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Processes



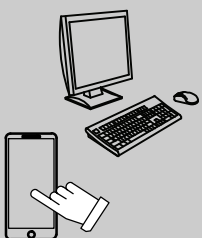
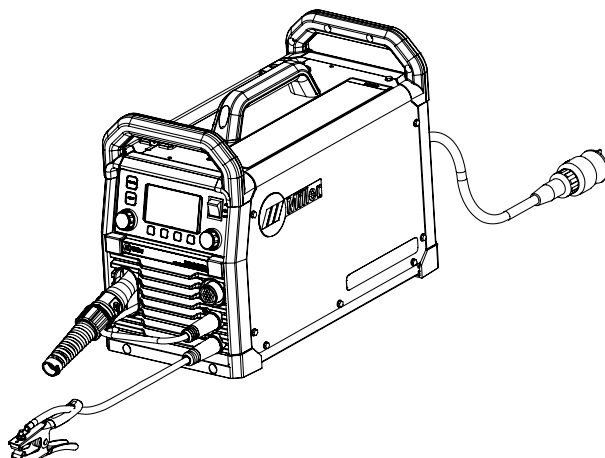
Multiprocess Welding

Description



Arc Welding Power Source

Multimatic[®] 215 PRO



For product information,
Owner's Manual translations,
and more, visit

www.MillerWelds.com

OWNER'S MANUAL

From Miller to You

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

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

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

This Owner's Manual is designed to help you get the most out of your Miller products. Please take time to read the Safety Precautions. They will help you protect yourself against potential hazards on the worksite. We've made installation and operation quick and easy. With Miller, you can count on years of reliable service with proper maintenance. And if for some reason the unit needs repair, there's a Troubleshooting section that will help you figure out what the problem is, and our extensive service network is there to help fix the problem. Warranty and maintenance information for your particular model are also provided.

Miller Electric manufactures a full line of welders and welding-related equipment. For information on other quality Miller products, contact your local Miller distributor to receive the latest full line catalog or individual specification sheets. **To locate your nearest distributor or service agency call**

1-800-4-A-Miller, or visit us at www.MillerWelds.com on the web.



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



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



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SECTION 1 – SAFETY PRECAUTIONS – READ BEFORE USING

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

1-1. Symbol Usage

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

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

NOTICE – Indicates statements not related to personal injury.

 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. 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.
- Do not store or use equipment in standing water.
- 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) welding power source,

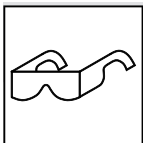
2) a DC manual (stick) welding power source, or 3) an AC welding power source with reduced open-circuit voltage. In most situations, use of a DC, constant voltage wire welding power source is recommended. And, do not work alone!

- 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.
- Use only well-maintained equipment. Repair or replace damaged parts at once. Maintain unit according to manual.
- Do not touch electrode holders connected to two welding machines at the same time because double open-circuit voltage can be present.
- 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.



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.



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.



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 the operator is wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.



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.



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.

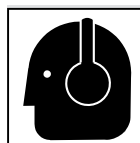
- Wear an approved welding helmet fitted with a proper shade of filter lenses to protect your face and eyes from arc rays and sparks when welding or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).
- Wear approved safety glasses with side shields under your helmet.
- Use protective screens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



NOISE can damage hearing.

Noise from some processes or equipment can damage hearing.

- Check for noise level limits exceeding those specified by OSHA.
- Wear appropriate ear protection if noise level is high.
- Warn others nearby about noise hazard.



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, arc gouging, plasma arc cutting, or induction heating operations.



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



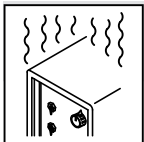
FIRE OR EXPLOSION hazard.

- 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.



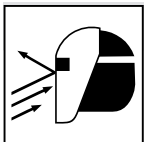
FALLING EQUIPMENT can injure.

- 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 output 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 while wearing proper face, hand, and body protection.
- Sparks can cause fires—keep flammables away.



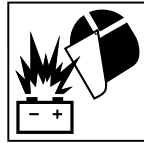
MOVING PARTS can injure.

- 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.



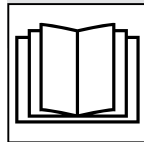
BATTERY EXPLOSION can injure.

- Do not use welding power source 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, 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.



HF RADIATION can cause interference.

- High-frequency (HF) 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 microprocessors, 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 equipment is installed and grounded according to this manual.
- If interference still occurs, the user must take extra measures such as moving the welding equipment, 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.

1-5. Principal Safety Standards

Safety in Welding, Cutting, and Allied Processes, American Welding Society standard ANSI Standard Z49.1. Website: www.aws.org.

Safe Practice For Occupational And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute. Website: safetyequipment.org.

Safe Practices for the Preparation of Containers and Piping for Welding and Cutting, American Welding Society Standard AWS F4.1. Website: www.aws.org.

National Electrical Code, NFPA Standard 70 from National Fire Protection Association. Website: www.nfpa.org.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1 from Compressed Gas Association. Website: www.cganet.com.

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2 from Canadian Standards Association. Website: 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.

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.

OSHA *Important Note Regarding the ACGIH TLV, Policy Statement on the Uses of TLVs and BEIs*. Website: 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.

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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, arc gouging, plasma arc cutting, and induction heating operations) creates EMF around the welding circuit. EMF 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 passersby or conduct individual risk assessment for operators. All operators should use the following procedures in order to minimize exposure to EMF fields:

1. Keep cables close together by twisting or taping them, or using a cable cover.
2. Do not place your body between 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 output circuit as possible.
5. Connect work clamp to workpiece as close to the arc as possible.
6. Do not work next to, sit or lean on, or carry the power source or other equipment while operating.

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, arc gouging, plasma arc cutting, or induction heating operations. If cleared by your doctor, follow the procedures above.

SECTION 2 – CONSIGNES DE SÉCURITÉ - LIRE AVANT UTILISATION

 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 des symboles, prendre garde et suivre les instructions afférentes pour éviter tout risque. Les consignes de sécurité présentées ci-après ne font que résumer les consignes de sécurité plus complètes contenue dans les Normes de sécurité principales. Lire et suivre 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.

 Aucune personne, et particulièrement les enfants, ne doit se trouver à proximité du poste de soudage pendant le fonctionnement.



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.
- Ne stockez pas et n'utilisez pas l'équipement dans de l'eau stagnante.
- 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.

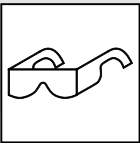
- D'autres consignes de sécurité sont nécessaires dans les conditions suivantes : risques électriques dans un environnement humide ou si l'on porte des vêtements mouillés ; sur des structures métalliques telles que sols, grilles ou échafaudages ; en position coincée comme assise, à genoux ou couchée ; 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).
- Brancher correctement la mise à la terre et utiliser cet appareil conformément à son manuel d'utilisateur et aux codes nationaux, provinciaux et municipaux.
- Toujours vérifier la mise à la terre — vérifier et assurez-vous que le conducteur de mise à la terre du cordon d'alimentation est bien raccordé à la borne de mise à la terre dans le boîtier de déconnexion 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.
- N'utiliser qu'un matériel en bon état. Réparer ou remplacer sur-le-champ les pièces endommagées. Entretenir l'appareil conformément à ce manuel.
- Ne pas toucher des porte électrodes connectés à deux machines en même temps à cause de la présence d'une tension à vide doublée.

- 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.



LES PIÈCES CHAUDES peuvent provoquer des brûlures.

- Ne pas toucher des parties chaudes à mains nues.
- 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.



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 FUMÉES ET LES GAZ peuvent être dangereux.

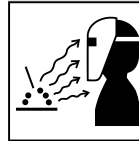
Le soudage génère des fumées et des gaz. Leur inhalation peut être dangereux pour votre santé.

- 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 dégraissages, 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 l'opérateur 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 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 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 appropriés pour protéger visage et yeux pendant le soudage (voir ANSI Z49.1 et Z87.1 énumérés 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 une protection corporelle en cuir ou des vêtements ignifuges (FRC). La protection du corps comporte des vêtements sans huile, comme des gants de cuir, une chemise solide, des pantalons sans revers, des chaussures hautes et une casquette.

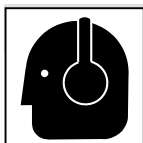


LE SOUDAGE peut provoquer un incendie ou une explosion.

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 homologuées.
- 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 défailir. 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 (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 le 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 dégelier des conduites gelées.
- En cas de non utilisation, enlever la baguette d'électrode du porte-électrode ou couper le fil à la pointe de contact.
- Porter une protection corporelle en cuir ou des vêtements ignifuges (FRC). La protection du corps comporte des vêtements sans huile, comme 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.



Le BRUIT peut endommager l'ouïe.

Le bruit produit par certains procédés ou équipements peut endommager l'ouïe.

- Vérifier si les niveaux de bruit excèdent les limites spécifiées par l'OSHA.
- Porter des protections auditives appropriées si le niveau de bruit est élevé.
- Avertir les personnes à proximité du danger inhérent au bruit.



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 à l'arc gougeage, de la découpe plasma ou une opération de chauffage par induction.



Si des BOUTEILLES sont endommagées, elles pourront exploser.

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

- Protéger les bouteilles de gaz comprimé d'une chaleur excessive, des chocs mécaniques, 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.
- Maintenir le chapeau de protection sur la soupape, sauf en cas d'utilisation ou de branchement de la bouteille.
- 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. Symboles de dangers supplémentaires en relation avec l'installation, le fonctionnement et la maintenance



Risque D'INCENDIE OU D'EXPLOSION.

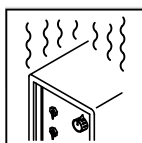
- Ne pas installer l'appareil au contact, au-dessus, ou à côté d'une surface combustible.
- Ne pas installer l'appareil à proximité de produits inflammables
- Ne pas surcharger l'installation électrique – s'assurer que l'alimentation est correctement dimensionnée et protégée avant de mettre l'appareil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



LA CHUTE DE L'ÉQUIPEMENT peut provoquer des blessures.

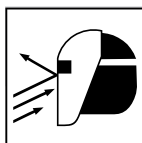
- Utiliser l'anneau de levage uniquement pour soulever l'appareil, NON PAS les organes de roulement, les bouteilles de gaz ou tout autre accessoire.
- Utilisez les procédures correctes et des équipements d'une capacité appropriée pour soulever et supporter l'appareil.
- En utilisant des fourches de levage 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 № 94-110) lors du levage manuel de pièces ou équipements lourds.



L'EMPLOI EXCESSIF peut SURCHAUFFER L'ÉQUIPEMENT.

- Laisser l'équipement refroidir ; respecter le facteur de marche nominal.
- Réduire le courant ou le cycle opératoire avant de recommencer 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 manoeuvre 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 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 gachette avant d'en avoir reçu l'instruction.
- Ne pas diriger le pistolet vers soi, d'autres personnes ou toute pièce mécanique en engageant le fil de soudage.



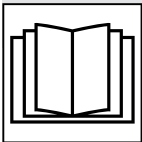
L'EXPLOSION DE LA BATTERIE peut provoquer des blessures.

- Ne pas utiliser poste 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.

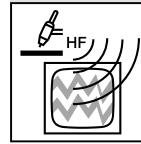
- S'abstenir de toucher des organes mobiles tels que des ventilateurs.
- Maintenir fermés et verrouillés les portes, panneaux, recouvrements et dispositifs de protection.
- Lorsque cela est nécessaire pour des travaux d'entretien et de dépannage, faire retirer les portes, panneaux, recouvrements ou dispositifs 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.

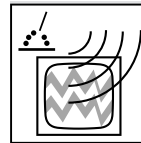
- Lire et appliquer les instructions sur les étiquettes et le Mode d'emploi avant l'installation, l'utilisation ou l'entretien de l'appareil. Lire les informations de sécurité au début du manuel et dans chaque section.

- N'utiliser que des pièces de remplacement provenant du fabricant.
- 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 (HF) risque de provoquer des interférences.

- Le rayonnement haute fréquence (HF) 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 appareil 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 appareil soudage, 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.

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.

Safe Practice For Occupational And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute. Website: safetysupply.com.

Safe Practices for the Preparation of Containers and Piping for Welding and Cutting, American Welding Society Standard AWS F4.1. Website: www.aws.org.

National Electrical Code, NFPA Standard 70 from National Fire Protection Association. Website: www.nfpa.org.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1 from Compressed Gas Association. Website: www.cganet.com.

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2 from Canadian Standards Association. Website: www.csa-group.org.

Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, NFPA Standard 51B from National Fire Protection Association. Website: 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.

OSHA *Important Note Regarding the ACGIH TLV, Policy Statement on the Uses of TLVs and BEIs*. Website: 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.

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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: par exemple, des restrictions d'accès pour les passants ou une évaluation individuelle des risques 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 sortie.
5. Connecter la pince sur la pièce aussi près que possible de la soudure.
6. Ne pas travailler à proximité de la source d'alimentation électrique de soudage ou de tout autre équipement pendant le fonctionnement, ni s'y asseoir ou s'y appuyer.

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 à l'arc, du coupage plasma ou de chauffage par induction. Si votre médecin vous l'autorise, suivre les procédures ci-dessus.

SECTION 3 – SPECIFICATIONS

3-1. Unit Specifications

A. MIG Specifications

Do not use information in unit specifications table to determine electrical service requirements. See Sections 4-6 and 4-7 for information on connecting input power.

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

Input Voltage	Rated Welding Output	Amperage Range	Maximum Open Circuit Voltage DC (U ₀ *)	Amperes Input at Rated Load Output, 50/60HZ, Single-Phase	KVA	KW
120 VAC, 15A Circuit	18 Volts DC at 80A 100% Duty Cycle	30 – 140	57	14.7	1.8	1.8
120 VAC, 20A Circuit	20.5 Volts DC at 130A 25% Duty Cycle			27.0	3.2	3.2
240 VAC	24.8 Volts DC at 215A 30% Duty Cycle	30 – 230	57	25.7	6.2	6.1

*See unit rating label and Section 10-2.

Wire Type and Dia	Solid/Stainless	Flux Cored	Wire Feed Speed Range
	.023 – .035 in. (0.6 – 0.9 mm)	.030 – .045 in. (0.8 – 1.1 mm)	60 – 600 IPM (1.5 – 15.24 m/min)

B. TIG Specifications

Do not use information in unit specifications table to determine electrical service requirements. See Sections 4-6 and 4-7 for information on connecting input power.

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

Input Voltage	Rated Welding Output	Amperage Range	Maximum Open-Circuit Voltage DC	Amperes Input at Rated Load Output, 50/60 Hz, Single-Phase	KVA	KW
120 VAC, 15A Circuit	14 Volts DC at 100A 100% Duty Cycle	20–150	57	14.5	1.8	1.7
120 VAC, 20A Circuit	15.6 Volts DC at 140A 40% Duty Cycle			22.7	2.8	2.7
240 VAC	17.6 Volts DC at 190A 20% Duty Cycle	20–210	57	16.57	3.9	3.9

C. Stick Specifications

Do not use information in unit specifications table to determine electrical service requirements. See Sections 4-6 and 4-7 for information on connecting input power.

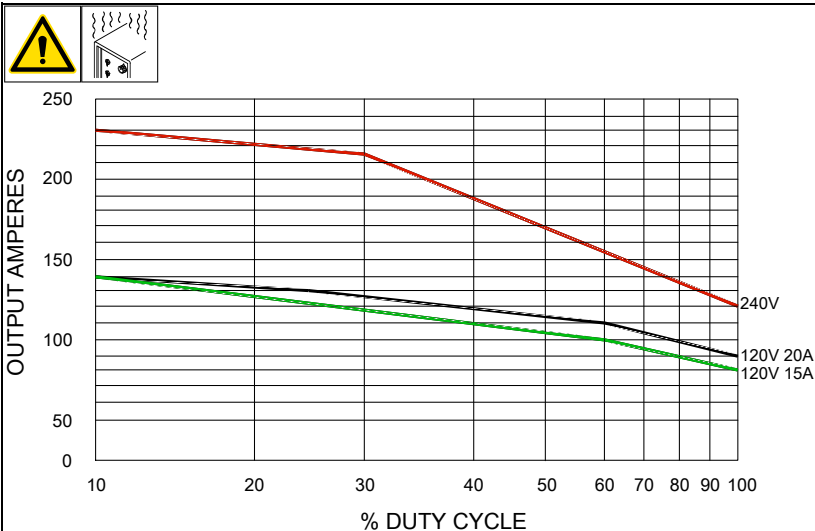
This equipment will deliver rated output at an ambient air temperature up to 104°F (40°C).

Input Voltage	Rated Welding Output	Amperage Range	Maximum Open-Circuit Voltage DC	Amperes Input at Rated Load Output, 50/60 Hz, Single-Phase	KVA	KW
120 VAC, 15A Circuit	22.4 Volts DC at 60A 100% Duty Cycle	30–100	57	13.49	1.6	1.6
120 VAC, 20A Circuit	23.8 Volts DC at 95A 40% Duty Cycle			22.44	2.7	2.7
240 VAC	27.6 Volts DC at 190A 20% Duty Cycle	30–200	57	24.96	6.0	6.0

3-2. Unit Dimensions

Weight w/ Gun	Overall Dimensions
35 lb (15.9 kg)	Length: 20 in. (508 mm) Width: 9.75 in. (248 mm) Height: 14.62 in. (372 mm)

3-3. Duty Cycle And Overheating—MIG



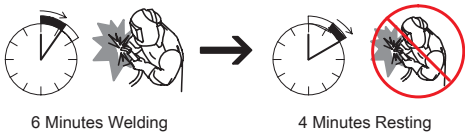
Duty Cycle is percentage of 10 minutes that unit can weld at rated load without overheating.

If unit overheats, output stops, and cooling begins. Wait fifteen minutes for unit to cool. Reduce amperage or duty cycle before welding.

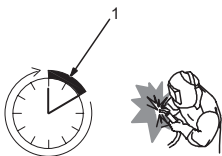
NOTICE – Exceeding duty cycle can damage unit and void warranty.

120V Input

60% duty cycle at 100 amps

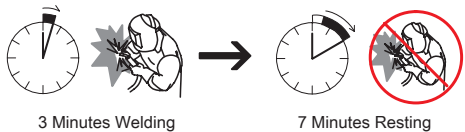


100% duty cycle at 80 amps

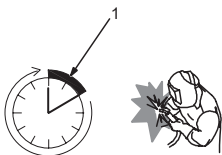


240V Input

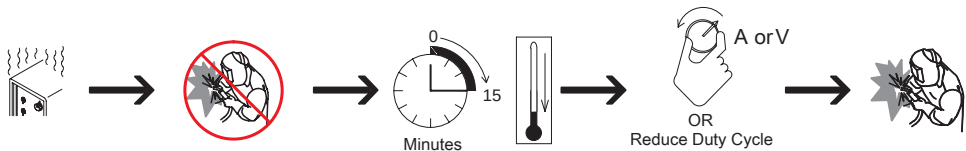
30% duty cycle at 215 amps



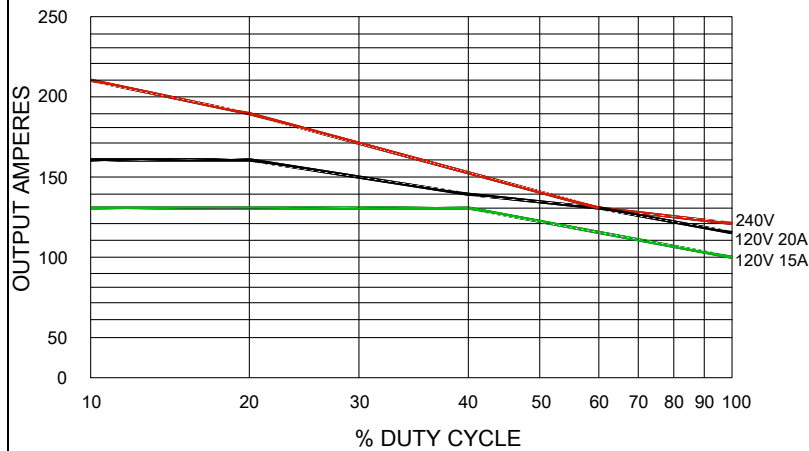
100% duty cycle at 120 amps



Overheating



3-4. Duty Cycle And Overheating—TIG



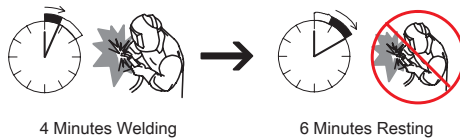
Duty Cycle is percentage of 10 minutes that unit can weld at rated load without overheating.

If unit overheats, output stops, and cooling begins. Wait fifteen minutes for unit to cool. Reduce amperage or duty cycle before welding.

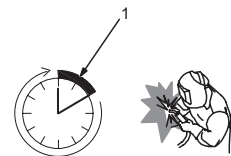
NOTICE – Exceeding duty cycle can damage unit and void warranty.

120V Input

40% duty cycle at 130 amps

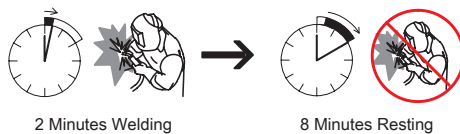


100% duty cycle at 100 amps

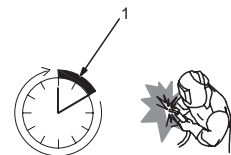


240V Input

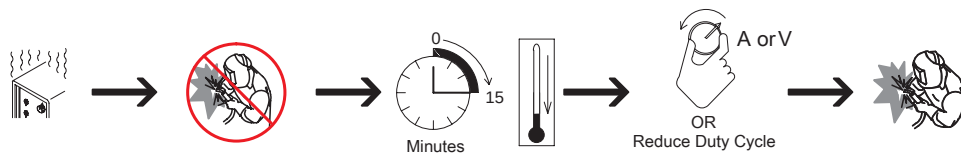
20% duty cycle at 190 amps



100% duty cycle at 120 amps



Overheating



3-5. Duty Cycle And Overheating—Stick



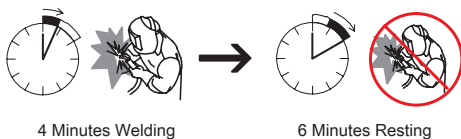
Duty Cycle is percentage of 10 minutes that unit can weld at rated load without overheating.

If unit overheats, output stops, and cooling begins. Wait fifteen minutes for unit to cool. Reduce amperage or duty cycle before welding.

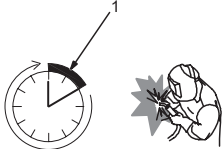
NOTICE – Exceeding duty cycle can damage unit and void warranty.

120V Input

40% duty cycle at 85 amps

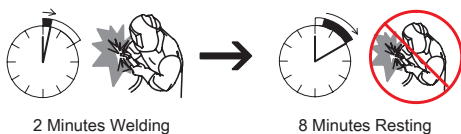


100% duty cycle at 60 amps

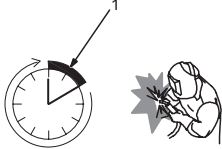


240V Input

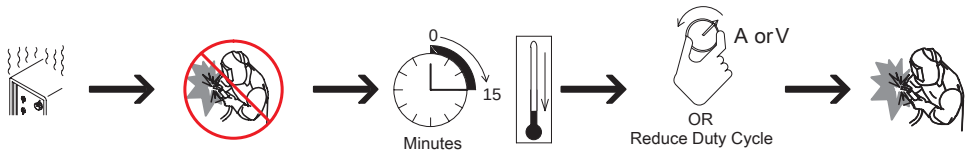
20% duty cycle at 190 amps



100% duty cycle at 110 amps



Overheating

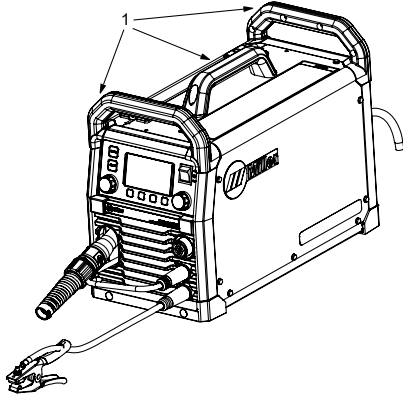


SECTION 4 – INSTALLATION

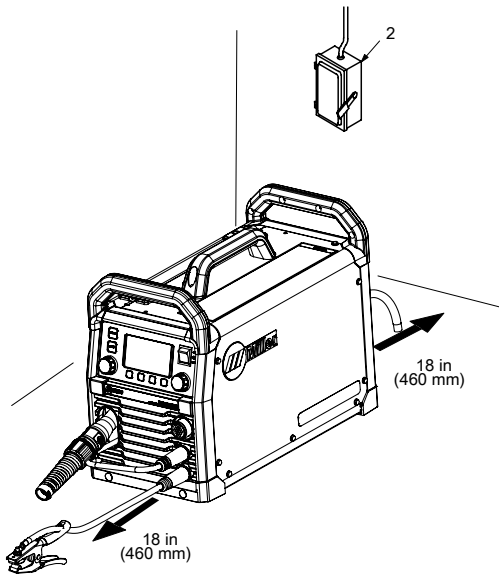
4-1. Selecting A Location



Movement



Location And Airflow



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

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

1 Lifting Handles

Use handles to lift unit.

