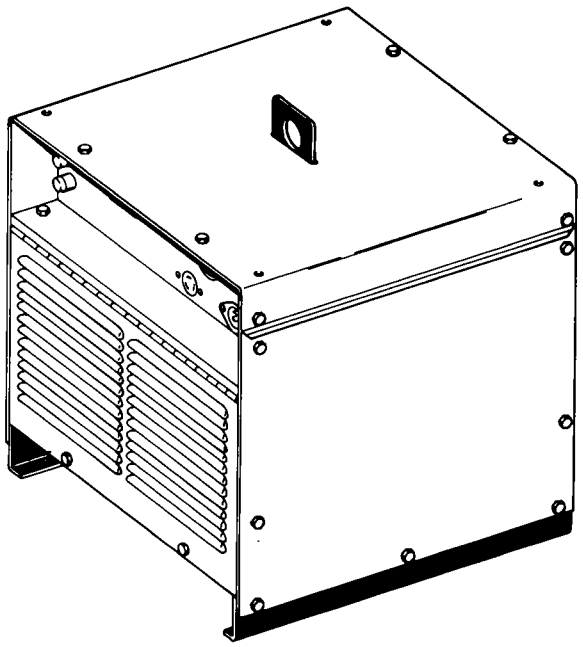
March 1979 FORM: OM-233

Effective With Serial No. HK243705

MODEL
A-500



OWNER'S MANUAL

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

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EFFECTIVE: JANUARY 1, 1979

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

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2. Original main power rectifiers . . . . . 3 years (labor - 1 year only)
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

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Section No. Page No.

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

A. Burn Prevention

Wear protective clothing - leather (or asbestos) gauntlet gloves, 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

Adequate ventilation. 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.

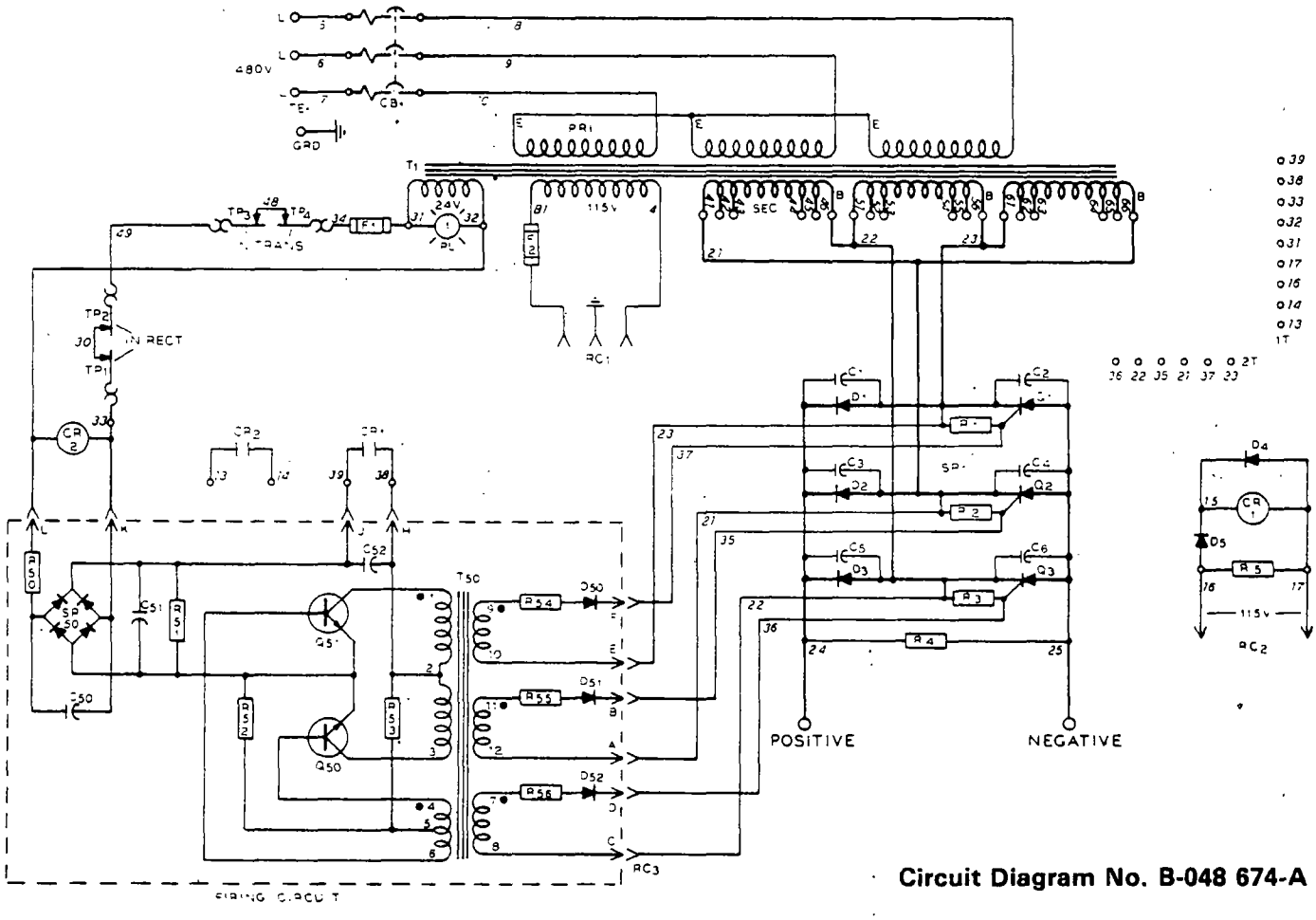
Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit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

ERRATA SHEET

After this manual was printed, refinements in equipment design occurred. This sheet lists exceptions to data appearing later in this manual.

AMENDMENT TO SECTION 5 - TROUBLESHOOTING

Amend Figure 5-1. Circuit Diagram



Circuit Diagram No. B-048 674-A

Figure 5-1. Circuit Diagram Effective With Serial No. HK282806

Item Or Page No.	Dia. Mkgs.	Part No.	Replaced With	Description	Quantity
Pg 2	Q50,51	024 207	037 236	TRANSISTOR, 15 amp 100 volts NPN	2
13		081 516	048 560	PANEL, rear	1
40		010 337	023 365	WEDGE, 3/16 x 1 x 4-1/2	9
68	SR1	035 224	083 971	RECTIFIER, SCR/silicon diode (Eff W/JB556978)	1
75		603 105	603 105	HOSE, neoprene No. 1 5/16 ID (order by ft) (qty chg)	1 ft
76	R1-3	030 026	Deleted	(Eff W/JB556978)	
78	Q1-3	039 526	083 936	THYRISTOR, SCR 300 amp 300 volts (Eff W/JB556978) (consisting of)	3
	R1-3		030 026	. RESISTOR, carbon 0.5 watt 560 ohm	1
	C1-6		031 689	CAPACITOR, ceramic 0.01 uf 500 volts dc (Eff W/HK282806)	6
			000 914	LINK, connecting	6

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

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

Check for leaks on first pressurization and regularly thereafter. 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.

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 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 requirement 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.

*Trademark of Proctor & Gamble.

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 Wire

Electrode wire becomes electrically HOT when the power switch of gas metal-arc welding equipment is ON and welding gun trigger is pressed. Keep hands and body clear of wire and other HOT parts.

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.

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, 2501 NW 7th St., Miami, Fla. 33125.

