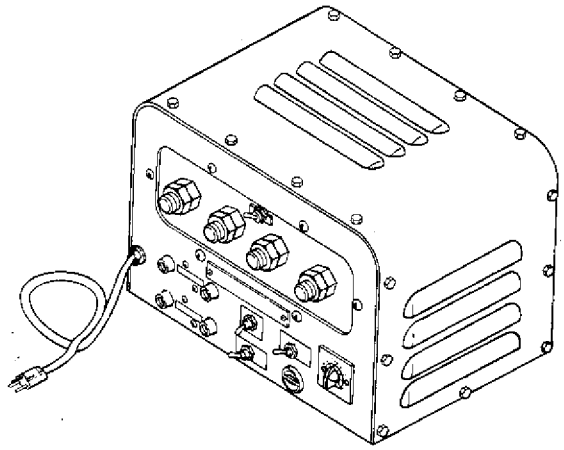
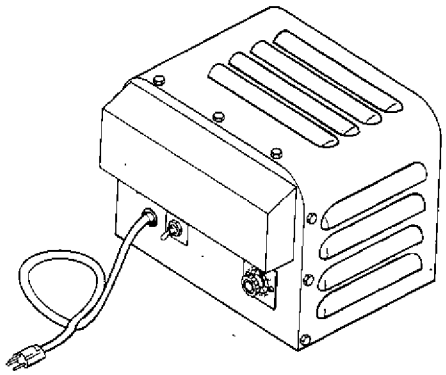
March 1975 FORM: OM-610A

Effective with style No. HD-1





MODEL	STOCK NO.
HF-15-1	900 320
HF-15-2	900 323
HF-15-4	900 326
HF-15-5	900 329
HF-15-1WG	900 332
HF-15-2WG	900 335
HF-15-4WG	900 338
HF-15-5WG	900 341
HF-20-1	900 344
HF-20-2	900 347
HF-20-4	900 350
HF-20-5	900 353
HF-20-1WG	900 356
HF-20-2WG	900 359
HF-20-4WG	900 362
HF-20-5WG	900 365

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

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.

ERRATA SHEET

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

Effective with Style No. HF-6A

Item No.	Dia. Mkgs.	Part No. Listed In Parts List	Replaced With Part No.	Description	Quantity
19	GS1,WS1	035 601	003 638	VALVE	2
		033 050	003 639	COIL, valve 115 volts ac	1
127	GS1,WS1	035 601	003 638	VALVE	2
		033 050	003 639	COIL, valve 115 volts ac	1

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

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_____

TABLE OF CONTENTS

SECTION 1 - INTRODUCTION

Model	Input Volts	Welding Amps. Rating 60% Duty Cycle	Dimensions (Inches)			Net Wt. Pounds
			Width	Height	Depth	
HF-15-1	115	500	15	11-1/2	11-1/4	45
HF-15-2	230	500	15	11-1/2	11-1/4	45
HF-15-4	460	500	15	11-1/2	11-1/4	45
HF-15-5	575	500	20-1/4	13-1/2	15	82
HF-20-1	115	1000	20-1/4	13-1/2	15	75
HF-20-2	230	1000	20-1/4	13-1/2	15	75
HF-20-4	460	1000	20-1/4	13-1/2	15	75
HF-20-5	575	1000	20-1/4	13-1/2	15	105
HF-15-1WG	115	500	15	15-1/2	11-1/2	55
HF-15-2WG	230	500	15	15-1/2	11-1/2	67
HF-15-4WG	460	500	15	15-1/2	11-1/2	67
HF-15-5WG	575	500	20-1/4	13-1/2	15	90
HF-20-1WG	115	1000	20-1/4	13-1/2	15	92
HF-20-2WG	230	1000	20-1/4	13-1/2	15	98
HF-20-4WG	460	1000	20-1/4	13-1/2	15	98
HF-20-5WG	575	1000	20-1/4	13-1/2	15	115

Figure 1-1. Specifications

1-1. 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.

1-2. 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.

1-3. DESCRIPTION

These high-frequency models are designed for use with either ac or dc arc welding. These units consist of a spark gap type oscillator which superimposes the high-frequency energy onto the welding circuit.

WG Models are equipped with gas and water valves and also have a post flow time delay relay, and control circuits to provide automatic control of the flow of water and shielding gas.

1-4. SAFETY

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 2 - INSTALLATION

2-1. LOCATION

NOTE

High-frequency has certain undesirable characteristics which should be eliminated or at least minimized. Any electrical equipment utilizing high-frequency energy in any way is capable of radiating interference if not properly installed. Since the high-frequency unit is a basic type of radio transmitter, it may cause interference with reception of nearby radio units. It is recommended therefore that a maximum of protection be provided to arrest, as much as possible, leakage of radiation. This may be accomplished by strict observance of the rules outlined under preventative measure against high-frequency radiation at the rear of this manual.

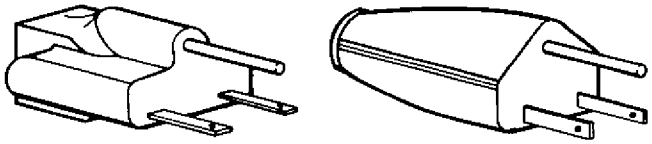
It is recommended that the high-frequency unit be located close to the electrode holder. This will make it possible to use a short welding cable between the high-frequency unit and the electrode holder and prevent high-frequency dissipation and erratic operation.

2-2. ELECTRICAL INPUT CONNECTIONS (Figure 2-1)

Check the nameplate on the high-frequency unit for electrical input voltages and frequency.

The 115 volts models have a parallel prong plug and the 230 volts models have a tandem prong plug. See Figure 2-1. Any model having an electrical input voltage above 250 volts comes equipped with a three-conductor cord without plug and must be connected directly to a main disconnect switch or other suitable means of connecting to the main power input line.

The green wire must be connected to ground and the other two wires will go to the power distribution system.



Tandem Plug
230 Volts

Parallel Plug
115 Volts

TA-001 911

Figure 2-1. Electrical Input Connection Plugs

2-3. SECONDARY CONNECTIONS (Figure 2-2)

Four studs and nuts are provided on the front panel for secondary connections. Connect the welding cables from the secondary connections on the welding power source to the two corresponding connections on the high-frequency unit identified as WELDING MACHINE, WORK, and ELECTRODE. These connections are on the left side of the high-frequency control panel.

High-frequency units having gas and water valves (WG models) will not function properly on welding power sources equipped with a primary contactor if the primary contactor is to be used for on-off control of the welding arc. The welding power source must be energized at all times in order for the WG model high-frequency unit to function properly. The gas and water control will not function if voltage at the welding power source output terminals is not present when an arc is not being maintained. Any device which reduces or eliminates the open-circuit voltage on the welding power source between welds will serve to de-energize the control circuit in the WG model high-frequency unit and will prevent the controls in the unit from functioning properly.

When high-frequency units with gas and water control (WG models) are used and on-off control of the welding arc is desired, a secondary contactor must be employed and connected in series with the work lead. See Figure 2-2.

Connect a suitable size and type welding cable from the WORK (Red) terminal on the high-frequency unit to the workpiece. If a water and gas (WG) model high-frequency unit is used and a secondary contactor is employed for on-off arc control, connect the welding cable to the upper terminal on the secondary contactor instead of the workpiece. Connect a welding cable from the bottom terminal of the secondary contactor to the workpiece.

Connect leads from the secondary contactor operating coil, if used, to a 115 volts 60 Hertz ac line and make some provisions for an ON-OFF Switch.

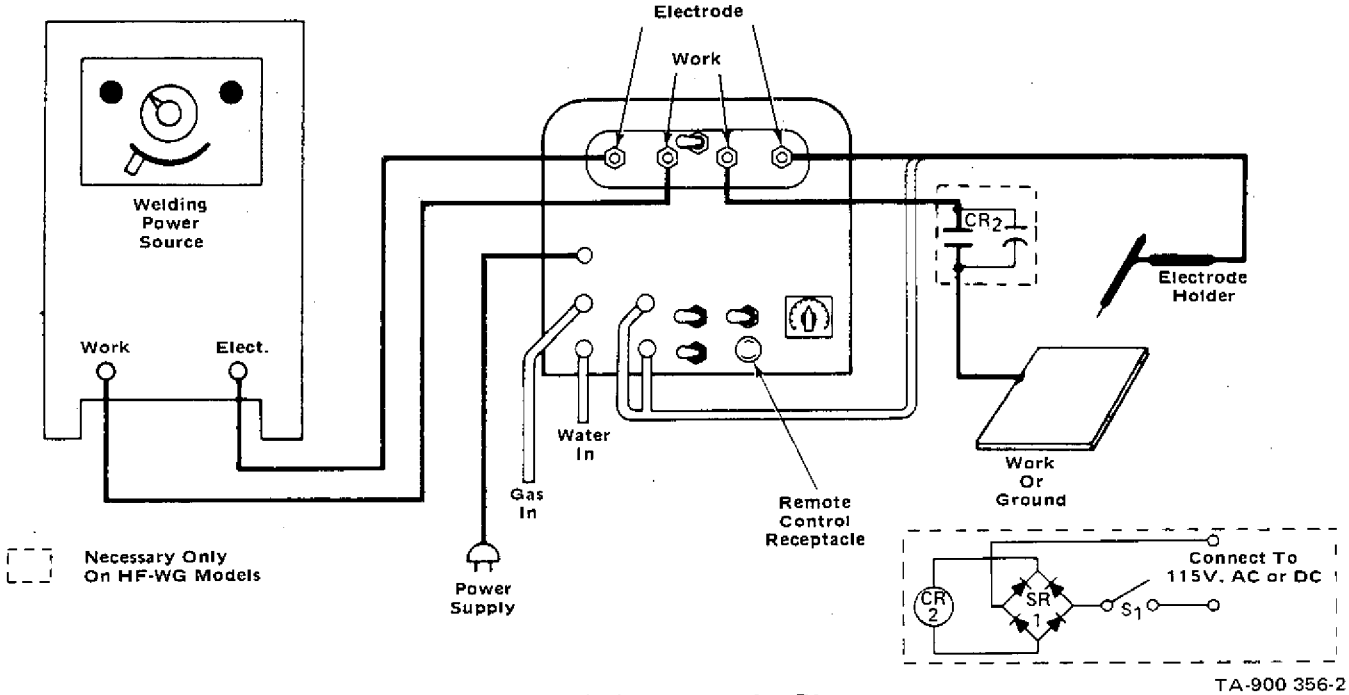
When welding with dc, if the welding power source is not equipped with a polarity switch, the polarity may be reversed by reversing the connections on the WORK and ELECTRODE secondary terminals on the welding power source.

