

August 1973

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MODEL

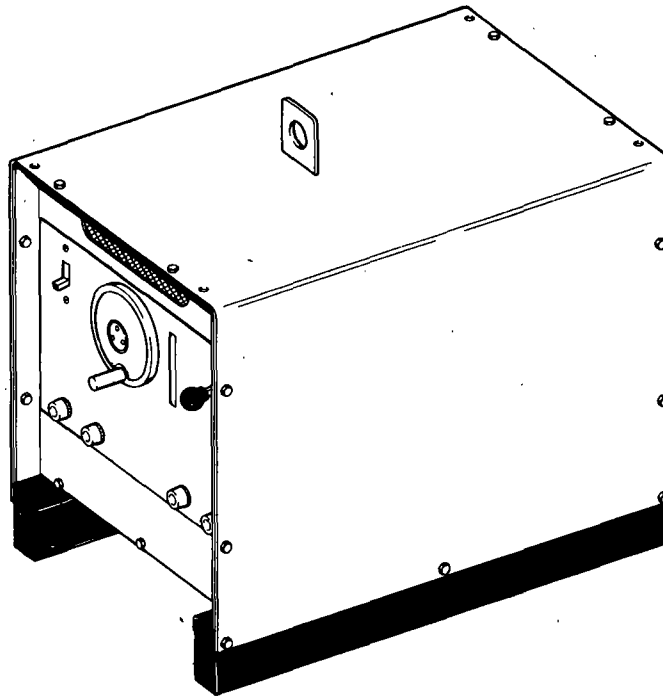
STOCK NO.

Two Fifty Twin

901 973

Two Fifty Twin-P

901 976



MODEL/STOCK NO.	SERIAL/STYLE NO.	DATE PURCHASED

OWNER'S MANUAL



MILLER ELECTRIC MFG. CO.
APPLETON, WISCONSIN, USA 54911

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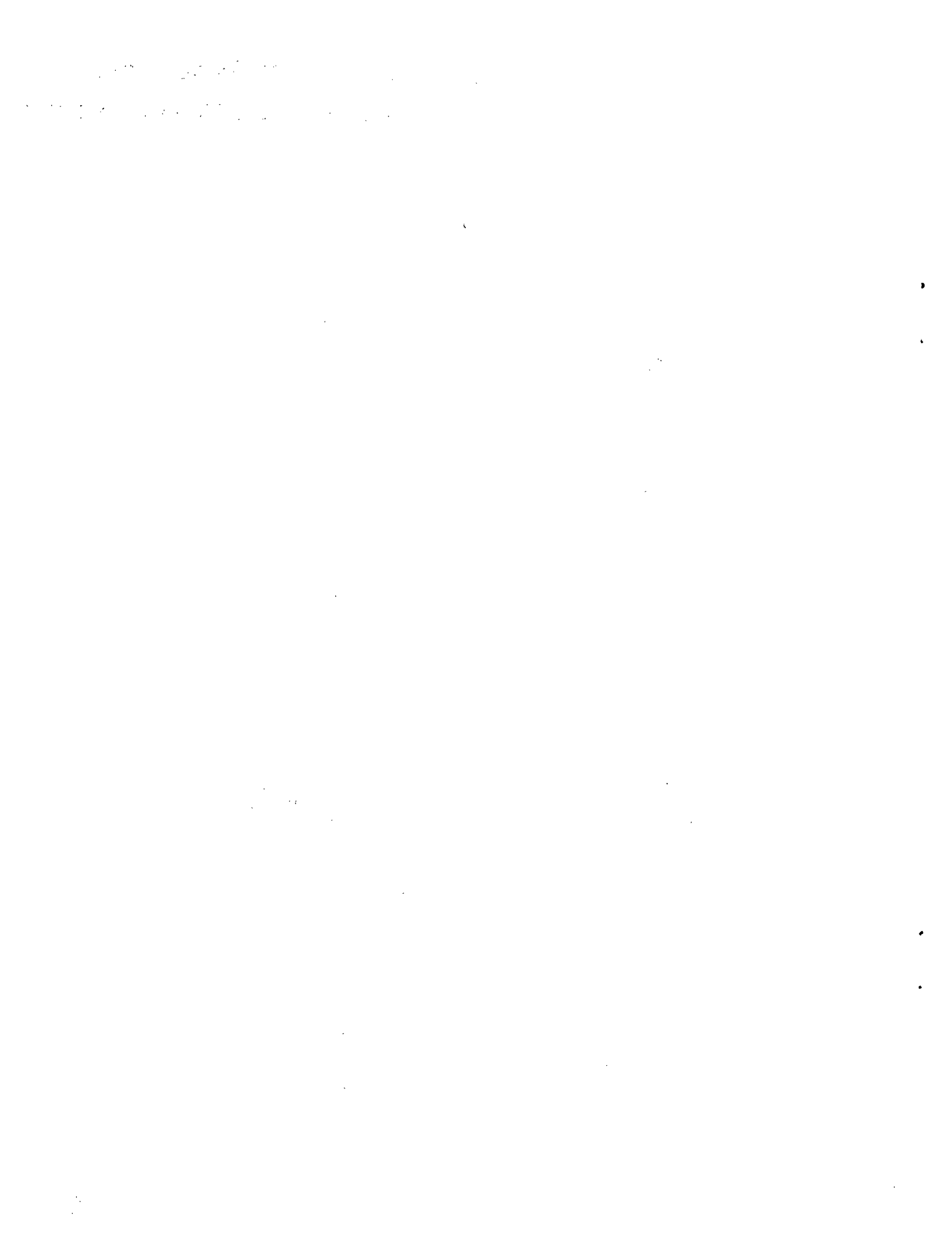


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SECTION 1- SAFETY RULES FOR OPERATION OF ARC WELDING MACHINE

1 - 1. GENERAL

These rules apply to ac and dc welding generators, ac transformer and ac/dc welding machines, and dc transformer rectifier welding machines.

In arc-welding operations, where electrically energized parts are exposed, observe the following safety rules to insure maximum personal safety and protect nearby persons.

Failure to observe these safety precautions may expose not only you, but fellow workers as well, to serious injuries. Once these rules are learned and kept in mind, proceed with maximum assurance.

1 - 2. WELDING CABLES

DON'T overload cables, (Figure 1-1)

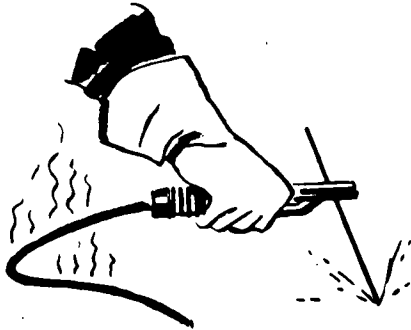


Figure 1-1. Don't overload cables

NEVER use welding cables at currents in excess of their rated capacity. It will cause overheating and rapid deterioration of the insulation. It is also uneconomical.

DON'T use worn or poorly connected cables. (Figure 1-2)

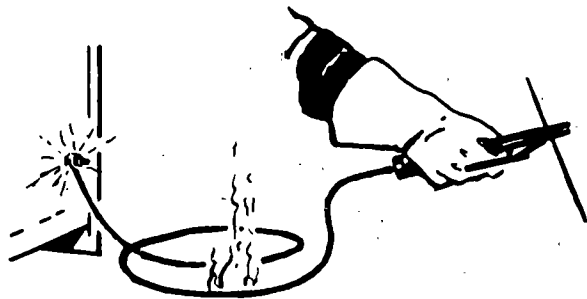


Figure 1-2. Don't use worn or poorly connected cables

Inspect the cables frequently. Immediately repair all breaks in the insulation with rubber and friction tapes. Tighten all cable connections and adequately insulate any joints where a connector may have an exposed conductive part. In addition to the potential hazard to life, a hazard occurs when exposed sections of cable come in contact with grounded metallic objects, causing an arc. Unprotected eyes may be injured and fire may result if combustible materials such as oil or grease are in the vicinity. The efficiency and quality of welding will be improved by elimination of these dangerous grounds, and by keeping connections tight.

1 - 3. ELECTRODE HOLDER

DON'T use electrode holders with defective jaws. (Figure 1-3)

Keep the jaws of the electrode holder tight and the gripping surfaces in good condition to provide close contact with the electrodes. Defective jaws will permit the electrode to wobble, making control of the welding operations difficult.

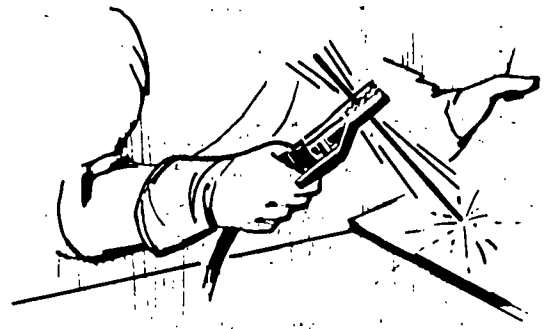


Figure 1-3. Don't use Electrode Holder with defective jaws

DON'T use electrode holder with loose cable connections.

Keep the connections of the electrode lead to the holder tight at all times.

Use only fully insulated electrode holders (and without protruding screwheads.)

Never touch two electrode holders from two separate welding machines at the same time.

1 - 4. CODE CONFORMANCE

The machine and its equipment must be installed and maintained in accordance with the National Electrical Code and local requirements.

1 - 5. PARALLEL CONNECTIONS

See diagrams in the instruction manual applying to the welding machine used.

1 - 6. POWER DISCONNECT SWITCH

If the welding machine does not include a power disconnect switch, install one at or near the machine.

1 - 7. POLARITY SWITCH

DON'T operate the polarity switch under load.

The polarity switch (when supplied) is provided for changing the electrode lead from positive (reverse polarity) to negative (straight polarity). Never move it while under the load of a welding current. Operate this switch only while the machine is idling and the welding circuit is open. The potential dangers of opening the circuit while carrying high current are:

1. An arc will form between the contact surfaces of the switch and severely burn them.
2. The person throwing the switch may receive a severe burn from this arcing.

1 - 8. RANGE SWITCH

DON'T operate the range switch under load.

The range switch (when supplied) is provided for obtaining required current settings. It must never be operated while the machine is under the load of welding current. Operate the range switch only while the machine is idling and the welding circuit is open. The potential danger of switching the circuit while carrying high current is the formation of an arc between the contact surface which will severely burn them. Repeated occurrences of this arcing will eventually prevent operation of the contacts.

