Thunderbolt XL

225 AC, 225/150 AC/DC, And 300/200 AC/DC

OWNER’S MANUAL

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

Miller 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 specification sheets. To locate your nearest distributor or service agency call 1-800-4-A-Miller, or visit us at www.MillerWelds.com on the web.
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COMPLETE PARTS LIST – Available at www.MillerWelds.com

WARRANTY
SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING

Protect yourself and others from injury — read, follow, and save these important safety precautions and operating instructions.

1-1. Symbol Usage

DANGER! – Indicates a hazardous situation which, if not avoided, will result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.

Indicates a hazardous situation which, if not avoided, could result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.

NOTICE – Indicates statements not related to personal injury.

1-2. Arc Welding Hazards

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

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

During operation, keep everybody, especially children, away.

ELECTRIC SHOCK can kill.

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

- Do not touch live electrical parts.
- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.
- Do not use AC output in damp areas, if movement is confined, or if there is a danger of falling.
- Use AC output ONLY if required for the welding process.
- If AC output is required, use remote output control if present on unit.
- Additional safety precautions are required when any of the following electrically hazardous conditions are present: in damp locations or while wearing wet clothing; on metal structures such as floors, gratings, or scaffolds; when in cramped positions such as sitting, kneeling, or lying; or when there is a high risk of unavoidable or accidental contact with the workpiece or ground. For these conditions, use the following equipment in order presented: 1) a semiautomatic DC constant voltage (wire) welder, 2) a DC manual (stick) welder, or 3) an AC welder with reduced open-circuit voltage. In most situations, use of a DC, constant voltage wire welder (stick) welder, or 3) an AC welder with reduced open-circuit voltage is recommended. And, do not work alone!
- 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, ground, and operate 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.
- Keep cords dry, free of oil and grease, and protected from hot metal and sparks.
- Frequently inspect input power cord and ground conductor for damage or bare wiring – replace immediately if damaged – bare wiring can kill.
- Turn off all equipment when not in use.
- Do not use worn, damaged, undersized, or repaired 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.
- Do not touch electrode holders connected to two welding machines at the same time since double open-circuit voltage will be present.
- 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. Disconnect cable for process not in use.
- Use GFCI protection when operating auxiliary equipment in damp or wet locations.

SIGNIFICANT DC VOLTAGE exists in inverter welding power sources AFTER removal of input power.

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

HOT PARTS can burn.

- Do not touch hot parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.
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 local forced ventilation at the arc to remove welding fumes and gases. The recommended way to determine adequate ventilation is to sample for the composition and quantity of fumes and gases to which personnel are exposed.
- If ventilation is poor, wear an approved air-supplied respirator.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer's instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, and metals.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watchperson 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 while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.
- Do not weld where flying sparks can strike flammable material.

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 an approved welding helmet fitted with a proper shade of filter lenses to protect your face and eyes from arc rays and sparks 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, glare and sparks; warn others not to watch the arc.
- Wear body protection made from durable, flame-resistant material (leather, heavy cotton, wool). Body protection includes oil-free clothing such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.

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.

- Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Do not weld where flying sparks can strike flammable material.
- Protect yourself and others from flying sparks and hot metal.
- 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 containers that have held combustibles, or on closed containers such as tanks, drums, or pipes unless they are properly prepared according to AWS F4.1 and AWS A6.8.0 (see Safety Standards).
- Do not weld where the atmosphere may contain flammable dust, gas, or liquid vapors (such as gasoline).
- 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, sparks, 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 body protection made from durable, flame-resistant material (leather, heavy cotton, wool). Body protection includes oil-free clothing 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.
- After completion of welding, inspect area to ensure it is free of sparks, glowing embers, and flames.
- Use only correct fuses or circuit breakers. Do not oversize or bypass them.
- Follow requirements in OSHA 1910.252 (a) (2) (iv) and NFPA 51B for hot work and have a fire watcher and extinguisher nearby.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer's instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, and metals.

FLYING METAL or DIRT 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 compressed gas supply when not in use.
- Always ventilate confined spaces or use approved air-supplied respirator.

ELECTRIC AND MAGNETIC FIELDS (EMF) can affect Implanted Medical Devices.

- Wearers of Pacemakers and other Implanted Medical Devices should keep away.
- Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating 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.

Compressed 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, physical damage, 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 compressed 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. Do not stand in front of or behind the regulator when opening the valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Use the right equipment, correct procedures, and sufficient number of persons to lift and move cylinders.
- Read and follow instructions on compressed gas cylinders, associated equipment, and Compressed Gas Association (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 EQUIPMENT can injure.**
- 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.
- Keep equipment (cables and cords) away from moving vehicles when working from an aerial location.
- Follow the guidelines in the Applications Manual for the Revised NIOSH Lifting Equation (Publication No. 94-110) when manually lifting heavy parts or equipment.

**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.

**FLYING SPARKS can injure.**
- Wear a face shield to protect eyes and face.
- Shape tungsten electrode only on grinder with proper guards in a safe location wearing proper face, hand, and body protection.
- Sparks can cause fires — keep flammables away.

**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.

**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.

**MOVING PARTS can injure.**
- Keep away from moving parts.
- Keep away from pinch points such as drive rolls.
- Keep all doors, panels, covers, and guards closed and securely in place.
- Have only qualified persons remove doors, panels, covers, or guards for maintenance and troubleshooting as necessary.
- Reinstall doors, panels, covers, or guards when maintenance is finished and before reconnecting input power.

**READ INSTRUCTIONS.**
- Read and follow all labels and the Owner’s Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.
- Use only genuine replacement parts from the manufacturer.
- Perform maintenance and service according to the Owner’s Manuals, industry standards, and national, state, and local codes.

