- *Allow equipment and work to cool before handling.*

FUMES AND GASES can seriously harm your health.

- *Cutting aluminum plate on a water table may cause hydrogen detonation beneath the workpiece. Contact equipment manufacturer for recommended practices for cutting aluminum.*
- *Ventilate to keep from breathing fumes and gases.*
- *If ventilation is inadequate use approved breathing apparatus.*
- *When possible cut over a water reservoir or properly ventilated work table designed to minimize fumes, gases, and sparks.*

HOT METAL AND SPARKS can cause fire or burns.

- *Do not cut over combustible material and watch for fire.*
- *Have fire extinguisher nearby and know how to use it.*

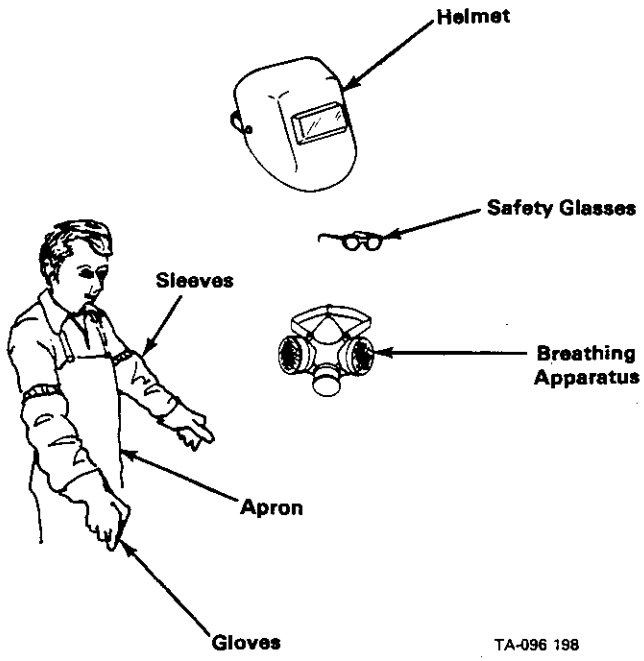


Figure 5 - 1. Safety Equipment

CUTTING CONTAINERS can result in explosions, fire, or poisonous fumes.

- *Cut containers only after proper cleaning.*

See Section 1 - Safety Rules For Operation Of Arc Welding Power Source for basic welding safety information.

CAUTION: CUTTING CURRENT can damage ignition system.

- *Disconnect battery ground cable when cutting on automobile.*

WARNING: PILOT ARC can cause burns.

- *Keep torch tip clear of personnel when switch is depressed.*
- *Turn off power source before removing or replacing torch parts.*

5 - 1. START-UP

1. Determine material type and thickness and cutting parameters using Recommended Plasma Arc Cutting Parameters (Figure 2-3).
2. Place torch guide pad in upper groove of drill plate skirt for cutting in LOW range or in lower groove for cutting in HI range.
3. Attach WORK cable to work.
4. Turn on air supply.
5. Turn line disconnect and the power source POWER switch to ON position. POWER ON light will illuminate.
6. Hold READY switch in ON position. Illumination of READY light indicates that the torch is ready for operation.
7. Begin cutting.

IMPORTANT: *Correct cutting sequence includes 1 to 1.5 seconds of preflow air and 3 seconds of high frequency pilot arc during arc initiation. There is 20 to 25 seconds of post flow air after torch trigger is released to allow for proper cooling of torch after arc is extinguished*

5 - 2. SHUT DOWN

1. Release torch trigger.
2. Shut off air supply.
3. Turn POWER switch to OFF position.

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Disconnect input power and employ "lockout/tagging procedures" before internally inspecting or servicing.*

Lockout/tagging procedures consist of padlocking line disconect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

HOT SURFACES can cause severe burns.

- *Allow cooling period before servicing.*

Troubleshooting of internal parts to be performed only by qualified persons.

IMPORTANT: *Periodically inspect the labels on the unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See Parts List for part number of precautionary labels.*

6 - 1. FAN MOTOR - This unit is equipped with an exhaust fan and relies on forced draft for adequate cooling. The fan motor is manufactured with lifetime sealed bearings and requires no maintenance.

6 - 2. INTERNAL CLEANING - Occasionally blow out or vacuum the dust and dirt from around the internal components. Do this periodically depending on the location of the unit and the amount of dust and dirt in the atmosphere. The power source outer enclosure should be removed and a clean, dry airstream or vacuum suction should be used for this cleaning operation.

6 - 3. CABLES - Periodically inspect cables and torch for breaks in insulation and ensure that all connections are clean and tight. Repair or replace cables as necessary. Clean and tighten connections periodically.

6 - 4. SPARK GAPS (Figure 6-1) - It is necessary to readjust the spark gaps every three to four months or when intermittent operation occurs. Normal spark gap setting is 0.025 in. (0.635 mm).

IMPORTANT: *Cleaning or dressing the points of the spark gaps is not recommended, as the material at the points is tungsten and is impossible to file. The entire point should be replaced when the tungsten section has completely disappeared.*

To adjust the spark gaps, proceed as follows:

1. Loosen screw A on both sides.
2. Place feeler gauge of proper thickness between point C.
3. Apply slight pressure against point B so feeler gauge is held firmly in gap.
4. Tighten screw A.

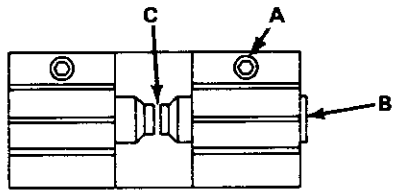


Figure 6 - 1. Spark Gap Adjustment

6 - 5. TROUBLESHOOTING - It is assumed that proper installation has been made, according to Section 3 of this manual, and that the power source has been functioning properly until trouble developed.

