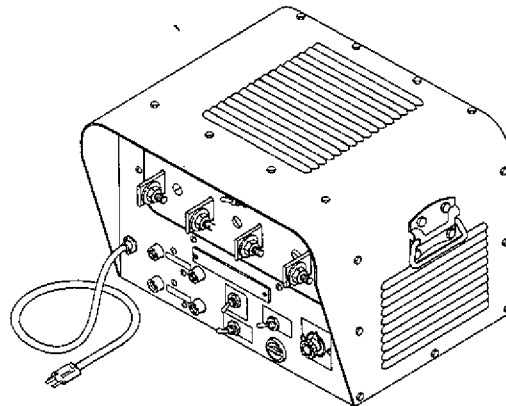
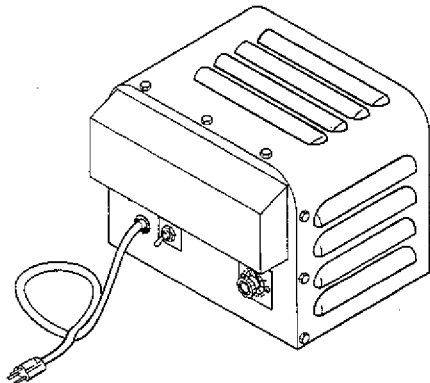


IMPORTANT: Read and understand the entire contents of both this manual and the power source manual used with this unit, with special emphasis on the safety material throughout both manuals, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of welding equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.

Effective With Style No. JE-50

MODEL

HF-15-1
HF-15-2
HF-15-4
HF-15-5
HF-15-1WG
HF-15-2WG
HF-15-4WG
HF-15-5WG
HF-20-1
HF-20-2
HF-20-4
HF-20-5
HF-20-1WG
HF-20-2WG
HF-20-4WG
HF-20-5WG



OWNER'S MANUAL

**MILLER ELECTRIC MFG. CO.**

718 S. BOUNDS ST, P.O. Box 1079
APPLETON, WI 54912 USA

NWSA CODE NO. 4579
PRINTED IN U.S.A.

LIMITED WARRANTY

EFFECTIVE: FEBRUARY 25, 1985

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

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

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

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

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

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

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

In the case of Miller's breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be, at Miller's option (1) repair or (2) replacement or, where authorized in writing by Miller in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized Miller service station or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at Customer's risk and expense. MILLER's option of repair or replacement will be F.O.B., Factory, at Appleton, Wisconsin, or F.O.B., at a MILLER authorized service facility, therefore, no compensation for transportation costs of any kind will be allowed. Upon receipt of notice of apparent defect or failure, Miller shall instruct the claimant on the warranty claim procedures to be followed.

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

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

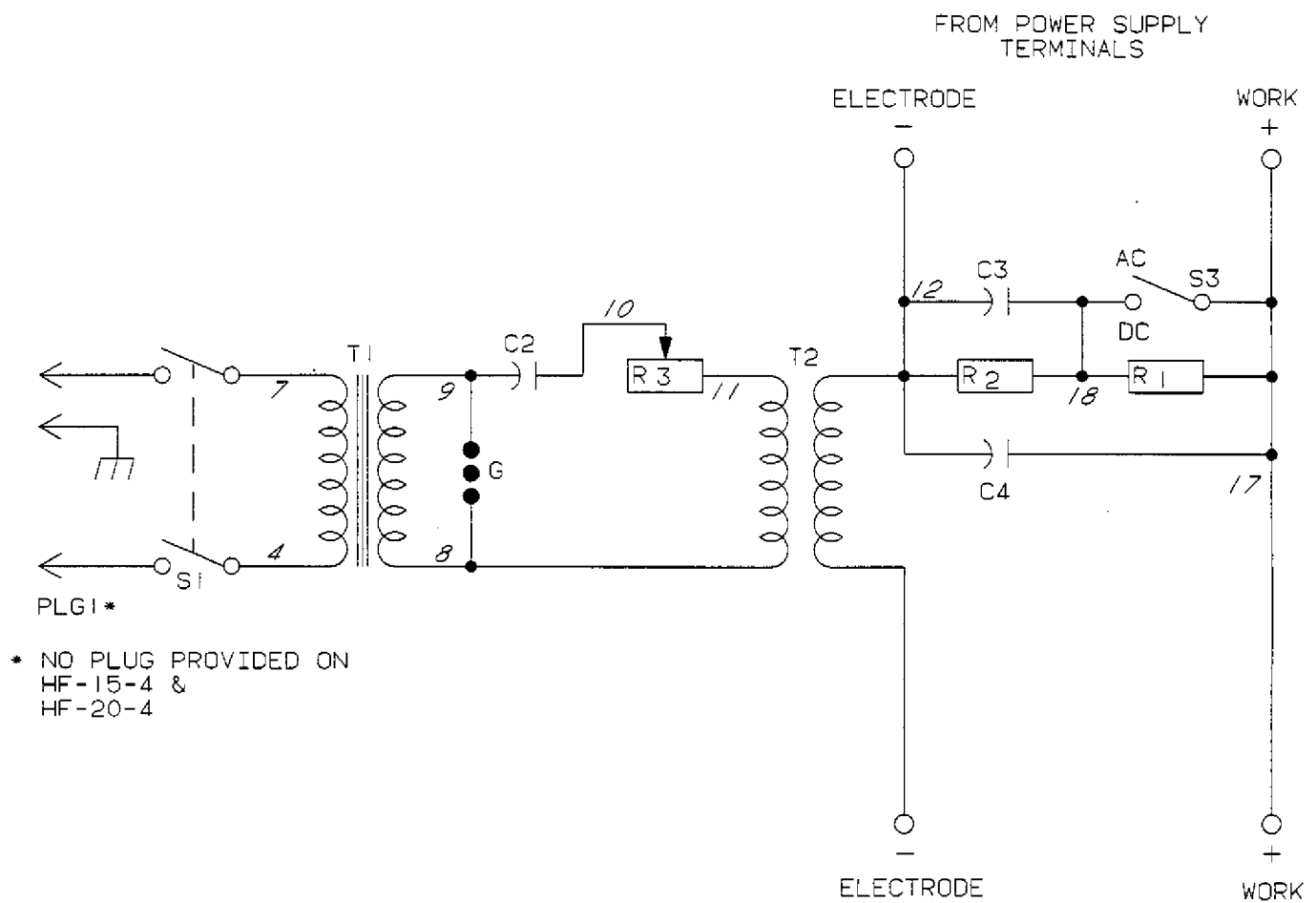
ERRATA SHEET

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

AMENDMENT TO SECTION 6 – MAINTENANCE & TROUBLESHOOTING

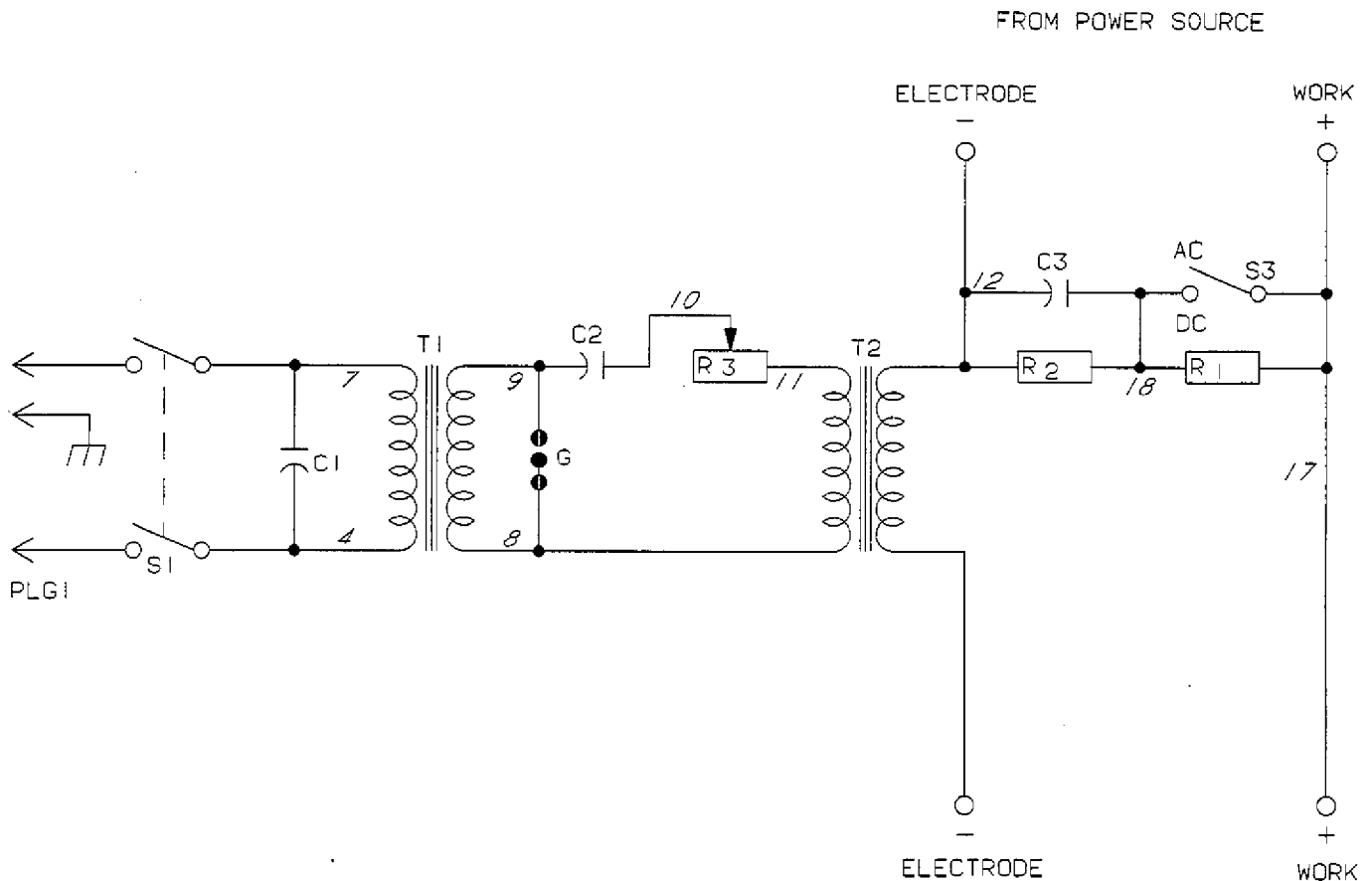
Amend Figure 6-1. Circuit Diagram For 115, 230, 460 Volts HF Models Without Gas & Water Controls.

IMPORTANT: Use Style Number of unit to select appropriate Figure 6-1 (see Pages 1 and 2 on this Errata Sheet).



Circuit Diagram No. SA-119 239

Figure 6-1. Circuit Diagram For 115, 230, 460 Volts HF Models Without Gas & Water Controls
Effective With Style No. JJ-22 Thru KB-5



Circuit Diagram No. SA-139 635

Figure 6-1. Circuit Diagram For 115 And 230 Volts HF Models Without Gas & Water Controls
Effective With Style No. KB-6

AMENDMENT TO PARTS LIST

Amend Parts List as follows:

**	Dia. Mkgs.	Part No.	Replaced With	Description	Quantity
2-8		020 640	115 157	HF PANEL	1
3-2	T2	033 601	033 373	COIL, coupling air (115V model)	1
3-3		038 891	038 326	STUD, brs 3/8-16 x 2-1/4 (115V model)	1
3-16		010 883	010 885	STRIP, conductor	1
3-17		010 884	010 885	STRIP, conductor	1
3-19	C2	031 602	096 761	CAPACITOR, mica .002uf 10,000V (115V model)	1
3-21	T1	036 865	074 398	TRANSFORMER, 115V	1
4-4	SR2	035 914	035 704	RECTIFIER, integ 30A 600V	1
6-4		601 794	601 795	BOLT, mach stl hexhd .250-20 x 4.500	2
6-6	S3	011 649	011 609	SWITCH, tgl DPDT 15A 125V	1
6-7		048 428	140 055	COIL, coupling air HF	1
6-8		605 787	605 787	WASHER, (qty chg)	2
6-9		601 840	601 879	NUT, stl hex full fnsh .500-13	2
6-10		038 825	123 155	SCREW, cap stl hexhd .500-13 x 1.250	2
6-12		048 430	139 749	TERMINAL BOARD, pwr input/output	1
6-13	S1	011 745	011 611	SWITCH, tgl SPDT 15A 125VAC	1

Parts List continued:

**	Dia. Mkgs.	Part No.	Replaced With	Description	Quantity
6-13	S1	011 608	011 611	SWITCH, tgl SPDT 15A 125VAC	1
6-15		011 106	Deleted	Eff w/KB-6	
6-17	R3	603 942	605 828	RHEOSTAT, WW 50W 1.5 ohm	1
6-20		030 471	Deleted	Eff w/KB-6	
6-21		024 366	097 922	KNOB	1
6-23		023 618	141 386	CORD SET, pwr 115V 16ga 3/c 10ft 6 in	1
6-23		023 625	119 350	CORD SET, pwr 230V 16ga 3/c 10ft (Eff w/JJ-22 thru KB-5)	1
6-23		119 350	141 394	CORD SET, pwr 230V 16ga 3/c 10ft 6 in (Eff w/KB-6)	1
6-24		010 610	139 042	BUSHING, strain relief .270/.480 ID x .804 mtg hole	1
6-26		020 642	112 366	HF PANEL	1
6-26		020 657	140 053	HF PANEL (for HF 20-1 only)	1
6-26		020 658	140 052	HF PANEL	1
6-26		020 660	112 364	HF PANEL	1
6-26		020 641	112 364	HF PANEL	1
6-		Added	605 321	NUT, stl hex .468-32	2
8-		040 814	Deleted		
8-4		600 729	600 340	CABLE, No. 16 2/c (order by ft)	20ft
10-1		016 606	139 766	MOUNTING BOARD, component HF	1
10-2	C4	031 605	Deleted		
10-3	C3	081 291	106 935	CAPACITOR, polyp film 10uf 250VAC	1
10-4		081 282	Deleted		
10-5		007 532	Deleted		
10-6		059 887	Deleted		
10-9		010 885	Deleted		
10-10		010 883	Deleted		
10-13	CR1	034 601	059 267	RELAY, encl 12VDC DPDT	1
10-15		010 884	Deleted		
10-16		010 886	Deleted		
10-17	C2	031 602	096 761	CAPACITOR, mica .002uf 10000V	3
10-18	C6	046 140	046 140	CAPACITOR, (qty chg)	1
10-20	T1	036 865	074 398	TRANSFORMER	1
10-20	T1	036 864	098 966	TRANSFORMER	1
10-20	T1	Added	074 398	TRANSFORMER, (HF 15-5WG (all HF 20-WG))	1
10-21		038 887	Deleted		
10-	C1	Added	141 204	CAPACITOR, (HF 20-1 & HF 20-2 only)	1
10-	C5	Added	046 139	CAPACITOR, elctlt 22uf 50VDC	1
10-		Added	004 948	LABEL, warning arc welding can be injurious etc	1

**First digit represents page no – digits following dash represent item no.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER 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_____

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

SECTION 1 - RÈGLES DE SÉCURITÉ POUR LE FONCTIONNEMENT DU POSTE DE SOUDAGE À L'ARC

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

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

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

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

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

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

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

1-2. GENERAL PRECAUTIONS

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

A. Burn Prevention

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

Wear helmet with safety goggles or glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a **MUST** for welding or cutting, (and chipping) to protect the eyes

1-1. INTRODUCTION - Contrairement à l'apprentissage de la vie, l'apprentissage de la sécurité par expérience personnelle, comme l'enfant qui touche un poêle chaud, est dangereux, imprudent et inutile. Instruisez-vous donc de l'expérience d'autrui.

