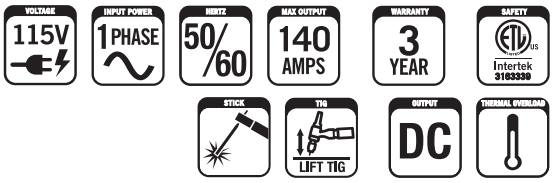
Firepower



FIREPOWER TIG 140 AC/DC

Operating Manual

English

Canadien Français

Americas Español

C ETL US LISTED
Intertek
3163339

Revision: AA	Issue Date: August 8, 2014	Manual No.: 0-5355

VICTOR TECHNOLOGIES™

www.firepower.com

WE APPRECIATE YOUR BUSINESS!

Congratulations on receiving your new Firepower product. We are proud to have you as our customer and will strive to provide you with the best service and support in the industry. This product is backed by our extensive warranty and world-wide service network.

We know you take pride in your work and we feel privileged to provide you with this high performance product that will help you get the job done.

YOU ARE IN GOOD COMPANY!

Firepower is a Global Brand of Arc Welding Products for Victor Technologies Inc. We distinguish ourselves from our competition through market-leading innovation and truly dependable products that will stand the test of time.

We strive to enhance your productivity, efficiency and welding performance enabling you to excel in your craft. We design products with the welder in mind delivering- advanced features, durability, ease of use and ergonomic comfort.

Above all, we are committed to a safer working environment within the welding industry. Your satisfaction with this product and its safe operation is our ultimate concern. Please take the time to read the entire manual, especially the Safety Precautions.

If you have any questions or concerns regarding your new Firepower product, please contact our friendly and knowledgeable Customer Service Team at:

1-800-462-2782 (USA) and 1-905-827-4515 (Canada),
or visit us on the web at **www.Firepower.com**

WARNINGS

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Welding Power Supply
Operating Manual Number 0-5355 for:

FIREPOWER TIG 140 AC/DC, Power Supply Only	Part Number	1442-0031
FIREPOWER TIG 140 AC/DC, System	Part Number	1442-0030

Published by:
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16052 Swingley Ridge Road,
Suite 300 St, Louis, MO 63017
USA

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Publication Date: August 8, 2014

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

TABLE OF CONTENTS

TABLE OF CONTENTS

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SECTION 1: SAFETY INSTRUCTIONS AND WARNINGS

WARNING

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR. DO NOT LOSE THESE INSTRUCTIONS. READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Some of these practices apply to equipment connected to power lines; other practices apply to engine driven equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld.

Safe practices are outlined in the American National Standard Z49.1 entitled: SAFETY IN WELDING AND CUTTING. This publication and other guides to what you should learn before operating this equipment are listed at the end of these safety precautions. **HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.**

1.01 Arc Welding Hazards

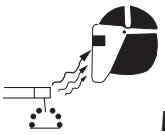
WARNING

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 semi-automatic 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.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine before installing or servicing this equipment. Lock input power disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to its Owner's Manual and national, state, and local codes.
6. Turn off all equipment when not in use. Disconnect power to equipment if it will be left unattended or out of service.
7. Use fully insulated electrode holders. Never dip holder in water to cool it or lay it down on the ground or the work surface. Do not touch holders connected to two welding machines at the same time or touch other people with the holder or electrode.
8. Do not use worn, damaged, undersized, or poorly spliced cables.
9. Do not wrap cables around your body.
10. Ground the workpiece to a good electrical (earth) ground.
11. Do not touch electrode while in contact with the work (ground) circuit.
12. Use only well-maintained equipment. Repair or replace damaged parts at once.
13. In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.
14. Wear a safety harness to prevent falling if working above floor level.

15. Keep all panels and covers securely in place.



WARNING

ARC RAYS can burn eyes and skin; NOISE can damage hearing. Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Noise from some processes can damage hearing.

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Use approved ear plugs or ear muffs if noise level is high.

WARNING

FUMES AND GASES can be hazardous to your health.

AWS F2.2:2001 (R2010), Adapted with permission of the American Welding Society (AWS), Miami, Florida

Guide for Shade Numbers

Process	Electrode Size in. (mm)	Arc Current (Amperes)	Minimum Protective Shade	Suggested* Shade No. (Comfort)
Shielded Metal Arc Welding (SMAW)	Less than 3/32 (2.4) 3/32-5/32 (2.4-4.0) 5/32-1/4 (4.0-6.4) More than 1/4 (6.4)	Less than 60 60-160 160-250 250-550	7 8 10 11	- 10 12 14
Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW)		Less than 60 60-160 160-250 250-550	7 10 10 10	- 11 12 14
Gas Tungsten arc Welding (GTAW)		Less than 50 50-150 150-500	8 8 10	10 12 14
Air Carbon Arc Cutting (CAC-A)	(Light) (Heavy)	Less than 500 500-1000	10 11	12 14
Plasma Arc Welding (PAW)		Less than 20 20-100 100-400 400-800	6 8 10 11	6 to 8 10 12 14
Plasma Arc Cutting (PAC)		Less than 20 20-40 40-60 60-80 80-300 300-400 400-800	4 5 6 8 8 9 10	4 5 6 8 9 12 14

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding, cutting, or brazing where the torch and/or the flux produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line of the visible light spectrum.

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

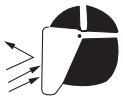
1. Keep your head out of the fumes. Do not breathe the fumes.
2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
6. 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.
7. 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 if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

WARNING

WELDING can cause fire or explosion.

Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

1. Protect yourself and others from flying sparks and hot metal.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables within 35 ft. (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire, and keep a fire extinguisher nearby.
6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Do not weld on closed containers such as tanks or drums.
8. 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 and fire hazards.
9. Do not use welder to thaw frozen pipes.
10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.



WARNING

FLYING SPARKS AND HOT METAL can cause injury.

Chipping and grinding cause flying metal. As welds cool, they can throw off slag.

1. Wear approved face shield or safety goggles. Side shields recommended.
2. Wear proper body protection to protect skin.

WARNING

CYLINDERS can explode if damaged.

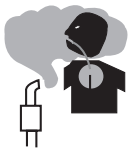
Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.

5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinder is in use or connected for use.
8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.

WARNING

Engines can be dangerous.



WARNING

ENGINE EXHAUST GASES can kill.

Engines produce harmful exhaust gases.

1. Use equipment outside in open, well-ventilated areas.
2. If used in a closed area, vent engine exhaust outside and away from any building air intakes.

WARNING

ENGINE FUEL can cause fire or explosion.

Engine fuel is highly flammable.

1. Stop engine before checking or adding fuel.
2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Allow engine to cool before fueling. If possible, check and add fuel to cold engine before beginning job.
4. Do not overfill tank — allow room for fuel to expand.
5. Do not spill fuel. If fuel is spilled, clean up before starting engine.

WARNING

MOVING PARTS can cause injury.

Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.
3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. To prevent accidental starting during servicing, disconnect negative (-) battery cable from battery.
5. Keep hands, hair, loose clothing, and tools away from moving parts.
6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.

WARNING

SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin.

Batteries contain acid and generate explosive gases.

1. Always wear a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and –) on batteries.

WARNING

STEAM AND PRESSURIZED HOT COOLANT can burn face, eyes, and skin.

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.

3. Allow pressure to escape before completely removing cap.

Pb! ***WARNING***

WARNING: This product contains chemicals, including lead, known to the State of California to cause birth defects and other reproductive harm. ***Wash hands after handling.***

NOTE

Considerations About Welding And The Effects of Low Frequency Electric and Magnetic Fields

The following is a quotation from the General Conclusions Section of the U.S. Congress, Office of Technology Assessment, Biological Effects of Power Frequency Electric & Magnetic Fields - Background Paper, OTA-BP-E-63 (Washington, DC: U.S. Government Printing Office, May 1989): "...there is now a very large volume of scientific findings based on experiments at the cellular level and from studies with animals and people which clearly establish that low frequency magnetic fields interact with, and produce changes in, biological systems. While most of this work is of very high quality, the results are complex. Current scientific understanding does not yet allow us to interpret the evidence in a single coherent framework. Even more frustrating, it does not yet allow us to draw definite conclusions about questions of possible risk or to offer clear science-based advice on strategies to minimize or avoid potential risks."

To reduce magnetic fields in the workplace, use the following procedures.

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cable around the body.
4. Keep welding Power Source and cables as far away from body as practical.

ABOUT PACEMAKERS:

The above procedures are among those also normally recommended for pacemaker wearers. Consult your doctor for complete information.

1.02 General Safety Information for Victor CS Regulator

A Fire Prevention

Welding and cutting operations use fire or combustion as a basic tool. The process is very useful when properly controlled. However, it can be extremely destructive if not performed correctly in the proper environment.

1. The work area must have a fireproof floor.
2. Work benches or tables used during welding or cutting operations must have fireproof tops.
3. Use heat resistant shields or other approved material to protect nearby walls or unprotected flooring from sparks and hot metal.
4. Keep an approved fire extinguisher of the proper size and type in the work area. Inspect it regularly to ensure that it is in proper working order. Know how to use the fire extinguisher.
5. Move combustible materials away from the work site. If you can not move them, protect them with fireproof covers.

WARNING

NEVER perform welding, heating, or cutting operations on a container that has held toxic, combustible or flammable liquids, or vapors. NEVER perform welding, heating, or cutting operations in an area containing combustible vapors, flammable liquids, or explosive dust.

B Housekeeping

WARNING

NEVER allow oxygen to contact grease, oil, or other flammable substances. Although oxygen by itself will not burn, these substances become highly explosive. They can ignite and burn violently in the presence of oxygen.

Keep ALL apparatus clean and free of grease, oil and other flammable substances.

C Ventilation

WARNING

Adequately ventilate welding, heating, and cutting work areas to prevent accumulation of explosive or toxic concentrations of gases. Certain combinations of metals, coatings, and gases generate toxic fumes. Use respiratory protection equipment in these circumstances. When welding/brazing, read and understand the Material Safety Data Sheet for the welding/brazing alloy.

D Personal Protection

Gas flames produce infrared radiation which may have a harmful effect on the skin and especially on the eyes. Select goggles or a mask with tempered lenses, shaded 4 or darker, to protect your eyes from injury and provide good visibility of the work.

Always wear protective gloves and flame-resistant clothing to protect skin and clothing from sparks and slag. Keep collars, sleeves, and pockets buttoned. **DO NOT** roll up sleeves or cuff pants.

When working in a non-welding or cutting environment, always wear suitable eye protection or face shield.

WARNING

Practice the following safety and operation precautions EVERY TIME you use pressure regulation equipment. Deviation from the following safety and operation instructions can result in fire, explosion, damage to equipment, or injury to the operator.

E Compressed Gas Cylinders

The Department of Transportation (DOT) approves the design and manufacture of cylinders that contain gases used for welding or cutting operations.

1. Place the cylinder (Figure 1-1) where you will use it. Keep the cylinder in a vertical position. Secure it to a cart, wall, work bench, post, etc.

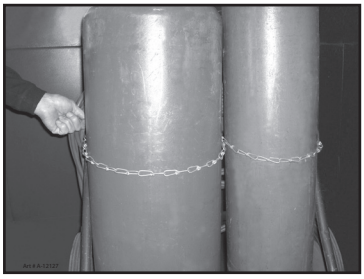


Figure 1-1: Gas Cylinders

WARNING

Cylinders are highly pressurized. Handle with care. Serious accidents can result from improper handling or misuse of compressed gas cylinders DO NOT drop the cylinder, knock it over, or expose it to excessive heat, flames or sparks. DO NOT strike it against other cylinders. Contact your gas supplier or refer to CGA P-1 "Safe Handling of Compressed Gases in Containers" publication.

NOTE

CGA P-1 publication is available by writing the Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly,VA 20151-2923

2. Place the valve protection cap on the cylinder whenever moving it, placing it in storage, or not using it. Never drag or roll cylinders in any way. Use a suitable hand truck to move cylinders.
3. Store empty cylinders away from full cylinders. Mark them "EMPTY" and close the cylinder valve.

4. NEVER use compressed gas cylinders without a pressure reducing regulator attached to the cylinder valve.
5. Inspect the cylinder valve for oil, grease, and damaged parts.

WARNING

DO NOT use the cylinder if you find oil, grease or damaged parts. Inform your gas supplier of this condition immediately.

6. Momentarily open and close (called "cracking") the cylinder valve to dislodge any dust or dirt that may be present in the valve.

CAUTION

Open the cylinder valve slightly. If you open the valve too much, the cylinder could tip over. When cracking the cylinder valve, DO NOT stand directly in front of the cylinder valve. Always perform cracking in a well ventilated area. If an acetylene cylinder sprays a mist when cracked, let it stand for 15 minutes. Then, try to crack the cylinder valve again. If this problem persists, contact your gas supplier.

1.03 Principal Safety Standards

Safety in Welding and Cutting, ANSI Standard Z49.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

Safety and Health Standards, OSHA 29 CFR 1910, from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWS F4.1, from American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, NFPA Standard 51B, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

1.04 Symbol Chart

Note that only some of these symbols will appear on your model.

	On
	Off
	Dangerous Voltage
	Increase/Decrease
	Circuit Breaker
	AC Auxiliary Power
	Fuse
	Amperage
	Voltage
	Hertz (cycles/sec)
	Frequency
	Negative
	Positive
	Direct Current (DC)
	Protective Earth (Ground)
	Line
	Line Connection
	Auxiliary Power
 115V 15A	Receptacle Rating- Auxiliary Power

	Single Phase
	Three Phase
	Three Phase Static Frequency Converter-Transformer-Rectifier
	Remote
	Duty Cycle
	Percentage
	Panel/Local
	Shielded Metal Arc Welding (SMAW)
	Gas Metal Arc Welding (GMAW)
	Gas Tungsten Arc Welding (GTAW)
	Air Carbon Arc Cutting (CAC-A)
	Constant Current
	Constant Voltage Or Constant Potential
	High Temperature
	Fault Indication
	Arc Force
	Touch Start (GTAW)
	Variable Inductance
	Voltage Input

	Wire Feed Function
	Wire Feed Towards Workpiece With Output Voltage Off.
	Welding Gun
	Purging Of Gas
	Continuous Weld Mode
	Spot Weld Mode
t	Spot Time
t1	Preflow Time
t2	Postflow Time
	2 Step Trigger Operation Press to initiate wirefeed and welding, release to stop.
	4 Step Trigger Operation Press and hold for preflow, release to start arc. Press to stop arc, and hold for preflow.
t	Burnback Time
IPM	Inches Per Minute
MPM	Meters Per Minute
S	See Note
	See Note
	Art # A-04130_AB

Note: For environments with increased hazard of electrical shock, Power Supplier bearing the S mark conform to EN50192 when used in conjunction with hand torches with exposed tips, if equipped with properly installed standoff guides.

 Cannot be disposed with household garbage.

1.05 Precautions De Securite En Soudage A L'arc

MISE EN GARDE

LE SOUDAGE A L'ARC EST DANGEREUX

PROTEGEZ-VOUS, AINSI QUE LES AUTRES, CONTRE LES BLESSURES GRAVES POSSIBLES OU LA MORT. NE LAISSEZ PAS LES ENFANTS S'APPROCHER, NI LES PORTEURS DE STIMULATEUR CARDIAQUE (A MOINS QU'ILS N'AIENT CONSULTE UN MEDECIN). CONSERVEZ CES INSTRUCTIONS. LISEZ LE MANUEL D'OPERATION OU LES INSTRUCTIONS AVANT D'INSTALLER, UTILISER OU ENTRETENIR CET EQUIPEMENT.

Les produits et procédés de soudage peuvent sauser des blessures graves ou la mort, de même que des dommages au reste du matériel et à la propriété, si l'utilisateur n'adhère pas strictement à toutes les règles de sécurité et ne prend pas les précautions nécessaires.

En soudage et coupage, des pratiques sécuritaires se sont développées suite à l'expérience passée. Ces pratiques doivent être apprises par étude ou entraînement avant d'utiliser l'equipement. Toute personne n'ayant pas suivi un entraînement intensif en soudage et coupage ne devrait pas tenter de souder. Certaines pratiques concernent les équipements raccordés aux lignes d'alimentation alors que d'autres s'adressent aux groupes électrogènes.

La norme Z49.1 de l'American National Standard, intitulée "SAFETY IN WELDING AND CUTTING" présente les pratiques sécuritaires à suivre. Ce document ainsi que d'autres guides que vous devriez connaître avant d'utiliser cet équipement sont présentés à la fin de ces instructions de sécurité.

SEULES DES PERSONNES QUALIFIEES DOIVENT FAIRE DES TRAVAUX D'INSTALLATION, DE REPARATION, D'ENTRETIEN ET D'ESSAI.

