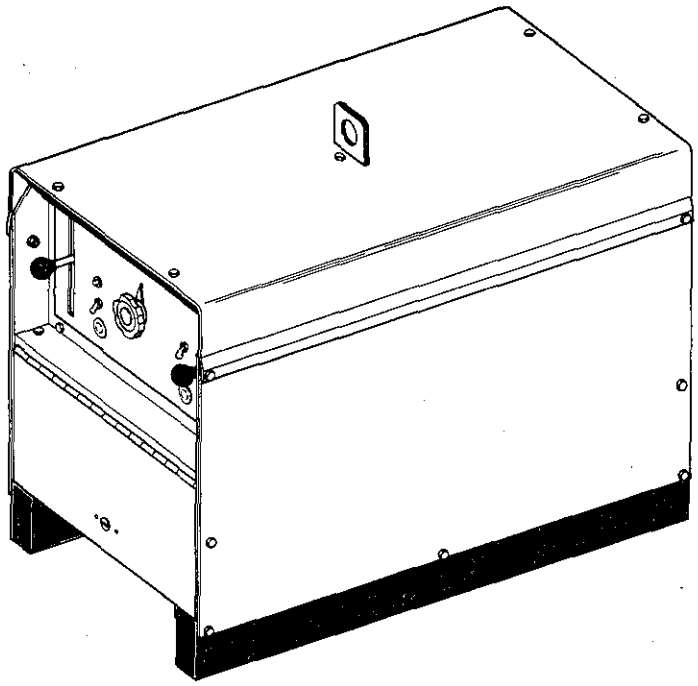
April 1975 FORM: OM-315

Effective with serial No. HF826825

MODEL	STOCK NO.
DIALARC HF	901 782
DIALARC HF-P	901 788



OWNER'S MANUAL

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

NWSA CODE NO. 4579

PRINTED IN U.S.A.

WARRANTY

MILLER Electric Mfg. Co., Appleton, Wisconsin, warrants all new equipment to be free from defects in material and factory workmanship for the periods indicated below, provided the equipment is installed and operated according to manufacturer's instructions.

MILLER Electric Mfg. Co.'s obligation, under this warranty, is limited to replacing or repairing any defective part or correcting any manufacturing defect without charge during the warranty period if MILLER'S inspection confirms the existence of such defects. MILLER'S option of repair or replacement will be f.o.b. factory at Appleton, Wisconsin or f.o.b. a MILLER authorized service facility, and therefore no compensation for transportation costs of any kind will be allowed.

The warranty period, beginning on the date of sale to the original purchaser-user of the equipment, will be as follows:

1.	Arc welders, power sources, and components	—	1 year
2.	Original main power rectifiers	—	3 years (unconditionally)
3.	MHFC-L1 Feeder, MHG-35C1, 20E, 20K, and all guns and torches	—	90 days
4.	All other Millermatic Feeders	—	1 year
5.	Mag-Diesel engine on DEL-200	—	6 months
6.	All other engines	—	1 year

Engine Warranties are covered by the engine manufacturers, subject to their procedures and to be handled through their authorized local Service Stations or agencies. No warranty will be made in respect to trade accessories, such being subject to the warranties of their respective manufacturers.

MILLER Electric Mfg. Co. will not be liable for any loss or consequential damage or expense accruing directly or indirectly from the use of equipment covered in this warranty.

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

OPTIONAL ACCESSORIES

No. 2 WA Welding Accessories (Stock No. 040 039)
Consists of 35 feet of No. 2 electrode cable with insulated electrode holder, 30 feet of No. 2 ground cable, ground clamp, welding helmet, wire scratch brush. Jack plugs are furnished with the welder.

No. 2B (Stock No. 040 014)
Four 8" solid rubber tired wheels with towing handle.

No. 1BCR (Stock No. 040 010)
Same as No. 1B, but with provisions for carrying two gas cylinders.

No. 2BCR (Stock No. 040 015)
Same as No. 2B, but with provisions for carrying two gas cylinders.

RHC-3 (Stock No. 040 056)
Remote hand amperage control. Supplied with 20' cable and plug.

RFC-3A (Stock No. 040 068)
Remote foot amperage control. Supplied with 20' cable and plug.

RFC-23AG (Stock No. 041 161)
Remote foot control for amperage and contactor. Supplied with 20' cable and plug.

RHS-2G (Stock No. 041 157)
Momentary contact (normally open) hand switch for remote contactor control. Fastens to TIG torch handle.

CERTIFICATE

NAME OF EQUIPMENT:_____ MODEL NO._____

SERIAL NO._____ DATE_____

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

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

USER'S CERTIFICATION

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

Date Installed_____ Signed_____

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

1-1. INTRODUCTION

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

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

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

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

Responsibilities of installer, user, and serviceman. Installation, operation, checking, and repair of this equipment must be done only by a competent person, experienced with such equipment.

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 these safety rules. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupation 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.

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, cadium, 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. The space will then be safe to re-enter, if downstream valves have been accidently opened or left open.

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 trichlorethylene or perchlorethylene.

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 can not 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.

Secure from falling. Chain or secure cylinders upright when a regulator (and hose) are connected to it.

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 metal 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. For metal-to-metal seating, use correct wrenches, available from your supplier. For O-ring connections, hand tighten.

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.
Before opening cylinder valve, check that hoses are connected and that downstream valves are closed.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against

possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators. It will reduce backfiring and chance of flashbacks.

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 and repair them only if recommended in equipment instruction manual. Send others for repair to manufacturer's designated repair center where special techniques and tools are used by trained personnel. Refer to User Responsibilities 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 1-2 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. 9 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

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.

Model	Rated Welding Current Amperes (Shielded Metal-Arc)	Welding Current Ranges (Shielded Metal-Arc)	Rated Welding Current Amperes (Gas Tungsten-Arc) (TIG)	Welding Current Ranges (Gas Tungsten-Arc) (TIG)	Max. Open-Circuit Voltage	Amperes Input At Rated Load Output 60 Hz Single-Phase (208) 200 Volts	230 Volts	460 Volts	KVA	KW	Overall Dimensions (Inches)	Weight (Pounds) Net	Ship
Without Power Factor	250 amps at 30 volts 40% Duty Cycle	AC LOW 10-45 MED 35-160 HIGH 85-295	AC 200 amps at 40% Duty Cycle 125 amps at 100% Duty Cycle	AC LOW 10-45 MED 40-165 HIGH 140-310	AC 75	99	90	45	20.6	12.8	Height-26-5/8 Width -19 Depth -33	476	486
With Power Factor	200 amps at 40 volts 60% Duty Cycle	DC LOW 10-50 MED 35-150 HIGH 80-270	DC 250 amps at 40% Duty Cycle	DC LOW 10-55 MED 40-190 HIGH 125-310	DC 76	84	76	38	17.5	12.8		486	496

Figure 2-1. Specifications

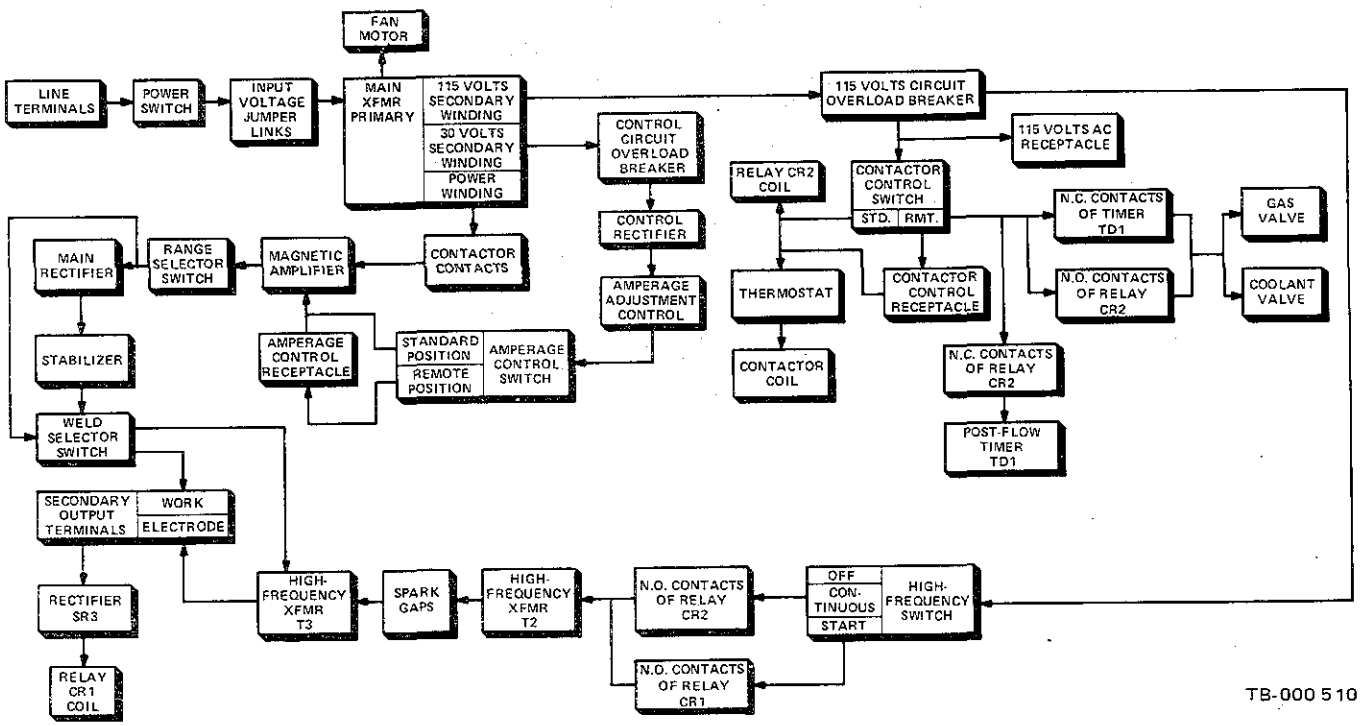

Figure 2-2. Block Diagram

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 single-phase welding power source which produces ac and dc welding current. This welding power source is designed to be used in conjunction with the Shielded Metal-Arc (Stick Electrode) and Gas Tungsten-Arc (TIG) Welding processes.

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 safety 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)

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. A minimum of 18 inches of unrestricted space must be maintained between the welding power source front and rear panels and the nearest obstruction. Also, the underside of the welding power source must be kept completely free of obstructions. The installation site should also permit easy removal of the welding power source outer enclosure for maintenance functions.

IMPORTANT

Do not place any filtering device over the intake air passages of the welding power source as this would restrict the volume of intake air and thereby subject the welding power source internal components to an overheating condition and subsequent failure. Warranty is void if any type of filtering device is used.

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

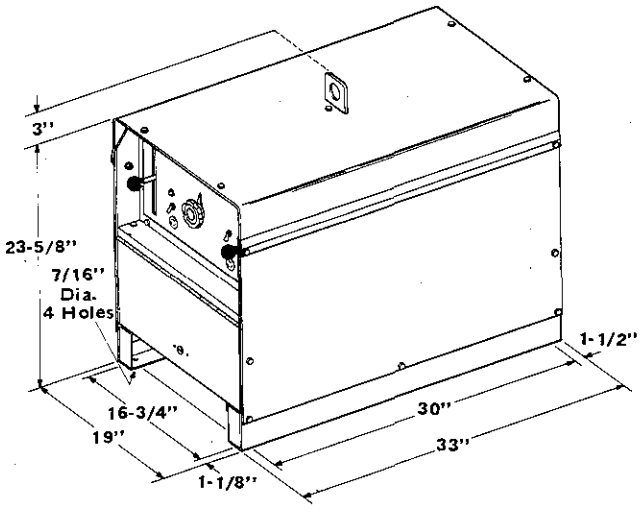

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Figure 3-1. Dimensional Drawing

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

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 locking facilities are not available, attach a red tag to the line disconnect switch (or fuse box) to warn others that the circuit is being worked on.