CAUTION

To comply with normal safety requirements, a hinged door has been provided to protect against accidental contact with the weld power terminals of this equipment. Before making weld cable connections to these terminals, make sure that the equipment supplying power to this unit is de-energized.

2-4. WATER AND GAS CONNECTIONS

The water and gas valves are located on the front panel. Connect the water and gas line from the respective sources to the gas and water valve connection labeled IN. Connect the electrode holder gas and water hose to the gas and water valve connection labeled OUT. The OUT connections have a right hand, 5/8-18 female thread. Make sure the direction of flow through the valves is as indicated on the front panel.



TA-900 356-2

Figure 2-2. Interconnection Diagram

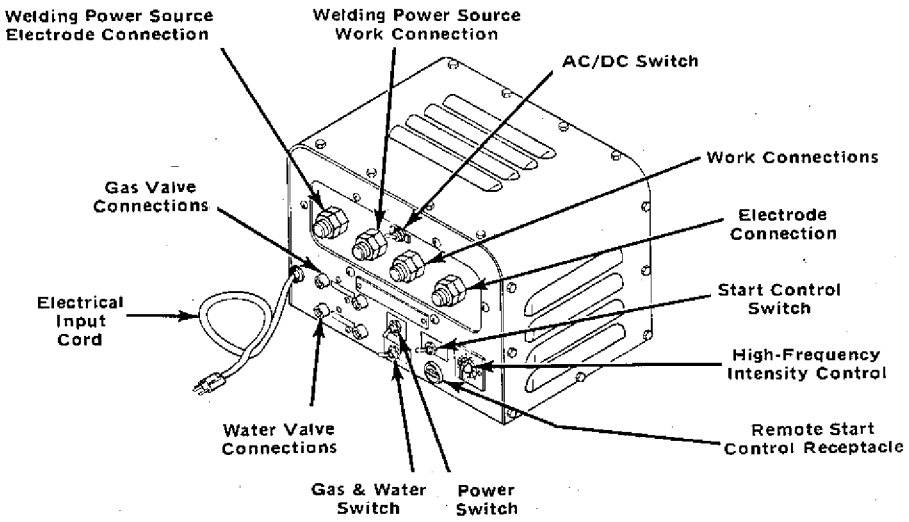
SECTION 3 - FUNCTION OF CONTROLS

3-1. AC/DC SWITCH

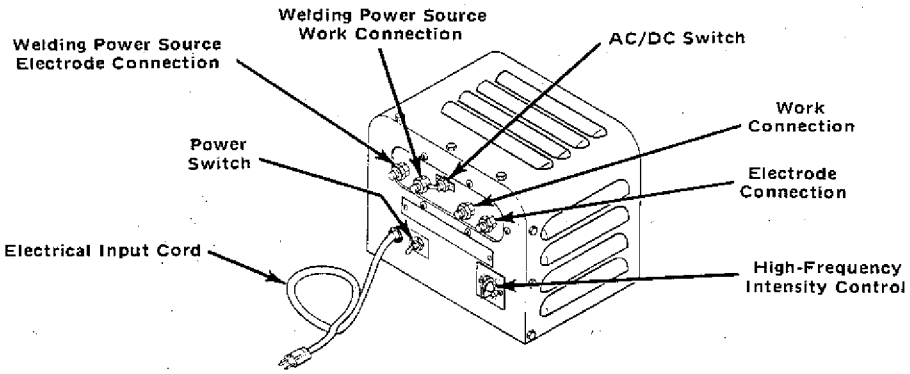
The START CONTROL Switch, located on the front panel, will determine whether high-frequency will be present at the electrode throughout the weld or only during arc initiation.

A. AC Position

When in the AC position, high-frequency will be present at the electrode until the welding arc is broken.



MODELS WITH WATER AND GAS CONTROL



MODELS WITHOUT WATER AND GAS CONTROL

Figure 3-1. External View of High-Frequency Units

B. DC Position

When in the DC position, high-frequency will be present at the electrode only until an arc is initiated. Once an arc is established, the high-frequency will shut off and will not be made available again until the arc is broken and a re-start is attempted.

3-2. HIGH-FREQUENCY INTENSITY CONTROL

A High-Frequency Intensity Control is provided on the front panel for controlling the strength of the high-frequency. Rotating the control in a clockwise direction will increase the intensity of the high-frequency.

NOTE

As the high-frequency intensity is increased, the possibility of causing interference with local radio and television receivers also increases. It is recommended that the High-Frequency Intensity Control be set at as low a position as possible in order to avoid receiver interference.

3-3. POWER SWITCH

This high-frequency unit is equipped with a POWER Switch in order to provide on and off control of the electrical input power. Placing the POWER Switch in the ON position will energize the high-frequency unit and place it in a ready-to-operate status. Placing the switch in the OFF position will shut the unit down.

CAUTION

Even though the POWER Switch is in the OFF position and the high-frequency unit is apparently shutdown, electrical input power is still present on all circuitry up to the input terminals of the POWER Switch. To completely shut the unit down whenever going inside of the unit, it will be necessary to remove the electrical input plug from the electrical input supply.

3-4. WATER-GAS POST-FLOW TIMER (WG Models Only)

An adjustable 0 to 60 second Water-Gas Post-Flow Timer, located on the inside of the unit, is provided for controlling the period of time shielding gas and water (coolant) will be allowed to flow after the arc is extinguished.

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

NOTE

This timer is shipped set for 30 seconds.

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 timer has timed out, the gas and water valve will close and thereby cut off shielding gas and water flow. The timer will then automatically reset and be ready for another weld cycle.

3-5. GAS AND WATER SWITCH (WG Models Only)

A GAS and WATER Switch is provided on the front panel for determining whether or not shielding gas and water will be permitted to flow. Placing the GAS and WATER Switch in the ON position will permit the GAS and WATER Valves to function normally. The OFF position will completely shut the valves down.

3-6. START CONTROL SWITCH (WG Models Only)

A two position switch, labeled START CONTROL, is provided on the front panel for selecting either touch start or high-frequency arc initiation.

A. Touch Position

When in the TOUCH position, it will be necessary to touch the electrode to the workpiece. Once an arc is established, high-frequency will be present. The time period the high-frequency will be present will be determined by the position that the AC/DC Switch is in.

B. Switch Position

Whenever the SWITCH position is to be used, it will be necessary to connect the supplied Remote Hand Switch to the Remote Start Control Receptacle.

Whenever in the SWITCH position and the Remote Hand Switch is depressed, high-frequency will be present at the electrode. The time period that the high-frequency will be present will be determined by the position of the AC/DC Switch.

SECTION 4 - MAINTENANCE

CAUTION

Be sure the electrical input voltage is removed from the high-frequency unit before attempting any inspection or work on the inside of the unit. Placing The POWER Switch on the high-frequency unit in the OFF position, does not remove voltage from the power terminals on the inside of the unit.

4-1. SPARK GAPS

The spark gaps can readily be inspected by opening the rear door of the high-frequency unit. The spark gaps are normally set at .008 inches apart when shipped. It will be necessary to periodically readjust these after extended operation. Usually, inspection and adjustment every three to four months will suffice. Readjustment is also indicated when intermittent operation of the gaps is noted. Usually this occurs when the gap setting has increased to .012 inch or greater.

4-2. SPARK GAP ADJUSTMENT (Figure 4-1)

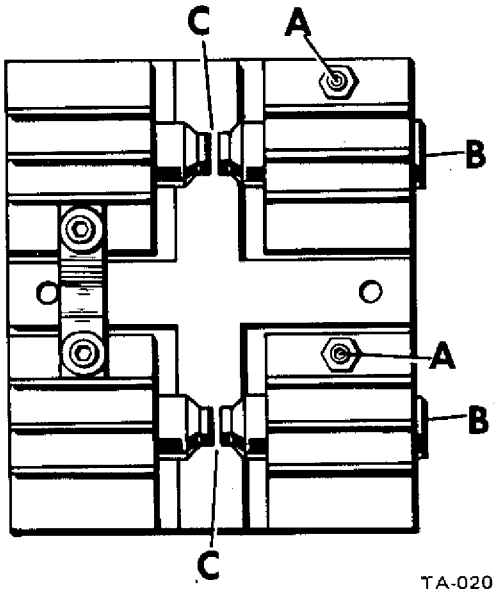


Figure 4-1. Spark Gap Adjustment

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 gap setting to .010 inch or even .015 inches. This naturally also increases the high-frequency radiation and it is suggested that the minimum gap setting (.008 inches) consistent with good welding operation, be used.

Widening the spark gaps through normal operation may, if not corrected, increase the loading of the high voltage capacitors and thus contribute to their premature failure. Cleaning or dressing of the points of the spark gap is not recommended as the material at the points is tungsten and it is impossible to file. The entire point should be replaced when they become extremely pitted or burned to such an extent that little or no tungsten point material is left.

To adjust spark gaps proceed as follows:

1. Loosen screws (A).
2. Place feeler gauge between gaps (C).
3. Apply slight pressure against spark gap holder (B) so feeler gauge is held firmly in gap.
4. Tighten screws (A).

