



OM-255 441E 2015-07

Processes



TIG (GTAW) Welding



Stick (SMAW) Welding

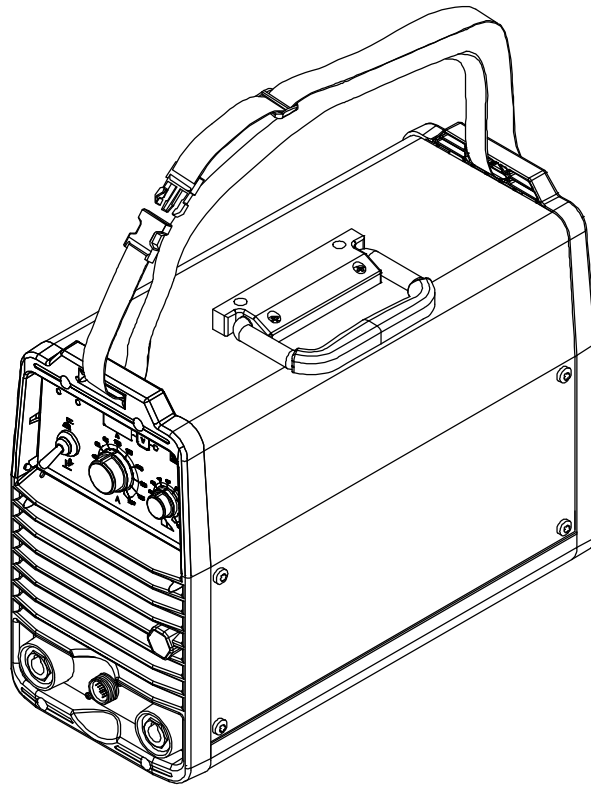
Description



Arc Welding Power Source

STi 203

CE



OWNER'S MANUAL

From Miller to You

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

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

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

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



Miller Electric manufactures a full line of welders and welding related equipment. For information on other quality Miller products, contact your local Miller distributor to receive the latest full line catalog or individual catalog sheets.



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



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DECLARATION OF CONFORMITY

for European Community (CE marked) products.

ITW Welding Italy S.r.l Via Privata Iseo 6/E, 20098 San Giuliano M.se, (MI) Italy declares that the product(s) identified in this declaration conform to the essential requirements and provisions of the stated Council Directive(s) and Standard(s).

Product/Apparatus Identification:

Product	Stock Number
STi 203	059016015

Council Directives:

- 2006/95/EC Low Voltage
- 2004/108/EC Electromagnetic Compatibility
- 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment

Standards:

- IEC 60974-1:2012 Arc Welding Equipment – Part 1: Welding Power Sources
- IEC 60974-10:2007 Arc Welding Equipment – Part 10: Electromagnetic Compatibility Requirements

EU Signatory:

July 1st, 2015

Massimiliano Lavarini

Date of Declaration

ITW WELDING ITALY PRODUCTION MANAGER

956 172 218

SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING

som 2013-09

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

1-1. Symbol Usage




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



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

NOTICE – Indicates statements not related to personal injury.

1-2. Arc Welding Hazards

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

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

 During operation, keep everybody, especially children, away.



ELECTRIC SHOCK can kill.

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

- Do not touch live electrical parts.

- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.
- Do not use AC output in damp areas, if movement is confined, or if there is a danger of falling.
- Use AC output ONLY if required for the welding process.
- If AC output is required, use remote output control if present on unit.
- Additional safety precautions are required when any of the following electrically hazardous conditions are present: in damp locations or while wearing wet clothing; on metal structures such as floors, gratings, or scaffolds; when in cramped positions such as sitting, kneeling, or lying; or when there is a high risk of unavoidable or accidental contact with the workpiece or ground. For these conditions, use the following equipment in order presented: 1) a semiautomatic DC constant voltage (wire) welder, 2) a DC manual (stick) welder, or 3) an AC welder with reduced open-circuit voltage. In most situations, use of a DC, constant voltage wire welder is recommended. And, do not work alone!
- Disconnect input power or stop engine before installing or servicing this equipment. Lockout/tagout input power according to OSHA 29 CFR 1910.147 (see Safety Standards).
- Properly install, ground, and operate this equipment according to its Owner's Manual and national, state, and local codes.
- Always verify the supply ground – check and be sure that input power cord ground wire is properly connected to ground terminal in

 Indicates special instructions.



This group of symbols means Warning! Watch Out! ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.

disconnect box or that cord plug is connected to a properly grounded receptacle outlet.

- When making input connections, attach proper grounding conductor first – double-check connections.
- Keep cords dry, free of oil and grease, and protected from hot metal and sparks.
- Frequently inspect input power cord and ground conductor for damage or bare wiring – replace immediately if damaged – bare wiring can kill.
- Turn off all equipment when not in use.
- Do not use worn, damaged, undersized, or repaired cables.
- Do not drape cables over your body.
- If earth grounding of the workpiece is required, ground it directly with a separate cable.
- Do not touch electrode if you are in contact with the work, ground, or another electrode from a different machine.
- Do not touch electrode holders connected to two welding machines at the same time since double open-circuit voltage will be present.
- Use only well-maintained equipment. Repair or replace damaged parts at once. Maintain unit according to manual.
- Wear a safety harness if working above floor level.
- Keep all panels and covers securely in place.
- Clamp work cable with good metal-to-metal contact to workpiece or worktable as near the weld as practical.
- Insulate work clamp when not connected to workpiece to prevent contact with any metal object.
- Do not connect more than one electrode or work cable to any single weld output terminal. Disconnect cable for process not in use.
- Use GFCI protection when operating auxiliary equipment in damp or wet locations.

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

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



HOT PARTS can burn.

- Do not touch hot parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.



FUMES AND GASES can be hazardous.

Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use local forced ventilation at the arc to remove welding fumes and gases. The recommended way to determine adequate ventilation is to sample for the composition and quantity of fumes and gases to which personnel are exposed.
- If ventilation is poor, wear an approved air-supplied respirator.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer's instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, and metals.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watch-person nearby. Welding fumes and gases can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.
- Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
- Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.



ARC RAYS can burn eyes and skin.

Arc rays from the welding process produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin. Sparks fly off from the weld.

- Wear an approved welding helmet fitted with a proper shade of filter lenses to protect your face and eyes from arc rays and sparks when welding or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).
- Wear approved safety glasses with side shields under your helmet.
- Use protective screens or barriers to protect others from flash, glare and sparks; warn others not to watch the arc.
- Wear body protection made from durable, flame-resistant material (leather, heavy cotton, wool). Body protection includes oil-free clothing such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.

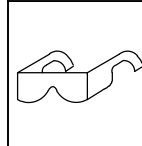


WELDING can cause fire or explosion.

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

- Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Do not weld where flying sparks can strike flammable material.
- Protect yourself and others from flying sparks and hot metal.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not weld on containers that have held combustibles, or on closed containers such as tanks, drums, or pipes unless they are properly prepared according to AWS F4.1 and AWS A6.0 (see Safety Standards).
- Do not weld where the atmosphere may contain flammable dust, gas, or liquid vapors (such as gasoline).
- Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock, sparks, and fire hazards.
- Do not use welder to thaw frozen pipes.

- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
- Wear body protection made from durable, flame-resistant material (leather, heavy cotton, wool). Body protection includes oil-free clothing such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding.
- After completion of work, inspect area to ensure it is free of sparks, glowing embers, and flames.
- Use only correct fuses or circuit breakers. Do not oversize or bypass them.
- Follow requirements in OSHA 1910.252 (a) (2) (iv) and NFPA 51B for hot work and have a fire watcher and extinguisher nearby.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer's instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, and metals.



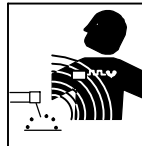
FLYING METAL or DIRT can injure eyes.

- Welding, chipping, wire brushing, and grinding cause sparks and flying metal. As welds cool, they can throw off slag.
- Wear approved safety glasses with side shields even under your welding helmet.



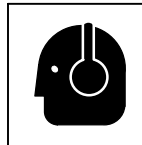
BUILDUP OF GAS can injure or kill.

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



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

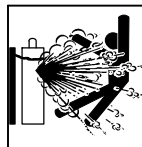
- Wearers of Pacemakers and other Implanted Medical Devices should keep away.
- Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations.



NOISE can damage hearing.

Noise from some processes or equipment can damage hearing.

- Wear approved ear protection if noise level is high.



CYLINDERS can explode if damaged.

Compressed gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

- Protect compressed gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flames, sparks, and arcs.
- Install cylinders in an upright position by securing to a stationary support or cylinder rack to prevent falling or tipping.
- Keep cylinders away from any welding or other electrical circuits.
- Never drape a welding torch over a gas cylinder.
- Never allow a welding electrode to touch any cylinder.
- Never weld on a pressurized cylinder – explosion will result.
- Use only correct compressed gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
- Turn face away from valve outlet when opening cylinder valve. Do not stand in front of or behind the regulator when opening the valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Use the right equipment, correct procedures, and sufficient number of persons to lift and move cylinders.
- Read and follow instructions on compressed gas cylinders, associated equipment, and Compressed Gas Association (CGA) publication P-1 listed in Safety Standards.

1-3. Additional Symbols For Installation, Operation, And Maintenance



FIRE OR EXPLOSION hazard.

- Do not install or place unit on, over, or near combustible surfaces.
- Do not install unit near flammables.
- Do not overload building wiring – be sure power supply system is properly sized, rated, and protected to handle this unit.



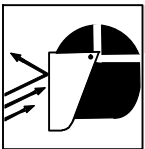
FALLING EQUIPMENT can injure.

- Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift and support unit.
- If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.
- Keep equipment (cables and cords) away from moving vehicles when working from an aerial location.
- Follow the guidelines in the Applications Manual for the Revised NIOSH Lifting Equation (Publication No. 94–110) when manually lifting heavy parts or equipment.



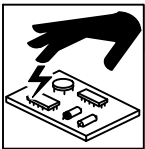
OVERUSE can cause OVERHEATING

- Allow cooling period; follow rated duty cycle.
- Reduce current or reduce duty cycle before starting to weld again.
- Do not block or filter airflow to unit.



FLYING SPARKS can injure.

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



STATIC (ESD) can damage PC boards.

- Put on grounded wrist strap BEFORE handling boards or parts.
- Use proper static-proof bags and boxes to store, move, or ship PC boards.



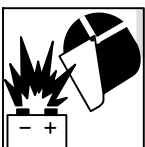
MOVING PARTS can injure.

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



WELDING WIRE can injure.

- Do not press gun trigger until instructed to do so.
- Do not point gun toward any part of the body, other people, or any metal when threading welding wire.



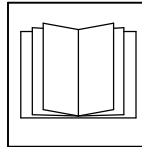
BATTERY EXPLOSION can injure.

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



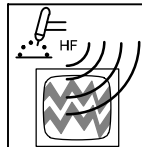
MOVING PARTS can injure.

- Keep away from moving parts such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.
- Have only qualified persons remove doors, panels, covers, or guards for maintenance and troubleshooting as necessary.
- Reinstall doors, panels, covers, or guards when maintenance is finished and before reconnecting input power.



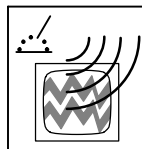
READ INSTRUCTIONS.

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



H.F. RADIATION can cause interference.


- High-frequency (H.F.) can interfere with radio navigation, safety services, computers, and communications equipment.
- Have only qualified persons familiar with electronic equipment perform this installation.
- The user is responsible for having a qualified electrician promptly correct any interference problem resulting from the installation.
- If notified by the FCC about interference, stop using the equipment at once.
- Have the installation regularly checked and maintained.
- Keep high-frequency source doors and panels tightly shut, keep spark gaps at correct setting, and use grounding and shielding to minimize the possibility of interference.




ARC WELDING can cause interference.

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

1-4. California Proposition 65 Warnings

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

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

1-5. Principal Safety Standards

Safety in Welding, Cutting, and Allied Processes, ANSI Standard Z49.1, is available as a free download from the American Welding Society at <http://www.aws.org> or purchased from Global Engineering Documents (phone: 1-877-413-5184, 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 (phone: 1-877-413-5184, website: www.global.ihs.com).

Safe Practices for Welding and Cutting Containers that have Held Combustibles, American Welding Society Standard AWS A6.0, from Global Engineering Documents (phone: 1-877-413-5184, website: www.global.ihs.com).

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Quincy, MA 02269 (phone: 1-800-344-3555, website: www.nfpa.org and www.sparky.org).

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151 (phone: 703-788-2700, website: www.cganet.com).

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 5060

Spectrum Way, Suite 100, Ontario, Canada L4W 5NS (phone: 800-463-6727, website: www.csa-international.org).

Safe Practice For Occupational And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 25 West 43rd Street, New York, NY 10036 (phone: 212-642-4900, website: www.ansi.org).

Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, NFPA Standard 51B, from National Fire Protection Association, Quincy, MA 02269 (phone: 1-800-344-3555, website: www.nfpa.org).

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, from U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 (phone: 1-866-512-1800) (there are 10 OSHA Regional Offices—phone for Region 5, Chicago, is 312-353-2220, website: www.osha.gov).

Applications Manual for the Revised NIOSH Lifting Equation, The National Institute for Occupational Safety and Health (NIOSH), 1600 Clifton Rd, Atlanta, GA 30333 (phone: 1-800-232-4636, website: www.cdc.gov/NIOSH).

1-6. EMF Information

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

1. Keep cables close together by twisting or taping them, or using a cable cover.
2. Do not place your body between welding cables. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around your body.


4. Keep head and trunk as far away from the equipment in the welding circuit as possible.
5. Connect work clamp to workpiece as close to the weld as possible.
6. Do not work next to, sit or lean on the welding power source.
7. Do not weld whilst carrying the welding power source or wire feeder.



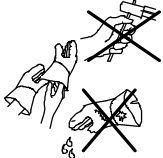
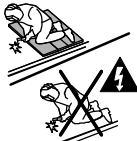
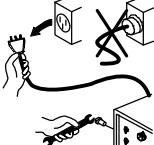

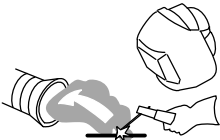
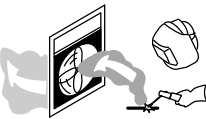
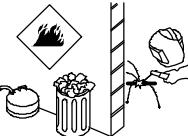

About Implanted Medical Devices:



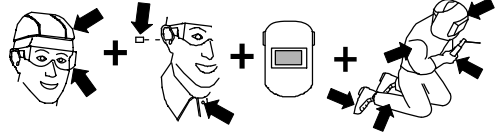
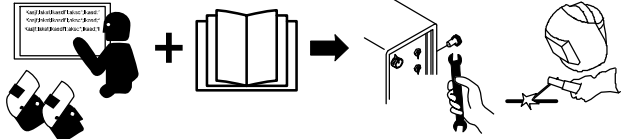
Implanted Medical Device wearers should consult their doctor and the device manufacturer before performing or going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations. If cleared by your doctor, then following the above procedures is recommended.

