Welding & Cutting Equipment

www.canaweld.com

MULTIPROCESS

6001 series

Owner's Manual

DC CV CC 3 PHASE 50/60 HZ IEC CSA/CPS Certified

www.canaweld.com

Thank You

From

Canaweld

Thank you for choosing a Canaweld machine, with 40+ years of welding equipment manufacturing experience overseas, you can feel confident that you have made the right choice.

Since the 1980s, the founders of Canaweld have been actively involved in research & development, production and sales within the welding and cutting industries. They have filed countless patents and set new standards in the welding industry.

For over a decade the founders of Canaweld, have been members of the Technical Committee (TC 26) of the **International Electro-technical Commission (IEC). IEC** is the world's leading organization on international standards for all electrical, electronic, and related technologies.

The company has also been an **expert member of the Canadian Standards Association (CSA), within the Technical Committee, responsible for Canadian standards of welding and cutting machines.**

Canaweld was created with the aim of providing our customers with advanced technologies. Our products, from design to assembly, are created with years of experience in research & development, materials engineering, quality control and testing.

Canaweld machines are among the best in the world in terms of quality.
The materials used in our designs are some of the best available on the market.
We believe in the high performance of our equipment and, therefore, offer a 3-year warranty.

We use strict test procedures, and our expectations exceed the required standards. For example, according to International Standards, machines must be tested at 40°C (104°F), but Canaweld tests the machines at both 40°C and 50°C (122°F). In doing so, we ensure that our machines will continue to operate even in hot climates.

Finally, all machines are only packaged and shipped when they pass strict mandatory tests.

This user manual should be read carefully to fully understand the machine you have purchased and how to maintain it in the best operating condition.

For more information on our full line of products please visit our website or contact a dealer in your local area, our dealer list can be found on our website: www.canaweld.com

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1.1 General Safety Precautions

Users of Canaweld welding and plasma cutting equipment are ultimately responsible for ensuring that everyone working on or around the equipment follow all safety measures. Safety precautions must fulfill the criteria for welding or plasma cutting equipment of this sort. In addition to the usual workplace laws, the following guidelines should be followed. To keep yourself and others safe, read, obey, and save these critical safety warnings and operating instructions. You are entirely responsible for the Product's safe operation. Canaweld does not and cannot give any assurances or warranties about the product's safety in your environment. This device is not designed for use in residential areas where the electrical power comes from a public low-voltage supply source. Due to both conducted and radiated disturbances, it may be challenging to ensure electromagnetic compatibility of the equipment in certain regions. This product is only for removing metal. Any other usage might result in bodily harm and/or damage to the equipment. In the event of a malfunction, contact a professional for assistance.

All work must be done by skilled employees who are familiar with how the welding or plasma cutting equipment works. Incorrect equipment operation can lead to dangerous circumstances, resulting in harm to the operator and equipment damage. Anyone who works with welding or plasma cutting equipment should understand how it works, where the emergency stops are situated, what safety measures should be followed, and how to utilize plasma cutting and/or welding.

Use approved personal safety equipment, such as safety glasses, flame-resistant clothes, and safety gloves. Avoid wearing scarves, bracelets, rings, and other loose-fitting items that may become stuck or cause burns. The operator must guarantee that no unauthorized personnel are present in the equipment's working area when it is turned on and no one is exposed to the arc when it is struck. The work environment must be free from drafts and appropriate for the job. The return cable must be securely connected and working on high voltage equipment must be done by a qualified electrician only. A proper and clearly marked fire extinguishing equipment must be close at hand. While the equipment is in operation, do not lubricate or maintain it.

1.2 Safety Precautions & Symbol

Before working on the machine, read the owner's manual.

Read the safety information at the beginning of the manual. To fully understand the machine's capabilities and safety measures, read this manual thoroughly. Follow the Owner's Manuals, industry standards, and national, province, state, and local requirements.

DANGER!

The symbol indicates a dangerous action that will result in death or serious injury if not prevented. The potential dangers or hazards are depicted in the symbols next to them or discussed in the text.

ELECTRIC SHOCK

Touching electrical components can cause fatal electric shock and severe burns. By using a dry insulating mat or cover, insulate yourself from the workpiece and ground. While the machine is powered on, do not remove the machine cover, or touch any electrical components or circuits without a pair of proper and dry insulating gloves. Equipment that has been incorrectly placed or grounded is a hazard. ELECTRIC SHOCK can cause death or severe injuries. Do not touch any active electrical components. Wear dry insulating gloves and body protection with no holes in them. Use dry insulating mats or blankets large enough to avoid any direct touch with the work or ground to isolate oneself from the work and ground. If the torch pieces touch the work or the ground, do not touch them. Inspect the input power cable and ground conductor on a regular basis for aging or bare wiring; repair promptly if damaged; bare wiring can kill. When not in use, turn off all equipment. Do not utilize cables that are worn, broken, undersized, or repaired. Avoid wrapping the torch cable around your body. If codes demand it, connect the workpiece to a good electrical (earth) ground. Only use well-maintained equipment. Repair or replace broken pieces at the same time. When operating above floor level, use a safety harness. Maintain the integrity of all panels and coverings. Do not try to bypass or overcome the safety mechanisms. Only use the torch types which indicated in the owner's manual. When the trigger is pressed, keep your hands away from the electrode/tungsten tip and the arc. Clamp the work cable to the workpiece (not a component that will fall away) or the worktable as close to the welding area as possible. When not attached to the workpiece, insulate the work clamp to avoid contact with any metal objects. Before inspecting, cleaning, or replacing torch parts, and before installing or repairing this machine, turn off the power. Install, ground, and operate this equipment in accordance with its owner's manual and any national, province, state, and local laws. Always ensure that the input power cord ground wire is correctly connected to the ground terminal and the cord connector is attached to a properly grounded receptacle outlet. Attach the correct grounding conductor first while establishing input connections. Maintain cables by keeping them dry, clear of oil and grease, and away from hot metal and sparks.

High DC VOLTAGE exists inside the machine even after turning off.

Even after disconnecting the input power, there is dangerous DC voltage in inverter welding power sources. Before touching any parts, turn off the inverter, disconnect the input power, and wait for the input capacitors to discharge.

BURNS AND ELECTRIC SHOCK RISK WEAR DRY INSULATED GLOVES.

When replacing the consumables, always use dry insulated gloves. During welding, the consumables get extremely hot, and serious burns are possible. If the power supply is turned on, touching the consumables might cause an electric shock. Never

touch the exposed parts of the welding torch/electrode holder of the machine, change or clean consumables while the machine is on, because the shocking voltage between the parts will be extremely dangerous and even fatal.

WELDING can result in a fire or explosion.

From the welding arc, hot metal and sparks are ejected that can cause fire or explosion. Before performing any welding, double-check that the location is safe. Welding has the potential to start a fire or explosion. Remove all combustible materials around the work area. If this isn't feasible, use certified covers to firmly cover them. Avoid welding in areas where flying sparks might ignite combustible materials. Make sure you and others are safe from flying sparks and hot metal. Be aware that welding sparks and hot materials can easily pass-through minor gaps and holes and onto surrounding places. Keep an eye out for flames and a fire extinguisher nearby. Welding on a ceiling, floor, bulkhead, or wall might result in a fire on the concealed side. Do not weld on combustible-filled containers or closed containers like tanks, drums, or pipelines unless they have been adequately prepared according to relevant safety standards. Check the area for sparks, glowing embers, and flames when the task is completed. Only use the proper fuses or circuit breakers. Do not oversize or bypass them. All work should be done in accordance with applicable safety regulations, and a fire watcher and extinguisher should be available. To avoid welding currents from traveling too long, perhaps unknown courses and generating electric shock, sparks, and fire dangers, connect the work cable to the work as near to the welding area as possible. Never weld on containers containing potentially combustible products; they must first be emptied and thoroughly cleaned. Never perform welding where combustible dust, gas, or liquid vapors (such as gasoline) are present in the atmosphere. Welding pressurized cylinders, pipelines, or containers is prohibited. Wear flame-resistant, long-lasting body protection (leather, heavy cotton, wool). Oil-free clothes, such as leather gloves, a thick shirt, cuffless pants, work boots with electrical insulated sole, and a hat, are all recommended for body protection. Avoid placing the device near or on flammable materials. Before performing any welding, make sure you don't have any combustibles on you, such as butane lighter or matches.

EXCESSIVE NOISE HAZARD

Be cautious if there is excessive noise in the workplace. Wear hearing protection if the noise level is too high. Workers nearby are also impacted by noise and may require hearing protection.

Hot PARTS HAZARD

All welded pieces become extremely hot immediately after welding or cutting, causing burns to anybody in touch with exposed skin. After welding or cutting, do not contact the workpiece, ground clamp, or electrode holder/torch instantly, and wait for a cooling interval before picking them up. To avoid burns, use proper equipment while working with hot parts, and use thick insulating welding/cutting gloves and clothes as well.

WELDING/CUTTING FUMES HAZARD

Welding and cutting generate gases and fumes. The inhalation of these gases and vapors might be hazardous. These gases and fumes can replace oxygen in the body, causing harm or death. Keep your head away from the welding or cutting area and avoid inhaling the fumes and gases. If the weld/cut is indoors, ventilate the environment or utilize local forced ventilation at the weld site to eliminate smoke and gas. Wear an authorized air supply respirator if ventilation is insufficient. Only work inside if you are properly ventilated or using an air-supplied respirator. For any materials being used, read the Material Safety Data Sheet (MSDS) and the manufacturer's instructions.

DANGEROUS GASES AND FUMES HAZARD

Welding and cutting coated metal, such as stainless steel, are not permitted, unless the coating has been removed from the weld or cut area, and the area is thoroughly ventilated, and an air-supplied respirator is used as well. During welding or cutting, the coating and all metals containing these elements can produce harmful fumes. Do not cut containers that contain poisonous or reactive products or containers that have previously held toxic or reactive materials; they must first be emptied and thoroughly cleaned. Cut away from degreasing, cleaning, or spraying processes. The arc's heat and light can combine with vapors to produce very poisonous and unpleasant fumes.

DANGEROUS GAS HAZARD FROM THE SHIELDING / CUTTING GAS CYLINDERS

Turn off the shielding/cutting gas, when not in use. These gases can displace air, lowering oxygen levels and resulting in harm or death.

CYLINDERS can explode if they are damaged.

Excessive heat, mechanical shocks, physical damage, slag, open flame, sparks, and arcs should all be avoided while using compressed gas cylinders. Keep cylinders away from any electrical or cutting/welding circuits. Never allow a welding torch/electrode holder or plasma arc torch to make electrical contact with a cylinder. An explosion will occur if you cut a pressurized cylinder. When the cylinder is not in use or attached for use, keep the protective cap on the valve. To avoid falling or tipping, install and secure cylinders in an upright position by chaining them to a fixed support or equipment cylinder rack. Lift and move cylinders with the proper equipment, procedures, and a sufficient number of people. Read and obey the directions on compressed gas cylinders, associated equipment, and Compressed Gas Association (CGA). Use just the right compressed gas cylinders, regulators, hoses, and fittings for the job, and keep them and their parts in excellent working order. When opening the cylinder valve, face away from the valve outlet. When opening the valve, make sure you're not standing in front of or behind the regulator.

WELDING/CUTTING RAYS HAZARD

The visible and invisible light (ultraviolet and infrared rays) produced by the welding or cutting process can burn the eyes and skin. Wear an appropriate welding helmet with suitably shaded filter lenses to protect your face and eyes from welding rays. Cover any exposed skin, arms, or neck. Wear protective clothing made of flame-resistant material (leather, thick cotton, or wool). Protect people from flashes, glare, and sparks by using a safety screen or barriers.

ESD- ELECTROSTATIC DISCHARGE

During welding/cutting, an electric static charge can be produced and released into any items contacted by the welder/cutter after welding/cutting. Before touching any boards or electronic components, put on a grounded wrist strap. When storing, moving, or shipping PC boards, use proper static-proof bags and boxes.

MOVING PARTS HAZARD

Typical welding/cutting machines may include several moving elements, such as rollers and fans. Hands should be kept away from moving elements like fans. Keep a safe distance from moving parts. Keep your distance from pinch spots like drive rolls. Keep loose garments and hair out of the path of moving parts. All doors, panels, covers, and guards should be closed and secured. Only allow qualified individuals to remove doors, panels, coverings, or guards as needed for maintenance and troubleshooting. When the maintenance is performed, reinstall the doors, panels, covers, or guards before reconnecting the input power.

BATTERY EXPLOSION can cause injury.

Do not use welding machine to charge batteries or jump start vehicles that can cause explosion.

FALLING EQUIPMENT can cause injury.

Lift just the unit, not the gas cylinders, or other attachments together. Make sure you have equipment with adequate capacity to raise the unit. If you're going to relocate the unit using lift forks, be sure they're long enough to reach the other side. When working from an aerial location, keep equipment (cables and cords) out of the way of moving vehicles.

Sparks and hot metal blow out from the cutting arc can cause injury.

Flying hot metal generated by chopping and grinding can cause injury. Wear a face shield or safety goggles with side shields that are approved. Protect your skin by wearing suitable body protection. To prevent sparks from entering your ears, use flame-resistant ear plugs or earmuffs. Wear safety glasses with side shields or wear face shields.

EXPLODING INVERTER PARTS can cause injury.

When electricity is connected to inverter power sources, faulty parts can explode or cause other parts to explode. Turn off the power source and then start to service the inverters, and always wear a face shield and long sleeves to protect your body and skin.

EMF- ELECTRIC MAGNETIC FIELDS can cause fault in electrical devices such as pacemakers.

Electric magnetic fields are formed during welding or cutting, which might cause faults in electrical components or Implanted Medical Devices in the surrounding area. Those who wear pacemakers or other implanted medical devices should stay away from EMF emitted by welders/cutters. Before arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations, wearers of implanted medical devices should consult their doctor and the device manufacturer.

Welding can cause interference in electronic equipment.

Electronic equipment, such as computers and computer-driven equipment, such as robots, can be harmed by electromagnetic energy. Keep cables short, close together, and low as possible, to prevent any interference. Welding should be done far away from any sensitive electrical equipment. Ensure that this welding power source is installed and grounded in accordance with the instructions in this manual. If interference still occurs, the user should consider relocating the equipment, employing shielded cables, utilizing line filters, or shielding the workspace.

Moving PARTS can bring injury

Avoid touching moving components.
Avoid tight spots, such as drive rolls.

Welding wire has the potential to cause harm

Wait to pull the trigger on the gun until directed to.
When threading welding wire, never point a gun at the human body, any metal, or any other object.

ELECTRIC SHOCK RISK

Keep your hands and other metallic items far from the welding wire and driving components while the procedure is in progress.

1**.3 Important Safety Precautions**

- Put on dry insulating gloves. Avoid touching the electrode with your bare hand. Wearing damp or damaged gloves is not permitted.
- Injuries can be caused by flying components. When servicing a unit, always wear a face shield. Put on a cap and safety glasses. Wear a welding helmet with the appropriate filter shade. Wear full bodily protection.
- The most unstable position of the equipment must not be inclined up more than 10°. Auxiliary components such as gas cylinders, wire feed units, or cooling devices may impact stability depending on the kind of equipment, and they must be considered.
- Before changing torch consumables, working on the machine, turn off the power and unplug the input plug.
- After the power is switched off, dangerous voltage remains on the input capacitors. Do not touch fully charged capacitors. Always wait 60 seconds after turning off the power before working on the machine and check the input

capacitor voltage to ensure it is near zero before touching any parts.

1.4 Minimizing EMF (Electrical and Magnetic Fields) Exposure from the Welding / Cutting Circuit.

Arc welding and related processes such as gouge, plasma arc cutting, and spot welding generate an EMF field surrounding the welding circuits. Some medical devices, such as pacemakers, can be affected by EMF. Protective precautions for those who have medical implants must be implemented. For example, limit passing by or do individual risk assessments for welders. By following the relevant procedures, EMF exposure can be reduced. Twist or tape cables together, or use a cable cover, to keep them close together.

Precautions about Implanted Medical Devices

Before performing or going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating procedures, implanted medical device wearers should consult their doctor and the device manufacturer. Follow the above procedures only if your doctor has approved you.

Avoid putting your body between welding or cutting cables. Arrange the wires so that they are to one side and away from the operator. Work away from the welding power source and do not sit or lean on it. Keep your head and body as far away from the welding circuit's equipment as possible.

Work clamp should be connected to the workpiece as near to the weld or cut area as possible. Welding should not be done while carrying the welding or cutting power source or wire feeder. If you have an Implanted Medical Device in your body, you should consult your doctor before doing or going near arc welding, spot welding, gouging, or plasma arc cutting activities. Do not wrap cables around your body or coil them. It is the user's responsibility to install and operate the equipment in accordance with the manufacturer's instructions. If electromagnetic disturbances are detected, it is the user's obligation to fix the problem with the manufacturer's technical help. In other circumstances, resolving the problem may be easy by connecting the machine to the earth and the workpiece. In other circumstances, it might include building an electromagnetic screen that encloses the power source and the work area, along with applying some input filters. Cutting/welding equipment must be connected to the power source in accordance with the manufacturer's instructions. If interference occurs, further precautions, such as mains supply filtering, may be required. Shielding the supply cable of permanently installed equipment in metallic conduit or equivalent should be considered. The shielding should be electrically continuous over its whole length. The shielding should be attached to the power supply to preserve excellent electrical contact between the conduit and the power source enclosure. The user must analyze any electromagnetic concerns in the surrounding region before installing the device. The user must confirm that all other devices in the area are compatible. This may necessitate extra precautions. Where the workpiece is not tied to earth for electrical safety or because of its size and location, such as a ship's hull or constructing steel work, a connection linking the workpiece to earth may minimize emissions in some cases. The workpiece without earth increases the danger of harm to users or damage to other electrical equipment. The workpiece should be connected to earth by a direct connection to the workpiece. If direct connection is not permitted, bonding should be accomplished via adequate capacitances determined in accordance with national rules. Changing the earth circuit arrangements should be authorized only by someone who is qualified to assess whether the alterations would raise the danger of injury, such as by enabling parallel cutting/welding current return pathways, which may damage the earth circuits of other equipment. IEC 60974-9 provides additional advice, Arc Welding Equipment, Part 9: Installation and Use.

Interference concerns may be alleviated by selective screening and shielding of other cables and equipment in the direct vicinity. For some particular applications, screening of the complete cutting/welding system may be considered.

1.5 Grounding of Welding/Cutting Machines:

In an electric circuit, there is an active wire that supplies power, a neutral wire that returns the current and a 'grounding wire' that provides an additional path for electrical current to safely return to the ground in the event of a short circuit. A copper conductor is connected from the wiring system's metal rod to a set of ground connection terminals in the service panel.