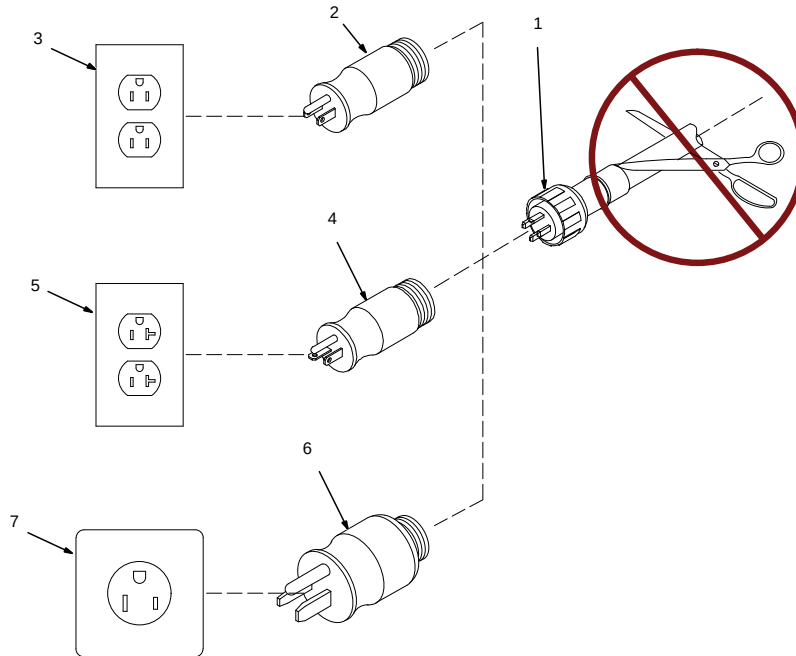
2 Line Disconnect Device

Locate unit near correct input power supply.

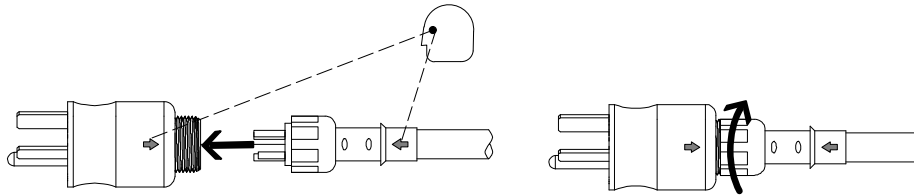
4-2. Multi-Voltage Plug (MVP) Connection



Selecting Plug



Connecting Plug To Power Cord



MVP Plug1 2010-10 / Ref. 803812C

⚠ Do not cut off power cord connector and rewire. The power cord connector and plugs will work with standard NEMA receptacles. Modifying power cord, connector, and plugs will void product warranty.

Selecting Plug

1 Power Cord Connector From Welding Power Source

Select plug for power supply receptacle available at site. Not all plugs shown are provided as standard with unit.

- 2 Plug – NEMA Type 5–15P
- 3 Receptacle – NEMA Type 5–15R (Customer Supplied)
- 4 Plug – NEMA Type 5–20P (Optional)
- 5 Receptacle – NEMA Type 5–20R (Customer Supplied)
- 6 Plug – NEMA Type 6–50P
- 7 Receptacle – NEMA Type 6–50R (Customer Supplied)

⚠ Follow electrical service guide for 240 VAC in Section . Do not use plug rating to size branch circuit protection.

Connecting Plug To Power Cord

Align arrow on plug with arrow on power cord connector. Push together.

Tighten threaded collar. As threaded collar is tightened, push plug onto adapter until collar is completely tight.

Connect plug to receptacle.

4-3. 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.

Select weld cables that meet all applicable local and national regulations.

	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)	250 ft (70 m)	300 ft (90 m)	350 ft (105 m)	400 ft (120 m)
Welding Amperes	10 - 60% Duty Cycle AWG (mm ²)	60 - 100% Duty Cycle AWG (mm ²)	10 - 100% Duty Cycle AWG (mm ²)					
100	4 (20)	4 (20)	4 (20)	3 (30)	2 (35)	1 (50)	1/0 (60)	1/0 (60)
150	3 (30)	3 (30)	2 (35)	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	3/0 (95)
200	3 (30)	2 (35)	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	4/0 (120)
250	2 (35)	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	2x2/0 (2x70)	2x2/0 (2x70)
300	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	2x2/0 (2x70)	2x3/0 (2x95)	2x3/0 (2x95)

* 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 drop of 4 volts or less or at least 300 circular mils per ampere.
() = mm² for metric use.

***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>.

4-4. Electrical Service Guide

⚠ Failure to follow these electrical service guide recommendations could create an electric shock or fire hazard. These recommendations are for an individual branch circuit sized for the rated output and duty cycle of one welding power source. In individual branch 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 exceed $\pm 10\%$ of indicated required input voltage. If actual input voltage is outside of this range, output may not be available.

	50/60 Hz 1-Phase	50/60 Hz 1-Phase
Rated Supply Voltage (V)	240	120
Rated Maximum Supply Current I_{max} (A)	28.9	A 15 or 20 ampere individual branch circuit protected by time-delay fuses or circuit breaker is required. See Section 4-6.
Rated Effective Supply Current I_{eff} (A)	14.6	
Maximum Recommended Standard Fuse Rating In Amperes ¹		
Time Delay Fuses ²	35	
Normal Operating Fuses ³	40	
Maximum Recommended Supply Conductor Length In Feet (Meters) ⁴	40 (12.2)	
Minimum Supply Conductor Size In AWG (mm ²) ⁵	14 (2.1)	
Minimum Grounding Conductor Size In AWG (mm ²) ⁵	14 (2.1)	

Reference: 2026 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). See UL 248.

4 Maximum total length of copper supply conductors in entire installation (raceway and/or flexible cord).

5 Raceway conductor size is determined per NEC Table 310.16 for insulated copper conductors having a temperature rating of 75°C (167°F) with not more than three single current-carrying conductors in the raceway, corrected for an ambient temperature of 40°C per Table 310.15(B)(1)(1).

4-5. Input Power Extension Cord Data

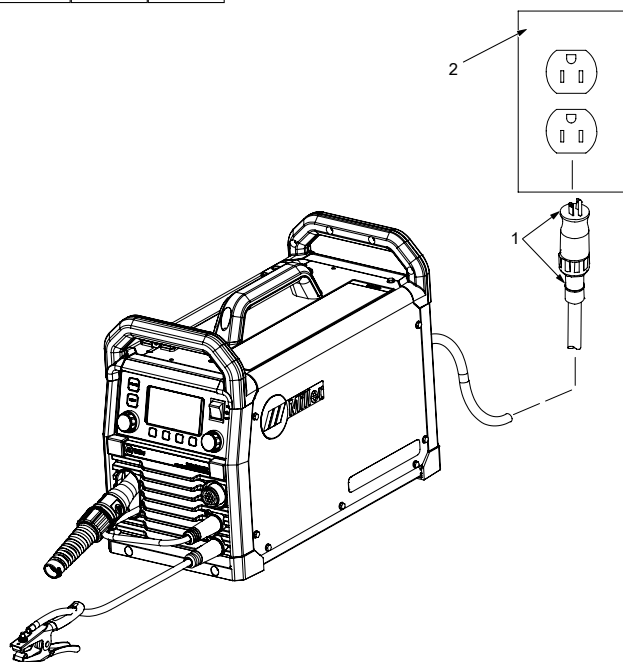
⚠ Extension cord must contain an equipment grounding conductor. Use extension cord only for temporary wiring. Remove extension cord immediately after completing the project.

Cord Type	Minimum Conductor Size	Number Of Conductors	Maximum Cord Length
Heavy Duty (Hard Usage)	12 AWG (4 mm ²)	3	50 ft (15 m)

Read OSHA Standard 1910.334 for more information on the use of cord and plug connected equipment.

Read National Electrical Code (NEC) Article 590 for more information on temporary wiring.

4-6. Connecting 120 Volt Input Power



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

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

NOTICE – The Auto-Line circuitry in this unit automatically links the power source to the primary voltage being applied, either 120 or 240 VAC.

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

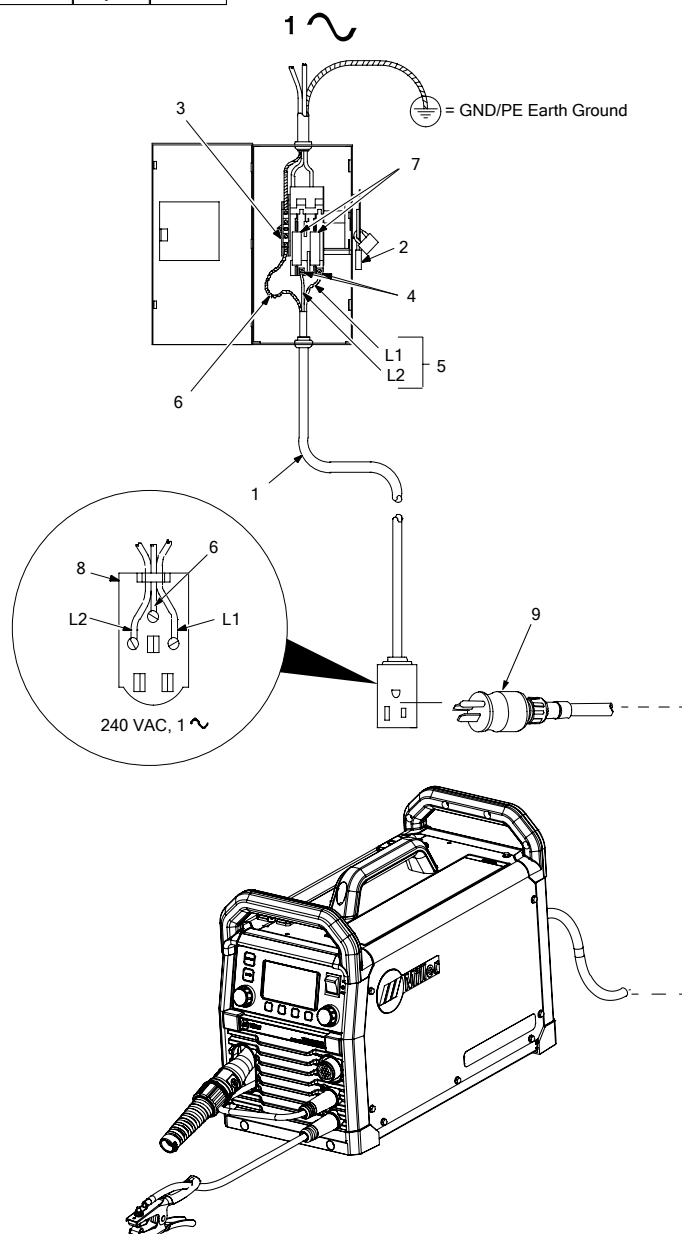
For 120 volts AC input power, a 15 or 20 ampere individual branch circuit protected by time-delay fuses or circuit breaker is required.

1 Multi-Voltage Plug And Power Cord Connector (NEMA Type 5–15P Plug Shown)

For multi-voltage plug connections, see Section [4-2](#).

2 Receptacle – NEMA Type 5–15R (Customer Supplied)

4-7. Connecting 1-Phase Input Power For 240 VAC



⚠ 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 links the power source to the primary voltage being applied, either 120 or 240 VAC.

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

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

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

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

7 Over-Current Protection

Select type and size of over-current protection using Electrical Service Guide (fused disconnect switch shown).

8 Receptacle (NEMA 6-50R) Customer Supplied

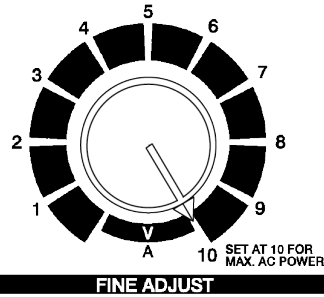
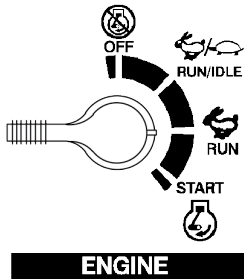
Close and secure door on disconnect device. Follow established lockout/tagout procedures to put unit in service.



4-8. Generator Requirements



Generator settings, if applicable

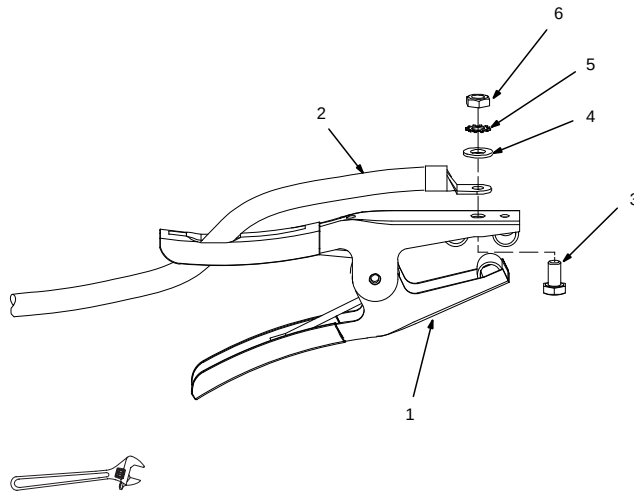


⚠ Engine Control Switch must be set at "RUN" position - not "RUN/IDLE".

⚠ Set generator Fine Adjustment Control to 10 for maximum auxiliary power.

Minimum auxiliary power requirement at rated load is 9.5 kW continuous at 240 volts AC for full output. Smaller generators will reduce output capability.

4-9. Installing Work Clamp



⚠ Tighten connection hardware with proper tools. Do not just hand tighten hardware. A loose electrical connection will cause poor weld performance and excessive heating of the work clamp.

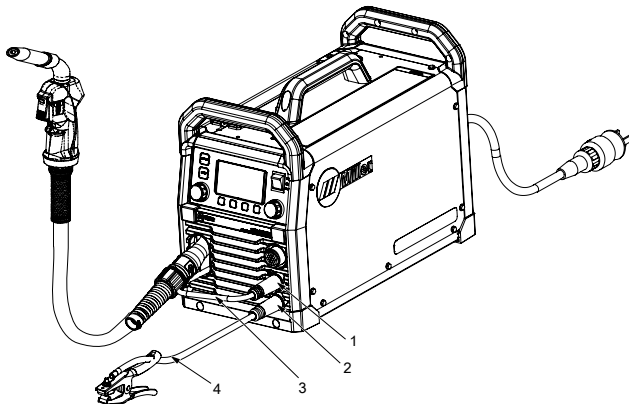
- 1 Work Clamp
- 2 Work Cable From Unit
- 3 Screw
- 4 Flat Washer
- 5 Lock Washer
- 6 Nut

Route work cable through hole in clamp handle. Secure cable with hardware as shown

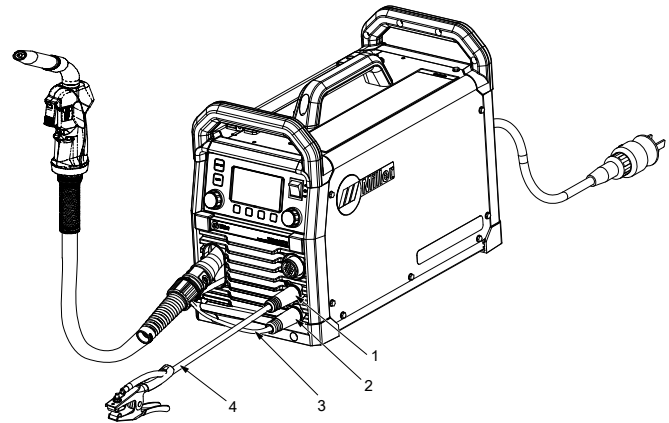
4-10. Process/Polarity Table

Process	Polarity	Cable Connections	
		Cable To Electrode	Cable To Work
MIG (GMAW) – Solid wire with shielding gas	DCEP – Reverse polarity	Connect to positive (+) output terminal	Connect to negative (–) output terminal
Flux-Cored (FCAW) – Self-shielding wire – no shielding gas	DCEN – Straight Polarity	Connect to negative (–) output terminal	Connect to positive (+) output terminal
TIG (GTAW)	DCEN – Straight Polarity	Connect to negative (–) output terminal	Connect to positive (+) output terminal
STICK (SMAW)	DCEP – Reverse polarity	Connect to positive (+) output terminal	Connect to negative (–) output terminal

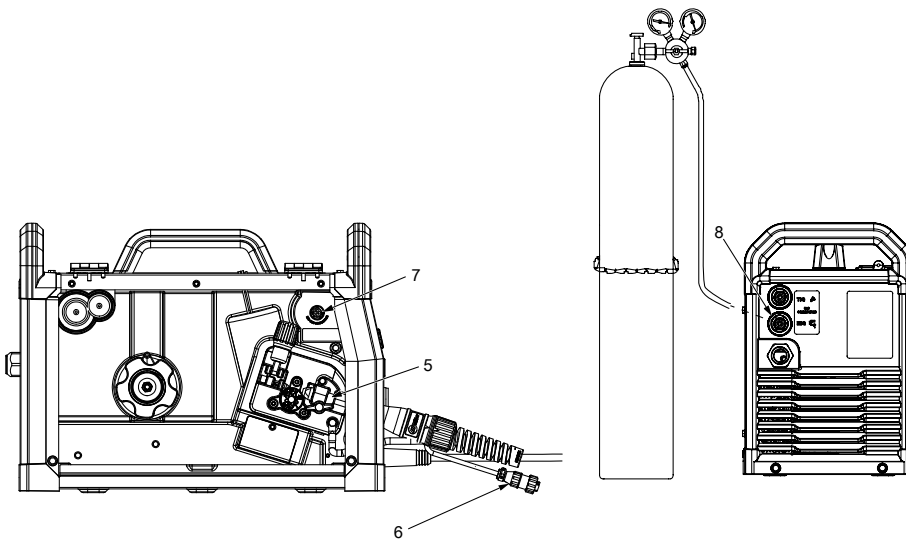
4-11. MIG Welding Connections



MIG – DCEP (Direct Current Electrode Positive)



Flux-Cored – DCEN (Direct Current Electrode Negative)



⚠ Turn off unit and disconnect input power before making connections.

- 1 Positive Weld Output Receptacle
- 2 Negative Weld Output Receptacle
- 3 Wire Drive Assembly Cable
- 4 Work Clamp And Cable

Ensure all connections are tight.

- 5 Gun End

Connect gun end to drive assembly.

- 6 Trigger Control Cable
- 7 Four Pin Trigger Control Cable Receptacle

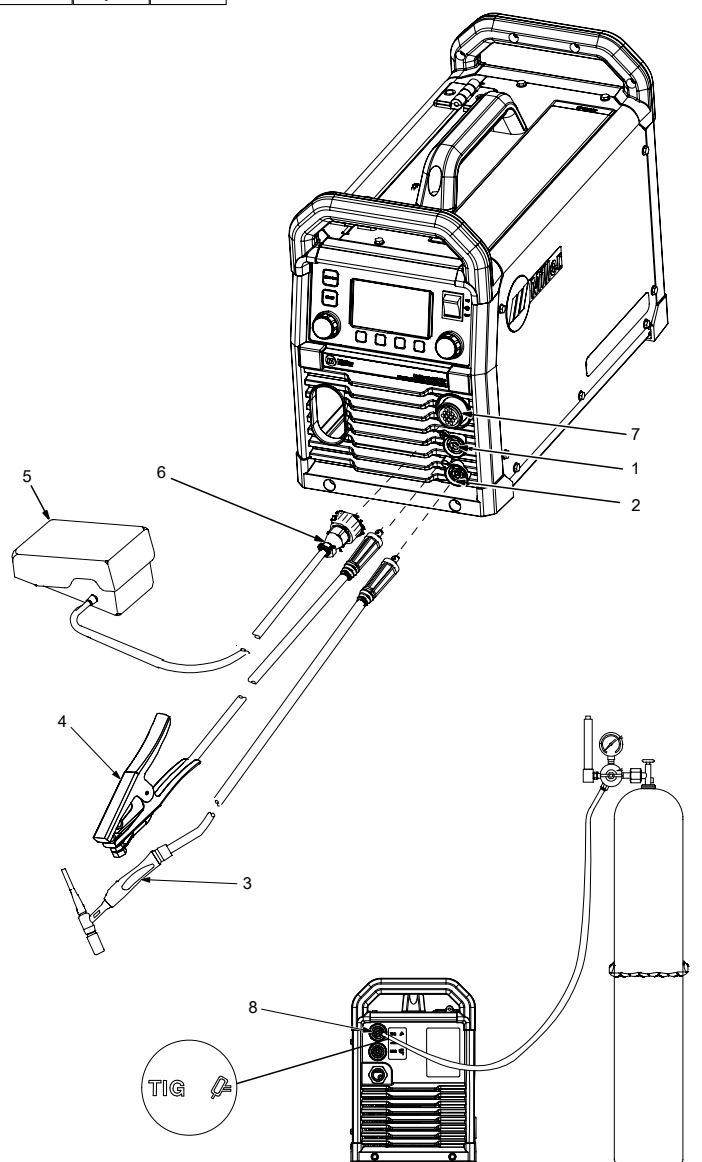
Route trigger control cable through MIG gun hole.

Connect plug on end of cable to four pin receptacle inside unit.

- 8 MIG Shielding Gas Connection

See Section [4-18](#) for regulator to bottle connections and reference P-Chart (see Section [5-16](#)) for recommended gas mixtures.

4-12. TIG Welding Connections



⚠ Turn off unit and disconnect input power before making connections.

⚠ Do not use worn, damaged, undersized, or repaired cables.

- 1 Positive Weld Output Receptacle
- 2 Negative Weld Output Receptacle
- 3 TIG Torch And Cable
- 4 Work Clamp And Cable

Connect TIG torch cable to the negative receptacle and connect work cable to positive receptacle. Turn connectors clockwise.

Ensure all connections are tight.

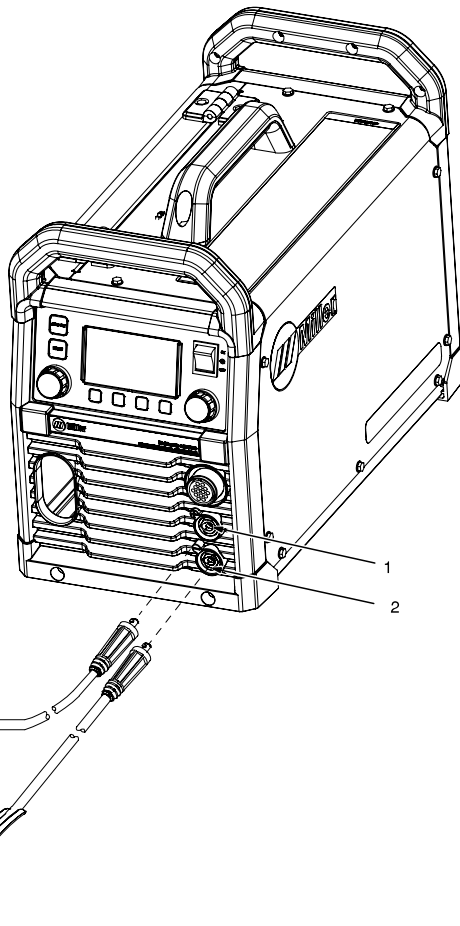
- 5 Foot Control
- 6 Remote Control Cable
- 7 Remote Control Receptacle

Connect foot control to remote control receptacle.

- 8 TIG Shielding Gas Connection

Use Argon gas for TIG welding (see Section [4-18](#)).

4-13. Stick Welding Connections



⚠ Turn off unit and disconnect input power before making connections.