Des méthodes de sécurité issues de l'expérience du soudage et du coupage sont décrites dans le manuel. La recherche, le progrès et l'expérience dans ce domaine ont développé un matériel fiable et des méthodes de sécurité pour l'installation, le fonctionnement et l'entretien. Des accidents se produisent lorsque le matériel est inadéquatement utilisé ou entretenu. La raison de ces méthodes de sécurité peut ne pas être toujours donnée. Certaines sont fondées sur le sens commun, d'autres demanderont à être expliquées par des livres techniques. Il est plus sage de suivre les règles.

Lisez et comprenez ces méthodes de sécurité avant d'essayer d'installer, de faire fonctionner ou de réparer l'appareil. Pour votre sécurité personnelle et celle d'autrui, conformez-vous à ces règles et aux manuels d'instructions.

Manquer d'observer ces méthodes de sécurité pourrait entraîner des blessures graves ou même la mort. Quand la sécurité devient une habitude, le matériel peut alors être utilisé en toute confiance.

Ces méthodes de sécurité sont divisées en deux sections: 1 - Précautions générales, communes au soudage et au coupage à l'arc, et 2 - Soudage à l'arc (et coupage) (uniquement).

Normes de référence: Des publications des normes américaines de sécurité sont aussi à votre disposition pour d'autres modes opératoires plus complets que ceux du présent manuel. Elles sont données dans l'Index des Normes de ces règles de sécurité. ANSI Z49-1 est la plus complète.

Les codes de l'ACNOR, les codes provinciaux et municipaux donnent aussi les exigences pour une installation, une utilisation et un entretien sûrs.

1-2. PRÉCAUTIONS GÉNÉRALES

Plusieurs procédés du soudage à l'arc, des électrodes alliés, et les flux peuvent produire des vapeurs, gaz, et niveaux de rayonnement différents. Pour tout renseignement supplémentaire à ce manuel, consultez aussi les fabricants des électrodes et des flux afin d'obtenir les renseignements techniques spécifiques et les mesures de précaution concernant leurs matériaux.

A. Prévention des brûlures

Portez des vêtements de protection - des gants à crispin spécialement désignés pour le soudage, un casque et des chaussures de sécurité. Boutonnez le col de votre chemise et les pattes de vos poches, et portez des pantalons sans revers pour éviter que des étincelles et du laitier ne s'y introduisent.

Portez un masque avec lunettes de sécurité ou avec écrans latéraux de protection, des lunettes filtrantes ou des couvre-lentilles (protégés par un verre clair). Pour le soudage ou le coupage (et le burinage), il est

from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

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

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

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

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

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

B. Toxic Fume Prevention

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

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

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

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

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

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

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant

OBLIGATOIRE de protéger ses yeux contre l'énergie de rayonnement et les éclats de métal. Remplacez le verre protecteur lorsqu'il est brisé, piqué ou qu'il a reçu des projections. Voir 1.3A.2.

Évitez de porter des habits imprégnés d'huile ou de graisse. Une étincelle pourrait les enflammer.

Ne manipulez jamais sans gants un métal chaud tel que des chutes d'électrode et des pièces à souder.

Premiers soins et traitement des yeux: Tout atelier devrait avoir à sa disposition un poste de premiers soins ainsi qu'une personne compétente, à moins qu'un service médical ne soit à proximité pour soigner immédiatement les brûlures des yeux et de la peau.

Portez des bouche-oreilles lorsque vous travaillez au plafond ou dans un espace restreint. Portez un casque lorsque d'autres personnes travaillent au plafond.

Les personnes devant souder ou couper ne doivent pas employer des préparations inflammables pour leurs cheveux.

B. Prévention des gaz toxiques

Les gaz, les vapeurs, la chaleur, un enrichissement ou un manque d'oxygène peuvent entraîner un malaise, une maladie ou même la mort. Remédiez-y par la ventilation décrite dans la Norme ANSI Z49.1 paragraphe 1 de l'Index des Normes. NE ventilez JAMAIS à l'oxygène.

En soudant ou en coupant, les plomb, cadmium, zinc, mercure et beryllium ou autres matériaux semblables peuvent créer des concentrations nocives de gaz toxiques. On doit avoir recours à une ventilation aspirante adéquate du local, ou alors toute personne sur les lieux, de même que le soudeur, doit porter un masque à adduction d'air. On doit employer les deux pour le beryllium.

Les métaux enrobés ou composés de matériaux émettant des gaz toxiques ne doivent pas être chauffés à moins que l'enrobage ne soit ôté de la surface à travailler, que le local ne soit bien ventilé, ou que le soudeur ne porte un masque à adduction d'air.

Ne travaillez dans un espace restreint que s'il est bien ventilé et, si nécessaire, portez un masque à adduction d'air.

On doit éviter les fuites de gaz dans un espace restreint. Les fuites de gaz en grande quantité peuvent transformer dangereusement la concentration d'oxygène. N'amenez pas de bouteilles de gaz dans un espace restreint.

En quittant un espace restreint, FERMEZ le robinet d'alimentation de gaz de la bouteille. Ainsi on pourra rentrer en toute sécurité dans la pièce, même si les robinets "aval" ont été ouverts par accident, ou si on les a laissés ouverts.

Les vapeurs de dissolvants chlorés peuvent être décomposées par la chaleur de l'arc (ou de la flamme) et former du PHOSGÈNE, gaz très toxique, et d'autres produits irritant les poumons et les yeux. L'énergie ultra-violet de l'arc peut aussi décomposer les vapeurs de trichloroéthylène et de perchloroéthylène pour former du phosgène. NE SOUDEZ PAS ou ne coupez pas dans des endroits où les vapeurs de dissolvants peuvent être attirées dans l'atmosphère de soudage ou de

energy can penetrate to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

C. Fire and Explosion Prevention

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

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

To prevent fires and explosion:

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

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

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

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

- appreciable combustibles (including building construction) are within 35 feet
- appreciable combustibles are further than 35 feet but can be ignited by sparks
- openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
- 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 com-

coupage et où l'énergie de rayonnement peut pénétrer dans des atmosphères contenant des quantités même minuscules de trichloroéthylène ou de perchloroéthylène.

C. Prévention des incendies et des explosions

Les causes d'incendie et d'explosion sont les combustibles atteints par l'arc, la flamme, les étincelles, le laitier chaud ou les matériaux chauffés, le mauvais emploi des gaz comprimés et des bouteilles ainsi que les courts-circuits.

Sachez que les éclats d'étincelles ou la chute du laitier peuvent s'infiltrer dans les fissures, le long des tuyauteries, par les fenêtres et les portes et par les couvertures des murs ou du sol, sans que le soudeur portant des lunettes ne les voie. Les étincelles et les scories peuvent voler jusqu'à 35 pieds.

Pour prévenir les incendies et les explosions: Veillez à ce que votre appareil soit propre et en état de marche, dénué d'huile et de graisse, et de particules de métal sur les pièces électriques qui pourraient entraîner des courts-circuits.

Si des combustibles se trouvent à proximité, ne soudez pas, ne coupez pas. Si possible, déplacez votre travail loin des combustibles. Évitez les ateliers de peinture au pistolet, les cuves d'immersion, les entrepôts, les ventilateurs. Si cela n'est pas possible, placez les combustibles à au moins 35 pieds des étincelles et de la chaleur et protégez-les des étincelles avec des couvertures ou des écrans protecteurs adéquats, bien ajustés et ignifugés.

On ne doit pas souder (ou couper) le côté opposé des murs touchant les combustibles. Les murs, plafonds et planchers proches du travail doivent être protégés par des couvertures ou écrans protecteurs ignifugés.

Un surveillant doit se tenir à proximité avec un matériel de lutte contre l'incendie adéquat, pendant et quelque temps après le soudage ou le coupage si:

- Des quantités appréciables de combustibles (y compris une construction en chantier) se trouvent à moins de 35 pieds.
- Des quantités appréciables de combustibles sont à plus de 35 pieds mais peuvent être enflammées par des étincelles.
- Des ouvertures (cachées ou visibles) sur les planchers ou les murs à moins de 35 pieds peuvent exposer des combustibles aux étincelles.
- Les combustibles adjacents aux murs, plafonds, toits ou cloisons métalliques peuvent être enflammés par une chaleur rayonnante ou transmise.

Avant de commencer, avisez le contremaître pour qu'il s'assure que les précautions adéquates soient prises.

Une fois le travail terminé, vérifiez qu'il n'y ait pas d'étincelles, de cendres ardentes ou de flammes dans le local.

On ne doit jamais souder ni couper sur un récipient ayant contenu des combustibles, ou pouvant produire des vapeurs inflammables ou toxiques à la chauffe, à moins que le récipient n'ait été lavé au préalable, comme décrit dans la Norme AWS A6.0, figurant au paragraphe 3 de l'Index des Normes.

Cela comprend: un nettoyage à fond à la vapeur ou au caustique (ou un lavage avec dissolvant ou eau selon la solubilité du combustible) suivi d'une purge et d'une in-

bustible'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.

jection d'azote ou de gaz carbonique, en utilisant un équipement de protection comme recommandé dans l'A6-0. L'atmosphère inerte peut être remplacée par un niveau d'eau arrivant au-dessous du travail à effectuer.

Vous devez laver un récipient dont la nature de contenu est inconnue (voir paragraphe ci-dessus). NE vous fiez PAS à l'odorat ou à la vue pour dire si l'on peut le souder ou le couper en toute sécurité.

Vous devez pratiquer un évent sur les pièces ou récipients creux avant de les souder ou couper: ils peuvent exploser.

Atmosphères explosives: Ne soudez ni ne coupez jamais dans des lieux où l'air peut contenir des poussières, gaz ou vapeurs liquides inflammables (tels que l'essence).

D. Gaz comprimé

Précautions générales: Suivez les précautions de ce manuel, et celles décrites à la Norme CGA P-1 (Précautions de sécurité pour la manipulation de gaz comprimés en bouteilles), paragraphe 6 de l'Index des Normes.

1. Détendeurs de pression

La soupape de sûreté d'un détendeur est destinée à protéger seulement le détendeur de la surpression. Elle n'a pas pour but de protéger les boyaux et le chalumeau: on protège ceux-ci par des soupapes de retenue conçues spécialement pour cette fonction.

Ne montez jamais un détendeur sur une bouteille contenant un gaz différent de celui pour lequel le détendeur a été conçu.

Enlevez immédiatement un détendeur défectueux pour le faire réparer (d'abord, fermez le robinet de la bouteille). Les symptômes suivants dénotent la défectuosité du détendeur:

Fuites - si le gaz fuit extérieurement.
Ascension excessive - si la pression de débit continue à monter, le robinet du chalumeau étant fermé.
Manomètre défectueux - si l'aiguille du manomètre ne s'écarte pas de la goupille de butée lors de la mise en pression, ou ne revient pas sur la goupille après l'échappement de la pression.

Réparation. N'ESSAYEZ PAS de réparer vous-mêmes. Envoyez les détendeurs défectueux à réparer aux ateliers de réparation agréés du fabricant, où des techniques et des outils spéciaux sont utilisés par un personnel formé.

2. Bouteilles

Les bouteilles doivent être manipulées avec soin pour prévenir les fuites ou dégâts à leurs parois, robinets ou systèmes de sûreté. Évitez qu'un circuit électrique soit en contact avec les bouteilles, y compris les rails de contact, les fils électriques ou les circuits de soudage. Cela pourrait créer des arcs courts-circuits pouvant entraîner des accidents graves (Voir 1.3C.).

Chaque bouteille doit porter les inscriptions ICC ou DOT. C'est un gage de sécurité pourvu que la bouteille soit bien manipulée.

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

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

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

Locate or secure cylinders so they cannot be knocked over.

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

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

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

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

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

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

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

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

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

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

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

Coil excess hose to prevent kinks and tangles.

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

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

Identification du gaz: N'utilisez que les bouteilles indiquant la nature du gaz; ne vous fiez pas à la couleur pour reconnaître la nature du gaz. Adressez-vous à votre fournisseur si cela n'est pas indiqué.

N'EFFACEZ ou ne modifiez JAMAIS les noms, numéros ou autres indications sur une bouteille. Cela est illégal et dangereux.

Vides: Maintenez les robinets fermés, remplacez bien les chapeaux; inscrivez "Vides"; séparez-les des "Pleines" et retournez-les rapidement.

Emploi interdit: N'utilisez une bouteille ou son contenu que pour ce à quoi elle est destinée, mais JAMAIS comme support ou rouleau.

Placez les bouteilles pour qu'elles ne tombent pas. Lorsqu'un détendeur (et un boyau) est monté sur elles, placez les ou attachez-les debout.

Passages et lieux de travail. Enlevez les bouteilles d'un endroit où l'on pourrait les frapper.

Transport des bouteilles. Avec une grue, utilisez un support fiable tel qu'une plate-forme ou un cadre. NE SOULEVEZ PAS des bouteilles du sol par leur robinet ou chapeau, ou avec des chaînes, élingues ou aimants.

N'EXPOSEZ PAS les bouteilles à une chaleur excessive, aux étincelles, au laitier et aux flammes, etc., pouvant causer leur rupture. Le contenant ne doit jamais dépasser 55°C. Refroidissez en pulvérisant de l'eau si nécessaire.

Protégez les bouteilles et particulièrement les soupapes contre les chocs, les chutes, les chutes d'objets et la température. Remettez bien les chapeaux lorsque vous déplacez les bouteilles.

Robinet coincé. N'UTILISEZ PAS un marteau ou une clé métallique pour ouvrir un robinet de bouteille que l'on ne peut pas ouvrir à la main. Avisez votre fournisseur.

Mélange de gaz. N'essayez jamais de mélanger des gaz dans une bouteille.

Ne rechargez jamais une bouteille. Les éléments de la bouteille ne doivent jamais être modifiés ou remplacés.

3. Boyau

Utilisation interdite. N'utilisez jamais un boyau autre que celui approprié au gaz indiqué. La règle générale d'identification est: rouge pour les gaz combustibles, vert pour l'oxygène, et noir pour les gaz inertes.

Utilisez des bagues ou colliers appropriés au boyau (et non du fil ordinaire ou autre substitution) pour brancher les boyaux à l'appareillage.

N'utilisez pas des raccords en cuivre. N'utilisez que des accessoires standard en laiton pour raccorder un boyau.

Utilisez une petite longueur de boyau. Cela évitera les noeuds et l'usure prématurée. Suspendez le boyau au-dessus du sol pour éviter qu'il ne soit écrasé, piétiné ou endommagé.

Enroulez le surplus de boyau pour éviter les noeuds et emmêlements. Évitez que le boyau ne soit endommagé par des tranchants, étincelles, laitier et flamme nue.

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

4. Proper Connections

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

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

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

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

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

5. Pressurizing Steps:

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

Stand to side of regulator while opening cylinder valve.

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

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

Check for leaks on first pressurization and regularly thereafter. Brush with soap solution (capful of Ivory Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

E. User Responsibilities

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

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Vérifiez régulièrement les fuites, l'usure et les raccordements lâches. Plongez le boyau sous pression dans de l'eau; les bulles indiqueront les fuites.

Réparation. Coupez la partie percée ou usée, et raccordez (1-2D3). N'UTILISEZ JAMAIS de ruban adhésif.

4. Branchements corrects

Avant de brancher le détendeur, nettoyez la sortie du robinet de la bouteille des impuretés qui peuvent obstruer les orifices et endommager les sièges. Sauf pour l'hydrogène, ouvrez momentanément le robinet, en éloignant la sortie des personnes et des sources inflammables. Essayez avec un tissu propre et non graisseux.

Appareillez le détendeur à la bouteille. Avant de brancher, vérifiez que la marque du détendeur et la description de la bouteille concordent, et que l'orifice d'entrée du détendeur et l'orifice de sortie de la bouteille aillent ensemble. NE BRANCHEZ JAMAIS un détendeur conçu pour un gaz spécial (ou des gaz spéciaux) à une bouteille contenant d'autres gaz.

Serrez les branchements. Lorsque vous assemblez des branchements filetés, nettoyez et polissez les sièges où c'est nécessaire. Serrez. Si les branchements perdent, démontez-les, nettoyez et resserez avec une clef adéquate.