**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.

**BATTERY EXPLOSION can injure.**
- Do not use welder to charge batteries or jump start vehicles unless it has a battery charging feature designed for this purpose.

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

**READ INSTRUCTIONS.**
- Use only genuine replacement parts from the manufacturer.
- Perform maintenance and service according to the Owner’s Manuals, industry standards, and national, state, and local codes.

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- Keep away from moving parts such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.
1-4. California Proposition 65 Warnings

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

This product contains chemicals, including lead, known to the state of California to cause cancer, birth defects, or other reproductive harm. Wash hands after use.

1-5. Principal Safety Standards


1-6. EMF Information

Electric current flowing through any conductor causes localized electric and magnetic fields (EMF). The current from arc welding (and allied processes including spot welding, gouging, plasma arc cutting, and induction heating operations) creates an EMF field around the welding circuit. EMF fields may interfere with some medical implants, e.g. pacemakers. Protective measures for persons wearing medical implants have to be taken. For example, restrict access for passers-by or conduct individual risk assessment for welders. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

1. Keep cables close together by twisting or taping them, or using a cable cover.
2. Do not place your body between welding cables. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around your body.
4. Keep head and trunk as far away from the equipment in the welding circuit as possible.
5. Connect work clamp to workpiece as close to the weld as possible.
6. Do not work next to, sit or lean on the welding power source.
7. Do not weld whilst carrying the welding power source or wire feeder.

About Implanted Medical Devices:

Implanted Medical Device wearers should consult their doctor and the device manufacturer before performing or going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations. If cleared by your doctor, then following the above procedures is recommended.
Pour écarter les risques de blessure pour vous-même et pour autrui — lire, appliquer et ranger en lieu sûr ces consignes relatives aux précautions de sécurité et au mode opératoire.

2-1. Symboles utilisés

**DANGER!** - Indique une situation dangereuse qui si on l’évite ne peut donner la mort ou des blessures graves. Les dangers possibles sont montrés par les symboles joints ou sont expliqués dans le texte.

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**NOTE** – Indique des déclarations pas en relation avec des blessures personnelles.

2-2. Dangers relatifs au soudage à l’arc

Les symboles représentés ci-dessous sont utilisés dans ce manuel pour attirer l’attention et identifier les dangers possibles. En présence de l’un de ces symboles, prendre garde et suivre les instructions afférentes pour éviter tout risque. Les instructions en matière de sécurité indiquées ci-dessous ne constituent qu’un sommaire des instructions de sécurité plus complètes fournies dans les normes de sécurité énumérées dans la Section 2-5. Lire et observer toutes les normes de sécurité.

Seul un personnel qualifié est autorisé à installer, faire fonctionner, entretenir et réparer cet appareil.

Pendant le fonctionnement, maintenir à distance toutes les personnes, notamment les enfants de l’appareil.

Une décharge électrique peut entraîner la mort.

- **Ne pas toucher à aucune pièce en danger.**
- Portez des gants isolants et des vêtements de protection secs et sans trous.
- S’isoler de la pièce à couper et du sol en utilisant des housses ou des tapis assez grands afin d’éviter tout contact physique avec la pièce à couper ou le sol.
- 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.
- D’autres consignes de sécurité sont nécessaires dans les conditions suivantes : risques électriques dans un environnement humide ou si l’on porte des vêtements mouillés ; sur des structures métalliques telles que sols, grilles ou échafaudages ; en position coincée comme assise, à genoux ou couchée ; ou s’il y a un risque élevé de contact inévitable ou accidentel avec la pièce à souder ou le sol. Dans ces conditions, utiliser les équipements suivants, dans l’ordre indiqué : 1) un poste à souder DC à tension constante (à fil), 2) un poste à souder DC manuel (électrode) ou 3) un poste à souder AC à tension à vide réduite. Dans la plupart des situations, l’utilisation d’un poste à souder DC à fil à tension constante est recommandée. En outre, ne pas travailler seul !
- Installez, mettez à la terre et utilisez correctement cet équipement conformément à son Manuel d’Utilisation et aux réglementations nationales, gouvernementales et locales.
- 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 bonne 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.
- Les câbles doivent être exempts d’humidité, d’huile et de graisse ; protégez-les contre les étincelles et les pièces métalliques chaudes.
- Vérifier fréquemment le cordon d’alimentation et le conducteur de mise à la terre afin de s’assurer qu’il n’est pas altéré ou dénudé --, le remplacer immédiatement s’il l’est --. Un fil dénudé peut entraîner la mort.
- L’équipement doit être hors tension lorsqu’il n’est pas utilisé.
- Ne pas utiliser des câbles usés, endommagés, de grosseur insuffisante ou mal épissés.
- Ne pas enrouler les câbles autour du corps.
- Si la pièce soude doit être mise à la terre, le faire directement avec un câble distinct.
- Ne pas toucher l’électrode quand on est en contact avec la pièce, la terre ou une électrode provenant d’une autre machine.
- Ne pas toucher des portes électrodes connectés à deux machines en même temps de cause de la présence d’une tension à vide doublée.
- N’utiliser qu’un matériel en bon état. Réparer ou remplacer sur-le-champ les pièces endommagées. Entretenir l’appareil conformément à ce manuel.
- Porter un harnais de sécurité si l’on doit travailler au-dessus du sol.
- S’assurer que tous les panneaux et couvercles sont correctement en place.
- 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.
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 génére des rayons visibles et invisibles intense (ultraviolets et infrarouges) susceptibles de provoquer des brûlure dans les yeux et sur la peau. Des étincelles sont projetées pendant le soudage.