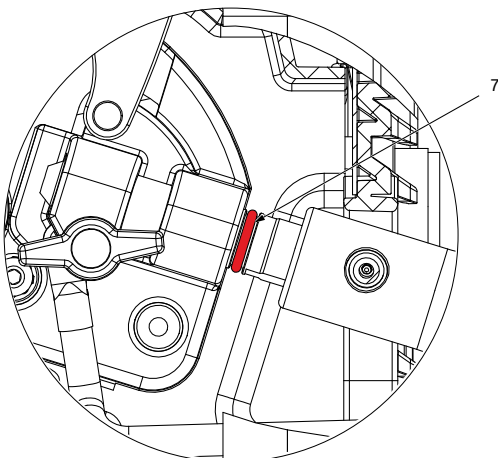
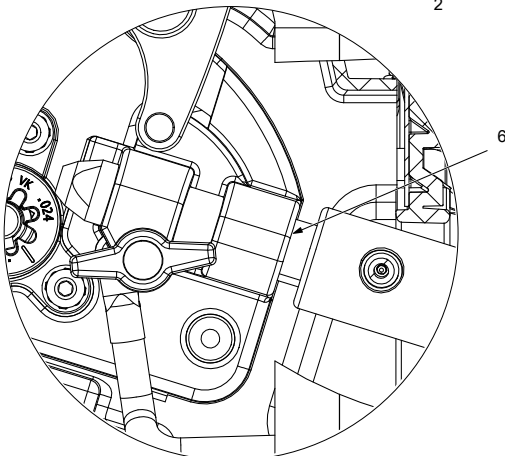
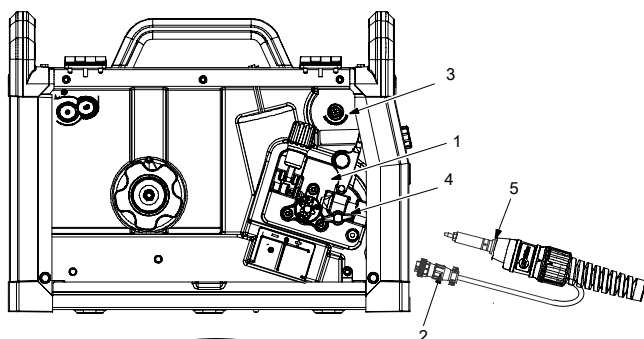
⚠ Do not use worn, damaged, undersized, or repaired cables.

- 1 Positive Weld Output Receptacle
- 2 Negative Weld Output Receptacle
- 3 Stick Electrode Holder And Cable
- 4 Work Clamp And Cable

Connect stick electrode holder cable to the positive output receptacle, and connect work clamp to negative output receptacle. Turn connectors clockwise.

Ensure all connections are tight.

4-14. Installing Welding Gun Or Spool Gun



- 1 Drive Assembly
- 2 Gun Trigger Plug
- 3 Gun Trigger Receptacle

Route gun trigger plug through front panel.

Insert plug into receptacle, and tighten threaded collar.

- 4 Gun Securing Knob
- 5 Gun End

Loosen knob. **Insert end of gun through opening in front panel until it is fully seated against drive assembly.** Tighten knob

- 6 Correct View

Gun power pin o-ring fully seated in drive casting pin receptacle.

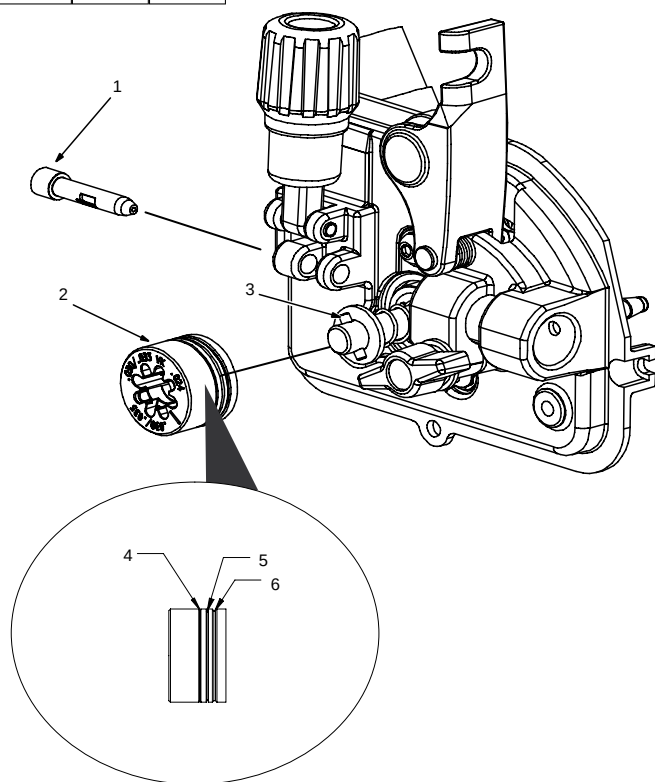
- 7 Incorrect View

Gun power pin o-ring visible, not fully seated in drive casting power pin receptacle.

Close door.

 *Be sure that gun end is tight against drive assembly. Incorrect installation will have adverse effects on gas flow.*

4-15. Changing Drive Roll Or Wire Inlet Guide



1 Inlet Wire Guide

Change guide when worn.

Remove guide by pressing on barbed area or cutting off one end near housing and pulling it out of hole. Push new guide into hole from rear until it snaps in place.

2 Drive Roll

The drive roll includes three different sized grooves. The text aligned with the drive roll retaining pin indicates the selected groove.

3 Retaining Pin

4 0.024V Groove

5 0.030-0.035V Groove

6 0.030-0.035 V-Knurled Groove

To secure drive roll, locate open slot and push drive roll completely over retaining pin, then rotate drive roll to desired slot.

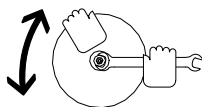
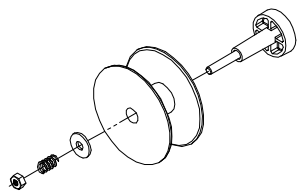
Table 4-1. Drive Roll Grooves And Wire Type Compatibility

Groove	Compatible Wire
0.024V	0.024 Solid Wire
0.030-0.035V	0.030-0.035 Solid Wire
0.030-0.035 V-Knurled	0.030-0.045 Flux-Cored

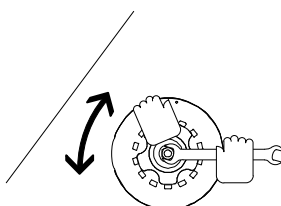
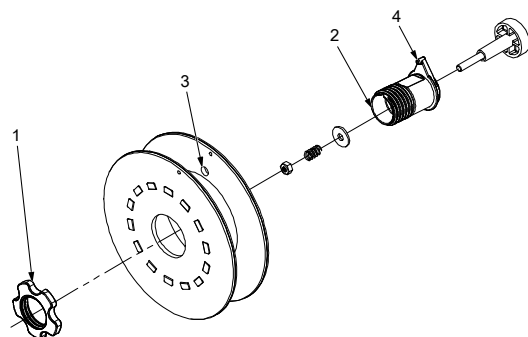
4-16. Installing Wire Spool And Adjusting Hub Tension



Installing 4 in. (102 mm) Wire Spool



Installing 8 in. (203 mm) Wire Spool



When a slight force is needed to turn spool, tension is set.

1 Retaining Ring

2 Adapter

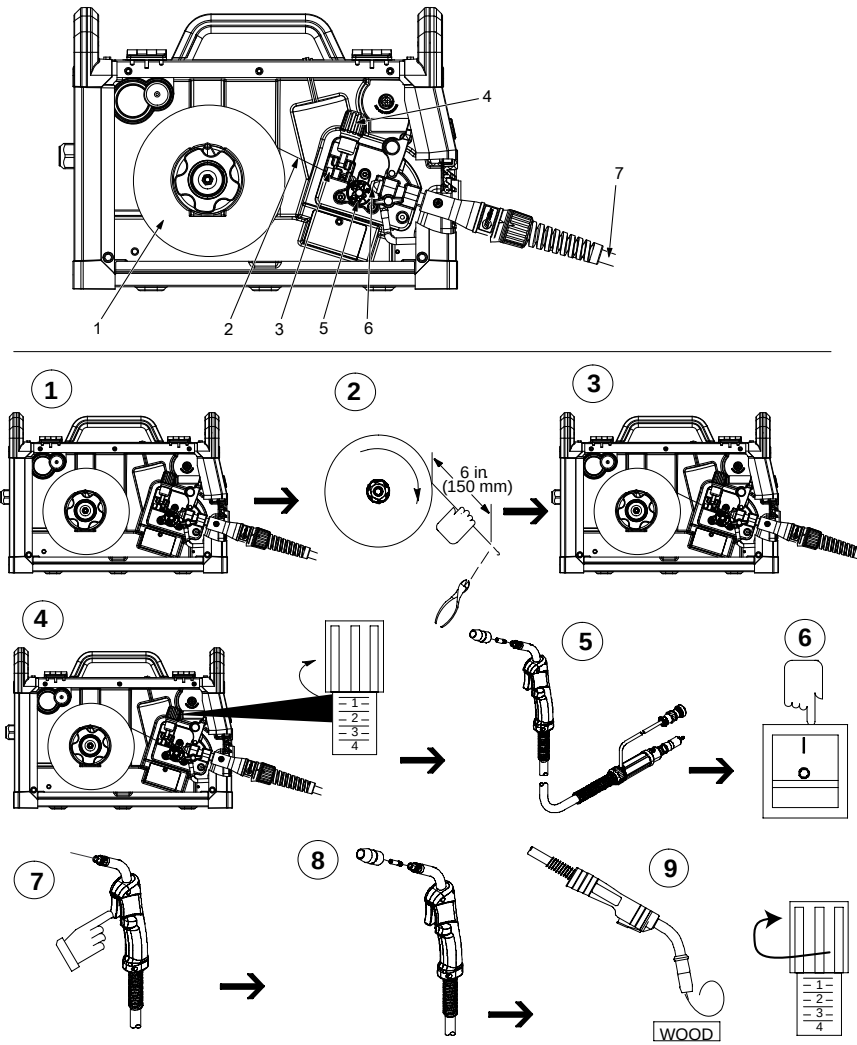
3 Locking Hole

4 Locking Pin

Align locking hole in spool with locking pin on spool hub.

1/2 in.

4-17. Threading Welding Wire



- 1 Wire Spool
- 2 Welding Wire
- 3 Inlet Wire Guide
- 4 Pressure Adjustment Knob
- 5 Drive Roll
- 6 Outlet Wire Guide
- 7 Gun Conduit Cable

Lay gun cable out straight.

Step 1. Open pressure assembly.

Step 2. Pull and hold wire; cut off end.

Hold wire tightly to keep it from unraveling.

Step 3. Push wire through guides into gun; continue to hold wire.

Step 4. Close and tighten pressure assembly, and let go of wire.

Use pressure indicator to set a desired drive roll pressure. Begin with a setting of 2. If necessary, make additional adjustments after trying this initial setting.

Step 5. Remove gun nozzle and contact tip.

Step 6. Turn power on.

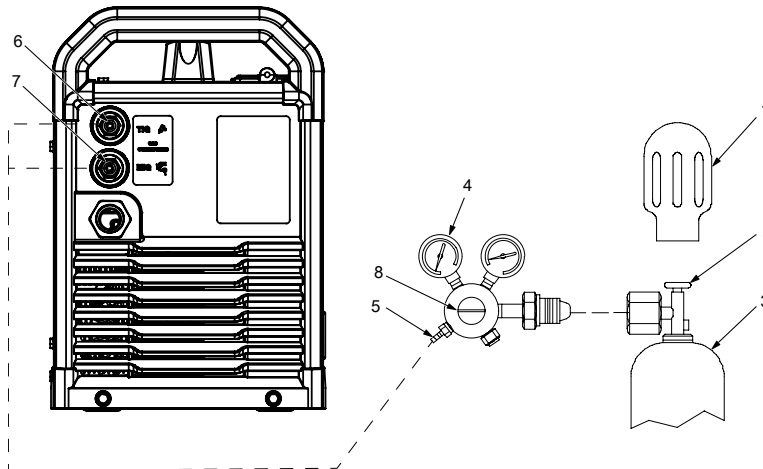
Step 7. Press gun trigger until wire comes out of gun.

Step 8. Reinstall contact tip and nozzle.

Step 9. Feed wire onto a non-conductive surface (e.g. wood) to check drive roll pressure. Tighten knob enough to prevent slipping.

Cut off wire. Close and latch door.

4-18. Installing Gas Supply



5/8, 1-1/8 in.



DO NOT use Argon/Mixed gas regulator/flowmeter with CO₂ shielding gas. See Parts List for optional CO₂ gas regulator/flowmeter and hose.

Obtain gas cylinder and chain to running gear, wall, or other stationary support so cylinder cannot fall and break off valve.

1 Cap

2 Cylinder Valve

Remove cap, stand to side of valve, and open valve slightly. Gas flow blows dust and dirt from valve. Close valve.

3 Argon Gas Or Mixed Gas Cylinder

4 Regulator/Flowmeter

Install so face is vertical.

5 Regulator/Flowmeter Gas Hose Connection

6 Welding Power Source Gas Hose Connection (TIG)

7 Welding Power Source Gas Hose Connection (MIG)

Connect supplied gas hose between regulator/flowmeter gas hose connection, and fitting on rear of welding power source.

8 Flow Adjust

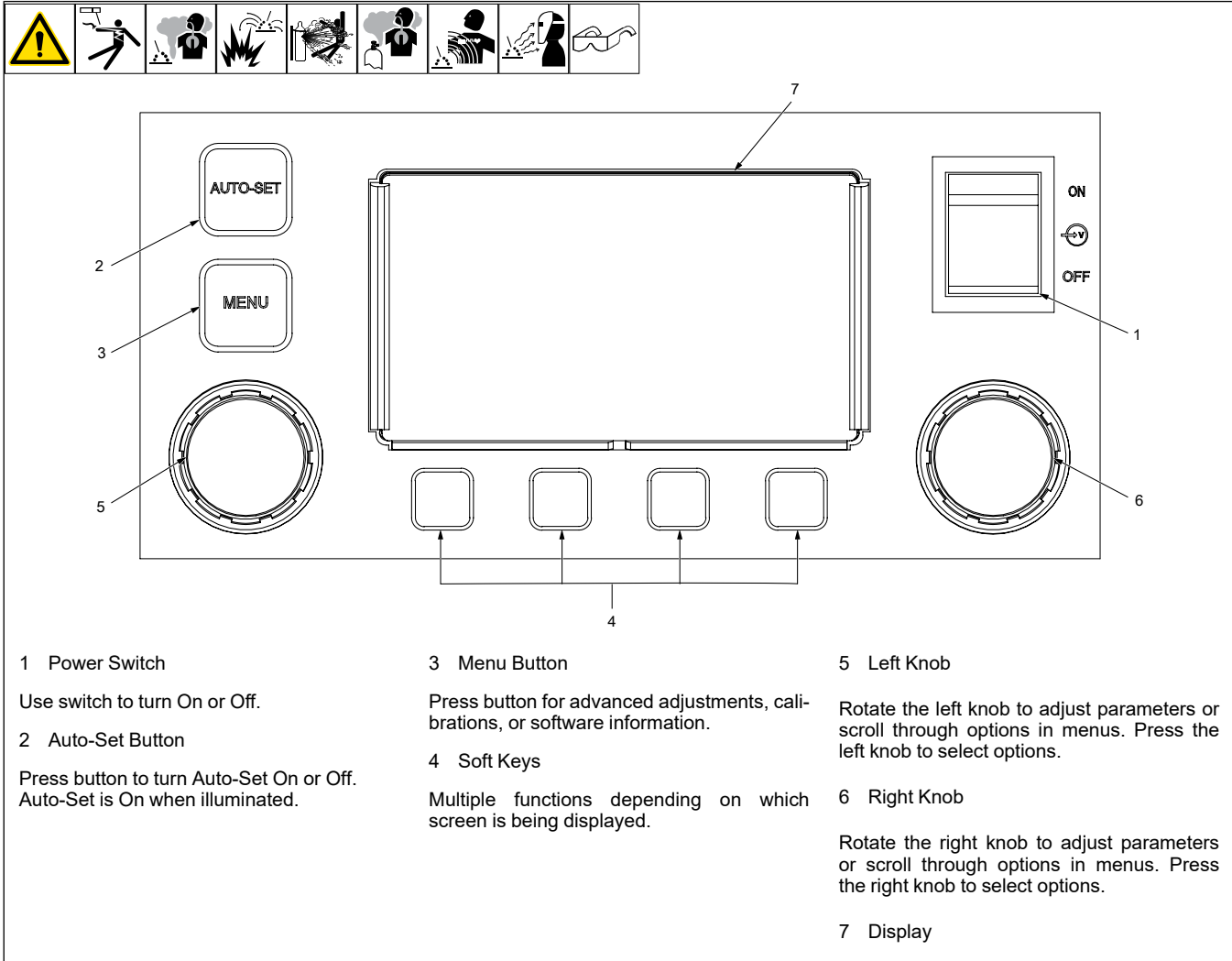
Flow rate should be set when gas is flowing through welding power source and welding gun. Open pressure assembly so that wire will not feed. Press gun trigger to start gas flow.

Typical flow rate is 20 to 25 cfh (cubic feet per hour). Check wire manufacturer's recommended flow rate.

After flow is set, close pressure assembly.

SECTION 5 – OPERATION

5-1. Controls



1 Power Switch

Use switch to turn On or Off.

2 Auto-Set Button

Press button to turn Auto-Set On or Off. Auto-Set is On when illuminated.

3 Menu Button

Press button for advanced adjustments, calibrations, or software information.

4 Soft Keys

Multiple functions depending on which screen is being displayed.

5 Left Knob

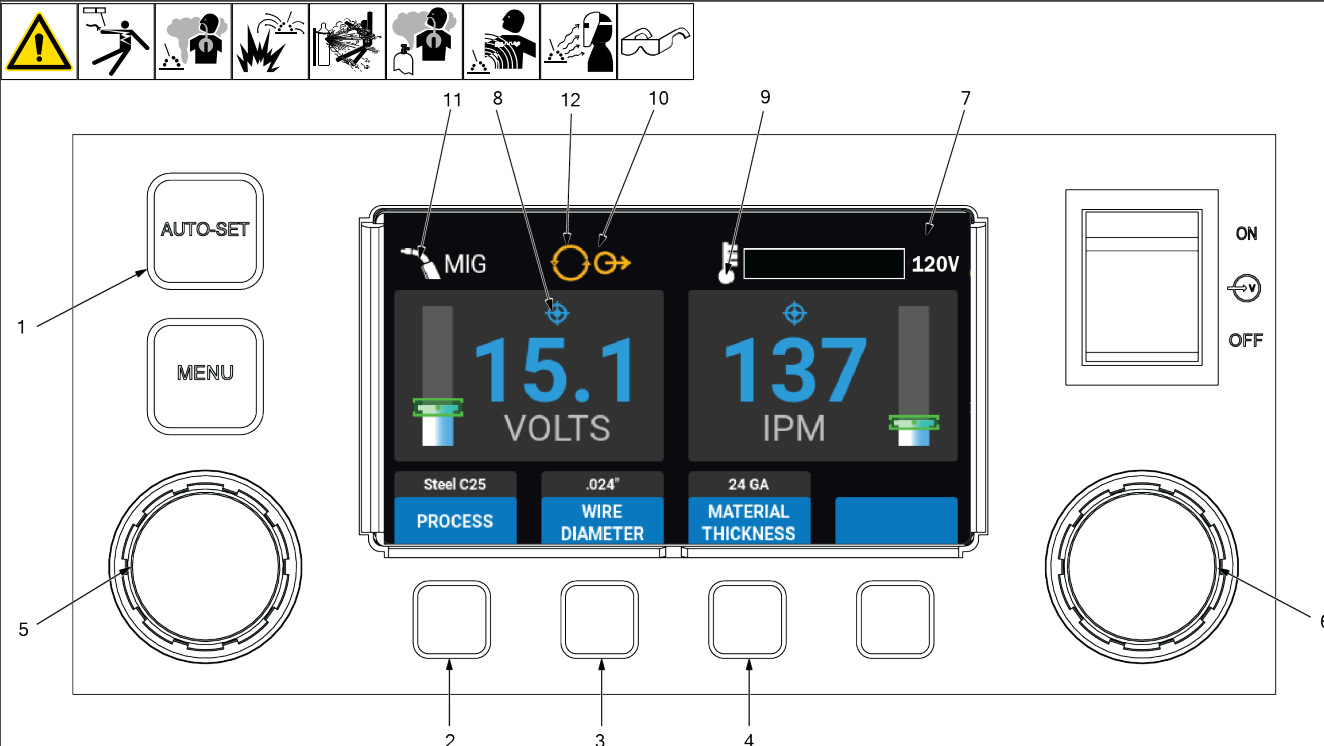
Rotate the left knob to adjust parameters or scroll through options in menus. Press the left knob to select options.

6 Right Knob

Rotate the right knob to adjust parameters or scroll through options in menus. Press the right knob to select options.

7 Display

5-2. Using Auto-Set™



1 Auto-Set Button

Press to turn Auto-Set on or off. Auto-Set is on when illuminated.

2 Process Soft Key

Press soft key to open the process selection menu. Turn either knob to highlight desired process. Press either knob to select process.

3 Wire Diameter/Tungsten Size/Electrode Size Soft Key

See processes for specific uses (Section [5-2A](#) through [C](#)).

4 Material Thickness Soft Key

Press to open the material thickness menu. Turn either knob to highlight desired material thickness. Press either knob to enter material thickness selection.

5 Left Knob

See processes for specific uses (see Section [5-2A](#) through [C](#)).

6 Right Knob

See processes for specific uses (see Section [5-2A](#) through [C](#)).

7 Input Voltage

Displays connected input voltage.

8 Bulls eye Indicator

Indicates recommended parameters.

9 Temperature Gauge

Indicates approximate machine temperature. When gauge is at maximum temperature, machine will be in an over temp condition (see Sections [3-3](#) through [3-5](#)).

10 Output Enabled

⚠ **Weld output terminals are energized at all times when Output Enabled symbol is displayed.**

Indicates weld output.

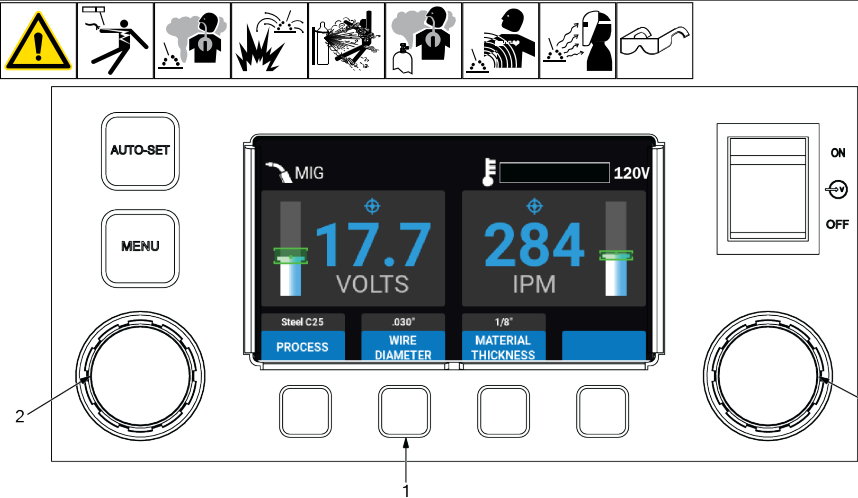
11 Selected Process

Indicates which process is currently selected.

12 Reversed Polarity Indicator

Detected cable polarity does not match the recommended configuration for the selected process.

A. Using Auto-Set for MIG/Flux-Cored Processes



1 Wire Diameter Soft Key

Press to open the wire diameter menu. Turn either knob to highlight desired wire diameter. Press either knob to select wire diameter.

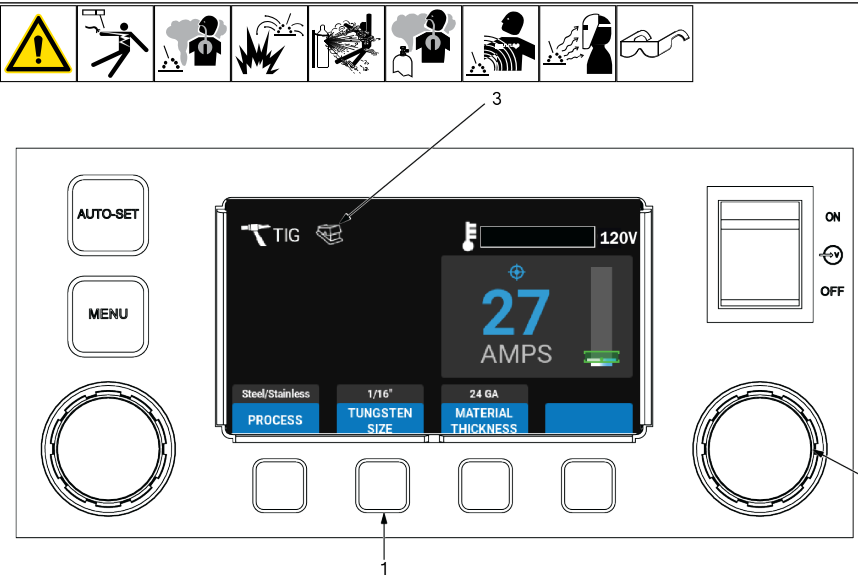
2 Left Knob

Use to fine tune the voltage setting within Auto-Set.