Adaptateurs. Placez, si besoin est, un adaptateur CGA (en vente chez votre fournisseur) entre la bouteille et le détendeur. Avec deux clefs, serrez l'adaptateur fileté À DROITE et À GAUCHE.

On peut reconnaître les branchements de sortie du détendeur (ou boyau) à l'aide du filetage à droite pour l'oxygène et à gauche (identifié par un écrou cannelé) pour les gaz combustibles.

5. Démarches de mise en pression

Purgez le détendeur de résidu de gaz avant d'ouvrir la bouteille (ou le robinet de canalisation) en serrant la vis de réglage (dans le sens des aiguilles d'une montre). Cette opération permet au siège de haute pression de s'ouvrir à la mise en pression, supprimant ainsi toute surchauffe de compression. Maintenez la vis de réglage des détendeurs à simple détente légèrement engagée. Avant d'ouvrir le robinet de la bouteille, assurez-vous que les boyaux sont branchés et que les soupapes aval sont fermées.

Tenez-vous latéralement au détendeur en ouvrant le robinet de la bouteille. Ouvrez-le lentement pour que la pression du détendeur monte progressivement. Lorsque le manomètre est mis sous pression (indique le maximum) le robinet de la bouteille de gaz inerte ou d'oxygène devra être ouvert à fond pour assurer l'étanchéité et celui de la bouteille de gaz combustible ouvert de moins d'un tour pour pouvoir le refermer rapidement en cas d'urgence.

Référez-vous aux tableaux de pression (distribués par votre fournisseur) pour un réglage recommandé de pression sûr et efficace sur les détendeurs. Vérifiez les fuites à la première mise en pression puis régulièrement, brossez avec une solution savonneuse (un bouchon d'Ivory Liquid* ou semblable par gallon d'eau). Les bulles indiquent une fuite. Enlevez l'eau savonneuse après examen; le savon sec est inflammable.

*Marque de Commerce de Proctor & Gamble

F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

G. Rope Staging-Support

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

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

A. Burn Protection

Comply with precautions in 1-2.

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

1. Protective Clothing

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

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

2. Eye and Head Protection

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

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

Protect filter plate with a clear cover plate.

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

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

E. Responsabilités de l'utilisateur

Ôtez immédiatement les parties percées ou défectueuses. Voir les Responsabilités de l'Usager du manuel de l'appareil.

F. Appareil laissé sans surveillance

Fermez l'alimentation de gaz à la source et purgez.

G. Liens et supports temporaires

Pour vos travaux de soudage ou de coupage, n'utilisez pas de la corde comme soutien, elle est inflammable.

1-3. SOUDAGE À L'ARC - Conformez-vous aux précautions des paragraphes 1.1 et 1.2 de cette section. Le soudage à l'arc bien exécuté est sûr, mais un soudeur négligent est un danger. Le poste de soudage transporte des courants élevés sous de fortes tensions. L'arc est très vif et chaud. Les étincelles volent, les vapeurs montent, l'énergie ultra-violet et infrarouge rayonnent, les soudures sont chaudes, et des gaz comprimés peuvent être utilisés. Le soudeur prudent évite les risques inutiles, se protège et protège autrui contre les accidents. Les précautions sont décrites ici et dans les normes données dans l'index.

A. Protection contre les brûlures

Conformez-vous aux précautions du paragraphe 1.2. L'arc de soudage est intense et visiblement vif. Son rayonnement peut blesser les yeux, traverser les habits légers, se refléchir sur les surfaces claires, et brûler la peau et les yeux. Les brûlures de la peau ressemblent à un gros coup de soleil. Celles d'arcs sous gaz protecteur sont plus graves et plus douloureuses. **NE VOUS BRÛLEZ PAS - SUIVEZ LES PRÉCAUTIONS.**

1. Vêtements de protection

Portez des vêtements à manches longues (surtout pour l'arc en atmosphère inerte) avec gants, masque et chaussures (1.2A.).

Si nécessaire portez en plus une veste ou des manches en cuir, un tablier et des guêtres ignifugées. De préférence ne portez pas de vêtements en coton non traité.

Protection de la peau. Portez des vêtements épais foncés. Boutonnez le col pour protéger la poitrine et le cou, et boutonnez les poches pour prévenir l'infiltration d'étincelles.

2. Protection des yeux et de la tête

Évitez que vos yeux soient exposés à l'arc. **NE** regardez **JAMAIS** un arc électrique sans protection.

Lorsque vous soudez, portez un écran ou masque avec verre filtrant teinté N° 12 ou plus foncé. Mettez-le sur le visage avant d'amorcer l'arc.

Protégez le verre filtrant d'un couvre-verre clair. **NE PORTEZ PAS** un masque fendu ou brisé; le rayonnement peut s'infiltrer et causer des brûlures.

Les verres filtrants fendus, brisés ou lâches doivent être remplacés **IMMÉDIATEMENT**. Remplacez un couvre-verre brisé, piqué ou taché par des projections.

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.

Vous devez porter des lunettes à écrans latéraux sous le masque pour protéger les yeux dans le cas où le masque ne serait pas abaissé sur le visage avant l'amorçage de l'arc. Regarder momentanément un arc sans protection (principalement un arc en atmosphère inerte à haute intensité) peut brûler la rétine et laisser un point sombre permanent dans le champ de vision.

3. Protection du personnel à proximité

Local de soudage fermé. Pour le soudage de production, il vaut mieux utiliser une salle séparée ou une baie fermée. Dans les locaux ouverts, entourez les travaux d'écrans ou panneaux peu réfléchissants et ininflammables. Laissez l'air circuler librement, particulièrement au niveau du sol.

Donnez des masques aux personnes qui regarderont directement la soudure.

Autres personnes travaillant sur les lieux. Veillez à ce que toutes les personnes portent les lunettes de protection.

Avant d'attaquer la soudure, assurez-vous que les rebords d'écran ou les portes soient fermés.

B. Prévention des gaz toxiques

Suivez les précautions du paragraphe 1.2B. L'échappement du moteur de la génératrice doit être ventilé à l'air extérieur. L'oxyde de carbone peut tuer.

C. Prévention des incendies et des explosions

Suivez les précautions 1.2C. Puissance nominale de l'appareil. Ne surchargez pas le poste de soudage à l'arc. Cela peut surchauffer les câbles et causer un incendie.

Les branchements lâches de câble peuvent surchauffer ou faire des étincelles et causer un incendie.

N'amorcez jamais un arc sur une bouteille ou autre récipient sous pression. Cela créerait un point de rupture entraînant à plus ou moins longue échéance l'explosion du réservoir.

D. Gaz comprimé

Suivez les précautions 1.2D.

E. Prévention des décharges électriques

Des conducteurs chargés ou métal nu incorporés au circuit de soudage ou à un appareil chargé sans mise à la terre peuvent donner une décharge fatale à la personne dont le corps devient conducteur. **NE SOUDEZ PAS DEBOUT, ASSIS, COUCHÉ, PENCHÉ** sur une surface humide ni en contact avec une telle surface sans protection appropriée.

To protect against shock:

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

1. Grounding the Equipment

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

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

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

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

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

2. Electrode Holders

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

3. Connectors

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

Pour vous protéger contre les décharges électriques, maintenez votre corps et vêtements secs. Ne travaillez jamais dans un endroit humide sans isolation adéquate contre les décharges électriques. Lorsque vous ne pouvez éviter l'humidité ou la sueur, placez-vous sur un caillbotis sec ou un tapis en caoutchouc. La sueur, l'eau de mer, ou l'humidité entre le corps et une pièce CHARGÉE, ou une pièce de métal à la masse, réduisent la résistance électrique de la surface du corps, permettant l'entrée de courants dangereux, voire mortels.

1. Mise à la terre de l'appareil

Lorsque l'appareil de soudage à l'arc est mise à la terre suivant la norme National Electrical Code, et la masse est mise à la terre suivant la norme ANSI Z49.1 "Safety in Welding and Cutting," une tension peut exister entre l'électrode et un objet conducteur. Certaines de ces objets sont par exemple (mais pas seulement), des bâtiments, des outils électriques, des établis, des châssis de postes de soudure, des pièces d'ouvrage, etc. **Ne jamais touchez l'électrode ou des objets en métal avant d'avoir mis le poste de soudure à l'arrêt.**

À l'installation, branchez les châssis de chaque élément (source de courant, commande, établi et circuit d'eau) à la terre. Les conducteurs doivent pouvoir conduire les courants telluriques en toute sécurité. L'appareil chargé par les courants vagabonds peut donner une décharge risquant d'être mortelle. **NE BRANCHEZ PAS VOTRE PRISE DE TERRE** à une conduite électrique, ou à un tuyau de gaz ou de liquide inflammable tel que l'huile ou un combustible.

Connexion triphasée. Avant l'installation vérifiez la phase nécessaire à l'appareil. Si seul le triphasé est disponible, ne branchez l'appareil monophasé qu'à deux des fils de la ligne triphasée. **NE BRANCHEZ PAS** le conducteur de terre de l'appareil au troisième fil (sous tension), autrement l'appareil serait chargé: condition dangereuse pouvant donner une décharge fatale.

Avant le soudage, vérifiez si la prise de terre est uniforme. En branchant, assurez-vous que les conducteurs touchent le métal nu du châssis de l'appareil.

Lorsqu'un appareil doit être alimenté à partir d'un coffret d'alimentation, le conducteur de terre doit être relié à celui-ci.

Si vous avez en plus une fiche à trois broches pour la terre, ne branchez le conducteur de terre qu'à la broche de terre. Si le cordon d'alimentation a une fiche à trois broches, reliez-le à une prise femelle tripolaire reliée à la terre. N'enlevez jamais la broche de terre d'une fiche ou n'utilisez jamais une fiche dont la broche de terre serait brisée.

2. Pince-électrodes

Utilisez des pince-électrodes bien isolées. **N'UTILISEZ PAS** des pince-électrodes avec vis saillantes.

3. Connecteurs

Utilisez des connecteurs à verrouillage bien isolés pour assembler de longs câbles.

4. Cables

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

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

5. Terminals And Other Exposed Parts.

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

6. Electrode

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

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

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

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

7. Safety Devices

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

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

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

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

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

4. Câbles

Vérifiez fréquemment l'usure, les fissures et l'altération des câbles. **REMPLEZ IMMÉDIATEMENT** ceux dont l'isolation serait trop usée ou altérée pour prévenir les décharges mortelles provoquées par un câble dénudé. Vous pouvez enrouler les parties endommagées de ruban adhésif en épaisseur suffisante pour donner une résistance de câble neuf. Maintenez les câbles secs, dépourvus d'huile et de graisse et mettez-les à l'abri du métal chaud et des étincelles.

5. Têtes de câbles et autres parties dénudées

Avant la mise en marche, les têtes de câbles et autres parties dénudées d'un appareil électrique doivent être munies de leurs couvre-fils isolants.

6. Électrode

- a. Appareil équipé d'une commande marche/arrêt (contacteur)

En général, les postes de soudure utilisés pour le soudage à l'arc sous protection gazeuse avec électrode fusible (GMAW), ou avec électrode tungstène (GTAW) et des procédés semblables sont équipés d'une commande marche/arrêt de la puissance de sortie. Lorsque l'interrupteur est en position "MARCHE" et l'interrupteur du pistolet est fermé, le fil d'électrode devient chargé. Ne touchez jamais le fil d'électrode ou tout autre objet conducteur faisant contact avec le circuit d'électrode sans couper le courant au poste de soudure.

- b. Appareil non-équipé d'une commande marche/arrêt (sans contacteur)

Les postes de soudure utilisés pour le soudage à l'arc avec électrode enrobée (SMAW) et des procédés semblables peuvent être non-équipés d'une commande marche/arrêt de la puissance de sortie. Lorsque l'interrupteur est en position "MARCHE" l'électrode devient chargé. Ne touchez jamais l'électrode sans couper le courant au poste de soudure.

7. Dispositif de sécurité

Le dispositif de sécurité-verrouillage et coupe-circuit ne doit pas être débranché ou déshunté.

Avant l'installation, l'inspection ou la réparation de l'appareil, mettez l'alimentation sur ARRÊT et enlevez les fusibles généraux (ou verrouillez les interrupteurs) pour éviter une remise en MARCHE accidentelle. Débranchez tous les câbles de la source de courant ainsi que les prises des cordons d'alimentation en 115 volts.

Lors du soudage, n'ouvrez pas le circuit d'alimentation et ne changez pas la polarité. S'il est débranché au cours d'une urgence, faites attention aux brûlures de décharge ou aux jaillissements d'étincelles.

Appareil laissé sans surveillance. Mettez toujours sur ARRÊT et débranchez l'appareil.

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

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

1-4. STANDARDS BOOKLET INDEX - For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 550 Le Jeune Rd, P.O. Box 351040, Miami, FL 33135.
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the U.S. Government Printing Office, Washington, D.C. 20402.
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY -TOE FOOTWEAR obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES obtainable from the American Welding Society, 550 Le Jeune Rd., P.O. Box 351040, FL 33135.
8. NFPA Standard 51, OXYGEN - FUEL GAS SYSTEMS FOR WELDING AND CUTTING obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
9. NFPA Standard 70-1978, NATIONAL ELECTRICAL CODE obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

L'interrupteur d'arrêt doit toujours se trouver à proximité de la source de courant.

F. Protection pour toute personne portant des appareils électroniques de sauvetage (appareil pour le règlement de battement de coeur)

Inducteurs de courant élevé peuvent nuire le fonctionnement d'un appareil pour le "règlement de battement de coeur." Toute personne portant un appareil électronique de sauvetage (appareil pour le règlement de battement de coeur), devrait consulter un docteur avant d'approcher toute opération de soudage à l'arc, à la gouge ou à point.

1-4. INDEX DES NORMES - Pour plus de renseignements, référez-vous aux normes de l'ACNOR ou aux normes américaines suivantes:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING distribué par l'American Welding Society, 550 Le Jeune Rd., P.O. Box 351040 Miami, FL 33135
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING distribué par le Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402
3. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, distribué par U.S. Department of Labor, Washington D.C. 20210
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION distribué par l'American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY - TOE FOOTWEAR distribué par l'adresse donnée en 4.
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES distribué par l'adresse donnée en 4.
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE COMBUSTIBLES distribué par l'adresse donnée en 1.
8. NFPA Standard 51, OXYGEN - FUEL GAS SYSTEMS FOR WELDING AND CUTTING distribué par la National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210
9. NFPA Standard 70-1978, NATIONAL ELECTRICAL CODE distribué par l'adresse donnée en 8
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES distribué par l'adresse donnée en 8

11. CGA Pamphlet P-1, **SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS** obtainable from the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.
12. CSA Standard W117.2, **CODE FOR SAFETY IN WELDING AND CUTTING** obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.
13. NWSA booklet, **WELDING SAFETY BIBLIOGRAPHY** obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.
14. American Welding Society Standard AWSF4.1 "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", obtainable from the American Welding Society, 550 Le Jeune Rd., P.O. Box 351040, Miami, FL 33135.
15. ANSI Standard Z88.2 "Practice for Respiratory Protection" obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

11. CGA Pamphlet P-1, **SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS** distribué par la Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.
12. CSA Standard W117.2, **CODE FOR SAFETY IN WELDING AND CUTTING** distribué par la Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.
13. NWSA booklet, **WELDING SAFETY BIBLIOGRAPHY** distribué par la National Welding Supply Association, 1900 Arch Street Philadelphia, PA 19103.
14. American Welding Societe Standard AWSF4.1 "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", distribué par l'American Welding Societe, 550 Le Jeune Rd., P.O. Box 351040, Miami, FL 33135
15. ANSI Standard Z88.2 "Practice For Respiratory Protection" distribué par l'American National Standards Institute, 1430 Broadway, New York, NY 10018.