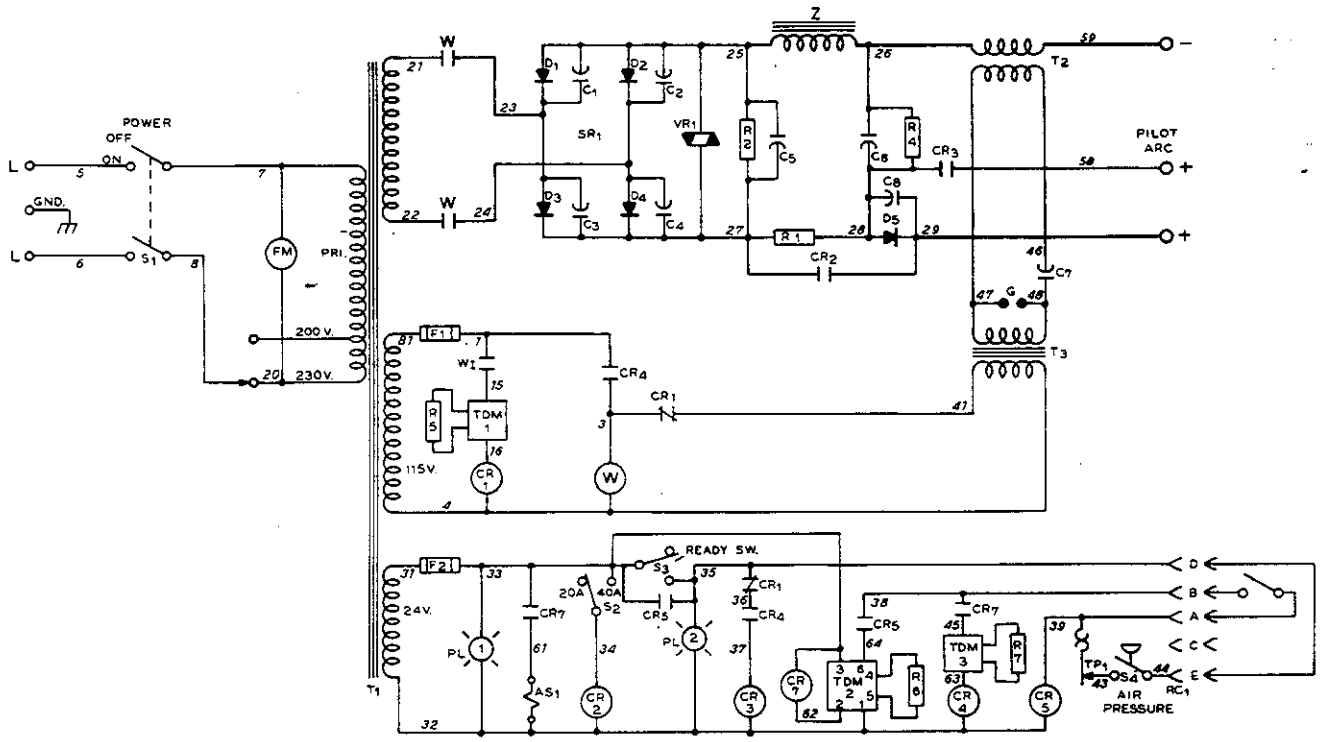
The following chart is designed to diagnose and provide remedies for some of the troubles that may develop in this power source.

Use this chart in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

TROUBLE	PROBABLE CAUSE	REMEDY
No open circuit voltage; fan runs.	Contactor coil W.	Replace contactor W.
	Contactor points.	Replace points.
Lack of high-frequency, difficulty in establishing arc.	Spark gap spacing incorrect.	Adjust spark gap (see section 6-5).
	Leakage of high-frequency from torch cable.	Replace cable.
	Timer TMD1.	Replace timer.
	Resister R5. Control Relay CR1.	Replace R5. Replace CR1.

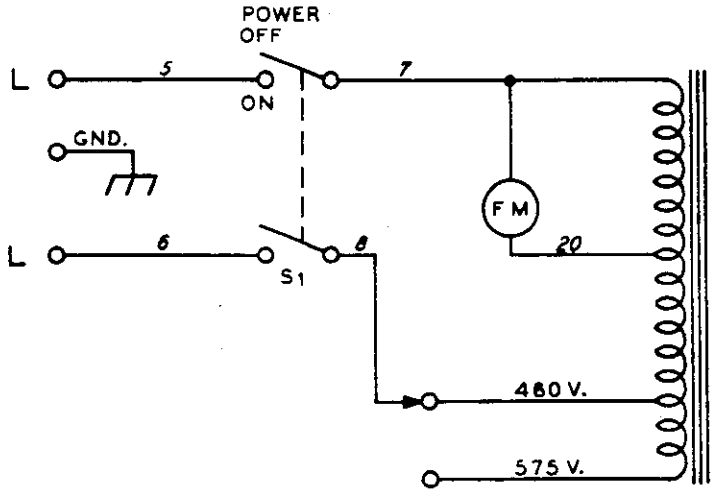
TROUBLE	PROBABLE CAUSE	REMEDY
Double arcing during pilot arc.	New nozzle with partially used electrode.	Install new electrode.
No air flow when torch trigger pressed.	Air pressure switch S4.	Replace S4.
	Torch switch.	Check torch switch.
Short circuit between nozzle and workpiece.	Accumulation of slag on nozzle and standoff shoe.	Shut power source down and clean nozzle end.
No cutting arc.	Ground cable loose or disconnected.	Check ground cable.
Power light out; fan motor does not run.	Blown fuse or open circuit breaker at line input power.	Replace fuse or reset circuit breaker at line input.
	POWER switch S1.	Replace S1.
Power light out; fan motor runs.	Blown fuse F2.	Replace F2*.
READY light out.	Insufficient air pressure.	Readjust air pressure.
	Air pressure switch S4.	Check S4.
	Control relay CR5.	Replace CR5.
	Control relay CR4.	Replace CR4.
	Thermal protector TP1 open.	Replace TP1.
	Control relay CR6.	Replace CR6.
	Blown fuse F2.	Replace F2.*
READY light on, pilot starts but no low range.	Resistor R1.	Replace R1.
	Diode D5.	Replace D5.
READY light on, pilot starts but no HI range.	RANGE switch S2.	Replace S2.
	Control relay CR2.	Replace CR2.

*Be sure replacement fuse is same size, type, and rating.



Circuit Diagram No. B-097 611

Figure 6 - 2. Circuit Diagram For Zip Cut



Circuit Diagram No. A-096 656

Figure 6 - 3. Primary Circuit Diagram

SECTION 7 - CERTIFICATION FOR HIGH FREQUENCY ARC WELDING EQUIPMENT

7 - 1. GENERAL - This following information is necessary to make a proper installation of the high frequency arc welding equipment described in this instruction manual. In order to comply with Part 18 of the Rules and Regulations of the Federal Communications Commission, the certificate in front of this manual must be filled in completely and signed. The certificate must be kept WITH THE EQUIPMENT AT ALL TIMES to comply with the regulation.

The manufacturer of the equipment covered herein has conducted approved field tests and certifies that the radiation can reasonably be expected to be within the legal limits if the correct installation procedures, as outlined, are followed.

The importance of a correct installation cannot be overemphasized since case histories of interference due to high frequency stabilized arc Welding Machines have shown that invariably an inadequate installation was at fault.

The user of the equipment must complete the certification by stating that he has installed the equipment and is using it, according to the manufacturer's instructions. The user must sign the certification notice appearing in front of this instruction booklet indicating that he has complied with the requirements.