Because electricity always seeks the shortest path to the earth, if the neutral wire is broken or interrupted, it is the grounding wire that provides a direct path to the ground. Because of this direct physical connection, the earth can act as the path of least resistance, preventing an appliance or person from becoming the shortest path.

Importance of Electrical Grounding

Protects Against Electrical Overloads

You may occasionally experience power surges or be struck by lightning during severe weather conditions. These occurrences may generate dangerously high levels of electricity, which can destroy your electrical appliances. By grounding the electrical system, all excess electricity is directed to the earth rather than frying the system's connected appliances. The appliances will be secure and safe from large electrical surges.

Stabilizes the Voltage Levels

Grounding the electrical system makes it easier to distribute the right amount of power to the right places. This ensures that the circuits are never overloaded and, as a result, do not blow. The earth can be regarded as a common reference point for any electrical system's voltage sources. This aids in maintaining stable voltage levels throughout the electrical system.

Earth Conducts with Least Resistance

One of the primary reasons for grounding your electrical appliances is that the earth is a great conductor, capable of carrying all excess electricity with minimal resistance. When you ground the electrical system and connect it to the earth, you are allowing excess electricity to flow somewhere without resistance rather than through you or your appliances.

Prevents Serious Damage and Death

When you fail to ground the electrical system, you endanger your appliances and even your life. When high voltage is passed through a device, it is fried and irreparably damaged.

An excess of electricity can even start a fire, endangering your property and the lives of your loved ones.

Welding and Cutting Equipment Grounding

Welding/cutting machines are typically grounded via a third grounding wire connected to their electrical connections. Mobile engine-driven generator welding units should be grounded by connecting a cable from the machine's ground stud to a metal stake driven into the ground. Always follow the manufacturer's instructions for properly grounding the model being used.

Auxiliary receptacles on welding machines may or may not be protected by a ground-fault circuit interrupter (GFCI). In wet or damp areas, GFCI adapters or "pigtails" should be used. Tools, extension cords, and other items plugged into these receptacles must be grounded or double insulated.

When connecting the work piece to the welding table, make sure the table is grounded as well (typically a cable from the table leg to the building structure). Avoid grounding to a structure that is a long distance away from the weld. Never use flammable liquid pipelines as a ground, and never use electrical conduit as a ground.

Precautions to prevent an electrical shock.

To reduce the extent of live parts, ensure that all cables are in good condition, with no bare insulation or frayed wires.

Keep cables safe from vehicle traffic and other hazards so they don't get damaged, cut, or pinched.

Check that the rod electrode holder is properly insulated.

During a welding/cutting operation, always keep your hands and body dry.

Avoid standing in water, on wet surfaces, using wet hands, or wearing sweaty clothing. Never immerse energized (hot) electrode holders or torches in water.

Avoid coming into direct contact with live welding equipment and the workpiece. Connect the work or metal to a good electrical ground. Always shield yourself from the work and the ground. If performing arc welding in wet or high humidity conditions, wear appropriate protective equipment such as rubber boots and rubber pads. Wear rubber gloves beneath your welding gloves. Use an insulating mat under the operator if the welding/cutting operation must be performed on steel or another conductive material. Put the welding or cutting machine in close proximity. In the event of an emergency or an accident, the machine can be quickly turned off to cut off the power source. When not in use or on breaks, turn off the welding or cutting machine. Before leaving the cutting/welding area, disconnect the machine from the power grid. When moving from one working position to another, do not hold or move the torch/electrode holder and the Ground (Earth) return cable at the same time If the power source to the equipment has not been cut.

What should I do in case of an electric shock?

Call for medical assistance right away.

DO NOT USE YOUR "BARE HANDS" on the victim until he or she is away from the live electrical source. If an appliance or electrical equipment is the electrical source, turn off the power at the fuse box or circuit breaker panel, or, if possible, turn off the appliance or electrical equipment and unplug it. Simply turning off the equipment is insufficient.

If the electricity cannot be turned off and the victim is still in contact with the electrical source, determine whether the victim should be moved, or the wire should be pushed away from the victim (call for emergency help if the wire is a high voltage power line).

Wear dry gloves or cover your hands with cloth if you must move a victim away from a live contact, and stand on dry insulating material such as cardboard, wood, or clothes. When attempting to move the victim, ensure that you have good footing and will not slip or fall.

Move the wire or power source away from the victim or push the victim off the live electrical source with a dry piece of wood, broom, or other dry, insulating object or material.

If there is a risk of neck or spinal injuries (for example, from a fall), do not move the victim unless absolutely necessary.

If the victim is not breathing, provide artificial respiration.

If the victim's heart has stopped, perform CPR (only if you are trained in CPR).

Apply a sterile dressing to burns. There could be burns where the power source touched the victim and where the electricity exited the body (to ground). Electrical burns may appear minor on the surface, but they can be severe deep within the tissue. Maintain the victim's comfort, warmth, and rest, and keep an eye on his or her breathing.

Information Sources for Grounding

American Welding Society, ANSI Z49.1:2005 "Safety in Welding, Cutting & Allied Processes."

National Fire Protection Association, NFPA 70, "National Electrical Code", 2005.

American Welding Society, Safety and Health Fact Sheet No. 29, "Grounding of Portable and Vehicle Mounted Welding Generators", July 2004.

American Welding Society, AWS A3.0-2001, "Standard Welding Terms and Definitions"

Guide for Helmet Shade Number

When cutting or watching, use face protection (helmet or shield) with appropriate filter glasses to protect your face and eyes from arc rays and sparks (see Safety Standards). The suggested colors in the table below are offered for the convenience of the operator.

Process	Welding Current (A)	Minimum Protective Shade Size	Recommended* Shade Size
GMAW / MIG & Flux Cored Arc Welding (FCAW)	Less than 55	7	-
	55 to 155	10	11
	155 to 240	10	12
Gas Tungsten Arc Welding (GTAW)	Less than 50	8	10
	50 to 150	8	12
	150 to 500	10	14
Shielded Metal Arc Welding (SMAW)	Less than 60	7	10
	60 to 160	8	10
	160 to 250	10	12
	250 to 550	11	14

Recommendation: take a shade that is too dark to see the weld zone. Then try a lighter shade which ensures sufficient view of the weld zone without going below the minimum.

Additional Safety Information

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

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

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

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

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

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

Safe Practice for Occupational and Educational Eye and Face Protection, ANSI Standard Z87.1 from American National Standards Institute. Website: www.ansi.org.

❑Précautions de sécurité et les symboles (French)

Mesures de sécurité generals

Les utilisateurs d'équipement de soudage et de coupage au plasma Canaweld sont en fin de compte responsables de s'assurer que toute personne travaillant sur ou autour de l'équipement respecte toutes les mesures de sécurité. Les mesures de sécurité doivent répondre aux critères d'un équipement de soudage ou de découpe au plasma de ce type. En plus des lois habituelles sur le lieu de travail, les directives suivantes doivent être suivies. Pour assurer votre sécurité et celle des autres, lisez, respectez et conservez ces avertissements de sécurité et instructions d'utilisation essentiels. Vous êtes entièrement responsable de l'utilisation sûre du produit. Canaweld ne donne et ne peut donner aucune assurance ou garantie quant à la sécurité du produit dans votre environnement. Cet appareil n'est pas conçu pour être utilisé dans des zones résidentielles où l'alimentation électrique provient d'une source publique de basse tension. En raison des perturbations conduites et rayonnées, il peut être difficile d'assurer la compatibilité électromagnétique de l'appareil dans certaines régions. Ce produit est uniquement destiné à enlever du métal. Toute autre utilisation peut entraîner des blessures corporelles et/ou endommager l'équipement. En cas de dysfonctionnement, contactez un professionnel pour obtenir de l'aide. Tous les travaux doivent être effectués par des employés qualifiés qui connaissent le fonctionnement de l'équipement de soudage ou de découpe au plasma. Une utilisation incorrecte de l'équipement peut conduire à des circonstances dangereuses, entraînant des blessures pour l'opérateur et des dommages pour l'équipement. Toute personne qui travaille avec un équipement de soudage ou de découpe au plasma doit comprendre comment il fonctionne, où se trouvent les arrêts d'urgence, quelles sont les mesures de sécurité à respecter et comment utiliser la découpe au plasma et/ou le soudage. Utilisez des équipements de sécurité personnelle approuvés, tels que des lunettes de sécurité, des vêtements résistant aux flammes et des gants de sécurité. Évitez de porter des écharpes, des bracelets, des bagues et d'autres articles amples qui pourraient se coincer ou causer des brûlures. L'opérateur doit garantir qu'aucune personne non autorisée ne se trouve dans la zone de travail de l'équipement lorsqu'il est allumé et que personne n'est exposé à l'arc lorsqu'il est amorcé. L'environnement de travail doit être exempt de courants d'air et adapté à la tâche. Le câble de retour doit être solidement connecté et les travaux sur les équipements à haute tension ne doivent être effectués que par un électricien qualifié. Un équipement d'extinction d'incendie approprié et clairement identifié doit être à portée de main. Pendant que l'équipement est en fonctionnement, ne le lubrifiez pas et ne l'entretenez pas.

Précautions et symboles de sécurité

Avant de travailler sur la machine, lisez le manuel d'utilisation.

Lisez les informations de sécurité au début du manuel. Trouvez chaque partie à étudier dans le manuel pour bien comprendre les capacités de la machine. Respectez les manuels du propriétaire, les normes industrielles et les exigences nationales, provinciales, étatiques et locales.

DANGER !

Le symbole indique une action dangereuse qui entraînera la mort ou des blessures graves si elle n'est pas évitée. Les dangers ou risques potentiels sont représentés par les symboles qui leur sont accolés ou discutés dans le texte.

CHOC ELECTRIQUE

Le contact avec des composants électriques peut provoquer un choc électrique mortel et des brûlures graves. En utilisant un tapis isolant sec ou une couverture, isolez-vous de la pièce à travailler et de la terre. Lorsque la machine est sous tension, ne retirez pas le capot de la machine et ne touchez pas les composants ou circuits électriques sans un gant isolant sec et approprié. Un équipement mal placé ou mal mis à la terre présente un risque. Les CHOCS ELECTRIQUES peuvent causer la mort ou des blessures graves. Ne pas entrer en contact avec des composants électriques actifs. Porter des gants isolants secs et des protections corporelles non trouées. Utiliser des tapis ou des couvertures isolants secs suffisamment grands pour éviter tout contact direct avec l'ouvrage ou le sol afin de s'isoler de l'ouvrage et du sol. Si les pièces de la torche entrent en contact avec l'ouvrage ou le sol, ne pas les toucher.

Inspectez régulièrement le câble d'alimentation d'entrée et le conducteur de terre pour vérifier qu'ils ne sont pas vieillissants ou dénudés ; réparez-les rapidement s'ils sont endommagés ; les fils dénudés peuvent tuer. Lorsque vous n'utilisez pas l'appareil, éteindre tous les équipements. N'utilisez pas de câbles usés, cassés, sous-dimensionnés ou réparés. Évitez d'enrouler le câble du chalumeau autour de votre corps. Si les codes l'exigent, connectez la pièce de travail à une bonne mise à la terre électrique (earth). N'utilisez que du matériel bien entretenu. Réparez ou remplacez les pièces cassées en même temps. Lorsque vous travaillez au-dessus du niveau du sol, utilisez un harnais de sécurité. Maintenez l'intégrité de tous les panneaux et revêtements.N'essayez pas de contourner ou de surmonter les mécanismes de sécurité. N'utilisez que les types de torche indiqués dans le manuel d'utilisation. Lorsque vous appuyez sur la gâchette, gardez vos mains de l'électrode/du bout du tungstène et de l'arc. Fixez le câble de travail à la pièce (et non à un élément qui va tomber) ou à la table de travail, aussi près que possible de la zone de soudage. Lorsqu'elle n'est pas fixée à la pièce, isolez la pince de travail pour éviter tout contact avec des objets métalliques.

Avant d'inspecter, de nettoyer ou de remplacer des pièces de la torche, et avant d'installer ou de réparer cette machine, mettez-la hors tension. Installez, mettez à la terre et utilisez cet équipement conformément au manuel d'utilisation et aux lois nationales, provinciales, nationales et locales. Assurez-vous toujours que le fil de terre du cordon d'alimentation d'entrée est correctement connecté à la borne de terre et que le connecteur du cordon est fixé à une prise de courant correctement mise à la terre. Fixez d'abord le bon conducteur de mise à la terre lorsque vous établissez les connexions d'entrée. Entretenez les câbles en les gardant au sec, exempts d'huile et de graisse, et à l'écart du métal chaud et des étincelles.

Une tension continue élevée existe à l'intérieur de la machine même après l'avoir éteinte.

Même après avoir déconnecté l'alimentation d'entrée, il existe une tension continue dangereuse dans les sources d'alimentation de soudage de l'onduleur. Avant de toucher une quelconque pièce, éteignez l'onduleur, déconnectez l'alimentation d'entrée et attendez que les condensateurs d'entrée se déchargent.

RISQUE DE BRÛLURES ET DE CHOCS ÉLECTRIQUES - PORTER DES GANTS SECS ISOLÉS

Lors du remplacement des consommables, utilisez toujours des gants secs et isolés. Pendant le soudage, les consommables deviennent extrêmement chauds et des brûlures graves sont possibles. Si l'alimentation électrique est sous tension, le fait de toucher les consommables peut provoquer un choc électrique. Ne touchez jamais les parties exposées de la torche de soudage/du porte-électrode de la machine, ne changez pas ou ne nettoyez pas les consommables lorsque la machine est allumée, car la tension de choc entre les pièces sera extrêmement dangereuse, voire mortelle.

La soudure peut provoquer un incendie ou une explosion.

L'arc de soudage projette du métal chaud et des étincelles qui peuvent provoquer un incendie ou une explosion. Avant d'effectuer toute soudure, vérifiez que l'endroit est sûr. Le soudage est susceptible de déclencher un incendie ou une explosion. Retirez tous les matériaux combustibles autour de la zone de travail. Si cela n'est pas possible, utilisez des couvertures certifiées pour les recouvrir fermement. Évitez de souder dans des zones où des étincelles pourraient enflammer des matériaux combustibles. Assurez-vous que vous et les autres personnes êtes à l'abri des étincelles et du métal chaud. Sachez que les étincelles de soudage et les matériaux chauds peuvent facilement passer à travers de petits trous et interstices et atteindre les endroits environnants. Gardez un œil sur les flammes et un extincteur à proximité.Le soudage sur un plafond, un plancher, une cloison ou un mur peut provoquer un incendie sur le côté caché. Ne soudez pas sur des récipients remplis de combustible ou des récipients fermés tels que des réservoirs, des fûts ou des canalisations, à moins qu'ils n'aient été préparés de manière adéquate conformément aux normes de sécurité en vigueur.

Une fois la tâche terminée, vérifiez l'absence d'étincelles, de braises incandescentes et de flammes dans la zone. N'utilisez que les fusibles ou les disjoncteurs appropriés. Ne les surdimensionnez pas et ne les contournez pas. Tous les travaux doivent être effectués conformément aux règles de sécurité en vigueur, et un surveillant d'incendie et un extincteur doivent être disponibles. Pour éviter que les courants de soudage ne se déplacent trop longtemps, peut-être sur des parcours inconnus, et ne génèrent des chocs électriques, des étincelles et des risques d'incendie, connectez le câble de travail à l'ouvrage aussi près que possible de la zone de soudage. Ne soudez jamais sur des récipients contenant des produits potentiellement combustibles; ils doivent d'abord être vidés et soigneusement nettoyés. Ne jamais effectuer de soudage lorsque des poussières, des gaz ou des vapeurs liquides combustibles (comme l'essence) sont présents dans l'atmosphère. Il est interdit de souder des bouteilles, des canalisations ou des conteneurs sous pression. Portez des protections corporelles résistantes aux flammes et de longue durée (cuir, coton lourd, laine). Pour la protection corporelle, il est recommandé de porter des vêtements exempts d'huile, tels que des gants en cuir, une chemise épaisse, un pantalon sans revers, des bottes de travail avec une semelle isolée électriquement et un chapeau.

Évitez de placer l'appareil à proximité ou sur des matériaux inflammables. Avant d'effectuer des travaux de soudage, assurez-vous que vous n'avez pas de combustibles sur vous, comme un briquet au butane ou des allumettes.

RISQUE DE BRUIT EXCESSIF

Soyez prudent s'il y a un bruit excessif sur le lieu de travail. Portez des protections auditives si le niveau sonore est trop élevé. Les travailleurs à proximité sont également touchés par le bruit et peuvent avoir besoin de protections auditives.

DANGER LIÉ AUX PIÈCES CHAUDES

Toutes les pièces soudées deviennent extrêmement chaudes immédiatement après le soudage ou le coupage, provoquant des brûlures à toute personne en contact avec la peau exposée. Après le soudage ou le coupage, ne pas toucher instantanément la pièce, la pince de masse ou le porte-électrode/la torche, et attendre un intervalle de refroidissement avant de les ramasser. Pour éviter les brûlures, utilisez un équipement approprié lorsque vous travaillez avec des pièces chaudes, ainsi que des gants et des chiffons de soudage/coupage épais et isolants.

RISQUE DE FUMÉES DE SOUDAGE/COUPAGE

Le soudage et le coupage génèrent des gaz et des fumées. L'inhalation de ces gaz et vapeurs peut être dangereuse. Ces gaz et vapeurs peuvent remplacer l'oxygène dans le corps, ce qui peut causer des dommages ou la mort. Tenez votre tête éloignée de la zone de soudage ou de découpage et évitez d'inhaler les fumées et les gaz. Si la soudure/le découpage a lieu à l'intérieur, ventilez l'environnement ou utilisez une ventilation forcée locale sur le site de soudure pour éliminer la fumée et les gaz. Porter un appareil respiratoire à adduction d'air autorisé si la ventilation est insuffisante. Ne travaillez à l'intérieur que si vous êtes correctement ventilé ou si vous utilisez un respirateur à adduction d'air. Pour tous les matériaux utilisés, lisez la fiche de données de sécurité (FDS) et les instructions du fabricant.

RISQUE DE GAZ ET DE FUMÉES DANGEREUX

Le soudage et le coupage de métaux revêtus, comme l'acier inoxydable, ne sont pas autorisés, à moins que le revêtement n'ait été retiré de la zone de soudage ou de coupage, et que la zone soit bien ventilée et qu'un masque respiratoire à adduction d'air soit également utilisé. Pendant le soudage ou le découpage, le revêtement et tous les métaux contenant ces éléments peuvent produire des fumées nocives. Ne coupez pas les récipients qui contiennent des produits toxiques ou réactifs ou les récipients qui ont précédemment contenu des matériaux toxiques ou réactifs ; ils doivent d'abord être vidés et soigneusement nettoyés. Coupez à l'écart des processus de dégraissage, de nettoyage ou de pulvérisation. La chaleur et la lumière de l'arc peuvent se combiner aux vapeurs et produire des fumées très toxiques et désagréables.