1 - 9. EXHAUST GASES

DON'T use gas engine units in confined spaces without venting the exhaust gases. (Figure 1-4)

If gasoline or other fuel driven welding machines are operated indoors, provide means to pipe the exhaust gases to the outside air to avoid carbon monoxide poisoning.

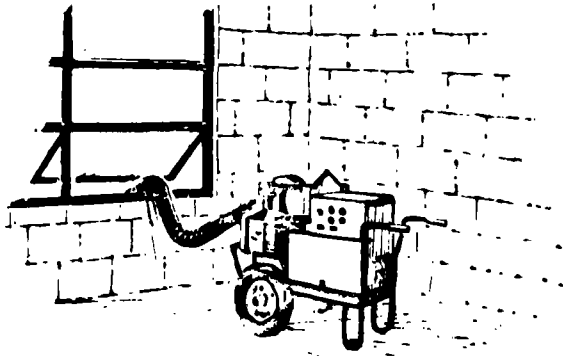


Figure 1-4. Vent exhaust gases

1-10. POWER CIRCUIT GROUND

DON'T use welding machine without grounding frame or case. (Figure 1-5)

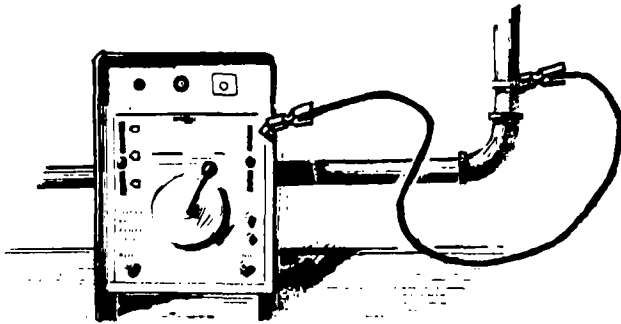


Figure 1-5. Ground frame or case

Ground the ground cable of every power circuit to prevent accidental shock by stray current. The potential danger is that development of a stray current may give a fatal shock should a person, for example, place one hand on the welding machine and the other on the switch box, or other grounded equipment. Do not ground to pipelines carrying gases or flammable liquids and conduits carrying electrical conductors. Be sure conductors can safely carry the ground current. When connecting the welding machine, properly ground the machine frame or case.

1-11. CONTAINERS WHICH HELD COMBUSTIBLES

DON'T weld on containers which have held combustible or flammable materials or materials which, when heated, give off flammable or toxic vapors without proper cleaning, purging, or inerting.

Welding containers which have held flammable or combustible materials may be extremely dangerous. To prevent a fire or explosion of the container, follow the recommendations of the American Welding Society Pamphlet A6.0 "Welding or Cutting Containers Which Have Held Combustibles".

DON'T depend on your eyes or nose to decide if it is safe to weld on a closed container.

Find out what was in the container or use an explosimeter. A very small amount of residual flammable gas or liquid can cause a serious explosion.

NEVER use oxygen to ventilate a container.

When you know the container held a gas or liquid which will readily dissolve in water:

1. Flush out with water several times and then fill with water as far as work permits, positioning container to permit introduction of as much water as possible.
2. Before welding be sure there is a vent or opening to provide for release of air pressure.

When you know the container held a gas or liquid which will not readily dissolve in water:

1. Clean out thoroughly with steam or a cleansing agent and purge all air or inert with a gas such as carbon dioxide or nitrogen before repairing. Carbon dioxide is heavier than air and will tend to remain in the container if the opening is at the top.
2. Use steam to clean out light material.
3. Use a strong caustic soda solution to clean out heavy oils or grease.
4. Be sure to purge all air or inert with a gas, such as nitrogen or carbon dioxide, no matter how well you have cleaned. There may still be traces of oil, grease, or other readily oxidizable material under the seams.

Be careful when cleaning with steam or caustic soda wear goggles and gloves.

DON'T clean where there is poor ventilation.

Ventilation is necessary to carry away harmful or explosive vapors.

DON'T clean where there are open flames.

When scraping or hammering to remove heavy sludge or scale, use a spark resistive tool and keep it wet to avoid sparks.

Keep your head and arms as far away from your work as possible.

1-12. HOLLOW CASTINGS

DON'T weld on hollow (cored) castings that have not been properly vented. The casting may explode. (Figure 1-6)



Figure 1-6. Don't weld on hollow (cored) castings

1-13. EXPLOSION HAZARDS

NEVER weld in or near explosive atmospheres. Such atmospheres can be created by flammable gas leaks or by vapors from flammable liquids (gasoline, alcohol, etc.) or by combustible dusts.

1-14. VENTILATION

DON'T weld in confined spaces without adequate ventilation.

When welding in confined spaces, provide ventilation in accordance with United States of American Standard Z49.1, 1967. Always provide adequate ventilation by blowers, air lines, or other acceptable means. Never use compressed oxygen. The depletion of the oxygen supply, the heat of welding, and the fumes given off may cause severe discomfort or a serious illness.

When toxic fumes from lead or cadmium bearing materials or any other substances are present in harmful concentrations, always use an air supplied respirator.

1-15. SOLVENTS

Do not weld where chlorinated hydrocarbon vapors from degreasing, cleaning, or spraying may reach or be drawn into air surrounding the welding operation. The heat of the arc can decompose solvent vapors to form phosgene, a highly toxic gas and other irritating decomposition products.

Do not weld where ultraviolet light from the electric arc can penetrate air containing even minute amounts of vapors from solvents such as trichloroethylene or perchloroethylene. Ultraviolet light can decompose the vapors to form phosgene, a highly toxic gas and other irritating products.

1-16. FIRE HAZARDS

DON'T weld near flammable or combustible materials.

Fires can be caused by the arc, by contact with the heated metal, by slag, or sparks. Keep combustibles at least 35 feet from the arc or suitably protected. If welding must be done in a particular area, move the combustibles away. If they cannot be moved, cover them completely with fire resistive screens. Cover cracks or openings in floors or walls; sweep floor free of combustibles and wet down, if wood, being sure welder wears insulation shoe coverings. Avoid welding on partition walls in contact with combustibles. Heated metal on the other side of partition wall being welded upon can ignite combustibles in contact with the partition. Where other than a minor fire might develop, have a fire watcher stand-by with suitable fire extinguishing equipment for at least one-half hour after the welding is completed.

1-17. ELECTRICAL SHOCK-VOLTAGE

OPEN power circuits before checking machines.

Before working on the wiring, switches, controls, etc., open the power line disconnect switch. In most welding shops the power supply used for arc welding machines is 230 or 460 volts. Open circuit voltages are usually less than 100 volts and welding or arc voltage drops are still lower. However, all of these voltages are capable of developing a harmful or fatal current to the body.

DON'T touch electrically "hot" parts.

NEVER touch any exposed or non-insulated part of the cables, cable connectors, clamps, electrode holders, electrodes, or the power supply equipment to prevent harmful or fatal electric shock or burns.

1-18. ELECTRICAL SHOCK-DAMPNESS

NEVER work in a damp area without suitable insulation against shock. Keep hands, feet, and clothing dry at all times.

To prevent harmful body shocks, keep hands, feet and clothing dry. Never stand or lie in puddles of water, damp ground, or against grounded metal when welding without suitable insulation against shock. Always find a dry board or rubber mat to stand on when water, moisture, or perspiration cannot be avoided. Dampness between the body and an energized or grounded metallic part lowers the resistance to the passage of current to the body which may produce a harmful or fatal shock. Salt in perspiration or sea water dangerously lowers contact resistances.

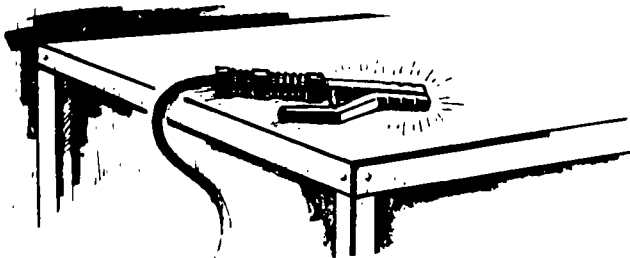


Figure 1-7. Don't leave electrode in contact with grounded metallic surface.

1-19. STARTING UNDER LOAD

DON'T leave an uninsulated electrode holder, or a "live"

electrode on the table top or in contact with a grounded metallic surface. (Figure 1-7)

When it is not in use, never place an electrode holder in contact with the tabletop or other metallic surface in contact with welding ground. Provide an insulated hook or holder for the electrode holder. A potential danger is that a holder in contact with the ground circuit provides a dead short circuit on the welding machine. If the machine should be started up, this short circuit would cause an excessive load on the machine and may damage the insulation.

1-20. FACE PROTECTION

DON'T use cracked or defective helmets or shields.

Keep the helmet, hand shields, or face shield in good condition. If cracks occur in the fibre material, replace the shield, since the leakage of arc rays may cause serious burns.

1-21. EYE PROTECTION

NEVER under any circumstances, look at an electric arc without eye protection.

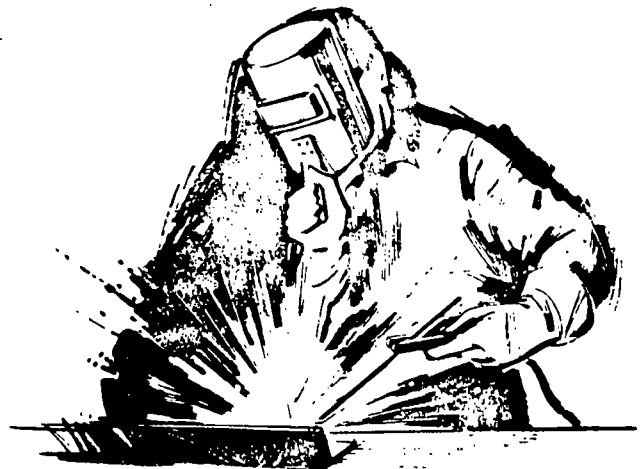


Figure 1-8. Use eye protection at all times

CAUTION

Make sure that flash goggles are used under the welding helmet at all times, particularly while gas shielded-arc welding.

In some type of arc welding, such as gas shielded-arc welding, ultra-violet and infra-red radiation from the arc is particularly intense and requires constant attention to avoid arc flashes to the welder when striking an arc and to avoid exposure to other welders.

NEVER strike an arc without ascertaining that nearby persons either have the necessary protective equipment or are looking in the opposite direction.