4-3. HIGH VOLTAGE CAPACITORS

These parts are rarely a source of trouble. A defective capacitor, however, is evident usually by the appearance of melted sealing material at the bottom of the housing or evidence of oil leakage in certain cases. Any local radio repair shop can readily determine the condition of the capacitors. (If one of the high voltage capacitors should fail, operation may be continued with one capacitor until a new one can be secured). In order to prevent excessive overload on the remaining single capacitor, the spark gap point setting should be reduced to about .004 inches.

4-4. BY-PASS PANEL

The purpose of the by-pass panel is to reduce the high-frequency feed back into the transformer of the welding power source.

A defective capacitor in this circuit would reduce the high-frequency output and would be evident by loss of oil from the metal case. The resistors would show evidence of being cracked if they are defective. Failure in this circuit is rare and would be suspected only as a last resort.

SECTION 5 - TROUBLESHOOTING

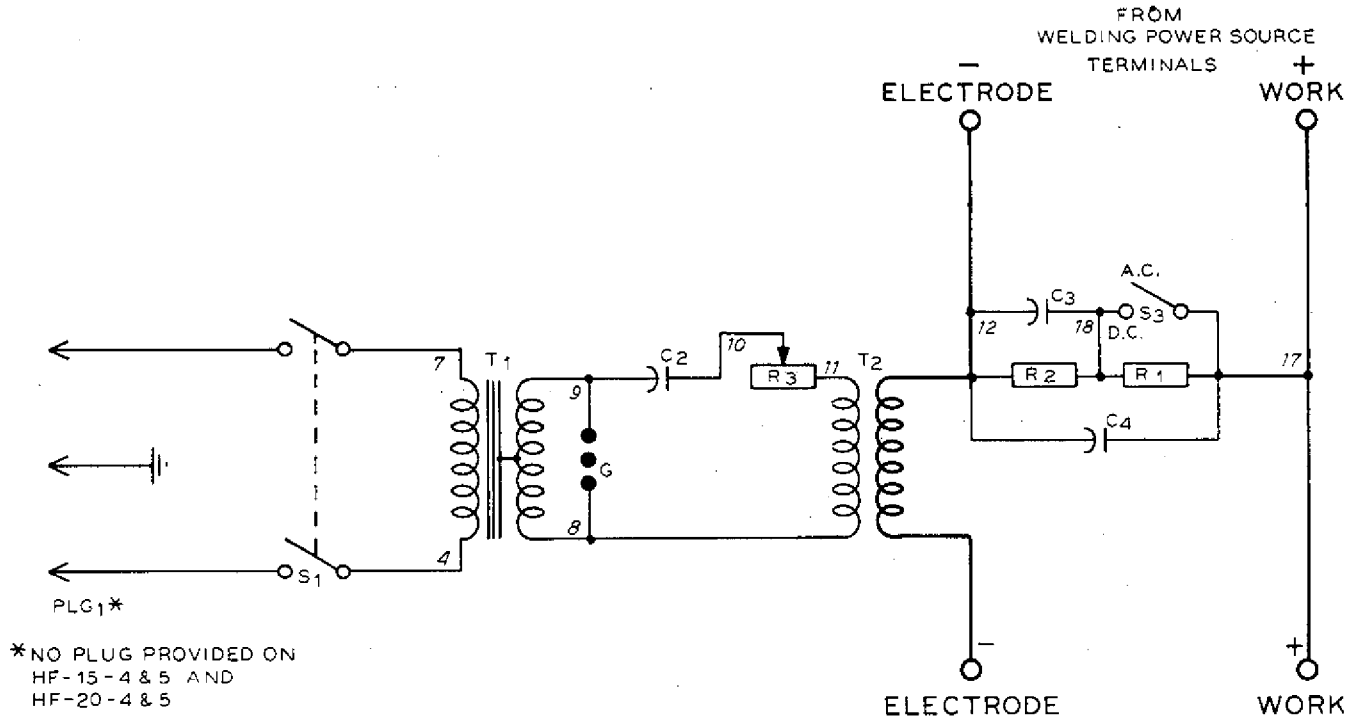
The data collected here, discusses some of the common problems which may occur in this unit.

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.

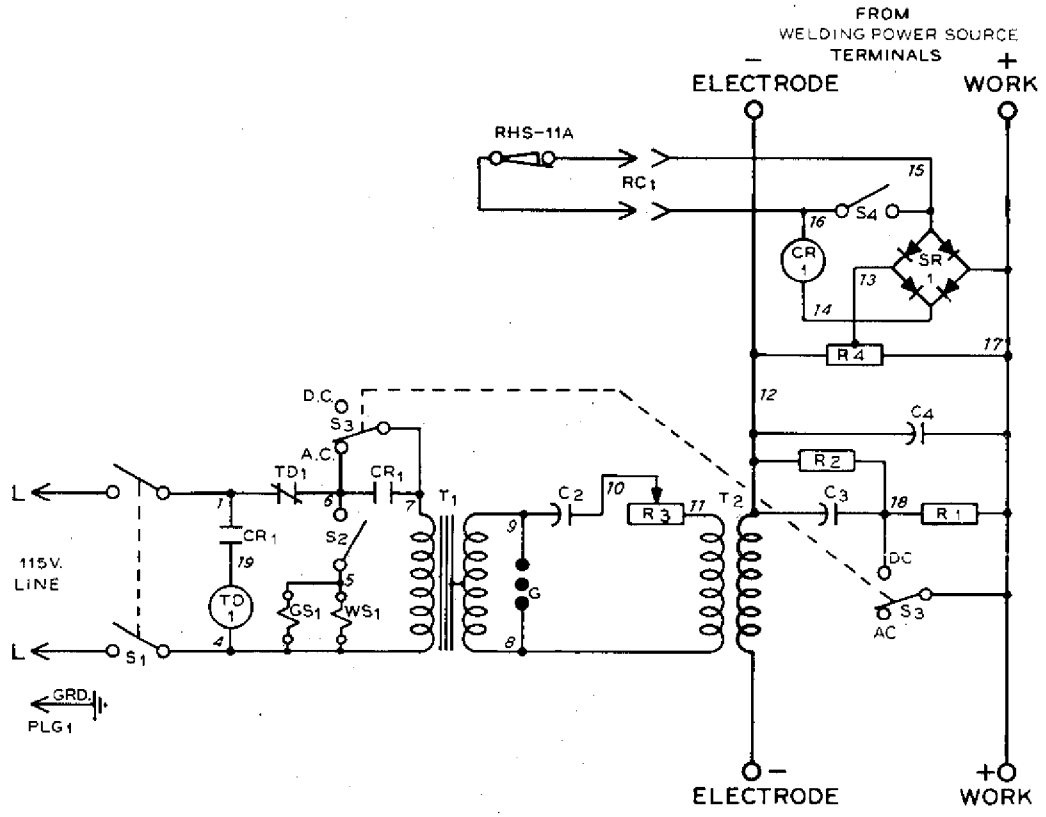
It is recommended that the circuit diagram be used for reference during the troubleshooting.

TROUBLE	PROBABLE CAUSE	REMEDY
Lack of high-frequency, difficulty in establishing arc.	Spacing of spark gaps has increased.	Set spark gap points .008" to .010".
	Use of tungsten larger than recommended for welding amperage involved.	Use proper size Tungsten.
	Dissipation of high-frequency from electrode holder lead.	Make certain electrode holder cable is not in close proximity to any grounded metal.
	High-Frequency Intensity Control setting too low.	Increase setting of High-Frequency Intensity Control.
Wandering arc - poor control of direction of arc.	Use of tungsten considerably larger than recommended.	Use proper size tungsten.
Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Water in electrode holder.	Refer to electrode holder parts list for parts or parts requiring replacement.
	Loose gas fittings on regulator or gas line. This will siphon oxygen into the weld zone.	Check all gas fittings and tighten.
	Insufficient gas flow.	Increase gas flow setting.
	Drafts blowing gas shield away from tungsten.	Shield weld zone from drafts.
	Dirty filler rod or material.	Use clean filler rod or material.
	Gas shutting off too quickly after end of weld.	Increase time delay setting of Post-Flow Gas and Water Valve Timer.
	Insufficient high-frequency.	Increase setting of High-Frequency Intensity Control.