2. ANSI Standard Z87.1, SAFE PRACTICE FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

3. American Welding Society Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable same as item 1.

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

5. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable same as item 4.

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

7. OSHA Standard 29 CFR, Part 1910, Subpart Q, WELDING, CUTTING AND BRAZING.

SECTION 2 - INTRODUCTION

Open Circuit Voltage Ranges	Rated Welding Current 100% Duty Cycle	input At Rated Load Output 60 Hz. Three-Phase					Dimensions (Inches)	Weight (Pounds)	
		Amperes At			kva	kw		Net	Ship
		230V	460V	480V					
39.4 34.4 29.3 38.7 33.6 28.6 37.9 32.9 27.9 37.3 32.2 27.1 36.5 31.5 26.4 35.8 30.8 25.7 35.1 30.1 24.9 24.2	500 Amperes @ 35 Volts	54	27	26	21.6	20.4	Height - 17-3/4* Width - 19-1/2 Depth - 18-1/4	260	275

*Add 2-1/4" For Lifting Eye.

Figure 2-1. Specifications

2-1. GENERAL

This manual has been prepared especially for use in familiarizing personnel with the design, installation, operation, maintenance, and troubleshooting of this equipment. All information presented herein should be given careful consideration to assure optimum performance of this equipment.

2-2. 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 and freight bill will be furnished by the carrier on request if occasion to file claim arises.

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

2 - 3. DESCRIPTION

This unit is a water-cooled, constant potential welding power source which produces dc current. This welding power source is designed to be used in conjunction with the Gas Metal-Arc Welding (GMAW) process.

This unit is designed to be operated from a single input voltage, three-phase, 60 Hertz power.

2-4. SAFETY

Before the equipment is put into operation, the safety section at the front of this manual should be read completely. This will help avoid possible injury due to misuse or improper welding applications.

The following definitions apply to CAUTION, IMPORTANT, and NOTE blocks found throughout this manual:

CAUTION

Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may create a hazard to personnel.

IMPORTANT

Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may result in damage to equipment.

NOTE

Under this heading, explanatory statements will be found that need special emphasis to obtain the most efficient operation of the equipment.

SECTION 3 - INSTALLATION

3-1. LOCATION

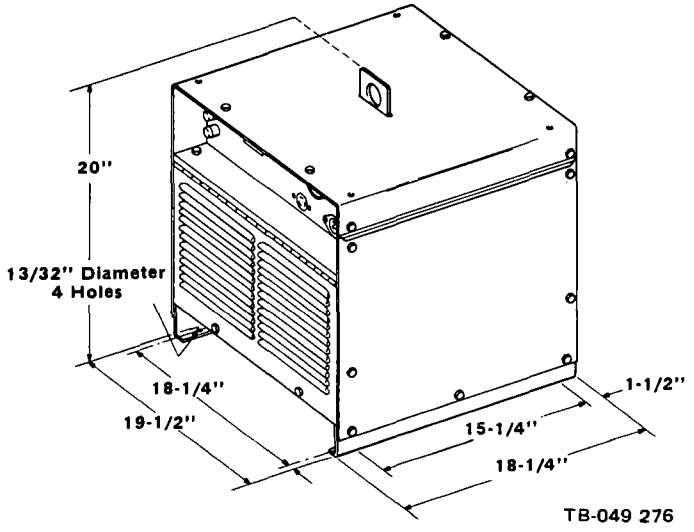


Figure 3-1. Dimensional Drawing

A proper installation site should be selected for the welding 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 welding power source, and also least subjects the unit to dust, dirt, moisture, and corrosive vapors. The installation site should also permit easy removal of the welding power source outer enclosure for maintenance functions.

Holes are provided in the welding power source base for mounting purposes. Figure 3-1. gives overall dimensions and the base mounting hole layout.

On most welding power sources a lifting device is provided for moving the unit. However, if a fork lift vehicle is used for lifting the unit, be sure that the lift forks are long enough to extend completely under the base.

IMPORTANT

The use of lift forks too short to extend out of the opposite side of the base will expose internal components to damage should the tips of the lift forks penetrate the bottom of the unit.

3-2. ELECTRICAL INPUT CONNECTIONS

A. Electrical Input Requirements

This welding power source is designed to be operated from a three-phase, 60 Hertz, ac power supply which has a line voltage rating that corresponds with the electrical input voltage 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 welding power source are to be made.

B. Input Conductor Connections

NOTE

It is recommended that a line disconnect switch be installed in the input circuit to the welding power source. This would provide a safe and convenient means to completely remove all electrical power from the welding power source whenever it is necessary to perform any internal function on the unit.

CAUTION

Before making electrical input connections to the welding power source, "machinery lockout procedures" should be employed. If the connection is to be made from a line disconnect switch, the switch should be padlocked in the open position. If the connection is made from a fuse box, remove the fuses from the box and padlock the cover in the closed position. If the unit is connected to a circuit breaker, or other disconnecting device without locking facilities, attach a red tag to the device to warn others that the circuit is being worked on.

CAUTION

Connect the input conductors to the welding power source before making connections to the three-phase power supply.

The input conductors should be covered with an insulating material which conforms to local electrical standards. Table 3-1 is provided only as a guide for selecting the proper size input conductors and fuses.

Table 3-1. Input Conductor And Fuse Size

Input Conductor Size - AWG*			Fuse Size In Amperes		
230V	460V	480V	230V	460V	480V
6(8)	10(10)	10(10)	90	45	45

*Input conductor sizes are based on 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.

Insert the three input conductors plus one ground conductor through the access hole on the rear panel. This hole will accept standard conduit fittings. See Figure 3-2 for hole location and size.

NOTE

It is recommended that a terminal lug of adequate amperage capacity be attached to the ends of the input and ground conductors. The hole diameter in the terminal lug must be of proper size to accommodate the line and ground terminal studs.

Connect the three input conductors to the line terminals on the primary terminal board and connect the ground conductor to the ground terminal (see Figure 3-2 for location of terminals). The remaining end of the ground conductor should be connected to a proper ground. Use a grounding method that is acceptable to the local electrical inspection authority.

CAUTION

The ground terminal is connected to the welding power source chassis and is for grounding purposes only. Do not connect a conductor from the ground terminal to any one of the line terminals as this will result in an electrically energized welding power source chassis.

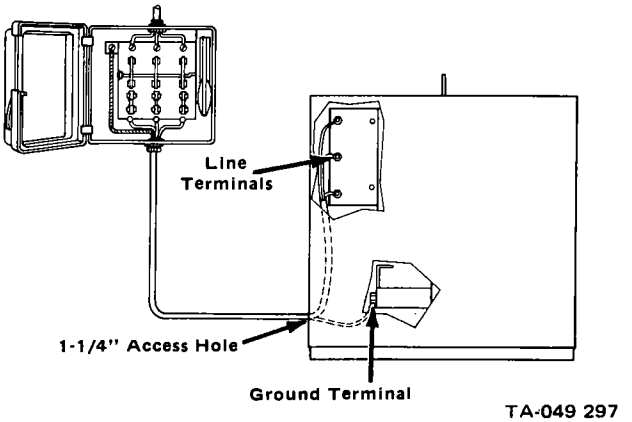


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Figure 3-2. Input Conductor Connections

3-3. WELD OUTPUT CONNECTIONS

To obtain the full rated output from this unit, it is necessary to select, install, and maintain proper welding cables. Failure to comply in any of these areas may result in less than satisfactory welding performance.

