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October 2004

**Processes**



TIG (GTAW) Welding



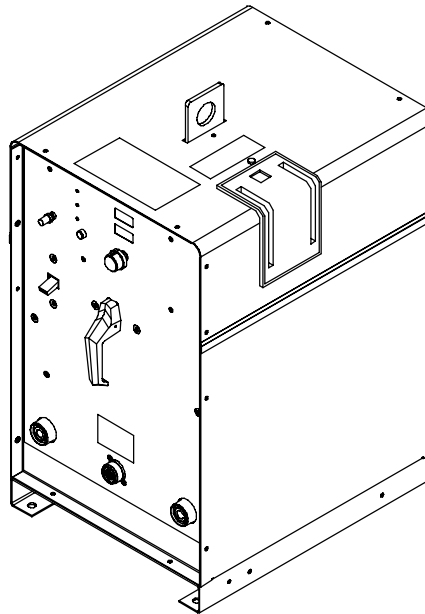
Stick (SMAW) Welding

**Description**



Arc Welding Power Source

# Syncrowave<sup>®</sup> 180 SD



230 Volt Model

**OWNER'S MANUAL**



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# From Miller to You

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*Thank you and congratulations* on choosing Miller. Now you can get the job done and get it done right. We know you don't have time to do it any other way.

That's why when Niels Miller first started building arc welders in 1929, he made sure his products offered long-lasting value and superior quality. Like you, his customers couldn't afford anything less. Miller products had to be more than the best they could be. They had to be the best you could buy.

Today, the people that build and sell Miller products continue the tradition. They're just as committed to providing equipment and service that meets the high standards of quality and value established in 1929.

This Owner's Manual is designed to help you get the most out of your Miller products. Please take time to read the Safety precautions. They will help you protect yourself against potential hazards on the worksite.

We've made installation and operation quick and easy. With Miller you can count on years of reliable service with proper maintenance. And if for some reason the unit needs repair, there's a Troubleshooting section that will help you figure out what the problem is. The parts list will then help you to decide the exact part you may need to fix the problem. Warranty and service information for your particular model are also provided.



Miller is the first welding equipment manufacturer in the U.S.A. to be registered to the ISO 9001:2000 Quality System Standard.



Miller Electric manufactures a full line of welders and welding related equipment. For information on other quality Miller products, contact your local Miller distributor to receive the latest full line catalog or individual catalog sheets. **To locate your nearest distributor or service agency call 1-800-4-A-Miller, or visit us at [www.MillerWelds.com](http://www.MillerWelds.com) on the web.**



Working as hard as you do – every power source from Miller is backed by the most hassle-free warranty in the business.



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# SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING

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## 1-1. Symbol Usage



Means Warning! Watch Out! There are possible hazards with this procedure! The possible hazards are shown in the adjoining symbols.

▲ Marks a special safety message.

☞ Means "Note"; not safety related.



This group of symbols means Warning! Watch Out! possible ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.

## 1-2. Arc Welding Hazards

▲ The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard. The safety information given below is only a summary of the more complete safety information found in the Safety Standards listed in Section 1-5. Read and follow all Safety Standards.

▲ Only qualified persons should install, operate, maintain, and repair this unit.

▲ During operation, keep everybody, especially children, away.



### 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

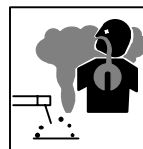
live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

- Do not touch live electrical parts.
- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.
- Do not use AC output in damp areas, if movement is confined, or if there is a danger of falling.
- Use AC output ONLY if required for the welding process.
- If AC output is required, use remote output control if present on unit.
- Disconnect input power or stop engine before installing or servicing this equipment. Lockout/tagout input power according to OSHA 29 CFR 1910.147 (see Safety Standards).
- Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.
- Always verify the supply ground – check and be sure that input power cord ground wire is properly connected to ground terminal in disconnect box or that cord plug is connected to a properly grounded receptacle outlet.
- When making input connections, attach proper grounding conductor first – double-check connections.
- Frequently inspect input power cord for damage or bare wiring – replace cord immediately if damaged – bare wiring can kill.
- Turn off all equipment when not in use.
- Do not use worn, damaged, undersized, or poorly spliced cables.
- Do not drape cables over your body.

- If earth grounding of the workpiece is required, ground it directly with a separate cable.
- Do not touch electrode if you are in contact with the work, ground, or another electrode from a different machine.
- Use only well-maintained equipment. Repair or replace damaged parts at once. Maintain unit according to manual.
- Wear a safety harness if working above floor level.
- Keep all panels and covers securely in place.
- Clamp work cable with good metal-to-metal contact to workpiece or worktable as near the weld as practical.
- Insulate work clamp when not connected to workpiece to prevent contact with any metal object.
- Do not connect more than one electrode or work cable to any single weld output terminal.

### SIGNIFICANT DC VOLTAGE exists after removal of input power on inverters.

- Turn Off inverter, disconnect input power, and discharge input capacitors according to instructions in Maintenance Section before touching any parts.



### FUMES AND GASES can be hazardous.

Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
- If ventilation is poor, use an approved air-supplied respirator.
- Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instructions for metals, consumables, coatings, cleaners, and degreasers.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watch-person nearby. Welding fumes and gases can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.
- 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.
- 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.



### ARC RAYS can burn eyes and skin.

Arc rays from the welding process produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin. Sparks fly off from the weld.

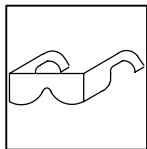
- Wear a welding helmet fitted with a proper shade of filter to protect your face and eyes when welding or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).
- Wear approved safety glasses with side shields under your helmet.
- Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
- Wear protective clothing made from durable, flame-resistant material (leather and wool) and foot protection.



### WELDING can cause fire or explosion.

Welding on closed containers, such as tanks, drums, or pipes, can cause them to blow up. Sparks can fly off from the welding arc. The flying sparks, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode to metal objects can cause sparks, explosion, overheating, or fire. Check and be sure the area is safe before doing any welding.

- Protect yourself and others from flying sparks and hot metal.
- Do not weld where flying sparks can strike flammable material.
- Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not weld on closed containers such as tanks, drums, or pipes, unless they are properly prepared according to AWS F4.1 (see Safety Standards).
- 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.
- Do not use welder to thaw frozen pipes.
- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
- Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding.



### FLYING METAL can injure eyes.

- Welding, chipping, wire brushing, and grinding cause sparks and flying metal. As welds cool, they can throw off slag.
- Wear approved safety glasses with side shields even under your welding helmet.



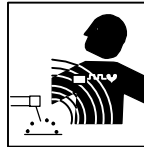
### BUILDUP OF GAS can injure or kill.

- Shut off shielding gas supply when not in use.
- Always ventilate confined spaces or use approved air-supplied respirator.



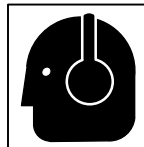
### HOT PARTS can cause severe burns.

- Do not touch hot parts bare handed.
- Allow cooling period before working on gun or torch.



### MAGNETIC FIELDS can affect pacemakers.

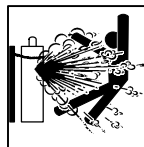
- Pacemaker wearers keep away.
- Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations.



### NOISE can damage hearing.

Noise from some processes or equipment can damage hearing.

- Wear approved ear protection if noise level is high.



### CYLINDERS can explode if damaged.

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.

- Protect compressed gas cylinders from excessive heat, mechanical shocks, slag, open flames, sparks, and arcs.
- Install cylinders in an upright position by securing to a stationary support or cylinder rack to prevent falling or tipping.
- Keep cylinders away from any welding or other electrical circuits.
- Never drape a welding torch over a gas cylinder.
- Never allow a welding electrode to touch any cylinder.
- Never weld on a pressurized cylinder – explosion will result.
- Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
- Turn face away from valve outlet when opening cylinder valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.

### 1-3. Additional Symbols For Installation, Operation, And Maintenance



#### FIRE OR EXPLOSION hazard.

- Do not install or place unit on, over, or near combustible surfaces.
- Do not install unit near flammables.
- Do not overload building wiring – be sure power supply system is properly sized, rated, and protected to handle this unit.



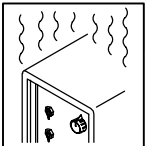
#### MOVING PARTS can cause injury.

- Keep away from moving parts such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.



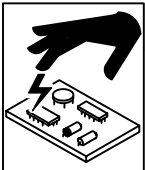
#### FALLING UNIT can cause injury.

- Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift and support unit.
- If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.



#### OVERUSE can cause OVERHEATING

- Allow cooling period; follow rated duty cycle.
- Reduce current or reduce duty cycle before starting to weld again.
- Do not block or filter airflow to unit.



#### STATIC (ESD) can damage PC boards.

- Put on grounded wrist strap BEFORE handling boards or parts.
- Use proper static-proof bags and boxes to store, move, or ship PC boards.



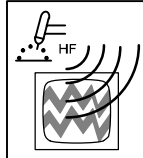
#### MOVING PARTS can cause injury.

- Keep away from moving parts.
- Keep away from pinch points such as drive rolls.



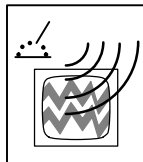
#### WELDING WIRE can cause injury.

- Do not press gun trigger until instructed to do so.
- Do not point gun toward any part of the body, other people, or any metal when threading welding wire.



#### H.F. RADIATION can cause interference.

- High-frequency (H.F.) can interfere with radio navigation, safety services, computers, and communications equipment.
- Have only qualified persons familiar with electronic equipment perform this installation.
- The user is responsible for having a qualified electrician promptly correct any interference problem resulting from the installation.
- If notified by the FCC about interference, stop using the equipment at once.
- Have the installation regularly checked and maintained.
- Keep high-frequency source doors and panels tightly shut, keep spark gaps at correct setting, and use grounding and shielding to minimize the possibility of interference.



#### ARC WELDING can cause interference.

- Electromagnetic energy can interfere with sensitive electronic equipment such as computers and computer-driven equipment such as robots.
- Be sure all equipment in the welding area is electromagnetically compatible.
- To reduce possible interference, keep weld cables as short as possible, close together, and down low, such as on the floor.
- Locate welding operation 100 meters from any sensitive electronic equipment.
- Be sure this welding machine is installed and grounded according to this manual.
- If interference still occurs, the user must take extra measures such as moving the welding machine, using shielded cables, using line filters, or shielding the work area.

### 1-4. California Proposition 65 Warnings

- ▲ Welding or cutting equipment 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 Section 25249.5 et seq.)
- ▲ Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.

#### For Gasoline Engines:

- ▲ Engine exhaust contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

#### For Diesel Engines:

- ▲ Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

## 1-5. Principal Safety Standards

*Safety in Welding, Cutting, and Allied Processes*, ANSI Standard Z49.1, from American Welding Society, 550 N.W. LeJeune Rd, Miami FL 33126 (phone: 305-443-9353, website: [www.aws.org](http://www.aws.org)).

*Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping*, American Welding Society Standard AWS F4.1, from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126 (phone: 305-443-9353, website: [www.aws.org](http://www.aws.org)).

*National Electrical Code*, NFPA Standard 70, from National Fire Protection Association, P.O. Box 9101, 1 Battery March Park, Quincy, MA 02269-9101 (phone: 617-770-3000, website: [www.nfpa.org](http://www.nfpa.org) and [www.sparky.org](http://www.sparky.org)).

*Safe Handling of Compressed Gases in Cylinders*, CGA Pamphlet P-1, from Compressed Gas Association, 1735 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102 (phone: 703-412-0900, website: [www.cganet.com](http://www.cganet.com)).

*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 (phone: 800-463-6727 or in Toronto 416-747-4044, website: [www.csa-international.org](http://www.csa-international.org)).

*Practice For Occupational And Educational Eye And Face Protection*, ANSI Standard Z87.1, from American National Standards Institute, 11 West 42nd Street, New York, NY 10036-8002 (phone: 212-642-4900, website: [www.ansi.org](http://www.ansi.org)).

*Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, NFPA Standard 51B, from National Fire Protection Association, P.O. Box 9101, 1 Battery March Park, Quincy, MA 02269-9101 (phone: 617-770-3000, website: [www.nfpa.org](http://www.nfpa.org) and [www.sparky.org](http://www.sparky.org)).

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, from U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250 (there are 10 Regional Offices—phone for Region 5, Chicago, is 312-353-2220, website: [www.osha.gov](http://www.osha.gov)).

## 1-6. EMF Information

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

Welding current, as it flows through welding cables, will cause electromagnetic fields. There has been and still is some concern about such fields. However, after examining more than 500 studies spanning 17 years of research, a special blue ribbon committee of the National Research Council concluded that: "The body of evidence, in the committee's judgment, has not demonstrated that exposure to power-frequency electric and magnetic fields is a human-health hazard." However, studies are still going forth and evidence continues to be examined. Until the final conclusions of the research are reached, you may wish to minimize your exposure to electromagnetic fields when welding or cutting.

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

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around your body.
4. Keep welding power source and cables as far away from operator as practical.
5. Connect work clamp to workpiece as close to the weld as possible.

### About Pacemakers:

Pacemaker wearers consult your doctor first. If cleared by your doctor, then following the above procedures is recommended.



# SECTION 2 – CONSIGNES DE SÉCURITÉ – À LIRE AVANT UTILISATION

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## 2-1. Signification des symboles



Signifie « Mise en garde. Faire preuve de vigilance. » Cette procédure présente des risques identifiés par les symboles adjacents aux directives.

### ▲ Identifie un message de sécurité particulier.

Signifie « NOTA » ; n'est pas relatif à la sécurité.



Ce groupe de symboles signifie « Mise en garde. Faire preuve de vigilance. » Il y a des dangers liés aux CHOCS ÉLECTRIQUES, aux PIÈCES EN MOUVEMENT et aux PIÈCES CHAUDES. Se reporter aux symboles et aux directives ci-dessous afin de connaître les mesures à prendre pour éviter tout danger.

## 2-2. Dangers relatifs au soudage à l'arc

▲ Les symboles ci-après sont utilisés tout au long du présent manuel pour attirer l'attention sur les dangers potentiels et les identifier. Lorsqu'on voit un symbole, faire preuve de vigilance et suivre les directives mentionnées afin d'éviter tout danger. Les consignes de sécurité énoncées ci-après ne font que résumer le contenu des normes de sécurité mentionnées à la section 2-4. Lire et respecter toutes ces normes.

▲ L'installation, l'utilisation, l'entretien et les réparations ne doivent être confiés qu'à des personnes qualifiées.

▲ Pendant l'utilisation de l'appareil, tenir à l'écart toute personne, en particulier les enfants.



### LES DÉCHARGES ÉLECTRIQUES peuvent être mortelles.

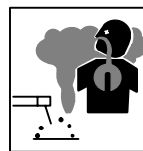
Un simple contact avec des pièces sous tension peut causer une électrocution ou des blessures graves. L'électrode et le circuit de soudage sont sous tension dès que l'appareil est en fonctionnement. Le circuit d'entrée et les circuits internes de l'appareil sont également sous tension. En soudage semi-automatique ou automatique, le fil, le dévidoir, le logement des galets d'entraînement et les pièces métalliques en contact avec le fil de soudage sont sous tension. Tout matériel mal installé ou mal mis à la terre présente un danger.

- Ne jamais toucher aux pièces électriques sous tension.
- Porter des gants et des vêtements de protection secs et exempts de trous.
- S'isoler de la pièce et de la terre au moyen de tapis ou autres dispositifs isolants suffisamment grands pour empêcher tout contact physique avec la pièce ou la terre.
- Ne pas se servir d'une source de courant alternatif dans les zones humides, les endroits confinés ou là où on risque de tomber.
- Ne se servir d'une source de courant alternatif QUE si le procédé de soudage l'exige.
- Si l'utilisation d'une source de courant alternatif s'avère nécessaire, se servir de la fonction de télécommande si l'appareil en est équipé.
- Couper l'alimentation ou arrêter le moteur avant de procéder à l'installation, à la réparation ou à l'entretien de l'appareil. Couper/étiqueter l'alimentation selon la norme OSHA 29 CFR 1910.147 (voir les normes de sécurité).
- Installer et mettre à la terre correctement l'appareil conformément à son manuel d'utilisation et aux codes nationaux, provinciaux et municipaux.
- Toujours vérifier la terre du cordon d'alimentation – Vérifier et s'assurer que le fil de terre du cordon d'alimentation est bien raccordé à la borne de terre du sectionneur ou que la fiche du cordon est raccordée à une prise correctement mise à la terre.
- Pour exécuter les branchements d'entrée, fixer d'abord le conducteur de mise à la terre adéquat et contre-vérifier les connexions.
- Vérifier fréquemment le cordon d'alimentation et s'assurer qu'il n'est ni endommagé ni dénudé ; le remplacer immédiatement s'il est endommagé – tout câble dénudé peut causer une électrocution.
- Mettre l'appareil hors tension quand on ne l'utilise pas.
- Ne pas utiliser de câbles usés, endommagés, de calibre insuffisant ou mal épissés.
- Ne pas s'enrouler les câbles autour du corps.
- Si la pièce soudée doit être mise à la terre, le faire directement avec un câble distinct.
- Ne pas toucher l'électrode quand on est en contact avec la pièce, la terre ou une électrode d'une autre machine.

- N'utiliser que du matériel en bon état. Réparer ou remplacer sur-le-champ les pièces endommagées. Entretien l'appareil conformément au présent manuel.
- Porter un harnais de sécurité quand on travaille en hauteur.
- Maintenir solidement en place tous les panneaux et capots.
- Fixer le câble de retour de façon à obtenir un bon contact métal sur métal avec la pièce à souder ou la table de travail, le plus près possible de la soudure.
- Ne pas connecter plus d'une électrode ou plus d'un câble de masse à un même terminal de sortie.

### Il subsiste un COURANT CONTINU IMPORTANT dans les convertisseurs après la suppression de l'alimentation électrique.

- Arrêter les convertisseurs, débrancher le courant électrique et décharger les condensateurs d'alimentation selon les instructions énoncées à la section Entretien avant de toucher les pièces.



### LES FUMÉES ET LES GAZ peuvent être dangereux.

Le soudage génère des fumées et des gaz dont l'inhalation peut être dangereuse pour la santé.

- Se tenir à distance des fumées et ne pas les inhaler.
- À l'intérieur, ventiler la zone et/ou utiliser un dispositif d'aspiration au niveau de l'arc pour l'évacuation des fumées et des gaz de soudage.
- Si la ventilation est insuffisante, utiliser un respirateur à adduction d'air agréé.
- Lire les fiches techniques de santé-sécurité (FTSS) et les instructions du fabricant concernant les métaux, les consommables, les revêtements, les nettoyeurs et les dégraissateurs.
- Ne travailler dans un espace clos que s'il est bien ventilé ou porter un respirateur à adduction d'air. Demander toujours à un surveillant dûment formé de se tenir à proximité. Des fumées et des gaz de soudage peuvent se substituer à l'air, abaisser la teneur en oxygène et causer des lésions ou des accidents mortels. S'assurer que l'air est respirable.
- Ne pas souder à proximité d'opérations de dégraissage, de nettoyage ou de pulvérisation. La chaleur et les rayons de l'arc peuvent réagir en présence de vapeurs et former des gaz hautement toxiques et irritants.
- Ne pas souder de métaux munis d'un revêtement, tels que la tôle d'acier galvanisée, plombée ou cadmiée, à moins que le revêtement n'ait été enlevé dans la zone de soudage, que l'endroit soit bien ventilé, et si nécessaire, porter un respirateur à adduction d'air. Les revêtements et tous les métaux renfermant ces éléments peuvent dégager des fumées toxiques lorsqu'on les soude.



### LES RAYONS DE L'ARC peuvent causer des brûlures oculaires et cutanées.

Le rayonnement de l'arc génère des rayons visibles et invisibles intenses (ultraviolets et infrarouges) susceptibles de causer des brûlures oculaires et cutanées. Des étincelles sont projetées pendant le soudage.

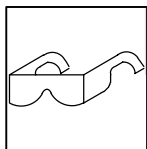
- Porter un masque de soudage muni d'un filtre de la nuance adéquate pour se protéger le visage et les yeux pendant le soudage ou pour regarder (voir les normes de sécurité ANSI Z49.1 et Z87.1).
- Porter des lunettes de sécurité à écrans latéraux sous le masque.
- Utiliser des écrans ou des barrières pour protéger les tiers de l'éclat éblouissant ou aveuglant de l'arc ; leur demander de ne pas regarder l'arc.
- Porter des vêtements de protection en matière durable et ignifuge (cuir ou laine) et des chaussures de sécurité.



### LE SOUDAGE peut causer un incendie ou une explosion.

Le soudage effectué sur des récipients fermés tels que des réservoirs, des fûts ou des conduites peut causer leur éclatement. Des étincelles peuvent être projetées de l'arc de soudure. La projection d'étincelles, les pièces chaudes et les équipements chauds peuvent causer des incendies et des brûlures. Le contact accidentel de l'électrode avec tout objet métallique peut causer des étincelles, une explosion, un surchauffement ou un incendie. Avant de commencer le soudage, vérifier et s'assurer que l'endroit ne présente pas de danger.