A. Input Electrical Requirements

This welding power source is designed to be operated from a single-phase, 60 Hertz, ac power supply which has a line voltage rating that corresponds with one of the primary voltages shown on the welding power source 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

CAUTION

Do not connect the input conductors to the single-phase power supply until all input electrical connections have been made to the welding power source.

It is recommended that the input conductors be of the heavy rubber covered type or be installed in solid or flexible conduit. Select the proper size input conductors and fuse from Table 3-1.

Table 3-1. Input Conductor and Fuse Size

	Input Conductor Size (AWG)				Fuse Size In Amperes			
Model	200V	230V	460V	575V	200V	230V	460V	575V
Without P.F.C.	No. 3	No. 3	No. 8	No. 8	150	150	70	60
With P.F.C.	No. 4	No. 4	No. 8	No. 10	125	70	60	60
	(8)	(8)	(8)	(10)				

*Numbers in ( ) indicate ground conductor size.

Insert the two input conductors plus one ground conductor through the access hole on the rear panel. The 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 on the primary terminal board.

Connect the two input conductors to the terminals on the primary terminal board labeled L or LINE and connect the ground conductor to the terminal labeled GRD (See Figure 3-2). The remaining end of the ground conductor should be connected to a proper ground. Use whatever grounding method that is acceptable to the local electrical inspection authority.

CAUTION

The terminal labeled GRD is connected to the welding power source chassis and is for grounding purposes only. Do not connect a conductor from the terminal labeled GRD to any one of the L or LINE terminals as this will result in an electrically hot welding power source chassis.

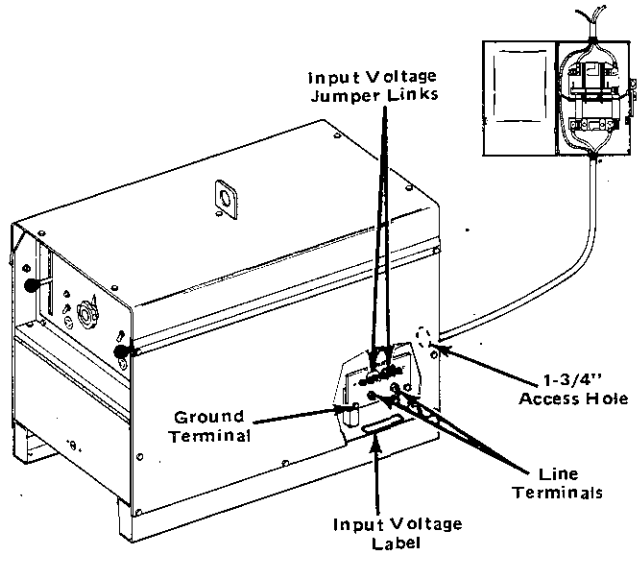

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Figure 3-2. Input Conductor Connections

C. Matching The Welding Power Source To The Available Input Voltage

The input voltage jumper links provided on the primary terminal board permit the welding power source to be operated from various line voltages. The various voltages from which this welding power source may be operated are stated on the welding power source nameplate, and on the input voltage label. See Figure 3-2 for location. The input voltage jumper links on this welding power source are positioned for the highest of the voltages stated on the nameplate. If the welding power source is to be operated from a line voltage which is lower than the highest voltage for which the unit was designed, the jumper links will have to be moved to the proper position before operation of the welding power source commences. Figure 3-3 shows the various positions for which the jumper links may be set on the standard welding power source. If the input voltages on the welding power source nameplate differ from those shown in Figure 3-3, the input voltage jumper links must be positioned as shown on the input voltage label.

NOTE

If only one jumper link is required on each of the grouped terminals, it is recommended that the unused jumper links be placed across the terminals which are to be used. This will prevent losing the jumper links which are not required for this connection.

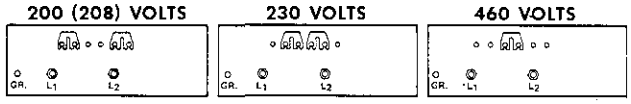

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Figure 3-3. Input Voltage Jumper Link Arrangement

3 - 3. 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 electrode holder must be used to ensure the operator's safety.

Table 3-2. Secondary Weld Cable Size

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

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NOTE: *A. 50 FEET OR LESS.

*B. CABLE SIZE IS BASED ON DIRECT CURRENT (DC), 60% 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.

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 length for the weld circuit. This means the length of the Electrode cable that connects the Electrode Holder to the welding power source and the Work or ground cable between the welding power source and the work piece. For example: If the Electrode cable is 75 feet long and the Work or ground cable is 25 feet long, select the size cable from Table 3-2 that is recommended for 100 feet. In a situation where a maximum weld current of 150 amperes is anticipated, No. 3 weld cable is recommended for both the Electrode and Work cables.

To ensure that the weld current output will be in accordance with the labeling of the positions on the WELD SELECTOR Switch, connect the electrode holder cable to the ELECTRODE terminal and the work cable to the WORK terminal.

3 - 4. REMOTE AMPERAGE CONTROL CONNECTIONS (Figure 4-1)

The AMPERAGE CONTROL Receptacle provides a junction

point for connecting a Remote Amperage Control to the amperage control circuitry in the welding power source.

To connect the Remote Amperage Control to the AMPERAGE CONTROL Receptacle, insert the three-prong plug from the Remote Amperage Control into the receptacle and rotate the plug as far as it will turn in a clockwise direction. Once fully rotated, the plug will be locked in the receptacle and will not pull out under stress.

3 - 5. CONTACTOR CONTROL CONNECTIONS (Figure 4-1)

The CONTACTOR CONTROL Receptacle provides a junction point for connecting a Remote Contactor Control device to the contactor control circuitry in the welding power source.

To connect the Remote Contactor Control to the CONTACTOR CONTROL Receptacle, insert the three-prong plug from the Remote Contactor Control device into the CONTACTOR CONTROL Receptacle and rotate the plug as far as it will turn in a clockwise direction. The plug will now be locked in the receptacle and will not pull out under stress.

3 - 6. COOLANT VALVE CONNECTIONS (Figure 4-1)

A valve is provided in order to control on and off flow of coolant to the electrode holder. The COOLANT Valve input and output connections both have left hand threading. Ensure that the hose from the coolant source is attached to the connection on the COOLANT Valve labeled IN. The coolant hose from the electrode holder must be attached to the connection on the COOLANT Valve labeled OUT.

IMPORTANT

If a Coolant Pump is to be used and the Coolant Pump is not equipped with a by-pass network, do not make connections from the Coolant Pump to the COOLANT Valve but rather connect the Coolant Pump directly to the electrode holder coolant hoses. Failure to comply may result in damage to the Coolant Pump due to excessive back pressure when the COOLANT Valve is closed.

3 - 7. SHIELDING GAS VALVE CONNECTIONS (Figure 4-1)

A valve is provided in order to control on and off flow of shielding gas to the electrode holder. The Gas Valve input and output connections both have right hand threading. Ensure that the hose from the shielding gas source is attached to the connection on the GAS Valve labeled IN. The shielding gas hose from the electrode holder must be attached to the connection on the GAS Valve labeled OUT.

SECTION 4 - FUNCTION OF CONTROLS

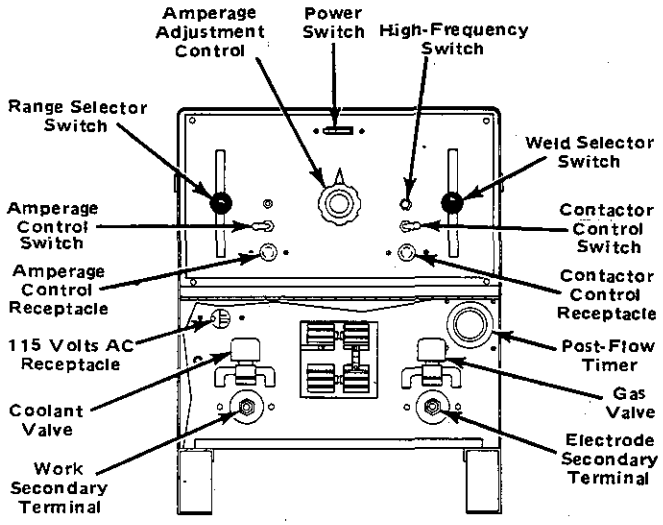

Figure 4-1. Front Panel View

4 - 1. POWER SWITCH (Figure 4-1)

Placing the POWER Switch in the ON position will energize the welding power source fan and control circuitry and place the welding power source in a ready-to-weld status. Placing the POWER Switch in the OFF position will shut the welding power source down.

CAUTION

Even though the POWER Switch is in the OFF position and the welding power source is apparently electrically shut down, electrical input power is still present on all circuitry up to the POWER Switch. To completely cut-off all electrical input power to the welding power source, it will be necessary to place the line disconnect switch in the OFF position or remove the electrical input fuses.

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

The RANGE SELECTOR Switch provides the capability of selecting from three coarse amperage ranges. The amperage range of each switch position is displayed on the welding power source nameplate. If the amperage desired falls in the overlapping area of two ranges, use the lower of the two ranges, as better fine amperage adjustment is obtained in the lower of the two ranges.

IMPORTANT

Do not change the position of the RANGE SELECTOR Switch while welding or under load as this will cause the contacts of the switch to arc. Arcing across the contacts will cause the contacts to become pitted and thereby eventually to become inoperative.

4 - 3. AMPERAGE ADJUSTMENT CONTROL (Figure 4-1)

The AMPERAGE ADJUSTMENT Control, located on the upper center portion of the front panel, provides a means of selecting the exact amperage desired within the range being used. Rotating the control in a clockwise direction will increase the amperage output.

NOTE

The contacts of the AMPERAGE ADJUSTMENT Control are of the continuous contact type, thereby making it possible to adjust the amperage output while welding.

The scale surrounding the AMPERAGE ADJUSTMENT Control is calibrated in percentage and should not be misconstrued as an amperage or voltage reading.

4 - 4. AMPERAGE CONTROL RECEPTACLE & SWITCH (Figure 4-1)

If a Remote Amperage Control is to be used, make connections from the Remote Amperage Control to the AMPERAGE CONTROL Receptacle as instructed in item 3-4.

When remote control of the amperage is desired, it is essential that the AMPERAGE CONTROL Switch be placed in the REMOTE position. Likewise, if a Remote Amperage Control is not to be utilized, the switch must be in the STANDARD position. When in the STANDARD position, only the AMPERAGE ADJUSTMENT Control on the front panel will control the amperage.

When a Remote Amperage Control is being used, it should be noted that the Remote Amperage Control is functioning as a

fine amperage adjustment for the AMPERAGE ADJUSTMENT Control setting on the welding power source. For example: If the AMPERAGE ADJUSTMENT Control on the welding power source is set at the mid-range position, the Remote Amperage Control will provide (from the min. to max. positions) fine amperage adjustment on one half of the welding power source output for the current range selected by means of the RANGE SELECTOR Switch. If full adjustment thru use of the Remote Amperage Control of the current range selected is desired, the AMPERAGE ADJUSTMENT Control on the welding power source must be set at the maximum position.

