



OM-2224

191 802

February 1999

Processes



Stick (SMAW) Welding



TIG (GTAW) Welding

Description



Arc Welding Power Source

# Maxstar<sup>®</sup> 140

With Auto-Link<sup>®</sup>



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[www.Miller-Welds.com](http://www.Miller-Welds.com)

## OWNER'S MANUAL

# From Miller to

# You

*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



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

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 which exact part you may need to fix the problem. Warranty and service information for your particular model are also provided.

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 call 1-800-4-A-Miller.



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

*Miller offers a Technical Manual which provides more detailed service and parts information for your unit. To obtain a Technical Manual, contact your local distributor. Your distributor can also supply you with Welding Process Manuals such as SMAW, GTAW, GMAW, and GMAW-P.*



# TABLE OF CONTENTS

## **WARNING**

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

The following terms are used interchangeably throughout this manual:  
TIG = GTAW  
Stick = SMAW

<b>SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING</b> .....	<b>1</b>
1-1. Symbol Usage .....	1
1-2. Arc Welding Hazards .....	1
1-3. Additional Symbols For Installation, Operation, And Maintenance .....	3
1-4. Principal Safety Standards .....	3
1-5. EMF Information .....	4
<b>SECTION 1 – CONSIGNES DE SECURITE – LIRE AVANT UTILISATION</b> .....	<b>5</b>
1-1. Signification des symboles .....	5
1-2. Dangers relatifs au soudage à l'arc .....	5
1-3. Dangers supplémentaires en relation avec l'installation, le fonctionnement et la maintenance .....	7
1-4. Principales normes de sécurité .....	8
1-5. Information sur les champs électromagnétiques .....	8
<b>SECTION 2 – SPECIFICATIONS AND INSTALLATION</b> .....	<b>9</b>
2-1. Specifications .....	9
2-2. Description .....	9
2-3. Included with Your Unit (Stick Only) .....	10
2-4. Included with Your Unit (TIG / Stick) .....	10
2-5. Duty Cycle And Overheating .....	11
2-6. Volt-Ampere Curves .....	12
2-7. Selecting A Location .....	13
2-8. Typical Connection Methods .....	13
2-9. Connecting to Weld Output Receptacles .....	14
2-10. Rear Panel And Power Switch .....	14
2-11. Connecting Input Power .....	15
2-12. Installing 230 Volts AC Input Power Cord .....	16
<b>SECTION 3 – OPERATION</b> .....	<b>17</b>
3-1. Front Panel Controls .....	17
3-2. Lift-Arc <sup>®</sup> TIG Procedure .....	18
<b>SECTION 4 – MAINTENANCE AND TROUBLESHOOTING</b> .....	<b>18</b>
4-1. Routine Maintenance .....	18
4-2. Blowing Out Inside Of Unit .....	19
4-3. Troubleshooting .....	20
<b>SECTION 5 – ELECTRICAL DIAGRAM</b> .....	<b>21</b>
<b>SECTION 6 – STICK WELDING (SMAW) GUIDELINES</b> .....	<b>22</b>
<b>SECTION 7 –SELECTING AND PREPARING TUNGSTEN ELECTRODE</b> .....	<b>30</b>
<b>SECTION 8 – GUIDELINES FOR TIG WELDING (GTAW)</b> .....	<b>32</b>
<b>SECTION 9 – PARTS LIST</b> .....	<b>36</b>



# 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.

ℹ 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 1-4. 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.

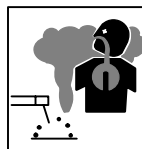
Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, 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.

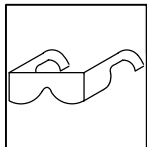
- Wear a welding helmet fitted with a proper shade of filter to protect your face and eyes when welding or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).
- Wear approved safety glasses with side shields under your helmet.
- Use protective screens or barriers to protect others from flash 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.

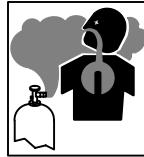
Welding on closed containers, such as tanks, drums, or pipes, can cause them to blow up. Sparks can fly off from the welding arc. The flying sparks, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode to metal objects can cause sparks, explosion, overheating, or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



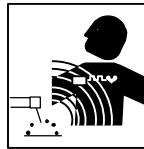
### BUILDUP OF GAS can injure or kill.

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



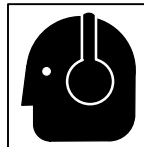
### HOT PARTS can cause severe burns.

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



### MAGNETIC FIELDS can affect pacemakers.

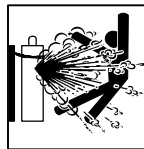
- Pacemaker wearers keep away.
- Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations.



### 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



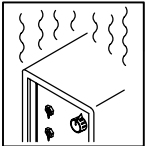
### FIRE OR EXPLOSION hazard.

- 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.



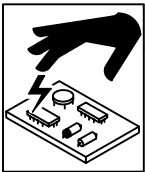
### FALLING UNIT can cause injury.

- 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.



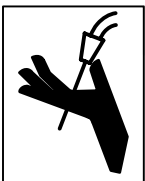
### STATIC (ESD) can damage PC boards.

- 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.



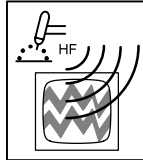
### WELDING WIRE can cause injury.

- 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.



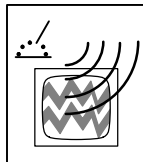
### MOVING PARTS can cause injury.

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



### 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. Principal Safety Standards

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

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

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

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

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

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

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

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

## 1-5. 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 1 – CONSIGNES DE SECURITE – LIRE AVANT UTILISATION

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## 1-1. Signification des symboles



Signifie Mise en garde ! Soyez vigilant ! Cette procédure présente des risques de danger ! Ceux-ci sont identifiés par des 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 ! Soyez vigilant ! Il y a des risques de danger reliés aux CHOCS ÉLECTRIQUES, aux PIÈCES EN MOUVEMENT et aux PIÈCES CHAUDES. Reportez-vous aux symboles et aux directives ci-dessous afin de connaître les mesures à prendre pour éviter tout danger.

## 1-2. Dangers relatifs au soudage à l'arc

▲ Les symboles présentés ci-après sont utilisés tout au long du présent manuel pour attirer votre attention et identifier les risques de danger. Lorsque vous voyez un symbole, soyez vigilant et suivez les directives mentionnées afin d'éviter tout danger. Les consignes de sécurité présentées ci-après ne font que résumer l'information contenue dans les normes de sécurité énumérées à la section 1-4. Veuillez lire et respecter toutes ces normes de sécurité.

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

▲ Au cours de l'utilisation, tenir toute personne à l'écart et plus particulièrement les enfants.



### UN CHOC ÉLECTRIQUE peut tuer.

Un simple contact avec des pièces électriques peut provoquer une électrocution ou des blessures graves. L'électrode et le circuit de soudage sont sous tension dès que l'appareil est sur ON. Le circuit d'entrée et les circuits internes de l'appareil sont également sous

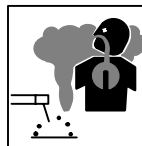
tension à ce moment-là. En soudage semi-automatique ou automatique, le fil, le dévidoir, le logement des galets d'entraînement et les pièces métalliques en contact avec le fil de soudage sont sous tension. Des matériels mal installés ou mal mis à la terre présentent un danger.

- Ne jamais toucher les pièces électriques sous tension.
- Porter des gants et des vêtements de protection secs ne comportant pas de trous.
- S'isoler de la pièce et de la terre au moyen de tapis ou d'autres moyens isolants suffisamment grands pour empêcher le contact physique éventuel avec la pièce ou la terre.
- Ne pas se servir de source électrique à courant électrique dans les zones humides, dans les endroits confinés ou là où on risque de tomber.
- Se servir d'une source électrique à courant électrique UNIQUEMENT si le procédé de soudage le demande.
- Si l'utilisation d'une source électrique à courant électrique 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. Déverrouiller l'alimentation selon la norme OSHA 29 CFR 1910.147 (voir normes de sécurité).
- Installer et mettre à la terre correctement cet 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.
- En effectuant les raccordements d'entrée fixer d'abord le conducteur de mise à la terre approprié et contre-vérifier les connexions.
- Vérifier fréquemment le cordon d'alimentation pour voir s'il n'est pas endommagé ou dénudé – remplacer le cordon immédiatement s'il est endommagé – un câble dénudé peut provoquer une électrocution.
- Mettre l'appareil hors tension quand on ne l'utilise pas.
- Ne pas utiliser des câbles usés, endommagés, de grosseur insuffisante ou mal épissés.
- Ne pas 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 utiliser le connecteur de pièce ou le câble de retour.

- Ne pas toucher l'électrode quand on est en contact avec la pièce, la terre ou une électrode provenant d'une autre machine.
- N'utiliser qu'un matériel en bon état. Réparer ou remplacer sur-le-champ les pièces endommagées. Entretien l'appareil conformément à ce 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-métal avec la pièce à souder ou la table de travail, le plus près possible de la soudure.
- Isoler la pince de masse quand pas mis à la pièce pour éviter le contact avec tout objet métallique.

### Il y a DU 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 indiquées dans la partie entretien avant de toucher les pièces.



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

Le soudage génère des fumées et des gaz. Leur inhalation peut être dangereux pour votre santé.

- Eloigner votre tête des fumées. Ne pas respirer les fumées.
- A l'intérieur, ventiler la zone et/ou utiliser un échappement au niveau de l'arc pour l'évacuation des fumées et des gaz de soudage.
- Si la ventilation est insuffisante, utiliser un respirateur à alimentation d'air homologué.
- Lire les spécifications de sécurité des matériaux (MSDSs) et les instructions du fabricant concernant les métaux, les consommables, les revêtements, les nettoyants et les dégraissants.
- Travailler dans un espace fermé seulement s'il est bien ventilé ou en portant un respirateur à alimentation d'air. Demander toujours à un surveillant dûment formé de se tenir à proximité. Des fumées et des gaz de soudage peuvent déplacer l'air et abaisser le niveau d'oxygène provoquant des blessures ou des accidents mortels. S'assurer que l'air de respiration ne présente aucun danger.
- Ne pas souder dans des endroits situés 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 des métaux munis d'un revêtement, tels que l'acier galvanisé, plaqué en plomb ou au cadmium à moins que le revêtement n'ait été enlevé dans la zone de soudure, que l'endroit soit bien ventilé, et si nécessaire, en portant un respirateur à alimentation d'air. Les revêtements et tous les métaux renfermant ces éléments peuvent dégager des fumées toxiques en cas de soudage.



## LES RAYONS DE L'ARC peuvent provoquer des brûlures dans les yeux et sur la peau.

Le rayonnement de l'arc du procédé de soudage génère des rayons visibles et invisibles intenses (ultraviolets et infrarouges) susceptibles de provoquer des brûlures dans les yeux et sur la peau. Des étincelles sont projetées pendant le soudage.

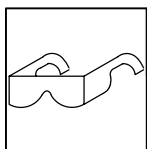
- Porter un casque de soudage muni d'un écran de filtre approprié pour protéger votre visage et vos yeux pendant le soudage ou pour regarder (voir ANSI Z49.1 et Z87.1 énuméré dans les normes de sécurité).
- Porter des protections approuvés pour les oreilles si le niveau sonore est trop élevé.
- Utiliser des écrans ou des barrières pour protéger des tiers de l'éclair et de l'éblouissement; demander aux autres personnes de ne pas regarder l'arc.
- Porter des vêtements de protection constitué dans une matière durable, résistant au feu (cuir ou laine) et une protection des pieds.



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

Le soudage effectué sur des conteneurs fermés tels que des réservoirs, tambours ou des conduites peut provoquer leur éclatement. Des étincelles peuvent être projetées de l'arc de soudure. La projection d'étincelles, des pièces chaudes et des équipements chauds peut provoquer des incendies et des brûlures. Le contact accidentel de l'électrode avec des objets métalliques peut provoquer 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 d'autres personnes de la projection d'étincelles et de métal chaud.
- Ne pas souder dans un endroit là où des étincelles peuvent tomber sur des substances inflammables.
- Déplacer 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 homologués.
- Des étincelles et des matériaux chauds du soudage peuvent facilement passer dans d'autres zones en traversant de petites fissures et des ouvertures.
- Surveiller tout déclenchement d'incendie et tenir un extincteur à proximité.
- Le soudage effectué sur un plafond, plancher, paroi ou séparation peut déclencher un incendie de l'autre côté.
- Ne pas effectuer le soudage sur des conteneurs fermés tels que des réservoirs, tambours, ou conduites, à moins qu'ils n'aient été préparés correctement conformément à AWS F4.1 (voir les normes de sécurité).
- Brancher le câble sur la pièce la plus près possible de la zone de soudage pour éviter le transport du courant sur une longue distance par des chemins inconnus éventuels en provoquant des risques d'électrocution et d'incendie.
- Ne pas utiliser le poste de soudage pour dégelier des conduites gelées.
- En cas de non utilisation, enlever la baguette d'électrode du porte-électrode ou couper le fil à la pointe de contact.
- Porter des vêtements de protection dépourvus d'huile tels que des gants en cuir, une chemise en matériau lourd, des pantalons sans revers, des chaussures hautes et un couvre chef.
- Avant de souder, retirer toute substance combustible de vos poches telles qu'un allumeur au butane ou des allumettes.



## DES PARTICULES VOLANTES peuvent blesser les yeux.

- Le soudage, l'écaillage, le passage de la pièce à la brosse en fil de fer, et le meulage génèrent des étincelles et des particules métalliques volantes. Pendant la période de refroidissement des soudures, elles risquent de projeter du laitier.
  - Porter des lunettes de sécurité avec écrans latéraux ou un écran facial.



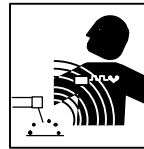
## LES ACCUMULATIONS DE GAZ risquent de provoquer des blessures ou même la mort.

- Fermer l'alimentation du gaz protecteur en cas de non utilisation.
- Veiller toujours à bien aérer les espaces confinés ou se servir d'un respirateur d'adduction d'air homologué.