DANGER DE GAZ DANGEREUX PROVENANT DES CYLINDRES DE GAZ DE BLINDAGE / DE COUPE

Éteignez le gaz de protection/de coupe lorsqu'il n'est pas utilisé, car ces gaz peuvent déplacer l'air, abaisser les niveaux d'oxygène et entraîner des blessures ou la mort.

RISQUE DE RAYONS DE SOUDAGE/ COUPAGE

La lumière visible et invisible (rayons ultraviolets et infrarouges) produite par le processus de soudage ou de coupage peut brûler les yeux et la peau. Portez un casque de soudage approprié avec des lentilles filtrantes convenablement ombragées pour protéger votre visage et vos yeux des rayons de soudage. Couvrez toute peau, bras ou cou exposés. Portez des vêtements de protection fabriqués dans un matériau résistant aux flammes (cuir, coton épais ou laine). Protégez les personnes contre les éclairs, l'éblouissement et les étincelles en utilisant un écran ou des barrières de sécurité.

Les CYLINDRES peuvent exploser s'ils sont endommagés.

La chaleur excessive, les chocs mécaniques, les dommages physiques, les scories, les flammes nues, les étincelles et les arcs électriques doivent être évités lors de l'utilisation des bouteilles de gaz comprimé. Tenir les bouteilles à l'écart de tout circuit électrique ou de tout circuit de coupure ou de soudage. Ne laissez jamais une torche de soudage/un porte-électrode ou une torche à arc plasma entrer en contact électrique avec une bouteille. Une explosion se produira si vous coupez une bouteille sous pression. Lorsque la bouteille n'est pas utilisée ou fixée pour être utilisée, gardez le bouchon de protection sur le robinet. Pour éviter de tomber ou de basculer, installez et fixez les bouteilles en position verticale en les enchaînant à un support fixe ou à un support de bouteilles d'équipement. Soulevez et déplacez les bouteilles avec l'équipement et les procédures appropriés et un nombre suffisant de personnes. Lisez et respectez les instructions figurant sur les bouteilles de gaz comprimé, l'équipement associé et la Compressed Gas Association (CGA). Utilisez les bouteilles de gaz comprimé, les détendeurs, les tuyaux et les raccords qui conviennent le mieux à votre travail et maintenez-les, ainsi que leurs pièces, en excellent état de fonctionnement. Lorsque vous ouvrez le robinet de la bouteille, ne vous approchez pas de la sortie du robinet. Lorsque vous ouvrez le robinet, assurez-vous de ne pas vous tenir devant ou derrière le détendeur.

ESD-DÉCHARGE STATIQUE ELECTRIQUE

Pendant le soudage/la découpe, une charge électrique statique peut être produite et libérée dans tous les objets avec lesquels le soudeur/la découpe entre en contact après le soudage/la découpe. Avant de toucher des cartes ou des composants électroniques, mettez un bracelet relié à la terre. Lorsque vous stockez, déplacez ou expédiez des cartes PC, utilisez des sacs et des boîtes antistatiques appropriés.

RISQUE D'EXPOSITION À DES PIÈCES EN MOUVEMENT

Les machines de soudage/coupage typiques peuvent comprendre plusieurs éléments mobiles, tels que des rouleaux et des ventilateurs. Les mains doivent être tenues à l'écart des éléments mobiles comme les ventilateurs. Gardez une distance de sécurité avec les pièces en mouvement. Restez à distance des points de pincement comme les rouleaux d'entraînement. Gardez les vêtements amples et les cheveux hors de la trajectoire des pièces mobiles. Toutes les portes, panneaux, couvercles et protections doivent être fermés et sécurisés. Ne permettez qu'à des personnes qualifiées de retirer les portes, panneaux, couvercles et protections doivent être fermés et sécurisés. Ne permettez qu'à des personnes qualifiées de retirer les portes, panneaux,

couvertures ou protections si nécessaire pour la maintenance et le dépannage. Une fois l'entretien effectué, réinstallez les portes, panneaux, couvertures ou protections avant de reconnecter l'alimentation d'entrée.

L'EXPLOSION DE LA BATTERIE peut causer des blessures.

N'utilisez pas la machine à souder pour charger des batteries ou démarrer des véhicules, car cela pourrait provoquer une explosion.

LA CHUTE D'UN ÉQUIPEMENT peut causer des blessures

Ne soulevez que l'unité, et non le train de roulement, les bouteilles de gaz ou autres accessoires, à l'aide de l'anneau de levage. Assurez-vous de disposer d'un équipement d'une capacité suffisante pour soulever l'unité. Si vous devez déplacer l'appareil à l'aide de fourches de levage, assurez-vous qu'elles sont suffisamment longues pour atteindre l'autre côté. Lorsque vous travaillez depuis un emplacement aérien, gardez l'équipement (câbles et cordons) hors de la trajectoire des véhicules en mouvement.

Les étincelles et les projections de métal chaud provenant de l'arc de coupe peuvent causer des blessures.

Les projections de métal chaud générées par le hachage et le meulage peuvent causer des blessures. Portez un écran facial ou des lunettes de sécurité avec écrans latéraux homologués. Protégez votre peau en portant une protection corporelle appropriée. Pour éviter que les étincelles ne pénètrent dans vos oreilles, utilisez des bouchons d'oreille ou des protège-oreilles résistant aux flammes. Portez des lunettes de sécurité avec des écrans latéraux ou des écrans faciaux.

L'EXPLOSION DES PIÈCES DE L'INVERSEUR peut provoquer des blessures.

Lorsque l'électricité est connectée aux sources d'alimentation des onduleurs, les pièces défectueuses peuvent exploser ou provoquer l'explosion d'autres pièces. Coupez la source d'alimentation et commencez à entretenir les onduleurs, et portez toujours un écran facial et des manches longues pour protéger votre corps et votre peau.

Les champs électromagnétiques peuvent provoquer des défaillances dans les appareils électriques tels que les stimulateurs cardiaques.

Des champs électromagnétiques se forment pendant le soudage ou le découpage, ce qui peut provoquer des défaillances dans les composants électriques ou les dispositifs médicaux implantés dans la zone environnante. Les personnes qui portent des stimulateurs cardiaques ou d'autres dispositifs médicaux implantés doivent rester à l'écart des CEM émis par les soudeurs/coupeurs. Avant toute opération de soudage à l'arc, de soudage par points, de gougeage, de découpe à l'arc plasma ou de chauffage par induction, les porteurs de dispositifs médicaux implantés doivent consulter leur médecin et le fabricant du dispositif.

La soudure peut provoquer des interférences dans les équipements électroniques

Les équipements électroniques, tels que les ordinateurs et les équipements pilotés par ordinateur, comme les robots, peuvent être endommagés par l'énergie électromagnétique. Gardez les câbles courts, proches les uns des autres et aussi bas que possible, pour éviter toute interférence. Le soudage doit être effectué loin de tout équipement électrique sensible. Assurez-vous que cette source de courant de soudage est installée et mise à la terre conformément aux instructions de ce manuel. Si les interférences persistent, l'utilisateur doit envisager de déplacer l'équipement, d'utiliser des câbles blindés, des filtres de ligne ou de protéger l'espace de travail.

Les pièces en mouvement peuvent provoquer des blessures.

Évitez de toucher les composants en mouvement. Évitez les endroits étroits, comme les rouleaux d'entraînement.

Le fil de soudure peut potentiellement causer des dommages

Attendez d'avoir reçu l'ordre d'appuyer sur la gâchette du pistolet.

Lorsque vous enfilez un fil de soudure, ne dirigez jamais le pistolet vers le corps humain, un métal ou tout autre objet.

RISQUE DE CHOCS ÉLECTRIQUES

Gardez vos mains et autres objets métalliques loin du fil de soudure et des composants d'entraînement pendant la procédure.

Mesures de sécurité importantes

- Mettez des gants isolants secs. Évitez de toucher l'électrode à main nue. Le port de gants humides ou endommagés est interdit.
- Des blessures peuvent être causées par la projection de composants. Lors de l'entretien d'un appareil, portez toujours un écran facial. Mettez une casquette et des lunettes de sécurité. Portez un casque de soudage avec la teinte de filtre appropriée. Portez une protection corporelle complète.
- La position la plus instable de l'appareil ne doit pas être inclinée vers le haut de plus de 10°. Les composants auxiliaires tels que les bouteilles de gaz, les unités d'alimentation en fil ou les dispositifs de refroidissement peuvent avoir un impact sur la stabilité selon le type d'équipement, et il faut en tenir compte.
- Avant de changer les consommables de la torche, de travailler sur la machine, mettez-la hors tension et débranchez la fiche d'entrée.
- Après la mise hors tension, une tension dangereuse subsiste sur les condensateurs d'entrée. Ne pas entrer en contact avec des condensateurs complètement chargés. Attendez toujours 60 secondes après avoir coupé le courant avant de travailler sur la machine, et vérifiez que la tension du condensateur d'entrée est proche de zéro avant de toucher une quelconque pièce.

Minimiser l'exposition CEM (champs électriques et magnétiques) du circuit de soudage / coupage.

Le soudage à l'arc et les procédés connexes tels que le découpage à la gouge, le découpage au plasma et le soudage par points génèrent un champ électromagnétique autour des circuits de soudage. Certains dispositifs médicaux, comme les stimulateurs cardiaques, peuvent être affectés par les CEM. Des précautions de protection doivent être prises pour les personnes qui ont des implants médicaux. Par exemple, il faut limiter le passage ou procéder à une évaluation individuelle des risques pour les soudeurs. En suivant les procédures appropriées, l'exposition aux CEM peut être réduite. Torsadez ou scotchez les câbles ensemble, ou utilisez un cache-câble, pour les maintenir proches les uns des autres.

Précautions concernant les dispositifs médicaux implantés:

Avant d'effectuer ou de s'approcher de procédures de soudage à l'arc, de soudage par points, de gougeage, de découpe au plasma ou de chauffage par induction, les porteurs de dispositifs médicaux implantés doivent consulter leur médecin et le fabricant du dispositif. Ne suivez les procédures ci-dessus que si votre médecin vous a donné son accord.

Évitez de mettre votre corps entre les câbles de soudage ou de coupe. Disposez les câbles de manière à ce qu'ils soient sur le côté et loin de l'opérateur. Travaillez loin de la source de courant de soudage et ne vous asseyez pas ou ne vous appuyez pas dessus. Gardez votre tête et votre corps aussi loin que possible de l'équipement du circuit de soudage. La pince de travail doit être reliée à la pièce à souder aussi près que possible de la zone de soudure ou de coupe. Le soudage ne doit pas être effectué en portant la source de courant de soudage ou de coupe ou le dévidoir de fil. Si vous avez un dispositif médical implanté dans votre corps, vous devez consulter votre médecin avant d'effectuer ou de vous approcher d'activités de soudage à l'arc, de soudage par points, de gougeage ou de découpe à l'arc plasma. N'enroulez pas les câbles autour de votre corps et ne les enroulez pas.

Il est de la responsabilité de l'utilisateur d'installer et d'utiliser l'équipement plasma conformément aux instructions du fabricant. Si des perturbations électromagnétiques sont détectées, il est de l'obligation de l'utilisateur de résoudre le problème avec l'aide technique du fabricant. Dans d'autres circonstances, il peut être facile de résoudre le problème en reliant la machine de découpe à la terre et à la pièce de travail. Dans d'autres circonstances, il peut s'agir de construire un écran électromagnétique qui entoure la source d'énergie et la zone de travail, ainsi que d'appliquer certains filtres d'entrée.

Les équipements de coupe doivent être connectés à la source d'alimentation conformément aux instructions du fabricant. Si des interférences se produisent, des précautions supplémentaires, telles que le filtrage de l'alimentation secteur, peuvent être nécessaires. Le blindage du câble d'alimentation de l'équipement de coupe installé en permanence dans un conduit métallique ou équivalent doit être envisagé. Le blindage doit être électriquement continu sur toute sa longueur. Le blindage doit être fixé à l'alimentation électrique du matériel de coupe afin de préserver un excellent contact électrique entre le conduit et le boîtier de la source d'alimentation. L'utilisateur doit analyser tout préoccuper électromagnétique dans la région environnante avant d'installer l'appareil. L'utilisateur doit confirmer que tous les autres appareils de la région sont compatibles. Cela peut nécessiter des précautions supplémentaires.

Lorsque la pièce de travail n'est pas reliée à la terre pour des raisons de sécurité électrique ou en raison de sa taille et de son emplacement, comme la coque d'un navire ou la construction d'un ouvrage en acier, une connexion reliant la pièce de travail à la terre peut minimiser les émissions dans certains cas. La pièce de travail sans mise à la terre augmente le risque de blessures pour les utilisateurs ou de dommages pour d'autres équipements électriques. La pièce de travail doit être reliée à la terre par une connexion directe à la pièce de travail. Si la connexion directe n'est pas autorisée, la mise à la terre doit être réalisée par des capacités adéquates déterminées conformément aux règles nationales.

La modification des dispositions du circuit de terre ne doit être autorisée que par une personne qualifiée pour évaluer si les modifications augmentent le risque de blessure, par exemple en activation des voies de retour de courant de coupe parallèles, qui peuvent endommager les circuits de terre d'autres équipements. La norme CEI 60974-9 fournit des conseils supplémentaires, Matériel de soudage à l'arc, partie 9 : Installation et utilisation. Les problèmes d'interférence peuvent être atténués par le blindage sélectif d'autres câbles et équipements situés à proximité directe. Pour certaines applications, le blindage de l'ensemble du système de découpe au plasma peut être envisagé.

1.7 Warning Label

This power supply has this warning notice attached to it. It is critical that the operator and maintenance professional comprehend the meaning of these warning symbols.

These instructions, employer safety procedures, and material safety data sheets should all be read and followed. For complete understanding about safety in welding, cutting and allied processes, refer to CSA's W117.2:19 (www.csagroup.org), OSHA's 29 CFR 1910 (www.osha.gov), American Welding Society's ANSI Z49.1:2021 (www.aws.org) and ISO's 17846:2004 (www.iso.org).

WARNING

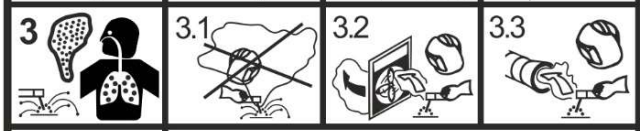
welding may be hazardous to both the operator and others in the work vicinity. Before operating, read the manual. Failure to apply all of these safety precautions can lead to death.

1. Welding sparks might result in an explosion or fire.

1.1 Avoid welding near combustible materials.
1.2 Keep a fire extinguisher close at hand and ready to use.
1.3 As a welding table, never use a drum or any closed container.

2. Dangerous voltage, Electric Shock or Burn Risk

2.1 Put on insulating gloves. Replace damp or damaged gloves. Do not touch the electrode barehanded.
2.2 Protect yourself against electric shock by isolating yourself from the work and the ground.
2.3 Before maintenance turn off the power. Do not come into contact with any live parts.

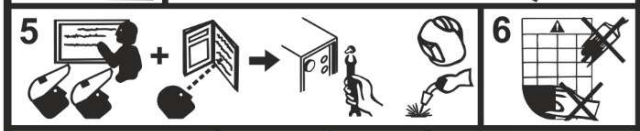


3. Welding fumes can potentially harmful.

3.1 Avoid inhaling fumes.
3.2 Avoid working in confined places. Ventilation is necessary to eliminate fumes
3.3 To get rid of the fumes, use forced ventilation or local exhaust.

4. Arc rays can cause eye and skin injury.

4.1 Wear the proper protective equipment to cover your head, eyes, ears, hands, and body. Button up the shirt collar. Keep noise out of your ears.
Wear a welding helmet with the appropriate filter shade.



5. Get trained.
This device should only be operated by qualified individuals. Keep non-qualified people and minors at a safe distance.

6. This label should not be removed, destroyed, or covered.
Replace if it is missing, damaged, or worn.

7. Moving PARTS can bring injury. Avoid touching moving components. Avoid tight spots, such as drive rolls.

8. Welding wire has the potential to cause harm. Never point a gun at the human body, any metal, or any other object.

9. ELECTRIC SHOCK RISK. Keep your hands and other metallic items far from the welding wire and driving components.

WARNING:

This product may expose you to chemicals such as lead and lead compounds, which are known to the state of California to cause cancer, birth defects, and other reproductive damage. For additional information, visit www.p65warnings.ca.gov.

AVERTISSEMENT

Le soudage à la baguette peut être dangereux pour l'opérateur et les autres personnes se trouvant à proximité. Avant de travailler, lisez le manuel. Le fait de ne pas appliquer toutes ces mesures de sécurité peut entraîner la mort.

1. Les étincelles de soudage peuvent provoquer une explosion ou un incendie.

1.1 Évitez de souder à proximité de matériaux combustibles.
1.2 Gardez un extincteur à portée de main et prêt à être utilisé.
1.3 Comme table de soudage, n'utilisez jamais un baril ou tout autre récipient fermé.

2. Tension dangereuse. Risque de choc électrique ou de brûlure.

2.1 Mettez des gants isolants. Remplacez les gants humides ou endommagés. Ne pas toucher l'électrode à main nue.
2.2 Protégez-vous contre les chocs électriques en vous isolant du travail et du sol.
2.3 Avant toute maintenance, coupez l'alimentation électrique. N'entrez pas en contact avec les pièces sous tension.

3. Les fumées de soudage peuvent être potentiellement dangereuses.

3.1 Évitez d'inhaler les fumées.
3.2 Pour se débarrasser des fumées, utilisez une ventilation forcée ou une aspiration locale.
3.3 Évitez de travailler dans des endroits confinés. La ventilation est nécessaire pour éliminer les fumées.

4. Les rayons d'arc peuvent causer des blessures aux yeux et à la peau.

4.1 Portez l'équipement de protection approprié pour couvrir votre tête, vos yeux, vos oreilles, vos mains et votre corps. Boutonnez le col de votre chemise. Empêchez le bruit d'entrer dans vos oreilles. Portez un casque de soudage avec la teinte de filtre appropriée.

5. Se former.
Cet appareil ne doit être utilisé que par des personnes qualifiées. Maintenez les personnes non qualifiées et les mineurs à une distance de sécurité.

6. Cette étiquette ne doit pas être enlevée, détruite ou recouverte.
Remplacez-la si elle est manquante, endommagée ou usée.

7. Les pièces en mouvement peuvent provoquer des blessures. Évitez de toucher les composants en mouvement. Évitez les endroits étroits, comme les rouleaux d'entraînement.