- Porter un casque de soudage et des gants de cuir, des pantalons sans revers, des chaussures hautes et une casquette.
- Porter des lunettes de sécurité avec écrans latéraux même sous les conditions les plus difficiles (voir les Normes de Sécurité).
2-3. Dangers supplémentaires en relation avec l’installation, le fonctionnement et la maintenance

**LES BOUTEILLES peuvent exploser si elles sont endommagées.**

Les bouteilles de gaz comprimé 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 excessi-ve, des chocs mécaniques, des dommages physiques, du laitier, des flammes ouvertes, des étincelles et des arcs.
- Placer les bouteilles debout en les fixant dans un support sta-

**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 pro-

**LA CHUTE DE L’ÉQUIPEMENT peut provoquer des blessures.**

- Utiliser l’anneau de levage uniquement pour soulever l’appareil, NON PAS les chariots, les bouteilles de gaz ou tout autre accessoire.
- Utiliser un équipement de levage de capacité suffisante pour lever l’appareil.
- En utilisant desfourches de levage pour déplacer l’unité, s’assurer que les fourches sont suffisamment longues pour dépasser du côté opposé de l’appareil.
- Tenir l’équipement (câbles et cordons) à distance des véhicules mobiles lors de toute opération en hauteur.

**LES ÉTINCELLES PROJETÉES peuvent provoquer des blessures.**

- Porter un écran facial pour protéger le visage et les yeux.
- Affûter l’électrode au tungstène uniquement à la meuleuse dotée de protecteurs. Cette manœuvre est à exécuter dans un endroit sûr lorsqu’il est certifié que l’entourage est exempt de substances inflammables.
- Les étincelles risquent de causer un incendie – éloigner toute sub-

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

- Fermer l’alimentation du gaz comprimé en cas de non utilisation.
- Veiller toujours à bien aérer les espaces con-fi-nés ou se servir d’un respirateur d’adduction d’air homologué.

**LES CHAMPS ÉLECTROMAGNÉTIQUES (CEM) peuvent affecter les implants mé-

**LE BRUIT peut endommager l’ouïe.**

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

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

OM-316 Page 7
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.

Les PIÈCES MOBILES peuvent causer 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 gâchette 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.

L’EXPLOSION DE LA BATTERIE peut provoquer des blessures.
- Ne pas utiliser l’appareil de soudage pour charger des batteries ou faire démarrer des véhicules à l’aide de câbles de démarrage, sauf si l’appareil dispose d’une fonctionnalité de charge de batterie destinée à cet usage.

Les PIÈCES MOBILES peuvent causer des blessures.
- S’abstenir de toucher des organes mobiles tels que des ventilateurs.
- Maintenir fermés et verrouillés les portes, panneaux, recouvrements et dispositifs de protection.
- Lorsque cela est nécessaire pour des travaux d’entretien et de dépannage, faire retirer les portes, panneaux, recouvrements ou dispositifs de protection uniquement par du personnel qualifié.
- Remettre les portes, panneaux, recouvrements ou dispositifs de protection quand l’entretien est terminé et avant de rebrancher l’alimentation électrique.

LIRE LES INSTRUCTIONS.
- Lire et appliquer les instructions sur les étiquettes et le Mode d’emploi avant l’installation, l’utilisation ou l’entretien de l’appareil.
- Lire les informations de sécurité au début du manuel et dans chaque section.
- N’utiliser que les pièces de rechange recommandées par le constructeur.
- Effectuer l’entretien en respectant les manuels d’utilisation, les normes industrielles et les codes nationaux, d’état et locaux.

LE RAYONNEMENT HAUTE FRÉQUENCE (H.F.) risque de provoquer des interférences.
- Le rayonnement haute fréquence (H.F.) peut provoquer des interférences avec les équipements de radio-navigate et de communication, les services de sécurité et les ordinateurs.
- Demander seulement à des personnes qualifiées familiariées 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.
2-4. Proposition californienne 65 Avertissements

Les équipements de soudage et de coupe produisent des fumées et des gaz qui contiennent des produits chimiques dont l’État de Californie reconnaît qu’ils provoquent des malformations congénitales et, dans certains cas, des cancers. (Code de santé et de sécurité de Californie, chapitre 25249.5 et suivants)

Ce produit contient des produits chimiques, notamment du plomb, dont l’État de Californie reconnaît qu’ils provoquent des cancers, des malformations congénitales ou d’autres problèmes de procréation. Se laver les mains après utilisation.

2-5. Principales normes de sécurité


2-6. Informations relatives aux CEM

Le courant électrique qui traverse tout conducteur génère des champs électromagnétiques (CEM) à certains endroits. Le courant issu d’un soudage à l’arc (et de procédés connexes, y compris le soudage par points, le gougeage, le découpage plasma et les opérations de chauffage par induction) crée un champ électromagnétique (CEM) autour du circuit de soudage. Les CEM peuvent créer des interférences avec certains implants médicaux comme des stimulateurs cardiaques. Des mesures de protection pour les porteurs d’implants médicaux doivent être prises: Limiter par exemple tout accès aux passants ou procéder à une évaluation des risques individuels pour les soudeurs. Tous les soudeurs doivent appliquer les procédures suivantes pour minimiser l’exposition aux CEM provenant du circuit de soudage:

1. Rassembler les câbles en les torsadant ou en les attachant avec du ruban adhésif ou avec une housse.
2. Ne pas se tenir au milieu des câbles de soudage. Disposer les câbles d’un côté et à distance de l’opérateur.

3. Ne pas courber et ne pas entourer les câbles autour de votre corps.
4. Maintenir la tête et le torse aussi loin que possible du matériel du circuit de soudage.
5. Connecter la pince sur la pièce aussi près que possible de la soudure.
6. Ne pas travailler à proximité d’une source de soudage, ni s’asseoir ou se pencher dessus.
7. Ne pas souder tout en portant la source de soudage ou le dévidoir.

