

**Processes**



TIG (GTAW) Welding



Stick (SMAW) Welding

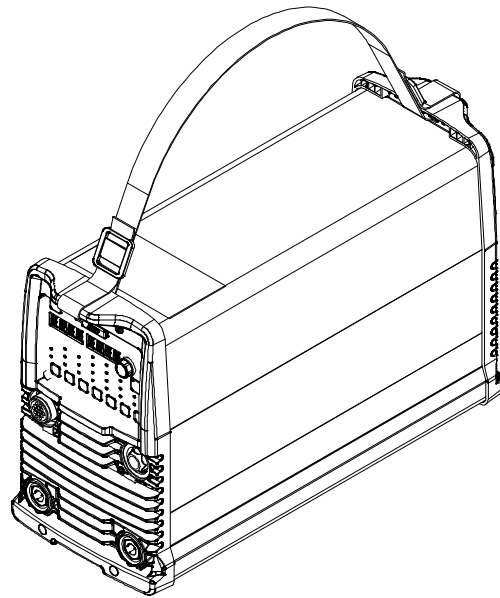
**Description**



120–480 Volt Models W/Autoline<sup>®</sup>  
Arc Welding Power Source

# Maxstar<sup>®</sup> 210 DX

By  Miller.



## OWNER'S MANUAL

File: TIG (GTAW)





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## Red-D-Arc Welderrentals

1-866-RED-D-ARC

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## WARRANTY

COMPLETE PARTS LIST – Available at [www.MillerWelds.com](http://www.MillerWelds.com)

# SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING

som 2020-02

 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.

 Indicates special instructions.



This group of symbols means Warning! Watch Out! ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid these 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 Principal Safety Standards listed in Section 1-5. Read and follow all Safety Standards.



Only qualified persons should install, operate, maintain, and repair this equipment. A qualified person is defined as one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project and has received safety training to recognize and avoid the hazards involved.



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 weld output in damp, wet, or confined spaces, 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 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 unit, disconnect input power, and discharge input capacitors according to instructions in Manual 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.
- Ventilate the work 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.



### 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.

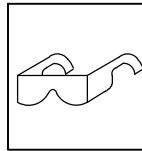


### WELDING can cause fire or explosion.

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 cut or weld on tire rims or wheels. Tires can explode if heated. Repaired rims and wheels can fail. See OSHA 29 CFR 1910.177 listed in Safety Standards.
- 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 A6.0 (see Safety Standards).
- Do not weld where the atmosphere can 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 work, 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.



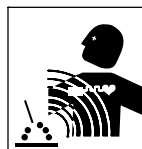
### FLYING METAL or DIRT can injure eyes.

- 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.



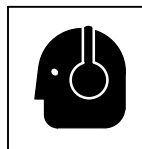
### BUILDUP OF GAS can injure or kill.

- 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 proper equipment, correct procedures, and sufficient number of persons to lift, move, and transport 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 Hazards For Installation, Operation, And Maintenance



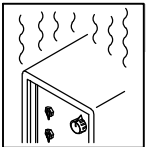
### FIRE OR EXPLOSION hazard.

- 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.



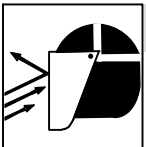
### FALLING EQUIPMENT can injure.

- Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories.
- Use correct procedures and 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.



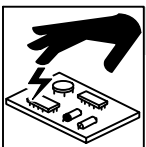
### OVERUSE can cause OVERHEATING

- 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.



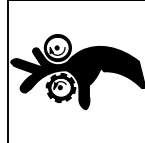
### FLYING SPARKS can injure.

- 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.



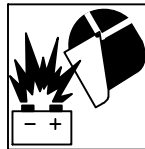
### MOVING PARTS can injure.

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



### WELDING WIRE can injure.

- 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.



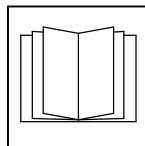
### BATTERY EXPLOSION can injure.

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



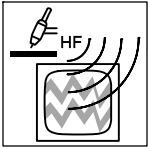
### MOVING PARTS can injure.

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

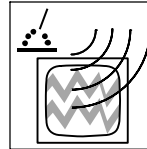
- Read and follow all labels and the Owner's Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.
- Use only genuine replacement parts from the manufacturer.
- Perform installation, maintenance, and service according 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.



#### ARC WELDING can cause interference.

- Electromagnetic energy can interfere with sensitive electronic equipment such as computers and computer-driven equipment such as robots.

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

### 1-4. California Proposition 65 Warnings

**WARNING:** This product can expose you to chemicals including lead, which are known to the state of California to cause cancer and birth defects or other reproductive harm.

For more information, go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

### 1-5. Principal Safety Standards

*Safety in Welding, Cutting, and Allied Processes*, American Welding Society standard ANSI Standard Z49.1. Website: [www.aws.org](http://www.aws.org).

*Safe Practice For Occupational And Educational Eye And Face Protection*, ANSI Standard Z87.1 from American National Standards Institute. Website: [www.ansi.org](http://www.ansi.org).

*Safe Practices for the Preparation of Containers and Piping for Welding and Cutting*, American Welding Society Standard AWS F4.1 from Global Engineering Documents. Website: [www.global.ihs.com](http://www.global.ihs.com).

*Safe Practices for Welding and Cutting Containers that have Held Combustibles*, American Welding Society Standard AWS A6.0 from Global Engineering Documents. Website: [www.global.ihs.com](http://www.global.ihs.com).

*National Electrical Code*, NFPA Standard 70 from National Fire Protection Association. Website: [www.nfpa.org](http://www.nfpa.org) and [www.sparky.org](http://www.sparky.org).

*Safe Handling of Compressed Gases in Cylinders*, CGA Pamphlet P-1 from Compressed Gas Association. Website: [www.cganet.com](http://www.cganet.com).

*Safety in Welding, Cutting, and Allied Processes*, CSA Standard W117.2 from Canadian Standards Association. Website: [www.csagroup.org](http://www.csagroup.org).

*Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, NFPA Standard 51B from National Fire Protection Association. Website: [www.nfpa.org](http://www.nfpa.org).

OSHA *Occupational Safety and Health Standards for General Industry*, Title 29, Code of Federal Regulations (CFR), Part 1910.177 Subpart N, Part 1910 Subpart Q, and Part 1926, Subpart J. Website: [www.osha.gov](http://www.osha.gov).

OSHA *Important Note Regarding the ACGIH TLV, Policy Statement on the Uses of TLVs and BEIs*. Website: [www.osha.gov](http://www.osha.gov).

*Applications Manual for the Revised NIOSH Lifting Equation* from the National Institute for Occupational Safety and Health (NIOSH). Website: [www.cdc.gov/NIOSH](http://www.cdc.gov/NIOSH).

### 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 can 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.



# SECTION 2 – CONSIGNES DE SÉCURITÉ – LIRE AVANT UTILISATION

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**⚠** 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 pas peut donner la mort ou des blessures graves. Les dangers possibles sont montrés par les symboles joints ou sont expliqués dans le texte.



Indique une situation dangereuse qui si on l'évite pas peut donner la mort ou des blessures graves. Les dangers possibles sont montrés par les symboles joints ou sont expliqués dans le texte.

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

Indique des instructions spécifiques.



Ce groupe de symboles veut dire Avertissement! Attention! DANGER DE CHOC ELECTRIQUE, PIECES EN MOUVEMENT, et PIECES CHAUDES. Reportez-vous aux symboles et aux directives ci-dessous afin de connaître les mesures à prendre pour éviter tout danger.

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



Les symboles 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 consignes de sécurité présentées ci-après ne font que résumer les informations contenues dans les principales normes de sécurité énumérées à la section 2-5. Lire et observer toutes les normes de sécurité.



L'installation, l'utilisation, l'entretien et les réparations ne doivent être confiés qu'à des personnes qualifiées. Une personne qualifiée est définie comme celle qui, par la possession d'un diplôme reconnu, d'un certificat ou d'un statut professionnel, ou qui, par une connaissance, une formation et une expérience approfondies, a démontré avec succès sa capacité à résoudre les problèmes liés à la tâche, le travail ou le projet et a reçu une formation en sécurité afin de reconnaître et d'éviter les risques inhérents.



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



### UNE DÉCHARGE ÉLECTRIQUE peut entraîner la mort.

Le contact d'organes électriques sous tension peut provoquer des accidents mortels ou des brûlures graves. Le circuit de l'électrode et de la pièce est sous tension lorsque le courant est délivré à la sortie. Le circuit d'alimentation et les circuits internes de la machine sont également sous tension lorsque l'alimentation est sur Marche. Dans le mode de soudage avec du fil, le fil, le dérouleur, le bloc de commande du rouleau et toutes les parties métalliques en contact avec le fil sont sous tension électrique. Un équipement installé ou mis à la terre de manière incorrecte ou impropre constitue un danger.

- Ne pas toucher aux pièces électriques sous tension.
- Porter 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 utiliser de sortie de soudage CA dans des zones humides ou confinées ou s'il y a un risque de chute.
- 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 !

- 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).
- 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 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.
- 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 soudée doit être mise à la terre, le faire directement avec un câble distinct.
- Ne pas toucher l'électrode quand on est en contact avec la pièce, la terre ou une électrode provenant d'une autre machine.
- Ne pas toucher des porte électrodes connectés à deux machines en même temps à 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. Entretien 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.
- Ne pas raccorder plus d'une électrode ou plus d'un câble de masse à une même borne de sortie de soudage. Débrancher le câble pour le procédé non utilisé.
- Utiliser une protection différentielle lors de l'utilisation d'un équipement auxiliaire dans des endroits humides ou mouillés.

### Il reste une TENSION DC NON NÉGLIGEABLE dans les sources de soudage onduleur UNE FOIS l'alimentation coupée.

- Éteignez l'unité, débranchez le courant électrique, et déchargez les condensateurs d'alimentation selon les instructions indiquées dans le manuel avant de toucher les pièces.



### LES PIÈCES CHAUDES peuvent provoquer des brûlures.

- Ne pas toucher à mains nues les parties chaudes.
- Prévoir une période de refroidissement avant de travailler à l'équipement.

- Ne pas toucher aux pièces chaudes, utiliser les outils recommandés et porter des gants de soudage et des vêtements épais pour éviter les brûlures.



### 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.
- À l'intérieur, ventiler la zone et/ou utiliser une ventilation forcée au niveau de l'arc pour l'évacuation des fumées et des gaz de soudage. Pour déterminer la bonne ventilation, il est recommandé de procéder à un prélèvement pour la composition et la quantité de fumées et de gaz auxquelles est exposé le personnel.
- Si la ventilation est médiocre, porter un respirateur anti-vapeurs approuvé.
- Lire et comprendre les fiches de données de sécurité et les instructions du fabricant concernant les adhésifs, les revêtements, les nettoyants, les consommables, les produits de refroidissement, les dégraisseurs, les flux et les métaux.
- 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 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.

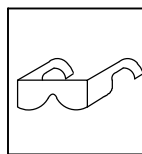
- Porter un casque de soudage approuvé muni de verres filtrants approprié pour protéger visage et yeux pour protéger votre visage et vos yeux pendant le soudage ou pour regarder (voir ANSI Z49.1 et Z87.1 énuméré dans les normes de sécurité).
- Porter des lunettes de sécurité avec écrans latéraux même sous votre casque.
- Avoir recours à des écrans protecteurs ou à des rideaux pour protéger les autres contre les rayonnements les éblouissements et les étincelles ; prévenir toute personne sur les lieux de ne pas regarder l'arc.
- Porter un équipement de protection pour le corps fait d'un matériau résistant et ignifuge (cuir, coton robuste, laine). La protection du corps comporte des vêtements sans huile comme par ex. des gants de cuir, une chemise solide, des pantalons sans revers, des chaussures hautes et une casquette.



### 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.

- 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.
- Ne pas souder dans un endroit où des étincelles peuvent tomber sur des substances inflammables.
- Se protéger et d'autres personnes de la projection d'étincelles et de métal chaud.
- 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 couper ou souder des jantes ou des roues. Les pneus peuvent exploser s'ils sont chauffés. Les jantes et les roues réparées peuvent défaillir. Voir OSHA 29 CFR 1910.177 énuméré dans les normes de sécurité.
- 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 et AWS A6.0 (voir les Normes de Sécurité).
- Ne pas souder là où l'air ambiant pourrait contenir des poussières, gaz ou émanations inflammables (vapeur d'essence, par exemple).
- Brancher le câble de masse 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, d'étincelles et d'incendie.
- Ne pas utiliser le poste de soudage pour dégeler des conduites gelées.
- En cas de non utilisation, enlever la baguette d'électrode du porte-électrode ou couper le fil à la pointe de contact.
- Porter un équipement de protection pour le corps fait d'un matériau résistant et ignifuge (cuir, coton robuste, laine). La protection du corps comporte des vêtements sans huile comme par ex. des gants de cuir, une chemise solide, des pantalons sans revers, des chaussures hautes et une casquette.
- Avant de souder, retirer toute substance combustible de vos poches telles qu'un allumeur au butane ou des allumettes.
- Une fois le travail achevé, assurez-vous qu'il ne reste aucune trace d'étincelles incandescentes ni de flammes.
- Utiliser exclusivement des fusibles ou coupe-circuits appropriés. Ne pas augmenter leur puissance; ne pas les ponter.
- Suivre les recommandations dans OSHA 1910.252(a)(2)(iv) et NFPA 51B pour les travaux à chaud et avoir de la surveillance et un extincteur à proximité.
- Lire et comprendre les fiches de données de sécurité et les instructions du fabricant concernant les adhésifs, les revêtements, les nettoyants, les consommables, les produits de refroidissement, les dégraisseurs, les flux et les métaux.



### DES PIÈCES DE METAL ou DES SALETES peuvent provoquer des blessures dans 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 comprimé en cas de non utilisation.
- Veiller toujours à bien aérer les espaces confinés ou se servir d'un respirateur d'adduction d'air homologué.



### Les CHAMPS ÉLECTROMAGNÉTIQUES (CEM) peuvent affecter les implants médicaux.

- Les porteurs de stimulateurs cardiaques et autres implants médicaux doivent rester à distance.
- Les porteurs d'implants médicaux doivent consulter leur médecin et le fabricant du dispositif avant de s'approcher de la zone où se déroule le soudage à l'arc, du soudage par points, du gougeage, de la découpe plasma ou une opération de chauffage par induction.



### 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.



### 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 excessive, 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 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 comprimé, régulateurs, tuyaux et raccords convenables pour cette application spécifique; les maintenir ainsi que les éléments associés en bon état.
- Tourner le dos à la sortie de vanne lors de l'ouverture de la vanne de la bouteille. Ne pas se tenir devant ou derrière le régulateur lors de l'ouverture de la vanne.
- Le couvercle du détendeur doit toujours être en place, sauf lorsque la bouteille est utilisée ou qu'elle est reliée pour usage ultérieur.
- Utilisez les équipements corrects, les bonnes procédures et suffisamment de personnes pour soulever, déplacer et transporter les bouteilles.
- Lire et suivre les instructions sur les bouteilles de gaz comprimé, l'équipement connexe et le dépliant P-1 de la CGA (Compressed Gas Association) mentionné dans les principales normes de sécurité.

## 2-3. Dangers supplémentaires en relation avec l'installation, le fonctionnement et la maintenance



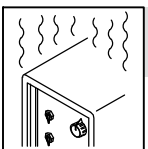
### Risque D'INCENDIE OU D'EXPLOSION.

- 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 protégée avant de mettre l'appareil en service.



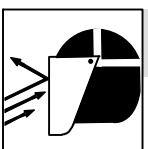
### LA CHUTE DE L'ÉQUIPEMENT peut provoquer des blessures.

- Utiliser l'anneau de levage uniquement pour soulever l'appareil, NON PAS les chariots, les bouteilles de gaz ou tout autre accessoire.
- Utilisez les procédures correctes et des équipements d'une capacité appropriée pour soulever et supporter 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.
- Tenir l'équipement (câbles et cordons) à distance des véhicules mobiles lors de toute opération en hauteur.
- Suivre les consignes du Manuel des applications pour l'équation de levage NIOSH révisée (Publication N°94-110) lors du levage manuel de pièces ou équipements lourds.



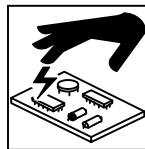
### L'EMPLOI EXCESSIF peut SURCHAUFFER L'ÉQUIPEMENT.

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



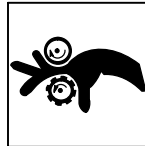
### LES ÉTINCELLES PROJÉTÉES peuvent provoquer des blessures.

- 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 lorsque l'on porte l'équipement homologué de protection du visage, des mains et du corps.
- Les étincelles risquent de causer un incendie – éloigner toute substance inflammable.



### 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.



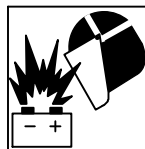
### Les PIÈCES MOBILES peuvent causer des blessures.

- 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.



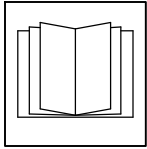
### L'EXPLOSION DE LA BATTERIE peut provoquer des blessures.

- 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.

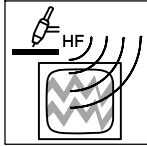
- S'abstenir de toucher des organes mobiles tels que des ventilateurs.
- Maintenir fermés et verrouillés les portes, panneaux, recouvrements et dispositifs de protection.
- Lorsque cela est nécessaire pour des travaux d'entretien et de dépannage, faire retirer les portes, panneaux, recouvrements ou dispositifs 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'installation, l'entretien et toute intervention selon les manuels d'utilisateurs, les normes nationales, provinciales et de l'industrie, ainsi que les codes municipaux.



### 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-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.

## 2-4. Proposition californienne 65 Avertissements

**⚠ AVERTISSEMENT : ce produit peut vous exposer à des produits chimiques tels que le plomb, reconnus par l'État de Californie comme cancérigènes et sources de malformations ou d'autres troubles de la reproduction.**

Pour plus d'informations, consulter [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

## 2-5. Principales normes de sécurité

*Safety in Welding, Cutting, and Allied Processes*, American Welding Society standard ANSI Standard Z49.1. Website: [www.aws.org](http://www.aws.org).

*Safe Practice For Occupational And Educational Eye And Face Protection*, ANSI Standard Z87.1 from American National Standards Institute. Website: [www.ansi.org](http://www.ansi.org).

*Safe Practices for the Preparation of Containers and Piping for Welding and Cutting*, American Welding Society Standard AWS F4.1 from Global Engineering Documents. Website: [www.global.ihs.com](http://www.global.ihs.com).

*Safe Practices for Welding and Cutting Containers that have Held Combustibles*, American Welding Society Standard AWS A6.0 from Global Engineering Documents. Website: [www.global.ihs.com](http://www.global.ihs.com).

*National Electrical Code*, NFPA Standard 70 from National Fire Protection Association. Website: [www.nfpa.org](http://www.nfpa.org) and [www.sparky.org](http://www.sparky.org).

*Safe Handling of Compressed Gases in Cylinders*, CGA Pamphlet P-1 from Compressed Gas Association. Website: [www.cganet.com](http://www.cganet.com).

*Safety in Welding, Cutting, and Allied Processes*, CSA Standard W117.2 from Canadian Standards Association. Website: [www.csagroup.org](http://www.csagroup.org).

*Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, NFPA Standard 51B from National Fire Protection Association. Website: [www.nfpa.org](http://www.nfpa.org).

OSHA *Occupational Safety and Health Standards for General Industry*, Title 29, Code of Federal Regulations (CFR), Part 1910.177 Subpart N, Part 1910 Subpart Q, and Part 1926, Subpart J. Website: [www.osha.gov](http://www.osha.gov).

OSHA *Important Note Regarding the ACGIH TLV, Policy Statement on the Uses of TLVs and BEIs*. Website: [www.osha.gov](http://www.osha.gov).

*Applications Manual for the Revised NIOSH Lifting Equation* from the National Institute for Occupational Safety and Health (NIOSH). Website: [www.cdc.gov/NIOSH](http://www.cdc.gov/NIOSH).

## 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 champs électromagnétiques produits peuvent causer interférence à certains implants médicaux, p. ex. les 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.