8. Le fil de soudure peut potentiellement causer des dommages. Ne jamais pointer une arme à feu vers le corps humain, un métal ou tout autre objet.

9. RISQUE DE CHOCS ÉLECTRIQUES. Gardez vos mains et tout autre objet métallique à l'écart du fil de soudure et des composants de

AVERTISSEMENT :

Ce produit peut vous exposer à des produits chimiques tels que le plomb et les composés de plomb, qui sont connus dans l'État de Californie pour causer le cancer, des anomalies congénitales et d'autres dommages à la reproduction. Pour plus d'informations, consultez le site www.p65warnings.ca.gov.

❑Introduction

Thank you for buying our product. In order to get the best performance out of the equipment and ensure the maximum lifespan of its parts, the use and maintenance instructions contained in this manual must be read and strictly complied with, as well as the safety instructions contained in the relevant folder. If repairs to the equipment are required, we recommend that our clients contact our service center workshops, as they have the necessary equipment and personnel that are specifically trained and constantly updated.

All our machines and equipment are constantly developed and so changes may be made in terms of their construction and features.

❑Description

Multiprocess series are multiple process welders with perfect performance. Pretty weld formation, high deposit rate and low welding distortion are outstanding features. Stopping arc procedure has remarkable reducing melting ball feature and the advanced waveform control technology brings fewer spatter. It's easy to operate. With digital display user can adjust welding parameters accurately and in wide range. These machines capable of delivering superior performance whether you are welding MIG MAG, Stick welding, Gouging and TIG welding with a lift start. Its robust design and 100% duty cycle make these welders an ideal all-around workhorse for all medium to heavy duty applications.

The principal characteristics of these welding units are:

- Specially designed for tough conditions.
- Heavy duty, reliable with a robust design.
- High power at 100% duty cycle, tested in 104°F/40°C and 140°F/60°C.
- Excellent design characteristics ensure high welding quality, precise arc striking and highly stable arc.
- Less spatter, stable current and excellent welding performance.
- Digital display for accurate parameter preset, easy to operate.
- Continuous adjustment of current and voltage with wide range.
- Fully encapsulated PCB to avoid dust contamination.
- Automatic compensation for main power fluctuations within ±20%.
- Electronic continuous control of inductance.
- VRD feature.
- 2 step/4 step.
- An excellent CC/CV characteristic ensures high quality and trouble-free welding.
- Exceptional welding characteristics in MIG MAG, TIG, Stick welding and gouging.
- Very easy arc starting and very stable wire feeding.
- User friendly parameter settings.
- Initial and final crater control.
- Comprehensive 3 years warranty.

❑Technical data

This welding power supply is made to operate on more than one primary voltage value. Available models of this welding power source are described below, please pay attention when ordering.

(Subject to change without notice.)

Table 1

Model	UNIT	Multiprocess 6001V-575V		
		MIG	STICK	TIG
Input Voltage Range	V	(575) -25% +10%(Three Phase, 50/60 Hz)		
Parameters are provided in 575VAC				
Primary Current@ I2MAX	A	28.5	27	21
I1eff max	A	28.5	27	21
Welding Current Range	A	30-500	20-450	20-450
Duty Cycle @ I2max in 104°F (40°C)		100%(500A)	100%(450A)	100%(450A)
Duty Cycle @ 100% in 104°F (40°C)	A	500	450	450
Duty Cycle @ 60% in 104° F (40°C)	A	-	-	-
Open Circuit Voltage	V	90	90 (27-VRD)	
Output Voltage Range	V	15.5-39	20.8-38	10.8-28
Protection class		IP 21 S		
Insulation class		F		
Standards		IEC 60974-1 - IEC 60974-5		
Weight	lb. (Kg)	147 (66)		
Dimensions (D, W, H)	inch (mm)	24.8x12.2x26 (630x310x665)		

Table 2

Model	UNIT	Multiprocess 6001V		
		MIG	STICK	TIG
Input Voltage Range	V	(440/460/480) -15%+10%(Three Phase, 50/60 Hz)		
Parameters are provided in 460VAC				
Primary Current@ I2MAX	A	34	35	27
I1eff max	A	34	35	27
Welding Current Range	A	30-500	20-500	20-500
Duty Cycle @ I2max in 104°F (40°C)		100%(500A)	100%(500A)	100%(500A)
Duty Cycle @100% in 104°F (40°C)	A	500	500	500
Duty Cycle @ 60% in 104° F (40°C)	A	-	-	-
Open Circuit Voltage	V	74	74 (27-VRD)	
Output Voltage Range	V	15.5-39	20.8-40	10.8-30
Protection class		IP 21 S		
Insulation class		F		
Standards		IEC 60974-1 - IEC 60974-5		
Weight	lb. (Kg)	143 (64.5)		
Dimensions (D, W, H)	inch (mm)	24.8x12.2x26 (630x310x665)		

Table 3

Model	UNIT	Multiprocess 6001		
		MIG	STICK	TIG
Input Voltage Range	V	(400) -15% +10% (Three Phase, 50/60 Hz)		
Parameters are provided in 400VAC				
Primary Current@ I2MAX	A	43	45	35
I1eff max	A	43	45	35
Welding Current Range	A	30-500	20-500	20-500
Duty Cycle @ I2max in 104°F (40°C)		100%(500A)	100%(500A)	100%(500A)
Duty Cycle @100% in 104°F (40°C)	A	500	500	500
Duty Cycle @ 60% in 104° F (40°C)	A	-	-	-
Open Circuit Voltage	V	86	86 (27-VRD)	
Output Voltage Range	V	15.5-39	20.8-40	10.8-30
Protection class		IP 21 S		
Insulation class		F		
Standards		IEC 60974-1 - IEC 60974-5		
Weight	lb. (Kg)	134 (61)		
Dimensions (D, W, H)	inch (mm)	24.8x12.2x26 (630x310x665)		

MIG wire sizes	Inch (mm)	Solid: 0.030 - 0.06 (0.8 - 1.6) AL: 0.035 - 0.06 (0.9 - 1.6) Flux-cored: 0.045 - 0.06 (1.2 - 1.6)
MIG wire spool Diameter / Weight	Inch (mm)/ kg	Ø12 (300) / 15
N° MIG drive rollers		4
MIG welding wire speed	IPM (m/ min)	98.4 – 787.4 (2.5 - 20)
Stick electrodes	Inch (mm)	5/64 – 1/4 (2 – 6.4)
TIG electrodes	Inch (mm)	1/16-1/4(1.6-6.4)

❑Usage limits (IEC 60974-1)

The use of a welder is typically discontinuous, in that it is made up of effective work periods (welding) and rest periods (for the positioning of parts, the replacement of wire and underflushing operations etc. This welder is dimensioned to supply a I2 max nominal current in complete safety for a period of work of X% of the total usage time. The regulations in force establish the total usage time to be 10 minutes. The work cycle is considered to be X% of this period of time. When the work cycle permitted is exceeded a trip switch trips, which protects the welding machine's internal components against dangerous overheating and prevents incorrect functioning of the machine (After several minutes the overheat cut-off rearms automatically and the welder is ready for use again (Automatic reset error). This equipment is built to have a protection level of IP 21 S.

❑How to lift up the machine

Strap the hoisting belts around the machine and lift it up carefully and safely, slinging it from the bottom up. The welder has two handles to carry it around manually.

NOTE: These hoisting and transportation devices conform to local and national standards. Do not use other hoisting and transportation systems.

❑Open the packaging

The system essentially consists of:

- **MULTIPROCESS 6001** weld unit.
- **MIG WIRE FEEDER CWF5041**.
- Ground clamp set (500A-10ft).
- MIG-MAG torch (500A-4m).
- TIG torch, air cooled (optional).
- Transport trolley.
- Electrode holder set (500A-10ft).
- Regulator.
- Torch spares.
- Drive rollers.
- Operating manual.

Upon receiving the system:

- Remove the welding generator and all relevant accessories components from their packaging.
- Check that the weld machine is in good condition, if not report any problems immediately to the seller-distributor.
- Make sure all ventilation grilles are open and that no foreign bodies are blocking the air circulation.

❑Installation and connections

The installation site for the system must be carefully chosen in order to ensure its satisfactory and safe use. The user is responsible for the installation and use of the system in accordance with the producer's instructions contained in this manual. Before installing the system, the user must take into consideration the potential electromagnetic problems in the work area. In particular, we suggest that you should avoid installing the system close to:

- Signaling, control and telephone cables.
- Radio and television transmitters and receivers.
- Computers and control and measurement instruments.
- Security and protection instruments.

Persons fitted with pace-makers, hearing aids and similar equipment must consult their doctor before going near a machine in operation. The equipment's installation environment must comply to the protection level of the frame i.e. IP 21 S (IEC 60529 publication). The system is capable of working in environments where working conditions are particularly hard.

This system is cooled by means of the forced circulation of air, and must therefore be placed in such a way that the air may be easily sucked in and expelled through the apertures made in the frame.

The equipment must be assembled as follows:

- Mount on the trolley.
- Fix the welding unit to the trolley.

- Connect the welding machine to the utility line.
- Connect up the welding cables.

General requirements for work area:

- Ensure a clear, well lit work area with unrestricted movement for the operator.
- The work area should be well ventilated, as welding emits fumes which can be dangerous.
- Always maintain easy access to the ON/OFF switch of the welder, and the electrical mains supply.
- Do not expose the welder to rain and do not operate in damp or wet locations.

Where welding must be undertaken in environments with increased risk of electric shock, confined spaces or in the presence of flammable or explosive materials, it is important that the environment be evaluated in advance by an “expert supervisor”. It is also recommended that welding in these circumstances be carried out in the presence of persons trained to intervene in emergencies.

❑Connecting the welding machine to the utility line

Connection of the machine to the user line (electrical current) must be performed by qualified personnel.

Before connecting the welding machine to the mains power supply, make sure that rated voltage and frequency correspond to those provided by the mains power supply and that the welding machine’s power switch is turned to “O”. The four pole cable supplied with the system must be used for the connection to the mains power supply. This cable is made up:

- Three conductors that are used to connect the machine to the power supply.
- The fourth, which is YELLOW GREEN, is used for making the “GROUND” connection.

Connect a suitable load of normalised plug (3p + t) to the power cable and provide for an electrical socket complete with fuses or an automatic switch. The ground terminal must be connected to the ground conducting wire (YELLOW- GREEN) of the supply. Table 4 shows the capacity values that are recommended for fuses in the line with delays.

NOTE: Any extensions to the power cable must be of a suitable diameter, and absolutely not of a smaller diameter than the special cable supplied with the machine.

Table 4

Model	MULTIPROCESS 6001
Rated input voltage/frequency	3 Phase 400V -15% +10%, 50/60 HZ
Rated input capacity	31.2 KVA
Maximum primary current	45A
Input protection fuse	D50
Recommended cord size(Minimum)	≥ AWG10 (6mm²)
Recommended grounding conductor size(Minimum)	≥ AWG10 (6mm²)

❑ Command and control units

Pos. 1 Control panel.
Pos. 2 Wire feeder control socket.
Pos. 3 Fast coupling reverse polarity.
Pos. 4 Fast coupling straight polarity.
Pos. 5 Power supply switch.in the “O” position the welder is off.
Pos. 6 Mains cable.
Pos. 7 Power supply socket for gas heater.
Pos. 8 Fan cover.
Pos. 9 Working mode selection button. Press to select 2T and 4T.

2T trigger control: This is a two-touch setting that requires the welder to press the torch trigger to start and release to stop. This ideal for short welds

4T trigger control: This is a four-touch setting. This requires you to press and release the trigger to activate the welder and start welding without having to hold the trigger. To deactivate 4T, you press and release the trigger to stop the welding process. This is ideal for longer weld runs.

Pos. 10 Welding mode selection button. Press to select MIG, MAG, and Stick, Gouging, and TIG (Lift).
Pos. 11 Crater filler current, preset crater filler current when on 4-step mode.
Pos. 12 Inductance adjustment knob, adjust this knob to change welding stability, welding depth and spatter.
Pos. 13 Crater filler voltage knob. Preset crater filler voltage when on 4-step mode.

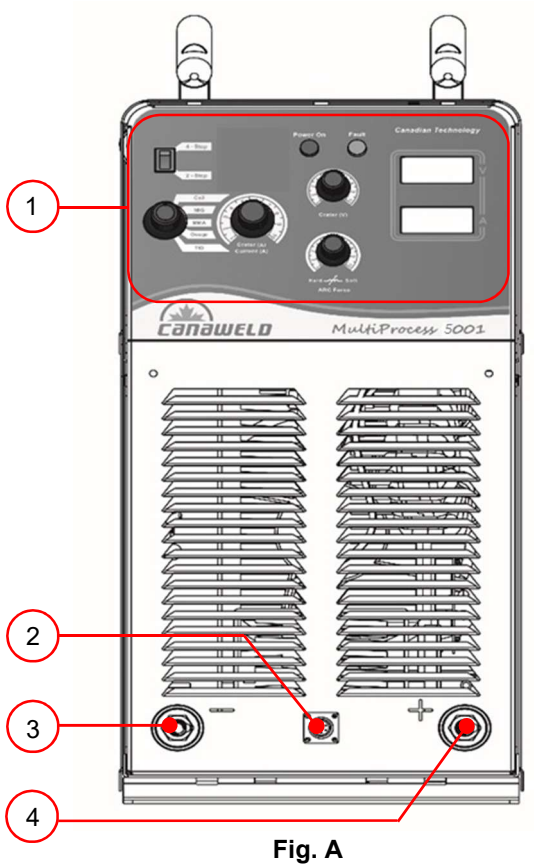
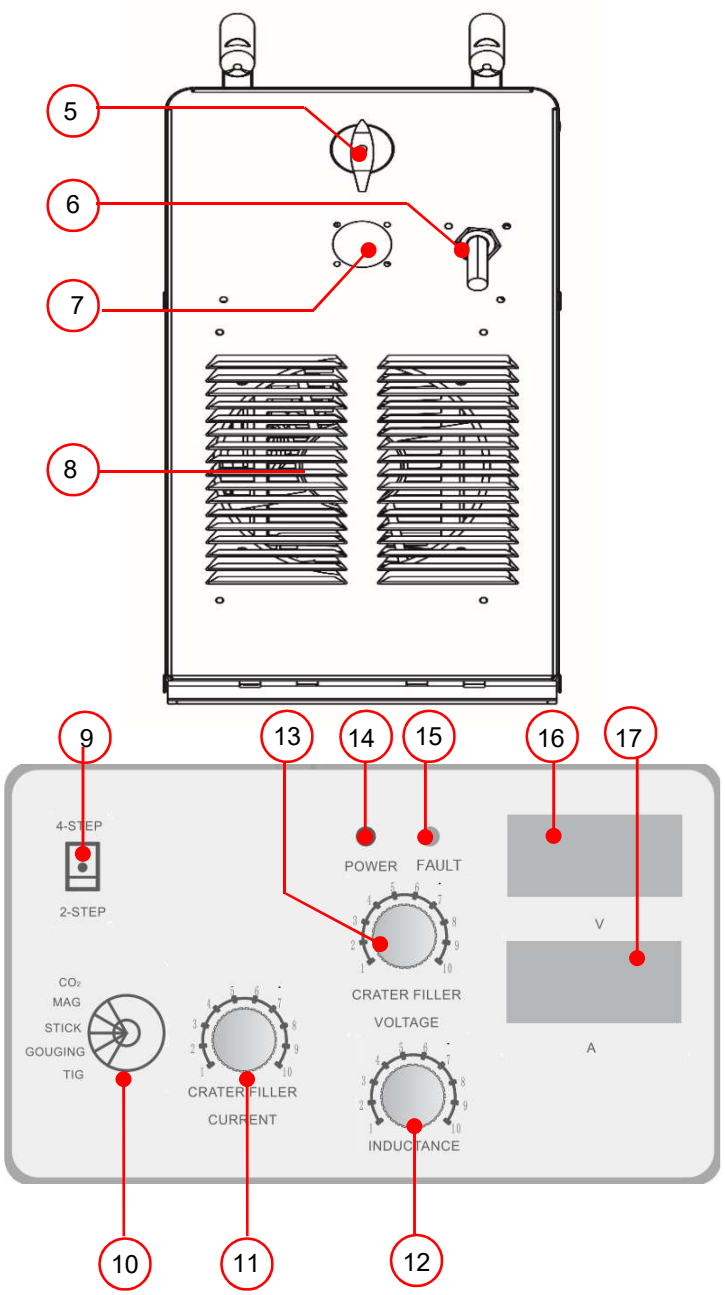


Fig. A



Pos. 14 Power LED, illuminates when power is on.

Pos. 15 Overload error indicator, illuminates when the machine is overloaded.

Pos. 16 Voltage display, displays the welding voltage when machine is in MIG (CO2)/MAG mode. When machine is in open load, display the preset welding voltage value. During welding, display the actual welding voltage value. When the machine is in TIG, Stick or Gouging mode, the display will show the actual voltage in open load and during welding.

Pos. 17 Current display, displays the welding current in Amps when machine is in MIG (CO2)/MAG mode. When machine is in open load, display the wire feeding speed (0-100) and during welding, display the actual welding current value. When the machine is in TIG, Stick or Gouging, the display will show the preset welding current value and during welding display the actual welding current value.

Fig. B

Pos. 18 Spool cover
Pos. 19 Welding voltage adjustment knob
Pos. 20 Wire speed adjustment knob
Pos. 21 Torch holder
Pos. 22 Wire test
Pos. 23 Central adaptor (MIG torch connection Socket)

❑Loading wire and assembly of drive roller

- Open the door of Spool Cover. (Pos.18,Fig. B)
- Remove the Spool Hub Nut and place spool of wire on Spool Hub.
- Install Spool Hub Nut and adjust firmly, without too much pressure.
- Release the Wire Feed Tensioning Knob by pulling it towards you. Open the locking arms to release the feed rolls.
- Remove the pressure rolls and select the Pressure Rolls according to the **Table 5**. Each roller shows the type of wire and diameter on the two external sides.
- Remove the Drive Rolls and check the Drive Roller is matched to the wire size for the job. The proper wire feed rolls must be chosen according to the size and material of the wire. Select the new wire feed rolls according to the **Table 5**. Mount the appropriate roller making sure the groove is in the right position for the diameter of the wire being used.
- Thread the end of the wire into the back guide (Pos. 5, Fig. C) on the drawing mechanism. Take the end of the wire and feed into the Guide tube until it passes to the inlet tube and out of the central connection.