SECTION 2 – DEFINITIONS










2-1. Additional Safety Symbols And Definitions







 Some symbols are found only on CE products.


	<p>Warning! Watch Out! There are possible hazards as shown by the symbols.</p> <p style="text-align: right;">Safe1 2012-05</p>
	<p>Do not discard product (where applicable) with general waste. Reuse or recycle Waste Electrical and Electronic Equipment (WEEE) by disposing at a designated collection facility. Contact your local recycling office or your local distributor for further information.</p> <p style="text-align: right;">Safe37 2012-05</p>
	<p>Wear dry insulating gloves. Do not touch electrode with bare hand. Do not wear wet or damaged gloves.</p> <p style="text-align: right;">Safe2 2012-05</p>
	<p>Protect yourself from electric shock by insulating yourself from work and ground.</p> <p style="text-align: right;">Safe3 2012-05</p>
	<p>Disconnect input plug or power before working on machine.</p> <p style="text-align: right;">Safe5 2012-05</p>
	<p>Keep your head out of the fumes.</p> <p style="text-align: right;">Safe6 2012-05</p>
	<p>Use forced ventilation or local exhaust to remove the fumes.</p> <p style="text-align: right;">Safe8 2012-05</p>
	<p>Use ventilating fan to remove fumes.</p> <p style="text-align: right;">Safe10 2012-05</p>
	<p>Keep flammables away from welding. Do not weld near flammables.</p> <p style="text-align: right;">Safe12 2012-05</p>
	<p>Welding sparks can cause fires. Have a fire extinguisher nearby, and have a watchperson ready to use it.</p> <p style="text-align: right;">Safe14 2012-05</p>

	<p>Do not weld on drums or any closed containers.</p> <p style="text-align: right;">Safe16 2012-05</p>
	<p>Do not remove or paint over (cover) the label.</p> <p style="text-align: right;">Safe20 2012-05</p>
	<p>Wear hat and safety glasses. Use ear protection and button shirt collar. Use welding helmet with correct shade of filter. Wear complete body protection.</p> <p style="text-align: right;">Safe38 2012-05</p>
	<p>Become trained and read the instructions before working on the machine or welding.</p> <p style="text-align: right;">Safe40 2012-05</p>

2-2. Miscellaneous Symbols And Definitions

A	Amperes
	Output/On
	Gas Tungsten Arc Welding (GTAW)
	Shielded Metal Arc Welding (SMAW)
V	Volts
	Voltage Input
	3 Phase Static Frequency Converter-Transformer-Rectifier
	Voltage Output
	Off
	Remote
	Lift-Arc Start (GTAW)

	Protective Earth (Ground)
	Process
	High Temperature
	Increase/Decrease Of Quantity
I	On
%	Percent
+	Positive
-	Negative
	Alternating Current
Hz	Hertz
	Arc Force (DIG)


I₂	Rated Welding Current
X	Duty Cycle
==	Direct Current
	Line Connection
U₂	Conventional Load Voltage
U₁	Primary Voltage
IP	Degree Of Protection
I_{1max}	Rated Maximum Supply Current
I_{1eff}	Maximum Effective Supply Current
U₀	Rated No Load Voltage (Average)

SECTION 3 – SPECIFICATIONS

3-1. Serial Number And Rating Label Location

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

3-2. Specifications

 Do not use information in unit specifications table to determine electrical service requirements. See Sections 4-7 and 4-8 for information on connecting input power.


Welding Process	Rated Output	Welding Amperage Range	Max. Open-Circuit Voltage (U ₀)	Amperes Input At Rated Output, 50/60Hz			KVA	KW	Dimensions	Weight
				380	400	440				
Stick	200 A @ 28 VDC, 40% Duty Cycle	5 – 200	85 VDC	13.5	12.8	11.5	8.86	6.51	Length: 460 mm (18.1 in.) Width: 190 mm (7.48 in.) Height: 345 mm (13.6 in.)	17 Kg (37.5 lb)
TIG	200 A @ 18 VDC, 40% Duty Cycle			8.7	8.3	7.5	5.73	4.20		

3-3. Environmental Specifications

A. IP Rating

IP Rating	Operating Temperature Range
IP23 This equipment is designed for outdoor use. It may be stored, but is not intended to be used for welding outside during precipitation unless sheltered.	-10 to 40 °C (14 to 104°F) IP23 2014-06

B. Information On Electromagnetic Fields (EMF)

 **This equipment shall not be used by the general public as the EMF limits for the general public might be exceeded during welding.**


This equipment is built in accordance with EN 60974-1 and is intended to be used only in an occupational environment (where the general public access is prohibited or regulated in such a way as to be similar to occupational use) by an expert or an instructed person.

Wire feeders and ancillary equipment (such as torches, liquid cooling systems and arc striking and stabilizing devices) as part of the welding circuit may not be a major contributor to the EMF. See the Owner's Manuals for all components of the welding circuit for additional EMF exposure information.

- The EMF assessment on this equipment was conducted at 0.5 meter.
- At a distance of 1 meter the EMF exposure values were less than 20% of the permissible values.

ce-emf 1 2010-10

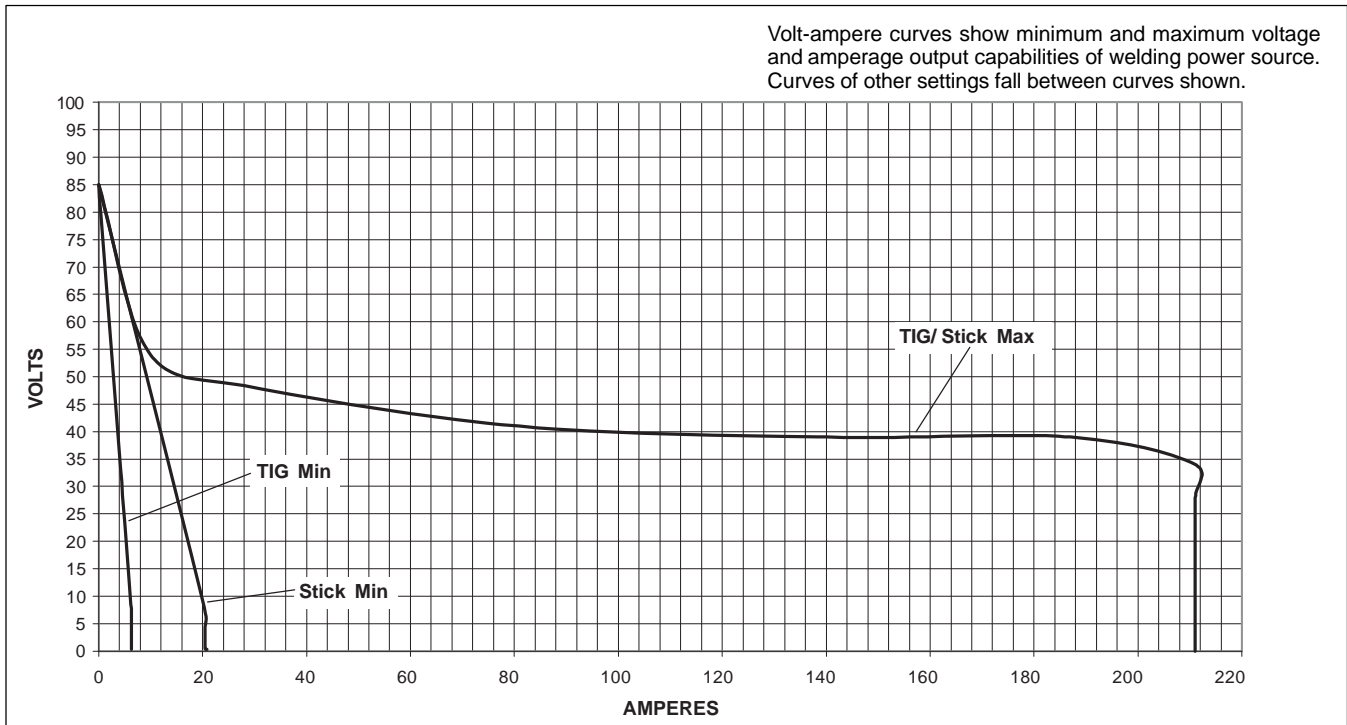
C. Information On Electromagnetic Compatibility (EMC)

 **This Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low voltage supply system. There can be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances.**

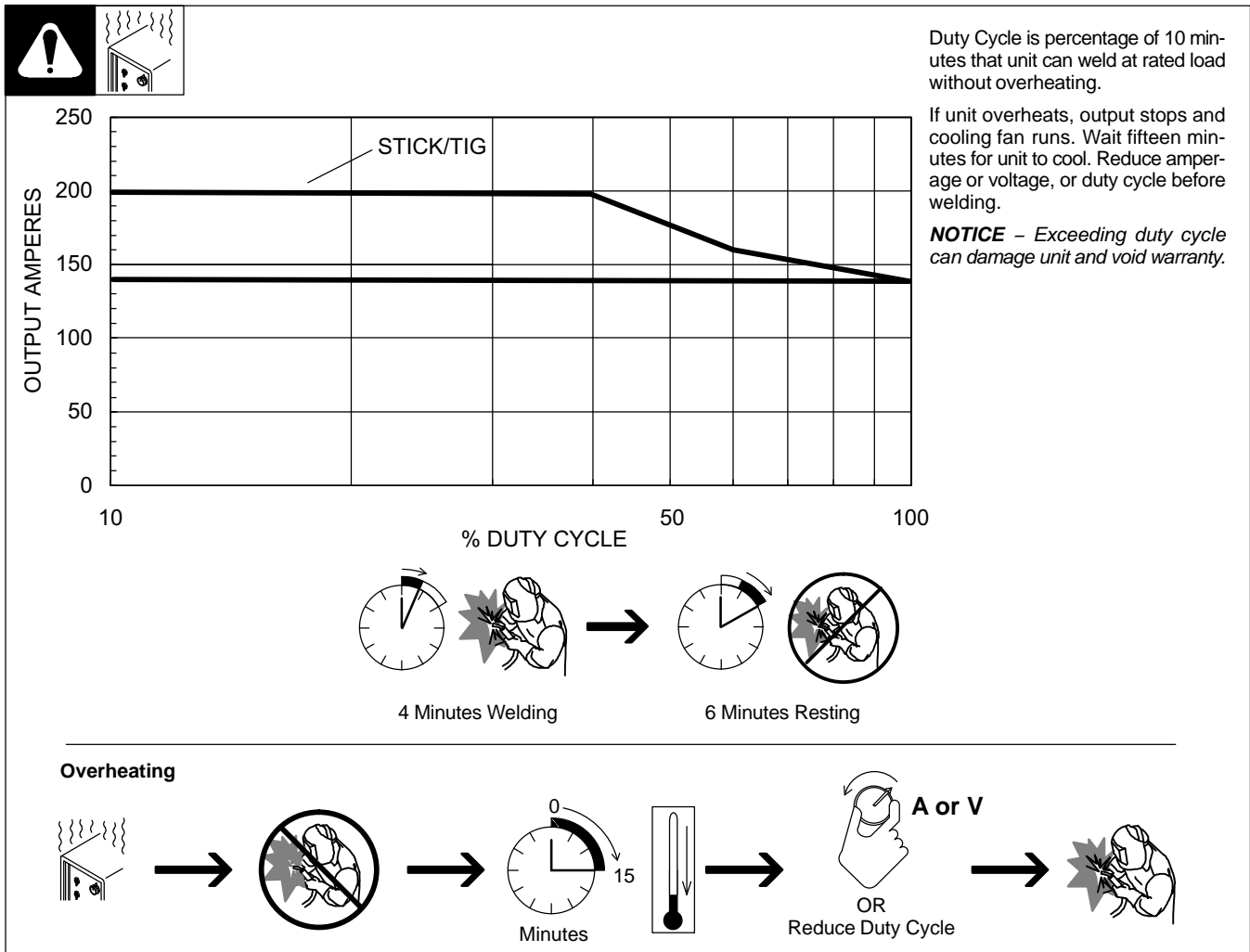
This equipment does not comply with IEC 61000-3-12. If it is connected to a public low voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment can be connected. IEC/TS 61000-3-4 can be used to guide parties concerned by the installation of arc welding equipment with an input current greater than 16 A in a low voltage network.

ce-emc 2 2014-07

3-4. Volt-Ampere Curves

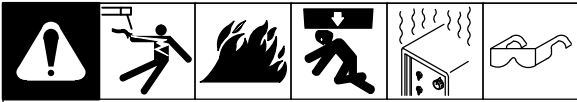


3-5. Duty Cycle And Overheating

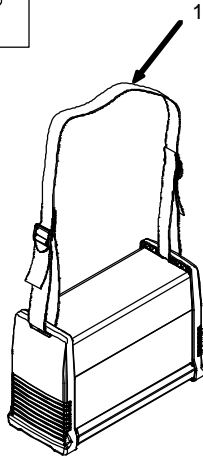


SECTION 4 – INSTALLATION

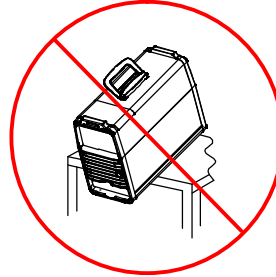
4-1. Selecting a Location



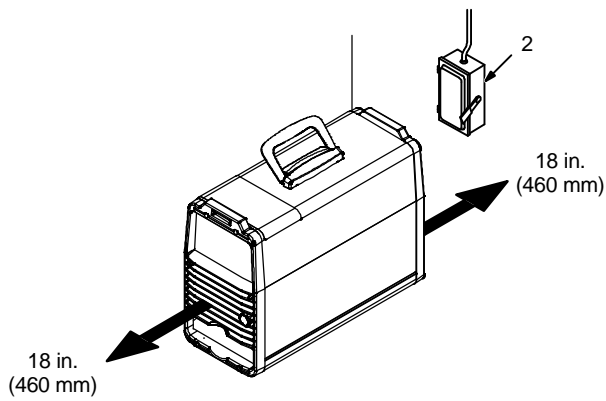
Movement



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



Location And Airflow



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

- 1 Shoulder Strap
Use strap to lift unit.
- 2 Line Disconnect Device
Locate unit near correct input power supply.

loc_small 2015-04

4-2. Selecting Cable Sizes*

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

Welding Amperes	Weld Cable Size** and Total Cable (Copper) Length in Weld Circuit Not Exceeding***							
	30 m (100 ft) or Less		45 m (150 ft)	60 m (200 ft)	70 m (250 ft)	90 m (300 ft)	105 m (350 ft)	120 m (400 ft)
	10 – 60% Duty Cycle mm ² (AWG)	60 – 100% Duty Cycle mm ² (AWG)	10 – 100% Duty Cycle mm ² (AWG)					
100	20 (4)	20 (4)	20 (4)	30 (3)	35 (2)	50 (1)	60 (1/0)	60 (1/0)
150	30 (3)	30 (3)	35 (2)	50 (1)	60 (1/0)	70 (2/0)	95 (3/0)	95 (3/0)
200	30 (3)	35 (2)	50 (1)	60 (1/0)	70 (2/0)	95 (3/0)	120 (4/0)	120 (4/0)

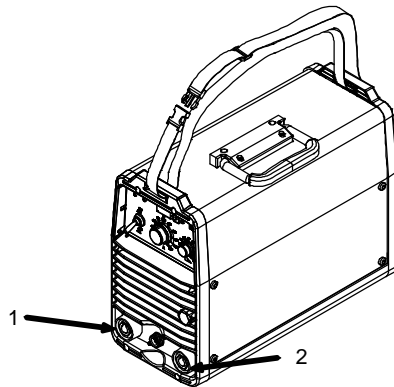
* This chart is a general guideline and may not suit all applications. If cable overheats, use next size larger cable.