CAUTION

Ensure that the unit is completely shut down before making any weld output connections.

A. Location

The POSITIVE and NEGATIVE weld output terminals are located on the upper portion of the front panel.

B. Welding Cables

If welding cables were not ordered with this unit, the steps listed should be followed to ensure the best welding performance:

1. It is recommended that the welding cables be kept as short as possible, be placed close together, and be of adequate current carrying capacity. The resistance of the welding cables and connections causes a voltage drop which is added to the voltage of the arc. Excessive cable resistance may result in overloading as well as reducing the maximum current output capability of this unit. Proper operation is to a great extent dependent on the use of welding cables and connections that are in good condition and of adequate size.
2. Use Table 3-2 as a guide for selecting correct cable size for the anticipated maximum weld current which will be used. Table 3-2 shows total cable length, which includes the electrode and work cable. Example: If the electrode holder cable is 75 feet long and the work cable is 25 feet long, select the size cable that is recommended for 100 feet at the maximum weld current that is to be used.
3. Do not use damaged or frayed cables.
4. Use correct lugs on the weld cables to connect the work clamp and to connect the cables to the weld output terminals.
5. Ensure that all connections are clean and tight.

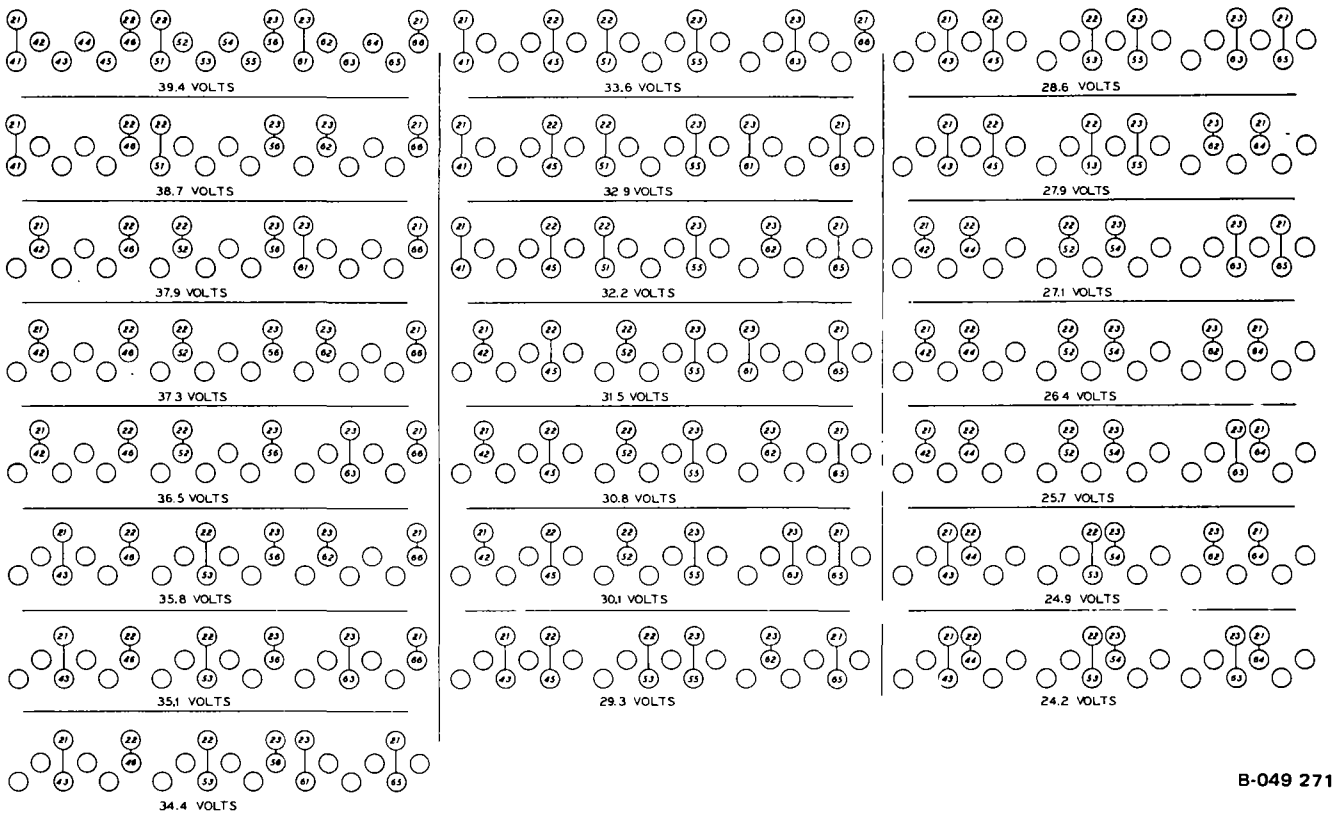

Figure 3-3. DC Open Circuit Voltage Selection

Table 3-2. Welding Cable Size

WELDING AMPERES	*TOTAL LENGTH OF CABLE (COPPER) IN WELD CIRCUIT							
	*50	100	150	200	250	300	350	400
100	4	4	2	2	2	1	1/0	1/0
150	2	2	2	1	1/0	2/0	3/0	3/0
200	1	1	1	1/0	2/0	3/0	4/0	4/0
250	1/0	1/0	1/0	2/0	3/0	4/0	4/0	2-2/0
300	2/0	2/0	2/0	3/0	4/0	4/0	2-2/0	2-3/0
350	3/0	3/0	3/0	4/0	4/0	2-2/0	2-3/0	2-3/0
400	3/0	3/0	3/0	4/0	2-2/0	2-3/0	3-2/0	2-4/0
500	4/0	4/0	4/0	2-2/0	2-3/0	2-3/0	2-4/0	3-3/0
600	2-2/0	2-2/0	2-2/0	2-3/0	3-2/0	2-4/0	3-3/0	3-4/0
700	2-3/0	2-3/0	2-3/0	2-4/0	3-3/0	3-4/0	4-4/0	4-4/0

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NOTE: *A. 50 FEET OR LESS.

*B. CABLE SIZE IS BASED ON DIRECT CURRENT (DC), 100% DUTY CYCLE AND EITHER A 4 VOLTS OR LESS DROP OR A CURRENT DENSITY OF NOT OVER 300 CIRCULAR MILS PER AMP.

*C. WELD CABLE INSULATION WITH A VOLTAGE RATING TO WITHSTAND THE OPEN-CIRCUIT VOLTAGE (OCV) OF THE WELDING POWER SOURCE MUST BE USED. WHILE MOST WELDING POWER SOURCES HAVE AN OPEN-CIRCUIT VOLTAGE OF LESS THAN 100 VOLTS, SOME WELDING POWER SOURCES OF SPECIAL DESIGN MAY HAVE HIGHER OPEN-CIRCUIT VOLTAGE.

3 - 4. OPEN CIRCUIT VOLTAGE SELECTION (Figure 3-3)

Behind the access door on the front panel is an 18 tap terminal board. This terminal board provides facilities for changing the dc open circuit voltage. Twenty-two open circuit voltages are obtainable. To obtain the desired open circuit voltage, position the six leads connected to the terminal board as shown in Figure 3-3.

3 - 5. CONTACTOR CONTROL RECEPTACLE (Figure 3-4)

The CONTACTOR CONTROL receptacle is a two pole twist-lock receptacle that provides a junction point for a Contactor Control. In order for open circuit voltage to be present, 115 volts ac must be applied to the CONTACTOR CONTROL receptacle. To suspend weld output, 115 volts ac must be removed from the receptacle.