Fig. C

1. Wire Tensioning Knob
2. Pressure rolls
3. Drive rolls
4. Locking arms

Table 5

Filler wire	Pressure roll profile	Drive Roll profile
Hard wire	Flat	V-groove
Soft wire	U-groove	U-groove
Flux-cored wire	Flat	V-groove, knurled

– Hard wire, such as carbon steel wire, stainless steel wire.
– Soft wire, such as Aluminum and Aluminum alloys, also for copper and copper alloy wire.

- Put down Wire Tensioning Arms so it locks into position, and turn the Wire Tensioning Knob to gently tighten.

Important: too much pressure will cause wire crushed, and the wire coating be damaged and it will cause the wearing out of feed rollers and increase the wire feeding resistance.

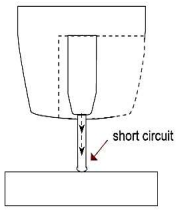
❑MIG-MAG Techniques

Definition of MIG Welding

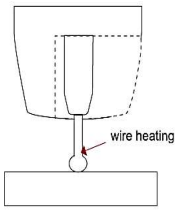
A continuous, consumable wire electrode and a shielding gas are supplied via a welding gun in the semi-automatic or automated arc welding method known as MIG (metal inert gas), often referred to as GMAW (gas metal arc welding) or MAG (metal active gas welding). With MIG welding, a constant voltage, direct current power supply is most commonly utilized. In MIG welding, there are four main metal transfer techniques: short circuit (also known as dip transfer), globular transfer, spray transfer, and pulsed-spray. Each has unique characteristics as well as associated benefits and drawbacks.

Short Circuit Transfer

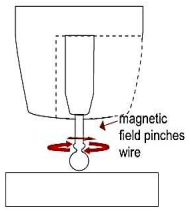
The most popular technique is short circuit transfer, in which the wire electrode is passed constantly through and out of the contact tip of the welding torch. A short circuit results from the wire touching the workpiece. The molten bead splits from the wire's end and forms a droplet that is deposited into the weld pool as the wire heats up and starts to create one. The arc appears constant to the human eye because of this process, which is repeated around 100 times every second.



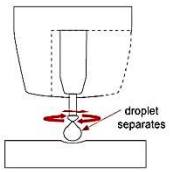
A short circuit results from the wire touching the workpiece. There is no arc because there is no gap between the wire and the base metal.



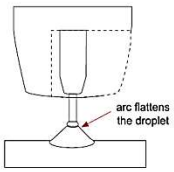
Since the wire can't handle the entire current flow, resistance increases, and the wire starts to melt.



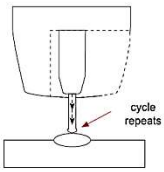
The magnetic field that is produced by the current flow starts to squeeze the melting wire, turning it into a droplet.



The pinch separates the droplet as it forms, and it then falls into the weld pool that is currently developing.



When a droplet separates, an arc is formed, and the force and heat of the arc flatten the droplet into the weld pool.



The heat from the arc is reduced by the wire feed speed, and the wire then re-approaches the work to short circuit and complete the cycle.

Basic MIG Welding

Good weld quality and weld profile depends on the gun angle, the direction of travel, electrode extension (stick out), travel speed, the thickness of base metal; wire feed speed and arc voltage. To follow are some basic guides to assist with your setup.

Torch Position - Travel Direction, Work Angle:

Typically, torch position or technique refers to the angle and travel direction that the wire is aimed at the base metal. The characteristic of the weld bead profile and degree of weld penetration will depend on travel speed and work angle.

Push Technique

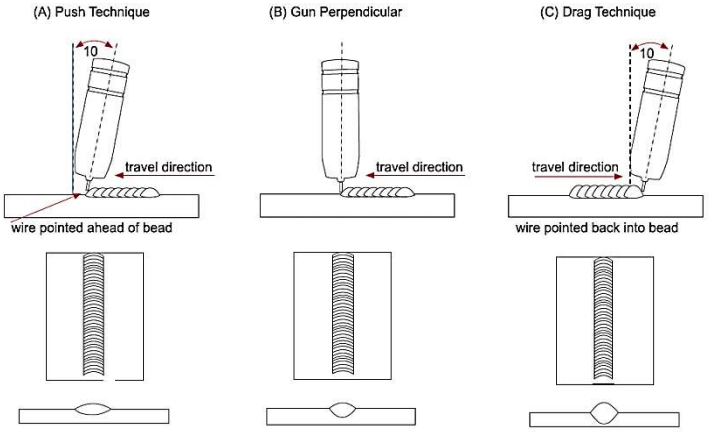
The wire is pushed in the direction of the un-melted work surface from the leading edge of the weld pool. With this method, it is possible to see the weld joint and the wire's path into the joint more clearly. When using the push technique, heat is directed away from the weld puddle, allowing for higher travel speeds and a flatter weld profile with light penetration, which is advantageous when welding thin materials. The larger and flatter welds require less time to clean up and grind.

Perpendicular Technique

This method, which involves feeding the wire straight into the weld, is typically utilized in automated settings or when the circumstances ask for it. In general, a deeper penetration is attained, and the weld profile is taller.

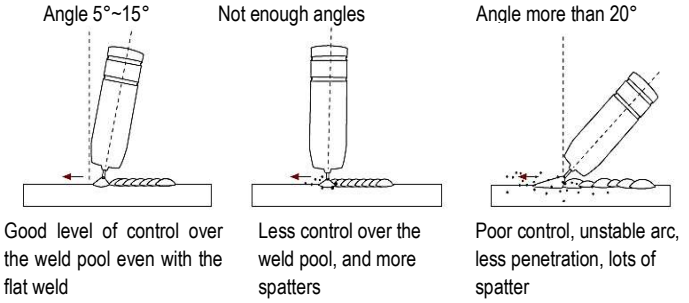
Drag Technique

The wire and torch are pulled away from the weld bead. The base metal receives greater heat, deeper melting, more penetration, and a higher, more built-up weld profile as a result of the concentrated arc and heat on the weld pool.



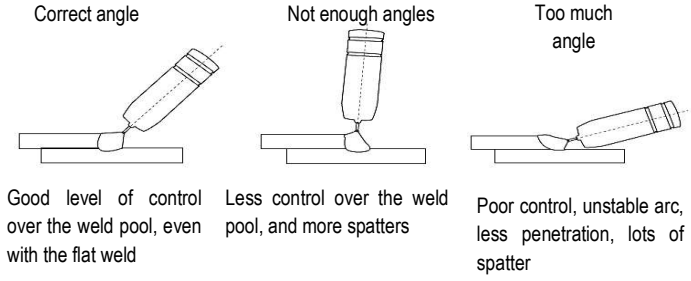
Travel Angle

The travel angle is the right-to-left angle with respect to the welding direction. An optimal travel angle for controlling the weld pool is between 5° and 15°. An unstable arc state with poor weld metal transfer, little penetration, high levels of spatter, poor gas shield, and a subpar completed weld will result from a travel angle greater than 20°.



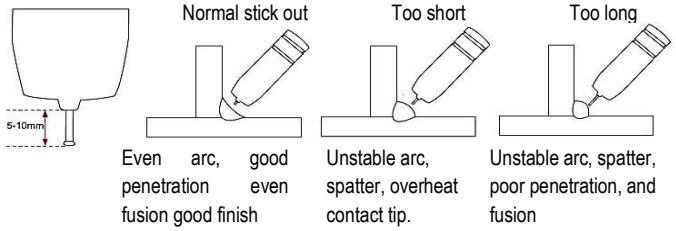
Angle to the Work

The work angle is the torch's forward-backward angle with respect to the work piece. The proper work angle produces a nice bead shape, eliminates undercutting, inconsistent penetration, poor gas shielding, and produces final welds of higher quality.



Stick Out

Stick out is the length of the un-melted wire sticking out from the contact tip's end. An even current flow, a stable arc, and a consistent stick out of 5 to 10 mm will result in good penetration and even fusion. A too-short stick-out produces an unstable weld pool, produces spatter, and overheats the contact tip. An unstable arc, a lack of penetration, a lack of fusion, and increased splatter are all effects of a too-lengthy stick-out.

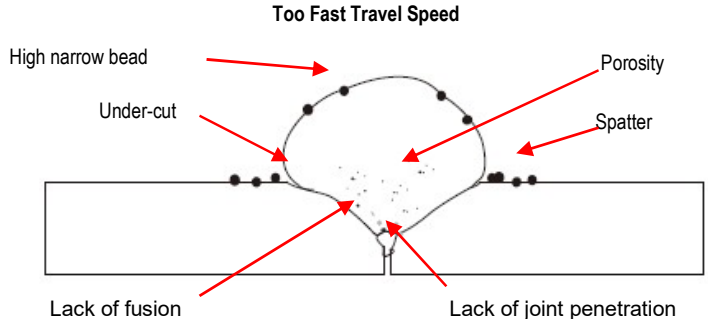


Travel Speed

The speed at which the torch is moved along the weld joint is known as travel speed, and it is typically measured in inches per minute (IPM). The welder's control over the weld pool places a limit on the travel speed, which can vary based on the environment and his or her expertise. Compared to the drag method, push technique allows for faster travel speeds. Additionally, the gas flow must be proportional to the travel speed, rising with faster travel speeds and falling with slower ones. As the material thickness and amperage rise, the required travel speed must also fall.

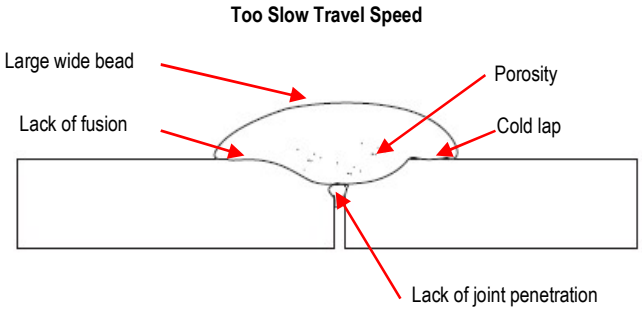
Too Fast Travel Speed

If the travel speed is too fast, the weld bead solidifies too quickly, trapping gases inside the weld metal and resulting in porosity. A too-fast travel speed generates too little heat per inch of travel, resulting in decreased penetration and lower weld fusion. Undercutting of the base metal can also happen and an empty groove in the base metal is created, when the travel speed is too fast for molten metal to flow into the weld crater formed by the arc heat.



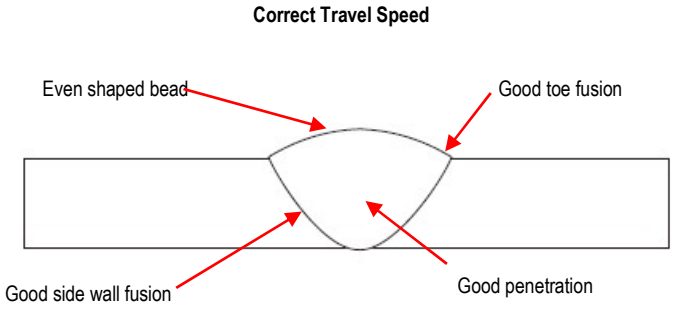
Too Slow Travel Speed

A large weld without sufficient penetration and fusion results from a slow travel speed. Instead of penetrating into the base metal, the arc's energy condenses on top of the weld pool. This results in a weld deposit of low quality and a broader weld bead with more weld metal deposited per inch than is necessary.



Correct Travel Speed

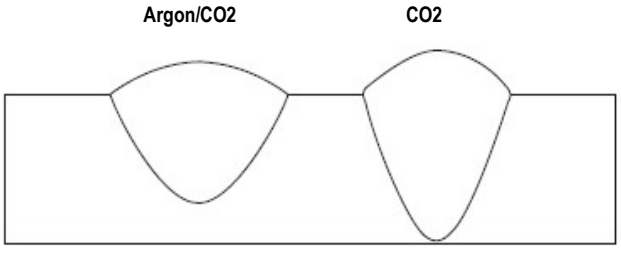
The right travel speed keeps the arc at the weld pool's leading edge, allowing the base metal to melt just enough to produce good penetration, fusion, and wetting out of the weld pool, which results in a high-quality weld deposit.



Shielding Gas Selection

The gas is used in the MIG process to shield the atmosphere from the wire, the arc, and the molten metal being welded. Without the shielding gas, most metals would react with atmospheric air when heated to a molten state, resulting in weld flaws such as porosity, lack of fusion, and slag inclusions. To shield the welding zone from the atmosphere, the proper gas flow is also crucial.

Always utilize the proper shielding gas. The weld profile produced by CO2 is thinner and a little bit higher than that produced by an Argon/CO2 mixed gas because CO2 is beneficial for steel and gives good penetration. Better weld ability for thin metals and a larger range of setup tolerance on the machine are two benefits of argon CO2 (argon 80% & CO2 20%) mixed gas.



Penetration Pattern for Steel

Applications using silicone bronze and aluminum benefit from argon gas at 100% mixture. It gives good weld control and penetration. CO2 is not recommended for certain metal alloys.

Wire types and sizes

Use the appropriate type of wire for the base metal you are welding. Use aluminum wire for aluminum, stainless steel wire for stainless steel, and steel wires for steel.

For thin base metals, use wire with a smaller diameter. Use a larger machine and higher wire diameter for thicker materials and be sure your machine is capable of welding those materials. For a starting point, refer to the “Welding Wire Thickness Chart” below as a reference.

STEEL WELDING WIRE DIAMETER CHART

MATERIAL THICKNESS In. (mm)	RECOMMENDED WIRE DIAMETERS In. (mm)					
	0.024 (0.6)	0.031 (0.8)	0.035 (0.9)	0.040 (1.0)	0.047 (1.2)	0.063 (1.6)
24 Gauge , 0.024 (0.6)	■					
22 Gauge , 0.031 (0.8)	■	■				
21 Gauge , 0.035 (0.9)	■	■				
20 Gauge , 0.040 (1.0)	■	■	■			
18 Gauge , 0.047 (1.2)	■	■	■			
16 Gauge , 0.063 (1.6)	■	■	■			
14 Gauge , 0.078 (2.0)	■	■	■	■		
1 (2.5)		■	■	■	■	
1/8” , 0.125 (3.0)		■	■	■	■	■
0.16 (4.0)		■	■	■	■	■
0.2 (5.0)			■	■	■	■
1/4" , 0.25 (6.0)			■	■	■	■
5/16” - 0.315 (8.0)			■	■	■	■
3/8” , 0.375 (9.5)				■	■	■
0.55 (14)				■	■	■
0.7 (18)					■	■
0.86 (22)						■

Depending on the amperage capacity of your machine, multi-pass runs, or a beveled junction design may be necessary for material thicknesses of 0.2 in. (5 mm) and higher.

❑MIG-MAG welding

To begin MIG-MAG welding, carry out the following tasks (with the machine switched off):

1. Connecting the cables (Fig. D1)

1) Connect the gas hose to the pressure reducer fitted on the cylinder beforehand. Gas cylinders are supplied with a pressure reducer to adjust pressure of the gas used for welding.
2) Screw the torch to the central adaptor connection on the front panel of the wire feeder (Pos. 23, Fig. B). Tighten MIG torch connector to machine.
3) Connect up the earthing system cable to the rapid coupling marked by a **-** (negative) symbol and then the relevant ground clamps to the piece being welded or to its support in an area free from rust, paint and grease. Using particularly long earthing cables reduces the voltage and causes some problems from increased resistance and inductance of the cables that could cause faulty welding. Follow instructions to avoid these problems:
   - Use earthing and extension cables with appropriate section.
   - Lay out the cables as a flat as possible to prevent them from coiling up.

2. Set up of MIG TORCH

1) Remove Nozzle and Contact tip from torch. (Fig. D2, pos. 3,4)
2) Lay the MIG torch out straight and flat on the ground.
3) Remove the liner retaining nut from the central torch end. You may need to change liner before you feed the wire through, as they will only fit specific sizes. You will also need to change your liner if it is clogged, damaged or kinked.
4) Carefully remove the liner completely from the torch.
5) Carefully feed the new liner into the torch lead all the way out the end of the torch. The liner inside the torch guides the filler wire through the torch lead, and it ensures that the wire makes it out of the torch tip. Like with most things welding, the liner needs to match the type and size of filler material. If you are using mild steel or stainless steel, you can use a standard MIG liner, if you are using Aluminum, you will need a Teflon liner. Torch liners are also color coded. Blue color is for 0.6-0.8mm wire, Red color is for 0.9-1.2mm wire and Yellow color is for 1.2-1.6mm wire. These colors apply to both steel and aluminum liners.
6) Fit the retaining nut and slightly tighten the nut about half way.
7) Snip the excess liner off to just below flush with the torch neck. The liner should line up with the bottom of where the tip holder screws in.
8) Replace the front end parts of the torch. If you cannot screw the tip holder back into place, the liner is too long and needs to be trimmed. However, don't cut it too short, as leaving a gap between the liner and tip holder inside the torch will also cause issues.

   When you are changing your liner, it's best to keep the torch entirely straight and go slowly, as you don't want to link the liner itself.

   Lay your new liner next to your old liner and use the older liner as a measurement guide, cutting the new one to the same length. That way, you can be sure that the liner will fit in the torch perfectly.
9) Plug machine to the utility line according to the rating plate of machine and switch to I position on the back of machine. (Pos.5, Fig. A)
10) Press the wire test button. This will feed the wire through the torch. Release button when wire appears at the end of the torch.
11) Trim wire to the end of the nozzle.

Fig. D1

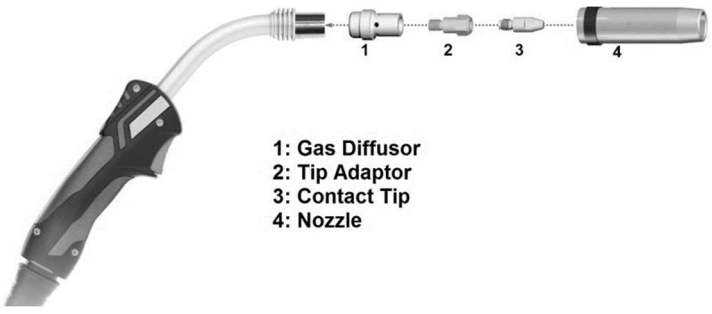


Fig. D2

3. Welding

1) Select Co2 or MAG mode, adjust inductance; select 2/4 step mode. On 4 step mode adjust crater filler.
2) Make the adjustments and select the parameters on the wire feeder control panel. Adjust proper welding current and voltage.
3) Open the tap on the cylinder slowly and adjust the reducer knob to obtain a pressure of about 1.0 to 1.5 bar, and regulate the flow to about 15 lit/min.
4) The welding machine is ready for welding. To begin welding, approach the point to be welded and press the button on the torch.
5) When you have finished welding, remove the waste, turn off the machine and close the gas cylinder.