**Weld cable size is based on either a 4 volts or less drop or a current density of at least 300 circular mils per ampere.

***For distances longer than those shown in this guide, call a factory applications representative.

Milan Ref. S-0007-L 2015-02

4-3. Weld Output Terminals



⚠ Turn off power before connecting to weld output terminals.

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

- 1 Positive (+) Weld Output Terminal
- 2 Negative (-) Weld Output Terminal

☞ Sections 4-5 and 4-6 for standard connection diagrams.

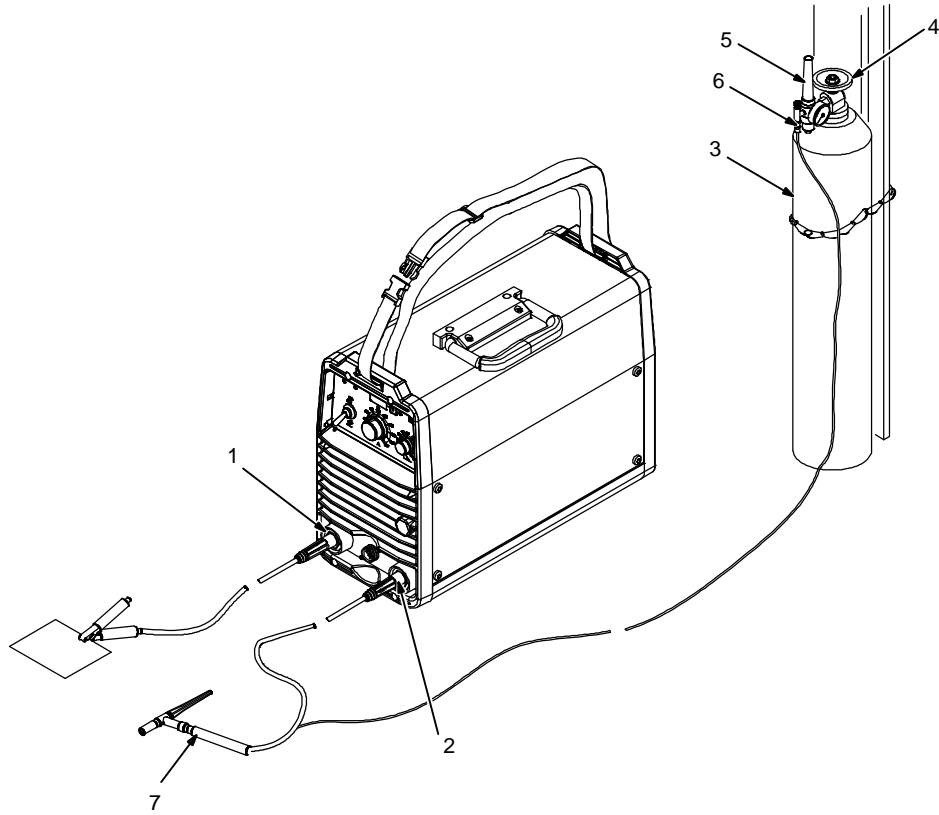
956142915_1-A output term1 2015-02

4-4. Remote 14 Receptacle Information

	REMOTE 14	Socket*	Socket Information
		REMOTE OUTPUT CONTROL	A
B			Contact closure to A completes 24 volt DC contactor control circuit and enables output.
C			Output to remote control; +5 volts DC output to remote control.
D			Remote control circuit common.
E			0 to +5 volts DC input command from remote control.
CHASSIS	G	Chassis common.	

956142915_1-A

4-5. TIG Lift-Arc DCEN (Direct Current Electrode Negative) Connections



⚠ Turn off power before making connections.

1 Positive (+) Weld Output Terminal

Connect work lead to positive weld output terminal.

2 Negative (-) Weld Output Terminal

Connect TIG torch to negative weld output terminal.

3 Gas Cylinder

4 Cylinder Valve

Open valve slightly so gas flow blows dirt from valve. Close valve.

5 Regulator/Flowmeter

6 Flow Adjust

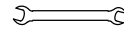
Typical flow rate is 15 cubic feet per hour (7.1 liters per minute).

Connect torch gas hose to regulator/flowmeter.

7 Gas Valve

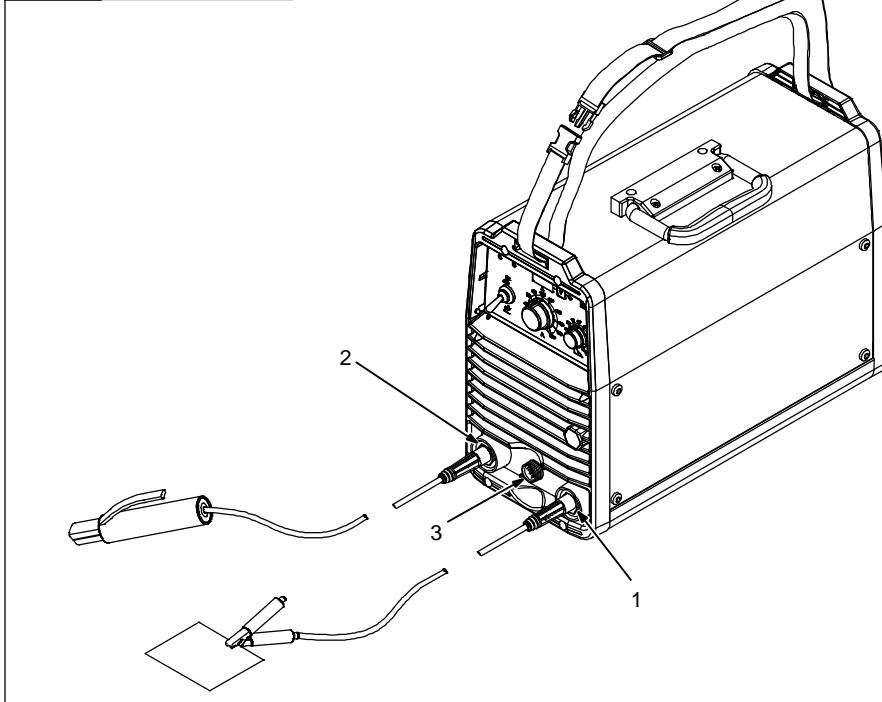
Valve controls gas preflow and postflow. Open valve on torch just before welding.

Tools Needed:



21 mm (11/16, 1-1/8 in.)

4-6. Stick DCEP (Direct Current Electrode Positive) Connections



⚠ Turn off power before making connections.

- 1 Negative (-) Weld Output Terminal

Connect work lead to negative weld output terminal.

- 2 Positive (+) Weld Output Terminal

Connect electrode holder to positive weld output terminal.

- 3 Remote 14 Receptacle

If desired, connect remote control to Remote 14 receptacle (see Section 4-4).

4-7. Electrical Service Guide

Elec Serv 2014-01

Actual input voltage cannot exceed -10% of minimum, or +10% of maximum input voltages indicated in table.

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

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

	Three-Phase, 40% Duty Cycle
Input Voltage (V)	380–440 +/- 10%
Input Amperes (A) At Rated Output	13.5–11.5
Max Recommended Standard Fuse Rating In Amperes ¹	
Time Delay Fuses ²	10
Normal Operating Fuses ³	20
Min Input Conductor Size In AWG ⁴	13 (2.63 mm ²)
Max Recommended Input Conductor Length In Feet (Meters)	(3.5)
Min Grounding Conductor Size In AWG ⁴	13 (2.63 mm ²)

Reference: 2014 National Electrical Code (NEC) (including article 630)

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

2 "Time-Delay" fuses are UL class "RK5" . See UL 248.

3 "Normal Operating" (general purpose - no intentional delay) fuses are UL class "K5" (up to and including 60 amps), and UL class "H" (65 amps and above).

4 Conductor data in this section specifies conductor size (excluding flexible cord or cable) between the panelboard and the equipment per NEC Table 310.15(B)(16). If a flexible cord or cable is used, minimum conductor size may increase. See NEC Table 400.5(A) for flexible cord and cable requirements.

4-8. Connecting Input Power

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

⚠ Disconnect and lockout/tagout input power before connecting input conductors from unit.

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

For Three-Phase Operation

- 1 Input Power Cord.
- 2 Disconnect Device (switch shown in the OFF position)
- 3 Green Or Green/Yellow Grounding Conductor
- 4 Disconnect Device Grounding Terminal
- 5 Input Conductors (L1, L2 And L3)
- 6 Disconnect Device Line Terminals

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

Connect input conductors L1, L2, and L3 to disconnect device line terminals.

7 Over-Current Protection

Select type and size of over-current protection using Section 4-7 (fused disconnect switch shown).

Close and secure door on disconnect device. Remove lockout/tagout device, and place switch in the On position.

Tools Needed:

4-9. Connecting To 3-Phase Engine Generator w/400 Volt Output

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

☞ Obtain a 400 volt plug that matches the receptacle on the engine generator. Install the plug on the cord of the welding power source according to the plug manufacturer's instructions.

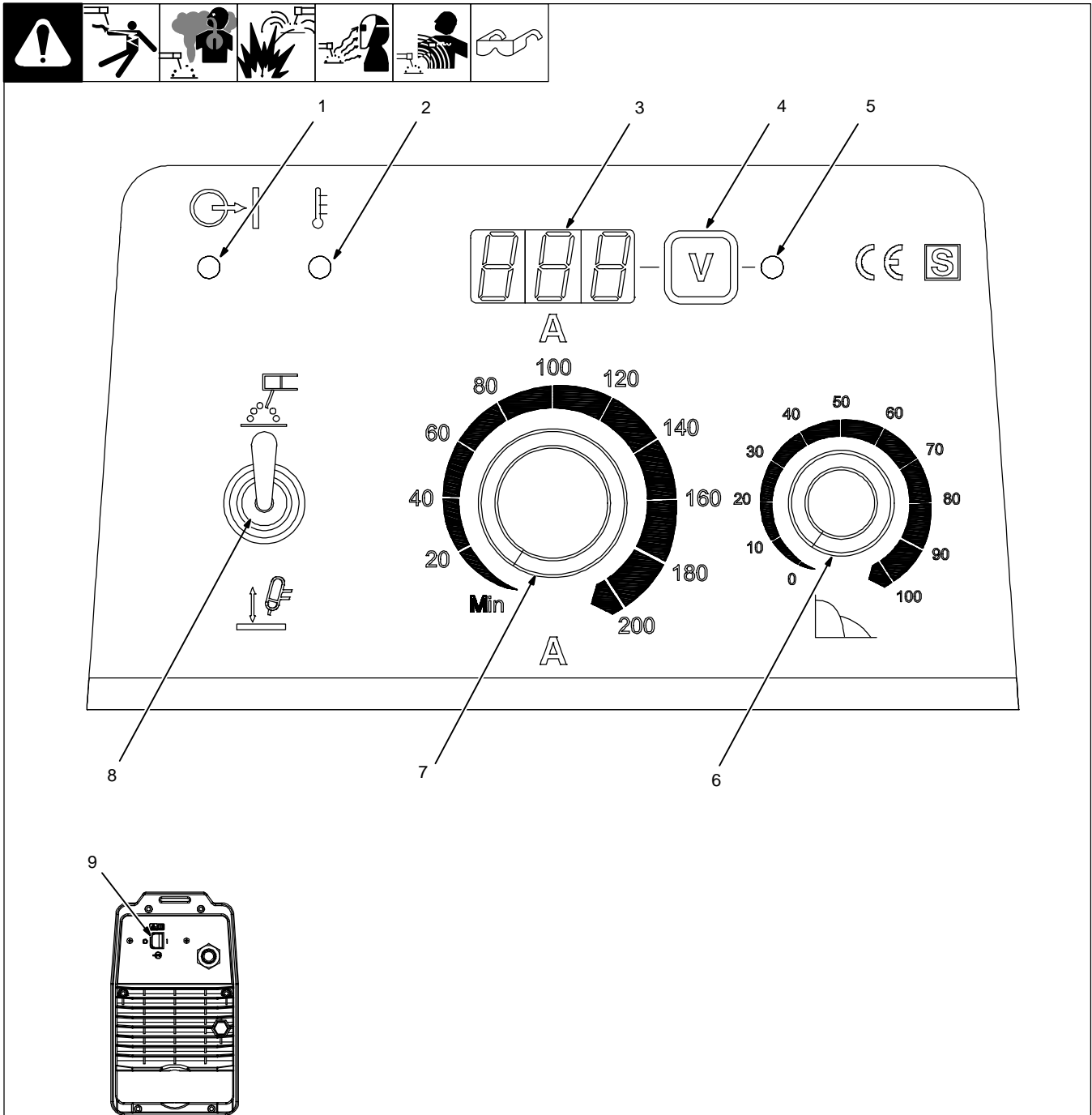
Generator Requirements

- Engine generator must provide the correct input amperage (see Section 4-7).
- Frequency must be between 50 and 60 Hz

NOTICE – Make sure welding power source is off during engine generator start-up. Do not turn on the welding power source until the generator has reached normal operating speed.