3 Right Knob

Use to fine tune the wire feed speed setting within Auto-Set.

B. Using Auto-Set for TIG



1 Tungsten Size Soft Key

Press to open the tungsten size menu. Turn either knob to highlight desired tungsten size. Press either knob to select tungsten size.

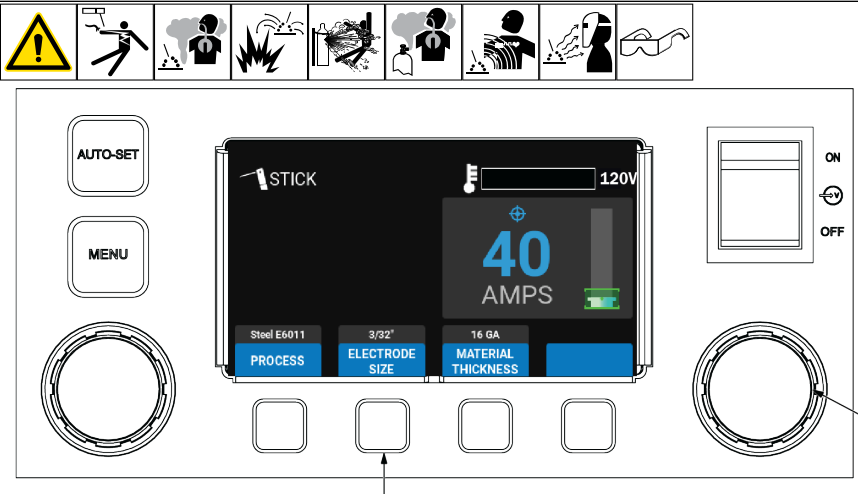
2 Right Knob

Use to fine tune the amperage setting within Auto-Set.

3 TIG Remote Connected

Indicates a remote is connected.

C. Using Auto-Set for Stick



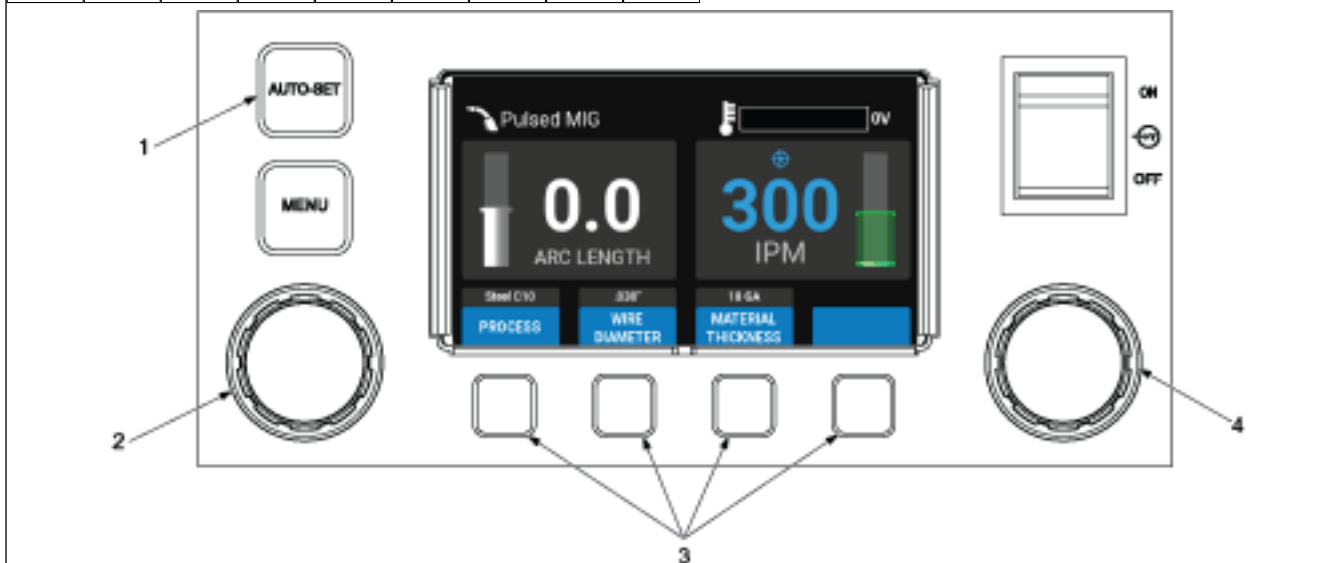
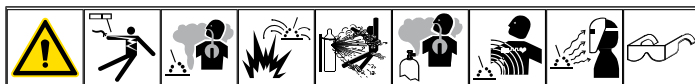
1 Electrode Size Soft Key

Press to open the electrode size menu. Turn either knob to highlight desired electrode size. Press either knob to select electrode size.

2 Right Knob

Use to fine tune the amperage setting within Auto-Set.

5-3. Using Pulsed MIG Auto-Set Mode



Pulsed MIG is a spray transfer that produces less heat input than conventional spray transfer, resulting in less warping, distortion, and spatter. Pulsed MIG is often used for MIG welding aluminum.

- 1 Auto-Set Button
- 2 Left Knob
- 3 Soft Keys
- 4 Right Knob

Press MIG Process, Auto-Set and Pulse buttons.

Use soft keys to select wire and gas for Pulsed MIG.

Use soft key to select wire diameter.

Use soft keys to move cursor to left or right to select material thickness.

Use left knob to fine tune arc length. Arc length defaults to 0.0.

Use right knob to fine tune wire feed speed.

Arc Length

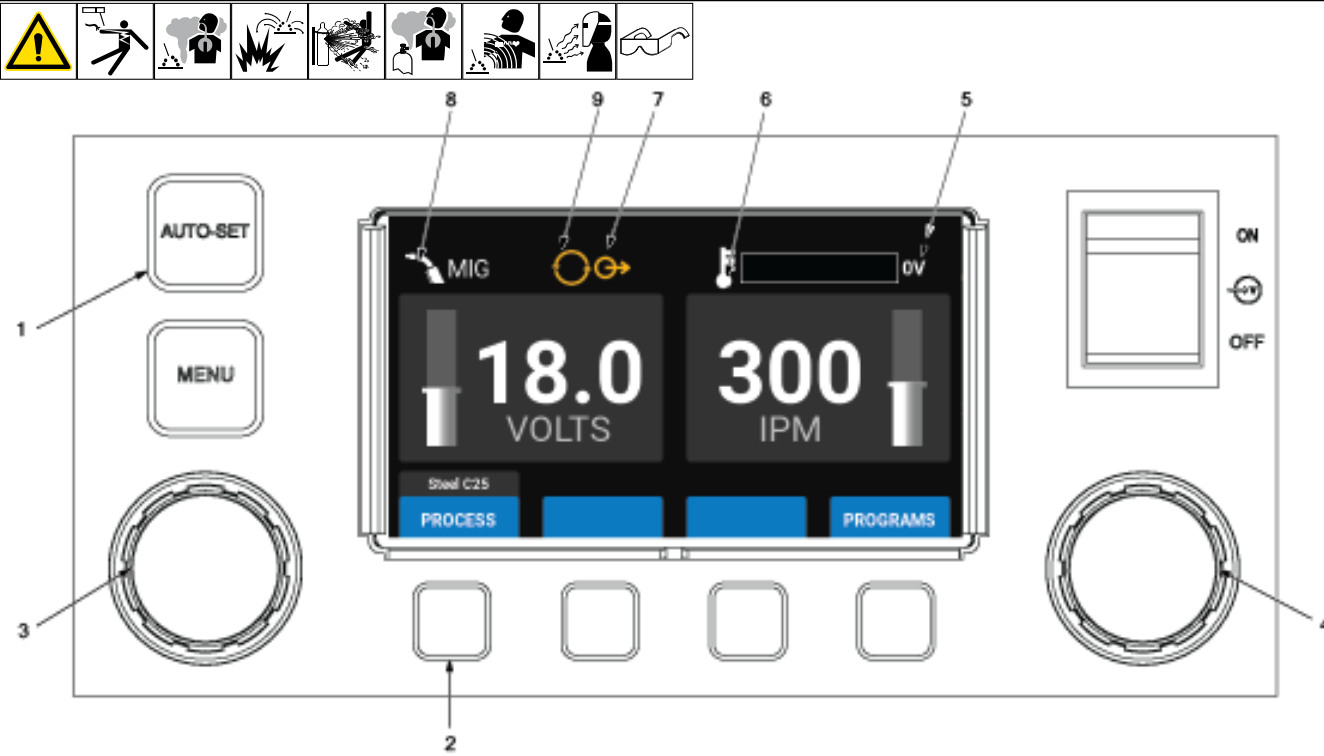
Arc length can be adjusted from -9.9 to 10. Adjusting the Arc Length will vary the length of the welding arc cone.

Increase Arc Length to reduce amount of shorting or Spatter experienced during weld.

Decrease Arc Length if wire feels too close to the contact tip.

If a gas is used other than what is listed on the Pulsed MIG welding program chart, the Arc Length can be adjusted to help customize your arc to the gas being used.

5-4. Using Manual Mode



1 Auto-Set Button

Press to turn Auto-Set on or off. Auto-Set is On when illuminated.

2 Process Soft Key

Press soft key to open the process selection menu. Turn either knob to highlight desired material thickness. Press either knob to enter material thickness

3 Left Knob

See processes for specific uses (Section [5-4A](#) through [C](#)).

4 Right Knob

See processes for specific uses (Section [5-4A](#) through [C](#)).

5 Input Voltage

Displays connected input voltage.

6 Temperature Gauge

Indicates approximate machine temperature. When gauge is at maximum temperature, machine will be in an over temp condition. See Section [3-3](#).

7 Output Enabled

8 Selected Process

Indicates which process is currently selected.

9 Reversed Polarity Indicator

Detected cable polarity does not match the recommended configuration for the selected process.

Warning: Weld output terminals are energized at all times when Output Enabled symbol is displayed.

Indicates weld output.

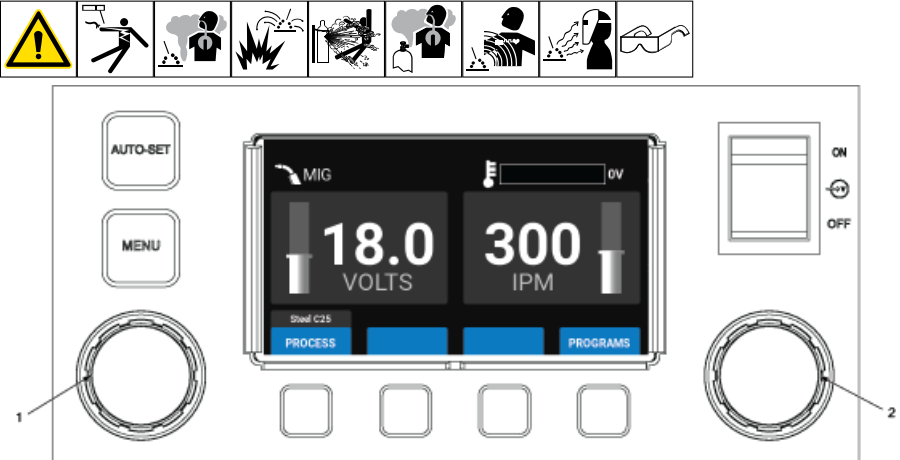
White color indicates the electrode is electrically live and a weld will be initiated when contacted with workpiece.

Yellow color indicates active welding.

It is important to select the correct process and material type as these will change background settings for optimal performance.

Manual Mode will start with the last settings from Auto-Set™, enabling you to adjust the parameters without being limited by the green brackets.

A. Using MIG/Flux-Cored Manual Mode



1 Left Knob

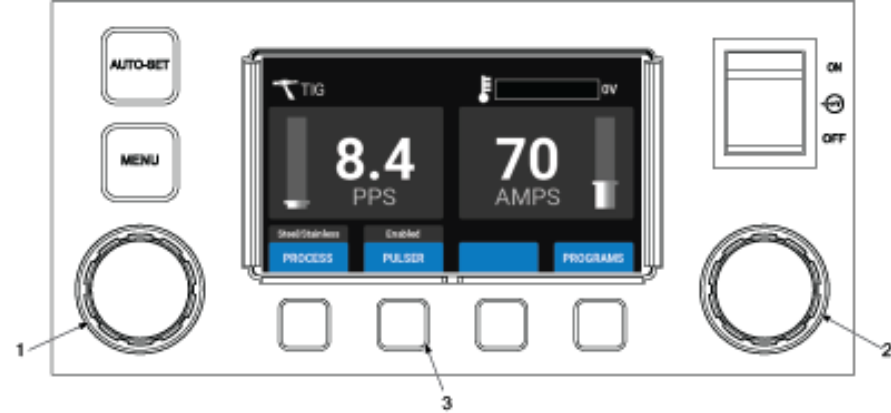
Use left knob to adjust voltage.

2 Right Knob

Use right knob to adjust wire feed speed.

B. Using TIG Manual Mode





1 Left Knob

Use left knob to adjust PPS.

2 Right Knob

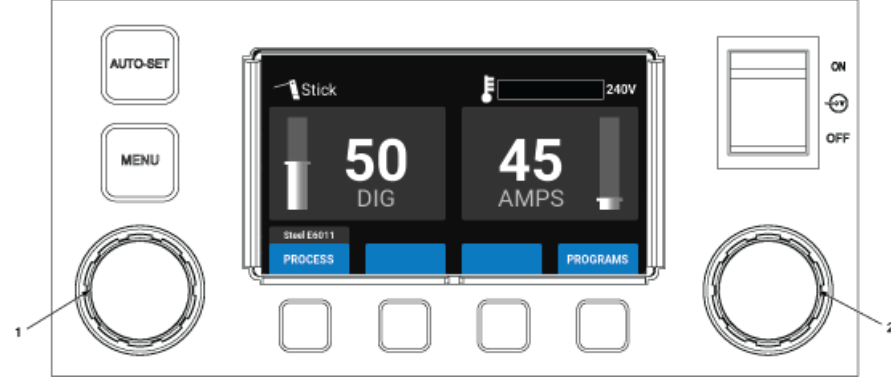
Use right knob to adjust amperage.

3 Pulser Soft Key

Press to toggle Pulser.

C. Using Stick Manual Mode





1 Left Knob

Use left knob to adjust DIG.

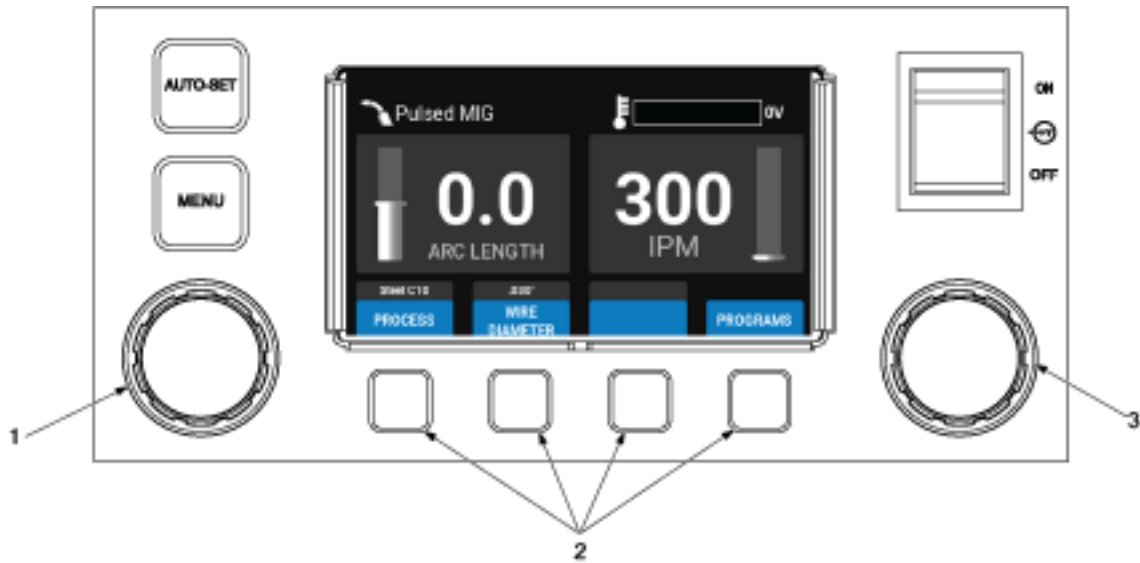
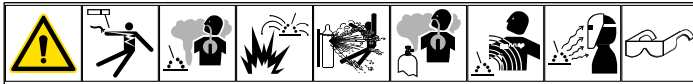
DIG controls the amount of additional amperage at low voltage (short arc length) conditions. Increase DIG for less electrode sticking and more penetration. Decrease DIG for softer arc that will penetrate less.

DIG Range: 0-99 (Default/Recommended Value is 50)

2 Right Knob

Use right knob to adjust amperage.

5-5. Using Pulsed MIG Manual Mode



1 Left Knob

Arc Length

Arc length can be adjusted from -9.9 to 10 . Adjusting the Arc Length will vary the length of the welding arc cone.

Increase Arc Length to reduce amount of shorting or Spatter experienced during weld. Decrease Arc Length if wire feels too close to the contact tip.

If a gas is used other than what is listed on the Pulsed MIG welding program chart, the

Arc Length can be adjusted to help customize your arc to the gas being used.

2 Soft Keys

3 Right Knob

In the Setup menu, rotate left knob to highlight material and gas. Rotate right knob to select material and gas being used.

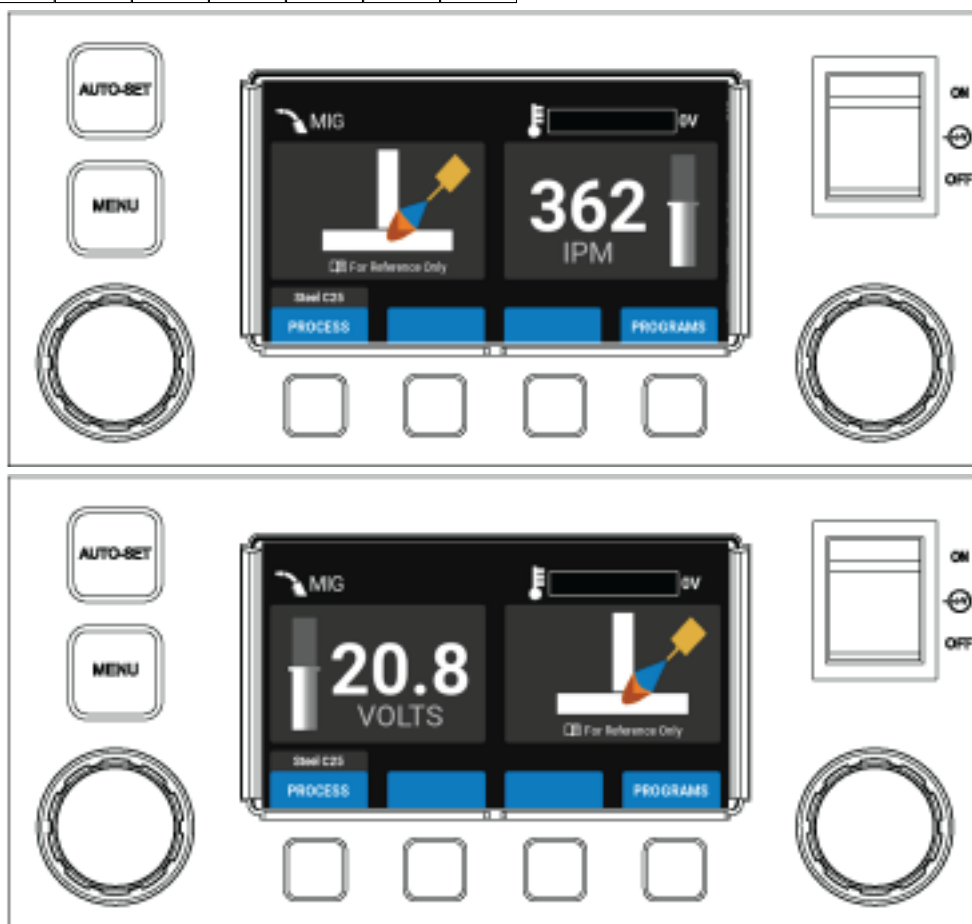
Rotate left knob to highlight wire diameter. Rotate right knob to select wire diameter being used.

Press Home to return to welding mode.

Operation

Adjust right knob for proper wire feed speed and adjust left knob to change arc length if required. Refer to Pulse MIG welding chart for proper Wire Speed setting for metal and metal thickness being welded. All Pulse MIG programs are set up with the gases listed in the Pulse MIG welding chart. If alternate gases are used, adjust arc length and/or arc control to adjust arc characteristics.

5-6. Using BeadVision™

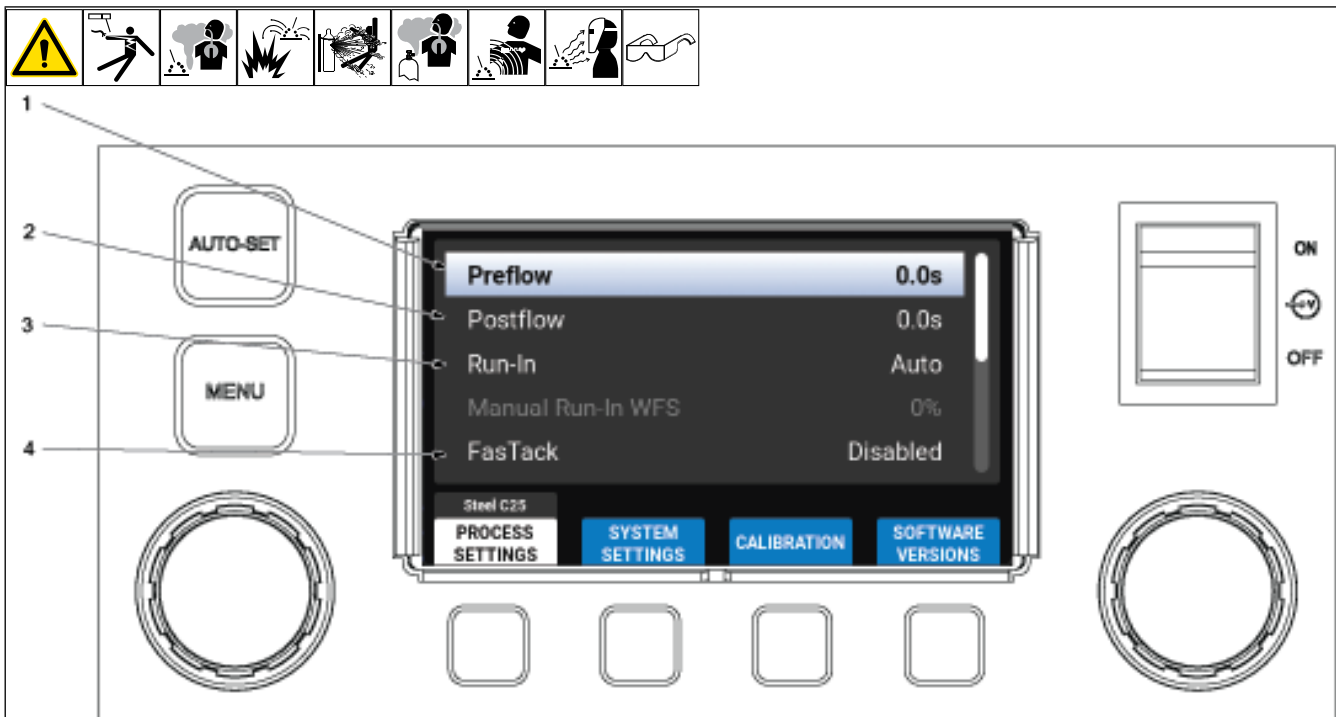


☞ BeadVision is meant to give the user an educational experience when making weld adjustments on the user interface, showing how each weld parameter effects the bead and penetration profile of the weld. This graphic

is not meant to simulate a “realistic” weld at the current set points but rather give the user an idea of how the parameters being adjusted will affect the general performance and behavior of the weld.