In the event that interference with authorized services occurs, in spite of the fact that the radiation from the welding equipment is within the specified limits, the user is required to take suitable steps to clear the situation. The factory personnel will assist the user by supplying technical information to clear the situation.

In lieu of complying with the installation requirements and the certification of each individual installation, the user may elect to certify his entire plant by having a reputable engineering firm make a plant radiation survey. In such cases, the installation instructions incorporated in this instruction booklet could very well serve as a guide in minimizing interference that might be contributed by the high frequency arc welding equipment.

7 - 2. GENERAL INFORMATION - In a high frequency stabilized arc Welding Machine Installation, interfering radiation can escape in four distinct ways as outlined below:

1. Direct radiation from the welding machine. This is radiation that escapes directly from the Welding Machine case. This is very pronounced if access doors are left open and unfastened and if the Welding Machine case is not properly grounded. Any opening in the metal Welding Machine case will allow some radiation to escape. The high frequency unit of this certified equipment is adequately shielded to prevent direct radiation of any consequences if proper grounding is carried out.

2. Direct feedback to the power line. High frequency energy may get on the power line by direct coupling inside the equipment or the high frequency unit, the power line then serving as a radiating antenna.

   By proper shielding and filtering, direct coupling is prevented in this certified equipment.

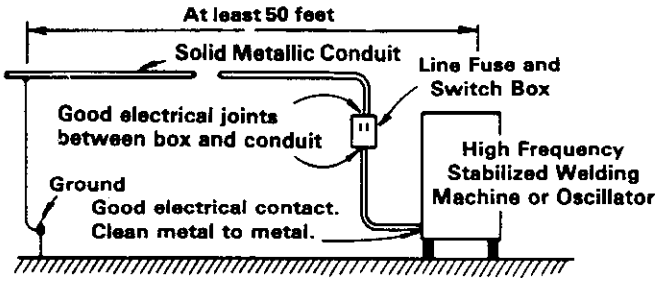


Figure 7 - 1. Power Service Installation H.F. Stabilized Arc Welding Machine

3. Direct radiation from welding leads. Direct radiation from the welding leads, although very pronounced, decreases rapidly with distance from the welding leads. By keeping the welding leads as short as possible, the operator can do a great deal to minimize interference from the source.

   The intensity and frequency of the radiation can be altered over wide limits by changing the location and relative position of the welding leads and work. If possible, loops and suspended sections should be avoided.

4. Pick-up and reradiation from power lines. Even though welding lead radiation falls off rapidly with distance, the field strength in the immediate vicinity of the welding area may be extremely high. Unshielded wiring and ungrounded metallic objects in this strong field may pick up the direct radiation, conduct the energy for some distance, and produce a strong interference field in another area.

   This is usually the most troublesome source of interference, but careful adherences to proper installation procedure as outlined in this booklet will minimize this type of interference.

7 - 3. POWER SERVICE - The specific installation instructions for making the proper primary connections to the equipment as outlined in the instruction booklet furnished with the equipment, should be followed carefully with one exception as noted in the following paragraph.

Frequently installation instructions specify that the primary power service shall be run in solid or flexible metallic conduit. Ordinary helically wrapped conduit is designed for mechanical protection and is not suitable for electrical shielding. Only solid metallic conduit or conduit of "equivalent electrical shielding ability" should be used to enclose the primary power service leads.

Solid metallic shielding shall enclose the primary power service to the equipment from a point 50 feet from the equipment in an unbroken run.

This shielding shall be grounded at the farthest point from the equipment and should make good electrical contact with the casing of the equipment. The ground should be in accordance with the specifications outlined in the section entitled "GROUNDS" and as shown in Figure 7-1. Care should be taken that paint or corrosion at the junction of conduit and case, does not interfere with good electrical contact.

There shall be no gap in this shielding run. This simply means that within 50 feet of the equipment, no portion of the power wires serving the equipment shall be unshielded. If there is any question about the electrical efficiency of the joints between individual conduit sections, outlet boxes and the equipment case, bonding should be carried out by soldering a copper strap or wire across the joint as shown in Figure 7-2.

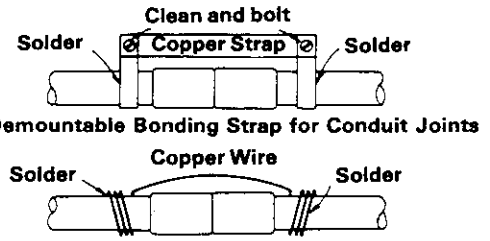


Figure 7-2. Two Recommended Methods For Electrical Bonding Across Poor Conductivity Conduit Joints

7 - 4. WELDING MACHINE - The location of the equipment should be chosen with respect to nearness to a suitable ground connection. The equipment case, firmly bonded to the power conduit, should be grounded to the work terminal of the equipment with a copper cable or braid with rated current carrying capacity equal to or greater than that of the power service wires.

This "work" output terminal of the equipment should then be grounded to a "good electrical ground" (as defined in section entitled "GROUNDS") with a short length of welding cable of the same capacity as the "work lead". (See Figure 7-3).

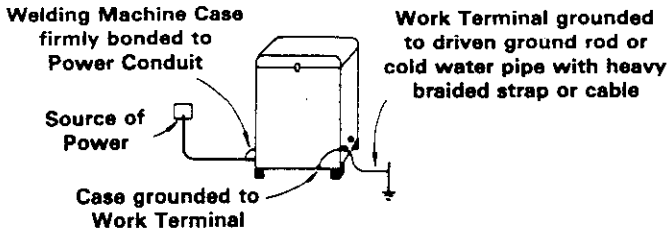


Figure 7-3. Ground Connections At Welding Machine

No change in the wiring or the location of parts inside the equipment, other than power service tap changes or other adjustments specifically covered shall be made. The equipment shall not be modified in any way since changes in the equipment can affect the radiation characteristics and may not be in accordance with the test data upon which the manufacturer bases his certification.

While the equipment is in operation, all access and service doors shall be closed and properly fastened.

Spark gap settings shall be maintained at the minimum separation consistent with satisfactory welding results.

7 - 5. WELDING LEADS - In order to minimize direct weld lead radiation, the welding leads (electrode lead and work lead) must be kept as short as possible. Certification tests on this machine have been made with leads 25 feet long. Considerable improvement in radiation minimization can be had by shortening the leads as much as possible.

Keeping the electrode lead and ground or work lead as close as possible and on the floor serves to reduce the radiation. (See Figure 7-4).