SECTION 5 – OPERATION

5-1. Controls



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

1 Power On Light

The power on light turns on when power is turned on.

2 High Temperature Light (LED)

Light comes on if unit overheats. Welding can resume when unit has cooled (see Sections 3-5 and 6-2).

3 Ammeter/Voltage Display (Meter)

Upon power up, selected amperage is displayed for three seconds, after which 000 is displayed.

While welding, actual arc amperage is displayed, not the amperage selected with the Amperage control.

4 Amperage/Voltage Display Push Button

Push button to change between amperage and voltage display.

5 Voltage Display Indicator LED

LED is lit when voltage is being displayed.

6 DIG Control

See Section 5-6.

7 Amperage Control

See Section 5-5.

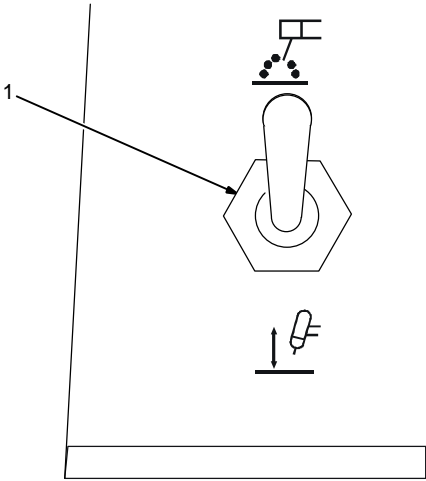
8 Process Controls

See Section 5-2.

9 Power Switch


Use switch to turn unit and indicator light On/Off.


5-2. Process Control




1 Process Control


Use the Process control to select the Stick process (up), or the TIG Lift Arc process (down).

 **Stick (SMAW)** - This is a DCEP (direct current electrode positive) process. Make connections according to Section 4-6.

 **TIG Lift-Arc™** - This is a DCEN (direct current electrode negative) process in which the electrode must come in contact with the work piece to initiate an arc (see Section 5-3). Make connections according to Section 4-5.

5-3. Lift-Arc Start Procedure



 **Lift-Arc Start**

With Lift-Arc™ selected, start arc as follows:

- 1 TIG Electrode
- 2 Workpiece

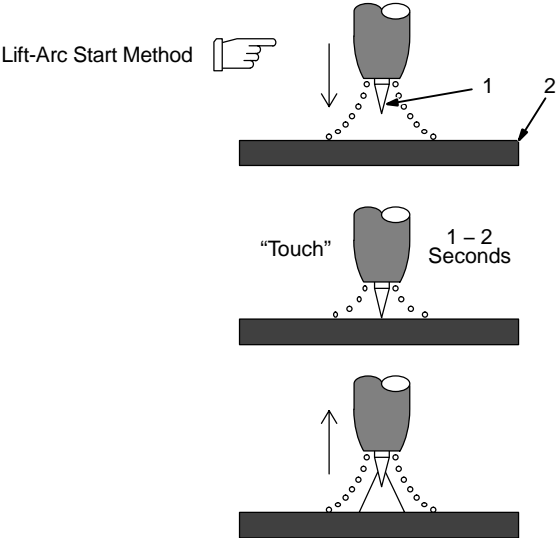
Turn gas on. Touch tungsten electrode to workpiece at weld start point. **Hold electrode to workpiece for 1-2 seconds**, and slowly lift electrode. Arc is formed when electrode is lifted.

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

Application:

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

Lift-Arc Start Method



Do NOT Strike Like A Match!

5-4. Stick Start Procedure – Scratch Start Technique



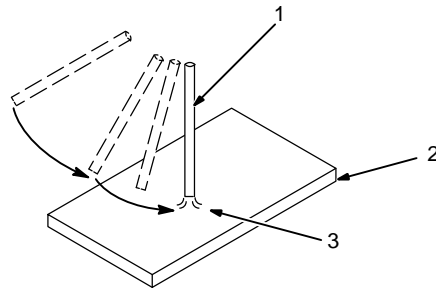
With Stick selected, start arc as follows:

- 1 Electrode
- 2 Workpiece
- 3 Arc

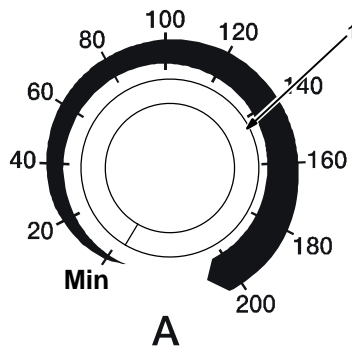
Drag electrode across workpiece like striking a match; lift electrode slightly after touching work. If arc goes out electrode was lifted too high. If electrode sticks to workpiece, use a quick twist to free it.

⚠ For models with stock number 907 220, normal open-circuit voltage (80 volts) is present before electrode touches workpiece.

For models with stock numbers 907 036 and 907 037, normal open-circuit voltage is not present before electrode touches workpiece; only a low sensing voltage is present between electrode and workpiece.

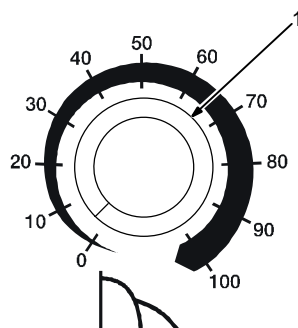


5-5. Amperage Control



A 1 A (Amperage Control)
Rotate knob clockwise to increase amperage (Min-200 amps).

5-6. DIG Control



D 1 DIG Control
Control increases SMAW short-circuit amperage at low arc voltage. This allows the operator to use a very short arc length without sticking the electrode.

Set control at 0 for normal welding amperage. Turn clockwise to increase short-circuit amperage.

SECTION 6 – MAINTENANCE AND TROUBLESHOOTING

6-1. Routine Maintenance

					Disconnect power before maintaining.
<i>Maintain more often during severe conditions.</i>					

A. Welding Power Source

	✓ = Check * To be done by Factory Authorized Service Agent	◇ = Change	● = Clean	△ = Repair	☆ = Replace
Every 3 Months					
	✓☆ Labels		✓☆ Gas Hoses		
Every 3 Months					
Every 6 Months	<p>Do not remove case when blowing out inside of unit (see Section 6-3).</p>				
	<p>●: During heavy service, clean monthly.</p>				

6-2. High Temperature Help Display

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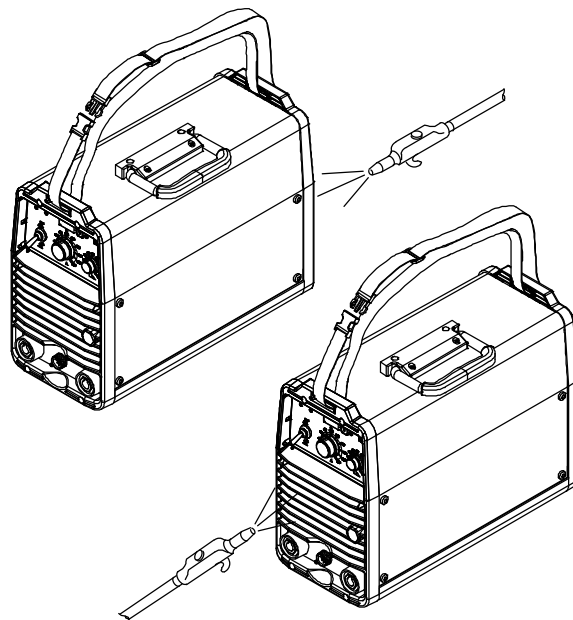
1 High Temperature Light (LED)
2 Meter Help Display

When unit over heats, High Temperature light turns on and unit emits an audible beep. The meter displays three dashes as shown. Unit shuts down and fans run until temperature drops within normal operating range (see Section 3-5).

NOTICE – Wait at least four minutes before checking to see if temperature is within normal operating range.

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6-3. Blowing Out Inside Of Unit



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

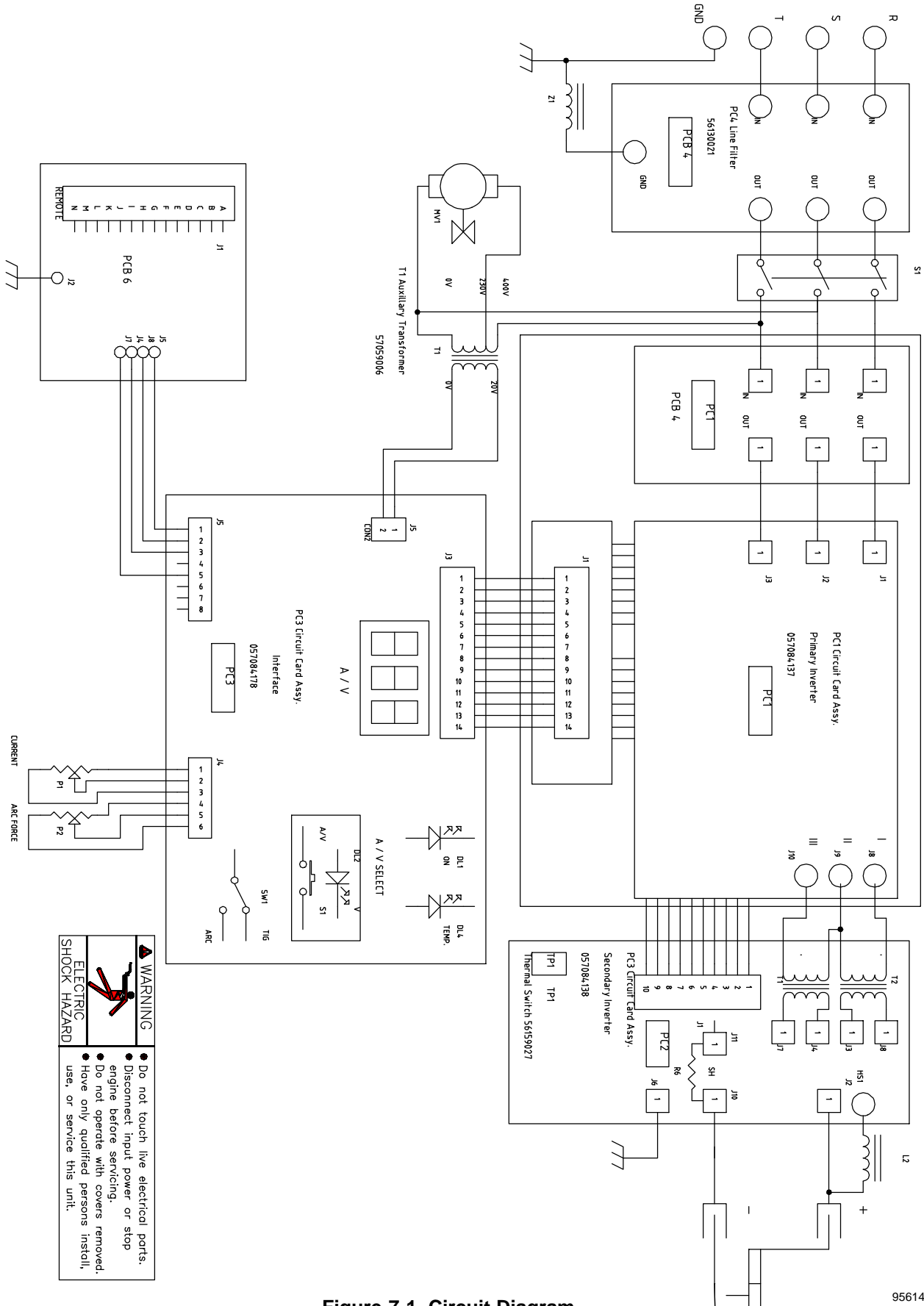
To blow out unit, direct airflow through front and back louvers as shown.

6-4. Troubleshooting



Trouble	Remedy
No weld output; unit completely inoperative.	Place line disconnect switch in On position (see Section 4-8).
	Check and replace line fuse(s), if necessary, or reset circuit breaker (see Section 4-8).
	Check for proper input power connections (see Section 4-8).
No weld output; Output LED on.	Input voltage outside acceptable range of variation (see Section 4-7).
No weld output; Overtemp LED on.	Unit overheated. Allow unit to cool with fan On (see Sections 3-5).
Erratic or improper weld output.	Use proper size and type of weld cable (see Section 4-2).
	Clean and tighten all weld connections (see Section 4-2).
Fan not operating.	Check for and remove anything blocking fan movement.
	Have Factory Authorized Service Agent check fan motor.
Wandering arc	Use proper size tungsten (see Section 9).
	Use properly prepared tungsten (see Section 9).
	Reduce gas flow rate (see Section 4-5).
Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Shield weld zone from drafts.
	Allow adequate postflow time to shield tungsten while it cools, after welding stops.
	Check and tighten all gas fittings (see Section 4-5).
	Water in torch. Refer to torch manual.