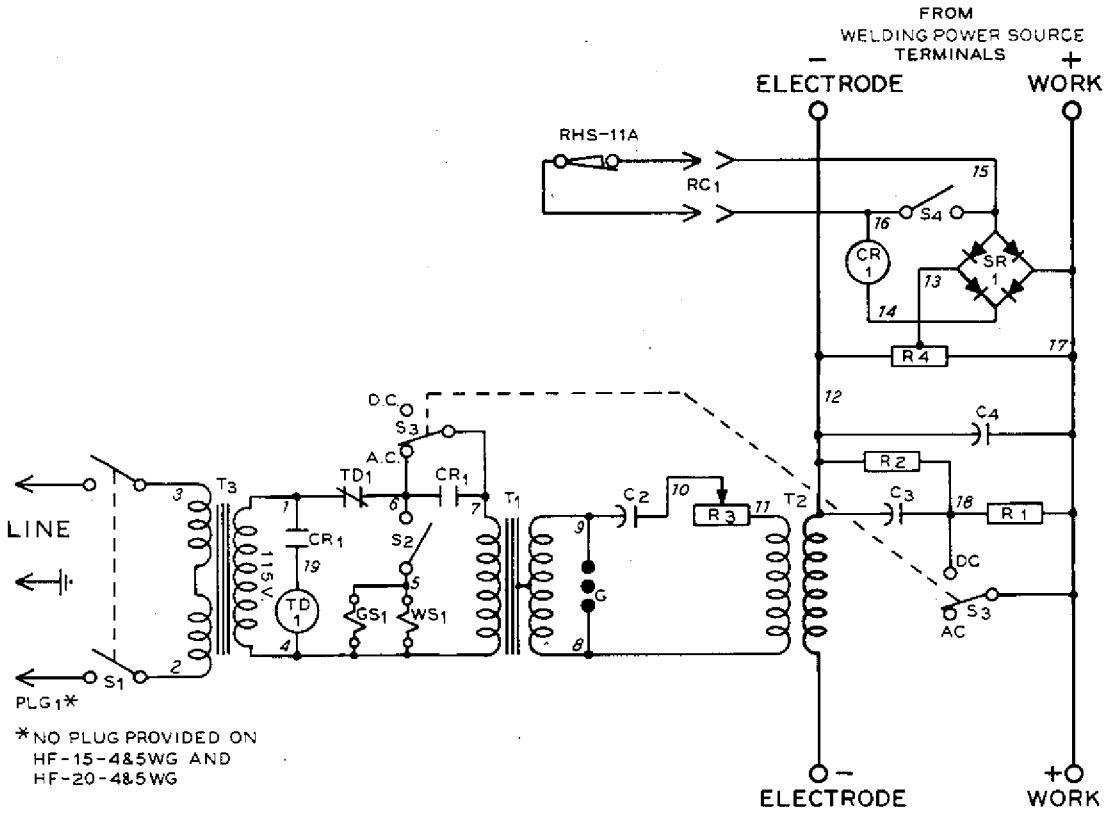
Circuit Diagram
No. CA-900 320-1A

Figure 5-1. High Frequency Units Without Gas & Water Control



Circuit Diagram
No. CA-900 332-1A

Figure 5-2. 115 Volt High Frequency Units With Gas & Water Control



Circuit Diagram
No. CA-900 335-1A

Figure 5-3. 230, 460 or 575 Volt High Frequency Units With Gas & Water Control

SECTION 6 - CERTIFICATION FOR HIGH FREQUENCY ARC WELDING EQUIPMENT

1. GENERAL

a. The 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.

b. 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.

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

d. 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.

e. 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.

f. 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.

2. GENERAL INFORMATION

a. 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.

(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.

3. POWER SERVICE

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

b. 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.

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

d. 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 Fig. A. Care should be taken that paint or corrosion at the junction of conduit and case, does not interfere with good electrical contact.

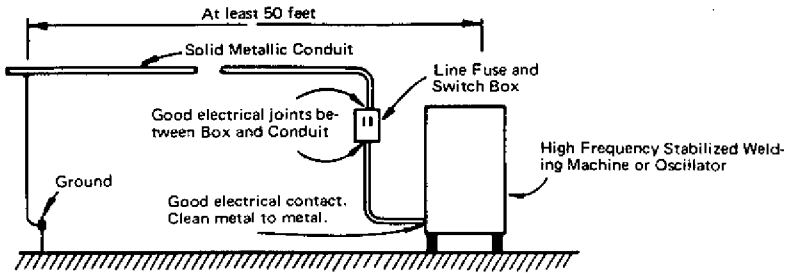
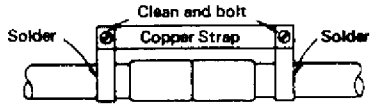
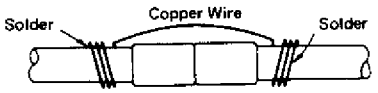


Figure A – Power Service Installation H. F. Stabilized Arc Welding Machine

e. 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 Fig. B.



(a) Demountable Bonding Strap for Conduit Joints



(b) Solid Bonding with Copper Wire for Conduit Joints

Figure B – Two Recommended Methods For Electrical Bonding Across Poor Conductivity Conduit Joints

4. WELDING MACHINE

a. 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.

b. 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 Fig. C)

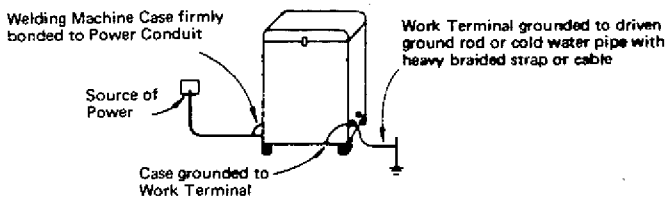


Figure C – Ground Connections At Welding Machine

c. 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.

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

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

5. WELDING LEADS

a. 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.

b. Keeping the electrode lead and ground or work lead as close as possible and on the floor serves to reduce the radiation. (See Fig. D)

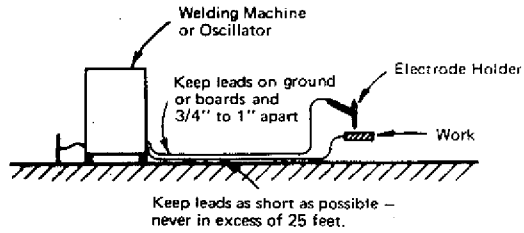


Figure D – General Rules For Welding Leads

5. WIRING IN THE VICINITY OF THE WELDING AREA

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

b. 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.

c. 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 Fig. E)

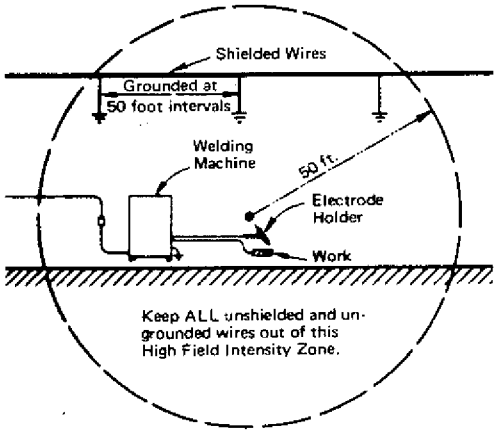


Figure E – General Requirements To Minimize Reradiation Pick-Up In The Vicinity Of The Weld Zone

d. 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.

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

f. 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.

g. 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.

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

i. 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.

7. GROUNDS

a. 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:

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

c. 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.

d. 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.

e. 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. METAL BUILDING

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

b. 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.

c. 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.

9. INDIVIDUAL INSTALLATION CERTIFICATION

a. 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.

b. 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.

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

10. CHECK LIST

a. 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 radius contered 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?

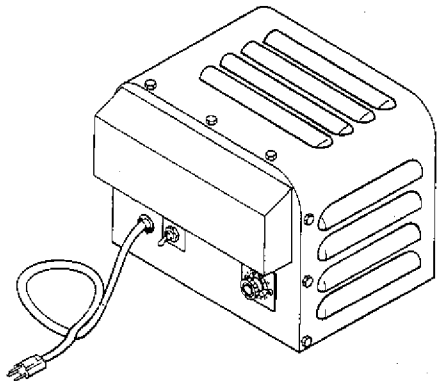
(27) Are the connections to the ground clean and tight?

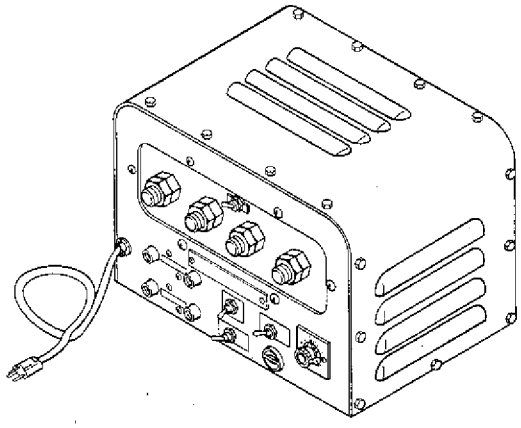
(28) If operated within a metal building, is the building properly grounded?

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

March 1975 FORM: OM-610A

Effective with style No. HD-1





MODEL	STOCK NO.
HF-15-1	900 320
HF-15-2	900 323
HF-15-4	900 326
HF-15-5	900 329
HF-15-1WG	900 332
HF-15-2WG	900 335
HF-15-4WG	900 338
HF-15-5WG	900 341
HF-20-1	900 344
HF-20-2	900 347
HF-20-4	900 350
HF-20-5	900 353
HF-20-1WG	900 356
HF-20-2WG	900 359
HF-20-4WG	900 362
HF-20-5WG	900 365

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

PARTS LIST

miller®

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

NWSA CODE NO. 4579

PRINTED IN U.S.A.