❑TIG Welding Procedure

Application range

Regarding materials, thickness, and welding positions, TIG welding is a versatile welding technique. It enables the production of excellent welded joints. Due to a number of intriguing benefits, the method works better than conventional fusion welding techniques. One of these benefits is its adaptability for a wide range of jobs. TIG welding has several uses and can weld practically any metallic material. Today, stainless, acid-proof, and non-scaling steels, as well as aluminum and nickel alloys, are the most often used materials. The technique is distinguished by the production of weld metal with extremely high purity and surface quality. As a result, the process is utilized when welding quality is critical, such as when making goods for the chemical and power industries, or when welding materials prone to scaling, such as titanium and zirconium. Square butt joints may be welded from one side on plate thicknesses ranging from 0.3 to 4 mm without the need of filler metal. TIG welding is mostly utilized in manual welding, but it is also used in automated welding processes such as automatic tube welding and tube sheet welding. The technique adapts itself wonderfully to automation.

TIG procedure can be used to connect almost all types of metallic materials if they are at all suitable for fusion welding. It is also a highly clean procedure that ensures a high-quality welded junction while also producing very little spatter and other contaminants. TIG welding also has the unique benefit that, unlike other procedures that use consumable electrodes, the current and feeding of welding consumables are not related. As a result, the welder is able to add only the necessary amount of welding consumable at any given moment and optimize the current for the welding activity. The method is thus especially well-suited for location welding and welding root passes. Due to these benefits, the TIG method is being employed with success in several fields of industries and trade.

Special Characteristics

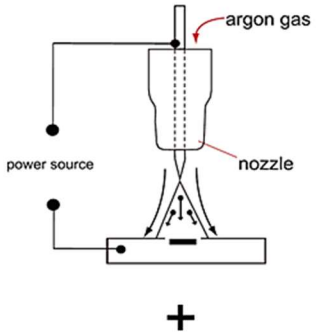
- High quality
- Smooth and even weld surface
- Spatter free
- Slag formation free
- Wilding without Fume

The TIG welding method, like any other welding approach, must be learned first by practice. The following are some broad pointers for putting this plan into action. In many ways, manual TIG welding is similar to the forward technique of gas welding. In both cases, the torch is held in one hand while the filler material is held in the other. In both cases, the "nozzle" is pointed away from the weld spot, and the welder uses filler metal to weld toward the hand with the filler metal. The welder may manage the amount of heat given to the workpiece in this technique by altering the length of the arc.

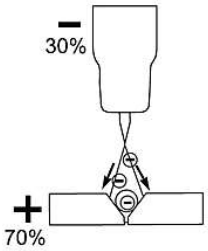
DC TIG Welding

During the process, the electrode merely serves as a footing for the arc and must not melt (the melting temperature of tungsten is more than 3300°C). When welding with direct current, the electrode is linked to the power source's negative pole, which creates the least heat. The electrode and the molten pool, throughout the welding process, are shielded by a gas, typically pure argon. Any filler material required is fed in by hand, just like in gas welding.

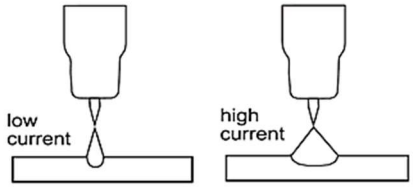
The DC power source utilizes DC (direct current), in which the major electrical component, electrons, move in only one direction, from the negative pole (terminal) to the positive pole (terminal). There is an electrical principle at work in the DC electrical circuit that should always be considered while operating any DC circuit.



A DC circuit always has 70% of the energy (heat) on the positive side. This is important because it decides which terminal the TIG torch will be attached to (this rule applies to all the other forms of DC welding as well).An arc is formed between a tungsten electrode and the metal workpiece during DC TIG welding. An inert gas flow protects the weld region from contamination of the tungsten, molten pool, and weld area. When the TIG arc strikes an inert gas, it is ionized and superheated, altering its molecular structure and converting it to a plasma stream. The TIG arc is the plasma stream that flows between the tungsten and the workpiece and may reach temperatures of 19,000°C. It is a highly pure and focused arc that allows for the controlled melting of most metals into a weld pool. TIG welding allows the operator the most flexibility to weld the widest range of materials, thicknesses, and types. DC TIG welding produces the cleanest weld possible, with no sparks or splatter.



The arc's intensity is proportional to the current flowing from the tungsten. To control the power of the arc, the welder alters the welding current. Thin material typically requires a less strong arc with less heat to melt the material, requiring less current (amps), whereas thicker material requires a more powerful arc with more heat, necessitating more current (amps).



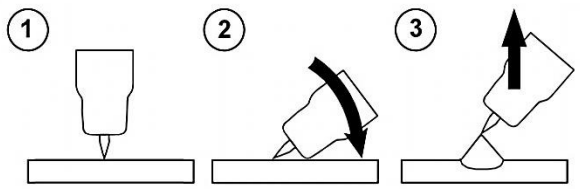
TIG (Lift) ignition method

In less sophisticated DC welding, the arc can be struck by lightly brushing the electrode on the workpiece. The arc ignites, when the tungsten electrode tip comes into touch with the workpiece.

The process is described below.

- Place the tungsten electrode tip on the workpiece with care and push the torch trigger afterwards (a factory set amount of current will flow, regardless of the main current set).
- Invert the torch over the torch gas nozzle edge to create a 2-3 mm gap between the electrode tip and the workpiece. The arc ignites, and the welding current is raised to the start or main current set, depending on the selected operating mode.
- Return the torch to its regular welding position.

To end the welding process, release the torch trigger or push and release (depending on the selected method).



TIG (Lift) Ignition Method

How to TIG Weld?

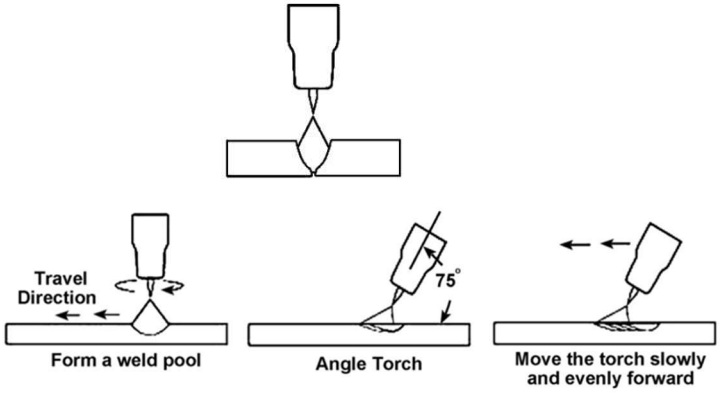
Because there are some slight variations between gas and TIG welding, an experienced gas welder who wants to switch to TIG welding must learn a new approach. Managing the filler material, on the other hand, is typically not a problem. A proficient arc welder will find it easier to sustain the arc but will need more skills in accurately applying the filler metal.

TIG Welding Fusion Technique

Manual TIG welding is sometimes regarded as the most challenging of all welding procedures. Because the welder must maintain a limited arc length, tremendous care and expertise are necessary to avoid electrode contact with the work piece.

TIG welding, like Oxygen Acetylene torch welding, usually takes two hands and requires the welder to manually feed a filler wire into the weld pool with one hand while managing the welding torch with the other. However, some welding involving thin materials, such as edge, corner, and butt joints, can be completed without the need of filler metal.

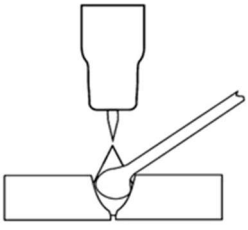
Fusion welding is the process of melting the edges of metal objects together using just the heat and arc force generated by the TIG arc. Once the arc has been begun, the torch tungsten is maintained in position until a weld pool is formed; a circular movement of the tungsten will aid in the formation of a weld pool of the required size. Once the weld pool is formed, tilt the torch at a 75° angle and advance smoothly and evenly along the connection, fusing the materials together.



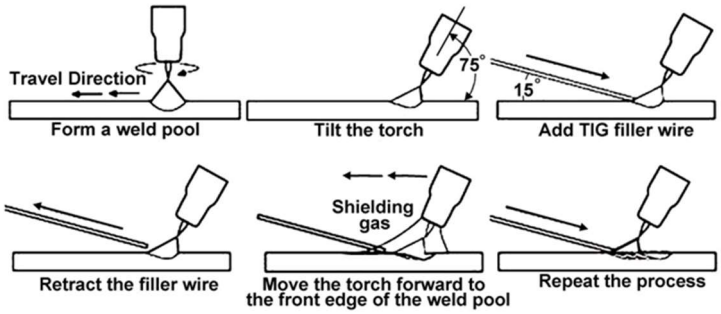
TIG Welding with Filler Wire Technique

In many cases, while welding stainless steel and copper, the filler material can be continuously fed into the pool's edge. However, despite the argon shielding, this approach is not recommended for welding aluminum because the aluminum wire would become so hot that scaling would occur on its surface despite the argon shielding. As the wire melts, it transports oxides into the molten pool to such an extent that the arc's cleaning effect on the oxides would be insufficient, resulting in a poor-quality weld. As a result, the wire is pulled back and forth, with the tip sinking beneath the pool's edge at regular intervals.

The heavier the gauge of the filler material required to fill up the joint, the thicker the material to be welded. As a result, as the electrode tip is fed into the pool, a heavy filler wire may come into contact with it. It is better to move the torch back and forth along the weld in this case. When the arc's heat has adequately fused the weld point's edges, raise the torch 6 to 12 mm above the weld point and plunge the welding wire tip into the molten pool to be melted off. To continue the fusing process, the wire is pushed back, and the flame is pushed ahead along the weld. The flame and the filler wire both move in a rhythmic back and forth motion.



This method is recommended for welding from one side with plate thicknesses more than 6 mm.
The filler material is fed in at the pool's edge and must not come into touch with the electrode tip or enter the arc, as seen in the image. The wire tip, on the other hand, must always be maintained close to the molten pool. This keeps it within the argon gas envelope that covers the arc and weld pool, preventing surface oxidation scaling as much as possible.
As mentioned before and in many cases, TIG welding requires the addition of filler wire to the weld pool in order to enhance the weld and generate a robust weld. Once the arc has been begun, the torch tungsten is maintained in position until a weld pool is formed; a circular movement of the tungsten will aid in the formation of a weld pool of the required size. Once the weld pool is formed, tilt the torch at a 75° angle and move the torch smoothly and uniformly along the joint. The filler metal is added to the weld pool's leading edge. The filler wire is normally held at a 15° angle and fed into the leading edge of the molten pool; as the torch moves ahead, the arc will melt the filler wire into the weld pool. The wire is fed into the molten pool and withdrawn in a repeated process while the torch is pushed gently and evenly ahead. It is critical to retain the molten end of the filler wire within the gas shield during welding to prevent it from oxidizing and polluting the weld pool.



TIG Torch

The TIG torch should be as flexible and portable as possible. Therefore, it should be as light as possible to avoid making handling the torch uncomfortable during extended welding sessions. Additionally, it needs to be small enough to allow access in tight spaces. The electrically conducting parts must be designed so that heat buildup does not make the torch unpleasant to wield.
There are TIG torches available with self-cooling capacities of up to 250 amps. When higher amperages are required, water-cooled torches should be used. It is possible to change the head angle to find the least fatiguing working position.

Shielding gas

Inert gases shield the weld pool from the negative effects of the ambient air because they do not chemically react with it or mix with other chemicals. Argon makes up around 1% of the volume of the atmosphere and is heavier than air. The best and most popular shielding gas for TIG welding is argon because it is quickly ionized and insensitive to changes in arc length.
The electrode and molten pool are mostly shielded by the gas both during welding and afterwards until they have cooled. Enough gas post-flow time guarantees that the molten metal pool cools off without any contact with ambient air.
The flow rate in liters per minute is used to specify the shielding gas supply. This is defined by the weld pool size, which in turn depends on the electrode diameter, gas nozzle diameter, nozzle distance from the surface of the base material, ambient air flow, and type of shielding gas. As a general guideline, add 5 to 10 liters of shielding gas per minute to the most popular tungsten electrode diameters. Manometers can be used to measure indirect flow rate by positioning them in front of an interconnected nozzle that monitors pressure in relation to flow rate. The manometer's scale is directly calibrated in liters per minute. More particularly, float type meters and measuring devices that directly measure using glass tubes measure the actual protective gas flow rate.

Shielding Gas for protecting the root of welding

Root gas protects the back of the weld from the effects of air and gives the weld a surface that is resistant to acids and other substances of the kind. Stainless steel, acid-resistant steel, and titanium are examples of materials that need root gas. Pure argon or mixtures of 10% hydrogen and 90% nitrogen are the most often used shielding gases.

TIG Process Gas Cups

The purpose of the ceramic gas cup is to shield the tungsten and weld pool from oxidation while welding. There are nozzles of various sizes to provide the coverage required for the majority of applications.
The most economical nozzles are made of 90 or 95 percent alumina oxide and are suitable for lower amperage applications. However, these nozzles tend to degrade, break, and come off when used in higher amperage applications since they are not particularly good at withstanding thermal stress.

Lava nozzles are more expensive and more resistant to cracking than alumina oxide nozzles. These nozzles perform effectively in situations requiring medium to high amperage.
Some recommended electrode diameter, cup size and gas flow rate have been shown in the following simplified chart. Recommended values may differ according to the actual welding conditions and other parameters such as welding position, workpiece thickness, and ambient temperature and so on.

Welding Amperage (A)		Recommended Electrode Diameter in. (mm)	Recommended Cup Size (Diameter)	Gas Flow (Argon)
AC	DC			CFH (L/min)
5-20	5-20	0.20 (0.50)	Size(3) 11/64 (4.3mm) Size(4) 1/4" (6.3 mm) Size(5) 5/16" (8 mm)	5-8 (3-4)
20-70	25-75	0.40 (1.00)	Size(4) 1/4" (6.3 mm) Size(5) 5/16" (8 mm)	5-12 (3-6)
70-150	75-140	1/16 (1.6)	Size(4) 1/4" (6.3 mm) Size(5) 5/16" (8 mm) Size(6) 3/8" (9.5mm)	7-15 (4-7)
135-230	140-240	3/32 (2.4)	Size(6) 3/8" (9.5mm) Size(7) 7/16" (11.1mm) Size(8) 1/2" (12.7 mm)	10-20 (5-10)
225-330	240-350	1/8 (3.2)	Size(7) 7/16" (11.1mm) Size(8) 1/2" (12.7 mm) Size(10) 5/8" (15.8 mm)	10-25 (5-12)
310-430	350-490	5/32 (4.00)	Size(8) 1/2" (12.7 mm) Size(10) 5/8" (15.8 mm)	15-30 (7-14)
410-530	475-780	3/16 (4.8)	Size(8) 1/2" (12.7 mm) Size(10) 5/8" (15.8 mm)	20-40 (10-19)

Note: Welding with inverter welding machines often requires less heat input (lower amperage). The recommended parameters are all approximate and are only for manual welding, not automated welding. Test the welds to ensure they meet your requirements.

Gas Lens

Gas lenses provide better coverage in comparison to the standard Colette bodies. Using a gas lens can reduce gas consumption up to 50%. The electrode stick-out may be increased to 15-20 mm, enabling easier access in small spaces and better welding process monitoring.

Gas Lens Body Gas lens Cup

TIG Welding Filler Metal Rod Consumables

TIG welding typically employs rod-shaped welding consumables. Welding consumables are often chosen in accordance with the source metal. However, when specific alloying elements are utilized, the welding consumable must differ from the parent metal for metallurgical reasons.

The welding consumable's diameter must be matched to the welding task. This is determined by the thickness of the material and the diameter of the tungsten electrode. Welding rods are typically 1000 mm long and to minimize mistakes, they are labeled individually with the name and/or a trade number.

Cleaning the welding surface

Before beginning the welding process, it is crucial to properly clean the workpiece's surfaces and the fusion faces for the best welding outcomes. Grease, corrosion, filth, and paint should be removed from the surfaces, and the surface must be bright before welding. Wherever feasible, scale layers should also be eliminated. Frequently, brushing is sufficient, but in some cases, the surface must be processed mechanically, either by grinding or another way. For corrosion-resistant materials, only stainless-steel brushes should be used; otherwise, iron particles on the surface might produce rust. In the case of aluminum, it's crucial that the surface doesn't have a heavy layer of oxide so that pores may form. Use the proper chemicals to clean the welding surfaces. Be aware that solvents containing chlorine may release toxic vapors.

Tungsten Electrodes

Electrodes for TIG welding

TIG welding normally utilizes four different types of electrodes. They are thorium-alloyed tungsten, zirconium-alloyed tungsten, rare earth-alloyed tungsten, and pure tungsten. Tungsten electrodes are non-consumable and available in a range of sizes; they are constructed of pure tungsten or a tungsten-and-other-rare-earth-element alloy. TIG welding was traditionally performed using pure tungsten electrodes. By alloying this type of electrode metal with thorium or zirconium, several advantages were obtained, including an increase in electron flow, which results in enhanced striking and re-striking and, as a consequence, higher arc stability. Furthermore, alloyed electrodes are more robust, can tolerate higher currents, and are less prone to tungsten inclusions in the weld.

Pure tungsten (Color Code: Green):

This electrode is made of pure tungsten and has a melting temperature of 3400°C. The electrode tip must be rounded for welding aluminum alloys. Tungsten is a rare metallic element that is used to make TIG welding electrodes. TIG relies on the hardness and high-temperature resistance of tungsten to transfer the welding current to the arc. Although pure tungsten has historically resisted heat better because it rounds out rather than creating tiny nodules, it is no longer the ideal material for AC TIG welding. Due to the properties of pure tungsten in combination with AC mode welding, the tungsten balls up, resulting in a larger arc cone and potential arc wandering. The tungsten can become so hot that it splits or falls off, contaminating the weld puddle, when the pure tungsten ball becomes larger than the tungsten's exterior diameter. Pure tungsten may still be needed for some welding processes. To focus heat into the weld and away from the electrode in these circumstances, this machine with extended balance control and AC frequency modification is useful. However, the operators won't experience all the advantages of TIG inverter technology by utilizing the pure tungsten electrode.

Alloyed Tungsten Electrodes

Alloyed tungsten electrodes, also known as rare earth tungsten electrodes, exceed traditional pure tungsten and help to maximize the operation's quality and productivity since they contain components like cerium or lanthanum. The right alloyed tungsten depends on the material being welded, the required amperage, and whether AC or DC welding current is used. Unlike pure tungsten, which tends to ball up, rare earth tungsten keeps its point. Additionally, rare earth tungsten alloyed is a superior choice for AC TIG welding because of features like enhanced balancing control and output frequency that remove more heat from the tungsten to reduce the nodules. It reduces nodules and keeps an electrode pointed by concentrating less heat on the tungsten. Choosing rare earth tungsten electrodes in combination with the advanced square-wave technology has another benefit that allows the use of the

smaller tungsten electrodes, which provide more control and a more concentrated arc. Just keep in mind that, It is impossible to compare electrodes made by different manufacturers simply by considering the oxide percentages, because the crucial production factors, such as the distribution and particle size of the oxide, varies amongst the various producers. The only way to know which tungsten is best for you is to test it out in a real-life experiment. The ends of all tungsten electrodes are color-coded for easy identification. The most common tungsten electrodes are listed below.