For welding operations in open areas, provide portable, non-reflecting screens to shield persons nearby from the rays of the arc. Eye burns from the arc, through not generally permanent injuries, are exceedingly painful. Such burns frequently referred to as "flashes", feel like hot sand in the eye. If the eye is focused on the arc without filter-glass protection, infra-red radiation can cause retinal scarring and impaired vision. For eye burns consult your first aid station or doctor.

NEVER use cracked, ill-fitting, or defective plates.

The filter glass plate provided in the helmets and shields must be of reputable manufacture conforming to the latest American National Standards Institute, Standard Z2.1. Replace cracked or ill-fitting filter plates promptly.

NEVER use filter plates without a protecting cover glass.

Keep a clean cover glass in front of the filter plate for the protection thereof. Frequent renewal of these cover glasses is necessary, since they become covered with spatter, reducing vision.

1-22. CLOTHING

NEVER use poor, inadequate, or worn-out clothing. Wear heavy shoes, tightly laced. Keep clothing dry.

Proper and dry, oil-free clothing is essential for the welder's protection. Clothing must not only keep off the spatter and molten particles, but must also obstruct the rays of the arc and, when necessary, insulate the body from harmful electrical currents.

Wear leather or asbestos gloves at all times to protect the hands and wrists. Dark colored shirts are preferred to light ones because light ones reflect arc rays to exposed parts of the body. In the case of gas shielded-arc welding, light colors are more reflective and may cause eye burns due to the intense ultra-violet rays given off by the process. Avoid cotton fabrics when gas shielded-arc welding.

An arc burn on the skin resembles a sunburn, except that it is usually more severe. Clothing can be made flame resistant by treatment with a solution of 3/4 pound of sodium stannate in 1 gallon of water, then wrung out and dipped in a solution of 1/4 pound ammonium sulphate per gallon of water. Don't wash clothing so prepared in water, but dry clean.

When welding operations are to be performed in vertical and overhead positions, leather sleevelets, aprons, and in some cases leggings and ear plugs should be used to prevent severe burns from spatter and molten metal.

1-23. HOT METAL BURNS

NEVER pick up hot objects. (Figure 1-9)

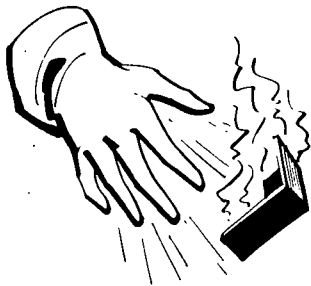


Figure 1-9. Never pick up hot objects

NEVER pick up pieces of metal which have just been welded or heated, or the stub ends of electrodes which have been discarded.

1-24. GRINDING AND CHIPPING

NEVER do any chipping or grinding without protective goggles. (Figure 1-10)



Figure 1-10. Never do any chipping or grinding without protective goggles.

Whenever it is necessary to grind or chip metal, wear protective goggles specifically designed for this purpose. Serious eye injuries may result from failure to wear protective goggles.

1-25. COMPRESSED GAS CYLINDERS

NEVER strike an arc on a compressed gas cylinder. Always observe the following precautions in regards to compressed gas cylinders:

1. Avoid accidental contact of the electrodes, electrode holder, or other electrically energized parts with a compressed gas cylinder or any other pressure vessel. Serious accidents or fires may result.
2. Use I.C.C. or D.O.T. cylinders. They are manufactured and maintained in accordance with D.O.T. requirements and are safe so long as they are properly handled. Don't drop cylinders.
3. Identify gas content by the name marked on the cylinder. If the cylinder is unmarked, do not use it. Return it to the supplier. Do not rely on a color code.
4. Never use a cylinder or its contents for other than intended purposes.
5. Keep oil and grease away from oxygen cylinders and cylinder valves.
6. Keep cylinders away from exposure to sparks, hot slag, open flame and all possible sources of ignition or excessive heat.
7. Be careful that cylinders are not placed so as to become a part of an electrical circuit. Avoid third rails, wires and electric welding circuits.
8. When transporting cylinders by crane, use cradle platform or other suitable support.
9. Never lift the cylinders by slings, by the caps or by electric magnets.
10. Never use cylinders as supports or rollers.
11. Never try to mix any gases in a cylinder.
12. Never try to refill a cylinder.
13. Mark or tag empty cylinders "Empty" or "MT".
14. Send "Emptys" back to the supplier promptly.
15. Keep "Emptys" and "Fulls" separate.
16. Never tamper with or alter cylinder numbers or other markings. This is not only foolish but may be illegal.
17. Do not tamper with or change fittings on cylinders.
18. If valves cannot be opened by hand, do not use hammer or wrench. Notify supplier.
19. Protect cylinder valves from bumps, falls, falling objects, and from weather. Keep them covered with cylinder caps when moving cylinders.
20. Keep valves closed on empty cylinders.
21. See that your cylinders are clear of passageways and active work areas and that they are secured against falling.
22. If adapter is required between cylinder and regulator, always use a standard adapter. These may be obtained from your supplier. Where right and left hand threads are used on adapter, use two wrenches to insure leak proof connections.
23. Do not store cylinders in unventilated areas.

SECTION 2 - INTRODUCTION

Model	Welding Current Ranges Amperes	Max. Open Circuit Voltage	Rated Welding Current Amperes	Amperes Input At Rated Load Output 60 Hz. Single Phase					Overall Dimensions (Inches)	Weight (Pounds)	
				(208) 200 Volts	230 Volts	460 Volts	kva	kw		Net	Ship
Without Power Factor Correction	ac Low 25-125 High 105-325	ac 78	250 @ 30 Volts, 30% Duty Cycle	103	90	45	20.7	11.8	Height - 26-1/4 Width - 19 Depth - 28	332	342
			200 @ 28 Volts, 50% Duty Cycle	80	70	35	16.1	8.2			
With Power Factor Correction	dc Low 20-95 High 70-250	dc 75	250 @ 30 Volts, 30% Duty Cycle	78	68	34	15.6	11.8		340	350
			200 @ 28 Volts, 50% Duty Cycle	57	50	25	11.5	8.2			

NEMA RATING the above electrical specifications conform with Nema Rating EW 1-1971, Nema Class II (30) and comply with ANSI Standard C87.1-1971.

Figure 2-1. Specifications

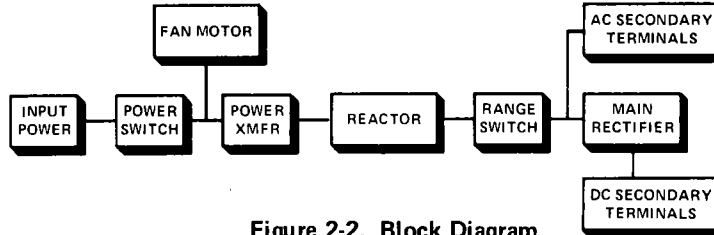


Figure 2-2. Block Diagram

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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 Designation and/or Stock Number and Serial (or Style) Number of the equipment be supplied.

2-3. DESCRIPTION

This unit is a single phase powered welding power source, which produces both ac and dc welding current.

This welding power source is capable of operation on either 200, 230 or 460 volt 60 Hertz primary electrical power. Jumper links are provided with the welding power source for the purpose of matching the machine to one of the above available input voltages.

Proper installation can contribute materially to the satisfactory and trouble-free operation of the welding power source. It is suggested that each step in this section be studied carefully and followed in detail.

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

Installation, operating, and maintenance procedures, practices, etc., which will result in personnel injury or loss of life if not carefully followed.

IMPORTANT

Installation, operating, and maintenance procedures, practices, etc., which will result in damage to equipment.

NOTE

Installation, operating, and maintenance procedures, practices, etc., which it is essential to emphasize.

SECTION 3 - INSTALLATION

3-1. LINE DISCONNECT SWITCH

CAUTION

A precautionary measure should be taken to provide maximum protection against electrical shock. Before electrical connections are made from the switch, be sure that the line disconnect switch has been opened or the primary input circuit fuses have been removed and remain that way until the installation has been completed.

Proper installation can contribute materially to the satisfactory and trouble-free operation of the welding machine. It is suggested that each step in this section be studied carefully and followed in detail.

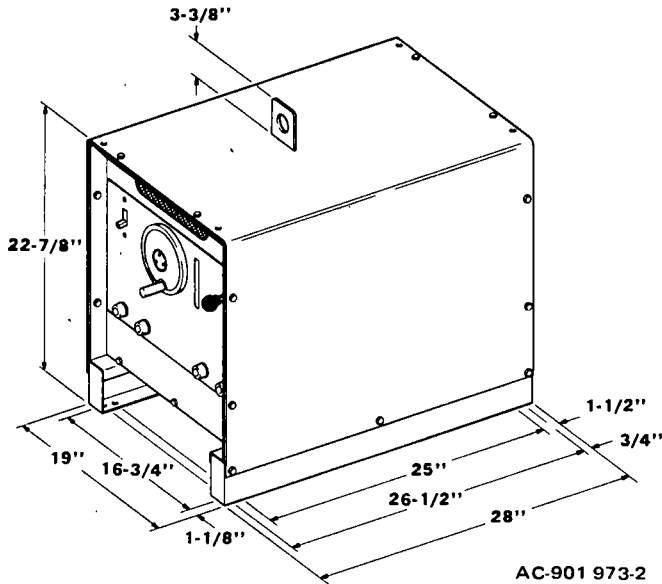
3-2. LOCATION

A good installation is essential if the welding power source is to provide satisfactory and dependable service.

IMPORTANT

The welding power source should be located so that the front and rear panels with the air vents are clear of any obstruction. Cooling air is drawn in through the front upper air vent and expelled out of the rear panel air vent.

The location should be such that a minimum amount of dust and dirt will be drawn into the air stream. Preventive maintenance consists of removing the wrapper from the welding power source and blowing out the dust accumulation inside the unit. For this reason it is desirable to locate the unit so that the wrapper can be removed without any difficulty.



AC-901 973-2

Figure 3-1. Dimensional Drawing

3-3. PRIMARY CONNECTIONS

This ac/dc arc welding power source is a single phase unit and must be connected to a single phase power line. Consult the local public electric utility if there is any question about the system used locally or the proper connections necessary to connect single phase power service to the welding power source.

NOTE

It is recommended that the primary leads be of the heavy rubber covered type or run in solid or flexible conduit. Select the proper size primary fuse and cable from Table 3-1.