En ce qui concerne les implants médicaux :
Les porteurs d’implants doivent d’abord consulter leur médecin avant de s’approcher des opérations de soudage à l’arc, de soudage par points, de gougeage, du coupage plasma ou de chauffage par induction. Si le médecin approuve, il est recommandé de suivre les procédures précédentes.
### SECTION 3 – DEFINITIONS

#### 3-1. Miscellaneous Symbols And Definitions

Some symbols are found only on CE products.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Amperes</td>
</tr>
<tr>
<td>!</td>
<td>Single Phase</td>
</tr>
<tr>
<td><img src="h" alt="Do Not Switch Under Load" /></td>
<td></td>
</tr>
<tr>
<td><img src="h" alt="Input" /></td>
<td></td>
</tr>
<tr>
<td><img src="h" alt="On" /></td>
<td>On</td>
</tr>
<tr>
<td><img src="h" alt="Off" /></td>
<td>Off</td>
</tr>
<tr>
<td><img src="h" alt="Output" /></td>
<td>Output</td>
</tr>
<tr>
<td><img src="h" alt="Hz" /></td>
<td>Hertz</td>
</tr>
<tr>
<td><img src="h" alt="Alternating Current" /></td>
<td>Alternating Current</td>
</tr>
<tr>
<td><img src="h" alt="Electrode Positive" /></td>
<td>Electrode Positive</td>
</tr>
<tr>
<td><img src="h" alt="Electrode Negative" /></td>
<td>Electrode Negative</td>
</tr>
<tr>
<td><img src="h" alt="Direct Current" /></td>
<td>Direct Current</td>
</tr>
<tr>
<td><img src="h" alt="Welding Arc" /></td>
<td>Welding Arc</td>
</tr>
<tr>
<td><img src="h" alt="Volts" /></td>
<td>Volts</td>
</tr>
<tr>
<td><img src="h" alt="Work" /></td>
<td>Work</td>
</tr>
<tr>
<td><img src="h" alt="Electrode" /></td>
<td>Electrode</td>
</tr>
<tr>
<td><img src="h" alt="Single Phase Transformer" /></td>
<td>Single Phase Transformer</td>
</tr>
<tr>
<td><img src="h" alt="Single Phase Transformer AC &amp; Rectifier DC Power Source" /></td>
<td>Single Phase Transformer AC &amp; Rectifier DC Power Source</td>
</tr>
<tr>
<td><img src="h" alt="Line Connection" /></td>
<td>Line Connection</td>
</tr>
<tr>
<td><img src="h" alt="Input Power Or Input Voltage" /></td>
<td>Input Power Or Input Voltage</td>
</tr>
<tr>
<td><img src="h" alt="Shielded Metal Arc Welding (SMAW)" /></td>
<td>Shielded Metal Arc Welding (SMAW)</td>
</tr>
<tr>
<td><img src="h" alt="Rated No-Load Voltage" /></td>
<td>Rated No-Load Voltage</td>
</tr>
<tr>
<td><img src="h" alt="Primary Voltage" /></td>
<td>Primary Voltage</td>
</tr>
<tr>
<td><img src="h" alt="Load Voltage" /></td>
<td>Load Voltage</td>
</tr>
<tr>
<td><img src="h" alt="Rated Supply Current" /></td>
<td>Rated Supply Current</td>
</tr>
<tr>
<td><img src="h" alt="Rated Welding Current" /></td>
<td>Rated Welding Current</td>
</tr>
<tr>
<td><img src="h" alt="Duty Cycle" /></td>
<td>Duty Cycle</td>
</tr>
<tr>
<td><img src="h" alt="Temperature" /></td>
<td>Temperature</td>
</tr>
<tr>
<td><img src="h" alt="Rated Maximum Supply Current" /></td>
<td>Rated Maximum Supply Current</td>
</tr>
<tr>
<td><img src="h" alt="Percent" /></td>
<td>Percent</td>
</tr>
<tr>
<td><img src="h" alt="Protective Earth (Ground)" /></td>
<td>Protective Earth (Ground)</td>
</tr>
</tbody>
</table>
### SECTION 4 – SPECIFICATIONS

#### 4-1. Unit Specifications

**A. AC/DC Models**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Rated Welding Output</th>
<th>Amperage Range</th>
<th>Maximum Open-Circuit Voltage</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>225 A @ 25 Volts AC, 20% Duty Cycle @ 60 Hz; 15% Duty Cycle @ 50 Hz</td>
<td>Low: 30 – 150 High: 40 – 235</td>
<td>80 VAC</td>
<td>104 lb (47 kg)</td>
</tr>
<tr>
<td>DC</td>
<td>150 A @ 25 Volts DC, 20% Duty Cycle @ 60 Hz; 15% Duty Cycle @ 50 Hz</td>
<td>30 – 160</td>
<td>80 VDC</td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>300 A @ 30 Volts AC, 20% Duty Cycle @ 50/60 Hz</td>
<td>Low: 40 – 200 High: 65 – 300</td>
<td>80 VAC</td>
<td>134 lbs (61 kg)</td>
</tr>
<tr>
<td>DC</td>
<td>200 A @ 25 Volts DC, 20% Duty Cycle @ 50/60 Hz</td>
<td>30 – 200</td>
<td>80 VDC</td>
<td></td>
</tr>
</tbody>
</table>

**Overall Dimensions**

- Height: 18-3/4 in. (476 mm); Width: 12-3/4 in. (323 mm); Depth: 17-1/2 in. (445 mm)

*While idling

---

**B. AC Models**

<table>
<thead>
<tr>
<th>Rated Welding Output</th>
<th>Amperage Range</th>
<th>Max Open-Circuit Voltage</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>225 A @ 25 Volts AC; 20% Duty Cycle @ 60 Hz; 15% Duty Cycle @ 50 Hz</td>
<td>Low: 30 – 150A High: 40 – 235A</td>
<td>80 VAC</td>
<td>230 V</td>
</tr>
</tbody>
</table>

**Overall Dimensions**

- Height: 18-3/4 in. (476 mm); Width: 12-3/4 in. (323 mm); Depth: 17-1/2 in. (445 mm)

*While idling
4-2. Duty Cycle Charts

A. For AC/DC Models

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

**NOTICE** – Exceeding duty cycle can damage unit and void warranty.

A. For 225/150A Models*

*These models have a 15% duty cycle when used with 50 Hz input power.