☞ This feature may be turned off in the System Settings menu by changing “Bead Profile Preview” to “Disabled.”

5-7. Process Settings for MIG/Flux Cored/Pulsed MIG



1 Prewflow

Controls the amount of time shielding gas flows after the trigger is depressed and prior to feeding wire. Prewflow is used to purge the immediate weld area of atmosphere. It also aids in consistent arc starts. Prewflow settings range from 0 to 5 seconds. To adjust, press either knob to show time menu, change the time setting up or down with right knob, then press either knob to enter the selected setting.

2 Postflow

Controls the amount of time that shielding gas flows after welding stops. Postflow is used to cool wire and weld, and to prevent contamination of the weld. Postflow settings range from 0 to 5 seconds, with factory preset at 0 seconds. To adjust, press either knob to show time menu, change the time setting up or down with the right knob, then press either knob to enter the selected setting.

3 Run-In

Run-In (Smooth-Start™) is a feature that reduces the wire speed prior to the welding arc being struck to produce smoother arc starts with less spatter.

Run-In Setup

To change setting, use either knob to highlight Run-In, then press either knob to enter Run-In Menu. Use the right knob to choose among the options listed below. Press either knob to select setting.

● Manual

When Run-In is set to Manual, it can be set to a percentage of the wire feed speed. To adjust the percentage, press either knob to enter the percentage menu, adjust the percentage up or down with the right knob, and press either knob to select the percentage.

● Auto (Default)

When Run-In is set to Auto, the welder determines the optimal Run-In wire feed speed for each start.

● Disabled

When Run-In is set to Disabled, the Run-In wire feed speed is the same as the set wire feed speed.

4 Fastack™

Enabling Fastack reduces arc start time by automatically increasing the Run-In speed when doing repetitive arc starts. Fastack automatically uses a slower wire feed speed when the wire is cool and a faster wire feed speed when the wire is hot. Default setting is Enabled. To adjust, use either knob to highlight Fastack, then press either knob to enter the Fastack menu. Use the right knob to highlight which option you want, then press either knob to select setting. Fastack can be used while Run-In is set to Manual or Auto.

5 Crater Setup

When the crater function is enabled, it will ramp the output down to limit the void or crater at the end of the weld.

To change setting, use either knob to highlight Crater, then press either knob to enter Crater Menu. Use the right knob to enable Crater, and its associated options listed below. Press either knob to select setting.

● Crater Wire Speed

When Crater is set to Enabled, the wire feed speed can be set to a percentage of the wire feed speed selected on the preset screen. To adjust the percentage, press either knob to enter the percentage menu. Adjust the percentage up or down with the right knob, and press either knob to select percentage.

● Crater Voltage

When Crater is set to Enabled, the voltage can be set to a percentage of the voltage selected on the preset screen. To adjust the percentage, press either knob to enter the percentage menu. Adjust the percentage up or down with the right knob, and press either knob to select percentage.

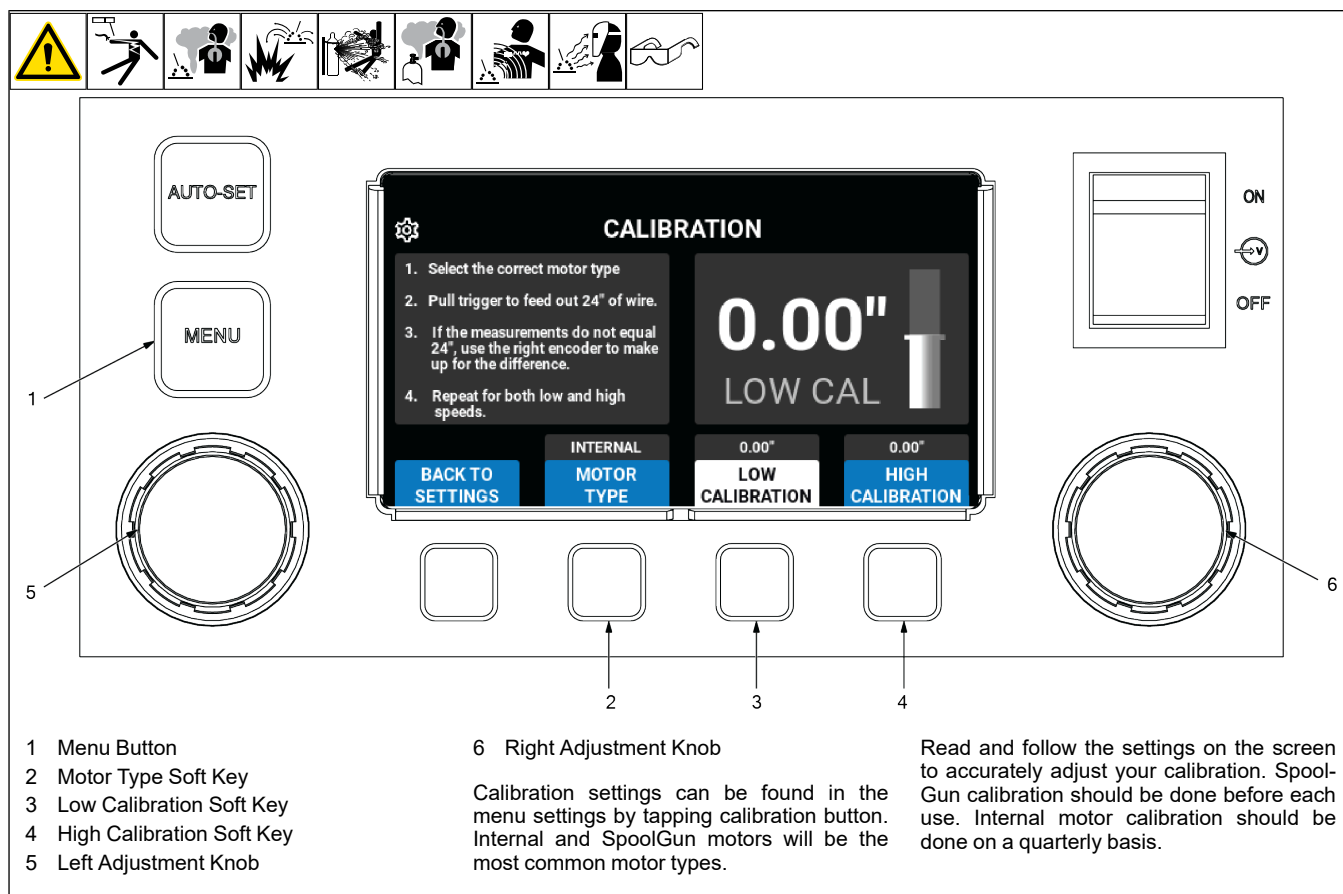
● Crater Ramp Time

When Crater is set to Enabled, the ramp time may be adjusted. The ramp time will adjust how quickly the set-points ramp down to the selected percentages listed above. To adjust the ramp time, press either knob to enter the ramp time menu. Adjust the time up or down with the right knob, and press either knob to select ramp time.

● Crater Time

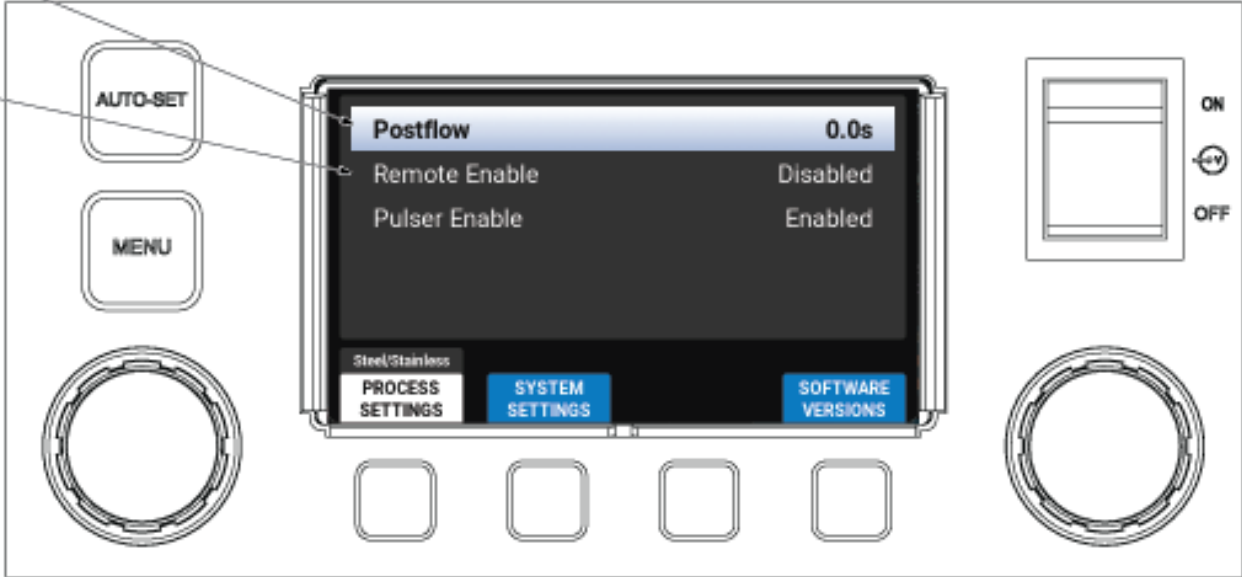
When Crater is set to Enabled, the crater time may be adjusted. The crater time will adjust the total time spent in crater. To adjust the crater time, press either knob to enter the crater time menu. Adjust the time up or down with the right knob, and press either knob to select crater time.

5-8. Motor Calibration Screen



5-9. Process Settings for TIG





1 Postflow

Controls the amount of time that shielding gas flows after welding stops. Postflow is used to cool tungsten and weld, and to prevent contamination of tungsten and weld. Postflow settings range from 0 to 30 seconds, with factory preset at 5 seconds. To adjust, press either knob to show time menu, adjust the time setting up or down

with the right knob, then press either knob to enter the selected setting.

2 Remote Enable

When setting is enabled, foot/finger control maximum is determined by the TIG amperage setting (see Section [5-2B.](#)). When disabled, welding amperage will always be equal to preset value.

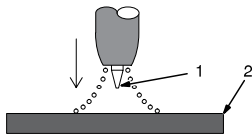
When remote is connected while setting is disabled, a selection prompt will appear to confirm settings.

When no remote is connected while setting is enabled an error will occur (see Section [6-4](#)).

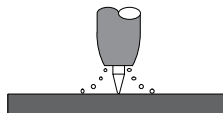
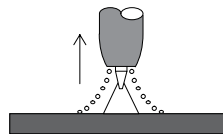
5-10. Lift-Arc Start Procedure



Lift-Arc Start Method



“Touch” 1–2 Seconds

Do NOT Strike Like A Match!

Lift-Arc Start

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

- 1 TIG Electrode
- 2 Workpiece

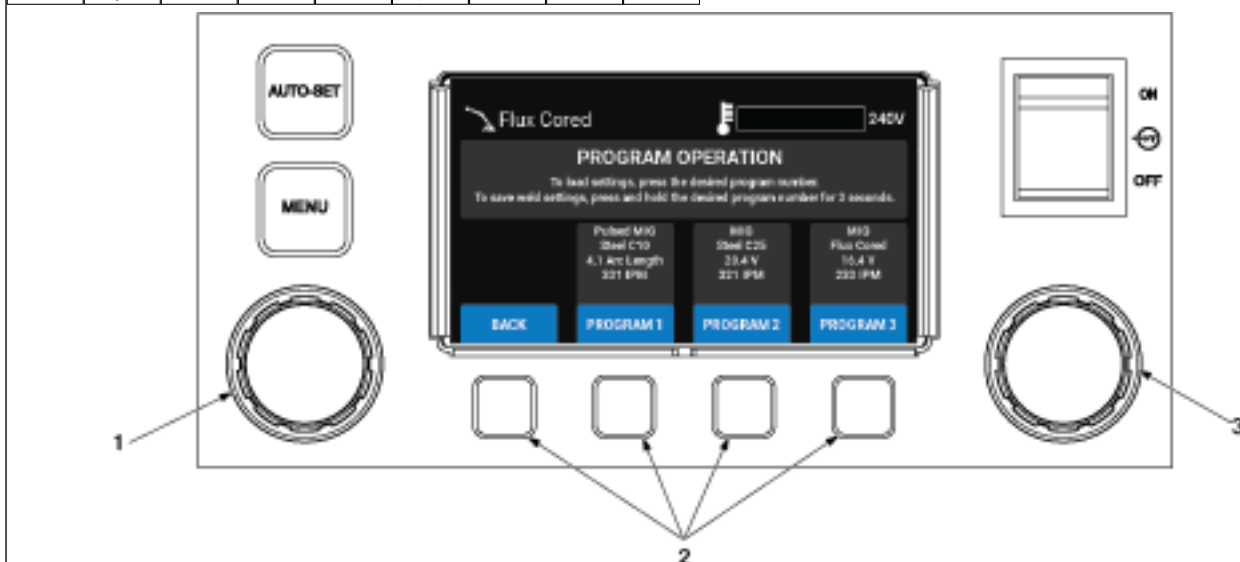
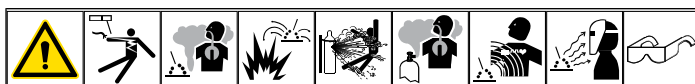
Turn gas on. Touch tungsten electrode to workpiece at weld start point, enable output and shielding gas with torch trigger, foot control, or hand control. **Hold electrode to workpiece for 1-2 seconds**, and slowly lift electrode. Arc is formed when electrode is lifted.

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 a properly prepared electrode to touch workpiece without overheating, sticking, or getting contaminated.

Application:

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

5-11. Manual Program Mode



- 1 Left Knob
- 2 Soft Keys
- 3 Right Knob

The unit can store 3 programs. The program slots are empty when the machines come from the factory.

Saving Programs In Manual Mode

To enter the Program menu from the Manual Mode home screen, press the Program button.

The left-most button will be a back button to return to the preset screen, while 3 program slots will appear above the other three soft keys.

Determine where you would like to save the settings. Push and hold that Program soft-key for two seconds. The box above the blue Program label will list relevant program info when the program has been successfully saved.

Saving Programs From Auto-Set Mode

Program mode cannot be accessed from Auto-Set mode. The setpoints will persist after leaving Auto-Set.

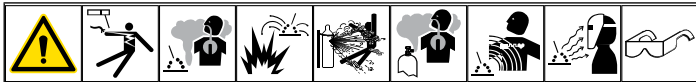
Recalling Programs

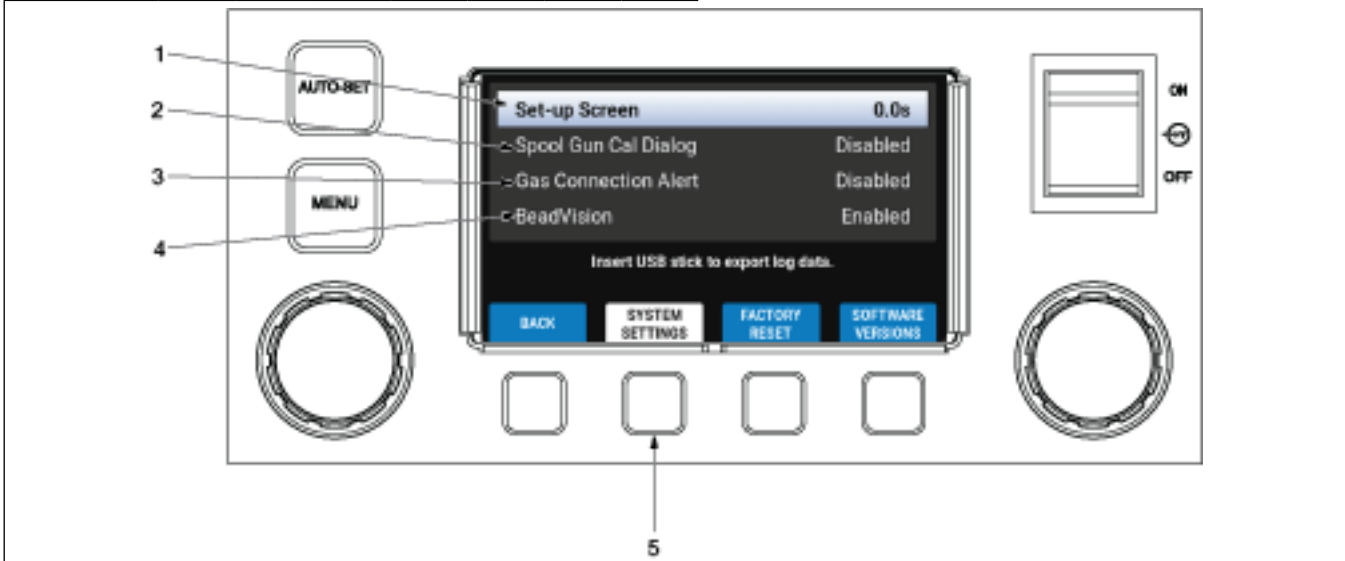
Push the Program button to select desired program. A pop-up will appear with all the settings inherited from the loaded program.

Exiting Program Mode

Press the back button over button 1 to exit Program mode and return to Manual mode.

5-12. System Settings





1 Set Up Screen

Controls the length of time the set up screen will show after selecting a new process. This screen shows the correct connections, polarities, gas mixture, and flow rate for the selected process and wire/gas. This setting can be adjusted from 0 to 30 seconds. To adjust, use either knob to highlight setting, then press either knob to show time menu. Adjust time up or down with right knob, then press either knob to select time.

2 Spoolgun Cal Dialog

A prompt for calibrating the spoolgun will appear on start up or when a spoolgun is connected. To adjust, use either knob to highlight setting, then press either knob to enter settings menu. Use the right knob to highlight which option you want, then press either knob to select setting. Default setting is enabled.

4 BeadVision

BeadVision is meant to give the user an educational experience when making weld adjustments on the user interface, showing how each weld parameter effects the bead and penetration profile of the weld.

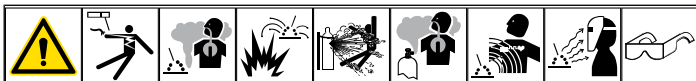
3 Gas Connection Alert

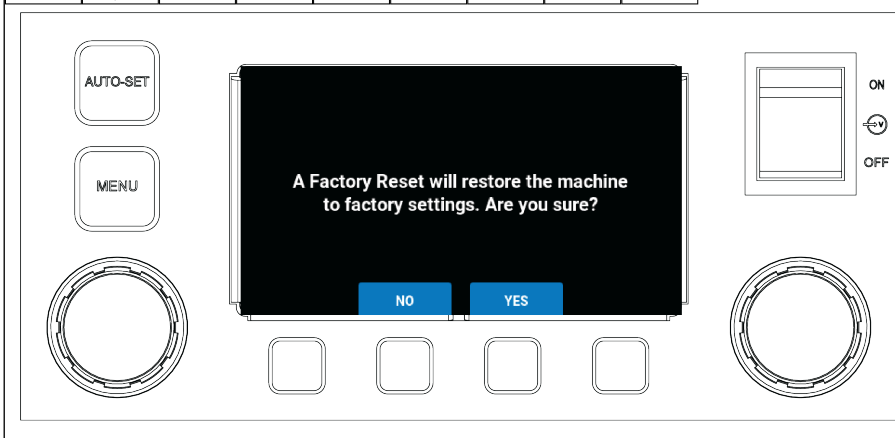
With Gas Connection Alert enabled, the welding power source will determine if shielding gas is present when the welding gun trigger is depressed. If no shielding gas is detected, the User Interface will display an error message. This error indicates that your gas supply is either not turned on, depleted, or not connected. Additionally, when enabled, the shielding gas valve will open for a short period of time during the power-up sequence. This will purge any shielding

5 Export Logs

To export logs, insert USB drive into USB port located in the wire drive assembly area, behind the user interface (see Section 5.15). Once USB drive is plugged in, the System Settings soft key will change to Export Logs. Press export to download log onto connected USB drive. Screen will display "USB Busy" then "USB Done." Once done you can remove the USB drive.

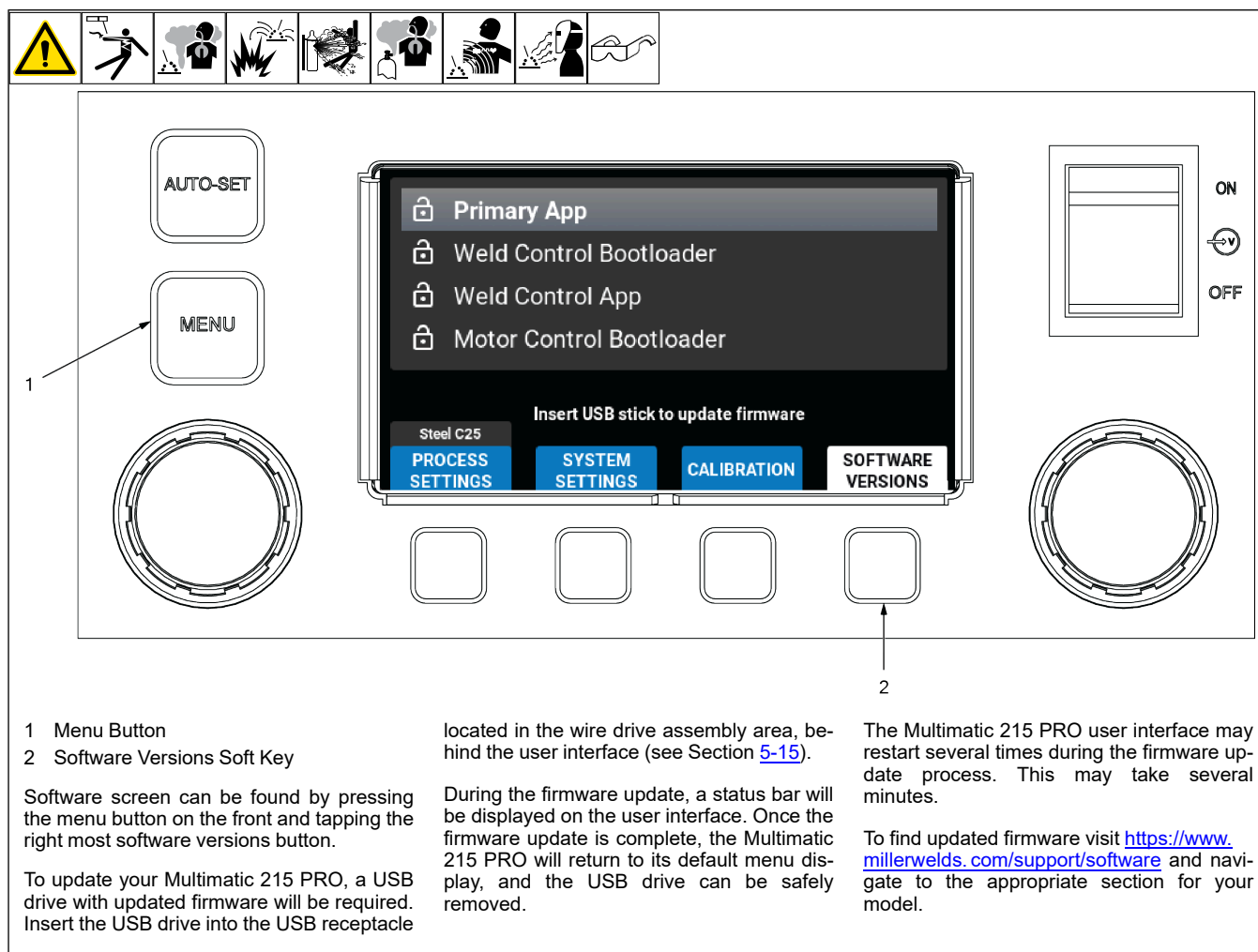
5-13. Factory Reset



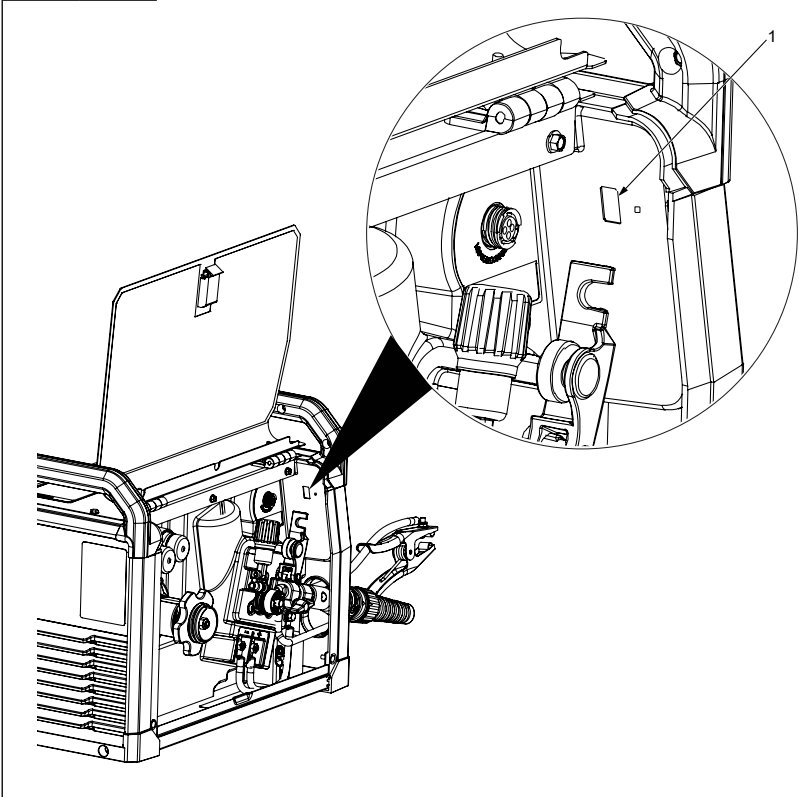


To factory reset machine, while in System Settings, press the factory reset soft key. Option for yes or no will populate the screen. Select yes to confirm to reset system to factory settings. Factory reset will reset all process settings. Motor/spoolgun calibration and software information will be retained.