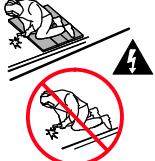
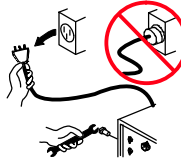

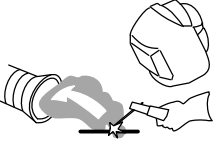
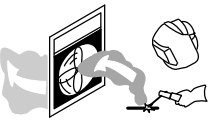
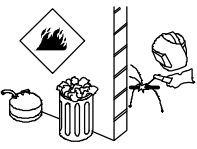

### En ce qui concerne les implants médicaux :




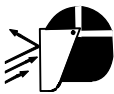

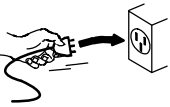
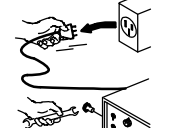


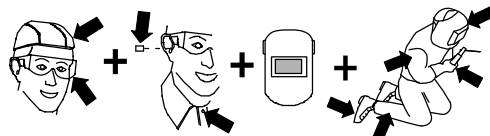
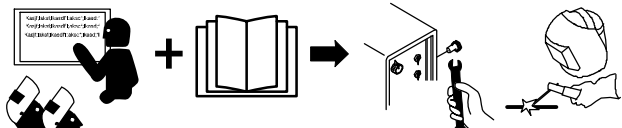
Les porteurs d'implants doivent d'abord consulter leur médecin avant de s'approcher des opérations de soudage à l'arc, de soudage par points, de gougeage, du coupage plasma ou de chauffage par induction. Si le médecin approuve, il est recommandé de suivre les procédures précédentes.

## SECTION 3 – DEFINITIONS

### 3-1. Additional Safety Symbols And Definitions













 Some symbols are found only on CE products.





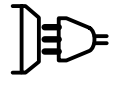



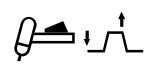
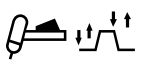
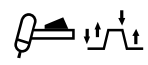
	<p>Warning! Watch Out! There are possible hazards as shown by the symbols.</p> <p style="text-align: right;">Safe1 2012-05</p>
	<p>Wear dry insulating gloves. Do not touch electrode with bare hand. Do not wear wet or damaged gloves.</p> <p style="text-align: right;">Safe2 2017-04</p>
	<p>Protect yourself from electric shock by insulating yourself from work and ground.</p> <p style="text-align: right;">Safe3 2017-04</p>
	<p>Disconnect input plug or power before working on machine.</p> <p style="text-align: right;">Safe5 2017-04</p>
	<p>Keep your head out of the fumes.</p> <p style="text-align: right;">Safe6 2017-04</p>
	<p>Use forced ventilation or local exhaust to remove the fumes.</p> <p style="text-align: right;">Safe8 2012-05</p>
	<p>Use ventilating fan to remove fumes.</p> <p style="text-align: right;">Safe10 2012-05</p>
	<p>Keep flammables away from welding. Do not weld near flammables.</p> <p style="text-align: right;">Safe12 2012-05</p>
	<p>Welding sparks can cause fires. Have a fire extinguisher nearby, and have a watchperson ready to use it.</p> <p style="text-align: right;">Safe14 2012-05</p>






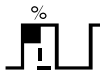

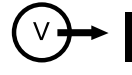



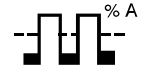






	<p>Do not weld on drums or any closed containers.</p> <p style="text-align: right;">Safe16 2017-04</p>
	<p>Do not remove or paint over (cover) the label.</p> <p style="text-align: right;">Safe20 2017-04</p>
	<p>When power is applied failed parts can explode or cause other parts to explode.</p> <p style="text-align: right;">Safe26 2012-05</p>
	<p>Flying pieces of parts can cause injury. Always wear a face shield when servicing unit.</p> <p style="text-align: right;">Safe27 2012-05</p>
	<p>Always wear long sleeves and button your collar when servicing unit.</p> <p style="text-align: right;">Safe28 2012-05</p>
	<p>After taking proper precautions as shown, connect power to unit.</p> <p style="text-align: right;">Safe29 2012-05</p>
	<p>Disconnect input plug or power before working on machine.</p> <p style="text-align: right;">Safe30 2012-05</p>
	<p>Do not use one handle to lift or support unit.</p> <p style="text-align: right;">Safe31 2017-04</p>
	<p>Do not discard product (where applicable) with general waste. Reuse or recycle Waste Electrical and Electronic Equipment (WEEE) by disposing at a designated collection facility. Contact your local recycling office or your local distributor for further information.</p> <p style="text-align: right;">Safe37 2017-04</p>
	<p>Wear hat and safety glasses. Use ear protection and button shirt collar. Use welding helmet with correct shade of filter. Wear complete body protection.</p> <p style="text-align: right;">Safe38 2012-05</p>
	<p>Become trained and read the instructions before working on the machine or welding.</p> <p style="text-align: right;">Safe40 2012-05</p>



### 3-2. Miscellaneous Symbols And Definitions

<b>A</b>	Amperage
	Panel-Local
	Gas Tungsten Arc Welding (GTAW)
	Shielded Metal Arc Welding (SMAW)
<b>V</b>	Volts
	Voltage Input
	3 Phase Static Frequency Converter-Transformer-Rectifier
	Voltage Output
	Circuit Breaker
	Remote
	Lift-Arc Start (GTAW)
	Protective Earth (Ground)
	Postflow Timer
	Prewflow Timer
<b>S</b>	Seconds
<b>I</b>	On
<b>O</b>	Off
<b>+</b>	Positive
<b>-</b>	Negative

	Alternating Current
	Gas Input
	Gas Output
<b>I<sub>2</sub></b>	Rated Welding Current
<b>X</b>	Duty Cycle
	Direct Current
	Line Connection
<b>U<sub>2</sub></b>	Conventional Load Voltage
<b>U<sub>1</sub></b>	Primary Voltage
<b>IP</b>	Degree Of Protection
<b>I<sub>1max</sub></b>	Rated Maximum Supply Current
<b>I<sub>1eff</sub></b>	Maximum Effective Supply Current
<b>U<sub>0</sub></b>	Rated No Load Voltage (OCV)
	Pulse Background Amperage
	Initial Amperage
	Increase/Decrease Of Quantity
	Normal Trigger Operation (GTAW)
	Two-Step Trigger Operation (GTAW)
	Four-Step Trigger Operation (GTAW)
<b>%</b>	Percent

<b>Hz</b>	Hertz
	Recall From Memory
	Arc Force (DIG)
	HF Impulse Starting (GTAW)
	Final Slope
	Final Amperage
	Pulse Percent On Time
	Initial Slope
	Contactor Control (Stick)
	Pulsar On-Off
	TIG Weld Amps And Peak Amps While Pulsing
	Pulse Frequency
	Background Amps
	Process
	Pulsar
	Sequence
	Output
	Adjust
	Suitable For Areas Of Increased Shock Hazard



## SECTION 4 – SPECIFICATIONS

### 4-1. Serial Number And Rating Label Location

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

### 4-2. Software Licensing Agreement

The End User License Agreement and any third-party notices and terms and conditions pertaining to third-party software can be found at <https://www.millerwelds.com/eula> and are incorporated by reference herein.

### 4-3. Information About Default Weld Parameters And Settings

**NOTICE** – Each welding application is unique. Although certain Miller Electric products are designed to determine and default to certain typical welding parameters and settings based upon specific and relatively limited application variables input by the end user, such default settings are for reference purposes only; and final weld results can be affected by other variables and application-specific circumstances. The appropriateness of all parameters and settings should be evaluated and modified by the end user as necessary based upon application-specific requirements. The end user is solely responsible for selection and coordination of appropriate equipment, adoption or adjustment of default weld parameters and settings, and ultimate quality and durability of all resultant welds. Miller Electric expressly disclaims any and all implied warranties including any implied warranty of fitness for a particular purpose.

### 4-4. Specifications

☞ Do not use information in unit specifications table to determine electrical service requirements. See Sections 5-5, 5-6 and 5-7 for information on connecting input power.

☞ This equipment will deliver rated output at an ambient air temperature up to 104 °F ( 40 °C).

Welding Amperage Range	Max Open Circuit Voltage (Uo)	Low Open-Circuit Voltage (Uo)	Rated Peak Striking Voltage (Up)	IP Rating
1-210*	80	8-15***	15KV**	23

\*Welding range for Stick process is 5-210 amperes. For TIG, the amperage range is tungsten diameter dependent (see Section 6-3).

\*\* Arc starting device is designed for manual guided operations.

\*\*\* Low open-circuit voltage while in TIG Lift Arc™, or while in Stick with low open-circuit voltage selected.

Process	Output Ratings			Phase	Current Draw (A) At Rated Input Voltage (V)				Input Power	
	Current (A)	Voltage (V)	Duty Cycle		208V	240V	400V	480V	kW	kVA
STICK	210	28.4	30%	1	36	30	18	15	7.3	7.4
				3	21	18	10	9	7.1	7.4
	160	26.4	60%	1	26	22	13	11	5.3	5.3
				3	15	13	8	6	5.2	5.5
	125	25	100%	1	19	16	10	8	3.9	4.0
				3	11	10	6	5	3.9	4.1
TIG	210	18.4	60%	1	24	20	12	10	4.9	4.9
				3	14	12	7	6	4.9	5.2
	175	17	100%	1	19	17	10	8	4.0	4.0
				3	12	10	6	5	4.0	4.2



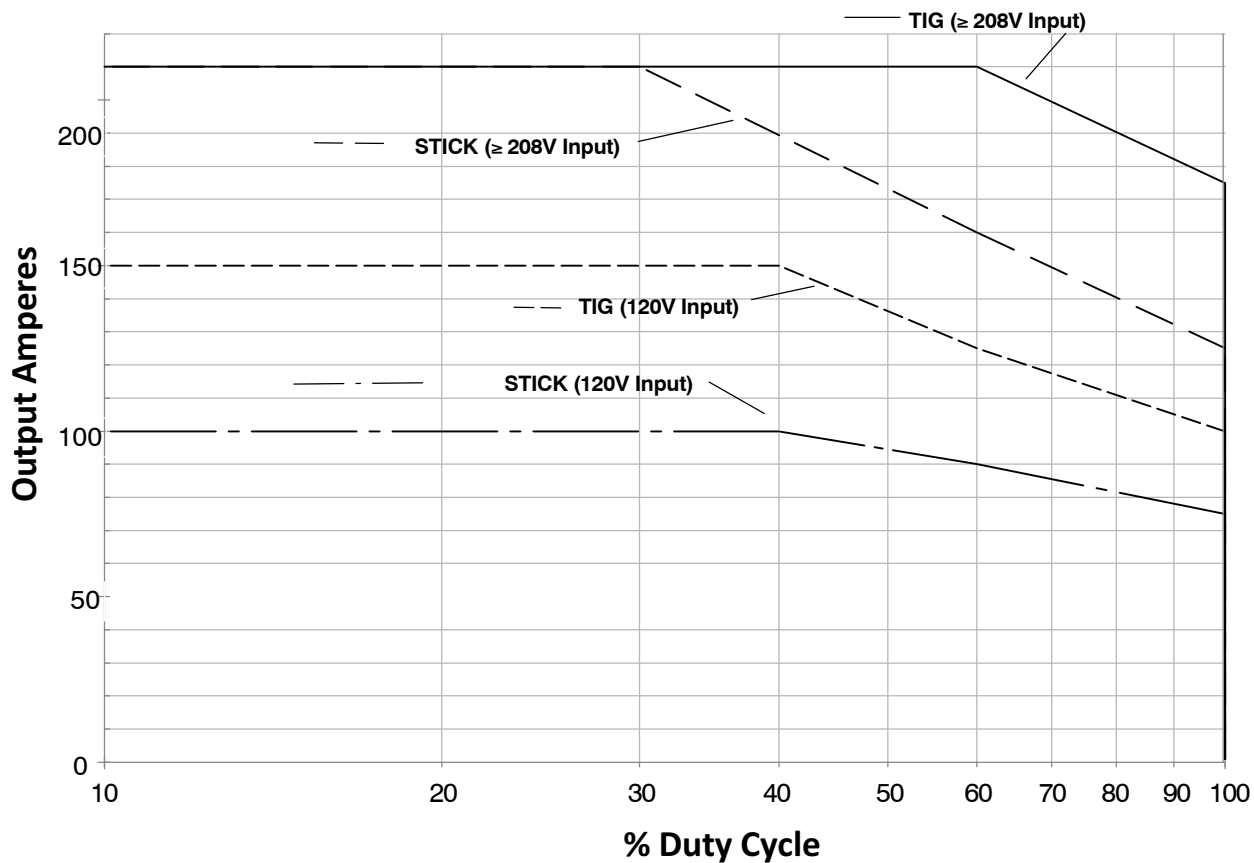
## 4-5. Duty Cycle And Overheating



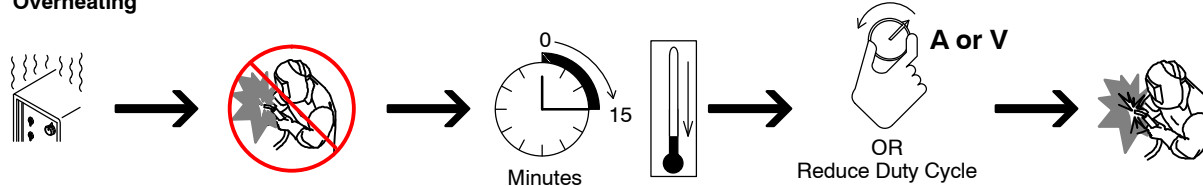
Duty Cycle is percentage of 10 minutes that unit can weld at rated load without overheating.

If unit overheats, output stops, a Help message is displayed (see Section 8-3), and cooling fan runs. Wait fifteen minutes for unit to cool. Reduce amperage or voltage, or duty cycle before welding.

**NOTICE** – Exceeding duty cycle can damage machine or torch and void warranty.



### Overheating



## 4-6. Static Characteristics

The static (output) characteristics of the welding power source can be described as *drooping* during the SMAW and GTAW processes. Static characteristics are also affected by control settings (including software), electrode, shielding gas, weldment material, and other factors. Contact the factory for specific information on the static characteristics of the welding power source.

## 4-7. Environmental Specifications

### A. IP Rating


IP Rating
IP23
This equipment is designed for outdoor use.
IP23 2017-02

### B. Temperature Specifications

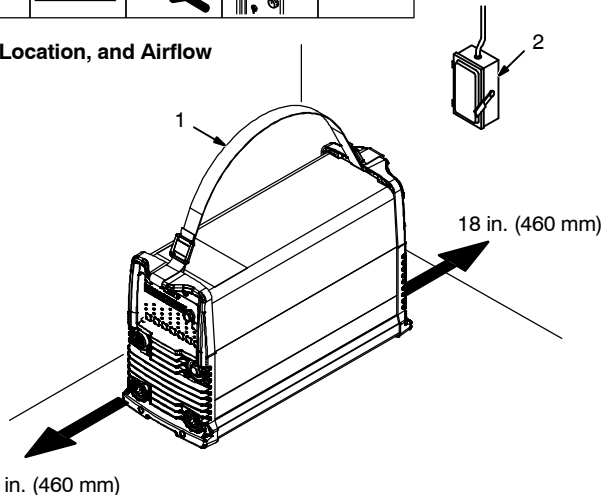
Operating Temperature Range*	Storage Temperature Range
14 to 104°F (-10 to 40°C)	-4 to 131°F (-20 to 55°C)
*Output is derated at temperatures above 104°F (40°C).	Temp_2016-07

# SECTION 5 – INSTALLATION

## 5-1. Selecting a Location




**Movement, Location, and Airflow**



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

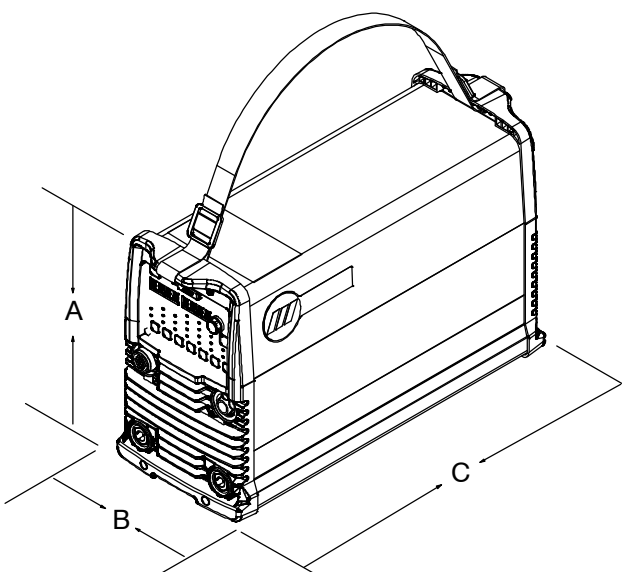
- 1. Carry Strap**  
Use strap to carry power source only. Do not use to lift power source when attached to cart/cooler.
- 2. Line Disconnect Device**  
Locate unit near correct input power supply.

**⚠ Do not move or operate unit where it could tip.**



805497-A / 805503-B loc\_dynasty 2018-08

## 5-2. Dimensions, Weights, And Mounting Options

 <p>Ref. 805497-A</p>	<b>Dimensions</b>	
	A	13-5/8 in. (346 mm)
	B	8-5/8 in. (219 mm)
	C	19-1/2 in. (495 mm)
	<b>Weight</b>	
38 lb (17.2 Kg)		

## 5-3. Selecting Cable Sizes\*

**NOTICE** – The Total Cable Length in Weld Circuit (see table below) is the combined length of both weld cables. For example, if the power source is 100 ft (30 m) from the workpiece, the total cable length in the weld circuit is 200 ft (2 cables x 100 ft). Use the 200 ft (60 m) column to determine cable size.

Welding Amperes***	Weld Cable Size** and Total Cable (Copper) Length in Weld Circuit Not Exceeding			
	100 ft (30 m) or Less****		150 ft (45 m)	200 ft (60 m)
	10 – 60% Duty Cycle AWG (mm <sup>2</sup> )	60 – 100% Duty Cycle AWG (mm <sup>2</sup> )	10 – 100% Duty Cycle AWG (mm <sup>2</sup> )	
100	4 (20)	4 (20)	4 (20)	3 (30)
150	3 (30)	3 (30)	2 (35)	1 (50)
200	3 (30)	2 (35)	1 (50)	1/0 (60)
250	2 (35)	1 (50)	1/0 (60)	2/0 (70)

\* This chart is a general guideline and may not suit all applications. If cable overheats, use next size larger cable.

\*\*Weld cable size (AWG) is based on either a 4 volts or less drop or a current density of at least 300 circular mils per ampere.  
( ) = mm<sup>2</sup> for metric use

\*\*\* Select weld cable size for pulsing application at peak amperage value.

\*\*\*\*For distances longer than 100 ft (30 m) and up to 200 ft (60 m), use direct current (DC) output only. For distances longer than those shown in this guide, see AWS Fact Sheet No. 39, Welding Cables, available from the American Welding Society at <http://www.aws.org>.

Ref. S-0007-M 2017-08 (TIG)



## 5-5. Electrical Service Guide

### A. Electrical Service Guide For Three-Phase Operation

**⚠** 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.

*☞ Actual input voltage should not fall below 108 volts AC or rise above 528 volts AC. If actual input voltage is outside this range, unit may not operate according to specifications.*

Input Voltage (V)	Three-Phase			
	208	240	400	480
Rated Maximum Supply Current $I_{1max}$ (A)	20.5	17.7	10.4	8.7
Maximum Effective Supply Current $I_{1eff}$ (A)	11	10	6	5
Max Recommended Standard Fuse Rating In Amperes <sup>1</sup>				
Time Delay Fuses <sup>2</sup>	25	20	10	10
Normal Operating Fuses <sup>3</sup>	30	25	15	15
Min Input Conductor Size In AWG <sup>4</sup>	14	14	14	14
Max Recommended Input Conductor Length In Feet (Meters)	58 (18)	78 (24)	221 (67)	319 (97)
Min Grounding Conductor Size In AWG <sup>4</sup>	14	14	14	14

Reference: 2017 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) and is based on allowable ampacities of insulated copper conductors having a temperature rating of 167°F (75°C) with not more than three single current-carrying conductors in a raceway. 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.