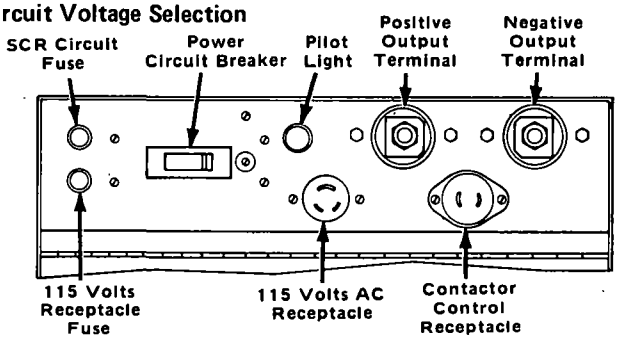

Figure 3-4. Front Panel

3 - 6. WATER CONNECTIONS

On the left side of the rear panel are water connections labelled WATER IN and WATER OUT. These connections are female type and have right-hand threading. It is recommended that the water pressure be set between 40 and 60 psi.

IMPORTANT

It is imperative that water flow through the welding power source is not interrupted while the unit is in use. Failure to comply may result in damage to the main rectifier and transformer if the thermostats should fail.

When the welding power source is shutdown, it is recommended that water flow be stopped. This will prevent water condensation inside the welding power source.

When the welding power source is being moved or during storage, the water should be drained from the unit and the water lines purged with air to prevent freezing should the unit be exposed to freezing temperatures.

3 - 7. WIRE FEEDER SHUTDOWN CONTROL

A set of normally-open contacts from control relay CR2 are connected to terminals 13 and 14 of terminal strip 1T. This set of contacts is intended to be wired in series with one of

the wire feeder electrical input power leads for the purpose of shutting the wire feeder down in the event that one or more of the thermostats in the welding power source should open and shut the welding power source down. Failure to connect the wire feeder to the contacts of CR2 would result in the wire feeder continuing to feed wire even though weld current is not present. Make the connections to the welding power source as follows:

1. Remove the right side panel. Terminal strip 1T is located in the upper rear corner of the right side of the welding power source.
2. Locate the 7/8" hole in the rear panel of the welding power source and route leads from the wire feeder through the hole to terminal strip 1T.
3. Connect wire feeder input power leads to terminals 13 and 14 of terminal strip 1T.
4. Replace right side panel.

3 - 8. 115 VOLTS AC RECEPTACLE (Figure 3-4)

The three-pole, twistlock receptacle on the front panel of the welding power source is intended to provide 115 volts, 60 Hertz electrical power for operation of accessory equipment. To secure the corresponding three-pole plug in this receptacle, insert the plug into the receptacle and rotate the plug clockwise.

IMPORTANT

The 115 VOLTS AC receptacle is protected by fuse F2 which is located on the front panel. If it should become necessary to replace the fuse, ensure that a fuse of the same rating is used for a replacement. A fuse of a larger rating will permit overloading of the 115 volts circuitry and thereby cause damage to the welding power source.

3 - 9. OVERLOAD PROTECTION

The SCR circuitry is protected by a miniature fuse F1 located on the front panel of the welding power source (see Figure 3-4). If fuse F1 should open, the weld output would cease.

There are thermostats located in the main rectifier and transformer. In the event water flow stops while the unit is in use and the main rectifier and/or transformer becomes too warm, the thermostat(s) will open and suspend all output. If this occurs, initiate water flow and allow the unit a cooling period before attempting to resume operation.

The POWER circuit breaker CB1 will open to interrupt incoming power if the input power is too high. The circuit breaker must be manually reset.

3-10. DUTY CYCLE (Figure 3-5)

The duty cycle of a welding power source is the percentage of a ten minute period that a welding power source can safely be operated at a given output. This welding power source is rated at 100 percent duty cycle. This means that the welding power source can be safely operated at rated load continuously. Figure 3-5 enables the operator to determine the safe output of the welding power source at various duty cycles.

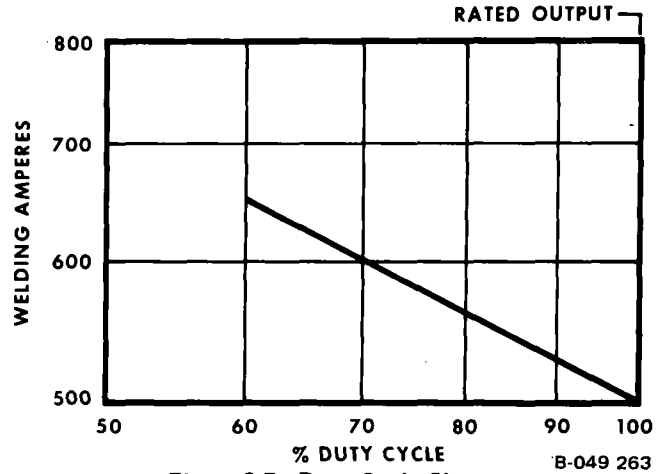

Figure 3-5. Duty Cycle Chart

3-11. VOLT-AMPERE CURVE (Figure 3-6)

The volt-ampere curves, Figure 3-6, show the output voltage available at each given output current.

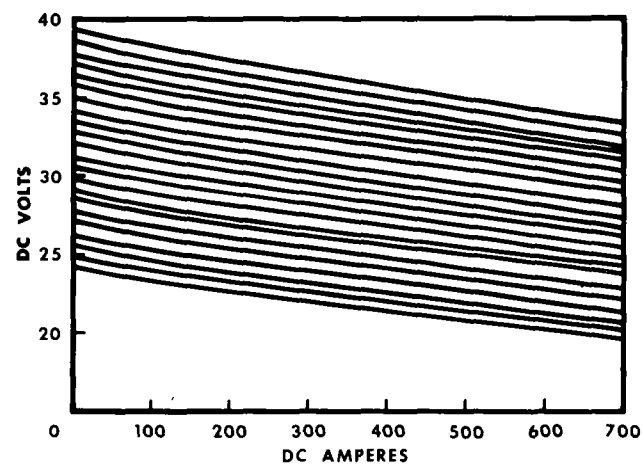

Figure 3-6. Volt-Ampere Curve

SECTION 4 - SEQUENCE OF OPERATION

4 - 1. GAS METAL-ARC WELDING (GMAW)

1. Make electrical input and weld output connections as outlined in Section 3-2 and 3-3.
2. Make water connections as required and turn water flow on.
3. Select desired dc open circuit voltage as outlined in Section 3-4.
4. Make connections to CONTACTOR CONTROL receptacles.
5. Place POWER circuit breaker in ON position.
6. Close the Contactor Control to apply 115 volts ac to the welding power source voltage control circuit.

CAUTION

Prior to welding, it is imperative that proper protective clothing (welding coat and gloves) and eye protection (glasses and/or welding helmet) be put on. Failure to comply may result in serious and even permanent bodily damage.

7. Commence welding.

4 - 2. SHUTTING DOWN

1. Open the Contactor Control to remove 115 volts ac from the welding power source voltage control circuit.
2. Allow the welding power source to idle with the water flowing for a cooling period.
3. Turn off water flow.
4. Place the POWER circuit breaker in the OFF position.

SECTION 5 - TROUBLESHOOTING

CAUTION

Hazardous voltages are present on the internal circuitry of the welding power source as long as power is connected to the unit. Disconnect power before attempting any inspection or work on the inside of the unit. Troubleshooting of internal circuitry should be performed by qualified personnel only.

