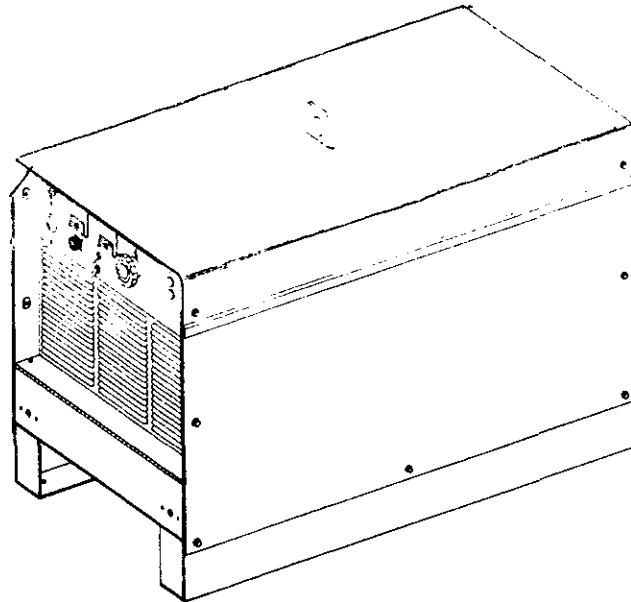


**IMPORTANT:** Read and understand the entire contents of this manual, with special emphasis on the safety material throughout the manual, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation 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.

**MODEL**

DELTAWELD<sup>®</sup> 450  
DELTAWELD<sup>®</sup> 650



# 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.

**	Dia. Mkgs.	Part No.	Replaced With	Description	Quantity
2-21	T1		091 075	TRANSFORMER, power main (230/460)(consisting of) .....	1
			090 839	. COIL, pri/sec LH .....	1
			090 840	. COIL, pri/sec RH & center .....	2
2-21	T1		091 077	TRANSFORMER, power main (200/230/460)(consisting of) .....	1
			090 845	. COIL, pri/sec LH .....	1
			090 846	. COIL, pri/sec RH & center .....	2
2-21	T1	091 076	109 685	TRANSFORMER, power main (230/460/575)(consisting of) .....	1
			105 905	. COIL, pri/sec LH .....	1
			105 906	. COIL, pri/sec RH & center .....	2
6-25		605 583	605 583	CATCH (qty chg)(Eff w/JG068600).....	1
6-26		027 408	098 887	DOOR, access-front (Eff w/JG068600) .....	1
6-27		019 627	097 926	KNOB .....	1

\*\*First digit represents page no - digits following dash represents item no.  
**BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.**



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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 béryllium 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 béryllium.

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-violette 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:

- a. appreciable combustibles (including building construction) are within 35 feet
- b. appreciable combustibles are further than 35 feet but can be ignited by sparks
- c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
- d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 3 in Standards index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the 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:

- a. Des quantités appréciables de combustibles (y compris une construction en chantier) se trouvent à moins de 35 pieds.
- b. Des quantités appréciables de combustibles sont à plus de 35 pieds mais peuvent être enflammées par des étincelles.
- c. Des ouvertures (cachées ou visibles) sur les planchers ou les murs à moins de 35 pieds peuvent exposer des combustibles aux étincelles.
- d. 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 SCULEVEZ 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.

\*Trademark of Proctor & Gamble

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-violette 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 réfléchir 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 caillebotis 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. REMPLACEZ 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 procès 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 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 procès 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:

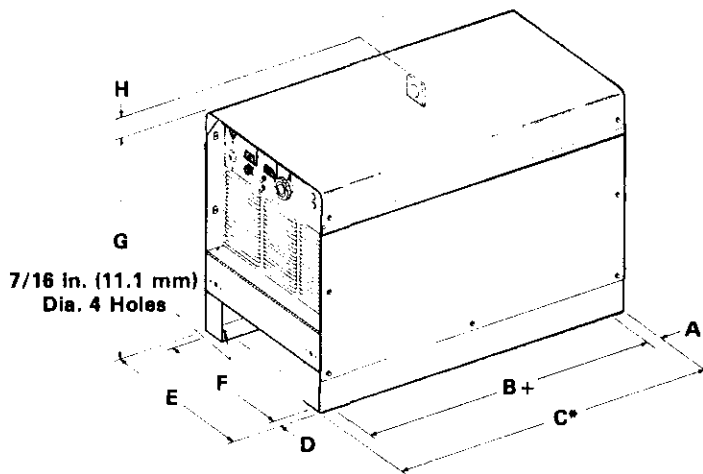
1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING distribué par l'American Welding Society, 550 Le Jeune Rd., P.O. Box 351040 Miami, FL 33135
2. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING distribué par le Superintendent of Documents, U.S. Government Printing Office, Washington 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	Rated Welding Current Amperes 100% Duty Cycle	Voltage Range	Max. Open-Circuit Voltage	Input At Rated Load Output 60 Hz. Three-Phase						Weight	
				Amperes At				kva	kw	Net	Ship
				200V	230V	460V	575V				
450 Ampere	450 @ 38 Volts	14-38	48	81	70	35	28	28	23	434 lbs. (197 kgs)	447 lbs. (203 kgs)
650 Ampere	650 @ 44 Volts	14-46	60	136	118	59	47	46.6	37	558 lbs. (253 kgs)	574 lbs. (260 kgs)

**Figure 2 - 1. Specifications**



Base Mounting Hole Layout		
	Inches	Millimeters
A	1-1/2	38.1
B	32-3/4	831.9
C	35-3/4	908.1
D	1-1/8	28.6
E	22-1/4	565.2
F	20	508.0
G	27-1/2	698.5
H	2-3/4	69.9

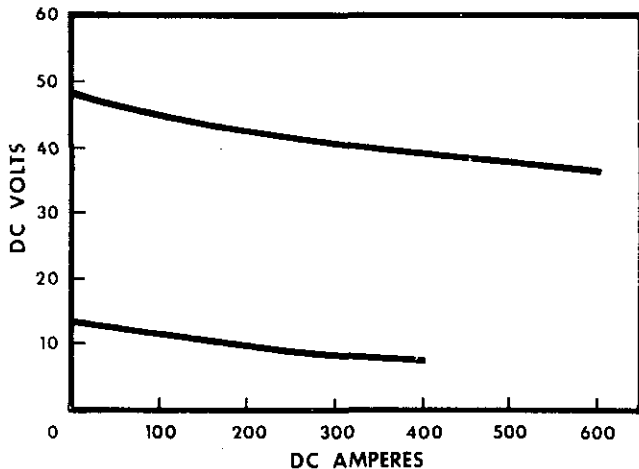
+37 in. (939.8 mm) On 650 Ampere Model  
\*40 in. (1016 mm) On 650 Ampere Model

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**Figure 2-2. Overall Dimensions And Base Mounting Hole Layout**

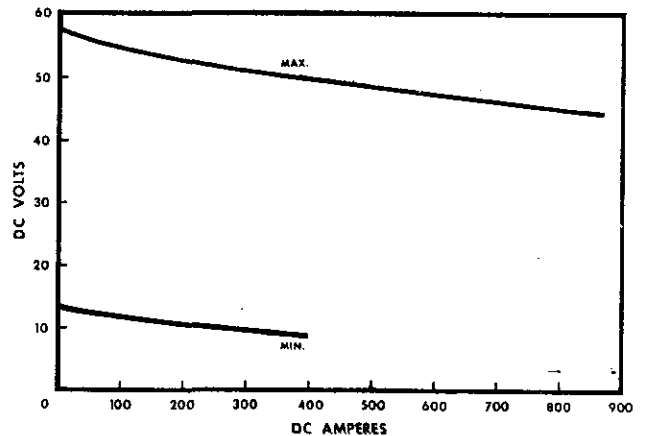
**2 - 1. VOLT-AMPERE CURVES (Figure 2-3) -** The volt-ampere curves show the voltage and amperage output capabilities of the welding power source at the min. and max. values of the VOLTAGE ADJUSTMENT control. Curves of other settings will fall between the curves shown.

With the use of the volt-ampere curves it is possible to determine the weld current at any particular load voltage.



**450 Ampere Models**

B-083 401



**650 Ampere Models**

B-045 804-A

**Figure 2-3. Volt-Ampere Curves**

**2 - 2. DUTY CYCLE (Figure 2-4) -** The duty cycle of a welding power source is the percentage of a ten minute period that a welding power source can safely be operated at a given output. This welding power source is rated at 100 percent duty cycle. This means that the welding power source can be safely operated at rated load continuously. Figure 2-4 enables the operator to determine the safe output of the welding power source at various duty cycles.

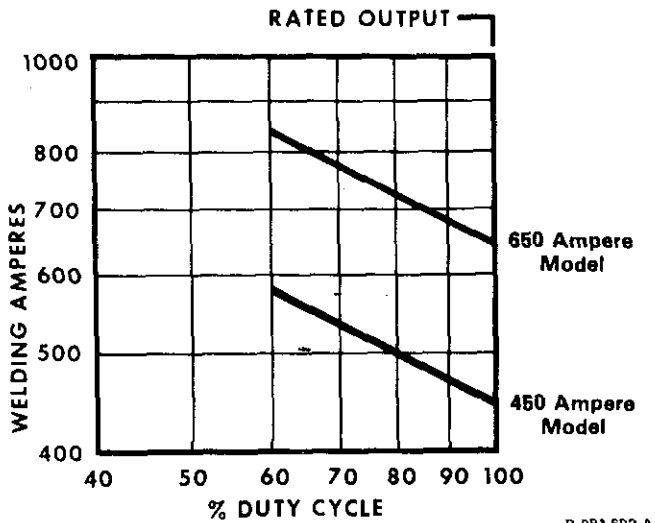


Figure 2-4. Duty cycle Chart

**CAUTION:** EXCEEDING DUTY CYCLE RATINGS will damage the welding power source.

- Do not exceed duty cycles indicated.