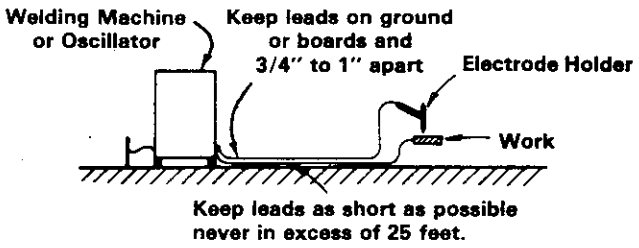


Figure 7-4. General Rules For Welding Leads

7 - 6. WIRING IN THE VICINITY OF THE WELDING AREA - As discussed in the general information section, the most serious source of interference is reradiation from wires that are located near the welding area.

Any ungrounded electrical conductor in the strong "directly radiated" field, producd by the welding leads, serves as a pick-up device and may conduct the interference for some distance and reradiate strongly at another location.

For purpose of simplification and standardization, the space all around the weld zone at a distance of 50 feet in all directions is referred to as the High Field Intensity (H.F.I.) zone. (See Figure 7-5).

To minimize radiation of this type all wiring in the H.F.I. zone shall be in rigid metallic conduit, lead covered cable, copper braid or material of equivalent shielding efficiency. Ordinary flexible helically wrapped metallic conduit, commonly referred to as "B.X." is not satisfactory for shielding, and should not be used. The shield on all wiring should be grounded at intervals of 50 feet and good electrical bonding between sections shall be maintained.

This shielding requirement applies to all wiring, including telephone, inter-communication, signal and control and incidental service.

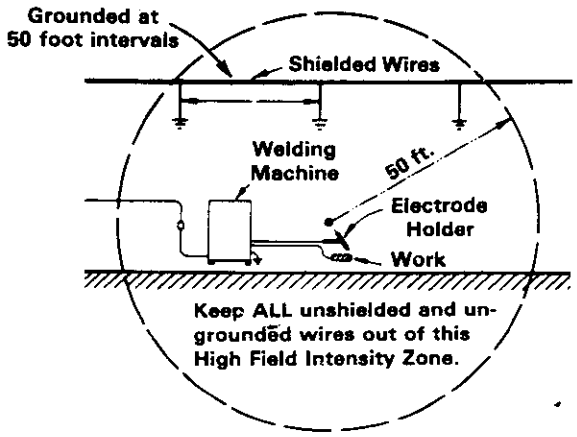


Figure 7-5. General Requirements to Minimize Reradiation Pick-Up In the Vicinity of the Weld Zone

Extreme precaution should be taken to make sure that the location of the zone is chosen so that none of the conditions are voided by unshielded wires off the premises but still within the radial dimensions of the H.F.I. zone.

This 50 foot H.F.I. zone is a minimum that is imposed on the installation. Certification tests by the manufacturer are based on this limit.

Keeping unshielded wires farther than 50 feet from the weld zone will materially aid in minimizing interference.

If it is impossible to relocate unshielded wires, that section within the H.F.I. zone, should be placed in conduit and each end of the conduit section grounded.

IMPORTANT: *It must be emphasized that all changes in power and lighting wiring should be made by a qualified electrician and comply with the National Electrical Code requirements. Any shielding or relocation of telephone or signal wires must be done either by the service company concerned or with the specific permission of said company.*

7 - 7. GROUNDS - Frequent reference is made to a "good ground" in previous sections. Although there is considerable leeway in the interpretation of this term, for the purpose covered in this booklet the following specifications apply:

A "ground" connection should be made to a driven rod at least 8 feet long and driven into moist soil.

A cold water pipe can be used in place of the ground rod provided it enters the ground within 10 feet of the equipment to be grounded.

All leads connecting the point to be grounded to the ground rod or pipe should be as short as possible since the ground lead itself can become an effective radiating antenna.

The effectiveness of a ground in reducing interference depends upon the ground conductivity. In certain locations it may bcome necessary to improve the ground conductivity by treating soil around the ground rod with a sait solution.

7 - 8. METAL BUILDING - It is frequently thought that operating of high frequency stabilized are welding equipment in metallic buildings will completely eliminate troublesome radiation. This, however, is a false assumption.

A metallic building structure, if properly grounded, may serve to reduce direct radiation from the weld zone but will have no effect on conducted interference and reradiation. As a result, all installation requirements necessary for certification must be complied with.

If the metallic building is not properly grounded, bonding to several good electrical grounds placed around the periphery of the building will give reasonable assurance that the building itself is not contributing to the radiation.

7 - 9. INDIVIDUAL INSTALLATION CERTIFICATION - Any or all of the above installation requirements may be waived by the user if he desires to exercise the option of making an individual field survey of the particular unit installation (or the complete installation if more than one unit is involved), and certifying on that basis.

This survey shall be made by a competent engineer in accordance with the test procedure requirements as set forth in Part 18 of the Rules and Regulations of the Federal Communications Commission.

Surveys of this nature can cover a single unit or multiple units or may include the complete plant structure.

7-10. CHECK LIST - The following questions may be used by the installer as a check to see if all installation requirements have been met:

1. Has the equipment been located so that ground leads can be kept short?
2. Are the power leads, serving the unit, in conduit?
3. Is there good electrical contact between power conduit and case?
4. Do the conduit couplings make good electrical contact? (If in doubt, use bonding).
5. Is there good electrical contact between conduit and switch on service boxes?
6. If rigid metallic conduit is not used, is the shielding used of equivalent shielding efficiency? (Copper sleeving, lead covered cable, etc., is satisfactory. Spirally wound flexible metallic conduit is not suitable.)
7. Is the conduit system grounded at a point at least 50 feet from the equipment?
8. Is the conduit run complete (without any gap) in the H.F.I. zone?
9. Is the equipment case connected to the work terminal of the secondary?

10. Is the wire used for this connection of sufficient size?

11. Is the work terminal connected to a good electrical ground?

12. Is the cable or copperbraid used for this connection equal to or greater in current carrying capacity than the welding lead?

13. Is this cable as short as possible?

14. Are the spark gaps set at .025 in. or less?

15. Are all service and access doors closed and bolted?

16. Are the welding leads less than 25 feet long?

17. Are they as short as possible?

18. Are the welding leads on the floor or placed on a suitable board?

19. Are the welding leads approximately 3/4" to 1" apart?

20. Have you visualized the H.F.I. zone, a sphere with a 50 foot radius centered on the weld zone?

21. Have the unshielded power and light wires originally in this H.F.I. zone been placed in grounded shields or been relocated outside the zone?

22. Have all large metallic objects and any long guy or supporting wires in the H.F.I. zone been grounded?

23. Have you checked so that no external power or telephone lines off the premises are within the zone?

24. Are the grounds driven ground rods?

25. Is a cold water pipe used as ground?

26. If so, does it enter the ground 10 feet or less from the connection?

27. Are the connections to the ground clean and tight?

28. If operated within a metal building, is the building properly grounded?

If your answer is "yes" to the above questions, you can certify the installation by signing the certificate.

