

TIGWAVE[®] 250 AC/DC
Transformer-Rectifier Welding Machine

For the Following Specs:

- 7114-1 200/230/460/575 V 60 Hz
- 7114A-1 200/230/460/575 V 60 Hz
- 7114-2 220/380/415/500 V 50/60 Hz
- 7114B-2 220/380/415/500 V 50/60 Hz
- 7114-3 220/380/415/500 V 50/60 Hz w/PF Capacitors
- 7114B-3 220/380/415/500 V 50/60 Hz w/PF Capacitors



OWNER'S MANUAL Number **430429-127**
Revised March 27, 1998

IMPORTANT: Read these instructions before installing, operating, or servicing this system.

THERMAL ARC INC., TROY, OHIO 45373-1085, U.S.A.

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CERTIFICATION NOTICE

DIAGRAMS

INTRODUCTION

How To Use This Manual

This Owner's Manual usually applies to just the underlined specification or part numbers listed on the cover. If none are underlined, they are all covered by this manual.

To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.

Throughout this manual, the words **WARNING**, **CAUTION**, and **NOTE** may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

WARNING gives information regarding possible personal injury. Warnings will be enclosed in a box such as this.

CAUTION refers to possible equipment damage. Cautions will be shown in bold type.

NOTE offers helpful information concerning certain operating procedures. Notes will be shown in italics.

Equipment Identification

The unit's identification number (specification or part number), model, and serial number usually appear on a nameplate attached to the control panel. In some cases, the nameplate may be attached to the rear panel. Equipment which does not have a control panel such as gun and cable assemblies are identified only by the specification or part number printed on the shipping container. Record these numbers for future reference.

Receipt Of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to Thermal Arc, Order Department, 2200 Corporate Drive, Troy, Ohio 45373-1085. Include all equipment identification numbers as described above along with a full description of the parts in error.

Move the equipment to the installation site before uncrating the unit. A lifting eye extends through the top of the cabinet on most equipment to facilitate handling with a hoist or crane. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.

WARNING: Falling machine due to lifting eye failure may cause death or serious injury.

- Lifting device may fail when overloaded.
- This lifting device is designed to lift the power source **ONLY**. If the machine is equipped with a trailer or accessories over 100 pounds, **DO NOT LIFT** by lifting eyes.
- Avoid sudden jerks, drops, or swinging.
- Check lifting device components visually for looseness and signs of metal fatigue.
- Before changing any hardware, check grade and size of bolts, and replace with bolts of equal or higher size and grade.

Additional copies of this manual may be purchased by contacting Thermal Arc at the address given above. Include the Owner's Manual number and equipment identification numbers.

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ARC WELDING SAFETY INSTRUCTIONS AND WARNINGS

WARNING

ARC WELDING can be hazardous.

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR. DO NOT LOSE THESE INSTRUCTIONS. READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld. Certain of the practices apply to equipment connected to power lines; other practices apply to engine driven equipment.

Safe practices are outlined in the American National Standard Z49.1 entitled: **SAFETY IN WELDING AND CUTTING**. This publication and other guides to what you should learn before operating this equipment are listed at the end of these safety precautions.

HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.

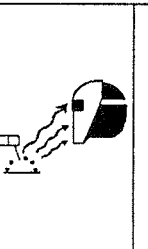


ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine before installing or servicing this equipment. Lock input power disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.

6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
7. Use fully insulated electrode holders. Never dip holder in water to cool it or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
8. Do not use worn, damaged, undersized, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Ground the workpiece to a good electrical (earth) ground.
11. Do not touch electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts at once.
13. In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.
14. Wear a safety harness to prevent falling if working above floor level.
15. Keep all panels and covers securely in place.



ARC RAYS can burn eyes and skin; NOISE can damage hearing.

Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Noise from some processes can damage hearing.


1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Use approved ear plugs or ear muffs if noise level is high.


Eye protection filter shade selector for welding or cutting (goggles or helmet), from AWS A6.2-73.


Welding or Cutting Operation	Electrode Size Metal Thickness or Welding Current	Filter Shade No.	Welding or Cutting Operation	Electrode Size Metal Thickness or Welding Current	Filter Shade No.
Torch soldering	—	2	Gas metal-arc welding (MIG)		
Torch brazing	—	3 or 4	Non-ferrous base metal	All	11
Oxygen cutting			Ferrous base metal	All	12
Light	Under 1 in., 25 mm	3 or 4	Gas tungsten arc welding (TIG)	All	12
Medium	1 to 6 in., 25-150 mm	4 or 5	Atomic hydrogen welding	All	12
Heavy	Over 6 in., 150 mm	5 or 6	Carbon arc welding	All	12
Gas welding			Plasma arc welding	All	12
Light	Under 1/8 in., 3 mm	4 or 5	Carbon arc air gouging		
Medium	1/8 to 1/2 in., 3-12 mm	5 or 6	Light		12
Heavy	Over 1/2 in., 12 mm	6 or 8	Heavy		14
Shielded metal-arc welding (stick) electrodes	Under 5/32 in., 4 mm	10	Plasma arc cutting		
	5/32 to 1/4 in., 4 to 6.4 mm	12	Light	Under 300 Amp	9
	Over 1/4 in., 6.4 mm	14	Medium	300 to 400 Amp	12
			Heavy	Over 400 Amp	14

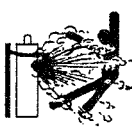
ARC WELDING SAFETY INSTRUCTIONS AND WARNINGS


Instruction 830001

	<p>FUMES AND GASES can be hazardous to your health.</p> <p>Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.</p>	<ol style="list-style-type: none">4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.7. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.
<ol style="list-style-type: none">1. Keep your head out of the fumes. Do not breath the fumes.2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.3. If ventilation is poor, use an approved air-supplied respirator.		

	<p>WELDING can cause fire or explosion.</p> <p>Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, hot work-piece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.</p>	<ol style="list-style-type: none">5. Watch for fire, and keep a fire extinguisher nearby.6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.7. Do not weld on closed containers such as tanks or drums.8. Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.9. Do not use welder to thaw frozen pipes.10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.11. Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
<ol style="list-style-type: none">1. Protect yourself and others from flying sparks and hot metal.2. Do not weld where flying sparks can strike flammable material.3. Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.		





	<p>FLYING SPARKS AND HOT METAL can cause injury.</p> <p>Chipping and grinding cause flying metal. As welds cool, they can throw off slag.</p>	<ol style="list-style-type: none">1. Wear approved face shield or safety goggles. Side shields recommended.2. Wear proper body protection to protect skin.
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	<p>CYLINDERS can explode if damaged.</p> <p>Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.</p>	<ol style="list-style-type: none">3. Keep cylinders away from any welding or other electrical circuits.4. Never allow a welding electrode to touch any cylinder.5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.6. Turn face away from valve outlet when opening cylinder valve.7. Keep protective cap in place over valve except when cylinder is in use or connected for use.8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.
<ol style="list-style-type: none">1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.		

<p>⚠ WARNING</p>		<p>ENGINES can be hazardous.</p>
	<p>ENGINE EXHAUST GASES can kill.</p> <p>Engines produce harmful exhaust gases.</p>	<ol style="list-style-type: none">1. Use equipment outside in open, well-ventilated areas.2. If used in a closed area, vent engine exhaust outside and away from any building air intakes.

ARC WELDING SAFETY INSTRUCTIONS AND WARNINGS

Instruction 830001

	<p>ENGINE FUEL can cause fire or explosion.</p> <p>Engine fuel is highly flammable.</p> <p>1. Stop engine before checking or adding fuel.</p>	<p>2. Do not add fuel while smoking or if unit is near any sparks or open flames.</p> <p>3. Allow engine to cool before fueling. If possible, check and add fuel to cold engine before beginning job.</p> <p>4. Do not overfill tank — allow room for fuel to expand.</p> <p>5. Do not spill fuel. If fuel is spilled, clean up before starting engine.</p>
	<p>MOVING PARTS can cause injury.</p> <p>Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.</p> <p>1. Keep all doors, panels, covers, and guards closed and securely in place.</p> <p>2. Stop engine before installing or connecting unit.</p>	<p>3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.</p> <p>4. To prevent accidental starting during servicing, disconnect negative (-) battery cable from battery.</p> <p>5. Keep hands, hair, loose clothing, and tools away from moving parts.</p> <p>6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.</p>
	<p>SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin.</p> <p>Batteries contain acid and generate explosive gases.</p>	<p>1. Always wear a face shield when working on a battery.</p> <p>2. Stop engine before disconnecting or connecting battery cables.</p> <p>3. Do not allow tools to cause sparks when working on a battery.</p> <p>4. Do not use welder to charge batteries or jump start vehicles.</p> <p>5. Observe correct polarity (+ and -) on batteries.</p>
	<p>STEAM AND PRESSURIZED HOT COOLANT can burn face, eyes, and skin.</p> <p>The coolant in the radiator can be very hot and under pressure.</p>	<p>1. Do not remove radiator cap when engine is hot. Allow engine to cool.</p> <p>2. Wear gloves and put a rag over cap area when removing cap.</p> <p>3. Allow pressure to escape before completely removing cap.</p>

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Sec. 25249.5 et seq.)

NOTE: Considerations About Welding And The Effects Of Low Frequency Electric And Magnetic Fields

The following is a quotation from the General Conclusions Section of the U.S. Congress, Office of Technology Assessment, Biological Effects of Power Frequency Electric & Magnetic Fields — Background Paper, OTA-BP-E-63 (Washington, DC: U.S. Government Printing Office, May 1989): "... there is now a very large volume of scientific findings based on experiments at the cellular level and from studies with animals and people which clearly establish that low frequency magnetic fields can interact with, and produce changes in, biological systems. While most of this work is of very high quality, the results are complex. Current scientific understanding does not yet allow us to interpret the evidence in a single coherent framework. Even more frustrating, it does not yet allow us to draw definite conclusions about questions of possible risk or to offer clear science-based advice on strategies to minimize or avoid potential risks."

To reduce magnetic fields in the workplace, use the following procedures:

- | | |
|---|---|
| 1. Keep cables close together by twisting or taping them. | 3. Do not coil or drape cables around the body. |
| 2. Arrange cables to one side and away from the operator. | 4. Keep welding power source and cables as far away from body as practical. |

About Pacemakers:

The above procedures are among those also normally recommended for pacemaker wearers. Consult your doctor for complete information.

PRINCIPAL SAFETY STANDARDS

Safety in Welding and Cutting, ANSI Standard Z49.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

Safety and Health Standards, OSHA 29 CFR 1910, from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWS F4.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, NFPA Standard 51B, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

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PRECAUTIONS DE SECURITE EN SOUDAGE A L'ARC

MISE EN GARDE

LE SOUDAGE A L'ARC EST DANGEREUX

PROTEGEZ-VOUS, AINSI QUE LES AUTRES, CONTRE LES BLESSURES GRAVES POSSIBLES OU LA MORT. NE LAISSEZ PAS LES ENFANTS S'APPROCHER, NI LES PORTEURS DE STIMULATEUR CARDIAQUE (A MOINS QU'ILS N'AIENT CONSULTE UN MEDECIN). CONSERVEZ CES INSTRUCTIONS. LISEZ LE MANUEL D'OPERATION OU LES INSTRUCTIONS AVANT D'INSTALLER, UTILISER OU ENTREtenir CET EQUIPEMENT.

Les produits et procédés de soudage peuvent sauser des blessures graves ou la mort, de même que des dommages au reste du matériel et à la propriété, si l'utilisateur n'adhère pas strictement à toutes les règles de sécurité et ne prend pas les précautions nécessaires.

En soudage et coupage, des pratiques sécuritaires se sont développées suite à l'expérience passée. Ces pratiques doivent être apprises par étude ou entraînement avant d'utiliser l'équipement. Toute personne n'ayant pas suivi un entraînement intensif en soudage et coupage ne devrait pas tenter de souder. Certaines pratiques concernent les équipements raccordés aux lignes d'alimentation alors que d'autres s'adressent aux groupes électrogènes.

La norme Z49.1 de l'American National Standard, intitulée "SAFETY IN WELDING AND CUTTING" présente les pratiques sécuritaires à suivre. Ce document ainsi que d'autres guides que vous devriez connaître avant d'utiliser cet équipement sont présentés à la fin de ces instructions de sécurité.

SEULES DES PERSONNES QUALIFIEES DOIVENT FAIRE DES TRAVAUX D'INSTALLATION, DE REPARATION, D'ENTRETIEN ET D'ESSAI.

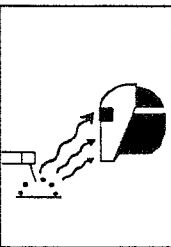


L'ELECTROCUTION PEUT ETRE MORTELLE.

Une décharge électrique peut tuer ou brûler gravement. L'électrode et le circuit de soudage sont sous tension dès la mise en circuit. Le circuit d'alimentation et les circuits internes de l'équipement sont aussi sous tension dès la mise en marche. En soudage automatique ou semi-automatique avec fil, ce dernier, le rouleau ou la bobine de fil, le logement des galets d'entraînement et toutes les pièces métalliques en contact avec le fil de soudage sont sous tension. Un équipement inadéquatement installé ou inadéquatement mis à la terre est dangereux.

1. Ne touchez pas à des pièces sous tension.
2. Portez des gants et des vêtements isolants, secs et non troués.
3. Isolez-vous de la pièce à souder et de la mise à la terre au moyen de tapis isolants ou autres.
4. Déconnectez la prise d'alimentation de l'équipement ou arrêtez le moteur avant de l'installer ou d'en faire l'entretien. Bloquez le commutateur en circuit ouvert ou enlevez les fusibles de l'alimentation afin d'éviter une mise en marche accidentelle.
5. Veuillez à installer cet équipement et à le mettre à la terre selon le manuel d'utilisation et les codes nationaux, provinciaux et locaux applicables.

6. Arrêtez tout équipement après usage. Coupez l'alimentation de l'équipement s'il est hors d'usage ou inutilisé.
7. N'utilisez que des porte-électrodes bien isolés. Ne jamais plonger les porte-électrodes dans l'eau pour les refroidir. Ne jamais laisser traîner par terre ou sur les pièces à souder. Ne touchez pas aux porte-électrodes raccordés à deux sources de courant en même temps. Ne jamais toucher quelqu'un d'autre avec l'électrode ou le porte-électrode.
8. N'utilisez pas de câbles électriques usés, endommagés, mal épissés ou de section trop petite.
9. N'enroulez pas de câbles électriques autour de votre corps.
10. N'utilisez qu'une bonne prise de masse pour la mise à la terre de la pièce à souder.
11. Ne touchez pas à l'électrode lorsqu'en contact avec le circuit de soudage (terre).
12. N'utilisez que des équipements en bon état. Réparez ou remplacez aussitôt les pièces endommagées.
13. Dans des espaces confinés ou mouillés, n'utilisez pas de source de courant alternatif, à moins qu'il soit muni d'un réducteur de tension. Utilisez plutôt une source de courant continu.
14. Portez un harnais de sécurité si vous travaillez en hauteur.
15. Fermez solidement tous les panneaux et les capots.



LE RAYONNEMENT DE L'ARC PEUT BRÛLER LES YEUX ET LA PEAU; LE BRUIT PEUT ENDOMMAGER L'OUÏE.

L'arc de soudage produit une chaleur et des rayons ultraviolets intenses, susceptibles de brûler les yeux et la peau. Le bruit causé par certains procédés peut endommager l'ouïe.

1. Portez une casque de soudeur avec filtre oculaire de nuance appropriée (consultez la norme ANSI Z49 indiquée ci-après)

pour vous protéger le visage et les yeux lorsque vous soudez ou que vous observez l'exécution d'une soudure.

2. Portez des lunettes de sécurité approuvées. Des écrans latéraux sont recommandés.
3. Entourez l'aire de soudage de rideaux ou de cloisons pour protéger les autres des coups d'arc ou de l'éblouissement; avertissez les observateurs de ne pas regarder l'arc.
4. Portez des vêtements en matériaux ignifuges et durables (laine et cuir) et des chaussures de sécurité.
5. Portez un casque antibruit ou des bouchons d'oreille approuvés lorsque le niveau de bruit est élevé.

PRECAUTIONS DE SECURITE EN SOUDAGE A L'ARC
Instruction 830002

SELECTION DES NUANCES DE FILTRES OCULAIRES POUR LA PROTECTION DES YEUX EN COUPAGE ET SOUDAGE
 (selon AWS A 8.2-73)

Opération de Coupage ou soudage	Dimension d'électrode ou Epaisseur de métal ou Intensité de courant	Nuance de de filtre oculaire
Brasage tendre au chalumeau	toutes conditions	2
Brasage fort au chalumeau	toutes conditions	3 ou 4
Oxycoupage		
mince	moins de 1 po. (25 mm)	2 ou 3
moyen	de 1 à 6 po. (25 à 150 mm)	4 ou 5
épais	plus de 6 po. (150 mm)	5 ou 6
Soudage aux gaz		
mince	moins de 1/8 po. (3 mm)	4 ou 5
moyen	de 1/8 à 1/2 po. (3 à 12 mm)	5 ou 6
épais	plus de 1/2 po. (12 mm)	6 ou 8
Soudage à l'arc avec électrode enrobées (SMAW)	moins de 5/32 po. (4 mm) de 5/32 à 1/4 po. (4 à 6.4 mm) plus de 1/4 po. (6.4 mm)	10 12 14
Soudage à l'arc sous gaz avec fil plein (GMAW)		
métaux non-ferreux	toutes conditions	11
métaux ferreux	toutes conditions	12
Soudage à l'arc sous gaz avec électrode de tungstène (GTAW)	toutes conditions	12
Soudage à l'hydrogène atomique (AHW)	toutes conditions	12
Soudage à l'arc avec électrode de carbone (CAW)	toutes conditions	12
Soudage à l'arc Plasma (PAW)	toutes dimensions	12
Gougeage Air-Arc avec électrode de carbone		
mince		12
épais		14
Coupage à l'arc Plasma (PAC)		
mince	moins de 300 ampères	9
moyen	de 300 à 400 ampères	12
épais	plus de 400 ampères	14



LES VAPEURS ET LES FUMÉES SONT DANGEREUSES POUR LA SANTÉ.