B. For 300/200A Models*

For 225A Models*

*These models have a 15% duty cycle when used with 50 Hz input power.

B. For AC Models

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

**NOTICE** – Exceeding duty cycle can damage unit and void warranty.

For 225A Models*

*These models have a 15% duty cycle when used with 50 Hz input power.
4-3. Volt-Ampere Curves

A. For AC/DC Models

The volt-ampere curves show the minimum and maximum voltage and amperage output capabilities. Curves of other settings fall between the curves shown.

A. For 225/150A Models

B. For 300/200A Models
B. For AC Models

The volt-ampere curves show the minimum and maximum voltage and amperage output capabilities. Curves of other settings fall between the curves shown.

For 225A Models

A=LOW RANGE
B=HIGH RANGE

Notes
5-1. Serial Number And Rating Label Location

The serial number and rating information for this product is located on the back. Use rating label to determine input power requirements and/or rated output. For future reference, write serial number in space provided on back cover of this manual.

5-2. Selecting A Location

![Diagram showing selective a location](image)

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

1. **Hand Cart**
   Use cart or similar device to move unit.

2. **Line Disconnect Device**
   Locate unit near correct input power.

18 in. (460 mm)
5-3. Installing Electrode Holder And Work Clamp

**Tools Needed:**

- 14 mm
- 6 mm

**Removal of Barrel from Electrode Holder**

1. Electrode Holder
2. Barrel
3. Access Hole
4. Set Screw

Loosen set screw through access hole and slide barrel away from electrode holder.

**Installing Electrode Cable and Barrel onto Electrode Holder**

5. Electrode Cable From Unit (Has Bare Conductors on End)
6. Terminal Screw

Back out terminal screw from electrode holder. Insert electrode cable through barrel into end of electrode holder and tighten terminal screw securely.

Move barrel toward electrode holder and tighten set screw to secure barrel in place.

**Installing Work Cable onto Work Clamp**

7. Work Clamp
8. Work Cable From Unit (Has Ring Terminal on End)
9. Mounting Bolt

Route work cable through work clamp as shown and install onto mounting bolt using supplied hardware.

**Important:**

- Turn Off unit and disconnect input power before installing electrode holder or work clamp.

---

Ref. 802 251-A / 802 105-D
5-4. Weld Output Cables

For weld output cable replacements or extensions, contact your Factory Authorized Service Agent.

5-5. Electrical Service Guide

Failure to follow these electrical service guide recommendations could create an electric shock or fire hazard. These recommendations are for a dedicated circuit sized for the rated output and duty cycle of the welding power source.

In dedicated circuit installations, the National Electrical Code (NEC) allows the receptacle or conductor rating to be less than the rating of the circuit protection device. All components of the circuit must be physically compatible. See NEC articles 210.21, 630.11, and 630.12.

<table>
<thead>
<tr>
<th>Input Voltage (V)</th>
<th>50/60 Hz</th>
<th>Single Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>220</td>
<td>230</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input Amperes (A) At Rated Output</th>
<th>50/60 Hz</th>
<th>Single Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47.5</td>
<td>[67]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max Recommended Standard Fuse Rating In Amperes¹</th>
<th>50/60 Hz</th>
<th>Single Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-Delay Fuses²</td>
<td>[90]</td>
<td>50 [80]</td>
</tr>
<tr>
<td>Normal Operating Fuses ³</td>
<td>[110]</td>
<td>70 [100]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Min Input Conductor Size In AWG ⁴</th>
<th>50/60 Hz</th>
<th>Single Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>[10]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max Recommended Input Conductor Length In Feet (Meters)</th>
<th>50/60 Hz</th>
<th>Single Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[75 (23)]</td>
<td>87 (26)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[82 (25)]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Min Grounding Conductor Size In AWG ⁴</th>
<th>50/60 Hz</th>
<th>Single Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>[10]</td>
</tr>
</tbody>
</table>

Reference: 2014 National Electrical Code (NEC) (including article 630)
1 If a circuit breaker is used in place of a fuse, choose a circuit breaker with time-current curves comparable to the recommended fuse.
2 “Time-Delay” fuses are UL class “RK5”. See UL 248.
3 “Normal Operating” (general purpose - no intentional delay) fuses are UL class “K5” (up to and including 60 amps), and UL class “H” (65 amps and above).
4 Conductor data in this section specifies conductor size (excluding flexible cord or cable) between the panelboard and the equipment per NEC Table 310.15(B)(16). If a flexible cord or cable is used, minimum conductor size may increase. See NEC Table 400.5(A) for flexible cord and cable requirements.
5-6. Connecting Input Power

For Models Supplied With Plug

- Disconnect and lockout/tag-out input power before installing receptacle.
- Have only qualified persons make this installation. See rating label in Section 5-2, and be sure to supply correct input power.