4 - 5. CONTROL CIRCUIT OVERLOAD BREAKER (Figure 4-1)

The CONTROL CIRCUIT OVERLOAD BREAKER is supplied in order to provide protection to the control circuit components. Should a short occur in the amperage adjustment control circuit, this breaker would open and thereby cause the weld output to drop to the minimum of the range in use. When this occurs, neither the AMPERAGE ADJUSTMENT Control or Remote Amperage Control will have any effect on varying the weld output. To place the welding power source in a ready-to-weld status should this circuit breaker trip, the circuit breaker must be manually depressed. Should the circuit breaker continue to trip after each reset, an internal problem in the control circuitry is most probably present. Do not attempt any further welding until the trouble has been remedied.

4 - 6. WELD SELECTOR SWITCH (Figure 4-1)

The WELD SELECTOR Switch provides a means of selecting either ac, dc straight, or dc reverse polarity without changing the secondary cable connections.

Placing the WELD SELECTOR Switch fully up will provide DC STRAIGHT polarity; fully down will provide DC REVERSE polarity; the center position will provide AC weld current.

CAUTION

Do not change the position of the WELD SELECTOR Switch while welding or under load as this will cause the contacts of the switch to arc. Arcing across the contacts will cause the contacts to become pitted and thereby eventually to become inoperative.

4 - 7. CONTACTOR CONTROL RECEPTACLE & SWITCH (Figure 4-1)

If a Remote Contactor Control device is to be used, make connections to the CONTACTOR CONTROL Receptacle as instructed in item 3-5.

A prerequisite for remote control of the contactor, is to have the CONTACTOR CONTROL Switch on the welding power source in the REMOTE position. If this switch is left in the STANDARD position, the contactor will energize as soon as the POWER Switch is positioned to ON.

CAUTION

Whenever the CONTACTOR CONTROL Switch is in the STANDARD position, open-circuit voltage will be present at the secondary terminals for as long as the POWER Switch is positioned to ON.

The Remote Contactor Control device will, when closed, energize the contactor and GAS and COOLANT Valves. (High-frequency will also be present when the Remote Contactor Control device is closed if the HIGH-FREQUENCY Switch is in the START or CONTINUOUS position.) When the Remote Contactor Control device is opened, the contactor will open and suspend the weld output; also the POST-FLOW Timer will energize and begin to time out.

A. Thermostat Protection

This welding power source is protected from damage due to excessive overload by a thermostat which is physically located in the main transformer and electrically connected in series with the contactor coil. Should this thermostat detect an overheated condition in the main transformer it will open. As soon as the thermostat has opened, it will cause the contactor to open and thereby suspend all weld output. The symptom of an overload condition would be the inability to cause the contactor to energize by placing the CONTACTOR CONTROL Switch in the STANDARD position or by placing the CONTACTOR CONTROL Switch in the REMOTE position and then closing the Remote Contactor Control Switch. Should an overload condition be noted, leave the POWER Switch in the ON position and allow the welding power source to idle for approximately 5 minutes. After this 5 minute cooling period, the thermostat will automatically close and once again permit normal operation.

4 - 8. HIGH-FREQUENCY SWITCH (Figure 4-1)

The HIGH-FREQUENCY Switch, located on the front panel, provides three positions which determines whether the high-frequency will be on or off.

A. Start Position

When in the START position, high-frequency will be present at the welding electrode from the time the contactor is closed until the arc is initiated. Once an arc is established, and even though the contactor is closed, the high-frequency will be de-energized. High-frequency will be present again only after the arc is broken and restarted.

B. Continuous Position

The CONTINUOUS position will provide high-frequency for as long as the contactor is closed. The high-frequency and weld current may be shut off during the weld by opening the Remote Contactor Control Switch.

C. Off Position

High-frequency will not be available when in the OFF position, even if the contactor is closed. This position must be used when performing Shielded Metal-Arc (Stick Electrode) Welding.

CAUTION

Never try to use high-frequency when performing Shielded Metal-Arc (Stick Electrode) Welding. Failure to comply may result in the high-frequency arcing through the electrode holder and seriously injurying the operator.

4 - 9. POST-FLOW TIMER (Figure 4-1)

An adjustable 0 to 60 second POST-FLOW Timer is provided for controlling the period of time shielding gas and coolant will be allowed to flow after the arc is extinguished.

To select the desired portion of the maximum 60 second post-flow time period available, rotate the adjustable stop arm on the timer until the appropriate setting is obtained.

As soon as the arc has been extinguished, the POST-FLOW Timer will begin to time out the selected period of post-flow time. Once the selected post-flow time has elapsed, the GAS and COOLANT Valves will close and thereby cut-off shielding gas and coolant flow. The timer will then automatically reset and be ready for another weld cycle.

NOTE

Neither the POST-FLOW Timer or GAS and COOLANT Valves will function when the CONTACTOR CONTROL Switch is in the STANDARD position. In order to make these items operational, the REMOTE position of the CONTACTOR CONTROL Switch must be used.

4-10. 115 VOLTS AC RECEPTACLE (Figure 4-1)

A 115 VOLTS AC Receptacle is provided on the lower portion of the front panel for operating accessory equipment which requires 115 volts, 60 Hertz electrical power. Up to 10

amperes of 115 volts ac may be obtained from this receptacle.

NOTE

A circuit breaker, located behind the lower front access door, is supplied in order to provide protection to the 115 volts circuitry in the welding power source. Should the amperage draw from the 115 VOLTS AC Receptacle exceed 10 amperes, this circuit breaker would open and prevent any output from the receptacle. To reset this circuit breaker should it open, manually depress the red button portion of the circuit breaker. Should this circuit breaker continue to open upon reset, an internal trouble is probable and no further use of the 115 VOLTS AC Receptacle should be attempted until the trouble has been remedied.

4-11. DUTY CYCLE (Figure 4-2)

Welding power sources are rated on a percent duty cycle based on 10 minute intervals. For example: a 40 percent duty cycle simply means that the welding current is on for 4 minutes, off for 6 minutes, and so on. It must be kept in mind that time intervals of other than 10 minutes will yield different test rating results. As the output is reduced or increased, the duty cycle will increase or decrease.

Figure 4-2 enables the operator to determine the safe output of the welding power source at various duty cycles.

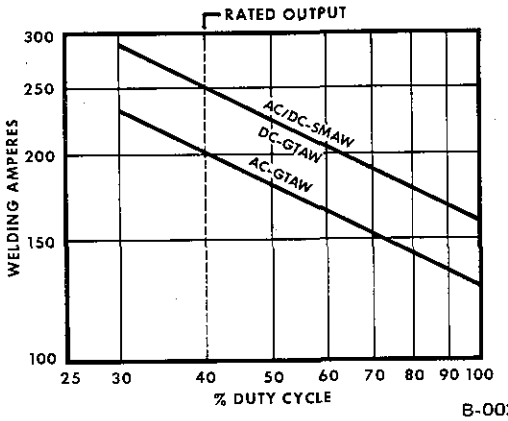

Figure 4-2. Duty Cycle Chart

IMPORTANT

Exceeding the indicated duty cycle will cause the welding power source to overheat and thereby cause damage to the welding power source.

4-12. VOLT-AMPERE CURVE (Figure 4-3)

The volt-ampere curve shows the output voltage available at any given output current within the limits of the minimum and maximum AMPERAGE ADJUSTMENT 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 only the maximum and minimum settings of the AMPERAGE ADJUSTMENT Control for each of the welding current ranges available. Curves of other settings will fall between the maximum and minimum curves shown.

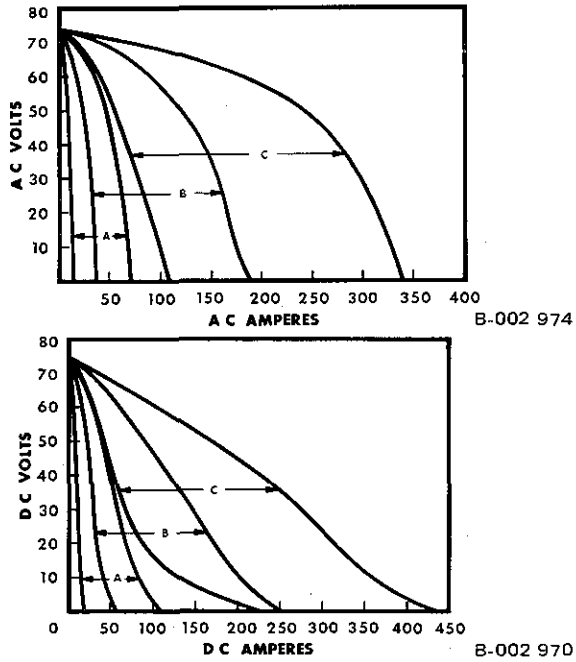

Figure 4-3. Volt-Ampere Curves

SECTION 5 - SEQUENCE OF OPERATION

CAUTION

Never, under any circumstances, operate the welding power source with any portion of the outer enclosure 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 any portion of the outer enclosure removed.

5 - 1. SHIELDED METAL-ARC (STICK ELECTRODE) WELDING

1. Make secondary welding connections as explained in item 3-3.
2. Select the proper electrode for the welding application and insert it into the electrode holder.
3. Place the WELD SELECTOR Switch in the desired position.
4. Place the RANGE SELECTOR Switch in the desired position.
5. Rotate the AMPERAGE ADJUSTMENT Control to the desired setting.
6. If a Remote Amperage Control is not to be used, place the AMPERAGE CONTROL Switch in the STANDARD position. If a Remote Amperage Control is to be used, place the AMPERAGE CONTROL Switch in the REMOTE position.
7. Place the CONTACTOR CONTROL Switch in the STANDARD position.
8. Place the HIGH-FREQUENCY Switch in the OFF position.

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.

9. Place the POWER Switch in the ON position.
10. Commence welding.

5 - 2. GAS TUNGSTEN-ARC (TIG) WELDING

1. Make secondary connections as explained in item 3-3.
2. Select the proper electrode for the welding application and insert it into the electrode holder.

3. Make shielding gas connections as explained in item 3-7 to the GAS Valve and coolant connections as explained in item 3-6 to the COOLANT Valve.

4. Connect the plug from the Remote Contactor Control device to the CONTACTOR CONTROL Receptacle and place the CONTACTOR CONTROL Switch in the REMOTE position.

5. Place the WELD SELECTOR Switch in the desired position.

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

7. Rotate the AMPERAGE ADJUSTMENT Control to the desired setting.

8. If a Remote Amperage Control is not to be used, place the AMPERAGE CONTROL Switch in the STANDARD position. If a Remote Amperage Control is to be used, place the AMPERAGE CONTROL Switch in the REMOTE position.

9. Place the HIGH-FREQUENCY Switch in the desired position.

10. Rotate the POST-FLOW Timer to the desired time setting.

11. Turn on the shielding gas at the shielding gas container and coolant at the coolant source.

12. Place the POWER Switch in the ON position.

13. Commence welding.

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.

5 - 3. SHUTTING DOWN

1. Break the arc.

2. Allow the welding power source to idle for 3 minutes with no load applied.

3. Place the POWER Switch in the OFF position.

4. Turn off the shielding gas and coolant if used.

CAUTION

If welding is performed in a confined area, failure to turn off the shielding gas supply could result in a build-up of gas fumes, thereby endangering personnel re-entering the welding area.

SECTION 6 - MAINTENANCE

CAUTION

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

6 - 1. FAN MOTOR

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

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. The welding power source outer enclosure should be removed and a clean dry air stream should be used for this cleaning operation.