### B. Electrical Service Guide For Single-Phase Operation (Maxstar)

**⚠** 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.

*☞ Actual input voltage should not fall below 108 volts AC or rise above 528 volts AC. If actual input voltage is outside this range, unit may not operate according to specifications.*

Input Voltage (V)	Single-Phase				
	120	208	240	400	480
Rated Maximum Supply Current $I_{1max}$ (A)	27.4	35.8	29.9	17.6	14.6
Maximum Effective Supply Current $I_{1eff}$ (A)	17.3	20	17	10	8
Max Recommended Standard Fuse Rating In Amperes <sup>1</sup>					
Time Delay Fuses <sup>2</sup>	30	40	35	20	15
Normal Operating Fuses <sup>3</sup>	40	50	45	25	20
Min Input Conductor Size In AWG <sup>4</sup>	12	12	12	14	14
Max Recommended Input Conductor Length In Feet (Meters)	33 (10)	44 (13)	60 (18)	111 (34)	160 (49)
Min Grounding Conductor Size In AWG <sup>4</sup>	12	12	12	14	14

Reference: 2017 National Electrical Code (NEC) (including article 630)

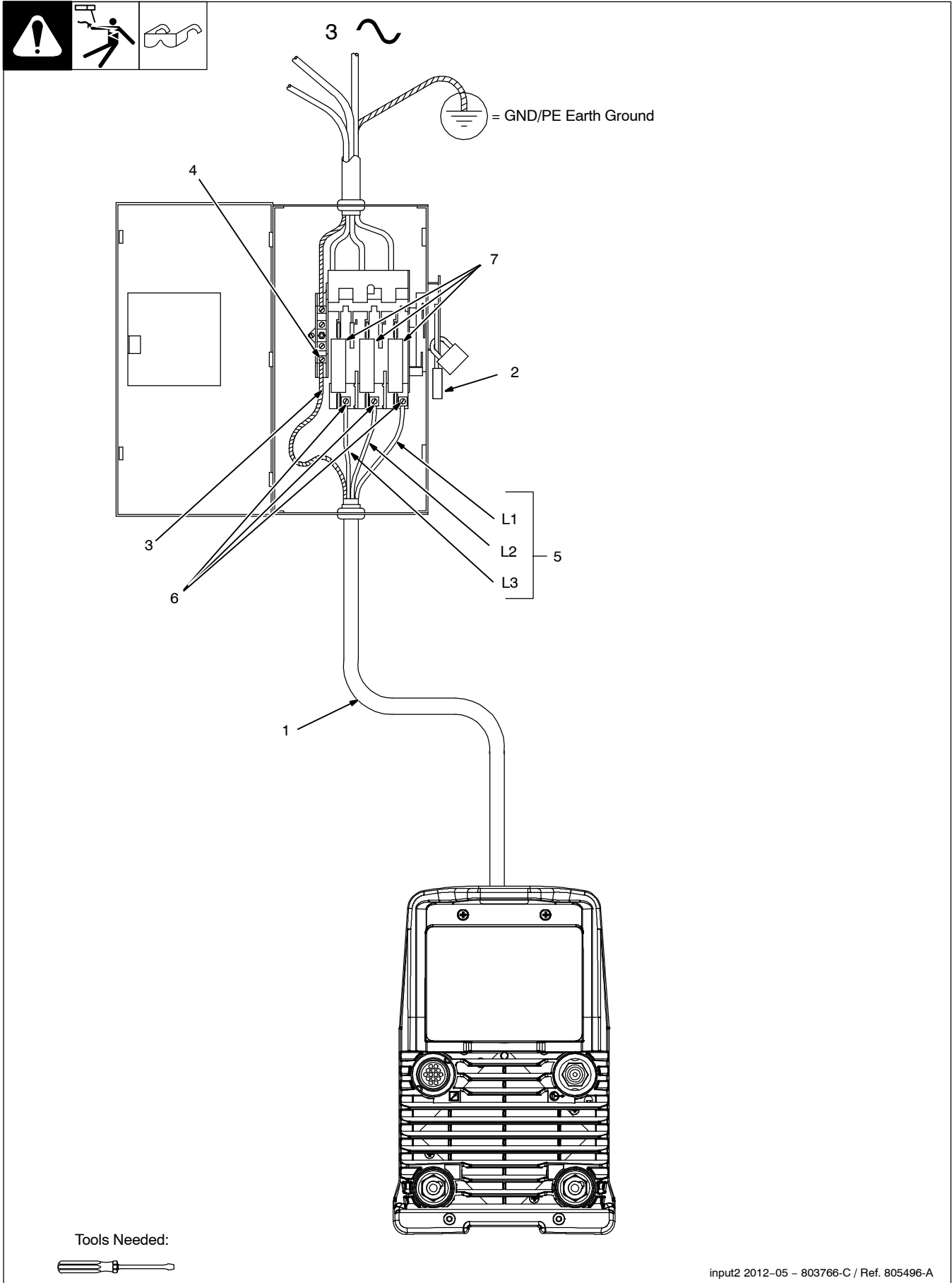
1 If a circuit breaker is used in place of a fuse, choose a circuit breaker with time-current curves comparable to the recommended fuse.

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) and is based on allowable ampacities of insulated copper conductors having a temperature rating of 167°F (75°C) with not more than three single current-carrying conductors in a raceway. 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 Three-Phase Input Power

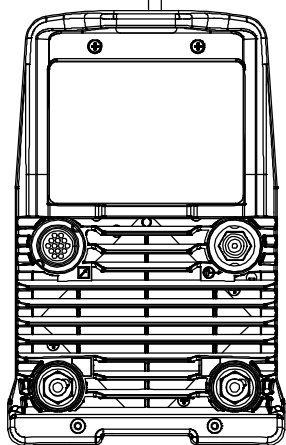
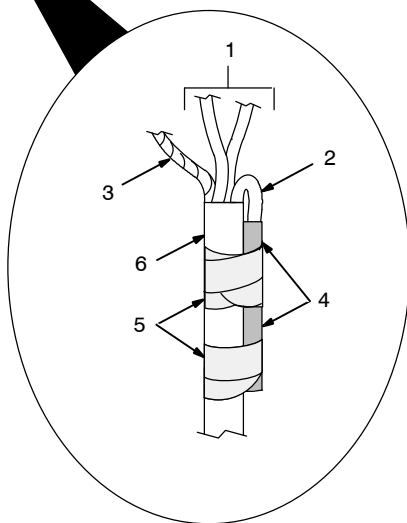
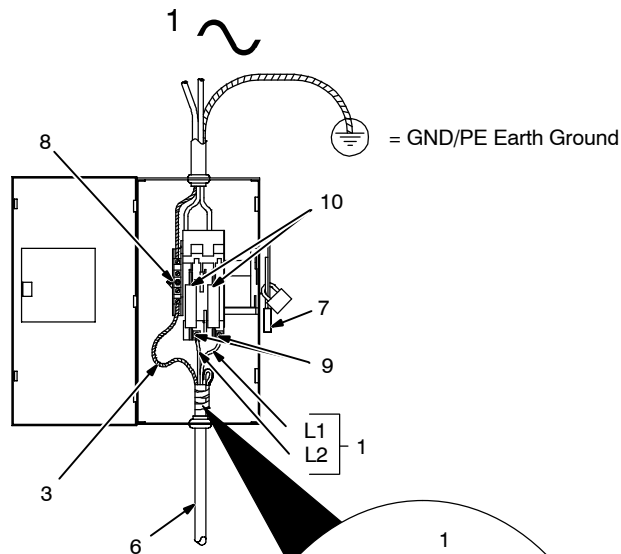


input2 2012-05 - 803766-C / Ref. 805496-A

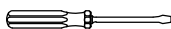




## 5-7. Connecting Single-Phase Input Power



Tools Needed:



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

**⚠** Disconnect and lockout/tagout input power before connecting input conductors from unit. Follow established procedures regarding the installation and removal of lockout/tagout devices.

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

**NOTICE** – The Auto-Line circuitry in this unit automatically adapts the power source to the primary voltage being applied. Check input voltage available at site. This unit can be connected to any input power between 120–480 VAC without removing cover to relink the power source.

See rating label on unit and check input voltage available at site.

1. Black And White Input Conductor (L1 And L2)
2. Red Input Conductor
3. Green Or Green/Yellow Grounding Conductor
4. Insulation Sleeving
5. Electrical Tape

Insulate and isolate red conductor as shown.

6. Input Power Cord.
7. Disconnect Device (switch shown in the OFF position)
8. Disconnect Device Grounding Terminal
9. Disconnect Device Line Terminals

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

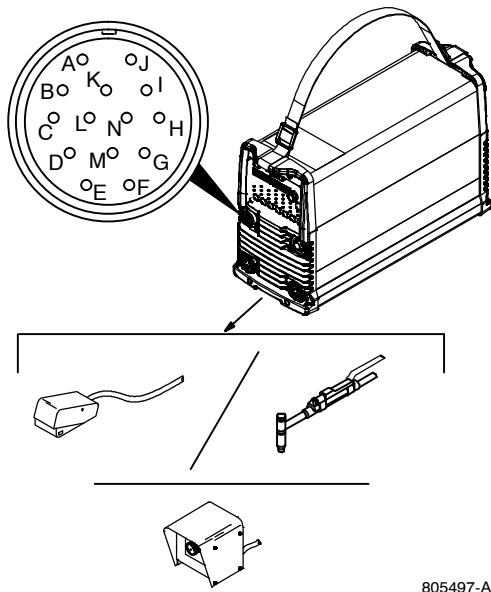


Connect input conductors L1 and L2 to disconnect device line terminals.

10. Overcurrent Protection


Select type and size of overcurrent protection using Section 5-5 (fused disconnect switch shown).

Close and secure door on disconnect device. Follow established lockout/tagout procedures to put unit in service.

## 5-8. Remote 14 Receptacle Information

 805497-A	 <b>REMOTE 14</b>	Socket	Socket Information
	<b>15 VOLTS DC</b>  <b>OUTPUT CONTACTOR</b>		A
B			Contact closure to A completes 15 volts DC contactor control circuit and enables output.
<b>REMOTE OUTPUT CONTROL</b>		C	Output to remote control; +10 volts DC output to remote control.
		D	Remote control circuit common.
		E	0 to +10 volts DC input command signal from remote control. *Reconfigurable as input for Output Enable (Weld Stop) – used to remotely stop the weld outside the normal welding cycle. Connection to the D socket must be maintained at all times. If the connection is broken, output stops, and Auto Stop is displayed.
<b>Output Signals</b>		F	Current feedback; +1 volt DC per 100 amperes.
		H	Voltage feedback; +1 volt DC per 10 volts output.
		I*	Valid arc indication closed to socket G with valid arc. Electrical specifications: open collector transistor (see Section 5-9 for connection example).
		J*	Arc length control lockout closed to socket G during Initial and Final Amperage and Slope, and during the background time of a <=10 Hz pulse waveform. Electrical specifications: open collector transistor (see Section 5-9 for connection example).
<b>COMMON</b>		G	Return for all output signals: F, H, I, J and A.
		K	Chassis
<b>Serial Communication Bus</b>		L**	Modbus Common (RS485 Common)
		M**	Modbus D1 (RS485 B+)
		N**	Modbus D0 (RS485 A-)

Sockets G and K are electrically isolated from each other.

 If a remote hand control, like the RHC-14, is connected to the Remote 14 receptacle, some current value above min. must be set on the remote control before the Panel or Remote contactor is turned on. Failure to do so will cause current to be controlled by the panel control, and the remote hand control will not function.

\*Available with optional Automation Expansion memory card.

\*\*Available with optional Modbus Expansion memory card. Modbus serial communication provides access to all front panel parameters and machine functionality. See Owner's Manual 265415 for a list of Modbus registers. Modbus expansion also includes functionality of Automation, Hot Wire and Hot Start Adjust Expansions.

## Notes

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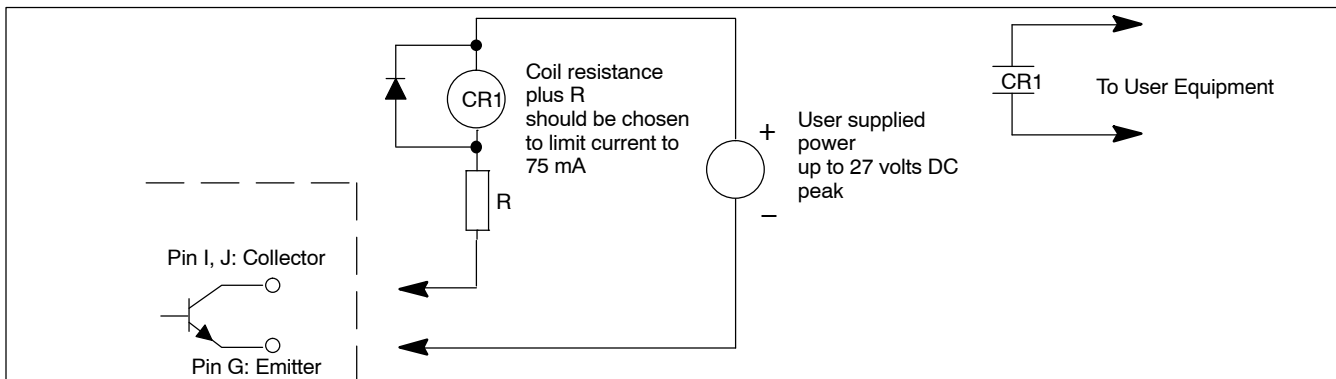
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## 5-9. Simple Automation Application



## 5-10. Software Updates

### A. Reasons For Downloads Of Software Updates

- To get the latest feature and software improvements with future software updates.
- For all circuit board replacements, a software update is required to ensure proper unit operation.
- A software update is required to ensure proper software expansion operation of all purchased feature expansions.

### B. Requirements

A computer with an SD memory card port, or SD memory card reader is required to download software updates.

8 GB max SD memory card.

The SD logo is a registered trademark of SD-3C LLC.

## Notes

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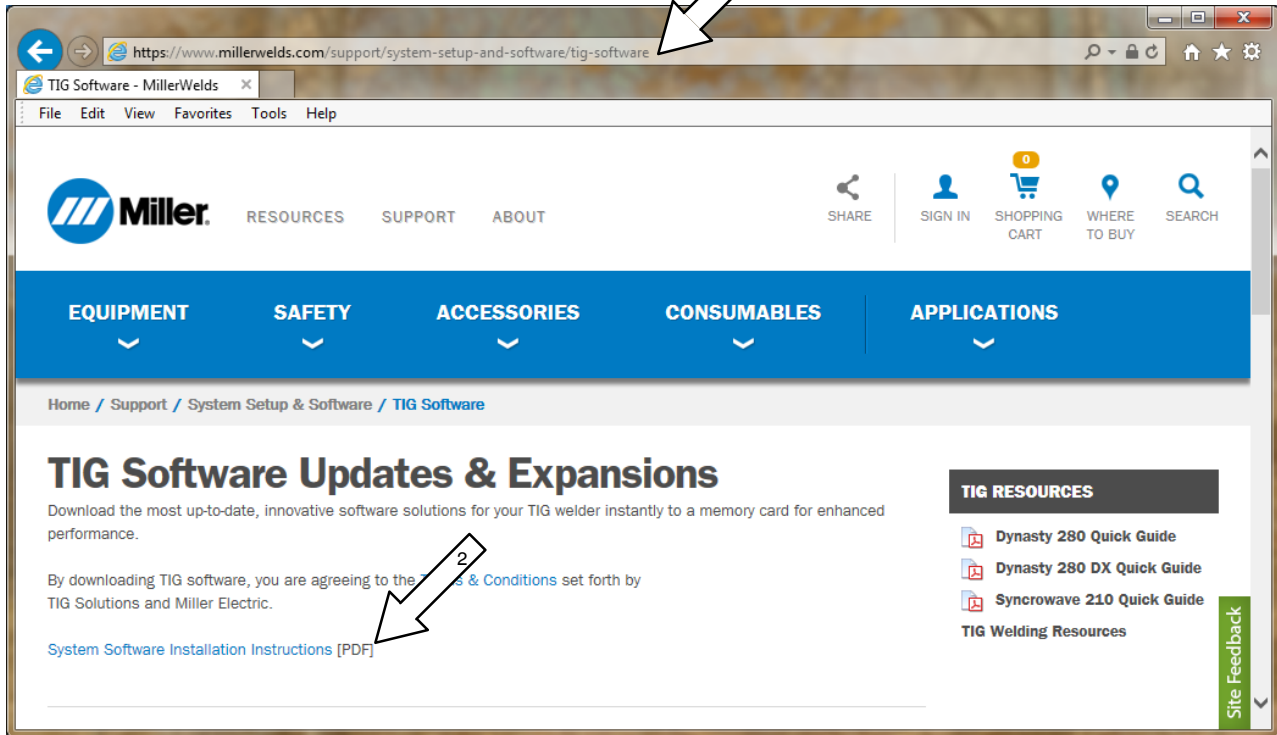


**Work like a Pro!**

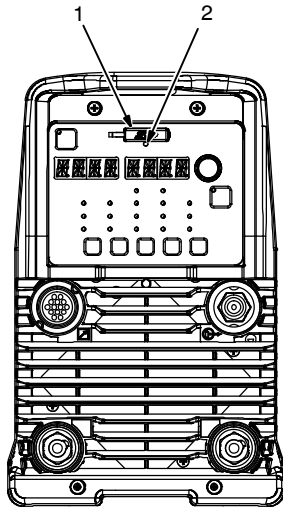
**Pros weld and cut safely. Read the safety rules at the beginning of this manual.**

### C. How To Download Software Updates

1. On your web browser, go to <http://www.millerwelds.com/support/system-setup-and-software/tig-software>.
2. Select System Installation Instructions (PDF) and follow the instructions.



### D. Software Installation



Software updates may reset machine back to default values.

Card Requirements:

8 GB max memory card required.

1. Memory Card Port
2. Indicator LED

Insert card containing new software into port while machine is on, (but not while welding). Inserting card while welding will interrupt the welding process.

LED indicator blinks green when machine is reading from or writing to the card, and the meter displays go blank. The update time may vary

up to three minutes. **Do Not** remove card while LED is blinking green.

After successfully reading from or writing to the card, the LED switches from blinking to continuous green, and the meters illuminate. The machine is now ready for use.

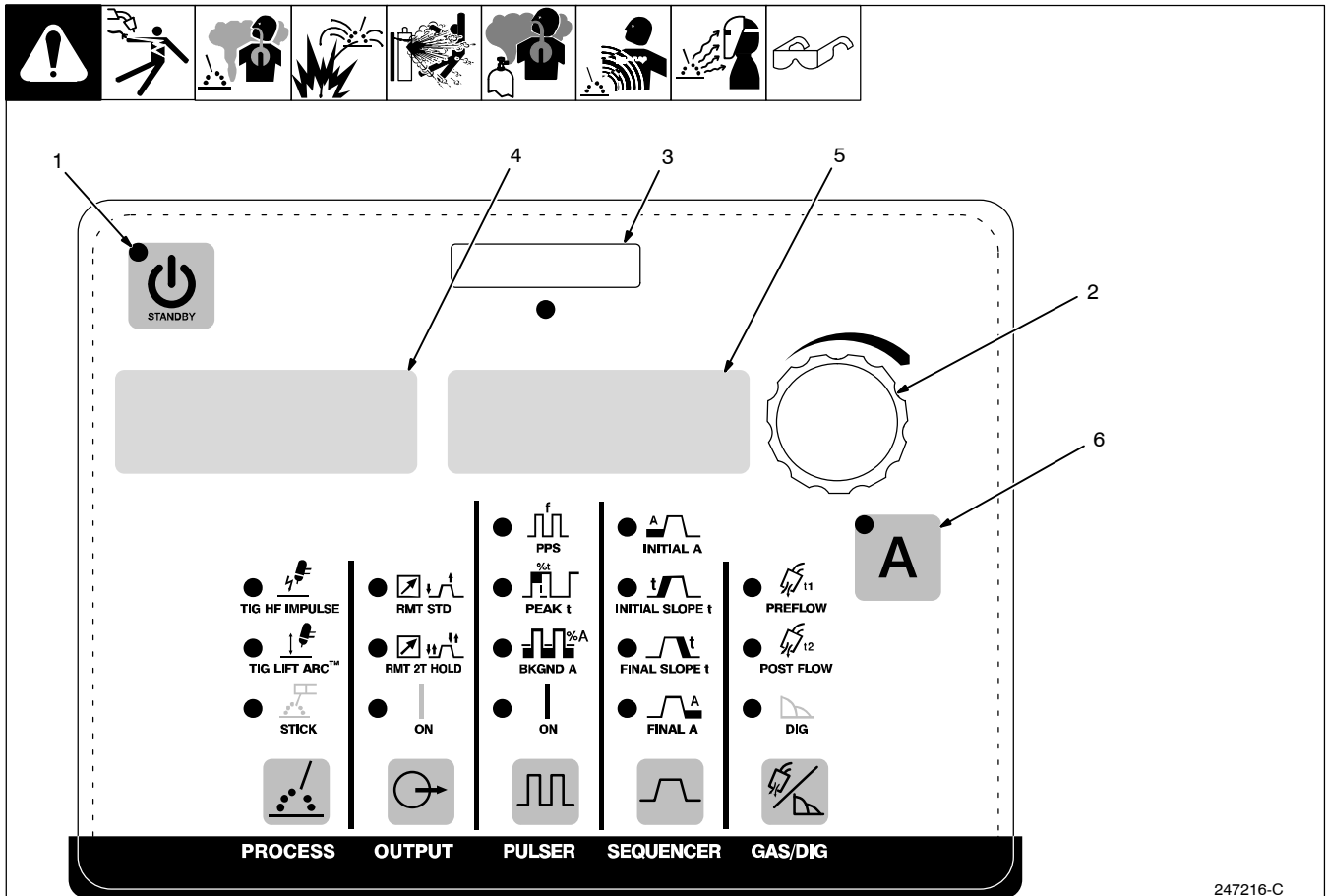
#### Troubleshooting:

Indicator LED is blinking red: Error updating software, or software is not compatible. Try removing and inserting card.