1.06 Dangers relatifs au soudage à l'arc

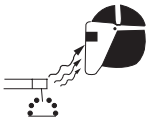
AVERTISSEMENT

L'ELECTROCUTION PEUT ETRE MORTELLE.

Une décharge électrique peut tuer ou brûler gravement. L'électrode et le circuit de soudage sont sous tension dès la mise en circuit. Le circuit d'alimentation et les circuits internes de l'équipement sont aussi sous tension dès la mise en marche. En soudage automatique ou semi-automatique avec fil, ce dernier, le rouleau ou la bobine de fil, le logement des galets d'entrainement et toutes les pièces métalliques en contact avec le fil de soudage sont sous tension. Un équipement inadéquatement installé ou inadéquatement mis à la terre est dangereux.

1. Ne touchez pas à des pièces sous tension.
2. Portez des gants et des vêtements isolants, secs et non troués.
3. Isolez-vous de la pièce à souder et de la mise à la terre au moyen de tapis isolants ou autres.
4. Déconnectez la prise d'alimentation de l'équipement ou arrêtez le moteur avant de l'installer ou d'en faire l'entretien. Bloquez le commutateur en circuit ouvert ou enlevez les fusibles de l'alimentation afin d'éviter une mise en marche accidentelle.
5. Veuillez à installer cet équipement et à le mettre à la terre selon le manuel d'utilisation et les codes nationaux, provinciaux et locaux applicables.
6. Arrêtez tout équipement après usage. Coupez l'alimentation de l'équipement s'il est hors d'usage ou inutilisé.
7. N'utilisez que des porte-électrodes bien isolés. Ne jamais plonger les porte-électrodes dans l'eau pour les refroidir. Ne jamais les laisser traîner par terre ou sur les pièces à souder. Ne touchez pas aux porte-électrodes raccordés à deux sources de courant en même temps. Ne jamais toucher quelqu'un d'autre avec l'électrode ou le porte-électrode.
8. N'utilisez pas de câbles électriques usés, endommagés, mal épissés ou de section trop petite.

9. N'enroulez pas de câbles électriques autour de votre corps.
10. N'utilisez qu'une bonne prise de masse pour la mise à la terre de la pièce à souder.
11. Ne touchez pas à l'électrode lorsqu'en contact avec le circuit de soudage (terre).
12. N'utilisez que des équipements en bon état. Réparez ou remplacez aussitôt les pièces endommagées.
13. Dans des espaces confinés ou mouillés, n'utilisez pas de source de courant alternatif, à moins qu'il soit muni d'un réducteur de tension. Utilisez plutôt une source de courant continu.
14. Portez un harnais de sécurité si vous travaillez en hauteur.
15. Fermez solidement tous les panneaux et les capots.



AVERTISSEMENT

LE RAYONNEMENT DE L'ARC PEUT BRÛLER LES YEUX ET LA PEAU; LE BRUIT PEUT ENDOMMAGER L'OUIE.

L'arc de soudage produit une chaleur et des rayons ultraviolets intenses, susceptibles de brûler les yeux et la peau. Le bruit causé par certains procédés peut endommager l'ouïe.

1. Portez une casque de soudeur avec filtre oculaire de nuance appropriée (consultez la norme ANSI Z49 indiquée ci-après) pour vous protéger le visage et les yeux lorsque vous soudez ou que vous observez l'exécution d'une soudure.

AWS F2.2:2001 (R2010), Adapted with permission of the American Welding Society (AWS), Miami, Florida

Guide for Shade Numbers

Process	Electrode Size in. (mm)	Arc Current (Amperes)	Minimum Protective Shade	Suggested* Shade No. (Comfort)
Shielded Metal Arc Welding (SMAW)	Less than 3/32 (2.4) 3/32-5/32 (2.4-4.0) 5/32-1/4 (4.0-6.4) More than 1/4 (6.4)	Less than 60 60-160 160-250 250-550	7 8 10 11	- 10 12 14
Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW)		Less than 60 60-160 160-250 250-550	7 10 10 10	- 11 12 14
Gas Tungsten arc Welding (GTAW)		Less than 50 50-150 150-500	8 8 10	10 12 14
Air Carbon Arc Cutting (CAC-A)	(Light) (Heavy)	Less than 500 500-1000	10 11	12 14
Plasma Arc Welding (PAW)		Less than 20 20-100 100-400 400-800	6 8 10 11	6 to 8 10 12 14
Plasma Arc Cutting (PAC)		Less than 20 20-40 40-60 60-80 80-300 300-400 400-800	4 5 6 8 8 9 10	4 5 6 8 9 12 14

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding, cutting, or brazing where the torch and/or the flux produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line of the visible light spectrum.

2. Portez des lunettes de sécurité approuvées. Des écrans latéraux sont recommandés.
3. Entourez l'aire de soudage de rideaux ou de cloisons pour protéger les autres des coups d'arc ou de l'éblouissement; avertissez les observateurs de ne pas regarder l'arc.
4. Portez des vêtements en matériaux ignifuges et durables (laine et cuir) et des chaussures de sécurité.
5. Portez un casque antibruit ou des bouchons d'oreille approuvés lorsque le niveau de bruit est élevé.

AVERTISSEMENT

LES VAPEURS ET LES FUMEES SONT DANGEREUSES POUR LA SANTE.

Le soudage dégage des vapeurs et des fumées dangereuses à respirer.

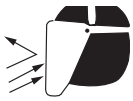
1. Eloignez la tête des fumées pour éviter de les respirer.
2. A l'intérieur, assurez-vous que l'aire de soudage est bien ventilée ou que les fumées et les vapeurs sont aspirées à l'arc.
3. Si la ventilation est inadequate, portez un respirateur à adduction d'air approuvé.
4. Lisez les fiches signalétiques et les consignes du fabricant relatives aux métaux, aux produits consummables, aux revêtements et aux produits nettoyants.
5. Ne travaillez dans un espace confiné que s'il est bien ventilé; sinon, portez un respirateur à adduction d'air. Les gaz protecteurs de soudage peuvent déplacer l'oxygène de l'air et ainsi causer des malaises ou la mort. Assurez-vous que l'air est propre à la respiration.
6. Ne soudez pas à proximité d'opérations de dégraissage, de nettoyage ou de pulvérisation. La chaleur et les rayons de l'arc peuvent réagir avec des vapeurs et former des gaz hautement toxiques et irritants.
7. Ne soudez des tôles galvanisées ou plaquées au plomb ou au cadmium que si les zones à souder ont été grattées à fond, que si l'espace est bien ventilé; si nécessaire portez un respirateur à adduction d'air. Car ces revêtements et tout métal qui contient ces éléments peuvent dégager des fumées toxiques au moment du soudage.

AVERTISSEMENT

LE SOUDAGE PEUT CAUSER UN INCENDIE OU UNE EXPLOSION

L'arc produit des étincellies et des projections. Les particules volantes, le métal chaud, les projections de soudure et l'équipement surchauffé peuvent causer un incendie et des brûlures. Le contact accidentel de l'électrode ou du fil-électrode avec un objet métallique peut provoquer des étincelles, un échauffement ou un incendie.

1. Protégez-vous, ainsi que les autres, contre les étincelles et du métal chaud.
2. Ne soudez pas dans un endroit où des particules volantes ou des projections peuvent atteindre des matériaux inflammables.
3. Enlevez toutes matières inflammables dans un rayon de 10, 7 mètres autour de l'arc, ou couvrez-les soigneusement avec des bâches approuvées.
4. Méfiez-vous des projections brulantes de soudage susceptibles de pénétrer dans des aires adjacentes par de petites ouvertures ou fissures.
5. Méfiez-vous des incendies et gardez un extincteur à portée de la main.
6. N'oubliez pas qu'une soudure réalisée sur un plafond, un plancher, une cloison ou une paroi peut enflammer l'autre côté.
7. Ne soudez pas un récipient fermé, tel un réservoir ou un baril.
8. Connectez le câble de soudage le plus près possible de la zone de soudage pour empêcher le courant de suivre un long parcours inconnu, et prévenir ainsi les risques d'électrocution et d'incendie.
9. Ne dégelez pas les tuyaux avec un source de courant.
10. Otez l'électrode du porte-électrode ou coupez le fil au tube-contact lorsqu'inutilisé après le soudage.
11. Portez des vêtements protecteurs non huileux, tels des gants en cuir, une chemise épaisse, un pantalon revers, des bottines de sécurité et un casque.



AVERTISSEMENT

LES ETINCELLES ET LES PROJECTIONS BRULANTES PEUVENT CAUSER DES BLESSURES.

Le piquage et le meulage produisent des particules métalliques volantes. En refroidissant, la soudure peut projeter du éclats de laitier.

1. Portez un écran facial ou des lunettes protectrices approuvées. Des écrans latéraux sont recommandés.
2. Portez des vêtements appropriés pour protéger la peau.

AVERTISSEMENT

LES BOUTEILLES ENDOMMAGEES PEUVENT EXPLOSER

Les bouteilles contiennent des gaz protecteurs sous haute pression. Des bouteilles endommagées peuvent exploser. Comme les bouteilles font normalement partie du procédé de soudage, traitez-les avec soin.

1. Protégez les bouteilles de gaz comprimé contre les sources de chaleur intense, les chocs et les arcs de soudage.
2. Enchainez verticalement les bouteilles à un support ou à un cadre fixe pour les empêcher de tomber ou d'être renversées.
3. Eloignez les bouteilles de tout circuit électrique ou de tout soudage.
4. Empêchez tout contact entre une bouteille et une électrode de soudage.
5. N'utilisez que des bouteilles de gaz protecteur, des détendeurs, des boyauxs et des raccords conçus pour chaque application spécifique; ces équipements et les pièces connexes doivent être maintenus en bon état.
6. Ne placez pas le visage face à l'ouverture du robinet de la bouteille lors de son ouverture.
7. Laissez en place le chapeau de bouteille sauf si en utilisation ou lorsque raccordé pour utilisation.
8. Lisez et respectez les consignes relatives aux bouteilles de gaz comprimé et aux équipements connexes, ainsi que la publication P-1 de la CGA, identifiée dans la liste de documents ci-dessous.

AVERTISSEMENT

LES MOTEURS PEUVENT ETRE DANGEREUX

LES GAZ D'ECHAPPEMENT DES MOTEURS PEUVENT ETRE MORTELS.

Les moteurs produisent des gaz d'échappement nocifs.

1. Utilisez l'équipement à l'extérieur dans des aires ouvertes et bien ventilées.
2. Si vous utilisez ces équipements dans un endroit confiné, les fumées d'échappement doivent être envoyées à l'extérieur, loin des prises d'air du bâtiment.

AVERTISSEMENT

LE CARBURANT PEUR CAUSER UN INCENDIE OU UNE EXPLOSION.

Le carburant est hautement inflammable.

1. Arrêtez le moteur avant de vérifier le niveau e carburant ou de faire le plein.
2. Ne faites pas le plein en fumant ou proche d'une source d'étincelles ou d'une flamme nue.
3. Si c'est possible, laissez le moteur refroidir avant de faire le plein de carburant ou d'en vérifier le niveau au début du soudage.
4. Ne faites pas le plein de carburant à ras bord: prévoyez de l'espace pour son expansion.
5. Faites attention de ne pas renverser de carburant. Nettoyez tout carburant renversé avant de faire démarrer le moteur.

AVERTISSEMENT

DES PIECES EN MOUVEMENT PEUVENT CAUSER DES BLESSURES.

Des pièces en mouvement, tels des ventilateurs, des rotors et des courroies peuvent couper doigts et mains, ou accrocher des vêtements amples.

1. Assurez-vous que les portes, les panneaux, les capots et les protecteurs soient bien fermés.
2. Avant d'installer ou de connecter un système, arrêtez le moteur.
3. Seules des personnes qualifiées doivent démonter des protecteurs ou des capots pour faire l'entretien ou le dépannage nécessaire.
4. Pour empêcher un démarrage accidentel pendant l'entretien, débranchez le câble d'accumulateur à la borne négative.
5. N'approchez pas les mains ou les cheveux de pièces en mouvement; elles peuvent aussi accrocher des vêtements amples et des outils.
6. Réinstallez les capots ou les protecteurs et fermez les portes après des travaux d'entretien et avant de faire démarrer le moteur.

AVERTISSEMENT

DES ETINCELLES PEUVENT FAIRE EXPLOSER UN ACCUMULATEUR; L'ELECTROLYTE D'UN ACCUMU-LATEUR PEUT BRULER LA PEAU ET LES YEUX.

Les accumulateurs contiennent de l'électrolyte acide et dégagent des vapeurs explosives.

1. Portez toujours un écran facial en travaillant sur un accumu-lateur.
2. Arrêtez le moteur avant de connecter ou de déconnecter des câbles d'accumulateur.
3. N'utilisez que des outils anti-étincelles pour travailler sur un accumulateur.
4. N'utilisez pas une source de courant de soudage pour charger un accumulateur ou survolter momentanément un véhicule.
5. Utilisez la polarité correcte (+ et –) de l'accumulateur.

AVERTISSEMENT

LA VAPEUR ET LE LIQUIDE DE REFROIDISSEMENT BRULANT SOUS PRESSION PEUVENT BRULER LA PEAU ET LES YEUX.

Le liquide de refroidissement d'un radiateur peut être brûlant et sous pression.

1. N'ôtez pas le bouchon de radiateur tant que le moteur n'est pas refroidi.
2. Mettez des gants et posez un torchon sur le bouchon pour l'ôter.
3. Laissez la pression s'échapper avant d'ôter complètement le bouchon.

AVERTISSEMENT

AVERTISSEMENT: Ce produitcontient des produits chimiques, notamment du plomb, reconnu par l'Étatde la Californie pour causerdes malformations congénitaleset d'autresdommages touchant le système reproductif. ***Se laver les mains après manipulation.***

REMARQUE

Facteurs relatifs au soudage et aux effets des champs magnétiques et électriques de basse fréquence

Voici une citation tirée du chapitre des conclusions générales du document de base de l'Office of Technology Assessment (bureau des évaluations technologiques) de l'U.S. Congress, « Biological Effects of Power Frequency Electric & Magnetic Fields », OTA-BP-E-63 (Washington, DC : U.S. Government Printing Office, mai 1989) : « ... il existe de nos jours, un nombre très élevé de travaux scientifiques qui rapportent les résultats d'expériences menées au niveau cellulaire et d'études auprès d'homme et d'animaux qui établissent nettement le rapport entre les champs magnétiques de basse fréquence et les systèmes biologiques, soit par des interactions ou des modifications. Quoique la plupart de ces travaux soient de très bonne qualité, les résultats sont complexes. À la lumière des connaissances scientifiques actuelles, il nous est encore impossible d'interpréter les évidences en un seul cadre de référence cohérent. La situation est toutefois très contrariante. En effet, il nous est aussi impossible de tirer des conclusions définitives quant aux risques éventuels ou de proposer des stratégies fondées sur

des faits scientifiques visant à atténuer ou éviter des risques potentiels ».

Pour atténuer les champs magnétiques sur les lieux de travail, respectez les procédures qui suivent :

1. Maintenez les câbles l'un près de l'autre en les entrelaçant ou les reliant ensemble au ruban.
2. Acheminez les câbles à un côté du soudeur, le plus loin possible.
3. N'enroulez pas de câble autour du corps.
4. Maintenez le bloc d'alimentation du poste de soudage et les câbles aussi loin que possible du corps.

STIMULATEURS CARDIAQUES :

Les procédures décrites ci-dessus sont habituellement celles recommandées pour les porteurs de stimulateurs cardiaques. Pour de plus amples renseignements, consulter un médecin.

1.07 Informations Générales de Sécurité

A Prévention D'incendie

Les opérations de soudage utilisent le feu ou la combustion comme outil de base. Ce processus est très utile quand il est correctement contrôlé.

1. La zone doit comporter un sol ignifugé.
2. Les établis ou tables utilisés pendant les opérations de soudage doivent avoir un revêtement ignifuge.
3. Utilisez des écrans résistants à la chaleur ou en matériau approuvé pour protéger les cloisons proches ou le sol vulnérable des étincelles et du métal chaud.
4. Gardez un extincteur approuvé du bon type et de la bonne taille dans la zone de travail. Inspectez-le régulièrement pour vous assurer qu'il est en état de fonctionner. Apprenez à vous en servir.
5. Enlevez tous les matériaux combustibles de la zone de travail. Si vous ne pouvez pas les enlever, protégez-les avec une couvre ignifuge.