Le soudage dégage des vapeurs et des fumées dangereuses à respirer.

- Eloignez la tête des fumées pour éviter de les respirer.
- A l'intérieur, assurez-vous que l'aire de soudage est bien ventilée ou que les fumées et les vapeurs sont aspirées à l'arc.
- Si la ventilation est inadéquate, portez un respirateur à adduction d'air approuvé.
- Lisez les fiches signalétiques et les consignes du fabricant relatives aux métaux, aux produits consommables, aux revêtements et aux produits nettoyants.
- Ne travaillez dans un espace confiné que s'il est bien ventilé; sinon, portez un respirateur à adduction d'air. Les gaz protecteurs de soudage peuvent déplacer l'oxygène de l'air et ainsi causer des malaises ou la mort. Assurez-vous que l'air est propre à la respiration.
- Ne soudez pas à proximité d'opérations de dégraissage, de nettoyage ou de pulvérisation. La chaleur et les rayons de l'arc peuvent réagir avec des vapeurs et former des gaz hautement toxiques et irritants.
- Ne soudez des tôles galvanisées ou plaquées au plomb ou au cadmium que si les zones à souder ont été grattées à fond, que si l'espace est bien ventilé; si nécessaire portez un respirateur à adduction d'air. Car ces revêtements et tout métal qui contient ces éléments peuvent dégager des fumées toxiques au moment du soudage.



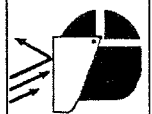
LE SOUDAGE PEUT CAUSER UN INCENDIE OU UNE EXPLOSION

L'arc produit des étincelles et des projections. Les particules volantes, le métal chaud, les projections de soudure et l'équipement surchauffé peuvent causer un incendie et des brûlures. Le contact accidentel de l'électrode ou du fil-électrode avec un

objet métallique peut provoquer des étincelles, un échauffement ou un incendie.

1. Protégez-vous, ainsi que les autres, contre les étincelles et du métal chaud.
2. Ne soudez pas dans un endroit où des particules volantes ou des projections peuvent atteindre des matériaux inflammables.
3. Enlevez toutes matières inflammables dans un rayon de 10,7 mètres autour de l'arc, ou couvrez-les soigneusement avec des bâches approuvées.

4. Méfiez-vous des projections brûlantes de soudage susceptibles de pénétrer dans des aires adjacentes par de petites ouvertures ou fissures.
5. Méfiez-vous des incendies et gardez un extincteur à portée de la main.
6. N'oubliez pas qu'une soudure réalisée sur un plafond, un plancher, une cloison ou une paroi peut enflammer l'autre côté.
7. Ne soudez pas un récipient fermé, tel un réservoir ou un baril.
8. Connectez le câble de soudage le plus près possible de la zone de soudage pour empêcher le courant de suivre un long parcours inconnu, et prévenir ainsi les risques d'électrocution et d'incendie.
9. Ne dégelez pas les tuyaux avec une source de courant.
10. Otez l'électrode du porte-électrode ou coupez le fil au tube-contact lorsqu'inutilisé après le soudage.
11. Portez des vêtements protecteurs non huileux, tels des gants en cuir, une chemise épaisse, un pantalon revers, des bottines de sécurité et un casque.



LES ETINCELLES ET LES PROJECTIONS BRULANTES PEUVENT CAUSER DES BLESSURES.

Le piquage et le meulage produisent des particules métalliques volantes. En refroidissant, la soudure peut projeter des éclats de laitier.

1. Portez un écran facial ou des lunettes protectrices approuvées. Des écrans latéraux sont recommandés.
2. Portez des vêtements appropriés pour protéger la peau.



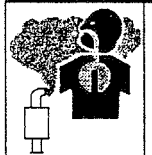
LES BOUTEILLES ENDOMMAGEES PEUVENT EXPLOSER

Les bouteilles contiennent des gaz protecteurs sous haute pression. Des bouteilles endommagées peuvent exploser. Comme les bouteilles font normalement partie du procédé de soudage, traitez-les avec soin.

1. Protégez les bouteilles de gaz comprimé contre les sources de chaleur intense, les chocs et les arcs de soudage.
2. Enchaînez verticalement les bouteilles à un support ou à un cadre fixe pour les empêcher de tomber ou d'être renversées.
3. Eloignez les bouteilles de tout circuit électrique ou de tout soudage.

4. Empêchez tout contact entre une bouteille et une électrode de soudage.
5. N'utilisez que des bouteilles de gaz protecteur, des détendeurs, des boyaux et des raccords conçus pour chaque application spécifique; ces équipements et les pièces connexes doivent être maintenus en bon état.
6. Ne placez pas le visage face à l'ouverture du robinet de la bouteille lors de son ouverture.
7. Laissez en place le chapeau de bouteille sauf si en utilisation ou lorsque raccordé pour utilisation.
8. Lisez et respectez les consignes relatives aux bouteilles de gaz comprimé et aux équipements connexes, ainsi que la publication P-1 de la CGA, identifiée dans la liste de documents ci-dessous.

MISE EN GARDE



LES GAZ D'ÉCHAPPEMENT DES MOTEURS PEUVENT ÊTRE MORTELS.

Les moteurs produisent des gaz d'échappement nocifs.

LES MOTEURS PEUVENT ÊTRE DANGEREUX

1. Utilisez l'équipement à l'extérieur dans des aires ouvertes et bien ventilées.
2. Si vous utilisez ces équipements dans un endroit confiné, les fumées d'échappement doivent être envoyées à l'extérieur, loin des prises d'air du bâtiment.



LE CARBURANT PEUT CAUSER UN INCENDIE OU UNE EXPLOSION.




Le carburant est hautement inflammable.

1. Arrêtez le moteur avant de vérifier le niveau de carburant ou de faire le plein.

2. Ne faites pas le plein en fumant ou proche d'une source d'étincelles ou d'une flamme nue.
3. Si c'est possible, laissez le moteur refroidir avant de faire le plein de carburant ou d'en vérifier le niveau au début du soudage.
4. Ne faites pas le plein de carburant à ras bord: prévoyez de l'espace pour son expansion.
5. Faites attention de ne pas renverser de carburant. Nettoyez tout carburant renversé avant de faire démarrer le moteur.

PRECAUTIONS DE SECURITE EN SOUDAGE A L'ARC

Instruction 830002

	DES PIÈCES EN MOUVEMENT PEUVENT CAUSER DES BLESSURES.	<ol style="list-style-type: none">3. Seules des personnes qualifiées doivent démonter des protecteurs ou des capots pour faire l'entretien ou le dépannage nécessaire.4. Pour empêcher un démarrage accidentel pendant l'entretien, débranchez le câble d'accumulateur à la borne négative.5. N'approchez pas les mains ou les cheveux de pièces en mouvement; elles peuvent aussi accrocher des vêtements amples et des outils.6. Réinstallez les capots ou les protecteurs et fermez les portes après des travaux d'entretien et avant de faire démarrer le moteur.
<p>Des pièces en mouvement, tels des ventilateurs, des rotors et des courroies peuvent couper doigts et mains, ou accrocher des vêtements amples.</p>	<ol style="list-style-type: none">1. Assurez-vous que les portes, les panneaux, les capots et les protecteurs soient bien fermés.2. Avant d'installer ou de connecter un système, arrêtez le moteur.	
	DES ÉTINCELLES PEUVENT FAIRE EXPLOSER UN ACCUMULATEUR; L'ELECTROLYTE D'UN ACCUMULATEUR PEUT BRÛLER LA PEAU ET LES YEUX.	<ol style="list-style-type: none">1. Portez toujours un écran facial en travaillant sur un accumulateur.2. Arrêtez le moteur avant de connecter ou de déconnecter des câbles d'accumulateur.3. N'utilisez que des outils anti-étincelles pour travailler sur un accumulateur.4. N'utilisez pas une source de courant de soudage pour charger un accumulateur ou survolter momentanément un véhicule.5. Utilisez la polarité correcte (+ et -) de l'accumulateur.
<p>Les accumulateurs contiennent de l'électrolyte acide et dégagent des vapeurs explosives.</p>	LA VAPEUR ET LE LIQUIDE DE REFROIDISSEMENT BRÛLANT SOUS PRESSION PEUVENT BRÛLER LA PEAU ET LES YEUX.	<ol style="list-style-type: none">1. N'ôtez pas le bouchon de radiateur tant que le moteur n'est pas refroidi.2. Mettez des gants et posez un torchon sur le bouchon pour l'ôter.3. Laissez la pression s'échapper avant d'ôter complètement le bouchon.
	<p>Le liquide de refroidissement d'un radiateur peut être brûlant et sous pression.</p>	

PRINCIPALES NORMES DE SECURITE

Safety in Welding and Cutting, norme ANSI Z49.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

Safety and Health Standards, OSHA 29 CFR 1910, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, norme AWS F4.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

National Electrical Code, norme 70 NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, document P-1, Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, norme CSA W117.2 Association canadienne de normalisation, Standards Sales, 276 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, norme ANSI Z87.1, American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, norme 51B NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

DESCRIPTION OF EQUIPMENT

Special consideration must be given to the design of a welding machine which will serve the requirements of the TIG welding process, because of certain inherent characteristics of that process. This Model TIGWAVE[®] 250 AC/DC welding machine has been designed and built with these requirements in mind. It will give long and satisfactory service, producing welds that are correct and sound, if it is installed properly, used correctly, and maintained well.

"Inert Gas Metal Arc Welding, Non-Consumable" is the descriptive name of the welding process whereby the arc is maintained between a non-consumable metal electrode (usually tungsten), and the

work. The arc zone must be shielded by an inert gas such as argon or helium. Various trade names, such as "Heliarc", "Heliweld", "Argonweld" (and perhaps others) are frequently used when referring to this particular process. For simplicity and uniformity, any reference to the process in this manual will be made by the term "TIG".

This process can be used for making clean, sound welds on most metals and alloys irrespective of their composition. In many instances, it provides the only suitable method of joining certain metals. Cleaning is reduced to a minimum and frequently is eliminated, both before and after welding.

ITEM	SPEC NO. 7114-1 & 7114A-1		SPEC NO. 7114-2 & 7114A-2		SPEC NO. 7114-3 & 7114A-3	
	<u>Nema Class II</u> (40)	<u>Nema Class I</u> (60)	<u>Nema Class II</u> (40)	<u>Nema Class I</u> (60)	<u>Nema Class II</u> (40)	<u>Nema Class I</u> (60)
Rated Output Amperage	250A	200A	250A	200A	250A	200A
Rated Output Voltage	30 V	28 V	30 V	28 V	30 V	28 V
Rated Duty Cycle	40%	60%	40%	60%	40%	60%
Rated Input Voltage	200/230/460/575V	200/230/460/575V	220/380/415/500V	220/380/415/500V	220/380/415/500V	220/380/415/500V
Rated Input Amperage	111/98/49/39	90/78/39/31	94/55/50/40	85/50/45/38	Caps. are std.	aps. are std.
Input kW	13.5 kW	8.5 kW	13 kW	8.5 kW	13 kW	8.5 kW
Input kVA	22 kVA	18 kVA	20 kVA	18.5 kVA	Caps. are std.	Caps. are std.
Rated Input Amperage with Capacitors	90/80/40/32	72/62/31/25	84/48/44/37	61/35/32/27	84/48/44/37	61/35/32/27
Input kVA with Capacitors	18 kVA	14.5 kVA	18 kVA	13.5 kVA	18 kVA	13.5 kVA
Input Frequency	60 Hz	60 Hz	50 Hz	50 Hz	50 Hz	50 Hz
Input Phase	Single	Single	Single	Single	Single	Single
Preflow Gas Time	.1-5 sec					
Postflow Gas Time	3-50 sec					
Crater Fill Time	.5-15 sec					
Spot Time (Option)	.25-6 sec					
Maximum Open Circuit Voltage	80 V					
Output Amperage Range	5-310 A					
Auxiliary Power	1 kVA-115 V, 9A					

Table 3-1 Machine Specifications

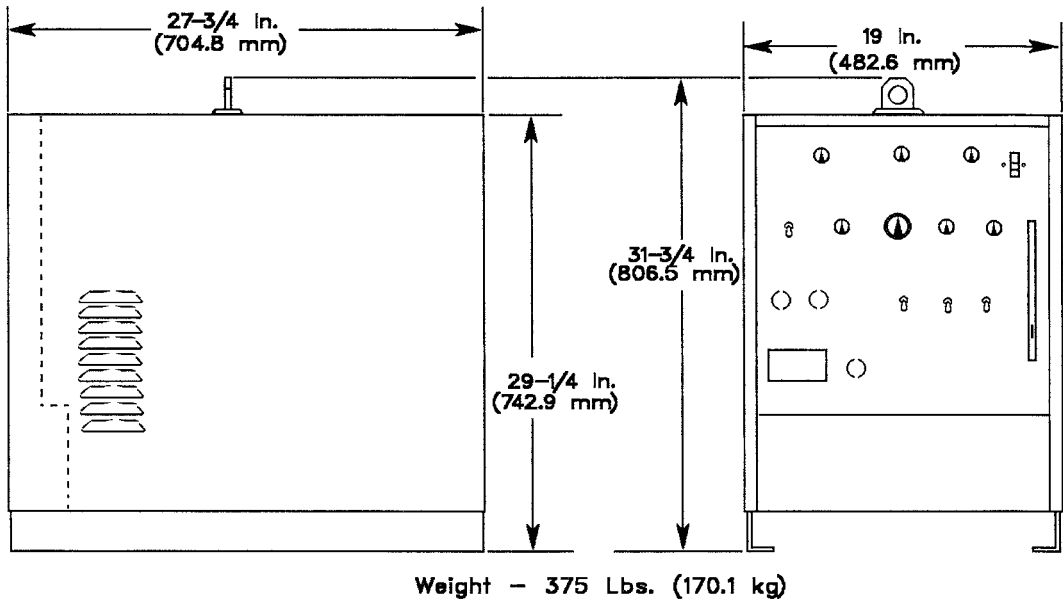


Figure 3-1 Dimensions and Weight Information

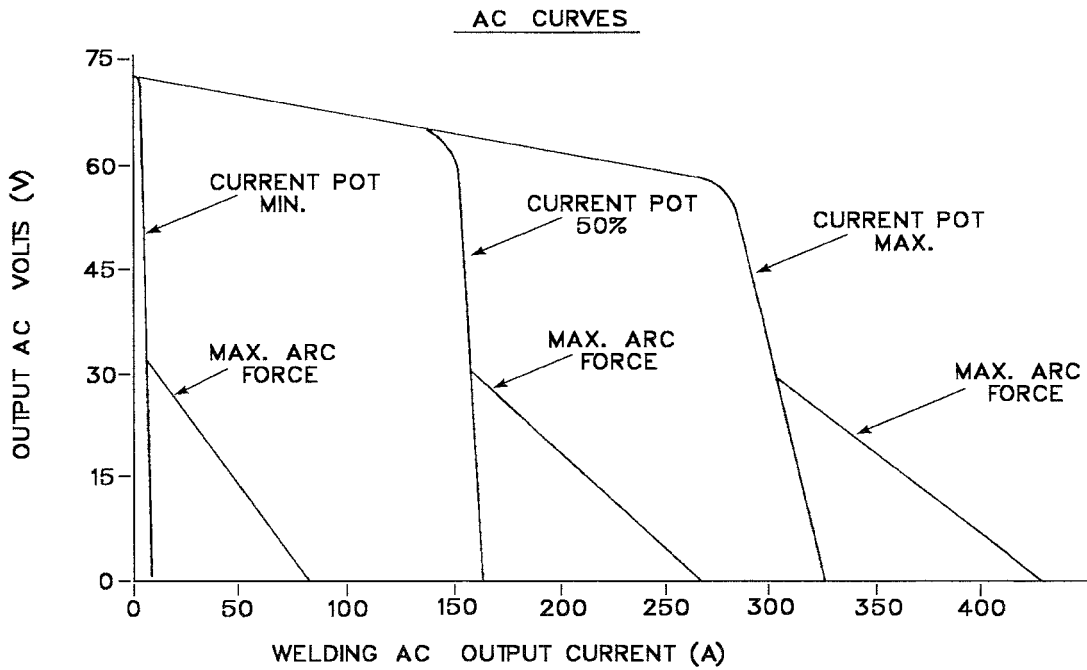
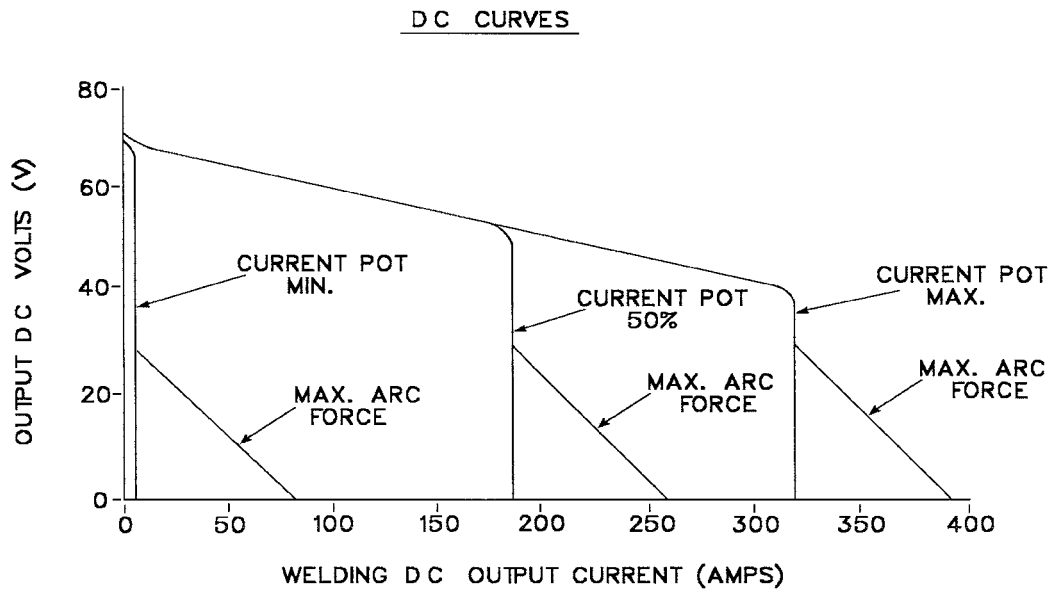