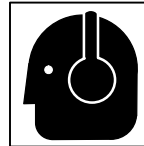
## DES PIÈCES CHAUDES peuvent provoquer des brûlures graves.

- Ne pas toucher des parties chaudes à mains nues
- Prévoir une période de refroidissement avant d'utiliser le pistolet ou la torche.



## LES CHAMPS MAGNÉTIQUES peuvent affecter les stimulateurs cardiaques.

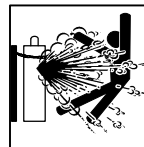
- Porteurs de stimulateur cardiaque, restez à distance.
- Les porteurs d'un stimulateur cardiaque doivent d'abord consulter leur médecin avant de s'approcher des opérations de soudage à l'arc, de gougeage ou de soudage par points.



## LE BRUIT peut affecter l'ouïe.

Le bruit des processus et des équipements peut affecter l'ouïe.

- Porter des protections approuvés pour les oreilles si le niveau sonore est trop élevé.



## Si des BOUTEILLES sont endommagées, elles pourront exploser.

Des bouteilles de gaz protecteur contiennent du gaz sous haute pression. Si une bouteille est endommagée, elle peut exploser. Du fait que les bouteilles de gaz font normalement partie du procédé de soudage, les manipuler avec précaution.

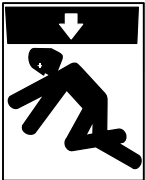
- Protéger les bouteilles de gaz comprimé d'une chaleur excessive, des chocs mécaniques, du laitier, des flammes ouvertes, des étincelles et des arcs.
- Placer les bouteilles debout en les fixant dans un support stationnaire ou dans un porte-bouteilles pour les empêcher de tomber ou de se renverser.
- Tenir les bouteilles éloignées des circuits de soudage ou autres circuits électriques.
- Ne jamais placer une torche de soudage sur une bouteille à gaz.
- Une électrode de soudage ne doit jamais entrer en contact avec une bouteille.
- Ne jamais souder une bouteille pressurisée – risque d'explosion.
- Utiliser seulement des bouteilles de gaz protecteur, régulateurs, tuyaux et raccords convenables pour cette application spécifique; les maintenir ainsi que les éléments associés en bon état.
- Ne pas tenir la tête en face de la sortie en ouvrant la soupape de la bouteille.
- Maintenir le chapeau de protection 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 CGA énumérées dans les normes de sécurité.

## 1-3. Dangers supplémentaires en relation avec l'installation, le fonctionnement et la maintenance



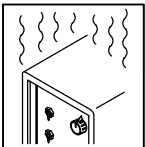
### Risque D'INCENDIE OU D'EXPLOSION.

- Ne pas placer l'appareil sur, au-dessus ou à proximité de surfaces inflammables.
- 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 protégé avant de mettre l'appareil en service.



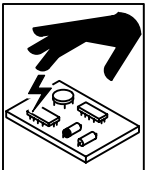
### LA CHUTE DE L'APPAREIL peut blesser.

- Utiliser l'anneau de levage uniquement pour soulever l'appareil, NON PAS les chariot, les bouteilles de gaz ou tout autre accessoire.
- Utiliser un engin d'une capacité appropriée pour soulever l'appareil.
- En utilisant des fourches de levage pour déplacer l'unité, s'assurer que les fourches sont suffisamment longues pour dépasser du côté opposé de l'appareil.



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

- Prévoir une période de refroidissement, respecter le cycle opératoire nominal.
- Réduire le courant ou le cycle opératoire avant de recommencer le soudage.
- Ne pas obstruer les passages d'air du poste.



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

- Établir la connexion avec la barrette de terre 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.



### DES ORGANES MOBILES peuvent provoquer des blessures.

- Ne pas s'approcher des organes mobiles.
- Ne pas s'approcher des points de coincement tels que des rouleaux de commande.



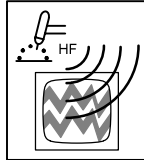
### LES FILS DE SOUDAGE peuvent provoquer des blessures.

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



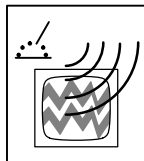
### DES ORGANES MOBILES peuvent provoquer des blessures.

- Rester à l'écart des organes mobiles comme le ventilateur.
- Maintenir fermés et fixement en place les portes, panneaux, recouvrements et dispositifs de protection.



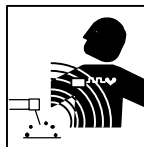
### LE RAYONNEMENT HAUTE FRÉQUENCE (H.F.) risque de provoquer des interférences.

- Le rayonnement haute fréquence peut provoquer des interférences avec les équipements de radio-navigation et de communication, les services de sécurité et les ordinateurs.
- Demander seulement à des personnes qualifiées familiarisées avec des équipements électroniques de faire fonctionner l'installation.
- L'utilisateur est tenu de faire corriger rapidement par un électricien qualifié les interférences résultant de l'installation.
- Si le FCC signale des interférences, arrêter immédiatement l'appareil.
- Effectuer régulièrement le contrôle et l'entretien de l'installation.
- Maintenir soigneusement fermés les portes et les panneaux des sources de haute fréquence, maintenir les éclateurs à une distance correcte et utiliser une terre et un blindage pour réduire les interférences éventuelles.



### LE SOUDAGE À L'ARC risque de provoquer des interférences.

- L'énergie électromagnétique risque de provoquer des interférences pour 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 électromagnétiquement.
- Pour réduire la possibilité d'interférence, maintenir les câbles de soudage aussi courts que possible, les grouper, et les poser aussi bas que possible (ex. par terre).
- Veiller à souder à une distance de 100 mètres de tout équipement électronique sensible.
- Veiller à ce que ce poste de soudage soit posé et mis à la terre conformément à ce mode d'emploi.
- En cas d'interférences après avoir pris les mesures 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.

## 1-4. Principales normes de sécurité

*Safety in Welding and Cutting*, norme ANSI Z49.1, de l'American Welding Society, 550 N.W. Lejeune Rd, Miami FL 33126

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

*Recommended Safe Practice for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances*, norme AWS F4.1, de l'American Welding Society, 550 N.W. Lejeune Rd, Miami FL 33126

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

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

*Règles de sécurité en soudage, coupage et procédés connexes*, norme CSA W117.2, de l'Association canadienne de normalisation, vente de normes, 178 Rexdale Boulevard, Rexdale (Ontario) Canada M9W 1R3.

*Safe Practices For Occupation And Educational Eye And Face Protection*, norme ANSI Z87.1, de l'American National Standards Institute, 1430 Broadway, New York, NY 10018.

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

## 1-5. Information sur les champs électromagnétiques

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

Le courant de soudage, pendant son passage dans les câbles de soudage, causera des champs électromagnétiques. Il y a eu et il y a encore un certain souci à propos de tels champs. Cependant, après avoir examiné plus de 500 études qui ont été faites pendant une période de recherche de 17 ans, un comité spécial ruban bleu du National Research Council a conclu: "L'accumulation de preuves, suivant le jugement du comité, n'a pas démontré que l'exposition aux champs magnétiques et champs électriques à haute fréquence représente un risque à la santé humaine". Toutefois, des études sont toujours en cours et les preuves continuent à être examinées. En attendant que les conclusions finales de la recherche soient établies, il vous serait souhaitable de réduire votre exposition aux champs électromagnétiques pendant le soudage ou le coupage.

Afin de réduire les champs électromagnétiques dans l'environnement de travail, respecter les consignes suivantes :

- 1 Garder les câbles ensemble en les torsadant ou en les attachant avec du ruban adhésif.
- 2 Mettre tous les câbles du côté opposé de l'opérateur.
- 3 Ne pas courber pas et ne pas entourer pas les câbles autour de votre corps.
- 4 Garder le poste de soudage et les câbles le plus loin possible de vous.
- 5 Relier la pince de masse le plus près possible de la zone de soudure.

### Consignes relatives aux stimulateurs cardiaques :

Les personnes qui portent un stimulateur cardiaque doivent avant tout consulter leur docteur. Si vous êtes déclaré apte par votre docteur, il est alors recommandé de respecter les consignes ci-dessus.

# SECTION 2 – SPECIFICATIONS AND INSTALLATION

## 2-1. Specifications

Input Power Single-Phase AC	Rated Welding Output	Welding Amperage Range	Maximum Open-Circuit Voltage DC	Amperes Input At Rated Load Output, 50/60Hz, Single-Phase	KVA AT 100% Duty Cyc.	KW	Dimensions	Weight
115 Volts	80A @ 23.2 Volts DC, 100% Duty Cycle	5 – 110A	93V	26	3.0	2.0	H: 8 in (203 mm) W: 4-5/16 in (110 mm) L: 12-1/4 in (311 mm)	10 lb (4.5 kg)
230 Volts	100A @ 24 Volts DC, 100% Duty Cycle	5 – 140A	93V	20	4.6	2.6		

## 2-2. Description



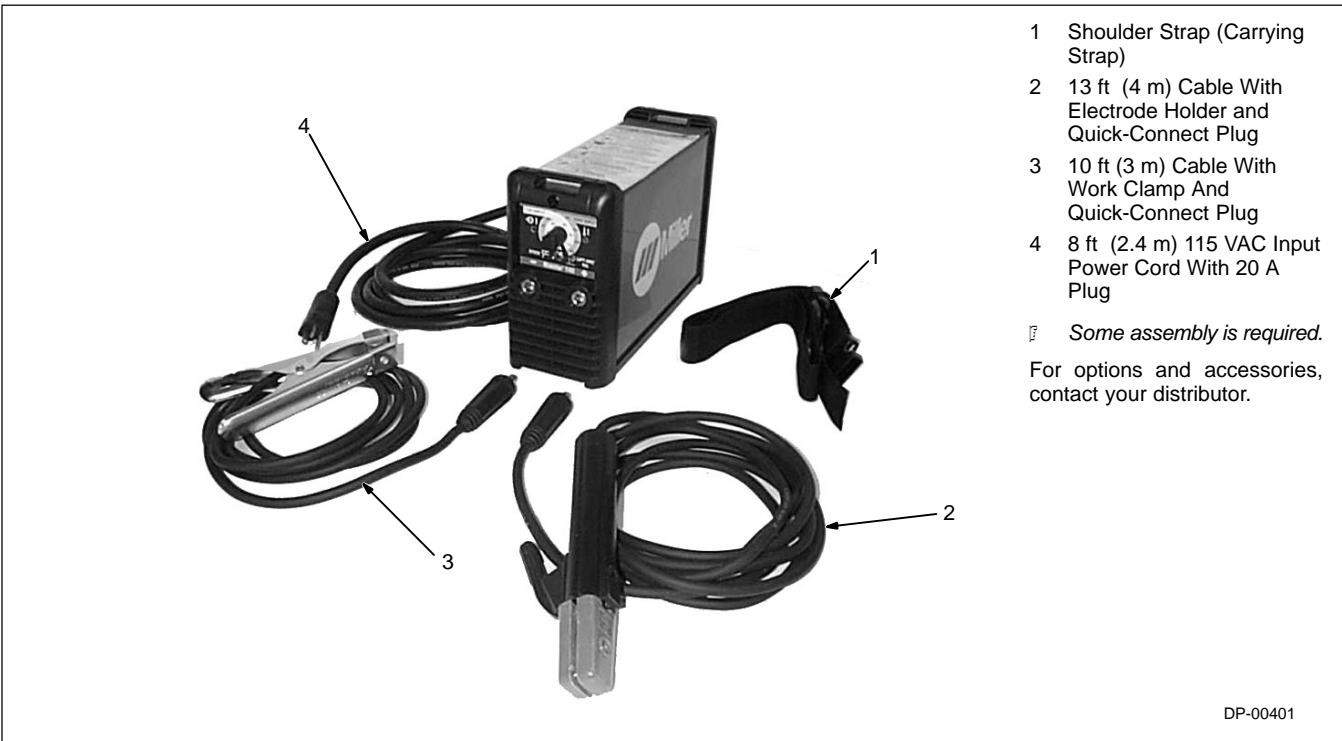
### 1 Welding Power Source

This unit is a compact, light weight, portable welding power source containing the latest high performance electronics that supplies DC weld output for use with the Stick Electrode and TIG welding processes.

This unit also has a carrying strap and quick-disconnect weld output receptacles to aid portability and to encourage use wherever the job may be located. Because of its electronic design, this unit consumes only modest amounts of input power and provides superb arc characteristics. Further, it is easy to install and simple to operate. This welding power source is equipped with the advanced Auto-Link circuitry which automatically adjusts the unit to operate from the available input voltage without making any internal changes. The circuitry works with either 115 or 230 volts input power.