AVERTISSEMENT

N'effectuez JAMAIS d'opérations de soudage sur un récipient qui a contenu des liquides ou vapeurs toxiques, combustibles ou inflammables. N'effectuez JAMAIS d'opérations de soudage dans une zone contenant des vapeurs combustibles, des liquides inflammables ou des poussières explosives.

B Entretien des Locaux

AVERTISSEMENT

Ne laissez jamais l'oxygène en contact avec la graisse, l'huile ou d'autres substances inflammables. Bien que l'oxygène ellemême ne brûle pas, ces substances peuvent devenir extrêmement explosives. Elles peuvent prendre feu et brûler violemment en présence d'oxygène.

Gardez **TOUS** les appareils propres et exempts de graisse, huile ou autres substances inflammables.

C Aération

AVERTISSEMENT

Ventilez les zones de soudage, chauffage et découpage de façon adéquate pour éviter l'accumulation de gaz explosifs ou toxiques. Certaines combinaisons de métaux, revêtements et gaz génèrent des fumées toxiques: Utilisez un équipement de protection respiratoire dans ces circonstances. Si vous soudez ou brasez, lisez et assimilez la fiche technique de sécurité de matériau relative à l'alliage de soudage/brasage.

D Protection Personnelle

Les flammes de gaz produisent une radiation infrarouge qui peut avoir un effet néfaste sur la peau, et particulièrement sur les yeux. Choisissez des lunettes ou un masque avec des verres trempés assombris au niveau 4 ou plus sombre, pour protéger vos yeux des dommages et garder une bonne visibilité sur le travail.

Portez en permanence des gants de protection et des vêtements ignifuges pour la protection de la peau et des vêtements contre les étincelles et le laitier. Gardez col,

manches et poches boutonnés. Il ne faut pas remonter vos manches ou les pantalons à revers.

Quand vous travaillez dans un environnement non dédié au soudage ou découpage, portez toujours une protection des yeux appropriées ou un masque facial.

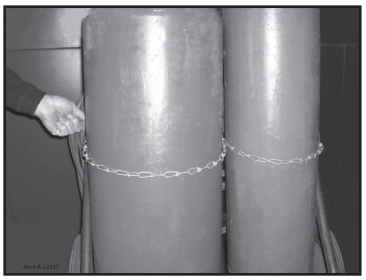
AVERTISSEMENT

Mettez en pratique les procédures de sécurité et de mode opératoire suivantes à chaque fois que vous utilisez cet appareil de régulation de pression. Si vous déviez de ces procédures, cela peut entraîner incendie, explosion, dégâts matériels et/ou blessures corporelles pour l'opérateur.

E Bouteilles de Gaz Comprimé

Le Département des Transports américain (DOT) approuve la conception et la fabrication des bouteilles qui contiennent les gaz utilisés pour les opérations de soudage ou de découpage.

1. Placez la bouteille (Le schéma 1) là où elle sera utilisée. Gardez-la en position verticale. Fixez-la sur un chariot une cloison, un établi, etc.



Le schéma 1-1: Cylindres de gaz

AVERTISSEMENT

Les bouteilles sont sous haute pression. Manipulez-les avec précautions. Des accidents sérieux peuvent résulter d'une mauvaise manutention ou d'un mauvais emploi des bouteilles de gaz comprimé. NE faites PAS tomber la bouteille, ne la cognez pas, ne l'exposez pas à une chaleur excessive, aux flammes ou étincelles. NE la cognez PAS contre d'autres bouteilles. Contactez votre fournisseur de gaz ou reportezvous à la publication CGA P-1 "Manipulation sécurisée des gaz comprimés en conteneur" pour plus d'informations sur l'utilisation et la manutention des bouteilles.

AVIS

Ce document CGA p. t peut être obtenu en écrivant à "Compressed Gas Association", 4221 Walney Roed, 5th Floor. Chantilly, VA 20151.2923, USA.

2. Placez le bouchon de protection de vanne sur la bouteille à chaque fois que vous la déplacez ou ne l'utilisez pas. Ne faites jamais glisser ou rouler d'aucune manière les bouteilles. Utilisez un diable approprié pour les déplacer.
3. Entreposez les bouteilles vides à l'écart des bouteilles pleines. Marquez-les "VIDE" et refermez leur vanne.
4. N'utilisez **JAMAIS** des bouteilles de gaz comprimé sans un régulateur de pression en série sur la vanne de bouteille.
5. Inspectez la vanne de bouteille pour y détecter de l'huile ou de la graisse, ou dès pièces endommagées.

AVERTISSEMENT

N'UTILISEZ PAS la bouteille si vous trouvez de l'huile, de la graisse ou des pièces endommagées. Informez immédiatement votre fournisseur de' gaz de cet état.

6. Ouvrez et fermez momentanément la vanne de la bouteille, délogeant ainsi d'éventu Iles poussières ou saletés. qui pourraient être présentes dans la vanne.

Mise en Garde

Ouvrez la vanne de bouteille légèrement. Si vous l'ouvrez trop en grand, la bouteille pourrait se renverser. Quand vous ouvrez/fermez rapidement la vanne de bouteille, ne vous tenez pas directement devant. Opérez toujours cette opération dans une zone bien ventilée. Si une bouteille d'acétylène crache un brouillard, laissez reposer pendant 15 minutes. Essayez de nouveau la vanne. Si le problème persiste, contactez votre fournisseur de gaz.

1.08 Principales Normes De Securite

Safety in Welding and Cutting, norme ANSI Z49.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

Safety and Health Standards, OSHA 29 CFR 1910, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, norme AWS F4.1, American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33128.

National Electrical Code, norme 70 NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

Safe Handling of Compressed Gases in Cylinders, document P-1, Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202.

Code for Safety in Welding and Cutting, norme CSA W117.2 Association canadienne de normalisation, Standards Sales, 276 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

Safe Practices for Occupation and Educational Eye and Face Protection, norme ANSI Z87.1, American National Standards Institute, 1430 Broadway, New York, NY 10018.

Cutting and Welding Processes, norme 51B NFPA, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

1.09 Graphique de Symbole

Seulement certains de ces symboles apparaîtront sur votre modèle.

	Sous Tension
	Hors Tension
	Tension dangereuse
	Augmentez/Diminuer
	Disjoncteur
	Source AC Auxiliaire
	Fusible
A	Intensité de Courant
V	Tension
Hz	Hertz (cycles/sec)
f	Fréquence
	Négatif
	Positif
	Courant Continue (DC)
	Terre de Protection
	Ligne
	Connexion de la Ligne
	Source Auxiliaire
115V 15A	Classement de Prise-Source Auxiliaire

1 ~	Mono Phasé
3 ~	Trois Phasé
	Tri-Phase Statique Fréquence Convertisseur Transformateur-Redresseur
	Distant
X	Facteur de Marche
%	Pourcentage
	Panneau/Local
	Soudage Arc Electrique Avec Electrode Enrobé (SMAW)
	Soudage á L'arc Avec Fil Electrodes Fusible (GMAW)
	Soudage á L'arc Avec Electrode Non Fusible (GTAW)
	Decoupe Arc Carbone (CAC-A)
	Courant Constant
	Tension Constante Ou Potentiel Constant
	Haute Température
	Force d'Arc
	Amorçage de L'arc au Contact (GTAW)
	Inductance Variable
V	Tension

	Déroulement du Fil
	Alimentation du Fil Vers la Pièce de Fabrication Hors Tension
	Torch de Soudage
	Purge Du Gaz
	Mode Continu de Soudure
	Soudure Par Point
t	Duréc du Pulse
t1	Durée de Pré-Dèbit
t2	Durée de Post-Dèbit
	Détente à 2-Temps Appuyez pour dèruarer l'alimentation du fils et la soudure, le relâcher pour arrêter.
	Détente à 4-Temps Maintenez appuyez pour pré-dèbit, relailez pour initier l'arc. Appuyez pour arrêter l'arc, et mainteuir pour pré-dèbit.
t	Probléme de Terre
IPM	Pouces Par Minute
MPM	Mètres Par Minute
S	Voir Note
	Voir Note
	Art # A-07639_AB

Note: Pour les environnements avec des risques de choc électrique, le fournisseur d'énergie portant la marque S conforme à EN50192 lorsqu'utilisé en conjonction avec des lampes de poche avec des conseils exposés, si équipés avec des guide à l'hauteur de buse correctement installé.

Ne pas déposer avec les déchets ménagers.

1.10 Declaration of Conformity

Declaration of Conformity

Manufacturer: Victor Technologies International Inc.

Address: 16052 Swingley Ridge Road
Suite 300
Chesterfield, MO 63033 U.S.A.

Type of Equipment: Welder

Model /Number: Firepower 140 AC/DC

Serial Number: Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

Market Release Date: 7-16-2014

The product is designed and manufactured to a number of standards and technical requirements. Among them are:

* IEC 60974-1 applicable to welding equipment and associated accessories.

Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Victor Technologies. has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturer's Authorized Representative

Joe Mueller Sr VP GM Sales Americas

Address: Victor Technologies LTD (Formerly Thermadyne Corporation)
16052 Swingley Ridge Road
Suite 300
Chesterfield, MO 63033 U.S.A.

Date: 7-16-2014

Signature

Joe Mueller

Full Name

Sr VP GM Sales Americas

(Position)

Classification: The equipment described in this manual is **Class A** and intended for industrial use.

Warning

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 may be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances.

SECTION 2: INTRODUCTION

2.01 How To Use This Manual

To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.

Throughout this manual, the words WARNING, CAUTION, and NOTE may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

WARNING

A WARNING gives information regarding possible personal injury.

CAUTION

A CAUTION refers to possible equipment damage.

NOTE

A NOTE offers helpful information concerning certain operating procedures.

You will also notice icons from the safety section appearing throughout the manual. These are to advise you of specific types of hazards or cautions related to the portion of information that follows. Some may have multiple hazards that apply and would look something like this:

2.02 Equipment Identification

The unit's identification number (specification or part number), model, and serial number usually appear on a nameplate attached to the control panel. In some cases, the nameplate may be attached to the rear panel, or bottom of the machine. Equipment which does not have a control panel such as gun and cable assemblies is identified only by the specification or part number printed on the shipping container. Record these numbers on the bottom of page ii for future reference.

2.03 Receipt of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to the location in your area listed in the back cover of this manual.

Include all equipment identification numbers as described above along with a full description of the parts in error.

Move the equipment to the installation site before un-crating the unit. Use care to avoid damaging the equipment when using bars, hammers, etc., to un-crate the unit.

2.04 Description

The FIREPOWER TIG 140 AC/DC is a single phase constant current welding inverter capable of performing SMAW (STICK), GTAW (HF TIG) and GTAW (LIFT TIG) welding processes. The unit is equipped with digital amperage , and a host of other features in order to fully satisfy the broad operating needs of the modern user. The unit is also fully compliant to Standard CSA E60974-1 and ANSI/IEC 60974-1.

The FIREPOWER TIG 140 AC/DC provides excellent welding performance across a broad range of applications when used with the correct welding consumables and procedures. The following instructions detail how to correctly and safely set up the machine and give guidelines on gaining the best efficiency and quality from the Power Source. Please read these instructions thoroughly before using the unit.

2.05 User Responsibility

This equipment will perform as per the information contained herein when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Defective equipment (including welding leads) should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated, should be replaced immediately. Should such repairs or replacements become necessary, it is recommended that such repairs be carried out by appropriately qualified persons approved by Firepower. Advice in this regard can be obtained by contacting an Accredited Firepower Distributor.

This equipment or any of its parts should not be altered from standard specification without prior written approval of Firepower. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use or unauthorized modification from standard specification, faulty maintenance, damage or improper repair by anyone other than appropriately qualified persons approved by Firepower.

2.06 Transporting Methods

This unit is equipped with a handle for carrying purposes.

WARNING

ELECTRIC SHOCK can kill. DO NOT TOUCH live electrical parts. Disconnect input power conductors from de-energized supply line before moving the welding power source.

WARNING

FALLING EQUIPMENT can cause serious personal injury and equipment damage.

Lift unit with handle on top of case.

Use handcart or similar device of adequate capacity.

If using a fork lift vehicle, place and secure unit on a proper skid before transporting.

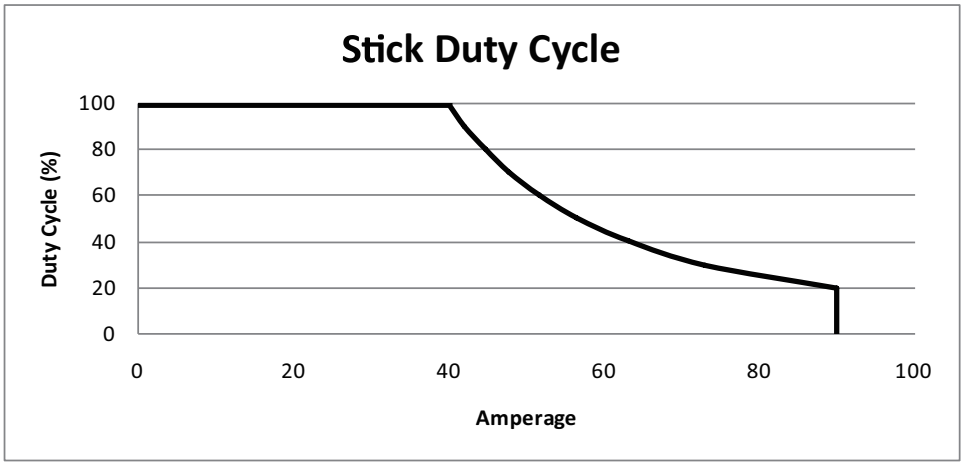
2.07 Packaged Items

- FIREPOWER TIG 140 AC/DC Inverter Power Source
- Tweco 140 Amp Electrode Holder with 13ft (4m) Lead
- Tweco 140 Amp Work Clamp with 10ft (3m) Lead
- Controls & Accessory
- AC Plug
- Victor Argon Flow Gauge & 12.5 ft (3.8m) Hose
- Shoulder Strap
- Operating Manual & CD

Figure 2-1: FIREPOWER TIG 140 AC/DC Packaged System

2.08 Duty Cycle

The rated duty cycle of a Welding Power Source, is a statement of the time it may be operated at its rated welding current output without exceeding the temperature limits of the insulation of the component parts. To explain the 10 minute duty cycle period the following example is used. Suppose a Welding Power Source is designed to operate at a 20% duty cycle, 200 amperes at 18.0 volts. This means that it has been designed and built to provide the rated amperage (200A) for 2 minutes, i.e. arc welding time, out of every 10 minute period (20% of 10 minutes is 2 minutes). During the other 8 minutes of the 10 minute period the Welding Power Source must idle and be allowed to cool. The thermal cut out will operate if the duty cycle is exceeded.



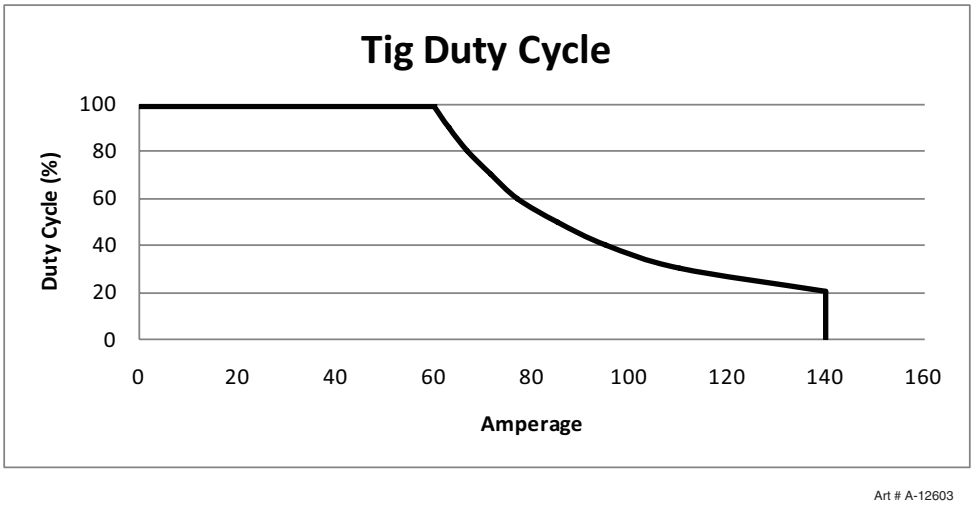


Figure 2-2: FIREPOWER TIG 140 AC/DC Duty Cycle

2.09 Specifications

Description	FIREPOWER TIG 140 AC/DC
Part Number (Power Supply Only)	1442-0031
Power Source Weight	48.4lbs (22kg)
Power Source Dimensions	H15.75"×W9.45"×D18.7" (H400mm×W240mm×D475mm)
Cooling	Fan Cooled (Runs Continually)
Welder Type	Inverter Power Source
Applicable Standards / Approvals	CSA E60974-1, ANSI/IEC 60974-1
Number of Phases	1
Nominal Supply Frequency	50/60Hz
Welding Current Range (STICK Mode)	10 - 90A
Welding Current Range (TIG Mode)	10 - 140A
Nominal Supply Voltage	120V
Effective Input Current (I_{1eff}) (See Note 1) STICK TIG	 16.9A 18.5A
Maximum Input Current (I_{1max}) STICK TIG	 37.8A 41.0A
Single Phase Generator Requirement (See Note 2)	5KVA
STICK (SMAW) Welding Output, 40ºC, 10 min.	90A @ 20%, 23.6V 50A @ 60%, 22.0V 40A @ 100%, 21.6V
TIG (GTAW) Welding Output, 40ºC, 10 min.	140A @ 20%, 15.6V 75A @ 60%, 13.0V 60A @ 100%, 12.4V
Open circuit voltage	76.6 VDC / 92.8VAC
Protection Class	IP23S

Table 2-1: FIREPOWER TIG 140 AC/DC Specification

Note 1: The Effective Input Current should be used for the determination of cable size & supply requirements.