1. Proper Receptacle (NEMA 6-50R) (User-Supplied)
   Receptacle must comply with applicable codes.
2. Input And Grounding Conductors
   See size and length using Section 5-5. Conductors must comply with applicable codes.
3. Over-Current Protection
   Select type and size of over-current protection using Section 5-5.
4. Plug (NEMA 6-50P)
   Connect plug to properly installed receptacle.
   Close and secure door on disconnect device. Remove lockout/tagout device, and place switch in the On position.

For Models Not Supplied With Plug

- Installation must meet all National and Local Codes – have only qualified persons make this installation.
- Disconnect and lockout/tag-out input power before connecting input conductors from unit.
- Always connect green or green/yellow conductor to supplying grounding terminal first, and never to a line terminal.

1. Line Disconnect Device (Switch Shown In Off Position)
2. Disconnect Device Grounding Terminal
3. Green Or Green/Yellow Grounding Conductor
   Connect green or green/yellow grounding conductor to disconnect device grounding terminal first.
4. Disconnect Device Line Terminals
5. Black And White Input Conductors L1 And L2
   Connect input conductors L1 and L2 to disconnect device line terminals.
6. Over-Current Protection
   Select type and size of over-current protection using Section 5-5 (fused disconnect switch shown).
   Close and secure door on disconnect device. Remove lockout/tagout device, and place switch in the On position.
6-1. Controls

A. Controls For AC/DC Models

1. Amperage Adjustment Control
2. Power Switch
3. Mode Switch

For DC Weld Output
Use mode switch to select polarity of dc output, Electrode Positive/DCEP (+), or Electrode Negative/DCEN (-).

For AC Weld Output
Use mode switch to select ac low range or high range output.
B. Controls For AC Models

1. Amperage Adjustment Control
2. Power Switch
3. Mode Switch

Use mode switch to select AC low range or high range output.

WARNING: ELECTRIC SHOCK CAN KILL
- DO NOT USE AC OUTPUT IF MOVEMENT IS CONFUSED, OR IF THERE IS A DANGER OF FALLING.
- USE AC OUTPUT ONLY IF REQUIRED FOR THE WELDING PROCESS.

DO NOT SWITCH UNDER LOAD
NE PAS RÉGLER L’INTERRUPTEUR EN CHARGE

RATED WELD OUTPUT
PUISSANCE NOMINALE DE SOUDAGE

AC
VOLTS 25
AMPS 225
OUTPUT CYCLE 25%
FACTOR DE MARCHE MAX DCV
TENSION MAXIMUM
EN CIRCUIT OU VERT

ACCU-SET™
AMPERAGE CONTROL
COMMANDE D’AMPERAGE

ELECTRODE

AMPS

Ref. 218 237-A / 802 105-D
SECTION 7 – MAINTENANCE & TROUBLESHOOTING

7-1. Routine Maintenance

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Task</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 3 Months</td>
<td>Unreadable Labels</td>
<td></td>
</tr>
<tr>
<td>Every 6 Months</td>
<td>Inside Unit</td>
<td></td>
</tr>
</tbody>
</table>

7-2. Lubricating Shunt Block And Anti-Noise Adjustment

Tools Needed:
- 1/2 in.
- 5/16, 3/8 in.

⚠️ Turn Off welding power source and disconnect input power.
1. Wrapper
   Remove wrapper.
2. Shunt Block
   Do not grease screw threads on shunt block.
   Apply light coating of high-temperature grease to shaded areas of both shunt blocks. Turn amperage control handle to spread grease evenly.
3. Noise Adjustment Screws
   If shunt block vibrates and becomes noisy, tighten adjustment screws 1/4 turn. Install wrapper, turn On unit, and check for shunt noise. Repeat procedure until noise stops. Do not overtighten. Call your nearest Factory Authorized Service Agent if noise continues.

⚠️ Install wrapper before turning On power.
7-3. Reinstalling Amperage Adjustment Indicator

**Tools Needed:**
- 5/16, 3/8 in.
- T-20 Torx
- For 225 A models, X = 2–1/2 in.
- For 300 A models, X = 2–3/8 in.

**Important:** Turn Off welding power source and disconnect input power.

1. **Wrapper**
   - Remove wrapper from unit.
2. **Crank Handle**
3. **Shunt Shaft**
4. **Transformer And Shunt (Located Inside Unit)**
   - Insert crank handle onto shunt shaft protruding through front panel and turn crank handle to adjust shunt to the proper value of “X”, depending on model (see detail of transformer and shunt).
   - Remove crank handle.
5. **Pinion Gear**
   - Install pinion gear onto front panel making sure anti-rotation pins are in holes on front panel.
6. **Pointer Gear**
   - Install pointer gear overtop of pinion gear and rotate so pointer is indicating 130 Amps on AC Low Range scale (see example).
   - Install crank handle over top the stator/pinion gear assembly with the handle straight down. It may be necessary to turn the handle slightly so vertical alignment is possible.
7. **Securing Screw**
   - Install securing screw through handle, into threaded hole in shunt shaft. Tighten securely.
   - Reinstall wrapper.

Proper alignment of pointer and crank handle.
## 7-4. Troubleshooting

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No weld output; fan does not run.</td>
<td>Be sure line disconnect switch is in On position (see Section 5-6).</td>
</tr>
<tr>
<td></td>
<td>Check and replace line fuses if open. Reset breakers if necessary (see Section 5-6).</td>
</tr>
<tr>
<td>Fan does not run; weld output okay.</td>
<td>Be sure nothing is blocking movement of fan. If fan does not run freely, replace fan motor.</td>
</tr>
<tr>
<td>Erratic weld current.</td>
<td>Clean and tighten all weld cable connections.</td>
</tr>
<tr>
<td>Erratic arc with excessive spatter.</td>
<td>Use dry, properly stored electrodes.</td>
</tr>
<tr>
<td></td>
<td>Shorten arc length.</td>
</tr>
<tr>
<td></td>
<td>Reduce amperage setting (see Section 6-1).</td>
</tr>
<tr>
<td>Electrode freezing to work.</td>
<td>Increase amperage setting (see Section 6-1).</td>
</tr>
<tr>
<td></td>
<td>Increase arc length.</td>
</tr>
<tr>
<td></td>
<td>Use dry, properly stored electrodes.</td>
</tr>
<tr>
<td>Noise and vibration from shunt block.</td>
<td>Lubricate shunt block and/or tighten adjustment screws (see Section 7-2).</td>
</tr>
</tbody>
</table>
SECTION 8 – ELECTRICAL DIAGRAMS