## 2 - 3. GENERAL INFORMATION AND SAFETY

### A. General

Information presented in this manual and on various labels, tags, and plates provided on this 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.

The nameplate of this unit uses international symbols for labeling the front panel controls. The symbols also appear at the appropriate section in the text.

### 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 - 4. RECEIVING-HANDLING** - Prior to installing this equipment, clean all packing material from around the unit and carefully inspect for any damage that may have occurred during shipment. Any claims for loss or damage that may have occurred in transit must be filed **by the purchaser with the carrier**. A copy of the bill of lading and freight bill will be furnished by the manufacturer on request if occasion to file claim arises.

When requesting information concerning this equipment, it is essential that Model Description and Serial Number of the equipment be supplied.

**2 - 5. DESCRIPTION** - This unit is a three-phase constant potential dc arc welding power source with solid-state control. It produces dc weld current and is designed to be used for Gas Metal-Arc Welding. The number in the model designation refers to the rated welding current in amperes.

## SECTION 3 - INSTALLATION

### 3 - 1. LOCATION

**CAUTION:** IMPROPER LIFTING OF EQUIPMENT can result in personal injury and equipment damage.

- Use equipment of adequate capacity to lift the unit.
- If using lift forks to handle this unit, be sure the lift forks are long enough to extend out of the opposite side of the base.

Using lift forks too short will expose internal components to damage should the tips of the lift forks penetrate the bottom of the unit.

**RESTRICTED AIR FLOW** causes overheating and possible damage to internal parts.

- Maintain at least 18 inches (457 mm) of unrestricted space on all sides of unit and keep underside free of obstructions.

- Do not place any filtering device over the intake air passages of this welding power source.

Warranty is void if any type of filtering device is used.

This welding power source has a lifting device for moving the unit and holes in the base for mounting purposes. Figure 2-2 gives overall dimensions and base mounting hole layout.

The location should allow room to remove cover and panels for maintenance and repair.

The service life and efficiency of this unit are reduced when the unit is subjected to high levels of dust, dirt, moisture, corrosive vapors, and extreme heat.

### 3 - 2. WELD OUTPUT CONNECTIONS (Figure 4-1)



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

#### A. Welding Cables

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

1. Keep cables as short as possible and place cables close together. Excessive cable length adds resistance which may reduce output or cause overloading of the unit.
2. Select adequate size welding cable for the anticipated maximum weld current. Use total length of welding cables in the circuit to determine cable size. For example: If the cable to the wire feeder, or electrode holder cable is 25 feet (7.5 m) long and the work cable is 25 feet (7.5 m) long, select the size cable recommended in Table 3-1 for 50 ft (15 m).
3. Do not use damaged or frayed cables.
4. Install correct size lugs of adequate amperage capacity onto ends of both cables for connecting to work clamp, wire feeder, electrode holder if applicable, and weld output terminals.
5. If applicable install electrode holder onto cable following manufacturer's instructions. An insulated electrode holder must be used to ensure operator safety.
6. Install work clamp onto cable.

**Table 3-1. Welding Cable Size**

WELDING AMPERES	*TOTAL LENGTH OF CABLE (COPPER) IN WELD CIRCUIT							
	*50	100	150	200	250	300	350	400
100	4	4	2	2	2	1	1/0	1/0
150	2	2	2	1	1/0	2/0	3/0	3/0
200	1	1	1	1/0	2/0	3/0	4/0	4/0
250	1/0	1/0	1/0	2/0	3/0	4/0	4/0	2-2/0
300	2/0	2/0	2/0	3/0	4/0	4/0	2-2/0	2-3/0
350	3/0	3/0	3/0	4/0	4/0	2-2/0	2-3/0	2-3/0
400	3/0	3/0	3/0	4/0	2-2/0	2-3/0	3-2/0	2-4/0
500	4/0	4/0	4/0	2-2/0	2-3/0	2-3/0	2-4/0	3-3/0
600	2-2/0	2-2/0	2-2/0	2-3/0	3-2/0	2-4/0	3-3/0	3-4/0
700	2-3/0	2-3/0	2-3/0	2-4/0	3-3/0	3-4/0	4-4/0	4-4/0
800	2-3/0	2-3/0	2-3/0	2-4/0	3-3/0	3-4/0	4-4/0	4-4/0

A-002 623

- NOTE. \*A. 50 FEET OR LESS.  
 \*B. CABLE SIZE IS BASED ON DIRECT CURRENT (DC), 100% DUTY CYCLE AND EITHER A 4 VOLTS OR LESS DROP OR A CURRENT DENSITY OF NOT OVER 300 CIRCULAR MILS PER AMP.  
 \*C. WELD CABLE INSULATION WITH A VOLTAGE RATING TO WITHSTAND THE OPEN-CIRCUIT VOLTAGE (OCV) OF THE WELDING POWER SOURCE MUST BE USED. WHILE MOST WELDING POWER SOURCES HAVE AN OPEN-CIRCUIT VOLTAGE OF LESS THAN 100 VOLTS, SOME WELDING POWER SOURCES OF SPECIAL DESIGN MAY HAVE HIGHER OPEN-CIRCUIT VOLTAGE

### 3. Installation (Figure 4-1)

#### **WARNING:** ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Shut unit down and be sure it cannot be accidentally energized before making weld output connections.

1. Connect work cable to NEGATIVE weld output terminal.
2. Connect one end of remaining cable to POSITIVE weld output terminal.
3. Connect remaining end of POSITIVE weld output cable to wire feeder.

**IMPORTANT:** The connections given are for DC reverse polarity. If DC straight polarity is desired, reverse cable connections to weld output terminals (work becomes positive).

### 3 - 3. 115 VOLTS AC TWISTLOCK RECEPTACLE (Figure 4-1)



The three-pole, twistlock, 115 AC receptacle is provided to supply operating power to the wire feeder. Insert the 115 volts ac plug from the wire feeder into the receptacle and rotate clockwise.

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



**IMPORTANT:** Although the term CONTACTOR is used on the nameplate and throughout this manual, the output is not switched on or off by a physical secondary contactor; rather, the output is controlled by a Silicon Controlled Rectifier (SCR) stack which functions as a contactor.

The REMOTE CONTACTOR receptacle provides a junction point for connecting a wire feeder which supplies 115 volts ac to the contactor control circuitry in the welding power source. For wire feeders providing a switch closure for contactor control see Section 3-5.

To connect the wire feeder to the REMOTE CONTACTOR control receptacle, insert the two-pole plug on 115 volts/contactors cord from the wire feeder into the REMOTE CONTACTOR control receptacle and rotate clockwise.

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

REMOTE VOLTAGE



REMOTE CONTACTOR

The REMOTE VOLTAGE/CONTACTOR control receptacle provides a junction point for connecting a Remote Voltage Control (and/or a Remote Contactor Control or a wire feeder providing switch closure for contactor control) to the control circuitry of the welding power source. Insert the Remote Control plug fully into the receptacle and rotate the threaded collar clockwise.

3 - 6. ELECTRICAL INPUT CONNECTIONS



A. Electrical Input Requirements

This welding power source is designed to be operated from a three-phase, 60 Hertz, ac power supply which has a line voltage rating that corresponds with one of the electrical input voltages shown on the nameplate or primary data label. Consult the local electric utility if there is any question about the type of electrical system available at the installation site or how proper connections to the welding power source are to be made.

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

**WARNING:** ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Disconnect input power and employ "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.

**CAUTION:** INCORRECT INPUT VOLTAGE JUMPER LINK PLACEMENT can damage unit.

- Position jumper links as shown on the input voltage label located on primary terminal board.

**IMPORTANT:** Store unused jumper links across linked terminals.

This unit is equipped with input voltage jumper links either installed or in a bag on the primary terminal board to allow operation from different line voltages. If installed, the jumper links are positioned for the highest voltage stated on the nameplate or primary data label. If in a bag, proper installation is necessary before operation.

Open rear access door. Reposition or install if applicable the jumper links onto the primary terminal board to correspond to the available line voltage positions shown on the input voltage label (see Figure 3-1).

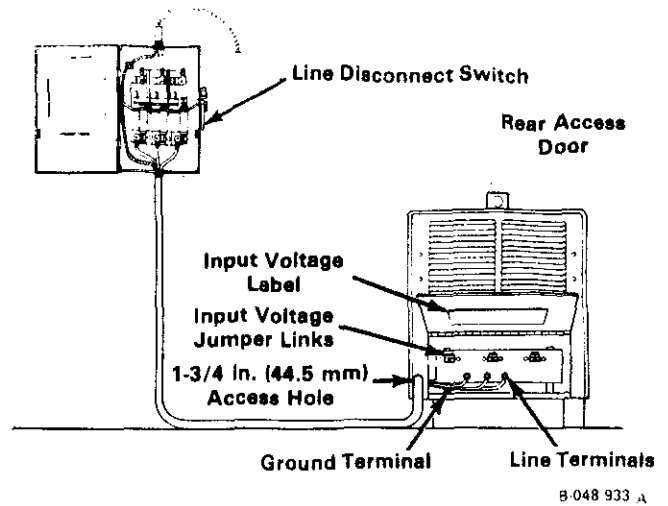


Figure 3-1. Input Conductor Connections

C. Input Conductor Connections

**WARNING:** ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- It is recommended that a fusible line disconnect switch be installed in the input circuit to the welding power source.