SECTION 2 - INTRODUCTION

Model	Input Volts	Rated Welding Amps. 60% Duty Cycle	Dimensions						Net Weight	
			Width		Length		Depth			
			In.	mm.	In.	mm.	In.	mm.	Lbs.	Kgs.
HF-15-1	115	500	15	381	11-1/2	292	11-1/4	286	45	20.4
HF-15-2	230	500	15	381	11-1/2	292	11-1/4	286	45	20.4
HF-15-4	460	500	15	381	11-1/2	292	11-1/4	286	45	20.4
HF-15-5	575	500	20-1/4	514	13-1/2	343	15	381	82	37
HF-20-1	115	1000	20-1/4	514	13-1/2	343	15	381	75	34
HF-20-2	230	1000	20-1/4	514	13-1/2	343	15	381	75	34
HF-20-4	460	1000	20-1/4	514	13-1/2	343	15	381	75	34
HF-20-5	575	1000	20-1/4	514	13-1/2	343	15	381	105	47
HF-15-1WG	115	500	15	381	15-1/2	394	11-1/2	292	55	24
HF-15-2WG	230	500	15	381	15-1/2	394	11-1/2	292	67	30
HF-15-4WG	460	500	15	381	15-1/2	394	11-1/2	292	67	30
HF-15-5WG	575	500	20-1/4	514	13-1/2	343	15	381	90	40
HF-20-1WG	115	1000	20-1/4	514	13-1/2	343	15	381	92	41
HF-20-2WG	230	1000	20-1/4	514	13-1/2	343	15	381	98	44
HF-20-4WG	460	1000	20-1/4	514	13-1/2	343	15	381	98	44
HF-20-5WG	575	1000	20-1/4	514	13-1/2	343	15	381	115	68

Figure 2-1. Specifications

2 - 1. GENERAL INFORMATION AND SAFETY

A. General

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

B. Safety

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

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

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

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

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

2 - 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 will be furnished by the manufacturer on request if occasion to file claim arises.

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

2 - 3. DESCRIPTION - This unit is a high frequency arc stabilizer which superimposes high frequency energy on either ac or dc power supply secondary outputs. It is designed primarily for use with the Gas Tungsten Arc Welding (GTAW) process. However it can also be used for other processes requiring arc initiation and stabilization such as Submerged Arc Welding (SAW) and Plasma Arc Applications.

WG models are equipped with gas and water valves, and a post-flow timer. These units do not function properly on welding power sources equipped with a primary contactor if the primary contactor provides 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.

SECTION 3 - INSTALLATION

3 - 1. LOCATION

IMPORTANT: Any type of electrical equipment that produces a sufficient amount of high-frequency energy, can radiate that energy and cause interference with reception on nearby radios. This unit produces high-frequency energy and is a basic type of radio transmitter. The rules outlined in Section 7 of this manual must be strictly observed to minimize radiation of high-frequency energy into the surrounding area.

Locate the high-frequency unit close to the work station. This will allow the electrode and work cables to be kept as short as possible, thereby minimizing high-frequency radiation.

3 - 2. COOLANT CONNECTIONS (WG Models Only)

CAUTION: OVERHEATING GAS TUNGSTEN-ARC WELDING (GTAW) GUN can damage gun.

- Do not connect coolant hoses to the high frequency unit if a recirculating coolant system is used. Make connections directly to the coolant system.

Connect a hose of suitable length and construction from the coolant source to the COOLANT IN connector on the front panel.

Connect the electrode holder coolant hose to the COOLANT OUT connector.

Both of the COOLANT connectors have 5/8"-18 left-handed threads.

3 - 3. GAS CONNECTIONS (WG Models Only) - Connect a hose of suitable length and construction from the shielding gas supply to the GAS IN connector on the front panel. The gas flow must be controlled with the aid of a regulator and flowmeter.

Connect the electrode holder shielding gas hose to the GAS OUT connector.

Both of the GAS connectors have 5/8"-18 right-handed threads.

3 - 4. REMOTE HAND SWITCH AND RECEPTACLE (WG Models Only) - A Remote Hand Switch, normally-closed, (RHS-11 or 11A) is supplied with WG models to provide start control of the high frequency, gas and water. The Remote Hand Switch must be connected to the receptacle on the front panel to enable the unit to function when the START control is in the SWITCH position.

3 - 5. SECONDARY CONNECTIONS

WARNING: ELECTRIC SHOCK can kill.

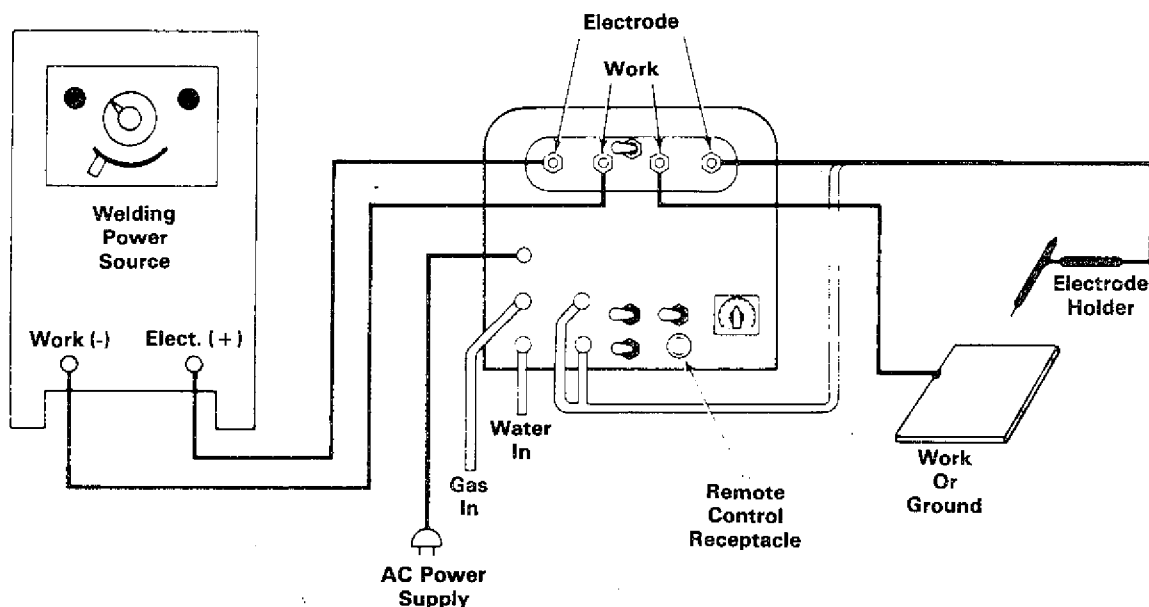
- Do not touch live electrical parts.
- Shut down the welding power source and the high frequency unit before making secondary connections.

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

IMPORTANT: Refer to the welding power source Owner's Manual for proper secondary cable sizes.

Four terminals are provided on the front panel for secondary connections. Connect the welding cables from the welding power source to the ELECTRODE and WORK terminals located on the left side of the front panel (see Figure 3-1).

Connect the electrode holder cable to the ELECTRODE terminal and the work cable to the WORK terminal on the right side of the front panel.



A-070 989

Figure 3-1. Interconnection Diagram

3 - 6. ELECTRICAL INPUT CONNECTIONS

A. 115 Volts AC And 230 Volts AC Models (Figure 3-2)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Do not cut ground terminal off plug.
- Ground in accordance with the National Electrical Code, state, or local codes.

CAUTION: DIRECT CURRENT (DC) will damage the unit.

- Connect unit only to alternating current (AC) supply.

The 115 volts ac models are equipped with a 3-prong parallel plug. The 230 volts ac models are equipped with a 3-prong tandem plug. Connect the plug to a matching, grounded receptacle.

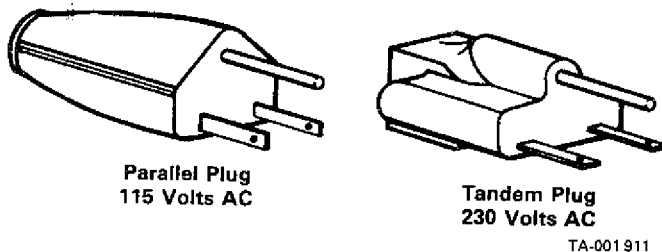


Figure 3-2. Electrical Input Connection Plugs

B. 460 Volts AC And 575 Volts AC Models

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down unit and disconnect input power employing "lockout/tagging procedures" before internally inspecting or servicing.

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

- Connect unit to single-phase, ac, input power.
- Connect the ground (green) lead to a proper electrical ground.

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

Use a grounding method that is acceptable to the local electrical inspection authority. Ensure that black and white leads are connected to line terminals.

Models having an electrical input voltage above 250 volts ac are 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 line.

SECTION 4 - OPERATOR CONTROLS

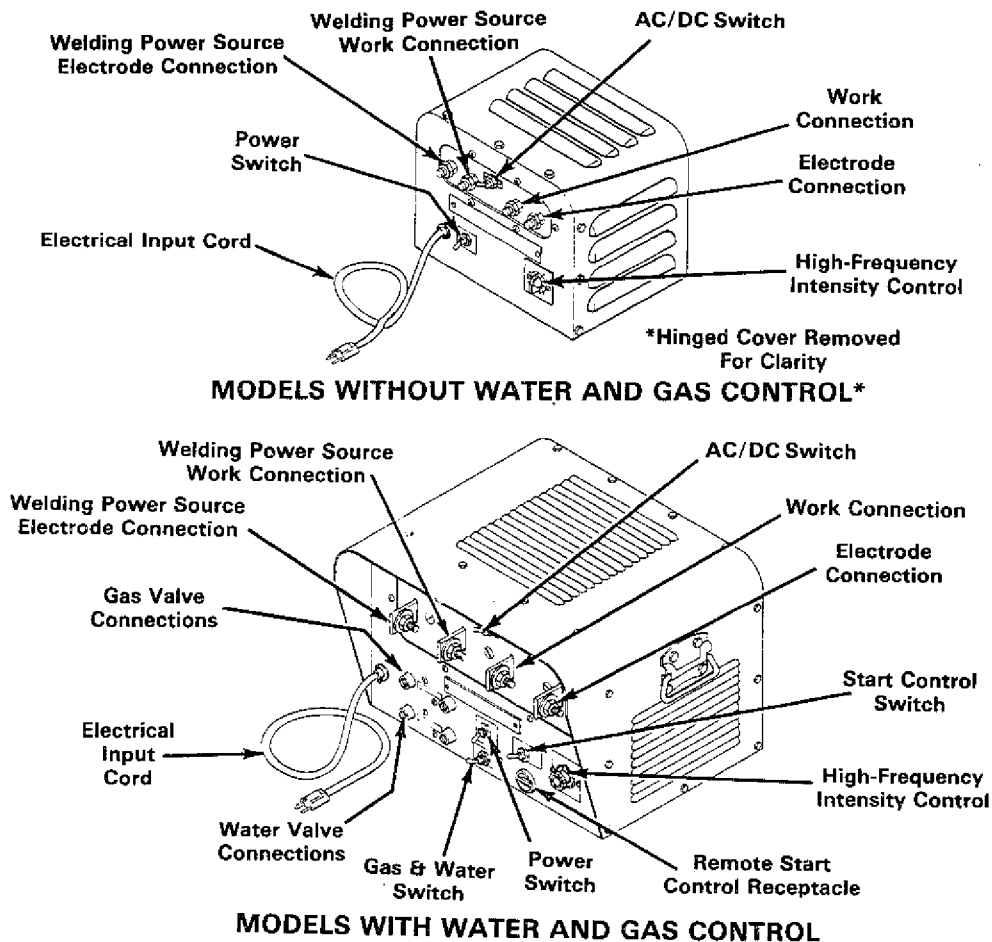


Figure 4-1. External View Of High-Frequency Units

4 - 1. AC/DC SWITCH (Figure 4-1) - The AC/DC switch establishes the proper circuitry for alternating current (ac) or direct current (dc) welding. The switch must be placed in the AC position when the unit is connected to an ac welding power source or DC when connected to a dc source.

A. For Models Without Gas And Water Control:

High frequency will be present at the electrode whenever the POWER switch is ON.

B. For Models With Gas And Water Control:

When the AC/DC switch is in the AC position, high frequency will be present from the time an arc start is initiated until the arc is broken and the postflow timer times out.

When the AC/DC switch is in the DC position, high frequency will be present only until an arc is initiated. Once an arc is established, the high frequency will shut off and remain off until a restart is attempted.

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

WARNING: USING HIGH FREQUENCY WITH THE SHIELDED METAL ARC WELDING (SMAW) PROCESS can result in serious personal injury.

- Place the POWER switch in the OFF position before doing Shielded Metal Arc Welding (SMAW).

The attempted use of high frequency to establish an arc with a stick electrode could cause an arc to form between the electrode holder and operator.

A. For Models Without Gas And Water Control

The position of the POWER switch determines whether or not high frequency will be present at the electrode. When the POWER switch is in the ON position, high frequency will be present; when in the OFF position, the unit is electrically shut down.

B. For Models With Gas And Water Control

Placing the POWER switch in the ON position electrically energizes the unit and places it in a ready-to-weld status. The position of the AC/DC switch determines when high frequency will be present. Placing the POWER switch in the OFF position shuts the unit down.

4 - 3. HIGH-FREQUENCY INTENSITY CONTROL (Figure 4-1) - The High-Frequency Intensity control determines the amount of high-frequency energy that is available to initiate and/or maintain an arc. Rotating the control clockwise increases the intensity of the high-frequency energy. Normally the control needs to be adjusted only initially.

IMPORTANT: As the high-frequency intensity is increased, the possibility of causing interference with local radio and television receivers also increases. Set the high-frequency intensity control for the lowest setting required to initiate and maintain an arc reliably.

4 - 4. POST-FLOW TIMER (WG Models Only)

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down unit and disconnect input power employing "lockout/tagging procedures" before adjusting the post-flow time.

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

An adjustable 0 to 60 second Post-Flow Timer, located behind the hinged access door on the rear panel, controls 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.

IMPORTANT: This timer is shipped set for 30 seconds.

4 - 5. GAS & WATER SWITCH (WG Models Only) (Figure 4-1) - The GAS & WATER switch determines whether or not gas and water will be permitted to flow. When the switch is in the ON position, the gas and water valves will function normally. When the switch is in the OFF position, the valves will remain closed throughout the weld cycle.

4 - 6. START CONTROL SWITCH (WG Models Only) (Figure 4-1) - 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 the switch is in the TOUCH position, the electrode must be touched to the workpiece to initiate an arc. High frequency will be present for a time period determined by the setting of the AC/DC switch.

B. Switch Position

Whenever the SWITCH position is to be used, it will be necessary to connect the supplied normally-closed Remote Hand Switch to the receptacle on the front panel (see Section 3-4).

When the START CONTROL is in the SWITCH position, high frequency will be available to initiate an arc when the Remote Hand Switch is closed. High frequency will be present for a time period determined by the setting of the AC/DC switch.

SECTION 5 - SEQUENCE OF OPERATION

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

- Keep all covers and panels in place while operating.

Warranty is void if the welding power source is operated with any portion of the outer enclosure removed.

ARC RAYS, SPARKS, AND HOT SURFACES can burn eyes and skin; **NOISE** can damage hearing.

- Wear correct eye, ear, and body protection.

FUMES AND GASES can seriously harm your health.

- Use enough ventilation to keep fumes and gases from the breathing zone.

MAGNETIC FIELDS FROM HIGH CURRENTS can affect pacemaker operation.

- Wearers should consult with their doctor before going near arc welding, gouging, or spot welding operations.

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

5 - 1. GAS TUNGSTEN ARC WELDING (GTAW)

1. Ensure that the unit has been installed as instructed in Section 3.
2. Turn on shielding gas and coolant at source.

3. Energize the welding power source.
4. Place the AC/DC switch in the proper position.
5. Rotate the High Frequency Intensity control to the desired position.
6. If the unit is equipped with gas and water valves:
 - a. Place the START CONTROL switch in the desired position.
 - b. Place the GAS & WATER switch in the desired position.
 - c. Rotate the Post-Flow Timer to the desired position (see Section 4-4).
7. Place the POWER switch in the ON position.
8. Begin welding.