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

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

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 weld output.	POWER circuit breaker open.	Manually reset POWER circuit breaker.
	Fuse F1 open.	Replace fuse F1.*
	Thermostat(s) open.	Allow a cooling period before attempting to resume operation.
	Control relay CR1 defective.	Check relay CR1 and replace if necessary.
	Printed circuit board not secure in receptacle.	Ensure that the printed circuit board is secure in receptacle.
	Printed circuit board defective.	Check printed circuit board and replace if necessary.
	Defective component in main rectifier SR1.	Check main rectifier SR1 components and replace necessary parts.
Limited output and low open-circuit voltage.	DC open-circuit voltage selector on wrong taps.	See Section 3-4 for proper open-circuit voltage selection.
	Open line fuse on one phase.	Check input line fuse(s) and replace as necessary.
	Printed circuit board not secure in receptacle.	Ensure that the printed circuit board is secure in receptacle.
	Printed circuit board defective.	Check printed circuit board and replace if necessary.
	Defective component in main rectifier SR1.	Check main rectifier SR1 components and replace necessary parts.
Erratic weld output.	Incorrect welding cable size.	Use proper size and type of cable (see Section 3-3, Table 3-2).
	Loose welding cable connections.	Ensure all connections are clean and tight.
No 115 volts ac at 115 VOLTS AC duplex receptacle.	Fuse F2 open.	Replace fuse F2.*

*If it becomes necessary to replace any fuse in the welding power source, ensure that a fuse of the proper size is used.

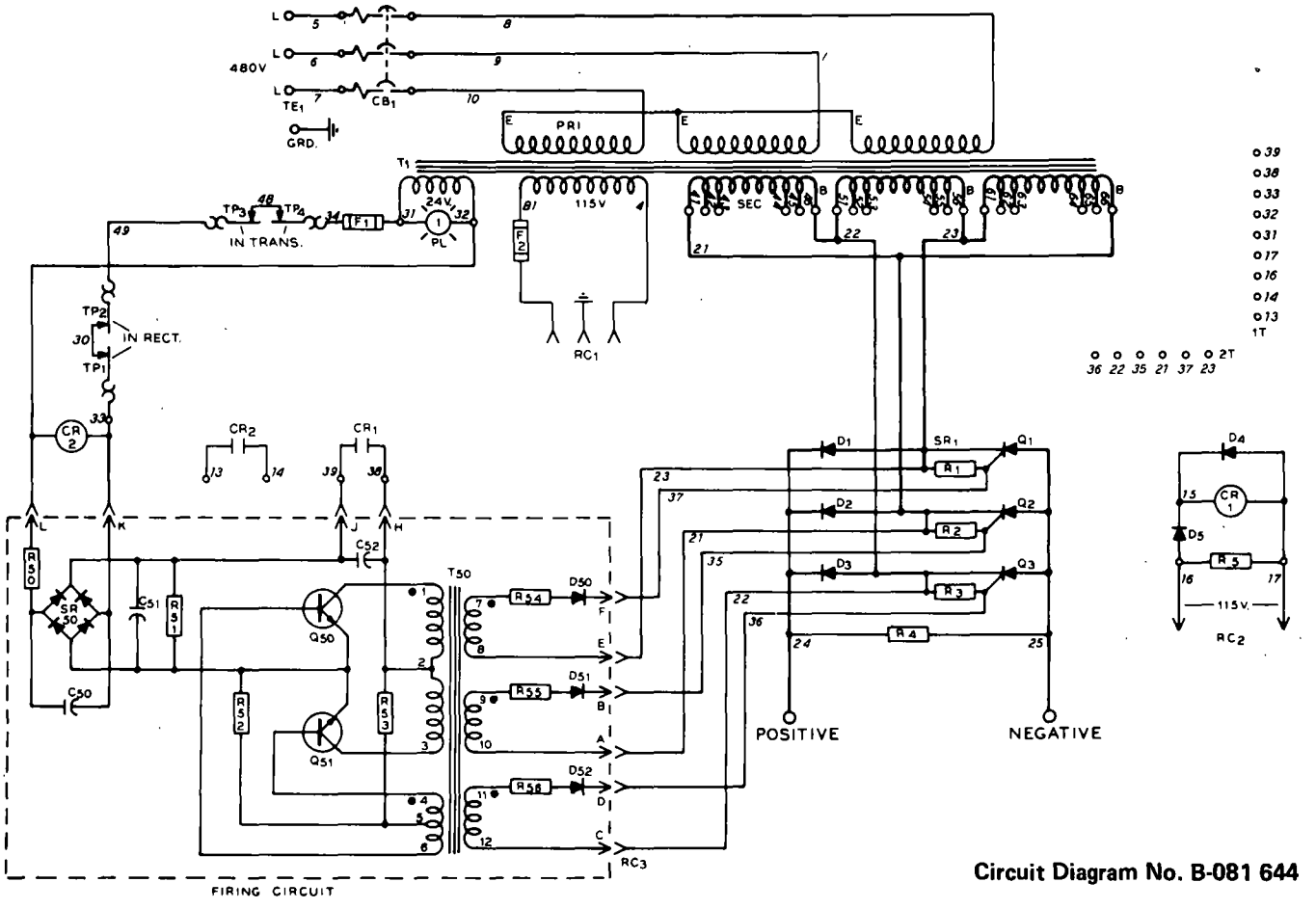

Figure 5-1. Circuit Diagram

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Effective With Serial No. HK243705

MODEL
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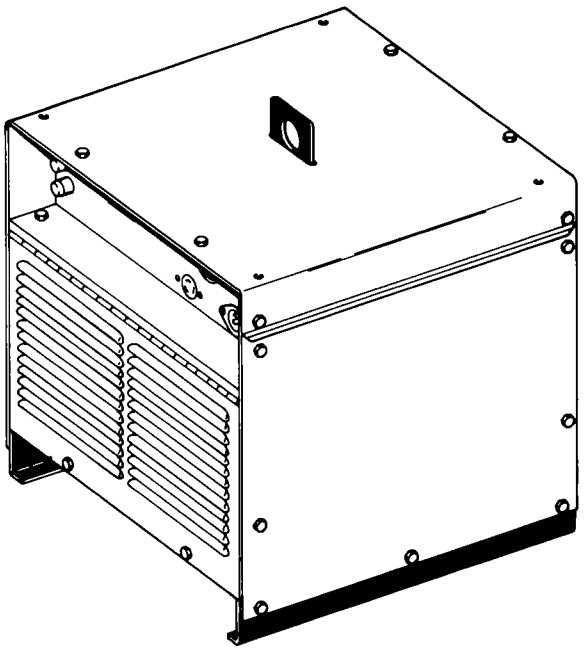