6 - 3. RECTIFIER

It is recommended that the rectifier be cleaned occasionally by blowing it out with compressed air. This cleaning operation is necessary so that maximum cooling will be accomplished by the air stream. This should be done periodically, depending upon the location of the unit and the amount of dust and dirt in the atmosphere. It is necessary to remove the outer enclosure for this cleaning operation.

6 - 4. SPARK GAP (Figure 6-1)

The spark gaps can be readily inspected by opening the access door on the front of the welding power source.

The spark gaps are normally set at .008" clearance at the factory. It will be necessary to periodically readjust these after extended operation. Usually inspection and adjustment every three or four months will suffice. Readjustment is also indicated when intermittent operation of the gaps is noted. Usually this occurs when the setting has increased to .013" or greater.

Generally speaking, the high-frequency output varies directly (up to a certain point) with the spark gap spacing. In extreme cases where the greatest amount of high-frequency is needed, it may be necessary to adjust the spark gap setting to .010" or even .013". This also increases the high-frequency radiation and it is suggested that the minimum gap setting (.004" to .008"), consistent with good welding operation, be used.

NOTE

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

To Adjust the Spark Gaps, Proceed as Follows:

1. Loosen screw A on both sides.

2. Place feeler gauge of proper thickness between points at gap C.

3. Apply slight pressure against point B so feeler gauge is held firmly in gap.

4. Tighten screws A.

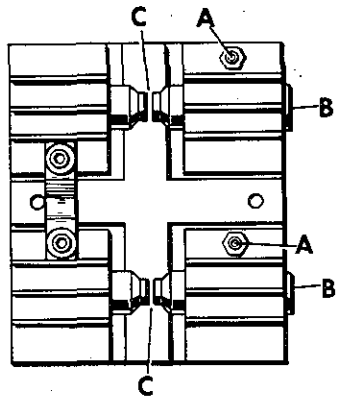

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Figure 6-1. Spark Gap Adjustment

SECTION 7 - TROUBLESHOOTING

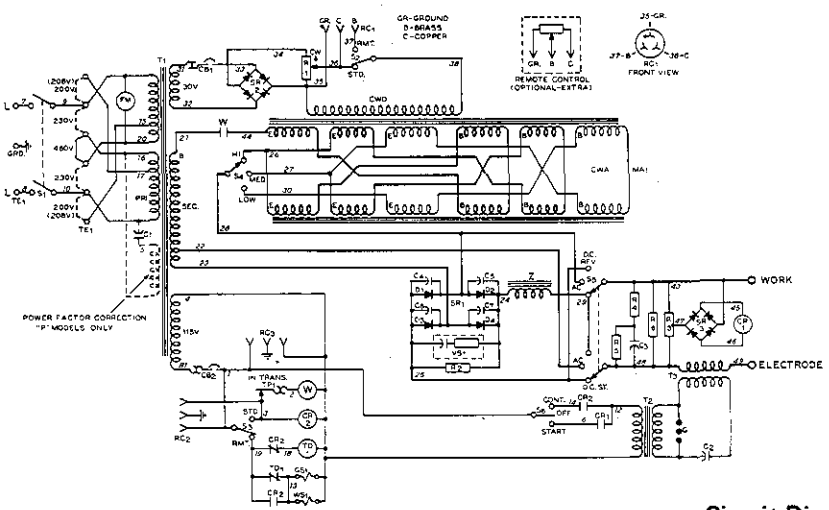
The data collected here, discusses some of the common problems which may occur in this welding power source.

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 troubeshooting.

TROUBLE	PROBABLE CAUSE	REMEDY
No welding current.	Open line fuse.	Replace fuse.
	POWER Switch defective.	Replace switch.
	Circuit breaker CB2 open.	Reset CB2. See item 4-10.
	Thermostat TP1 open.	Allow welding power source to idle for 5 minutes. See item 4-7A.
Erratic weld current.	Loose welding connections.	Secure connections.
	Bad or damp electrodes.	Use new dry electrodes.
Fan does not run.	POWER Switch defective.	Replace switch.
	Fan motor defective.	Replace fan motor.
	Line fuse open.	Replace fuse.
Welding current low. AMPERAGE ADJUSTMENT Control does not control current.	CONTROL CIRCUIT OVERLOAD BREAKER open.	Reset breaker. See item 4-5.
	AMPERAGE CONTROL Switch in REMOTE position with no Remote Amperage Control connected to AMPERAGE CONTROL Receptacle.	Place AMPERAGE CONTROL Switch in STANDARD position or connect a Remote Amperage Control to AMPERAGE CONTROL Receptacle.
Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Loose gas fittings on regulator of gas line.	Secure gas fittings.
	Insufficient gas flow.	Increase gas flow.
	Drafts blowing gas shield away from tungsten.	Shield welding arc area.
Wandering arc, poor control of direction of arc.	Tungsten used considerably larger than recommended.	Use proper size tungsten.
Lack of high-frequency, difficulty in establishing the arc.	Spark gap spacing incorrect.	Adjust spark gap (See item 6-4).
	Tungsten larger than recommended for weld current involved.	Use proper size tungsten.
	Leakage of high-frequency from electrode holder lead.	Replace lead.



Circuit Diagram No. CB-901 782-1A

Figure 7-1. Circuit Diagram

SECTION 8 - CERTIFICATION FOR HIGH FREQUENCY ARC WELDING EQUIPMENT

8 - 1. GENERAL

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

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

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

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

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

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

8 - 2. GENERAL INFORMATION

In a high frequency stabilized arc Welding Machine installation, interfering radiation can escape in four distinct ways as outlined below:

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

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

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

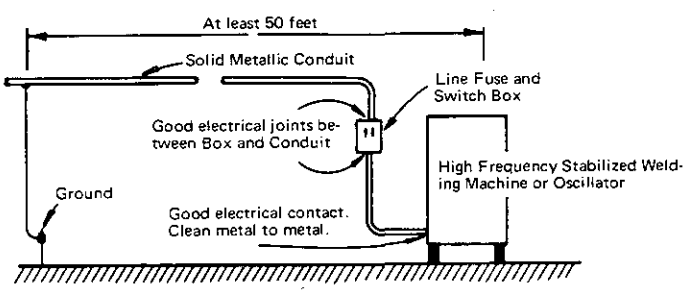


Figure 8-1. Power Service Installation H.F. Stabilized Arc Welding Machine

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

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

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

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

8 - 3. POWER SERVICE

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

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

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

This shielding shall be grounded at the farthest point from the equipment and should make good electrical contact with the casing of the equipment. The ground should be in accordance with the specifications outlined in the section entitled "GROUNDS" and as shown in Figure 8-1. Care should be taken that paint or corrosion at the junction of conduit and case, does not interfere with good electrical contact.

There shall be no gap in this shielding run. This simply means that within 50 feet of the equipment, no portion of the power wires serving the equipment shall be unshielded. If there is any question about the electrical efficiency of the joints between individual conduit sections, outlet boxes and the equipment case, bonding should be carried out by soldering a copper strap or wire across the joint as shown in Figure 8-2.

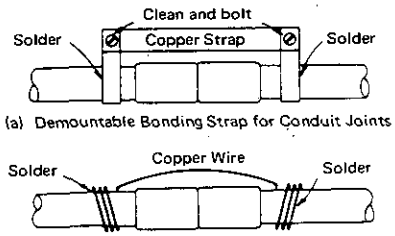


Figure 8-2. Two Recommended Methods For Electrical Bonding Across Poor Conductivity Conduit Joints

8 - 4. WELDING MACHINE

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

This "work" output terminal of the equipment should then be grounded to a "good electrical ground" (as defined in section entitled "GROUNDS") with a short length of welding cable of the same capacity as the "work lead". (See Figure 8-3).

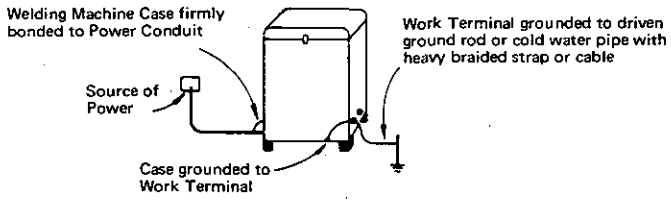


Figure 8-3. Ground Connections At Welding Machine

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

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

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

8 - 5. WELDING LEADS

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

Keeping the electrode lead and ground or work lead as close as possible and on the floor serves to reduce the radiation. (See Figure 8-4).

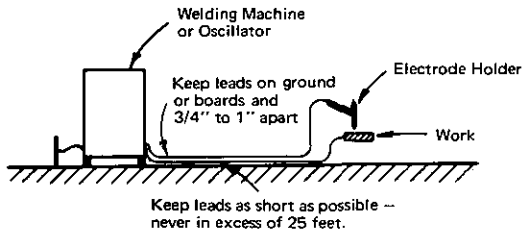


Figure 8-4. General Rules For Welding Leads

8 - 6. WIRING IN THE VICINITY OF THE WELDING AREA

As discussed in the general information section, the most serious source of interference is reradiation from wires that are located near the welding area.

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

For purpose of simplification and standardization, the space all around the weld zone at a distance of 50 feet in all directions is referred to as the High Field Intensity (H.F.I.) zone. (See Figure 8-5).

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

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

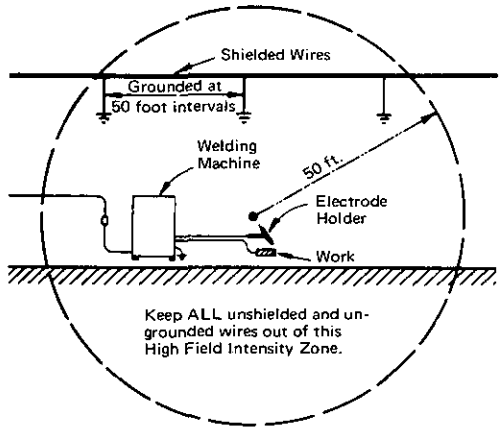


Figure 8-5. General Requirements to Minimize Reradiation Pick-Up In the Vicinity of the Weld Zone

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

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

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

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

NOTE

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

8 - 7. GROUNDS

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

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

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

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

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

8 - 8. METAL BUILDING

It is frequently through that operating of high frequency stabilized arc welding equipment in metallic buildings will completely eliminate troublesome radiation. This, however, is a false assumption.