Thoriated (Thorium alloyed) (Color Code: Red):

This electrode is commonly used in DC welding of stainless steel, mild steel, copper, titanium, and other materials. Thorium alloyed tungsten electrodes contain at least 97.30 percent tungsten and about 2 percent thorium. They are one of the most widely used electrodes in DC TIG welding and are favored for their durability and convenience of usage. Thorium, on the other hand, is a low-level radioactive threat, and many users have shifted to other options. In terms of radioactivity, thorium is an alpha emitter, although the hazards are insignificant when it is trapped in a tungsten matrix. Thoriated tungsten should never come into touch with open wounds or cuts. The most serious threat to welders is when thorium oxide enters the lungs. This can occur as a result of welding vapor exposure or swallowing of material/dust during tungsten grinding. For usage, follow the manufacturer's warnings, directions, and the material Safety Data Sheet (MSDS). Although Thoriated tungsten is still the most often utilized electrode in DC TIG applications, most industry professionals strongly advise utilizing Ceriated or Lanthanated electrodes for both AC and DC TIG welding due to radiation-related problems.

This type of tungsten alloy is a good all-purpose electrode. It operates well when overloaded with additional amperage and has one of the lowest work functions. The Thoriated offers a roughly 20% increase in current carrying capacity, usually longer lifespan, and better resistance to weld contamination. Compared to pure tungsten or Zirconiated tungsten electrodes, arc beginning is simpler, and the arc is more stable with these electrodes. When welding steel, it is preferable that it keeps a pointed tip design. Because it is challenging to retain the balled end, which is required for AC welding, it is not frequently utilized with AC TIG welding.

Rare earth-alloyed tungsten (Color Code: Purple and Turquoise)

Rare earth-alloyed tungsten electrodes include a minimum of 98 percent tungsten and up to 1.5 percent Lanthanum, as well as tiny amounts of zirconium and Yttrium. Rare earth-alloyed tungsten electrodes have conductivity comparable to Thoriated electrodes. This often implies that the electrodes may be replaced with Thoriated electrodes without needing substantial welding process adjustments. Superior arc starting, electrode longevity, and overall cost-effectiveness are provided by rare earth alloyed. When comparing the electrodes to 2 percent Thoriated tungsten, rare earth-alloyed requires fewer re-grinding and has a longer overall lifespan. In tests, the electrodes' ignition delay actually improves over time, whereas 2 percent Thoriated tungsten begins to degrade after only 25 starts. Rare earth-alloyed tungsten electrodes operate cooler than 2 percent Thoriated tungsten with comparable energy output, prolonging overall tip lifespan. The electrodes operate well in both AC and DC applications. **They may be used as a positive or negative DC electrode with a pointed end, or they can be balled for use with AC power sources.**

Ceriated (Color Code: Gray)

Ceriated tungsten electrodes are defined as having a minimum of 97.30 percent tungsten and 1.80 to 2.20 percent cerium. Ceriated tungsten works best in low current DC welding, and typically operates with around 10% less amps than Thoriated material. The Ceriated electrodes show a slower rate of vaporization or burn-off than pure tungsten. They offer great arc starting at low amperages and have proven popular in orbital tube welding and thin sheet metal operations. They are most commonly used to weld carbon steel, stainless steel, nickel alloys, and titanium, and in some situations, they can replace 2% Thoriated electrodes. Ceriated tungsten is ideally suited for lower amperages and should last longer than un-Ceriated tungsten. Thoriated or Lanthanated tungsten is better suited for higher amperage applications. Due to its characteristics, it is often suitable for quick welding sessions or when a fixed number of welds are required before the electrode needs to be changed. This electrode may be used for AC or DC welding; however, it is typically utilized for DC welding because AC welding could cause it to break.

Lanthanated (Color Code: Black, Gold, and Blue)

Minimum 97.80 percent tungsten and 1, 1.5, or 2 percent of lanthanum are present in Lanthanated tungsten electrodes, which are color-coded in black, gold, and blue, respectively. Lanthanum is not radioactive. These electrodes feature strong arc starting properties, a low burn off rate, high arc stability, and good re-ignition characteristics. Starting and maintaining low current arcs generally require 15% less amps. Lanthanated tungsten has the same conductivity properties as 2% Thoriated tungsten. Lanthanated tungsten electrodes are great for improving welding capabilities. They operate well on AC or DC negative electrodes with a pointed end for DC welding, or they can be balled for use with AC sine wave power sources. Lanthanated tungsten keeps its sharpened edge well, which is useful for welding steel and stainless steel on DC or AC from square or sine wave power sources.

Zirconiated (Zirconium alloyed) (Color Code: White, and Brown)

Zirconiated tungsten electrodes are composed of at least 99.10 percent tungsten and 0.15 to 0.40 percent of zirconium and it is non-radioactive. This electrode was designed primarily for AC welding; however, it may also be used in DC welding, but AC welding is the most prevalent use. Zirconiated tungsten provides a highly steady arc and is tungsten spitting resistant. Because it preserves a balled tip and is very resistant to contamination, it is perfect for AC welding. It has the same or better current carrying capability than Thoriated tungsten. Zirconium electrodes have a melting point of roughly 3800°C. Zirconiated tungsten electrodes often have welding characteristics halfway between pure and Thoriated tungsten. It

is ideal for welding light metals such as aluminum and magnesium.

Tungsten Electrodes Rating for Welding Currents

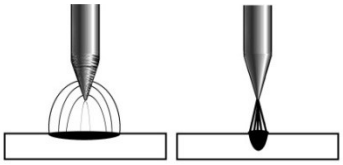
Tungsten Diameter In.(mm)	DC Current Amps Torch Negative RED (Thoriated)	AC Current Amps Un-Balanced White (Zirconiated)	AC Current Amps Balanced White (Zirconiated)
0.040 (1.0)	15-80	15-80	20-60
1/16 (1.6)	70-150	70-150	60-120
3/32 (2.4)	150-250	140-235	100-180
1/8 (3.2)	250-400	225-325	160-250
0.157(4.0)	400-500	300-400	200-320

Note:

Welding with inverter welding machines often needed less heat input (lower amperage). The recommended parameters are all approximate and are only for manual welding, not automated welding. Test the welds to ensure they meet your requirements.

Tungsten Preparation

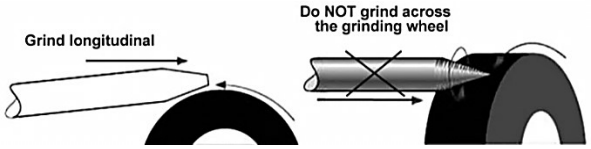
A pointed electrode produces a narrower, more concentrated arc than rounded or unprepared tungsten electrodes. This helps welders maintain a constant bead width and prevent distortion by improving arc control and accurately directing heat at the weld junction. As shown, it is critical that the electrode tip be correctly grounded. If the tip is not in good form, there is a high possibility that the arc will become unstable. The tip in the image has a 30° angle, which is ideal for low amperages. However, when the welding current increases, the angle must be increased. The table below illustrates the appropriate electrode tip angles. The tip's extreme point should be ground off since it cannot support high currents, burns off quickly, and may contaminate the weld pool. When welding with alternating current, the electrode tip should be softly rounded. It is enough to lightly bevel the electrode's edge. If the electrode tip becomes drop-shaped during AC welding, the amperage is too high for the diameter of the electrode being used.



Use only diamond wheels for cutting and grinding. While tungsten is a highly hard material, a diamond wheel's surface is even harder, which allows for more precise grinding. Weld inconsistency and weld flaws can be caused by grinding with aluminum oxide or other non-diamond wheels because they can produce jagged edges, irregularities, or poor surface finishes that are not visible to the naked eye.

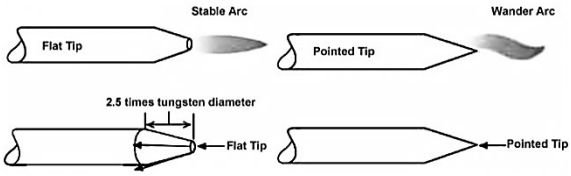
Welding Current (A)	Electrode Tip Angle (α)
20	30°
20 - 100	60 - 90°
100 - 200	90 - 120°
>200	120°

On the grinding wheel, always be sure to grind the tungsten in a longitudinal orientation. If electrodes are ground across, the electrons have to leap over the grinding marks and the arc might start before the tip and wander because tungsten electrodes are created with the molecular structure of the grain running lengthwise. The electrons flow constantly and easily to the end of the tungsten tip while grinding lengthwise with the grain. The arc starts straight and stays steady, narrow, and concentrated.



Electrode Flatted (Truncated) Tip

In precision arc welding, the form of the tungsten electrode tip is a significant process variable. The demand for various benefits will be balanced by a wise choice of tip/flat size. To assist in maintaining the heat created in the welding arc and lessen the chance of tungsten contamination, a truncated (flatted) tip is suggested rather than a sharp point. However, arc wander will be more likely to happen and arc starting will be more challenging the larger the flat, the weld penetration and electrode life will be improved by raising the flat to the highest height that still permits arc initiation and reduces arc wonder. To facilitate arc beginning, some welders continue to grind electrodes to a sharp point. However, they run the danger of reduced welding performance due to tip melting and the potential for the point to detach and fall into the weld pool.



Tungsten Electrode Grinder

The biggest health risk to welders is inhaling or ingesting thorium oxide dust created by grinding tungsten. In order to prevent such a hazardous situation, the use of the Canaweld Tungsten Electrode Grinder Utensil is highly advised.

The CANAWELD Premium Quality TIG Welding Tungsten Grinder is a time and money investment because it is carefully designed to grind welding electrodes with a precision ground finish for crisp, snappy arc starts, better arc control, clean arc transfer, longer electrode run time, and less tungsten waste. It is made to guarantee the safety of the welders' eyes, fingers, and lungs. To make this happen, this grinder machine comes with a cover plate. See the grinder user manual for further details.

Electrode Included Angle/Taper - DC Welding

In addition to tip/flat preparation, tungsten electrodes for DC welding should be ground longitudinally and concentrically with diamond wheels to a particular included angle. Different angles result in various arc shapes and provide various weld penetration capacities. The advantages of blunter electrodes with a larger included angle are generally as follows:

- Be More Durable
- Can withstand higher amps without degrading
- Have superior weld penetration
- Have a thinner arc shape.

Smaller included angles and sharper electrodes offer:

- Have a larger arc
- Provide less arc welding
- Have a more steady arc

Weld bead size and form are determined by the included angle. In general, penetration rises, and bead width reduces as the included angle increases.

Selecting the Size of the Electrode

The following table can be used as a starting point to choose the suitable electrode diameter based on the necessary welding amperage.

Tungsten Diameter in. (mm)	Diameter at the Tip in. (mm)	Constant Included Angle Degrees	Current Range Amps	Current Range Pulsed Amps
0.040 (1.0)	0.0050 (0.125)	12	02 - 15	02 - 30
	0.010 (0.25)	20	05 - 30	05 - 60
1/16 (1.6)	0.020 (0.5)	25	08 - 50	05 - 100
	0.032 (0.8)	30	10 - 70	10 - 140
3/32 (2.4)	0.032 (0.8)	35	12 - 90	12 - 180
	0.045 (1.1)	45	15 - 150	15 - 250
1/8 (3.2)	0.045 (1.1)	60	20 - 200	20 - 300
	0.057 (1.5)	90	25 - 250	25 - 350

Note: Welding with the inverter welding machines often needed less heat input (lower amperage).The recommended parameters are all approximate and are only for manual welding, not automated welding. Test the welds to ensure they meet your requirements.

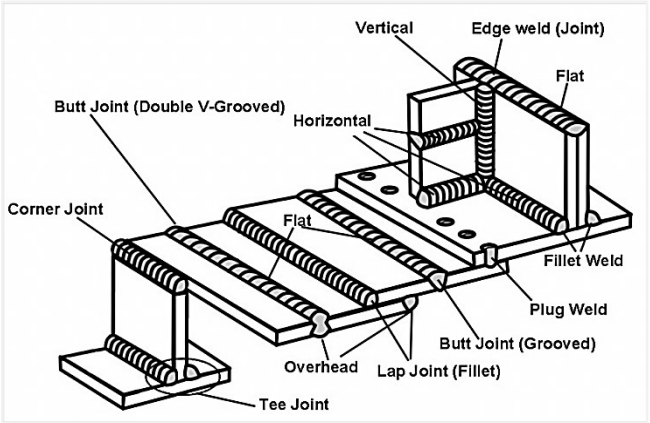
TIG Welding Parameters

It is important to keep in mind that just the current is set on the welding equipment when determining the welding settings. The welder controls the arc length, which dictates the arc voltage. Therefore, the arc voltage increases as the arc length does. As a starting point, a welding current that is adequate for welding typically ranges between 40 and 45 amps per millimeter of workpiece thickness.

Workpice Thickness inch	mm	Gauge	Welding Amperage DC	AC	Filler Rod Size inch (mm)
0.020	0.5	24	5-20	5-15	0.040 (1)
0.025	0.6	22	10-35	10-30	0.040 (1)
0.032	0.8	20	20-50	25-45	0.040 (1)
0.040	1	18	25-80	45-60	0.040 (1)
0.051	1.3	16	40-90	50-100	0.040 (1)
0.064	1.6	14	60-100	50-100	0.064 (1.6)
0.091	2.3	11	85-125	90-150	0.064 (1.6) - 0.094 (2.4)
1/8	3.2	8	100-135	125-190	0.064 (1.6) - 0.094 (2.4)
5/32	4	6	125-175	180-200	0.094 (2.4)
3/16	4.8	5	150-225	180-240	1/8 (3.2)

Note: Welding with inverter welding machines often needed less heat input (lower amperage).The recommended parameters are all approximate and are only for manual welding, not automated welding. Test the welds to ensure they meet your requirements.

Joint Forms



TIG on Stainless Steel (single run welding)

Workpiece Thickness Gauge, in. (mm)	Joint Form	Tungsten Electrode Diameter in. (mm)	Welding Wire Diameter in. (mm)	Argon Gas Flow Rate SCFH (L/min)	Welding Current (DCEP) A	Welding Speed in./min (cm/min)
22, 0.031 (0.8)	Butt	0.040 (1)	1/16 (1.6)	10.6	20 ~ 50	26 (66)
20, 0.037 (1.0)	Butt	1/16 (1.6)	1/16 (1.6)	10.6(5)	50 ~ 80	22 (56)
16, 0.063 (1.5)	Butt	1/16 (1.6)	1/16 (1.6)	14.9(7)	65 ~ 105	11.8 (30)
	Corner	1/16 (1.6)	1/16 (1.6)	14.9(7)	75 ~ 125	9.8 (25)
14, 0.078 (2.0)	Butt	1/16 (1.6)	3/32 (2.4)	14.9(7)	85 ~ 125	11.8 (30)
	Corner	1/16 (1.6)	3/32 (2.4)	14.9(7)	95 ~ 135	9.8 (25)
11, 1/8 (3.2)	Butt	1/16 (1.6)	3/32 (2.4)	14.9(7)	100 ~ 135	11.8 (30)
	Corner	1/16 (1.6)	3/32 (2.4)	14.9(7)	115 ~ 145	9.8 (25)
7, 3/16 (4.8)	Butt	3/32 (2.4)	1/8 (3.2)	17 (8)	150 ~ 225	9.8 (25)
	Corner	1/8 (3.2)	1/8 (3.2)	19.1	175 ~ 250	7.9 (20)

Note: Welding with inverter welding machines often needed less heat input (lower amperage).The recommended parameters are all approximate and are only for manual welding, not automated welding. Test the welds to ensure they meet your requirements.

❑TIG welding with “Lift”

To begin TIG welding, carry out the following tasks (with the machine switched off):

1) Install the TIG torch to the machine by connecting the Dinse connector to the negative output connection socket.
2) Screw the argon gas regulator onto the gas cylinder and tighten it; plug gas hose of torch into the gas outlet of shielding gas regulator and screw it.
3) Set up the TIG torch. Place the tungsten electrode into the torch head and ensure back cap and collet body are screwed in firmly.
4) Fit the earth lead Dinse plug to the positive terminal and then connect earth clamp to the workpiece ensuring that the clamp makes good connect with bare metal.
5) Power on the machine.
6) Select TIG mode on welding machine control panel.
7) Rotate current adjustment knob on welding machine control panel to adjust proper welding current.
8) Turn on regulator and set gas flow to between 10-15 L/min depending on your welding condition.
9) Establish electric arc successfully between tungsten electrode and the workpiece in contact way, and then start welding. (Lay the outside edge of the gas cup on the workpiece with the tungsten electrode 1-2mm from the workpiece. press the button on the TIG torch. With a small movement rotate the gas cup forward so that the tungsten electrode touches the workpiece. Now rotate the gas cup in the reverse direction to lift the tungsten electrode from the workpiece to create the arc.)
10) Pull out electric arc after finished welding.
11) Close cylinder valve after few seconds.

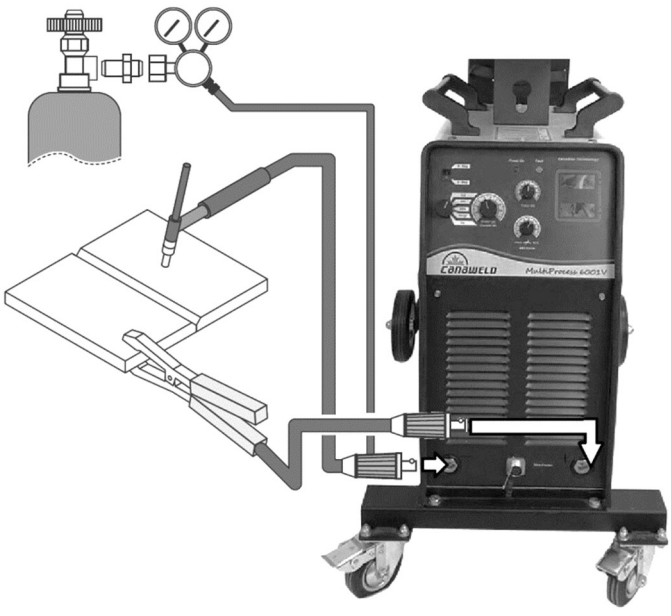
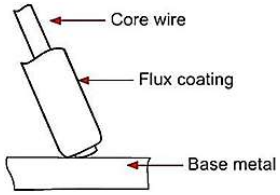


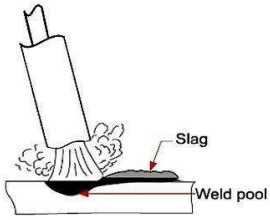
Fig. E

❑Stick Welding Procedure

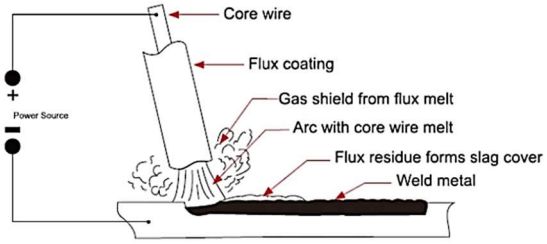
Manual metal arc welding, often known as stick welding, is one of the most used kinds of arc welding. A disposable electrode rod or "stick" and the base material are brought together by an electric current to form an arc. The electrode rod is constructed from a material that is compatible with the base material being joined, and it is coated with a flux that emits gaseous vapors that act as a shielding gas and as a coating of slag, as well, to protect the weld region from ambient contamination. The slag that accumulates over the weld metal after welding must be chipped away, and the electrode core itself serves as filler material.