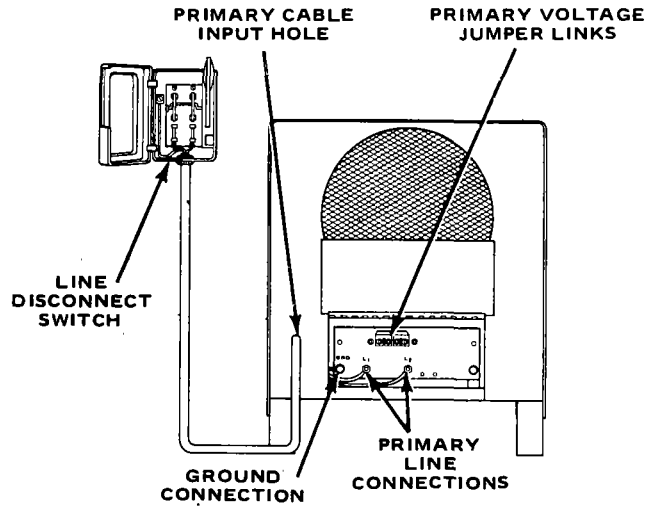
Table 3-1. Primary Wire and Fuse Size

MODEL	PRIMARY WIRE SIZE (AWG)				FUSE SIZE IN AMPERES			
	200V	230V	460V	575V	200V	230V	460V	575V
Without P.F.C.	No. 2	No. 2	No. 6	No. 8	150	150	70	60
With P.F.C.	No. 3	No. 4	No. 8	No. 10	125	100	50	40
	(8)	(8)	(8)	(8)				

*Numbers in () indicate ground wire size.

Insert the two primary leads plus one ground lead through the access hole provided on the lower left portion of the rear panel. See Figure 3-2 for hole location. This 1-3/4 inch diameter hole will accept standard conduit fittings.

The two primary leads are to be connected to terminals L1 and L2 on the primary terminal board (TE1), which is located behind the primary access door on the rear panel. The ground lead must be connected to the stud on the primary terminal board labeled GRD. The remaining end of the ground lead should be connected to a suitable ground such as: a water pipe, ground rod, etc. Use whatever grounding means is acceptable to the local electrical inspection authority.



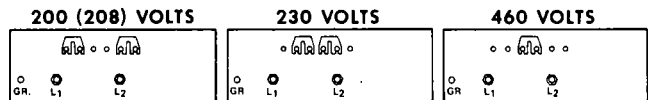
AC-901 973-3

Figure 3-2. Primary Connections

CAUTION

The stud labeled GRD is connected to the welding power source chassis and is for grounding purposes only. Do not connect a wire from the terminal labeled GRD to either one of the single phase line terminals as this will result in an electrically hot welding power source chassis.

The standard welding power source is designed to operate on either 200, 230 or 460 volts, 60 Hertz primary electrical power. This machine was shipped from the factory with the jumper links arranged for the highest voltage the machine has been designed to operate on. To setup the welding power source for the voltage to be used, position the jumper links, located on the primary terminal board, as shown in Figure 3-3.



A-010 586

Figure 3-3. Primary Voltage Jumper Link Arrangement

NOTE

Whenever only one jumper link connection is necessary to obtain the proper input voltage connections, such as 460 volts, connect both jumper links across the same two terminals. This will prevent losing the second jumper link.

3-4. SECONDARY WELDING CONNECTIONS

It is recommended that the welding cables be kept as short as possible, placed close together and be of adequate current carrying capacity. The resistance of the welding cables and connections cause a voltage drop which is added to the voltage of the arc. Excessive cable resistance may result in overloading as well as reducing the maximum current output of which the welding power source is capable.

The proper operation of any arc welding power source is to a great extent dependent on the use of welding cables and connections that are in good condition and of adequate size. An insulated holder must be used to ensure the operator's safety.

NOTE

When welding with ac, if the welding cables are coiled up they will generate a magnetic field that will seriously affect the operation of the welding power source. Always lay the welding cables out.

Use Table 3-2 as a guide for selecting the correct welding cable size for the anticipated maximum weld current that will be used. Table 3-2 takes into account the total cable for the weld circuit. This means the combined length of the Electrode cable that connects the Electrode Holder to the welding power source and the Work cable between the welding power source and the work piece. For example: If the Electrode cable is 75 feet long and the work cable is 25 feet long, you would select the size cable from Table 3-2 that is recommended for 100 feet at the maximum amperage that will be used. In the case of a maximum anticipated weld current of 250 amperes, 1/0" weld cable would be recommended for both the Electrode and Work cables.

Table 3-2. Secondary Cable Size

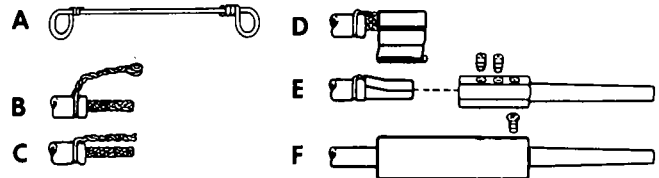
Welding Amperes	*Total Length Of Cable (copper) in Weld Circuit	
	*50	100
100	4	4
150	2	2
200	1	1
250	1/0	1/0

- NOTE: *A. 50 FEET OR LESS
 *B. CABLE SIZE IS BASED ON DIRECT CURRENT (DC), 30% 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 (O.C.V.) 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.

Two ac (yellow) receptacles and two (black & red) receptacles are provided on the lower portion of the front panel for making secondary connections. Plugs for these receptacles are provided. Connect the weld cables to these plugs as follows:

1. Remove 3/4 inch of insulation from one end of the welding cable.
2. Clamp the welding cable in a vise with the uninsulated end protruding upward out of the vise approximately 1-3/4 inches.
3. Place the steel tie wire approximately 1/4 inch (B) from the end of the insulation.
4. Make a half turn around the cable bringing the looped ends of the tie wire together.
5. Insert a rod of approximately 3/8 inch diameter through the two looped ends of the tie wire.

6. Twist the tie wire (B) until the entire tie wire is twisted and is tight around the insulation of the welding cable.
7. Clip off the looped ends of the tie wire.
8. Bend the twisted tie wire over along the side (C) of the uninsulated portion of the welding cable.
9. Wrap the strip of copper foil tightly around the uninsulated end of the welding cable and the twisted tie wire (D).
10. Place the jack plug on the end of the welding cable and push it onto the welding cable over the copper foil (E).
11. Insert the 1/4-20 set screws into the center and upper holes in the jack plug and tighten.



AA-901 024-4

Figure 3-4. Jack Plug Installation

12. Remove the welding cable from the vise and insert the jack plug into the fiber sleeve.
13. Slide the fiber sleeve over the jack plug and welding cable until the hole in the fiber sleeve lines up with the 8/32 inch hole in the jack plug.
14. Insert the 8/32 inch self tapping screw (F) through the hole in the fiber sleeve into the plug. Tighten the screw with a screw driver. Connect a work clamp to one of the unused ends of one of the cables. Connect an electrode holder to the unused end of the other welding cable. The method of connecting the cables to the work clamp and electrode holder will depend on the manufacturer's design.

To obtain dc straight polarity weld current, the Work cable should be plugged into the positive (red) receptacle on the front of the machine. The Electrode cable should be plugged into the negative (black) receptacle.

To obtain dc reverse polarity weld current, the above connections should be reversed.

For ac weld current, the Work and Electrode cables need only to be plugged into the two ac (yellow) receptacles.

SECTION 4 - OPERATION

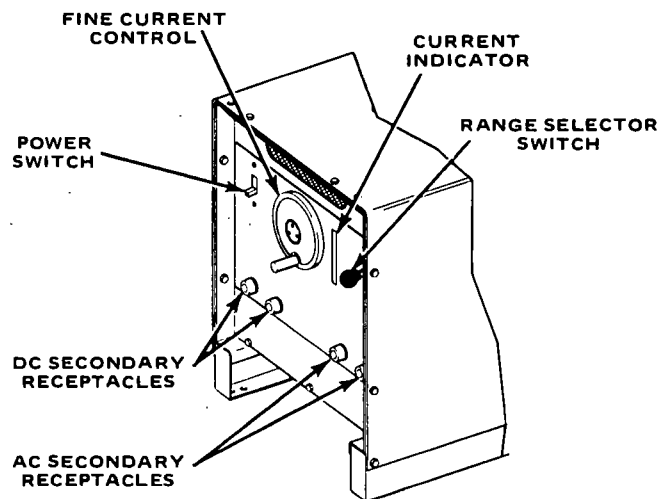
CAUTION

Never, under any circumstances, operate the welding power source with the cover removed. In addition to a safety hazard, improper cooling may result in damage to the welding transformer and the welding power source components. Warranty is void if the welding power source is operated with the wrapper removed.

4-1. RANGE SELECTOR SWITCH (Figure 4-1)

A RANGE SELECTOR Switch, located on the front control panel, is provided to select either a HIGH or LOW amperage range when welding with ac or dc. When this switch is placed in the HIGH position (up), an ac range of 105-325 amperes or a dc range of 70-250 amperes will be available. When in the LOW position (down), an ac range of 25-125 amperes or a dc range of 20-95 amperes will be available. Exact amperage selection within the range selected may be made by adjusting the Fine Current Control, the function of which will be explained in paragraph 4-2.

4-2. FINE CURRENT CONTROL & CURRENT INDICATOR (Figure 4-1)



AA-901 972-2

Figure 4-1. Front Panel View

The exact amount of desired welding current within the range chosen can be selected by rotating the Fine Current Control on the front of the welding power source. The Current Indicator on the front panel will show the current selected. When reading the Current Indicator for the amperage selected, ensure that the scale being read coincides with the amperage range being used.

4-3. ON-OFF POWER SWITCH

The POWER Switch controls the primary line power to the welding transformer. When the switch is placed in the ON position, open circuit voltage will be impressed across the Work and Electrode Receptacles and the welding power source will be in a ready-to-weld status.

4-4. DUTY CYCLE

The duty cycle of the welding power source is the percentage of a ten minute period that a welding power source can safely be operated at a given output current setting. This welding power source is rated at 250 amperes, 30 percent duty cycle. This means the welding power source can be safely operated at 250 amperes welding current for three minutes out of every ten. If the welding current is decreased, the duty cycle will increase. Figure 4-2 enables the operator to determine the safe output of the welding power source at various duty cycles.