DP-00400

### 2-3. Included with Your Unit (Stick Only)

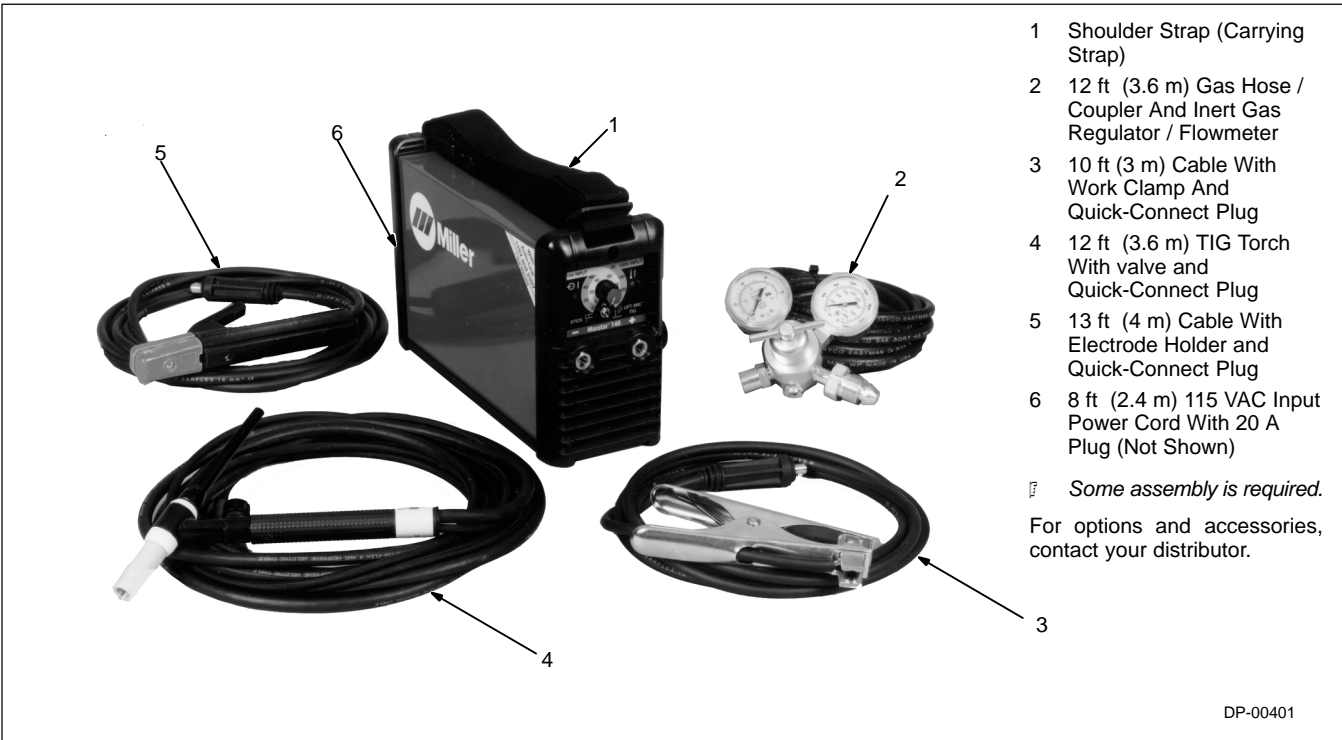


- 1 Shoulder Strap (Carrying Strap)
- 2 13 ft (4 m) Cable With Electrode Holder and Quick-Connect Plug
- 3 10 ft (3 m) Cable With Work Clamp And Quick-Connect Plug
- 4 8 ft (2.4 m) 115 VAC Input Power Cord With 20 A Plug

Some assembly is required.  
For options and accessories, contact your distributor.

DP-00401

### 2-4. Included with Your Unit (TIG / Stick)

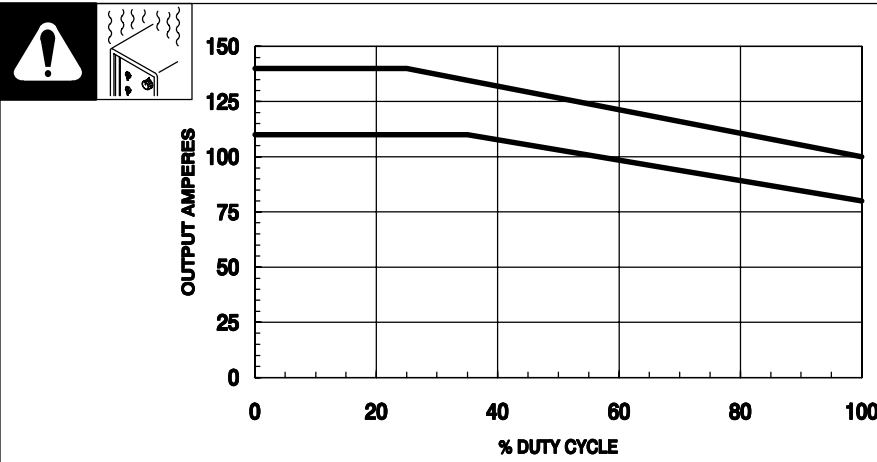


- 1 Shoulder Strap (Carrying Strap)
- 2 12 ft (3.6 m) Gas Hose / Coupler And Inert Gas Regulator / Flowmeter
- 3 10 ft (3 m) Cable With Work Clamp And Quick-Connect Plug
- 4 12 ft (3.6 m) TIG Torch With valve and Quick-Connect Plug
- 5 13 ft (4 m) Cable With Electrode Holder and Quick-Connect Plug
- 6 8 ft (2.4 m) 115 VAC Input Power Cord With 20 A Plug (Not Shown)

Some assembly is required.  
For options and accessories, contact your distributor.

DP-00401

## 2-5. Duty Cycle And Overheating



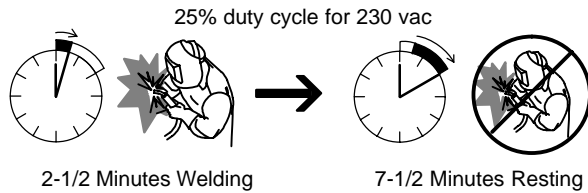
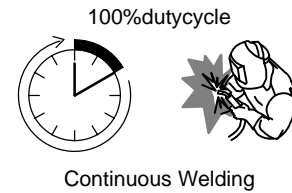
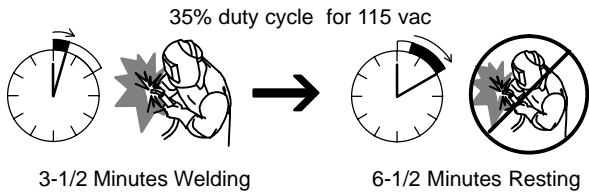
Duty Cycle is percentage of 10 minutes that unit can weld at rated load without overheating.

If unit overheats, output stops, the Overtemperature Light comes On, and the cooling fan runs. Wait fifteen minutes for unit to cool. Reduce amperage or voltage or duty cycle before starting to weld again.

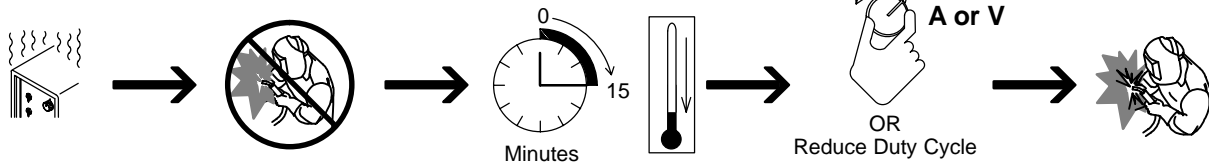
▲ Exceeding duty cycle can damage unit and void warranty.

110 A @ 35% Duty Cycle (115 V Input)  
140 A @ 25% Duty Cycle (230 V Input)

80 A @ 100% Duty Cycle (115 V Input)  
100 A @ 100% Duty Cycle (230 V Input)

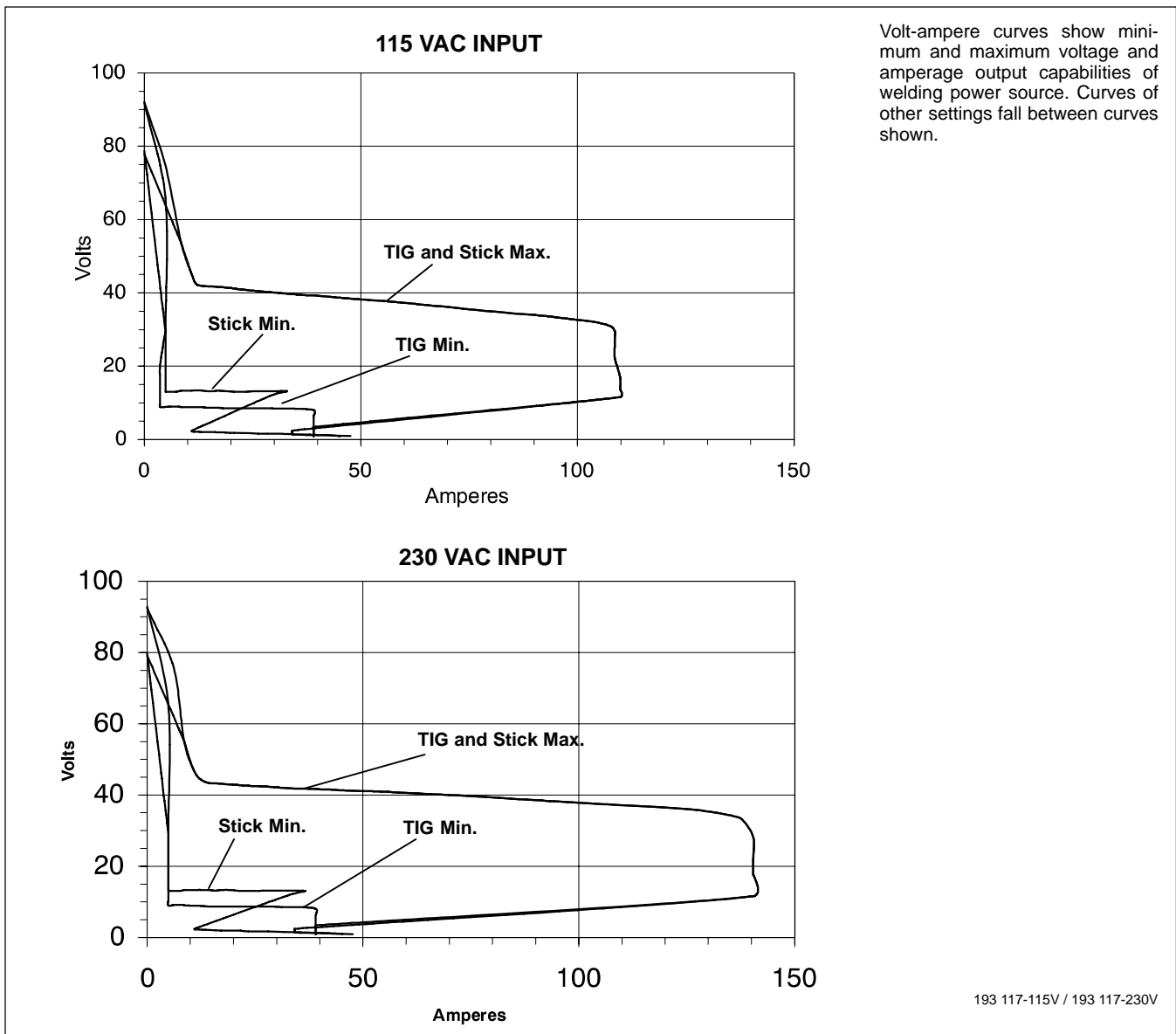


### Overheating



193 116

## 2-6. Volt-Ampere Curves



Volt-ampere curves show minimum and maximum voltage and amperage output capabilities of welding power source. Curves of other settings fall between curves shown.



## 2-7. Selecting A Location

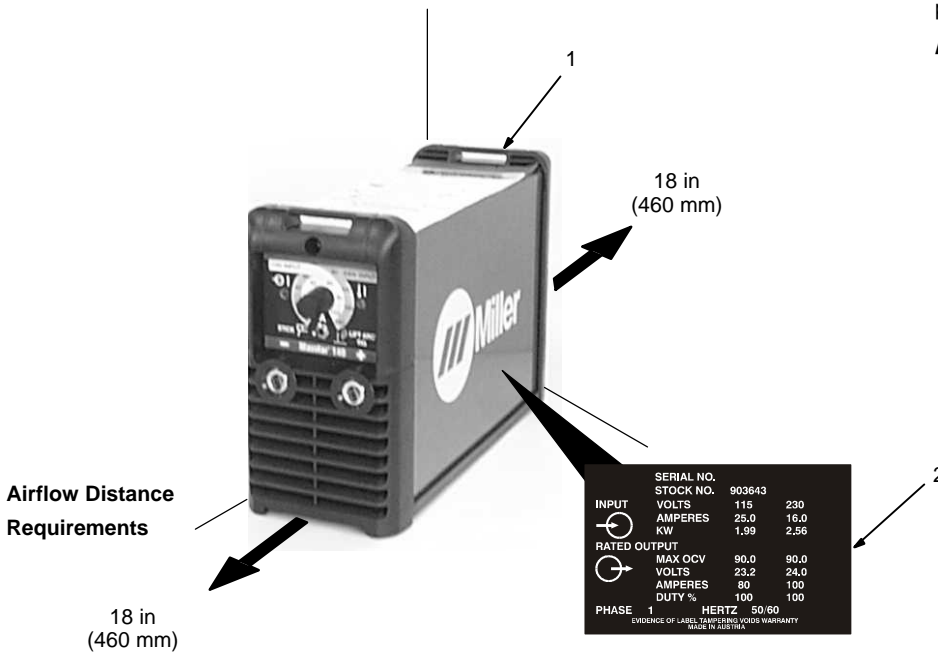


1 Welding Power Source  
Use shoulder strap to lift and move unit.

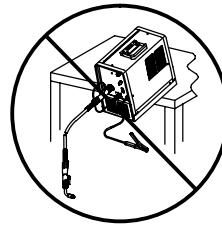
2 Rating Label

Label is located on side of unit. Use rating label to determine input power needs.

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



▲ Do not move or operate unit where it could tip.



ST-801 956-A / DP-00333 / 193 623

## 2-8. Typical Connection Methods



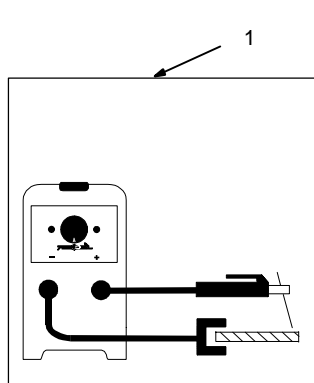
▲ **Turn Off welder before making connections.**

1 Stick Connections

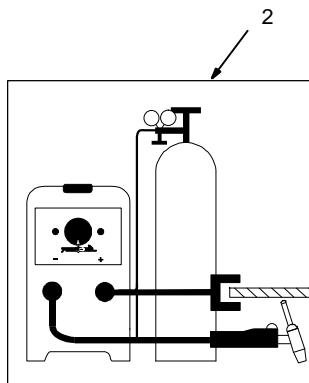
2 TIG Connections

Obtain gas cylinder and Proper TIG Torch from your distributor.