5 - 2. SHUTTING DOWN

1. Turn off shielding gas and coolant at source.
2. Shut down the welding power source and the high frequency unit.

WARNING: HIGH CONCENTRATION OF SHIELDING GASES can harm health or kill.

- Shut off gas supply when not in use.

SECTION 6 - MAINTENANCE & TROUBLESHOOTING

WARNING: ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut down unit and disconnect input power employing "lockout/tagging procedure" before making weld cable connections.

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

Work on internal parts to be performed by qualified persons only.

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

6 - 1. PREPARING TUNGSTEN ELECTRODES - Tungsten electrode shaping should be done on a fine grit, hard abrasive wheel. Since tungsten

is harder than most grinding wheels, causing the tungsten to be chipped away rather than cut away, the grinding marks should run lengthwise with the electrode.

On electrodes that are used on AC or DC Reverse Polarity and which form a hemisphere or balled end, the sharp edge of the electrode should be ground to a slight taper. Weld current will cause the electrode to form the balled end. The diameter of the end should not exceed the diameter of the electrode by more than 1-1/2 times. For example: A 1/8 in. (3.18 mm) diameter electrode should only form a 3/16 in. (4.76 mm) diameter end (see Figure 6-1).

In pointing an electrode, the end should be ground to a taper for a distance of 2 to 2-1/2 electrode diameters in length. For example: The ground surface for a 1/8 in. (3.18 mm) electrode would be 1/4 in. (6.35 mm) to 5/16 in. (7.94 mm) long (see Figure 6-1).

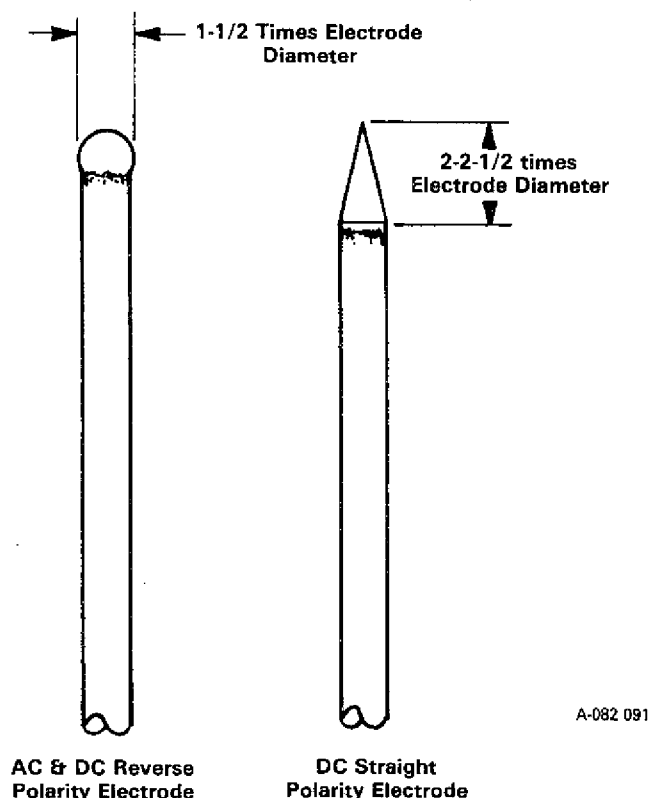


Figure 6-1. Properly Prepared Tungsten Electrodes

6 - 2. SPARK GAPS - The spark gaps can readily be inspected by opening the rear door of the high-frequency unit. The spark gaps are set at 0.008 inches (0.203 mm) 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 indicated when intermittent operation of the gaps is noted. Usually this occurs when the gap setting has increased to 0.012 inch (0.305 mm) or greater.

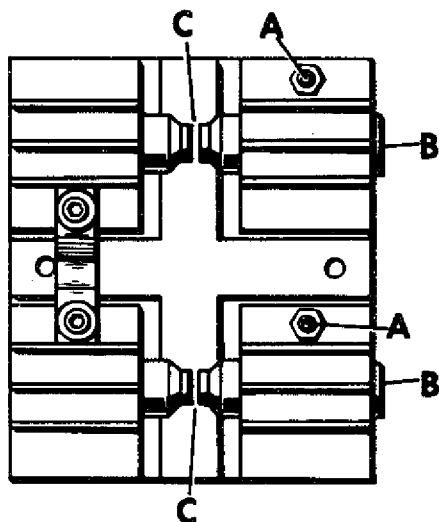


Figure 6-2. Spark Gap Adjustment

6 - 3. SPARK GAP ADJUSTMENT (Figure 6-2) - 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 0.010 inches (0.254 mm) or greater. This increases the high-frequency radiation and it is suggested that the minimum gap setting 0.008 in. or 0.203 mm consistent with good welding operation, be used.

Widening of 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 is not recommended as the material at the points is tungsten and is difficult to redress properly. The points should be replaced when they become extremely pitted or burned.

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).

6 - 4. HIGH VOLTAGE CAPACITORS - These parts are rarely a source of trouble. 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 0.004 inches (0.102 mm).

6 - 5. BY-PASS PANEL - The by-pass panel reduces the high-frequency feedback 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. Failure in this circuit is rare and would be suspected only as a last resort.

TROUBLE	PROBABLE CAUSE	SUGGESTED CHECK AND/OR REMEDY
Lack of high frequency; difficulty in establishing an arc.	Use of tungsten larger than recommended for welding amperage.	Use proper size tungsten for welding amperage (see Table 6-1).
	Dissipation of high frequency from electrode holder lead.	Ensure that electrode holder cable is not in close proximity to any grounded metal.
	Weld cable leakage.	Check cables and torch for cracked or deteriorated insulation or bad connections. Repair or replace necessary parts.
	Improper spark gap.	Check spark gaps G and adjust if necessary (see Section 6-2).
	High-Frequency Intensity control R3 setting too low or control inoperative.	Increase setting of R3. Check R3 for continuity and replace if necessary.
Wandering arc - poor control of direction of arc.	Use of tungsten considerably larger than recommended.	Use proper size tungsten (see Table 6-1).
	Improperly prepared tungsten.	Prepare tungsten as instructed in Section 6-1.
Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Water in electrode holder.	Refer to electrode holder parts list for part 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 TD1.
	Insufficient high-frequency.	Increase setting of High-Frequency Intensity control R3.

Table 6-1. Tungsten Size Chart

Pure Tungsten	Current Range - Amperes			
Diameter	DCSP-Argon	DCRP-Argon	ACHF-Argon	AC Balanced Wave-Argon
.010"	Up to 15	*	Up to 15	Up to 10
.020"	5-20	*	5-20	10-20
.040"	15-80	*	10-60	20-30
1/16"	70-150	10-20	50-100	30-80
3/32"	125-225	15-30	100-160	60-130
1/8"	225-360	25-40	150-210	100-180
5/32"	360-450	40-55	200-275	160-240
3/16"	450-720	55-80	250-350	190-300
1/4"	720-950	80-125	325-450	250-400
2% Thorium Alloyed Tungsten Diameter				
.010"	Up to 25	*	Up to 20	Up to 15
.020"	15-40	*	15-35	5-20
.040"	25-85	*	20-80	20-60
1/16"	50-160	10-20	50-150	60-120
3/32"	135-235	15-30	130-250	100-180
1/8"	250-400	25-40	225-360	160-250
5/32"	400-500	40-55	300-450	200-320
3/16"	500-750	55-80	400-500	290-390
1/4"	750-1000	80-125	600-800	340-525
Zirconium Alloyed Tungsten Diameter				
.010"	*	*	Up to 20	Up to 15
.020"	*	*	15-35	5-20
.040"	*	*	20-80	20-60
1/16"	*	*	50-150	60-120
3/32"	*	*	130-250	100-180
1/8"	*	*	225-360	160-250
5/32"	*	*	300-450	200-320
3/16"	*	*	400-550	290-390
1/4"	*	*	600-800	340-525

***NOT RECOMMENDED**

The figures listed are intended as a guide, and are a composite of recommendations from American Welding Society and electrode manufacturers.

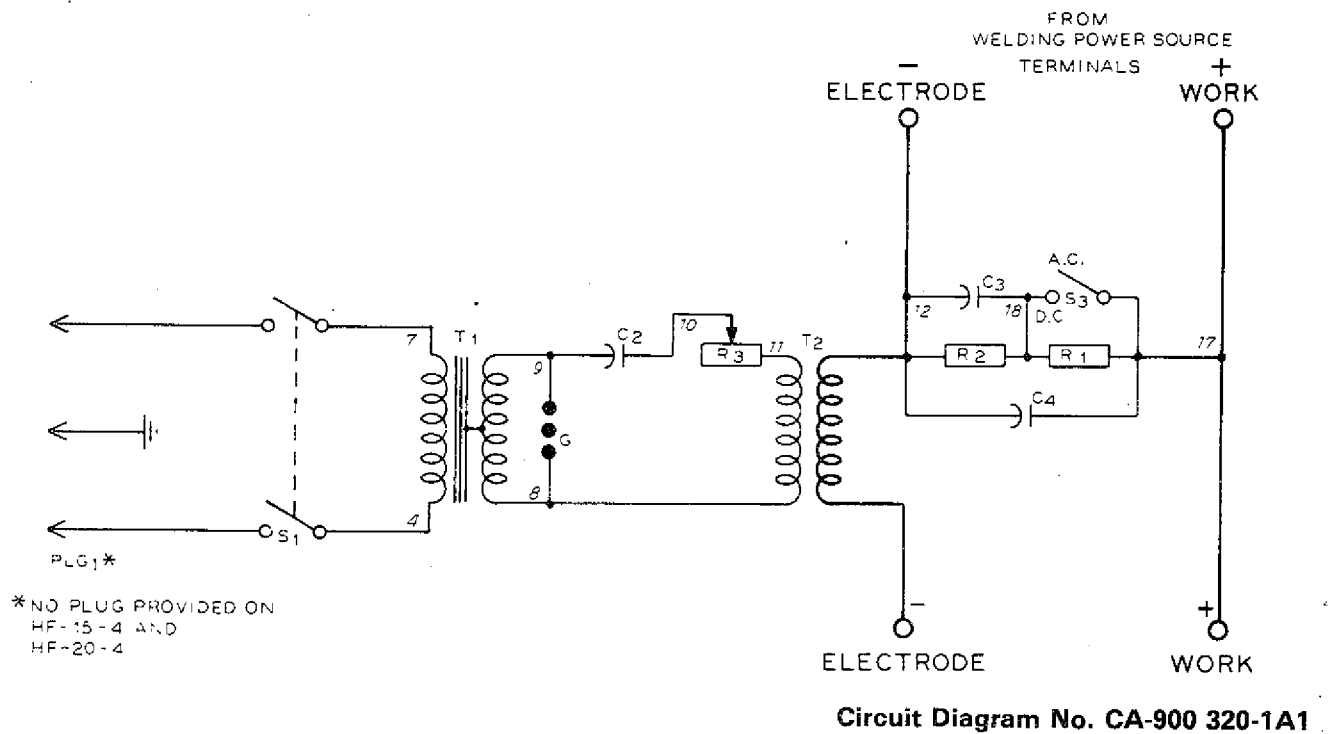


Figure 6-1. Circuit Diagram For 115, 230, 460 Volts HF Models Without Gas & Water Controls

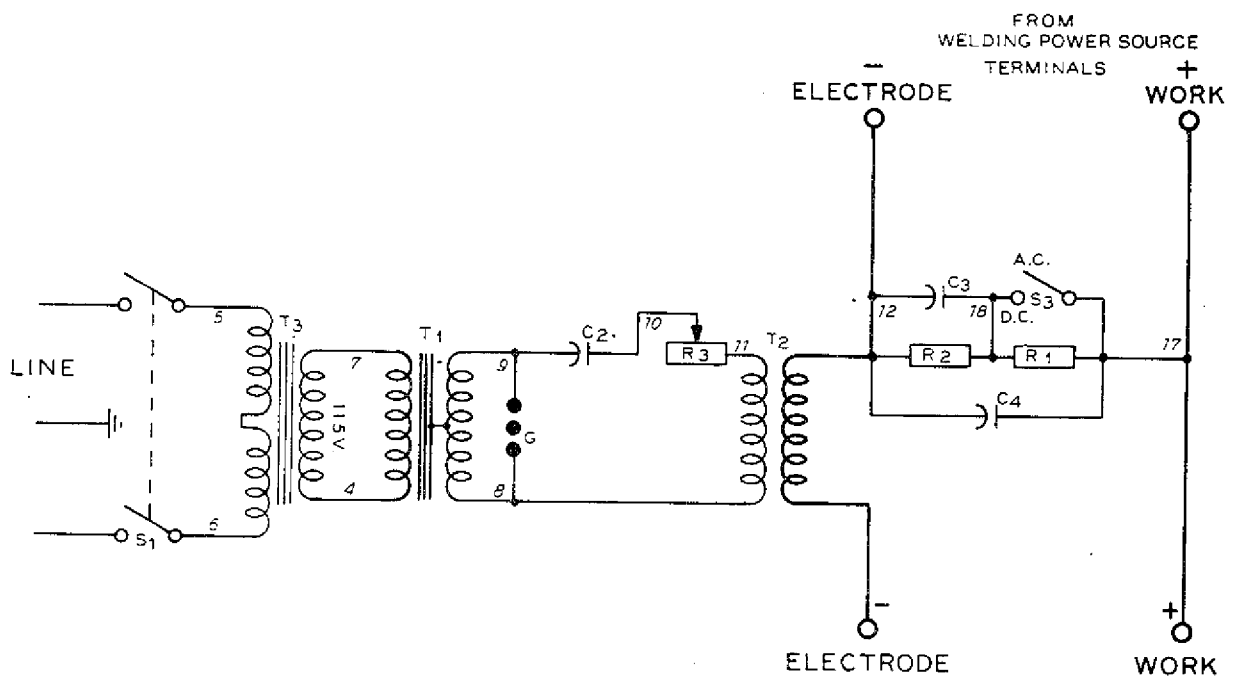
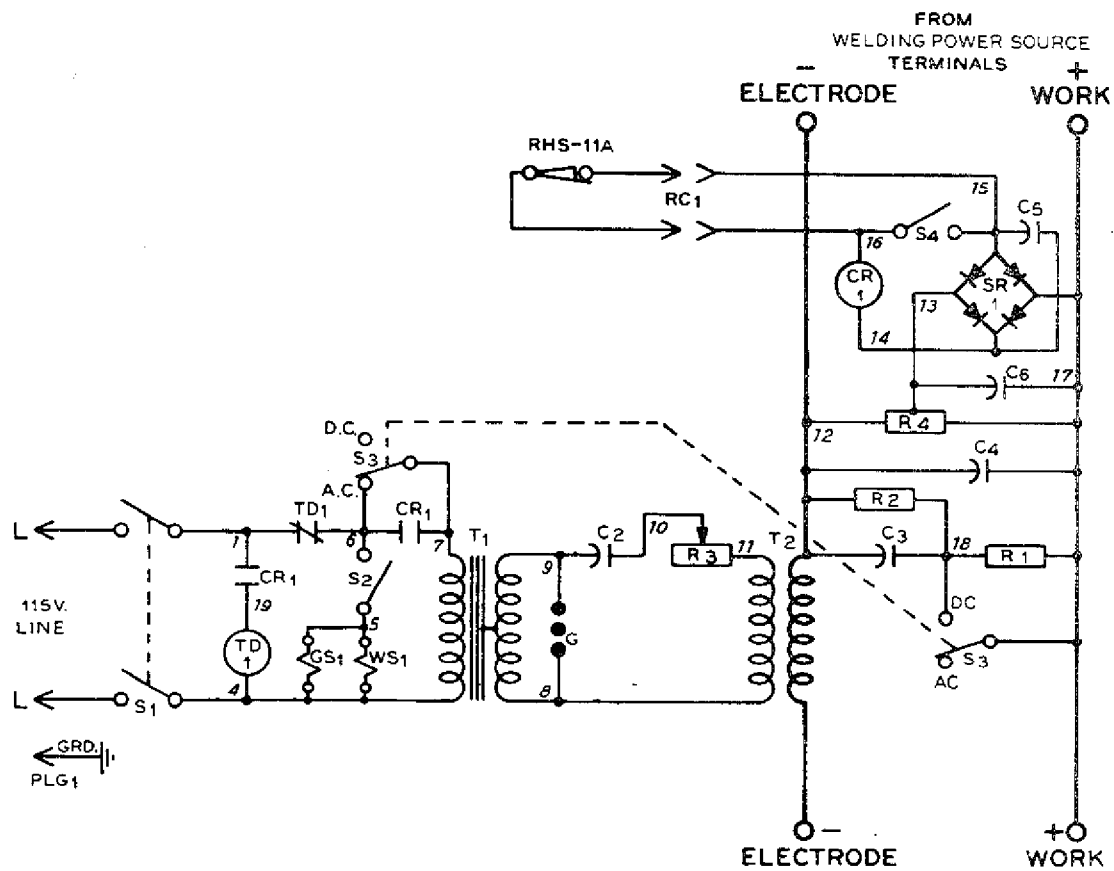
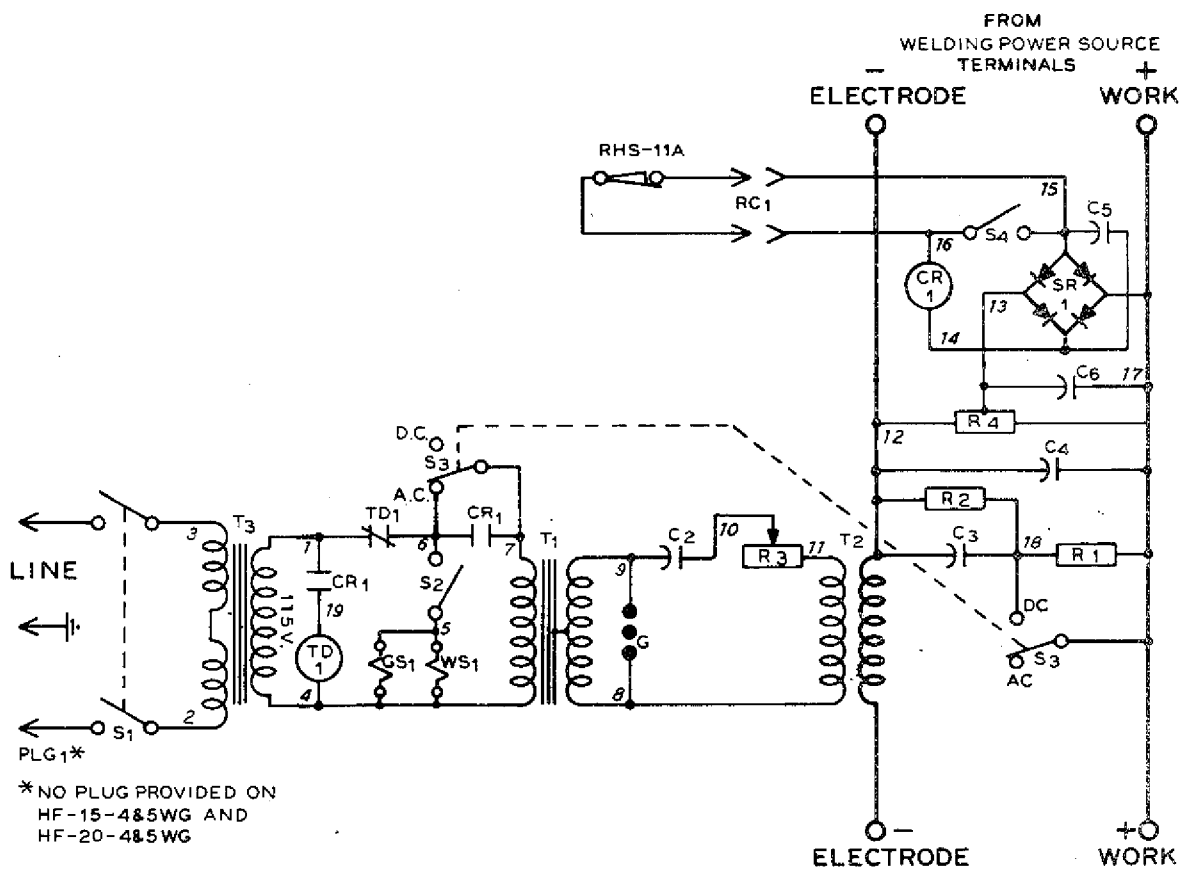