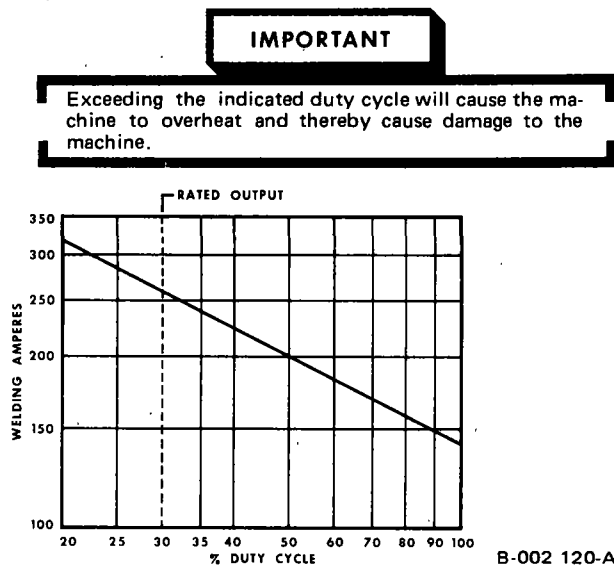


Figure 4-2. Duty Cycle Chart

4-5. VOLT-AMPERE CURVE

The volt-ampere curve shows the output voltage available at any given output current within the limits of the minimum and maximum Fine Current Control setting. Load voltage is predetermined to a large degree by arc characteristics. With the use of the volt-ampere curve, it is possible to determine the amperage required for a specific load voltage. With reference to the volt-ampere curve (Figure 4-3), the curve shows the maximum and minimum settings of the Fine Current Control only. Curves of other settings will fall between the maximum and minimum curves shown.

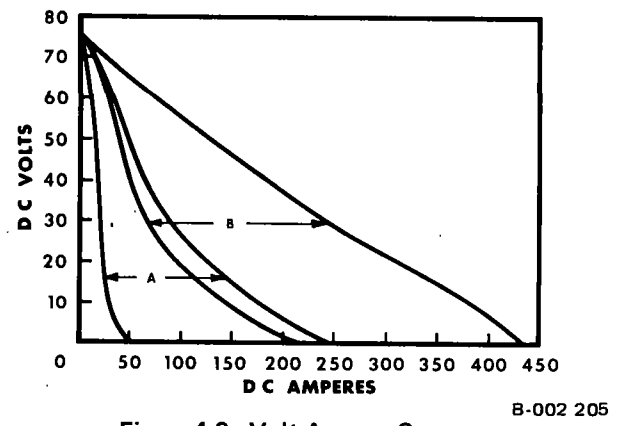
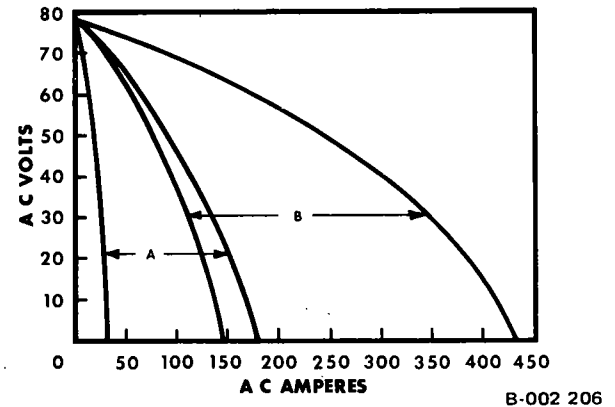


Figure 4-3. Volt-Ampere Curves

SECTION 5 - SEQUENCE OF OPERATION

5-1. SHIELDED METAL-ARC WELDING (SMAW)

1. Make primary and secondary connections as outlined in Section 3.

NOTE

An electrode holder and work clamp will have to be supplied by the operator and connected to the welding power source secondary leads.

2. Place the RANGE SELECTOR Switch in the desired position.

3. Rotate the Fine Current Control until the desired amperage is indicated on the Current Indicator.
4. Connect the work clamp to the item to be welded.
5. Place the desired electrode rod into the electrode holder.
6. Put on protective clothing and welding glasses.
7. Place the POWER Switch in the ON position and commence welding.
8. The Fine Current Control may be adjusted while welding if necessary.
9. After the welding job is completed, break the arc and place the POWER Switch in the OFF position.

SECTION 6 - MAINTENANCE

CAUTION

Be sure the branch circuit or main disconnect switch is open or primary input circuit fuses are removed before attempting any inspection or work on the inside of the welding power source. Placing the ON-OFF POWER Switch on the welding power source in the OFF position does not remove voltage from the power terminals inside of the machine.

6-1. POWER FACTOR CORRECTION CAPACITORS

The power factor correction capacitors are built into the welding power source as standard equipment on models with power factor correction only. These capacitors should require no maintenance or attention and should possess an infinite life, unless the power line is subjected to high voltage surges. If a capacitor should fail, it can readily be recognized by a bulged case and oil spillage and can be easily replaced.

6-2. TRANSFORMER

Occasional blowing out of the dust and dirt from around the transformer is recommended. This should be done periodically depending upon the location of the unit and the amount of dust and dirt in the atmosphere. A clean dry air stream should be used for this cleaning operation.

Approximately once a year, it may be necessary to lubricate the lead screw, guides and slider. Apply a light coat of Socony BRB high temperature grease (or equivalent), taking care to avoid getting grease on any electrical components of the welding power source.

6-3. FAN MOTOR

All models are equipped with an exhaust fan and rely on forced draft for adequate cooling for high duty cycles and overloads. The fan motor is manufactured with lifetime lubricated sealed ball bearings and no attention should be required.

6-4. INPUT POWER & WELDING CABLES

These leads should be inspected periodically. Frayed and broken wires are common at the electrode holder and work clamp. The insulation should be checked for cracking and bare spots.

SECTION 7 - TROUBLESHOOTING

INTRODUCTION

The data collected here, discusses some of the common problems which may occur in this welding power source. A little thought will probably solve the problem involved through the information provided.

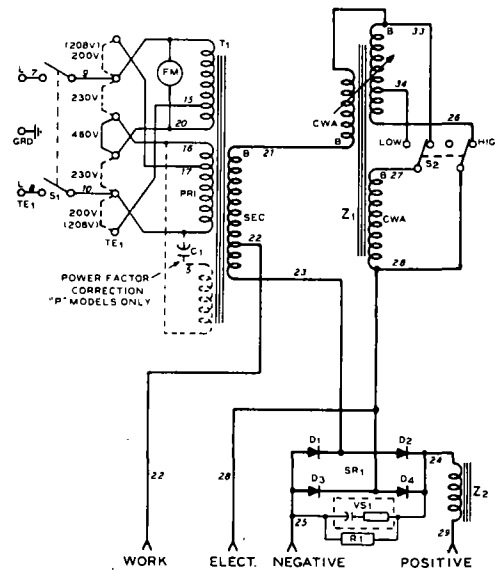
The assumption of this data is that a proper welding condition has been achieved and has been used until trouble developed. In all cases

of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

If after performing the following procedures the trouble is still not remedied, it is recommended that a serviceman be called.

It is recommended that the circuit diagram be used for reference during the troubleshooting.

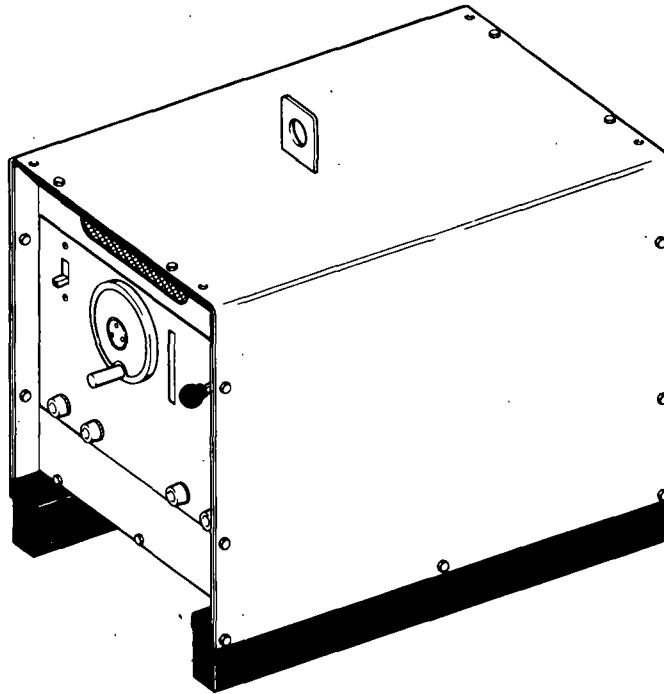
TROUBLE	PROBABLE CAUSE	REMEDY
High or low weld current output.	Jumper links on primary connection board connected for incorrect primary voltage.	Position jumper links for primary voltage being used. See Figure 3-3.
Erratic weld current.	Incorrect polarity on dc.	Make proper dc secondary connections as outlined in section 3-3.
	Loose secondary connections.	Tighten all secondary connections.
	Defective or damp electrodes.	Use new electrodes of same size and type.
Fan operates at slow rpm.	Jumper links on primary connection board connected for incorrect primary voltage.	Position jumper links for primary voltage being used. See Figure 3-3.
	Defective fan motor.	Replace.
Fan does not run.	Primary input line fuses blown.	Replace Fuses. See Table 3-1 for proper fuse size.
	Power switch defective.	Replace.
	Fan motor leads loose.	Tighten fan motor leads.
	Defective fan motor.	Replace.