PARTS LIST

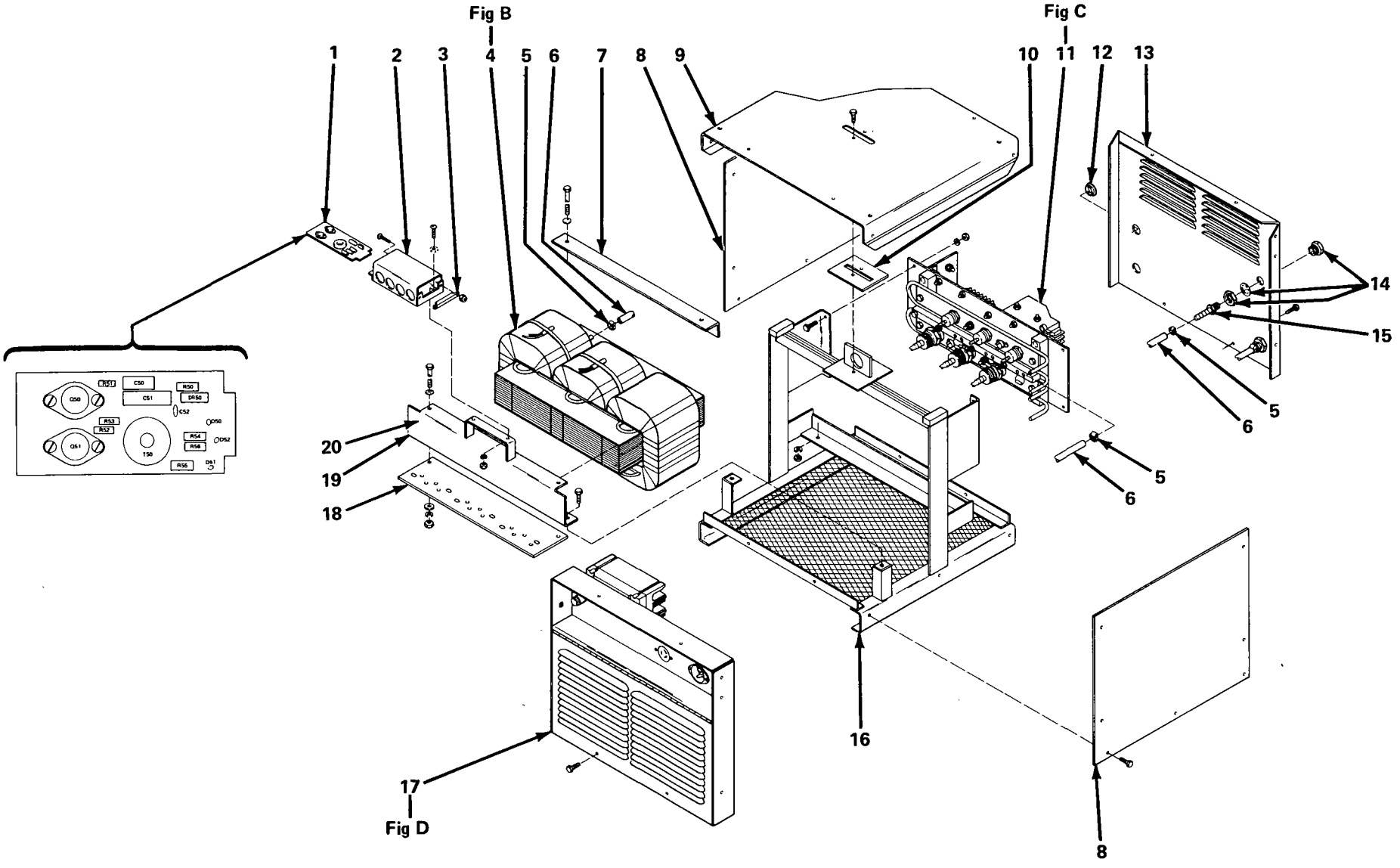

Figure A — Main Assembly

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure A			**Main Assembly**	
1		034 025	CIRCUIT CARD ASSEMBLY, firing - circuit (consisting of)	1
	C50	034 286	. CAPACITOR, poly film 0.1 uf 100 volts dc	1
	C51	031 633	. CAPACITOR, electrolyte 80 uf 25 volts dc	1
	C52	031 646	. CAPACITOR, ceramic 0.001 uf 1000 volts dc	1
	D50,51,52	026 202	. DIODE, rectifier 1 amp 400 volts straight polarity	3
	Q50,51	024 207	. TRANSISTOR, 15 amp 100 volts	2
	R50	030 761	. RESISTOR, carbon 1 watt 10 ohm	1
	R51	030 021	. RESISTOR, carbon 0.5 watt 4700 ohm	1
	R52	030 038	. RESISTOR, carbon 0.5 watt 220 ohm	1
	R53	030 004	. RESISTOR, carbon 0.5 watt 10K ohm	1
	R54,55,56	030 802	. RESISTOR, carbon 1 watt 22 ohm	3
	SR50	021 939	. RECTIFIER, integrated 1.5 amp 400 volts	1
	T50	032 304	. TRANSFORMER, inverter	1
2		032 979	ENCLOSURE, printed circuit board	1
3	RC3	039 756	CONNECTOR, amphenol	1
4	T1	081 551	TRANSFORMER, power - main (See Fig. B Page 3)	1
5		010 323	CLAMP, hose 1/4 - 5/8 dia	20
6		603 105	HOSE, neoprene - braid No. 1 x 5/16 ID (order by ft)	9 ft.
7		081 410	ANGLE, mounting - transformer rear	1
8		081 512	PANEL, side	2
9		081 514	COVER, top	1
10		022 627	GASKET, lifting - eye cover	1
11		Figure C	BAFFLE, with - components (See Page 4)	1
12		000 527	BLANK, snap - in 7/8	1
13		081 516	PANEL, rear	1
14		602 956	FITTING, pipe - brass adapter bulkhead 1/4 NPT x 15/16	2
15		604 308	FITTING, brass - barbed male 1/4 TBG x 1/4 NPT	2
16		081 402	BASE	1
17		Figure D	PANEL, front - with components (See Page 6)	1
18		081 420	TERMINAL BOARD, power output	1
19		081 426	BRACKET, mounting - transformer & circuit card enclosure	1
20		081 422	STRIP, insulating terminal - secondary	1

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

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure B		**081 551**	**Transformer, Power - Main (See Fig. A Page 2 Item 4)**	
31	TP3,4	026 181	THERMOSTAT, normally closed	2
32		605 538	CABLE TIE	4
33		**081 640	COIL, primary/secondary	2
34		**081 639	COIL, primary/secondary w/115 - 24 volts winding	1
35		**081 550	TRANSFORMER SUBASSEMBLY, power - main (consisting of)	1
36		081 526	. STRIP, mica 0.015 x 3-1/2 x 3-1/2	4
37		081 525	. STRIP, polyester glass laminate 0.031 x 3-1/2 x 3-1/2	4
38		081 527	. STRIP, mica 0.015 x 2-5/8 x 3-3/8	3
39		081 417	. HEAT SINK, coil - transformer	3
40		010 337	. WEDGE, polyester glass laminate 3/16 x 3/4 x 5	9