**Typical Stick Connections**

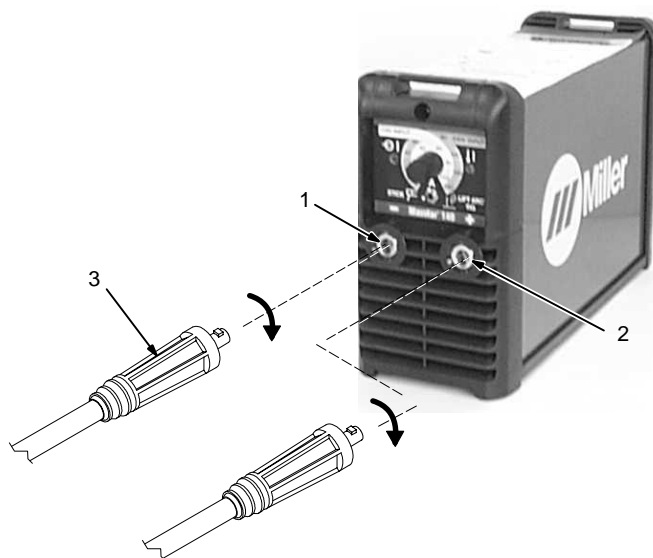


**Typical TIG Connections And Equipment**



ETP-1400-PDF

## 2-9. Connecting To Weld Output Receptacles



▲ **Turn Off welder before making connections.**

- 1 Negative (-) Weld Output Receptacle
- 2 Positive (+) Weld Output Receptacle
- 3 Connectors

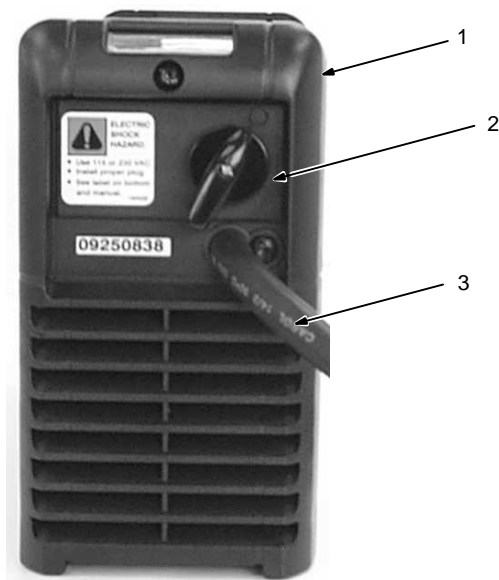
For TIG Welding (Electrode Negative), connect work cable connector to positive (+) receptacle and TIG Torch cable connector to negative (-) receptacle.

For STICK Welding (Electrode Positive), connect work cable connector to negative (-) receptacle and Electrode Holder cable connector to positive (+) receptacle.

To connect to receptacle, align keyway, insert connector, and turn clockwise (approximately 1/2 turn).

DP00333 / ST-157 359-A

## 2-10. Rear Panel And Power Switch



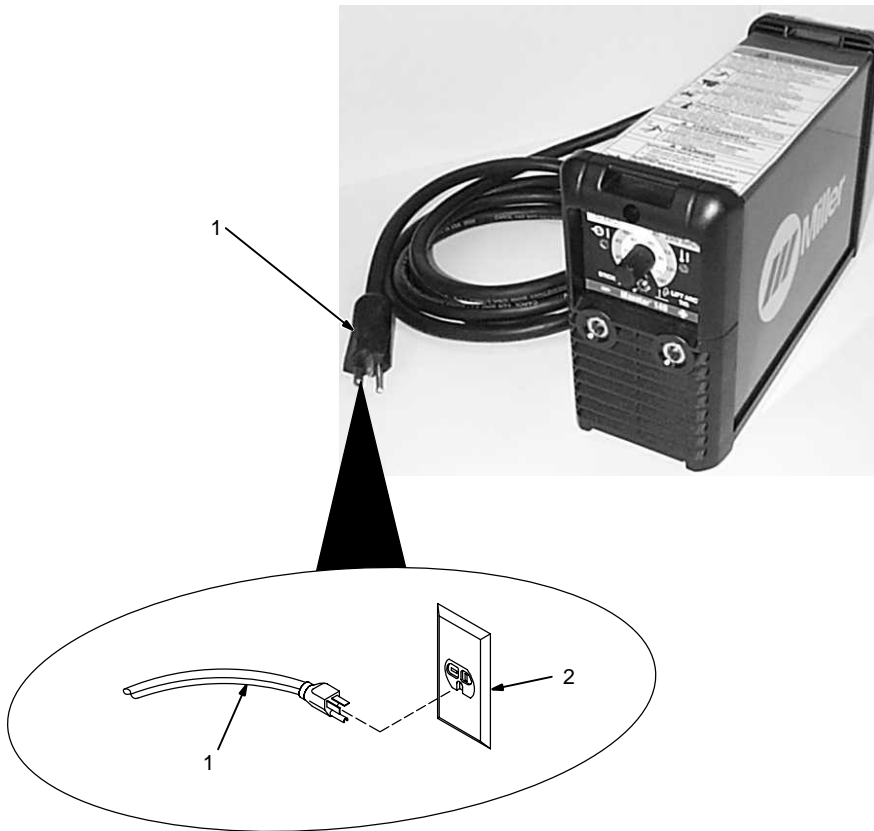
- 1 Rear Panel
- 2 Power On/Off Switch

Rotate the Power Switch to the On or Off position as needed according to the markings on the rear panel.

- 3 Input Power Cord

DP-00335

## 2-11. Connecting Input Power



▲ The welder is shipped with a 115 VAC input power cord installed. If unit is to be used on 230 VAC input power, install new power cord according to Section 2-12.

- 1 Input Power Cord
- 2 115 or 230 VAC Grounded Receptacle

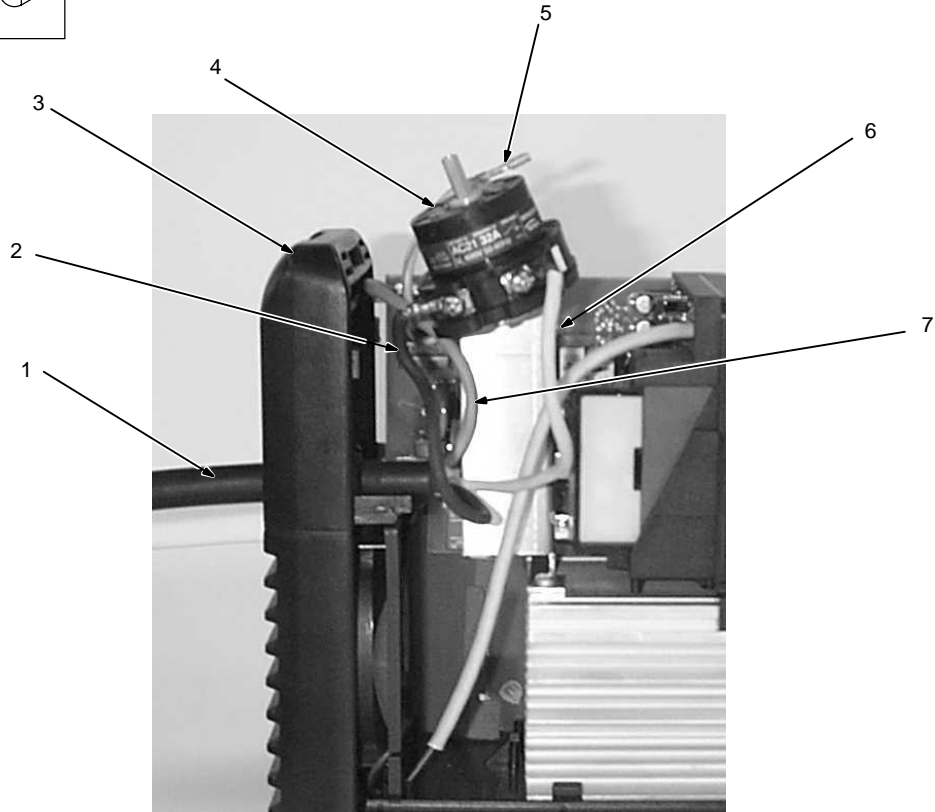
¶ *The Auto-Link circuitry in this unit automatically links the power source to the primary voltage being applied, either 115 or 230 VAC.*

An individual branch circuit capable of carrying 30 amperes and protected by fuses or circuit breaker is required. Recommended fuse or circuit breaker size is 35 amperes.

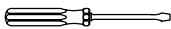
Connect input power plug to proper receptacle.

Ref.ST-157 357-C / DP-00400

## 2-12. Installing 230 Volts Ac Input Power Cord



### Tools Needed:



DP-00333

### ▲ Disconnect input power plug from receptacle before installing different input power cord.

Remove the case by removing the two top handle screws and sliding case up and off. Disconnect case grounding wire when removing case.

#### 1 Input Power Cord

Remove knob from Power Switch (4). Note how knob goes onto shaft.

Remove screws holding Power Switch in place, and pull switch out toward inside of unit.

Loosen strain relief clamp, and push several inches of power cord into unit.

Mark location of switch terminals where black and white leads are connected, and note location of ground lead. Disconnect leads from ground terminal and switch.

#### 2 Black Switch Lead

#### 3 Rear Panel

#### 4 Power Switch

Pull out power cord from rear of unit.

#### 5 Case Grounding Lead

#### 6 White Lead

#### 7 Green Ground Lead

Insert new power cord through strain relief, and push an extra inch into unit.

Connect ground lead and black and white leads to marked locations. Double-check all connections.

Reinstall Power Switch onto rear panel. Pull power cord back through strain relief until leads are properly dressed in unit. Tighten clamp.

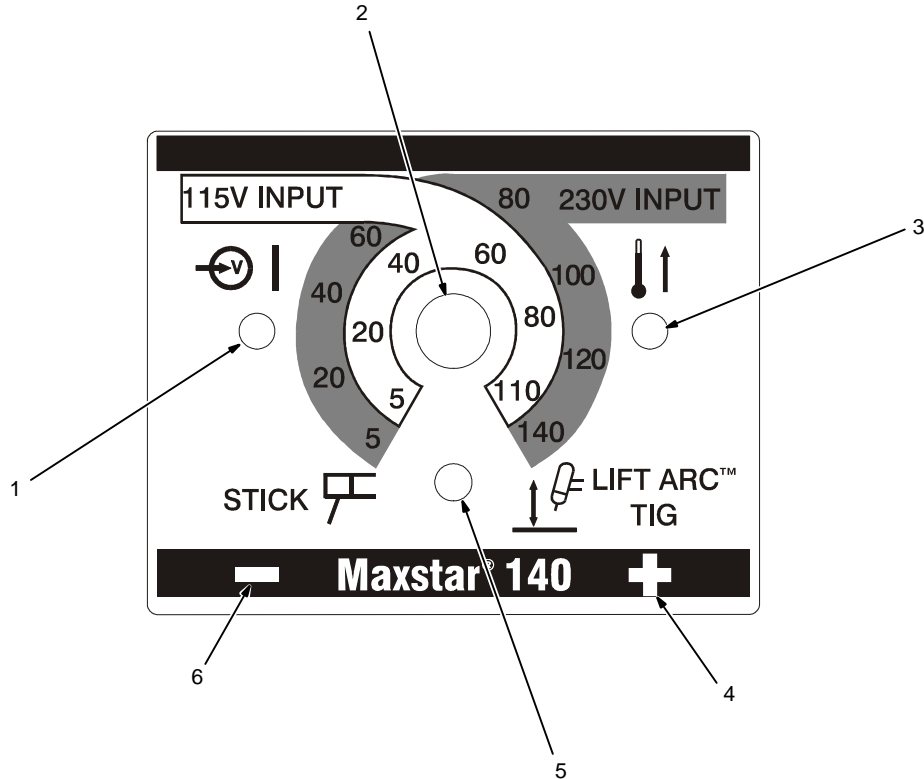
Reinstall case and reconnect case grounding lead during assembly.

# SECTION 3 – OPERATION

## 3-1. Front Panel Controls



**⚠** Weld output receptacles are energized when Power Switch is On and Input supply power is connected and On.



### 1 Ready Light

This light comes On when the Power Switch on the rear panel is placed in the ON position. The light indicates that the unit is energized and ready for welding operations.

*The fan motor is thermostatically controlled and only runs when cooling is needed.*

### 2 Amperage Adjustment Control

This control adjusts the desired amperage for the welding application. Use this control to set the required value for the specific job and electrode. The dial is calibrated in actual amperes according to the input voltage used to power the unit.

*The Amperage Adjustment Control is*

*a dual reading dial. Be sure to set it according to the input voltage supplying power to the unit.*

### 3 Overtemperature Light

This light comes ON when the unit overheats. When this happens, the unit shuts down and the fan motor runs. Once the unit has cooled down, the output will come back ON. Reduce the duty cycle or amperage before starting to weld again. This light flashes if the input voltage (primary) is too low or if there is an input overcurrent fault.

### 4 Positive Weld Output Receptacle

For STICK welding, connect the electrode cable to this receptacle (normally uses reverse polarity connections, but always

check electrode recommendations.) For TIG welding, connect work cable to this receptacle (normally uses straight polarity).

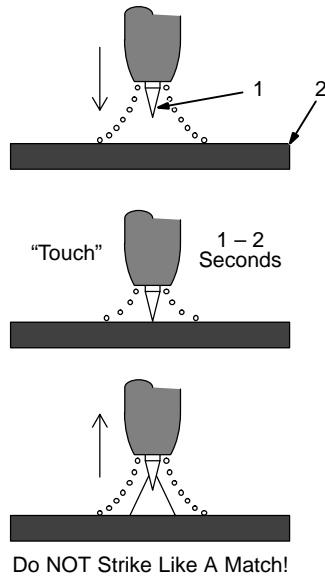
### 5 STICK / TIG Selector Switch

This switch provides a simple and easy way to select the required welding process. Place the switch in the desired position to suit the application. This switch is NOT a Polarity Switch. This switch activates the Lift Arc circuit.