Circuit Diagram No. CA-901 973-1A

Figure 7-1. Circuit Diagram

MODEL	STOCK NO.
Two Fifty Twin	901 973
Two Fifty Twin-P	901 976



MODEL/STOCK NO.	SERIAL/STYLE NO.	DATE PURCHASED

PARTS LIST



MILLER ELECTRIC MFG. CO.
APPLETON, WISCONSIN, USA 54911

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models	
				Without PFC	With PFC
Figure A Main Assembly					
1		014 632	WRAPPER	1	1
2		Figure B	PANEL ASSEMBLY, rear (See Page 2)	1	1
3	TE1	038 934	TERMINAL BOARD ASSEMBLY, primary (See Fig. C Page 3)	1	1
4		027 283	REACTOR & SHUNT (See Fig. E Page 4)	1	1
5		010 615	SPRING, indicator band	1	1
6		027 329	BAND, indicator	1	1
7	T1	027 280	TRANSFORMER, power (See Fig. D Page 3)	1	
7	T1	027 281	TRANSFORMER, power (See Fig. D Page 3)		1
8	Z2	027 218	STABILIZER	1	1
9		027 212	BAR, steel 1/4 x 1-1/2 x 18"	2	2
10		027 222	BASE	1	1
11		Figure F	PANEL ASSEMBLY, front (See Page 6)	1	1
12		039 901	PLUG ASSEMBLY, jack - black (consisting of)	1	1
13		602 160	. SCREW, self tapping - fil hd 8-32 x 1/4"	1	1
14		026 978	. INSULATOR, molded - black	1	1
15		101 219	. PLUG, jack	1	1
16		019 833	. STRIP, copper	1	1
17		602 178	. SCREW, set 1/4-20 x 3/8"	2	2
18		010 521	. WIRE, tie	1	1
19		039 608	PLUG ASSEMBLY, jack - red (consisting of)	1	1
20		019 833	. STRIP, copper	1	1
21		101 219	. PLUG, jack	1	1
22		602 178	. SCREW, set 1/4-20 x 3/8"	2	2
23		010 521	. WIRE, tie	1	1
24		602 814	. INSULATOR, molded - red	1	1
25		602 160	. SCREW, self tapping - fil hd 8-32 x 1/4"	1	1
26		026 032	HANDWHEEL	1	1
27		010 660	PIN, roll 1/8 x 1-1/8"	1	1
28		027 711	HUB, handwheel	1	1
	C1	025 317	CAPACITOR, 40 uf 440 volt		2
		027 214	STRIP, capacitor stop		1
		025 141	BRACKET, mtg - capacitor		1

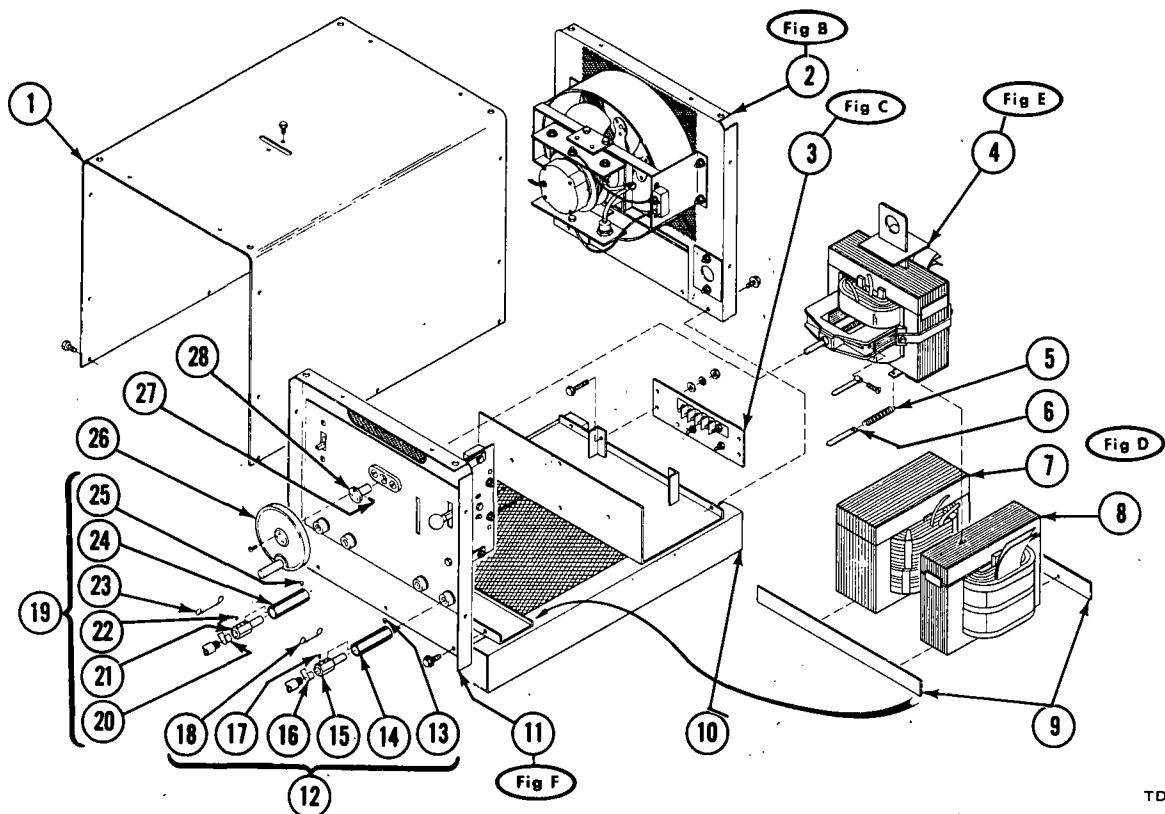
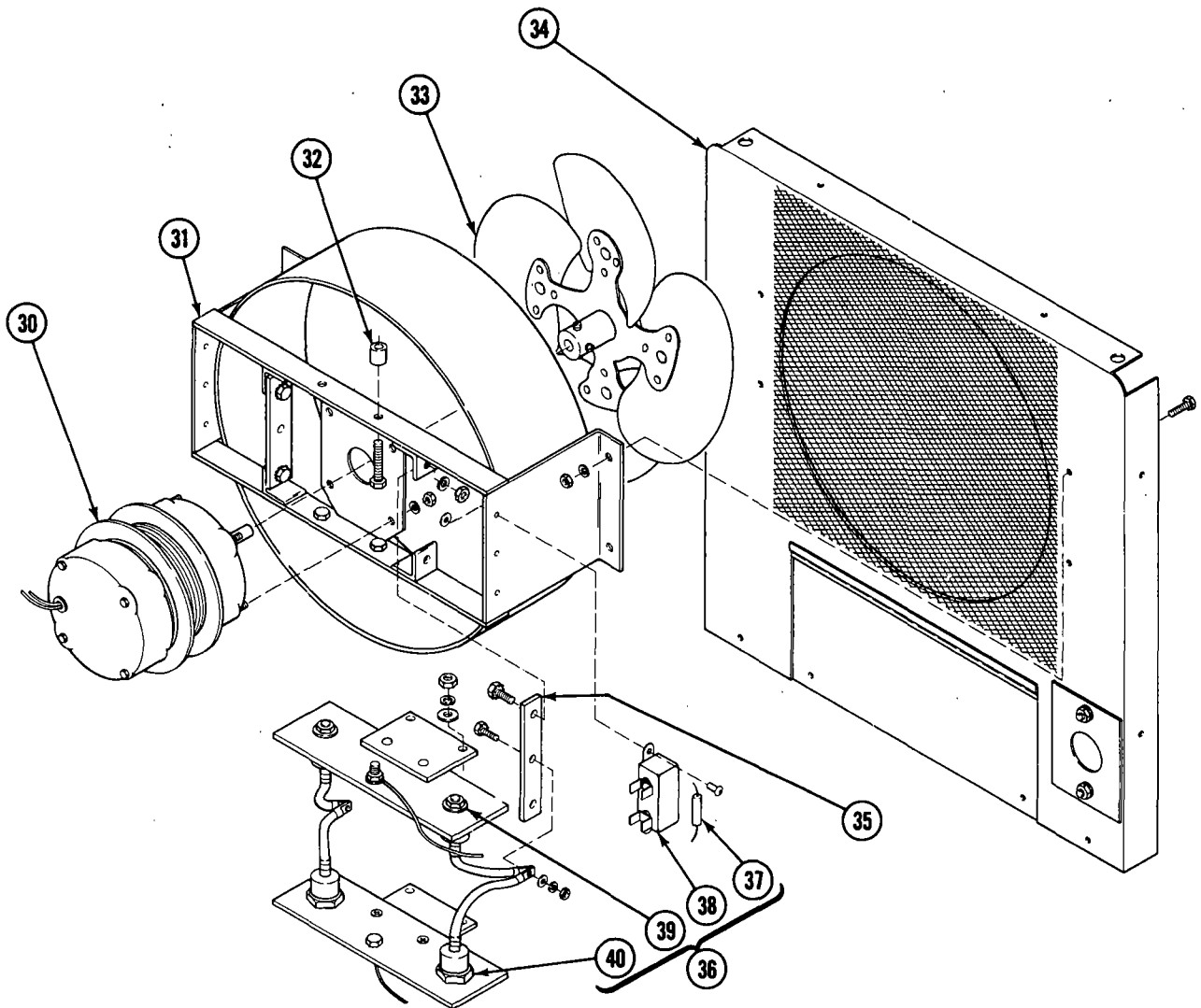


Figure A - Main Assembly

TD-901 973

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

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure B Panel Assembly, Rear (See Fig. A Page 1 Item 2)				
30	FM	032 603	MOTOR, fan (consisting of)	1
		*024 601	. BEARING	2
31		019 073	WINDTUNNEL	1
32		010 489	SPACER, mtg - rectifier	1
33		032 612	BLADE, fan	1
34		014 623	PANEL, rear	1
35		038 315	BOARD, junction - diode leads	2
36	SR1	027 198	RECTIFIER, main (consisting of)	1
37	R1	030 726	. RESISTOR, 1000 ohm 5 watt	1
38	VS1	024 471	. SUPPRESSOR, 1 uf 2.7 ohm	1
39		037 305	. DIODE, straight polarity	2
40		037 306	. DIODE, reverse polarity	2

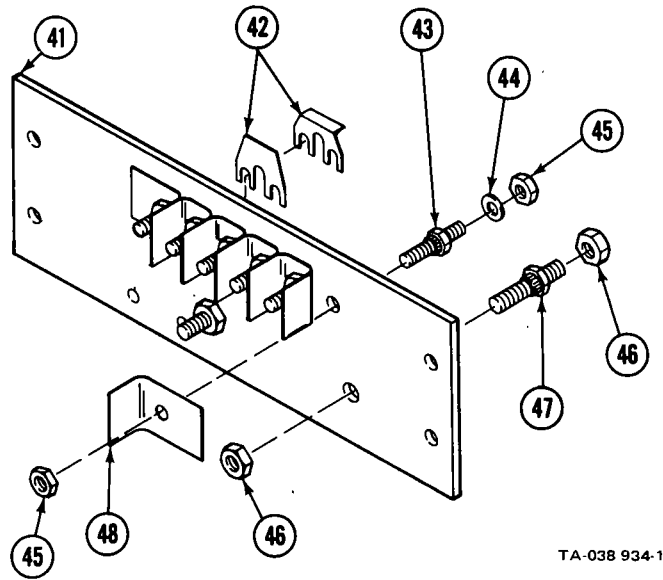


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Figure B - Panel Assembly, Rear