Figure 6-2. Circuit Diagram For 575 Volts HF Models Without Gas & Water Controls



Circuit Diagram No. A-084 268

Figure 6-3. Circuit Diagram For 115 Volts HF Models With Gas & Water Controls



Circuit Diagram No. A-084 267

Figure 6-4. Circuit Diagram For 230, 460, 575 Volts HF Models With Gas & Water Controls

SECTION 7 - CERTIFICATION FOR HIGH FREQUENCY ARC WELDING EQUIPMENT

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

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

The importance of a correct installation cannot be 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.

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

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

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

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

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

direct coupling inside the equipment or the high frequency unit, the power line then serving as a radiating antenna.

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

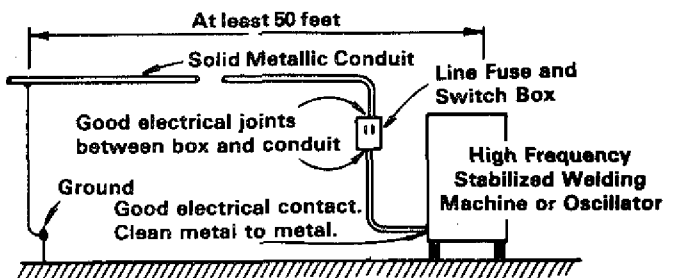


Figure 7-1. Power Service Installation H.F. Stabilized Arc Welding Machine

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

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

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

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

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

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

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

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

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

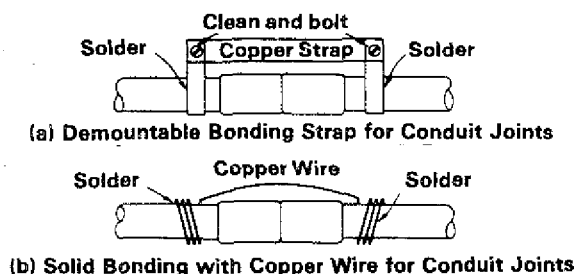


Figure 7-2. Two Recommended Methods For Electrical Bonding Across Poor Conductivity Conduit Joints

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

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

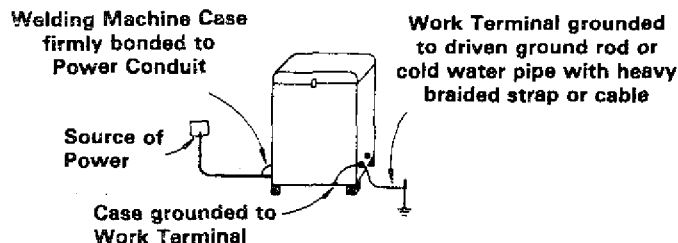


Figure 7-3. Ground Connections At Welding Machine

No change in the wiring or the location of parts inside the equipment, other than power service tap changes or other adjustments specifically covered shall be made. The equipment shall not be modified in any way since

changes in the equipment can affect the radiation characteristics and may not be in accordance with the test data upon which the manufacturer bases his certification.

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

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

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

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

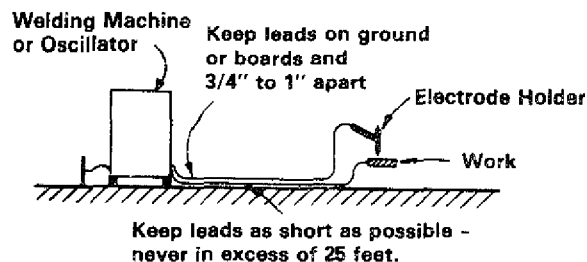


Figure 7-4. General Rules For Welding Leads

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

Any ungrounded electrical conductor in the strong "directly radiated" field, 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 7-5).

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

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

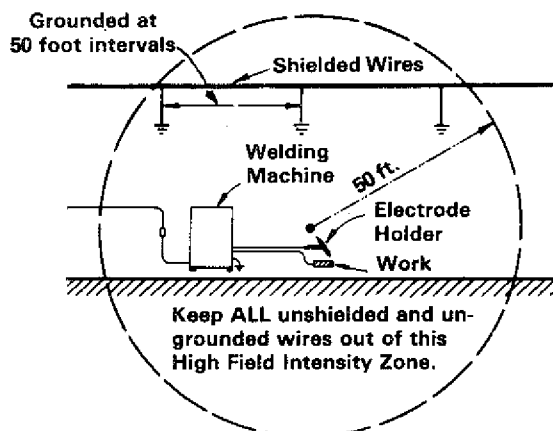


Figure 7-5. General Requirements to Minimize Reradiation Pick-up In The Vicinity of the Weld Zone

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

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

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

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

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 - 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.

7 - 8. METAL BUILDING - 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.

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

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

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

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

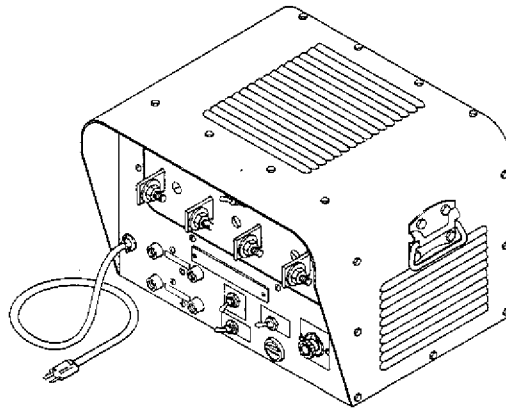
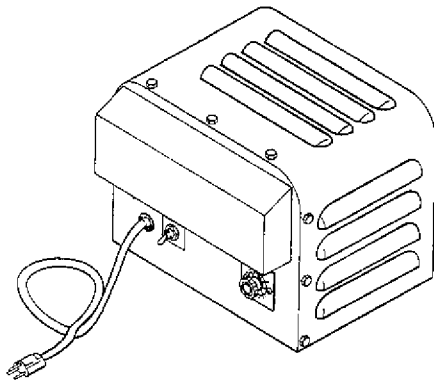
Surveys of this nature can cover a single unit or multiple units or may include the complete plant structure.

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

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

10. Is the wire used for this connection of sufficient size?
11. Is the work terminal connected to a good electrical ground?
12. Is the cable or copperbraid used for this connection equal to or greater in current carrying capacity than the welding lead?
13. Is this cable as short as possible?
14. Are the spark-gaps set at .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 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.



PARTS LIST

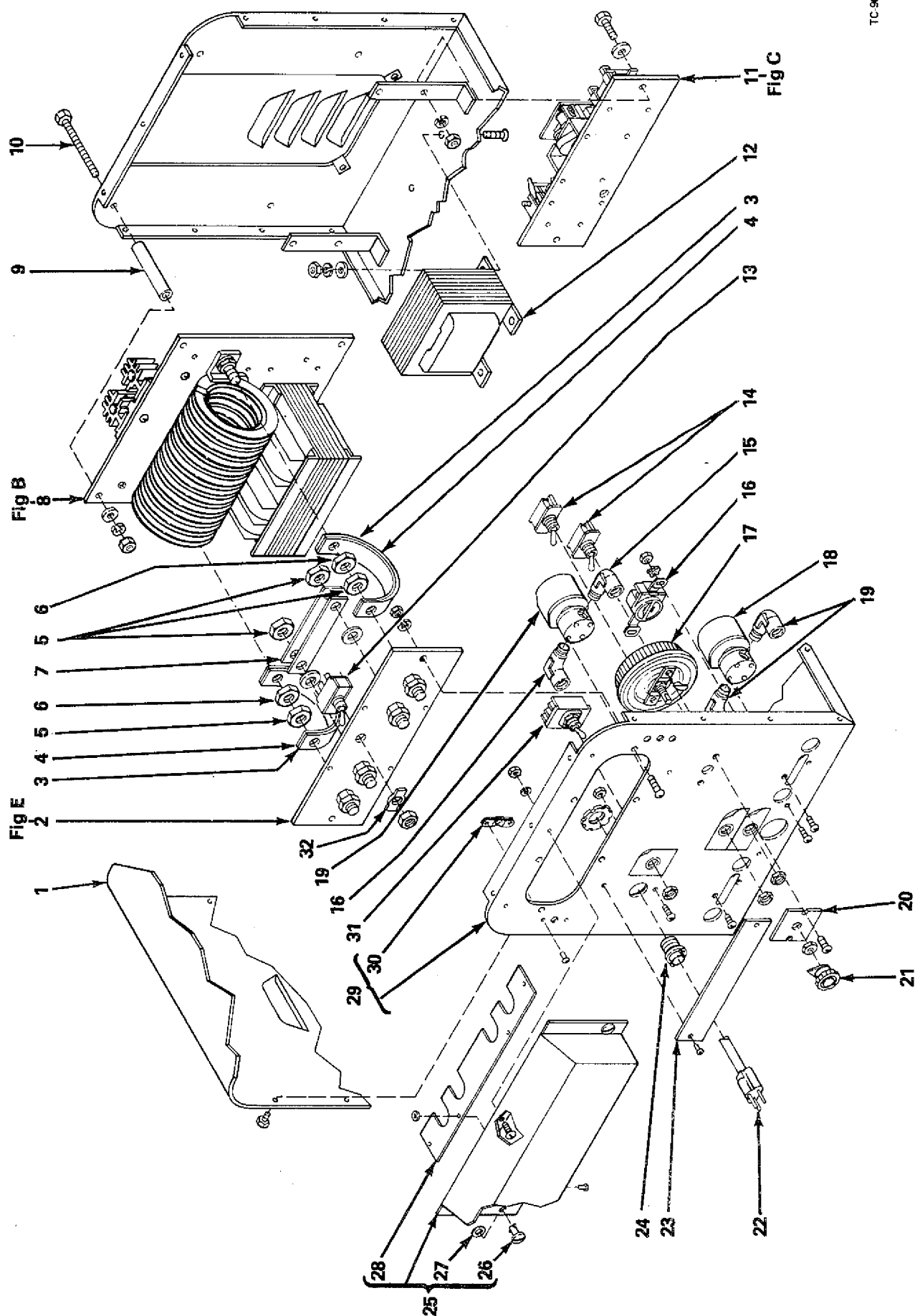


Figure A — Main Assembly

				Quantity					
				Models					
Item No.	Dia. Mkgs.	Part No.	Description	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 (Fig E Pg 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 (Fig B Pg 3)	1			1	1	1
8		020 655	HF PANEL (Fig B Pg 3)		1				
8		020 656	HF PANEL (Fig B Pg 3)			1			
9		010 006	TUBING, steel 3-1/4 long	4	4	4	4	4	4
10		601 794	BOLT, hex-hd 1/4-20 x 4	4	4	4	4	4	4
11		018 120	CONTROL PANEL (Fig C Pg 4)				1	1	1
12	T3	098 337	TRANSFORMER, KVA 115-230					1	1
13	S3	*011 620	SWITCH, toggle SPST 16 amp 125 volts ..	1	1	1			
13	S3	*011 649	SWITCH, toggle DPDT 15 amp 125 volts ..				1	1	1
14	S2,4	*011 620	SWITCH, toggle SPST 16 amp 125 volts ..				2	2	2
15		010 295	FITTING, hose M 1/4 NPT x 5/8 - 18 LH ..				2	2	2
16	RC1	039 602	RECEPTACLE, twistlock 2P2W 20A250V ..				1	1	1
		039 618	CAP, Arrow Hart 9102N (RC1)						
17	R3	603 942	RHEOSTAT, WW 150 watt 5 ohm	1	1	1	1	1	1
18	GS1,WS1	003 538	VALVE, 115V				2	2	2
19		010 296	FITTING, hose M 1/4 NPT x 5/8 - 18 RH ..				2	2	2
20		030 471	LABEL, indicator 0-100	1	1	1	1	1	1
21		024 366	KNOB, pointer	1	1	1	1	1	1
22		023 618	CORD SET, 115 volts 16 ga 3/c 10 ft	1			1		
22		023 625	CORD SET, 230 volts 16 ga 3/c 10 ft		1			1	
22		007 527	CORD SET, power			1			1
23			NAMEPLATE (order by model & style no.) ..	1	1	1	1	1	1
24		010 610	CONNECTOR, cable 3/8	1	1	1	1	1	1
25		027 343	COVER, terminal (consisting of)	1	1	1	1	1	1
26		604 768	. FASTENER, screw 1/4 turn No. 5	2	2	2	2	2	2
27		602 344	. RETAINER, screw	2	2	2	2	2	2
28		027 346	. INSULATOR, terminal.....	1	1	1	1	1	1
29		†017 053	CASE, base/front/rear (consisting of)	1	1	1			
29		†017 052	CASE, base/front/rear (consisting of)				1	1	1
30		602 347	. RECEPTACLE, screw 1/4 turn	2	2	2	2	2	2
		047 497	LABEL, general precautionary	1	1	1	1	1	1
31	S1	*011 745	SWITCH, toggle DPST 16 amp 125 volts ..	1			1		
31	S1	*011 608	SWITCH, toggle SPDT 15 amp 125 volts ..		1			1	
31	S1	*011 638	SWITCH, toggle 3PST 15 amp 125 volts ..			1			1
		087 073	STRIP, insulation-switch			1			1
32		011 106	PLATE, legend AC/DC	1	1	1	1	1	1
		Figure F	REMOTE HAND SWITCH (Pg 8)				1	1	1

*Recommended Spare Parts.