- Se protéger et protéger les tiers de la projection d'étincelles et de métal chaud.
- Ne pas souder à un endroit où des étincelles peuvent tomber sur des substances inflammables.
- Placer toutes les substances inflammables à une distance de 10,7 m de l'arc de soudage. En cas d'impossibilité, les recouvrir soigneusement avec des protections agréées.
- Des étincelles et des matières en fusion peuvent facilement passer même par des fissures et des ouvertures de petites dimensions.
- Surveiller tout déclenchement d'incendie et tenir un extincteur à proximité.
- Le soudage effectué sur un plafond, un plancher, une paroi ou une cloison peut déclencher un incendie de l'autre côté.
- Ne pas souder des récipients fermés tels que des réservoirs, des fûts ou des conduites, à moins qu'ils n'aient été préparés conformément à l'AWS F4.1 (voir les normes de sécurité).
- Brancher le câble sur la pièce le plus près possible de la zone de soudage pour éviter que le courant ne circule sur une longue distance, par des chemins inconnus, et ne cause des risques d'électrocution et d'incendie.
- Ne pas utiliser le poste de soudage pour dégeler des conduites gelées.
- En cas de non utilisation, enlever la baguette d'électrode du porte-électrode ou couper le fil au raz du tube-contact.
- Porter des vêtements de protection exempts d'huile tels que des gants en cuir, une chemise en tissu épais, des pantalons sans revers, des chaussures montantes et un masque.
- Avant de souder, retirer tout produit combustible de ses poches, tel qu'un briquet au butane ou des allumettes.



### LES PARTICULES PROJETÉES peuvent blesser les yeux.

- Le soudage, le burinage, le passage de la pièce à la brosse métallique et le meulage provoquent l'émission d'étincelles et de particules métalliques. Pendant leur refroidissement, les soudures risquent de projeter du laitier.
  - Porter des lunettes de sécurité à écrans latéraux agréés, même sous le masque de soudage.



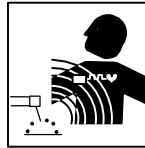
### LES ACCUMULATIONS DE GAZ peuvent causer des blessures ou même la mort.

- Couper l'alimentation en gaz protecteur en cas de non utilisation.
- Veiller toujours à bien ventiler les espaces confinés ou porter un respirateur à adduction d'air agréé.



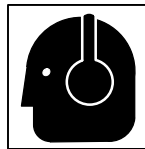
### LES PIÈCES CHAUDES peuvent causer des brûlures graves.

- Ne pas toucher les pièces chaudes à main nue.
- Prévoir une période de refroidissement avant d'utiliser le pistolet ou la torche.



### LES CHAMPS MAGNÉTIQUES peuvent perturber le fonctionnement des stimulateurs cardiaques.

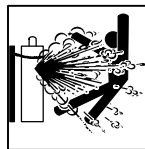
- Les personnes qui portent un stimulateur cardiaque doivent se tenir à distance.
- Ils doivent consulter leur médecin avant de s'approcher d'un lieu où on exécute des opérations de soudage à l'arc, de gougeage ou de soudage par points.



### LE BRUIT peut affecter l'ouïe.

Le bruit de certains processus et équipements peut affecter l'ouïe.

- Porter des protecteurs d'oreille agréés si le niveau sonore est trop élevé.



### Les BOUTEILLES endommagées peuvent exploser.

Les bouteilles de gaz protecteur contiennent du gaz sous haute pression. Toute bouteille endommagée peut exploser. Comme les bouteilles de gaz font normalement partie du procédé de soudage, les manipuler avec précaution.

- Protéger les bouteilles de gaz comprimé de la chaleur excessive, des chocs mécaniques, du laitier, des flammes nues, des étincelles et des arcs.
- Placer les bouteilles debout en les fixant dans un support stationnaire ou dans un porte-bouteilles pour les empêcher de tomber ou de se renverser.
- Tenir les bouteilles éloignées des circuits de soudage ou autres circuits électriques.
- Ne jamais poser une torche de soudage sur une bouteille de gaz.
- Ne jamais mettre une électrode de soudage en contact avec une bouteille de gaz.
- Ne jamais souder une bouteille contenant du gaz sous pression – elle risquerait d'exploser.
- N'utiliser que les bouteilles de gaz protecteur, régulateurs, tuyaux et raccords adéquats pour l'application envisagée ; les maintenir en bon état, ainsi que les pièces connexes.
- Détourner la tête lorsqu'on ouvre la soupape d'une bouteille.
- Laisser le capuchon protecteur sur la soupape, sauf en cas d'utilisation ou de branchement de la bouteille
- Lire et suivre les instructions concernant les bouteilles de gaz comprimé, les équipements associés et les publications P-1 de la CGA, mentionnées dans les normes de sécurité.

## 2-3. Autres symboles relatifs à l'installation, au fonctionnement et à l'entretien de l'appareil.



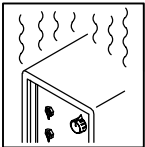
### Risque D'INCENDIE OU D'EXPLOSION

- Ne pas placer l'appareil sur une surface inflammable, ni au-dessus ou à proximité d'elle.
- Ne pas installer l'appareil à proximité de produits inflammables.
- Ne pas surcharger l'installation électrique – s'assurer que l'alimentation est correctement dimensionnée et protégée avant de mettre l'appareil en service.



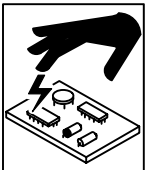
### LA CHUTE DE L'APPAREIL peut blesser.

- N'utiliser que l'anneau de levage pour lever l'appareil. NE PAS utiliser le chariot, les bouteilles de gaz ou tout autre accessoire.
- Utiliser un engin de capacité adéquate pour lever l'appareil.
- Si on utilise un chariot élévateur pour déplacer l'unité, s'assurer que les fourches sont suffisamment longues pour dépasser du côté opposé de l'appareil.



### L'EMPLOI EXCESSIF peut FAIRE SURCHAUFFER L'ÉQUIPEMENT.

- Prévoir une période de refroidissement ; respecter le cycle opératoire nominal.
- Réduire le courant ou le cycle opératoire avant de reprendre le soudage.
- Ne pas obstruer les orifices ou filtrer l'alimentation en air du poste.



### LES CHARGES ÉLECTROSTATIQUES peuvent endommager les circuits imprimés.

- Mettre un bracelet antistatique AVANT de manipuler des cartes ou des pièces.
- Utiliser des pochettes et des boîtes antistatiques pour stocker, déplacer ou expédier des cartes de circuits imprimés.



### LES PIÈCES MOBILES peuvent causer des blessures.

- Se tenir à l'écart des pièces mobiles.
- Se tenir à l'écart des points de coincement tels que les dévidoirs.



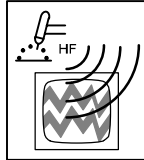
### LES FILS DE SOUDAGE peuvent causer des blessures.

- Ne pas appuyer sur la gâchette avant d'en avoir reçu l'instruction.
- Ne pas diriger le pistolet vers soi, vers d'autres personnes ou vers toute pièce mécanique en engageant le fil de soudage.



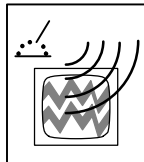
### LES ORGANES MOBILES peuvent causer des blessures.

- Se tenir à l'écart des organes mobiles comme les ventilateurs.
- Maintenir fermés et bien fixés les portes, panneaux, recouvrements et dispositifs de protection.



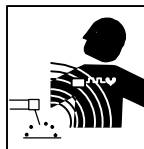
### LE RAYONNEMENT HAUTE FRÉQUENCE (H. F.) risque de causer des interférences.

- Le rayonnement haute fréquence peut causer des interférences avec les équipements de radio-navigation et de communication, les services de sécurité et les ordinateurs.
- Ne demander qu'à des personnes qualifiées familiarisées avec les équipements électroniques de faire fonctionner l'installation.
- L'utilisateur est tenu de faire corriger rapidement par un électricien qualifié les interférences causées par l'installation.
- Si la Federal Communications Commission signale des interférences, arrêter immédiatement l'appareil.
- Faire régulièrement contrôler et entretenir l'installation.
- Maintenir soigneusement fermés les panneaux et les portes des sources de haute fréquence, maintenir le jeu d'éclatement au réglage adéquat et utiliser une terre et un blindage pour réduire les interférences éventuelles.



### LE SOUDAGE À L'ARC peut causer des interférences.

- L'énergie électromagnétique peut causer des interférences avec l'équipement électronique sensible tel que les ordinateurs et l'équipement commandé par ordinateur tel que les robots.
- Veiller à ce que tout l'équipement de la zone de soudage soit compatible au point de vue électromagnétique.
- Pour réduire la possibilité d'interférence, maintenir les câbles de soudage aussi courts que possible, les grouper, et les poser aussi bas que possible (par ex. : à terre).
- Veiller à souder à une distance de 100 mètres de tout équipement électronique sensible.
- Veiller à ce que le poste de soudage soit posé et mis à la terre conformément au présent manuel.
- En cas d'interférences après exécution des directives précédentes, il incombe à l'utilisateur de prendre des mesures supplémentaires telles que le déplacement du poste, l'utilisation de câbles blindés, l'utilisation de filtres de ligne ou la pose de protecteurs dans la zone de travail.



### LES CHAMPS MAGNÉTIQUES peuvent affecter les stimulateurs cardiaques.

- Porteurs de stimulateur cardiaque, restez à distance.
- Les porteurs d'un stimulateur cardiaque doivent d'abord consulter leur médecin avant de s'approcher des opérations de soudage à l'arc, de gougeage ou de soudage par points.

## 2-4. Principales normes de sécurité

Safety in Welding, Cutting, and Allied Processes, norme ANSI Z49.1, de l'American Welding Society, 550 N.W. LeJeune Rd, Miami FL 33126 (téléphone : (305) 443-9353, site Web : [www.aws.org](http://www.aws.org)).

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping, norme American Welding Society AWS F4.1, de l'American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126 (téléphone : (305) 443-9353, site Web : [www.aws.org](http://www.aws.org)).

National Electrical Code, norme NFPA 70, de la National Fire Protection Association, P.O. Box 9101, 1 Battery March Park, Quincy, MA 02269-9101 (téléphone : (617) 770-3000, sites Web : [www.nfpa.org](http://www.nfpa.org) et [www.sparky.org](http://www.sparky.org)).

Safe Handling of Compressed Gases in Cylinders, brochure CGA P-1, de la Compressed Gas Association, 1735 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102 (téléphone : (703) 412-0900, site Web : [www.cganet.com](http://www.cganet.com)).

Code for Safety in Welding and Cutting, norme CSA W117.2, de la Canadian Standards Association, Standards Sales, 178 boulevard

Rexdale, Rexdale (Ontario) Canada M9W 1R3 (téléphone : (800) 463-6727 ou à Toronto : (416) 747-4044, site Web : [www.csa-international.org](http://www.csa-international.org)).

Practice For Occupational And Educational Eye And Face Protection, norme ANSI Z87.1, de l'American National Standards Institute, 11 West 42nd Street, New York, NY 10036-8002 (téléphone : (212) 642-4900, site Web : [www.ansi.org](http://www.ansi.org)).

Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, norme NFPA 51B, de la National Fire Protection Association, P.O. Box 9101, 1 Battery March Park, Quincy, MA 02269-9101 (téléphone : (617) 770-3000, site Web : [www.nfpa.org](http://www.nfpa.org) et [www.sparky.org](http://www.sparky.org)).

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, de l'U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250 (il y a 10 bureaux régionaux – Téléphone pour la Région 5, Chicago : (312) 353-2220, site Web : [www.osha.gov](http://www.osha.gov)).

## 2-5. Information sur les champs électromagnétiques

Données sur le soudage électrique et les effets des champs magnétiques basse fréquence sur l'organisme

En parcourant les câbles de soudage, le courant crée des champs électromagnétiques. Les effets potentiels de tels champs restent préoccupants. Cependant, après avoir examiné plus de 500 études qui ont été faites pendant une période de recherche de 17 ans, un comité de spécialistes du National Research Council a conclu : « L'accumulation de preuves n'a pas démontré que l'exposition aux champs magnétiques et aux champs électriques à haute fréquence constitue un risque pour la santé humaine ». Toutefois, les études et l'examen des preuves se poursuivent. En attendant les conclusions finales de la recherche, il serait souhaitable de réduire l'exposition aux champs électromagnétiques pendant le soudage ou le coupage.

Afin de réduire les champs électromagnétiques en milieu de travail, respecter les consignes suivantes :

1. Garder les câbles ensemble en les torsadant ou en les fixant avec du ruban adhésif.
2. Mettre tous les câbles du côté opposé à l'opérateur.
3. Ne pas s'enrouler les câbles autour du corps.
4. Garder le poste de soudage et les câbles le plus loin possible de soi.
5. Placer la pince de masse le plus près possible de la zone de soudage.

### Consignes relatives aux stimulateurs cardiaques :

Les personnes qui portent un stimulateur cardiaque doivent avant tout consulter leur médecin. Si ce dernier les déclare aptes, il leur est recommandé de respecter les consignes ci-dessus.

# SECTION 3 – INSTALLATION

## 3-1. Included with Your Unit

- 1 12 ft (3.7 m) Work Cable With Clamp And Quick-Connect
- 2 DB1712RDI 150 Amp TIG Torch with 12 ft (3.7 m) Cable
- 3 Electrode Holder and Quick-Connect
- 4 Gas Hose
- 5 Gas Regulator
- 6 RFCS-14 Foot Control with 20 ft (6 m) Cable
- 7 8 ft (2.4 m) Primary Cord Without Plug

Some assembly is required.

For options and accessories see back of book or contact your distributor.

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## 3-2. Selecting A Location

**Movement**

- 1 Lifting Eye
- 2 Lifting Forks

Use lifting eye or lifting forks to move unit.

If using lifting forks, extend forks beyond opposite side of unit.

- 3 Rating Label

Use rating label to determine input power needs.

- 4 Line Disconnect Device

Locate unit near correct input power supply.

Position unit so air can circulate.

For information about sources of high-frequency see Section 7.

For carts and caster kits see back of book or contact your distributor.

**▲ Special installation may be required where gasoline or volatile liquids are present – see NEC Article 511 or CEC Section 20.**

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**Location And Airflow**

18 in (460 mm)

18 in (460 mm)

18 in (460 mm)

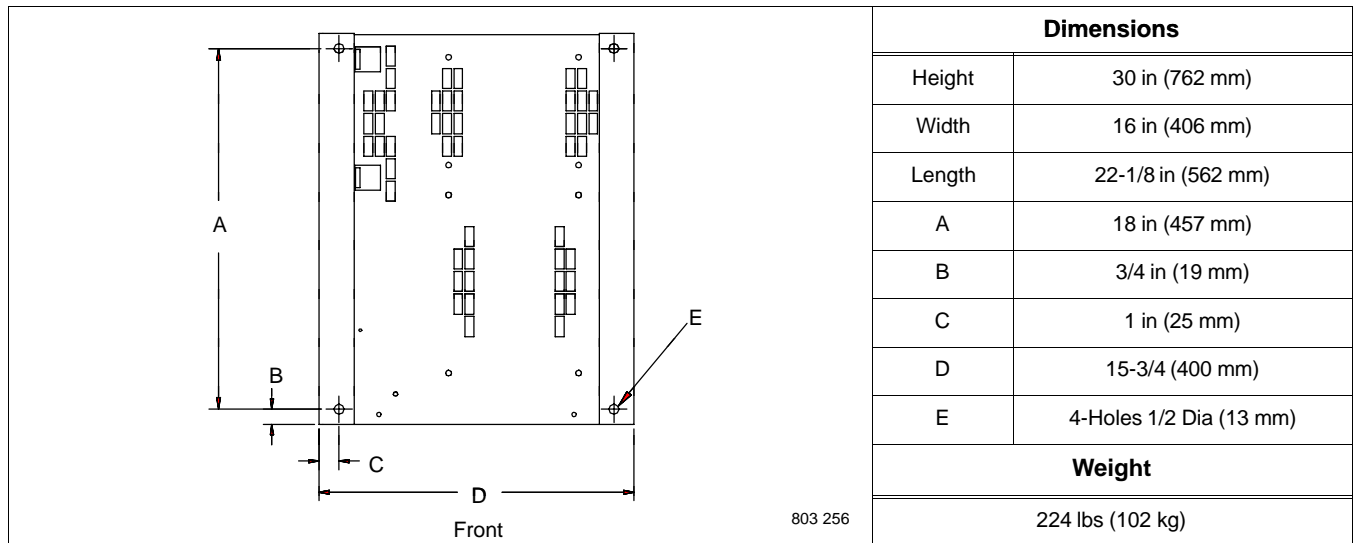
18 in (460 mm)

3

4

INPUT	SERIAL NO.
	STOCK NO.
VOLTS	
AMPERES	
KW	
PHASE	HERTZ

### 3-3. Dimensions And Weights

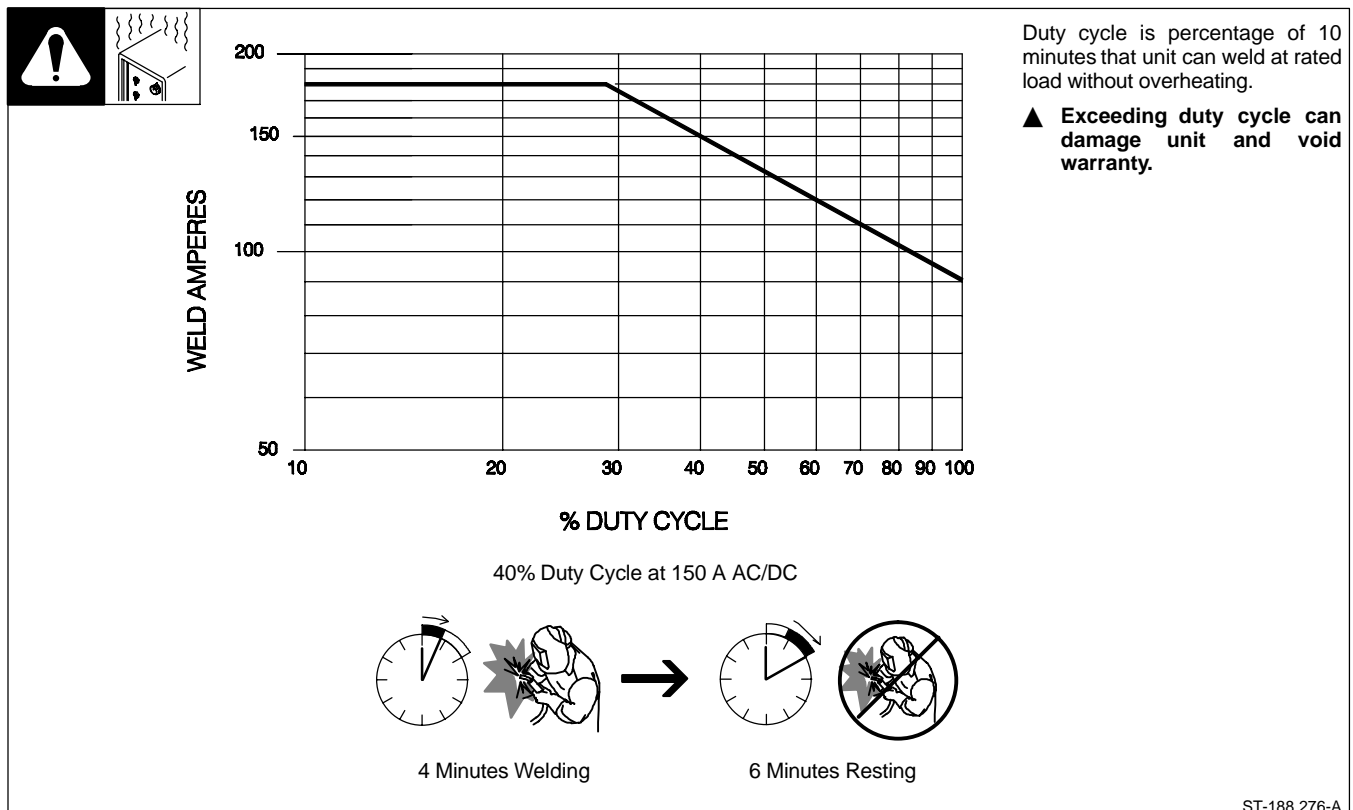


### 3-4. Specifications

Mode	Rated Output at 40% Duty Cycle	Rated Input, 60 HZ, Single-Phase	KVA	KW	Welding Amperage Range	Max. Open-Circuit Voltage
DC TIG	150 Amps at 16 Volts	208-230 V-45 A - (2)*	10.2 - (0.50)*	4.3 - (0.3)*	10-180	80
DC Stick	150 Amps at 26 Volts	208-230 V-47 A - (2)*	10.8 - (0.50)*	5.8 - (0.3)*	10-180	80
AC TIG	150 Amps at 16 Volts	208-230 V-54 A - (2)*	12.3 - (0.50)*	4.5 - (0.3)*	10-180	80
AC Stick	150 Amps at 26 Volts	208-230 V-54 A - (2)*	12.4 - (0.50)*	6 - (0.3)*	10-180	80

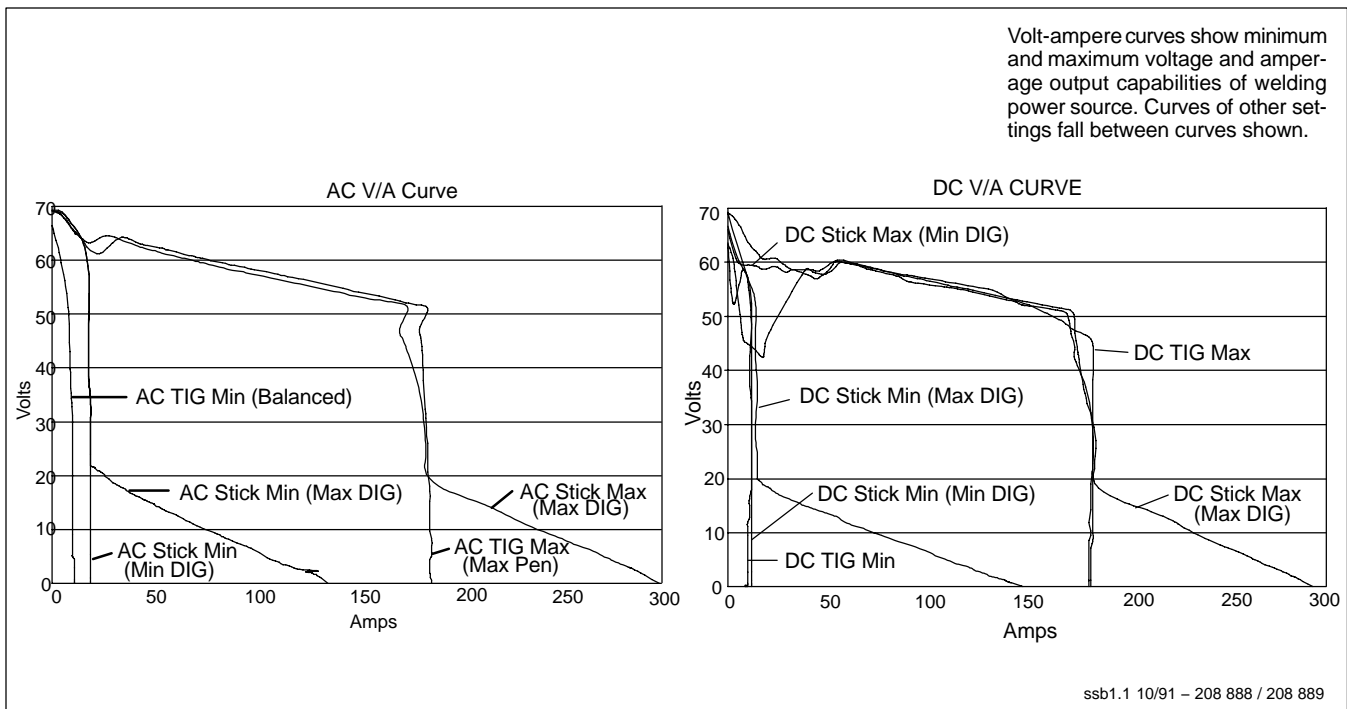
\* ( ) While idling.