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

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

8 - 9. INDIVIDUAL INSTALLATION CERTIFICATION

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

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

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

8-10. CHECK LIST

The following questions may be used by the installer as a check to see if all installation requirements have been met:

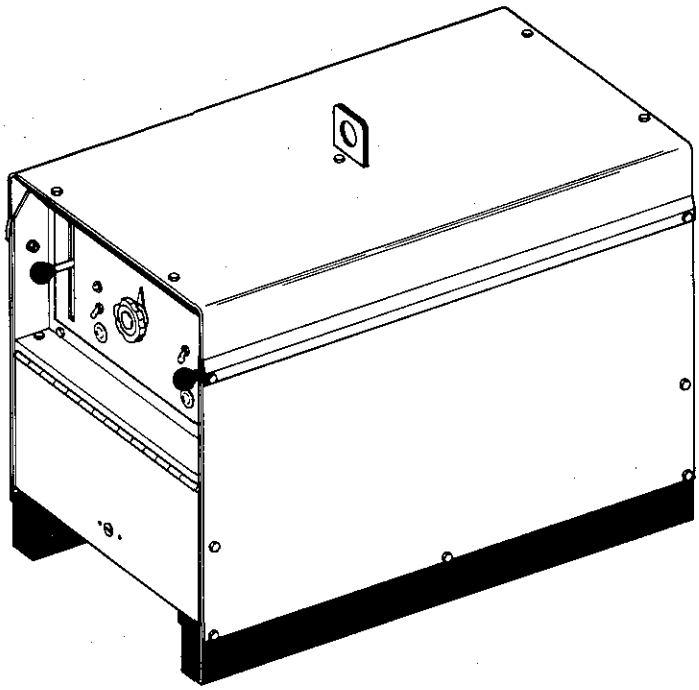
1. Has the equipment been located so that ground leads can be kept short?
2. Are the power leads, serving the unit, in conduit?
3. Is there good electrical contact between power conduit and case?
4. Do the conduit couplings make good electrical contact? (If in doubt, use bonding).
5. Is there good electrical contact between conduit and switch on service boxes?
6. If rigid metallic conduit is not used, is the shielding used of equivalent shielding efficiency? (Copper sleeving, lead covered cable, etc., is satisfactory. Spirally wound flexible metallic conduit is not suitable).
7. Is the conduit system grounded at a point at least 50 feet from the equipment?
8. Is the conduit run complete (without any gap) in the H.F.I. zone?
9. Is the equipment case connected to the work terminal of the secondary?
10. Is the wire used for this connection of sufficient size?
11. Is the work terminal connected to a good electrical ground?
12. Is the cable or copperbraid used for this connection equal to or greater in current carrying capacity than the welding lead?
13. Is this cable as short as possible?
14. Are the spark-gaps set at .008" or less?
15. Are all service and access doors closed and bolted?
16. Are the welding leads less than 25 feet long?
17. Are they as short as possible?
18. Are the welding leads on the floor or placed on a suitable board?
19. Are the welding leads approximately 3/4" to 1" apart?
20. Have you visualized the H.F.I. zone, a sphere with a 50 foot radious centered on the weld zone?
21. Have the unshielded power and light wires originally in this H.F.I. zone been placed in grounded shields or been relocated outside the zone?
22. Have all large metallic objects and any long guy or supporting wires in the H.F.I. zone been grounded?
23. Have you checked so that no external power or telephone lines off the premises are within the zone?
24. Are the grounds driven ground rods?
25. Is a cold water pipe used as ground?
26. If so, does it enter the ground 10 feet or less from the connection?
27. Are the connections to the ground clean and tight?
28. If operated within a metal building, is the building properly grounded?

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

April 1975 FORM: OM-315

Effective with serial No. HF826825

MODEL	STOCK NO.
DIALARC HF	901 782
DIALARC HF-P	901 788



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

PARTS LIST

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

NWSA CODE NO. 4579

PRINTED IN U.S.A.

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Model Without PFC	Quantity Model With PFC
Figure A			**Main Assembly**		
1	W	032 786	CONTACTOR, 60 amp 3 pole 600 volts (See Fig. G Page 6)	1	1
2		000 382	LINK, jumper - contactor	2	2
3	SR3	037 568	RECTIFIER, with mounting brackets (consisting of)	1	1
4		601 242	. INSULATOR, washer	2	2
5		102 363	. BRACKET, mounting - rectifier	2	2
6	CR2	034 615	RELAY, 115 volts ac 2PDT	1	1
7	CR1	034 601	RELAY, 24 volts dc 2PDT	1	1
8	R3	030 617	RESISTOR, WW adj 25 watt 2000 ohm	1	1
9		039 220	BRACKET, mounting - contactor	1	1
10	SR2	037 601	RECTIFIER, selenium - control	1	1
11		000 072	PANEL, side	2	2
12		000 073	COVER, top	1	1
13		026 627	GASKET, lifting eye	1	1
14		025 141	BRACKET, mounting - capacitor		1
15	C1	025 317	CAPACITOR, paper oil 40 uf 460 volts ac		2
16		Figure B	PANEL, rear - with components (See Page 2)	1	1
17	TE1	034 587	TERMINAL ASSEMBLY, primary (See Fig. C Page 3)	1	1
18	MA1	039 234	AMPLIFIER, magnetic (See Fig. E Page 4)	1	1
19	Z	027 218	STABILIZER	1	1
20	T1	039 232	TRANSFORMER, power - main (See Fig. D Page 3)	1	
20	T1	000 080	TRANSFORMER, power - main (See Fig. D Page 3)		1
	TP1	020 520	THERMOSTAT, normally closed	1	1
21		027 212	BAR, steel 1/4 x 1-1/2 x 18	2	2
22		039 221	BASE	1	1
23		000 076	HF PANEL (See Fig. F Page 5)	1	1
24		000 683	PIPE, black 1/8 x 3	2	2
25		Figure H	PANEL, front - with components (See Page 7)	1	1

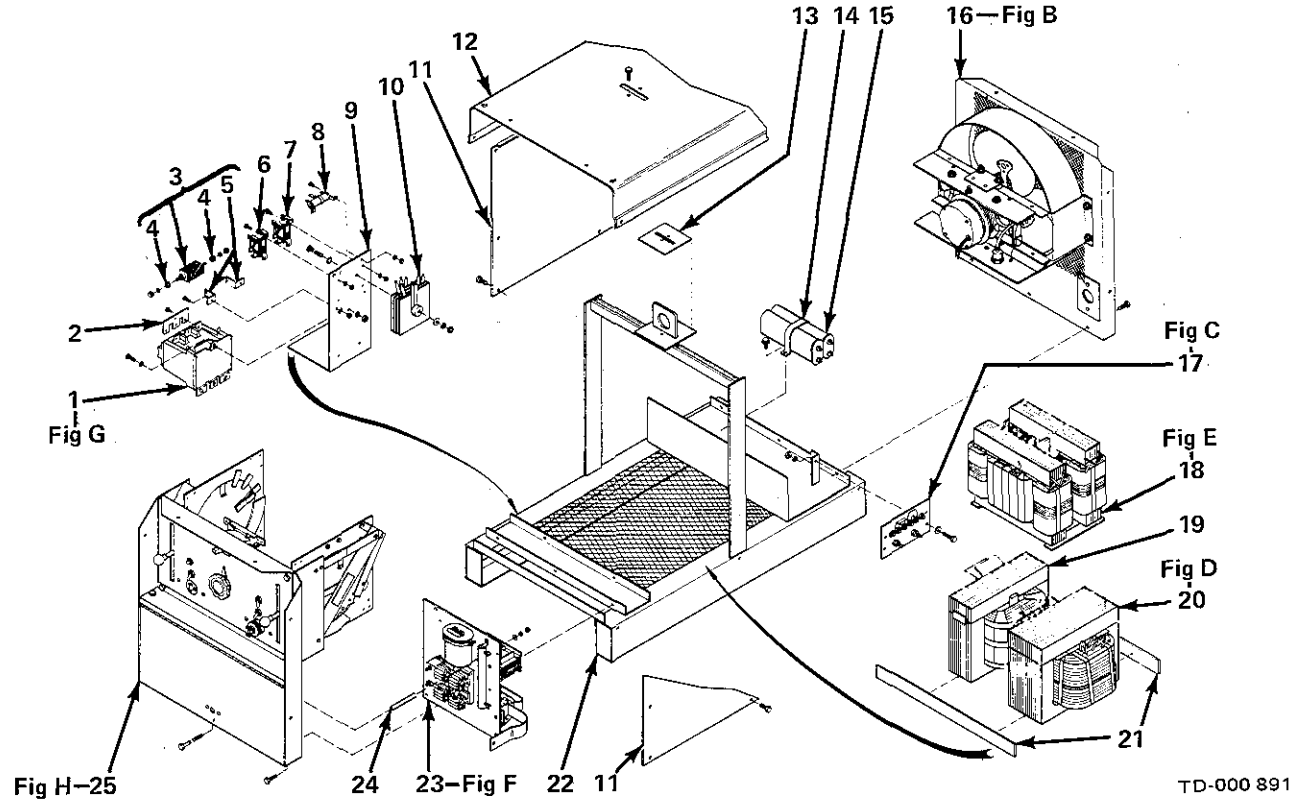
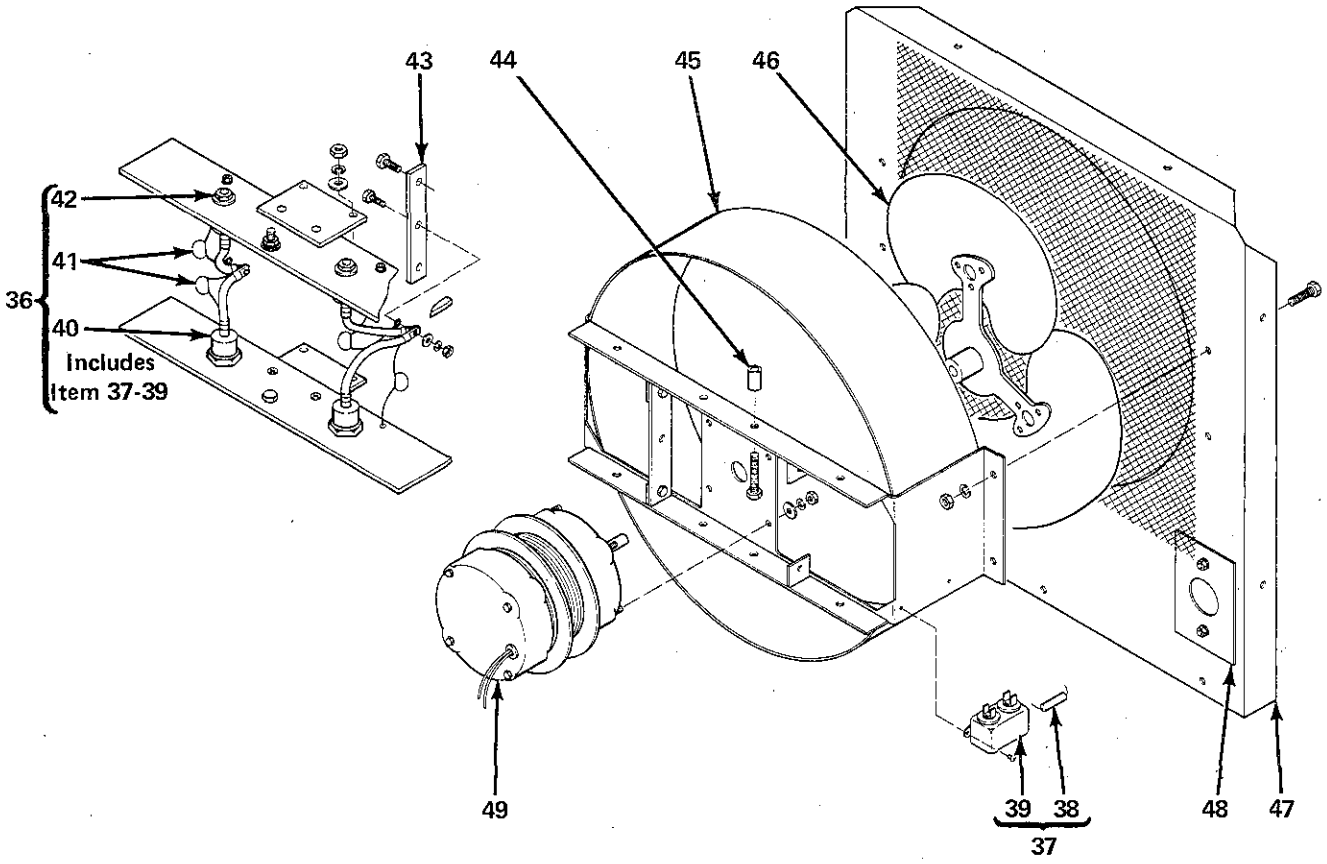