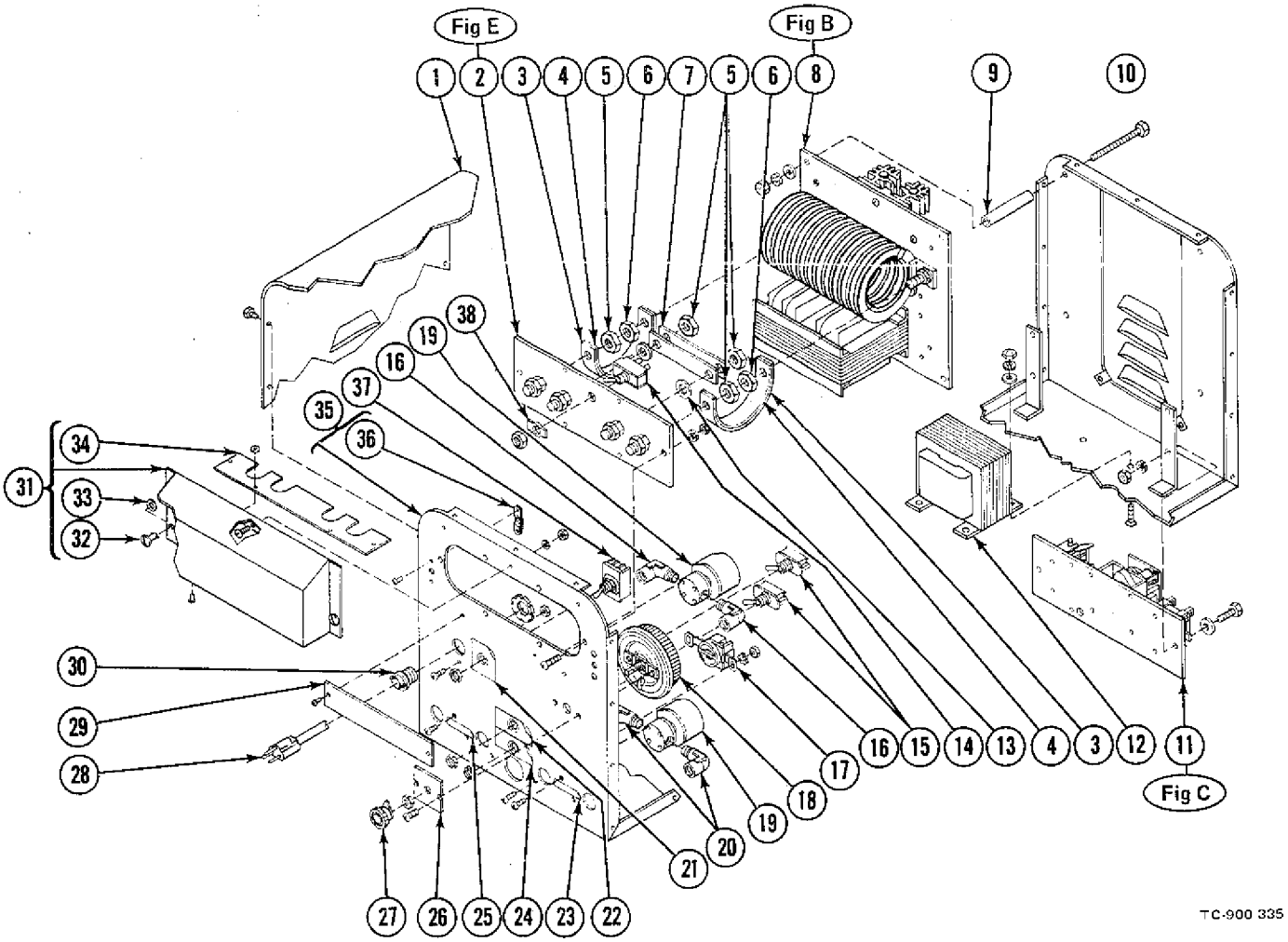


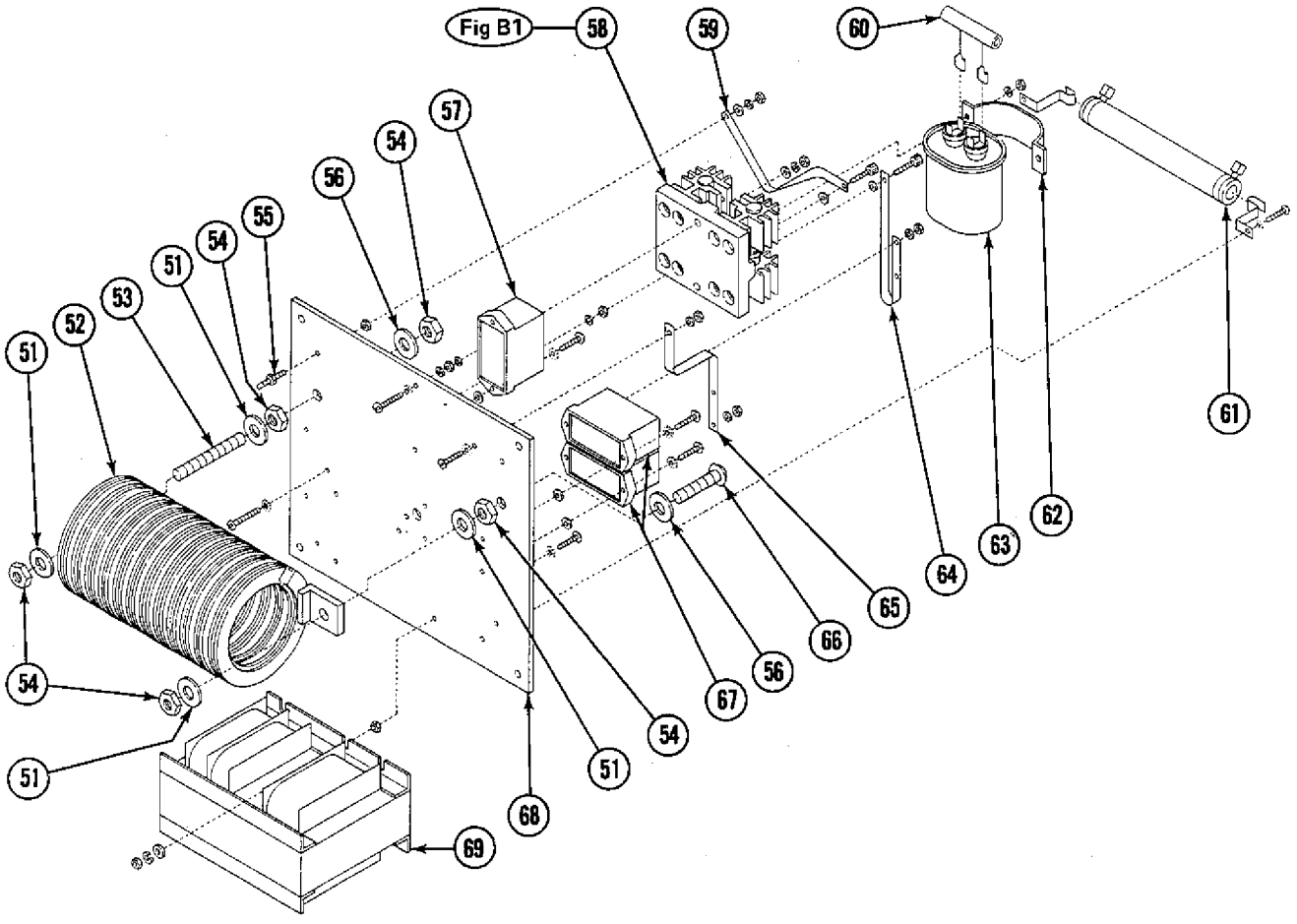
Figure A - Main Assembly

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity / Models HF 15-1	HF 15-2	HF 15-4	HF 15-1 WG	HF 15-2 WG	HF 15-4 WG
Figure A			**Main Assembly**						
1		100 236	WRAPPER	1	1	1			
1		017 051	WRAPPER				1	1	1
2		038 764	TERMINAL ASS'Y, power (See Fig. E Page 7).	1	1	1	1	1	1
3		010 007	BUS BAR, jumper	2	2	2	2	2	2
4		010 008	BUS BAR, jumper	2	2	2	2	2	2
5		601 840	NUT, brass - hex jam 1/2-13	4	4	4	4	4	4
6		601 838	NUT, brass - hex jam 3/8-16	2	2	2	2	2	2
7		010 009	BUS BAR, jumper	2	2	2	2	2	2
8		020 640	HF PANEL (See Fig. B Page 3)	1			1	1	1
8		020 655	HF PANEL (See Fig. B Page 3)		1				
8		020 656	HF PANEL (See Fig. B Page 3)			1			
9		010 006	TUBING, steel 3-1/4 long	4	4	4	4	4	4
10		601 794	BOLT, steel-hex hd 1/4-20 x 4	4	4	4	4	4	4
11		018 120	CONTROL PANEL (See Fig. C Page 4)				1	1	1
12	T3	036 824	TRANSFORMER, 1/3 kva					1	1
13		602 247	WASHER, steel-flat SAE 1/2	3	3	3	3	3	3
14	S3	*011 620	SWITCH, toggle SPST 16 ampere 125 volt	1	1	1			
14	S3	*011 649	SWITCH, toggle DPDT 15 ampere 125 volt				1	1	1
15	S2,4	*011 620	SWITCH, toggle SPST 16 ampere 125 volt				2	2	2
16		010 295	ELBOW, brass 90 deg street 5/18-18 LH				2	2	2
17	RC1	039 602	RECEPTACLE, twistlock 2P2W				1	1	1
18	R3	603 942	RHEOSTAT, WW 150 watt 5 ohm	1	1	1	1	1	1
19	GS1,WS1	035 601	VALVE, 115 volt ac (consisting of)				2	2	2
		033 050	. COIL				1	1	1
20		010 296	ELBOW, brass 90 deg street 5/8-18 RH				2	2	2
21		012 111	LABEL, power switch on-off	1	1	1	1	1	1
22		012 099	LABEL, gas & water on-off				1	1	1
23		013 983	LABEL, in-gas-out				1	1	1
24		012 100	LABEL, switch-touch start control				1	1	1
25		013 982	LABEL, in-water-out				1	1	1
26		013 518	PLATE, indicator 0-100	1	1	1	1	1	1
27		024 366	KNOB, pointer	1	1	1	1	1	1
28		023 602	CORD SET, 115 volt 16/3 (10 ft. long)	1		1	1		1
28		023 603	CORD SET, 230 volt 16/3 (10 ft. long)		1			1	
29			NAMEPLATE (order by stock, model & style numbers)	1	1	1	1	1	1
30		010 610	CONNECTOR, cable 3/8	1	1	1	1	1	1
31		027 343	COVER, terminal (consisting of)	1	1	1	1	1	1
32		604 768	. FASTENER, screw 1/4 turn No. 5	2	2	2	2	2	2
33		602 344	. RETAINER, screw	2	2	2	2	2	2
34		027 346	. INSULATOR, terminal	1	1	1	1	1	1
35		017 053	CASE SECTION, base/front/rear (consisting of)	1	1	1			
35		017 052	CASE SECTION, base/front/rear (consisting of)				1	1	1
36		602 347	. RECEPTACLE, screw 1/4 turn	2	2	2	2	2	2
37	S1	*011 638	SWITCH, toggle 3PST 15 ampere 125 volt	1	1	1	1	1	1
38		011 106	PLATE, legend AC/DC	1	1	1	1	1	1
		Figure G	REMOTE HAND SWITCH (See Page 9)				1	1	1

*Recommended Spare Parts.