†When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND STYLE NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity		
				Models		
				115 Volts	230 Volts	460 Volts

Figure B HF Panel (Fig A Pg 2 Item 8)

1		602 243	WASHER, flat - 3/8	2	2	2
2	T2	033 601	COIL, coupling - air	1	1	1
3		038 891	STUD, brass 3/8-16 x 2-1/4	1	1	1
4		601 838	NUT, brass - hex jam 3/8-16	6	6	6
5		038 887	STUD, brass 10-32 x 1-3/8 w/hex collar	2	2	2
6		010 910	WASHER, flat - SAE 3/8	2	2	2
7	C4	031 605	CAPACITOR, mica 0.001 uf 6000 volts dc	1	1	1
8	G	020 623	SPARK GAP ASSEMBLY (Fig B1 Pg 4)	1	1	1
9		010 885	STRIP, conductor (spark gap to board)	1	1	1
10	C3	081 291	CAPACITOR, HF (consisting of)	1	1	1
11		081 282	STRIP, mtg - capacitor	1	1	1
12		007 532	CLAMP, capacitor 1 inch dia	2	2	2
13		059 887	CAPACITOR, MF 10 uf 220 volts	1	1	1
14	R2	030 603	RESISTOR, WW fixed 10 watt 10K ohm	1	1	1
15	R1	083 784	RESISTOR, WW fixed 100 watt 10 ohm	1	1	1
16		010 883	STRIP, conductor (spark gap to capacitor)	1	1	1
17		010 884	STRIP, conductor (capacitor to board)	1	1	1
18		603 737	SCREW, brass - round hd 3/8-16 x 1-3/4	1	1	1
19	C2	*031 602	CAPACITOR, mica 0.002 uf 5000 volts dc	2	2	2
20		016 601	MOUNTING BOARD	1	1	1
21	T1	036 865	TRANSFORMER, 115 volts	1		
21	T1	036 864	TRANSFORMER, 220 volts		1	
21	T1	036 682	TRANSFORMER, 460 volts			1

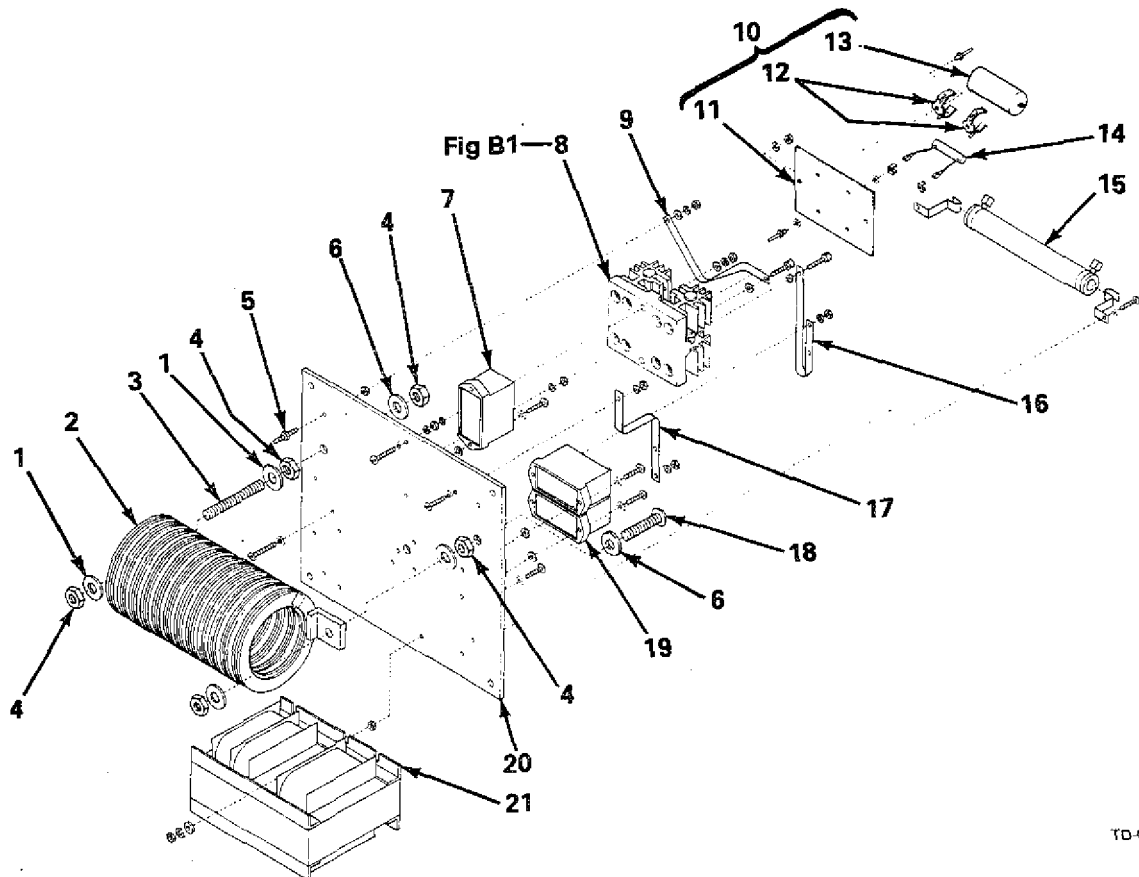


Figure B - HF Panel

*Recommended Spare Parts.

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

Item No.	Part No.	Description	Quantity
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Figure B1 020 623 Spark Gap Assembly (Fig B Pg 3 Item 8 & Fig G Pg 10 Item 8)

1	097 561	SCREW, round hd 10-24 x 3/4	8
2	095 621	BASE	1
3	*020 603	POINT, spark gap	4
4	602 023	SCREW, cap socket hd 10-24 x 3/4	4
5	010 888	CONNECTOR, holder	1
6	020 622	HOLDER, points	4

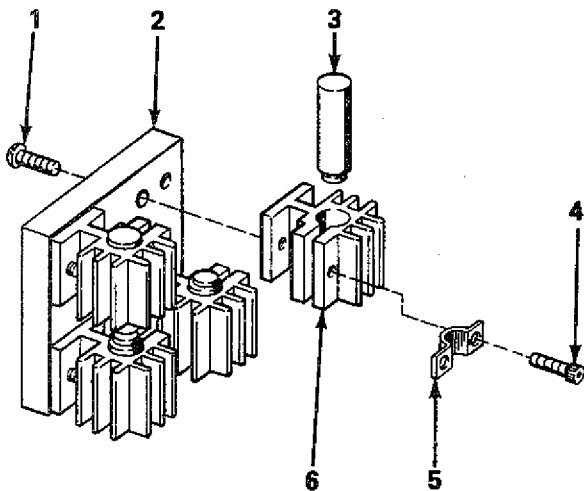


Figure B1 - Spark Gap Assembly

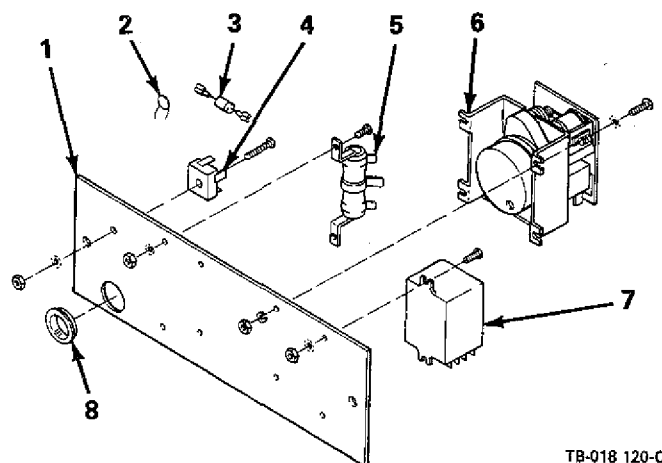


Figure C - Control Panel

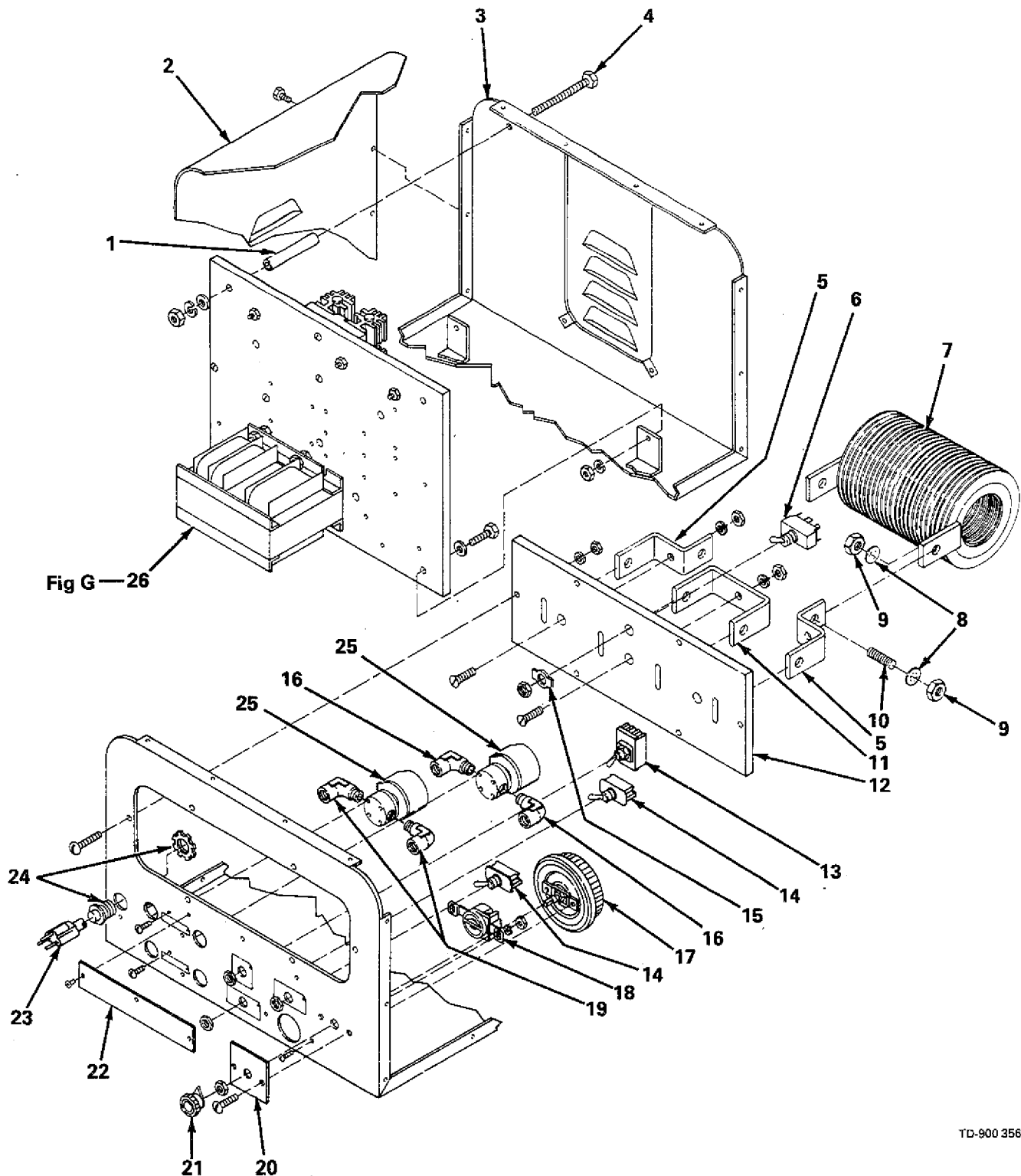
Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure C 018 120 Control Panel (Fig A Pg 2 Item 11)

1		084 235	PANEL, mtg-components	1
2	C6	046 140	CAPACITOR, ceramic 0.05 uf 500 volts dc	1
3	C5	046 139	CAPACITOR, electrolyte 22 uf 50 volts dc	1
4	SR1	035 914	RECTIFIER, integrated 30 amp 400 volts	1
5	R4	030 601	RESISTOR, WW adj 25 watt 1000 ohm	1
6	TD1	034 701	TIMER, 1 minute 115 volts	1
7	CR1	059 267	RELAY, enclosed 12 volts dc	1
8		010 493	BUSHING, snap 5/8 ID x 7/8 mtg hole	1

*Recommended Spare Parts.