Figure A — Main Assembly

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, Rear - With Components (See Fig. A Page 1 Item 16)**	
36	SR1	039 391	RECTIFIER, silicon diode (consisting of)	1
37		000 601	. SUPPRESSOR, rectifier (consisting of)	1
38	R2	030 726	. . RESISTOR, WW fixed 5 watt 1000 ohm	1
39	VS1	024 471	. . SUPPRESSOR, 1 uf 2.7 ohm	1
40		037 306	. DIODE, 150 amp 300 volts reverse polarity	2
41	C4-7	031 689	. CAPACITOR, ceramic 0.01 uf 500 volts with 3/16 & 1/4 terminals	4
42		037 305	. DIODE, 150 amp 300 volts straight polarity	2
43		038 315	JUNCTION BOARD, diode	2
44		010 489	TUBING, steel .275 ID x .060 wall x 3/4	1
45		039 243	WINDTUNNEL	1
46		032 604	BLADE, fan 60 Hz 14 inch 3 wing 19 degree	1
47		000 074	PANEL, rear	1
48		016 074	STRIP, adapter	1
49	FM	032 603	MOTOR, fan 230 volts (consisting of)	1
		024 601	. BEARING	2



TD-000 887

Figure B — Panel, Rear - With Components

Item No.	Factory Part No.	Description	Quantity
Figure C	**034 587**	**Terminal Assembly, Primary (See Fig. A Page 1 Item 17)**	
61	034 588	TERMINAL BOARD	1
62	038 618	LINK, jumper - terminal board	2
63	038 887	STUD, brass 10-32 x 1-3/8 with hex collar	6
64	010 913	WASHER, flat - brass 3/16	6
65	601 835	NUT, brass - hex 10-32	12
66	601 836	NUT, brass - hex jam 1/4-20	4
67	038 888	STUD, brass 1/4-20 x 1-1/2 with hex collar	2
68	026 631	INSULATION, stud barrier	6

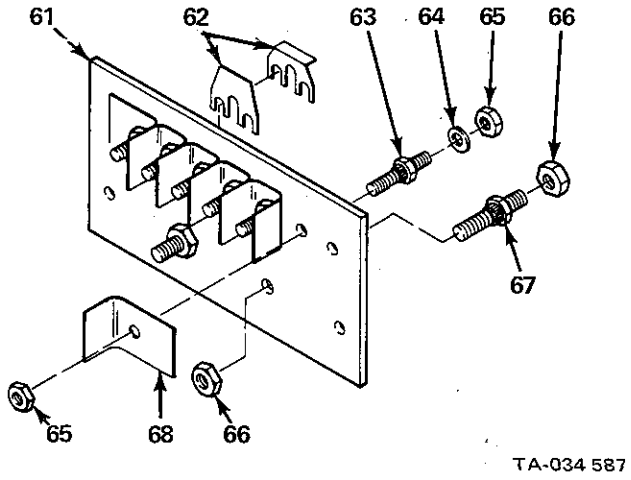


Figure C — Terminal Assembly, Primary

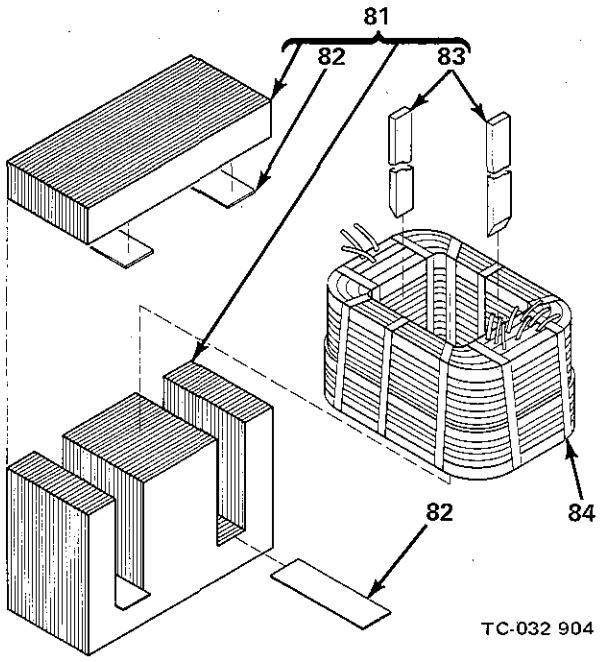


Figure D — Transformer, Power - Main

Item No.	Factory Part No.	Description	Quantity / Model: Without PFC (039 232)	Quantity / Model: With PFC (000 080)
Figure D		**Transformer, Power - Main (See Fig. A Page 1 Item 20)**		
81	**039 233	TRANSFORMER SUBASSEMBLY (consisting of)	1	1
82	026 188	. STRIP, glastic 1/16 x 1.666 x 5	4	4
83	026 966	. WEDGE, hardwood - single bevel 1/4 x 1 x 6	2	2
84	**039 174	COIL, primary/secondary	1	
84	**039 173	COIL, primary/secondary		1

**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 E	**039 234**	**Amplifier, Magnetic (See Fig. A Page 1 Item 18)**	
96	**039 235	AMPLIFIER SUBASSEMBLY	1
97	023 363	. WEDGE, glastic - single bevel 5/8 x 1/4 x 5	2
98	039 236	. STRIP, phenolic 3/8 x 2 x 4-1/2	1
99	010 400	. WEDGE, hardwood - single bevel 1/4 x 1/2 x 6	8
100	034 322	. STRIP, glastic 1/16 x 1.666 x 3	8
101	034 323	. STRIP, fiber 1/32 x 2-3/8 x 10	2
102	**039 175	COIL, control ac	4
103	**039 176	COIL, control dc	1

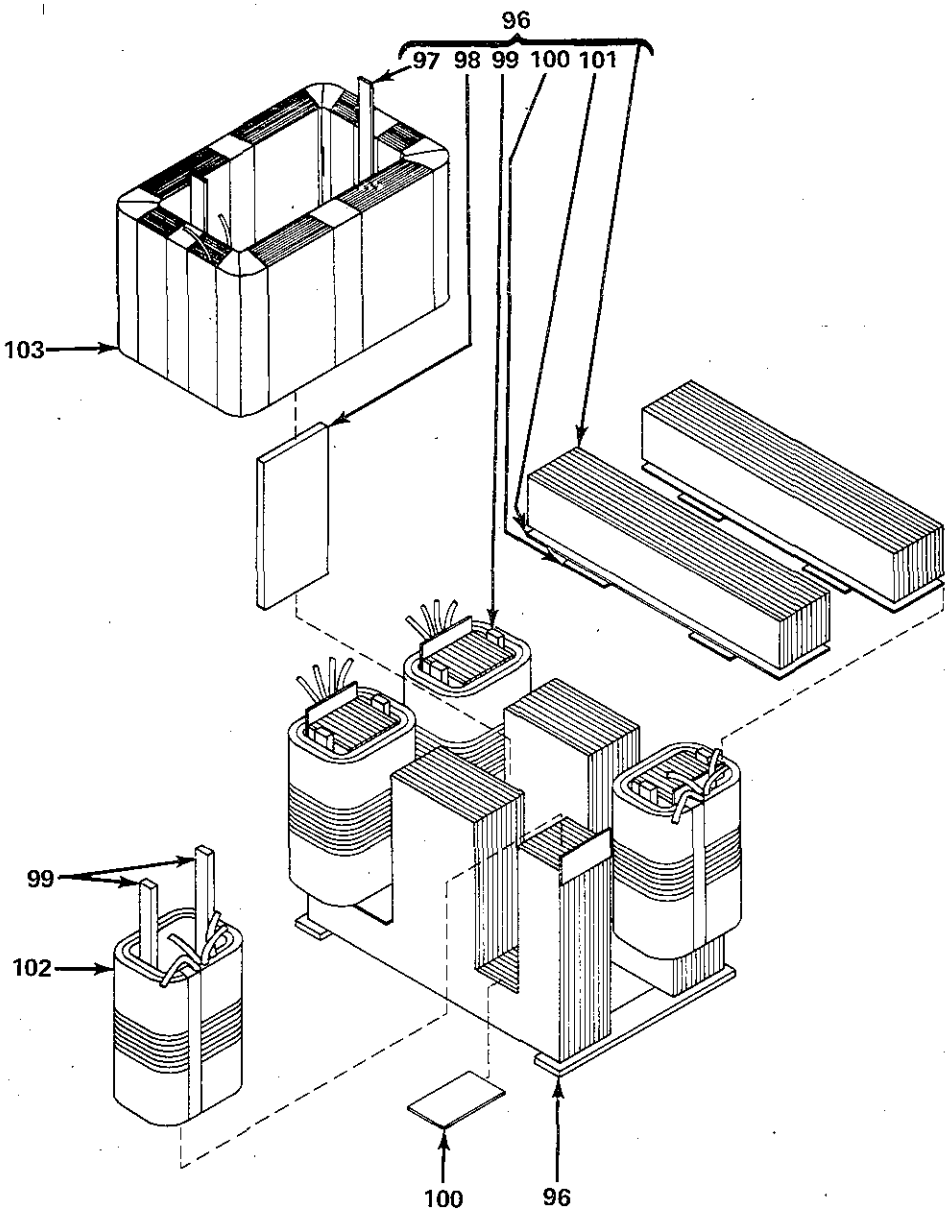


Figure E — Amplifier, Magnetic

**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 F		**000 076**	**HF Panel (See Fig. A Page 1 Item 23)**	
111		014 159	CLAMP, mounting - capacitor	1
112	R5	030 603	RESISTOR, WW fixed 10 watt 10K ohm	1
113	C3	031 601	CAPACITOR, paper oil 10 uf 600 volts dc	1
114	R6	030 965	RESISTOR, WW fixed 100 watt 100 ohm	1
115	T2	036 865	TRANSFORMER, 115 volts	1
116		000 681	STRIP, mounting - coil	2
117	T3	039 177	COIL, coupling - air	1
118		000 682	TUBING, fiber 1/4 ID x 5/16 x 3/4	2
119	R4	030 602	RESISTOR, WW fixed 100 watt 10 ohm	1
120		000 684	MOUNTING BOARD	1
121		020 623	SPARK GAP ASSEMBLY (consisting of)	1
122		020 621	. BASE	1
123	G	*020 603	. POINT	4
124		020 622	. HOLDER, point	4
125		010 888	. CONNECTOR, holder	1
126		000 914	LINK, connecting	1
127	C2	031 602	CAPACITOR, mica 0.002 uf 5000 volts dc	1