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

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models 115 Volt	230 Volt	460 Volt
Figure B			HF Panel (See Fig. A Page 2 Item 8)	020 640	020 655	020 656
51		602 243	WASHER, flat - steel standard 3/8	4	4	4
52	T2	033 601	COIL, coupling - air	1	1	1
53		038 891	STUD, brass 3/8-16 x 2-1/4	1	1	1
54		601 838	NUT, brass - hex jam 3/8-16	8	8	8
55		038 887	STUD, brass with hex collar 10-32 x 1-3/8	2	2	2
56		010 910	WASHER, flat - steel SAE 3/8	2	2	2
57	C4	031 605	CAPACITOR, mica 0.001 uf 6000 volt dc	1	1	1
58	G	020 623	SPARK GAP ASSEMBLY (See Fig. B1 Page 4)	1	1	1
59		010 885	STRIP, conductor (spark gap to board)	1	1	1
60	R2	030 603	RESISTOR, WW fixed 10 watt 10K ohm	1	1	1
61	R1	030 602	RESISTOR, WW fixed 100 watt 10 ohm	1	1	1
62		014 159	CLAMP, mtg - capacitor	1	1	1
63	C3	*031 601	CAPACITOR, 10 uf 600 volt dc	1	1	1
64		010 883	STRIP, conductor (spark gap to capacitor)	1	1	1
65		010 884	STRIP, conductor (capacitor to board)	1	1	1
66		603 737	SCREW, brass - round head 3/8-16 x 1-3/4	1	1	1
67	C2	*031 602	CAPACITOR, mica 0.002 uf 5000 volt dc	2	2	2
68		016 601	MOUNTING BOARD	1	1	1
69	T1	036 865	TRANSFORMER, 115 volt	1		
69	T1	036 864	TRANSFORMER, 220 volt		1	
69	T1	036 682	TRANSFORMER, 460 volt			1



TD-020 655

Figure B — HF Panel

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

Item No.	Factory Part No.	Description	Quantity
Figure B1	**020 623**	**Spark Gap Assembly (See Fig. B Page 3 Item 58 &) (Fig. F Page 8 Item 156)**	
76	020 621	BASE	1
77	*020 603	POINT, spark gap	4
78	604 772	WASHER, flat - steel SAE No. 8	4
79	602 023	SCREW, cap - steel socket hd 10-24 x 3/4	4
80	010 888	CONNECTOR, holder	1
81	020 622	HOLDER, points	4
82	010 913	WASHER, flat - brass 3/16	8
83	602 204	WASHER, lock - steel external tooth No. 10	8
84	602 101	SCREW, machine - steel round head 10-24 x 5/8	8

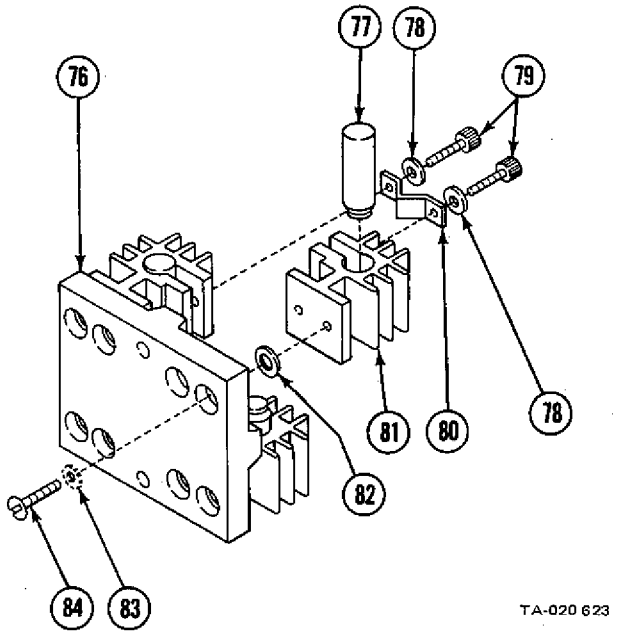


Figure B1 — Spark Gap Assembly

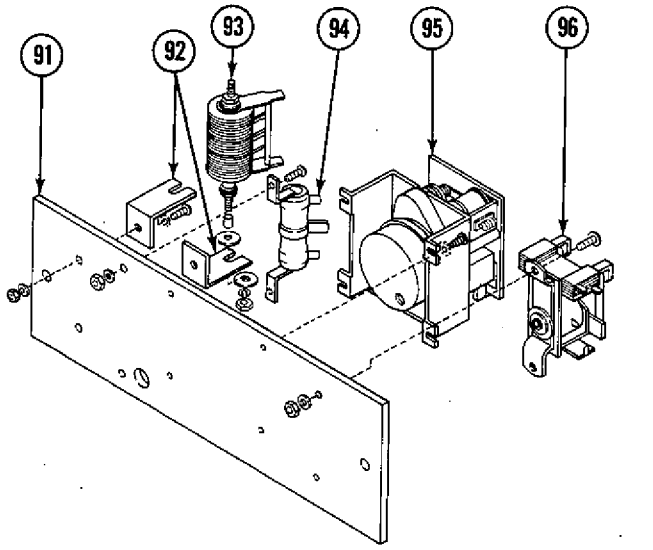


Figure C — Control Panel

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity
Figure C		**018 120**	**Control Panel (See Fig. A Page 2 Item 11)**	
91		038 094	MOUNTING BOARD	1
92		102 363	BRACKET, mtg - rectifier (included with SR1)	2
93	SR1	037 568	RECTIFIER	1
94	R4	030 601	RESISTOR, WW adj 25 watt 1000 ohm	1
95	TD1	034 701	TIMER, 1 minute 115 volt	1
96	CR1	034 601	RELAY, 24 volt dc DPDT	1