### 6 Negative Weld Output Receptacle

For STICK welding, connect the work cable to this receptacle (normally uses reverse polarity connections, but always check electrode recommendations.) For TIG welding, connect torch cable to this receptacle (normally uses straight polarity).

### 3-2. Lift-Arc™ TIG Procedure



With Process Switch in the Lift-Arc TIG position, start an arc as follows:

- 1 TIG Electrode
- 2 Workpiece

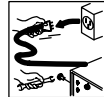
Touch tungsten electrode to workpiece at weld start point, **hold electrode to workpiece for 1-2 seconds**, and slowly lift electrode. An arc will form when electrode is lifted.

Open-circuit voltage is present before tungsten electrode touches workpiece. However, the arc will not initiate until after the electrode is lifted from workpiece. This allows electrode to touch workpiece without overheating, sticking, or getting contaminated.

Ref. S-156 279

## SECTION 4 – MAINTENANCE AND TROUBLESHOOTING

### 4-1. Routine Maintenance



▲ Disconnect power before maintaining.

⚠ Maintain more often during severe conditions.

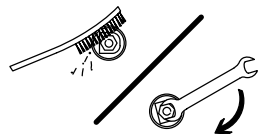


3 Months

Replace unreadable labels.



Clean and tighten weld terminals.

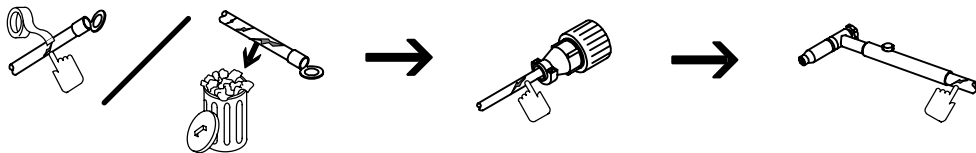


Replace Damaged Gas Hose



3 Months

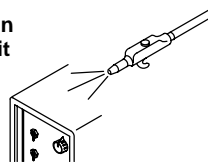
Repair Or Replace Cracked Cables And Cords



6 Months

▲ Do not remove case when blowing out inside of unit (see Section 4-2).

Blow out inside. During heavy service clean monthly.



## 4-2. Blowing Out Inside Of Unit



▲ Do not remove case when blowing out inside of unit.

To blow out unit, direct airflow through front and back louvers as shown.



DP-00333

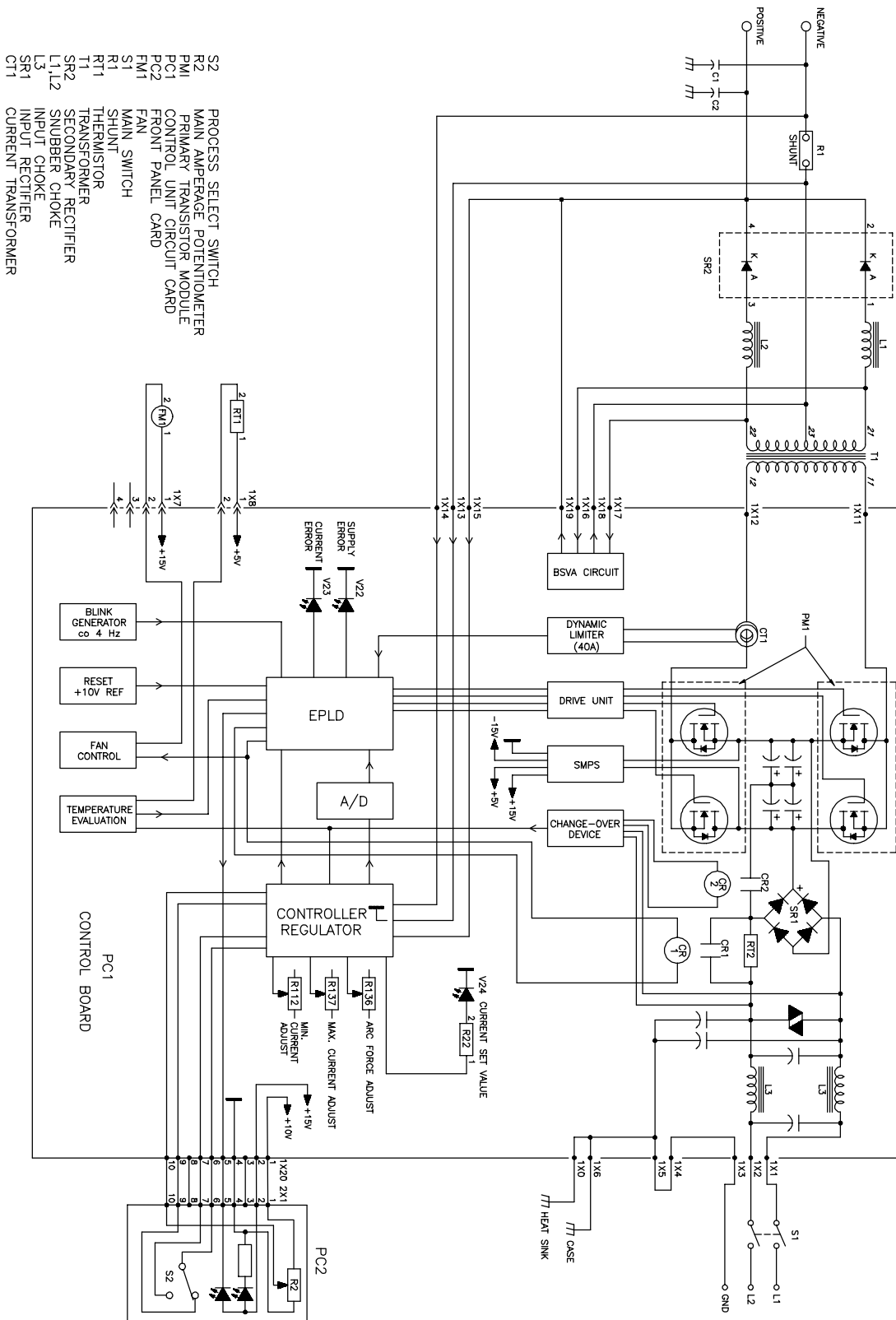
### 4-3. Troubleshooting



Trouble	Remedy
No weld output; unit completely inoperative; Ready light Off.	Place line disconnect switch for circuit powering welder in On position.
	Check and replace line fuse(s), if necessary, or reset circuit breaker.
	Be sure input power cord is plugged in and that receptacle is receiving input power.
No weld output; Ready light On; Over-Temperature light Off.	Check and secure loose weld cable(s) into receptacle(s) on welding power source.
	Check and correct poor connection of work clamp to workpiece.
No weld output; Ready light On; Over-Temperature light On.	Unit overheated causing thermal shutdown. Allow unit to cool with fan On (see Section 2-5).
	Reduce duty cycle or amperage to prevent further overload conditions.
	Check and correct blocked/poor airflow to and around unit or move unit clear of blockages (see Section 2-7).
	Check and clean dirty power module (see Section 4-2).
No weld output; Ready light On; Over-Temperature light Flashing.	Turn Power Switch Off and back On again. If light continues to flash, call or take machine to Factory Authorized Service Agent (this condition may indicate a fault in the power section).
Erratic or improper welding arc or output.	Use proper size and type of weld cable (see your Distributer).
	Clean and tighten all weld connections.
	Check and reverse electrode polarity; check and correct poor connections to workpiece.
Fan not operating (unit is equipped with Fan-On-Demand so fan runs only when needed).	Unit is cool and not warmed up enough to require fan cooling.
	Check for and remove anything blocking fan movement.
	Have Factory Authorized Service Agent check fan motor and control circuitry.
Stick welding problems: Hard starts; poor welding characteristics; unusual spattering problems.	Use proper type and size of electrode.
	Use method shown in Section 8 to get better starts.
	Check and reverse electrode polarity; check and correct poor connections to workpiece.
TIG welding problems: Wandering arc; hard starts; poor welding characteristics; spattering problems.	Use proper type and size of tungsten.
	Use properly prepared tungsten.
	Check and reverse electrode polarity; check and correct poor connections to workpiece.
TIG welding problems: Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Shield weld zone from drafts.
	Check shielding gas supply, and be sure it is the correct type (argon) and that the cylinder is not empty.
	Check and tighten all gas fittings.
	Check and change electrode polarity; move Changeover Switch to TIG position.



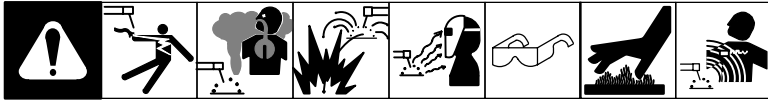
# SECTION 5 – ELECTRICAL DIAGRAM



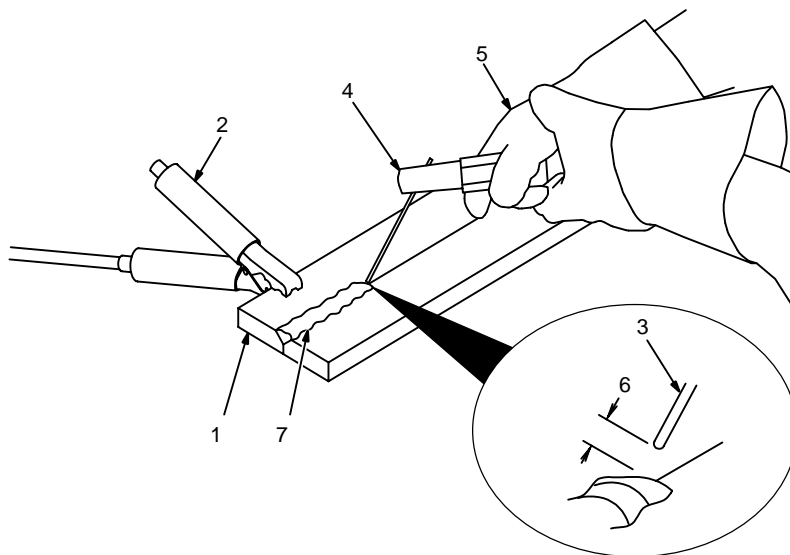
- S2 PROCESS SELECT SWITCH
- R2 MAIN AMPERAGE POTENTIOMETER
- PM1 PRIMARY TRANSISTOR MODULE
- PC1 CONTROL UNIT CIRCUIT CARD
- PC2 FRONT PANEL CARD
- F1 FAN
- S1 MAIN SWITCH
- S1 SHUNT
- T1 TRANSFORMER
- SR2 SECONDARY RECTIFIER
- L3 SNUBBER CHOKE
- SR1 INPUT RECTIFIER
- CT1 CURRENT TRANSFORMER

Figure 5-1. Circuit Diagram For Welding Power Source

# SECTION 6 – STICK WELDING (SMAW) GUIDELINES



## 6-1. 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 6-2).

4 Insulated Electrode Holder

5 Electrode Holder Position

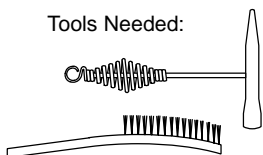
6 Arc Length

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:



stick 12/96 – ST-151 593

## 6-2. Electrode and Amperage Selection Chart

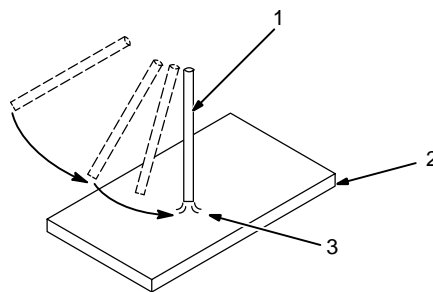
ELECTRODE	DIAMETER	AMPERAGE RANGE								
		50	100	150	200	250	300	350	400	450
6010 & 6011	3/32	■								
	1/8		■							
	5/32			■						
	3/16				■					
	7/32					■				
6013	1/4					■				
	1/16	■								
	5/64		■							
	3/32			■						
	1/8				■					
	5/32					■				
	3/16						■			
7014	7/32						■			
	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

## 6-3. Striking an Arc – Scratch Start Technique

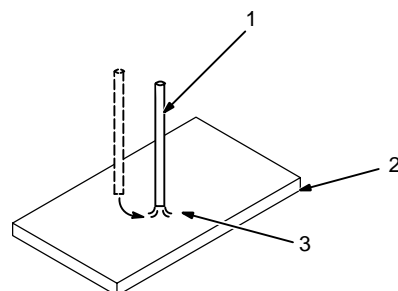


- 1 Electrode
- 2 Workpiece
- 3 Arc

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

## 6-4. Striking an Arc – Tapping Technique

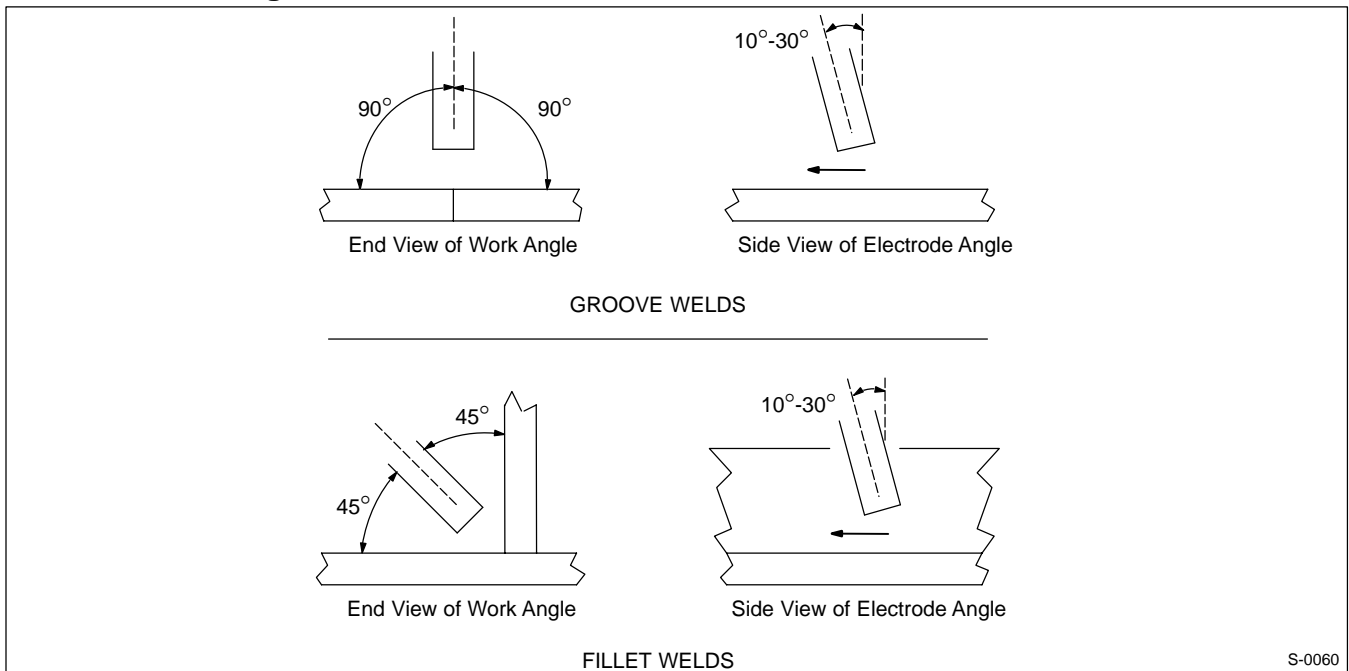


- 1 Electrode
- 2 Workpiece
- 3 Arc

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.