Figure 3-2 Volt Amp Curves

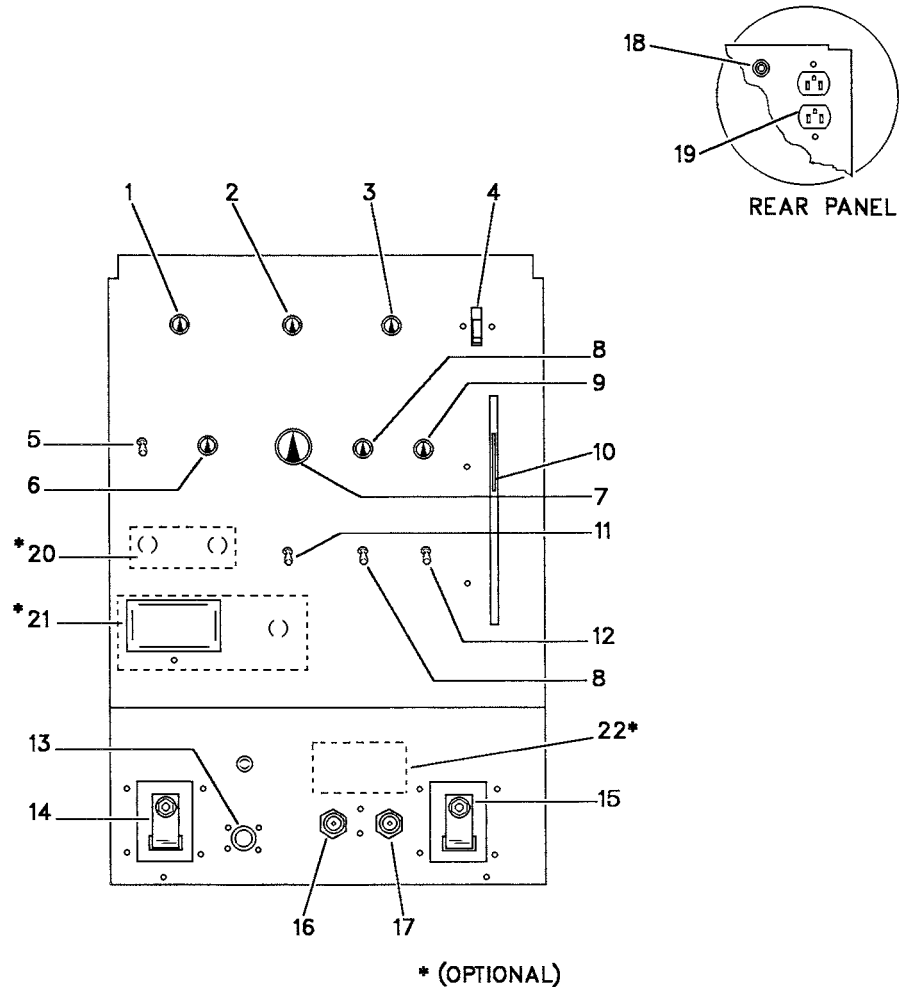
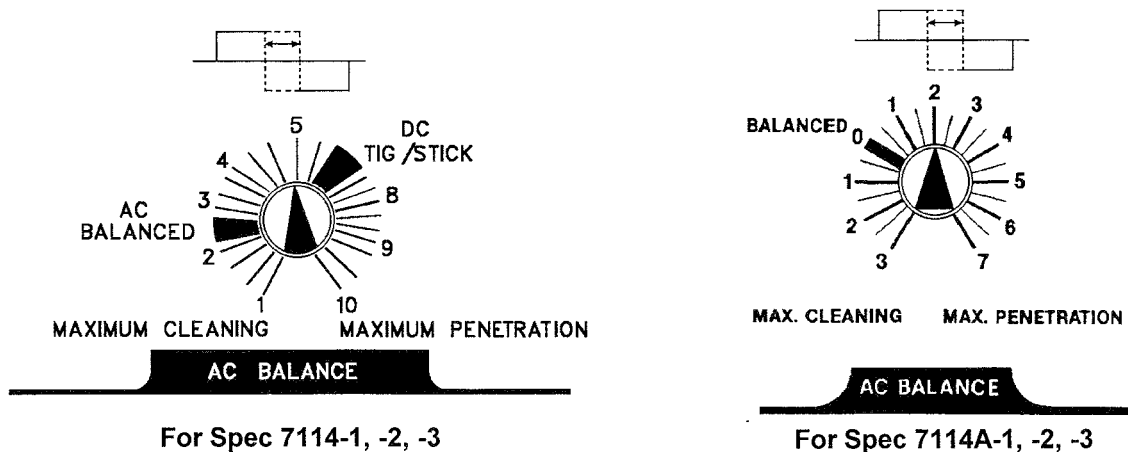


Figure 3-3 Controls, Instruments and Outlets

Controls, Instruments, and Outlets

1. **AC Balance Control** — The balance control adjusts the AC output waveform allowing for more penetration or cleaning of the work. The cleaning action is especially beneficial when welding aluminum alloys.



The numbered scale can be used for reference when setting up procedures. The numbers do not indicate a current or voltage level.

NOTE: When welding in DC, the balance knob should be located in the marked area for optimum performance and energy efficiency. Failure to do so may result in an unstable arc.

2. Arc Force Control — This potentiometer controls short circuit (welding) current to produce an increase in current as the arc length is shortened. The control is present to provide the degree of hot start required and the additional dynamic change for welding tight grooves and out of position. Turn clockwise to increase hot start characteristics or counterclockwise to obtain a soft start, smooth arc.

NOTE: This control is only active when the high frequency switch is in the STICK position. See high frequency switch for further information.

3. High Frequency Switch — This is a four-position multi-function switch. The four modes are as follows:

- a. **START:** Used for DC TIG. The high frequency automatically cuts off when a welding arc is established.
- b. **OFF:** High frequency is never on.
- c. **CONTINUOUS:** Used for AC TIG. High frequency is present when contactor is closed. It remains on throughout the weld.
- d. **STICK:** Used for stick welding. This position activates the arc force control and turns off the gas valve.

NOTE: For the high frequency circuit to operate, the output contactor switch must be in the remote position and a remote control device must be connected to the remote control receptacle.

4. Power ON/OFF Switch — The ON position energizes the power source and puts it in a ready state.

5. Trigger Hold ON/OFF Switch — With the trigger hold in the OFF position (see Figure 3-4), the operation is standard. When the contactor is closed, either by placing the output contactor in LOCAL or placing the torch/foot switch in ON position, the power source goes through a timed preflow and then begins to weld. It will continue to weld until the contactor or torch/foot switch is put in the OFF position. The TIGWAVE[®] will then go through a timed crater fill and postflow, if required, to end the cycle.

When the trigger is in the ON position, the TIGWAVE[®] is set up as indicated in Table 3-2 and goes through the cycle of Figure 3-5. When the torch switch or foot pedal is in the ON position, the TIGWAVE[®] goes through a timed preflow and then begins to weld. Any time after preflow or the weld begins, the torch switch or foot pedal can be put in the OFF position. The TIGWAVE[®] will continue to weld at the amperage set. To go into crater fill, postflow and end the weld, the torch switch or foot pedal must be turned ON again. Once crater fill begins or the weld ends, the switch/foot pedal can be turned off thus ending the cycle.

6. Preflow Time Control — Controls the length of time that water and shielding gas will flow before the weld begins. Preflow has an adjustable 0 to 5 sec-

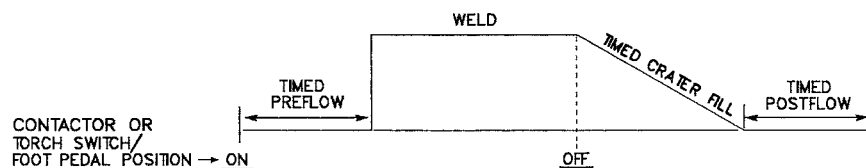


Figure 3-4 Trigger Hold Off

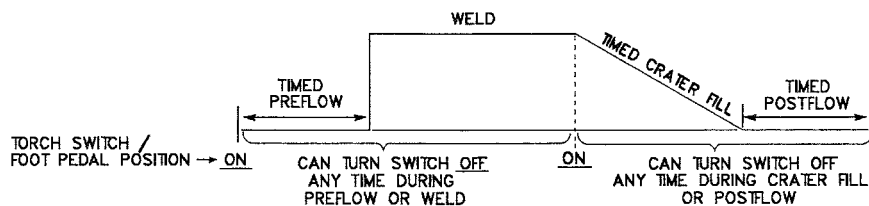


Figure 3-5 Trigger Hold On

TRIGGER HOLD "ON" OPERATION

FRONT PANEL CONTROLS	FOOT CONTROL OPERATION (200460-1, 362668C)	TORCH MOUNTED ON/OFF SWITCH WITH SEPARATE CURRENT CONTROL (492330-5, 6, 7; 366592-1; 363037-1)	TORCH MOUNTED ON/OFF SWITCH (201617-1, 365422-5)
Trigger Hold* Prewflow Time Amps Setting Amperage Control Switch Output Contactor Switch Crater Fill Switch Crater Fill Time Postflow Time	On Set as desired Set as desired Local Remote On or Off Set as desired Set as desired	On Set as desired Set as desired Local or Remote Remote On or Off Set as desired Set as desired	On Set as desired Set as desired Local Remote On or Off Set as desired Set as desired

* See Table 5-1 for operation instructions not involving Trigger Hold.

Table 3-2 Trigger Hold "On" Operation

ond time control. For no preflow, turn the knob counterclockwise as far as possible.

7. **Amperage Adjustment** — Calibrated in amps, this control determines the output welding amperage. In the case where a foot control or remote hand rheostat is used, it determines the maximum welding current available.

8. **Crater Fill Adjustment and Switch** — This is used in the TIG process at the end of a weld. It prevents a pit being left by tapering off the current to minimum amperage and thus giving the weld puddle time to solidify. To use, turn the crater fill switch to ON and adjust the time to crater. In stick or in TIG applications which do not require crater fill, place the switch in the OFF position. Crater fill time may be varied from .5 to 15 seconds.

9. **Postflow Time Control**

NOTE: Postflow is not operational when the high frequency switch is placed in the stick position.

Controls the length of time that water and shielding gas will flow after the welding arc has ended. Postflow has an adjustable 3 to 50 second time control.

10. **AC/DC Selector Switch** — Three-position switch that selects polarity and mode of operation.

CAUTION: Always set the selector switch exactly in one of its detent positions. Do not reset the switch while welding.

11. **Amperage Control Switch** — Place in REMOTE position when remote amperage control is desired (foot control, hand pendant, etc.). In remote, the front panel amps setting indicates the maximum amperage available to weld with and the foot control/hand pendant fine tunes the amperage. In the local position, the front panel amps control indicates the actual weld amperage.

12. **Output Contactor Switch** — Place in the Remote position when a remote control is connected to the remote control receptacle. If a remote control device is not being used, the switch must be in the LOCAL position.

CAUTION: Up to 80 volts is present at the output of the machine when in the local position.

NOTE: In order to TIG weld with high frequency, the output contactor must be in the REMOTE position and a remote control must be connected to the remote control receptacle.

13. **Remote Control Receptacle** — Provides connection point for remote controls to the machine. Used in conjunction with the output contactor switch (above).

DESCRIPTION OF EQUIPMENT

14. **Work Terminal** — Provides connection point for the welding cable lead which attaches to the workpiece (item being welded).

15. **Electrode Terminal** — Provides connection point for the torch cable.

16. **Gas "In" Connection** — Provides a connection point for shielding gas supply from the gas cylinders.

17. **Gas "Out" Connection** — Provides a connection point for feeding shielding gas to the torch.

18. **Circuit Breaker** — Rated at 15 amperes. Provides protection to the 115-volt circuits which include the fan, the 115-volt AC power receptacle, and the high frequency unit.

19. **AC Power Receptacle** — Provides 115 volts of auxiliary power for accessories. This receptacle is protected by the 15-amp circuit breaker. 1 kVA of power is available.

20. **Spot Timer (Option)** — Controls the time duration of a spot weld cycle. With the spot time switch in the OFF position, the timing circuit is disabled. In the ON position, the spot timer is adjust-

able between 0 and 6 seconds. The welding amperage is set using amperage adjustment knob.

NOTE: The "amperage control" switch must be in the "Local" position. The "Output Contactor" switch must be in the "Remote" position and a remote control must be connected to the "Remote Control Receptacle".

21. **AC/DC, Amps/Volts, Meter Kit (Option)** — A single meter with switch that will read AC/DC volts when in the VOLTS position or read AC/DC amps when in the AMPS position.

22. **Water Valve Kit (Option)** — Used to keep torch cool when a recirculating device is not present. Connect the hose from the water source to the "In" connector and connect the water hose from the torch to the "Out" connector.

23. **Fuses, 5 Amp Slow Blow** — Two fuses are found by removing the left side panel and looking into the P.C. Board compartment. The fuses provide protection to the P.C. Board, the gas valve and the optional water valve.

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INSTALLATION

Location

For best operating characteristics and longest unit life, take care in selecting an installation site. When installing the equipment, avoid locations exposed to high humidity, dust, high ambient temperature or corrosive fumes. Moisture condenses on machine parts and electrical controls, causing corrosion which can seriously affect operation and efficiency. Dust and dirt cause extra wear on all moving parts. Therefore, use care to locate the equipment so that excess moisture, dust, or corrosive fumes will not be drawn into the unit.

Adequate air circulation is needed at all times in order to assure proper operation. Provide a minimum of 12 inches (305 mm) of free air space at both sides and rear of the unit. Make sure that the ventilator openings are not obstructed. Air enters through the side panels of machine.

Because high frequency stabilized arc welding machines inherently radiate power at frequencies which may interfere with radio communication, including commercial, police, and aviation broadcasts, their operation is subject to control by the Federal Communications Commission.

Some general information on radio frequency radiation from high frequency stabilized arc welding machines is given below:

Direct Radiation From Welding Machine

The manufacturer controls direct radiation from the welding machine by proper design of the unit. If the user complies with the installation and operation instructions furnished by the manufacturer, direct radiation from the machine will be relatively low.

Direct Radiation From Welding Leads

The initial radiation, due almost entirely to the welding leads acting as an antenna, decreases rapidly with the distance from the leads. This radiation can be kept to a minimum by making the welding leads as short as possible. The frequency spectrum emitted by a particular unit can be altered substantially by changing the length or position of the weld-

ing leads and by differences in loading caused by operation with the electrode arcing to the work.

Radiation From Power Lines

High frequency voltage which is conducted from the welding machine to the power line may cause radiation from the line itself. This radiation can be kept to a minimum by careful design of the unit and, in some cases, by the use of line filters.

In a welding machine that has been certified by the manufacturer, the radiation from the power line is generally small when compared to the direct radiation from the welding leads.

Wiring In The Welding Area

The term "welding area" refers to the area in which the welding machine, the welding leads, and the welding work are located.

Re-Radiation

Ungrounded metallic objects in close proximity to the welding area can act as antenna which will pick up, conduct and re-radiate the high frequency generated by the welding machine. Unshielded wires in the immediate vicinity may conduct radiation, and re-radiate it. Therefore, no unshielded conductors shall be located within 50 feet (15,240 mm) of the welding area.