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

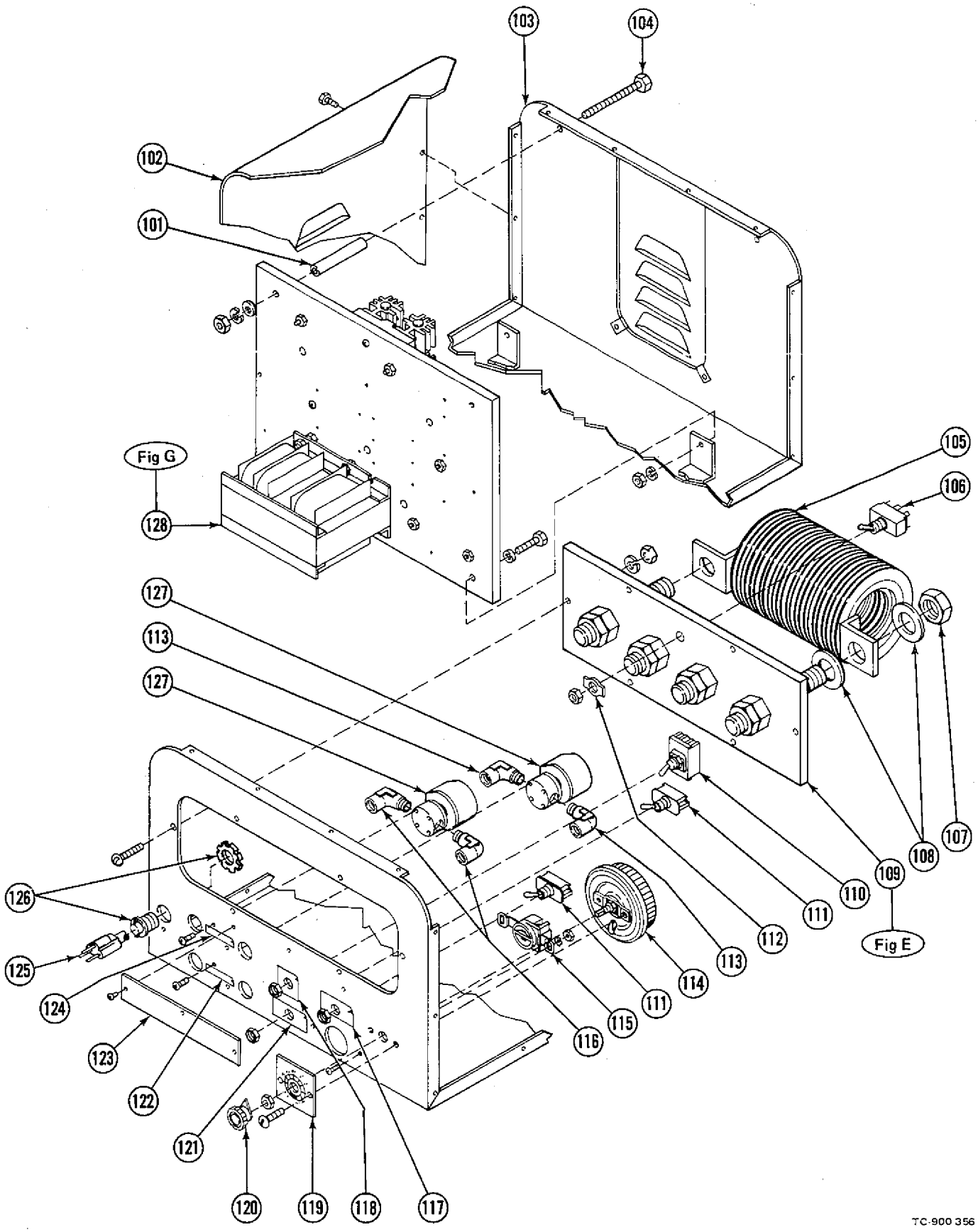


Figure D – Main Assembly

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity / Models HF 15-5	HF 20-1	HF 20-2	HF 20-4	HF 20-5	HF 15-5 WG	HF 20-1 WG	HF 20-2 WG	HF 20-4 WG	HF 20-5 WG
Figure D			**Main Assembly**										
101		010 006	TUBING, steel 3-1/4 long	2	2	2	2	2	2	2	2	2	2
102		015 380	WRAPPER	1	1	1	1	1	1	1	1	1	1
103		015 393	CASE SECTION, base/front/rear	1	1	1	1	1					
103		017 054	CASE SECTION, base/front/rear						1	1	1	1	1
104		601 794	BOLT, steel-hex hd 1/4-20 x 4	2	2	2	2	2	2	2	2	2	2
105	T2	033 620	COIL, coupling - air		1	1	1	1		1	1	1	1
106	S3	*011 649	SWITCH, toggle DPDT 15 amp 125 volt		1	1	1	1	1	1	1	1	1
107		010 365	NUT, brass-hex jam 1-8		2	2	2	2		2	2	2	2
108		602 251	WASHER, flat - steel SAE 1		4	4	4	4		4	4	4	4
		601 838	NUT, brass-hex jam 3/8-16	2					2				
		601 840	NUT, brass-hex jam 1/2-13	2					2				
109		038 763	TERMINAL ASS'Y, power (See Fig. E Page 7)	1					1				
109		038 765	TERMINAL ASS'Y, power (See Fig. E Page 7)		1	1	1	1		1	1	1	1
110	S1	*011 813	SWITCH, toggle 3PST 20 amp 250 volt	1				1	1				1
110	S1	*011638	SWITCH, toggle 3PST 15 amp 125 volt		1	1	1			1	1	1	
111	S2,4	*011 620	SWITCH, toggle SPST 16 amp 125 volt						2	2	2	2	2
112		011 106	PLATE, legend AC/DC	1	1	1	1	1	1	1	1	1	1
113		010 295	ELBOW, brass 90 deg street 5/8-18 LH						2	2	2	2	2
114	R3	603 942	RHEOSTAT, WW 150 watt 5 ohm	1	1	1	1	1	1	1	1	1	1
115	RC1	039 602	RECEPTACLE, twistlock 2P2W						1	1	1	1	1
116		010 296	ELBOW, brass 90 deg street 5/8-18 RH						2	2	2	2	2
117		012 100	LABEL, switch-start control	1	1	1	1	1	1	1	1	1	1
118		012 111	LABEL, switch on-off	1	1	1	1	1	1	1	1	1	1
119		013 518	PLATE, indicator 0-100	1	1	1	1	1	1	1	1	1	1
120		024 366	KNOB, pointer	1	1	1	1	1	1	1	1	1	1
121		012 099	LABEL, gas & water on-off						1	1	1	1	1
122		013 982	LABEL, in-water-out						1	1	1	1	1
123			NAMEPLATE (order by stock, model & style numbers	1	1	1	1	1	1	1	1	1	1
124		013 983	LABEL, in-gas-out						1	1	1	1	1
125		023 602	CORD SET, 115 volt 16 ga 3 conductor	1	1		1	1	1	1		1	1
125		023 603	CORD SET, 230 volt 16 ga 3 conductor			1					1		
126		010 610	CONNECTOR, cable 3/8	1	1	1	1	1	1	1	1	1	1
127	GS1, WS1	035 601	VALVE, 115 volt ac (consisting of)						2	2	2	2	2
		033 050	. COIL						1	1	1	1	1
128		020 642	HF PANEL (See Fig. F Page 8)	1									
128		020 657	HF PANEL (See Fig. F Page 8)		1			1					
128		020 658	HF PANEL (See Fig. F Page 8)			1							
128		020 659	HF PANEL (See Fig. F Page 8)				1						
128		020 660	HF PANEL (See Fig. F Page 8)						1				
128		020 641	HF PANEL (See Fig. F Page 8)							1	1	1	1
	T3	036 631	TRANSFORMER, 1/2 kva	1				1	1				1
	T3	036 824	TRANSFORMER, 1/3 kva								1	1	
		010 012	BUS BAR, coil to sec stud 11-3/4 lg	2					2				
		010 013	BUS BAR, coil to sec stud 12 lg	2					2				
		602 261	HANDLE, wrapper	2	2	2	2	2	2	2	2	2	2
		Figure G	REMOTE HAND SWITCH						1	1	1	1	1

*Recommended Spare Parts.

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

Item No.	Factory Part No.	Description	Quantity Models HF 15 038 764	HF 15-5 038 763	HF 20 038 765
Figure E		**Terminal Assembly, Power (See Fig. A Page 2 Item 2 &) (Fig. D Page 6 Item 109)**			
136	100 542	TERMINAL BOARD	1		
136	038 055	TERMINAL BOARD		1	
136	038 089	TERMINAL BOARD			1
137	038 900	STUD, brass 1/2-13 x 2-1/4	4		
137	038 654	STUD, brass 1/2-13 x 2-5/8		4	
137	038 133	STUD, brass 1-8 x 4			2
138	602 247	WASHER, flat - steel SAE 1/2	4	4	
138	602 251	WASHER, flat - steel SAE 1			4
139	602 217	WASHER, lock - steel external tooth 1/2	4	4	
139	602 220	WASHER, lock - steel external tooth 1			4
140	038 056	BUS BAR		2	
140	104 858	BUS BAR			1
141	601 840	NUT, brass - hex jam 1/2-13	8	8	
141	010 365	NUT, brass - hex jam 1-8			12
142	100 556	STUD, brass 1-8 x 6			2
143	010 912	PIN, spring 1/8 x 3/8			2
144	601 839	NUT, brass - hex full 1/2-13	4	4	
144	010 364	NUT, brass - hex full 1-8			4