### 3-5. Duty Cycle Chart



ST-188 276-A

### 3-6. Volt-Ampere Curves



### 3-7. Weld Output Terminals And Selecting Cable Sizes

**▲ ARC WELDING can cause Electromagnetic Interference.**

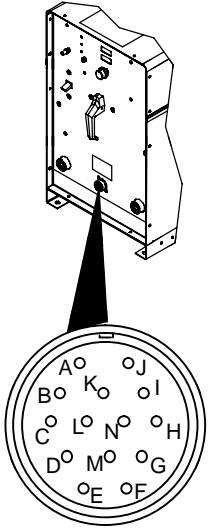


To reduce possible interference, keep weld cables as short as possible, close together, and down low, such as on the floor. Locate welding operation 100 meters from any sensitive electronic equipment. Be sure this welding machine is installed and grounded according to this manual. If interference still occurs, the user must take extra measures such as moving the welding machine, using shielded cables, using line filters, or shielding the work area.

<p><b>Weld Output Terminals</b></p> <p>▲ Turn off power before connecting to weld output terminals.</p> <p>▲ Do not use worn, damaged, undersized, or poorly spliced cables.</p>	Total Cable (Copper) Length In Weld Circuit Not Exceeding									
	Welding Amperes			100 ft (30 m) Or Less	150 ft (45 m)	200 ft (60 m)	250 ft (70 m)	300 ft (90 m)	350 ft (105 m)	400 ft (120 m)
		10 – 60% Duty Cycle	60 – 100% Duty Cycle	10 – 100% Duty Cycle						
<p>803 255</p>	100	4	4	4	3	2	1	1/0	1/0	
	150	3	3	2	1	1/0	2/0	3/0	3/0	
	200	3	2	1	1/0	2/0	3/0	4/0	4/0	
	250	2	1	1/0	2/0	3/0	4/0	2-2/0	2-2/0	


Weld cable size (AWG) is based on either a 4 volts or less drop or a current density of at least 300 circular mils per ampere.

S-0007-D

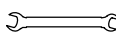
### 3-8. Remote 14 Receptacle

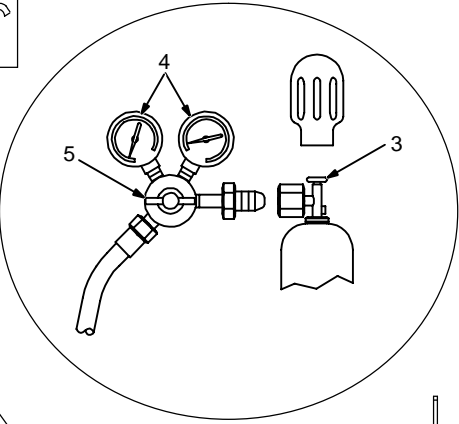
		<b>Socket*</b>	<b>Socket Information</b>
		A	24 volts DC.
		B	Contact closure to A completes 24 volts DC contactor control circuit.
	<b>A</b>	C	Command reference; 0 to +10 volts DC output to remote control.
		D	Remote control circuit common.
		E	0 to +10 volts DC input command signal from remote control.
K		Chassis common.	
*The remaining sockets are not used.			

### 3-9. Shielding Gas Connections



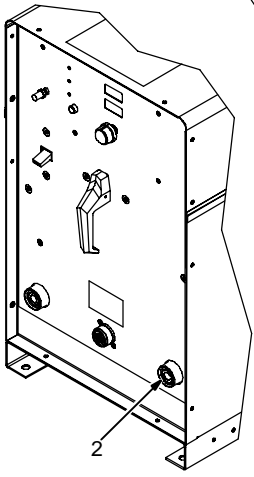
**Tools Needed:**

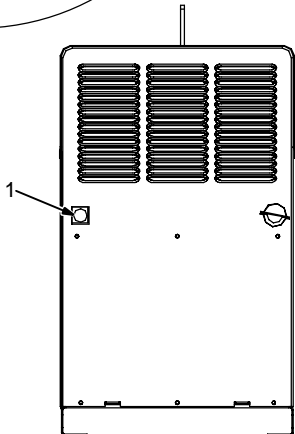
 5/8, 1-1/8 in



**▲ Turn Off power before connecting to receptacle.**

- 1 Gas Valve In Fitting  
Fitting has 5/8-18 right-hand threads.  
Located on rear of unit.
- 2 Gas Valve Out Fitting  
Gas connection is integrated into the Electrode weld output terminal by means of a flow-through type connector.
- 3 Cylinder Valve  
Open valve slightly so gas flow blows dirt from valve. Close valve.
- 4 Regulator/Flow Gauge  
Connect regulator/flow gauge to gas cylinder.  
Connect gas hose to gas in fitting.
- 5 Flow Adjust  
Typical flow rate is 20 cfh (cubic feet per hour).

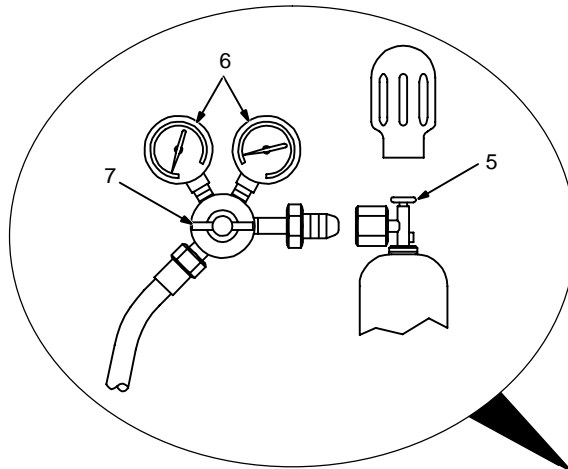




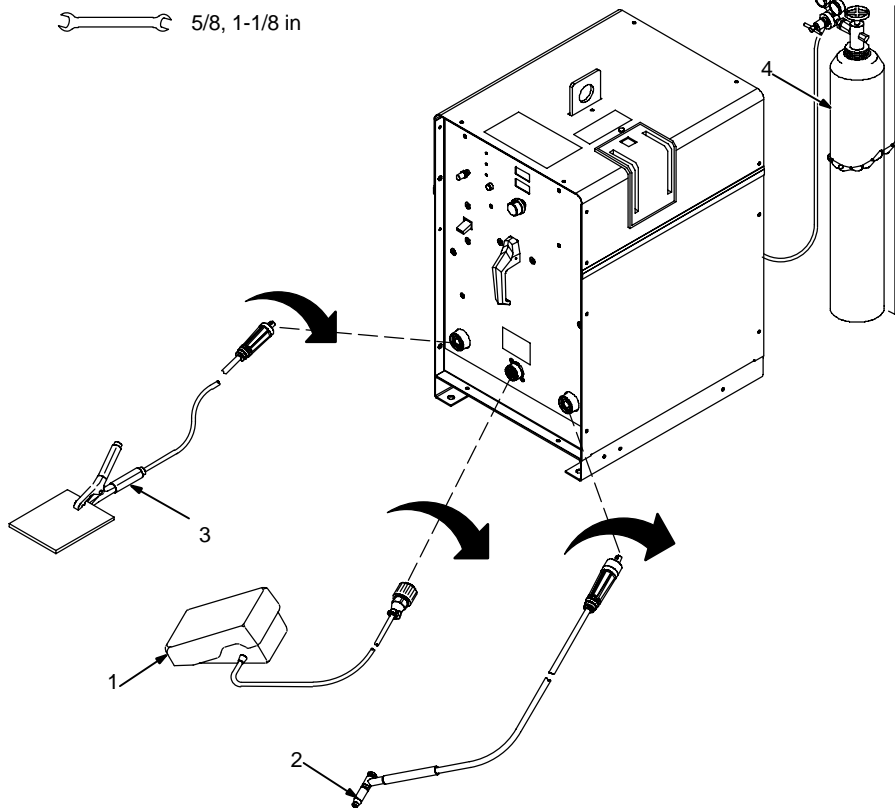
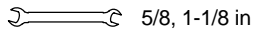
803 255 / Ref. 157 858



### 3-10. Typical TIG Connections



Tools Needed:



**▲ Turn off power before making connections.**

- 1 Remote Foot Control

A customer supplied remote fingertip control may also be used.

- 2 Torch
- 3 Work Clamp

Connect remote control, torch, and work clamp to receptacles as shown.

- 4 Cylinder

Chain or secure cylinder to running gear, wall, or other stationary support.

- 5 Cylinder Valve

Open valve slightly so gas flow blows dirt from valve. Close valve.

- 6 Regulator/Flow Gauge

Install so face is vertical.

- 7 Flow Adjust

Typical flow rate is 20 cfh (cubic feet per hour) (9.4 L/min).

**NOTE:** After activating remote control, 0.2 seconds of gas preflow will begin.

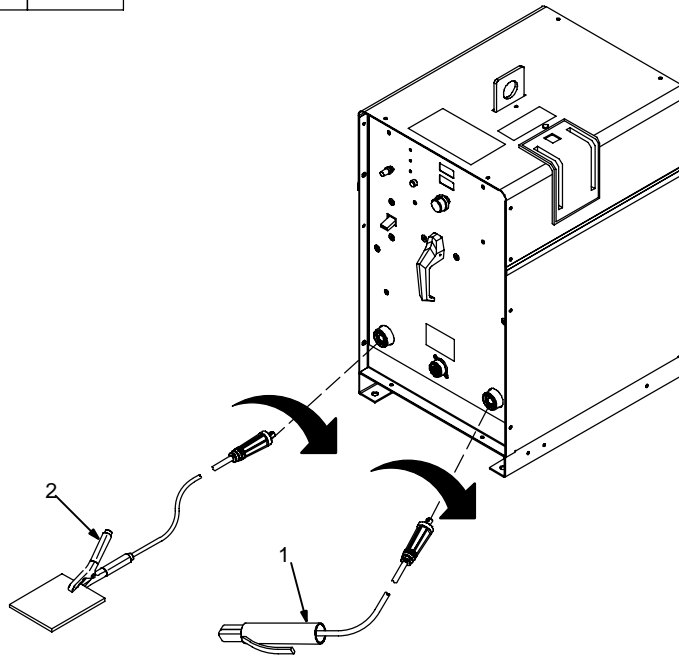
**Application:**

Preflow is used to purge the immediate weld area of atmosphere. Preflow also aids in consistent arc starting. Preflow is preset and is not adjustable.

**Application:**

Postflow is required to cool tungsten and weld, and to prevent contamination of tungsten and weld. Increase postflow time if tungsten or weld are dark in appearance (see Section 4-4).

### 3-11. Typical Stick Connections



▲ Turn off power before making connections.

- 1 Electrode Holder
- 2 Work Clamp

Connect electrode holder and work clamp to receptacles as shown.

### 3-12. Electrical Service Guide

#### NOTE

All values calculated at 40% duty cycle.

#### NOTE

Actual input voltage cannot exceed  $\pm 10\%$  of indicated required input voltage shown in table. If actual input voltage is outside of this range, damage to unit may occur.

	60 Hz Single Phase
Input Voltage	208-230
Input Amperes At Rated Output	54
Max Recommended Standard Fuse or circuit breaker Rating In Amperes <sup>1</sup>	
Time-Delay <sup>2</sup>	60
Normal Operating <sup>3</sup>	80
Min Input Conductor Size In AWG <sup>4</sup>	8
Max Recommended Input Conductor Length In Feet (Meters)	147 (45)
Min Grounding Conductor Size In AWG <sup>4</sup>	8

Reference: 1999 National Electrical Code (NEC)

1 Choose a circuit breaker with time current curves comparable to a time-delay fuse.

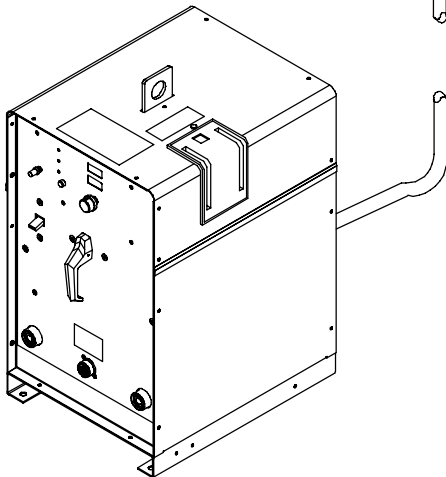
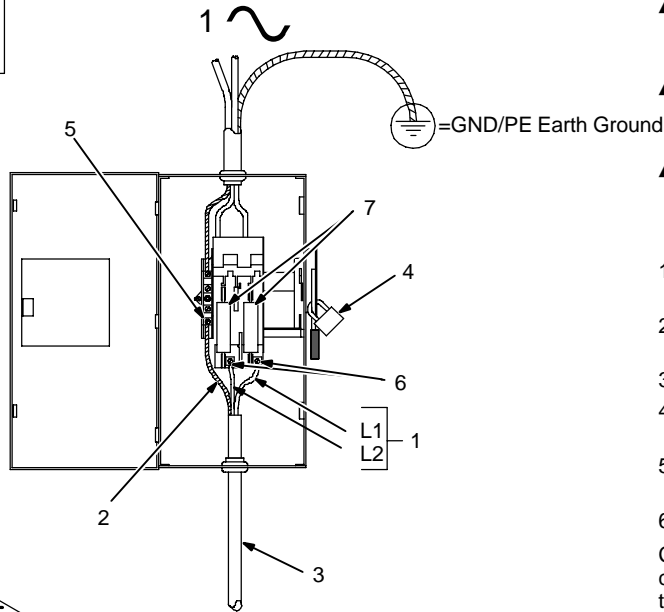
2 "Time-Delay" fuses are UL class "RK5" .

3 "Normal Operating" (general purpose - no intentional delay) fuses are UL class "K5" (up to and including 60 amp), and UL class "H" ( 65 amp and above).

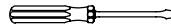
4 Conductor data in this section specifies conductor size (excluding flexible cord or cable) between the panelboard and the equipment per NEC Table 310.16. If a flexible cord or cable is used, minimum conductor size may increase. See NEC Table 400.5(A) for flexible cord and cable requirements.

▲ Failure to follow these fuse and circuit breaker recommendations could create an electric shock or fire hazard.

### 3-13. Connecting Input Power



Tools Needed:



▲ Installation must meet all National and Local Codes – have only qualified persons make this installation.

▲ Disconnect and lockout/tagout input power before connecting input conductors from unit.

▲ Always connect green or green/yellow conductor to supply grounding terminal first, and never to a line terminal.

- 1 Black And White Input Conductor (L1 And L2)
- 2 Green Or Green/Yellow Grounding Conductor
- 3 Input Power Cord.
- 4 Disconnect Device (switch shown in the OFF position)
- 5 Disconnect Device Grounding Terminal
- 6 Disconnect Device Line Terminals

Connect green or green/yellow grounding conductor to disconnect device grounding terminal first.

Connect input conductors L1 and L2 to disconnect device line terminals.

7 Over-Current Protection

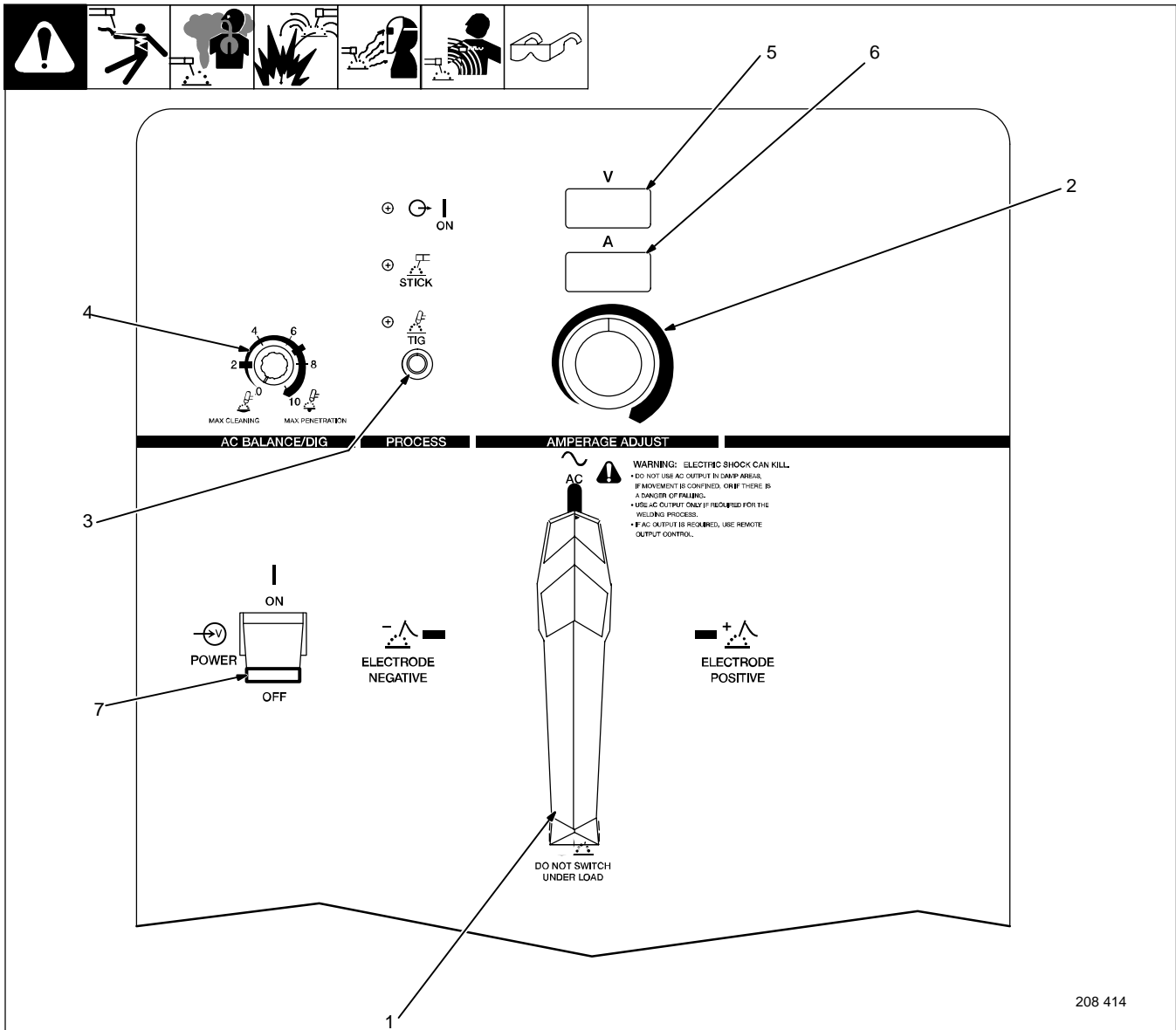
Select type and size of over-current protection using Section 3-12 (fused disconnect switch shown).

Close and secure door on disconnect device. Remove lockout/tagout device, and place switch in the On position.

803 254 / Ref. 803 766-B

# SECTION 4 – OPERATION

## 4-1. Controls



208 414

### 1 Output Selector Switch

▲ **Do not use AC output in damp areas, if movement is confined, or if there is danger of falling. Use AC output ONLY if required for the welding process, and then use a remote control.**

▲ **Do not change position of switch while welding or while under load.**

Use switch to select Direct Current Electrode Negative (DCEN), AC, or Direct Current Electrode Positive (DCEP) output without changing weld output cable connections.