March 1985 FORM: OM-284C

Effective With Serial No. JF858383

PARTS LIST

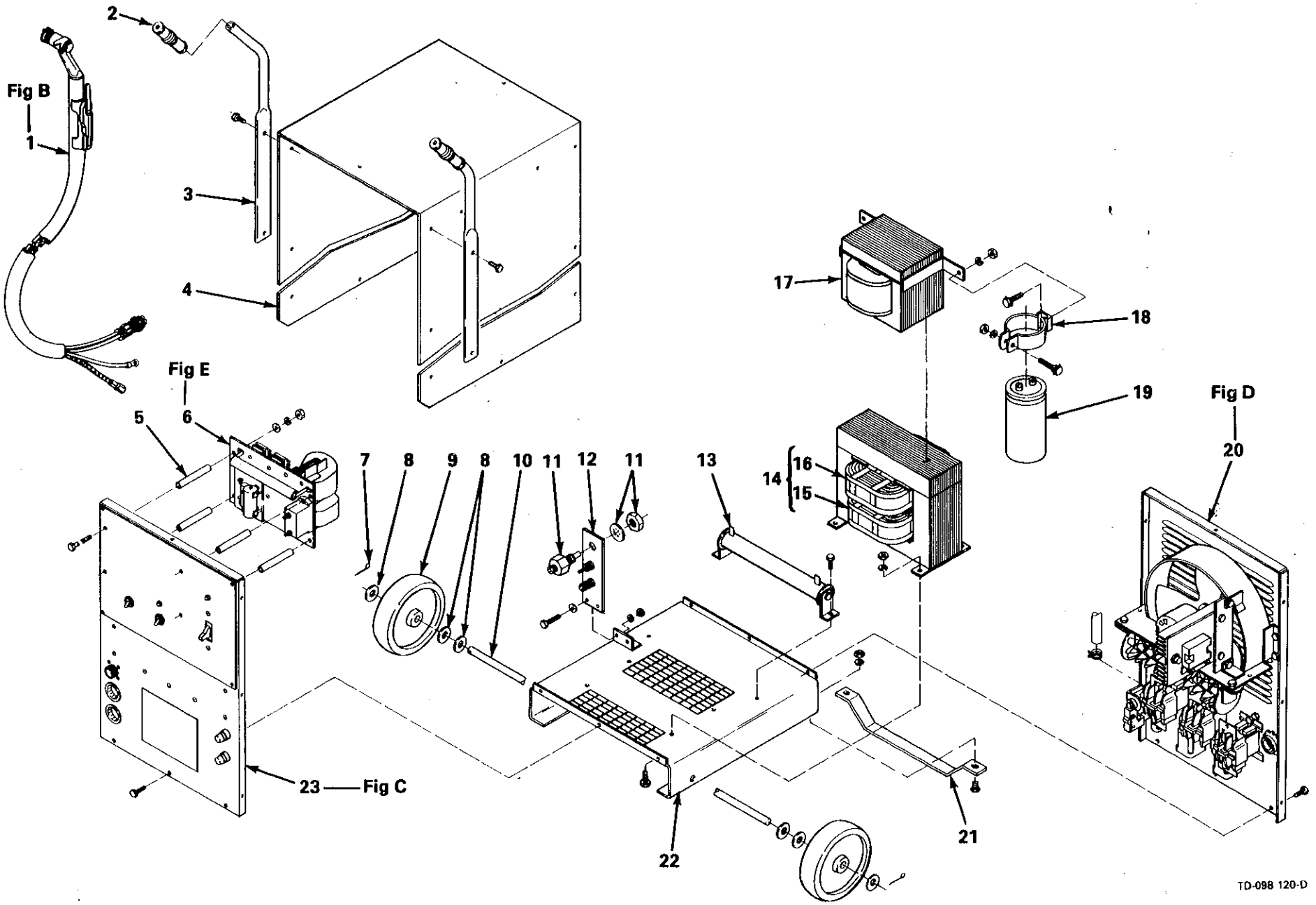


Figure A - Main Assembly

Replace Coils At Factory Or Factory Authorized Service Station.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure A			**Main Assembly**	
1		095 336	TORCH (Fig B Pg 4)	1
2		604 423	GRIP, handle	2
3		095 320	HANDLE	2
4		095 343	WRAPPER	1
5		010 006	TUBING, 5/8 OD x 12 ga wall x 3-1/4	4
6		097 719	HF PANEL (Fig E Pg 7)	1
7		605 946	PIN, cotter 1/8 x 1	2
8		602 246	WASHER, flat 1/2	6
9		095 094	WHEEL, 5 in dia	2
10		095 319	AXLE	2
11		096 520	FITTING, pipe-brass adapter bulk hd 3/16 TBG	1
12		095 325	TERMINAL BOARD, power output	1
13	R2	094 964	RESISTOR, WW fixed 375 watt 161 ohm	1
14	T1	095 455	TRANSFORMER, power-main (200/230 volts)(consisting of)	1
14	T1	096 552	TRANSFORMER, power-main (460/575 volts)(consisting of)	1
15	PRI	095 055	. COIL, primary (200/230 volts)	1
15	PRI	096 509	. COIL, primary (460/575 volts)	1
16	SEC	095 056	. COIL, secondary	1
17	Z	095 440	STABILIZER	1
18		010 083	HANGER, minerallic No. 6	1
19	C5	094 961	CAPACITOR, electrolyte 2500 uf 450 volts dc	1
20		097 514	FOOT, mtg-unit	1
21		Figure D	PANEL, rear-w/components (Pg 6)	1
22		095 338	BASE	1
23		Figure C	PANEL, front-w/components (Pg 5)	1
		096 397	HOSE, air 30 inches w/fittings	1
		087 318	CLAMP, 1 inch x 13/32	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