This means that all electrical power or lighting wiring within 50 feet (15,240 mm) of the welding area shall be enclosed in grounded rigid metallic conduit, copper braid, or some other material having an equivalent shielding efficiency, or shall consist of lead-covered cable. (Ordinary flexible helically wrapped metallic conduit is generally not suitable.) The shielding or cable covering shall be grounded at 50-foot (15,240 mm) intervals. Good electrical bonding shall be maintained between conduit sections.

Wiring, other than electrical power and lighting wiring within 50 feet (15,240 mm) of the welding area, shall be shielded and the shields shall be grounded. [This includes wiring located within 50 feet (15,240 mm) of the welding machine in a vertical or vertical-diagonal direction.]

The foregoing procedure shall apply even if:

1. The welding area is not a fixed location.
2. There are exposed wires off the premises but within 50 feet (15,240 mm) of the welding area.

Wiring Changes

All changes in power and lighting wiring shall be made by a qualified electrician. Any shielding or relocation of telephone or signal wires must be done by the service company concerned or with their specific permission.

This type of radiation can be kept to a minimum by installing the welding machine in accordance with the installation procedures outlined in this instruction manual.

Use In Metal Buildings

Where the welding area is enclosed within a metal building, proper precautions must be taken to insure that the building is properly grounded. This can be accomplished by placing several good electrical grounds around the periphery of the building. Refer to following grounding procedure.

The installation procedures described in this publication shall be observed even if the welding machine is operated within a shielded structure.

Welding Leads

The TORCH lead and the WORK lead must each be 25 feet (7620 mm) or less in length and run together at floor level whenever possible except the last 7 feet (2134 mm) at the torch or "whip" end. See Table 4-1 for lead sizes.

Remote Control Cables

(When used)

The remote control cables for gun trigger or foot control switch must also be 25 feet (7620 mm) in length, or less, and must be brought out close to and parallel to the welding leads.

Certification Notice

In order to comply with F.C.C. regulations after the unit has been installed in accordance with the preceding instructions, the user must post the certification notice at the location of the welding machine. A convenient form is enclosed which may be used for this purpose after it has been properly filled out.

Individual Installation Certification

1. The user may waive any of the requirements outlined in these special installation requirements if he desires to exercise the option of having an installation test survey made. This survey shall be made by a competent engineer in accordance with the test procedure requirements set forth in Part 18 of the Federal Communications' Rules and Regulations.

2. Certification may cover a unit installation or may be included in the certification of a complete plant.

Responsibility For Interference

In the event this equipment causes interference, it is the user's responsibility to take steps in eliminating the interference.

Grounding

The frame of this welding machine should be grounded for personnel safety. Where grounding is mandatory under state or local codes, it is the responsibility of the user to comply with all applicable rules and regulations. Where no state or local codes exist, it is recommended that the National Electrical Code be followed. Refer to Table 4-1 for wire sizes.

The work or work table must also be grounded by using a conductor attached to a driven ground or water pipe as described below. See Figures 4-1, 4-2, and 4-4.

The requirements and recommendations for grounding apply to rubber tire mounted equipment. In addition to the usual function of protecting personnel against the hazard of electrical shock due to fault in the equipment, grounding serves to discharge the static electrical charges which tend to build up on the surfaces of tire mounted equipment. These static charges sometimes cause painful shock to personnel, and in some instances, lead to the erroneous conclusion that an electrical fault exists in the equipment.

Use an input-power cable assembly which includes a grounding conductor to connect this equipment to the input power supply. When included in the cable assembly, the grounding conductor will be green or green with a yellow stripe, or bare. Connect the grounding conductor to the equipment grounding terminal, if provided, and if not, to the equipment frame, taking care to see that good electrical contact is made between conductor and frame. Connect the other end of the grounding conductor to the system ground.

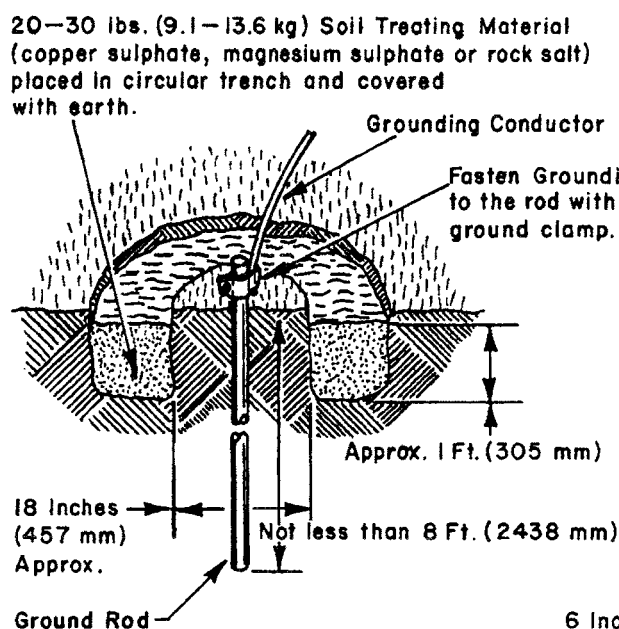
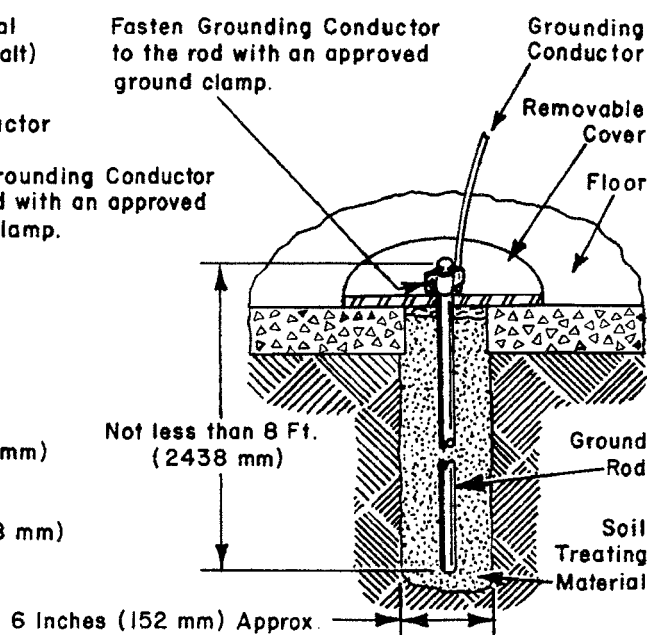


Figure 4-1 Outside Ground



A-008

Figure 4-2 Inside Ground

If, for any reason, an input cable which does not include a grounding conductor is used, the equipment may be grounded with a separate conductor if permitted under applicable code, or by special permission of the jurisdictional body responsible for enforcement of the code. Minimum size and color coding requirements must be in accordance with any applicable state or local code, or the National Electrical Code.

If metallic armored cable or conduit is used, the metal sheathing or conduit must be effectively grounded as required by state or local code, or the National Electrical Code.

If a system ground is not available, the welding machine must be connected to a driven ground rod (see Figures 4-1 and 4-2) or to a water pipe that enters the ground not more than 10 feet (3,048 mm) from the machine. Refer to the Wire and Fuse Size Chart, Table 4-1, for selection of the proper grounding conductor.

NOTE: The grounding conductor must be as short as possible in order to produce the most efficient installation.

Treating An Outside Ground — The soil treating materials are placed in a circular trench around the rod, but not in direct contact. The crystals are gradually dissolved by surface waters and the solution is carried into the most useful area of earth surrounding the electrode (rod). Flood the trench several times when making original installation. See Figure 4-1.

Treating An Inside Ground — Reduce the diameter of the hole to 6 inches (152 mm), pour soil treating material in and around the rod. Add enough water to dissolve 8 pounds (4.0 kg) of soil treating material. Flood the hole every 6 months and replace the soil treating material when it is all dissolved. See Figure 4-2.

Connection To Line Voltage

Refer to Table 4-1 for wire sizes required. The power supply wires serving the welding machine shall be completely enclosed for a distance of at least 50 feet (15,240 mm) (in any direction) from the machine in solid metallic conduit or closely braided copper sheathing. This shielding shall be connected to the ground at the extreme end of the shielding. The shielding shall be solidly connected to the case

Line Voltage	Input Wire Size (AWG)*	Ground Wire Size (AWG)*	Lag Fuse Rating
200	4	4	140
230	4	4	140
460	8	8	80
575	8	8	60

* Input conductor sizes are based on allowable ampacities of insulated copper conductors, with not more than three conductors in a raceway or cable.

Table 4-1 Recommended Wire and Fuse Sizes

so as to make good electrical contact and there shall be no gaps in the shielding run. (Ordinary flexible helically wrapped metal conduit is generally not suitable.)

CAUTION: Conductor size shall be selected to meet NEC, CE Code, and local codes and shall be modified as required for line voltage drop and ambient temperature.

This welding machine operates on a single-phase, AC input. See nameplate of the machine to determine required input voltage and frequency. Make certain that the welding machine is connected for the power supply voltage available. The input power cables should be connected to the power supply through a fused disconnect switch (furnished by the customer). Refer to the identification nameplate to determine the rating of the machine, then consult the local power company for wire and fuse size code. If no code exists, use the size of wire fuses listed in Table 4-1.

Input Connections To Power Source

WARNING: The fused disconnect switch: Open or place in the OFF position and remove the fuses. To avoid an accident, make the electric power connections to the welding machine first, then to the fused disconnect switch. This will prevent an accidental application of power while the machine is being connected.

1. A line (wall) disconnect switch, with fuses or circuit breakers should be provided at the main power panel (see Figure 4-4). The primary power input must have three insulated copper conductors (two power leads and one ground wire). The wires may be heavy rubber-covered cable or may be run

in a solid or flexible conduit. Do not connect the input conductors until step 3.

2. For access to input terminal board, remove the screws which secure the right side panel of the power supply. The input terminal board, Figure 4-3 or Figure 4-3A, is clearly marked to show the available primary voltage connections which may be used. Set the voltage links, on this board, to match your actual incoming voltage. As shipped from the factory, the input terminal board voltage links are set up for the highest line voltage.

3. Thread the input conductor cables from the wall disconnect switch through the (knock out) hole in the rear panel (see Figure 4-4). Connect the conductors to terminals L1 and L2 (on the input terminal board) using UL listed pressure wire connectors. Connect the ground wire to the grounding stud provided on the lifting yoke near the input terminal board.

WARNING: It is of the utmost importance that the chassis be connected to an approved electrical ground to prevent accidental shocking. Take care not to connect the ground wire to any of the primary leads.

4. Recheck all connections to make sure that they are tight, well insulated, and that the proper connection has been made.

External Power/Control/Hose Installation

Refer to Interconnection Diagram, Figure 4-4, for typical primary input, secondary output, process gas, and torch connections that are required for this unit's welding applications.

Place links in proper position based on input voltage value.

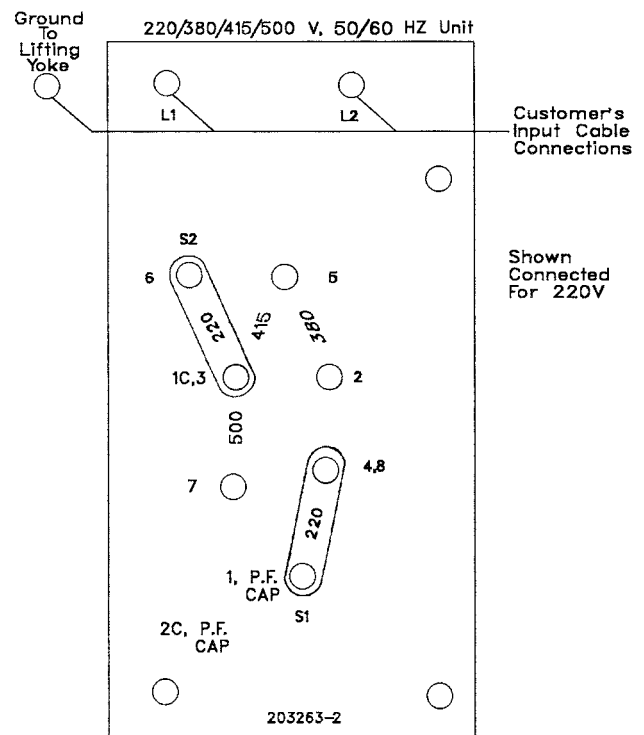
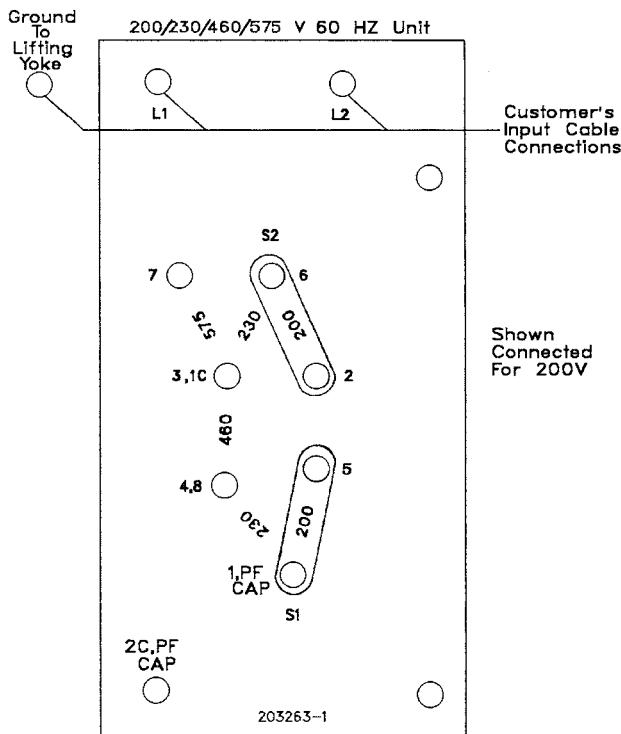


Figure 4-3 Input Voltage Connection & Changeover

Figure 4-3A Input Voltage Connection & Changeover

WARNING: Before making any connections to the power supply's output terminals, make sure that all primary input power to the machine is deenergized (off) at the customer's disconnect switch.

The proper operation of the welding machine depends to a great extent on the use of output cables that are insulated copper, adequately sized, in good condition and properly connected to the machine. It is recommended that the output cables be kept shorter than 25 ft. (this is particularly important for TIG applications using ACHF), and be of adequate current carrying capacity.

The resistance of the output cables and connections cause a voltage drop which is added to the voltage of the arc. Excessive cable resistance may result in overloading as well as reducing the maximum current output of which the power supply is capable. The welding output terminals are located

on the front panel. Table 4-2 will prove useful for selecting the recommended output cable size.

Use the type of hose and fittings designed for the particular gas or water to be used. Do not use electrically conductive hose to supply gas or water to the torch.

NOTE: When using a water-cooled torch, it is important to use clean water. Certain minerals or impurities can cause the water to become conductive resulting in poor starts and/or damage to the TIGWAVE[®].

Welding Adjustments

Keep spark gaps set at .012 inch (0.305 mm).

CAUTION: When the machine is in operation, make sure that the top is in place, and all access holes covered in the cabinet. Proper flow of cooling air must be directed through the unit to avoid overheating. Make no changes or adjustments not covered in this manual, as modification might affect radiation and thus void the manufacturer's certification.

Welding Current Amperes	TOTAL LENGTH OF LEAD CIRCUIT IN FEET (AND METERS) (ELECTRODE LEAD PLUS WORK LEAD)				
	50 Feet (15.2 M)	100 Feet (30.5 M)	150 Feet (45.7 M)	200 Feet (61.0 M)	250 Feet (76.2 M)
100	# 4	# 4	# 2	# 1	# 1
150	# 2	# 2	# 1	# 1/0	# 2/0
200	# 1	# 1	# 1/0	# 2/0	# 3/0
250	# 1/0	# 1/0	# 2/0	# 3/0	# 4/0
300	# 2/0	# 2/0	# 3/0	# 4/0	2 - # 2/0

NOTE: Lead size shown is for 90°C (194°F) insulation, 30°C (86°F) ambient, and not over 4.5 volts lead drop.