This would provide a safe and convenient means to completely remove all electrical power from the welding power source whenever it is necessary to internally inspect or service the unit.

- Employ "lockout/tagging procedures" on input line before making input connections to the welding power source.

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 input conductors to the welding power source before connecting to the three-phase input power.

Table 3-2 provides guidelines for selecting the proper size input conductors and line fuses. The input conductors should be covered with an insulating material that meets local electrical standards.

Install terminal lugs of adequate amperage capacity (see Table 3-2) and correct stud size to the input and ground conductors. Open rear access door (See Figure 3-1). Insert the conductors through the access hole in the rear panel (see Figure 3-1). This hole will accept standard conduit fittings.

Table 3 - 2. Input Conductor and Fuse Size

Model	Input Conductor Size - AWG*				Fuse Size In Amperes			
	200V	230V	460V	575V	200V	230V	460V	575V
450 Ampere	No. 4 (No. 6)	No. 4 (No. 8)	No. 10 (No. 10)	No. 10 (No. 12)	110	100	50	40
650 Ampere	No. 1/0 (No. 6)	No. 1 (No. 6)	No. 6 (No. 8)	No. 8 (No. 8)	175	150	80	60

\*Input conductor sizes are based on National Electrical Code specifications for allowable ampacities of insulated copper conductors, having a temperature rating of 75°C, with not more than three conductors in a raceway or cable. Numbers in ( ) are equipment ground conductor sizes.

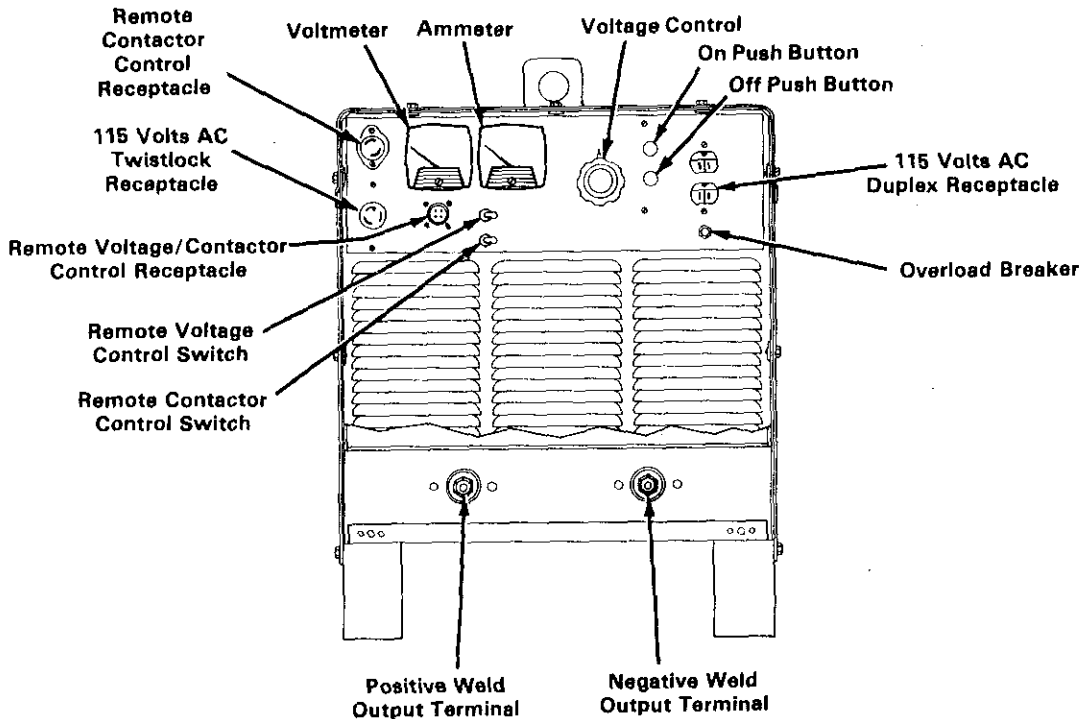
**WARNING: ELECTRIC SHOCK can kill.**

- Do not connect an input conductor to the ground terminal in the unit.
- Do not connect the ground conductor to an input line terminal.

Incorrect input connections can result in an electrically energized welding power source chassis. The ground terminal is connected to the welding power source chassis and is for grounding purposes only.

Connect the input conductors to the line terminals on the primary terminal board and connect the ground conductor to the ground terminal. (Refer to the input voltage label for identification of these terminals.) The remaining end of the ground conductor should be connected to a proper ground. Use a grounding method that is acceptable to the local electrical inspection authority. Close and secure rear access door.

**SECTION 4 - OPERATOR CONTROLS**



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Figure 4-1. Front Panel View

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



Depressing the POWER switch ON push button will energize the welding power source and place the unit in a ready-to-weld status. Depressing the POWER switch OFF push button will shut the welding power source down.

**IMPORTANT:** After any interruption of primary power, the POWER switch ON push button must be depressed to reenergize the welding power source.

**4-2. VOLTAGE ADJUSTMENT CONTROL (Figure 4-1)**



The VOLTAGE ADJUSTMENT control provides a means of selecting the desired voltage within the range of the welding power source. Rotating the control in a

clockwise direction increases the load voltage. The scale surrounding the VOLTAGE ADJUSTMENT control is calibrated in dc volts.

**IMPORTANT:** The VOLTAGE control can be adjusted while welding.

**4 - 3. REMOTE VOLTAGE CONTROL SWITCH (Figure 4-1)**

**REMOTE VOLTAGE**

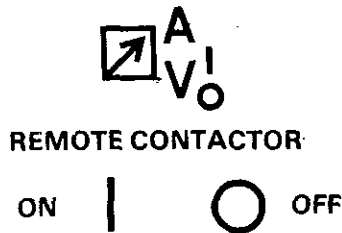


If remote voltage control is desired, place the REMOTE VOLTAGE control switch in the ON position. The Remote Voltage Control will adjust output over the full range of the welding power source.

If remote voltage control is not desired, place the REMOTE VOLTAGE control switch in the OFF position

**IMPORTANT:** If the welding application warrants such usage, this receptacle can also function as the Contactor Control receptacle by employing the appropriate switch (control) and placing the REMOTE CONTACTOR control switch in the ON position.

#### 4 - 4. REMOTE CONTACTOR CONTROL SWITCH (Figure 4-1)



**WARNING:** ELECTRIC SHOCK can kill.

- Keep the welding gun and work clamp electrically isolated when not welding.

If remote contactor control is desired, place the REMOTE CONTACTOR control switch in the ON position. Open-circuit voltage is present at the weld output terminals when the gun switch is closed.

If remote contactor control is not desired, place the REMOTE CONTACTOR control switch in the OFF position. Open-circuit voltage will be available whenever the POWER switch is in the ON position.

**4 - 5. METERS (Figure 4-1)** - The meters are provided to monitor the welding operation and serve as an indication of the welding process. They are not intended for exact current or voltage measurements. The voltmeter is internally connected to the welding power source output terminals. The voltmeter will indicate the voltage at the weld output terminals, but will not necessarily indicate the actual voltage at the welding arc (due to cable resistance, poor connections, etc.). The ammeter indicates output current of the unit.

## 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.

**4 - 6. FOLDBACK CIRCUIT OPERATION** - The foldback circuit is designed to prevent SCR failure caused by sustained short-circuit conditions. This circuitry will automatically reduce the output until the short-circuit condition is removed, at which time normal unit operation will automatically resume. The circuitry will not affect normal operation of the welding power source.

**4 - 7. OVERLOAD PROTECTION** - This unit is equipped with normally-closed thermostats TP1 and TP2 located on the main transformer and wired in series with the main contactor W coil. Should overheating of the main transformer occur, the thermostat(s) would open dropping out the main contactor and thereby suspending all weld output. A cooling period would then be needed before resuming operation.

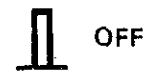
#### 4 - 8. 115 VOLTS AC DUPLEX RECEPTACLE (Figure 4-1)



The 115 V 15A AC duplex receptacle provides up to 15 amperes ac power for operating accessory equipment.

#### 4 - 9. OVERLOAD BREAKER (Figure 4-1)

OVERLOAD BREAKER



The 115 volts auxiliary power circuitry is protected by an overload breaker CB1. Should an overload condition occur at either of the 115 VOLTS AC receptacles, the overload breaker would open and suspend all output to these receptacles. It would then be necessary to manually depress the overload breaker to reset it.

**WELDING WIRE** can cause puncture wounds.

- Do not point gun toward any part of the body or other personnel.

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

#### 5 - 1. GAS METAL-ARC WELDING

1. Install the unit as instructed in Section 3.
2. Place the REMOTE CONTACTOR control switch in the desired position (see Section 4-4).

**IMPORTANT:** Place the REMOTE CONTACTOR control switch in the OFF position for the Air-Carbon-Arc Gouging process.



3. Place the REMOTE VOLTAGE control switch in the desired position.
4. Rotate the VOLTAGE ADJUSTMENT control to the desired position.
5. Turn on shielding gas supply.
6. Place the Line Disconnect Switch in the ON position.
7. Depress the POWER switch ON push button (see Section 4-1).

8. Begin welding.

## 5 - 2. SHUTTING DOWN

1. Stop welding.
2. Depress the POWER switch OFF push button.
3. Turn off the shielding gas supply at the source.

**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 unit down and disconnect from line 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.

**MOVING PARTS can cause serious injury.**

- Keep clear of moving parts.

**HOT SURFACES can cause severe burns.**

- Allow cooling period before servicing.

Troubleshooting of internal parts to be performed only by qualified persons.

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

**6 - 1. FAN MOTOR** - This unit is equipped with an exhaust fan and relies on forced draft for adequate cooling. The fan motor is manufactured with lifetime sealed bearings and requires no maintenance.