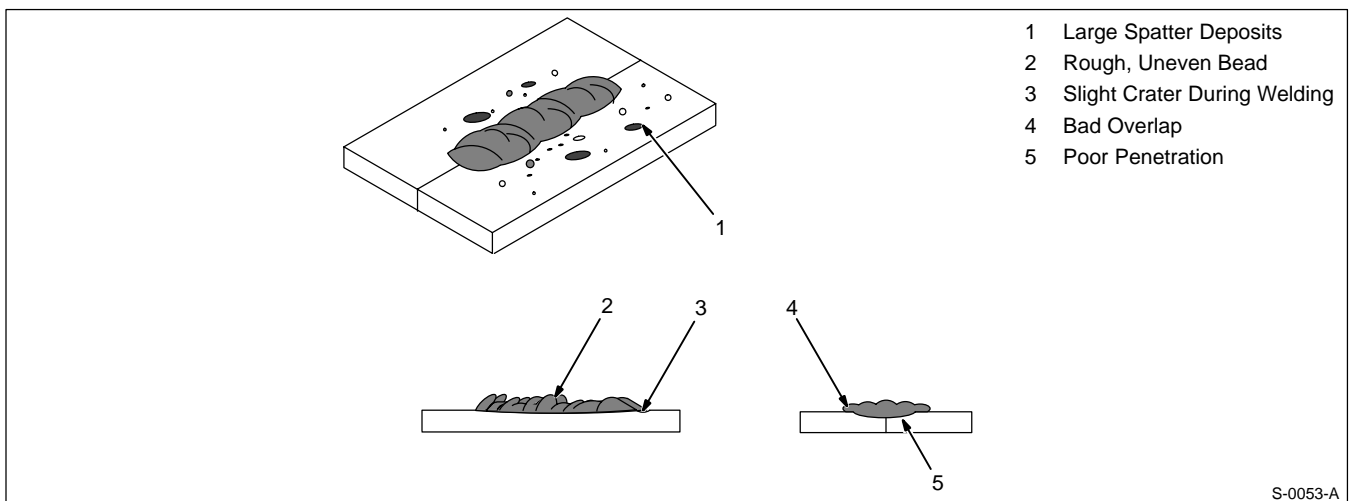
S-0050

## 6-5. Positioning Electrode Holder



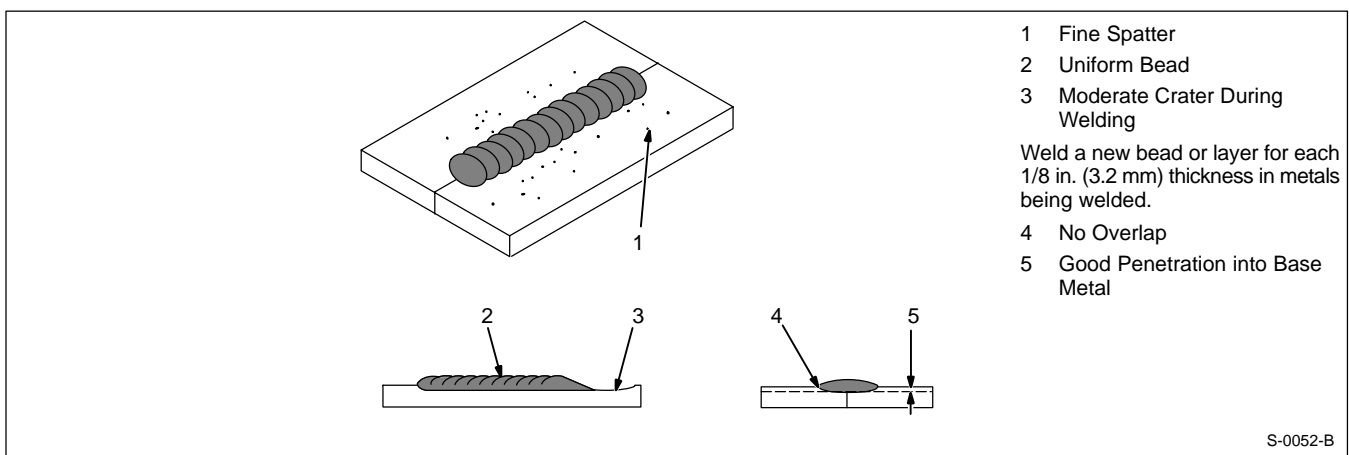
S-0060

## 6-6. Poor Weld Bead Characteristics



S-0053-A

## 6-7. Good Weld Bead Characteristics

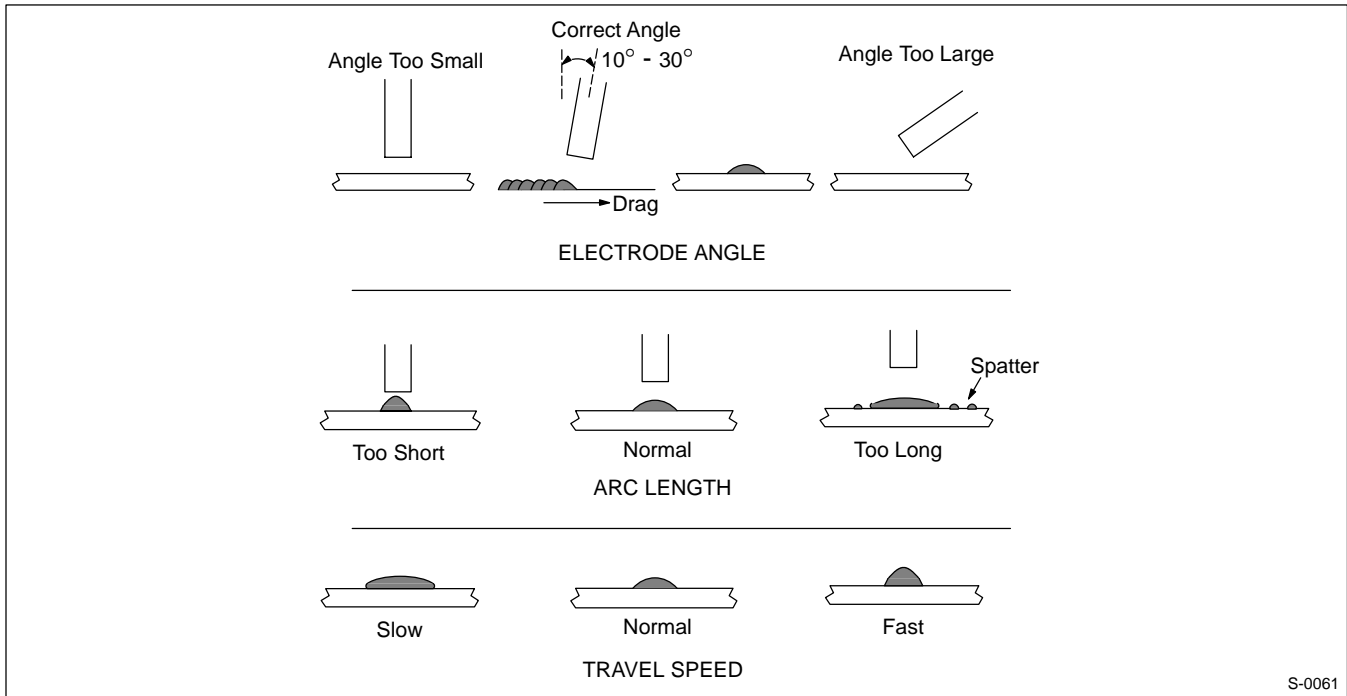


S-0052-B

## 6-8. Conditions That Affect Weld Bead Shape

### NOTE

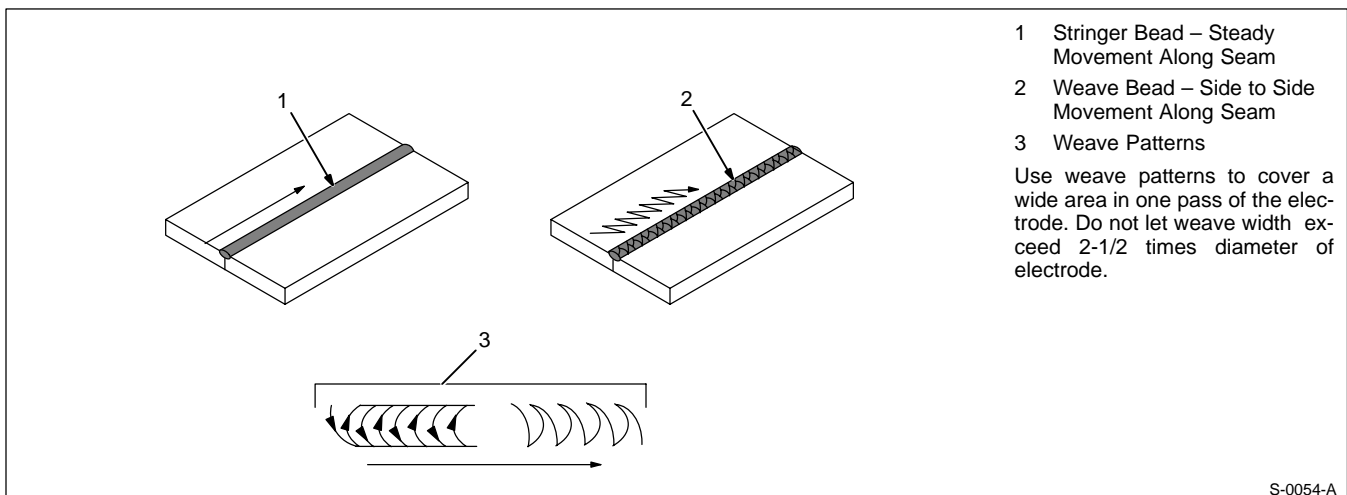
Weld bead shape is affected by electrode angle, arc length, travel speed, and thickness of base metal.



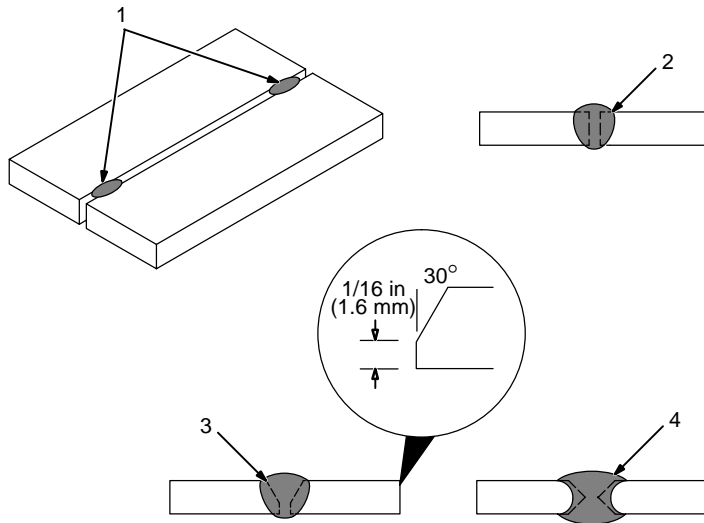
## 6-9. Electrode Movement During Welding

### 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.



## 6-10. 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 – 3/8 in (5-9 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.

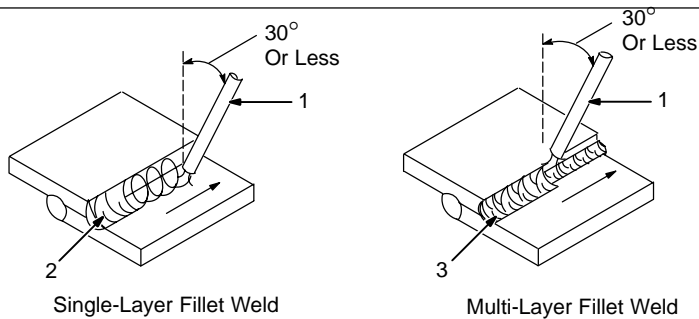
Create 30 degree angle of bevel on materials in V-groove welding.

### 4 Double V-Groove Weld

Good for materials thicker than 3/8 in (9 mm).