Table 4-2

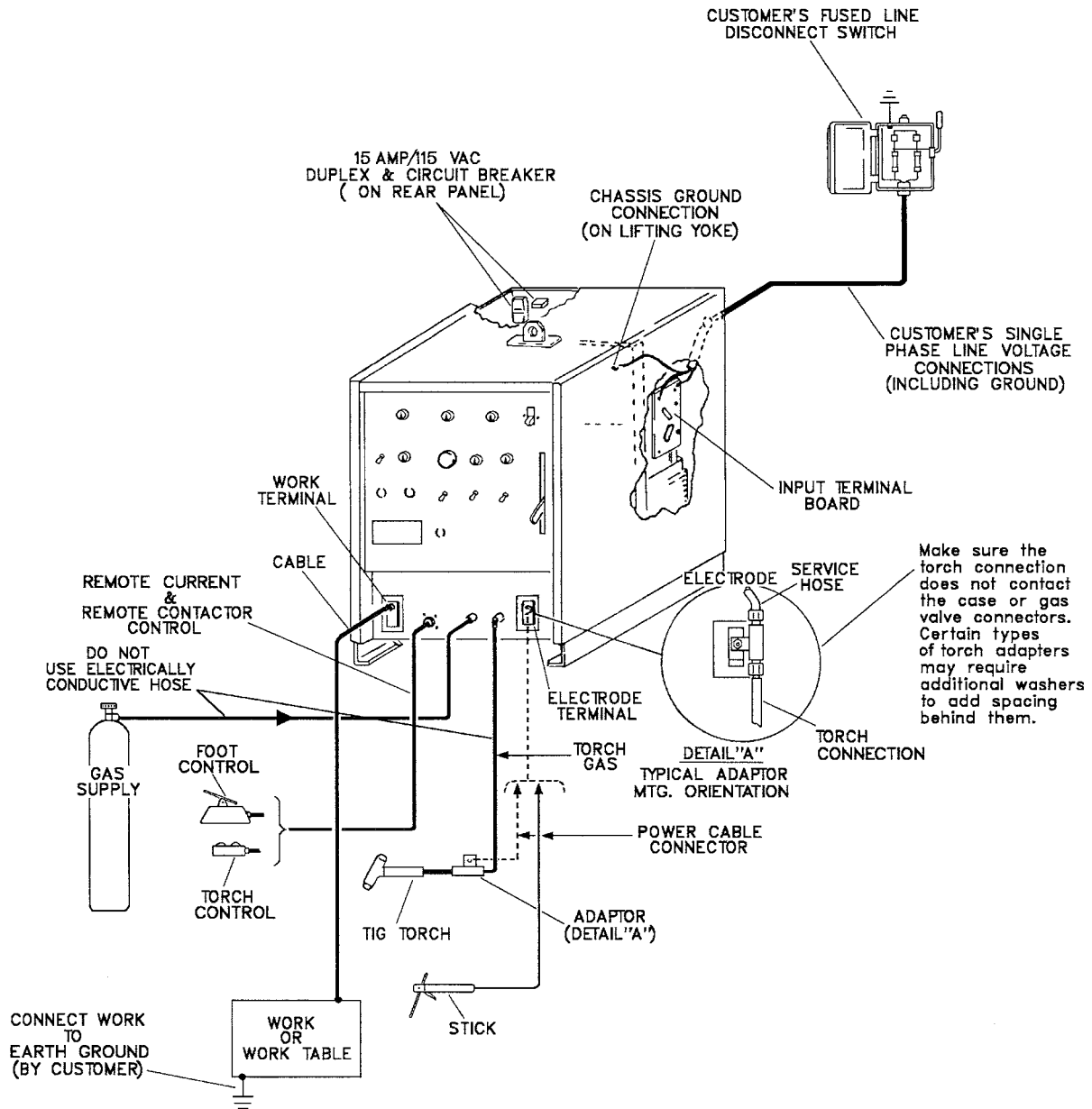


Figure 4-4 Connections and Precautions

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OPERATION

General

Read and understand the safety instructions at the beginning of this manual prior to operating the machine.

Table 5-1 provides a guide indicating which controls are used for the basic processes this machine can perform. Use this table as a check list when preparing to weld and in setting the controls. The control panel is clearly marked to identify controls and outlets (refer to Figures 3-3 and 4-4 if necessary).

WARNING: Electric shock can kill! Do not connect both a stick electrode cable and TIG torch to the welding terminals. Both systems will be energized with output voltage. Disconnect one of the systems while welding with the other.

Presetting Of Controls For TIG Welding

(Refer to Figure 3-3)

IMPORTANT: The output contactor switch must be in the REMOTE position and a remote control device must be plugged into the remote control receptacle in order to TIG weld with high frequency. Scratch start TIG welding can be performed in the ON or REMOTE output contactor switch position.

AC-DC Selector Switch — Set for AC or DC, plus the current polarity (if DC).

Power ON/OFF Switch — OFF.

High Frequency Switch — DC welding: START position. AC welding: CONTINUOUS position. DC scratch start welding: OFF position.

AC Balance — For DC, it must be set at "O" on dial.

All Other Controls — As desired for the job at hand.

TIG Welding Procedure

(See Table 5-1)

1. Make sure all steps under Presetting Controls have been carried out.

2. Attach the desired remote control device to the Remote Control Receptacle on front panel. See Figure 4-4.

3. Turn Remote/Local Switches to proper position. Two remote/local switches are included on the machine.

a. Output Contactor Control Switch — In the REMOTE position the remote control turns the welding output of the machine on and off in addition to allowing the high frequency to turn on. In the LOCAL position, open circuit voltage is available at the output terminals continuously and high frequency cannot turn on.

WARNING: Do not leave the output contactor switch in the ON position when not welding. In the ON position, gas will continue to flow and open circuit voltage will be present at the output terminals.

b. Remote Amperage Control Switch — In the REMOTE position, the remote control will control the variable output current within the amperage range established by the range switch and the amperage control dial settings on the front panel. The amperage control dial on the front panel sets the maximum amps which can be obtained with the remote control.

In the LOCAL position, the control panel dial adjusts the output amperage.

4. Turn on gas supply at gas cylinder.

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CONTROL OR OUTLET	AC TIG WELDING	DC TIG WELDING	DC SCRATCH START TIG WELDING	AC/DC STICK WELDING
AC-DC Selector Switch	AC	DCEN or DCEP	DCEN or DCEP	AC, DCEN or DCEP
Output Contactor Switch	Remote	Remote	Remote or Local	Remote or Local
Amperage Control Switch	Local or Remote	Local or Remote	Local or Remote	Local or Remote
AC Balance Control	Set as desired	DC Position	DC Position	AC or DC
Arc Force	NF	NF	NF	Set as desired
High Frequency	Continuous	Start	OFF	STICK
Trigger Hold*	OFF	OFF	OFF	OFF
Amps Potentiometer	Set as desired	Set as desired	Set as desired	Set as desired
Crater Fill Switch	Set as desired	Set as desired	Set as desired	OFF
Crater Fill Time	Set as desired	Set as desired	Set as desired	NF
Preflow	Set as desired	Set as desired	Set as desired	NF
Postflow	Set as desired	Set as desired	Set as desired	NF
Spot Timer Switch (Option)	Set as desired	Set as desired	Set as desired	Set as desired
Spot Timer Potentiometer (Option)	Set as desired	Set as desired	Set as desired	Set as desired

NF — Not Functional

* — Reference Table 3-2 for trigger hold "ON" operation.

Table 5-1

5. Turn main fused disconnect switch to ON or CLOSED position.

6. Turn POWER SWITCH to ON position. The cooling fan should now start, plus gas should begin to flow.

NOTE: This happens if the Remote Contactor Switch is set to LOCAL position. If it is in REMOTE position, gas comes ON when the Remote Switch is closed.

CAUTION: If any one of the items does not function, correct the malfunction before proceeding.

7. Adjust gas supply to the desired flow rate.

8. Place the welding torch in proximity of the work.

9. Activate the remote START switch or the remote control foot pedal. Open circuit voltage will appear, and high frequency will immediately initiate the welding arc.

CAUTION: Never initiate the arc by using the Power ON/OFF Switch as unsatisfactory performance will result.

NOTE: On DC TIG welding, the high frequency will shut off after the arc is established. On AC TIG, the high frequency will run continuously to stabilize the AC welding current. On scratch start DC TIG, no high frequency will be present.

10. Readjust any controls as necessary.

CAUTION: Once a welding arc is established, power should not be removed from the welding machine, and the POWER ON/OFF SWITCH should not be turned OFF until after postpurge is completed. The work or the torch may be damaged if water and/or gas ceases to flow too soon.

11. Welding can be interrupted by merely removing the torch from proximity of the work. High Fre-

quency will go ON. When the torch returns to the proximity of the work, the welding arc will be reestablished, and the High Frequency will turn OFF (on DC TIG welding).

12. To terminate welding, proceed in the following manner:

a. Release the foot switch, or activate the remote STOP switch. Gas will continue to flow until postpurge times out (a maximum of 50 seconds).

b. Leave torch in position over the work to provide shielding gas until the end of the postflow cycle.

c. After the flow of gas stops, that is, on completion of postflow, turn off the gas at source.

d. Turn the POWER ON/OFF Switch to OFF position.

e. Place the fused disconnect switch in the OPEN or OFF position.

Welding Currents For The TIG Process

Welding currents for the TIG process depend upon the size of the tungsten electrode used, the material being welded, welding speed, size and shape of the material, and other factors. Table 5-2 is a rough guide for usable current ranges for various tungsten electrode sizes.

Electrode Diameter Inches	Welding Current, Amps			
	ACHF		DCEN	DCEP
	Using pure tungsten electrodes	Using thoriated electrodes	Using pure or thoriated tungsten electrodes	
.020	5-15	5-20	5-20	----
.040	10-60	15-80	15-80	----
1/16	50-100	70-150	70-150	10-20
3/32	100-160	140-235	150-250	15-30
1/8	150-210	225-325	250-400	25-40
5/32	200-275	300-400	----	40-55
3/16	250-350	----	----	55-80
1/4	----	----	----	80-125

Table 5-2 Typical Current Ranges for Tungsten Electrodes

Regulation Of Inert Gas

The inert gas flow should be controlled accurately with a regulator and flowmeter. No specific recommendations for rates of flow can be given as this depends entirely on the welding conditions and the torch and nozzle used. Correct argon flow is usually between 8 and 35 cubic feet (226 to 990 liters) of gas per hour; and helium flow is between 18 and 85 cubic feet (510 to 2410 liters) per hour.

More specific information concerning the torch configurations available and the gas flows for each can be obtained from the manufacturer of the torch equipment.

Stick Welding Procedure

(See Table 5-1)

1. Follow all steps in preceding sections entitled "Presetting Controls" with one exception: place High Frequency Switch in STICK position.

NOTE: Shielding gas will not flow and high frequency will not turn on when the high frequency switch is in the STICK position.

2. Attach the desired remote control device to the Remote Control Connector (see Figure 4-4). Be sure Remote Amperage and Remote Contactor switches are in LOCAL position when no remote control is used.

3. Preset Weld Amperage Control to approximate setting for the welding to be done.

4. Place the fused disconnect switch in the ON or CLOSED position.

5. Power ON/OFF Switch: Place in the ON position (fan should start running). With Remote Contactor Switch in LOCAL position, open circuit voltage should now appear.

NOTE: In general, remote controls are not used with the stick process.

6. Touch the electrode to the work and adjust weld current to produce the desired welding arc.

7. Welding can be interrupted by removing the electrode from the work. Re-touching the electrode to the work will reestablish the arc.

8. To terminate welding, proceed in the following manner:

a. Remove the electrode from the work. This will break the welding arc, but open circuit voltage will remain.

b. Open the foot switch, or activate the optional remote STOP switch. This will remove open circuit voltage from the stick electrode holder.

c. Turn the Power ON/OFF Switch to OFF position.

d. Place the fused disconnect switch in the OPEN or OFF position.

WARNING: Carbon arc gouging will cause damage to the TIGWAVE[®] and is therefore not recommended.

MAINTENANCE

If this equipment does not operate properly, stop work immediately and investigate the cause of the malfunction. Maintenance work must be performed by an experienced person, and electrical work by a trained electrician. Do not permit untrained persons to inspect, clean, or repair this equipment. Use only recommended replacement parts.

WARNING: Be sure that the wall disconnect switch or circuit breaker is open before attempting any inspection or work on the inside of the power supply. Always wear safety goggles with side shields when blowing out the unit with low pressure air.

Cleaning

Since there are no moving parts (other than the fan) in the power supply, maintenance consists mainly of keeping the interior of the cabinet clean. Periodically remove the cover from the cabinet and blow accumulated dust and dirt from the air passages and the interior components, using clean low pressure air. It is imperative that the air passages, to the interior of the unit, be kept free of dirt accumulation to insure adequate circulation of cooling air, especially over the rectifier bridge plates and PC boards. The length of time between cleaning will depend on the location of unit, and the amount of dust in the atmosphere.

Lubrication

Fan motors with oil tubes require lubrication after one year of service. Motors without oil tubes are permanently lubricated and do not require any attention.

Spark Gaps

Check gaps frequently, as gap erosion is normal. Resurface gap faces as necessary to permit accurate gap spacing. Gain access to these gaps by removing the right side panel. The spark gaps (Figure 6-1) are located on the front panel of the machine.

Normal spark gap setting is .008 in. (.20 mm).

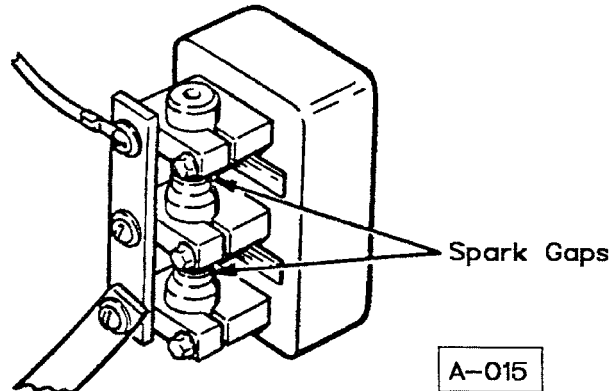


Figure 6-1 Spark Gaps

NOTE: High frequency output varies with the spark gap setting. When larger amounts of high frequency are required, the spark gaps can be adjusted up to .015 in. (.381 mm). This, however, increases the high frequency radiation which increases interference with communication equipment, and the internal electronic circuitry of the machine.

Do not file or dress the points of the spark gap. The entire electrode should be replaced when the tungsten section has completely disappeared.

Testing And Replacing Bridge Assembly Components

SCRs and silicon diodes are devices which allow current to flow in only one direction, and block current in the other direction. The SCRs and silicon diodes used in this power supply are designed to provide long trouble-free operation; however, should a failure occur, they may require replacement. The testing procedures to determine defective components follow:

1. Silicon Diode Rectifier — Disconnect the power lead to the diode to provide an open-circuit across

the component to be tested. Using an ohmmeter set to the R x 1 scale, check the resistance in the forward and reverse direction. A good diode will read high in reverse direction and low in the forward direction.

When replacing defective diodes, make sure mounting surfaces are clean. Coat mounting surfaces with Alcoa No. 2 heat sink compound, or equivalent. Replaced diode (nuts) should be tightened only until firm, and then torqued tight (recommended range is 275 inch lbs. min. to 325 inch lbs. max.).

2. Silicon Controlled Rectifier (SCR) — Disconnect the SCR wiring (but do not unclamp) to break continuity and provide an open-circuit across the component to be tested. Using an ohmmeter set to the R x 1 scale, check the resistance across the SCR in

both directions. A good SCR will read high in both directions. If the reading is low or zero in either direction, the SCR is defective.

When replacing defective SCRs, make sure the mounting surfaces are clean. Coat the mounting surfaces with Alcoa No. 2 electrical joint compound, available from Thermal Arc under P/N 903870. Make certain that the polarity on the replacement SCR is the same as on the unit being replaced. Place the top clamp piece over the bolts and tighten each nut hard finger tight. The clamp piece should be parallel to the top plate. Then tighten each nut approximately 1/4 turn at a time (alternately), for two complete revolutions until the force indicator on the clamp assembly reads 1.0 kilo pounds (1000 lbs.).

TROUBLESHOOTING

The following chart contains information which can be used to diagnose and correct unsatisfactory operation or failure of the various components of the welding machine. Each symptom of trouble is followed by a list of probable causes and procedures to correct them.

Troubleshooting Guide

Fan will not start.

Power switch OFF

Place power switch in ON position.

Power lines dead

Check voltage.

Broken power lead

Repair.

Wrong line voltage

Check power supply.

Incorrect input power connections at welding machine

Check connections. Refer to Figure 4-3.

Blown line fuses

Check for cause, replace.

Blown fuses inside machine near P.C. Board

Check for cause, replace.

Fan motor failed

Replace.

Power switch is turned on and blows fuse in supply circuit.

Wrong line voltage

Check nameplate of welding machine for line voltage to use, check line voltage.

Links on voltage changeover panel incorrectly connected

Check connections. Refer to Figure 4-3.

Fuse too small

Install proper size fuses. (See wire and fuse size chart in Installation chapter of this manual.)

Diode failed — (output rectifier)

Replace diode. See Maintenance chapter of this manual.

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Short circuit in primary connections

Remove short circuits.

Transformer failed

Repair or replace.

Welding machine delivers welding current but soon shuts down.

Welding machine overloaded, or duty cycle too high

Reduce load — overload can be carried only for a short time.

Thermal overload tripped

Do not operate continually at overload currents. Allow machine to cool.

Power leads too long or too small in cross section. Voltage drop through leads causes machine overload.

Replace with larger diameter leads. See wire and fuse chart in Installation chapter of this manual.

Ambient temperature too high

Operate at reduced loads when temperature exceeds 104°F (40°C).

Ventilation blocked

Check air intake and exhaust openings for obstruction and remove any found.

Fan not operating

Check bearings, disconnect leads and apply motor nameplate voltage to check.

Welding arc is loud and spatters excessively (stick electrode welding)

Current setting too high

Check setting and output with ammeter, or reduce current.

AC balance wrong

Set to DC TIG/STICK position.