**6 - 2. INTERNAL CLEANING** - Occasional blowing out or vacuuming of the dust and dirt from around the internal components is recommended. This should be done periodically depending on the location of the unit and the amount of dust and dirt in the atmosphere. The welding power source outer enclosure should be removed and a clean, dry airstream or vacuum suction should be used for this cleaning operation.

**6 - 3. WELD CABLES** - Periodically inspect cables for breaks in insulation and ensure that all connections are clean and tight. Repair or replace cables as necessary. Clean and tighten connections periodically.

**6 - 4. OUTPUT FILTER CAPACITOR BANK PROTECTION** - The filter capacitor bank in the secondary circuit is protected by a fuse F1, located on the base behind the right side panel. The fuse opens under unbalanced or single-phase primary input conditions. If the fuse opens, arc conditions for short circuit transfer welding become erratic.

**6 - 5. CIRCUIT BOARD PROTECTION** - Circuit card PC1 is protected by fuses F2, F3, F4, F5 and F6, located on the center baffle. If fuses F2 and/or F3 open, weld output stops completely. If fuses F4, F5 or F6 open, weld output becomes erratic.

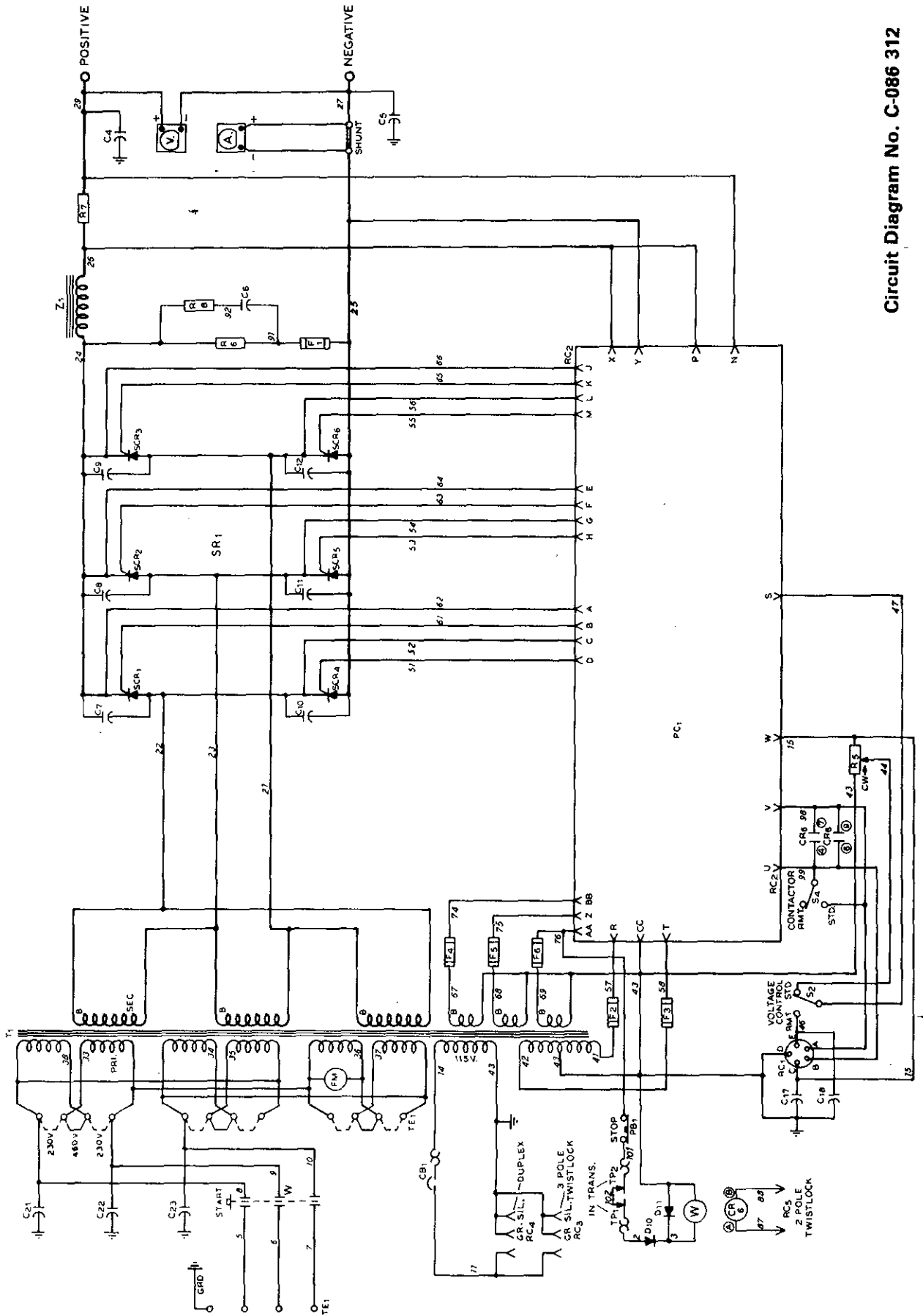
**6 - 6. TROUBLESHOOTING** - It is assumed that the unit was properly installed according to Section 3 of this manual, the operator is familiar with the function of controls, the welding power source was working properly, and that the trouble is not related to the welding process.

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

Use this chart in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

TROUBLE	PROBABLE CAUSE	REMEDY
Completely inoperative.	Open line fuse(s).	Replace open line fuse(s).
	POWER switch.	Replace switch.
	Poor and/or improper input connections.	Refer to Section 3-6 for proper input connections.
	Main transformer T1 overheating.	Allow unit to cool down. See Section 4-7.
No weld output; fan inoperative.	Poor electrical input and/or primary connections.	Check electrical input and/or primary connections at the primary terminal board TE1.
	Improper electrical input and/or output connections.	Refer to Sections 3-6 and 3-2 for proper electrical input and output connections.
	CONTACTOR switch S4 in ON position without a remote contactor control connected to the welding power source.	If remote contactor control is not desired, place S4 in the OFF position. If remote contactor control is desired, retain S4 in the ON position and make remote contactor control connections as instructed in Section 3-4.
	Fuse F2 and/or F3 open.	*Replace F2 and/or F3 (see Section 6-5).
	Printed circuit card PC1 inoperative or loose in edge connector.	Check PC1 connection. If PC1 loose in connector, tighten. If PC1 inoperative, replace.
Limited output and low open-circuit voltage.	Operation on single-phase. Open line fuse on one phase.	Check incoming three-phase power for correct voltage. Replace fuse if open.
	Input voltage jumper links connected for incorrect input voltage.	See Figure 3-1 or input voltage label.
	Poor and/or improper input and/or output connections.	Refer to Section 3-6 and 3-2 for proper input and output connections.
Erratic weld current.	Incorrect welding cable size.	Use proper size and type of cable. See Section 3-2.
	Loose welding cable connection.	Tighten all welding connections.
	Improper wire feeding set-up.	See INSTALLATION Section in Wire Feeder Owner's Manual.
	SCR in main rectifier SR1.	Replace SCR.
	Fuse F4, F5 or F6 open.	*Replace F4, F5 and/or F6 (see Section 6-5).
	PC1 card.	Replace PC1.
	Fuse F1 open.	*Replace F1 (see Section 6-4).
High weld output; VOLTAGE CONTROL does not vary output.	Printed circuit card PC1 inoperative or loose in edge connector.	Check PC1 connection. If PC1 loose in connector, tighten. If PC1 inoperative, replace.
No output at 115 VOLTS AC receptacle RC3 and RC4.	OVERLOAD BREAKER CB1 open.	Reset CB1.

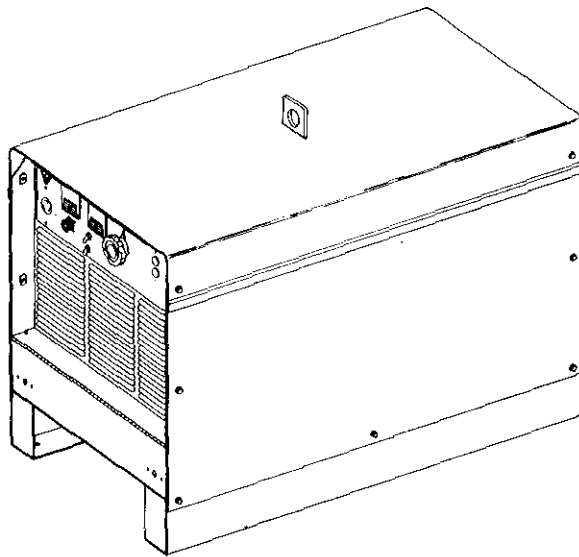
\*Be Sure Replacement Fuse Is Same Size, Type, And Rating.