Note 2: Generator Requirements at the Maximum Output Duty Cycle.

2.10 Optional Accessories

17 Style TIG Torch.....Part No. 1442-0022

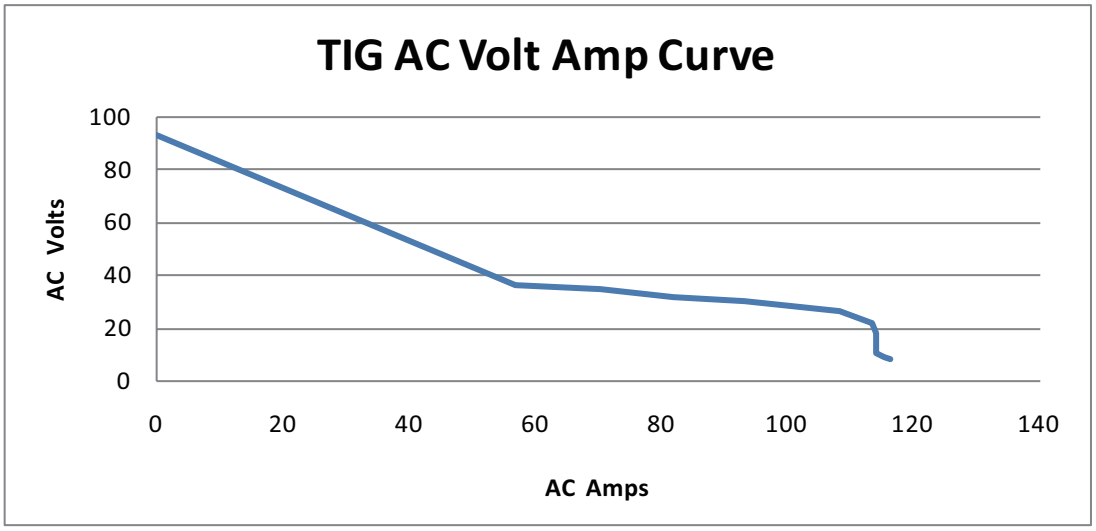
Basic Utility Cart..... Part No. 1444-0900

Foot Control ..... Part No. 1442-0025

Tweco Helmet (USA Only) ..... Part No. 1441-0087

2.11 Volt-Ampere Curves

Voltage-Amperage Curves shows maximum voltage and amperage output capabilities of welding power source. Curves of other settings fall between curves shown.



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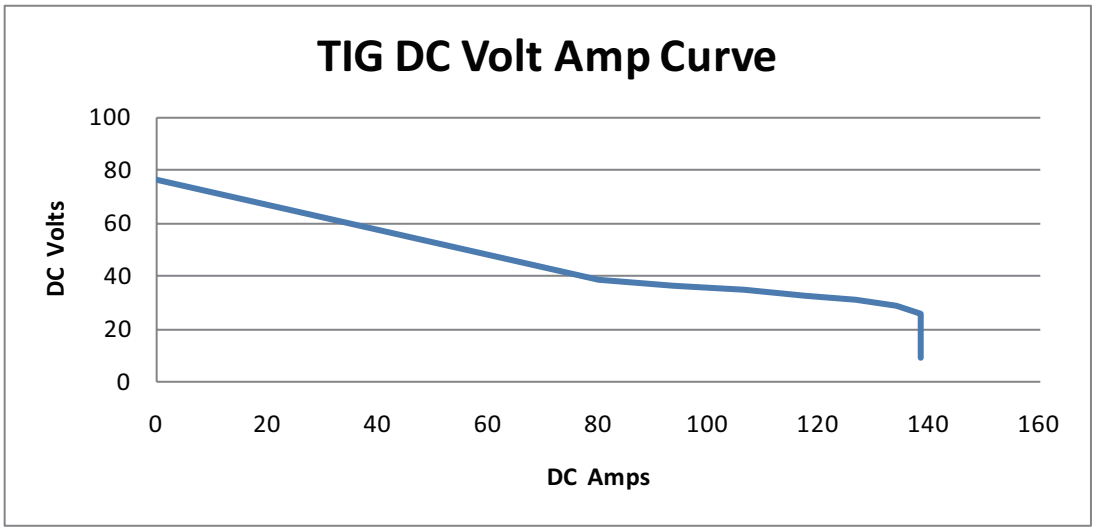

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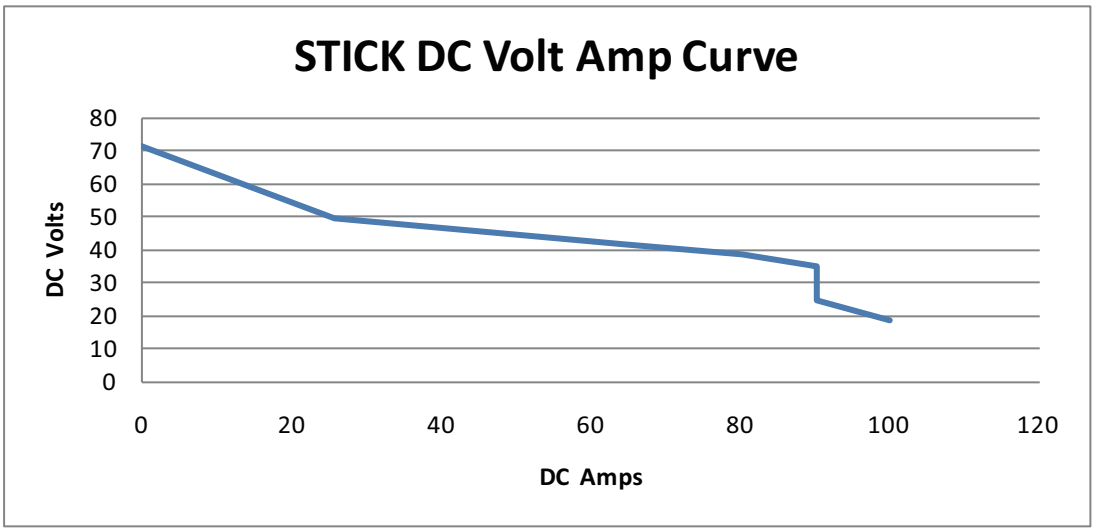

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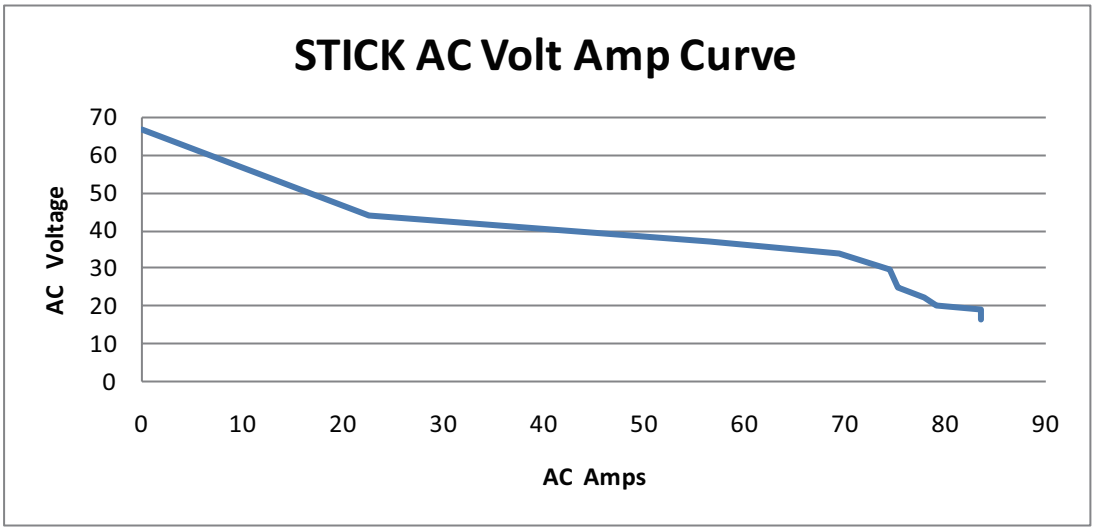

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Figure 2-3: FIREPOWER TIG 140 AC/DC Volt-Amp Curves

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SECTION 3:
INSTALLATION, OPERATION AND SETUP

3.01 Environment

These units are designed for use in environments with increased hazard of electric shock as outlined in IEC 60974-1. Additional safety precautions may be required when using unit in an environment with increased hazard of electric shock. Please refer to relevant local standards for further information prior to using in such areas.

A. Examples of environments with increased hazard of electric shock are:

   1. In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts.

   2. In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator.

   3. In wet or damp hot locations where humidity or perspiration considerable reduces the skin resistance of the human body and the insulation properties of accessories.

B. Environments with increased hazard of electric shock do not include places where electrically conductive parts in the near vicinity of the operator, which can cause increased hazard, have been insulated.

3.02 Location

Be sure to locate the welder according to the following guidelines:

A. In areas, free from moisture and dust.

B. Ambient temperature between 0° C to 40° C.

C. In areas, free from oil, steam and corrosive gases.

D. In areas, not subjected to abnormal vibration or shock.

E. In areas, not exposed to direct sunlight or rain.

F. Place at a distance of 12" (300 mm) or more from walls or similar that could restrict natural air flow for cooling.

G. The enclosure design of this power source meets the requirements of IP23S as outlined in IEC 60529. This provides adequate protection against solid objects (greater than 0.5" (12mm)), and direct protection from vertical drops. Under no circumstances should the unit be operated or connected in a micro environment that will exceed the stated conditions. For further information please refer to IEC 60529.

H. Precautions must be taken against the power source toppling over. The power source must be located on a suitable horizontal surface in the upright position when in use.

WARNING

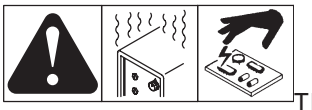
This equipment should be electrically connected by a qualified electrician.

3.03 Ventilation

WARNING

Since the inhalation of welding fumes can be harmful, ensure that the welding area is effectively ventilated.

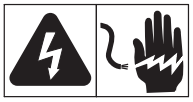
3.04 Mains Supply Voltage Requirements



The Mains supply voltage should be within ± 15% of the rated mains supply voltage. Too low a voltage may cause poor welding performance. Too high a supply voltage will cause components to overheat and possibly fail.

The Welding Power Source must be:

- Correctly installed, if necessary, by a qualified electrician.
- Correctly earthed (electrically) in accordance with local regulations.
- Connected to the correct size power point and fuse as per the Specifications on page 3-2.



WARNING

ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE is present after removal of input power. ***DO NOT TOUCH*** *live electrical parts.*

SHUT DOWN welding power source, disconnect input power employing lockout/tagging procedures. Lock-out/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting OFF and red-tagging circuit breaker or other disconnecting device.

Power Cords Included With Power Supply

Attached to the power supply is an input power cord with a 125 Volt 20 Amp 2 pole 3 wire grounding NEMA 5-20 P for plug.

WARNING

An electrical shock or fire hazard is probable if the following electrical service guide recommendations are not followed. These recommendations are for a dedicated branch circuit sized for the rated output and duty cycle of the welding Power Source.

	50 / 60 Hz Single Phase Supply
Supply Voltage	115 Volt +/- 10%
Input Current at Maximum Output	41.0 Amps
Maximum Recommended Fuse* or Circuit Breaker Rating * Time Delay Fuse, UL class RK5. Refer to UL248	20 Amps
Maximum Recommended Fuse^ or Circuit Breaker Rating ^Normal Operating , UL class K5. Refer to UL248	20 Amps
Minimum Recommended Cord Size	12 AWG
Maximum Recommended Extension Cord Length	10 ft
Minimum Recommended Grounding Conductor Size	12 AWG

Table 3-1: Electrical Service Guide

3.05 High Frequency Introduction

The importance of correct installation of high frequency welding equipment cannot be overemphasized. Interference due to high frequency initiated or stabilized arc is almost invariably traced to improper installation. The following information is intended as a guide for personnel installing high frequency welding machines.

WARNING EXPLOSIVES

The high frequency section of this machine has an output similar to a radio transmitter. The machine should NOT be used in the vicinity of blasting operations due to the danger of premature firing

WARNING COMPUTER

It is also possible that operation close to computer installations may cause computer malfunction.

3.06 High Frequency Interference

Interference may be transmitted by a high frequency initiated or stabilized arc welding machine in the following ways.

1. **Direct Radiation**: Radiation from the machine can occur if the case is metal and is not properly grounded. It can occur through apertures such as open access panels. The shielding of the high frequency unit in the Power Source will prevent direct radiation if the equipment is properly grounded.

2. **Transmission via the Supply Lead**: Without adequate shielding and filtering, high frequency energy may be fed to the wiring within the installation (mains) by direct coupling. The energy is then transmitted by both radiation and conduction. Adequate shielding and filtering is provided in the Power Source.

3. **Radiation from Welding Leads:** Radiated interference from welding leads, although pronounced in the vicinity of the leads, diminishes rapidly with distance. Keeping leads as short as possible will minimise this type of interference. Looping and suspending of leads should be avoided wherever possible.

4. **Re-Radiation from Unearthed Metallic Objects**: A major factor contributing to interference is re-radiation from unearthed metallic objects close to the welding leads. Effective grounding of such objects will prevent re-radiation in most cases.

3.07 Electromagnetic Compatibility

WARNING

Extra precautions for Electromagnetic Compatibility may be required when this Welding Power Source is used in a domestic situation.

A. Installation and Use - Users Responsibility

The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the welding circuit, see NOTE below. In other cases it could involve constructing an electromagnetic screen enclosing the Welding Power Source and the work, complete with associated input filters. In all cases, electromagnetic disturbances shall be reduced to the point where they are no longer Troublesome.

NOTE

The welding circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, e.g. by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

B. Assessment of Area

Before installing welding equipment, the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account.

1. Other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment.
2. Radio and television transmitters and receivers.
3. Computer and other control equipment.
4. Safety critical equipment, e.g. guarding of industrial equipment.
5. The health of people around, e.g. the use of pace-makers and hearing aids.
6. Equipment used for calibration and measurement.

7. The time of day that welding or other activities are to be carried out.

8. The immunity of other equipment in the environment: the user shall ensure that other equipment being used in the environment is compatible: this may require additional protection measures.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

C. Methods of Reducing Electromagnetic Emissions

1. Electricity Supply

   Welding equipment should be connected to the Electricity Supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the Electricity Supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the Welding Power Source so that good electrical contact is maintained between the conduit and the Welding Power Source enclosure.

2. Maintenance of Welding Equipment

   The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions.

3. Welding Cables

   The welding cables should be kept as short as possible and should be positioned close together but never coiled and running at or close to the floor level.

4. Equipotential Bonding

   Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching the metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

5. Earthing/grounding of the Work Piece

   Where the work piece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, e.g. ship's hull or building steelwork, a connection bonding the work piece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the work piece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the work piece to earth should be made by direct connection to the work piece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

6. Screening and Shielding

   Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening the entire welding installation may be considered for special applications.