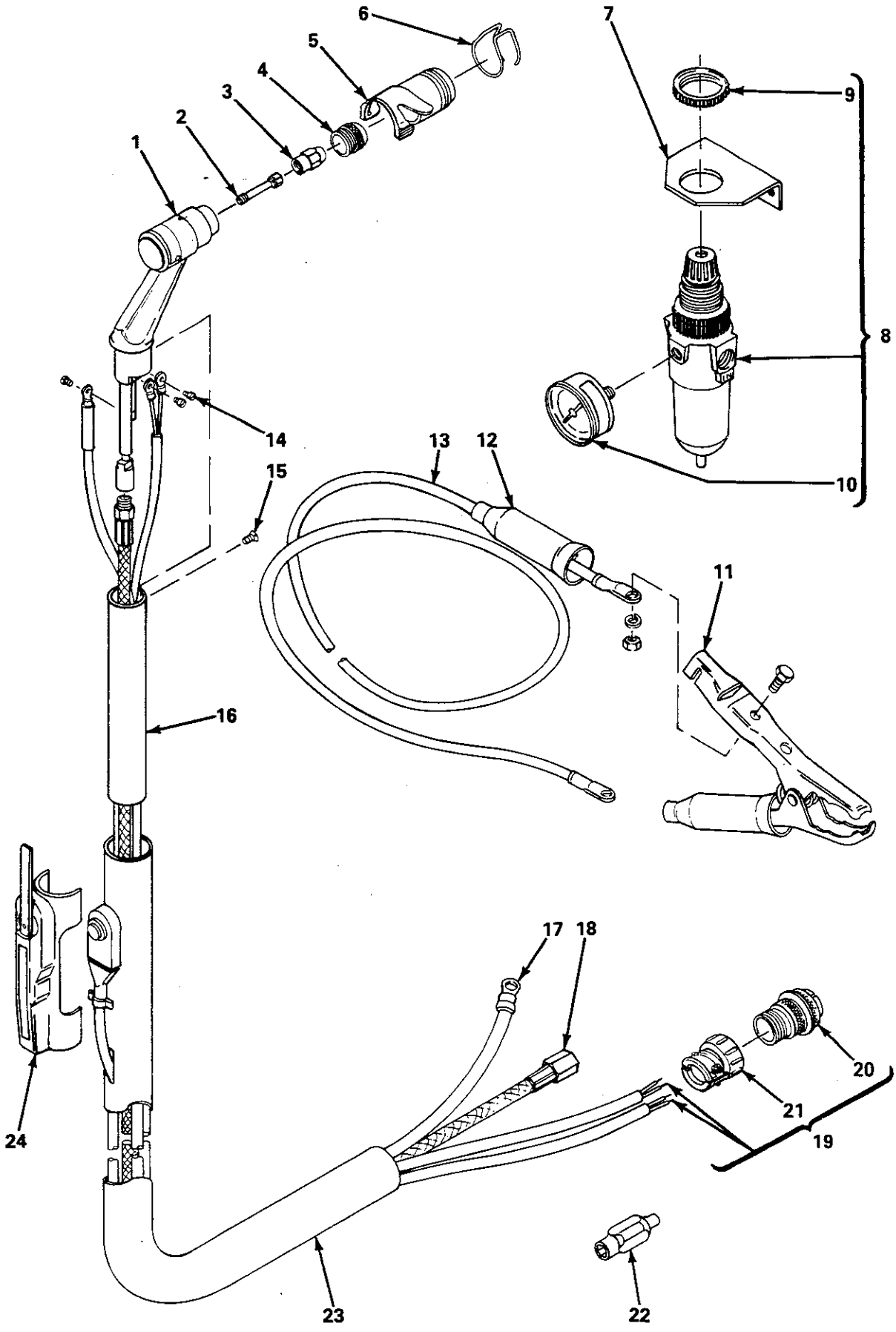


Figure B - Torch

Item No.	Part No.	Description	Quantity
Figure B	**095 336**	**Torch (Fig A Pg 2 Item 1)**	
1	095 793	TORCH HEAD	1
2	095 481	AIR PLUNGER TUBE	1
3	095 482	AIR ELECTRODES	3
4	095 483	NOZZLES M16 x 100	6
5	095 484	DRILL PLATE	2
6	095 485	GUIDE PADS	5
7	+095 324	BRACKET, mtg-regulator	1
8	+094 962	REGULATOR/FILTER (consisting of)	1
9	+096 304	. NUT, panel-mtg filter/regulator	1
10	+096 303	. GAUGE, pressure	1
11	+010 368	CLAMP, grd 100 amp	1
12	+026 843	INSULATOR, vinyl-black	1
13	+600 325	CABLE, weld No. 6 (order by ft)	20ft
14	095 480	SCREWS CM3-3U	3
15	095 479	SCREWS TF-90M3	3
16	095 486	TORCH HANDLE	1
17	095 477	NOZZLE SUPPLY CONDUITS	1
18	095 476	GAS ELECTRICITY CONDUITS	1
19	095 478	TRIGGER CONTROL (consisting of)	1
20	039 273	. PLUG, 5 pin MS-3106A-16S-8P	1
21	039 685	. CLAMP, cable	1
22	+096 680	WRENCH, electrode & stem remover	1
23	+095 475	NEOPRENE SHEATH	1
24	095 487	TRIGGER HOUSING	1

†These items are not included with torch.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure C			**Panel, Front-W/Components (Fig A Pg 2 Item 23)**	
1			NAMEPLATE (order by model & serial number)	1
2		+095 341	PANEL, front	1
3	S2	053 359	SWITCH, toggle SPST 20 amp 125 volts ac	1
4	S3	021 467	SWITCH, toggle SPST MC 3 amp 250 volts	1
5	PL1,2	048 573	LIGHT, indicator-red lens 28 volts	2
6	S1	045 834	SWITCH, toggle DPST 60 amp 600 volts	1
7	CR1	059 266	RELAY, enclosed 120 volts ac DPDT	1
8	TDM2	095 934	TIMER, 20 seconds (includes R6) 2.7 M .5W	1
9	TDM3	095 961	TIMER, 1 second (includes R7) 10K .5W	1
10	TDM1	095 962	TIMER, 3 seconds (includes R5) 27K .5W	1
11		046 432	HOLDER, fuse (consisting of)	2
12		059 139	. CAP, fuse holder	1
13	F1,2	*012 618	FUSE, miniature-glass 5 amp	2
14		095 727	LABEL, precautionary	1
15		057 358	BUSHING, snap 1 ID x 1.37 mtg hole	2
16	RC1	035 523	RECEPTACLE, 5 socket MS-3102A-16S-8S	1
17	CR7	006 393	RELAY, enclosed 24 volts ac DPDT	1