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



TD-900 356-A

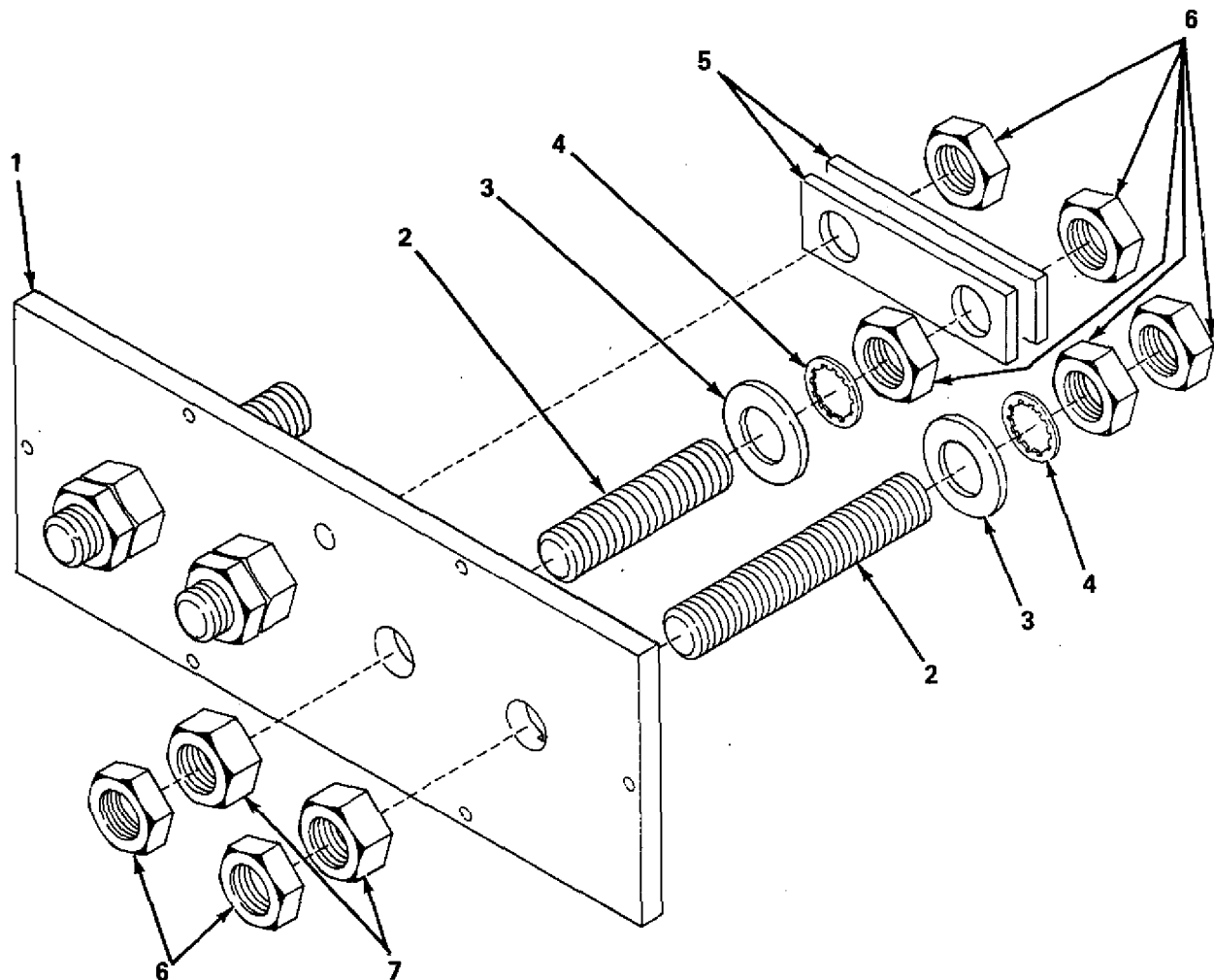
Figure D — Main Assembly

Item No.	Dia. Mkgs.	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													
1		010 006	TUBING, 3-1/4 long	2	2	2	2	2	2	2	2	2	2
2		015 380	WRAPPER	1					1				
2		048 431	WRAPPER		1	1	1	1		1	1	1	1
3		†015 393	CASE SECTION, base/front/rear	1	1	1	1	1					
3		†017 054	CASE SECTION, base/front/rear						1	1	1	1	1
		047 497	LABEL, general precautionary	1	1	1	1	1	1	1	1	1	1
4		601 794	BOLT, hex-hd 1/4-20 x 4	2	2	2	2	2	2	2	2	2	2
5		048 427	BUS BAR, output		2	2	2	2		2	2	2	2
6	S3	011 649	SWITCH, DPDT 15 amp 125 volts		1	1	1	1	1	1	1	1	1
7		048 428	COIL, coupling - air		1	1	1	1		1	1	1	1
8		605 787	WASHER, 1/2		4	4	4	4		4	4	4	4
9		601 840	NUT, 1/2-13		4	4	4	4		4	4	4	4
10		038 825	STUD, 1/2-13 x 2		2	2	2	2		2	2	2	2
11		048 426	BUS BAR, secondary		1	1	1	1		1	1	1	1
12		048 430	TERMINAL BOARD, power		1	1	1	1		1	1	1	1
13	S1	*011 813	SWITCH, toggle 3PST 20A 250V	1				1	1				1
13	S1	*011 745	SWITCH, toggle DPST 16A 125V		1					1			
13	S1	*011 608	SWITCH, toggle SPDT 15A 125V			1					1		
13	S1	*011 813	SWITCH, toggle 3PST 20A 600V				1					1	
14	S2,4	*011 620	SWITCH, toggle SPST 16A 125V						2	2	2	2	2
15		011 106	PLATE, legend AC/DC	1	1	1	1	1	1	1	1	1	1
16		010 295	FITTING, 1/4 NPT x 5/8 - 18 LH								2	2	2
17	R3	603 942	RHEOSTAT, WW 150 watt 5 ohm	1	1	1	1	1	1	1	1	1	1
18	RC1	039 602	RECEPTACLE, twistlock 2P2W						1	1	1	1	1
		039 618	CAP, Arrow Hart 9102N (RC1)										
19		010 296	FITTING, 1/4 NPT x 5/8 - 18 RH								2	2	2
20		030 471	LABEL, indicator 0-100	1	1	1	1	1	1	1	1	1	1
21		024 366	KNOB, pointer	1	1	1	1	1	1	1	1	1	1
22			NAMEPLATE (model & style no.)	1	1	1	1	1	1	1	1	1	1
23		023 618	CORD SET, 115V 16 ga 3/c 10 ft		1					1			
23		023 625	CORD SET, 230V 16 ga 3/c 10 ft			1					1		
23		007 527	CORD SET, power	1			1	1	1			1	1
24		010 610	CONNECTOR, cable 3/8	1	1	1	1	1	1	1	1	1	1
25	GS1, WS1												
		003 538	VALVE, 115V ac						2	2	2	2	2
26		020 642	HF PANEL (Fig G Pg 10)	1				1					
26		020 657	HF PANEL (Fig G Pg 10)		1								
26		020 658	HF PANEL (Fig G Pg 10)			1							
26		020 659	HF PANEL (Fig G Pg 10)				1						
26		020 660	HF PANEL (Fig G Pg 9)						1				
26		020 641	HF PANEL (Fig G Pg 9)							1	1	1	1
	T3	098 338	TRANSFORMER, kva 1/2	1				1	1				1
	T3	098 337	TRANSFORMER, kva 1/3								1	1	
		010 012	BUS BAR, coil to sec stud short	2					2				
		010 013	BUS BAR, coil to sec stud long	2					2				
		602 261	HANDLE, wrapper	2	2	2	2	2	2	2	2	2	2
			Figure F REMOTE HAND SWITCH (Pg 8)						1	1	1	1	1

*Recommended Spare Parts.

†When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND STYLE NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Part No.	Description	Quantity	
			Models	
			HF 15	HF 15-5
Figure E	Terminal Assembly, Power (Fig A Pg 2 Item 2)		038 764	038 763
1	100 542	TERMINAL BOARD	1	
1	038 055	TERMINAL BOARD		1
2	038 900	STUD, brass 1/2-13 x 2-1/4	4	
2	038 654	STUD, brass 1/2-13 x 2-5/8		4
3	602 247	WASHER, flat SAE 1/2	4	4
4	602 217	WASHER, lock external tooth 1/2	4	
4	605 787	WASHER, lock - internal tooth 1/2		4
5	038 056	BUS BAR		2
6	601 840	NUT, brass - hex jam 1/2-13	8	12
7	601 839	NUT, brass - hex full 1/2-13	4	4

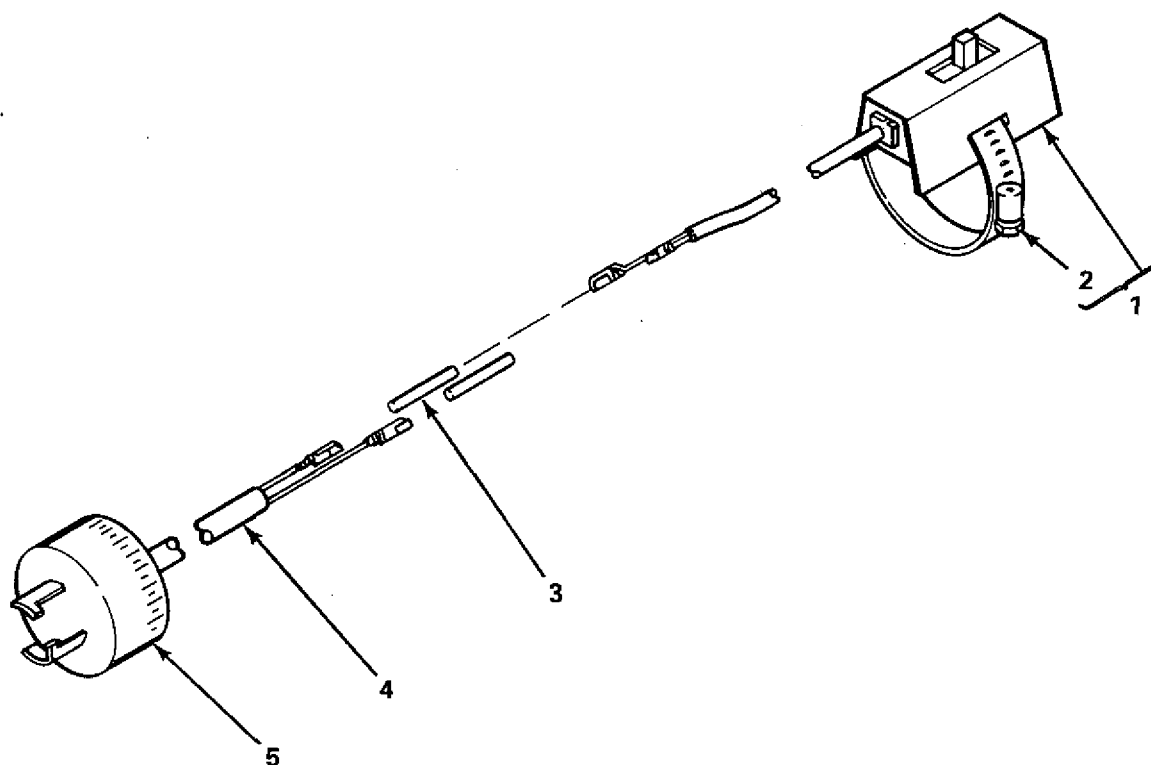


TB-082 460

Figure E — Terminal Assembly, Power

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

Item No.	Part No.	Description	Quantity
Figure F	040 814	Remote Hand Switch (RHS-11A)	
1	011 752	SWITCH, slide NC with leads (consisting of)	1
2	010 860	. CLAMP	1
3	603 522	TUBING, vinyl No. 5 (order by foot)	1 ft.
4	600 729	CORD SET, 115 volts 16 ga 2/c 20 ft.	1
5	039 618	CAP, twistlock 2P2W 20 amp 250 volts	1



TA-040 814

Figure F - Remote Hand Switch

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

Fig B1

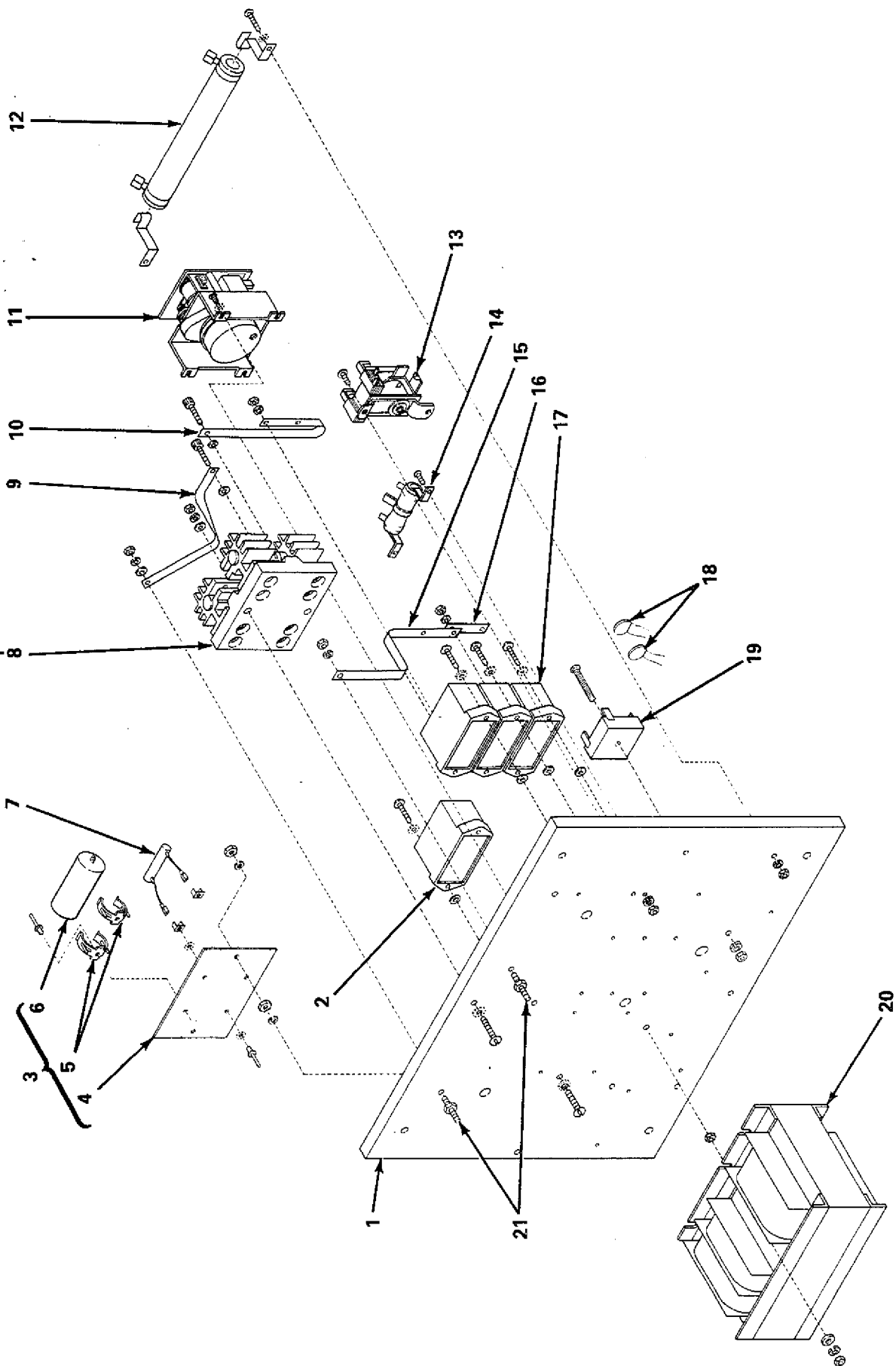


Figure HF Panel

Item No.	Dia. Mkgs.	Part No.	Description	Quantity					
				Models					
				HF 15-5	HF20-1 HF20-5	HF 20-2	HF 20-4	HF15-5 WG	All HF20WG
Figure G				020 642	020 657	020 658	020 659	020 660	020 641
HF Panel (See Fig. D Page 6 Item 26)									
1			016 606 MOUNTING BOARD	1	1	1	1	1	1
2	C4		031 605 CAPACITOR, mica 0.001 uf 6000V dc	1	1	1	1	1	1
3	C3		081 291 CAPACITOR, HF (consisting of)	1	1	1	1	1	1
4			081 282 . STRIP, mounting - capacitor	1	1	1	1	1	1
5			007 532 . CLAMP, capacitor 1 inch dia.	2	2	2	2	2	2
6			059 887 . CAPACITOR, metalfilm 10 uf 220V ..	1	1	1	1	1	1
7	R2		030 603 RESISTOR, WW fixed 10 watt 10K ...	1	1	1	1	1	1
8	G		020 623 SPARK GAP ASS'Y (Fig B1 Pg 4)	1	1	1	1	1	1
9			010 885 STRIP, conductor	1	1	1	1	1	1
10			010 883 STRIP, conductor	1	1	1	1	1	1
11	TD1		034 701 TIMER, 1 min 115 volts					1	1
12	R1		083 784 RESISTOR, WW fixed 100 watt 10 ohm	1	1	1	1	1	1
13	CR1		034 601 RELAY, 24 volts dc DPDT					1	1
14	R4		030 601 RESISTOR, WW adj 25 watt 1000 ohm					1	1
15			010 884 STRIP, conductor	1	1	1	1	1	1
16			010 886 STRIP, conductor		1	1	1		1
17	C2		*031 602 CAPACITOR, mica 0.002 uf 5000V dc ..	2	3	3	2	3	3
18	C5,6		046 140 CAPACITOR, ceramic 0.05 uf 500 volts dc					2	2
19	SR1		035 914 RECTIFIER, integrated 30 amp 400 volts					1	1
20	T1		036 865 TRANSFORMER, 115 volts	1	1			1	1
20	T1		036 864 TRANSFORMER, HV 220 volts			1			
20	T1		036 682 TRANSFORMER, HV 460 volts				1		
21			038 887 STUD, brass - w/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	

*Recommended Spare Parts.

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