3.08 140 AC/DC Power Source Controls, Indicators and Features

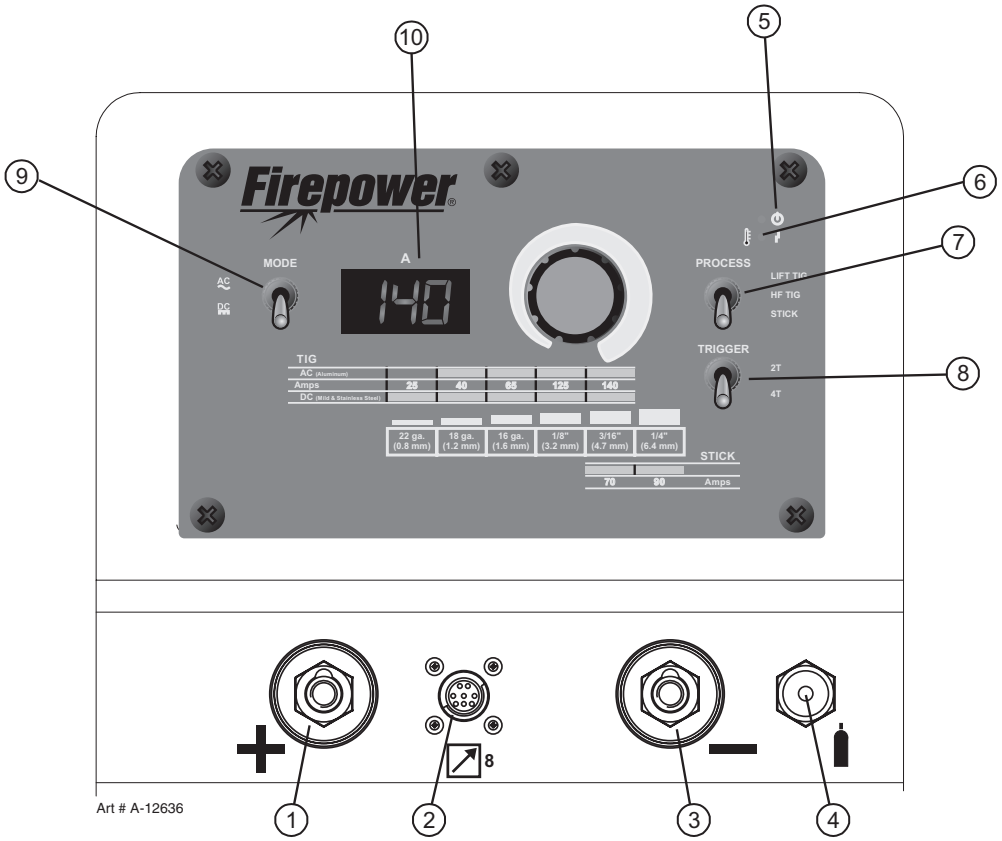


Figure 3-1: Controls on Front Panel

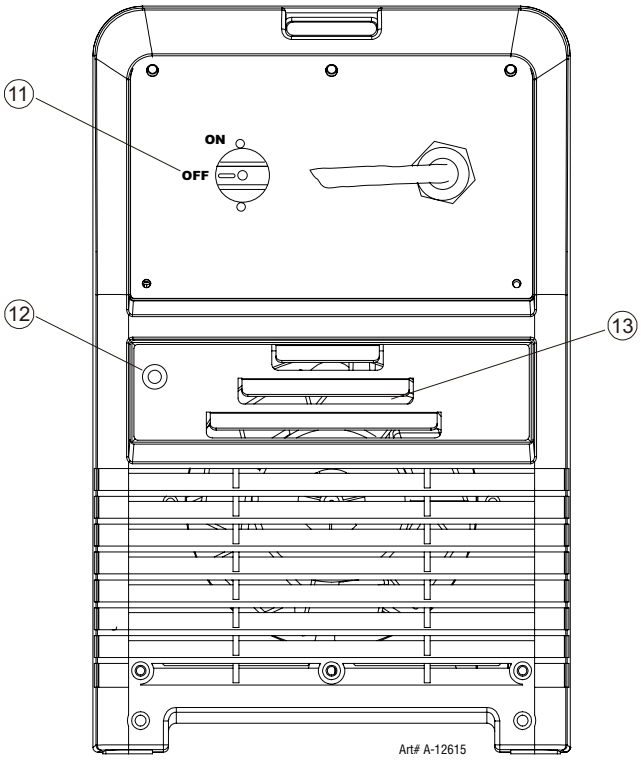


Figure 3-2: Rear Panel

1. Positive Welding Terminal

Positive Welding Terminal 2" (50mm) Heavy Duty Bayonet Dinse. Welding current flows from the Power Source terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

2. 8 Pin Control Socket

The 8 pin receptacle is used to connect a trigger switch or remote control to the welding Power Source circuitry:

To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise. The socket information is included in the event the supplied cable is not suitable and it is necessary to wire a plug or cable to interface with the 8 pin receptacle.

NOTE

When not using a Remote, disconnect any remote control device or it may limit the preview and actual output current range.

Socket Pin	Part Number / Description
1	Not used
2	Trigger Switch Input
3	Trigger Switch Input
4	Not used
5	Remote Control 5k ohm Potentiometers Maximum
6	Remote Control 5k ohm Potentiometers Minimum
7	Remote Control 5k ohm Potentiometer Wiper
8	Not used

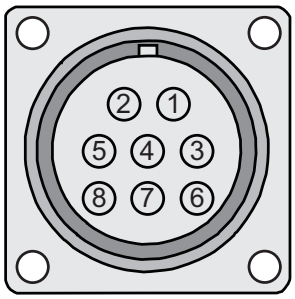


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Table 3-2: 8 Pin Control Plug Configuration

3. Negative Welding Terminal

Negative Welding Terminal 2" (50 mm) Dinse. Welding current flows from the Power Source terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection

CAUTION

Loose welding terminal connections can cause overheating and result in the male plug being fused in the terminal.

4. Shielding Gas Outlet

The Shielding Gas Outlet located on the front panel is a 5/8-18 UNF female gas fitting and is utilized for the connection of a suitable TIG Torch.

5. Power ON Indicator

The POWER ON indicator illuminates when the ON/OFF switch (20) is in the ON position and the correct mains voltage is present.

6. Fault Indicator (Thermal Overload or Primary Circuit Overcurrent)

1. Thermal Overload

This is due to the duty cycle of the power source being exceeded. Once the power source cools sufficiently it will automatically reset and the Fault Indicator and Err 000 will go off and the power source is then able to continue welding. During the time of cooling the power source should remain ON such that the fan continues to operate allowing the unit to cool sufficiently. If after 30 minutes with the fan running the Fault Indicator has not gone OFF then have an Accredited Firepower Service Provider check the power source.

2. Primary Circuit Overcurrent

This is due to primary circuit component(s) malfunctioning which results in excessive primary circuit current. Switch OFF the power source immediately to allow all components to cool down for at least 30 minutes. If after 30 minutes “Err 000” is displayed and Fault Indicator illuminates when the power source is switched back ON turn the power source OFF and have an Accredited Firepower Service Provider check the power source.

7. Process Selection Switch

The process selection control is used to select the desired welding mode. Three modes are available, GTAW (LIFT TIG), GTAW (HF TIG) and SMAW (Stick) modes.

Note that when the unit is powered off the mode selection control will automatically default to LIFT TIG mode.

This is necessary so as to prevent inadvertent arcing should an electrode holder be connected to the unit and mistakenly be in contact with the work piece during power up.

8. Trigger Mode Control Switch (HF TIG and LIFT TIG Mode only)

The trigger mode control is used to switch the functionality of the torch trigger between 2T (normal), and 4T (latch mode).

2T Normal Mode

In this mode, the torch trigger must remain depressed for the welding output to be active. Press and hold the torch trigger to activate the power source (weld). Release the torch trigger switch to cease welding.

NOTE

When operating in GTAW (HF and LIFT TIG modes), the power source will remain active until the selected down slope time has elapsed.

4T Latch Mode

This mode of welding is mainly used for long welding runs to reduce operator fatigue. In this mode the operator can press and release the torch trigger and the output will remain active. To deactivate the power source, the trigger switch must again be depressed and realized, thus eliminating the need for the operator to hold the torch trigger.

Note that when operating in GTAW (HF and LIFT TIG modes), the power source will remain activated until the selected down slope time has elapsed

NOTE

This Up Slope operates in (4T) TIG modes only and is used to set the time for the weld current to ramp up, after the torch trigger switch has been pressed then released, from Initial Current to High or Weld Current.

9. Mode Switch

Press the MODE button to toggle AC and DC output in all Process modes

10. Digital Ammeter

The digital amperage meter is used to display both the pre-set current and actual output current of the power source.

At times of non-welding, the amperage meter will display a pre-set (preview) amperage value. This value can be adjusted by varying the multifunction control when the Programming Parameter Indicator light shows WELD CURRENT .

When welding, the amperage meter will display actual welding current.

Should a remote device be connected the maximum setting of the power source will be determined by the respective front panel control, irrespective of the remote control device setting. As an example, if the output current on the power source front panel is set to 50% and the remote control device is set to 100%, the maximum achievable output from the unit will be 50%. Should 100% output be required, the respective power source front panel control must be set to 100%, in which case the remote device will then be able to control between 0-100% output.

11. ON / OFF Switch

This Switch is located on the rear of the Power Source and turns mains power off and on.

WARNING

When the front digital displays are lit, the machine is connected to the Mains supply voltage and the internal electrical components are at Mains voltage potential

12. Shielding Gas Inlet

Unit has a 5/8" Inert gas fitting suitable for connection of a gas hose to a regulated Shielding Gas Supply. The Shielding Gas inlet is located on the rear of the Power Source.

13. Cooling Fan

The 140 AC/DC is fitted with a cooling fan that will operate continuously when the ON/OFF switch on the rear panel is switched to the ON position.

3.09 FIREPOWER TIG 140 AC/DC - STICK

Select Stick mode with the Process Selection switch.

Select either AC or DC output with the Mode switch.

The Control Knob only adjusts weld current.

While welding the Control directly controls the WELD CURRENT.

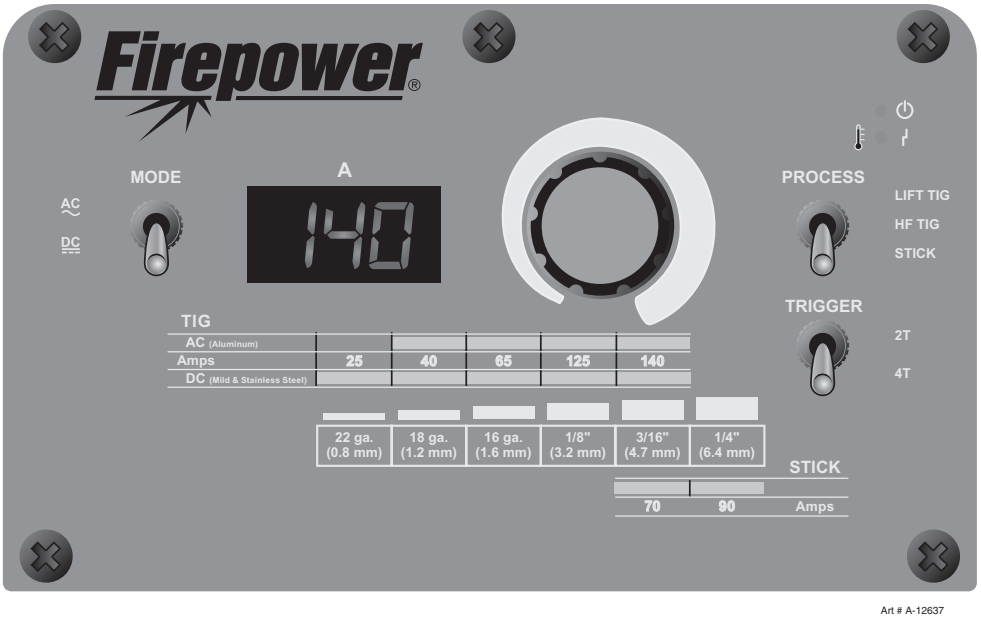


Figure 3-5: Stick Mode

3.10 FIREPOWER TIG 140 AC/DC – LIFT TIG and HF TIG Mode

Select Lift TIG or HF TIG with the Process Selection switch.

Select either AC or DC output with the Mode switch.

Use the Control to adjust the weld current.

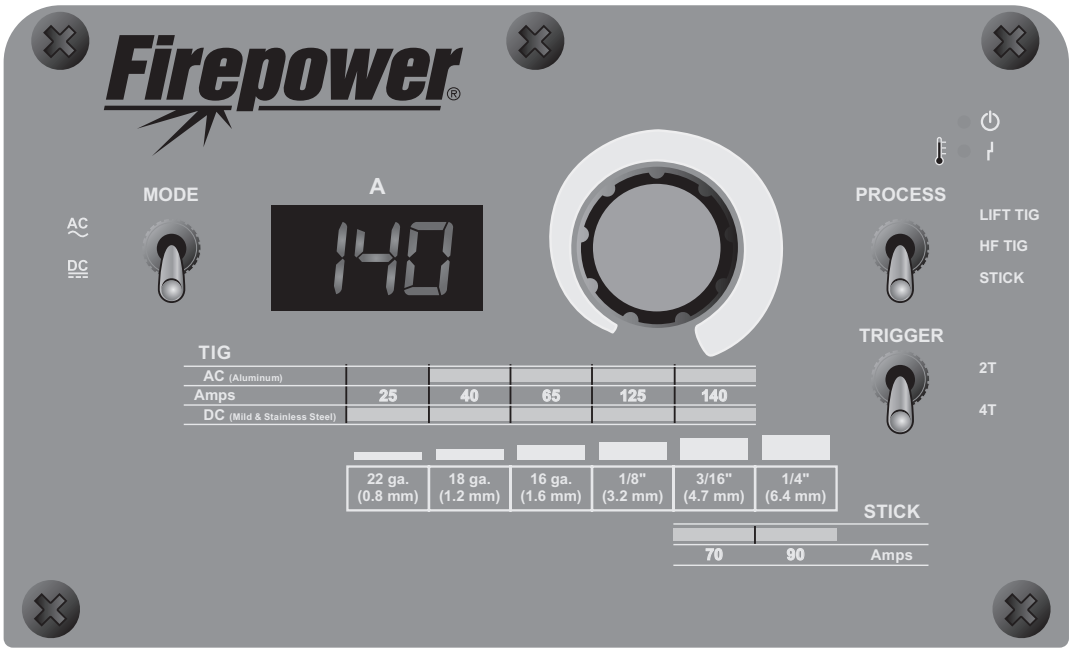


Figure 3-6: LIFT TIG and HF TIG Mode

3.11 Short Circuit Protection While Welding

To prolong the useful life of a TIG tungsten electrode and eliminate tungsten contamination to welding point, the 140 AC/DC incorporates special circuitry.

In all TIG processes, after the welding arc has established, if the tungsten electrode touches the work the current defaults to 33 amps. If the short exists for more than 1-2 seconds, the output is turned off.

In STICK mode, if the electrode touches the work for more than two seconds the welding current is reduced to 0 Amps.

3.12 Victor Regulator

Pressure regulator (Figure 3-7) attached to the cylinder valve reduce high cylinder pressures to suitable low working pressures for welding, cutting, and other applications.

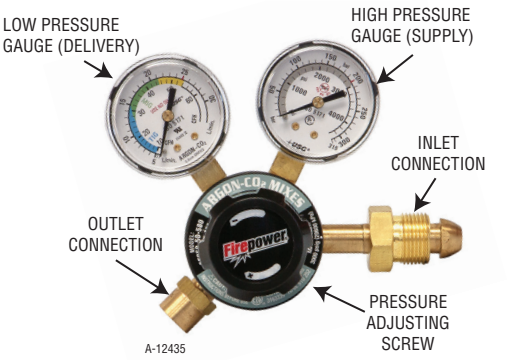


Figure 3-7: Victor CS Regulator

WARNING

Use the regulator for the gas and pressure for which it is designed. NEVER alter a regulator for use with any other gas.

NOTE

Regulators purchased with open 1/8", 1/4", 3/8", or 1/2" NPT ports must be assembled to their intended system.

1. Note the maximum inlet pressure stamped on the regulator. DO NOT attach the regulator to a system that has a higher pressure than the maximum rated pressure stamped on the regulator.
2. The regulator body will be stamped “IN" or “HP" at the inlet port. Attach the inlet port to the system supply pressure connection.
3. If gauges are to be attached to the regulator and the regulator is stamped and listed by a third party (i.e. “UL" or “ETL"). The following requirements must be met:
   a) Inlet gauges over 1000 PSIG (6.87 mPa) shall conform with the requirements of UL 404, “Indicating Pressure Gauges for Compressed Gas Service."
   b) Low pressure gauges must be UL recognized for the class of regulator they are being used on according to UL252A.

WARNING

DO NOT use a regulator that delivers pressure exceeding the pressure rating of the downstream equipment unless provisions are made to prevent over-pressurization (i.e. system relief valve). Make sure the pressure rating of the downstream equipment is compatible with the maximum delivery pressure of the regulator.