### 2 Amperage Adjust Control

For Stick (SMAW), use control to adjust amperage (see Section 4-2).

For remote amperage control used when TIG (GTAW) welding, front panel Amperage control setting is the maximum amperage available at the remote control device.

See Section 4-3 for example of remote amperage control.

### 3 Weld Process Button

Press button to select weld process.

In Stick position, weld output goes On and Off with Power switch.

In GTAW (TIG) position, remote control device turns on and adjusts weld output of unit as limited by Amperage control. For Direct Current Electrode Negative (DCEN), built-in arc starter comes on when needed to start or stabilize welding arc. For AC welding, the arc starter will turn on and stay on to start and stabilize the welding arc. No adjustments needed for arc starter.

The blue On LED indicates when weld output is on.

### 4 Balance/DIG Control

See Section 4-7.

### 5 Voltmeter

Voltmeter displays average voltage (to the nearest 0.1 V) at the weld output terminals.

### 6 Ammeter

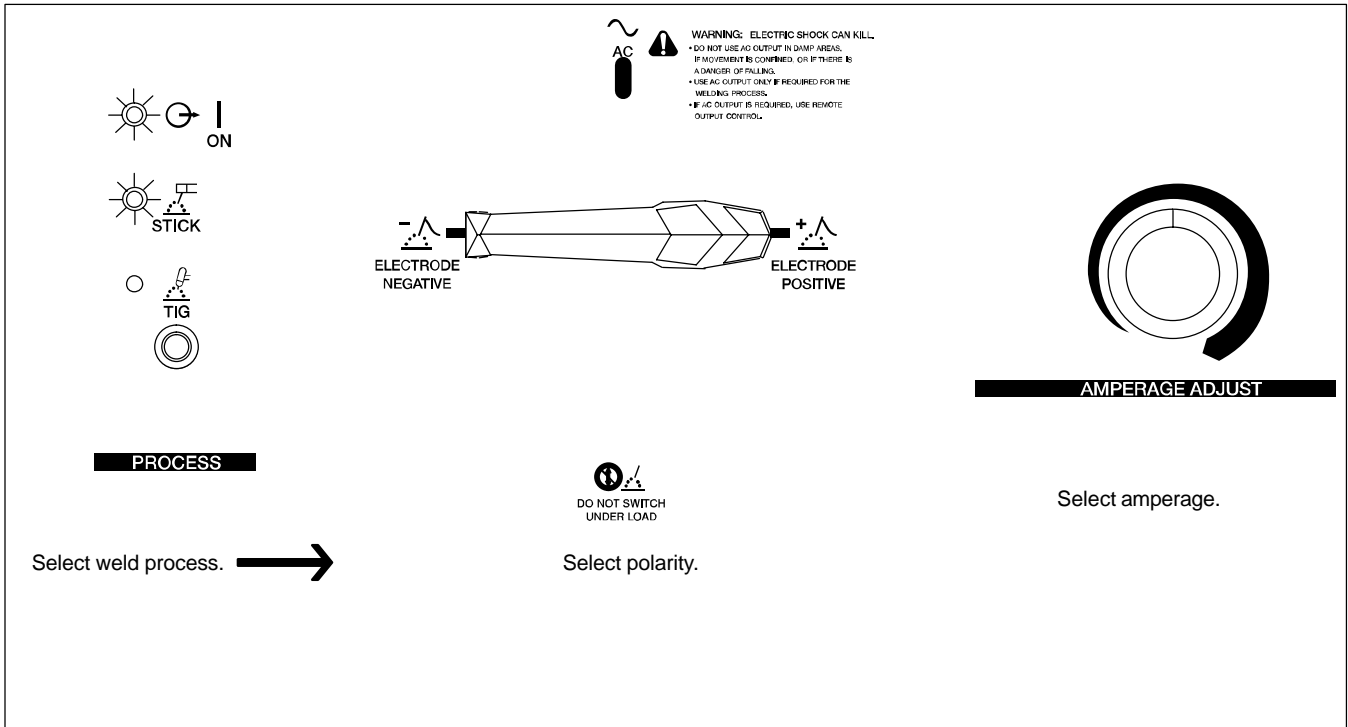
Use meter to preset amperage. Meter displays average weld amperage output of unit to nearest ampere when welding.

**NOTE:** Meters are self-calibrating. No adjustment available.

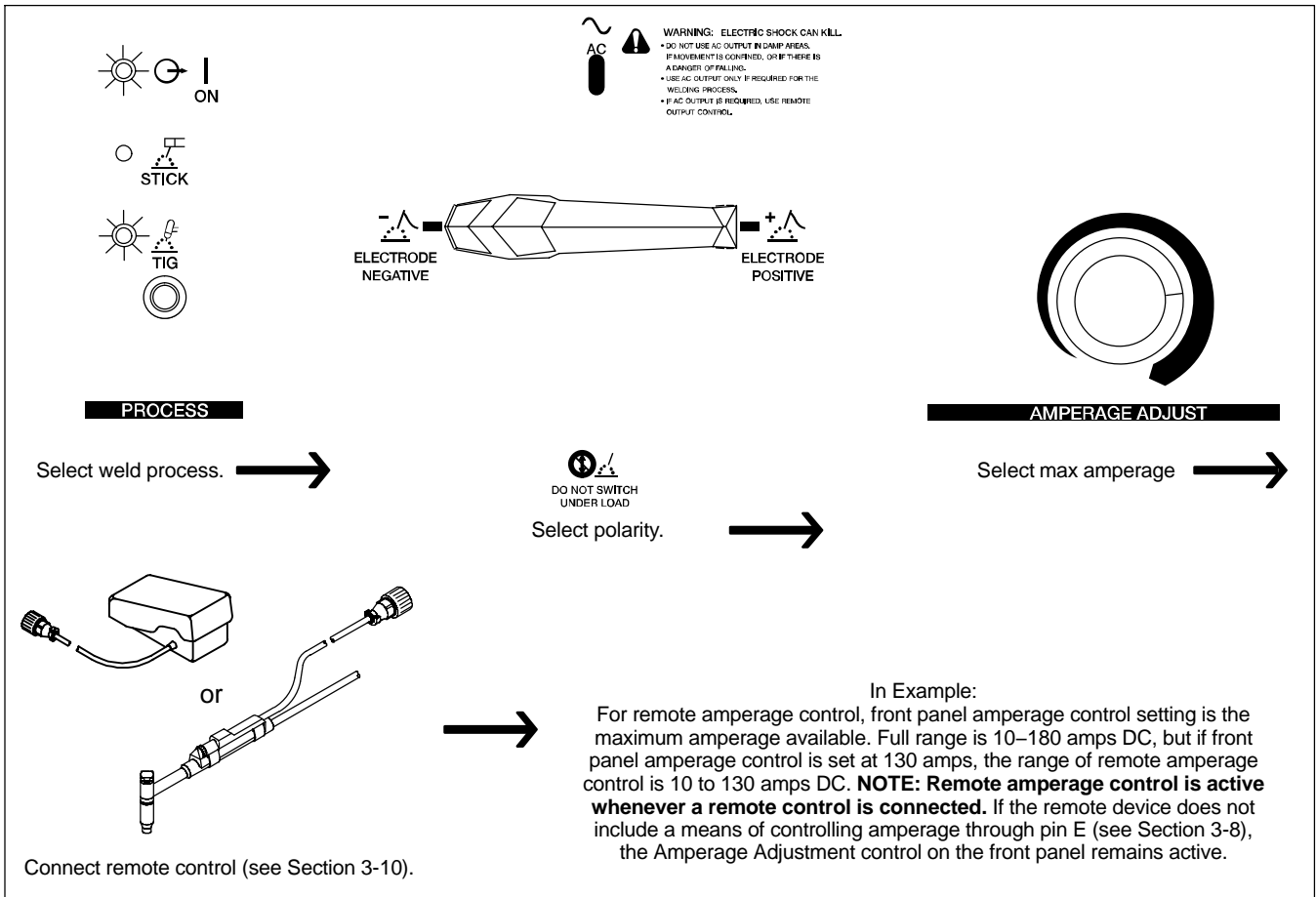
### 7 Power Switch

Use switch to turn unit and fan On and Off.

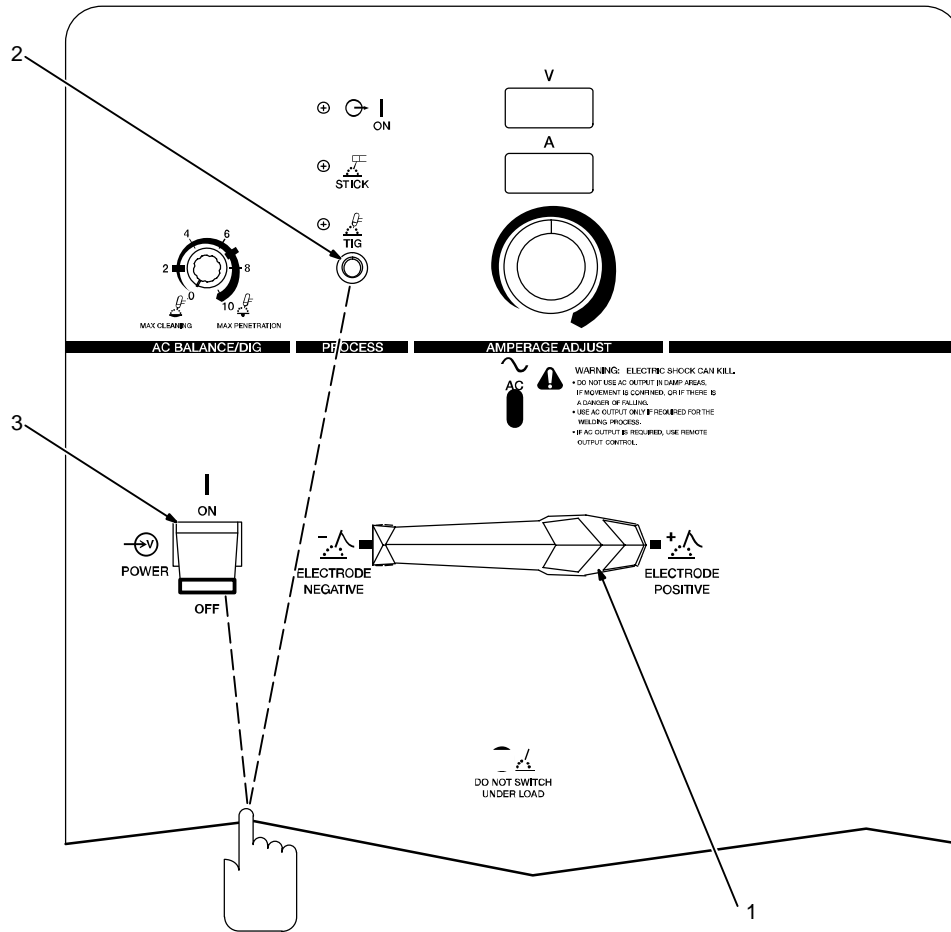
## 4-2. Example of Front Panel Amperage Control For Stick (SMAW) Welding



## 4-3. Example of Remote Amperage Control For TIG (GTAW) Welding



## 4-4. Postflow Control



To access postflow control, proceed as follows:

**1 Output Selector Switch**

Place switch in the Electrode Positive position.

**2 Weld Process Switch**

**3 Power Switch**

Press and hold Weld Process button while turning on the power. Hold button for approximately 7 seconds (or until software

version number clears meters).

The factory default setting is 12 seconds. To change the postflow time (5–18 seconds), press and release the weld process button until desired time is displayed on the meters. Press torch trigger or turn Off power to save setting.

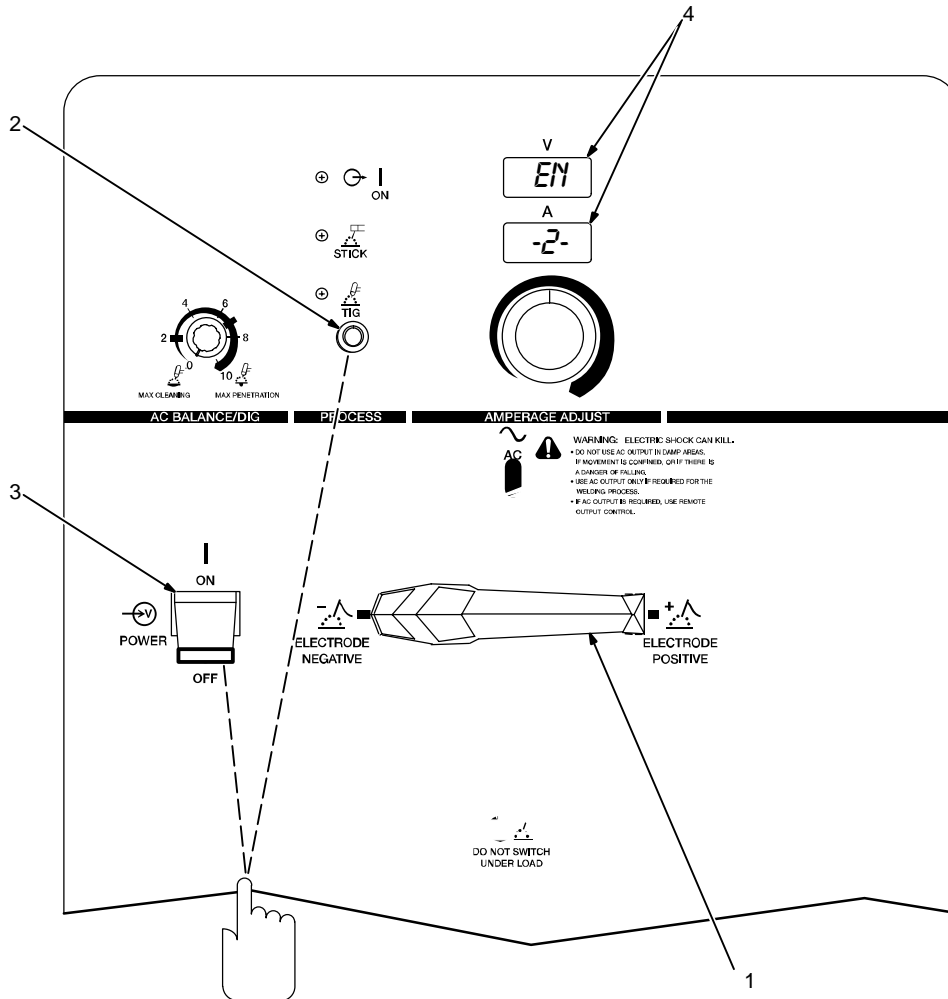
Use Postflow to set length of time gas flows after welding stops. It is important to set enough time to allow gas to flow until after the tungsten and weld puddle has cooled

down. Postflow time does not change if output is changed from DC to AC, or from AC to DC.

**Application:**

Postflow is required to cool tungsten and weld, and to prevent contamination of tungsten and weld. Increase postflow time if tungsten or weld are dark in appearance (approximately 1 second per 10 ampere of welding current).

## 4-5. Selecting TIG Starting Characteristics



Use this function to select desired TIG starting characteristics.

- 1 Output Selector Switch
- 2 Weld Process Button
- 3 Power Switch
- 4 Meters

To select or change TIG starting characteristics, proceed as follows: turn Off power. Place Output Selector Switch in desired position (each position, DCEN or AC has three applicable start characteristics op-

tions). Push and hold Weld Process button and turn On power. Hold button for approximately 7 seconds (or until software version number clears meters).

The meters will display [AC] [-2-] or [E-] [2], depending on position of Output Selector switch

Press Weld Process button again to step through the three start characteristics choices. Amperage (bottom) meter displays active choice 1=light start, 2=medium/normal start, 3=high/hot start.

Press torch trigger or turn Off power to save setting.

### Application:

Select 1 (light/soft start) – when welding at low amperages on thin gauge material.

Select 2 (medium/normal start) – factory default setting used for most welding applications.

Select 3 (high/hot start) – when welding at high amperages on thick materials with a large diameter tungsten.

## 4-6. Timer/Cycle Counter

**AC BALANCE/DIG**    **PROCESS**    **AMPERAGE ADJUST**

**WARNING: ELECTRIC SHOCK CAN KILL.**  
 \*DO NOT USE AC OUTPUT IN DAMP AREAS.  
 \*MOVEMENT IS FORWARDED OFF IF THERE IS A DANGER OF FALLING.  
 \*USE AC OUTPUT ONLY IF REQUIRED FOR THE WELDING PROCESS.  
 \*IF AC OUTPUT IS REQUIRED, USE REMOTE OUTPUT CONTROL.

**DO NOT SWITCH UNDERLOAD**

**1** Output Selector Switch  
**2** Power Switch

power on.

**3** Timer Display  
 The hours and minutes are displayed on the volt and amp meters for the first five

seconds, and are read as 1, 234 hours and 56 minutes.  
**4** Cycle Display  
 The cycles are displayed on the volt and amp meters for the next five seconds, and are read as 123, 456 cycles.



## 4-7. Balance/DIG Control

### 1 Balance/DIG Control

#### Balance Control (AC GTAW):

Control changes the AC output square wave. Rotating the control towards 10 provides deeper penetration. Rotating the control towards 0 provides more cleaning action of the workpiece.

When the control is in the Balanced position, the wave shape provides equal penetration and cleaning action.

#### Application:

When welding on oxide forming materials such as aluminum or magnesium, excess cleaning is not necessary. To produce a good weld, only a minimal amount, approximately a 0.10 in (2.5mm) of etched zone along the weld toes is required.

Set control to 7 and adjust as necessary. Joint configuration, set-up, process variables, and oxide thickness may affect setting.

**NOTE:** Arc rectification can occur when welding at high amperage and/or while welding with helium gas. If this condition occurs, increasing the Balance control towards maximum penetration, may help to restabilize the arc.

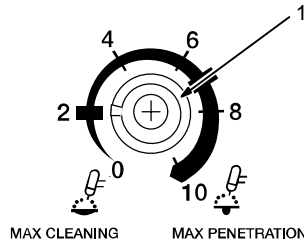
#### DIG Control (AC And DC SMAW):

When set at 0, short-circuit amperage at low arc voltage is the same as normal welding amperage.


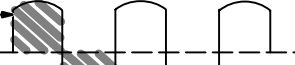

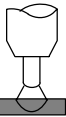


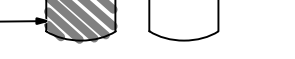
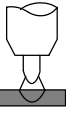
When setting is increased, short-circuit amperage at low arc voltage increases.

#### Application:

Control helps arc starting or making vertical or overhead welds by increasing amperage at low arc voltage, and reduces electrode sticking while welding.



### AC BALANCE/DIG

Balance Control Examples		
Setting	Output Waveforms	Arc
Balanced 	50% Electrode Positive  50% Electrode Negative 	
More Penetration 	40% Electrode Positive  60% Electrode Negative 	

# SECTION 5 – MAINTENANCE AND TROUBLESHOOTING


## 5-1. Routine Maintenance

		<p><b>▲ Disconnect power before maintaining.</b></p> <p> Maintain more often during severe conditions.</p>	
<p> <b>3 Months</b></p>			
<p>Replace unreadable labels.</p>		<p>Clean and tighten weld terminals.</p>	
<p>Repair or replace cracked weld cable.</p>		<p>Repair or replace cracked gas hose.</p>	
<p>Replace o-ring in Electrode/Gas Output receptacle if cracked.</p>			
<p> <b>6 Months</b></p>			
<p>Blow out or vacuum inside.</p>			

## 5-2. Adjusting Spark Gaps

<p><b>Tools Needed:</b></p>			
<p><b>▲ Disconnect and lockout/tagout input power before adjusting spark gaps.</b></p> <p>Remove left side panel.</p> <p>1 Tungsten End Of Point</p> <p>Replace point if tungsten end disappears; do not clean or dress tungsten.</p>		<p>2 Spark Gap</p> <p>Normal spark gap is 0.012 in (0.305 mm). If adjustment is needed, proceed as follows:</p> <p>3 Adjustment Screws</p> <p>Loosen screws. Place gauge of proper thickness in spark gap.</p>	<p>4 Pressure Point</p> <p>Apply slight pressure at point until gauge is held firmly in gap. Tighten screws to 12 in/lbs torque (overtightening will deform plastic base). Adjust other gap.</p> <p>Reinstall left side panel.</p>
<p>803 259</p>			

### 5-3. Voltmeter/Ammeter Help Displays

 All directions are in reference to the front of the unit. All circuitry referred to is located inside the unit. **There are no user serviceable parts inside unit.**

#### 0 Help 0 Display

Indicates a short in the thermal protection circuitry located on the transformer of the unit. If this display is shown, contact a Factory Authorized Service Agent.

#### 1 Help 1 Display

An SCR overcurrent or undercurrent condition has occurred. Turn power off and back on to correct condition. If problem continues, contact a Factory Authorized Service Agent.

#### 2 Help 2 Display

Indicates a malfunction in the thermal protection circuitry located on the transformer of the unit. If this display is shown, contact a Factory Authorized Service Agent.

#### 3 Help 3 Display

Indicates the transformer of the unit has overheated. The unit has shut down to allow the fan to cool it (see Section 3-5). Operation will continue when the unit has cooled.

#### 4 Help 4 Display

Indicates a malfunction in the thermal protection circuitry located on the rectifier assembly of the unit. If this display is shown, contact a Factory Authorized Service Agent.

#### 5 Help 5 Display

Indicates the rectifier assembly of the unit has overheated. The unit has shut down to allow the fan to cool it (see Section 3-5). Operation will continue when the unit has cooled.

#### 6 Help 6 Display

Not used.