Indicator LED is continuous red: Cannot read card. Card might be bad.

## SECTION 6 – MAXSTAR 210 DX OPERATION

### 6-1. Maxstar 210 DX Controls



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For all front panel switch pad controls: press switch pad to turn on light and enable function.

Green on nameplate indicates a TIG function, Gray indicates a Stick function.

#### 1. Standby Button

Use to turn machine on and off for daily operation.

#### 2. Encoder Control

Use encoder control in conjunction with applicable front panel function switch pads to change values for that function.

#### 3. Memory Card Port And Indicator

This port is used to add features to the machine and update software to the boards within the machine. Indicator is lit while card is being accessed.

#### 4. Volt Meter

Displays actual voltage when voltage is present at the weld output terminals. It is also used to display parameter descriptions while in the menu.

#### 5. Ammeter

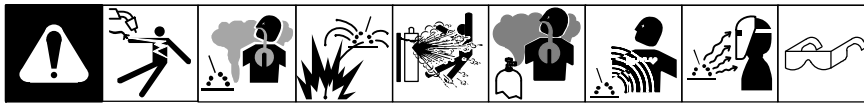
Displays actual amperage while welding and preset amperage while idle. It is also used to display parameter selection options while in the menu.

#### 6. Amperage Control

Use this control in conjunction with the encoder to set the weld amperage or peak amperage if the Pulser is active.



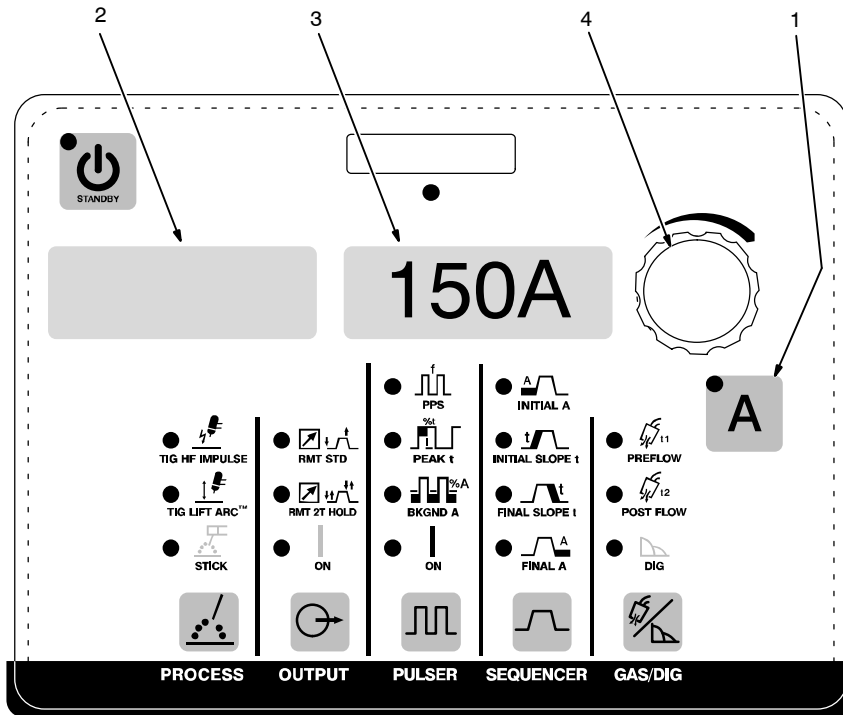
## 6-2. Accessing Control Panel Menu



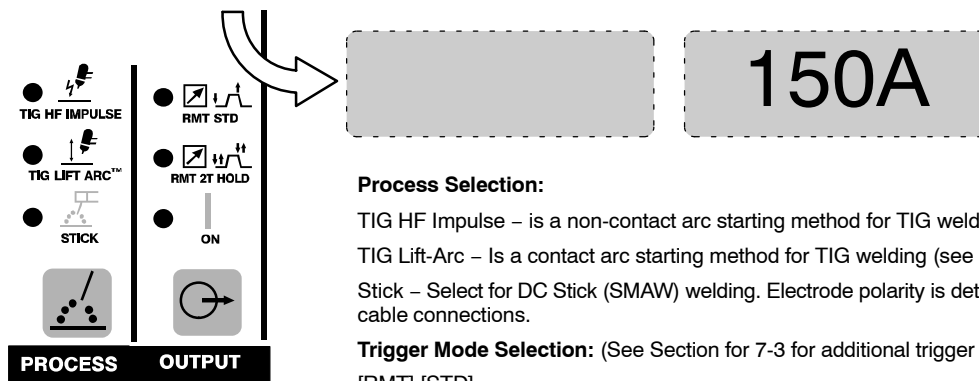
1. Amperage Button
2. Parameter Display
3. Setting Display
4. Encoder

Rotate Encoder to adjust parameter setting.

The Amperage Control controls the welding amperage output, and limits the maximum output of a remote amperage device.



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### Process Selection:

TIG HF Impulse – is a non-contact arc starting method for TIG welding (see Section 12-1).

TIG Lift-Arc – Is a contact arc starting method for TIG welding (see Section 12-1).

Stick – Select for DC Stick (SMAW) welding. Electrode polarity is determined by the welding cable connections.

**Trigger Mode Selection:** (See Section for 7-3 for additional trigger function options).

[RMT] [STD]

Typical setting for a remote foot or hand control. RMT STD requires a maintained contact closure to enable weld output. Amperage can be controlled with a remote potentiometer, or it can be set at the control panel.

[RMT] 2T [HOLD] (TIG Only)

Remote control required. Allows the operator to weld without holding the trigger closed. To start the weld, operator presses and releases trigger. To stop the weld, the operator again presses and releases the trigger. In this mode, only the output contactor is controlled by the remote control. Amperage must be set on the control panel. (see Section 7-3).


[OUT] [ON]

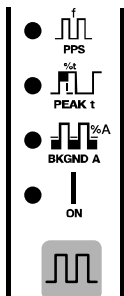
Output on. (Stick and TIG Lift Only)

**⚠ Weld output terminals are energized at all times when displays read [OUT] [ON].**

No remote control or trigger required. Amperage can be controlled at the control panel or with a remote potentiometer. Blue output on LED illuminates to indicate output is on.



 \*PRO-SET provides PROfessionally developed SETtings for the weld process. PRO-SET flashes one time and reveals the professional setting for the parameter.



**PULSER**

PPS	100
PK T	40%
BK A	25%

### Pulse Control

Pulsing is available while in the TIG process. Controls can be adjusted while welding.


Reduces heat input to minimize distortion and increase travel speed. Range is 01. to 500 (pulses per second).

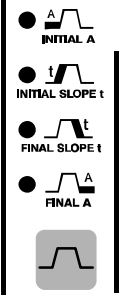
Press switch pad to enable pulser.

[PPS]\* Pulses Per Second: Range is 0.1 to 500.

[PK T]\* Peak Amperage Time: Range is 5 to 95%.

[BK A]\* Background Amperage Time: Range is 5 to 95% of peak amperage value.

 See Section 12-2 for additional Pulser information, or visit <http://www.millerwelds.com/resources/welding-resources/>



**SEQUENCER**

INTL	20A
ISLP	OFF
FSLP	OFF
FNL	10A

### Sequencer Control

The welding output can be programmed to specific amperages and durations for repetitive applications. Sequencer is only available in the TIG process. Sequencer is disabled if a remote control with variable amperage is connected to the machine.

[INTL] Initial Amperage: Range is min to 210 amps.

[ISLP] Initial Slope Time: Range is OFF to 25T (seconds).

[FSLP] Final Slope Time: Range is OFF to 25T (seconds).

[FNL] Final Amperage: Range is min to 210 amps.

(See Sections 7-1 and 7-2 for setting weld time.)

### Gas/DIG Control

[PRE] Preflow Time:

Controls length of time gas flows prior to arc start. Range is OFF to 50T (seconds).

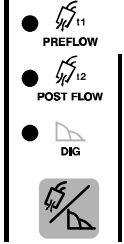
[POST] Post Flow Time:

Increasing setting increases length of time gas flows after welding stops. Range is OFF to 50T (seconds). AUTO calculates the time based on the maximum amperage of each welding cycle. The minimum time is eight seconds. Auto equals maximum amperage divided by 10.

[DIG]\* Arc Force Control:

Controls the amount of additional amperage at low voltage (short arc length) conditions. Adjust the force of the arc for different joint configurations and electrodes. Range is OFF to 100%. PRO-Set values available for both 6010 and 7018 electrodes.

CARBon ARC Gouging can be selected at one step above DIG's 100%.



**GAS/DIG**

PRE	0.2T
POST	AUTO
DIG	30%

### 6-3. Accessing User Setup Menu

The diagram illustrates the Miller welding power source control panel. At the top, a row of icons includes a warning symbol, a person with a lightning bolt, a person with a flame, a person with a spark, a person with a flame, a person with a flame, a person with a flame, a person with a flame, and a person with a flame. Below this, the main control panel is shown. A 'STANDBY' button is located at the top left. The 'USER MENU' is displayed in the center. A hand is shown pressing the 'A' button and the 'GAS/DIG' button. A rotary encoder is also shown. A legend at the bottom lists parameters: TUNG (3/32), RMT (2T), HOTS (ON).

1. Amperage Button
2. Gas/Dig Button
3. Parameter Display
4. Setting Display
5. Encoder

To access the User functions, press and hold the Amperage (A) and the Gas/DIG controls until USER MENU is displayed. To scroll through the user menu functions, press and release the Gas/DIG control.

Rotate Encoder to adjust parameter setting.

*Parameter automatically returns to amperage setting 15 seconds after Encoder is inactive.*

To exit user menu, press and release Amperage and Gas/DIG controls at the same time, or turn power off.

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- |      |      |
|------|------|
| TUNG | 3/32 |
| RMT  | 2T   |
| HOTS | ON   |

**Tungsten Diameter Selection:**  
 Each tungsten size has preset starting parameters specific to that diameter for optimized starting. Range is 0.020–1/8 in. or 0.5–3.2 mm. To manually set starting parameters, see Section 12-3.

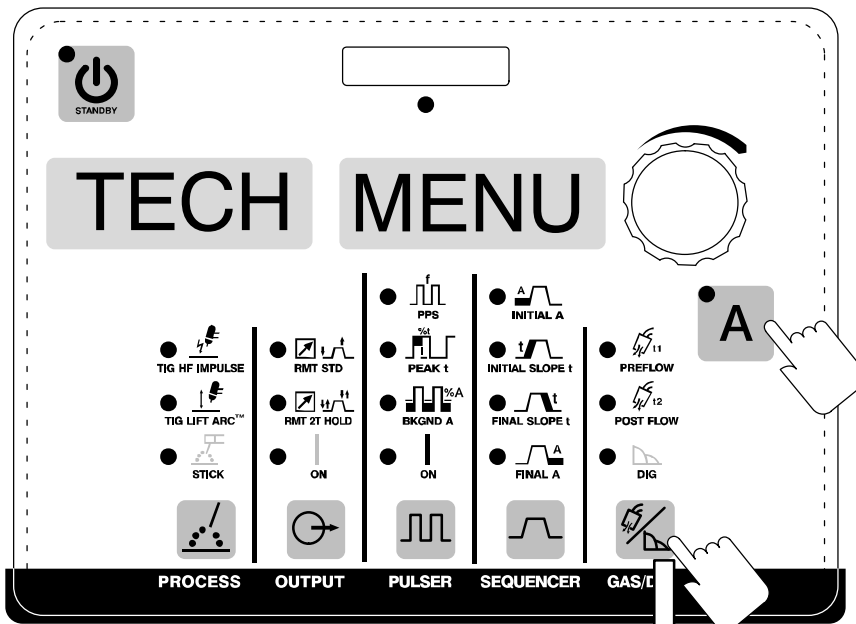
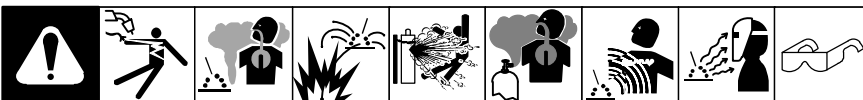
**Output Trigger Mode Functions:**  
 See Section 7-3 to reconfigure RMT functions.

**Arc Starting Mode Selection:**  
 [HOTS] [ON]  
 Provides additional amperage while striking the electrode to prevent the electrode from sticking.  
 [HOTS] [OFF]  
 No additional starting amperage to assist in starting the electrode.



## SECTION 7 – ADVANCED MENU FUNCTIONS

### 7-1. Accessing Tech Menu For Maxstar 210DX Models



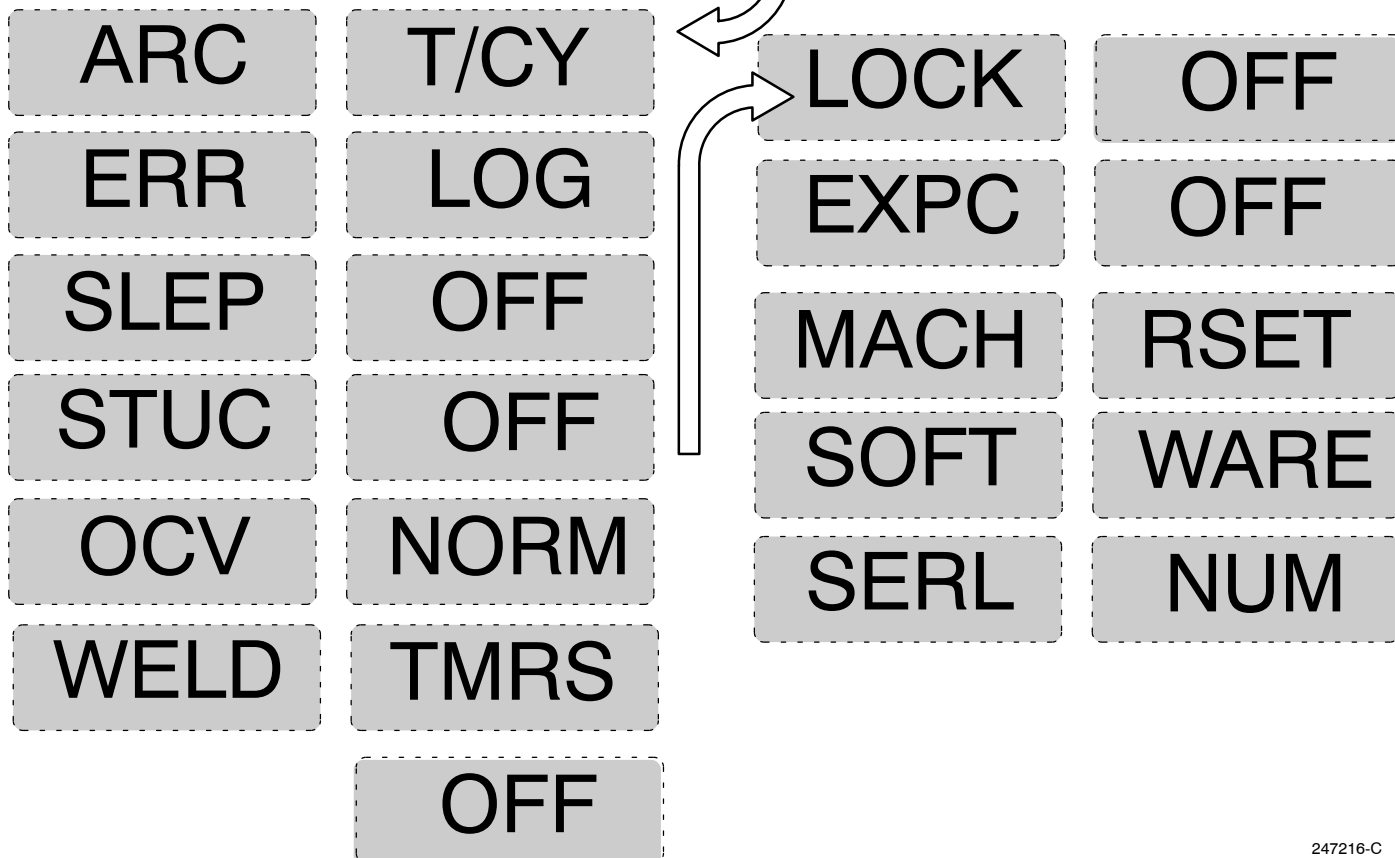
1. Amperage Button
2. Gas/Dig Button

Press and hold Amperage and Gas/Dig buttons for approximately two seconds to scroll past User Menu to Tech Menu. Use Gas/Dig button to cycle through parameters that can be set.

3. Parameter Display
4. Setting Display
5. Encoder

Rotate Encoder to adjust parameter setting.

To exit tech menu, press Amperage and Gas/DIG controls at the same time.



**[ARC] [T/CY] Arc Timer:** Monitors hours, minutes, and cycles of valid arc on. To view these different elements, rotate encoder. To reset, rotate encoder until [RESET] [YES] is displayed. Press Menu button to display [RESET] [Done]. Displays turn to [000] [000].

**[ERR] [LOG] Error Log:** Use to view last eight logged error events. Each event may list multiple Error Codes. See Section 8-4.

**[SLEP] Sleep Timer:** Turns power off after the machine exceeds the programmed idle time without operation. Press the Standby button to turn power on. To set or change time, rotate encoder to desired time. Timer range: 1, 5, 10, 20, 30, 45 minutes or one hour.

**[STUC] Stick Stuck:** Detects if the electrode is stuck or shorted to the workpiece. Turns weld output off to aid in freeing the electrode. To turn on, rotate encoder. Not recommended for air carbon arc or large diameter electrodes.

**[OCV] Open Circuit Voltage:** Allows user to select between Normal (NORM) and Low open circuit voltage. Low reduces open circuit voltage to between 8 and 12 volts. To select, turn encoder.

**[WELD] [TMRS] Weld Timers:** [ON] enable and [OFF] disable the feature. See Section 7-2 for information on setting weld timers. Weld Timers work with or without Sequencer feature.

**[LOCK]:** Limits user control and adjustability of machine. See Section 7-4 For instructions and operation.

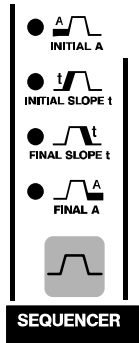
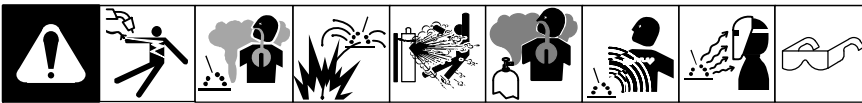
**[EXPC] External Pulse Control Commands:** Turn on when it is desired to control machine from an external source. When command is on, a command voltage of 0– 10 volts DC equals off – 210 amps.

**[MACH] [RESET] Machine Reset::** Resets all machine values back to factory defaults. To reset, turn encoder to [RESET] [YES]. Then press Amperage button. [RESET] [DONE] will be displayed when the reset is complete and factory defaults have been restored.