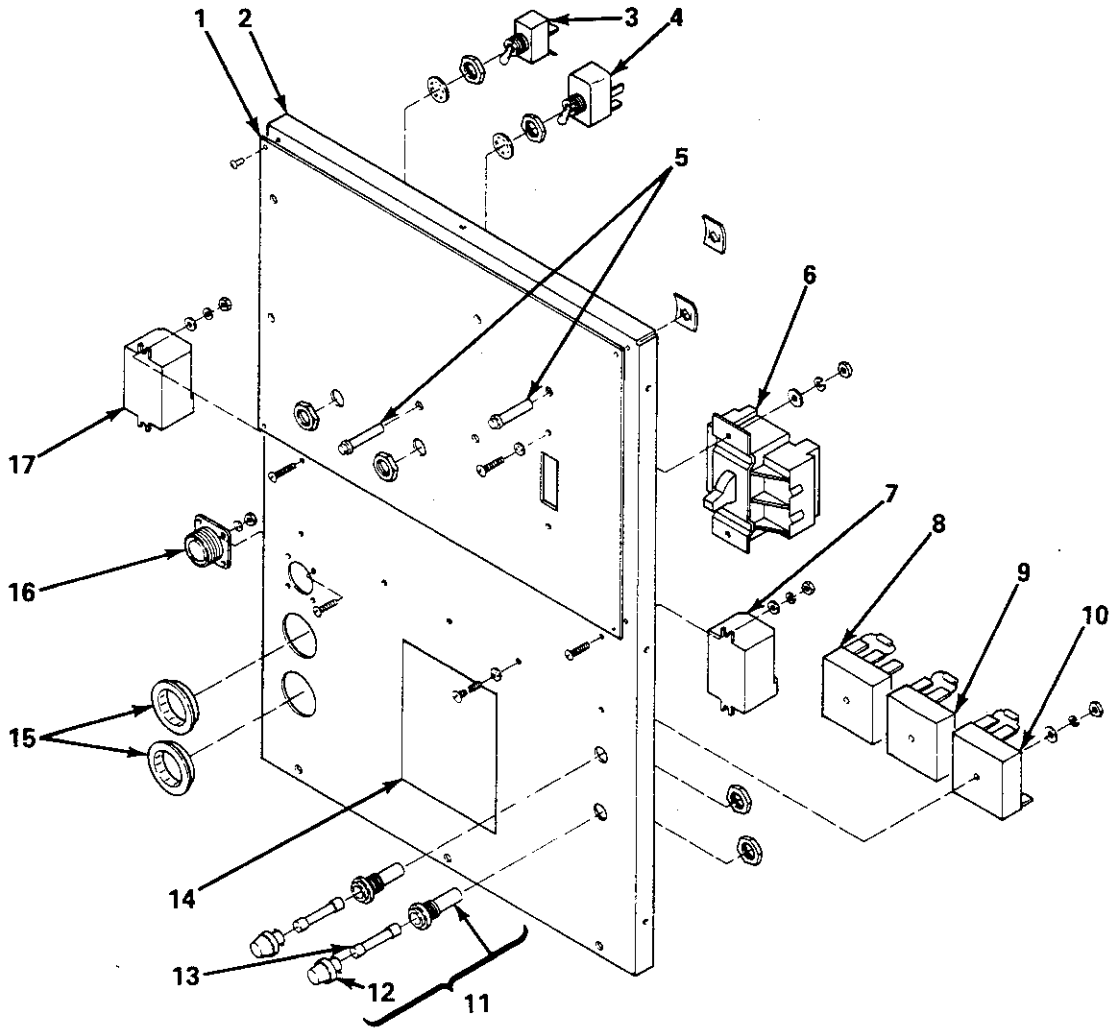


Figure C - Panel, Front - W/Components

*Recommended Spare Parts

+When ordering a component originally displaying a precautionary label the label should also be ordered.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure D			**Panel, Rear - W/Components (Fig A Pg 2 Item 21)**	
1	SR1	096 949	RECTIFIER, silicon/integrated (consisting of)	1
2		096 931	. STRIP, mtg	1
3	C1-4	031 688	. CAPACITOR, ceramic 0.01 uf 500 volts dc	4
4	C8	096 932	. CAPACITOR, ceramic 0.05 uf 500 volts dc	1
5	VR1	095 492	. SUPPRESSOR	1
6	D5	095 141	.-DIODE, 40 amp 1000 watts SP	1
7	D1-4	096 874	. RECTIFIER, integrated 100 amp 800 volts	1
8		096 930	. HEAT SINK	1
9		097 512	WINDTUNNEL, 11 inch	1
10		032 662	BLADE, fan 60 hz 10 inch 5 wing	1
11		096 918	PANEL, rear	1
12		600 313	CABLE, power 6 ga 3/c 600 volts (order by ft)	10ft
13		044 426	CONNECTOR, clamp-cable 1 inch	1
14	W1	034 895	INTERLOCK, contactor-no	1
15		034 260	LINK, connecting-contactor terminal	2
16	CR2,3	035 519	CONTACTOR, 40 amp 3 pole 24 volts (consisting of)	2
		024 493	. COIL, 24 volts ac	1
17	W	605 855	CONTACTOR, 40 amp 3 pole 120 volts (consisting of)	1
		032 349	. COIL, 120 volts ac	1
18		095 317	LINK, connecting-contactor terminal	2
19	CR4,5	006 393	RELAY, 24 volts ac DPDT flanged	2
20		010 296	FITTING, hose-elbow M 1/4 NPT x 5/8-18 RH	1
21		010 869	FITTING, pipe-brass bushing 1/4 x 1/8 NPT	1
22	S4	094 963	SWITCH, pressure-air 40-100 lbs	1
	TP1	020 520	THERMOSTAT, nc	1
23		071 270	FITTING, pipe-brass tee st 1/4 NPT	1
24	AS1	035 630	VALVE, 24 volts ac/6 volts dc 2 way 1/4 IPS port 1/8 orifice	1
25		010 678	FITTING, pipe-brass elbow st 1/4 NPT	1
26		096 916	HOSE, air-w/fittings	1
27	R1	097 495	RESISTOR, w/mtg-hardware	1
28	FM	032 678	MOTOR, 1/50 hp 230 volts ac 1500 rpm	1