#### 7 Help 7 Display

Not used.

#### 8 Help 8 Display

Not used.

#### 9 Help 9 Display

Indicates a short in the thermal protection circuitry located on the rectifier assembly of the unit. If this display is shown, contact a Factory Authorized Service Agent.

#### 10 Help 10 Display

Indicates Remote Output control is activated. Release Remote Output control to clear help message.

#### 11 Help 11 Display

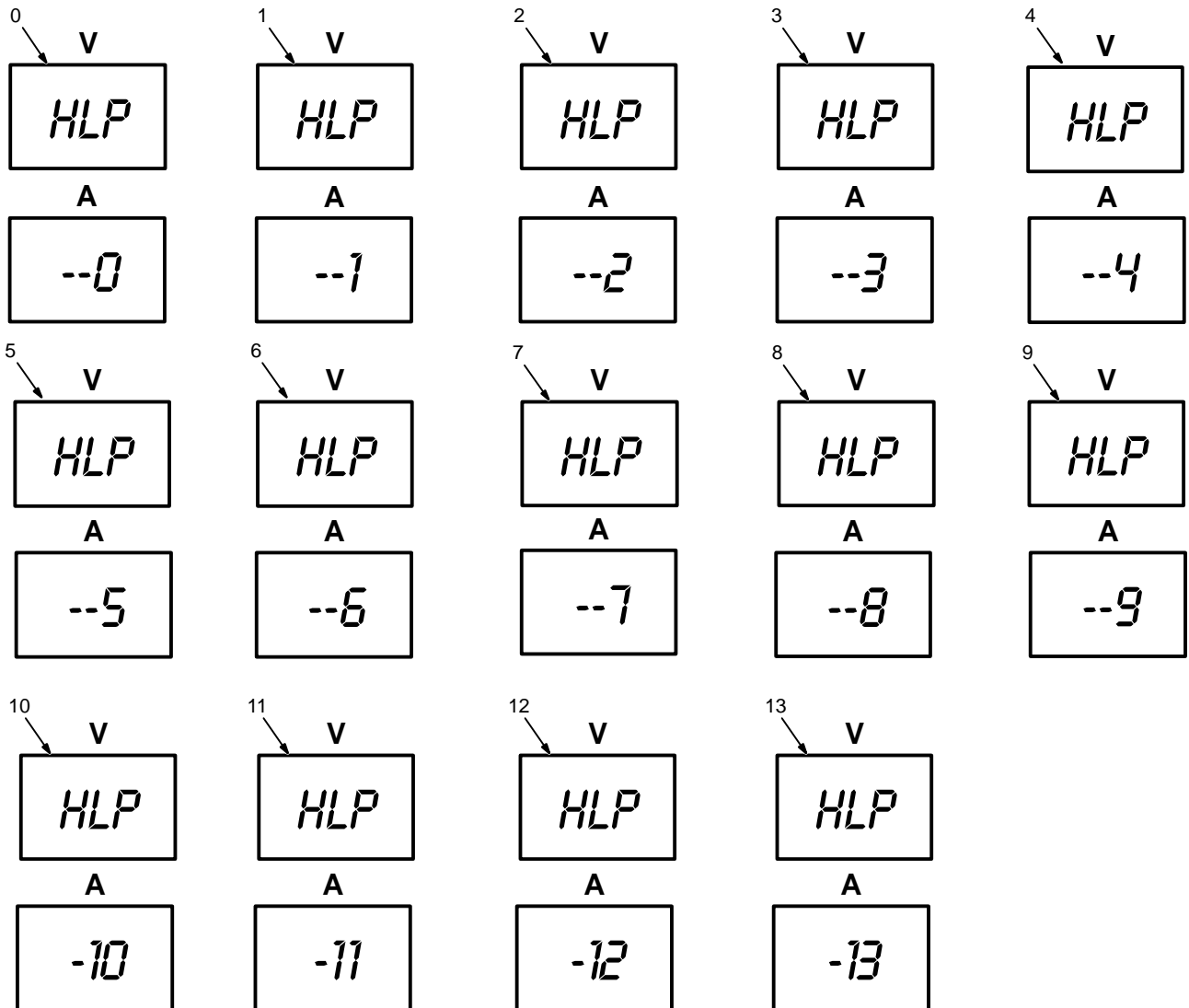
Indicates Output Selector switch is not in correct position (see Section 4-1).

#### 12 Help 12 Display

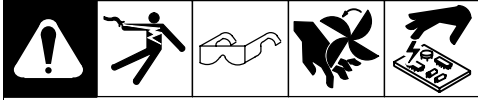
Indicates a non-allowable set-up on the front panel.

#### 13 Help 13 Display

Not used.



## 5-4. Troubleshooting

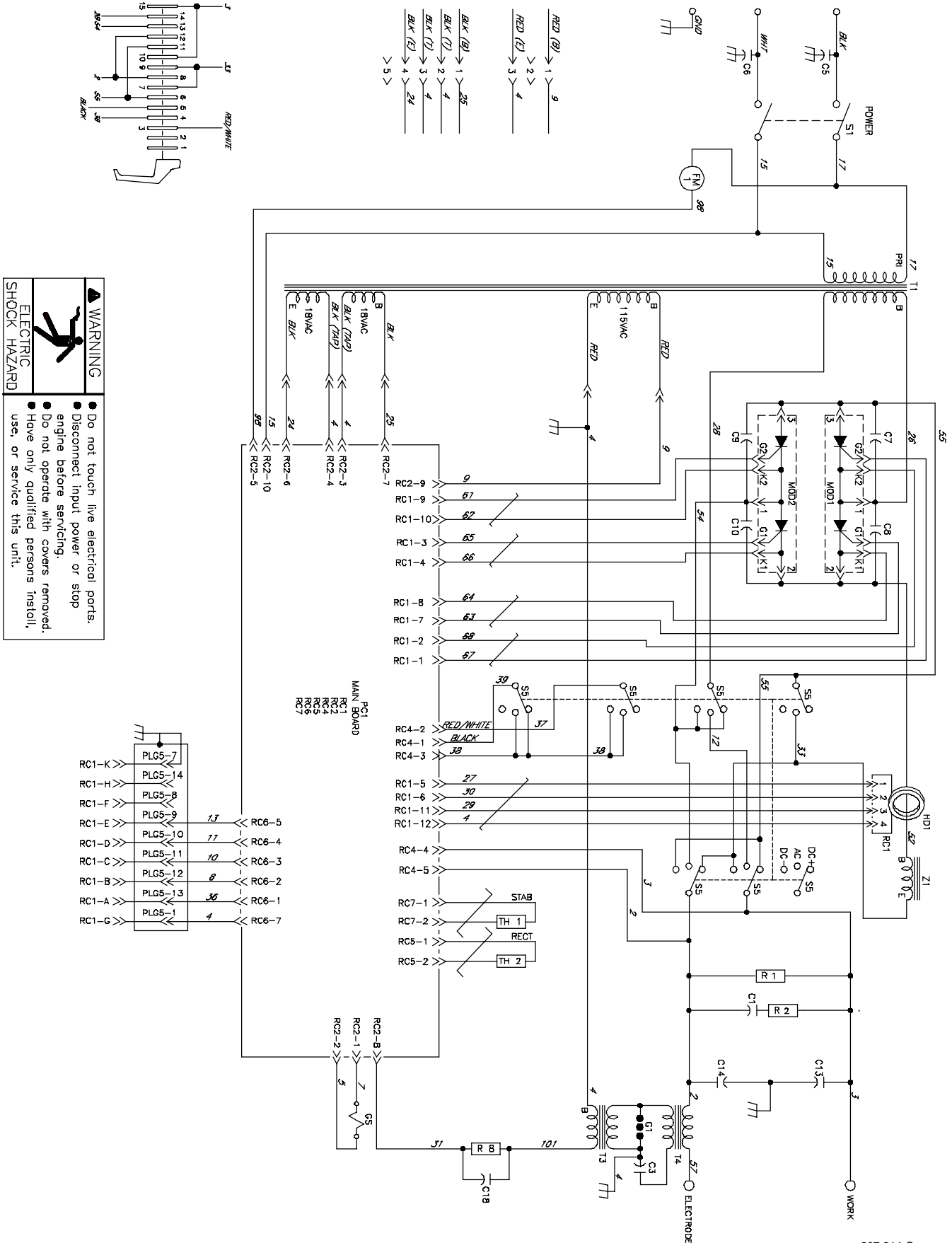


**NOTE:** The remedies listed below are recommendations only. If these remedies do not fix the trouble with your unit, have a Factory Authorized Service Agent check unit.  
**There are no user serviceable parts inside unit.**

Refer to Section 5-3 for any Help (HLP) message displayed on voltmeter/ammeter.

Trouble	Remedy
No weld output; unit completely inoperative.	Place machine power switch in On position (see Section 4-1).
	Place line disconnect switch in On position (see Section 3-13).
	Check and replace line fuse(s), if necessary (see Section 3-13).
	Check for proper input power connections (see Section 3-13).
No weld output; unit on.	Check, repair, or replace remote control.
	Have Factory Authorized Service Agent check unit.
Unit provides only maximum or minimum weld output.	Make sure Amperage control is in proper position (see Section 4-1).
	Have Factory Authorized Service Agent check unit.
Erratic or improper weld output.	Use proper size and type of weld cable (see Section 3-7).
	Clean and tighten all weld connections.
	Check position of Output Selector control (see Section Figure 4-1).
	If using remote control, check position of Amperage Adjustment control (see Section 4-1).
No control of weld output.	Make sure Amperage control is in proper position (see Section 4-1).
Lack of high frequency; difficulty in starting GTAW arc.	Select proper size tungsten.
	Be sure torch cable is not close to any grounded metal.
	Check cables and torch for cracked insulation or bad connections. Repair or replace.
	Check spark gaps (see Section 5-2).
Wandering arc – poor control of direction of arc.	Reduce gas flow rate.
	Select proper size tungsten.
	Properly prepare tungsten.
Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Shield weld zone from drafts.
	Increase postflow time.
	Check and tighten all gas fittings.
	Properly prepare tungsten.
Fan not operating.	Unit equipped with Fan-On-Demand™. Fans run only when necessary. Unit equipped with circuitry to protect against overheating.
No weld output; fan does not run.	Place line disconnect switch in On position (see Section 3-13).
	Check and replace line fuse(s), if necessary, or reset circuit breaker (see Section 3-13).
	Check for proper input power connections (see Section 3-13).
No weld output; fan on.	Be sure Polarity switch is not set between positions.
	Tighten remote control connection to Remote 14 receptacle (see Section 3-8).
	Check remote control (see remote control Owner's Manual).
	Unit overheated. Allow unit to cool (see Section 3-5).
Fan not operating; weld output available.	Check for and remove anything blocking fan movement.
	Have Factory Authorized Service Agent check fan motor.

# SECTION 6 – ELECTRICAL DIAGRAM



**WARNING**  
 ⚡  
 Do not touch live electrical parts.  
 Disconnect input power or stop engine before servicing.  
 Do not operate with covers removed.  
 Have only qualified persons install, use, or service this unit.

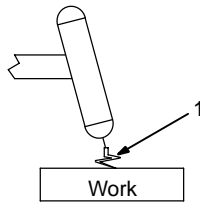
**ELECTRIC SHOCK HAZARD**

Figure 6-1. Circuit Diagram All Models

207 214-C

# SECTION 7 – HIGH FREQUENCY (HF)

## 7-1. Welding Processes Requiring High Frequency



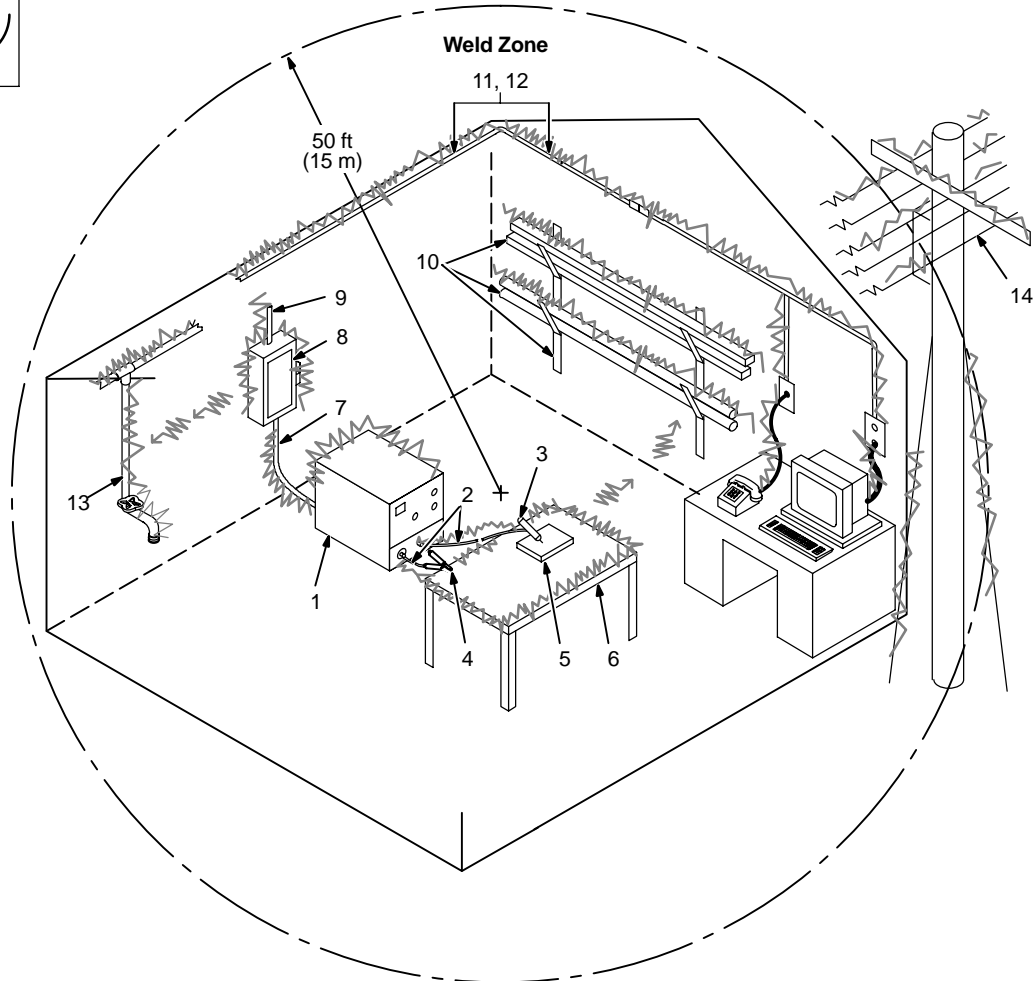
TIG

1 High-Frequency Voltage

TIG – helps arc jump air gap between torch and workpiece and/or stabilize the arc.

high\_freq 12/96 – S-0693

## 7-2. Sources Of HF Radiation From Incorrect Installation



S-0694

### Sources Of Direct HF Radiation

- 1 HF source (welding power source with built-in HF or separate HF unit)
- 2 Weld Cables
- 3 Torch
- 4 Work Clamp

- 5 Workpiece
- 6 Work Table

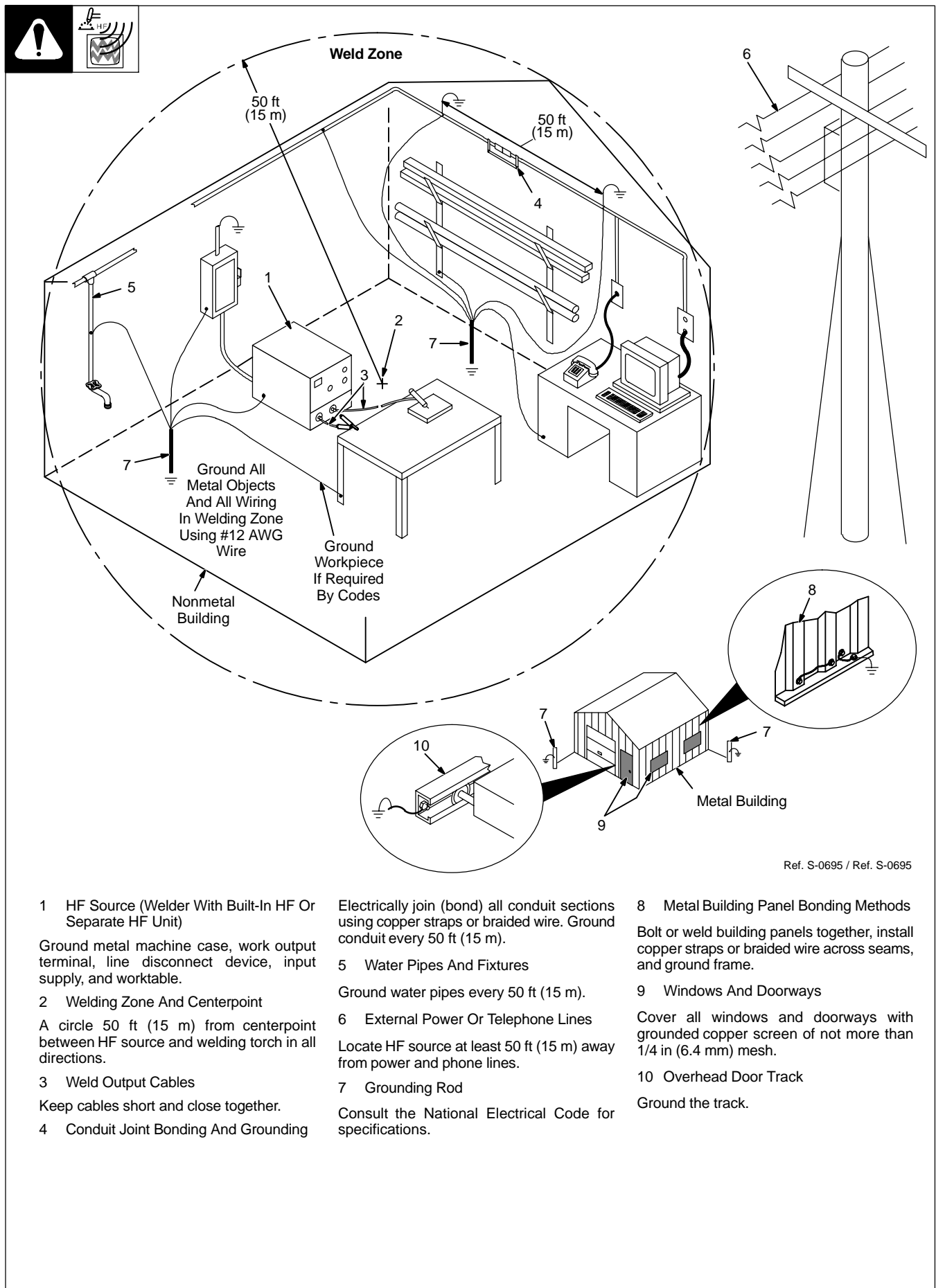
### Sources Of Conduction Of HF

- 7 Input Power Cable
- 8 Line Disconnect Device
- 9 Input Supply Wiring

### Sources Of Reradiation Of HF

- 10 Ungrounded Metal Objects
- 11 Lighting
- 12 Wiring
- 13 Water Pipes And Fixtures
- 14 External Phone And Power Lines

## 7-3. Correct Installation



1 HF Source (Welder With Built-In HF Or Separate HF Unit)

Ground metal machine case, work output terminal, line disconnect device, input supply, and worktable.

2 Welding Zone And Centerpoint

A circle 50 ft (15 m) from centerpoint between HF source and welding torch in all directions.

3 Weld Output Cables

Keep cables short and close together.

4 Conduit Joint Bonding And Grounding

Electrically join (bond) all conduit sections using copper straps or braided wire. Ground conduit every 50 ft (15 m).

5 Water Pipes And Fixtures

Ground water pipes every 50 ft (15 m).

6 External Power Or Telephone Lines

Locate HF source at least 50 ft (15 m) away from power and phone lines.

7 Grounding Rod

Consult the National Electrical Code for specifications.

8 Metal Building Panel Bonding Methods

Bolt or weld building panels together, install copper straps or braided wire across seams, and ground frame.

9 Windows And Doorways

Cover all windows and doorways with grounded copper screen of not more than 1/4 in (6.4 mm) mesh.

10 Overhead Door Track

Ground the track.

Ref. S-0695 / Ref. S-0695

# SECTION 8 – SELECTING AND PREPARING TUNGSTEN ELECTRODE FOR DC OR AC WELDING

ac/dc\_gtaw 2/2000



▲ Whenever possible and practical, use DC weld output instead of AC weld output.

## 8-1. Selecting Tungsten Electrode (Wear Clean gloves To Prevent Contamination Of Tungsten)

Electrode Diameter	Amperage Range - Gas Type♦ - Polarity			
	DC – Argon – Electrode Negative/Straight Polarity	DC – Argon – Electrode Positive/Reverse Polarity	AC – Argon	AC – Argon – Balanced Wave
<b>2% Ceria (Orange Band), 1.5% Lanthanum (Gray Band), Or 2% Thorium (Red Band) Alloy Tungstens</b>				
.010"	Up to 25	*	Up to 20	Up to 15
.020"	15-40	*	15-35	5-20
.040"	25-85	*	20-80	20-60
1/16"	50-160	10-20	50-150	60-120
3/32"	135-235	15-30	130-250	100-180
1/8"	250-400	25-40	225-360	160-250
5/32"	400-500	40-55	300-450	200-320
3/16"	500-750	55-80	400-500	290-390
1/4"	750-1000	80-125	600-800	340-525
<b>Pure Tungsten (Green Band)</b>				
.010"	Up to 15	*	Up to 15	Up to 10
.020"	5-20	*	5-20	10-20
.040"	15-80	*	10-60	20-30
1/16"	70-150	10-20	50-100	30-80
3/32"	125-225	15-30	100-160	60-130
1/8"	225-360	25-40	150-210	100-180
5/32"	360-450	40-55	200-275	160-240
3/16"	450-720	55-80	250-350	190-300
1/4"	720-950	80-125	325-450	250-400
<b>Zirconium Alloyed Tungsten (Brown Band)</b>				
.010"	*	*	Up to 20	Up to 15
.020"	*	*	15-35	5-20
.040"	*	*	20-80	20-60
1/16"	*	*	50-150	60-120
3/32"	*	*	130-250	100-180
1/8"	*	*	225-360	160-250
5/32"	*	*	300-450	200-320
3/16"	*	*	400-550	290-390
1/4"	*	*	600-800	340-525

♦ Typical argon shielding gas flow rates are 15 to 35 cfh (cubic feet per hour).