4. Be sure that the regulator has the correct pressure rating and gas service for the cylinder used.
5. Carefully inspect the regulator for damaged threads, dirt, dust, grease, oil, or other flammable substances. Remove dust and dirt with a clean cloth. Be sure the inlet swivel filter is clean and in place. Attach the regulator (Figure 3-9) to the cylinder valve. Tighten securely with a wrench.

WARNING

DO NOT attach or use the regulator if oil, grease, flammable substances or damage is present! Have a qualified repair technician clean the regulator or repair any damage.

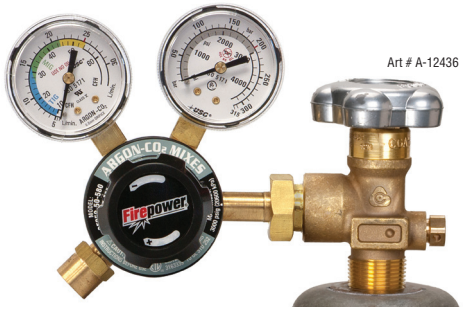


Figure 3-8: Regulator to Cylinder Valve

6. Before opening the cylinder valve, turn the regulator adjusting screw counterclockwise until there is no pressure on the adjusting spring and the screw turns freely.
7. Relief Valve (where provided): The relief valve is designed to protect the low pressure side of the regulator from high pressures. Relief valves are not intended to protect downstream equipment from high pressures.

WARNING

DO NOT tamper with the relief valve or remove it from the regulator.

WARNING

Stand to the side of the cylinder opposite the regulator when opening the cylinder valve. Keep the cylinder valve between you and the regulator. For your safety, NEVER STAND IN FRONT OF OR BEHIND A REGULATOR WHEN OPENING THE CYLINDER VALVE!

8. Slowly and carefully open the cylinder valve (Figure 3-9) until the maximum pressure shows on the high pressure gauge.

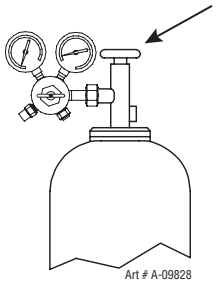


Figure 3-9: Open Cylinder Valve

9. Open the cylinder valve completely to seal the valve packing. On gauge less regulators, the indicator will register the cylinder contents open.

CAUTION

Keep the cylinder valve wrench, if one is required, on the cylinder valve to turn off the cylinder quickly, if necessary.

10. Attach the desired downstream equipment.

3.13 Specification for TIG Torch

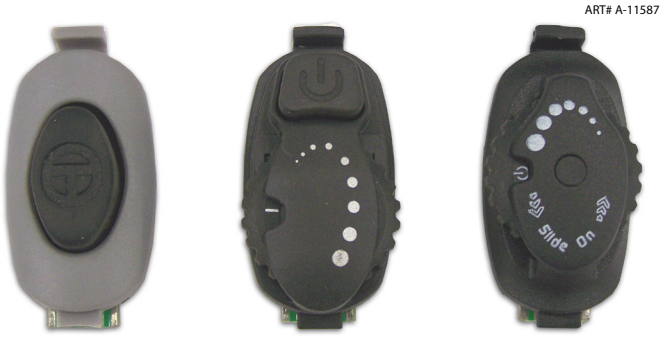
1. SPECIFICATION FOR TIG TORCH PART NO: W4013600 TO SUIT Firepower 140 AC/DC

TIG Torch Contents include:

1 x 17 TIG Torch with Long Back Cap, 12.5 ft lead length, 10.5" gas hose length, 9.5" control lead with 8 pin plug and Rigid Head.

Remote Control Cartridge, Potentiometer with integrated on/off switch (installed).

NOTE: The additional switches/controls below are interchangeable with the installed control in the TIG torch.



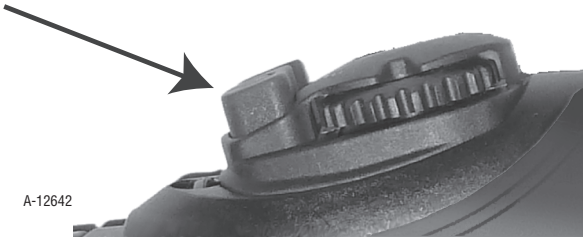
Control module with push button on/off switch only.

Control module with push button on/off switch with roller potentiometer.

Control module with roller potentiometer and integrated on/off switch.

Additional On/Off Switch Cartridge in a Sealed Plastic Bag.

Additional On/Off Switch-Remote Amperage Control Cartridge in a Sealed Plastic Bag (NOTE: You will not be able to view the pre-set amperage on the power source with this control, amperage will not be viewable until the arc is initiated).



1 x Accessory Kit containing 1 x Short Back Cap, 1 x Collet Body 1/8" (3.2mm),

1 x Collet Body 3/32" (2.4mm), 1 x Collet Body 1/16" (1.6mm), 1 x Collet 3/32" (2.4mm), 1 x Collet 1/16" (1.6mm), 1 x Nozzle Alumina No5, 1 x Nozzle Alumina No6, 1 x Tungsten Electrode 3/32" (2.4 mm) Thoriated Type (red band) and 1 x Tungsten Electrode 1/16" (1.6mm) Thoriated Type (red band).

3.14 Setup for TIG (GTAW) Welding

A. Select Lift TIG or HF TIG mode with the process selection control (refer to Section 3.08.7 for further information).

B. Connect the TIG Torch to the negative welding terminal (-). Welding current flows from the power source via 50mm Dinse terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

C. Connect the work lead to the positive welding terminal (+). Welding current flows from the Power Source via 50mm Dinse terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

CAUTION

Loose welding terminal connections can cause overheating and result in the male plug being fused in the bayonet terminal.

D. Connect the TIG torch trigger switch via the 8 pin socket located on the front of the power source as shown below. The TIG torch will require a trigger switch to operate in Lift TIG or HF TIG Mode.

Note: See Appendix A3 for TIG torch contents and trigger switch options.

NOTE

If the TIG torch has a remote TIG torch current control fitted then it will require to be connected to the 8 pin socket. (Refer to section 3.08.2 Remote Control Socket for further information).

E. Fit the welding grade shielding gas regulator/flowmeter to the shielding gas cylinder (refer to Section 3.12) then connect the shielding gas hose from the regulator/flowmeter outlet to the gas INLET on the rear of the FIREPOWER TIG 140 AC/DC Power Source. Connect the gas hose from the TIG torch to the gas OUTLET on the front of the 140 AC/DC Power Source.

WARNING

Before connecting the work clamp to the work make sure the mains power supply is switched off.

Secure the welding grade shielding gas cylinder in an upright position by chaining it to a suitable stationary support to prevent falling or tipping.

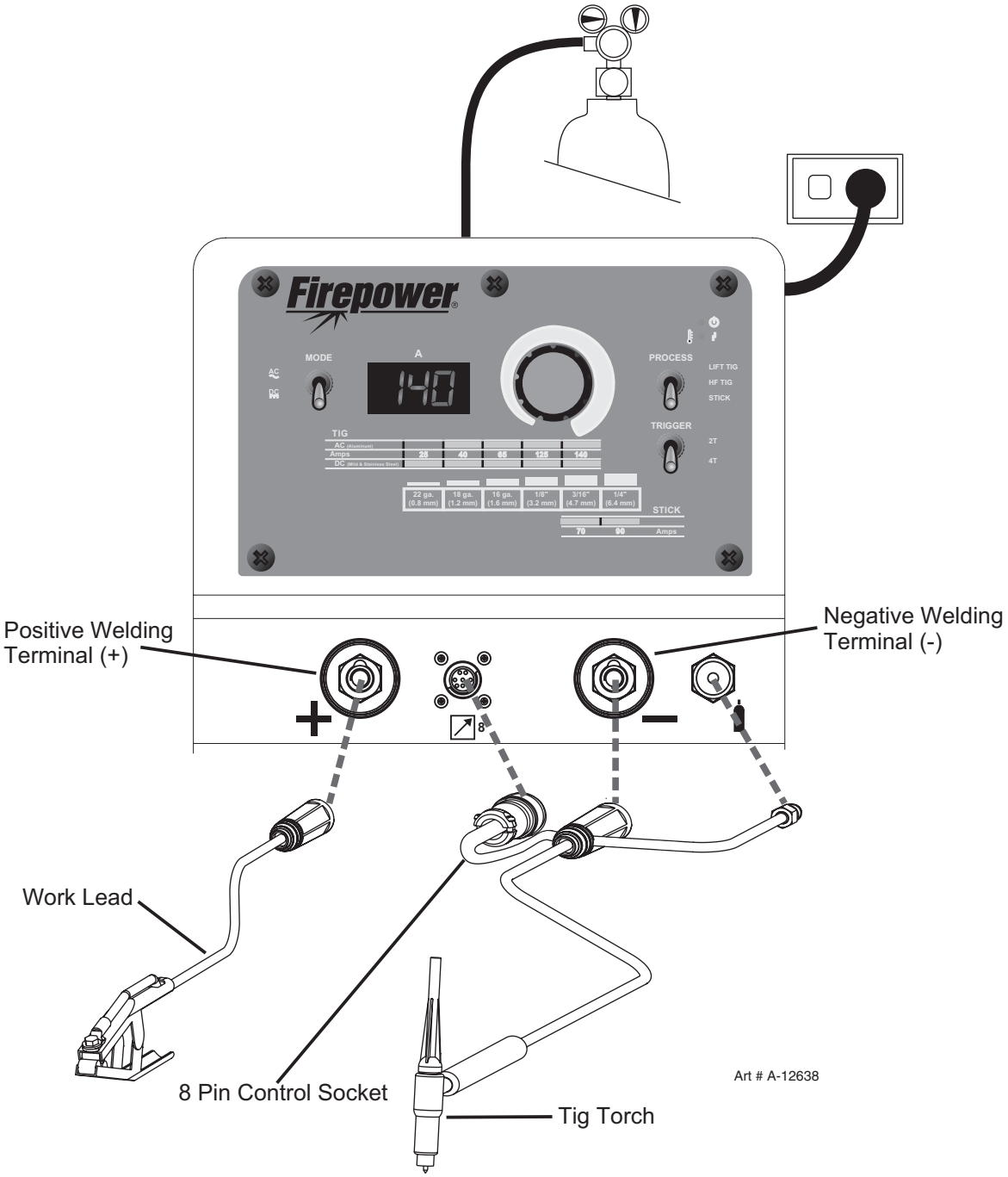


Figure 3-10: Setup for TIG Welding

NOTE

When the 140 AC/DC is used with a Remote Foot Control in, depress foot control to maximum to allow max current to be previewed/adjusted on the front panel. To avoid premature arcing, please ensure the TIG Torch is located away from your work piece.

LIFT TIG (GTAW) Sequence of Operation

CAUTION

Before any welding is to begin, be sure to wear all appropriate and recommended safety equipment.

1. Switch the ON/OFF Switch (located on the rear panel) to OFF.
2. Connect the ground (work) clamp cable to positive output terminal. It is essential that the male plug is inserted and turned fully clockwise until connector locks in place to achieve reliable electrical connection.
3. Connect the TIG torch as follows:
   a) Place the power cable into the negative output terminal. It is essential that the male plug is inserted and turned fully clockwise until connector locks in place to achieve reliable electrical connection;
   b) Place the 8 pin plug into the 8 pin socket. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.
   c) Place the TIG torch gas hose to the gas outlet and tighten with a wrench. Caution: DO NOT over tighten.
4. Using a secured Argon cylinder, slowly crack open then close the cylinder valve while standing off to the side of the valve. This will remove any debris that may be around the valve & regulator seat area.
5. Install the regulator (for details of VICTOR regulator, please refer to 3.18) and tighten with a wrench.
6. Connect one end of the supplied gas hose to the outlet of the Argon regulator and tighten with a wrench. Caution: DO NOT over tighten.
7. Connect the other end of the supplied gas hose to the gas inlet fitting on the rear panel of the welder and tighten with a wrench. Caution: DO NOT over tighten.
8. Open the Argon Cylinder Valve to the fully open position.
9. Connect the ground (work) clamp to your work piece.
10. Set the DOWN SLOPE control knob to the desire weld current ramp down time.
11. Set the weld current control knob to the desired amperage.
12. The tungsten must be ground to a blunt point in order to achieve optimum welding results. It is critical to grind the tungsten electrode in the direction the grinding wheel is turning.
13. Install the tungsten with approximately 1/8" (3.2mm) to ¼" (6.0mm) sticking out from the gas cup, ensuring you have correct sized collet.
14. Tighten the back cap then open the valve on the torch.
15. Plug the power cable into the appropriate outlet, and turn the switch to the “ON" position. The power LED light should illuminate. Set the “Process Selection Switch" to LIFT TIG.
16. You are now ready to begin TIG Welding.

NOTE

When the 140 AC/DC is used with a Remote Foot Control in, depress foot control to maximum to allow max current to be previewed/adjusted on the front panel. To avoid premature arcing, please ensure the TIG Torch is located away from your work piece.

3.15 Setup for STICK (SMAW) Welding

A. Connect the Electrode Holder lead to the positive welding terminal (+). If in doubt, consult the electrode manufacturer. Welding current flows from the Power Source via 50mm Dinse type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

B. Connect the work lead to the negative welding terminal (-). If in doubt, consult the electrode manufacturer. Welding current flows from the power source via 50mm Dinse type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

C. Select STICK mode with the process selection control (refer to Section 3.08.7 for further information)

WARNING

Before connecting the work clamp to the work and inserting the electrode in the electrode holder make sure the mains power supply is switched off.

CAUTION

Remove any packaging material prior to use. Do not block the air vents at the front or rear of the Welding Power Source.

CAUTION

Loose welding terminal connections can cause overheating and result in the male plug being fused in the bayonet terminal.

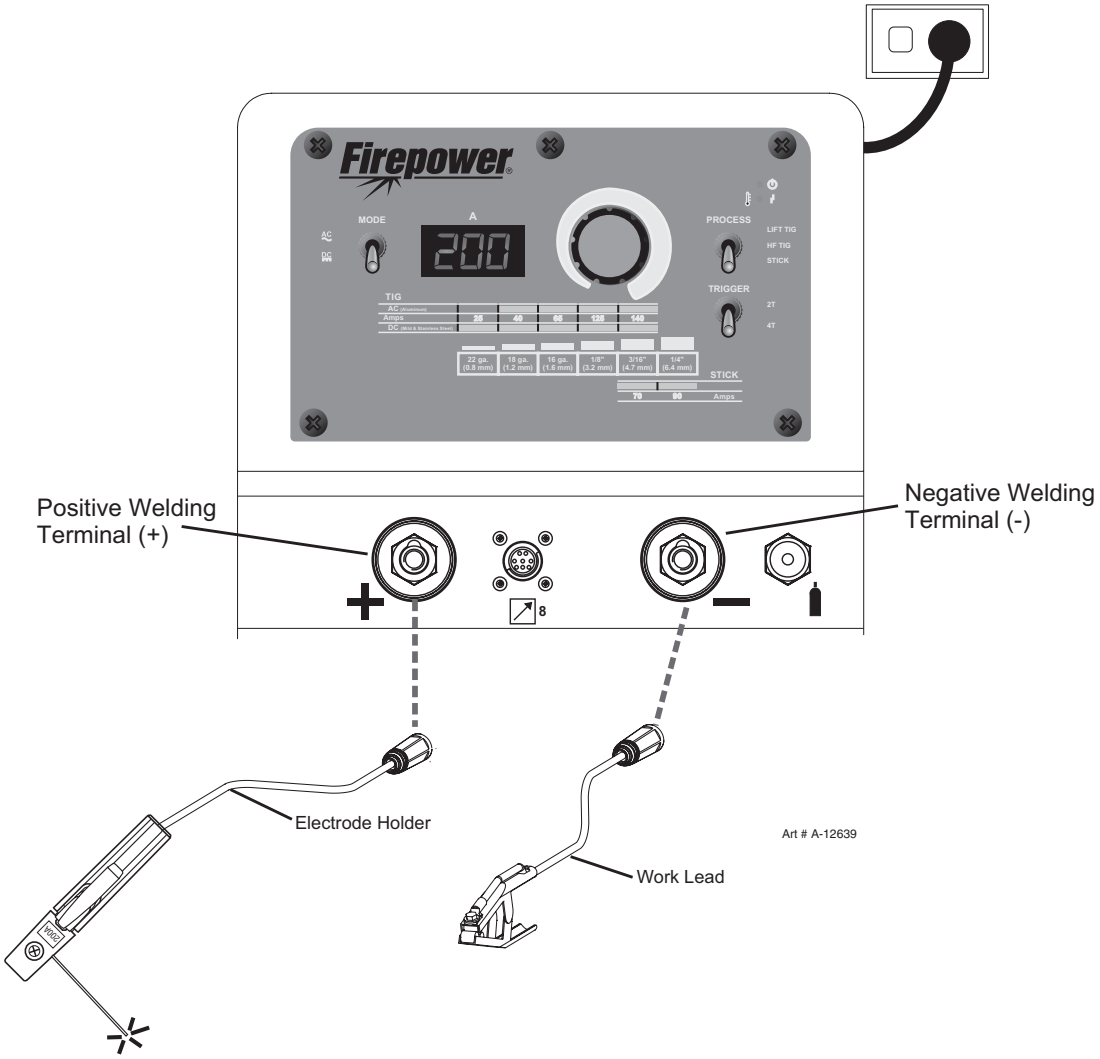


Figure 3-11: Setup for Stick Welding.(SMAW)

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SECTION 4:
BASIC WELDING GUIDE

4.01 STICK (SMAW) Basic Welding Technique

Size of Electrode

The electrode size is determined by the thickness of metals being joined and can also be governed by the type of welding machine available. Small welding machines will only provide sufficient current (amperage) to run the smaller size electrodes.