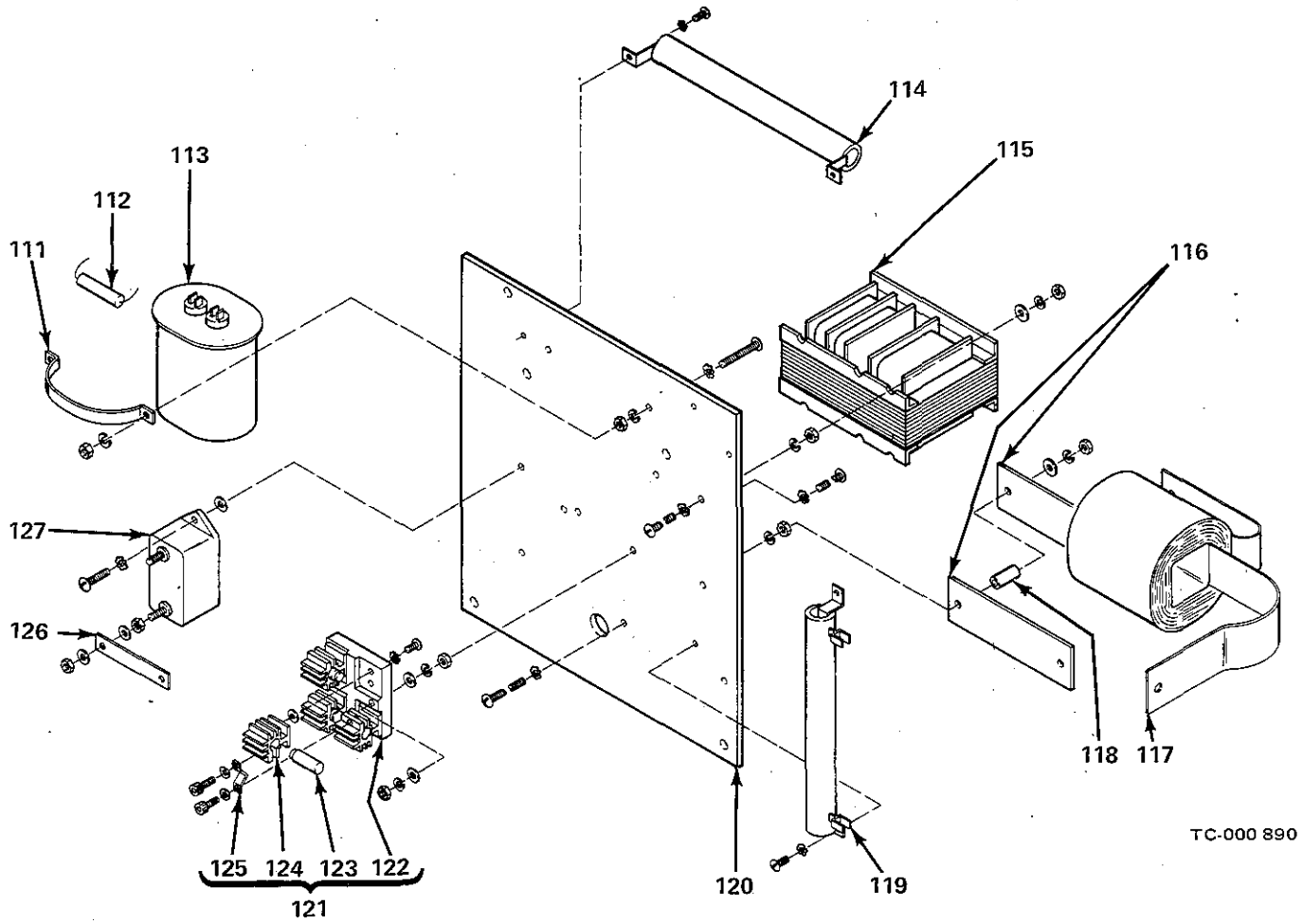


Figure F — HF Panel

*Recommended Spare Parts.

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

Item No.	Factory Part No.	Description	Quantity
Figure G	**032 786**	**Contactor (See Fig. A Page 1 Item 1)**	
136	035 837	COIL, contactor 115 volts	1
137	*035 836	KIT, point - contact	1