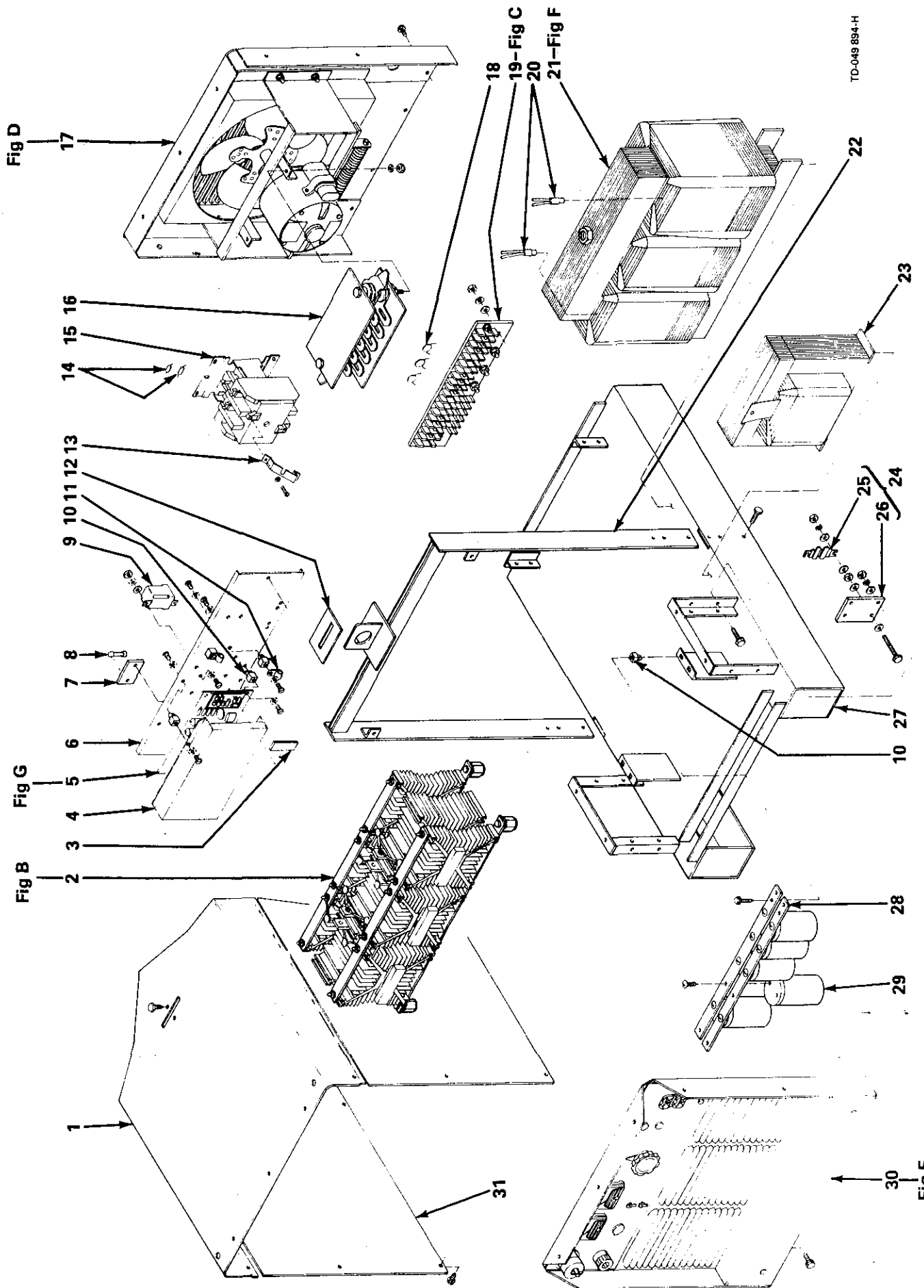
Circuit Diagram No. C-086 312

Figure 6 - 1. Circuit Diagram For Welding Power Source





# PARTS LIST



TD-049 894-H

Figure A - Main Assembly

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				450 Amp	650 Amp
<b>Figure A Main Assembly</b>					
1		006 017	COVER, top	1	
1		005 194	COVER, top		1
2	SR1	092 709	RECTIFIER, SCR main (Fig B Pg 3)	1	
2	SR1	092 617	RECTIFIER, SCR main (Fig B Pg 3)		1
3	RC2	081 380	HOUSING, connector - edge 14 pin	1	1
4		049 361	COVER, circuit card	1	1
5	PC1	083 480	CIRCUIT CARD, control (Fig G Pg 8)	1	
5	PC1	083 481	CIRCUIT CARD, control (Fig G Pg 8)		1
6		049 227	PANEL, mounting - component	1	1
7		082 976	HOLDER, fuse-miniature	1	1
8	F2-6	*012 633	FUSE, miniature-glass 1 amp	5	5
9	CR6	059 266	RELAY, enclosed 120 volts ac DPDT w/flange	1	1
10		080 509	GROMMET, screw 8/10	9	9
11		010 143	CLAMP, 3/8 dia	2	2
12		026 627	GASKET, lifting eye	1	
13		081 016	BRACKET, mounting - cable contactor	1	
13		049 014	BRACKET, mounting - cable contactor		1
14	D10,11	082 456	DIODE, 3 amp 600 volts	1	1
15	W	009 859	CONTACTOR, 50A 3P 120V w/no interlock (consisting of)	1	
		028 982	. COIL, 120 volts	1	
		*003 567	. KIT, contact point	1	
15	W	049 008	CONTACTOR, 75A 3P 600V (consisting of)		1
		003 710	. COIL, 120 volts ac		1
16	R7	086 661	RESISTOR, grid	1	1
17		Figure D	PANEL, rear - w/components (Pg 4)	1	1
18	C21-23	091 141	CAPACITOR, ceramic 0.0022 uf 6000 volts dc	3	3
19	TE1	038 145	TERMINAL ASSEMBLY, primary (Fig C Pg 4)(dual voltage)	1	1
19	TE1	038 126	TERMINAL ASSEMBLY, primary (Fig C Pg 4)(triple voltage)	1	1
20	TP1,2	026 181	THERMOSTAT, NC	2	2
21	T1	**See Note	TRANSFORMER, power - main (Fig F Pg 7)	1	1
		048 930	BUS BAR, connecting - transformer		1
23	Z1	047 695	STABILIZER	1	
23	Z1	047 720	STABILIZER		1
24	F1	092 740	PANEL, fuse (consisting of)	1	1
25		086 042	. FUSE, link 400A 250V	1	1
26		092 724	. STRIP, mtg-fuse	1	1
27		091 054	BASE	1	
27		091 215	BASE		1
28		085 527	BUS BAR, connecting - capacitors	2	2
29	C6	085 273	CAPACITOR, electrolytic 16000 uf 60 volts dc	6	6
30		Figure E	PANEL, front - w/components (Pg 6)	1	1
31		006 016	PANEL, side	2	
31		005 195	PANEL, side		2

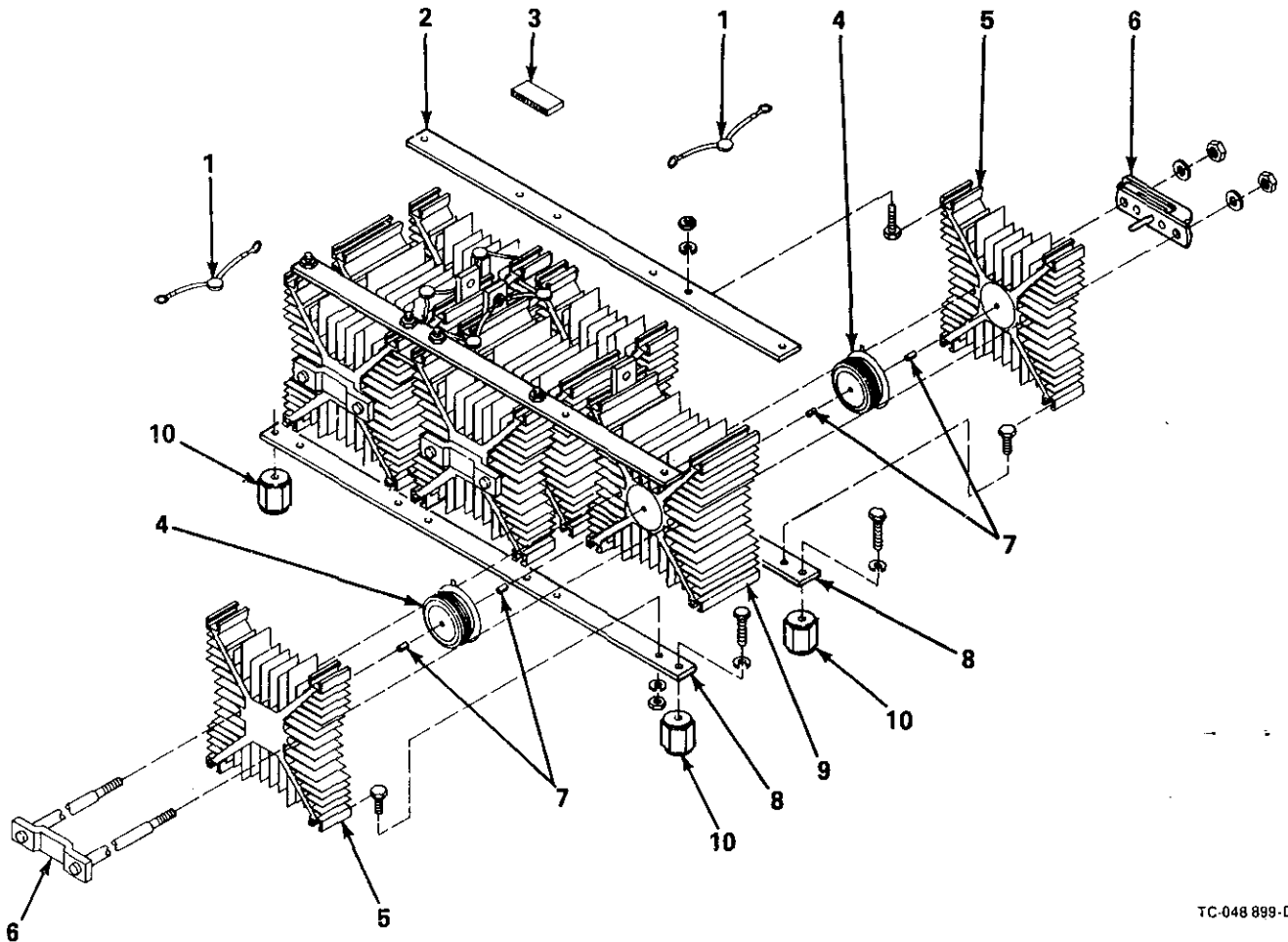
\*Recommended Spare Parts.