Polarity wrong

Check polarity, try reversing polarity.

Incorrect rod used on AC

Use AC or AC-DC rod for AC welding.

Welding arc sluggish.

Current too low

Check output and current recommended for electrode being used.

Poor connections

Check all electrode holders, electrode lead and work lead connections.

Leads too long or too small in diameter

Check lead voltage drop, use larger lead. (See Table 3-1.)

Low line voltage

Check power source. Notify power company if necessary.

Potentiometer does not control welding current.

LOCAL-REMOTE Switch set in wrong position

Make correct setting for type of operation desired.

Panel control set to 0 or very low when using remote rheostat control

Set panel rheostat to obtain desired welding current. See operating instructions.

Poor connections on Weld Current potentiometer

Repair.

Poor connection

Check all connections.

P.C. Control Board Failure

Replace.

Selector switch does not control polarity or permit adjustment between AC and DC welding.

Loose or broken connection

Reconnect, check both ends of each lead to selector switch.

Welding machine operates but welding current falls off.

Electrode or ground lead connections loose at machine, ground or work

Clean and tighten all connections, check ground return circuit.

Arc difficult to strike

Loose connection

Check connections.

Wrong type electrode

Use proper electrode.

Coolant water conductive

Replace water in circulator.

Operator gets shock when welding machine case is touched.

Case of welding machine not grounded

Ground welding machine case.

Weld metal will not flow, arc is erratic on AC-TIG welding.

Arc is played on weld puddle

Point torch in direction of weld, not directly into weld puddle.

Current too high

Reduce current.

Arc length too long

Reduce arc length.

Gas cup on torch too small

Increase size of gas cup.

Insufficient gas flow

Increase gas flow.

High frequency weak

See Maintenance chapter.

Wrong spark gap setting

Adjust gaps as instructed under Spark Gaps in this manual.

Helium inert gas used

Use argon gas if possible.

Welding speed too slow

Increase speed of travel with torch.

Arc is unstable on AC-TIG welding.

Spark gaps set incorrectly

Adjust gaps as instructed under Spark Gaps in this manual.

Welding lead too long

Move welding machine close to work.

High frequency too weak

See Maintenance chapter.

Arc is unstable

AC balance knob not in correct position

Set to correct position.

Dirt, grease, or oil on workpiece

Degrease and clean to bare metal by chemical or abrasive means if necessary.

Joints too narrow. Arc jumps from side to side.

Increase spacing of workpieces or shorten arc length.

Electrode too large; arc moves around on electrode.

Use smaller electrode or grind point. A polished electrode sometimes helps.

Arc too long

Shorten arc length.

Also see "Torch spits tungsten into work".

Torch "spits" tungsten into work

Tungsten is balled for AC-TIG welding either with reverse polarity DC or high AC current

Ball by grinding only.

Arc length too long

Shorten arc.

Tungsten too small

Increase size of tungsten.

Current too high

Decrease current.

Current too high after arc is struck on AC-TIG welding

Use foot rheostat to gradually increase current after arc is established, or hold 1/2" long a few seconds after striking.

Sharp point ground on tungsten

As rated current of tungsten is approached, reduce sharpness of point.

Postflow time too short, causing air contamination of tungsten

Increase postflow time until tungsten stays bright after gas shuts off.

Tungsten touching work, causing contamination of tungsten and work

Break off end of tungsten.

Leaky "O" rings in torch or leaky hoses in gas line

Replace.

Hoses previously used to carry oil, acetylene or other gases

Use new hoses.

Weld is dirty

Dirty work metal

Clean work metal with degreasing compound, soap and water compound or wire brush.

Dirty filler rod

Keep filler rod in location where it will not become dirty.

High frequency too weak

See Maintenance chapter.

Insufficient gas flow

Increase gas flow. Check for pinched hoses.

Leaky gas hoses

Replace.

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Hoses previously used to carry oil, acetylene or other gases, causing scum on weld

Use new hoses.

Loose connections in gas system

Tighten.

On DC-TIG straight polarity welding, high frequency jumps gap between electrode and work, but DC power does not follow to initiate the arc.

AC balance incorrect

Set to DC position.

Use of pure tungsten

Use thoriated tungsten on DC straight polarity welding.

Use of helium gas

Use argon gas for best arc-initiating properties.

Electrode held very near work after high frequency has begun jumping

After high frequency spark jumps, withdraw torch slightly.

Tungsten too large

Use smaller tungsten or grind point.

High frequency and arc extend from side of tungsten.

Rough tungsten

Use ground and polished tungsten.

Arc unstable at low current welding on DC straight polarity TIG.

High frequency switch set to START (high frequency cuts out)

Set to CONTINUOUS (high frequency is continuous).

Arc extends from side of tungsten

Use ground and polished tungsten.

Arc length too long

Use shortest arc length possible.

Arc wanders

See section on "Arc wanders".

Arc crater at end of weld

Torch withdrawn before arc is extinguished

Use crater fill timer.

Arc wanders

Tungsten contaminated by carbon

Break off end of tungsten and grind clean. Do not use carbon block for striking arc.

Arc blow

Change position of ground clamp.

Air drafts

Shield arc from air drafts.

Electrode too large; arc moves around on electrode

*Use smaller electrode or grind point. A polished electrode sometimes helps.
Grind point on electrode.*

Joint too narrow; arc jumps from side to side

Increase spacing of workpieces or shorten arc length. Reduce high frequency setting.

Tungsten discolors after weld

Insufficient gas postflow

Increase setting of postflow time.

Gas valve sticks

Replace.

Loose connections in gas system

Tighten.

Insufficient gas flow

Increase.

Leaky hoses

Replace.

Gas will not shut off

Postflow timer set too high

Decrease postflow timer setting.

Postflow timer contacts stick

Replace timer or clean contacts.

Valves stuck open

Replace valves.

Output contactor in ON position

Switch to remote.

High frequency but no power

Work lead hooked to ELECTRODE terminal

Connect to WORK terminal.

Porous welds on aluminum alloys

Too high welding temperature, weld speed too slow

Reduce current and weld as fast as possible.

Magnesium used as alloying material

Avoid welding aluminum alloys with high magnesium content.

Impurities in base metal; for example, calcium

Use higher grade material.

Weld solidifies rapidly

Use materials which solidify slowly. Reduce welding speed.

Welding cracking (aluminum)

Welding speed too slow

Increase speed.

Current too high

Reduce current.

Skip welding

Use continuous welds on aluminum and its alloys.

Welding so that welds intersect

Weld at low current and fast speed, or redesign piece to avoid intersection of welds.

Cold working

Do not weld cold-worked aluminum alloys and do not cold work after welding.

Mounting Procedure for SCRs

1. Thoroughly clean heat sink surface to eliminate any dirt or contamination.
2. Apply a thin coat of Alcoa #2 compound to cleaned surface. Alcoa #2 is available from Thermal Arc, part number 903870.
3. Positively locate the SCR in place in the heat sink. A small spring pin in the extruded heat sink will locate the SCR.
4. Place the clamp in position with the bolts through the holes in the heat sink, and proceed in following manner.
5. Tighten the nuts evenly until finger tight.
6. Tighten each bolt in 1/4 turn increments using correct size hex key.
7. Place the Force Indicator Gauge (903878) firmly against the springs as shown. Be sure both ends and the center are in firm contact with the springs. The gauge notch location will indicate the spring deflection or force. Correct mounting force is indicated as shown below.
8. Spring deflection over 2-1/4 inches of spring is $.037" \pm .002"$ for all clamps.
9. All clamps to be set at 4° mark. This corresponds to the VE3000-VE2500 section on the gauge label.

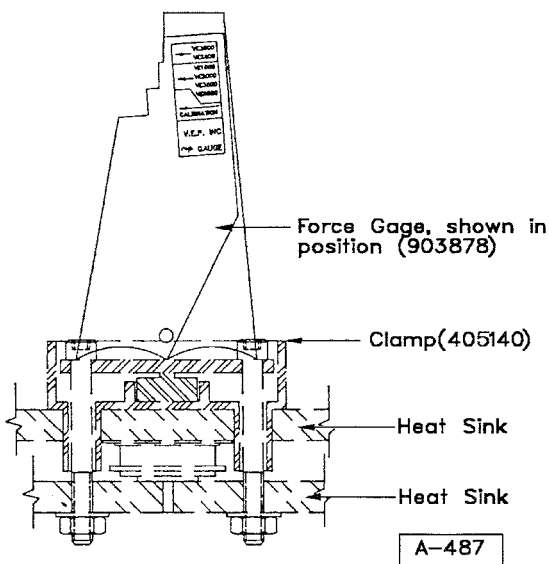


Figure 7-1

Examples:

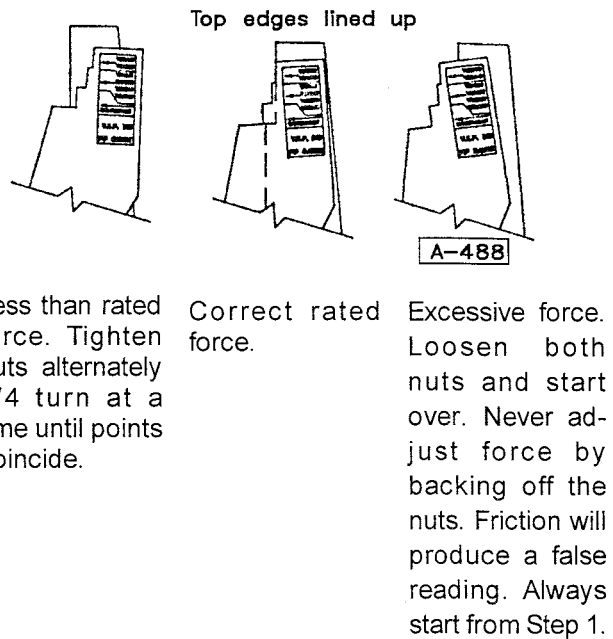
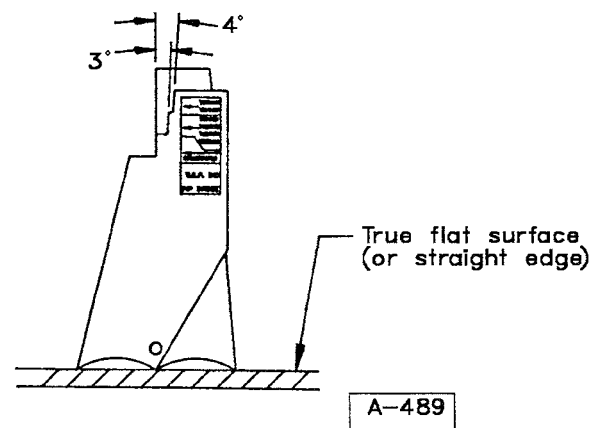


Figure 7-2

To Calibrate Force Gauge:

If the gauge is suspected of being out of calibration due to wear or damage, check it on a flat surface as shown below.



If the calibration edges do not line up, calibrate the gauge by filing the bottom contact points.

Figure 7-3

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PARTS LIST

Equipment Identification

All identification numbers as described in the Introduction chapter must be furnished when ordering parts or making inquiries. This information is usually found on the nameplate attached to the equipment. Be sure to include any dash numbers following the Specification or Assembly numbers.

How To Use This Parts List

The Parts List is a combination of an illustration (Figure Number) and a corresponding list of parts which contains a breakdown of the equipment into assemblies, subassemblies, and detail parts. All parts of the equipment are listed except for commercially available hardware, bulk items such as wire, cable, sleeving, tubing, etc., and permanently attached items which are soldered, riveted, or welded to another part. The part descriptions may be indented to show part relationships.

To determine the part number, description, quantity, or application of an item, simply locate the item in question from the illustration and refer to that item number in the corresponding Parts List.

An "Application Code" is used to distinguish parts that are applicable only to certain Specifications and/or Assemblies. This code is found in the rightmost column of the Parts List. If an item in the Parts

List applies to all Specifications or Assemblies, the word "ALL" will be in the Application Code column. Refer to the following list to determine the appropriate Application Codes for the Specifications or Assemblies covered by this manual. If only the assembly or specification number is listed, the use of an Application Code does not apply to this manual.

How To Select Recommended Spares

The first two columns of the Parts List are used to show the recommended quantity of parts which are typically required for spares or replacement purposes. The quantities under Class 1 are for parts that are consumed or that may need replacement in two years or less depending on operating hours. Class 2 quantities are for parts that may need replacement under unusual service conditions or additional operating hours. These are suggested quantities based on expected usage or the minimum package quantity. Class 1 spares are repeated under Class 2 but the quantities may be larger to allow for additional operating hours. Contact your equipment dealer for assistance in establishing the spare parts program best suited for your needs.

SPECIFICATION NUMBER

APPLICATION CODE

7114-1

A

7114-2

B

7114-3

C

7114A-1

D

7114A-2

E

7114A-3

F

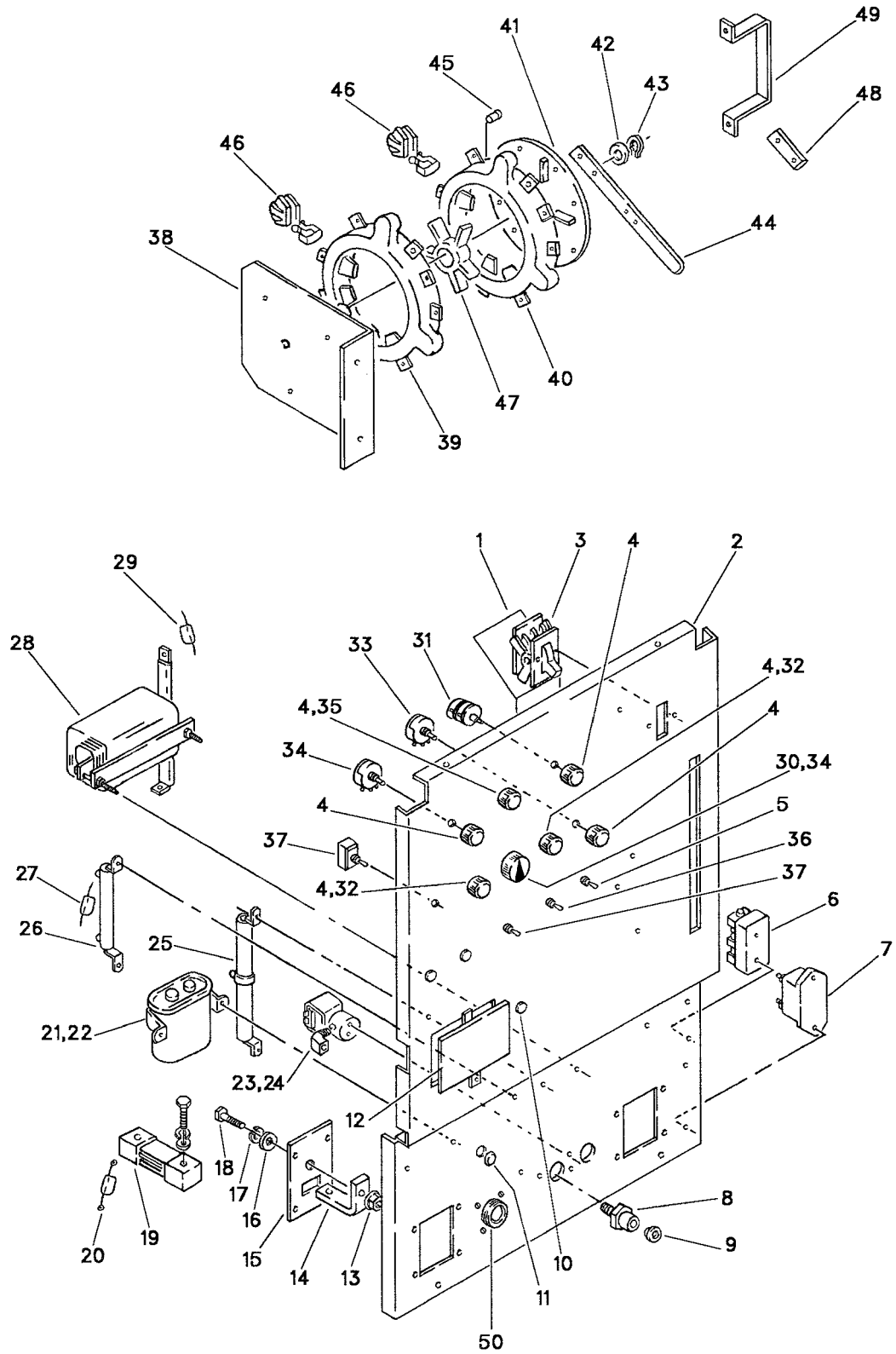


Figure 8-1 Control Panel

Parts List for Figure 8-1

Quantity	Item	Part	Description	Qty	Application
Recomm.	Number			per	Code
Spares				Assy	
Class 1	Class 2				
	1	491880-13	Insulator - Switch	1	All
		203504-1	Panel - Front Assembly	1	All
	2	203503	. Panel - Front	1	ABC
		203503-1	. Panel - Front	1	DEF
1	3	5TW-248	. Switch - Primary	1	All
	4	403701-1	. Knob - Control, Small	6	ABC
		403701-3	. Knob - Control, Small	6	DEF
	5	400400	. Switch - Toggle DPDT	1	All
	6	369286-1	. Spark Gap - Assembly	1	All
	7	493838	. Capacitor - Transmitting, Mica	1	All
	8	370447	. Adapter - Gas, Right Hand	2	All
	9	402128-10	. Protector - Plastic	2	All
	10	403091-12	. Plug - Hole, Plastic	3	All
	11	403091-3	. Plug - Hole, Plastic	1	All
	12	201255-1	. Cover - Meter Hole	1	ABC
		201255-2	. Cover - Meter Hole	1	DEF
	13	No Number	. Nut - 1/2-13, Hex, Flg. ST.	2	All
	14	5CW-974	. Bus - Stud, Cable	2	All
	15	368875	. Board - Insulator	2	All
	16	No Number	. Washer - 1/2, FL, ST.	6	All
	17	No Number	. Washer - LK, Std. 1/2	4	All
	18	No Number	. Screw - 1/2-13 x 1-1/2, HHC, ST.	2	All
	19	366761	. Shunt - 300 Amp, 50 MV	1	All
1	20	368705-29	. Capacitor - Assembly	1	All
	21	8RT-555	. Capacitor - 10 MFD, 230 V. AC	1	All
	22	402879	. Bracket - Mtg.	1	All
	23	404162-1	. Valve - Gas, 24 Volt	1	All
	24	W-10892-1	. Elbow - Street 90°, Brs.	1	All
	25	403765-12	. Resistor - 4 Ohm, 100 Watt	1	All
	26	AW-1651-4	. Resistor - 125 Ohm, 50 Watt	1	All
1	27	368705-24	. Capacitor - Assembly	1	All
	28	493834-1	. Coil - High Frequency Assembly	1	All
1	29	368705-30	. Capacitor - Assembly	1	All
	30	406806-1	. Knob - Control, 1-3/8	1	ABC
		406806-3	. Knob - Control, 1-3/8	1	DEF
		203610	. Harness - Wire Assembly	1	All
	31	408149-5	. . Switch - Rotary	1	All
	32	401428-3	. . Potentiometer - 250 K	2	All