SECTION 7 – ELECTRICAL DIAGRAMS




	WARNING	<ul style="list-style-type: none"> Do not touch live electrical parts. Disconnect input power or stop engine before servicing. Do not operate with covers removed. Have only qualified persons install, use, or service this unit.
	ELECTRIC SHOCK HAZARD	

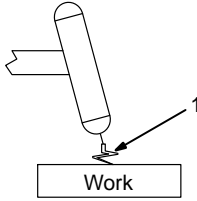
Figure 7-1. Circuit Diagram

956142913-B

SECTION 8 – HIGH FREQUENCY

8-1. Welding Processes Requiring High Frequency






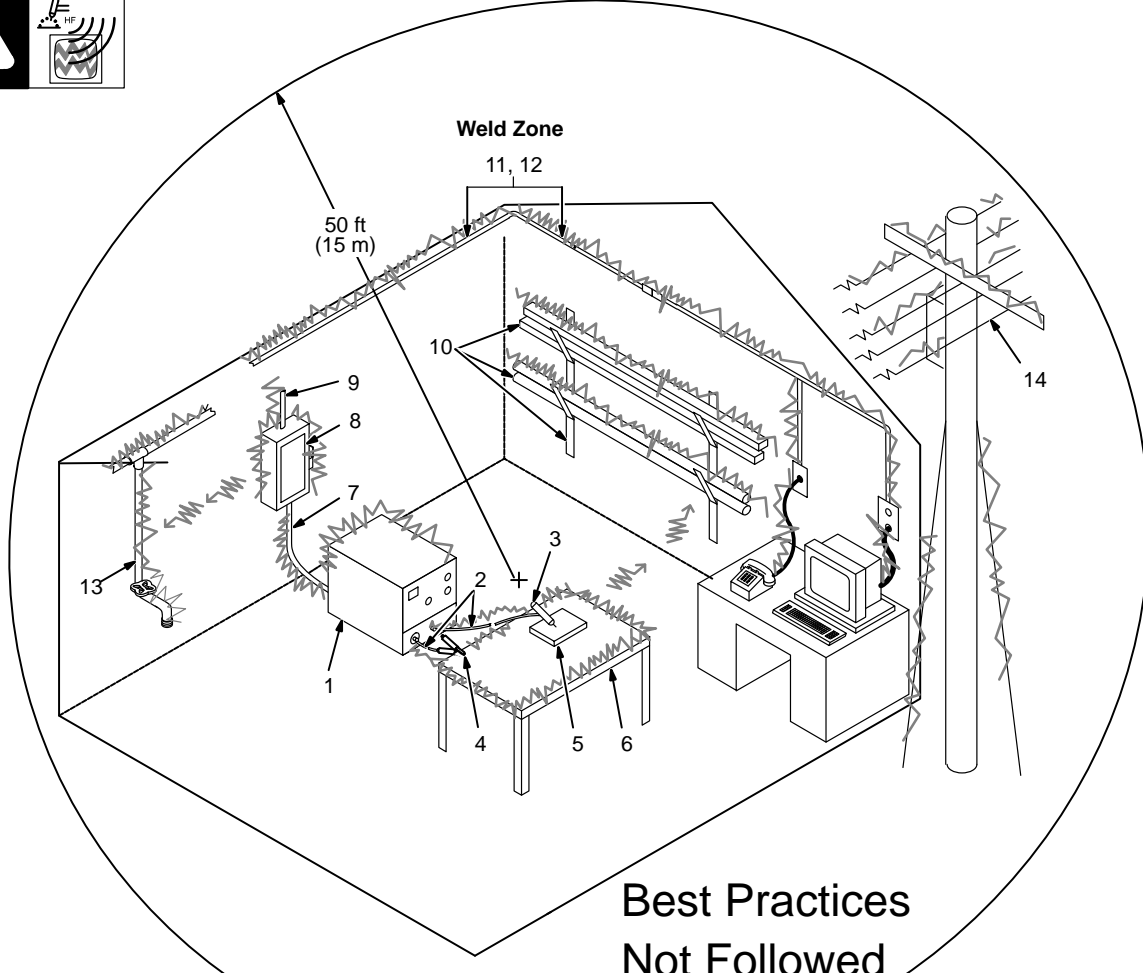
TIG

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

high_freq 5/10 – S-0693

8-2. Installation Showing Possible Sources Of HF Interference



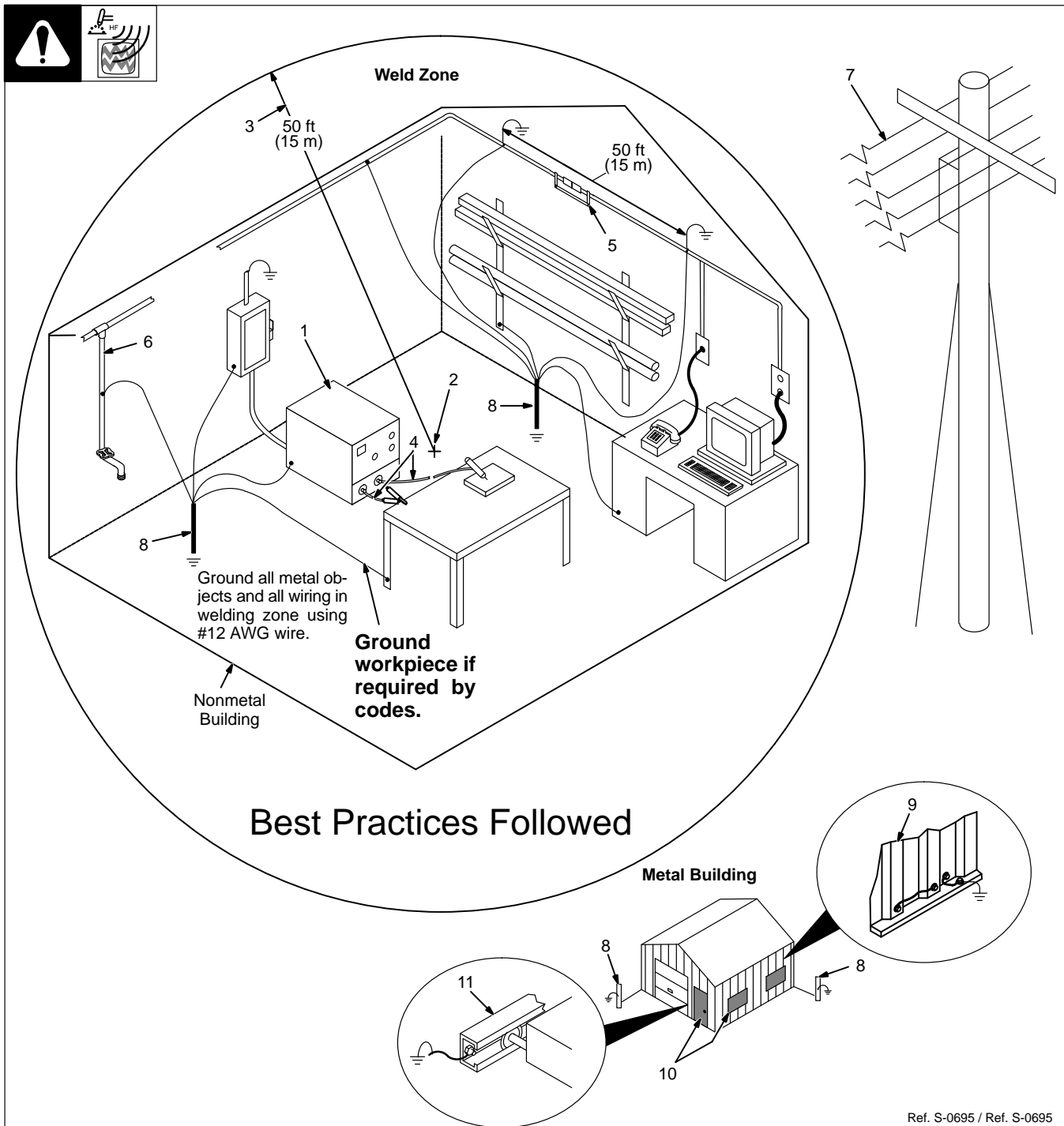


Best Practices
Not Followed

Sources of Direct High-Frequency Radiation	Sources of Conduction of High Frequency	Sources of Reradiation of High Frequency
1 High-Frequency Source (welding power source with built-in HF or separate HF unit)	7 Input Power Cable	10 Ungrounded Metal Objects
2 Weld Cables	8 Line Disconnect Device	11 Lighting
3 Torch	9 Input Supply Wiring	12 Wiring
4 Work Clamp		13 Water Pipes and Fixtures
5 Workpiece		14 External Phone and Power Lines
6 Work Table		

S-0694

8-3. Recommended Installation To Reduce HF Interference



- 1 High-Frequency Source (welding power source with built-in HF or separate HF unit)
Ground metal machine case (clean paint from around hole in case, and use case screw), work output terminal, line disconnect device, input supply, and worktable.
- 2 Center Point of Welding Zone
Midpoint between high-frequency source and welding torch.
- 3 Welding Zone
A circle 50 ft (15 m) from center point in all directions.
- 4 Weld Output Cables
Keep cables short and close together.

- 5 Conduit Joint Bonding and Grounding
Electrically join (bond) all conduit sections using copper straps or braided wire. Ground conduit every 50 ft (15 m).
- 6 Water Pipes and Fixtures
Ground water pipes every 50 ft (15 m).
- 7 External Power or Telephone Lines
Locate high-frequency source at least 50 ft (15 m) away from power and phone lines.
- 8 Grounding Rod
Consult the National Electrical Code for specifications.

- Metal Building Requirements**
- 9 Metal Building Panel Bonding Methods
Bolt or weld building panels together, install copper straps or braided wire across seams, and ground frame.
 - 10 Windows and Doorways
Cover all windows and doorways with grounded copper screen of not more than 1/4 in (6.4 mm) mesh.
 - 11 Overhead Door Track
Ground the track.

Ref. S-0695 / Ref. S-0695

SECTION 9 – SELECTING AND PREPARING A TUNGSTEN FOR DC OR AC WELDING WITH INVERTER MACHINES

gtaw_Inverter_2013-10



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

9-1. Selecting Tungsten Electrode (Wear Clean Gloves To Prevent Contamination Of Tungsten)

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

Electrode Diameter	Amperage Range - Gas Type ♦ - Polarity	
	(DCEN) – Argon Direct Current Electrode Negative (For Use With Mild Or Stainless Steel)	AC – Argon Balance Control @ 65% Electrode Negative (For Use With Aluminum)
2% Ceria, 1.5% Lanthanum, Or 2% Thorium Alloy Tungstens		
.010 in. (.25 mm)	Up to 25	Up to 20
.020 in. (.50 mm)	15-40	15-35
.040 in. (1 mm)	25-85	20-80
1/16 in. (1.6 mm)	50-160	50-150
3/32 in. (2.4 mm)	130-250	135-235
1/8 in. (3.2 mm)	250-400	225-360
5/32 in. (4.0 mm)	400-500	300-450
3/16 in (4.8 mm)	500-750	400-500
1/4 in. (6.4 mm)	750-1000	600-800

♦ Typical argon shielding gas flow rates are 11 to 35 CFH (cubic feet per hour).

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

9-2. Preparing Tungsten Electrode For DC Electrode Negative (DCEN) Welding Or AC Welding With Inverter Machines



Grinding the tungsten electrode produces dust and flying sparks which can cause injury and start fires. Use local exhaust (forced ventilation) at the grinder or wear an approved respirator. Read MSDS for safety information. Consider using tungsten containing ceria, lanthana, or yttria instead of thoria. Grinding dust from thoriated electrodes contains low-level radioactive material. Properly dispose of grinder dust in an environmentally safe way. Wear proper face, hand, and body protection. Keep flammables away.

Radial Grinding Causes Wandering Arc

Wrong Tungsten Preparation

2-1/2 Times Electrode Diameter

1 Grinding Wheel

2 Tungsten Electrode

3 Flat

4 Straight Ground

Ideal Tungsten Preparation – Stable Arc

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

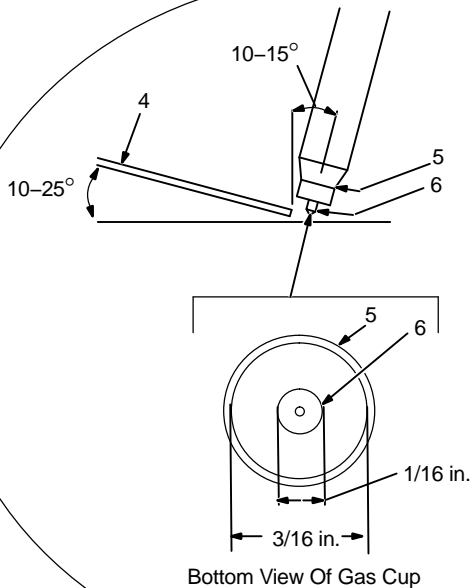
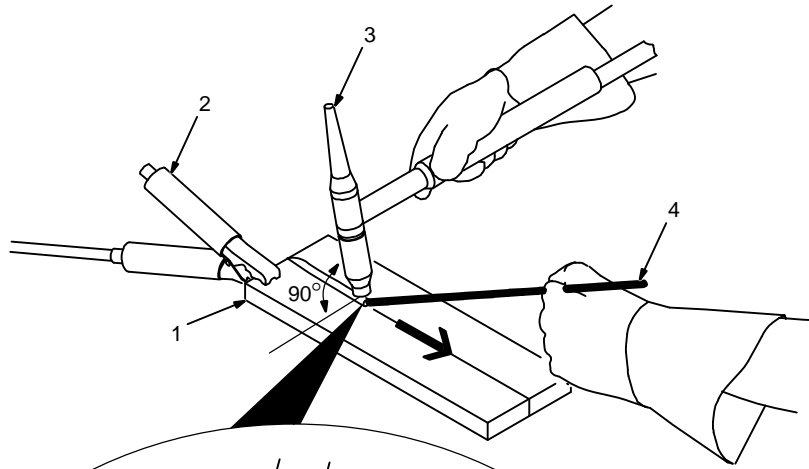
2 Tungsten Electrode
A 2% ceriated tungsten is recommended.

3 Flat
Diameter of this flat determines amperage capacity.

4 Straight Ground
Grind lengthwise, **not radial**.

SECTION 10 – GUIDELINES FOR TIG WELDING (GTAW)

10-1. Positioning The Torch



⚠ Grinding the tungsten electrode produces dust and flying sparks which can cause injury and start fires. Use local exhaust (forced ventilation) at the grinder or wear an approved respirator. Read MSDS for safety information. Consider using cerium or lanthanum based tungsten instead of thoriated. Thorium dust contains low-level radioactive material. Properly dispose of grinder dust in an environmentally safe way. Wear proper face, hand, and body protection. Keep flammables away.

- 1 Workpiece
Make sure workpiece is clean before welding.
- 2 Work Clamp
Place as close to the weld as possible.
- 3 Torch
- 4 Filler Rod (If Applicable)
- 5 Gas Cup
- 6 Tungsten Electrode

Select and prepare tungsten according to Section 9.

Guidelines:

The inside diameter of the gas cup should be at least three times the tungsten diameter to provide adequate shielding gas coverage. (For example, if tungsten is 1/16 in. diameter, gas cup should be a minimum of 3/16 in. diameter.)

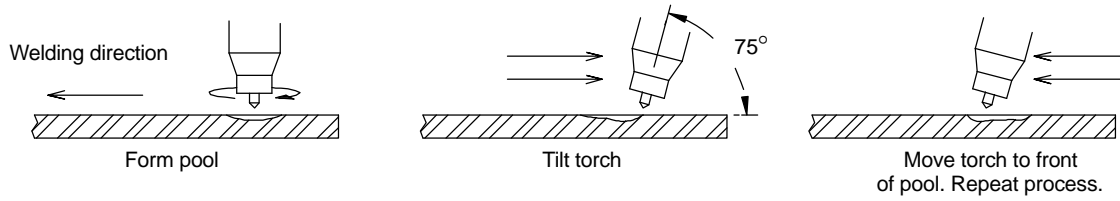
Tungsten extension is the distance the tungsten extends out gas cup of torch.