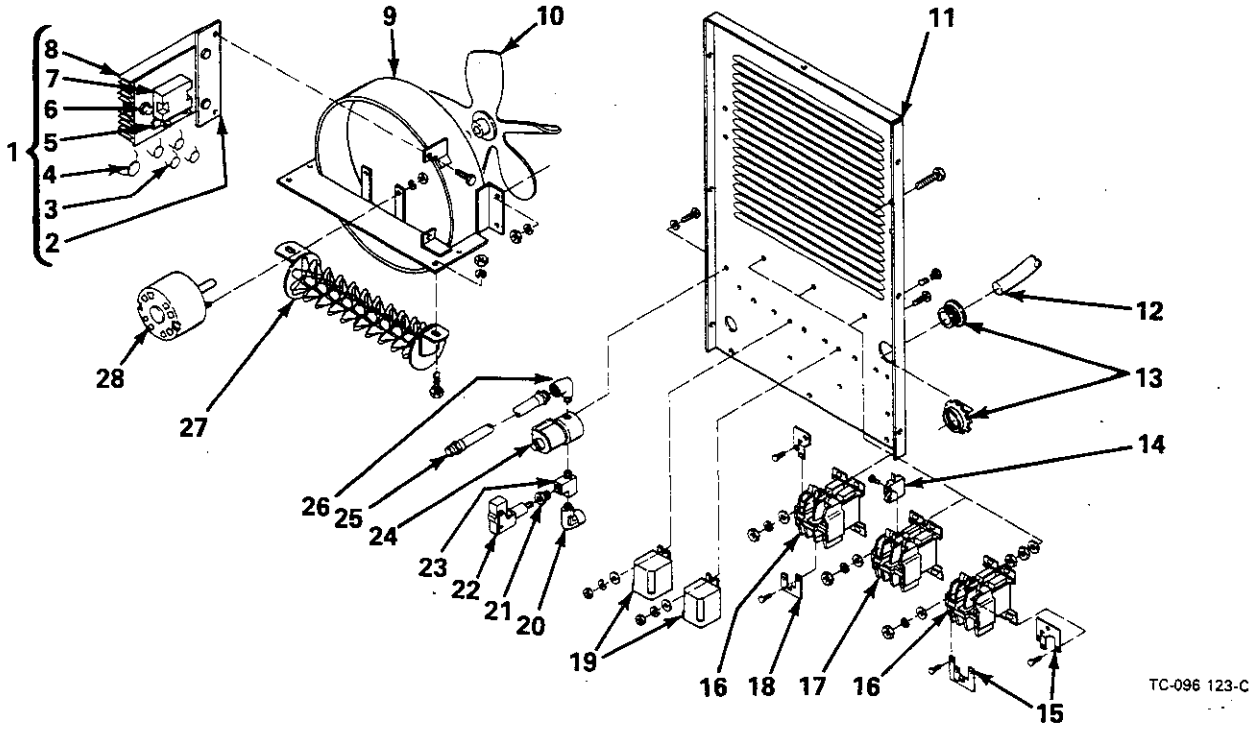


Figure D - PANEL, Rear - W/Components

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure E		**097 719**	**HF Panel (Fig A Pg 2 Item 6)**	
1		000 861	STRIP, mtg-coil	1
2	T2	095 318	COIL, coupling-air	1
3		020 622	HOLDER, points	2
4	G	*020 603	POINT, spark gap	2
5	T3	074 398	TRANSFORMER, 115 volts pri 3500 volts	1
6	C7	031 602	CAPACITOR, mica 0.002 uf 500 volts dc	2
7		095 316	MOUNTING BOARD	1
8	R4	097 744	RESISTOR, WW fixed 10 watt 10K ohm	1

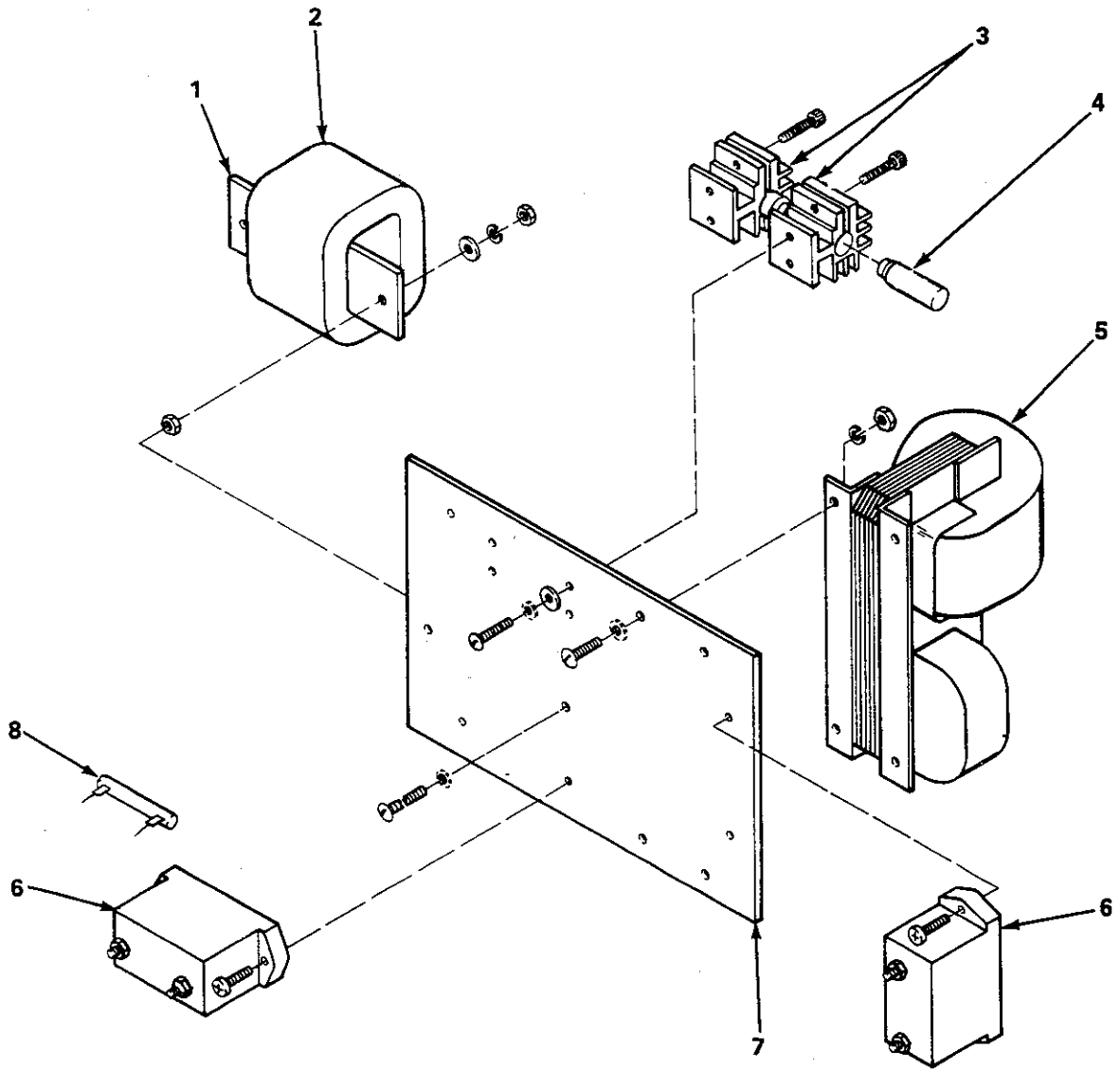


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Figure E - HF Panel

*Recommended Spare Parts

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.