Figure 8-1. Circuit Diagram For 225/150 AC/DC (230 Volts) Models

Figure 8-2. Circuit Diagram For 300/200 AC/DC (220 Volts) Models
Figure 8-3. Circuit Diagram For 225 AC (230 Volts) Models
9-1. 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.
- Always wear appropriate personal protective clothing.

1. Workpiece
   Make sure workpiece is clean before welding.

2. Work Clamp
   Place as close to the weld as possible.

3. Electrode
   Before striking an arc, insert an electrode in the electrode holder. A small diameter electrode requires less current than a large one. Follow recommendations of the electrode manufacturer when setting weld amperage (see Section 9-2).

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. Correct arc length is related to electrode diameter. Examine the weld bead to determine if the arc length is correct.
   Arc length for 1/16 and 3/32 in. diameter electrodes should be about 1/16 in. (1.6 mm); arc length for 1/8 and 5/32 in. electrodes should be about 1/8 in. (3 mm).

7. Slag
   Use a chipping hammer and wire brush to remove slag. Remove slag and check weld bead before making another weld pass.
9-2. Electrode and Amperage Selection Chart

9-3. Striking an Arc

Weld current starts when electrode touches workpiece.
1 Electrode
2 Workpiece
3 Arc

Scratch Technique
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.

Tapping Technique
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.
9-4. Positioning Electrode Holder

After learning to start and hold an arc, practice running beads of weld metal on flat plates using a full electrode.

Hold the electrode nearly perpendicular to the work, although tilting it ahead (in the direction of travel) will be helpful.

To produce the best results, hold a short arc, travel at a uniform speed, and feed the electrode downward at a constant rate as it melts.

9-5. Poor Weld Bead Characteristics

1. Large Spatter Deposits
2. Rough, Uneven Bead
3. Slight Crater During Welding
4. Bad Overlap
5. Poor Penetration

9-6. Good Weld Bead Characteristics

1. Fine Spatter
2. Uniform Bead
3. Moderate Crater During Welding
4. No Overlap
5. Good Penetration into Base Metal
9-7. Conditions That Affect Weld Bead Shape

- Electrode Angle:
  - Angle Too Small
  - Correct Angle: 10° - 30°
  - Angle Too Large

- Arc Length:
  - Too Short
  - Normal
  - Too Long

- Travel Speed:
  - Slow
  - Normal
  - Fast

- Drag and Spatter

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

9-8. Electrode Movement During Welding

- 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.

1. Stringer Bead – Steady Movement Along Seam
2. Weave Bead – Side to Side Movement Along Seam
3. Weave Patterns

Use weave patterns to cover a wide area in one pass of the electrode. Do not let weave width exceed 2-1/2 times diameter of electrode.

9-9. Welding Lap Joints

- Electrode
- Single-Layer Fillet Weld
  Move electrode in circular motion.
- 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.
9-10. Welding Groove (Butt) Joints

1 Tack Welds
Prevent butt joint distortion by tack welding the materials in position before final weld.

Workpiece distortion occurs when heat is applied locally to a joint. One side of a metal plate will “curl” up toward the weld. Distortion will also cause the edges of a butt joint to pull together ahead of the electrode as the weld cools.

2 Square Groove Weld
3 Single V-Groove Weld
4 Double V-Groove Weld

Materials up to 3/16 in. (5 mm) thick can often be welded without special preparation using the square groove weld. However, when welding thicker materials it may be necessary to prepare the edges (V-groove) of butt joints to ensure good welds.

The single or double V-groove weld is good for materials 3/16 – 3/4 in. (5-19 mm) thick. Generally, the single V-groove is used on materials up to 3/4 in. (19 mm) thick and when, regardless of thickness, you can weld from one side only. Create a 30 degree bevel with oxy-acetylene or plasma cutting equipment. Remove scale from material after cutting. A grinder can also be used to prepare bevels.

9-11. Welding Tee Joints

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 9-8. Remove slag before making another weld pass.
9-12. Weld Test

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

If the weld breaks, examine it to determine the cause.

If the weld is porous (many holes), the arc length was probably too long.

If the weld contains bits of slag, the arc may have been too long or the electrode was moved incorrectly which allowed molten slag to be trapped in the weld. This may happen on a V-groove joint made in several layers and calls for additional cleaning between layers.

If the original beveled surface is visible the material was not fully melted which is often caused by insufficient heat or too fast a travel speed.

9-13. Troubleshooting

<table>
<thead>
<tr>
<th>Porosity – small cavities or holes resulting from gas pockets in weld metal.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible Causes</strong></td>
</tr>
<tr>
<td>Arc length too long.</td>
</tr>
<tr>
<td>Damp electrode.</td>
</tr>
<tr>
<td>Workpiece dirty.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th><strong>Possible Causes</strong></th>
<th><strong>Corrective Actions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amperage too high for electrode.</td>
<td>Decrease amperage or select larger electrode.</td>
</tr>
<tr>
<td>Arc length too long or voltage too high.</td>
<td>Reduce arc length or voltage.</td>
</tr>
</tbody>
</table>

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

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

- Shallow fusion between weld metal and base metal.