\*\*Replace at Factory or Factory Authorized Service Station.

Note: When ordering these items be sure to provide voltage of the unit.

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

Item No.	Dia. Mkgs.	Part No.	Description	Quantity Models	
				450 Amp	650 Amp
<b>Figure B</b>			<b>Rectifier, SCR Main (Fig A Pg 2 Item 2)</b>	092 709	092 617
1	C7-12	048 420	CAPACITOR, ceramic 0.01 uf 500 volts dc	6	6
2		082 852	BUS BAR, output	2	2
3		081 379	HOUSING, connector-edge 12 pin	1	1
4	SCR1-6	048 736	THYRISTOR, SCR 300 amp 200 volts	6	
4	SCR1-6	046 996	THYRISTOR, SCR 470 amp 300 volts		6
5		048 779	HEAT SINK	6	
5		048 373	HEAT SINK		6
6		082 694	CLAMP, thyristor	1	
6		082 693	CLAMP, thyristor		1
7		028 516	PIN, spring 1/8 x 1/4	12	12
8		091 582	BAR, mtg-rectifier	2	2
9		048 777	HEAT SINK	3	
9		048 375	HEAT SINK		3
10		026 947	INSULATOR, stand-off 1 inch x 1/4-20	4	4



TC-048 899-D

Figure B - Rectifier, SCR Main

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



Item No.	Part No.	Description	Quantity	
<b>Figure C</b>	<b>Terminal Assembly, Primary (Fig A Pg 2 Item 19)</b>		038 145	038 126
1	601 835	NUT, hex-regular 10-32	24	46
2	038 058	TERMINAL BOARD	1	1
3	038 887	STUD, w/hex-collar 10-32 x 1-3/8	12	23
4	010 913	WASHER, flat-brass 3/16 ID x 1/2 OD	12	23
5	038 618	LINK, jumper	6	7
6	601 836	NUT, jam 1/4-20	6	6
7	010 915	WASHER, flat-brass 1/4 ID x 5/8 OD	6	6
8	038 888	STUD, w/hex-collar 1/4-20 x 1-1/2	3	3

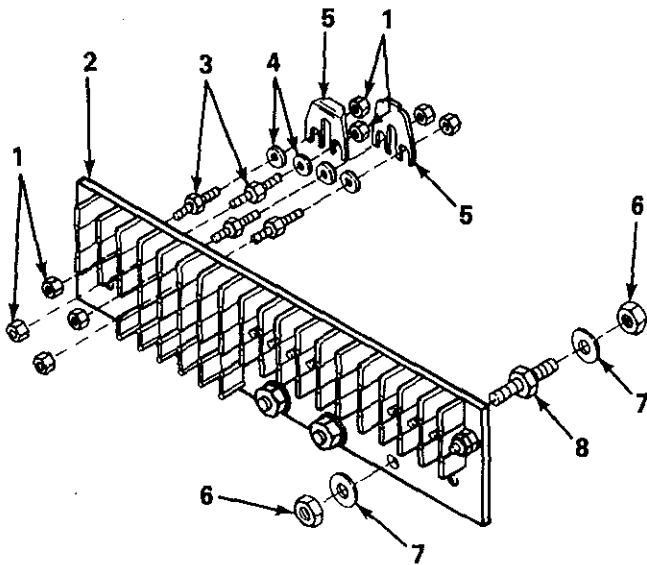


Figure C - Terminal Assembly, Primary

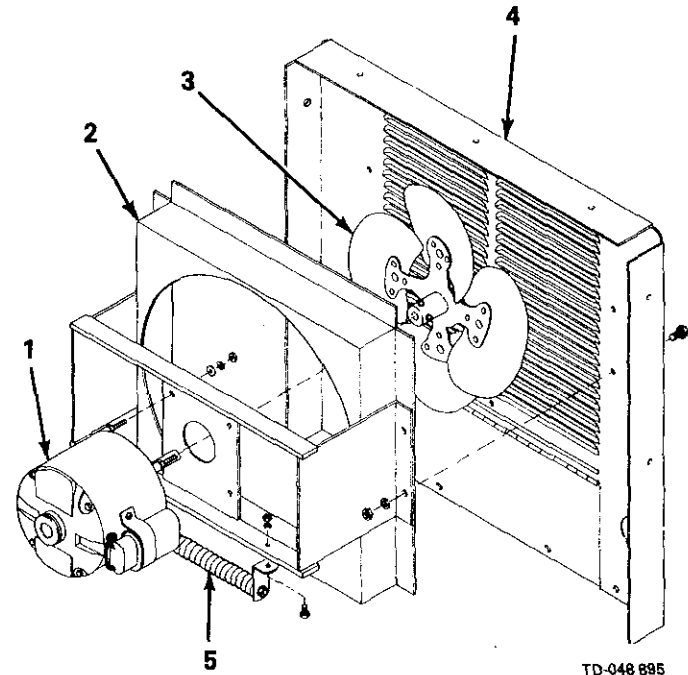


Figure D - Panel, Rear - W/Components

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				450 Amp	650 Amp
<b>Figure D</b>	<b>Panel, Rear - W/Components (Fig A Pg 2 Item 17)</b>				
1	FM	032 603	MOTOR, fan 230 volts (consisting of)	1	
		024 601	. BEARING	2	
1	FM	032 605	MOTOR, cap - single pole 1/4 hp 230 volts ac		1
2		047 718	CHAMBER, plenum	1	
2		082 332	CHAMBER, plenum		1
3		032 604	BLADE, fan 60 hz 14 inch 3 wing 19 degree	1	
3		605 799	BLADE, fan 60 hz 14 inch 5 wing 30 degree		1
4		018 144	PANEL, rear	1	1
5	R6	028 840	RESISTOR, WW adj 300 watt 5 ohm	1	1