S-0662

## 6-11. Lap Joint



### 1 Electrode

### 2 Single-Layer Fillet Weld

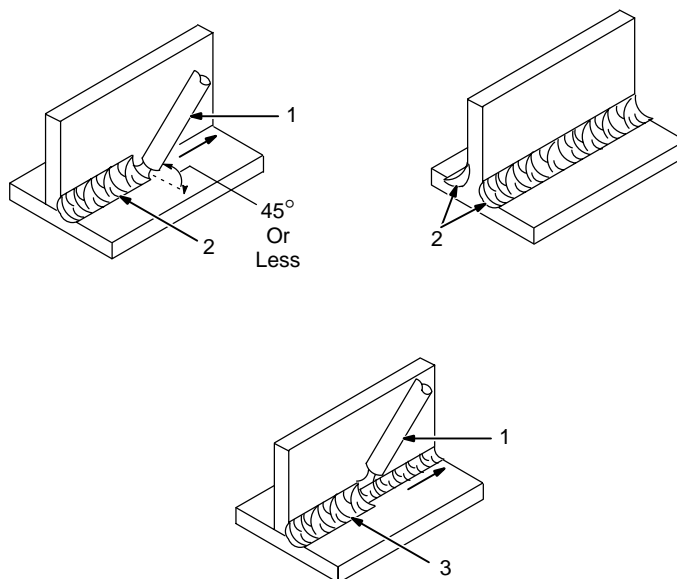
Move electrode in circular motion.

### 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

## 6-12. 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 6-9. Remove slag before making another weld pass.

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

### 6-13. 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

### 6-14. Troubleshooting – Porosity

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

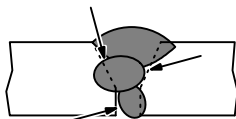
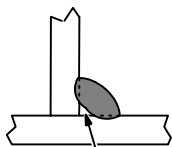
Possible Causes	Corrective Actions
Arc length too long.	Reduce arc length.
Damp electrode.	Use dry electrode.
Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.

### 6-15. 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.

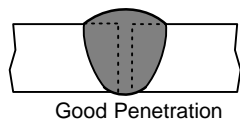
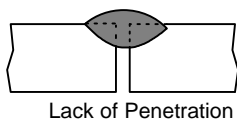
## 6-16. Troubleshooting – Incomplete Fusion



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.

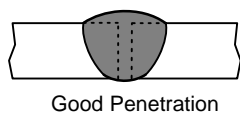
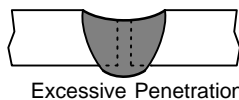
## 6-17. Troubleshooting – Lack Of Penetration



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.

## 6-18. Troubleshooting – Excessive Penetration

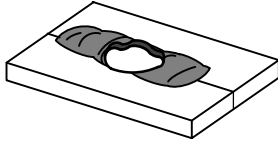


Excessive Penetration – weld metal melting through base metal and hanging underneath weld.

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



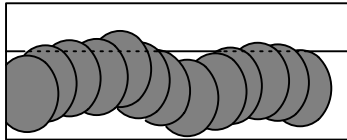
## 6-19. Troubleshooting – Burn-Through



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.

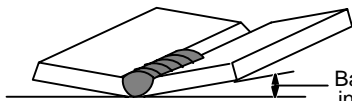
## 6-20. Troubleshooting – Waviness Of Bead



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.

## 6-21. 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 7 – SELECTING AND PREPARING TUNGSTEN ELECTRODE

gtaw 7/97

## NOTE

*For additional information, see your distributor for a handbook on the Gas Tungsten Arc Welding (GTAW) process. Wear clean gloves to prevent contamination of tungsten electrode.*

### 7-1. Selecting Tungsten Electrode

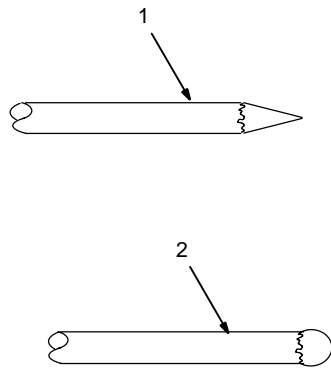
Electrode Diameter	Amperage Range - Gas Type ♦ - Polarity	
	DC – Argon – Electrode Negative/Straight Polarity	DC – Argon – Electrode Positive/Reverse Polarity
<b>2% Thorium Alloyed Tungsten (Red Band)</b>		
.010"	Up to 25	*
.020"	15-40	*
.040"	25-85	*
1/16"	50-160	10-20
3/32"	135-235	15-30
1/8"	250-400	25-40
5/32"	400-500	40-55
3/16"	500-750	55-80
1/4"	750-1000	80-125

♦ Typical argon shielding gas flow rates are 15 to 35 cfh (cubic feet per hour) – 7 to 16.5 lpm (liters per minute).

\*Not Recommended.

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

### 7-2. Safety Information About Tungsten

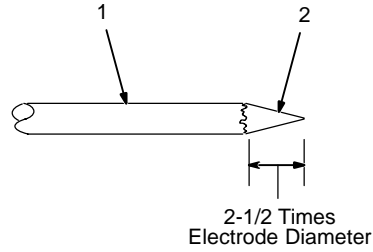


▲ Grinding the tungsten electrode produces dust and flying sparks which can cause injury and start fires. Use local exhaust (forced ventilation) at the grinder or wear an approved respirator. Read MSDS for safety information. Consider using tungsten containing ceria, lanthana, or yttria instead of thorium. 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.

- 1 Pointed Tungsten Electrode
- 2 Tungsten Electrode With Balled End

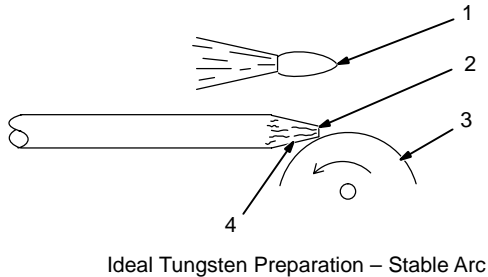
Ref. S-0161

### 7-3. Preparing Tungsten For DC Electrode Negative (DCEN) Welding



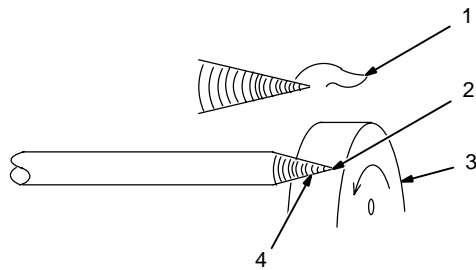
- 1 Tungsten Electrode
- 2 Tapered End

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
  - 4 Straight Ground

Ideal Tungsten Preparation – Stable Arc



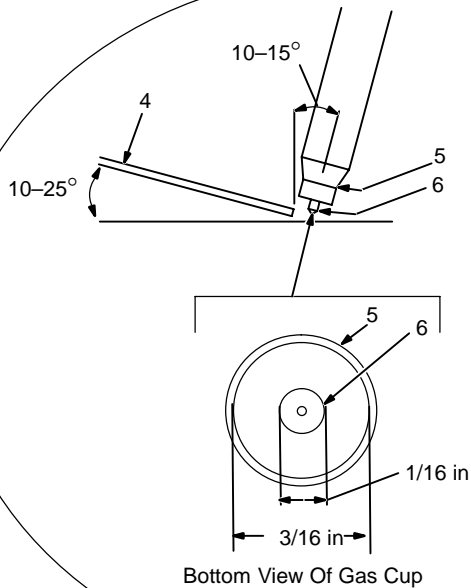
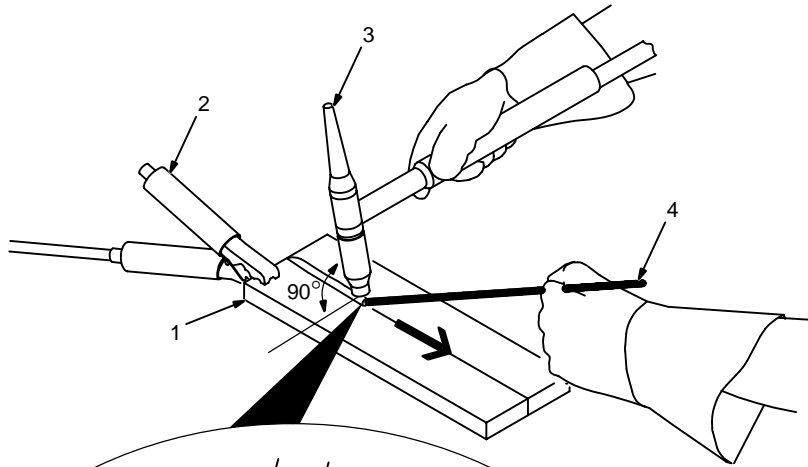
- 1 Arc Wander
- 2 Point
- 3 Grinding Wheel
- 4 Radial Ground

Wrong Tungsten Preparation – Wandering Arc

Ref. S-0161 / Ref. S-0162

# SECTION 8 – GUIDELINES FOR TIG WELDING (GTAW)

## 8-1. Positioning The Torch



▲ 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.

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 7-1, and 7-2 or 7-3.

### 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.

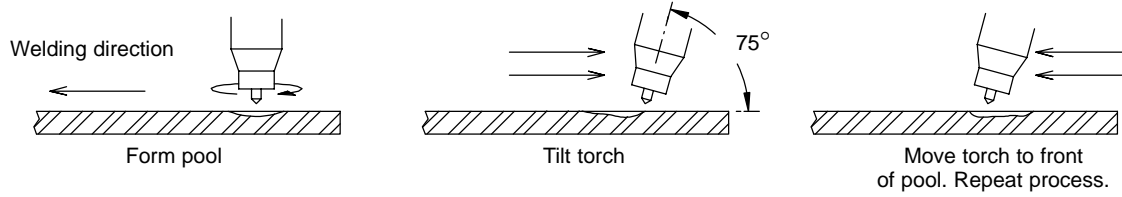
The tungsten extension should be no greater than the inside diameter of the gas cup.

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

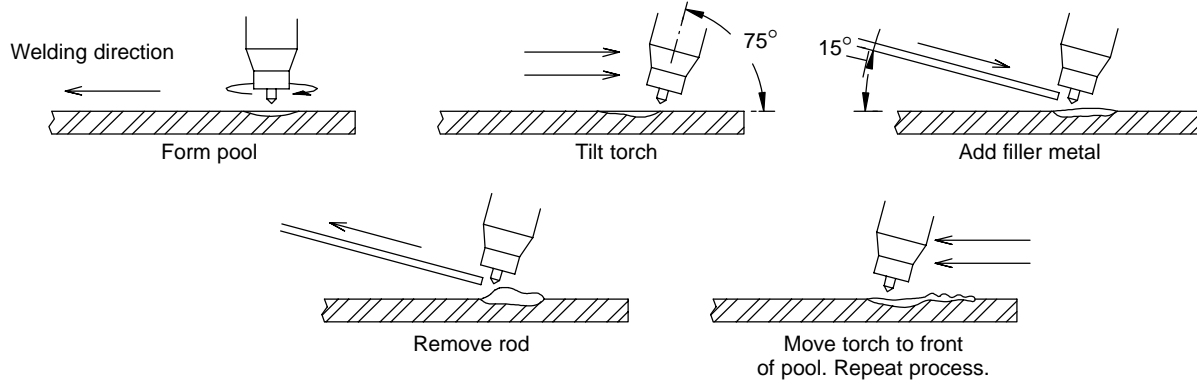
Ref. ST-161 892

## 8-2. Torch Movement During Welding

### Tungsten Without Filler Rod



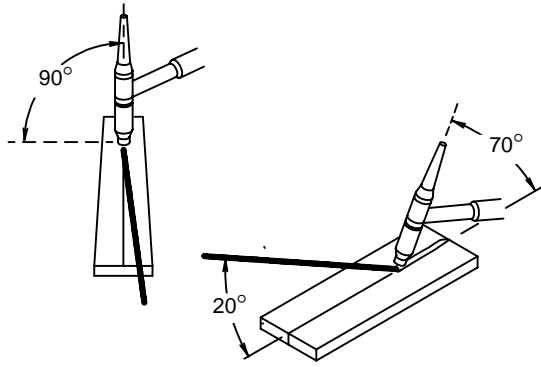
### Tungsten With Filler Rod



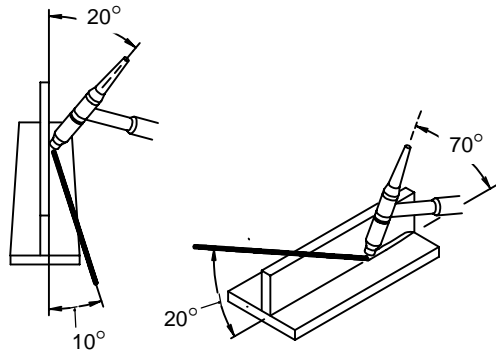
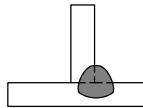
ST-162 002-B

### 8-3. Positioning Torch Tungsten For Various Weld Joints

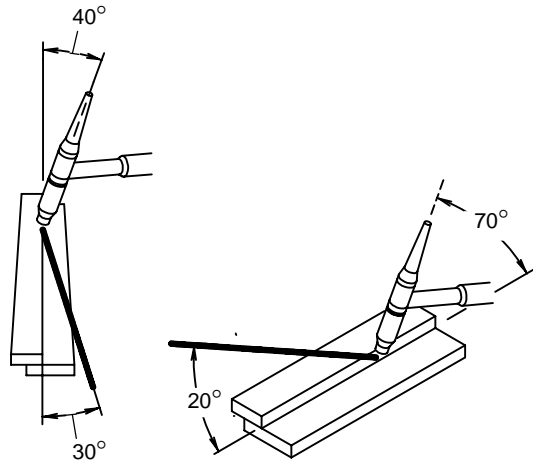
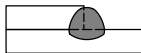
Butt Weld And Stringer Bead