**[SOFT] [WARE] Software Number:** Software number and revision will be displayed.

**[SERL] [NUM] Serial Number:** If serial number displayed does not match serial number of machine, see Section 8-4.

## 7-2. Sequencer And Weld Timer For DX Model



INTL	20A
INTL	OFF
ISLP	OFF
FSLP	OFF
FNL	10A
FNL	OFF
<b>A</b> WELD	OFF

### Sequencer Control With Weld Timers ON

This function is available while using the TIG process, but is disabled if a remote foot or fingertip control is connected while in the RMT STD mode. When active, the sequencer controls the following parameters of the weld cycle:

- Initial Amperage**  
Range is 2–210 amps AC, 1–210 amps DC
- Initial Time\***  
Range is OFF to 25.0T (seconds)
- Initial Slope Time**  
Range is OFF to 50.0T (seconds)
- Final Slope Time**  
Range is OFF to 50.0T (seconds)
- Final Amperage**  
Range is 2–210 amps AC, 1–210 amps DC
- Final Time\***  
Range is OFF to 25.0T (seconds)

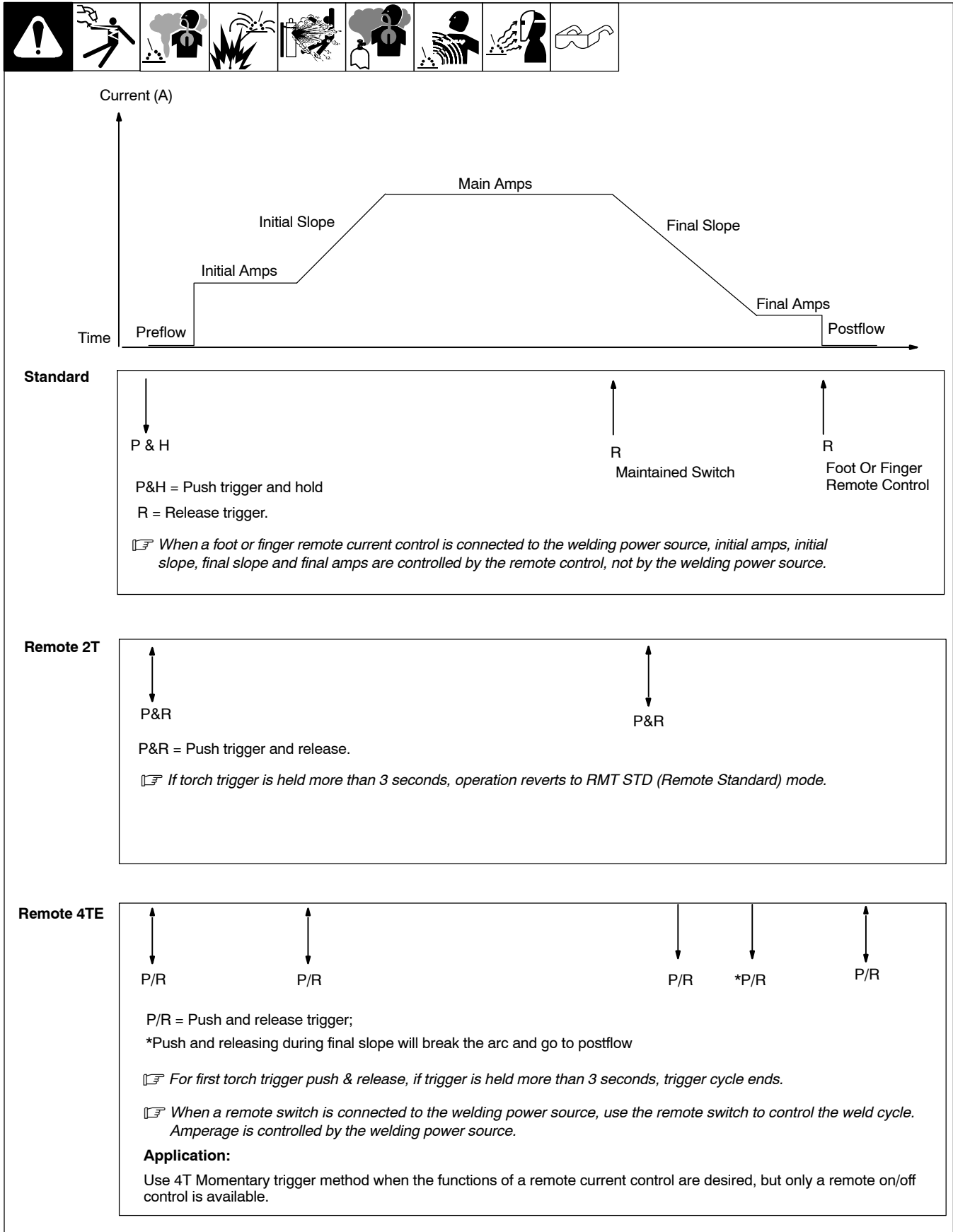
*When a remote switch is connected to the welding power source, use the remote switch to control the weld cycle. Amperage is controlled by the welding power source.*

\*enabled features with weld timer On (see Section 7-1).

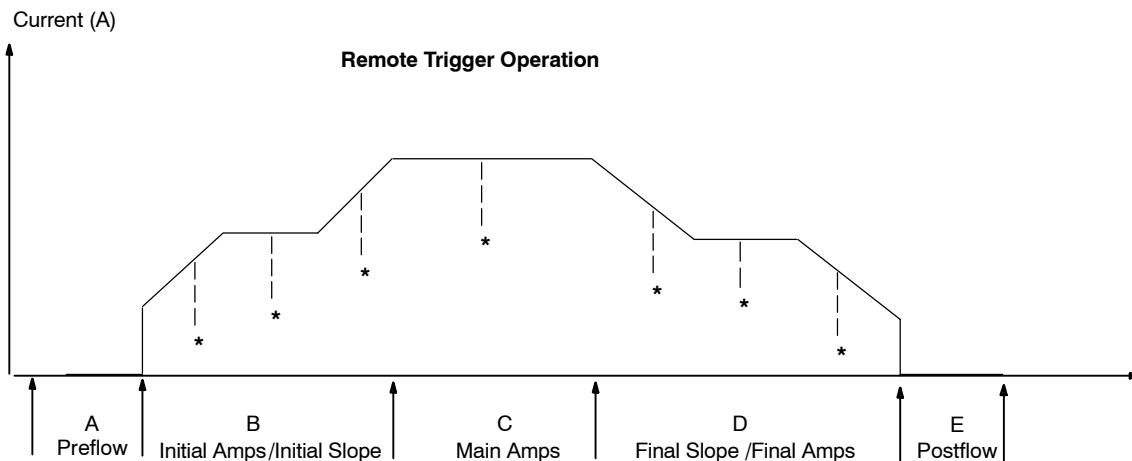
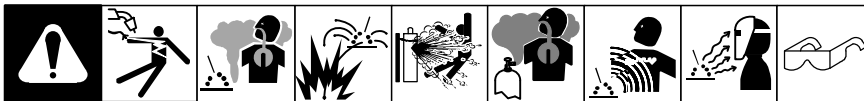
**Weld Timer**  
With Weld Timer enabled, press Amperage (A) button, and turn encoder to set weld time. Range is Off or 0.1–99.9 and 100–999 (sec) (see Section 7-1).

### 7-3. Output Control And Trigger Functions For DX Models

#### A. Remote (Standard), 2T, And 4TE Torch Trigger Operation



## B. 3T Specific Trigger Method



\* Arc can be extinguished at any time by pressing and releasing both initial and final switches, or by lifting the torch and breaking the arc.

### 1. 3T (Specific Trigger Operation)

Sequencer is required to reconfigure for 3T. **3T requires a specific type of remote control with two independent momentary-contact switches.** One will be designated initial switch, and it must be connected between Remote 14 receptacle pins A and B. The second will be designated as the final switch, and it must be connected between Remote 14 receptacle pins D and E.

2. Encoder Control  
To select 3T, turn Encoder control.

#### Definitions:

**Initial slope rate** is the rate of amperage change determined by the initial amperage, initial slope time, and main amperage.

**Final slope rate** is the rate of amperage change determined by the main amperage, final slope time, and final amperage.

#### Operation:

**A.** Press and release initial switch within 3/4 second to start shielding gas flow. To stop the preflow sequence before preflow time elapses (25 seconds), press and release final switch. The preflow timer will reset and the weld sequence can be started again.

*If an initial switch closure is not made again before preflow time ends, gas flow stops, the timer resets, and an initial switch press and release is necessary to start the weld sequence again.*

**B.** Press initial switch to start arc at initial amps. Holding switch will change amperage at initial slope rate (release switch to weld at desired amperage level).

**C.** When main amperage level is reached, initial switch can be released.

**D.** Press and hold the final switch to decrease amperage at final slope rate (release switch to weld at desired amperage level).

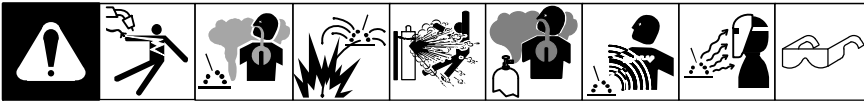
**E.** When final amperage has been reached, the arc extinguishes and shielding gas flows for the time set on the Postflow control.

#### Application:

With the use of two remote switches instead of potentiometers, 3T gives the operator the ability to infinitely increase, decrease, or pause and hold amperage within the range determined by the initial, main, and final amperages.



### C. 4T, 4Tm And 4TL Specific Trigger Method



#### 4T and 4Tm Application:

Use 4T and 4Tm (modified) trigger methods when the functions of a remote current control are desired, but only a remote on/off control is available.

4T\* allows the operator to toggle between weld current and final current.

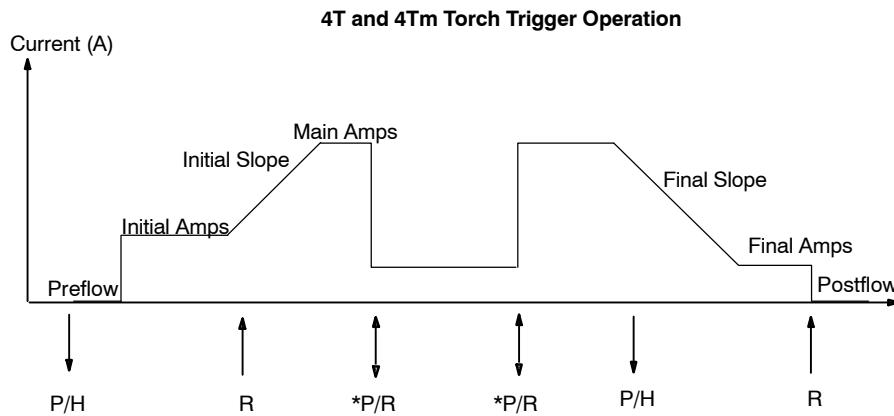
When a remote switch is connected to the welding power source, use the remote switch to control the weld cycle. Amperage is controlled by the welding power source.

#### 4TL Application:

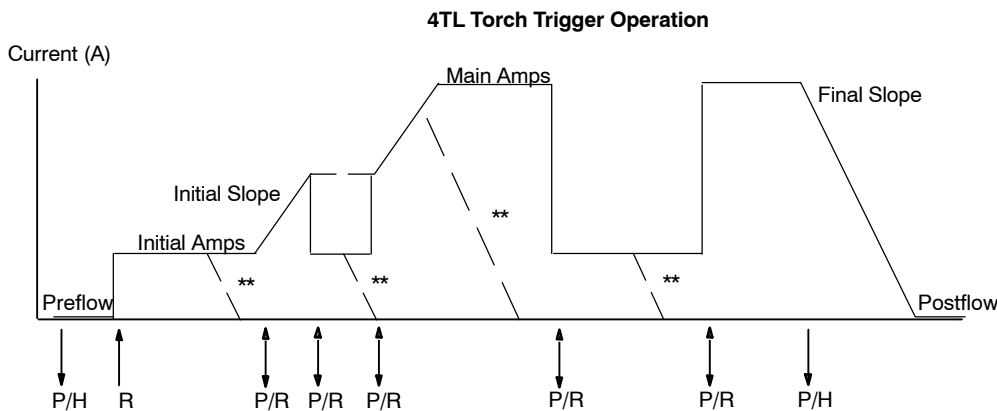
The ability to change current levels without either initial slope or final slope, gives the operator the opportunity to adjust filler metal without breaking the arc.

4TL (mini logic) allows the operator to toggle between initial slope or main amps and initial amps. Final Amperage is not available. Final slope always slopes to minimum amperage and ends the cycle.

When a remote switch is connected to the welding power source, use the remote switch to control the weld cycle. Amperage is controlled by the welding power source.

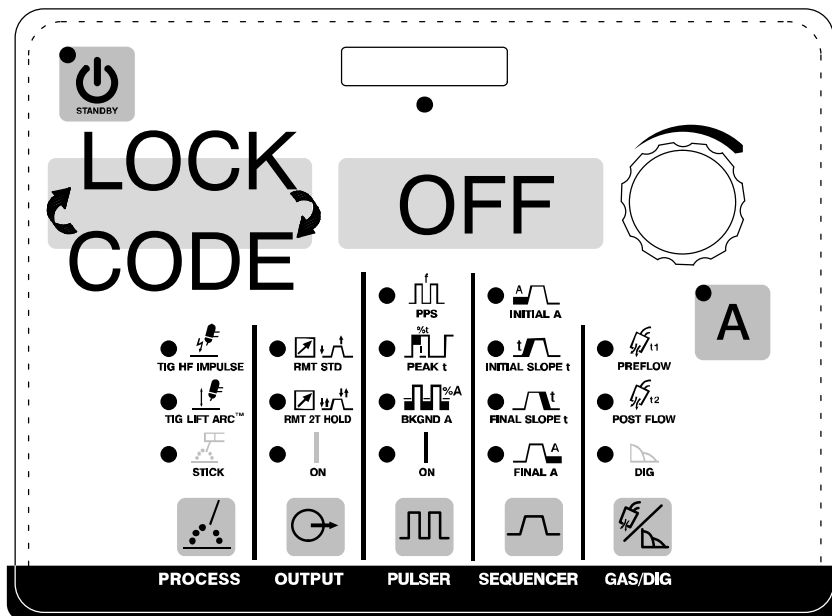
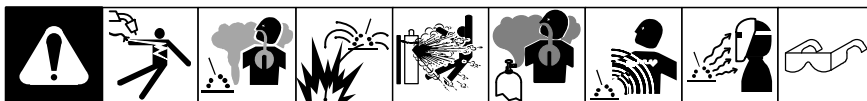


P/H = Push and hold trigger; R = Release trigger;  
 \*4T only: P/R = Push trigger and release in less than 3/4 seconds



P/H = Push and hold trigger; R = Release trigger; P/R = Push trigger and release in less than 0.75 seconds  
 \*\* = Arc can be extinguished at final slope rate at any time by pushing and holding trigger

## 7-4. Lockout Functions



247216-C

See Section 7-1 for information on how to access Lockout Functions.

There are four (1–4) different lockout levels. Each successive level allows the operator more flexibility.

*Before activating lockout levels, be sure that all procedures and parameters are established. Parameter adjustment is limited while lockout levels are active.*

**To turn On lockout feature, proceed as follows:**

1. Encoder Control
2. Amperage (A) Control

Press Amperage (A) control to toggle between the lock off and code off displays. Toggle control until [CODE] [OFF] is displayed

Turn encoder to select a lockout code number. Select a number between 1 and 999. The number will appear on the amperage, right, display.

*Remember (write down) this code number, as you will need this number to turn this feature off, or make changes to your settings.*

Toggle Amperage control until [LOCK] is displayed. You may now select a lockout level. See table below for the degree of adjustability associated with each lock level. Exit Advanced Functions according to Section 7-1.

**To turn Off lockout feature, proceed as follows:**

Toggle Amperage control until Code is displayed.

Use encoder control to enter the same code number that was used to turn on the lockout feature.





Press the Amperage control. The amperage meter display will turn to [OFF]. Lockout is now off. Exit Advanced Functions according to Section 7-1.





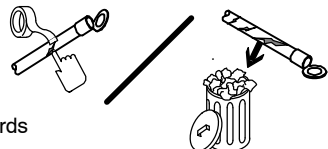
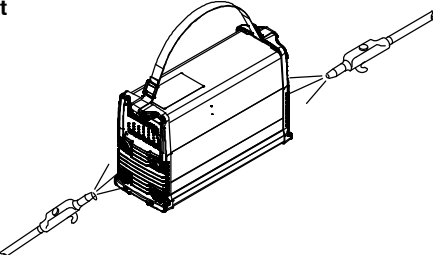
## 7-5. Lockout Levels Defined

Minimum Adjustability		Degree Of Adjustability				Maximum Adjustability	
Lock Level 1		Lock Level 2		Lock Level 3		Lock Level 4	
Adjustable	Locked	Adjustable	Locked	Adjustable	Locked	Adjustable	Locked
	Panel Amps		Panel Amps	Panel Amps +/- 10%		Remote Amps (min-panel)	
						Panel Amps +/- 10%	
	Process	Process		Process		Process	
Output		Output		Output		Output	
	Pulser		Pulser	Pulser (on/off only)		Pulser (on/off only)	
	Sequencer		Sequencer		Sequencer		Sequencer
	Gas/DIG		Gas/DIG		Gas/DIG		Gas/DIG
	Waveshape		Waveshape		Waveshape		Waveshape



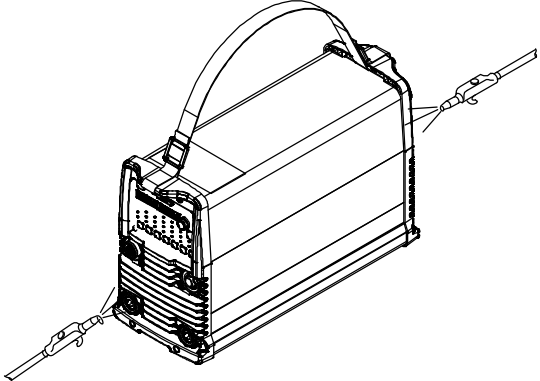
# SECTION 8 – MAINTENANCE AND TROUBLESHOOTING

## 8-1. Routine Maintenance

				<p><b>⚠ Disconnect power before maintaining.</b></p> <p> <i>Maintain more often during severe conditions.</i></p>
---	---	---	---	---

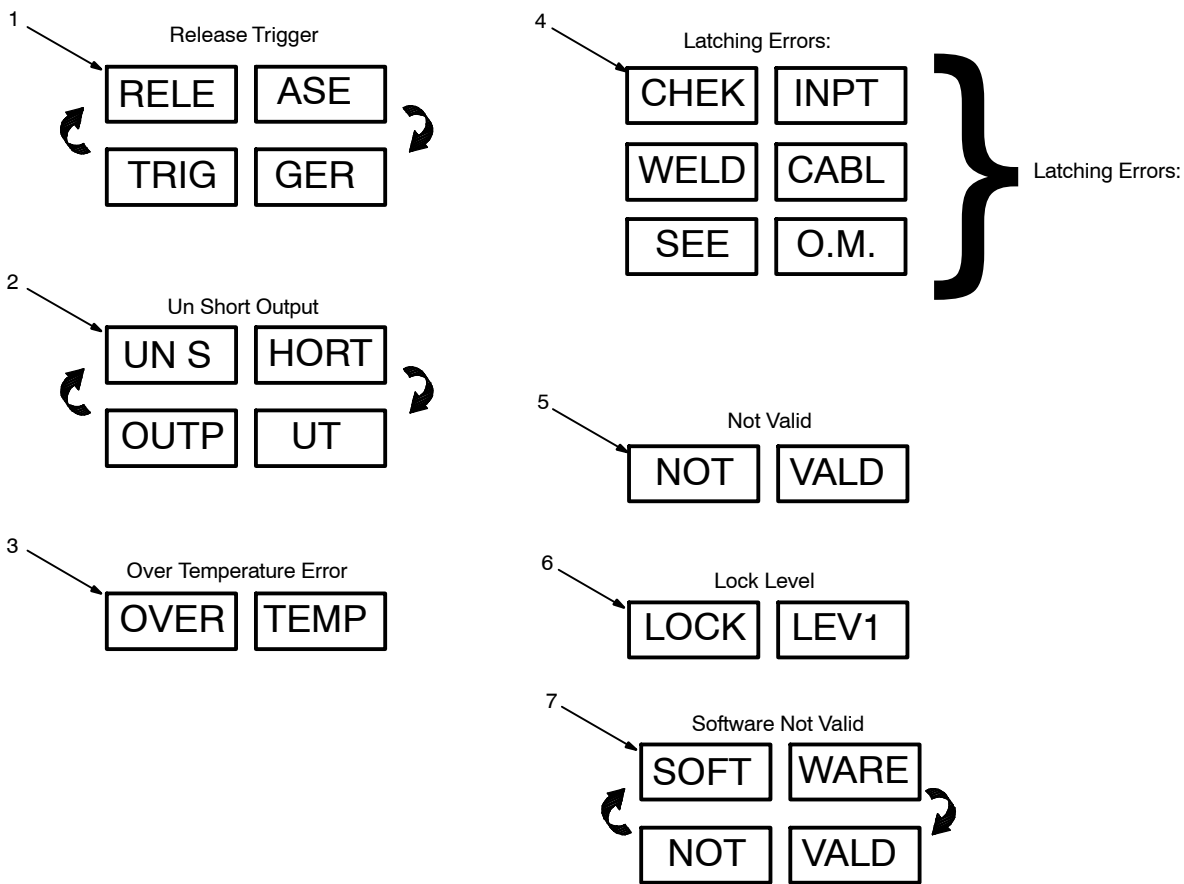
		✓ = Check * To be done by Factory Authorized Service Agent	◇ = Change	● = Clean	Δ = Repair	☆ = Replace
Every 3 Months	 ✓ ☆ Labels			 ✓ ☆ Gas Hoses		
Every 3 Months		 ✓ Δ ☆ Cables And Cords				
Every 6 Months		<b>⚠ Do not remove case when blowing out inside of unit</b>				
				●: During heavy service, clean monthly.		