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

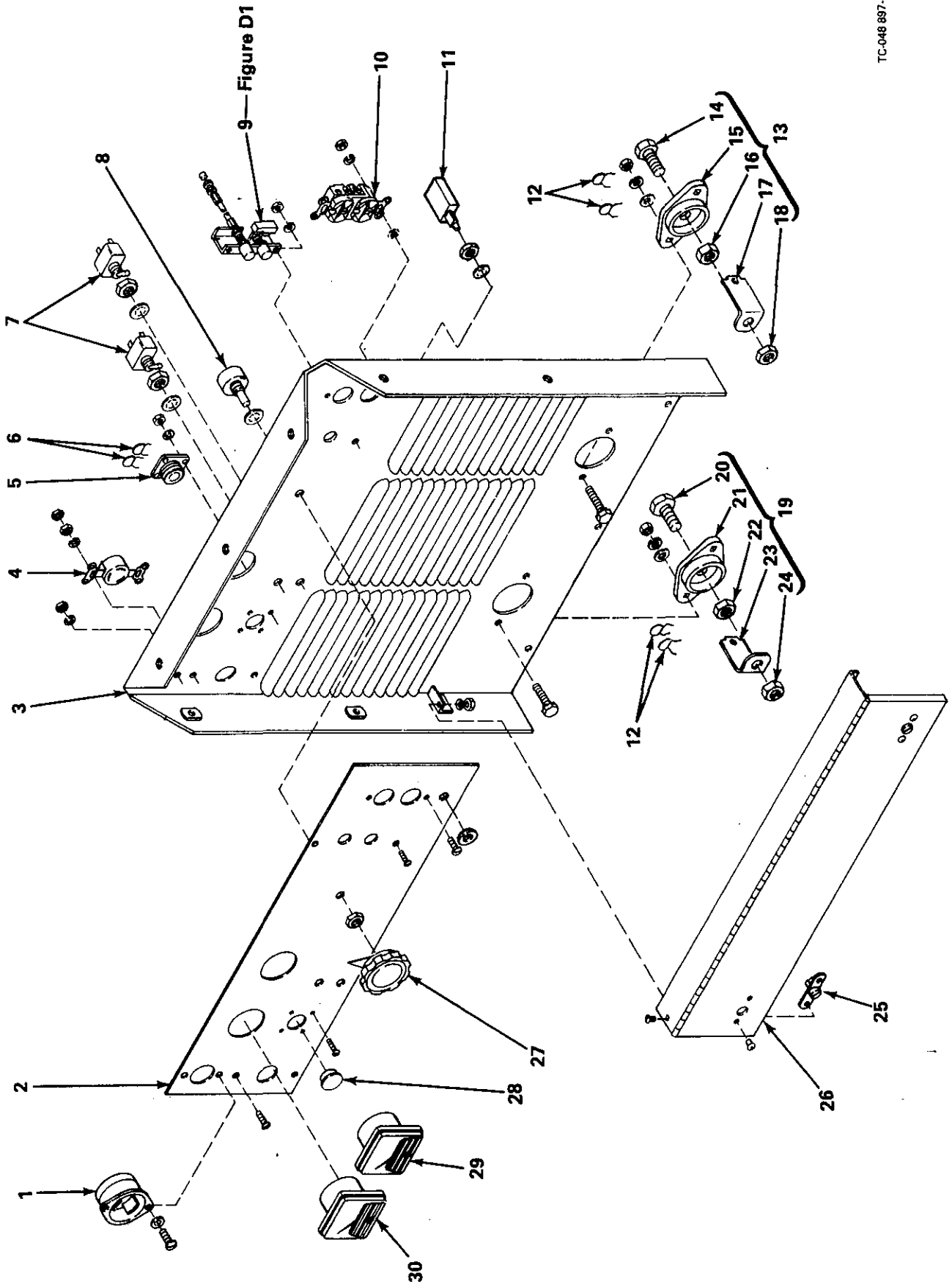


Figure E - Panel, Front - W/Components

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				450 Amp	650 Amp
<b>Figure E Panel, Front - W/Components (Fig A Pg 2 Item 30)</b>					
1	RC5	039 634	RECEPTACLE, twistlock - flange 2P2W 20 amp 250 volts . . . . .	1	1
2			NAMEPLATE (order by model and serial numbers) . . . . .	1	1
3		084 675	PANEL, front . . . . .	1	1
4	RC3	039 686	RECEPTACLE, twistlock grounded 2P3W 15 amp 277 volts . . . . .	1	1
5	RC1	035 523	RECEPTACLE, 5 socket MS-3102A-16S-8S . . . . .	1	1
6	C17,18	097 749	CAPACITOR, ceramic 0.5 uf 500 volts dc . . . . .	2	2
7	S2,4	011 609	SWITCH, toggle SPDT 15 amp 125 volts . . . . .	2	2
8	R5	072 462	POTENTIOMETER, 1 turn 2 watt 1000 ohm (consisting of) . . . . .	1	1
		072 590	. LOCK, shaft - potentiometer . . . . .	1	1
9	PB1	046 746	SWITCH, push button (Fig E1 Pg 7) . . . . .	1	
9	PB1	046 745	SWITCH, push button (Fig E1 Pg 7) . . . . .		1
10	RC4	604 176	RECEPTACLE, straight - duplex grounded 2P3W 15 amp 125 volts . . . . .	1	1
11	CB1	053 283	CIRCUIT BREAKER, manual reset 1P 15 amp 250 volts . . . . .	1	1
12	C4,5	087 337	CAPACITOR, ceramic 0.003 uf 3000 volts dc . . . . .	2	2
13	NEG	039 046	TERMINAL, power output (consisting of) . . . . .	1	1
14		601 976	. SCREW, cap - hex hd 1/2-13 x 1-1/2 . . . . .	1	1
15		039 045	. TERMINAL BOARD, black . . . . .	1	1
16		601 880	. NUT, hex - jam 1/2-13 . . . . .	1	1
17		039 044	. BUS BAR . . . . .	1	1
18		601 879	. NUT, hex - full 1/2-13 . . . . .	1	1
19	Pos	039 047	TERMINAL, power output (consisting of) . . . . .	1	1
20		601 976	. SCREW, cap - hex hd 1/2-13 x 1-1/2 . . . . .	1	1
21		039 049	. TERMINAL BOARD, red . . . . .	1	1
22		601 880	. NUT, hex - jam 1/2-13 . . . . .	1	1
23		039 044	. BUS BAR . . . . .	1	1
24		601 879	. NUT, hex - full 1/2-13 . . . . .	1	1
25		605 583	CATCH, spring loaded - door . . . . .	2	2
26		+ 027 408	DOOR, access - front . . . . .	1	1
		047 497	LABEL, general precautionary . . . . .	1	1
27		019 627	KNOB, pointer (R5) . . . . .	1	1
28		039 684	CAP, dust - connector . . . . .	1	1
29	A	025 103	METER, amp dc 50 MV 0-600 scale . . . . .	1	
29	A	059 118	METER, amp dc 50 MV 0-800 scale . . . . .		1
30	V	025 637	METER, volt dc 0-50 scale . . . . .	1	
30	V	025 638	METER, volt dc 0-100 scale . . . . .		1

+ When ordering a component originally displaying a precautionary label, the label should also be ordered.  
**BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.**

Item No.	Part No.	Description	Quantity	
			450 Amp	650 Amp
<b>Figure E1 Switch, Push Button (Fig E Pg 6 Item 9)</b>			046 746	046 745
1	059 885	BUTTON, push - reset red	1	1
2	018 606	SPRING, compression	1	1
3	045 546	PUSH BUTTON SET, w/cable & housing	1	
3	044 713	PUSH+BUTTON SET, w/cable & housing		1
4	081 008	BRACKET, mounting	1	1
5	027 878	SWITCH, limit - leaf actuating	1	1

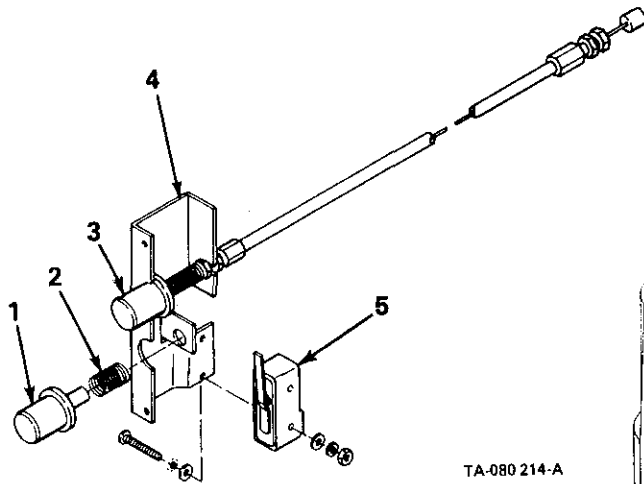
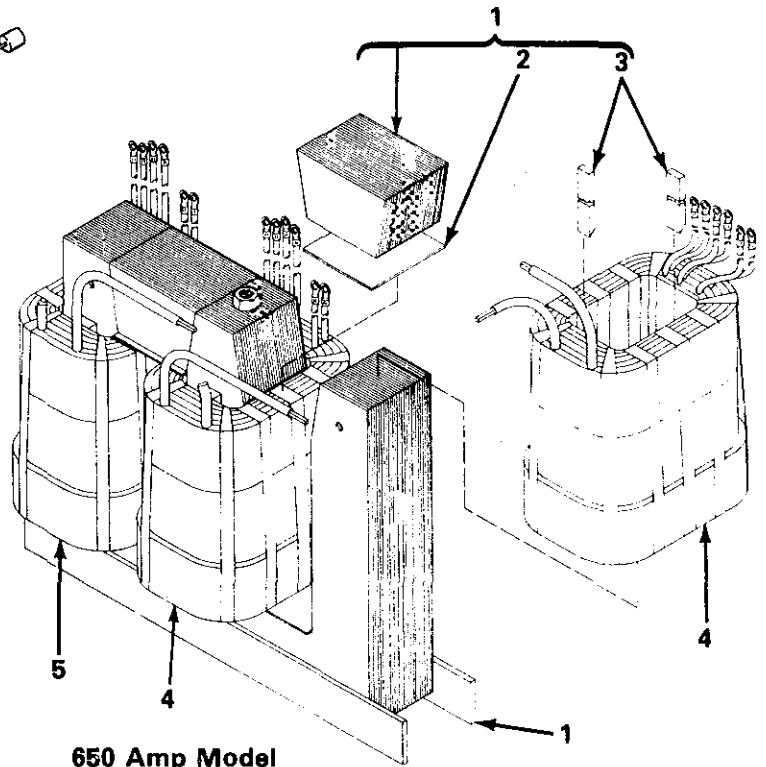


Figure E1 - Switch, Push Button



650 Amp Model Illustrated

Figure F - Transformer, Power - Main

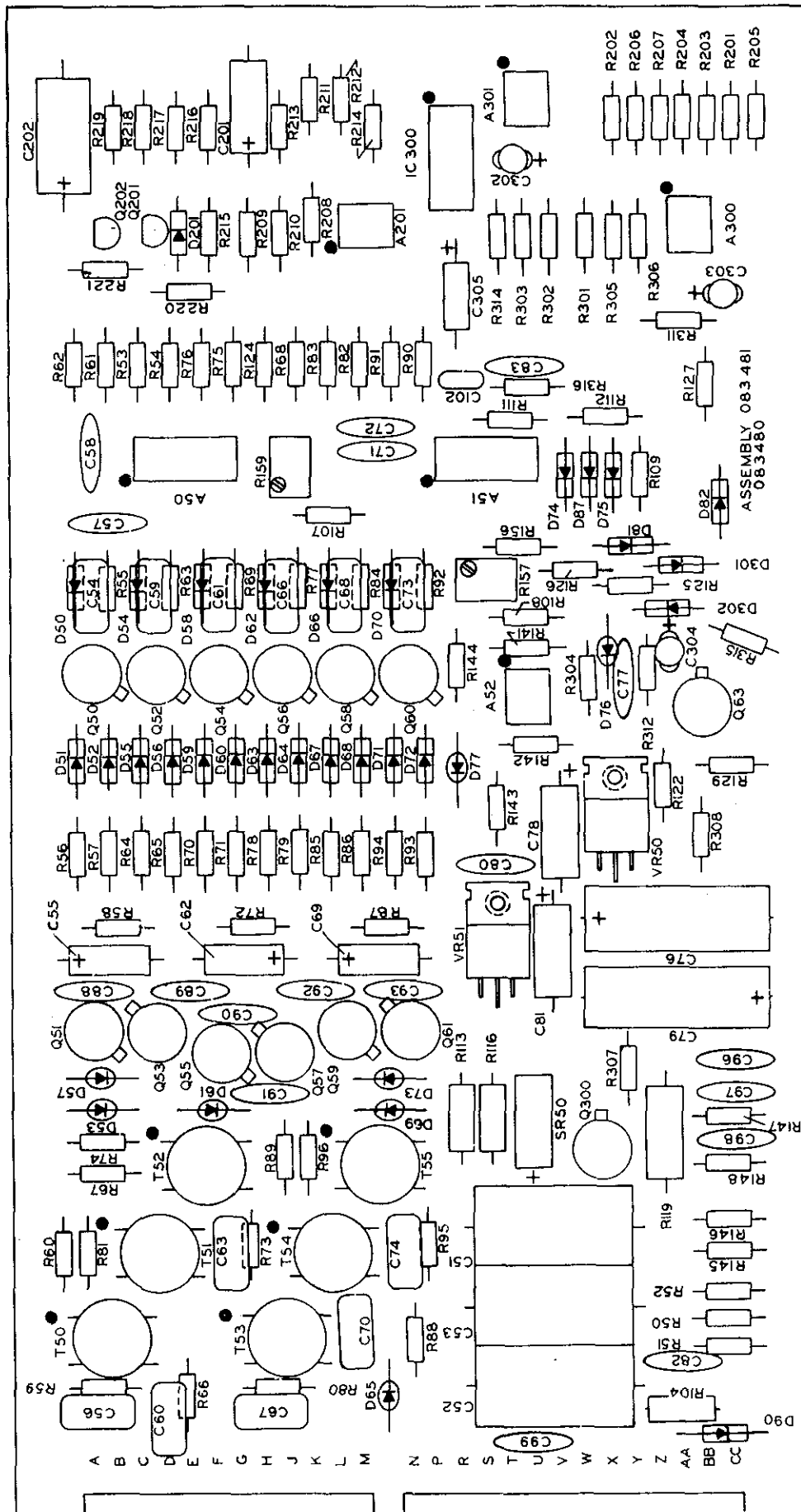
Item No.	Part No.	Description	Quantity	
			450 Amp	650 Amp
<b>Figure F Transformer, Power - Main (Fig A Pg 2 Item 21)</b>				
1	**049 888	TRANSFORMER SUBASSEMBLY (consisting of)	1	
1	**084 071	TRANSFORMER SUBASSEMBLY (consisting of)		1
2	028 175	. STRIP, 1/16 x 4 x 5	4	
2	049 294	. STRIP, 1/16 x 3-11/16 x 4		4
3	020 516	. WEDGE, 1/2 x 1 x 6	6	
3	035 026	. WEDGE, 1/2 x 1 x 9-1/2		6
4	**See Note	COIL, primary/secondary	2	
5	**See Note	COIL, primary/secondary		1