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Parts List for Figure 8-1

Quantity	Item	Part	Description	Qty	Application
Recomm.	Number			per	Code
Spares				Assy	
Class 1	Class 2				
	33	401428-6	. . Potentiometer - 1 MEG	1	All
	34	401428-1	. . Potentiometer - 10 K	2	All
	35	401428-2	. . Potentiometer	1	All
	36	405365-1	. . Switch - Toggle, SPST	1	All
	37	400400	. . Switch - Toggle, DPDT	2	All
		200825-3	Switch - Selector Assembly	1	ABC
		200825-7	Switch - Selector Assembly	1	DEF
	38	200824	. Plate - Mtg. Switch	1	All
	39	430548-4	. Ring - Contact, Sw. Assembly	1	All
	40	430548-1	. Ring - Contact, Sw. Assembly	1	All
	41	200997	. Plate - Front Switch	1	All
	42	SW-167-1	. Washer - Thrust	1	All
	43	16DA-4249-8	. Ring - Snap	1	All
	44	365123	. Handle - Switch	1	ABC
		365123-1	. Handle - Switch	1	DEF
	45	494839	. Catch - Friction Ball	3	All
	46	366798	. Contact - Movable	6	All
	47	366589	. Hub - Drive, Movable Contact	1	All
	48	203395	. Bar - Bus	1	All
	49	358084	. Bar - Bus	1	All
	—	361574	. Bar - Bus	1	All
	50	Ref.	Receptacle - Amphenol 10 Pin (Part of R.F. Suppressor Board 203617)	Ref.	All

— Not Illustrated

430429-127
PARTS LIST

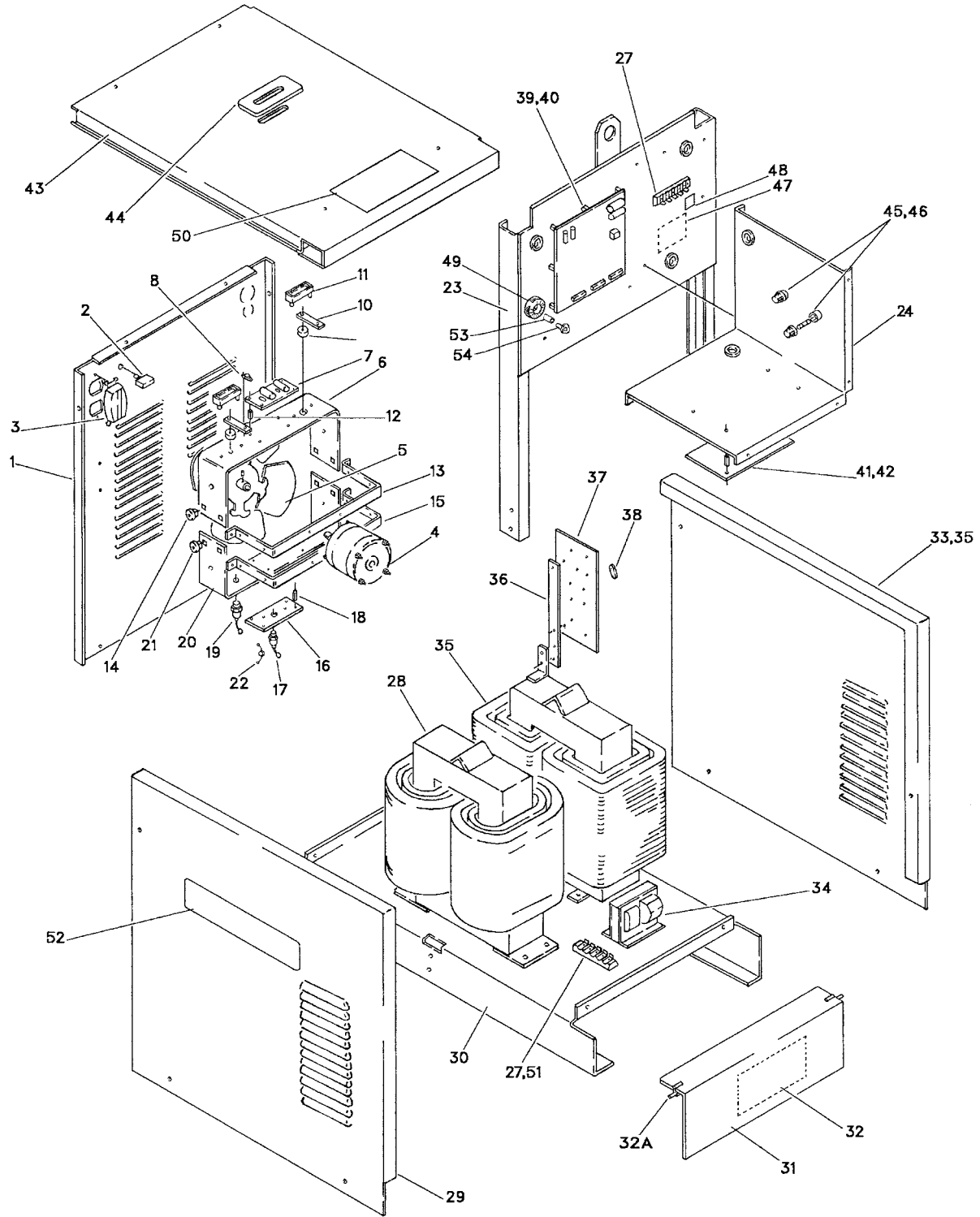


Figure 8-2 Frame Section

Parts List for Figure 8-2

Quantity	Recomm.	Item	Part	Description	Qty	Application
Spares	Class 1	Class 2	Number		per	Code
					Assy	
			203276-1	Panel - Rear Assembly	1	All
		1	203271	. Panel - Rear	1	ABC
			203271-1	. Panel - Rear	1	DEF
1		2	409527-3	. Circuit Breaker	1	All
		3	402670	. Receptacle - Duplex	1	All
1		4	12TW-595-1	. Motor - Fan	1	All
		5	8RT-609	. Fan	1	All
		—	W-9648-43	. Cable - Assembly	1	All
			203572	. Rectifier - Assembly	1	All
		6	203570	.. Heat Sink - Rect.	1	All
		7	203208	.. Suppressor - Surge Assembly	1	All
		8	404044-1	.. Thermostat - Overload	1	All
2		9	405138-2	.. Rectifier - Silicon Control	2	All
		10	203776-1	.. Bar - Bus	2	All
		11	405140-1	.. Clamp - Mtg.	2	All
		12	405535-1	.. Spacer	2	All
		13	201751	.. Bracket - Motor Mt.	1	ABC
			201751-1	.. Bracket - Motor Mt.	1	DEF
		14	406319-1	.. Grommet	4	All
			203573	. Output Diode - Assembly	1	All
		15	201751	.. Bracket - Motor Mount	1	All
		16	203569	.. Heat Sink - Diode	1	All
2		17	402833-3	.. Diode - Silicon, Neg. Base	2	All
		18	375426-11	.. Spacer - PC Board	4	All
1		19	402832-3	.. Diode - Silicon, Pos. Base	1	All
		20	203571	.. Heat Sink - Diode	1	All
		21	406319-1	.. Grommet - Mtg.	4	All
1		22	368705-26	.. Capacitor	1	All
		—	200527-2	.. Capacitor	1	All
		23	203269	Yoke - Lifting	1	ABC
			203269-1	Yoke - Lifting	1	DEF
		24	203574	Panel - Interior	1	ABC
			203574-1	Panel - Interior	1	DEF
		25		Delete		
		26		Delete		
		27	401937-1	Strip - Terminal	2	All
		28	204606	Reactor	1	All
		29	203274	Panel - Side, Left	1	ABC
			203274-1	Panel - Side, Left	1	DEF

— Not Illustrated

Parts List for Figure 8-2

Quantity	Recomm.	Item	Part	Description	Qty	Application
Spares	Class 1	Class 2	Number		per	Code
Class 1	Class 2				Assy	
			30	203266	1	ABC
				203266-1	1	DEF
			31	203576	1	ABC
				203576-1	1	DEF
			32	203487	1	All
			32A	203453	2	All
			33	203275	1	ABC
				203275-1	1	DEF
	1		34	493811-2	1	All
			35	203212-1	1	AD
				203316-1	1	BCEF
			36	203264	1	ABC
				203264-1	1	DEF
			37	203261	1	AD
				203261-1	1	BCEF
			38	CW-811	2	All
1	1		39	203440B	1	All
			40	404915-1	7	All
	1		41	203617	1	All
			42	404460-1	4	All
			43	203265	1	ABC
				203265-1	1	DEF
			44	12CW-2170	1	All
	2		45	402658	2	All
2	2		46	401972-2	2	All
			—	409569	1	All
			47	408891	1	All
			48	830116	1	All
			49	204130-1	1	All
			50	204036	1	All
	2		51	368705-31	2	All
			52	830200-2	2	All
			53	356331-4	1	All
			54	409869	1	All
			—	203619	1	All
			—	8TW-130	2	CF
			—	TRY-174-3	2	CF
			—	203665	1	CF
			—	Not Illustrated		

CERTIFICATION NOTICE

HIGH FREQUENCY STABILIZER

Serial No. _____

Model No. _____

This equipment may be reasonably expected to meet radiation limits of ten microvolts per meter at one mile, provided installation, operation, and maintenance is in accordance with the instructions of the manufacturer.

Thermal Arc Inc.
Troy, Ohio 45373

USER CERTIFICATE

The above equipment has been installed in accordance with manufacturer's instructions, and is being operated and maintained as outlined in these instructions.

USER: _____

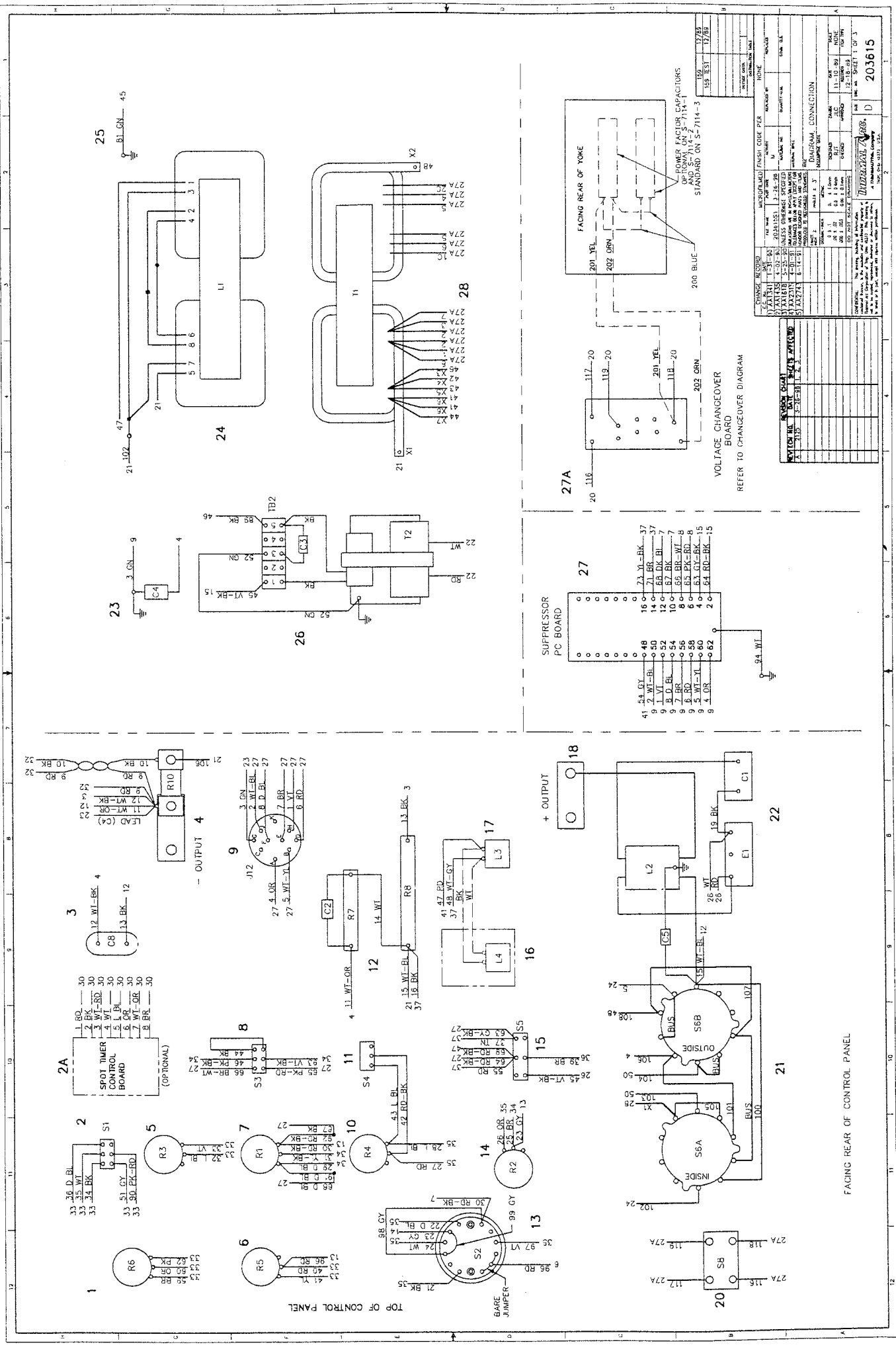
Date: _____

**THIS CERTIFICATION NOTICE MUST BE POSTED NEAR THE WELDING
MACHINE.**

DIAGRAMS

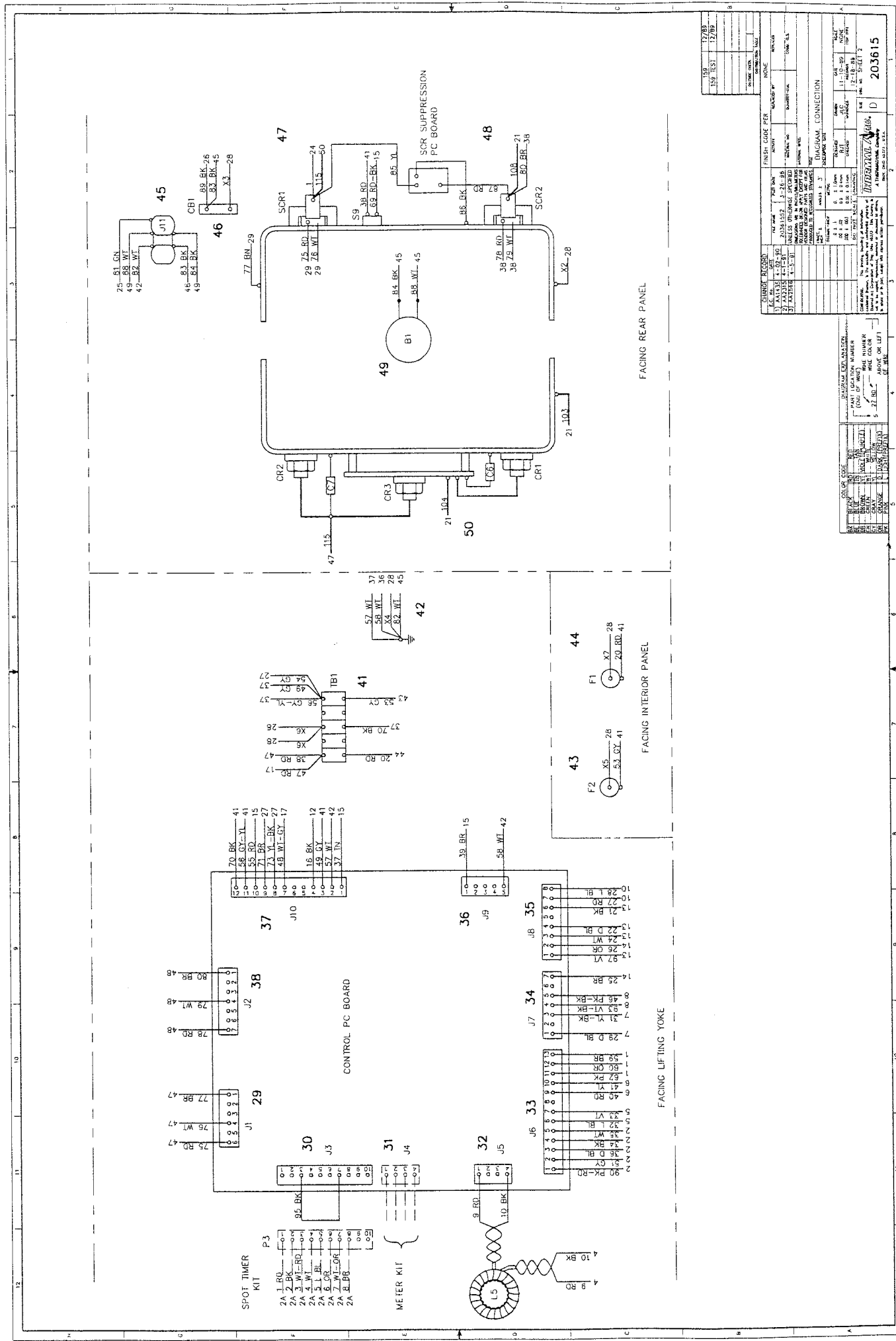
- Note the model and specification number shown on the equipment nameplate.
- Locate these numbers in the model and specification number columns below.
- Use only those diagrams and instructions that are applicable.