\*Not Recommended.

Figures listed are a guide and are a composite of recommendations from American Welding Society (AWS) and electrode manufacturers.

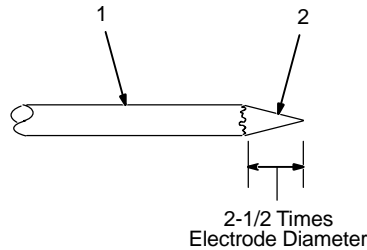


## 8-2. Preparing Tungsten Electrode For Welding



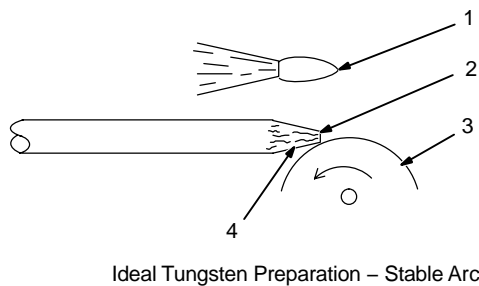
▲ Grinding the tungsten electrode produces dust and flying sparks which can cause injury and start fires. Use local exhaust (forced ventilation) at the grinder or wear an approved respirator. Read MSDS for safety information. Consider using tungsten containing ceria, lanthana, or yttria instead of thorium. Grinding dust from thoriated electrodes contains low-level radioactive material. Properly dispose of grinder dust in an environmentally safe way. Wear proper face, hand, and body protection. Keep flammables away.

### A. Preparing Tungsten For DC Electrode Negative (DCEN) Welding Or AC Welding With Inverter Machines



- 1 Tungsten Electrode
- 2 Tapered End

Grind end of tungsten on fine grit, hard abrasive wheel before welding. Do not use wheel for other jobs or tungsten can become contaminated causing lower weld quality.



- 1 Stable Arc
- 2 Flat

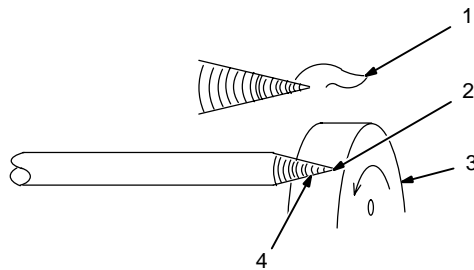
Diameter of this flat determines amperage capacity.

- 3 Grinding Wheel

Grinding wheel should be dedicated to grinding tungsten only.

- 4 Straight Ground

Ideal Tungsten Preparation – Stable Arc



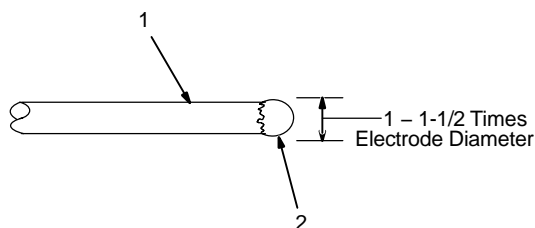
- 1 Arc Wander
- 2 Point
- 3 Grinding Wheel

Grinding wheel should be dedicated to grinding tungsten only.

- 4 Radial Ground

Wrong Tungsten Preparation – Wandering Arc

### B. Preparing Tungsten For Conventional AC Welding



- 1 Tungsten Electrode
- 2 Balled End

▲ Understand and follow safety symbols at start of Section 9-1 before preparing tungsten.

Ball end of tungsten by applying AC amperage recommended for a given electrode diameter (see Section 8-1). Let ball on end of the tungsten take its own shape.

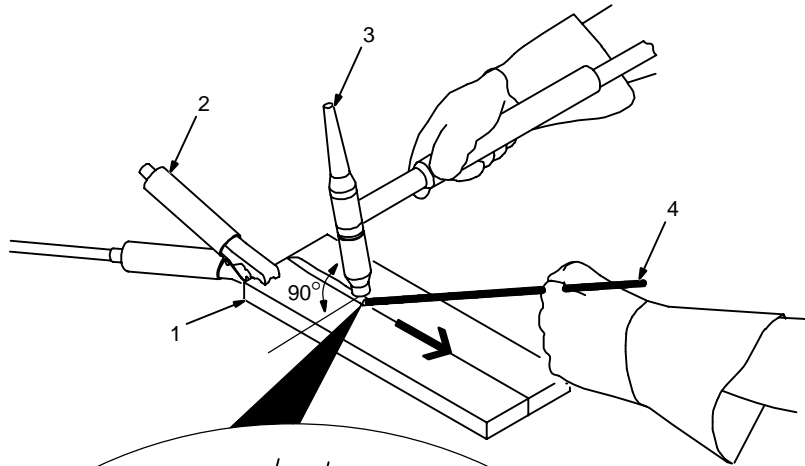
# SECTION 9 – GUIDELINES FOR TIG WELDING (GTAW)

## 9-1. Positioning The Torch



▲ Weld current can damage electronic parts in vehicles. Disconnect both battery cables before welding on a vehicle. Place work clamp as close to the weld as possible.

☞ For additional information, see your distributor for a handbook on the Gas Tungsten Arc Welding (GTAW) process.



1 Workpiece

Make sure workpiece is clean before welding.

2 Work Clamp

Place as close to the weld as possible.

3 Torch

4 Filler Rod (If Applicable)

5 Gas Cup

6 Tungsten Electrode

Select and prepare tungsten according to Sections 8-1 and 8-2.

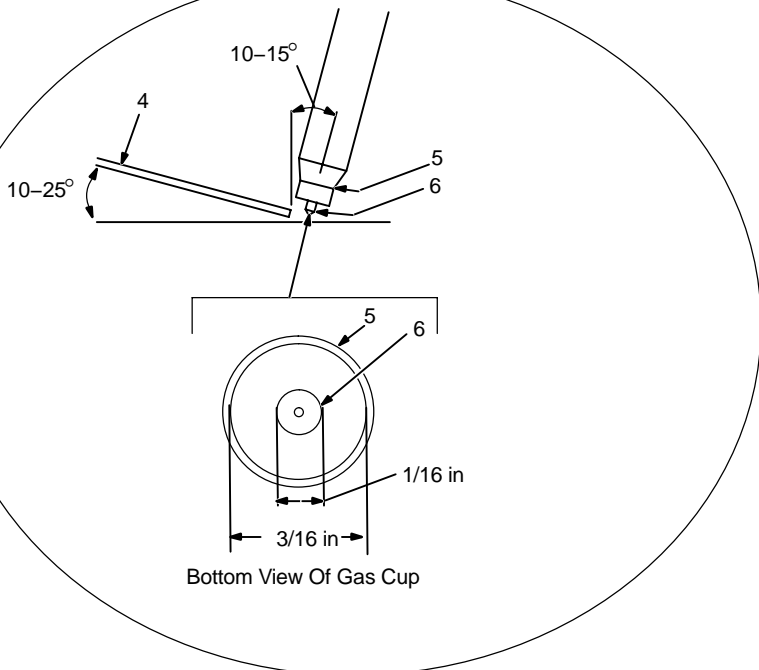
### Guidelines:

The inside diameter of the gas cup should be at least three times the tungsten diameter to provide adequate shielding gas coverage. (For example, if tungsten is 1/16 in diameter, gas cup should be a minimum of 3/16 in diameter.)

Tungsten extension is the distance the tungsten extends out gas cup of torch.

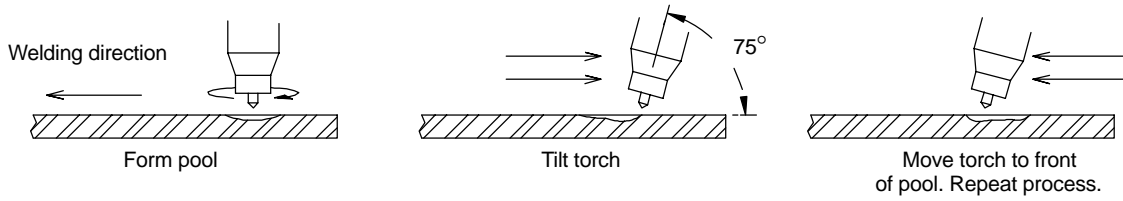
The tungsten extension should be no greater than the inside diameter of the gas cup.

Arc length is the distance from the tungsten to the workpiece.

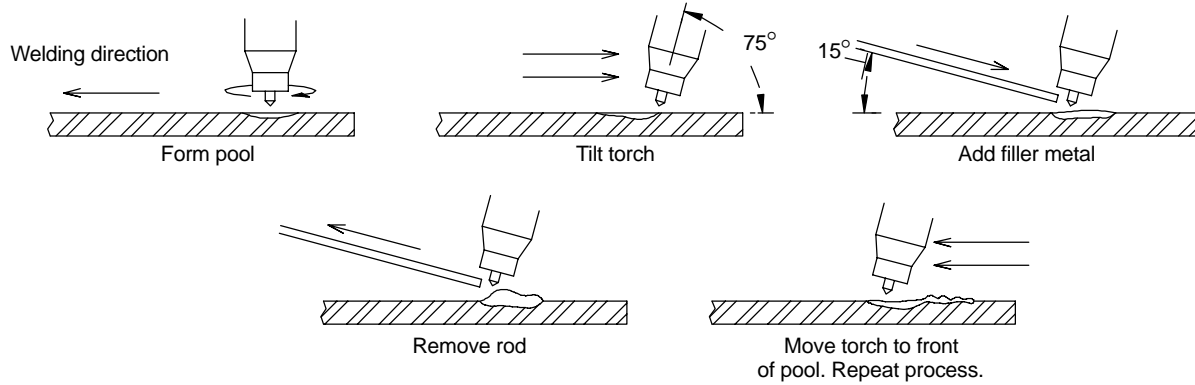


## 9-2. Torch Movement During Welding

### Tungsten Without Filler Rod



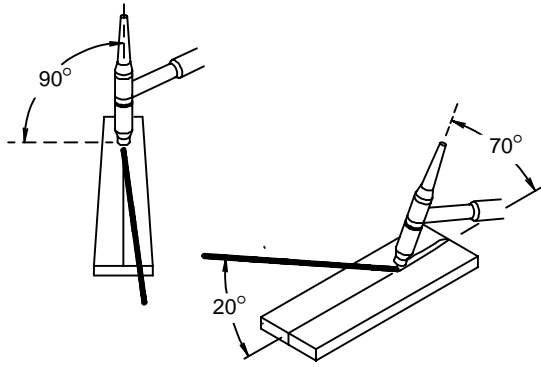
### Tungsten With Filler Rod



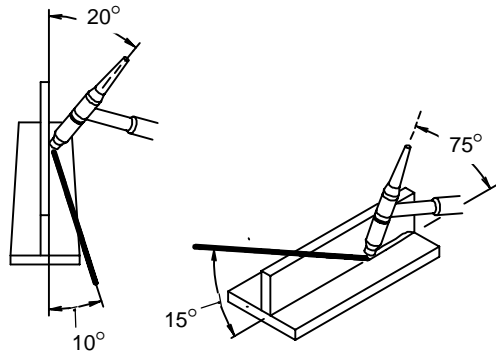
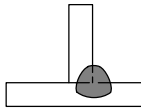
ST-162 002-B

### 9-3. Positioning Torch Tungsten For Various Weld Joints

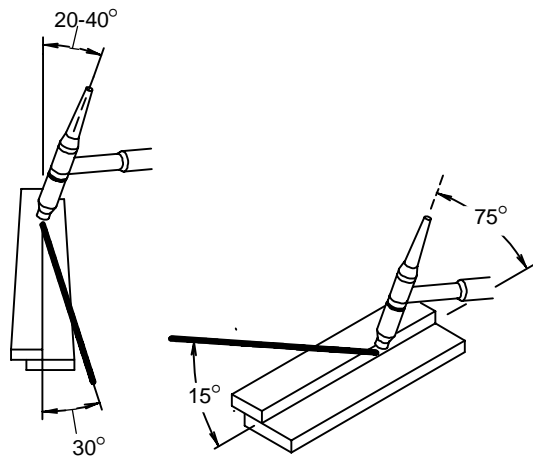
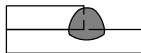
Butt Weld And Stringer Bead



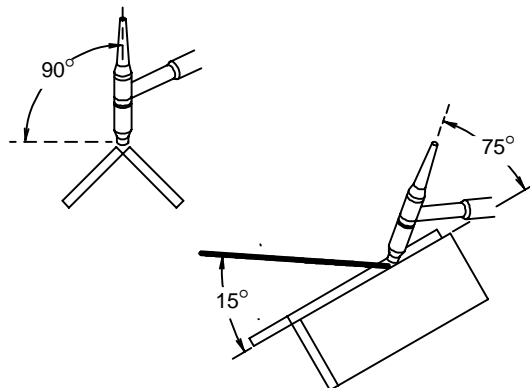
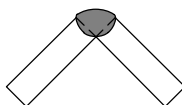
"T" Joint



Lap Joint



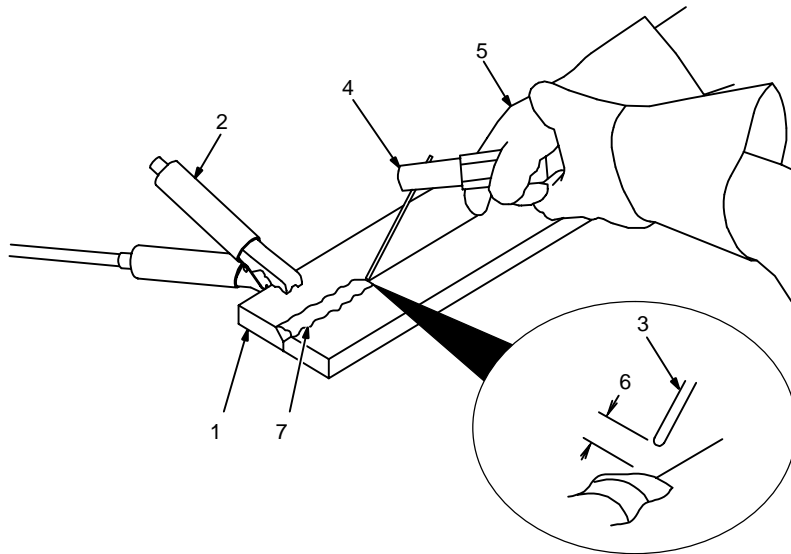
Corner Joint



# SECTION 10 – STICK WELDING (SMAW) GUIDELINES



## 10-1. Stick Welding Procedure



▲ Weld current starts when electrode touches workpiece.

▲ Weld current can damage electronic parts in vehicles. Disconnect both battery cables before welding on a vehicle. Place work clamp as close to the weld as possible.

1 Workpiece

Make sure workpiece is clean before welding.

2 Work Clamp

3 Electrode

A small diameter electrode requires less current than a large one. Follow electrode manufacturer's instructions when setting weld amperage (see Section 10-2).

4 Insulated Electrode Holder

5 Electrode Holder Position

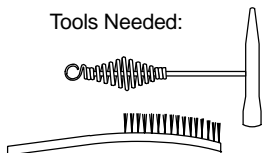
6 Arc Length

Arc length is the distance from the electrode to the workpiece. A short arc with correct amperage will give a sharp, crackling sound.

7 Slag

Use a chipping hammer and wire brush to remove slag. Remove slag and check weld bead before making another weld pass.

Tools Needed:



## 10-2. Electrode and Amperage Selection Chart

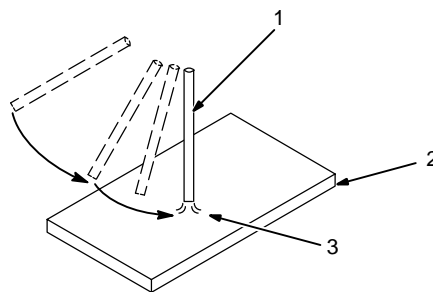
ELECTRODE	DIAMETER	AMPERAGE RANGE								
		50	100	150	200	250	300	350	400	450
6010 & 6011	3/32									
	1/8									
	5/32									
	3/16									
	7/32									
6013	1/4									
	1/16									
	5/64									
	3/32									
	1/8									
	5/32									
	3/16									
7014	7/32									
	1/4									
	3/32									
	1/8									
	5/32									
7018	3/16									
	7/32									
	1/4									
	3/32									
	1/8									
7024	5/32									
	3/16									
	7/32									
	1/4									
	3/32									
Ni-CI	1/8									
	5/32									
	3/16									
308L	3/32									
	1/8									
	5/32									

ELECTRODE	DC*	AC	POSITION	PENETRATION	USAGE
6010	EP		ALL	DEEP	MIN. PREP, ROUGH
6011	EP	✓	ALL	DEEP	HIGH SPATTER
6013	EP,EN	✓	ALL	LOW	GENERAL
7014	EP,EN	✓	ALL	MED	SMOOTH, EASY, FAST
7018	EP	✓	ALL	LOW	LOW HYDROGEN, STRONG
7024	EP,EN	✓	FLAT HORIZ FILLET	LOW	SMOOTH, EASY, FASTER
NI-CL	EP	✓	ALL	LOW	CAST IRON
308L	EP	✓	ALL	LOW	STAINLESS

\*EP = ELECTRODE POSITIVE (REVERSE POLARITY)  
EN = ELECTRODE NEGATIVE (STRAIGHT POLARITY)

Ref. S-087 985-A

## 10-3. Striking an Arc – Scratch Start Technique

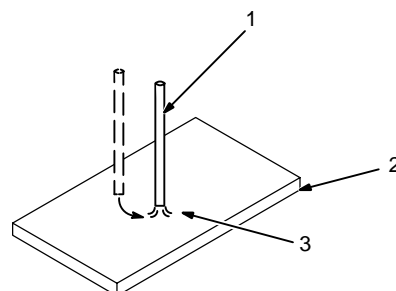


- 1 Electrode
- 2 Workpiece
- 3 Arc

Drag electrode across workpiece like striking a match; lift electrode slightly after touching work. If arc goes out electrode was lifted too high. If electrode sticks to workpiece, use a quick twist to free it.

S-0049

## 10-4. Striking an Arc – Tapping Technique

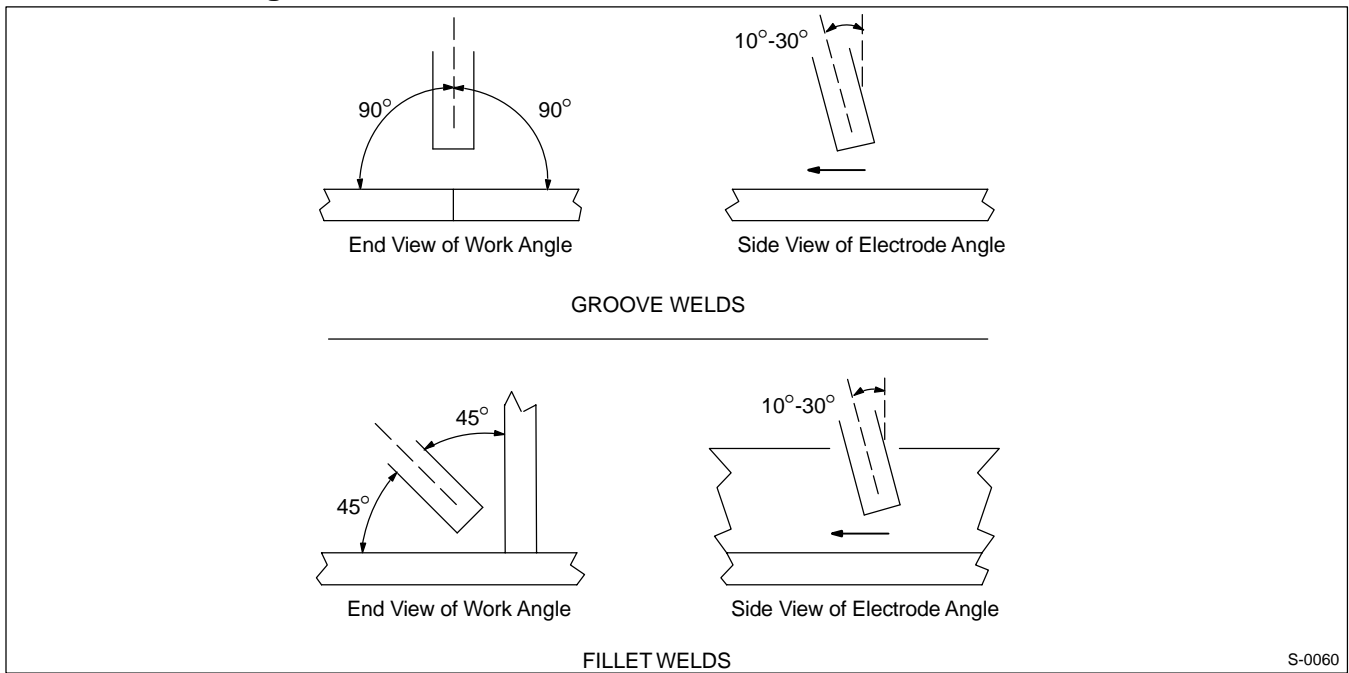


- 1 Electrode
- 2 Workpiece
- 3 Arc

Bring electrode straight down to workpiece; then lift slightly to start arc. If arc goes out, electrode was lifted too high. If electrode sticks to workpiece, use a quick twist to free it.