For thin sections, it is necessary to use smaller electrodes otherwise the arc may burn holes through the job. A little practice will soon establish the most suitable electrode for a given application.

Storage of Electrodes

Always store electrodes in a dry place and in their original containers.

Electrode Polarity

Electrodes are generally connected to the ELECTRODE HOLDER with the Electrode Holder connected positive polarity. The WORK LEAD is connected negative polarity and is connected to the work piece. If in doubt consult the electrode data sheet or your nearest Accredited Firepower Distributor.

Effects of Stick Welding Various Materials

A. High Tensile and Alloy Steels

The two most prominent effects of welding these steels are the formation of a hardened zone in the weld area, and, if suitable precautions are not taken, the occurrence in this zone of under-bead cracks. Hardened zone and under-bead cracks in the weld area may be reduced by using the correct electrodes, preheating, using higher current settings, using larger electrodes sizes, short runs for larger electrode deposits or tempering in a furnace.

B. Manganese Steels

The effect on manganese steel of slow cooling from high temperatures is to embrittle it. For this reason it is absolutely essential to keep manganese steel cool during welding by quenching after each weld or skip welding to distribute the heat.

C. Cast Iron

Most types of cast iron, except white iron, are weldable. White iron, because of its extreme brittleness, generally cracks when attempts are made to weld it. Trouble may also be experienced when welding white-heart malleable, due to the porosity caused by gas held in this type of iron.

D. Copper and Alloys

The most important factor is the high rate of heat conductivity of copper, making pre-heating of heavy sections necessary to give proper fusion of weld and base metal.

E. Types of Electrodes

Arc Welding electrodes are classified into a number of groups depending on their applications. There are a great number of electrodes used for specialized industrial purposes which are not of particular interest for everyday general work. These include some low hydrogen types for high tensile steel, cellulose types for welding large diameter pipes, etc The range of electrodes dealt with in this publication will cover the vast majority of applications likely to be encountered; are all easy to use.

Metal Being Joined	Electrode	Comments
Mild Steel	E6011	This electrode is used for all-position welding or for welding on rusty, dirty, less-than-new metal. It has a deep, penetrating arc and is often the first choice for repair or maintenance work.
Mild Steel	E6013	This all-position, electrode is used for welding clean, new sheet metal. Its soft arc has minimal spatter, moderate penetration and an easy-to-clean slag.
Mild Steel	E7014	All positional, ease to use electrode for use on thicker steel than E6013. Especially suitable sheet metal lap joints and fillet welds, general purpose plate welding.
Mild Steel	E7018	A low-hydrogen, all-position electrode used when quality is an issue or for hard-to-weld metals. It has the capability of producing more uniform weld metal, which has better impact properties at low temperatures.
Cast Iron	Eni-CI	Suitable for joining all cast irons except white cast iron.
Stainless Steel	E318L-16	High corrosion resistances. Ideal for dairy work etc.

Welding Position

The electrodes dealt with in this publication can be used in most positions, i.e. they are suitable for welding in flat, horizontal, vertical and overhead positions. Numerous applications call for welds to be made in positions intermediate between these. Some of the common types of welds are shown in Figures 4-5 through 4-12.

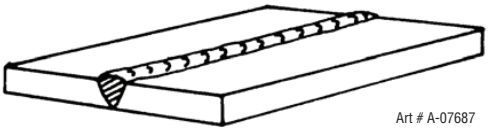


Figure 4-1: Flat Position, Down Hand Butt Weld

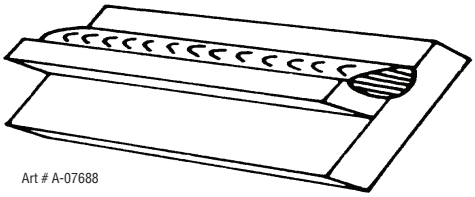


Figure 4-2: Flat Position, Gravity Fillet Weld

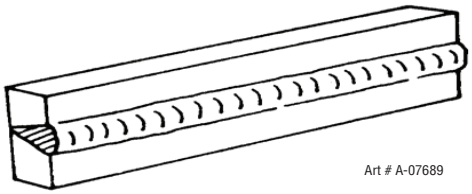


Figure 4-3: Horizontal Position, Butt Weld

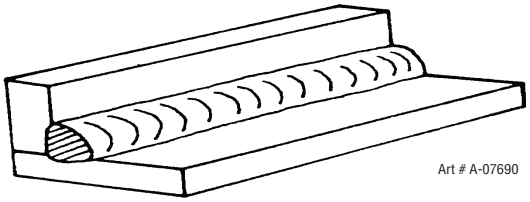


Figure 4-4: Horizontal-Vertical (HV) Position

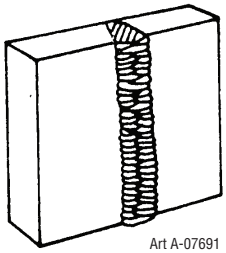


Figure 4-5: Vertical Position, Butt Weld

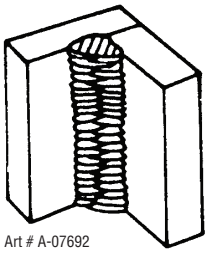


Figure 4-6: Vertical Position, Fillet Weld

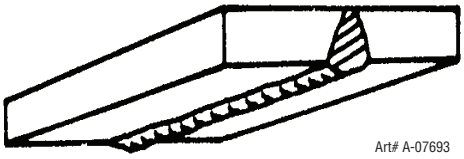


Figure 4-7: Overhead Position, Butt Weld

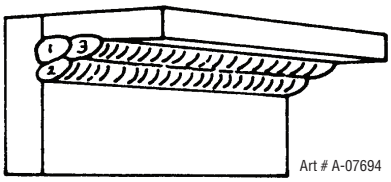


Figure 4-8: Overhead Position, Fillet Weld

Joint Preparations

In many cases, it will be possible to weld steel sections without any special preparation. For heavier sections and for repair work on castings, etc., it will be necessary to cut or grind an angle between the pieces being joined to ensure proper penetration of the weld metal and to produce sound joints.

In general, surfaces being welded should be clean and free of rust, scale, dirt, grease, etc. Slag should be removed from oxy-cut surfaces. Typical joint designs are shown in Figure 4-9.

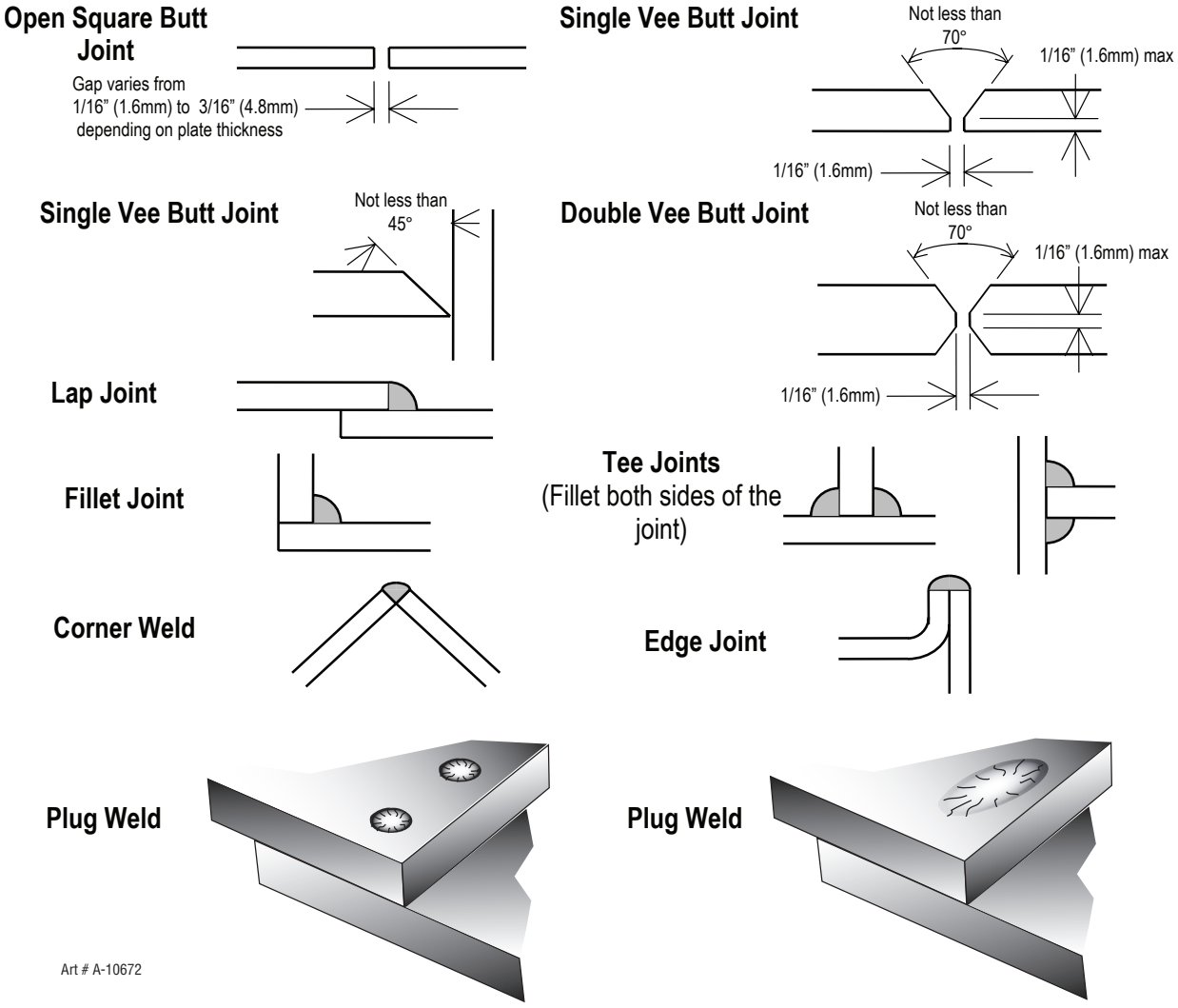


Figure 4-9: Typical Joint Designs for Arc Welding

Arc Welding Technique - A Word to Beginners

For those who have not yet done any welding, the simplest way to commence is to run beads on a piece of scrap plate. Use mild steel plate about 1/4" (6.0mm) thick and a 1/8" (3.2mm) electrode. Clean any paint, loose scale or grease off the plate and set it firmly on the work bench so that welding can be carried out in the downhand position. Make sure that the work clamp is making good electrical contact with the work, either directly or through the work table. For light gauge material, always clamp the work lead directly to the job, otherwise a poor circuit will probably result.

The Welder

Place yourself in a comfortable position before beginning to weld. Get a seat of suitable height and do as much work as possible sitting down.

Place the work so that the direction of welding is across, rather than to or from, your body. The electrode holder lead should be clear of any obstruction so that you can move your arm freely along as the electrode burns down. Be sure the insulation on your cable and electrode holder is not faulty, otherwise you are risking an electric shock.

Striking the Arc

Practice this on a piece of scrap plate before going on to more exacting work. You may at first experience difficulty due to the tip of the electrode "sticking" to the work piece. This is caused by making too heavy a contact with the work and failing to withdraw the electrode quickly enough. A low amperage will accentuate it. This freezing-on of the tip may be overcome by scratching the electrode along the plate surface in the same way as a match is struck. As soon as the arc is established, maintain a 1/16" (1.6mm) to 1/8" (3.2mm) gap between the burning electrode end and the parent metal. Draw the electrode slowly along as it melts down.

Another difficulty you may meet is the tendency, after the arc is struck, to withdraw the electrode so far that the arc is broken again. A little practice will soon remedy both of these faults.

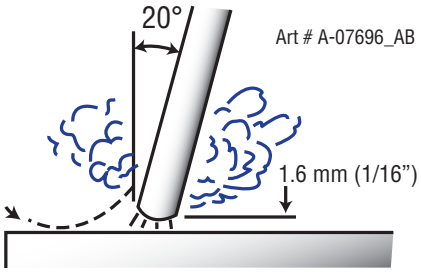


Figure 4-10: Striking an Arc

Arc Length

The securing of an arc length necessary to produce a neat weld soon becomes almost automatic. You will find that a long arc produces more heat. A very long arc produces a crackling or spluttering noise and the weld metal comes across in large, irregular blobs. The weld bead is flattened and spatter increases. A short arc is essential if a high quality weld is to be obtained although if it is too short there is the danger of it being blanketed by slag and the electrode tip being solidified in. If this should happen, give the electrode a quick twist back over the weld to detach it.

Rate of Travel

After the arc is struck, your next concern is to maintain it, and this requires moving the electrode tip towards the molten pool at the same rate as it is melting away. At the same time, the electrode has to move along the plate to form a bead. The electrode is directed at the weld pool at about 20^{o} from the vertical. The rate of travel has to be adjusted so that a well-formed bead is produced.

If the travel is too fast, the bead will be narrow and strung out and may even be broken up into individual globules. If the travel is too slow, the weld metal piles up and the bead will be too large.

Making Welded Joints

Having attained some skill in the handling of an electrode, you will be ready to go on to make up welded joints.

A. Butt Welds

Set up two plates with their edges parallel, as shown in Figure 4-11, allowing 1/16" (1.6mm) to 3/32" (2.4mm) gap between them and tack weld at both ends. This is to prevent contraction stresses from the cooling weld metal pulling the plates out of alignment. Plates thicker than 1/4" (6.0mm) should have their mating edges bevelled to form a 70º to 90º included angle. This allows full penetration of the weld metal to the root.

Do not weave the electrode, but maintain a steady rate of travel along the joint sufficient to produce a well-formed bead. At first you may notice a tendency for undercut to form, but keeping the arc length short, the angle of the electrode at about 20º from vertical, and the rate of travel not too fast, will help eliminate this. The electrode needs to be moved along fast enough to prevent the slag pool from getting ahead of the arc. To complete the joint in thin plate, turn the job over, clean the slag out of the back and deposit a similar weld.

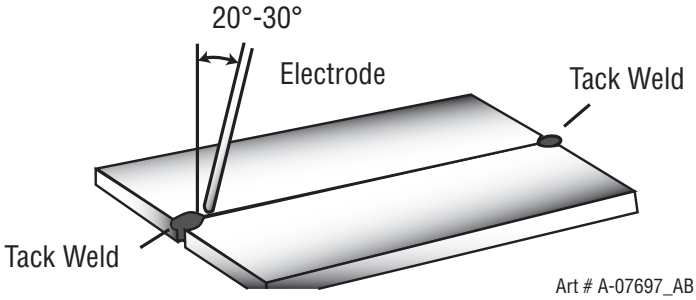


Figure 4-11: Butt Weld

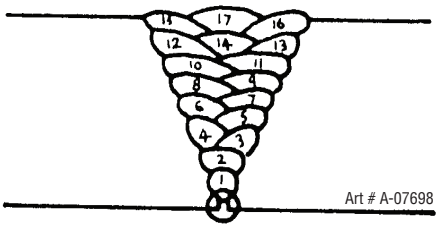


Figure 4-12: Weld Build up Sequence

Heavy plate will require several runs to complete the joint. After completing the first run, chip the slag out and clean the weld with a wire brush. It is important to do this to prevent slag being trapped by the second run. Subsequent runs are then deposited using either a weave technique or single beads laid down in the sequence shown in Figure 4-12. The width of weave should not be more than three times the core wire diameter of the electrode. When the joint is completely filled, the back is either machined, ground or gouged out to remove slag which may be trapped in the root, and to prepare a suitable joint for depositing the backing run. If a backing bar is used, it is not usually necessary to remove this, since it serves a similar purpose to the backing run in securing proper fusion at the root of the weld.