5-14. Software Screen



5-15. USB Location



1 Location of USB Port

Use for software upgrade (Section) and machine diagnostics. Not intended for charging external devices.

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MIG & Flux-Cored

Steel Wire Welding Parameters

		Welding Parameters for 120V Input Power												Welding Parameters for 240V Input Power											
Material	Polarity	Shielding Gas*	Wire Size	24 ga. (V/PPH)	22 ga. (V/PPH)	20 ga. (V/PPH)	18 ga. (V/PPH)	16 ga. (V/PPH)	14 ga. (V/PPH)	1/8 in. (V/PPH)	3/16 in. (V/PPH)	24 ga. (V/PPH)	22 ga. (V/PPH)	20 ga. (V/PPH)	18 ga. (V/PPH)	16 ga. (V/PPH)	14 ga. (V/PPH)	1/8 in. (V/PPH)	3/16 in. (V/PPH)	1/4 in. (V/PPH)	5/16 in. (V/PPH)	3/8 in. (V/PPH)			
	DC+*	C25	25-35 CCH	15.1/43	15.1/43	15.2/10	15.3/80	15.4/60	15.5/45	15.6/30	15.7/15	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10	16.7/10	16.8/10			
		75% Ar/25% CO2	100%*	14.9/26	14.9/26	15.0/20	15.1/15	15.2/10	15.3/10	15.4/10	15.5/10	15.6/10	15.7/10	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10			
		C100	25-35 CCH	14.9/26	14.9/26	15.0/20	15.1/15	15.2/10	15.3/10	15.4/10	15.5/10	15.6/10	15.7/10	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10			
		100% CO2	100%*	14.9/26	14.9/26	15.0/20	15.1/15	15.2/10	15.3/10	15.4/10	15.5/10	15.6/10	15.7/10	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10			
Steel	DC+P	C10	25-35 CCH	16.5/45	16.5/45	16.6/30	16.7/20	16.8/15	16.9/10	17.0/10	17.1/10	17.2/10	17.3/10	17.4/10	17.5/10	17.6/10	17.7/10	17.8/10	17.9/10	18.0/10	18.1/10	18.2/10			
		90% Ar/10% CO2	100%*	15.0/30	15.0/30	15.1/20	15.2/15	15.3/10	15.4/10	15.5/10	15.6/10	15.7/10	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10	16.7/10			
		C2	25-35 CCH	15.0/30	15.0/30	15.1/20	15.2/15	15.3/10	15.4/10	15.5/10	15.6/10	15.7/10	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10	16.7/10			
		100% CO2	100%*	15.0/30	15.0/30	15.1/20	15.2/15	15.3/10	15.4/10	15.5/10	15.6/10	15.7/10	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10	16.7/10			
Aluminum	DCEN	Si100	25-35 CCH	14.4/70	14.4/70	14.5/60	14.6/50	14.7/40	14.8/30	14.9/20	15.0/10	15.1/10	15.2/10	15.3/10	15.4/10	15.5/10	15.6/10	15.7/10	15.8/10	15.9/10	16.0/10	16.1/10			
		90% Ar/10% CO2	100%*	15.2/80	15.2/80	15.3/60	15.4/50	15.5/40	15.6/30	15.7/20	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10	16.7/10	16.8/10	16.9/10			
		C2	25-35 CCH	15.2/80	15.2/80	15.3/60	15.4/50	15.5/40	15.6/30	15.7/20	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10	16.7/10	16.8/10	16.9/10			
		100% Argon	100%*	15.2/80	15.2/80	15.3/60	15.4/50	15.5/40	15.6/30	15.7/20	15.8/10	15.9/10	16.0/10	16.1/10	16.2/10	16.3/10	16.4/10	16.5/10	16.6/10	16.7/10	16.8/10	16.9/10			
Aluminum 50XX	DC+P	100% Argon	25-45 CCH	.035"																					
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	DC+P	100% Argon	25-45 CCH	.035"																					
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	DC+P	100% Argon	25-45 CCH	.035"																					

SECTION 6 – MAINTENANCE AND TROUBLESHOOTING

6-1. Routine Maintenance



Disconnect power before maintaining.

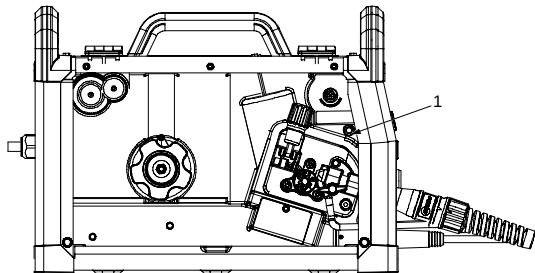
Service equipment more often if used in severe conditions.

Maintenance Schedule		Every 3 Months	Every 6 Months
Cords and Cables	Visually check condition of cords and cables. Replace damaged cords and cables.	•	
Gas Hoses	Visually check condition of gas hoses. Replace damaged hoses.	•	
Labels	Check and replace labels if damaged.	•	
Weld Terminals	Clean and tighten weld terminals.	•	
Clean Unit	Vacuum or blow out inside unit.		•

6-2. Overheating

Thermistors RT3, RT4, and RT1 protect the unit from damage due to overheating. If the Input Rectifier, Boost IGBTs, Boost Diode, Inverter IGBTs, or Output diodes get too hot, these thermistors command the weld controller to disable the welding output. The cooling fan will run continuously until these components return to normal temperatures. This may take several minutes. The welding output will be disabled until the unit cools to a predetermined reset temperature.

6-3. Overload Protection

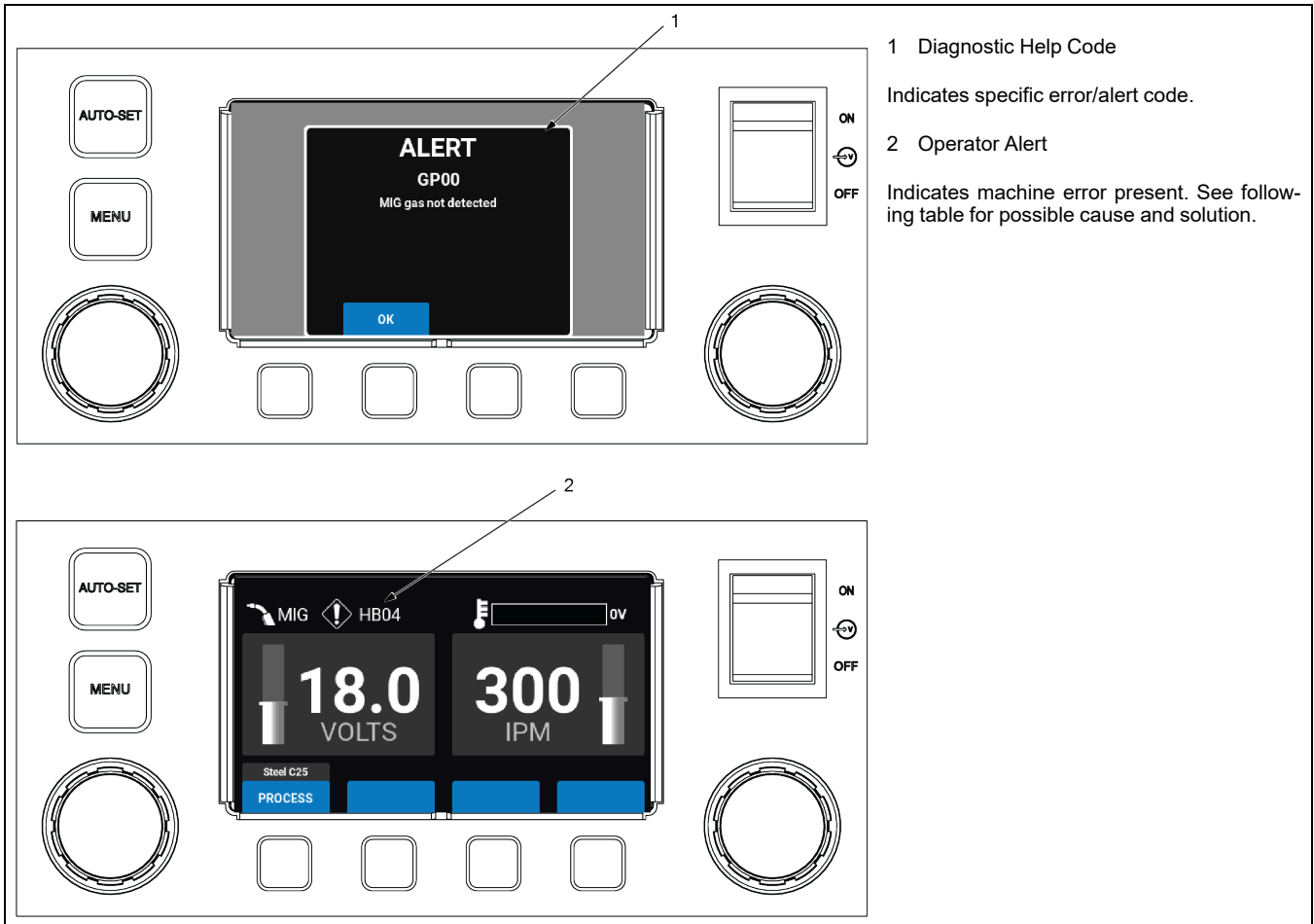


1 Supplementary Protector CB1

CB1 protects unit from overload. If CB1 opens, unit shuts down.

Press to reset supplementary protector.

6-4. Error Messages



LCD Diagnostic Display Message	Possible Cause	Potential Solution
ERROR LC07 Primary communications lost — Cycle power.	Loss of communications on control board.	Turn the power switch off, wait 5 seconds, turn the switch on. If problem persists, contact factory authorized service agent.
ERROR HE00 Primary gate supply fault — Have unit serviced.	Damaged control board	Contact factory authorized service agent.
ERROR HB04 Primary pre-charge fault — Have unit serviced.	Damaged control board	Contact factory authorized service agent.
ERROR HB03 Primary boost charge fault — Have unit serviced.	Damaged control board	Contact factory authorized service agent.

LCD Diagnostic Display Message	Possible Cause	Potential Solution
ALERT GP00 MIG gas not detected	Gas bottle valve not turned on.	Turn the gas bottle on.
	Gas hose not connected to MIG gas valve.	Connect the gas hose to the MIG gas valve.
	Shielding gas supply/bottle is depleted.	Replenish gas supply bottle.
	Gas hose or gas valve obstructed.	Clear the gas hose or gas valve obstruction.
	Damaged gas valve	If problem persists, contact factory authorized service agent.
	Damaged control board	
ALERT VV00 Primary over voltage — check input	The input voltage the unit is plugged into is too high.	Reduce primary input voltage to align with unit rating card.
	A power surge in the line voltage produced a high input voltage.	If problem persists, contact factory authorized service agent.
ALERT VU01 Primary under voltage	The input voltage the unit is plugged into is too low.	Increase primary input voltage to align with unit rating card. If problem persists, contact factory authorized service agent.
	An undersized extension cord that is too long is being used to supply power to the machine.	Replace extension cord with cord of proper length and size.
	An extension cord that is too long is being used to supply power to the machine.	
ERROR LC22 Wire feeder communications lost — Cycle power.	Loss of communication on control board.	Turn the power switch off, wait 5 seconds, turn the switch on.
		If problem persists, contact factory authorized service agent.
ERROR DE01 Secondary gate supply fault — Have unit serviced.	Damaged control board	Contact factory authorized service agent.
ERROR DH00 Secondary thermistor open — Have unit serviced.	Machine outside normal operating temperature.	Bring machine back into normal operating temperature.
	Damaged control board	Contact factory authorized service agent.
ERROR DH01 Secondary thermistor shorted — Have unit serviced.	Machine outside normal operating temperature.	Bring machine back into normal operating temperature.
	Damaged control board	Contact factory authorized service agent.
ERROR HH30 Primary thermistor open — Have unit serviced.	Machine outside normal operating temperature.	Contact factory authorized service agent.
	Damaged control board	Contact factory authorized service agent.
ERROR HH31 Primary thermistor shorted — Have unit serviced.	Machine outside normal operating temperature.	Bring machine back into normal operating temperature.
	Damaged control board	Contact factory authorized service agent.
ERROR DH10 Primary IGBT thermistor open — Have unit serviced.	Machine outside normal operating temperature.	Contact factory authorized service agent.
	Damaged control board	Contact factory authorized service agent.
ERROR DH11 Primary IGBT thermistor shorted — Have unit serviced.	Machine outside normal operating temperature.	Bring machine back into normal operating temperature.
	Damaged control board	Contact factory authorized service agent.

LCD Diagnostic Display Message	Possible Cause	Potential Solution
ALERT KP00 User interface button held — Release button.	A button is pressed for too long of a time on the user interface.	Release the button
	Damaged user interface board	If problem persists, contact factory authorized service agent.
	Damaged membrane	
ERROR WG01 MIG motor fault — Have unit serviced	The wire spool brake tension set too high.	Adjust the wire spool brake nut per Section 4-15 .
	Wire drive tensioning arm set too high.	Adjust tensioning arm per Section 4-15 .
	Obstruction in gun liner.	Clear obstruction from gun liner/contact tip.
	Excessive wear on inlet guide or tensioning arm.	If problem persists, contact factory authorized service agent.
	The brushes in the integrated motor may be worn out.	
ERROR WG02 Spool gun motor fault — Have gun serviced	The wire spool brake tension set too high.	Reduce tension
	Wire drive rolls tension set too high.	Reduce tension
	Obstruction in spool wire feed system.	Remove obstruction from wire feed system.
	Damaged spool gun cable	If problem persists, contact factory authorized service agent.
	The brushes in the spoolgun motor are worn out.	Test the gun trigger with an ohmmeter to make sure that the contacts open and close properly.
ERROR TP08 Four pin trigger fault — Have gun serviced	Damaged MIG gun	Contact factory authorized service agent.
ALERT TP02 MIG trigger held — Release trigger	The gun trigger is being held closed after the arc has been broken.	Release the gun trigger.
	The gun trigger is shorted.	If problem persists, contact factory authorized service agent.
ALERT DL07 Weld stuck — Weld current detected while jogging wire.	Weld current has been detected while jogging the filler metal wire.	Ensure wire does not contact work while jogging.
ALERT DL02 Weld stuck — Fix shorted output.	The weld output is shorted.	The welding gun is shorted to the work piece. Remove the welding gun from the work piece.
	Potential problem with control board PC1	If problem persists, contact factory authorized service agent.
ALERT DT00 Secondary Overtemp — Wait for system to cool down.	The welder has exceeded the duty cycle rating.	Wait until the cooling fan cools the unit to reset the thermal protection.
	The ambient temperature may be over 40 degrees Celsius, causing a reduction in the duty cycle rating.	Reduce output or duty cycle.
	The cooling fan may not be operating.	Replace the cooling fan if necessary.
	The front or rear cooling louvers may have a restriction, not allowing the proper amount of cooling air to flow through the system.	Remove restrictions from the front and rear cooling louvers.
	The machine may be placed in too close proximity to something else, restricting the air flow through the machine.	Make sure that the unit isn't too close in proximity to other things per the recommended operating conditions.

LCD Diagnostic Display Message	Possible Cause	Potential Solution
ALERT HT30 Primary Overtemp	The welder has exceeded the duty cycle rating.	Wait until the cooling fan cools the unit to reset the thermal protection.
	The ambient temperature may be over 40 degrees Celsius, causing a reduction in the duty cycle rating.	Reduce output or duty cycle.
	The cooling fan may not be operating.	Replace the cooling fan if necessary.
	The front or rear cooling louvers may have a restriction, not allowing the proper amount of cooling air to flow through the system.	Remove restrictions from the front and rear cooling louvers.
	The machine may be placed in too close proximity to something else, restricting the air flow through the machine.	Make sure that the unit isn't too close in proximity to other things per the recommended operating conditions.
ALERT DT10 Primary IGBT Overtemp Wait for the system to cool down.	The welder has exceeded the duty cycle rating.	Wait until the cooling fan cools the unit to reset the thermal protection.
	The ambient temperature may be over 40 degrees Celsius, causing a reduction in the duty cycle rating.	Reduce output or duty cycle.
	The cooling fan may not be operating.	Replace the cooling fan if necessary.
	The front or rear cooling louvers may have a restriction, not allowing the proper amount of cooling air to flow through the system.	Remove restrictions from the front and rear cooling louvers.
	The machine may be placed in too close proximity to something else, restricting the air flow through the machine.	Make sure that the unit isn't too close in proximity to other things per the recommended operating conditions.
ERROR LC10 User interface communications lost — Cycle power.	Control board and Display board not communicating.	Turn the power switch off, wait 5 seconds, turn the switch on. If problem persists, contact service. If problem persists, contact factory authorized service agent.
ERROR KC11 User interface communications lost — Cycle power.	Control board and Display board not communicating.	Turn the power switch off, wait 5 seconds, turn the switch on. If problem persists, contact service. If problem persists, contact factory authorized service agent.
ERROR KS01 User Interface run error — Update firmware	Control board and Display board not communicating.	Update the machine firmware
	Incompatible firmware	
ALERT WS01 Wire feeder run error — Update firmware	The machine firmware is outdated or corrupted.	Update the machine firmware
ERROR LA07 Weld library invalid —Update firmware	The machine firmware is outdated or corrupted.	Update the machine firmware
ERROR LA00 Weld control firmware invalid. — Update firmware.	The machine firmware is outdated or corrupted.	Update the machine firmware
ERROR KA00 User interface firmware invalid — Update firmware	The machine firmware is outdated or corrupted.	Update the machine firmware

LCD Diagnostic Display Message	Possible Cause	Potential Solution
ERROR WA00 Wire feeder firmware invalid — Update firmware.	The machine firmware is outdated or corrupted.	Update the machine firmware
ERROR KA05 Invalid system configuration — Update firmware.	Incompatible firmware	Update the machine firmware
ERROR UE25 EEPROM fault — Cycle power.	The user weld settings failed to load.	Switch the Power switch off, wait 5 seconds, and then switch it back on.
ALERT TP00 MIG trigger held — Release Trigger	The gun trigger is being held closed during power up.	Release the gun trigger.
	The gun trigger is being held closed during an error condition.	Test the gun trigger with an ohmmeter to make sure that the contacts open and close properly.
	The gun trigger shorted.	
ALERT WM01 Wire drive assembly cable disconnected — Connect cable.	The Wire Drive Assembly Cable is not connected to one of the Weld Output Receptacles.	For MIG (GMAW) operation, connect the Wire Drive Assembly Cable to the Positive Weld Output Receptacle (+). For Flux-Cored (FCAW) operation, connect the Wire Drive Assembly Cable to the Negative Weld Output Receptacle (-).
	Damaged harness or control board.	If problem persists, contact factory authorized service agent.
ALERT TP07 MIG Jog distance reached Release trigger.	The MIG jog distance has reached it's limit and the trigger is still being detected.	Release the gun trigger.
ERROR KP01 UI Membrane Switch Connection Fault — Have unit serviced.	The unit has detected a problem with the connection of the user interface membrane switch.	Contact factory authorized service agent.
ALERT GP01 TIG gas not connected.	Gas bottle valve not turned on.	Turn the gas bottle valve on.
	Gas hose not connected to TIG gas valve.	Connect the gas hose to the TIG gas valve.
	Shielding gas supply/bottle is depleted.	Replenish gas supply bottle.
	Gas hose/valve obstructed.	Clear the gas hose/valve of the obstruction.
	Damaged gas valve	If problem persists, contact factory authorized service agent.
	Damaged control board	
ALERT TP42 TIG 14-pin trigger held—Release trigger	The TIG remote control trigger is being held closed after the OCV timeout has occurred.	Release the TIG remote control trigger.
	The TIG remote control trigger is shorted.	Test the TIG remote control trigger with an ohmmeter to make sure that the contacts open and close properly.
ALERT LX00 Touch ramp failed — Retry touch start	The lift-TIG touch start current did not ramp up in the proper amount of time.	Retry the lift-TIG arc start
ALERT DL04 Stuck electrode — Fix shorted output	The weld output is shorted.	The stick electrode is shorted to the work. Remove the electrode from the work.
		The weld output is shorted in the machine. Replace the control board PC1.
ALERT DL05 Stuck tungsten — Fix shorted output	The weld output is shorted.	The tungsten is shorted to the work. Remove the tungsten from the work.
		The weld output is shorted in the machine. Replace the control board PC1.

LCD Diagnostic Display Message	Possible Cause	Potential Solution
ALERT TP40 TIG 14-pin trigger held — Release trigger	The TIG remote trigger is held for too long during preflow and no weld has started.	Release the trigger.
		Check the TIG trigger contacts with an ohmmeter for the proper opening and closing operation.
ALERT RP02 TIG remote not detected - Connect remote or select DISABLE REMOTE to use non-remote mode	The TIG remote setting is enabled, but no remote control is detected by the system.	Connect the TIG remote control.
		Switch the TIG remote setting off if it is not being used.
ALERT RP03 TIG remote disabled — Release remote	The TIG remote setting is disabled, but the presence of a remote control is detected by the system.	Enable the TIG remote control setting if it is being used.
		Disconnect the TIG remote control if it is not being used.
ALERT WM00 Wire drive assembly cable connected — Disconnect cable	The dongle connected to the MIG wire drive feed head is connected to the weld output Dinse connectors.	Disconnect the dongle from the MIG wire drive feed head from the weld output Dinse connectors.

6-5. Troubleshooting



Trouble	Remedy
No weld output; unit completely inoperative.	Place line disconnect switch in On position. Check and replace line fuse(s), if necessary, or reset supplementary protector. Be sure power cord is plugged in and that receptacle is receiving input power.
No weld output; unit is on.	Check and secure loose weld cable(s) into receptacle(s). Check and correct poor connection of work clamp to workpiece.
Erratic or improper welding arc or output.	Use proper size and type of weld cable (see your Distributor). Clean and tighten weld connections. Verify electrode polarity; check and correct poor connections to workpiece.
Fan not operating.	Unit not warmed up enough to require fan cooling. Check for and remove anything blocking fan movement. Have Factory Authorized Service Agent check fan motor and control circuitry.
Low weld output or no weld output control.	Connect work clamp to get good metal-to-metal contact. Refer to parameter chart on machine or in Section 5-16 to ensure proper weld parameter settings. Use Auto-Set for predefined parameter settings. Straighten gun cable and/or replace damaged parts. Adjust drive roll pressure. Change to proper drive roll groove. See Section 4-15 . Be sure that wire is positioned in proper drive roll groove and wire is laying in the groove. Replace contact tip if blocked (See gun Owner's Manual). Clean or replace wire inlet guide or liner if dirty or plugged. Replace drive roll or pressure bearing if worn or slipping. Secure gun trigger plug. Check and clear and restrictions at drive assembly and liner. Release gun trigger and allow gun and motor protection circuitry to reset. Have a Factory Authorized Service Agent check drive motor.
Stick welding problems: Hard starts; poor welding characteristics; unusual spattering.	Use proper size and type of electrode. Check and correct poor connections. Make sure a remote control is not connected.
TIG welding problems: Wandering Arc; Hard starts; poor welding characteristics; Spattering problems	Use proper type and size of tungsten. Use properly prepared tungsten. Verify electrode polarity.
TIG welding problems; Tungsten electrode oxidizing and not remaining bright after welding.	Shield weld zone from drafts. Check for correct type of shielding gas Check and tighten gas fittings. Verify electrode polarity.