## 8-2. Blowing Out Inside of Unit

			<p><b>⚠ Do not remove case when blowing out inside of unit.</b></p> <p>To blow out unit, direct airflow through front and back louvers as shown.</p>
---	---	--	--

805497-A

### 8-3. Voltmeter/Ammeter Display Messages



All directions are in reference to the front of the unit. All circuitry referred to is located inside the unit.

**1. [RELE] [ASE] / [TRIG] [GER]**

Remote 14 receptacle contactor control (Pins A-B) must be opened before proceeding.

**2. [UN S] [HORT] / [OUTP] [UT]**

Short on weld output connections must be removed before proceeding. See Section 8-4 if display shows after weld output connections have been verified as not having a short.

**3. [OVER] [TEMP]**

Over temperature condition has occurred. Error will clear after temperatures reach acceptable levels.

**4. Latching Errors:**

When one of the following errors occurs, the Standby LED flashes. To clear error, press Standby button or turn off power. See Section 8-4 if error does not clear or happens frequently.

[CHEK] [INPT] Check Input

High or low voltage has been sensed. Have a qualified person check input voltage.

[WELD] [CABL] Weld Cable

An error relate to the weld cables has been sensed. Straighten out or shorten weld cables. If carbon arc gouging, adjust DIG setting to CARBOn ARC. See Section 6-2.

[SEE] [O.M.] See Owner's Manual: See Section 8-4.

**5. [NOT] [VALD]**

Message is displayed when attempting an incompatible setup; i.e., pressing AC Waveshape while in DC.

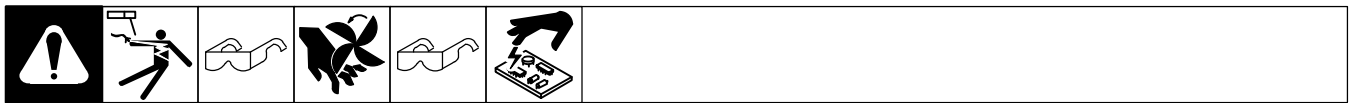
**6. [LOCK] [LEV1], 2, 3, 4**

Is displayed when attempting adjustments that are incompatible with the active selected lock level.

**7. [SOFT] [WARE] [NOT] [VALD]**

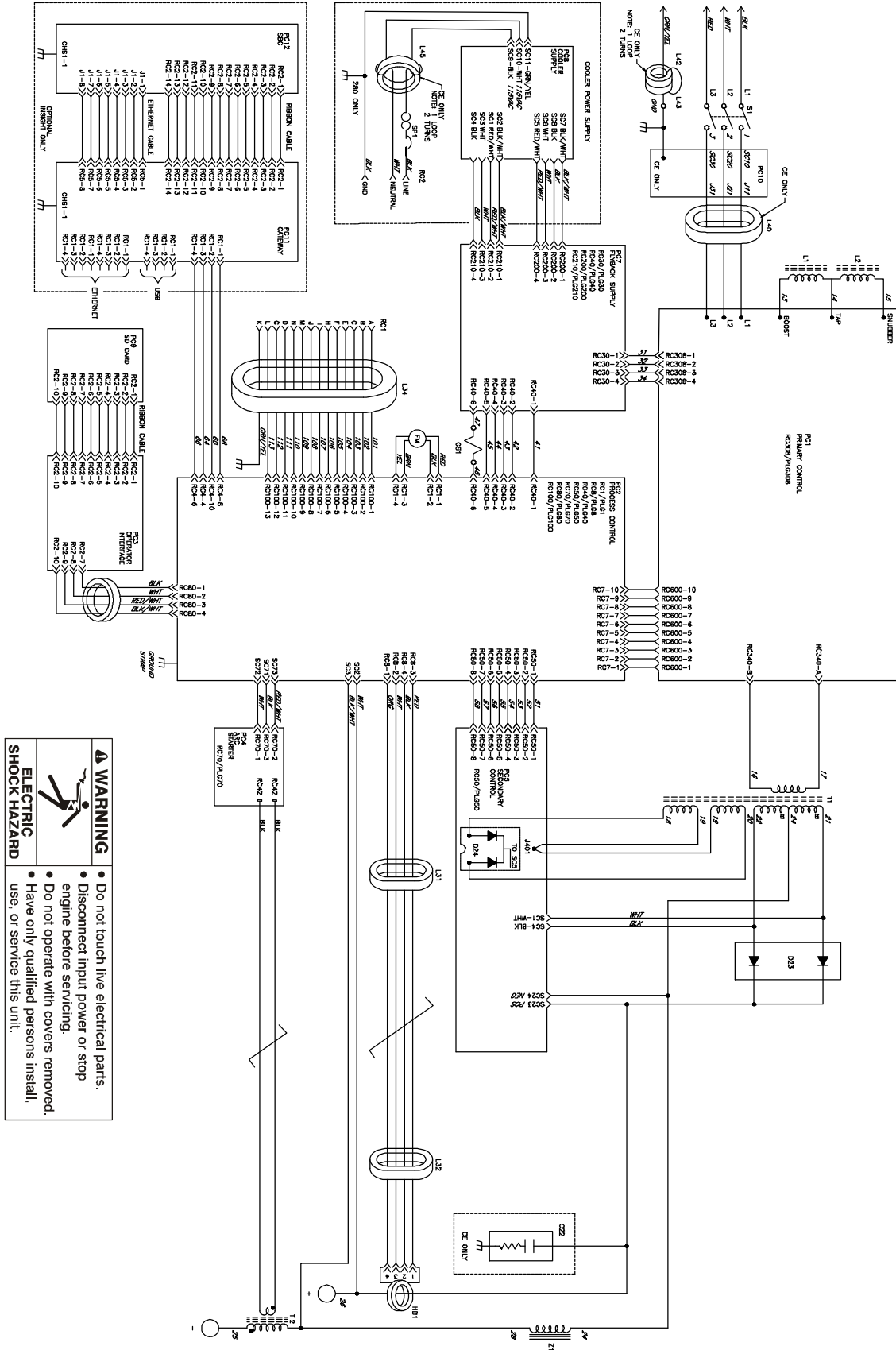
A software compatibility error has been detected. A software update is required (see Section 5-10 Software Updates). See Section 8-4 if display shows after a software update is performed.

## 8-4. Troubleshooting Table



Trouble	Remedy
No weld output; unit completely inoperative.	Place line disconnect switch in On position (see Section 5-6 or 5-7).
	Check and replace line fuse(s), if necessary, or reset circuit breaker (see Section 5-6 or 5-7).
	Check for proper input power connections (see Section 5-6 or 5-7).
No weld output; meter display On.	Input voltage outside acceptable range of variation (see Section 5-5).
	Check, repair, or replace remote control.
	Unit overheated. Allow unit to cool with fan On (see Section 4-5).
Erratic or improper weld output.	Use proper size and type of weld cable (see Section 5-3).
	Clean and tighten all weld connections (see Section 8-1).
Fan not operating.	Check for and remove anything blocking fan movement.
	Have Factory Authorized Service Agent check fan motor.
Wandering arc.	Use proper size tungsten (see Section 11).
	Use properly prepared tungsten (see Section 11).
	Reduce gas flow rate.
Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Shield weld zone from drafts.
	Increase postflow time.
	Check and tighten all gas fittings (see Section 8-1).
	Water in torch. Refer to torch manual.
Blank Display.	Verify Power to machine.
	A software update may be required (see Section 5-10, Software Updates). Contact factory if display remains blank after a software update is performed.
Error message [ERR] [LOG] is displayed.	Contact a Factory Authorized Service Agent for an explanation of the error code.
Latching Errors see Section 8-3.	Contact a Factory Authorized Service Agent if error does not clear or happens frequently.
Error message [SEE] [O.M.] is displayed.	Contact a Factory Authorized Service Agent.
Tech Menu (See Section 7) [SERL][NUM] is selected, and serial number displayed does not match serial number of machine.	Contact a Factory Authorized Service Agent.
Error message [UN S] [HORT] / [OUTP] [UT] is displayed.	Contact a Factory Authorized Service Agent if display shows after weld output connections have been verified as not having a short.
Error message [SOFT] [WARE] [NOT] [VALD] is displayed.	Contact a Factory Authorized Service Agent if display shows after a software update is performed.

# SECTION 9 - ELECTRICAL DIAGRAMS




**WARNING**  
**ELECTRIC SHOCK HAZARD**

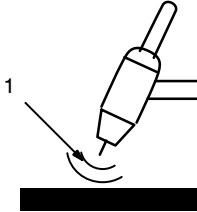
- Do not touch live electrical parts.
- Disconnect input power or stop engine before servicing.
- Do not operate with covers removed.
- Have only qualified persons install, use, or service this unit.

Figure 9-1. Circuit Diagram For Maxstar 210

# SECTION 10 – HIGH FREQUENCY

## 10-1. Welding Processes Requiring High Frequency






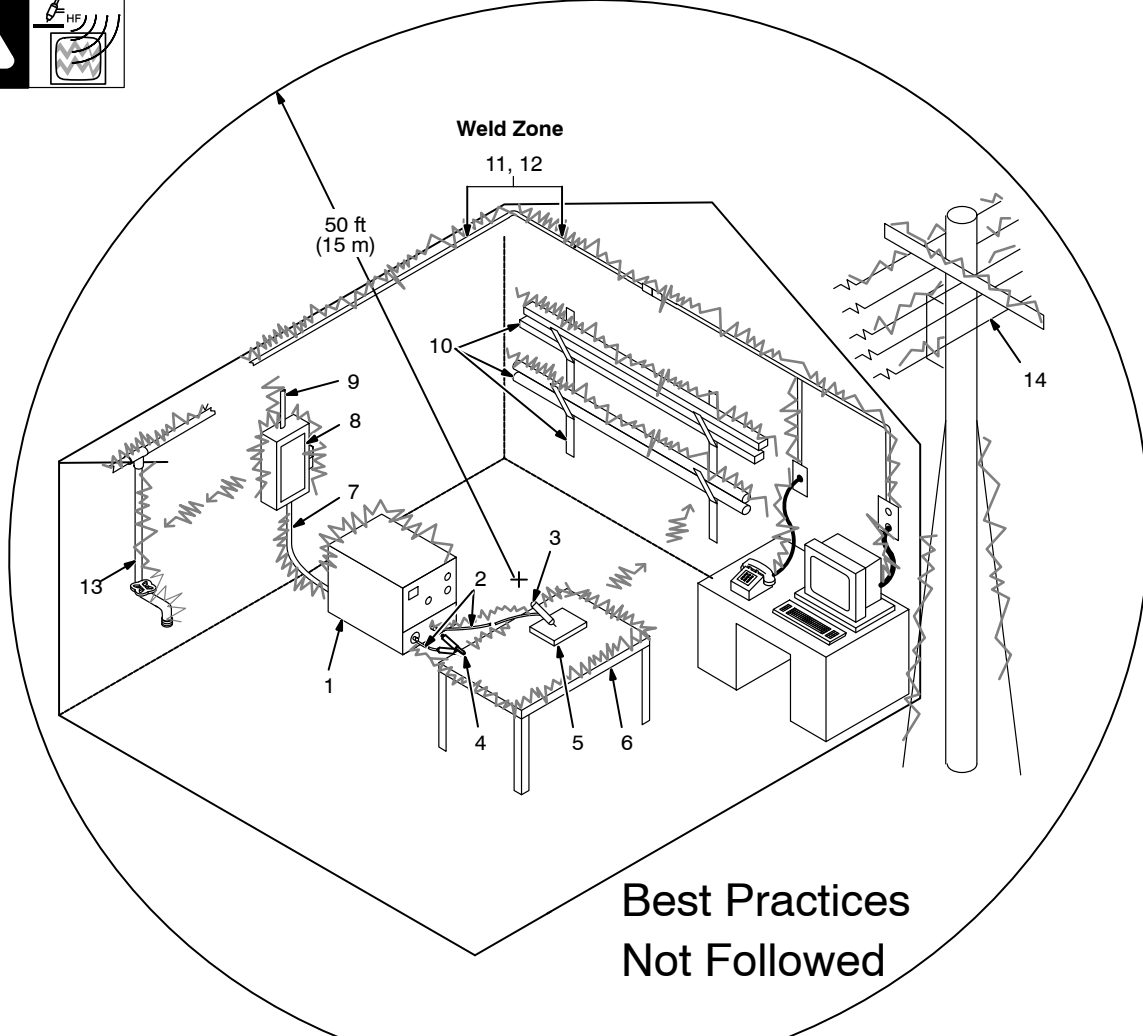
TIG

1. High-Frequency Voltage  
TIG – helps arc jump air gap between torch and workpiece and/or stabilize the arc.

high\_freq 2018-01

## 10-2. Installation Showing Possible Sources Of HF Interference



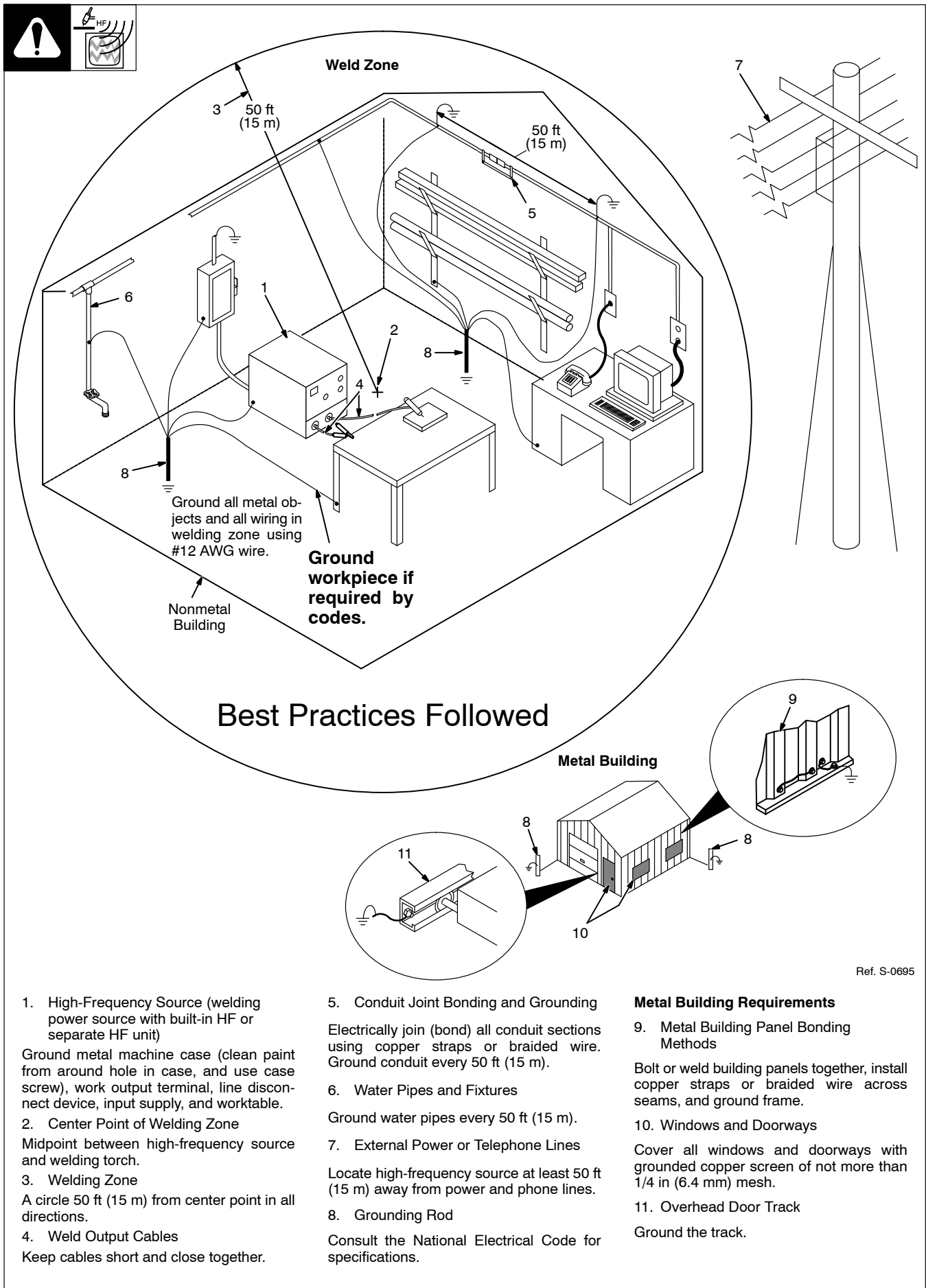


Best Practices  
Not Followed

Sources of Direct High-Frequency Radiation	Sources of Conduction of High Frequency	Sources of Reradiation of High Frequency
<ol style="list-style-type: none"> <li>1. High-Frequency Source (welding power source with built-in HF or separate HF unit)</li> <li>2. Weld Cables</li> <li>3. Torch</li> <li>4. Work Clamp</li> <li>5. Workpiece</li> <li>6. Work Table</li> </ol>	<ol style="list-style-type: none"> <li>7. Input Power Cable</li> <li>8. Line Disconnect Device</li> <li>9. Input Supply Wiring</li> </ol>	<ol style="list-style-type: none"> <li>10. Ungrounded Metal Objects</li> <li>11. Lighting</li> <li>12. Wiring</li> <li>13. Water Pipes and Fixtures</li> <li>14. External Phone and Power Lines</li> </ol>

S-0694

## 10-3. Recommended Installation To Reduce HF Interference



1. High-Frequency Source (welding power source with built-in HF or separate HF unit)

Ground metal machine case (clean paint from around hole in case, and use case screw), work output terminal, line disconnect device, input supply, and worktable.

2. Center Point of Welding Zone  
Midpoint between high-frequency source and welding torch.

3. Welding Zone  
A circle 50 ft (15 m) from center point in all directions.

4. Weld Output Cables  
Keep cables short and close together.

5. Conduit Joint Bonding and Grounding

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

6. Water Pipes and Fixtures

Ground water pipes every 50 ft (15 m).

7. External Power or Telephone Lines

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

8. Grounding Rod

Consult the National Electrical Code for specifications.

### Metal Building Requirements

9. Metal Building Panel Bonding Methods

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

10. Windows and Doorways

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

11. Overhead Door Track

Ground the track.



# SECTION 11 – SELECTING AND PREPARING A TUNGSTEN FOR DC OR AC WELDING WITH INVERTER MACHINES


gtaw\_Inverter\_2018-01




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

## 11-1. Selecting Tungsten Electrode (Wear Clean Gloves To Prevent Contamination Of Tungsten)

### A. Select Tungsten Electrode.

 Not all tungsten electrode manufacturers use the same colors to identify tungsten type. Contact the tungsten electrode manufacturer or reference the product packaging to identify the tungsten you are using.