\*\*Replace At Factory Or Factory Authorized Service Station.

Note: When ordering these items be sure to provide primary voltage of the unit.

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

Dia. Mkgs.	Part No.	Description	Quantity	
			450 Amp	650 Amp
<b>Figure G</b>		<b>Circuit Card, Control (Fig A Pg 2 Item 5)</b>	083 480	083 481
A50,51	052 133	IC, linear 4136 .....	2	2
A52	-035 845	IC, linear 307 .....	1	1
A201,300,301	009 159	IC, linear 358 .....	3	3
C51-53	035 834	CAPACITOR, metalized - film 1.5 uf 100 volts .....	3	3
C54,56,59-61,63, 66-68,70,73,74	035 833	CAPACITOR, mylar 0.033 uf 100 volts dc .....	12	12
C55,62,69	035 835	CAPACITOR, electrolytic 4.7 uf 35 volts .....	3	3
C57,58,71,72,77, 80,82,96	053 991	CAPACITOR, ceramic 0.5 uf 500 volts .....	8	8
C76,79	000 859	CAPACITOR, electrolytic 220 uf 35 volts dc .....	2	2
C78,81,201	007 742	CAPACITOR, electrolytic 10 uf 35 volts .....	3	3
C83,88-93,97-99	059 122	CAPACITOR, ceramic 0.01 uf 500 volts .....	10	10
C102	003 530	CAPACITOR, ceramic 1 uf 50 volts .....	1	1
C202	072 935	CAPACITOR, electrolytic 33 uf 35 volts dc .....	1	1
C302-304	072 130	CAPACITOR, tantalum 1 uf 35 volts dc .....	3	3
C305	031 677	CAPACITOR, tantalum 5.6 uf 35 volts dc .....	1	1
D50-52,54-56, 58-60,62-64,66-68, 70-72,74,75,81,82, 87,201,301,302	028 351	DIODE, signal 0.2 amp 75 volts SP .....	26	26
D53,57,61,65, 69,73,76,77	026 202	DIODE, rectifier 1 amp 400 volts SP .....	8	8
D90	028 293	DIODE, zener 6.2 volts 1 watt .....	1	1
IC300	008 968	IC, interface 200 .....	1	1
Q50,52,54,56,58,60 Q51,53,55,57,59, 61,300	037 277	TRANSISTOR, 200MA 30 volts NPN .....	6	6
Q63	035 842	TRANSISTOR, 6 amp 40 volts PNP .....	7	7
Q201	000 088	TRANSISTOR, 800MA 40 volts NPN .....	1	1
Q202	037 200	TRANSISTOR, 200MA 40 volts NPN .....	1	1
R50-52,111,112	037 201	TRANSISTOR, 200MA 40 volts PNP .....	1	1
R53,54,61,62,68, 75,76,82,83,90, 91,124,141-146	000 885	RESISTOR, carbon film 0.25 watt 10K ohm .....	5	5
R55,63,69,77,84, 92,108,216,218	035 884	RESISTOR, carbon film 0.25 watt 100K ohm .....	18	18
R56,64,70,78,85, 93,129,217,219, 305	035 826	RESISTOR, carbon film 0.25 watt 6800 ohm .....	9	9
R56,64,70,78,85, 93,129,215,217, 219,305	035 827	RESISTOR, carbon film 0.25 watt 10K ohm .....	10	11
R57,65,71,79,86,94	035 827	RESISTOR, carbon film 0.25 watt 10K ohm .....	6	6
R58,72,87	035 825	RESISTOR, carbon film 0.25 watt 1K ohm .....	6	6
R59,66,73,80,88,95	035 823	RESISTOR, carbon film 0.25 watt 100 ohm .....	3	3
R60,67,74,81,89,96	035 824	RESISTOR, carbon film 0.25 watt 270 ohm .....	6	6
R104	605 919	RESISTOR, carbon 0.25 watt 47 ohm .....	6	6
R107,126,302	035 820	RESISTOR, carbon film 0.50 watt 470 ohm .....	1	1
R109	035 888	RESISTOR, carbon film 0.25 watt 2200 ohm .....	3	3
R113,116	039 332	RESISTOR, carbon film 0.25 watt 15K ohm .....	1	1
R119	030 089	RESISTOR, carbon 0.5 watt 2.7 ohm .....	2	2
	030 045	RESISTOR, WW fixed 3.25 watt 100 ohm .....	1	1



**COMPONENTS TO BE REPLACED  
BY QUALIFIED PERSONNEL ONLY**

Figure G - Circuit Card, Control

Dia. Mkgs.	Part No.	Description	Quantity	
			450 Amp	650 Amp
<b>Figure G</b>		<b>Circuit Card, Control (Fig A Pg 2 Item 5) (Cont'd.)</b>	083 480	083 481
R122	039 325	RESISTOR, carbon film 0.25 watt 82K ohm .....	1	1
R125,209	035 887	RESISTOR, carbon film 0.25 watt 3300 ohm .....	2	2
R127	039 329	RESISTOR, carbon film 0.25 watt 2700 ohm .....	1	1
R147,148,301	035 896	RESISTOR, carbon film 0.25 watt 33K ohm .....	3	3
R156,304,306-308,316	039 331	RESISTOR, carbon film 0.25 watt 4700 ohm .....	6	6
R157	009 172	POTENTIOMETER, cermet 20 turn 0.5 watt 50K ohm .....	1	1
R159	009 173	POTENTIOMETER, cermet 20 turn 0.5 watt 5K ohm .....	1	1
R201,205,214	044 789	RESISTOR, carbon film 0.25 watt 100K ohm .....	3	3
R202,206	052 139	RESISTOR, carbon film 0.25 watt 39K ohm .....	2	2
R203,204	072 559	RESISTOR, carbon film 0.25 watt 22K ohm .....	2	2
R207,208,303	072 561	RESISTOR, carbon film 0.25 watt 270K ohm .....	3	3
R210,315	039 334	RESISTOR, carbon film 0.25 watt 27K ohm .....	2	2
R211	072 560	RESISTOR, carbon film 0.25 watt 1K ohm .....	1	
R211	044 633	RESISTOR, carbon film 0.25 watt 1.2K ohm .....		1
R212	072 559	RESISTOR, carbon film 0.25 watt 22K ohm .....	1	
R212	072 677	RESISTOR, carbon film 0.25 watt 33K ohm .....		1
R213,221	044 634	RESISTOR, carbon film 0.25 watt 330 ohm .....	2	
R213,220	044 635	RESISTOR, carbon film 0.25 watt 680 ohm .....		2
R215,312	039 330	RESISTOR, carbon film 0.25 watt 3900 ohm .....	2	
R220	044 635	RESISTOR, carbon film 0.25 watt 680 ohm .....	1	
R311	003 272	RESISTOR, carbon film 0.25 watt 1 meg ohm .....	1	1
R312	039 330	RESISTOR, carbon film 0.25 watt 3900 ohm .....		1
R314	039 106	RESISTOR, carbon film 0.25 watt 470 ohm .....	1	1
SR50	035 841	RECTIFIER, integrated 1.5 amp 200 volts .....	1	1
T50-55	035 846	TRANSFORMER, pulse .....	6	6
VR50	081 832	REGULATOR, voltage 0.5 amp 15 volts .....	1	1
VR51	046 932	REGULATOR, voltage 15 volts 1.5 amp .....	1	1
	081 382	CONNECTOR, edge - 14 pin .....	1	1
	081 381	CONNECTOR, edge - 12 pin .....	1	1

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