6-6. Drive Motor Protection And Tip Saver/Short Circuit Protection

A. Drive Motor Protection

Drive motor protection circuit protects drive motor from overload. If drive motor becomes inoperative, cycle unit power off and back on again.

B. Tip Saver/Short Circuit Protection

The tip saver/short circuit protection extends contact tip life and protects internal components from damage. If contact tip is shorted to workpiece, the unit shuts down the welding output. To resume operation, release gun trigger to reset unit. If the contact tip has stuck to the workpiece, release gun trigger, turn off unit, and remove contact tip from workpiece. Check contact tip and replace if damaged. Turn on unit to continue operation.

SECTION 7 – RECOMMENDED SPARE PARTS

Recommended Spare Parts

Part No.	Description	Quantity
261157	Roll, Drive V Groove .024, .030-.035, VK .030-.035	1
220179	Roll, Drive V Groove .024,.030-.035 Wire	1
202926	Roll, Drive VK Groove .030-.035/.045 Wire	1
280091	Nut, Hub	1
265004	Hub, Spool	1
296643	Lens Cover, Replaceable Multimatic Sims	1
219261	Adapter, Power Cable 5-15p (115V/15A)	1
219259	Adapter, Power Cable 5-20p (115V/20A)	1
219258	Adapter, Power Cable 6-50p (230V/50A)	1
1770030	MDX-100, 15ft	1

Optional Accessories

Part No.	Description	Quantity
301737	Protective Cover	1
770644	Cord, 250V 8/3 Extension 25' W/ 6-50 Ends	1
301589	Foot Pedal	1
301272	Spoolmate 150 Spool Gun 20ft	1
300371	Spoolmate 100 Series	1

 See OM-282976 for MDX-100 gun consumables.

SECTION 8 – REGULATORY/COMPLIANCE INFORMATION

8-1. Serial Number And Rating Label Location

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

8-2. 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.

8-3. 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.

8-4. Environmental Specifications

A. IP Rating

IP Rating
IP21
This equipment is designed for indoor use and is not intended to be used or stored outside.

B. Temperature Specifications

Operating Temperature Range*	Storage/Transportation 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).

SECTION 9 – ELECTRICAL DIAGRAMS

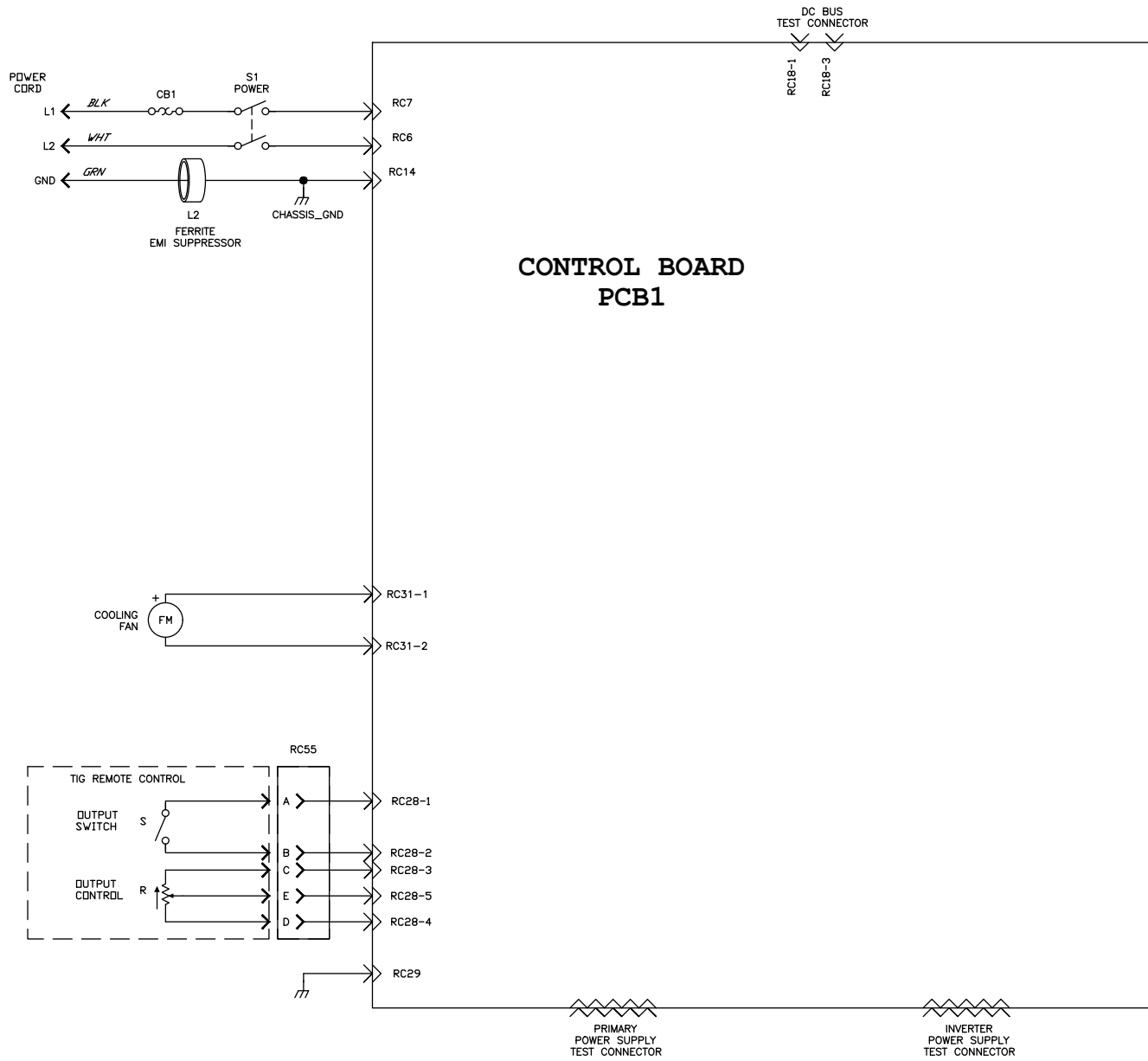
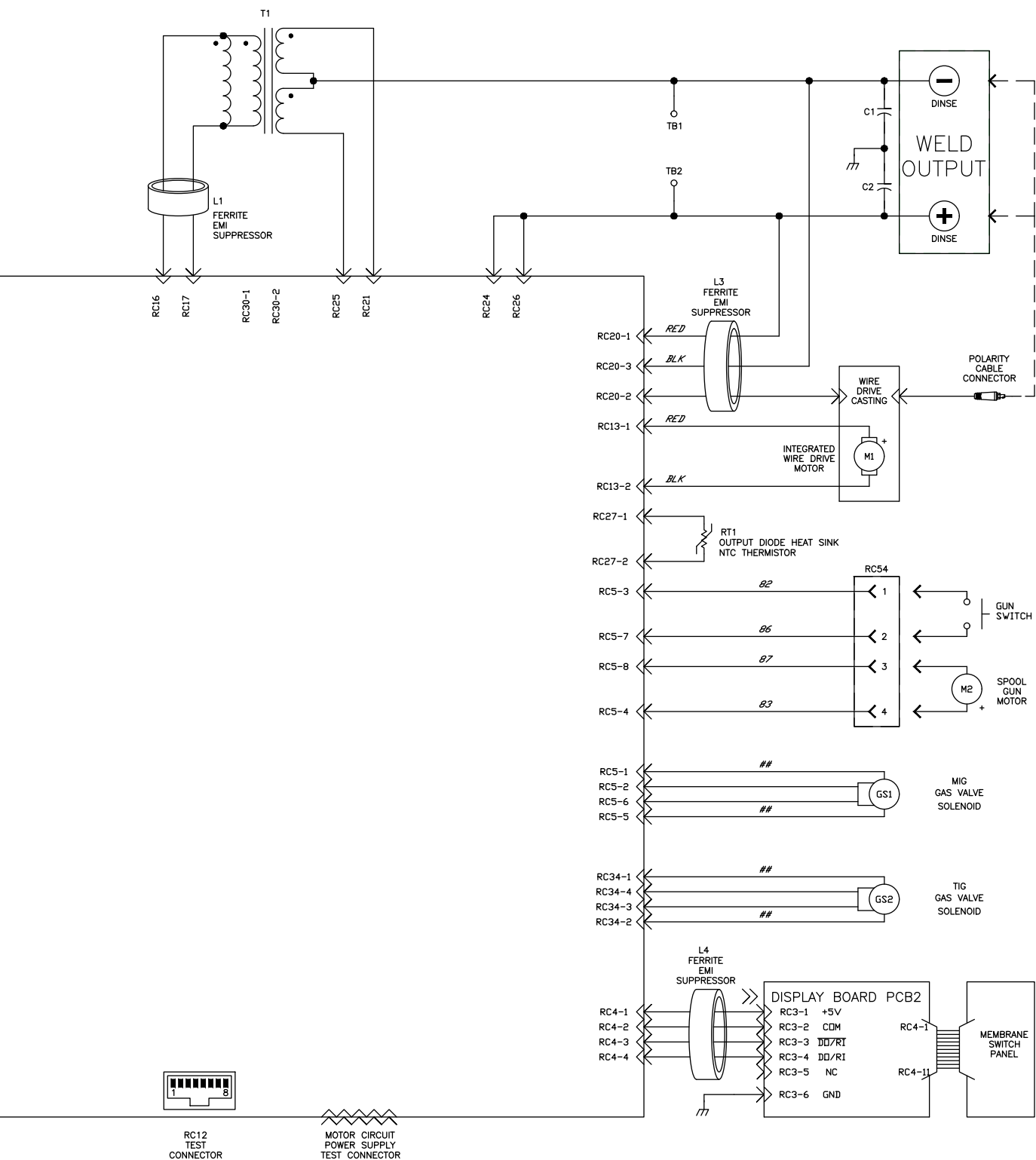


Figure 9-1. Circuit Diagram



296202-C

SECTION 10 – DEFINITIONS

10-1. Additional Safety Symbol Definitions

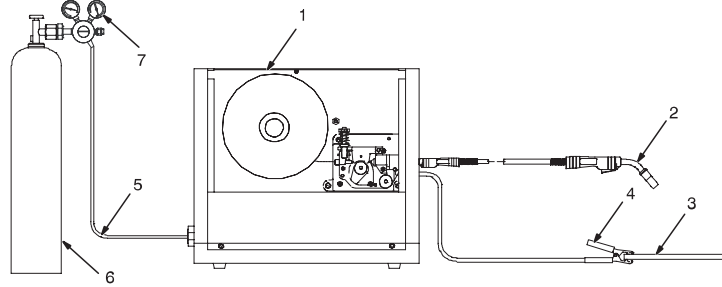
	Warning! Watch Out! There are possible hazards as shown by the symbols.
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10-2. Miscellaneous Symbols And Definitions

A	Amperage		Line Connection		USB
V	Voltage	Hz	Hertz		Push Button
U₀	Rated No Load Voltage (OCV)		Single Phase Static Frequency Converter-Transformer-Rectifier	I	On
==	Direct Current (DC)		Gas Tungsten Arc Welding (GTAW) Torch	O	Off
U₁	Primary Voltage		Shielded Metal Arc Welding (SMAW)		Settings
U₂	Conventional Load Voltage		Shielded Metal Arc (SMAW) Electrode Holder		Temperature Indication
I₂	Rated Welding Current		Gas Metal Arc Welding (GMAW)		Operator Alert
	Input Power Or Input Voltage		Gas Metal Arc Welding (GMAW) MIG / Gun Control		Output On
IP	Ingress Protection Rating		Wire Feed Spool Gun		TIG Remote
1~	Single Phase		Gas Tungsten Arc Welding (GTAW) / Tungsten Inert Gas (TIG) Welding		Polarity Reversed
	Remote	U_r	Reduced Rated No Load Voltage		Gas Postflow
	Circuit Breaker	I_{1eff}	Maximum Effective Supply Current		Gas Preflow
+	Positive	I_{1max}	Rated Maximum Supply Current		Run-In
-	Negative		Ground		Jog
X	Duty Cycle				

SECTION 11 – GMAW WELDING (MIG) GUIDELINES

11-1. Typical GMAW (MIG) Process Connections

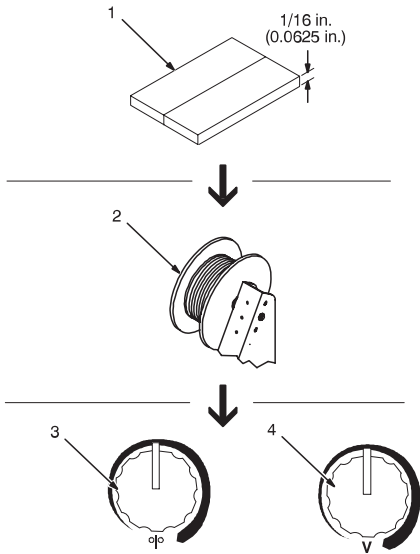


Weld current can damage electronic parts in vehicles. Disconnect both battery cables before welding on a vehicle. Place work clamp as close to the weld as possible.

- 1 Wire Feeder/Welding Power Source
- 2 Gun
- 3 Workpiece
- 4 Work Clamp

- 5 Gas Hose
- 6 Shielding Gas Cylinder
- 7 Regulator/Flowmeter

11-2. Typical GMAW (MIG) Process Control Settings



☞ These settings are guidelines only. Material and wire type, joint design, fitup, position, shielding gas, etc. affect settings. Test welds to be sure they comply to specifications.

1 Material Thickness

Material thickness determines weld parameters.

Convert material thickness to amperage (A):

$0.001 \text{ in. (0.025 mm)} = 1 \text{ ampere}$

$0.125 \text{ in. (3.17 mm)} \div 0.001 = 125 \text{ A}$

2 Select Wire Size

See table below.

3 Select Wire Feed Speed (Amperage)

Wire feed speed (amperage) controls weld penetration. See table below.

4 Select Voltage

Voltage controls height and width of weld bead.

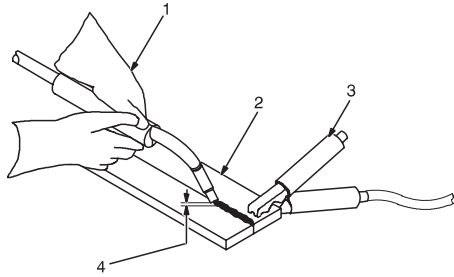
Low Voltage: wire stubs into work

High Voltage: arc is unstable (spatter)

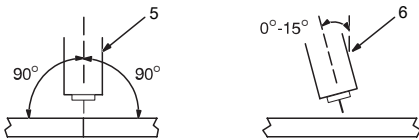
Set voltage midway between high and low voltage and adjust as needed for the weld.

Wire Size	Amperage Range	Recommended Wire Feed Speed	Wire Feed Speed *
0.023 in. (0.58 mm)	30-90 A	3.5 ipm (89 mmpm) per amp	$3.5 \times 125 \text{ A} = 437 \text{ ipm (11.11 mpm)}$
0.030 in. (0.76 mm)	40-145 A	2 ipm (51 mmpm) per amp	$2 \times 125 \text{ A} = 250 \text{ ipm (6.35 mpm)}$
0.035 in. (0.89 mm)	50-180 A	1.6 ipm (41 mmpm) per amp	$1.6 \times 125 \text{ A} = 200 \text{ ipm (5.08 mpm)}$
0.045 in. (1.14 mm)	75-250 A	1 ipm (25 mmpm) per amp	$1 \times 125 \text{ A} = 125 \text{ ipm (3.17 mpm)}$
*125 A based on 1/8 in. (3.17 mm) material thickness.		ipm = inches per minute; mmpm = millimeters per minute; mpm = meters per minute	

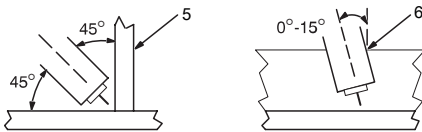
11-3. Holding And Positioning Welding Gun



Groove Welds



Fillet Welds



☞ Wire is energized when gun trigger is pressed. Before lowering helmet and pressing trigger, be sure wire is no more than 1/2 in. (13 mm) past end of contact tip, and tip of wire is positioned correctly on seam.

1 Hold Gun and Control Gun Trigger

Use both hands to stabilize the gun.

2 Workpiece

3 Work Clamp

4 Contact Tip To Work Distance (Stickout)

Short Circuit: 1/4 to 1/2 in. (6 to 13 mm)

Spray Transfer: 1/2 to 3/4 in. (13 to 14 mm)

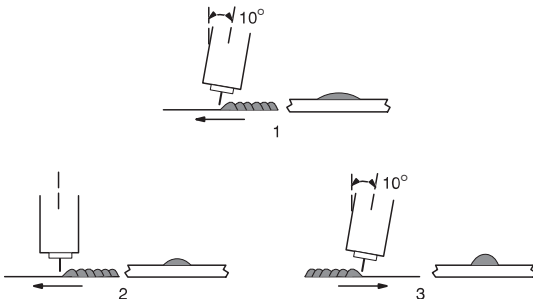
5 End View Of Work Angle

6 Side View Of Travel Angle

11-4. Conditions That Affect Weld Bead Shape



Gun Angles and Weld Bead Profiles



☞ Weld bead shape depends on gun angle, direction of travel, contact to work distance (stickout), travel speed, thickness of base metal, wire feed speed (weld current), and voltage.

1 Push

2 Perpendicular

3 Drag

4 Short

5 Normal

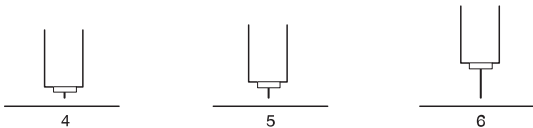
6 Long

7 Slow

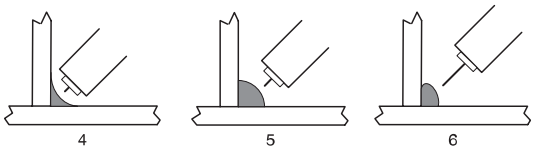
8 Normal

9 Fast

Contact Tip To Work Distance (Stickout)



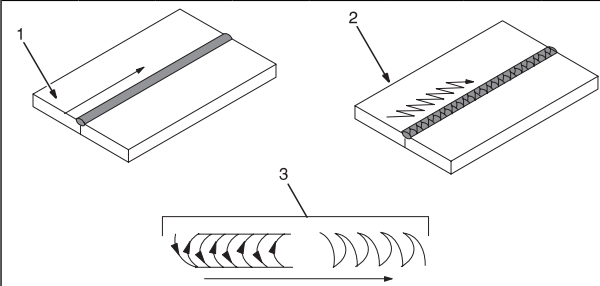
Fillet Weld Contact Tip To Work Distance (Stickout)



Travel Speed



11-5. Gun Movement During Welding

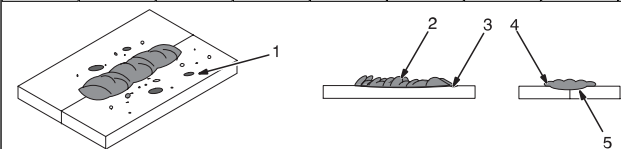


☞ Normally, a single stringer bead is satisfactory for most narrow groove weld joints; however, for wide groove weld joints or bridging across gaps, a weave bead or multiple stringer beads works better.

- 1 Stringer Bead - Steady Forward Movement Along Weld Joint
- 2 Weave Bead - Side To Side Movement Along Weld Joint
- 3 Weave Patterns

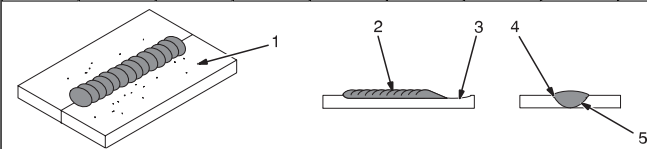
Use weave patterns to cover a wide area in one pass of the electrode.

11-6. Poor Weld Bead Characteristics



- 1 Large Spatter Deposits
- 2 Rough, Uneven Bead
- 3 Large Crater At End of Weld
- 4 Overlap Present
- 5 Little To No Penetration

11-7. Good Weld Bead Characteristics



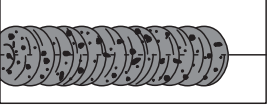
- 1 Little To No Micro Spatter
- 2 Uniform Bead
- 3 Little To No Crater At End Of Weld
- 4 No Overlap
- 5 Adequate Penetration Into Base Metal

11-8. Troubleshooting

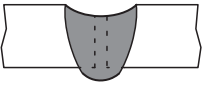
A. Excessive Spatter

	Excessive Spatter - scattering of molten metal particles that cool to solid form near weld bead.
Possible Causes	Corrective Actions
Wire feed speed too high.	Select lower wire feed speed.
Voltage too high.	Select lower voltage range.
Electrode extension (stickout) too long.	Use shorter electrode extension (stickout).
Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, undercoating, and dirt from work surface before welding.
Insufficient shielding gas at welding arc.	Increase flow of shielding gas at regulator/flowmeter and/or prevent drafts near welding arc.
Dirty welding wire.	Use clean, dry welding wire.
	Eliminate pickup of oil or lubricant on welding wire from feeder or liner.

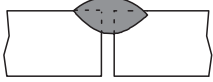
B. Porosity

	Porosity - small cavities or holes resulting from gas pockets in weld metal.
Possible Causes	Corrective Actions
Insufficient shielding gas at welding arc.	Increase flow of shielding gas at regulator/flowmeter and/or prevent drafts near welding arc.
	Remove spatter from gun nozzle.
	Check gas hoses for leaks.
	Ensure proper contact tip to work distance.
	Hold gun near bead at end of weld until molten metal solidifies.
Wrong gas.	Use welding grade shielding gas; change to different gas.
Dirty wire.	Use clean, dry wire.
	Eliminate pick up of oil or lubricant on wire from feeder or liner.
Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, coatings, and dirt from work surface before welding.
	Use a more highly deoxidizing wire (contact supplier).
Excessive contact tip to work distance	Ensure proper contact tip to work distance

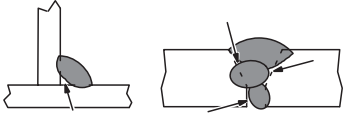
C. Excessive Penetration

	Excessive Penetration - weld metal melting through base metal.
Possible Causes	Corrective Actions
Excessive heat input.	Select lower voltage and reduce wire feed speed.
	Increase travel speed.

D. Incomplete Joint Penetration

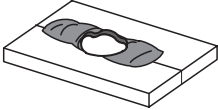
	Incomplete Joint Penetration - weld metal does not extend through the joint thickness.
Possible Causes	Corrective Actions
Improper joint preparation.	Joint preparation and design must provide access to bottom of groove while maintaining proper contact tip to work distance.
Improper weld technique.	Maintain proper work and travel angles.
	Keep arc on leading edge of weld puddle.
	Maintain proper contact tip to work distance.
Insufficient heat input.	Select higher wire feed speed and/or select higher voltage range.
	Reduce travel speed.

E. Incomplete Fusion

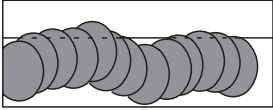
	Incomplete Fusion - failure of weld metal to fuse completely with base metal or a preceding weld bead.
Possible Causes	Corrective Actions
Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, undercoating, and dirt from work surface before welding.
Insufficient heat input.	Select higher voltage and/or adjust wire feed speed.
Improper welding technique.	Place bead in proper location(s) in joint during welding.
	Pause on groove side walls when using weaving technique.
	Keep wire on leading edge of weld puddle.

	Maintain proper work and travel angles.
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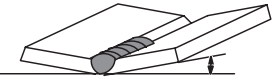
F. Burn-Through

	Burn-Through - a hole caused by excessive penetration.	
	Possible Causes	Corrective Actions
	Excessive heat input.	Select lower voltage and reduce wire feed speed. Increase and/or maintain steady travel speed.

G. Waviness Of Bead

	Waviness Of Bead - weld metal that is not parallel and does not cover joint formed by base metal.	
	Possible Causes	Corrective Actions
	Excessive contact tip to work distance.	Ensure proper contact tip to work distance.
	Unsteady hand.	Support hand on solid surface or use two hands.

H. Distortion

	Distortion - contraction of weld metal during welding that forces base metal to move. Illustration: Base metal moves in the direction of the weld bead.	
	Possible Causes	Corrective Actions
	Excessive heat input.	Use restraint (clamp) to hold base metal in position. Make tack welds along joint before starting welding operation. Select lower voltage range and/or reduce wire feed speed. Increase travel speed. Weld in small segments and allow cooling between welds.