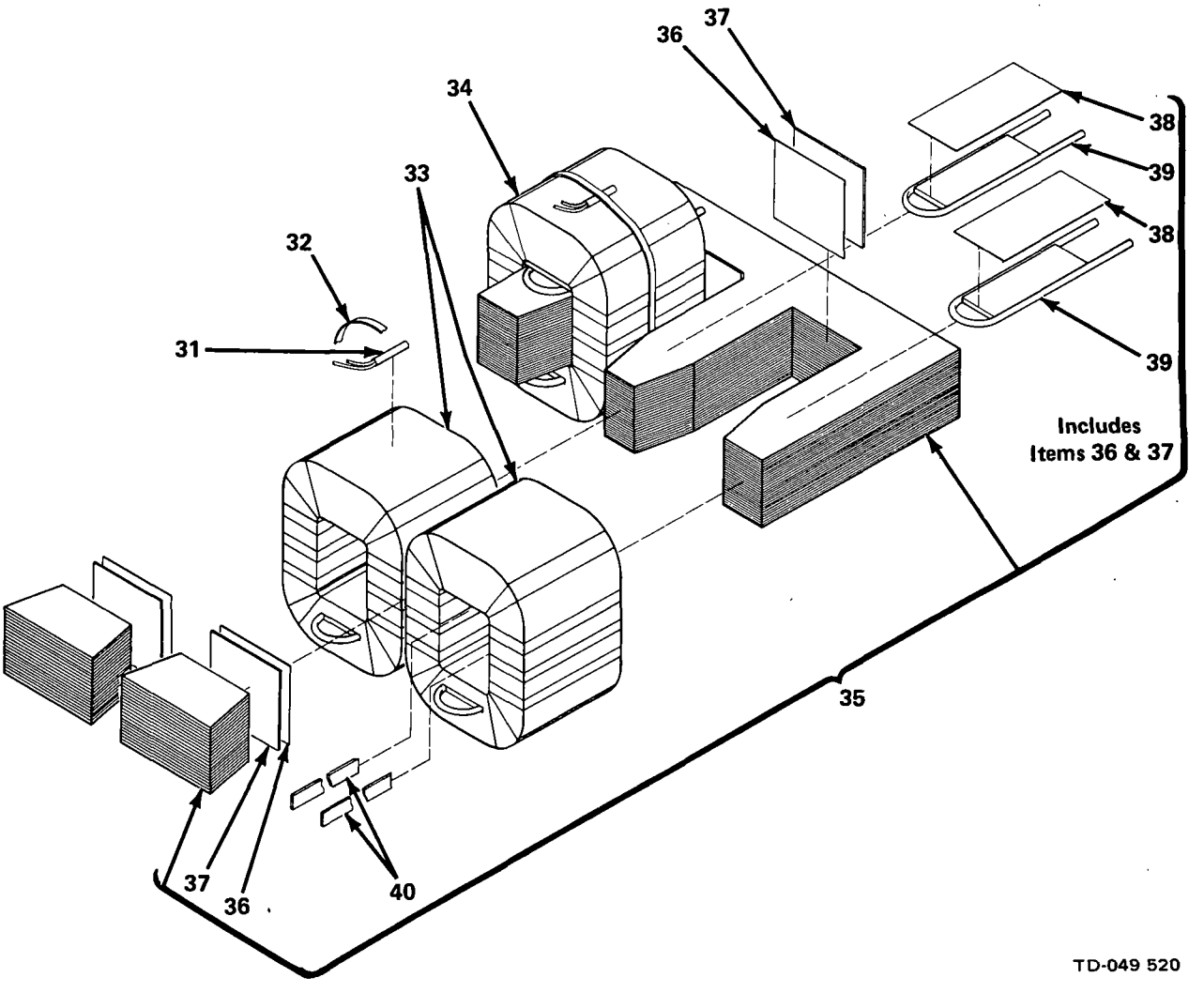

Figure B — Transformer, Power-Main

**Replace at Factory or Factory Authorized Service Station.

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

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure C			**Baffle, With - Components (See Fig. A Page 2 Item 11)**	
51	TE1	081 452	TERMINAL ASSEMBLY, primary (consisting of)	1
52		081 423	. TERMINAL BOARD	1
53		038 888	. STUD, brass 1/4-20 x 1-1/2 w/hex collar	3
54		010 915	. WASHER, flat - brass 1/4 ID x 5/8 OD	3
55		601 836	. NUT, brass - hex jam 1/4-20	12
56		081 416	ANGLE, mounting - terminal board primary	1
57	2T	038 772	BLOCK, terminal 20 amp 6 pole	1
58		081 506	BRACKET, mounting - wire harness	1
59	R4	030 837	RESISTOR, WW fixed 100 watt 25 ohm	1
60	CR2	034 619	RELAY, 24 volts ac DPDT	1
61		081 453	COVER, dust - relay	1
62	R5	030 601	RESISTOR, WW adj 25 watt 1000 ohm	1
63	1T	038 832	BLOCK, terminal 20 amp 9 pole	1
64	D4,5	026 202	DIODE, rectifier 1 amp 400 volts straight polarity	2
65	CR1	034 615	RELAY, 24 volts ac 2PDT	1
66		010 146	CLAMP, nylon 5/8 dia	1
67		081 421	BAFFLE, mounting - components	1
68	SR1	035 224	RECTIFIER, silicon diode (consisting of)	1
69	D1-3	034 164	. DIODE, rectifier 380 amp 300 volts straight polarity	3
70	TP1,2	032 810	. THERMOSTAT, normally closed	2
71		034 217	. HEAT SINK	1
72		034 221	. INSULATOR, mounting - rectifier	2
73		034 220	. STRIP, connecting - rectifier	1
74		010 323	. CLAMP, hose 1/4 - 5/8 dia	2
75		603 105	. HOSE, neoprene braided No. 1 x 5/16 ID (order by ft)	2 ft.
76	R1-3	030 026	. RESISTOR, carbon 0.5 watt 560 ohm	3
77		034 216	. HEAT SINK	1
78	Q1-3	039 526	. THYRISTOR, SCR 250 amp 200 volts	3