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

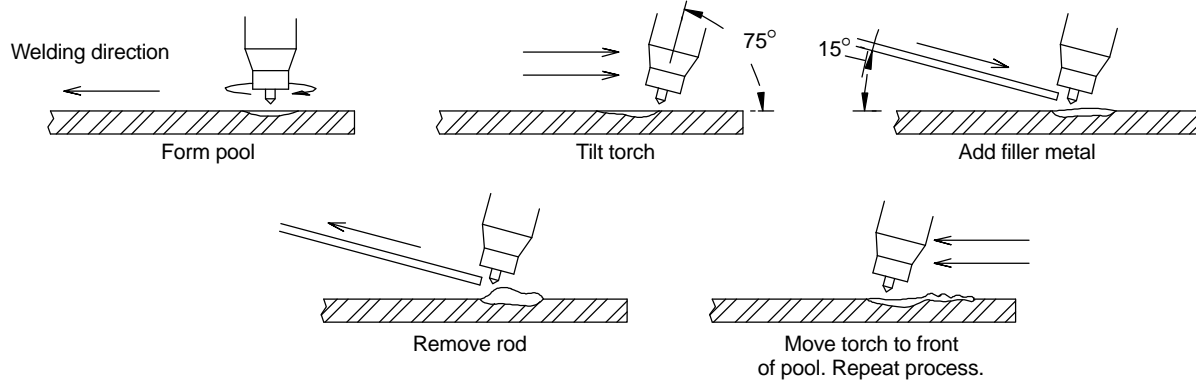
Arc length is the distance from the tungsten to the workpiece.

10-2. Torch Movement During Welding

Tungsten Without Filler Rod



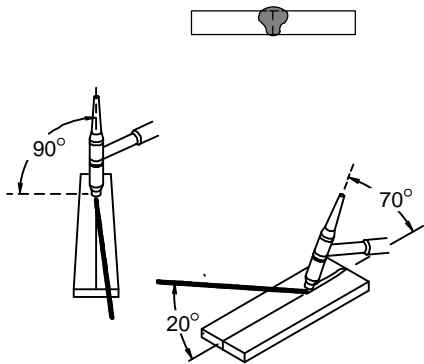
Tungsten With Filler Rod



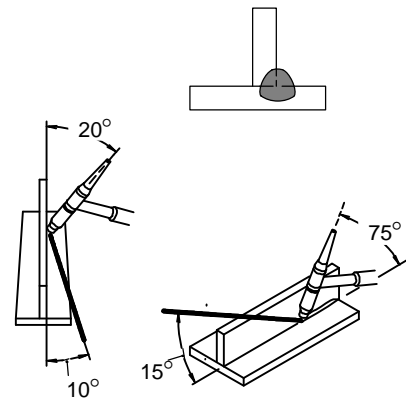
ST-162 002-B

10-3. Positioning Torch Tungsten For Various Weld Joints

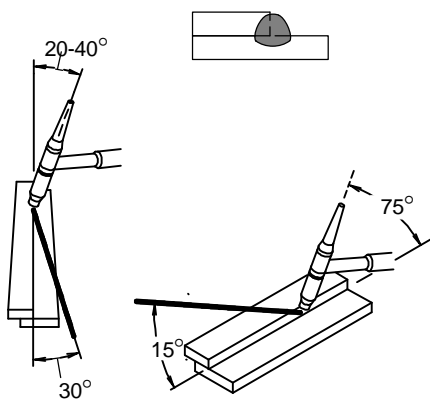
Butt Weld And Stringer Bead



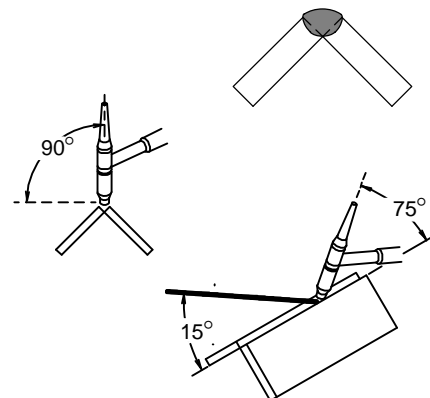
"T" Joint



Lap Joint



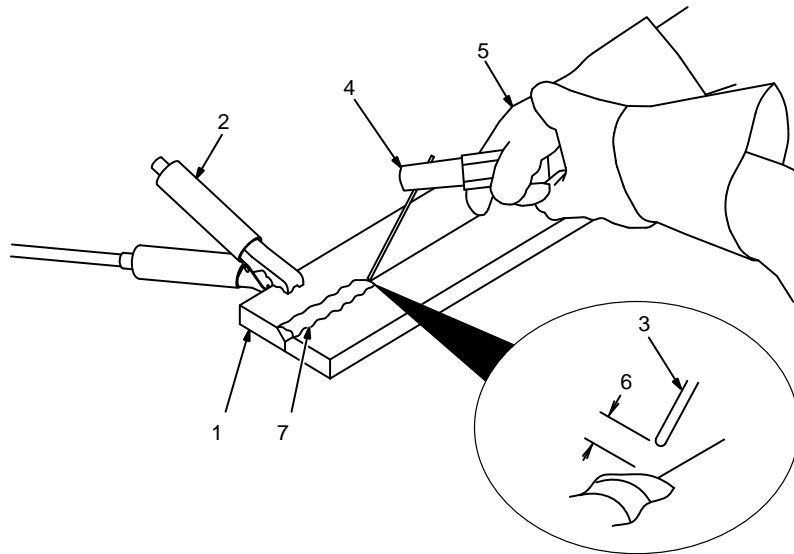
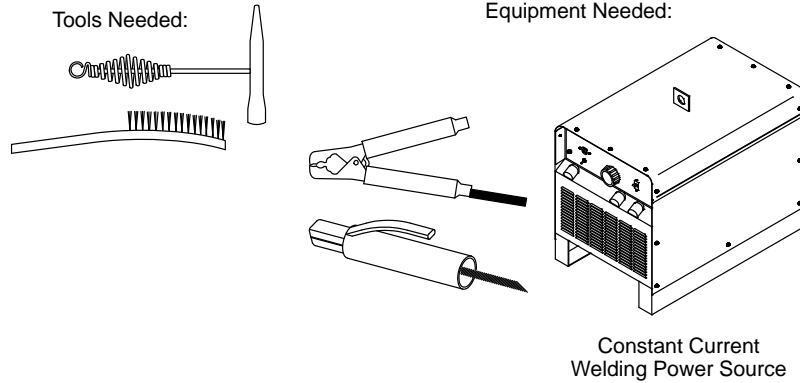
Corner Joint



ST-162 003 / S-0792

SECTION 11 – STICK WELDING (SMAW) GUIDELINES

11-1. Stick Welding Procedure



⚠ Weld current starts when electrode touches workpiece.

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

📖 Always wear appropriate personal protective clothing.

1 Workpiece

Make sure workpiece is clean before welding.

2 Work Clamp

Place as close to the weld as possible.

3 Electrode

Before striking an arc, insert an electrode in the electrode holder. A small diameter electrode requires less current than a large one. Follow recommendations of the electrode manufacturer when setting weld amperage (see Section 11-2).

4 Insulated Electrode Holder

5 Electrode Holder Position

6 Arc Length

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

Arc length for 1/16 and 3/32 in. diameter electrodes should be about 1/16 in. (1.6 mm); arc length for 1/8 and 5/32 in. electrodes should be about 1/8 in. (3 mm).

7 Slag

Use a chipping hammer and wire brush to remove slag. Remove slag and check weld bead before making another weld pass.

11-2. Electrode and Amperage Selection Chart



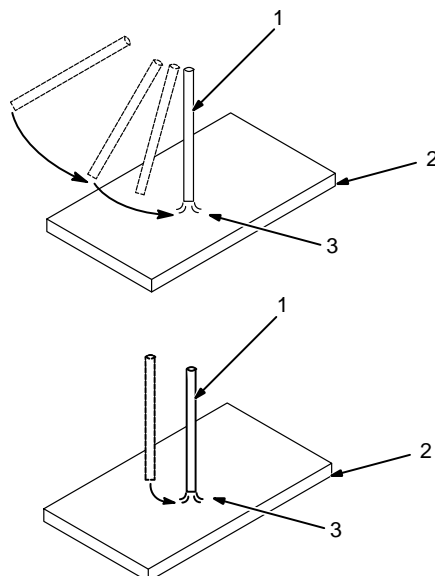
ELECTRODE	DIAMETER	AMPERAGE RANGE								
		50	100	150	200	250	300	350	400	450
6010 & 6011	3/32									
	1/8									
	5/32									
	3/16									
	7/32									
6013	1/4									
	1/16									
	5/64									
	3/32									
	1/8									
7014	5/32									
	3/16									
	7/32									
	1/4						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

ELECTRODE	DC*	AC	POSITION	PENETRATION	USAGE
6010	EP		ALL	DEEP	MIN. PREP, ROUGH HIGH SPATTER
6011	EP	✓	ALL	DEEP	MIN. PREP, ROUGH HIGH SPATTER
6013	EP,EN	✓	ALL	LOW	GENERAL
7014	EP,EN	✓	ALL	MED	SMOOTH, EASY, FAST
7018	EP	✓	ALL	MED	LOW HYDROGEN, STRONG
7024	EP,EN	✓	FLAT HORIZ FILLET	LOW	SMOOTH, EASY, FASTER
NI-CL	EP	✓	ALL	LOW	CAST IRON
308L	EP	✓	ALL	LOW	STAINLESS

*EP = ELECTRODE POSITIVE (REVERSE POLARITY)
EN = ELECTRODE NEGATIVE (STRAIGHT POLARITY)

Ref. S-087 985-A

11-3. Striking an Arc



⚠ Weld current starts when electrode touches workpiece.

- 1 Electrode
- 2 Workpiece
- 3 Arc

Scratch Technique

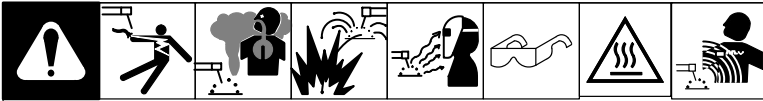
Drag electrode across workpiece like striking a match; lift electrode slightly after touching work. If arc goes out, electrode was lifted too high. If electrode sticks to workpiece, use a quick twist to free it.

Tapping Technique

Bring electrode straight down to workpiece; then lift slightly to start arc. If arc goes out, electrode was lifted too high. If electrode sticks to workpiece, use a quick twist to free it.

S-0049 / S-0050

11-4. Positioning Electrode Holder

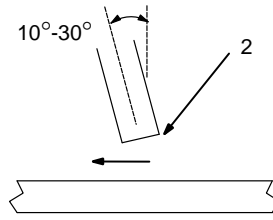
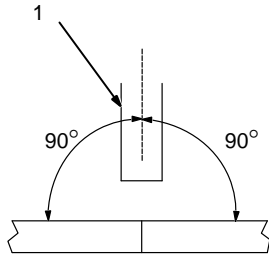


- 1 End View Of Work Angle
- 2 Side View Of Electrode Angle

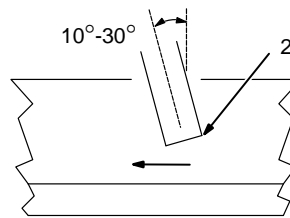
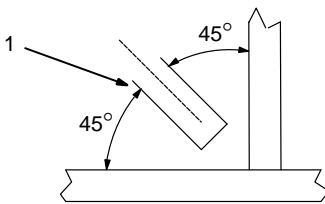
After learning to start and hold an arc, practice running beads of weld metal on flat plates using a full electrode.

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

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



Groove Welds



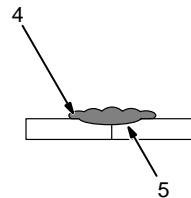
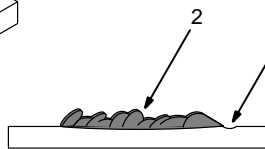
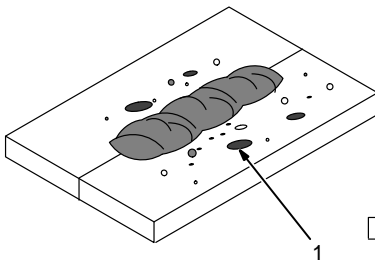
Fillet Welds

S-0060

11-5. Poor Weld Bead Characteristics

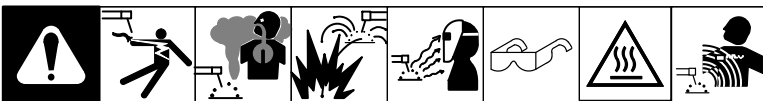


- 1 Large Spatter Deposits
- 2 Rough, Uneven Bead
- 3 Slight Crater During Welding
- 4 Bad Overlap
- 5 Poor Penetration



S-0053-A

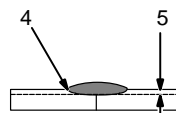
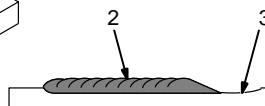
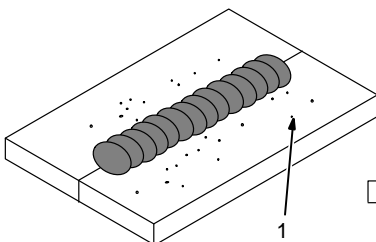
11-6. Good Weld Bead Characteristics



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

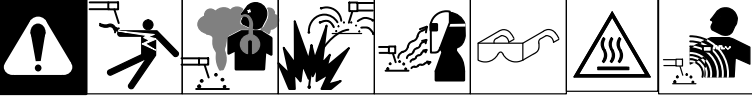
Weld a new bead or layer for each 1/8 in. (3.2 mm) thickness in metals being welded.