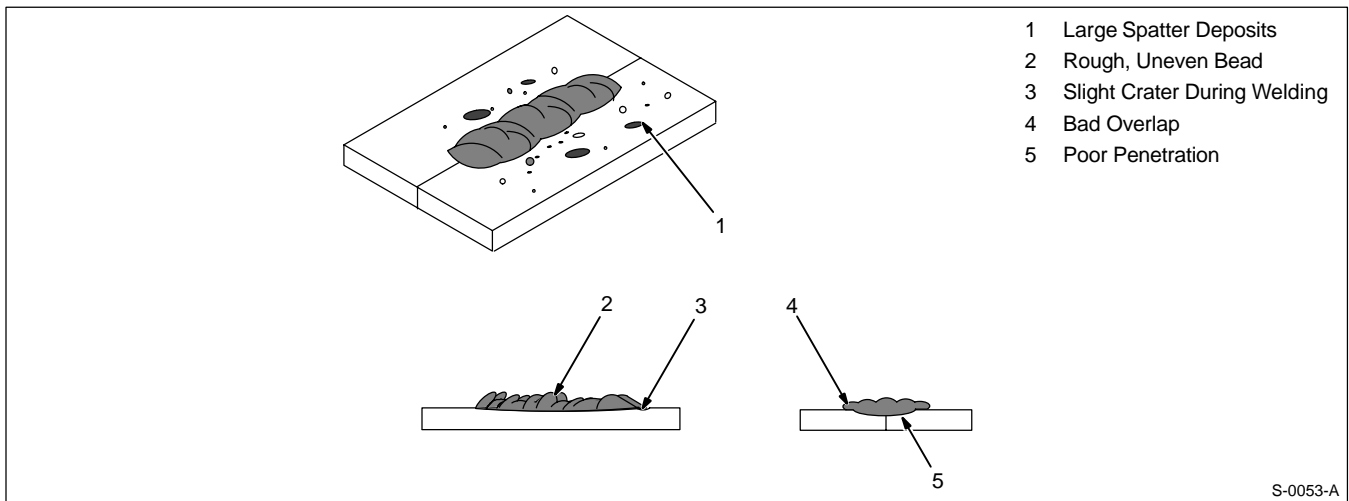
S-0050

## 10-5. Positioning Electrode Holder



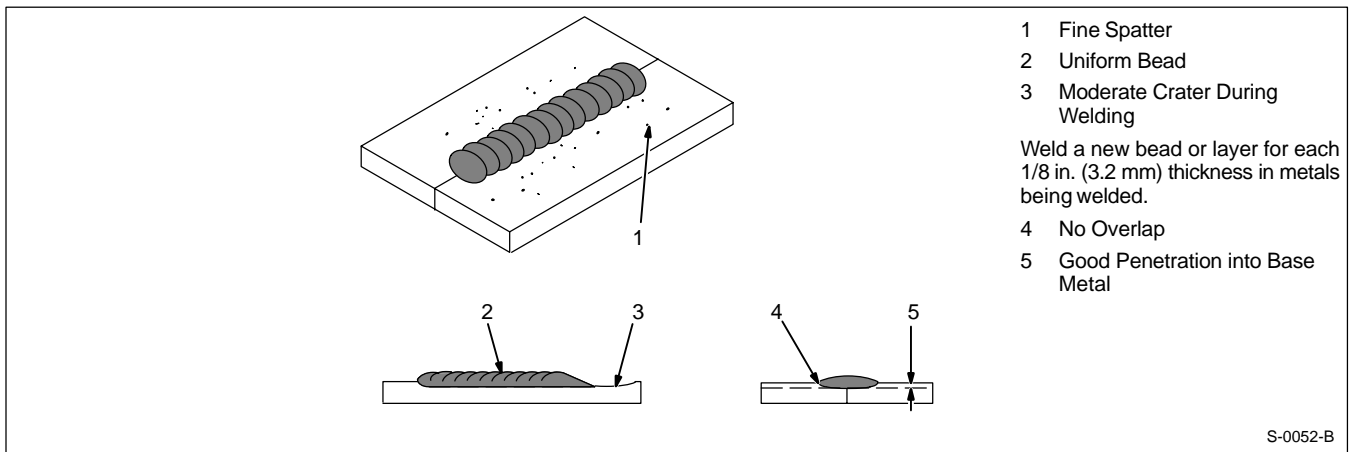
S-0060

## 10-6. Poor Weld Bead Characteristics



S-0053-A

## 10-7. Good Weld Bead Characteristics

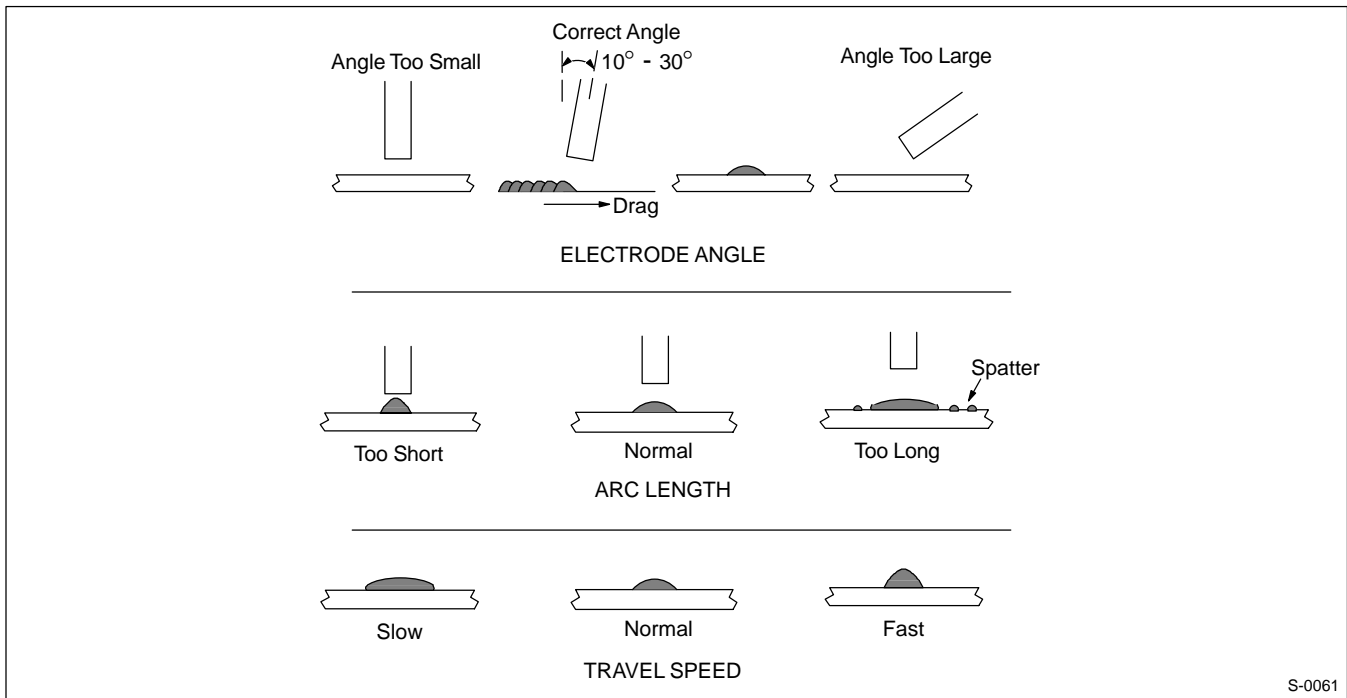


S-0052-B

## 10-8. Conditions That Affect Weld Bead Shape

### NOTE

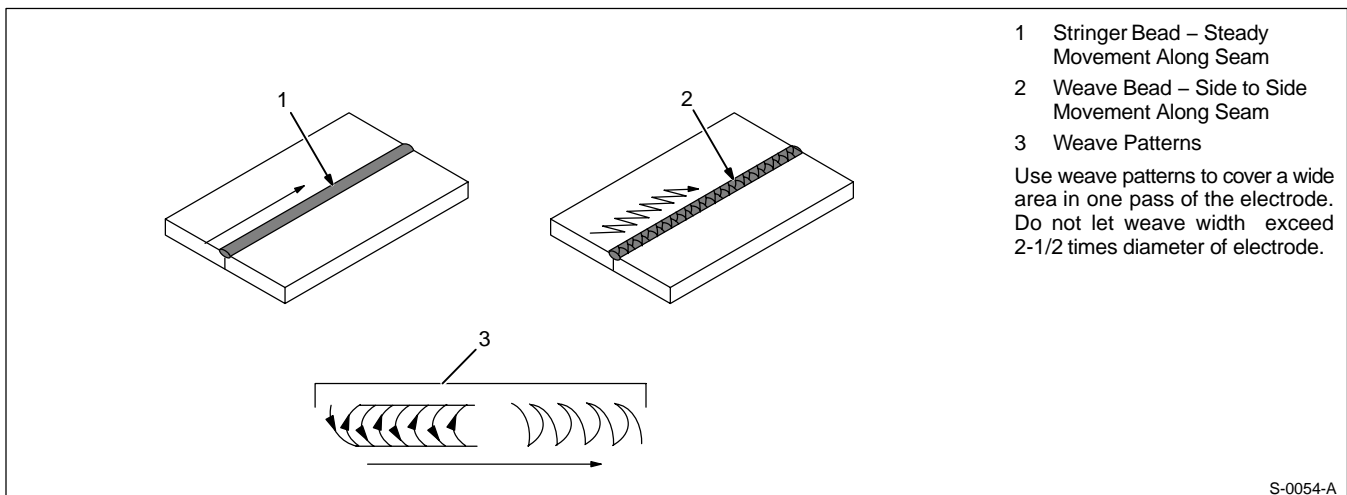
Weld bead shape is affected by electrode angle, arc length, travel speed, and thickness of base metal.



## 10-9. Electrode Movement During Welding

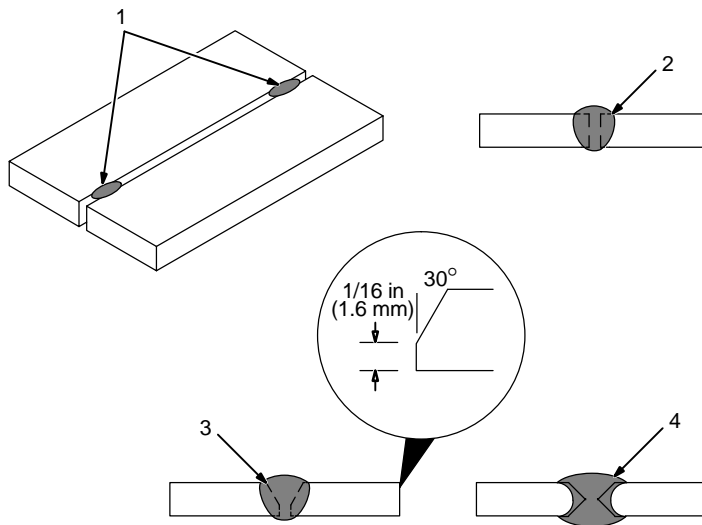
### NOTE

Normally, a single stringer bead is satisfactory for most narrow groove weld joints; however, for wide groove weld joints or bridging across gaps, a weave bead or multiple stringer beads work better.





## 10-10. Butt Joints



### 1 Tack Welds

Prevent edges of joint from drawing together ahead of electrode by tack welding the materials in position before final weld.

### 2 Square Groove Weld

Good for materials up to 3/16 in (5 mm) thick.

### 3 Single V-Groove Weld

Good for materials 3/16 – 3/4 in (5-19 mm) thick. Cut bevel with oxy-acetylene or plasma cutting equipment. Remove scale from material after cutting. A grinder can also be used to prepare bevels.

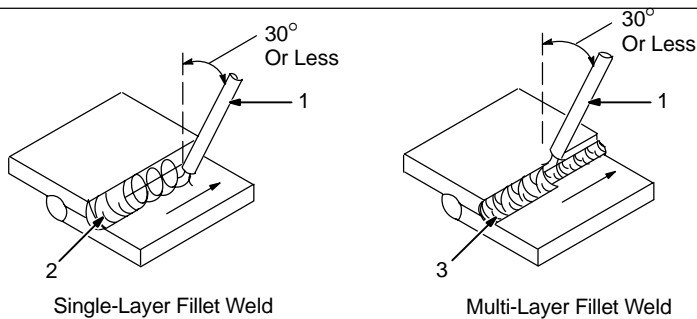
Create 30 degree angle of bevel on materials in V-groove welding.

### 4 Double V-Groove Weld

Good for materials thicker than 3/16 in (5 mm).

S-0662

## 10-11. Lap Joint



### 1 Electrode

### 2 Single-Layer Fillet Weld

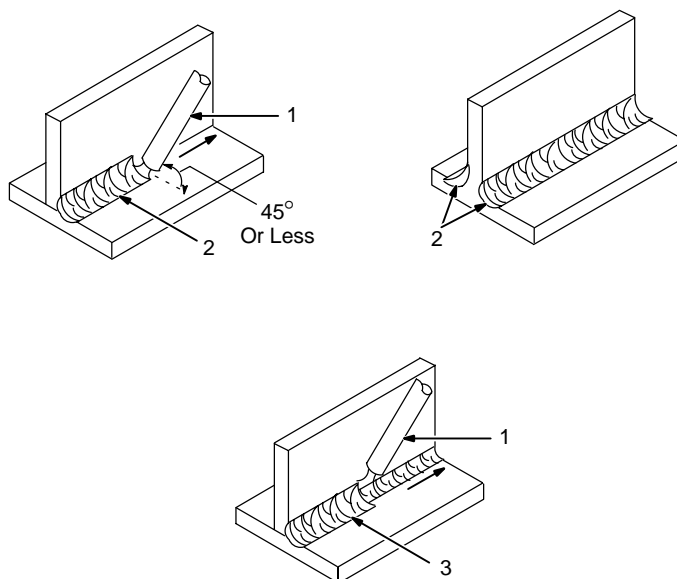
Move electrode in circular motion.

### 3 Multi-Layer Fillet Weld

Weld a second layer when a heavier fillet is needed. Remove slag before making another weld pass. Weld both sides of joint for maximum strength.

S-0063 / S-0064

## 10-12. Tee Joint



### 1 Electrode

### 2 Fillet Weld

Keep arc short and move at definite rate of speed. Hold electrode as shown to provide fusion into the corner. Square edge of the weld surface.

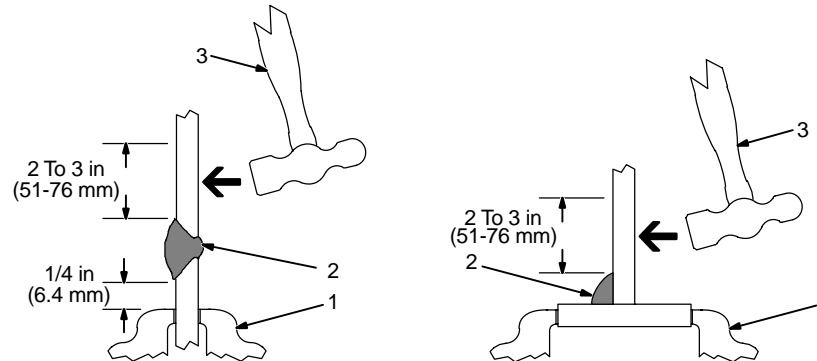
For maximum strength weld both sides of upright section.

### 3 Multi-Layer Deposits

Weld a second layer when a heavier fillet is needed. Use any of the weaving patterns shown in Section 10-9. Remove slag before making another weld pass.

S-0060 / S-0058-A / S-0061

### 10-13. Weld Test

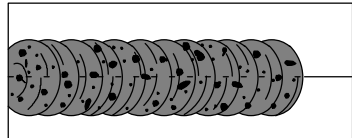


1 Vise  
2 Weld Joint  
3 Hammer

Strike weld joint in direction shown.  
A good weld bends over but does not break.

S-0057-B

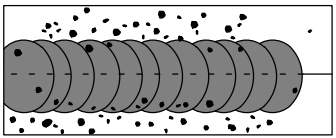
### 10-14. Troubleshooting – Porosity



Porosity – small cavities or holes resulting from gas pockets in weld metal.

Possible Causes	Corrective Actions
Arc length too long.	Reduce arc length.
Damp electrode.	Use dry electrode.
Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.

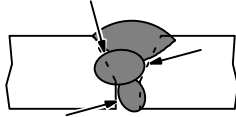
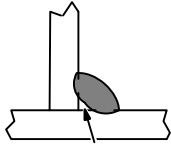
### 10-15. Troubleshooting – Excessive Spatter



Excessive Spatter – scattering of molten metal particles that cool to solid form near weld bead.

Possible Causes	Corrective Actions
Amperage too high for electrode.	Decrease amperage or select larger electrode.
Arc length too long or voltage too high.	Reduce arc length or voltage.

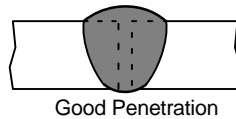
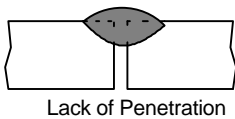
## 10-16. Troubleshooting – Incomplete Fusion



Incomplete Fusion – failure of weld metal to fuse completely with base metal or a preceding weld bead.

Possible Causes	Corrective Actions
Insufficient heat input.	Increase amperage. Select larger electrode and increase amperage.
Improper welding technique.	Place stringer bead in proper location(s) at joint during welding.
	Adjust work angle or widen groove to access bottom during welding.
	Momentarily hold arc on groove side walls when using weaving technique.
	Keep arc on leading edge of weld puddle.
Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.

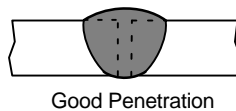
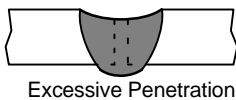
## 10-17. Troubleshooting – Lack Of Penetration



Lack Of Penetration – shallow fusion between weld metal and base metal.

Possible Causes	Corrective Actions
Improper joint preparation.	Material too thick. Joint preparation and design must provide access to bottom of groove.
Improper weld technique.	Keep arc on leading edge of weld puddle.
Insufficient heat input.	Increase amperage. Select larger electrode and increase amperage.
	Reduce travel speed.

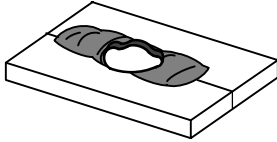
## 10-18. Troubleshooting – Excessive Penetration



Excessive Penetration – weld metal melting through base metal and hanging underneath weld.

Possible Causes	Corrective Actions
Excessive heat input.	Select lower amperage. Use smaller electrode.
	Increase and/or maintain steady travel speed.

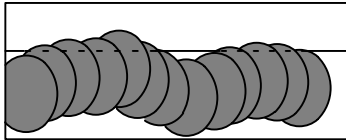
## 10-19. Troubleshooting – Burn-Through



Burn-Through – weld metal melting completely through base metal resulting in holes where no metal remains.

Possible Causes	Corrective Actions
Excessive heat input.	Select lower amperage. Use smaller electrode.
	Increase and/or maintain steady travel speed.

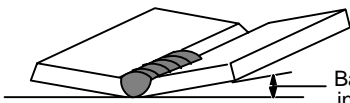
## 10-20. Troubleshooting – Waviness Of Bead



Waviness Of Bead – weld metal that is not parallel and does not cover joint formed by base metal.

Possible Causes	Corrective Actions
Unsteady hand.	Use two hands. Practice technique.

## 10-21. Troubleshooting – Distortion




Base metal moves in the direction of the weld bead.

Distortion – contraction of weld metal during welding that forces base metal to move.

Possible Causes	Corrective Actions
Excessive heat input.	Use restraint (clamp) to hold base metal in position.
	Make tack welds along joint before starting welding operation.
	Select lower amperage for electrode.
	Increase travel speed.
	Weld in small segments and allow cooling between welds.



# SECTION 11 – PARTS LIST

 Hardware is common and not available unless listed.