MODEL NO.	SPEC NO.	CONNECTION DIAGRAM	SCHEMATIC DIAGRAM	VOLTAGE CHANGEOVER DIAGRAM
TIGWAVE [®] 250 AC/DC	7114-1 7114A-1	203615	203615	203693
	7114-2 7114A-2	203615	203615	203693
	7114-3 7114A-3	203615	203615	203693



REV	DATE	BY	CHKD	DESCRIPTION
1	11-18-59			ISSUED FOR PRODUCTION
2	12-18-59			REVISED TO SHOW CHANGES
3	12-18-59			REVISED TO SHOW CHANGES
4	12-18-59			REVISED TO SHOW CHANGES
5	12-18-59			REVISED TO SHOW CHANGES
6	12-18-59			REVISED TO SHOW CHANGES
7	12-18-59			REVISED TO SHOW CHANGES
8	12-18-59			REVISED TO SHOW CHANGES
9	12-18-59			REVISED TO SHOW CHANGES
10	12-18-59			REVISED TO SHOW CHANGES
11	12-18-59			REVISED TO SHOW CHANGES
12	12-18-59			REVISED TO SHOW CHANGES
13	12-18-59			REVISED TO SHOW CHANGES
14	12-18-59			REVISED TO SHOW CHANGES
15	12-18-59			REVISED TO SHOW CHANGES
16	12-18-59			REVISED TO SHOW CHANGES
17	12-18-59			REVISED TO SHOW CHANGES
18	12-18-59			REVISED TO SHOW CHANGES
19	12-18-59			REVISED TO SHOW CHANGES
20	12-18-59			REVISED TO SHOW CHANGES
21	12-18-59			REVISED TO SHOW CHANGES
22	12-18-59			REVISED TO SHOW CHANGES
23	12-18-59			REVISED TO SHOW CHANGES
24	12-18-59			REVISED TO SHOW CHANGES
25	12-18-59			REVISED TO SHOW CHANGES
26	12-18-59			REVISED TO SHOW CHANGES
27	12-18-59			REVISED TO SHOW CHANGES
28	12-18-59			REVISED TO SHOW CHANGES

FACING REAR OF CONTROL PANEL



REV	DATE	BY	CHKD	DESCRIPTION
1	12/88			ISSUE
2	12/88			REVISED

ITEM NO.	QUANTITY	DESCRIPTION
1	1	PC BOARD
2	1	SCR BOARD
3	1	RELAY KIT
4	1	METER KIT
5	1	SPOT TIMER KIT

DATE	12/88
BY	
CHKD	
APP'D	
TITLE	WIRING CONNECTION
PROJECT	
DRAWING NO.	203615
SHEET NO.	1
TOTAL SHEETS	1

REVISIONS

NO. DATE BY CHKD DESCRIPTION

1 12/88 [] []

2 12/88 [] []

3 12/88 [] []

4 12/88 [] []

5 12/88 [] []

6 12/88 [] []

7 12/88 [] []

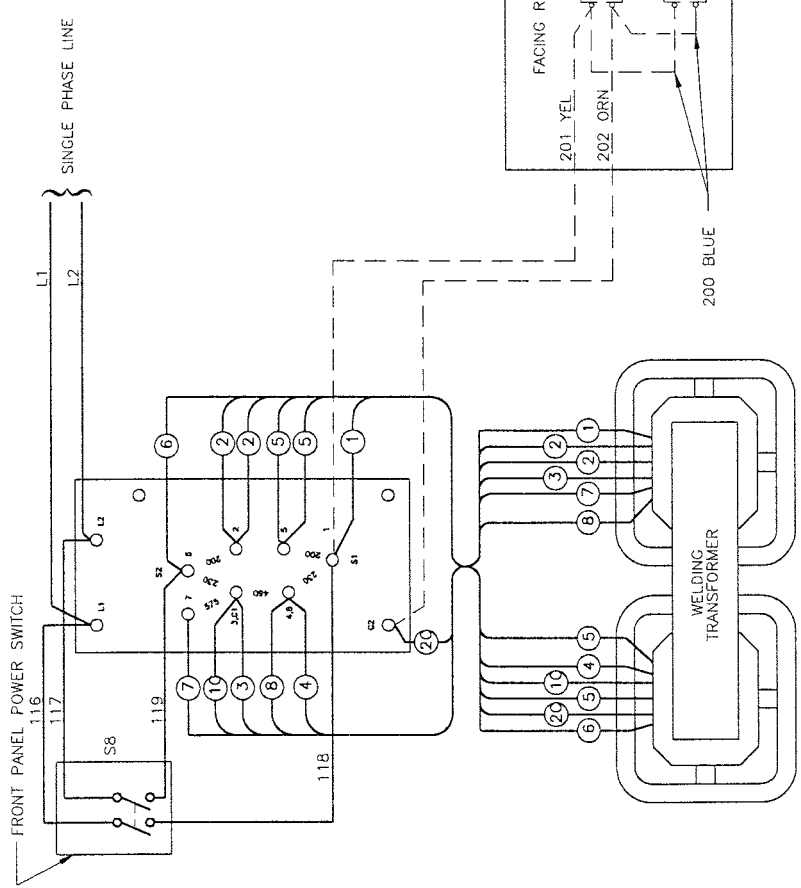
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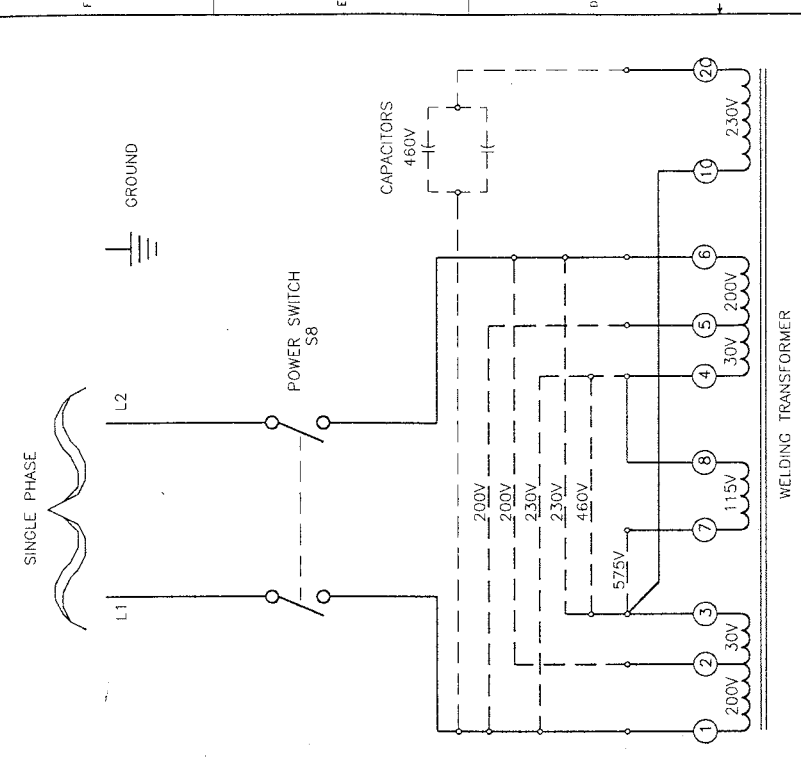
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12 12/88 [] []



PRIMARY VOLTAGE CONNECTIONS FOR 200/230/460/575 VOLT MODELS



FOR SECONDARY SCHEMATIC SEE 203615

INSTRUCTIONS FOR SETTING VOLTAGE CHANGEOVER PANEL AND CONNECTING POWER LINE (ALSO SEE INFORMATION IN INSTRUCTION MANUAL)

- CHECK NAMEPLATE OF WELDER TO BE CERTAIN IT IS DESIGNED FOR THE LINE VOLTAGE TO WHICH YOU WISH TO CONNECT IT.
- CONNECT THE LINKS AS SHOWN IN FIGS. 1, 2, 3, & 4 AT LEFT, AS APPLICABLE FOR THE PROPER LINE VOLTAGE.
- CHECK YOUR LOCAL CODES FOR THE PROPER LINE WIRE SIZE FOR THE LINE CURRENT SHOWN ON THE NAMEPLATE OF THE WELDER. IF NO CODES EXIST, USE THE CHART IN THE INSTALLATION MANUAL.
- CONNECT THE SINGLE PHASE POWER LINE TO THE TOP OF THE VOLTAGE CHANGEOVER BOARD AS IN DIAGRAM ABOVE (CAUTION—BE CERTAIN INPUT CIRCUIT IS OPEN BEFORE HANDLING LINE "GROUND").
- CONNECT THE POWER SYSTEM GROUND TO THE SCREW ON THE LIFTING YOKE MARKED "GROUND".

NOTES:

- ROUTE LEADS 201 YELLOW AND 202 ORANGE TO APPROPRIATE TERMINAL ON VOLTAGE CHANGEOVER BOARD.
- FOR SECONDARY CONNECTIONS SEE 203615.

CHANGE RECORD	DATE	FILE NAME	REV. DATE	FINISH CODE PER
1	AA13411-31-90	203693S1	11-3-97	NONE
2	AA27436-14-91			

REVISIONS	QUANTITY	DATE	SCALE
		11-6-89	FULL
		11-13-89	REV. TYPE

DIAGRAM, VOLTAGE CHANGEOVER

RESISTIVE DATA

RESISTANCE	ANGLE	SCALE
0 ± .1	0	± 1.0mm
.00 ± .02	0.0	± 0.4mm
.000 ± .003	0.00	± 0.1mm

DO NOT SCALE DRAWING

COMMENTS: This drawing is the property of International Brotherhood of Electrical Workers, Inc. and is not to be copied, reproduced, altered or distributed in whole or in part, except with express written permission. Rev. 010 4373, U.S.A.

203693

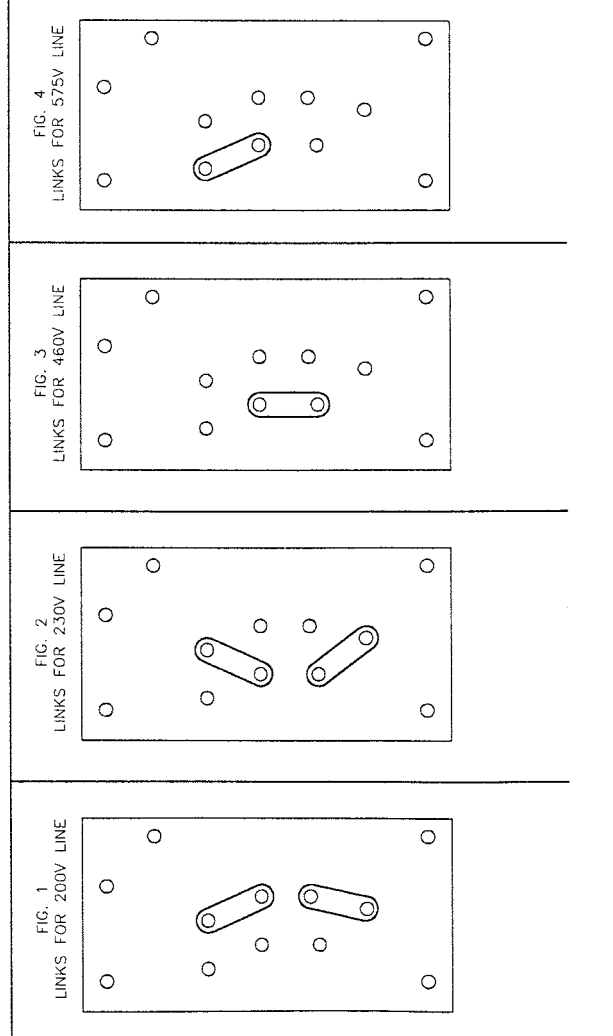


FIG. 1 LINKS FOR 200V LINE

FIG. 2 LINKS FOR 230V LINE

FIG. 3 LINKS FOR 460V LINE

FIG. 4 LINKS FOR 575V LINE

Statement of Warranty

LIMITED WARRANTY: Thermal Arc[®], Inc., A Thermadyne Company, warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal Arc products as stated below, Thermal Arc shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal Arc's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal Arc's sole option, of any components or parts of the product determined by Thermal Arc to be defective.

THERMAL ARC MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED. THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHERS, INCLUDING, BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal Arc shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal Arc with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal Arc whether arising out of contract, negligence, strike tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based. No employee, agent, or representative of Thermal Arc is authorized to change this warranty in any way or grant any other warranty.

PURCHASER'S RIGHTS UNDER THIS WARRANTY ARE VOID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH IN THERMAL ARC'S SOLE JUDGMENT MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL ARC PRODUCT.

PURCHASER'S RIGHTS UNDER THIS WARRANTY ARE VOID IF THE PRODUCT IS SOLD TO PURCHASER BY NON-AUTHORIZED PERSONS.

Except with regards to the products listed below, this warranty shall remain effective three (3) years from the date Thermal Arc's authorized distributor delivers the product to Purchaser, but in no event more than (4) years from the date Thermal Arc delivers the product to the authorized distributor.

Shorter warranty periods apply to the products listed below. On these products, the warranty is effective for the time stated below beginning on the date that the authorized distributor delivers the products to the Purchaser. Notwithstanding the foregoing, in no event shall the warranty period extend more than the time stated plus one year from the date Thermal Arc delivered the product to the authorized distributor.

	<u>ALL OTHER</u>	<u>P-WEE, PRO-LITE</u>	
<u>POWER SUPPLIES</u>	<u>POWER SUPPLIES</u>	<u>PRO-PLUS, PRO-WAVE</u>	<u>LABOR</u>
MAIN POWER MAGNETICS (STATIC & ROTATING)	3 YEARS	2 YEARS	1 YEAR
ORIGINAL MAIN POWER RECTIFIER	3 YEARS	2 YEARS	1 YEAR
CONTROL PC BOARD	3 YEARS	2 YEARS	1 YEAR
ALL OTHER CIRCUITS AND COMPONENTS INCLUDING	1 YEAR	1 YEAR	1 YEAR
BUT NOT LIMITED TO, CONTACTORS, RELAYS, SOLENOID, PUMPS, POWER SWITCHING SEMI-CONDUCTORS			

ENGINES: ENGINES ARE NOT WARRANTED BY THERMAL ARC, ALTHOUGH MOST ARE WARRANTED BY THE ENGINE MANUFACTURER. SEE THE ENGINE MANUFACTURES WARRANTY FOR DETAILS.

<u>CONSOLES, CONTROL EQUIPMENT, HEAT</u>	1 YEAR	1 YEAR	1 YEAR
--	--------	--------	--------

EXCHANGES, AND ACCESSORY EQUIPMENT

<u>TORCH AND LEADS</u>	180 DAYS	180 DAYS	180 DAYS
<u>REPAIR/REPLACEMENT PARTS</u>	90 DAYS	90 DAYS	90 DAYS

Warranty repairs or replacement claims under this limited warranty must be submitted to Thermal Arc by an authorized Thermal Arc[®] repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal Arc warranties.

Thermal Arc[®] is a Registered Trademark of Thermadyne Industries Inc.