- 4 No Overlap
- 5 Good Penetration into Base Metal



S-0052-B

11-7. Conditions That Affect Weld Bead Shape



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

Electrode Angle

Angle Too Small Correct Angle $10^{\circ} - 30^{\circ}$ Angle Too Large

Drag

Arc Length

Too Short Normal Too Long

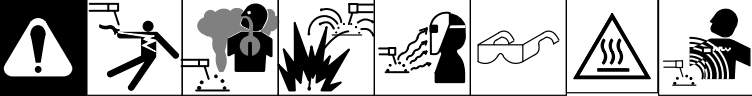
Spatter

Travel Speed

Slow Normal Fast

S-0061

11-8. Electrode Movement During Welding



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

1 Stringer Bead – Steady Movement Along Seam


2 Weave Bead – Side to Side Movement Along Seam

3 Weave Patterns

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

S-0054-A

11-9. Welding Lap Joints



1 Electrode

2 Single-Layer Fillet Weld

3 Multi-Layer Fillet Weld

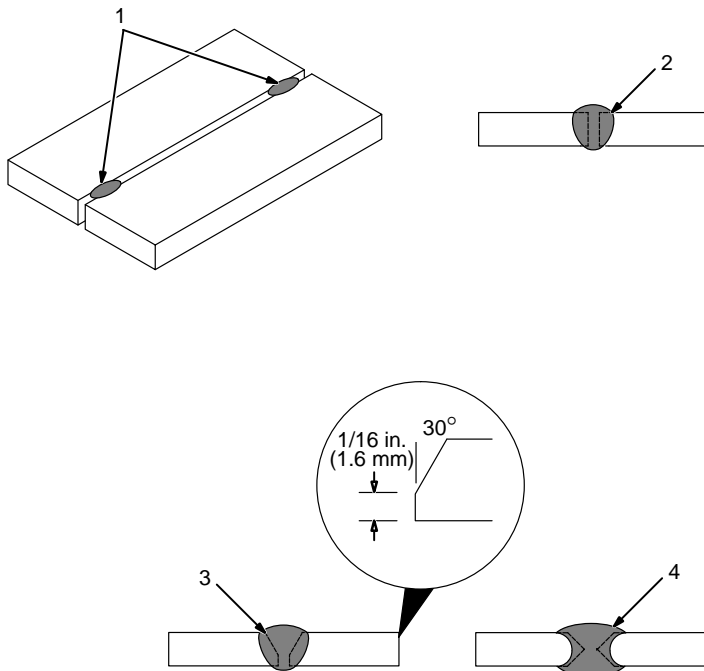
30° Or Less

30° Or Less

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

S-0063 / S-0064

11-10. Welding Groove (Butt) Joints



1 Tack Welds

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

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

2 Square Groove Weld

3 Single V-Groove Weld

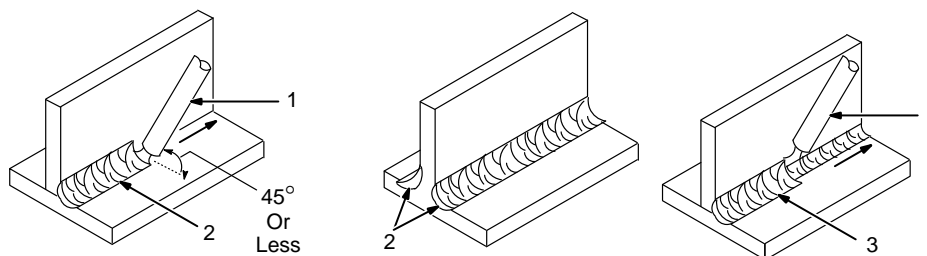
4 Double V-Groove Weld

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

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

S-0062

11-11. Welding Tee Joints



1 Electrode

2 Fillet Weld

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

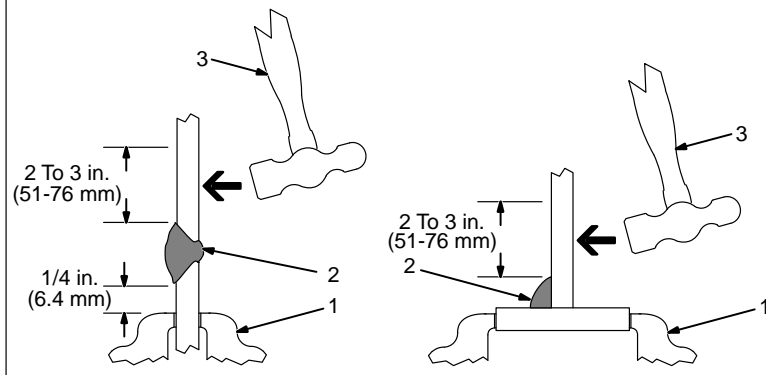
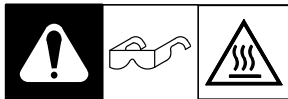
For maximum strength weld both sides of upright section.

3 Multi-Layer Deposits

Weld a second layer when a heavier fillet is needed. Use any of the weaving patterns shown in Section 11-8. Remove slag before making another weld pass.

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

11-12. Weld Test



- 1 Vise
- 2 Weld Joint
- 3 Hammer

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

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

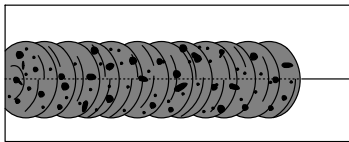
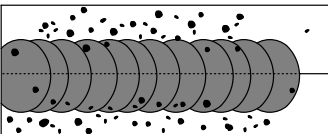
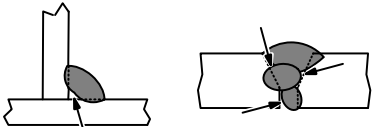
If the weld is porous (many holes), the arc length was probably too long.

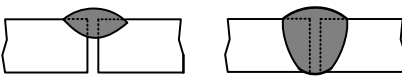
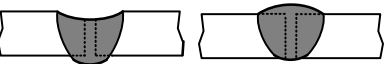
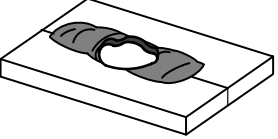
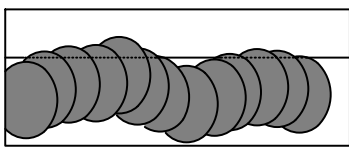
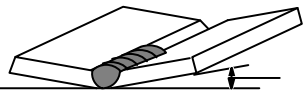
If the weld contains bits of slag, the arc may have been too long or the electrode was moved incorrectly which allowed molten slag to be trapped in the weld. This may happen on a V-groove joint made in several layers and calls for additional cleaning between layers.

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


S-0057-B

11-13. Troubleshooting

	<p>Porosity – small cavities or holes resulting from gas pockets in weld metal.</p>
<p>Possible Causes</p>	<p>Corrective Actions</p>
<p>Arc length too long.</p>	<p>Reduce arc length.</p>
<p>Damp electrode.</p>	<p>Use dry electrode.</p>
<p>Workpiece dirty.</p>	<p>Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.</p>
	<p>Excessive Spatter – scattering of molten metal particles that cool to solid form near weld bead.</p>
<p>Possible Causes</p>	<p>Corrective Actions</p>
<p>Amperage too high for electrode.</p>	<p>Decrease amperage or select larger electrode.</p>
<p>Arc length too long or voltage too high.</p>	<p>Reduce arc length or voltage.</p>
	<p>Incomplete Fusion – failure of weld metal to fuse completely with base metal or a preceding weld bead.</p>
<p>Possible Causes</p>	<p>Corrective Actions</p>
<p>Insufficient heat input.</p>	<p>Increase amperage. Select larger electrode and increase amperage.</p>
<p>Improper welding technique.</p>	<p>Place stringer bead in proper location(s) at joint during welding.</p>
	<p>Adjust work angle or widen groove to access bottom during welding.</p>
	<p>Momentarily hold arc on groove side walls when using weaving technique.</p>
<p>Keep arc on leading edge of weld puddle.</p>	
<p>Workpiece dirty.</p>	<p>Remove all grease, oil, moisture, rust, paint, coatings, slag, and dirt from work surface before welding.</p>

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

SECTION 12 – PARTS LIST

 Hardware is common and not available unless listed.

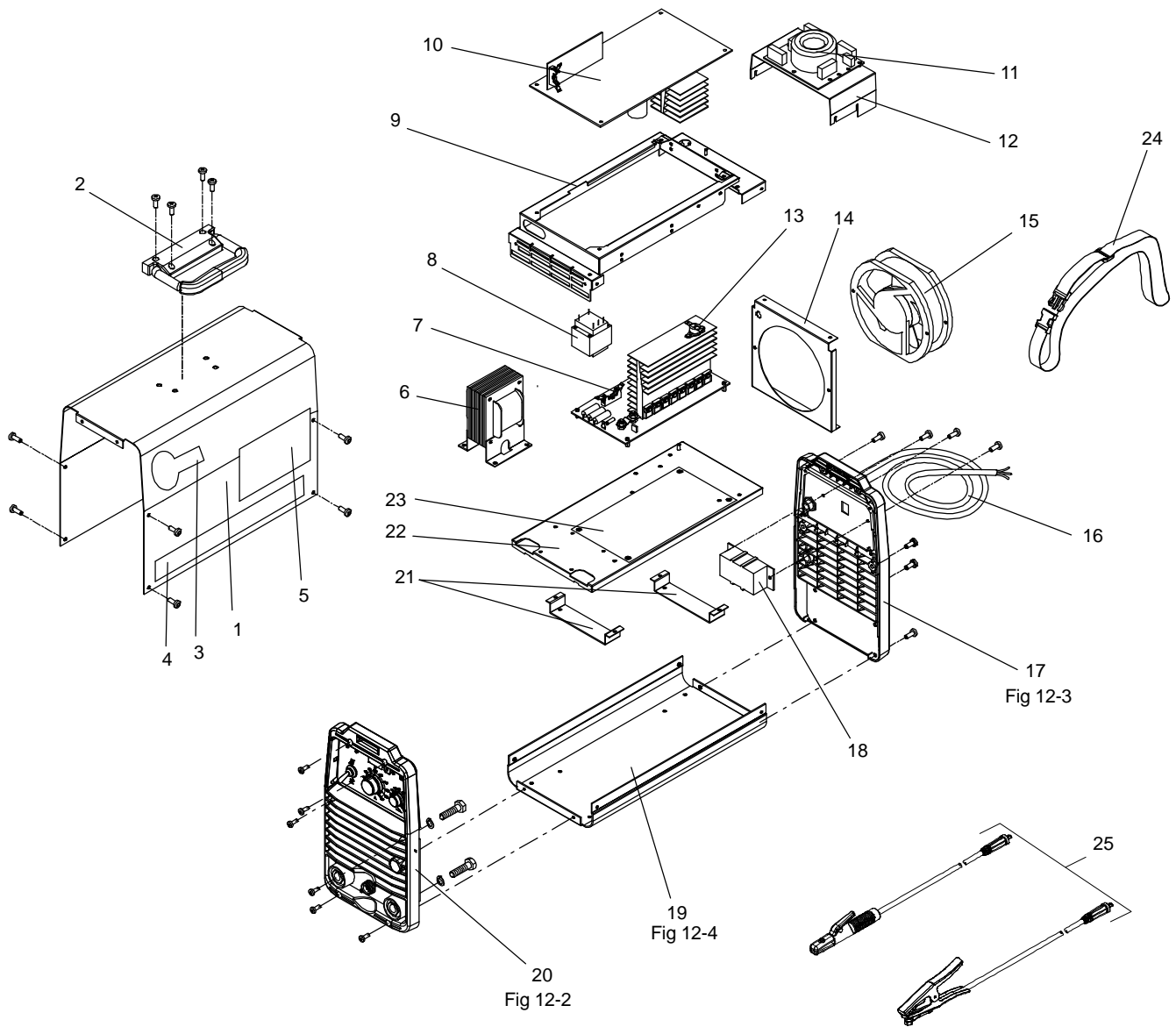


Figure 12-1. Main Assembly

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure 12-1. Main Assembly

1		+156121039	Wrapper	1
2		195585	Handle	1
3		199478	Label, Miller 6.000 X 2.500 Horizontal	2
4		956142676	Label, Side STi 203	2
5		179310	Label, Gen. Precautionary	2
6	Z1	57059007	Stabilizer Assy	1
7	PC2	057084138	PC2 Circuit Card Assy, Secondary Inverter	1
8	T1	57059006	Auxiliary Transformer	1
9		156005142	Support, Inverter PCB	1
10	PC1	057084137	PC1 Circuit Card Assy, Primary Inverter	1
11	PC4	56130021	PC4 Line Filter Board	1
12		156005139	Support, Line Input Filter PCB	1
13	TP1	56159027	Thermal Switch	1
14		156005138	Fan Motor, Support	1
15	FM1	56126076	Fan Motor	1
16		57014221	Cable, Primary 4 Core 2.5mm ²	1
17		Fig 12-3	Panel, Rear w/Components	1
18	S1	128756	Switch, Tgl 3Pst 40A 600 VAC Scr Term Wide Tgl	1
19		Fig 12-4	Base, Assembly w/Components	1
20		Fig 12-2	Panel, Front w/Components	1
21		756005028	Support, Intermediate, Panel	2
22		156118058	Intermediate, Panel	1
23		756084029	Mylar insulating	1
24		195663	Strap, Shoulder Assy 6 ft	1
25		058066104	Electrode Holder/Ground Clamp Cable Set, 3 Mt	1

+When ordering a component originally displaying a precautionary label, the label should also be ordered.

To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts.

Model and serial number required when ordering parts from your local distributor.

☞ Hardware is common and not available unless listed.