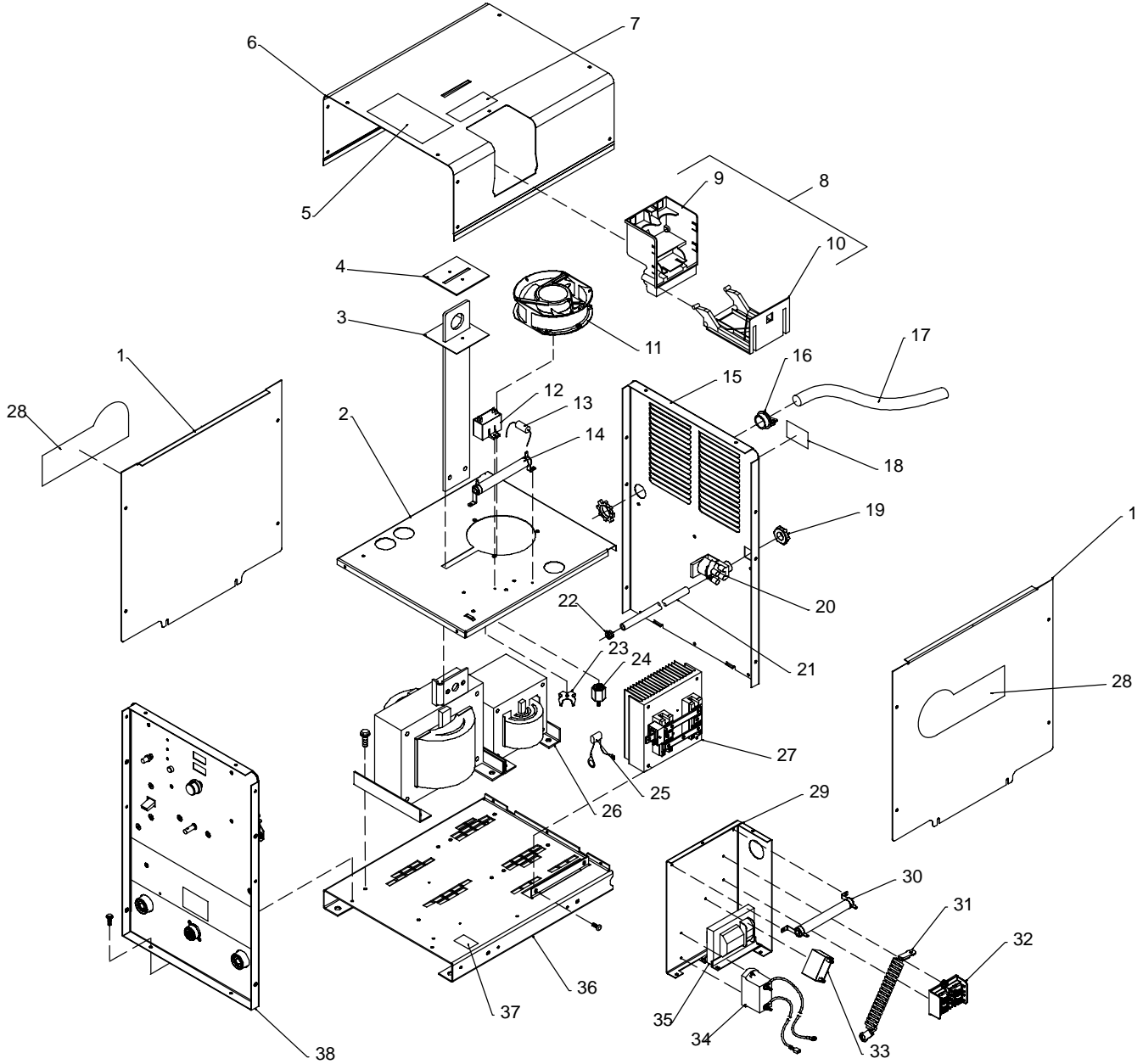


Figure 11-1. Main Assembly

803 252-B

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
<b>Figure 11-1. Main Assembly</b>				
1		208412	PANEL,SIDE	2
2		208435	BAFFLE,FAN	1
3		208874	SUPPORT,LIFT EYE	1
4		026627	GASKET,LIFTING EYE COVER	1
5		203990	LABEL,WARNING GENERAL PRECAUTIONARY STATIC	1
6		+208409	COVER, TOP	1
7		201019	LABEL,WARNING ELECTRIC SHOCK EXCESS WEIGHT	1
8		204389	HOLDER,TORCH/CABLE (CONSISTING OF)	1
9		200922	HOUSING, TORCH CABLE HOLDER	1
10		200920	DOOR, TORCH CABLE HOLDER,	1
11		208892	FAN,AC 230V BRUSHLESS	1
12	C1	191944	CAPACITOR,POLYP MET FILM .10UF 250VAC 10%	1
13	R2	189132	RESISTOR ASSY	1
14	R1	220808	RESISTOR,WW FXD 100 W 50 OHM W/CLIPS	1
15		+208410	PANEL,REAR	1
16		604102	CONN,CLAMP CABLE 1.000	1
17		190442	CORD SET,250V 8GA 3/C 10FT ST JKT	1
18		185759	LABEL,WARNING ELECTRIC SHOCK & INPUT POWER	1
19		137761	NUT, 750NPT 1.31HEX .27H NYL BLK	1
20	GS	216607	VALVE, 24VDC 2WAY CUSTOM PORT 1/8 ORF W/FRICT	1
21		209328	HOSE,NPRN BRD NO 1 X .250 ID X 19.500	1
22		089120	CLAMP,HOSE .375 - .450 CLP DIA SLFTTNG GREEN	1
23		208294	CONNECTOR,FASTON MALE 4-PRONG	1
24		207560	INSULATOR, STANDOFF W/STUD	1
25	C14	206878	CAPACITOR ASSY	1
26	T1,Z1	211260	TRANSFORMER/STABILIZER ASSEMBLY	1
	TH1	201 443	Thermistor, NTC 10k ohm @ 25 deg C 27.5 in lead	1
27		Fig.11-3	RECTIFIER ASSY,	1
28		194591	LABEL,MILLER 9.776 X 4.126 HORIZONTAL SYNCROWAV	2
29		208436	HF BOX,	1
30	R8	211261	RESISTOR,WW FXD 100 W 200 OHM W/CLIPS	1
31	T4	208890	COIL,COUPLING	1
32	G1	199854	SPARK GAP ASSY, (CONSISTING OF)	1
		199855	BASE,	1
		199856	HOLDER, POINTS	4
		196455	POINTS, SPARK GAP	4
33	C18	195552	CAPACITOR,POLYP MET FILM 20. UF 250 VAC 10%	1
34	C3	215779	CAPACITOR, MICA .002 UF 10000 V PANEL MTG W/LEA	1
35	T3	208045	XFMR,HIGH VOLTAGE 115V PRI 3600V SEC 30 MA W/TERM	1
36		+208413	BASE,	1
37		192828	LABEL,WARNING ELECTRICAL SHOCK ETC	1
38		Fig.11-2	FRONT PANEL, WITH COMPONENTS	1
	PLG1	202119	CONNECTOR W/SOCKETS	1
	PLG7	202116	CONNECTOR W/SOCKETS	1
	PLG8	202117	CONNECTOR W/SOCKETS	1
	PLG11	202118	CONNECTOR W/SOCKETS	1

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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**Figure 11-1. Main Assembly (Continued)**

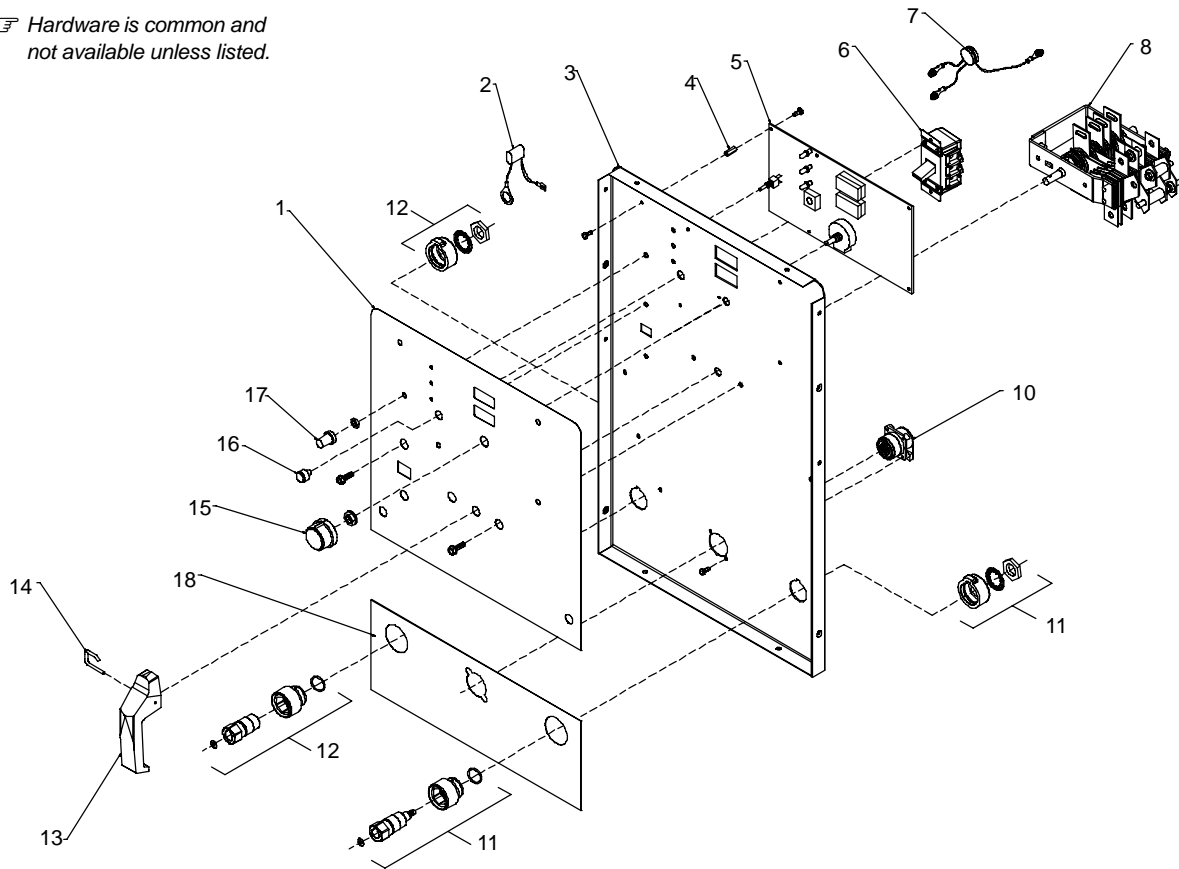
.....		207530	..... ACCESSORY KIT, (CONSISTING OF) .....	1
.....		209282	..... RFCS-14, FOOT CONTROL .....	1
.....		DB1712RDI	..... TORCH, TIG 150A 12.5 FT CABLE .....	1
.....		188 860	..... WORK CABLE, W/CLAMP .....	1
.....		192121	..... REGULATOR/FLOWMETER .....	1
.....		176840	..... HOLDER, ELECTRODE W/CABLE & DINSE CONNECTOR .....	1
.....		198317	..... HOSE, GAS .....	1
.....		141162	..... HOUSING PLUG+PINS,(SERVICE KIT) .....	0
.....		134460	..... CONN,TW LK INSUL MALE(DINSE TYPE)70 SERIES .....	0
.....		155552	..... CONN,TW LK INSUL MALE(DINSE TYPE)W/GAS PASSAGE .....	0
.....		206502	..... SERVICE KIT,SPARK GAP ASSY.(GROUND) .....	0

+When ordering a component originally displaying a precautionary label, the label should also be ordered.

**To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.**



☞ Hardware is common and not available unless listed.



803 257-B

**Figure 11-2. Panel, Front With Components**

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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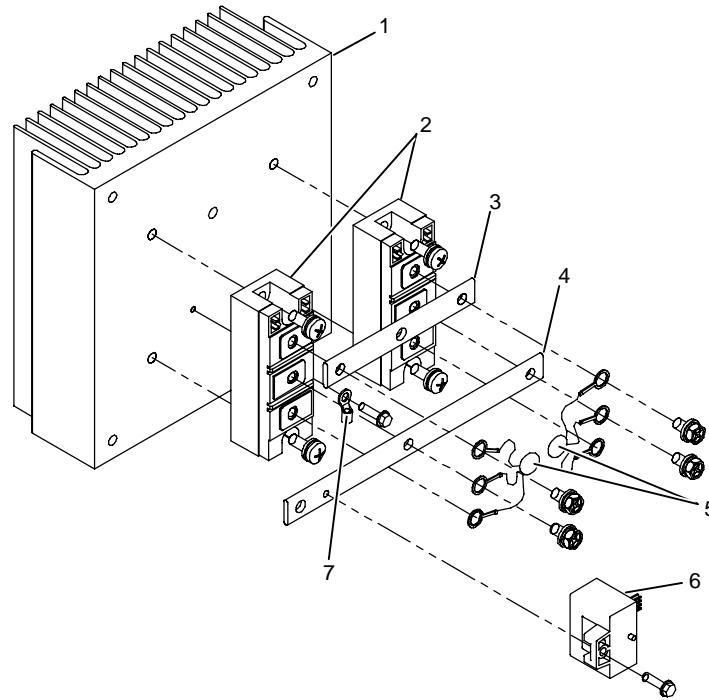
**Figure 11-2. Panel, Front With Components (Fig 11-1 Item 38)**

...	1	208414	NAMEPLATE, (order by model and serial number)	1
...	2	C13 209587	CAPACITOR ASSEMBLY	1
...	3	208411	PANEL,FRONT	1
...	4	190512	Stand-Off, No 6-32 x .64 lg	5
...	5	PC1 213996	CIRCUIT CARD ASSY,CONTROL & INTERFACE W/PROGRAM	1
...	6	PLG7, 15 131054	CONNECTOR & SOCKETS	2
...	7	PLG6 115092	CONNECTOR & SOCKETS	1
...	8	PLG4 115093	CONNECTOR & SOCKETS	1
...	10	PLG1 130203	CONNECTOR & SOCKETS	1
...	11	PLG2 131052	CONNECTOR & SOCKETS	1
...	12	S1 128755	SWITCH,TGL DPST 40A 600VAC SCR TERM WIDE TGL	1
...	13	C5, 6 111634	CAPACITOR ASSY,	1
...	14	S5 207236	SWITCH,POLARITY CHANGEOVER	1
...	15	211911	CONN, CIRC MS/CPC 14 SKT SIZE 20 RCPT W/FILTERING	1
...	16	185703	IRECEPTACLE, TWISTLOCK ASSEMBLY	1
...	17	186092	IRECEPTACLE KIT, DIN STYLE	1
...	18	175952	PLASTIC,HANDLE SWITCH	1
...	19	169136	PIN, HANDLE	1
...	20	174991	KNOB,POINTER 1.250 DIA X .250 ID W/SPRING CLIP-.21	1
...	21	195778	ACTUATOR, PUSH BUTTON ASSEMBLY	1
...	22	183332	KNOB,POINTER .570 DIA X .125 ID W/SPRING CLIP	1
...	23	210571	NAMEPLATE, LOWER	1

+When ordering a component originally displaying a precautionary label, the label should also be ordered.

**To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.**

☞ Hardware is common and not available unless listed.



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**Figure 11-3. Rectifier Assembly**

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
		<b>208 887</b>	<b>Figure 11-3. Rectifier Assembly (Fig 11-1 item 27)</b>	
... 1	...	206984	HEAT SINK,RECTIFIER	1
... 2	MOD1,2	208384	THYRISTOR,SCR MODULE 136A 400V DUAL	2
... 3	...	199962	BUS BAR,	1
... 4	...	207190	BUS BAR,RECTIFIER	1
... 5	C7,8,9,10	190460	CAPACITOR ASSY,	2
... 6	HD1 ..	191941	TRANSDUCER,CURRENT	1
... 7	TH2 ..	206327	THERMISTOR,NTC 30K OHM @ 25 DEG C 27IN LEAD	1

**To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.**

# TRUE BLUE® WARRANTY

Effective January 1, 2004

(Equipment with a serial number preface of "LE" or newer)

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

## Warranty Questions?

Call  
1-800-4-A-MILLER  
for your local  
Miller distributor.

Your distributor also gives  
you ...

### Service

You always get the fast,  
reliable response you  
need. Most replacement  
parts can be in your  
hands in 24 hours.

### Support

Need fast answers to the  
tough welding questions?  
Contact your distributor.  
The expertise of the  
distributor and Miller is  
there to help you, every  
step of the way.

**LIMITED WARRANTY** – Subject to the terms and conditions below, Miller Electric Mfg. Co., Appleton, Wisconsin, warrants to its original retail purchaser that new Miller equipment sold after the effective date of this limited warranty is free of defects in material and workmanship at the time it is shipped by Miller. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS.

Within the warranty periods listed below, Miller will repair or replace any warranted parts or components that fail due to such defects in material or workmanship. Miller must be notified in writing within thirty (30) days of such defect or failure, at which time Miller will provide instructions on the warranty claim procedures to be followed.

Miller shall honor warranty claims on warranted equipment listed below in the event of such a failure within the warranty time periods. All warranty time periods start on the date that the equipment was delivered to the original retail purchaser, or one year after the equipment is sent to a North American distributor or eighteen months after the equipment is sent to an International distributor.

1. 5 Years Parts — 3 Years Labor
  - \* Original main power rectifiers
  - \* Inverters (input and output rectifiers only)
2. 3 Years — Parts and Labor
  - \* Transformer/Rectifier Power Sources
  - \* Plasma Arc Cutting Power Sources
  - \* Semi-Automatic and Automatic Wire Feeders
  - \* Inverter Power Sources (Unless Otherwise Stated)
  - \* Water Coolant Systems (Integrated)
  - \* Intelligig
  - \* Maxstar 150
  - \* Engine Driven Welding Generators  
**(NOTE: Engines are warranted separately by the engine manufacturer.)**
3. 1 Year — Parts and Labor Unless Specified
  - \* DS-2 Wire Feeder
  - \* Motor Driven Guns (w/exception of Spoolmate Spoolguns)
  - \* Process Controllers
  - \* Positioners and Controllers
  - \* Automatic Motion Devices
  - \* RFCS Foot Controls
  - \* Induction Heating Power Sources and Coolers
  - \* Water Coolant Systems (Non-Integrated)
  - \* Flowgauge and Flowmeter Regulators (No Labor)
  - \* HF Units
  - \* Grids
  - \* Maxstar 85, 140
  - \* Spot Welders
  - \* Load Banks
  - \* Arc Stud Power Sources & Arc Stud Guns
  - \* Racks
  - \* Running Gear/Trailers
  - \* Plasma Cutting Torches (except APT & SAF Models)
  - \* Field Options  
**(NOTE: Field options are covered under True Blue® for the remaining warranty period of the product they are installed in, or for a minimum of one year — whichever is greater.)**
4. 6 Months — Batteries
5. 90 Days — Parts
  - \* MIG Guns/TIG Torches

- \* Induction Heating Coils and Blankets
- \* APT & SAF Model Plasma Cutting Torches
- \* Remote Controls
- \* Accessory Kits
- \* Replacement Parts (No labor)
- \* Spoolmate Spoolguns
- \* Canvas Covers

Miller's True Blue® Limited Warranty shall not apply to:

1. **Consumable components; such as contact tips, cutting nozzles, contactors, brushes, slip rings, relays or parts that fail due to normal wear. (Exception: brushes, slip rings, and relays are covered on Bobcat, Trailblazer, and Legend models.)**
2. Items furnished by Miller, but manufactured by others, such as engines or trade accessories. These items are covered by the manufacturer's warranty, if any.
3. Equipment that has been modified by any party other than Miller, or equipment that has been improperly installed, improperly operated or misused based upon industry standards, or equipment which has not had reasonable and necessary maintenance, or equipment which has been used for operation outside of the specifications for the equipment.

MILLER PRODUCTS ARE INTENDED FOR PURCHASE AND USE BY COMMERCIAL/INDUSTRIAL USERS AND PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT.

In the event of a warranty claim covered by this warranty, the exclusive remedies shall be, at Miller's option: (1) repair; or (2) replacement; or, where authorized in writing by Miller in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized Miller service station; or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at customer's risk and expense. Miller's option of repair or replacement will be F.O.B., Factory at Appleton, Wisconsin, or F.O.B. at a Miller authorized service facility as determined by Miller. Therefore no compensation or reimbursement for transportation costs of any kind will be allowed.

TO THE EXTENT PERMITTED BY LAW, THE REMEDIES PROVIDED HEREIN ARE THE SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL MILLER BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF PROFIT), WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.

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

Some states in the U.S.A. do not allow limitations of how long an implied warranty lasts, or the exclusion of incidental, indirect, special or consequential damages, so the above limitation or exclusion may not apply to you. This warranty provides specific legal rights, and other rights may be available, but may vary from state to state.

In Canada, legislation in some provinces provides for certain additional warranties or remedies other than as stated herein, and to the extent that they may not be waived, the limitations and exclusions set out above may not apply. This Limited Warranty provides specific legal rights, and other rights may be available, but may vary from province to province.





# Owner's Record

Please complete and retain with your personal records.

Model Name	Serial/Style Number
Purchase Date	(Date which equipment was delivered to original customer.)
Distributor	
Address	
City	
State	Zip



## For Service

**Call 1-800-4-A-Miller or see our website at [www.MillerWelds.com](http://www.MillerWelds.com) to locate a DISTRIBUTOR or SERVICE AGENCY near you.**

Always provide Model Name and Serial/Style Number.

Contact your Distributor for:

- Welding Supplies and Consumables
- Options and Accessories
- Personal Safety Equipment
- Service and Repair
- Replacement Parts
- Training (Schools, Videos, Books)
- Technical Manuals (Servicing Information and Parts)
- Circuit Diagrams
- Welding Process Handbooks

Contact the Delivering Carrier to:

File a claim for loss or damage during shipment.

For assistance in filing or settling claims, contact your distributor and/or equipment manufacturer's Transportation Department.

### Miller Electric Mfg. Co.

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Appleton, WI 54914 USA

### International Headquarters—USA

USA Phone: 920-735-4505 Auto-Attended  
USA & Canada FAX: 920-735-4134  
International FAX: 920-735-4125

### European Headquarters – United Kingdom

Phone: 44 (0) 1204-593493  
FAX: 44 (0) 1204-598066

[www.MillerWelds.com](http://www.MillerWelds.com)