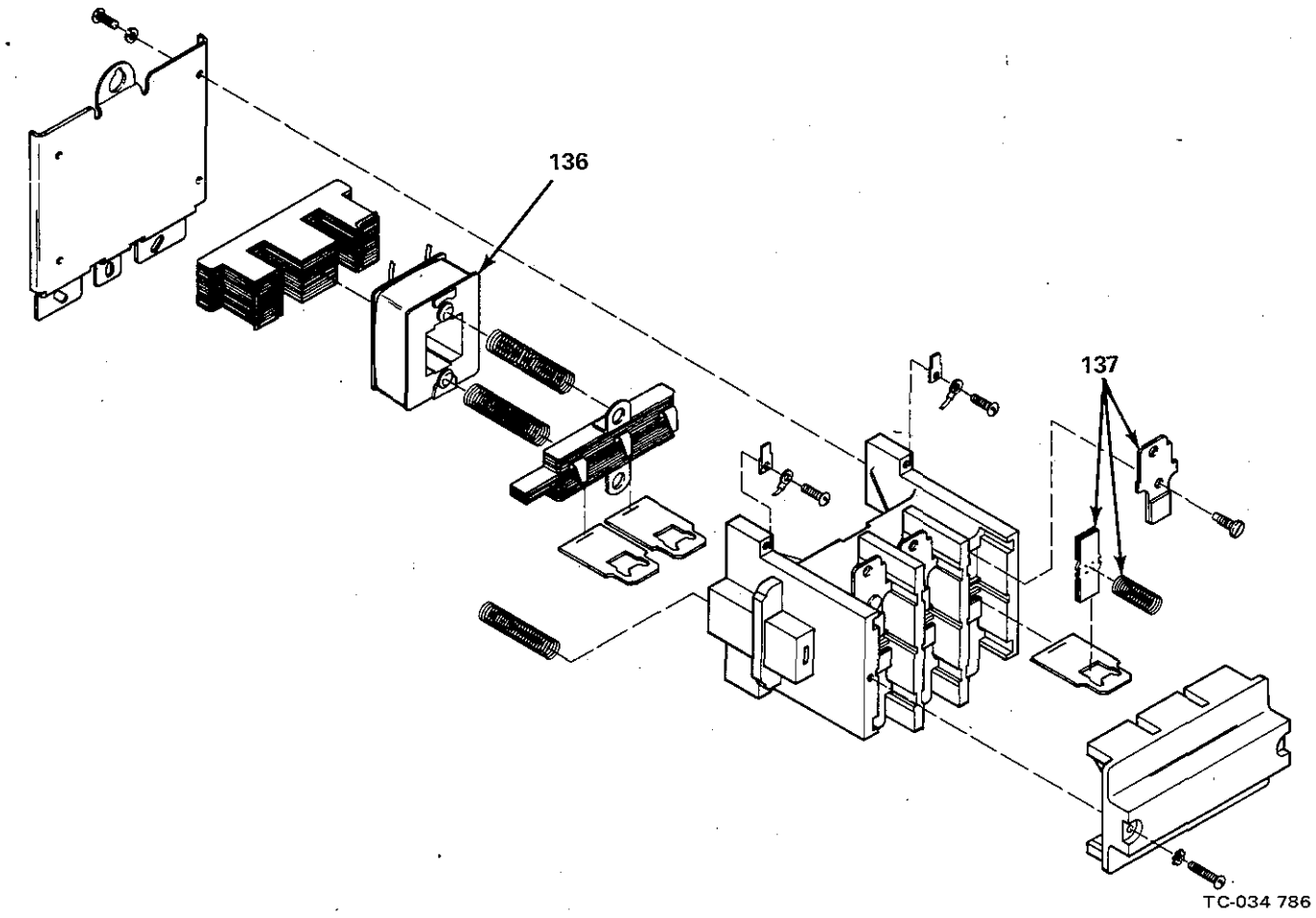


Figure G — Contactor

*Recommended Spare Parts

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

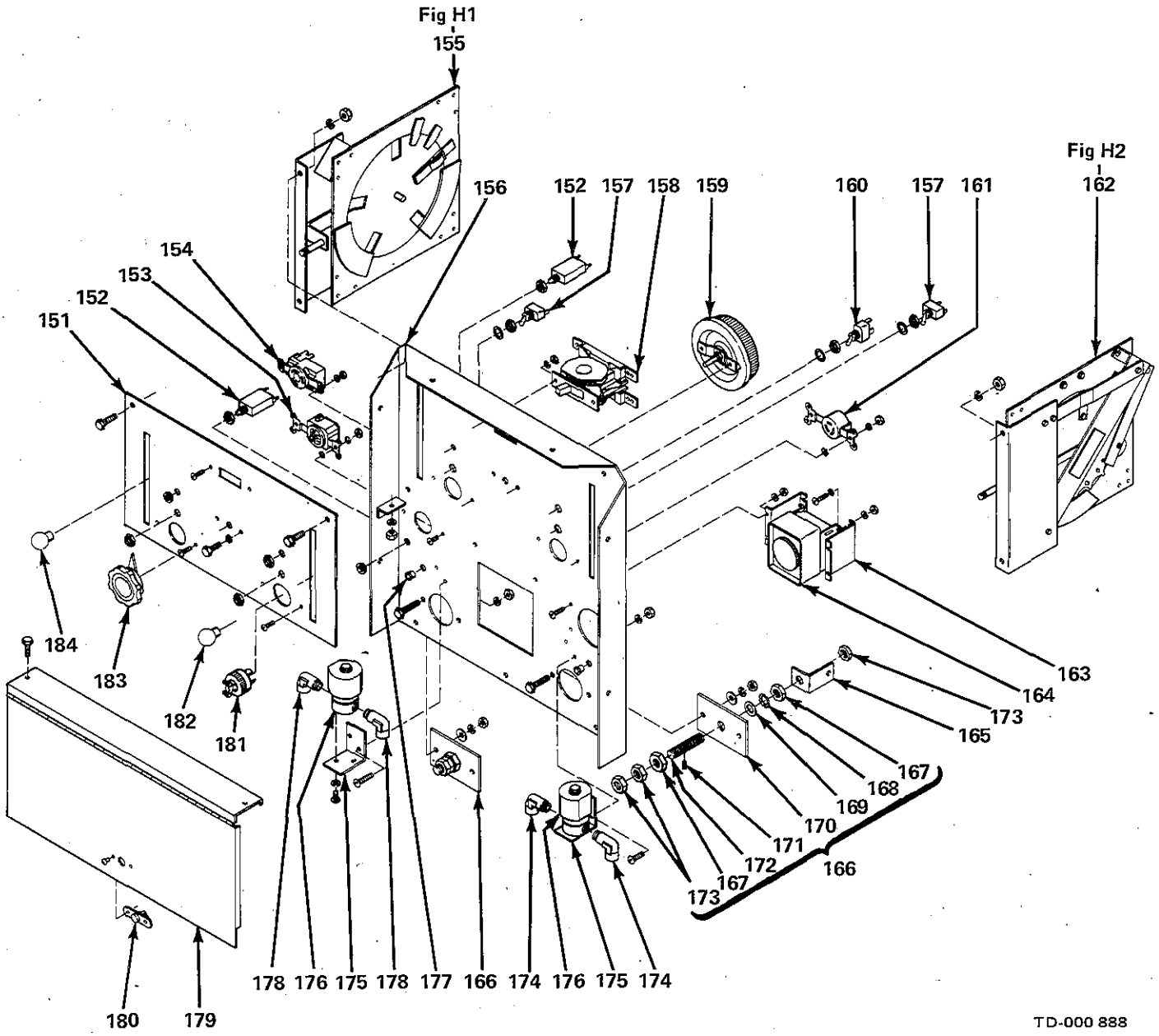


Figure H — Panel, Front - With Components

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure H			**Panel, Front - With Components (See Fig. A Page 1 Item 25)**	
151			NAMEPLATE (order by stock, model & serial numbers)	1
152	CB1,2	011 972	CIRCUIT BREAKER, 10 amp 250 volts	2
153	RC3	039 622	RECEPTACLE, grounded - straight 2P3W	1
154	RC1	039 607	RECEPTACLE, twistlock 3P3W	1
155	S4	000 071	SWITCH, range (See Fig. H1 Page 9)	1
156		000 075	PANEL, front	1
157	S2,3	011 609	SWITCH, toggle SPST 10 amp 125 volts	2
158	S1	025 865	SWITCH, toggle DPDT 60 amp 575 volts	1
159	R1	030 653	RHEOSTAT, WW 150 watt 15 ohm	1
160	S6	011 610	SWITCH, toggle SPDT 10 amp 125 volts center off	1
161	RC2	035 493	RECEPTACLE, grounded - twistlock 3P3W	1
162	S5	000 070	SWITCH, selector (See Fig. H2 Page 10)	1
163		014 206	BRACKET, mounting - timer	2
164	TD1	034 836	TIMER, 0-60 seconds 120 volts	1
165		000 383	BUS BAR, terminal output	1
166		038 630	TERMINAL, power output (consisting of)	2
167		601 840	. NUT, brass - hex jam 1/2-13	2
168		602 217	. WASHER, lock - steel external tooth 1/2	1
169		602 247	. WASHER, flat - steel SAE 1/2	1
170		038 603	. TERMINAL BOARD	1
171		010 912	. PIN, spring 1/8 x 3/8	1
172		038 982	. STUD, brass 1/2-13 x 2-5/8 centered drilled	1
173		601 839	. NUT, brass - hex full 1/2-13	3
174		010 296	ELBOW, brass - pipe street 90 degree 1/4MPT 5/8-18RH	2
175		014 028	ANGLE, mounting - solenoid	2
176	GS1,WS1	035 601	SOLENOID, 115 volts ac 2 way 1/4IPS port 1/8 orifice (consisting of)	2
		033 050	. COIL	1
177		057 084	BUSHING, snap 1/4 ID 3/8 mounting hole	2
178		010 295	ELBOW, brass - pipe street 90 degree 1/4MPT 5/8-18LH	2
179		000 077	DOOR, access - lower front	1
180		605 583	CATCH, spring loaded - door	1
181		035 494	CAP, grounded - twistlock 3P3W	1
182			KNOB, ball (included with S5 - See Fig. H2)	
183		019 627	KNOB, pointer	1
184			KNOB, ball (included with S4 - See Fig. H1)	

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

Item No.	Factory Part No.	Description	Quantity
Figure H1	**000 071**	**Switch, Range (See Fig. H Page 8 Item 155)**	
196	011 839	BRACKET, mounting - support	1
197	011 840	BRACKET, mounting - switch (consisting of)	1
198	010 671	. SPRING	1
199	000 530	CONTACT BOARD ASSEMBLY (consisting of)	1
200	011 968	. CONTACT BOARD, stationary	1
201	011 969	. CONTACT BOARD, movable	1
202	011 644	. CONTACT, stationary - switch	3
203	011 645	. CONTACT ASSEMBLY, movable (consisting of)	1
204	011 953	. . CONTACT, switch	2
205	011 074	. . SPRING, pressure	1
206	011 075	. . SPRING, pressure	1
207	100 622	. SHIM, guide	3
208	100 623	. GUIDE, contact	5
209	011 841	HANDLE, switch	1
210	019 603	KNOB, ball	1
211	014 203	BAR, mounting - support switch	1

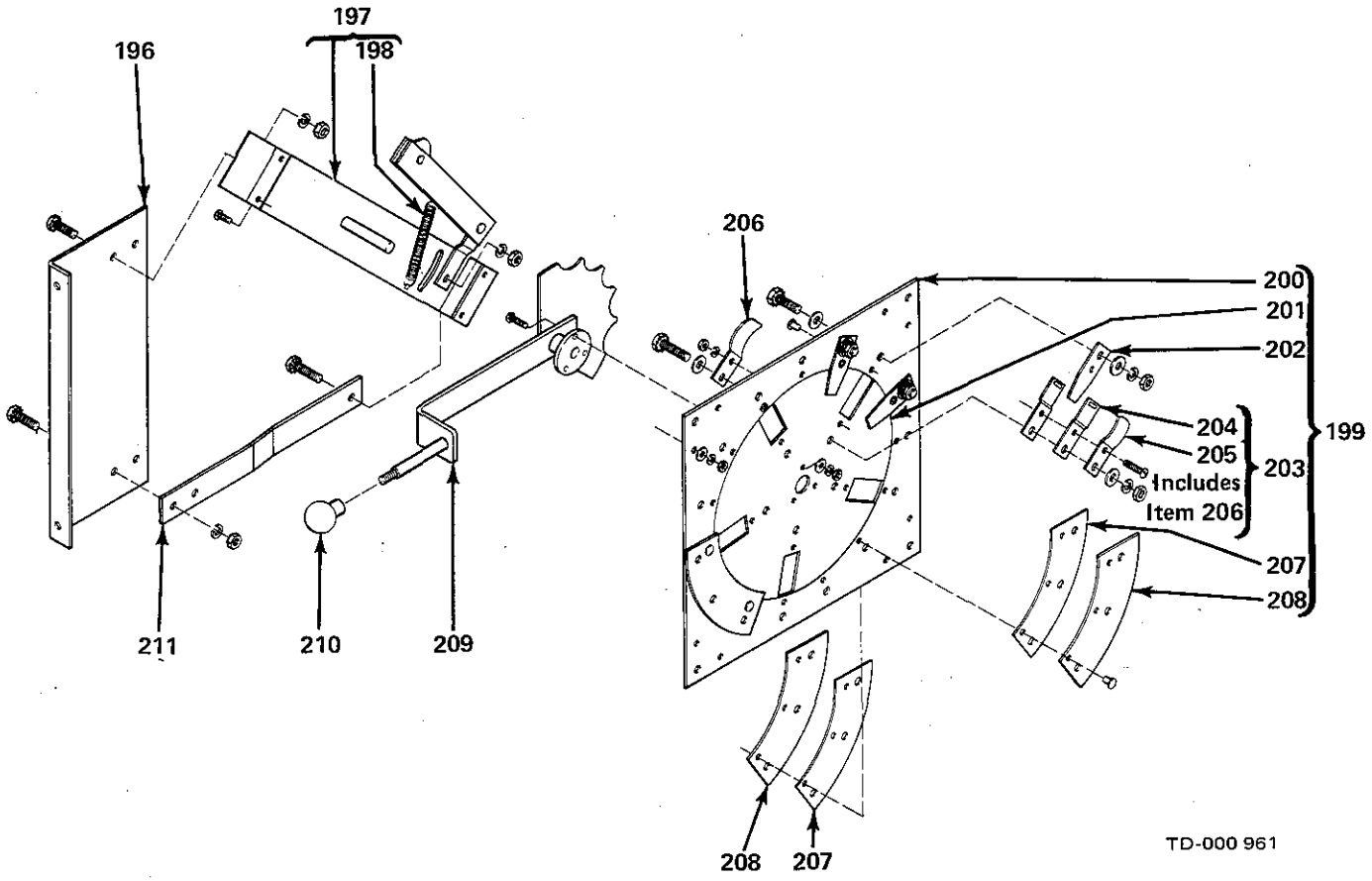


Figure H1 — Switch, Range

Item No.	Factory Part No.	Description	Quantity
Figure H2	**000 070**	**Switch, Selector (See Fig. H Page 8 Item 162)**	
221	000 531	CONTACT BOARD ASSEMBLY (consisting of)	1
222	011 968	. CONTACT BOARD, stationary	1
223	100 623	. GUIDE, contact	5
224	100 622	. SHIM, *guide*	3
225	011 969	. CONTACT BOARD, movable	1
226	011 645	. CONTACT ASSEMBLY, movable (consisting of)	2
227	011 075	. . SPRING, pressure	1
228	011 953	. . CONTACT, switch	2
229	011 074	. . SPRING, pressure	1
230	011 644	. CONTACT, stationary - switch	6
231	100 621	. LINK, connecting - switch	2
232	011 841	HANDLE, switch	1
233	011 840	BRACKET, mounting - switch (consisting of)	1
234	010 671	. SPRING	1
235	014 203	BAR, mounting - support switch	1
236	011 839	BRACKET, mounting - support	1
237	019 603	KNOB, ball	1

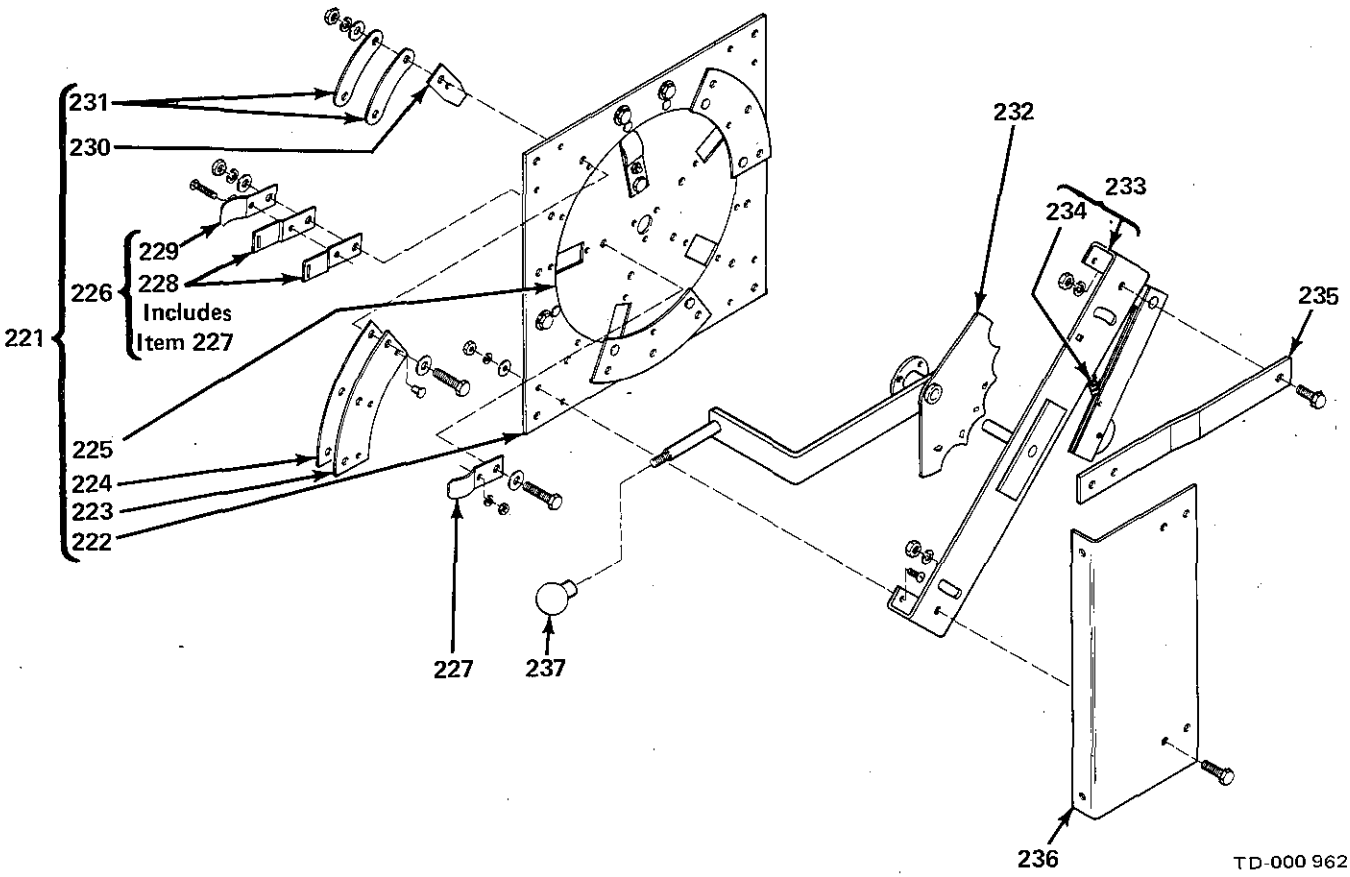


Figure H2 — Switch, Selector

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