11-9. Common MIG Shielding Gases

This is a general chart for common gases and where they are used. Many different combinations (mixtures) of shielding gases have been developed over the years. The most commonly used shielding gases are listed in the following table.

Gas	Application								
	Spray Arc Steel	Short Cir-cuiting Steel	GMAW-P Steel	Spray Arc Stainless Steel	Short Cir-cuiting Stainless Steel	GMAW-P Stainless Steel	Spray Arc Aluminum	Short Cir-cuiting Aluminum	GMAW-P Aluminum
Argon							All Positions	All Positions	All Positions
Argon + 2% O ₂	Flat & Horizontal Fillet		All Positions	Flat & Horizontal Fillet					
Argon + 2% CO ₂				Flat & Horizontal Fillet	All Positions	All Positions			
Argon + 5% CO ₂	Flat & Horizontal Fillet		All Positions						
Argon + 10% CO ₂	Flat & Horizontal Fillet	All Positions	All Positions						
Argon + 25% CO ₂		All Positions							
CO ₂		All Positions							
Helium							All Positions*		
Argon + Helium							All Positions*		
90% HE + 7-1/2% AR + 2-1/2% CO ₂					All Positions				
65% AR + 33% HE + 2% CO ₂						All Positions			

* Heavy Thicknesses

11-10. Troubleshooting Guide For Semiautomatic Welding Equipment

Problem	Probable Cause	Remedy
Wire feed motor operates, but wire does not feed.	Too little pressure on drive rolls.	Increase pressure setting on drive rolls.
	Incorrect drive rolls.	Check size stamped on drive rolls, replace to match wire size and type if necessary.
	Spool hub tension too high.	Decrease brake pressure on wire spool.
	Restriction in the gun and/or assembly.	Check and replace cable, gun, and contact tip if damaged. Check size of contact tip and cable liner, replace if necessary.
Wire curling up in front of the wire feed rolls (bird nesting).	Too much pressure on drive rolls.	Decrease spool hub tension.
	Incorrect liner or gun contact tip size.	Check size of contact tip and check liner length and diameter, replace if necessary.
	Gun end not inserted into drive housing properly.	Loosen gun securing bolt in drive housing and push gun end into housing just enough so it does not touch drive rolls.
	Dirty or damaged (kinked) liner.	Replace liner.
Wire feeds, but no gas flows (GMAW).	Gas cylinder empty.	Replace empty gas cylinder.
	Gas nozzle plugged.	Clean or replace gas nozzle.
	Gas cylinder valve not open or flowmeter not adjusted.	Open gas valve at cylinder and adjust flow rate.
	Restriction in gas line.	Check gas hose between flowmeter and wire feeder, and gas hose in gun and cable assembly.
	Loose or broken wires to gas solenoid.	Have Factory Authorized Service Agent repair wiring.
	Gas solenoid valve not operating.	Have Factory Authorized Service Agent replace gas solenoid valve.
	Incorrect primary voltage connected to welding power source.	Check primary voltage and relink welding power source for correct voltage.
Welding arc not stable.	Wire slipping in drive rolls.	Adjust pressure setting on drive rolls. Replace worn drive rolls if necessary.
	Wrong size gun liner.	Match liner to wire size and type.
	Incorrect voltage setting for selected wire feed speed on welding power source.	Readjust welding parameters.
	Loose connections at the gun weld cable or work cable.	Check and tighten all connections.
	Gun in poor shape or loose connection inside gun.	Repair or replace gun as necessary.
	Wrong size contact tip or worn out contact tip.	Match contact tip to wire size and type. Replace contact tip as necessary.

SECTION 12 – SELECTING AND PREPARING A TUNGSTEN FOR DC OR AC WELDING WITH INVERTER MACHINES

12-1. Selecting Tungsten Electrode



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

NOTICE – Wear clean gloves to prevent contamination of tungsten.

A. Select Tungsten Electrode

Amperage Range By Gas Type* And Polarity		
Electrode Diameter (2% Ceriated or 1.5% Lanthanum Alloy Tungstens)	DCEN – Argon Direct Current Electrode Negative (For Use With Mild Or Stainless Steel)	AC – Argon Unbalanced Wave (75% EN Balance) (For Use With Aluminum)
0.010 in. (0.25 mm)	Up to 15	Up to 15
0.020 in. (0.50 mm)	5–20	5–20
0.040 in. (1 mm)	15–80	15–80
1/16 in. (1.6 mm)	70–150	70–150
3/32 in. (2.4 mm)	150–200	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

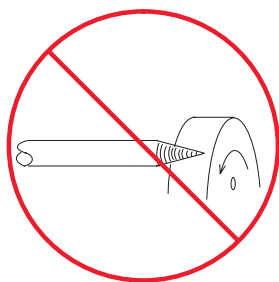
Tungsten Type	Application Notes
2% Cerium (Gray)	Good all-around tungsten for both AC and DC welding.
1.5–2% Lanthanum (Yellow/Blue)	Excellent low amp starts for AC and DC welding.
Pure Tungsten (Green)	Not recommended for inverters! For best results in most applications, use a sharpened cerium or lanthanum electrode for AC or DC welding.

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.

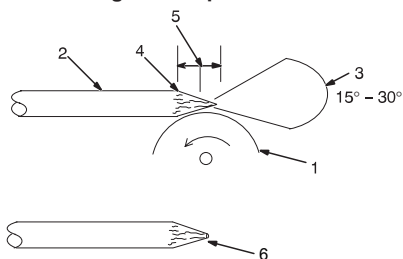
12-2. Preparing Tungsten Electrode For DC Electrode Negative (DCEN) Welding Or AC Welding With Inverter Machines



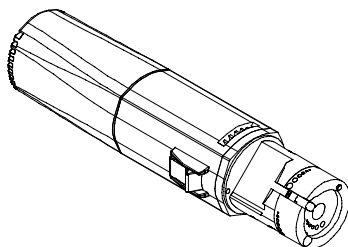
Wrong Tungsten Preparation — Radial Grinding Causes Wandering Arc



Better Tungsten Preparation — Stable Arc



Best Tungsten Preparation — Dedicated Tungsten Grinder



 Grinding the tungsten electrode produces dust and flying sparks which can cause injury and start fires. Use appropriate local exhaust (forced ventilation) at the grinder or wear an approved respirator. Read SDS for safety information. Properly dispose of grinder dust in an environmentally safe way. Wear proper face, hand, and body protection. Keep flammables away.

 Do not use thoriated tungsten. Use tungsten containing ceria, lanthana, or yttria instead of thoria. Grinding dust from thoriated electrodes contains low-level radioactive material.

 It is recommended to prepare tungsten with a tungsten grinder designed for that purpose whenever possible.

1 Grinding Wheel

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

2 Tungsten Electrode

A 2% ceriated tungsten is recommended.

3 Ideal Grind Angle Range: 15° to 30°

 30 degrees is the recommended electrode grind angle.

4 Straight Ground

Grind lengthwise, not radial.

5 1-1/2 to 4 Times Electrode Diameter

6 Straight Ground Tip

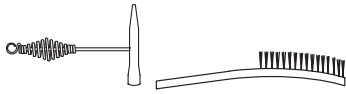
 Blunting the tip of the electrode is sometimes done to help maintain consistent geometry and resist tungsten erosion. This is especially helpful in AC when melt-back of the tungsten electrode is common.

SECTION 13 – STICK WELDING (SMAW) GUIDELINES

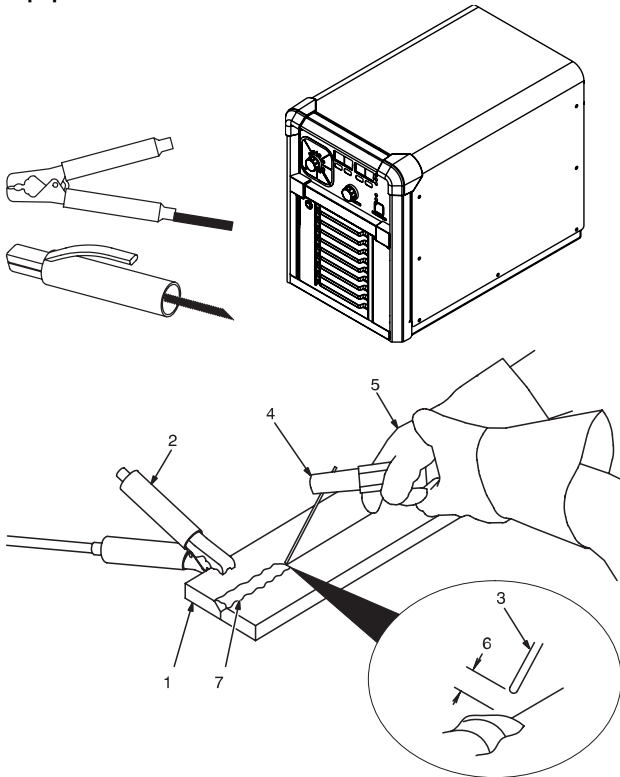
13-1. Stick Welding Procedure



Tools Needed:



Equipment Needed:



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

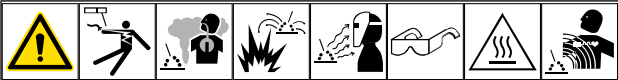
Arc length is the distance from the electrode to the workpiece. A short arc with correct amperage will give a sharp, crackling sound. Correct arc length is related to electrode diameter. Examine the weld bead to determine if the arc length is correct.

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

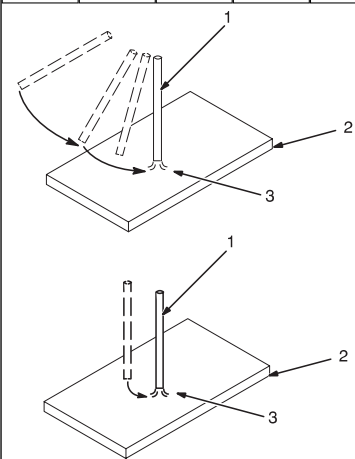


ELECTRODE	DIAMETER	AMPERAGE RANGE									
		50	100	150	200	250	300	350	400	450	
6010 & 6011	3/32										
	1/8										
	5/32										
	3/16										
	7/32										
6013	1/4										
	1/16										
	5/64										
	3/32										
	1/8										
7014	5/32										
	3/16										
	7/32						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

13-3. Striking An Arc



Weld current starts when electrode touches workpiece.

- 1 Electrode
- 2 Workpiece
- 3 Arc

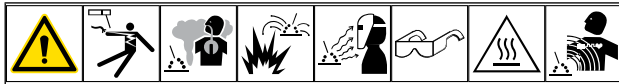
Scratch Technique

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.

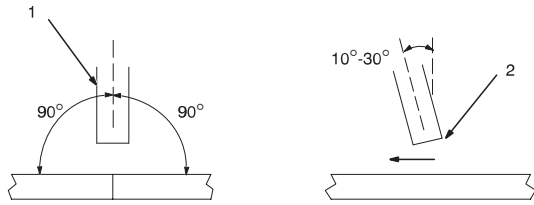
Tapping Technique

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.

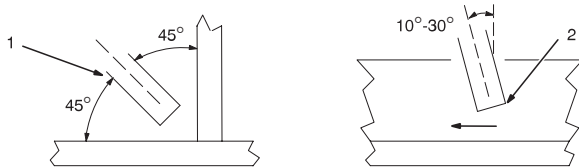
13-4. Positioning Electrode Holder



Groove Welds



Fillet Welds



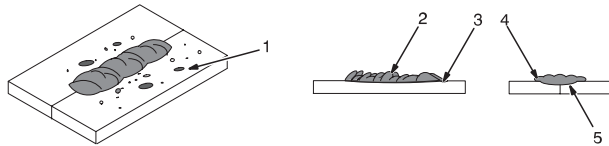
- 1 End View Of Work Angle
- 2 Side View Of Electrode Angle

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.

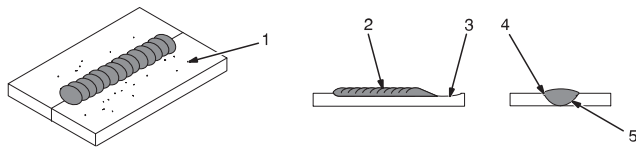
To produce the best results, hold a short arc, travel at a uniform speed, and feed the electrode downward at a constant rate as it melts.

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

13-6. Good Weld Bead Characteristics



- 1 Fine Spatter
- 2 Uniform Bead
- 3 Moderate Crater During Welding
- 4 No Overlap
- 5 Good Penetration into Base Metal

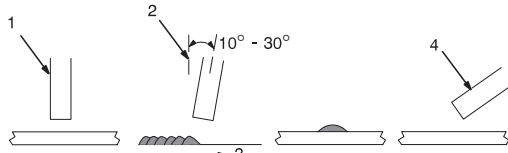
Weld a new bead or layer for each 1/8 in. (3.2 mm) thickness in metals being welded.

- 4 No Overlap
- 5 Good Penetration into Base Metal

13-7. Conditions That Affect Weld Bead Shape



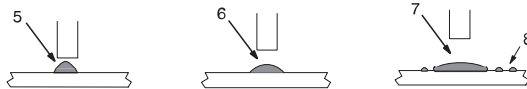
Electrode Angle



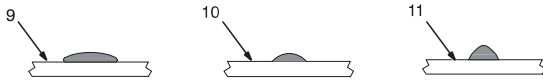
Weld bead shape is affected by electrode angle, arc length, travel speed, and thickness of base metal.

- 1 Angle Too Small
- 2 Correct Angle
- 3 Drag
- 4 Angle Too Large
- 5 Too Short
- 6 Normal
- 7 Too Long
- 8 Spatter
- 9 Slow
- 10 Normal
- 11 Fast

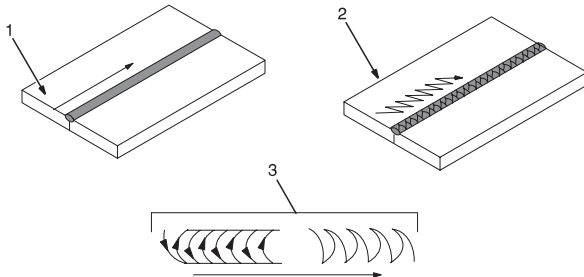
Arc Length



Travel Speed



13-8. Electrode Movement During Welding

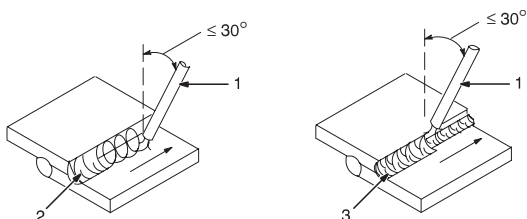


Normally, a single stringer bead is satisfactory for most narrow groove weld joints; however, for wide groove weld joints or bridging across gaps, a weave bead or multiple stringer beads works better.

- 1 Stringer Bead - Steady Movement Along Seam
- 2 Weave Bead - Side To Side Movement Along Seam
- 3 Weave Patterns

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

13-9. Welding Lap Joints



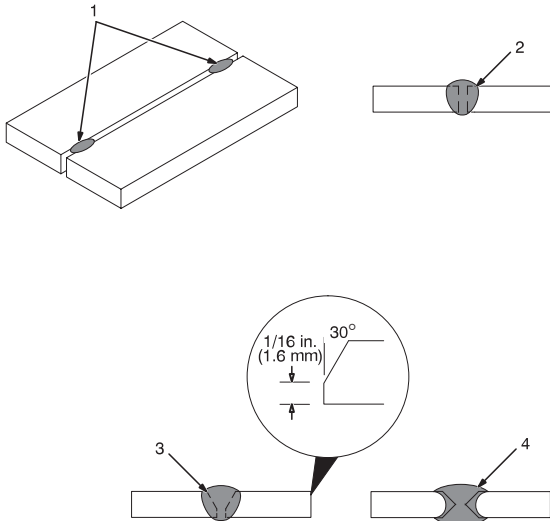
- 1 Electrode
- 2 Single-Layer Fillet Weld

Move electrode in circular motion.

- 3 Multi-Layer Fillet Weld

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

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

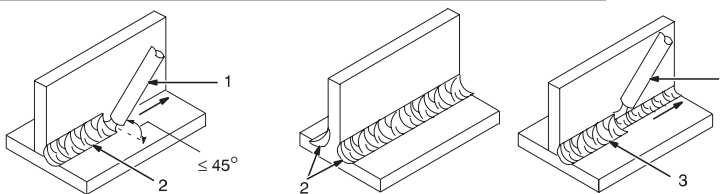
3 Single V-Groove Weld

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 oxyacetylene or plasma cutting equipment. Remove scale from material after cutting. A grinder can also be used to prepare bevels.

13-11. Welding T-Joints



1 Electrode

2 Fillet Weld

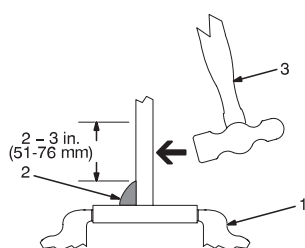
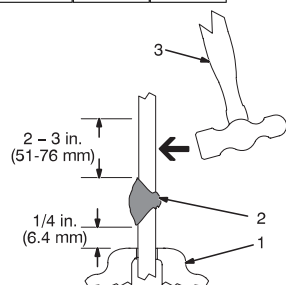
Keep arc short and move at definite rate of speed. Hold electrode as shown to provide fusion into the corner. Square edge of the weld surface.

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.

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.

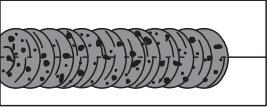
If the weld breaks, examine it to determine the cause.

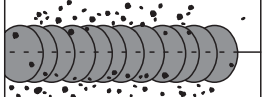
If the weld is porous (many holes), the arc length was probably too long.

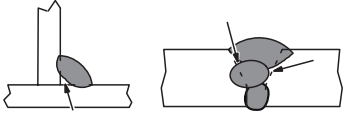
If the weld contains bits of slag, the arc may have been too long or the electrode was moved incorrectly which allowed molten slag to be trapped in the weld. This may happen on a V-groove joint made in several layers and calls for additional cleaning between layers.

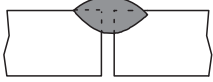
If the original beveled surface is visible the material was not fully melted which is often caused by insufficient heat or too fast a travel speed.

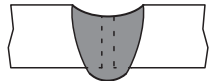
13-13. Troubleshooting

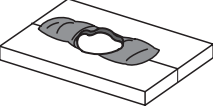
	Porosity - small cavities or holes resulting from gas pockets in weld metal.
Possible Causes	Corrective Actions
Arc length too long.	Reduce arc length.
Damp electrode.	Use dry electrode.
Workpiece dirty.	Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.

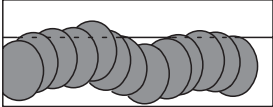
	Excessive Spatter - scattering of molten metal particles that cool to solid form near weld bead.
Possible Causes	Corrective Actions
Amperage too high for electrode.	Decrease amperage or select larger electrode.
Arc length too long or voltage too high.	Reduce arc length or voltage.

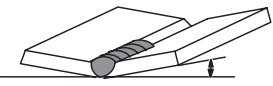
	Incomplete Fusion - failure of weld metal to fuse completely with base metal or a preceding weld bead.
Possible Causes	Corrective Actions
Insufficient heat input.	Increase amperage. Select larger electrode and increase amperage.
Improper welding technique.	Place stringer bead in proper location(s) at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

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

	Excessive Penetration - weld metal melting through base metal and hanging underneath weld.
Possible Causes	Corrective Actions
Excessive heat input.	Select lower amperage. Use smaller electrode.
	Increase and/or maintain steady travel speed.

	Burn-Through - weld metal melting completely through base metal resulting in holes where no metal remains.
Possible Causes	Corrective Actions
Excessive heat input.	Select lower amperage. Use smaller electrode.
	Increase and/or maintain steady travel speed.

	Waviness Of Bead - weld metal that is not parallel and does not cover joint formed by base metal.
Possible Causes	Corrective Actions
Unsteady hand.	Use two hands. Practice technique.

	Distortion - contraction of weld metal during welding that forces base metal to move. Illustration: Base metal moves in the direction of the weld bead.
Possible Causes	Corrective Actions
Excessive heat input.	Use restraint (clamp) to hold base metal in position.
	Make tack welds along joint before starting welding operation.
	Select lower amperage for electrode.
	Increase travel speed.
	Weld in small segments and allow cooling between welds.



Effective January 1, 2026 (Equipment with a serial number preface of NG 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, Miller Electric Mfg. LLC, Appleton, Wisconsin, warrants to authorized distributors that new Miller equipment sold after the effective date of this limited warranty is free of defects in material and workmanship at the time it is shipped by Miller. **THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS.**

Within the warranty periods listed below, Miller will repair or replace any warranted parts or components that fail due to such defects in material or workmanship. 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 Miller Service Operation Guide (SOG) may be denied by Miller.

Miller 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.

1 5 Years Parts — 3 Years Labor

- Original Main Power Rectifiers Only to Include SCRs, Diodes, and Discrete Rectifier Modules in non-inverter products

2 4 Years Parts (No Labor)

- Auto-Darkening ClearLight 2.0 and 4x Helmet Lenses

3 3 Years — Parts and Labor Unless Specified

- Auto-Darkening Helmet Lenses (No Labor)
- Copilot Collaborative Welding Systems
- Engine and Hydraulic Driven Welder/Generators (Including EnPak) (**NOTE: Engines are Warranted Separately by the Engine Manufacturer.**)
- Handheld Laser Power Sources
- 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

4 2 Years — Parts and Labor

- Auto-Darkening Weld Masks (No Labor)
- Fume Extractors - Filtair 215, Capture 5, Purifier, and Industrial Collector Series

5 1 Year — Parts and Labor Unless Specified

- ArcCapture Camera
- ArcReach Heater
- AugmentedArc, LiveArc, and MobileArc Welding Systems
- Automatic Motion Devices
- Bernard BTB Air-Cooled MIG Guns (No Labor)
- CoolBelt, PAPR Blower, and PAPR Face Shield (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, Standard, Telescopic, and ZoneFlow Extraction Arms and Motor Control Box
- Handheld Laser Torches (No Labor)
- Induction Heating Power Sources, Coolers (**NOTE: Digital Recorders are Warranted Separately by the Manufacturer.**)
- Insight Sensors
- Laser Welding Helmets (No Labor)
- Load Banks
- MDX Series MIG Guns (No Labor)
- Motor-Driven Guns
- Positioners and Controllers
- Racks (For Housing Multiple Power Sources)
- Running Gear/Trailers
- Spoolmate Spoolguns (No Labor)
- Subarc Wire Drive Assemblies
- Supplied Air Respirator (SAR) Boxes and Panels
- TIG Torches (No Labor)
- Tregaskiss Guns (No Labor)
- Venture 150 Battery (Warranted for 1 year or 1000 charge cycles, whichever comes first)
- Water Cooling Systems
- Wireless Remote Foot/Hand Controls and Receivers
- Work Stations/Weld Tables/Weld Booths (No Labor)
- XT Plasma Cutting Torches (No Labor)

6 6 Months — Parts

- 12 Volt Automotive-Style Batteries
- PAPR Batteries

7 90 Days — Parts

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

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

1. **Consumable components; such as contact tips, cutting nozzles, contactors, brushes, relays, work station table tops and welding curtains, or parts that fail due to normal wear. (Exception: brushes and relays are covered on all engine-driven products.)**
2. Items furnished by Miller, but manufactured by others, such as engines or trade accessories. These items are covered by the manufacturer's warranty, if any.
3. Equipment that has been modified by any party other than Miller, or equipment that has been improperly installed, improperly operated or

misused based upon industry standards, or equipment which has not had reasonable and necessary maintenance, or equipment which has been used for operation outside of the specifications for the equipment.

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

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

The above remedies are F.O.B. Appleton, WI, or Miller's 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 MILLER 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 MILLER.

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Support

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

Owner's Record

Please complete and retain with your personal records.

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

For Service

Contact a *DISTRIBUTOR* or *SERVICE AGENCY* near you.

Always provide Model Name and Serial/Style Number.

Contact your Distributor for:	Welding Supplies and Consumables Options and Accessories Personal Protective Equipment (PPE) Service and Repair Replacement Parts Training (Schools, Videos, Books) Welding Process Handbooks To locate a Distributor or Service Agency visit www.millerwelds.com or call 1-800-4-A-Miller
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Contact the Delivering Carrier to:	File a claim for loss or damage during shipment. For assistance in filing or settling claims, contact your distributor and/or equipment manufacturer's Transportation Department.
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