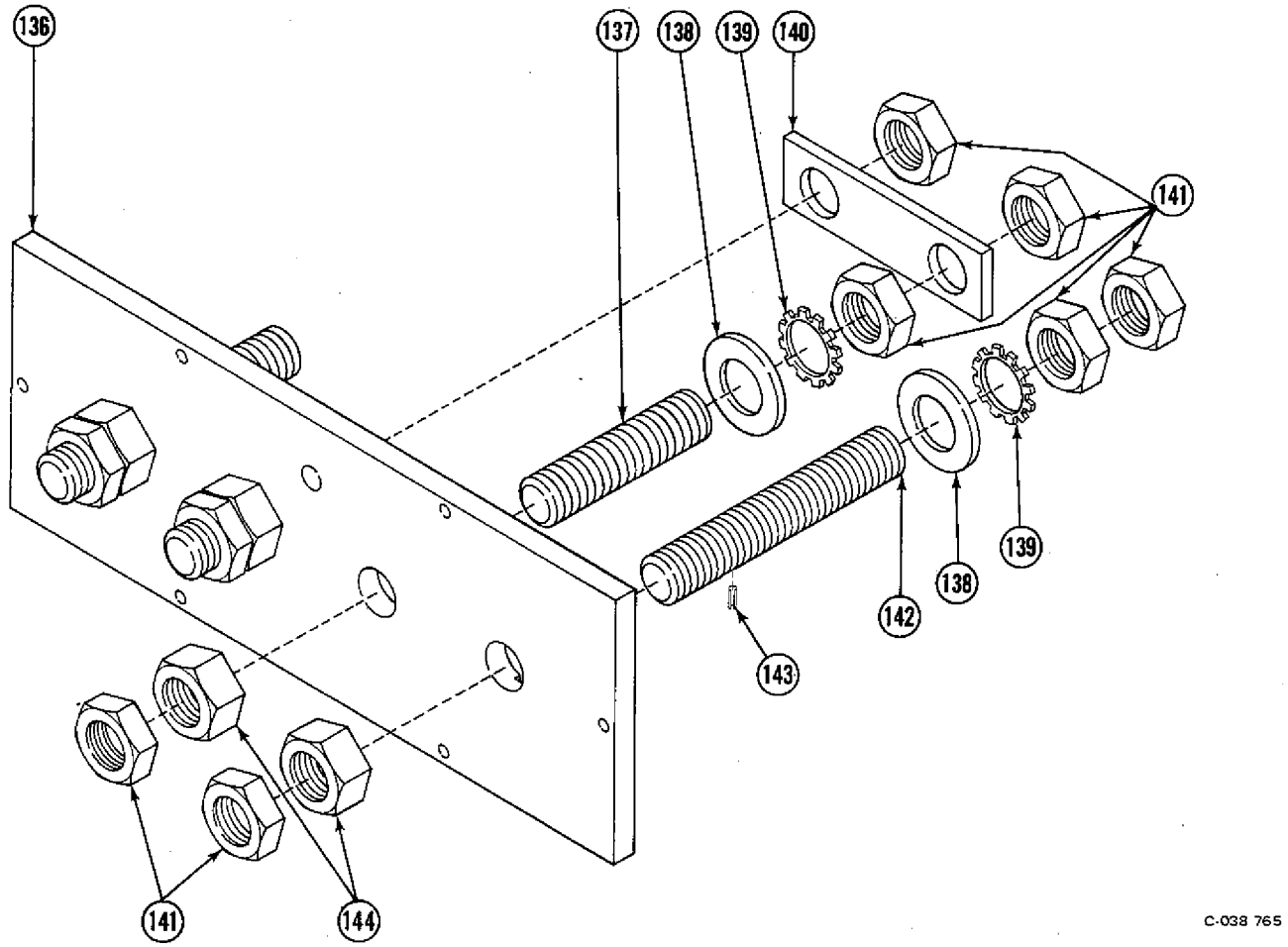


Figure E — Terminal Assembly, Power

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

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models HF 15-1	HF20-1 HF20-5	HF 20-2	HF 20-4	HF15-5 WG	All HF20WG
Figure F			HF Panel (See Fig. D Page 6 Item 128)	020 642	020 657	020 658	020 659	020 660	020 641
151		016 606	MOUNTING BOARD	1	1	1	1	1	1
152	C4	031 605	CAPACITOR, mica 0.001 uf 6000 volt dc	1	1	1	1	1	1
153	C3	*031 601	CAPACITOR, 10 uf 600 volt dc	1	1	1	1	1	1
154	R2	030 603	RESISTOR, WW fixed 10 watt 10K ohm	1	1	1	1	1	1
155		014 159	BRACKET, mtg - capacitor	1	1	1	1	1	1
156	G	020 623	SPARK GAP ASSEMBLY (See Fig. B1 Page 4)	1	1	1	1	1	1
157		010 885	STRIP, conductor	1	1	1	1	1	1
158		010 883	STRIP, conductor	1	1	1	1	1	1
159	TD1	034 701	TIMER, 1 minute 115 volt					1	1
160	R1	030 602	RESISTOR, WW fixed 100 watt 10 ohm	1	1	1	1	1	1
161	CR1	034 601	RELAY, 24 volt dc DPDT					1	1
162	R4	030 601	RESISTOR, WW adj 25 watt 1000 ohm					1	1
163		010 884	STRIP, conductor	1	1	1	1	1	1
164		010 886	STRIP, conductor		1	1	1		1
165	C2	*031 602	CAPACITOR, mica 0.002 uf 5000 volt dc	2	3	3	3	2	3
166	SR1	037 568	RECTIFIER (consisting of)					1	1
167		102 363	. BRACKET, mtg - rectifier					2	2
168	T1	036 865	TRANSFORMER, 115 volt	1	1			1	1
168	T1	036 864	TRANSFORMER, 220 volt			1			
168	T1	036 682	TRANSFORMER, 460 volt				1		
169		038 887	STUD, brass with hex collar 10-32 x 1-3/8	2	2	2	2	2	2
	T2	033 601	COIL, coupling - air	1				1	
		038 654	STUD, brass 1/2-13 x 2-5/8	1				1	
		602 060	SCREW, brass - rnd hd 3/8-16 x 2"	1				1	
		601 838	NUT, brass - hex jam 3/8-16	5				5	
		010 910	WASHER, flat - steel SAE 3/8	2				2	
		602 243	WASHER, flat - steel standard 3/8	4				4	

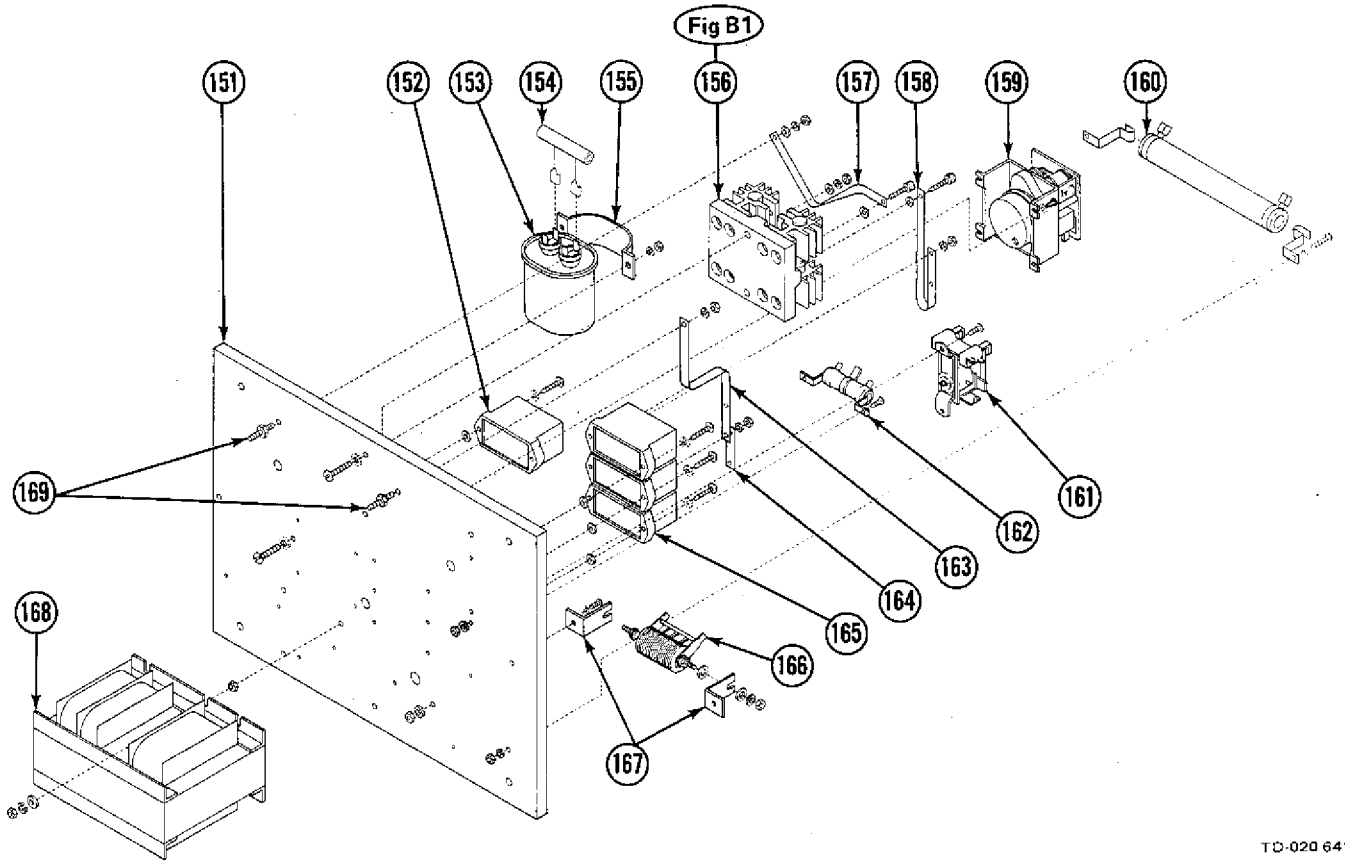


Figure F — HF Panel

*Recommended Spare Parts

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

Item No.	Factory Part No.	Description	Quantity
Figure G	**040 814**	**Remote Hand Switch (RHS-11A)**	
171	011 752	SWITCH, slide NC with leads (consisting of)	1
172	010 860	. CLAMP	1
173	603 522	TUBING, vinyl No. 5 (3-1/2" req. order by foot)	1 ft.
174	023 604	CORD SET, 16 ga 2 conductor 600 volt 28 ft. long	1
175	603 724	CAP, twistlock 2P2W	1

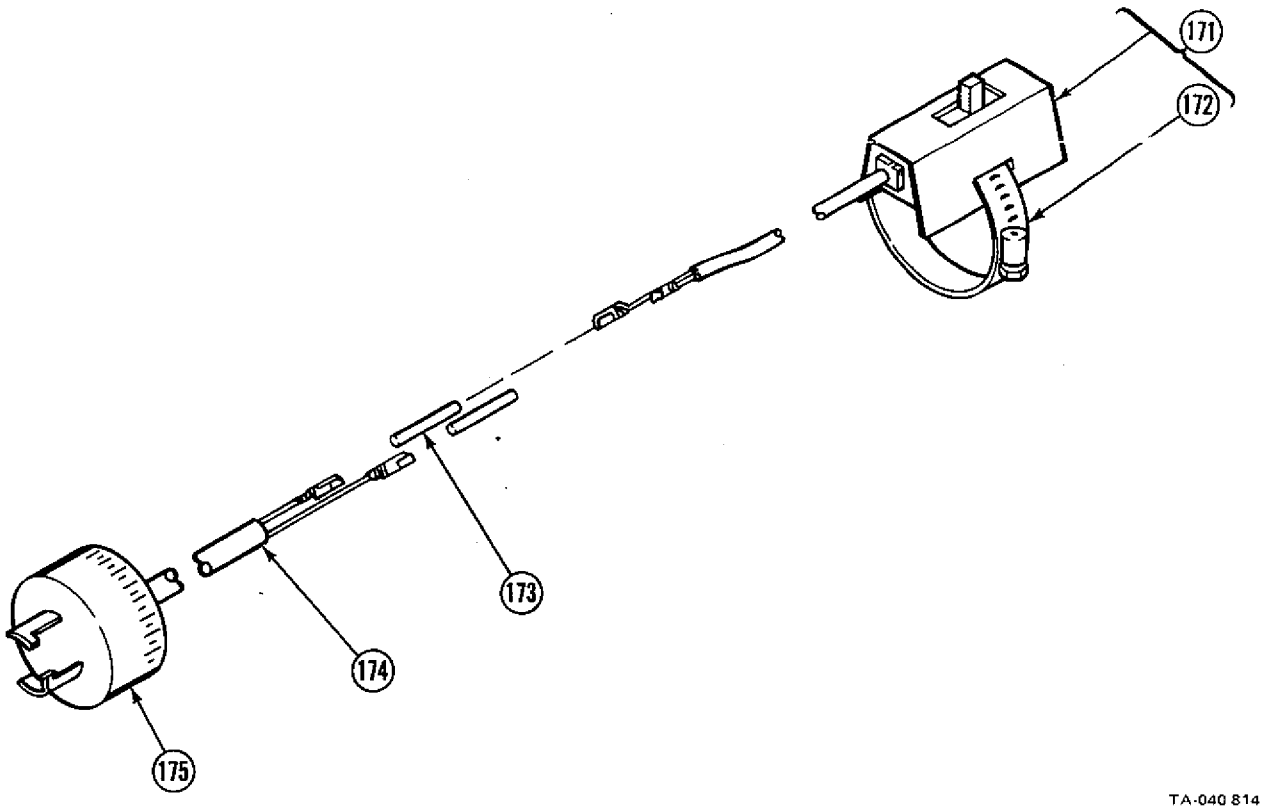


Figure G — Remote Hand Switch

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