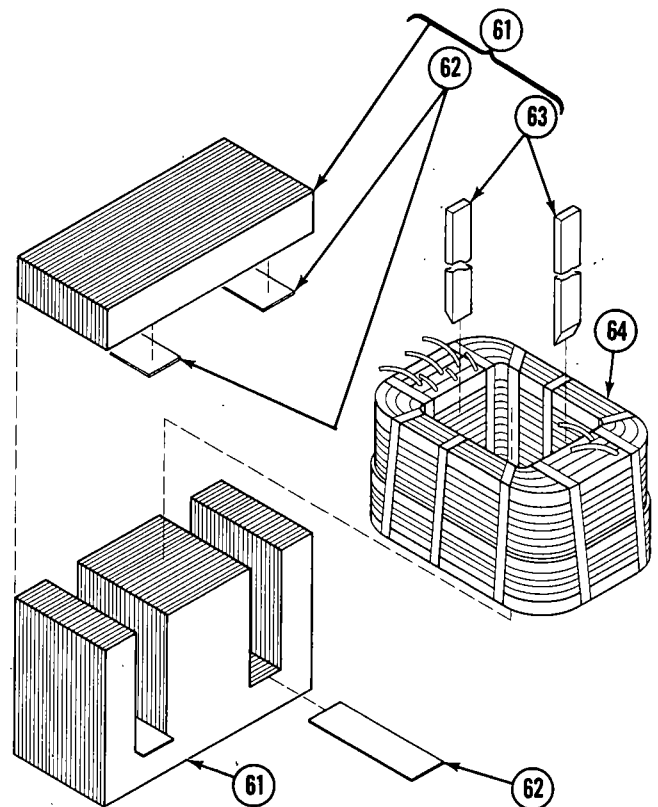
*Recommended Spare Parts
BE SURE TO PROVIDE STOCK, MODEL, AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Factory Part No.	Description	Quantity
Figure C	038 934	Terminal Board Ass'y, Primary (See Fig. A Page 1 Item 3)	
41	038 662	BOARD, mtg - components	1
42	038 618	LINK, jumper - brass	2
43	038 887	STUD, hex collar - brass 10-32 x 1-3/8"	6
44	010 910	WASHER, flat - brass 3/16"	6
45	601 835	NUT, hex - brass 10-32	12
46	601 836	NUT, hex - brass 1/4-20	4
47	038 888	STUD, hex collar - brass 1/4-20 x 1-3/4"	2
48	026 754	INSULATION	6



TA-038 934-1

Figure C — Terminal Board Assembly, Primary



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Figure D — Transformer, Power

Item No.	Factory Part No.	Description	Quantity Models	
			Without PFC	With PFC
Figure D		Transformer, Power (See Fig. A Page 1 Item 7)		
			027 280	027 281
61	**027 234	TRANSFORMER SUBASSEMBLY (consisting of)	1	1
62	026 188	STRIP, glastic	4	4
63	026 966	WEDGE, wood 1/4 x 1 x 6"	2	2
64	**027 279	COIL, secondary - primary	1	
64	**027 190	COIL, secondary - primary		1

**Replace at Factory or Authorized Service Station
BE SURE TO PROVIDE STOCK, MODEL, AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure E		027 283	Reactor & Shunt (See Fig. A Page 1 Item 4)	
76	Z1	**027 282	REACTOR (consisting of)	1
77		**027 191	. COIL, ac (top)	1
78		**027 192	. COIL, ac (bottom)	1
79		**027 230	. REACTOR SUBASSEMBLY (consisting of)	1
80		020 284	.. WEDGE, coil - front	1
81		020 301	.. GUIDE, wedge - rear	1
82		605 129	.. SCREW, machine rnd hd 1/4-20 x 7"	1
83		020 300	.. WEDGE, rear - movable	2
84		605 144	.. NUT, hex - self locking 1/4-20	1
85		027 691	.. STRIP, fiber .015 x 3-3/16 x 10"	1
86		010 188	.. INSULATION, molded - top	2
87		010 370	.. GUIDE, shunt - top	2
88		010 189	.. INSULATION, molded - bottom	2
89		010 369	.. GUIDE, shunt - bottom	2
90		601 869	NUT, hex 5/16-18	4
91		605 063	SCREW, set - headless 5/16-18 x 1-1/4"	4
92		010 256	BLOCK, anti block	4
93		027 215	SHUNT (See Fig. E1 Page 5)	1

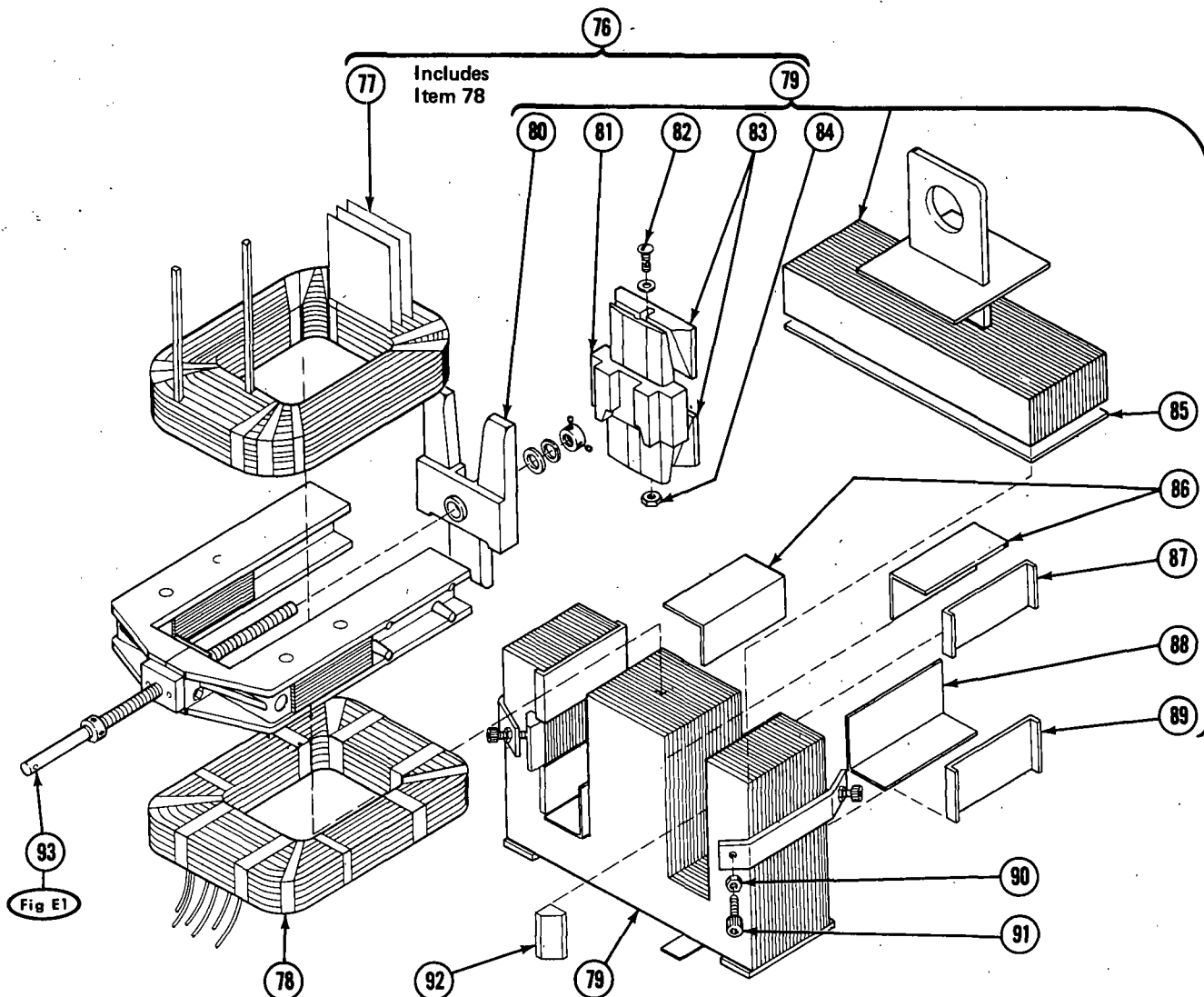


Figure E - Reactor & Shunt

TD-027 283

**Replace at Factory or Authorized Service Station
 BE SURE TO PROVIDE STOCK, MODEL, AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Factory Part No.	Description	Quantity
Figure E1	027 215	Shunt (See Fig. E Page 4 Item 93)	
101	027 673	SCREW, lead	1
102	024 785	COLLAR	2
103	027 672	BLOCK, travel shunt	1
104	601 860	NUT, hex 8-32	2
105	028 108	BLOCK, shunt	2
106	027 674	PLATE, lock	1
107	605 609	SCREW, machine - flat hd 10-32 x 1-1/2"	2
108	010 072	BEARING, thrust 7/16 ID x 3/4 OD x 1/16"	1
109	605 618	WASHER, spring 7/16"	1
110	602 176	SCREW, set 1/4-20 x 3/16"	4
111	604 633	SCREW, machine - rnd hd 8-32 x 1-1/2"	2
	602 146	SCREW, rnd hd - self tapping 8-32 x 3/4"	1