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

### Excessive Penetration

- Weld metal melting through base metal and hanging underneath weld.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive heat input.</td>
<td>Select lower amperage. Use smaller electrode.</td>
</tr>
<tr>
<td></td>
<td>Increase and/or maintain steady travel speed.</td>
</tr>
</tbody>
</table>

### Burn-Through

- Weld metal melting completely through base metal resulting in holes where no metal remains.

### Waviness Of Bead

- Weld metal that is not parallel and does not cover joint formed by base metal.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsteady hand.</td>
<td>Use two hands. Practice technique.</td>
</tr>
</tbody>
</table>

### Distortion

- Contraction of weld metal during welding that forces base metal to move.

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive heat input.</td>
<td>Use restraint (clamp) to hold base metal in position.</td>
</tr>
<tr>
<td></td>
<td>Make tack welds along joint before starting welding operation.</td>
</tr>
<tr>
<td></td>
<td>Select lower amperage for electrode.</td>
</tr>
<tr>
<td></td>
<td>Increase travel speed.</td>
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<tr>
<td></td>
<td>Weld in small segments and allow cooling between welds.</td>
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</table>
Warranty Questions?
Call 1-800-4-A-MILLER for your local Miller distributor.

Your distributor also gives you...
Service You always get the fast, reliable response you need. Most replacement parts can be in your hands in 24 hours.
Support Need fast answers to the tough welding questions? Contact your distributor. The expertise of the distributor and Miller is there to help you, every step of the way.

LIMITED WARRANTY – Subject to the terms and conditions below, Miller Electric Mfg. Co., Appleton, Wisconsin, warrants to its original retail purchaser that new Miller equipment sold after the effective date of this limited warranty is free of defects in material or 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 delivery date of the equipment to the original end-user purchaser, and not to exceed twelve months after the equipment is shipped to a North American distributor or eighteen months after the equipment is shipped to an international distributor.

1. 5 Years Parts — 3 Years Labor
   * Original Main Power Rectifiers Only To Include SCRs, Diodes, and Discrete Rectifier Modules
2. 3 Years — Parts and Labor
   * Auto-Darkening Helmet Lenses (Except Classic Series) (No Labor)
   * Engine Driven Welding Generators (NOTE: Engines are Warranted Separately by the Engine Manufacturer.)
   * Inverter Power Sources (Unless Otherwise Stated)
   * Plasma Arc Cutting Power Sources
   * Process Controllers
   * Semi-Automatic and Automatic Wire Feeders
   * Transformer/Rectifier Power Sources
3. 2 Years — Parts and Labor
   * Auto-Darkening Helmet Lenses – Classic Series Only (No Labor)
   * Fume Extractors – Capture 5, Filtair 400 and Industrial Collector Series
4. 1 Year — Parts and Labor Unless Specified
   * Automatic Motion Devices
   * CoolBelt and CoolBand Blower Unit (No Labor)
   * External Monitoring Equipment and Sensors
   * Field Options (NOTE: Field options are covered for the remaining warranty period of the product they are installed in, or for a minimum of one year — whichever is greater.)
   * RFCS Foot Controls (Except RFCS-RJ45)
   * Fume Extractors – Filtair 130, MWX and SWX Series
   * HF Units
   * ICE/XT Plasma Cutting Torches (No Labor)
   * Induction Heating Power Sources, Coolers (NOTE: Digital Recorders are Warranted Separately by the Manufacturer.)
   * Load Banks
   * Motor Driven Guns (except Spoolmate Spoolguns)
   * PAPR Blower Unit (No Labor)
   * Positioners and Controllers
   * Racks
   * Running Gear/Trailers
   * Spot Welders
   * Subarc Wire Drive Assemblies
   * Water Coolant Systems
   * TIG Torches (No Labor)
   * Wireless Remote Foot/Hand Controls and Receivers
   * Work Stations/Weld Tables (No Labor)
5. 6 Months — Parts
   * Batteries
   * Bernard Guns (No Labor)
   * Tregaskiss Guns (No Labor)
6. 90 Days — Parts
   * Accessory (Kits)
   * Canvas Covers
   * Induction Heating Coils and Blankets, Cables, and Non-Electronic Controls
   * M-Guns
   * MIG Guns and Subarc (SAW) Guns
   * Remote Controls and RFCS-RJ45
   * Replacement Parts (No labor)
   * Roughneck Guns
   * Spoolmate Spoolguns

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

1. Consumable components, such as contact tips, cutting nozzles, contactors, brushes, relays, work station table tops and welding curtains, or parts that fail due to normal wear. (Exception: brushes and relays are covered on all engine-driven products.)
2. Items furnished by Miller, but manufactured by others, such as engines or trade accessories. These items are covered by the manufacturer’s warranty, if any.
3. Equipment that has been modified by any party other than Miller, or equipment that has been improperly installed, improperly operated or misused based upon industry standards, or equipment which has not had reasonable and necessary maintenance, or equipment which has been used for operation outside of the specifications for the equipment.

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

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

TO THE EXTENT PERMITTED BY LAW, MILLER DISCLAIMS OR LIMITS IN ANY MANNER, ANY EXPRESS OR 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.

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Serial/Style Number</th>
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<tr>
<th>Purchase Date</th>
<th>(Date which equipment was delivered to original customer)</th>
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For Service

Contact a DISTRIBUTOR or SERVICE AGENCY near you.

Always provide Model Name and Serial/Style Number.

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

To locate a Distributor or Service Agency visit www.millerwelds.com or call 1-800-4-A-Miller

Contact the Delivering Carrier to:
- File a claim for loss or damage during shipment.
- For assistance in filing or settling claims, contact your distributor and/or equipment manufacturer’s Transportation Department.