Electrode Diameter	Amperage Range - Gas Type♦ - Polarity	
	(DCEN) – Argon Direct Current Electrode Negative (For Use With Mild Or Stainless Steel)	AC – Argon Unbalanced Wave (For Use With Aluminum)
<b>2% Ceriated, 1.5% Lanthanum, Or 2% Thorium Alloy Tungstens</b>		
.010 in. (.25 mm)	Up to 15	Up to 15
.020 in. (.50 mm)	5-20	5-20
.040 in. (1 mm)	15-80	15-80
1/16 in. (1.6 mm)	70-150	70-150
3/32 in. (2.4 mm)	150-250	140-235
1/8 in. (3.2 mm)	250-400	225-325
5/32 in. (4.0 mm)	400-500	300-400
3/16 in (4.8 mm)	500-750	400-500
1/4 in. (6.4 mm)	750-1000	500-630

♦ Typical argon shielding gas flow rates are 10 to 25 CFH (cubic feet per hour).

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

### B. Electrode Composition.

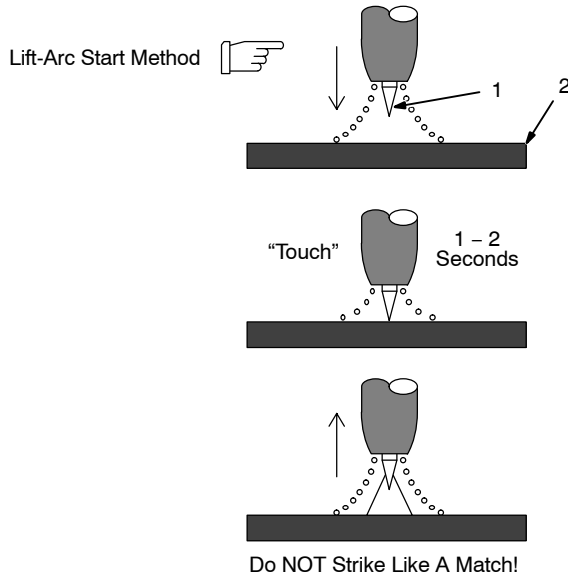
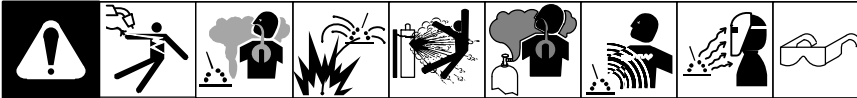
Tungsten Type	Application Notes
2% Cerium (Grey*)	Good all-around tungsten for both AC and DC welding.
1.5–2% Lanthanum (Yellow/Blue)	Excellent low amp starts for AC and DC welding.
2% Thorium (Red)	Commonly used for DC welding, not ideal for AC.
Pure Tungsten (Green)	<b>Not Recommended for inverters!</b> For best results in most applications use a sharpened cerium or lanthanum electrode for AC and DC welding.

\* Color may vary depending on manufacturer, please refer to manufacturer's guide for color designation.



# SECTION 12 – TIG PROCEDURES

## 12-1. Lift-Arc™ And HF TIG Start Procedures



### Lift-Arc Start

When Lift-Arc button light is On, start arc as follows:

1. TIG Electrode
2. Workpiece

Touch tungsten electrode to workpiece at weld start point, enable output and shielding gas with torch trigger, foot control, or hand control. **Hold electrode to workpiece for 1-2 seconds**, and slowly lift electrode. Arc is formed when electrode is lifted.

Normal open-circuit voltage is not present before tungsten electrode touches workpiece; only a low sensing voltage is present between electrode and workpiece. The solid-state output contactor does not energize until after electrode is touching workpiece. This allows electrode to touch workpiece without overheating, sticking, or getting contaminated.

### Application:

Lift-Arc is used for the DCEN or AC GTAW process when HF Start method is not permitted, or to replace the scratch method.

### HF Start

When HF Start button light is On, start arc as follows:

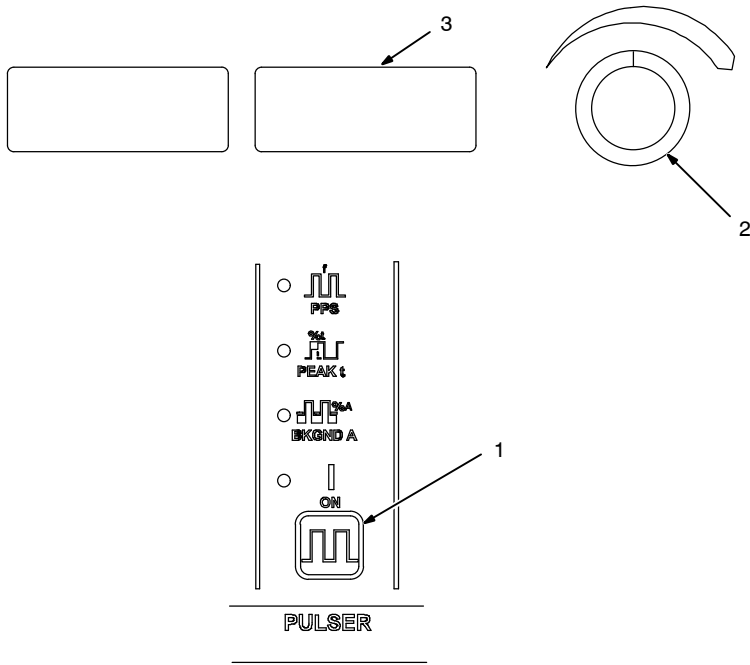
High frequency turns on to help start arc when output is enabled. High frequency turns off when arc is started, and turns on whenever arc is broken to help restart arc.

### Application:

HF start is used for the DCEN GTAW process when a non-contact arc starting method is required.

TIG\_DCstarting1 2018-08

## 12-2. Pulsar Control



### 1. Pulsar Control

Pulsing is available while using the TIG process. Controls can be adjusted while welding.

Press switch pad to enable pulser.

**ON** - When illuminated, this LED indicates the pulser is on.

Press switch pad until desired parameter LED is illuminated.

To turn Pulsar off, press and release switch pad until the On LED turns off.

### 2. Encoder Control (Set Value)

### 3. Ammeter (Displays Value)

See Section 6-2 for Pulsar parameter ranges.

**PPS** - Pulse frequency or pulses per second, is the number of pulse cycles per second. Pulse frequency helps reduce heat input, part warpage, and helps weld bead cosmetics. The higher the PPS setting, the smoother the ripple effect, the narrower the weld bead, and the more cooling you get. By setting PPS on the lower end, the pulse is slower, and the weld bead wider. This slow pulsing helps agitate the weld puddle to help release gas trapped in the weldment, and help reduce porosity (very useful in aluminum welding). Some beginners use a slower pulse rate (2-4 pps) to help them with their timing on adding filler material. An experienced welder may have the PPS setting much higher, depending on their personal preferences, and on what they are trying to accomplish.

**PEAK t** - (PEAK t) is the percentage of time in each cycle, spent at peak amperage (main amperage). Peak amperage is set with the Amperage control (see Section 6-1). If one pulse per second is being used, and peak time is set at 50%, one-half second is spent at peak amperage, and the other 50%, or one-half second, is spent at the background amperage. Increasing peak time increases time spent at peak amperage, which increases heat input into the part. A good starting point for peak time is about 50-60%. To find a good ratio, you will have to experiment a bit, but the idea is to decrease heat input into the part, and increase the cosmetics of the weld.

**BKGD A** - (Background amps) is set as a percentage of the peak amps setting. If peak amps is set at 200, and background amps at 50%, your background amps is 100 amps when the machine pulses on the background side of the cycle. The lower background amperage helps reduce heat input. Increasing or decreasing background amps increases or decreases the overall average amperage, which helps determine how fluid your puddle is on the background side of the pulse cycle. Overall, you want your puddle to shrink to about one-half the size, but still remain fluid. To start with, set background amps at about 20-30% for stainless/carbon steel, or at about 35-50% for aluminum alloys.

### 4. Pulsed Output Waveforms

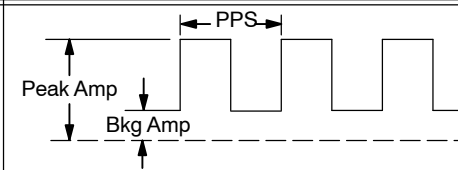
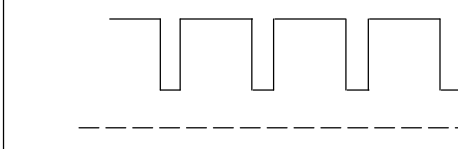
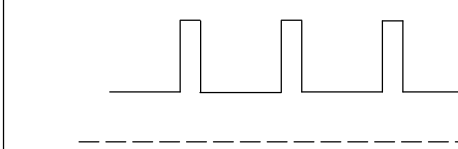
Example shows affect changing the Peak Time control has on the pulsed output waveform.

#### Application:

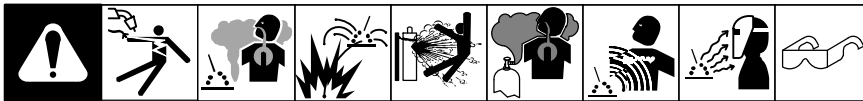
Pulsing refers to the alternating raising and lowering of the weld output at a specific rate. The raised portions of the weld output are controlled in width, height, and frequency, forming pulses of weld output. These pulses and the lower amperage level between them (called the background amperage) alternately heat and cool the molten weld puddle. The combined effect gives the operator better control of penetration, bead width, crowning, undercutting, and heat input. Controls can be adjusted while welding.

Pulsing can also be used for filler material addition technique training.

 Function is enabled, when LED is lit

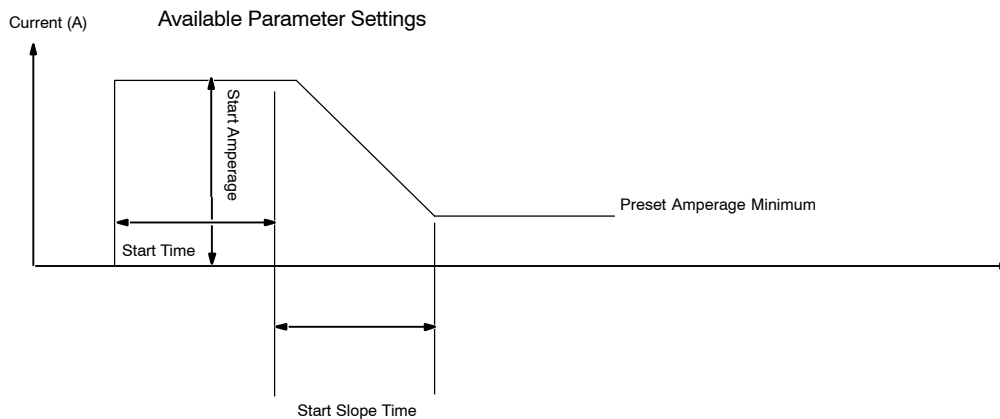
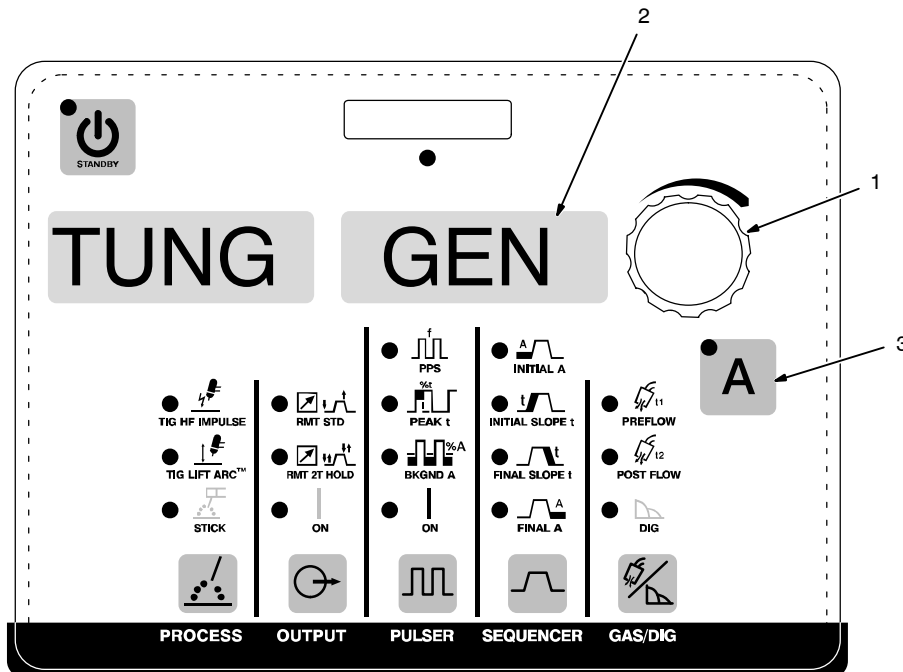
Percent (%) Peak Time Control Setting	Pulsed Output Waveforms
Peak 50%/Background 50% Balanced 50%	
More Time At Peak Amperage (80%)	
More Time At Background Amperage (20%)	

## 12-3. General (GEN) Tungsten Programmable TIG Starting Parameters



1. Encoder Control
2. Parameter Display
3. Amperage Button

Once inside the machine set up menu, tungsten parameter values can be manually changed by pressing the Amperage switch pad to step through each adjustable parameter. Turn encoder to change the value.



247216-C

### Parameter

- Start Output Polarity (POL)
- Start Amperage (STRT)
- Start Time (TIME)
- Start Slope (SSLP)
- Preset Minimum Amperage (PMIN)

### Default

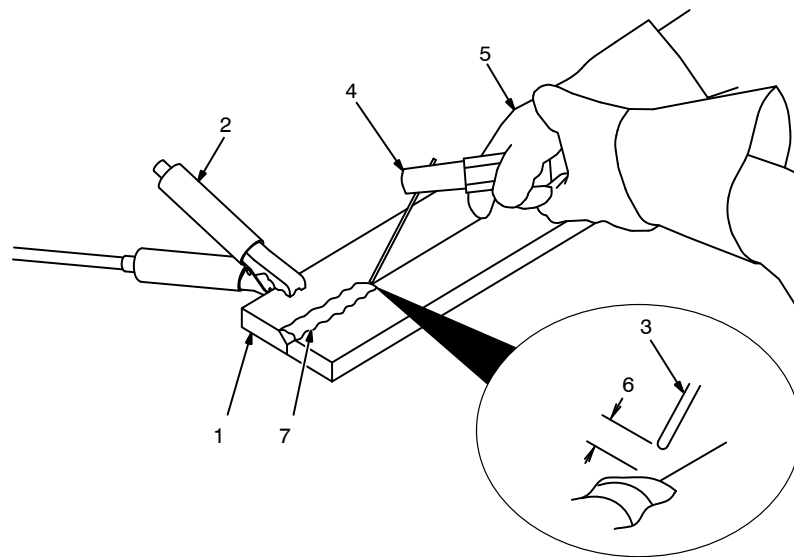
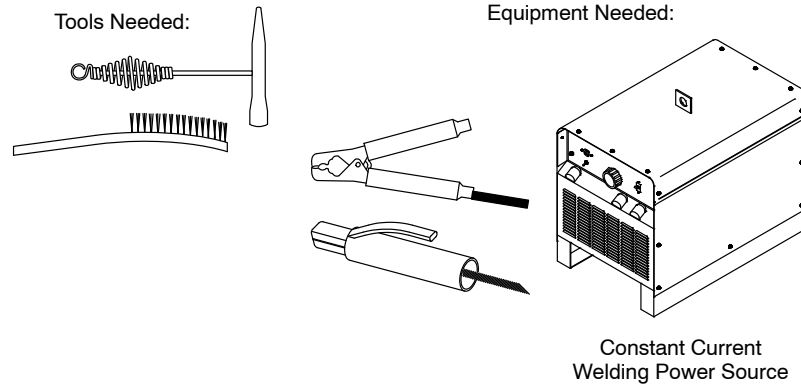
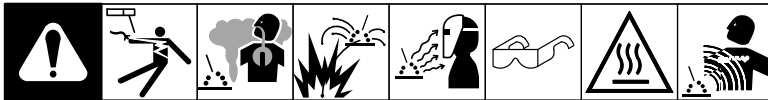
- EN (Electrode Negative)
- 25 A
- 120 ms
- 100 ms
- 10 A

### Range

- EP / EN
- 5–200 A
- 0–250 ms
- 0–250 ms
- 1–25 A

# SECTION 13 – STICK WELDING (SMAW) GUIDELINES

## 13-1. 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 13-2).

4. Insulated Electrode Holder

5. Electrode Holder Position

6. Arc Length

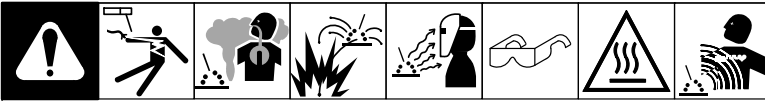
Arc length is the distance from the electrode to the workpiece. A short arc with correct amperage will give a sharp, crackling sound. Correct arc length is related to electrode diameter. Examine the weld bead to determine if the arc length is correct.

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.

### 13-2. Electrode And Amperage Selection Chart



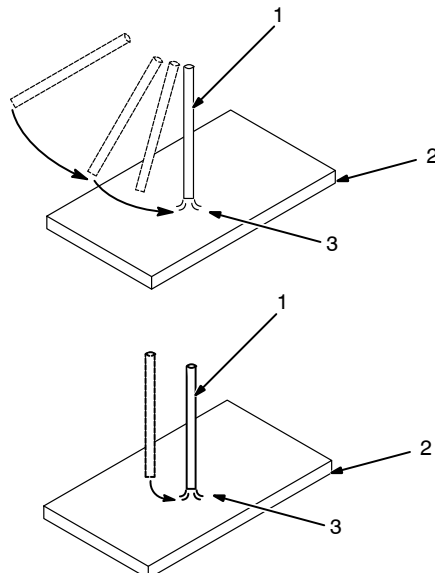
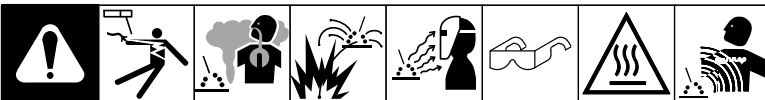
ELECTRODE	DIAMETER	AMPERAGE RANGE								
		50	100	150	200	250	300	350	400	450
6010 & 6011	3/32									
	1/8									
	5/32									
	3/16									
	7/32									
6013	1/4									
	1/16									
	5/64									
	3/32									
	1/8									
7014	5/32									
	3/16									
	7/32									
	1/4						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

ELECTRODE	DC*	AC	POSITION	PENETRATION	USAGE
6010	EP		ALL	DEEP	MIN. PREP, ROUGH HIGH SPATTER
6011	EP	✓	ALL	DEEP	
6013	EP,EN	✓	ALL	LOW	GENERAL
7014	EP,EN	✓	ALL	MED	SMOOTH, EASY, FAST
7018	EP	✓	ALL	MED	LOW HYDROGEN, STRONG
7024	EP,EN	✓	FLAT HORIZ*	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-087985-A

### 13-3. Striking An Arc



**⚠ Weld current starts when electrode touches workpiece.**

1. Electrode
2. Workpiece
3. Arc

#### Scratch Technique

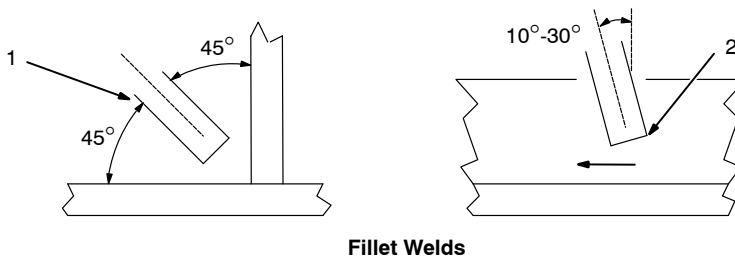
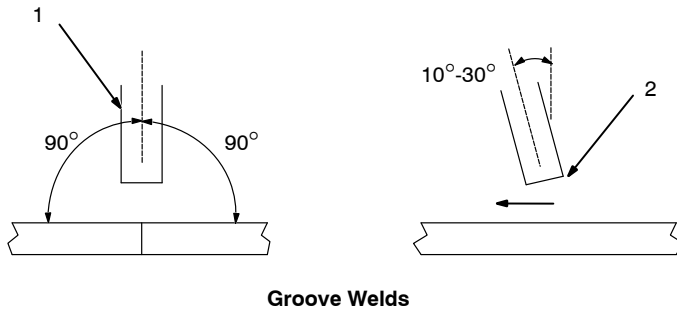
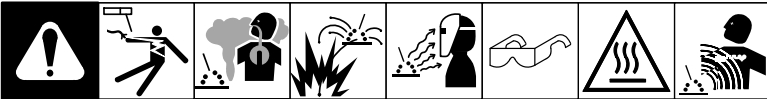
Drag electrode across workpiece like striking a match; lift electrode slightly after touching work. If arc goes out, electrode was lifted too high. If electrode sticks to workpiece, use a quick twist to free it.