By quickly contacting the electrode to the base metal, the arc is started. At the electrode's end, a molten pool is created as the heat from the arc melts the base metal's surface. The molten pool is where the melted electrode metal is moved across the arc to create the deposited weld metal. A slag that results from the electrode coating covers and shields the deposit. There is a protective gas surrounding the arc and the surrounding areas.



Solid metal wire is the core of manual metal arc (stick) electrodes, which also include a flux covering. The wire diameter and a string of letters and numbers are used to identify these electrodes. The metal alloy and the electrode's intended purpose are identified by the letters and numbers. The metal wire core works as a conductor of the current that maintains the arc. The core wire melts and is deposited into the welding pool. The term "Flux" refers to the coating on a shielded metal arc welding electrode. Numerous distinct tasks are accomplished by the flux on the electrode. Creating a protective slag covering over the weld as it cools, establishing arc characteristics, introducing alloying components, and forming a protective gas surrounding the weld region are some of these. In addition to adding filler metal to the molten pool, covered electrodes have several other uses. The electrode's coating performs most of these extra activities.



Electrode Selection

Choosing an electrode is typically simple because all that is required is to choose one with a composition that is comparable to the parent metal. However, there are a variety of electrodes available for various metals, each of which has unique characteristics to fit a particular sort of activity. It is advised that you speak with your welding provider to choose the ideal electrode choice.

Arc Length

The electrode should be carefully scraped on the work to strike the arc until the arc is formed. The smallest arc that provides a satisfactory surface for the weld should be used as the correct arc length, according to a straightforward rule. A too-long arc impairs penetration, causes spatter, and provides the weld a rough surface finish. A too-short arc will cause the electrode to stick and produce poor quality welds. The arc length for down hand welding should generally not be longer than the core wire's diameter.

Electrode Size

The thickness of the workpiece being welded often determines the size of the electrode, with a thicker section requiring a bigger electrode. The next chart lists the largest electrodes that may be used for different thicknesses based on the usage of a type 6013 all-purpose electrode.

Welding Current (Amperage)

Arc welding depends on selecting the appropriate current for the task at hand. When the current is regulated too low, it is challenging to initiate and maintain a constant arc. Beads with a noticeably rounded shape will be deposited due to the electrode's inclination to stick to the work and its poor penetration. A hot electrode undercuts and burns through the base metal while also producing a lot of splatters when there is too much current flowing through it. The maximum current that may be used for a certain operation without destroying the output, overheating the electrode, or producing a rough, spattered surface may be considered as the normal current. The allowable current ranges for a type 6013 general-purpose electrode are listed in the table.

Steel Sheet Thickness in. (mm)	Stick Electrode Rod Diameter in. (mm)	Current Range (Amps)
1/16 - 1/8 (1.6 – 3.17)	3/32 (2.4)	45 - 95
1/8 - 1/4 (3.17 – 6.35)	1/8 (3.2)	75 -130
1/4 - 3/8 (6.35 – 9.5)	5/32 (4.0)	105 -185
3/8 - 1/2 (9.5 -12.5)	3/16 (4.8)	150 - 225

Electrode Angle

To enable a seamless, equal transfer of metal, the electrode's angle with the work is crucial. The electrode is typically angled between 5 and 15 degrees toward the direction of motion when welding in a horizontal, above, horizontal fillet, or down hand position. The electrode should be at an angle of between 80 and 90 degrees to the workpiece while welding vertically up.

Travel Speed

The electrode should be moved at a pace that will provide the desired length of run in the direction of the joint being welded. To maintain the proper arc length at all times, the electrode is fed downward at the same time. While excessive travel speeds typically result in arc instability, slag inclusions, and poor mechanical characteristics, excessive travel speeds frequently result in poor fusion, lack of penetration, etc.

Material and Joint Preparation

The weldable material must be free of any pollutants that might contaminate the weld material and interfere with the arc, such as moisture, paint, oil, grease, mill scale, and rust. Joints may need to be prepared using sawing, punching, shearing, machining, flame cutting, and other techniques depending on the technology used. Edges should always be clean and free of debris. The type of joint will be determined by the application selected.

❑Stick welding (SMAW)

To begin Stick welding, carry out the following tasks (with the machine switched off):

1) Assemble Arc and Earth leads into the welding terminals depending on requirements of electrodes. Refer to your electrode packet for polarity and current requirements.
   - DCEP (most common application): Earth clamp connector into the negative terminal and electrode holder connector into the positive terminal.
   - DCEN (straight polarity): Earth clamp connector into the positive terminal and electrode holder connector into the negative terminal.
2) Connect Earth clamp firmly to workpiece ensuring that the clamp makes good contact with bare metal.
3) Take electrode holder and insert bare metal rod end of electrode and twist handle to clamp electrode.
4) Ensure the electrode and electrode holder is not near the workpiece, turn the machine on using the mains power switch.
5) Select Stick mode on welding machine control panel.
6) Rotate current adjustment knob on welding machine control panel to adjust proper welding current. Rotate arc force adjustment knob to adjust arc force current.
7) Start welding.
8) Pull out electric arc.

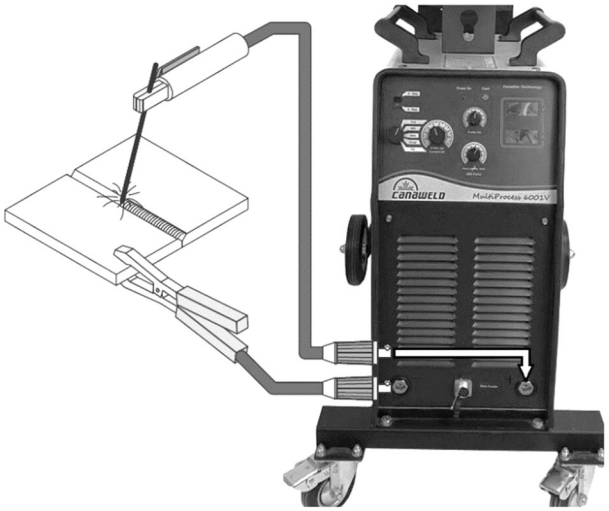
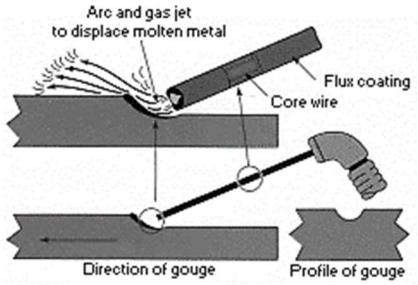


Fig. F

❑Gouging procedure

Gouging is a method for removing material in connection with welding or casting. A distinction is made between thermal and mechanical gouging methods. The thermal methods are generally faster, the thermal gouging is an essential part of welding fabrication. Used for rapid removal of unwanted metal, the material is locally heated and molten metal ejected, usually by blowing it away. Normal oxy-fuel gas or arc processes can be used to produce rapid melting and metal removal.



Gouging operations can be carried out using the following thermal processes:

- Oxy-fuel process
- Plasma arc
- Manual metal arc (MMA)
- Air carbon arc

Flame or Oxy-fuel Gouging

Flame gouging is a variant of conventional oxy-fuel gas welding. Oxygen and a fuel gas are used to produce a high temperature flame for melting the steel. When gouging, the steel is locally heated to a temperature above the 'ignition' temperature (typically 900°C) and a jet of oxygen is used to melt the metal - a chemical reaction between pure oxygen and hot metal. This jet is also used to blow away molten metal and slag. It should be noted that compared with oxy-fuel cutting, slag is not blown through the material, but remains on the top surface of the work piece. The gouging nozzle is designed to supply a relatively large volume of oxygen through the gouging jet. In oxy-fuel gouging, equal quantities of oxygen and acetylene are used to set a near-neutral preheating flame. The oxygen jet flow rate determines the depth and width of the gouge.

Plasma Arc Gouging

The use of the plasma arc as a gouging tool dates back to the 1960s when the process was developed for welding. Compared with the alternative oxy-fuel and manual metal arc gouging techniques, plasma arc has a needle-like jet which can produce a very precise groove, suitable for application on almost all ferrous and non-ferrous materials. Plasma gas can be argon, helium, argon/hydrogen, nitrogen, or air.

Manual Metal Arc and Air Carbon Arc Gouging

In these processes an electrical arc is generated to melt the material. Other techniques like special electrodes or a jet of compressed air are used to blow away the molten material. No specific high purity or compressed gases are needed in these processes.

The main advantage of manual metal arc (MMA) gouging is that the same power source can be used for welding, gouging or cutting, simply by changing the type of electrode.

The arc is formed between the tip of the electrode and the workpiece in conventional manual metal arc welding. Manual metal arc gouging differs due to requiring special purpose electrodes with thick flux coatings in order to generate a strong arc force and gas stream. Unlike manual metal arc welding where a stable weld pool must be maintained, this process can force the molten metal away from the arc zone to leave a clean-cut surface.

The manual metal arc gouging process is characterised by the large amount of gas which is generated to eject the molten metal. However, because the arc/gas stream is not as powerful as a gas or a separate air jet, the surface of the gouge is not as smooth as an oxyfuel gouge or air carbon arc gouge.

This type of gouging is used for localised gouging operations such as the removal of defects. It is also used where it is more convenient to switch from a welding electrode to a gouging electrode, rather than using specialised equipment.

If this process is correctly applied, manual metal arc gouging can produce relatively clean gouged surfaces. For general applications, welding can be carried out without the need to dress by grinding. However, when gouging stainless steel, a thin layer of higher carbon content material will be produced – this should be removed by grinding.

Electrode

According to the size of gouge specified, there is a wide range of electrode diameters available to choose from. These grooving electrodes are also not just restricted to steels, and the same electrode composition may be used for gouging stainless steel and non-ferrous alloys.

Power source

Manual metal arc gouging can be carried out using conventional DC and AC power sources. In DC gouging, electrode polarity is normally negative but electrode manufacturers may well recommend electrode polarity for their brand of electrodes and for gouging specific materials. When using an AC power source, a minimum of 70V open circuit (OCV) is required to stabilise the arc.

Although most manual metal arc welding power sources can be used for gouging, the current rating and OCV must be capable of accommodating current surges and longer arc lengths.

Guidance on gouging parameters can be found below:

Typical operating data for manual metal arc gouging

Electrode diameter (mm)	Current (A)	Gouging dimensions		Gouging speed (mm/min)
		Depth (mm)	Width (mm)	
3.2	210	2	6	1200
4.0	300	3	8	1000
4.8	350	4	10	800

Operational characteristics

The arc is struck with an electrode which is held at a normal angle to the workpiece (15 degrees backwards from the vertical plane in line with proposed direction of gouging). Once the arc is established, the electrode is immediately inclined in one smooth and continuous movement to an angle of around 15-20 degrees to the plate surface. With the arc pointing in the direction of travel, the electrode is pushed forward slightly to melt the metal. It should then be pulled back to allow the gas jet

to displace the molten metal and slag. This forward and backward motion is repeated as the electrode is guided along the line to complete the gouge.

To produce a consistent depth and width of gouge, a uniform rate of travel must be maintained, together with the angle of electrode: 10-20 degrees. If the electrode angle becomes too steep, in excess of about 20 degrees, the amount of slag and molten metal will increase. This is a result of the arc penetrating too deeply. Digging the electrode into the metal causes problems in controlling the gouging operation and will produce a rough surface profile. For gouging in positions other than vertical, the electrode is always pushed forward. With vertical surfaces, the electrode is directed and pushed vertically downwards.

Application

Manual metal arc gouging is used for localised gouging operations, removal of defects for example, and where it is more convenient to switch from a welding electrode to a gouging electrode rather than use specialised equipment. Compared with alternative gouging processes, metal removal rates are low and the quality of the gouged surface is inferior.

When correctly applied, manual metal arc gouging can produce relatively clean gouged surfaces. For general applications, welding can be carried out without the need to dress by grinding. However when gouging stainless steel, a thin layer of higher carbon content material will be produced - this should be removed by grinding.

Welding Standard

Note: All settings are approximate/welds should be tested to comply to your specifications.

Gouging Parameters

SECTIONAL FORM SHAPE	CARBON ROD STANDARD /MM	SUITABLE CURRENT/A
Round	Φ3×355	150-180
	Φ4×355	150-200
	Φ5×355	150-250
	Φ6×355	180-300
	Φ7×355	200-350
	Φ8×355	250-400
	Φ9×355	350-450
	Φ10×355	350-500
Square	3×12×355	200-300
	4×8×355	180-270
	4×12×355	200-400
	5×10×355	300-400
	5×12×355	350-450
	5×15×355	400-500
	5×18×355	450-550
	5×20×355	500 -600

❑Gouging welding

To begin gouging welding, carry out the following tasks (with the machine switched off):

1) Connect gouging torch gas tube with gas pressure reducer; gas pressure is between 0.4-0.6 MPa (4-6 bar).
2) Connect gouging torch with welding machine positive output terminal.
3) Connect work piece with welding machine negative output terminal.
4) Power on.
5) Select gouging on welding machine control panel.
6) Rotate current adjustment knob on welding machine control panel to adjust proper welding current, normal is above 300A.
7) Rotate arc force adjustment knob to increase arc force current, normal choose 5.
8) Gouging torch clamps carbon rod at 80-100 mm position.
9) Open gas switch on gouging torch.
10) Start gouging. (leftward welding)
11) Pull out electric arc.
12) Close compressed air; turn off gas switch on gouging torch.

❑Maintenance

ATTENTION: Cut off the power supply to the equipment before effecting any internal inspection.

IMPORTANT: Since the welding machines are fully electronic, removing the dust that is sucked into the machine by the fans is of utmost importance.

In order to achieve correct functioning of the machine, proceed as described:

- Periodic removal of accumulations of dirt and dust inside the equipment using compressed air. Do not point the jet of air directly at the electrical parts as this could damage them.
- Periodical inspection for worn cables or loose connections that could cause overheating.
- Make sure the air circuit is completely free of any impurities and that the connections are tight and free of any leaks. In this connection, inspect the solenoid valve very carefully.
- Check the wire feeder rolls periodically and replace them when wear impairs the regular flow of the wire (slipping etc.)

TORCH

The torch is subjected to high temperatures and is also stressed by traction and torsion. We recommend not to twist the wire and not to use the torch to pull the welder. As a result of the above the torch will require frequent maintenance such as:

- Cleaning welding splashes from the gas diffuser so that the gas flows freely.
- Substitution of the contact tip when the hole is deformed.
- Cleaning of the wire guide liner using trichloroethylene or specific solvents.
- Check of the insulation and connections of the power cable; the connections must be in good electrical and mechanical condition.

SPARE PARTS

Original spares have been specifically designed for our equipment.

The use of spares that are not original may cause variations in the performance and reduce the safety level of the equipment. We are not liable for damage due to use of spare parts that are not original.

❑The pointing out of any difficulties and their elimination

The supply line is attributed with the cause of the most common difficulties. In the case of breakdown, proceed as follows:

1) Check the value of the supply voltage.
2) Check that the power cable is perfectly connected to the plug and the supply switch.
3) Check that the power fuses are not burned out or loose.
4) Check whether the following are defective:
   - The switch that supplies the machine.
   - The plug socket in the wall.
   - The generator switch.

NOTE: Given the required technical skills necessary for the repair of the generator, in case of breakdown we advise you to contact skilled personnel or our technical service department.

❑Troubleshooting table

WARNING: Any internal inspections or repairs are only to be done by qualified personnel!

IMPORTANT: Remember to disconnect the mains power supply and wait for the internal capacitors to discharge (about 2 minutes) before starting to check and repair the machine if necessary.

Please refer to **Table 6** There is troubleshooting table that will help you figure out what the problem is.

Table 6

Defect	Solution
Main circuit breaker is ON, but indicators are not lit up.	• Input is default phase. Stop work • Circuit breaker is damaged. Replace it. • Fuse (2A) is fusing. Replace it.
After power on, the circuit breaker on rear panel automatically tripped.	• Circuit breaker is damaged. Replace it. • IGBT module is damaged. Replace IGBT and drive board. • Three phase rectifier bridge is damaged. Replace it.
During welding, the circuit breaker is tripped.	• Overloading, the duty cycle has been exceeding. Do not exceed the duty cycle. • Circuit breaker is damaged. Replace it.
Cannot adjust welding current value.	• Wire feeder control cable is broken. Reconnect it. • Check main control board is damaged or not. Check and replace. • Power source enter connector is loose or break. Check and reconnect.
Arc is not stable, spatter is high.	• Incorrect welding parameters. Check the settings. • Contact tip is worn out. Change the contact tip.
CO2 gas regulator heater does not work.	• CO2 gas regulator is damaged. Replace it.
	• Heater cable is broken or short circuit. Replace or reconnect. • Thermistor of heater is damaged. Replace it.
When torch trigger is pressed, wire feeding is ok, while no shielding gas.	• Main control board is damaged. Fix or replace main control board. • The solenoid valve is damaged. Change the solenoid valve.
When torch trigger is pressed, wire feeder does not work, and no open load voltage on displayer.	• Torch trigger is damaged. Replace or fix. • Control cable for wire feeder is broken. Reconnect. • Main control board in power source is damaged. Replace or fix.
Fault indicator is lit up.	• Temperature relay is damaged. Replace it. • Wires connected to temperature relay maybe broken. Reconnect. • Overloading, the duty cycle has been exceeded. Do not exceed the duty cycle. Wait several minutes for cooling down and it will return to normal.

❑Meaning of graphic symbols on machine

❑Wiring diagram