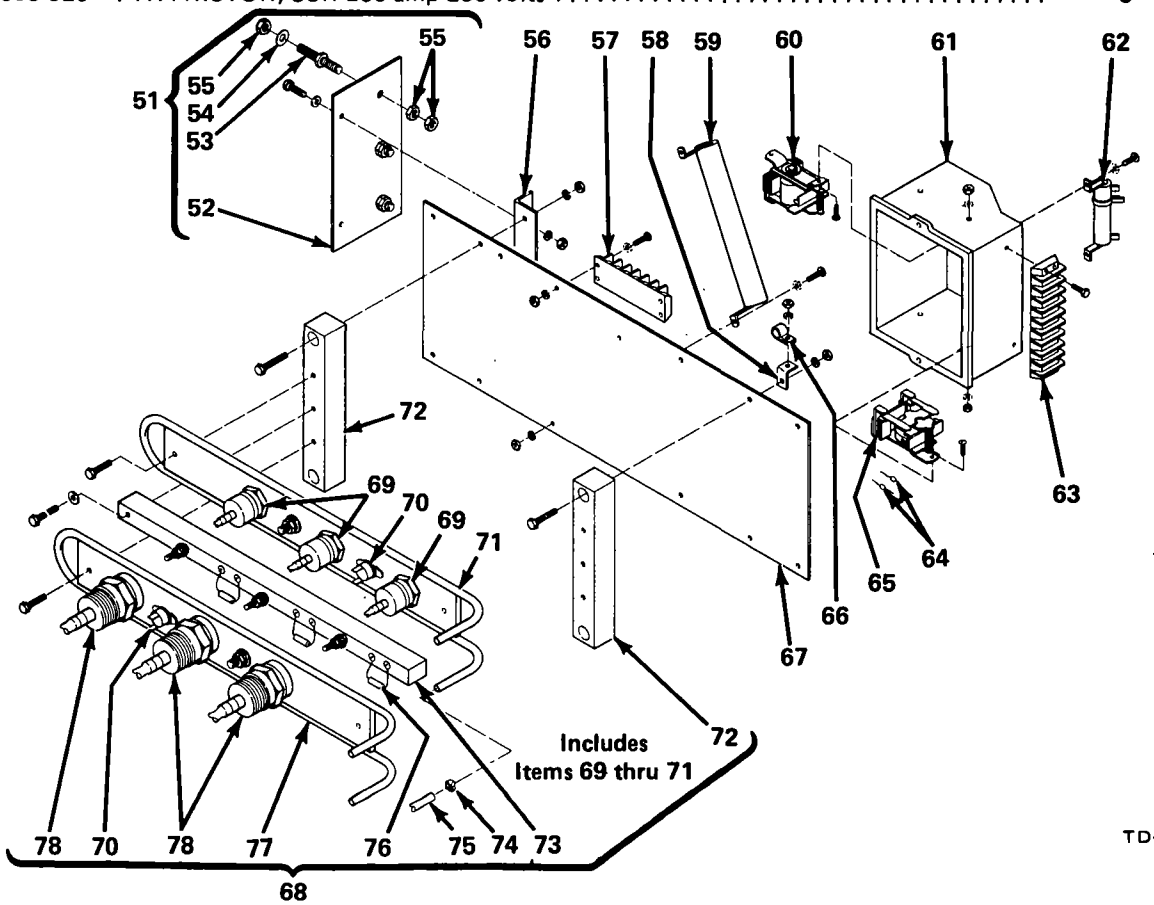

Figure C — Baffle, With-Components

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

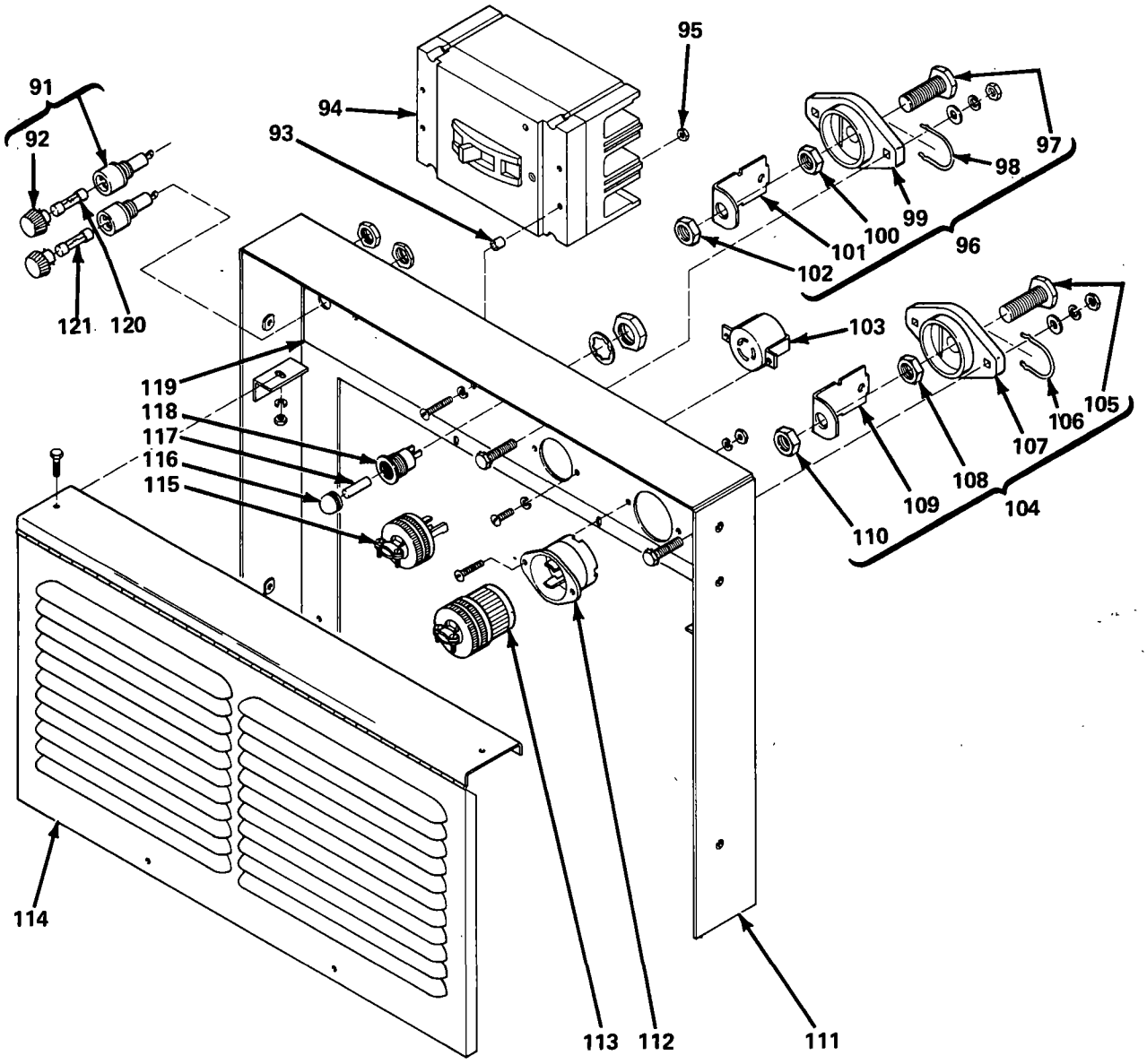

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Figure D — Panel, Front-With Components

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure D			**Panel, Front - With Components (See Fig. A Page 2 Item 17)**	
91		012 617	HOLDER, fuse - miniature (consisting of)	2
92		059 139	. CAP, fuseholder	2
93		034 223	TUBING, steel 5/16 OD x 17 ga wall x 3/4	4
94	CB1	034 167	CIRCUIT BREAKER, magnetic 3 pole 30 amp 600 volts ac	1
95		032 865	NUT, brass - hex special 10-32	4
96	POS	039 047	TERMINAL, power - output red (consisting of)	1
97		601 976	. SCREW, cap - steel hex hd 1/2-13 x 1-1/2	1
98		053 032	. CLIP, spring - bus bar	1
99		039 049	. TERMINAL BOARD, red	1
100		601 880	. NUT, steel hex jam 1/2-13	1
101		039 044	. BUS BAR	1
102		601 879	. NUT, steel - hex full 1/2-13	1
103	RC1	039 686	RECEPTACLE, twistlock grounded 2P3W	1
104	NEG	039 046	TERMINAL, power - output black (consisting of)	1
105		601 976	. SCREW, cap - steel hex hd 1/2-13 x 1-1/2	1
106		053 032	. CLIP, spring - bus bar	1
107		039 045	. TERMINAL BOARD, black	1
108		601 880	. NUT, steel - hex jam 1/2-13	1
109		039 044	. BUS BAR	1
110		601 879	. NUT, steel - hex full 1/2-13	1
111		081 513	PANEL, front	1
112	RC2	039 634	RECEPTACLE, twistlock flange 2P2W	1
113		039 635	CONNECTOR BODY, twistlock 2P2W	1
114		081 507	DOOR, access - front	1
115		039 687	CAP, twistlock grounded 2P3W 15 amp 277 volts	1
116		027 628	LENS, light - indicator clear red	1
117	PL1	*027 632	BULB, incandescant - slide base 24 volts	1
118		027 631	HOUSING, light - indicate slide base 125 volts	1
119			NAMEPLATE (order by model and serial number)	1
120	F1	*012 633	FUSE, miniature glass 1 amp	1
121	F2	*012 655	FUSE, miniature glass 10 amp	1

*Recommended Spare Parts.

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