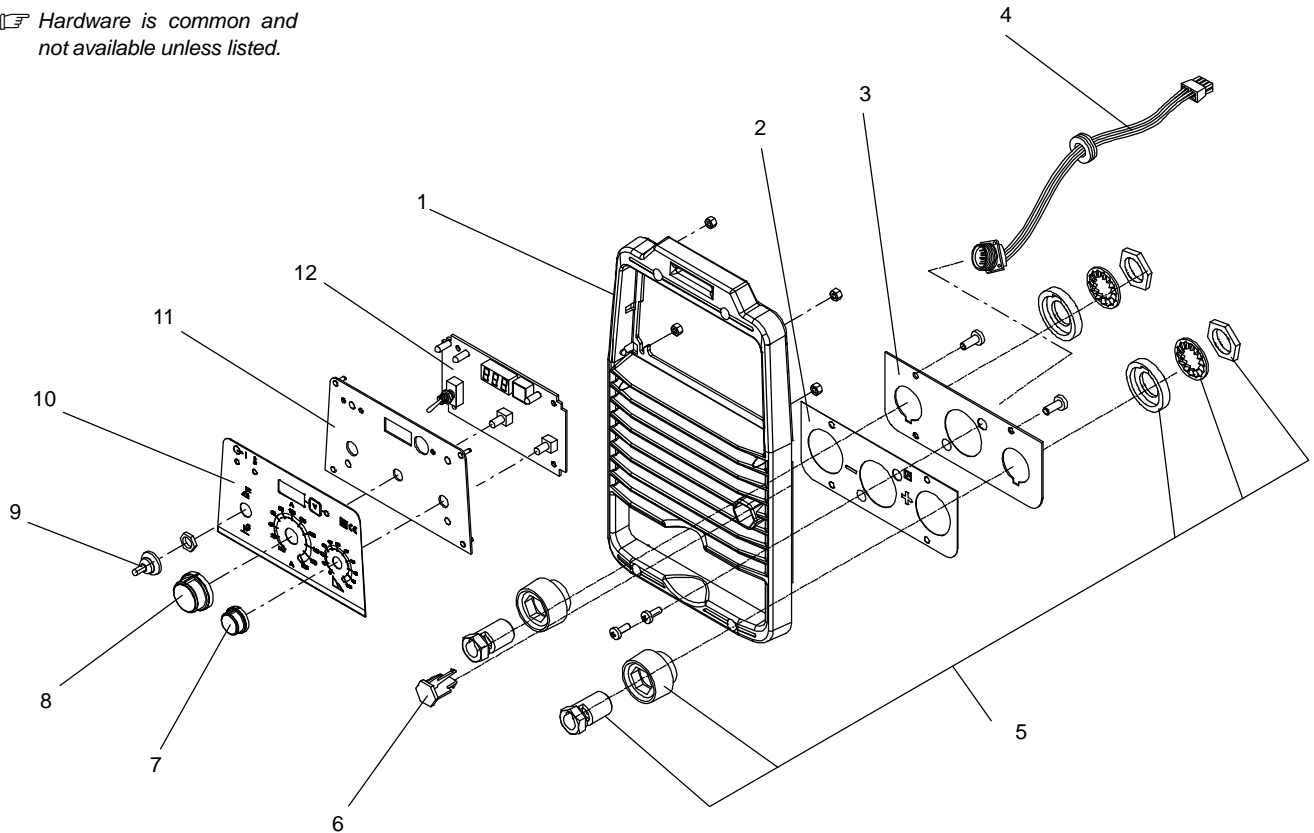


Figure 12-2. Panel, Front w/Components

956142915_4-A

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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12-2. Panel, Front w/Components (Figure 12-1 Item 1)

1		194242	Panel, Front/Rear	1
2		356029208	Nameplate, Lower STi 203	1
3		156118059	Panel, Front, Lower	1
4	RC1	056076259	Female 14-Pin Receptacle, Wiring Harness	1
5		56076257	Female Socket, Dinse	1
6		207253	Plug, Gas Fitting	1
7		193920	Knob, Pointer .840 Dia X .250 ld	1
8		193919	Knob, Pointer 1.250 Dia X .250 ld	1
9		656014013	Cover, Selector Switch	1
10		356029247	Nameplate, Upper STi 203	1
11		156118084	Panel, Front Upper	1
12	PC30	057084178	PC3 Circuit Card Assy, Interface	1

To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.

☞ Hardware is common and not available unless listed.

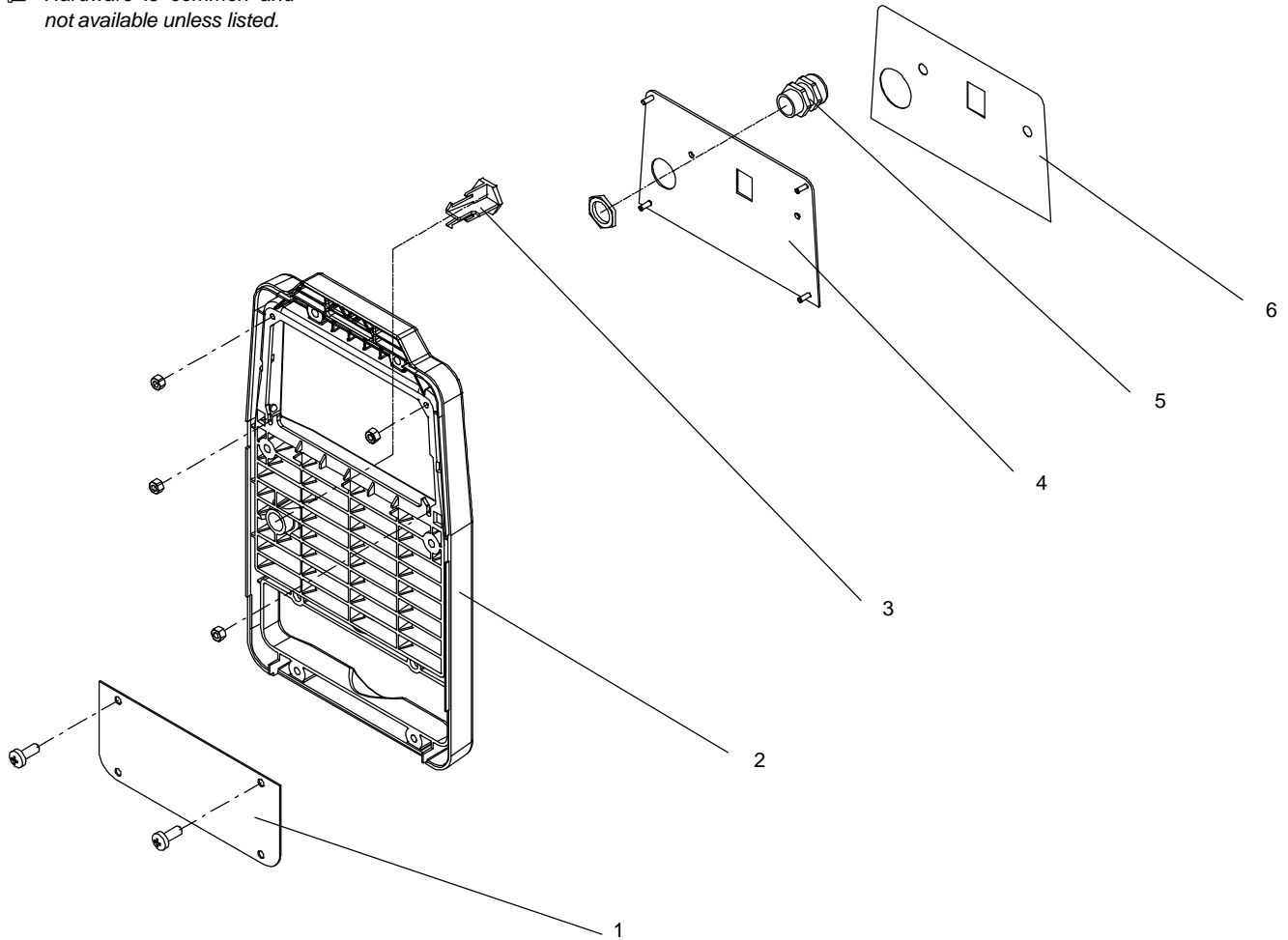


Figure 12-3. Panel, Rear w/Components

956142915_5-A

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure 12-3. Panel, Rear w/Components (Figure 12-1 Item 2)

1		V16118098	Panel, Rear Lower	1
2		194242	Panel, Front/Rear	1
3		207723	Plug, Gas Fitting	1
4		V15024100	Panel, Rear Upper	1
5		656089039	Bushing, Strain Relief	1
6		956142657	Switch, Label	1

To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.

☐ Hardware is common and not available unless listed.

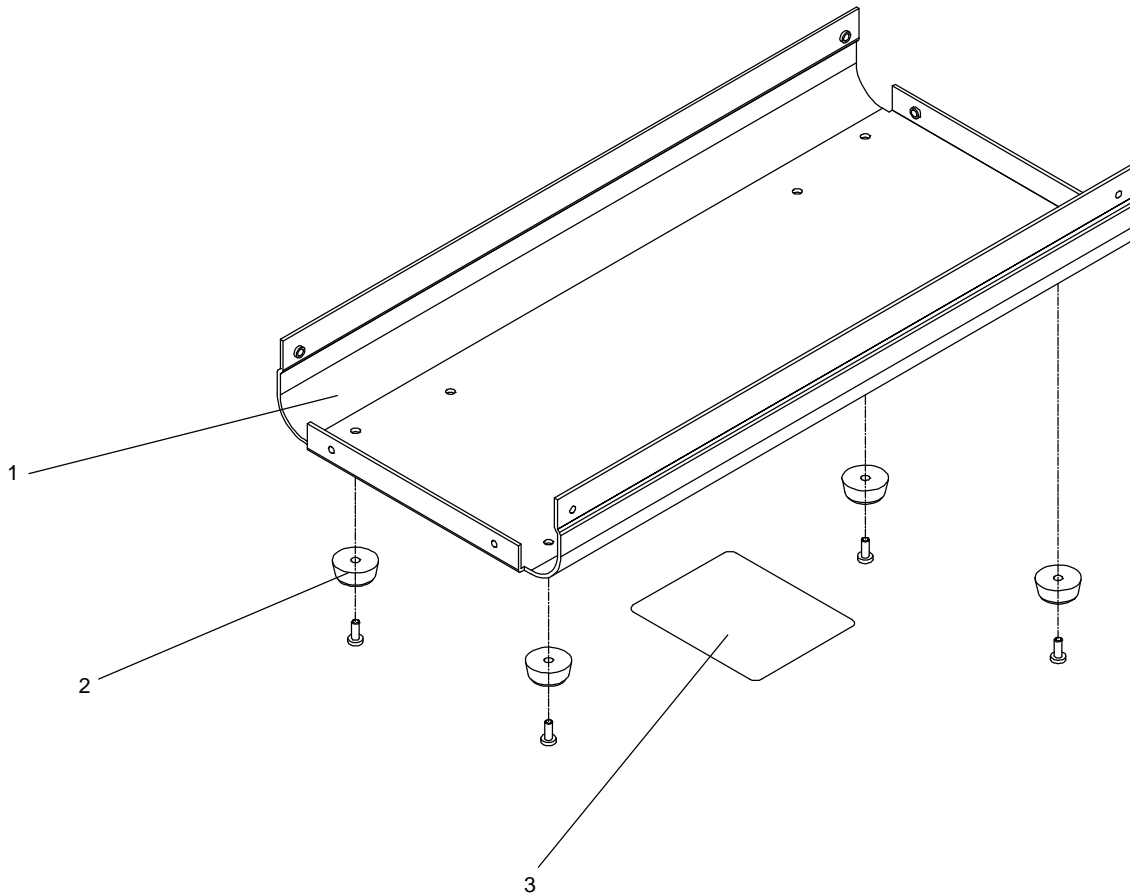


Figure 12-4. Base Assembly

956142915_6-A

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure 12-4. Base Assembly (Figure 12-1 Item 5)				

1		156006060	Base,	1
2		V56110090	Mount, Nprn	4
3		956142662	Rating Plate	1

To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.

TRUE BLUE[®]

WARRANTY

Effective January 1, 2015
(Equipment with a serial number preface of MF or newer)

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

LIMITED WARRANTY – Subject to the terms and conditions below, ITW Welding Products Italy warrants to its original retail purchaser that new Miller equipment sold after the effective date of this limited warranty is free of defects in material and workmanship at the time it is shipped by Miller. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS.

Within the warranty periods listed below, Miller will repair or replace any warranted parts or components that fail due to such defects in material or workmanship. Miller must be notified in writing within thirty (30) days of such defect or failure, at which time Miller will provide instructions on the warranty claim procedures to be followed. If notification is submitted as an online warranty claim, the claim must include a detailed description of the fault and the troubleshooting steps taken to identify failed components and the cause of their failure.

Miller shall honor warranty claims on warranted equipment listed below in the event of such a failure within the warranty time periods. All warranty time periods start on the date the equipment was delivered to the original retail purchaser or one year after the equipment is shipped to a European distributor or twelve months after the equipment is shipped to an International distributor.

1. 5 Years Parts — 3 Years Labor
 - * Original main power rectifiers only to include SCRs, diodes, and discrete rectifier modules with exclusion of STR, Si, STI, STH and MPi series.
2. 3 Years — Parts and Labor
 - * Engine Driven Welding Generators
(NOTE: Engines are warranted separately by the engine manufacturer.)
 - * Inverter Power Sources (Unless Otherwise Stated)
 - * Process Controllers
 - * Semi-Automatic and Automatic Wire Feeders
 - * Transformer/Rectifier Power Sources
3. 2 Years — Parts
 - * Auto-Darkening Helmet Lenses (No Labor)
 - * Migmatic 175
 - * HF Units
4. 1 Year — Parts and Labor Unless Specified
 - * Automatic Motion Devices
 - * Field Options
(NOTE: Field options are covered under True Blue[®] for the remaining warranty period of the product they are installed in, or for a minimum of one year — whichever is greater.)
 - * Induction Heating Power Sources, Coolers, and Electronic Controls/Recorders
 - * Motor-Driven Guns (w/exception of Spoolmate Spoolguns)
 - * Positioners and Controllers
 - * Powered Air Purifying Respirator (PAPR) Blower Unit (No Labor)
 - * Racks
 - * Running Gear and Trailers
 - * Subarc Wire Drive Assemblies
 - * Water Coolant Systems
 - * Work Stations/Weld Tables (No Labor)
5. 6 Months — Parts
 - * Batteries

6. 90 Days — Parts
 - * Accessory (Kits)
 - * Canvas Covers
 - * Induction Heating Coils and Blankets
 - * MIG Guns
 - * Remote Controls
 - * Replacement Parts (No Labor)
 - * Spoolmate Spoolguns
 - * Cables and Non-Electronic Controls

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

1. **Consumable components; such as contact tips, cutting nozzles, contactors, brushes, switches, slip rings, relays or parts that fail due to normal wear.**
2. Items furnished by Miller, but manufactured by others, such as engines or trade accessories. These items are covered by the manufacturer's warranty, if any.
3. Equipment that has been modified by any party other than Miller, or equipment that has been improperly installed, improperly operated or misused based upon industry standards, or equipment which has not had reasonable and necessary maintenance, or equipment which has been used for operation outside of the specifications for the equipment.

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

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

TO THE EXTENT PERMITTED BY LAW, THE REMEDIES PROVIDED HEREIN ARE THE SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL MILLER BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF PROFIT), WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT TORT OR ANY OTHER LEGAL THEORY WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.





Owner's Record

Please complete and retain with your personal records.

Model Name

Serial/Style Number

Purchase Date

(Date which equipment was delivered to original customer.)

Distributor

Address

Country

Zip/Postal Code



For Service

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

Always provide Model Name and Serial/Style Number.

Contact your Distributor for:

Welding Supplies and Consumables

Options and Accessories

Service and Repair

Replacement Parts

Owner's Manuals

Contact the Delivering Carrier to:

File a claim for loss or damage during shipment.

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

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Milanese, Italy

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Fax: 39 (0) 298290-203

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