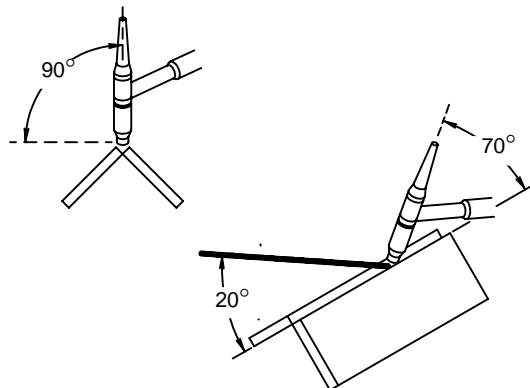
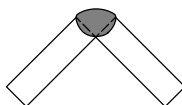
"T" Joint



Lap Joint

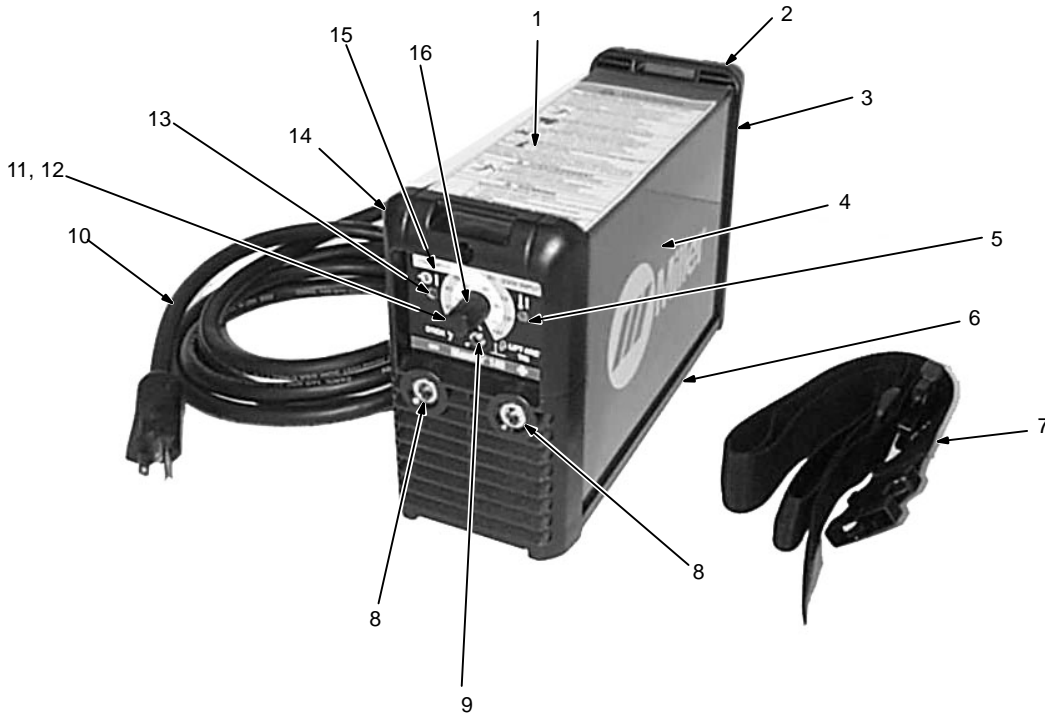


Corner Joint





# SECTION 9 – PARTS LIST



☐ Hardware is common and not available unless listed.

DP-00331

**Figure 9-1. Welding Power Source Components**

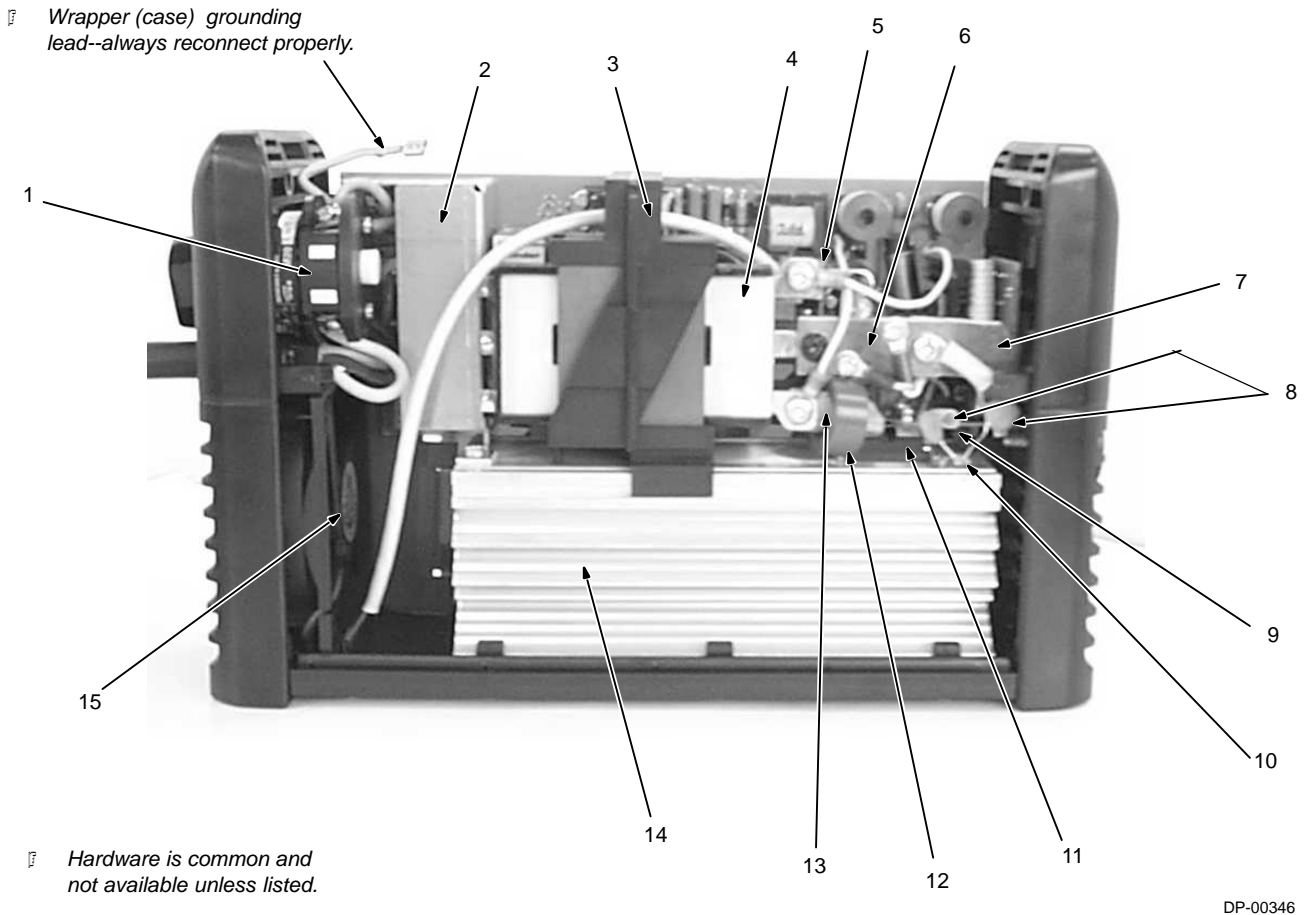
Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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**Figure 9-1. Control Box Components**

...	1	191 633	.. LABEL, WARNING, general precautionary	1
...	2	194 216	.. PANEL, REAR	1
...	3	190 028	.. LABEL, WARNING, electric shock hazard	1
...	4	194 218	.. WRAPPER (order by serial number)	1
...	5	V15	.. OVERTEMPERATURE LIGHT	1
...	6	194 217	.. BASE	1
...	7	194 220	.. SHOULDER STRAP	1
...	8	RC1,RC2	.. WELD OUTPUT RECEPTACLES	2
...	9	194 429	.. STICK / TIG SWITCH	1
...	10	194 070	.. CABLE, INPUT, 115V, 20A	1
...	10	194 069	.. CABLE, INPUT, 230V, 20A (optional)	1
...	11	194 221	.. AMPERAGE ADJUSTMENT KNOB	1
...	12	194 222	.. COVER, KNOB, BLUE	1
...	13	V21	.. READY LIGHT	1
...	14	194 215	.. PANEL, FRONT	1
...	15	192 999	.. NAMEPLATE	1
...	16	194 239	.. POTENTIOMETER	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.**





**Figure 9-2. Inside Left Components**

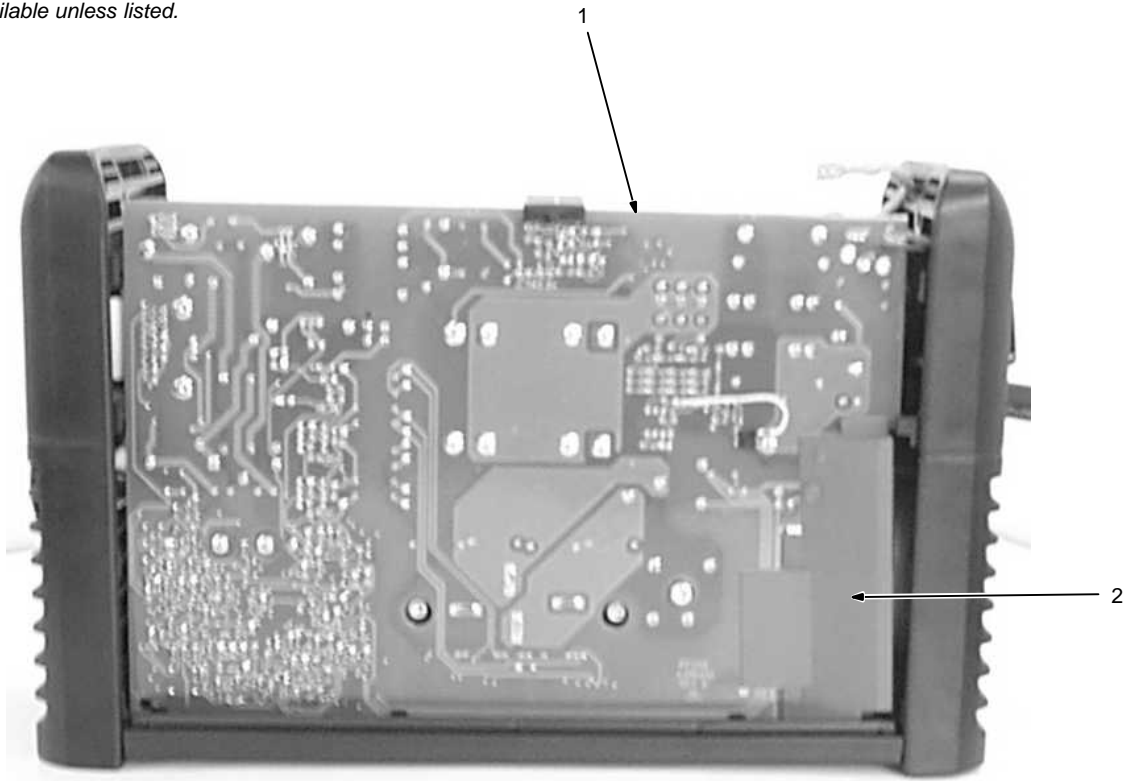
Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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**Figure 9-2. Inside Left Components**

...	1	S1	194 227	.. SWITCH, Input Power	1
...	2		194 237	.. BRACKET, shield, PC1	1
...	3		194 235	.. BRACKET, transformer	1
...	4	T1	194 224	.. TRANSFORMER, main	1
...	5		194 230	.. BUS BAR, transformer, top	1
...	6	R1	194 228	.. SHUNT	1
...	7		194 231	.. BUS BAR, negative output	1
...	8	C1,C2	194 233	.. CAPACITORS, output filter	1
...	9		194 244	.. BUS BAR, flexible, positive output	2
...	10	RT1	194 219	.. THERMISTOR, assy	1
...	11	SR1	155 350	.. RECTIFIER, output	1
...	12	Z1,Z2	194 234	.. TORROID, output filter	2
...	13		194 229	.. BUS BAR, transformer, bottom	1
...	14		194 232	.. HEAT SINK, .....	1
...	15	FM1	194 226	.. FAN MOTOR ASSY	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.**

Hardware is common and not available unless listed.



DP-00347

**Figure 9-3. Inside Right Components**

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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**Figure 9-3. Inside Right Components**

1	PC1, PC2	194 225	CIRCUIT CARD PC1, main	1
2		194 236	FAN MOTOR BRACKET	1

\*Recommended Spare Parts.

**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, 1998  
(Equipment with a serial number preface of "KJ" or newer)

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.

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

**LIMITED WARRANTY** – Subject to the terms and conditions 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. 1 Year — Parts and Labor
  - \* Maxstar 140
  - \* Motor Driven Guns (w/exception of Spoolmate 185)
  - \* Process Controllers
  - \* Positioners and Controllers
  - \* Automatic Motion Devices
  - \* Robots
  - \* IHPS Power Sources
  - \* Water Coolant Systems
  - \* HF Units
  - \* Grids
  - \* Spot Welders
  - \* Load Banks
  - \* SDX Transformers
  - \* Miller Cyclomatic Equipment
  - \* Running Gear/Trailers
  - \* Plasma Cutting Torches (except APT, ZIPCUT & PLAZCUT Models)
  - \* Deutz Engines (outside North America)
  - \* 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.)
2. 6 Months — Batteries
3. 90 Days — Parts and Labor
  - \* MIG Guns/TIG Torches
  - \* APT, ZIPCUT & PLAZCUT Model Plasma Cutting Torches
  - \* Remote Controls
  - \* Accessory Kits
  - \* Replacement Parts (No labor)
  - \* Spoolmate 185

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

1. 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.
2. Consumable components; such as contact tips, cutting nozzles, contactors, brushes, slip rings, relays or parts that fail due to normal wear.
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



# Resources Available

Always provide Model Name and Serial/Style Number.

Contact your Distributor for:

To locate distributor nearest you call  
1-800-4-A-Miller

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 for:

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

File a claim for loss or damage during  
shipment.

## Miller Electric Mfg. Co.

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Appleton, WI 54914 USA

## International Headquarters—USA

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USA & Canada FAX: 920-735-4134  
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