#### 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.

S-0049 / S-0050

### 13-4. Positioning Electrode Holder



1. End View Of Work Angle
2. Side View Of Electrode Angle

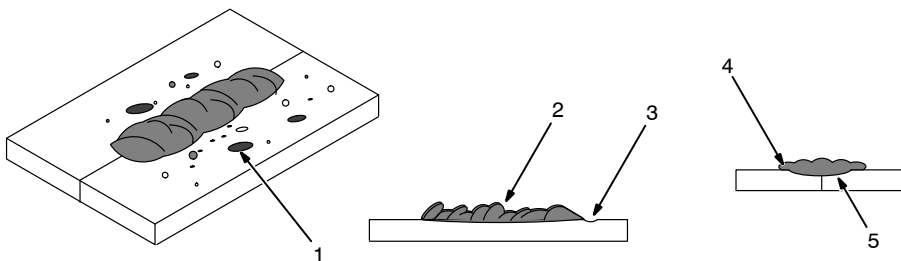
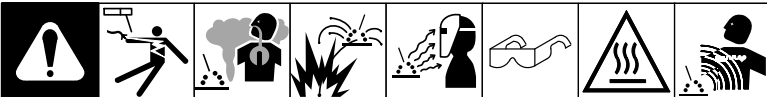
After learning to start and hold an arc, practice running beads of weld metal on flat plates using a full electrode.

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.*

S-0060

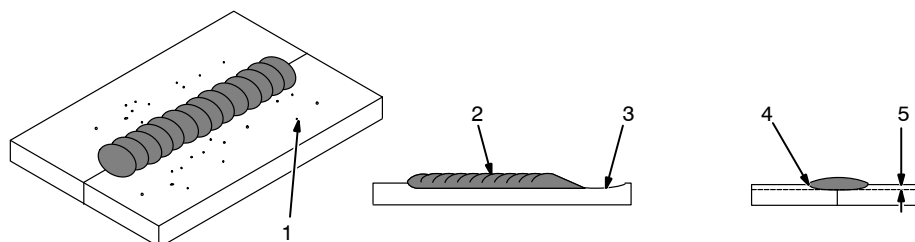
### 13-5. Poor Weld Bead Characteristics



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

S-0053-A

### 13-6. Good Weld Bead Characteristics



1. Fine Spatter
2. Uniform Bead
3. Moderate Crater During Welding

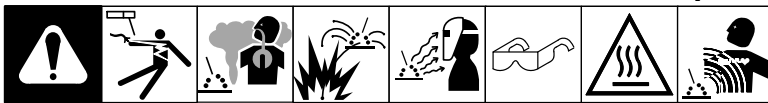
Weld a new bead or layer for each 1/8 in. (3.2 mm) thickness in metals being welded.

4. No Overlap
5. Good Penetration into Base Metal

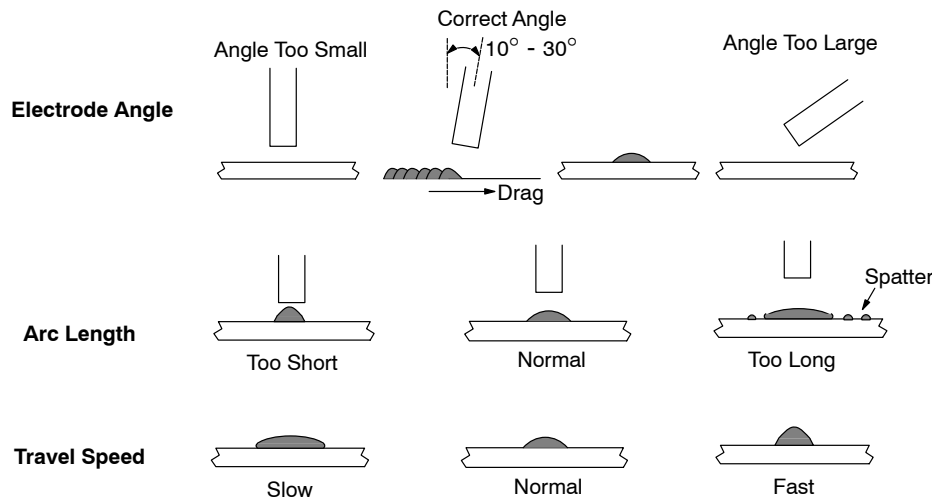
S-0052-B



### 13-7. Conditions That Affect Weld Bead Shape

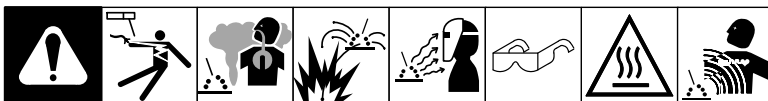


☞ Weld bead shape is affected by electrode angle, arc length, travel speed, and thickness of base metal.

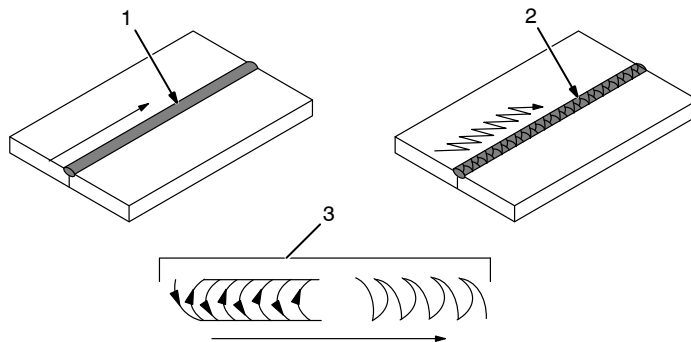


S-0061

### 13-8. Electrode Movement During Welding



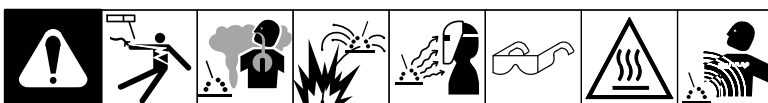
☞ Normally, a single stringer bead is satisfactory for most narrow groove weld joints; however, for wide groove weld joints or bridging across gaps, a weave bead or multiple stringer beads work better.



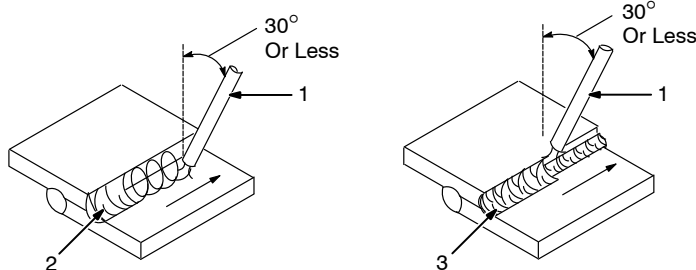
Use weave patterns to cover a wide area in one pass of the electrode. Do not let weave width exceed 2-1/2 times diameter of electrode.

S-0054-A

### 13-9. Welding Lap Joints

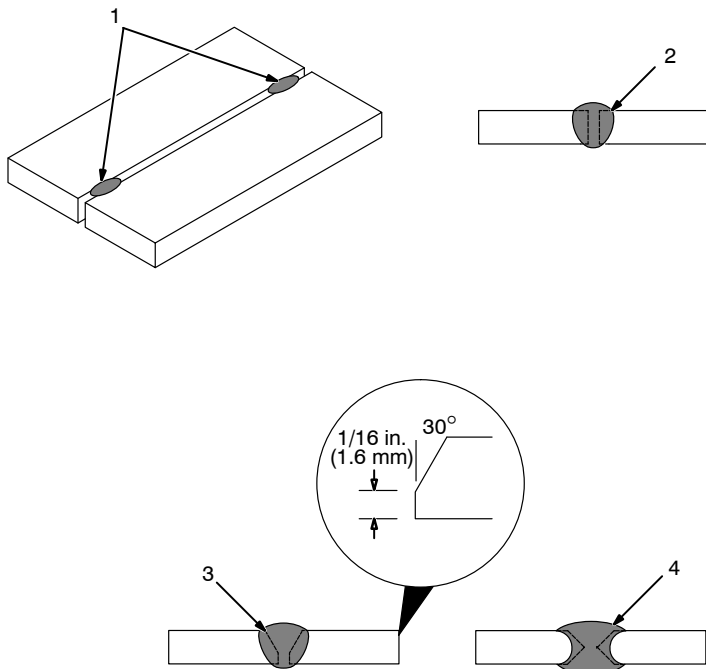
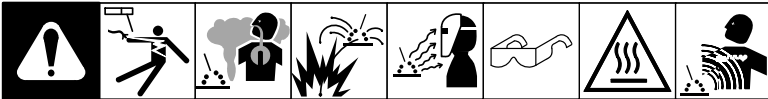


- Electrode
- Single-Layer Fillet Weld  
Move electrode in circular motion.
- Multi-Layer Fillet Weld  
Weld a second layer when a heavier fillet is needed. Remove slag before making another weld pass. Weld both sides of joint for maximum strength.



S-0063 / S-0064

## 13-10. 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

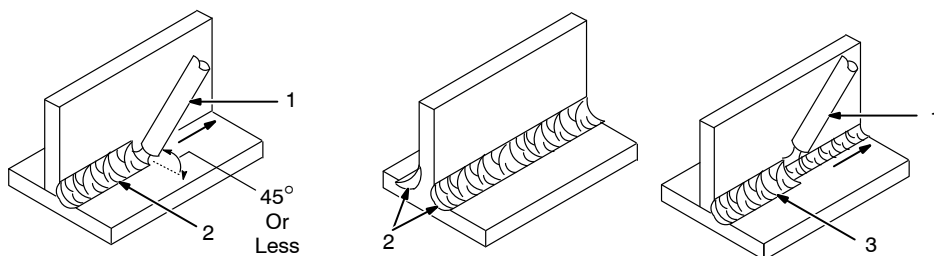
### 4. Double V-Groove Weld

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.

S-0062

## 13-11. Welding T-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.

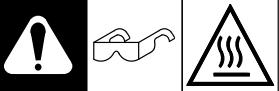
For maximum strength weld both sides of upright section.

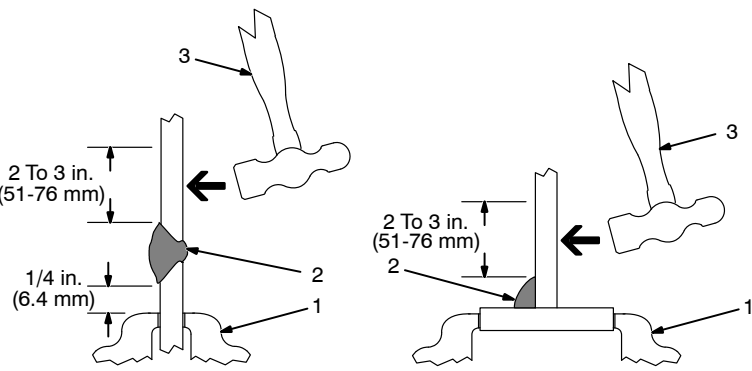
### 3. Multi-Layer Deposits

Weld a second layer when a heavier fillet is needed. Use any of the weaving patterns shown in Section 13-8. Remove slag before making another weld pass.

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

### 13-12. Weld Test





1. Vise
2. Weld Joint
3. Hammer

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.

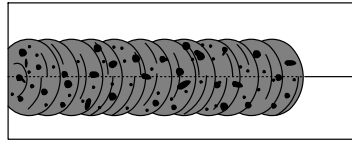
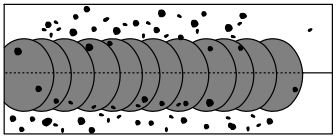
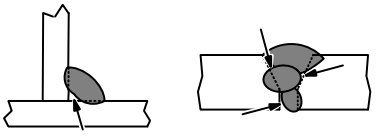
If the weld is porous (many holes), the arc length was probably too long.

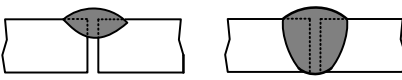
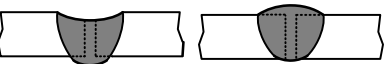
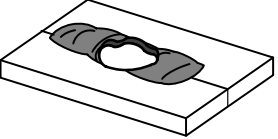
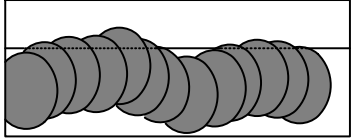
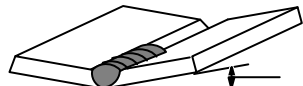
If the weld contains bits of slag, the arc may have been too long or the electrode was moved incorrectly which allowed molten slag to be trapped in the weld. This may happen on a V-groove joint made in several layers and calls for additional cleaning between layers.

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.

S-0057-B

### 13-13. Troubleshooting

	<p><b>Porosity</b> – small cavities or holes resulting from gas pockets in weld metal.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
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.
	<p><b>Excessive Spatter</b> – scattering of molten metal particles that cool to solid form near weld bead.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
Amperage too high for electrode.	Decrease amperage or select larger electrode.
Arc length too long or voltage too high.	Reduce arc length or voltage.
	<p><b>Incomplete Fusion</b> – failure of weld metal to fuse completely with base metal or a preceding weld bead.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
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.

 <p>Lack of Penetration      Good Penetration</p>	<p><b>Lack Of Penetration</b> – shallow fusion between weld metal and base metal.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
<p>Improper joint preparation.</p>	<p>Material too thick. Joint preparation and design must provide access to bottom of groove.</p>
<p>Improper weld technique.</p>	<p>Keep arc on leading edge of weld puddle.</p>
<p>Insufficient heat input.</p>	<p>Increase amperage. Select larger electrode and increase amperage.</p>
	<p>Reduce travel speed.</p>
 <p>Excessive Penetration      Good Penetration</p>	<p><b>Excessive Penetration</b> – weld metal melting through base metal and hanging underneath weld.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
<p>Excessive heat input.</p>	<p>Select lower amperage. Use smaller electrode.</p>
	<p>Increase and/or maintain steady travel speed.</p>
	<p><b>Burn-Through</b> – weld metal melting completely through base metal resulting in holes where no metal remains.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
<p>Excessive heat input.</p>	<p>Select lower amperage. Use smaller electrode.</p>
	<p>Increase and/or maintain steady travel speed.</p>
	<p><b>Waviness Of Bead</b> – weld metal that is not parallel and does not cover joint formed by base metal.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
<p>Unsteady hand.</p>	<p>Use two hands. Practice technique.</p>
 <p>Base metal moves in the direction of the weld bead.</p>	<p><b>Distortion</b> – contraction of weld metal during welding that forces base metal to move.</p>
<p><b>Possible Causes</b></p>	<p><b>Corrective Actions</b></p>
<p>Excessive heat input.</p>	<p>Use restraint (clamp) to hold base metal in position.</p>
	<p>Make tack welds along joint before starting welding operation.</p>
	<p>Select lower amperage for electrode.</p>
	<p>Increase travel speed.</p>
	<p>Weld in small segments and allow cooling between welds.</p>

# Notes

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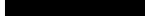

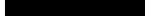
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## MATERIAL THICKNESS REFERENCE CHART

	24 Gauge (.025 in.)
	22 Gauge (.031 in.)
	20 Gauge (.037 in.)
	18 Gauge (.050 in.)
	16 Gauge (.063 in.)
	14 Gauge (.078 in.)
	1/8 in. (.125 in.)
	3/16 in. (.188 in.)
	1/4 in. (.25 in.)
	5/16 in. (.313 in.)
	3/8 in. (.375 in.)
	1/2 in. (.5 in.)



# Warranty

Effective January 1, 2020

(Equipment with a serial number preface of NA or newer)

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, warrants to authorized distributors that new equipment sold after the effective date of this limited warranty is free of defects in material and workmanship at the time it is shipped from factory. 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, manufacturer will repair or replace any warranted parts or components that fail due to such defects in material or workmanship. Manufacturer must be notified in writing within thirty (30) days of such defect or failure, at which time manufacturer will provide instructions on the warranty claim procedures to be followed. Notifications submitted as online warranty claims must provide detailed descriptions of the fault and troubleshooting steps taken to diagnose failed parts. Warranty claims that lack the required information as defined in the Service Operation Guide (SOG) may be denied.

Manufacturer shall honor warranty claims on warranted equipment listed below in the event of a defect within the warranty coverage time periods listed below. Warranty time periods start on the delivery date of the equipment to the end-user purchaser, or 12 months after the equipment is shipped to the distributor, whichever occurs first.

Limited Warranty shall not apply to:

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 Unless Specified
  - \* Auto-Darkening Helmet Lenses (No Labor) (See Classic Series Exception Below)
  - \* Engine Driven Welder/Generators  
**(NOTE: Engines are Warranted Separately by the Engine Manufacturer.)**
  - \* Insight Welding Intelligence Products (Except External Sensors)
  - \* Inverter Power Sources
  - \* 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)
  - \* Auto-Darkening Weld Masks (No Labor)
  - \* Fume Extractors – Capture 5, Filtair 400 and Industrial Collector Series
4. 1 Year — Parts and Labor Unless Specified
  - \* ArcReach Heater
  - \* AugmentedArc and LiveArc Welding Systems
  - \* Automatic Motion Devices
  - \* Bernard BTB Air-Cooled MIG Guns (No Labor)
  - \* CoolBelt (No Labor)
  - \* Desiccant Air Dryer System
  - \* 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, ZoneFlow Extraction Arms and Motor Control Box
  - \* 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)
  - \* PAPER Blower Unit (No Labor)
  - \* Positioners and Controllers
  - \* Racks (For Housing Multiple Power Sources)
  - \* Running Gear/Trailers

- \* Subarc Wire Drive Assemblies
- \* Supplied Air Respirator (SAR) Boxes and Panels
- \* TIG Torches (No Labor)
- \* Tregaskiss Guns (No Labor)
- \* Water Cooling Systems
- \* Wireless Remote Foot/Hand Controls and Receivers
- \* Work Stations/Weld Tables (No Labor)

5. 6 Months — Parts

- \* Batteries

6. 90 Days — Parts

- \* Accessories (Kits)
- \* ArcReach Heater Quick Wrap and Air Cooled Cables
- \* Canvas Covers
- \* Induction Heating Coils and Blankets, Cables, and Non-Electronic Controls
- \* MDX Series MIG Guns
- \* M-Guns
- \* MIG Guns, Subarc (SAW) Torches, and External Cladding Heads
- \* Remote Controls and RFCS-RJ45
- \* Replacement Parts (No labor)
- \* Spoolmate Spoolguns

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 manufacturer, 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 manufacturer, 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.
4. Defects caused by accident, unauthorized repair, or improper testing.

MANUFACTURER'S PRODUCTS ARE INTENDED FOR COMMERCIAL AND INDUSTRIAL USERS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT.

The exclusive remedies for warranty claims are, at manufacturer's option, either: (1) repair; or (2) replacement; or, if approved in writing by manufacturer, (3) the pre-approved cost of repair or replacement at an authorized service station; or (4) payment of or credit for the purchase price (less reasonable depreciation based upon use). Products may not be returned without manufacturer's written approval. Return shipment shall be at customer's risk and expense.

The above remedies are F.O.B. Appleton, WI, or at an authorized service facility. Transportation and freight are the customer's responsibility. TO THE EXTENT PERMITTED BY LAW, THE REMEDIES HEREIN ARE THE SOLE AND EXCLUSIVE REMEDIES REGARDLESS OF THE LEGAL THEORY. IN NO EVENT SHALL MANUFACTURER BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF PROFIT) REGARDLESS OF THE LEGAL THEORY. ANY WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY, OR REPRESENTATION, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE, ARE EXCLUDED AND DISCLAIMED BY MANUFACTURER.

Some US states do not allow limiting the duration of an implied warranty or the exclusion of certain damages, so the above limitations may not apply to you. This warranty provides specific legal rights, and other rights may be available depending on your state. In Canada, some provinces provide additional warranties or remedies, and to the extent the law prohibits their waiver, the limitations set out above may not apply. This Limited Warranty provides specific legal rights, and other rights may be available, but may vary by province.

# Owner's Record

Please complete and retain with your personal records.

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Model Name

Serial/Style Number

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Purchase Date

(Date which equipment was delivered to original customer.)

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Distributor

---

Address

---

City

---

State

Zip

---

**Red-D-Arc**  
**Welderentals**  
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Contact the Delivering Carrier for:

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.

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