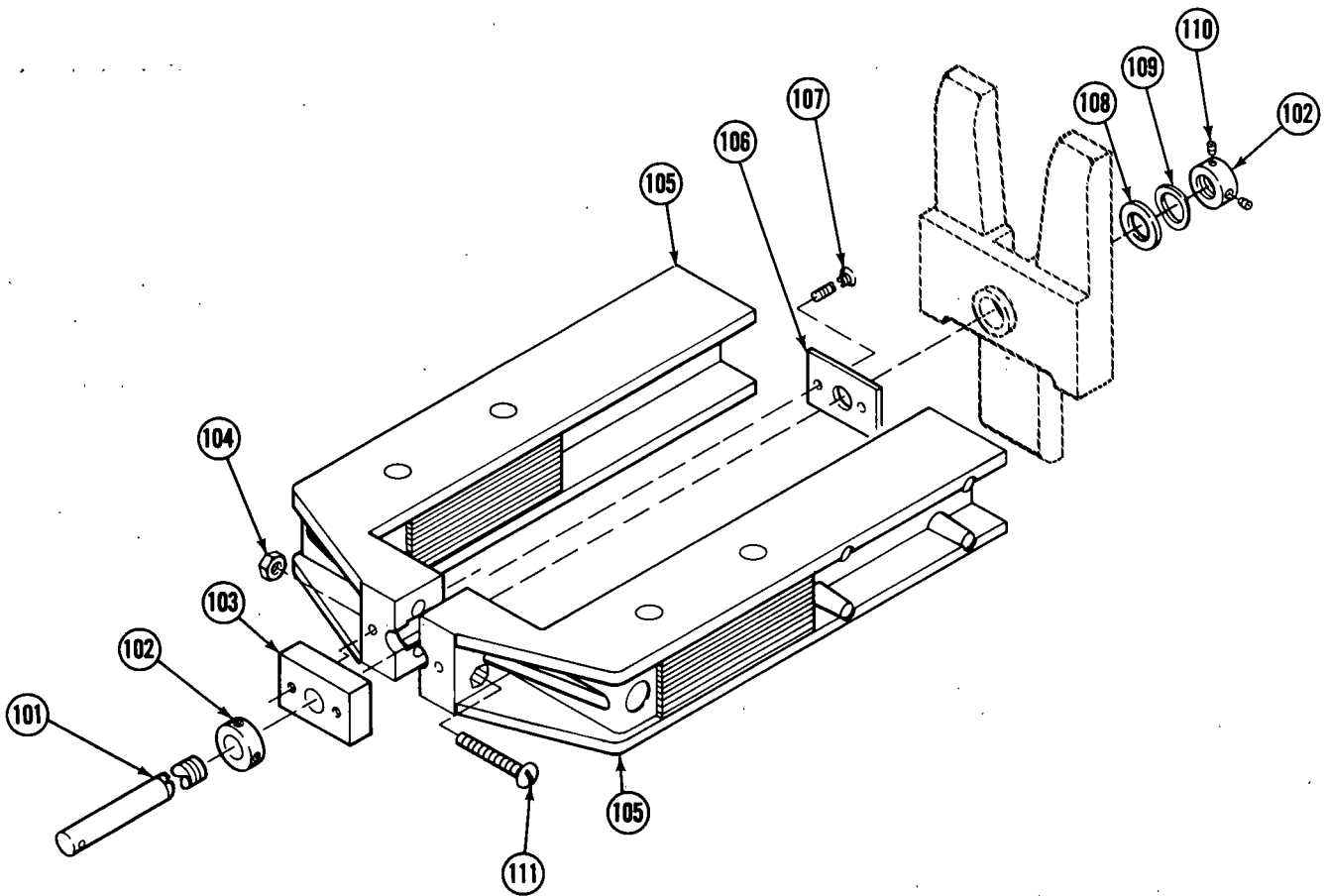


Figure E1 - Shunt

TB-027 215

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

Item Dia. Factory
No. Mkgs. Part No.

Description

Quantity

Figure F Panel Assembly, Front (See Fig. A Page 1 Item 11)

121			NAMEPLATE (order by stock, model & serial number)	1
122		027 710	BEARING, nylon	1
123		027 227	PANEL, front	1
124	S1	*025 865	SWITCH, 2PST 60 ampere	1
125	S2	027 925	SWITCH, current selector (See Fig. F1 Page 7)	1
126		057 608	RECEPTACLE ASSEMBLY, jack - yellow (consisting of)	2
127		601 881	. NUT, hex - jam 1/2-20	1
128		020 015	. RECEPTACLE, brass	1
129		604 668	. NUT, self locking 1/2-20	1
130		010 291	. WASHER, nylafil	1
131		039 889	. NUT, molded - yellow	1
132		039 826	RECEPTACLE ASSEMBLY, jack - black (consisting of)	1
127		601 881	. NUT, hex - jam 1/2-20	1
128		020 015	. RECEPTACLE, brass	1
129		604 668	. NUT, self locking 1/2-20	1
130		010 291	. WASHER, nylafil	1
133		039 796	. NUT, molded - black	1
134		039 800	RECEPTACLE ASSEMBLY, jack - red (consisting of)	1
127		601 881	. NUT, hex - jam 1/2-20	1
128		020 015	. RECEPTACLE, brass	1
129		604 668	. NUT, self locking 1/2-20	1
130		010 291	. WASHER, nylafil	1
135		039 768	. NUT, molded - red	1

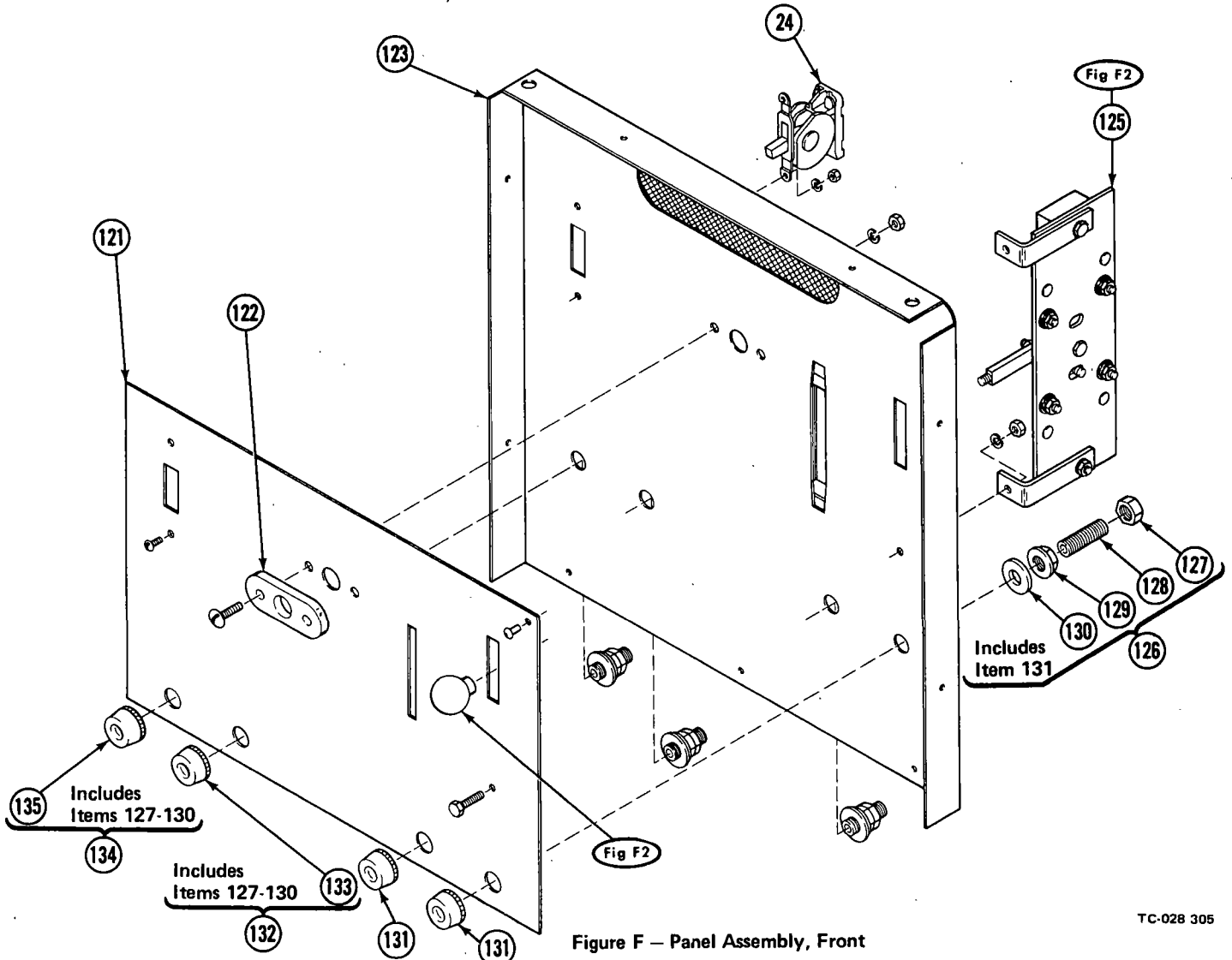


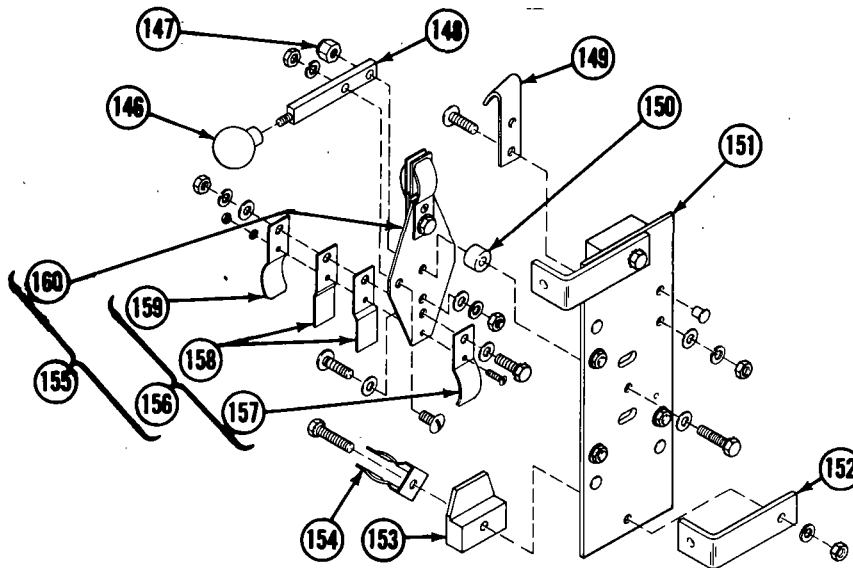
Figure F - Panel Assembly, Front

TC-028 305

*Recommended Spare Parts

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

Item No.	Factory Part No.	Description	Quantity
Figure F1	027 925	Switch, Current Selector (See Fig. F Page 6 Item 125)	
146	019 603	KNOB	1
147	604 318	NUT, hex - self locking 1/4-20	1
148	010 805	HANDLE	1
149	011 950	CONTACT, copper - top rear or bottom front	2
	011 951	CONTACT, copper - top front or bottom rear	2
150	024 694	BEARING	1
151	103 634	BOARD, glastic - mtg components	1
152	104 935	BRACKET, mtg - switch	2
153	011 948	GUIDE, molded	2
154	010 876	HANGER, Minerallac No. 1	1
155	038 769	PLATE ASSEMBLY, movable (consisting of)	1
156	011 645	CONTACT ASSEMBLY, movable (consisting of)	2
157	011 075	SPRING, pressure	1
158	011 953	CONTACT, copper	2
159	011 074	SPRING, pressure	1
160	103 632	PLATE, glastic	1



TB-027 925

Figure F1 - Switch, Current Selector

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



1

1

1