B. Fillet Welds

These are welds of approximately triangular cross-section made by depositing metal in the corner of two faces meeting at right angles. Refer to Figure 4-4.

A piece of angle iron is a suitable specimen with which to begin, or two lengths of strip steel may be tacked together at right angles. This is known as a horizontal-vertical (HV) fillet. Strike the arc and immediately bring the electrode to a position perpendicular to the line of the fillet and about 45º from the vertical. Some electrodes require to be sloped about 20º away from the perpendicular position to prevent slag from running ahead of the weld. Refer to Figure 4-13. Do not attempt to build up much larger than 1/4" (6.4mm) width with a 1/8" (3.2mm) electrode, otherwise the weld metal tends to sag towards the base, and undercut forms on the vertical leg. Multi-runs can be made as shown in Figure 4-14. Weaving in HV fillet welds is undesirable.

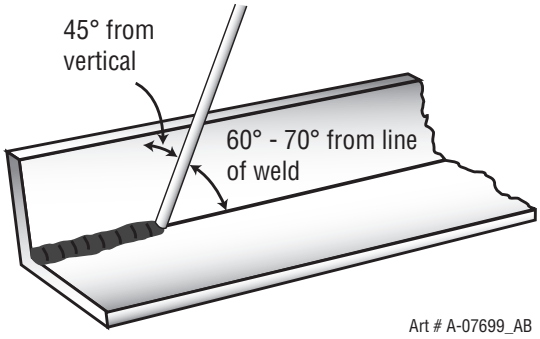


Figure 4-13: Electrode Position for HV Fillet Weld

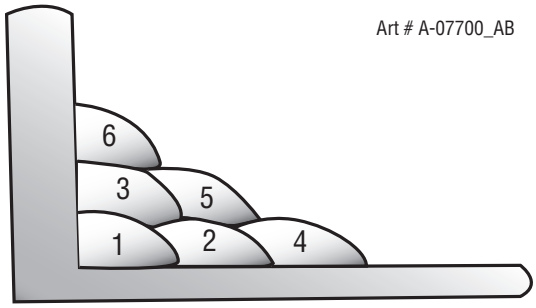


Figure 4-`14: Multi-runs in HV Fillet Weld

C. Vertical Welds

1. Vertical Up

Tack weld a three feet length of angle iron to your work bench in an upright position. Make yourself comfortable on a seat in front of the job and strike the arc in the corner of the fillet. The electrode needs to be about 10º from the horizontal to enable a good bead to be deposited. Refer Figure 4-15. Use a short arc, and do not attempt to weave on the first run. When the first run has been completed de-slag the weld deposit and begin the second run at the bottom. This time a slight weaving motion is necessary to cover the first run and obtain good fusion at the edges. At the completion of each side motion, pause for a moment to allow weld metal to build up at the edges, otherwise undercut will form and too much metal will accumulate in the centre of the weld. Figure 4-16 illustrates multi-run technique and Figure 4-17 shows the effects of pausing at the edge of weave and of weaving too rapidly.

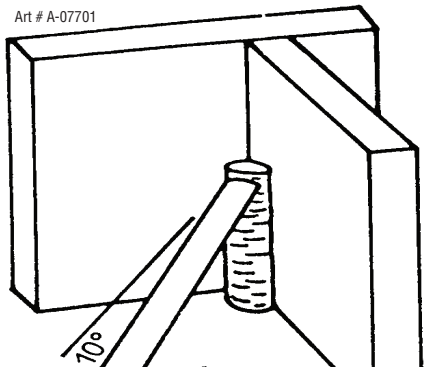


Figure 4-15: Single Run Vertical Fillet Weld

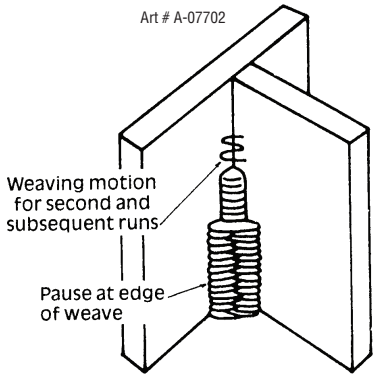


Figure 4-16: Multi Run Vertical Fillet Weld

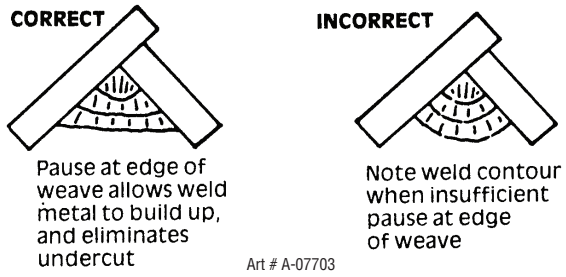


Figure 4-17: Examples of Vertical Fillet Welds

2. Vertical Down

Use a 1/8" (3.2mm) electrode at 100 amps. The tip of the electrode is held in light contact with the work and the speed of downward travel is regulated so that the tip of the electrode just keeps ahead of the slag. The electrode should point upwards at an angle of about 45º.

3. Overhead Welds

Apart from the rather awkward position necessary, overhead welding is not much more difficult that downhand welding. Set up a specimen for overhead welding by first tacking a length of angle iron at right angles to another piece of angle iron or a length of waste pipe. Then tack this to the work bench or hold in a vice so that the specimen is positioned in the overhead position as shown in the sketch. The electrode is held at 45º to the horizontal and tilted 10º in the line of travel (Figure 4-18). The tip of the electrode may be touched lightly on the metal, which helps to give a steady run. A weave technique is not advisable for overhead fillet welds.

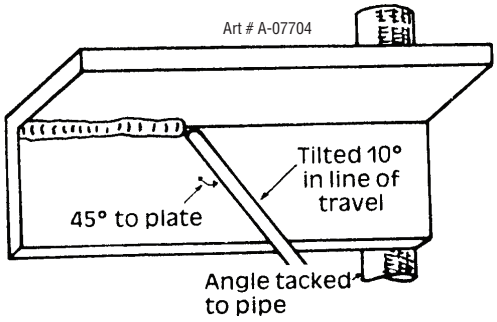


Figure 4-18: Overhead Fillet Weld

Distortion

Distortion in some degree is present in all forms of welding. In many cases it is so small that it is barely perceptible, but in other cases allowance has to be made before welding commences for the distortion that will subsequently occur. The study of distortion is so complex that only a brief outline can be attempted hear.

The Cause of Distortion

Distortion is caused by:

A. Contraction of Weld Metal:

Molten steel shrinks approximately 11 per cent in volume on cooling to room temperature. This means that a cube of molten metal would contract approximately 2.2 per cent in each of its three dimensions. In a welded joint, the metal becomes attached to the side of the joint and cannot contract freely. Therefore, cooling causes the weld metal to flow plastically, that is, the weld itself has to stretch if it is to overcome the effect of shrinking volume and still be attached to the edge of the joint. If the restraint is very great, as, for example, in a heavy section of plate, the weld metal may crack. Even in cases where the weld metal does not crack, there will still remain stresses "Locked-up" in the structure. If the joint material is relatively weak, for example, a butt joint in 5/64" (2.0mm) sheet, the contracting weld metal may cause the sheet to become distorted.

B. Expansion and Contraction of Parent Metal in the Fusion Zone:

While welding is proceeding, a relatively small volume of the adjacent plate material is heated to a very high temperature and attempts to expand in all directions. It is able to do this freely at right angles to the surface of the plate (i.e., "through the weld", but when it attempts to expand "across the weld" or "along the weld", it meets considerable resistance, and to fulfil the desire for continued expansion, it has to deform plastically, that is, the metal adjacent to the weld is at a high temperature and hence rather soft, and, by expanding, pushes against the cooler, harder metal further away, and tends to bulge (or is "upset". When the weld area begins to cool, the "upset" metal attempts to contract as much as it expanded, but, because it has been "upset" it does not resume its former shape, and the contraction of the new shape exerts a strong pull on adjacent metal. Several things can then happen.

The metal in the weld area is stretched (plastic deformation), the job may be pulled out of shape by the powerful contraction stresses (distortion), or the weld may crack, in any case, there will remain "locked-up" stresses in the job. Figures 4-19 and 4- 20 illustrate how distortion is created.

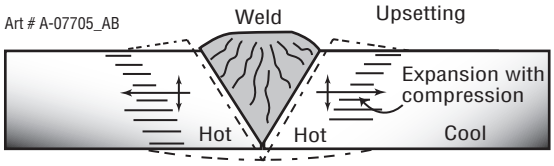


Figure 4-19: Parent Metal Expansion

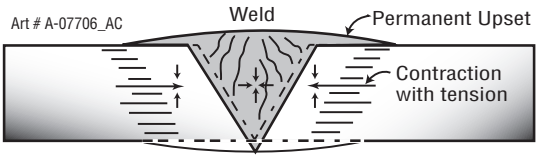


Figure 4-20: Parent Metal Contraction

Overcoming Distortion Effects

There are several methods of minimizing distortion effects.

A. Peening

This is done by hammering the weld while it is still hot. The weld metal is flattened slightly and because of this the tensile stresses are reduced a little. The effect of peening is relatively shallow, and is not advisable on the last layer.

B. Distribution of Stresses

Distortion may be reduced by selecting a welding sequence which will distribute the stresses suitably so that they tend to cancel each other out. See Figures 4-20 through 4-23 for various weld sequences. Choice of a suitable weld sequence is probably the most effective method of overcoming distortion, although an unsuitable sequence may exaggerate it. Simultaneous welding of both sides of a joint by two welders is often successful in eliminating distortion.

C. Restraint of Parts

Forcible restraint of the components being welded is often used to prevent distortion. Jigs, positions, and tack welds are methods employed with this in view.

D. Presetting

It is possible in some cases to tell from past experience or to find by trial and error (or less frequently, to calculate) how much distortion will take place in a given welded structure. By correct pre-setting of the components to be welded, constructional stresses can be made to pull the parts into correct alignment. A simple example is shown in Figure 4-21.

E. Preheating

Suitable preheating of parts of the structure other than the area to be welded can be sometimes used to reduce distortion. Figure 4-22 shows a simple application. By removing the heating source from b and c as soon as welding is completed, the sections b and c will contract at a similar rate, thus reducing distortion.

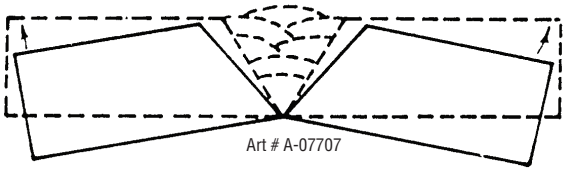
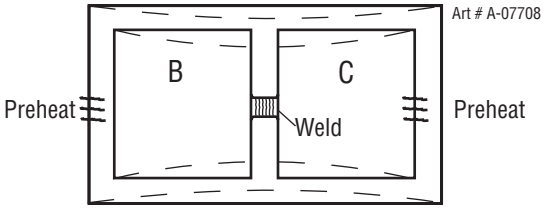


Figure 4-21: Principle of Presetting



Dotted lines show effect if no preheat is used

Figure 4-22: Reduction of Distortion by Preheating

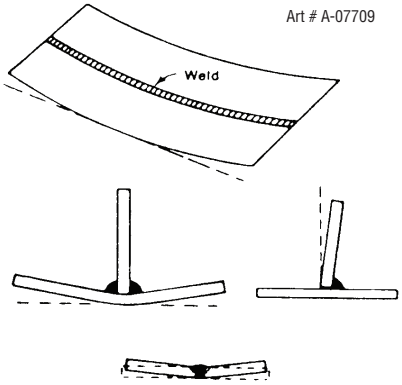
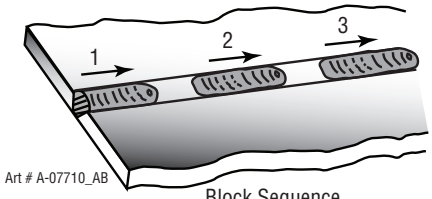


Figure 4-23: Examples of Distortion



Block Sequence.
The spaces between the welds are filled in when the welds are cool.

Figure 4-24: Welding Sequence

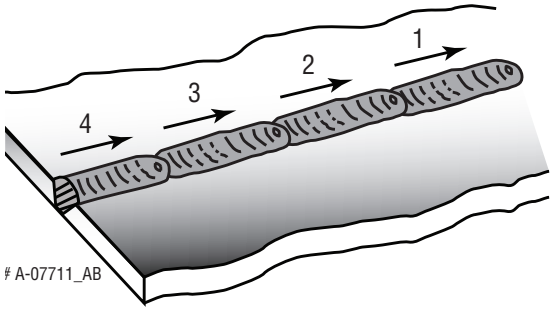


Figure 4-25: Step back Sequence

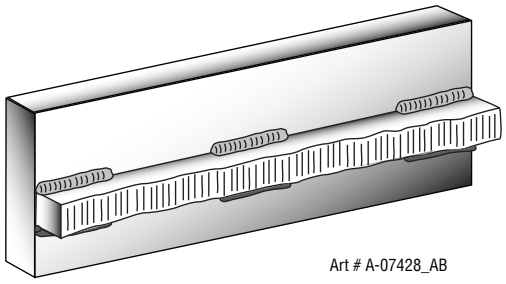


Figure 4-26: Chain Intermittent Welding

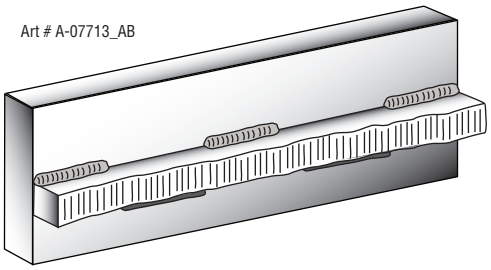


Figure 4-27: Staggered Intermittent Welding

4.02 STICK (SMAW) Welding Troubleshooting

FAULT	CAUSE	REMEDY
1 Welding current varying	ARC FORCE control knob is set at a value that causes the welding current to vary excessively with the arc length.	Reduce the ARC FORCE control knob until welding current is reasonably constant while prohibiting the electrode from sticking to the work piece when you “dig" the electrode into the workpiece.
2 A gap is left by failure of the weld metal to fill the root of the weld.	A Welding current too low	A Increase welding current.
	B Electrode too large for joint.	B Use smaller diameter electrode.
	C Insufficient gap.	C Allow wider gap.
3 Non-metallic particles are trapped in the weld metal.	A Non-metallic particles may be trapped in undercut from previous run.	A If a bad undercut is present clean slag bout and cover with a run from a smaller gauge electrode.
	B Joint preparation too restricted.	B Allow for adequate penetration and room for cleaning out the slag.
	C Irregular deposits allow slag to be trapped.	C If very bad, chip or grind out irregularities.
	D Lack of penetration with slag trapped beneath weld bead.	D Use smaller electrode with sufficient current to give adequate penetration. Use suitable tools to remove all slag from comers.
	E Rust or mill scale is preventing full fusion.	E Clean joint before welding.
	F Wrong electrode for position in which welding is done.	F Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.

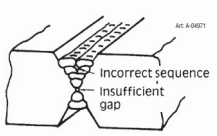
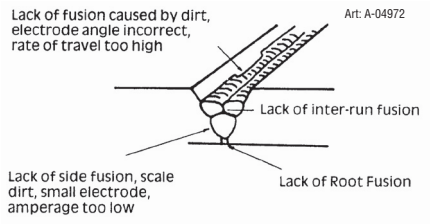
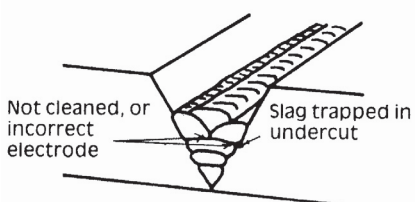


Figure 1 - Example of insufficient gap or incorrect sequence

FAULT	CAUSE	REMEDY
4 A groove has been formed in the base metal adjacent to the toe of a weld and has not been filled by the weld metal (undercut).	A Welding current is too high.	A Reduce welding current.
	B Welding arc is too long.	B Reduce the length of the welding arc.
	C Angle of the electrode is incorrect.	C Electrode should not be inclined less than 45° to the vertical face.
	D Joint preparation does not allow correct electrode angle.	D Allow more room in joint for manipulation of the electrode.
	E Electrode too large for joint.	E Use smaller gauge electrode.
	F Insufficient deposit time at edge of weave.	F Pause for a moment at edge of weave to allow weld metal buildup.
5 Portions of the weld run do not fuse to the surface of the metal or edge of the joint.	A Small electrodes used on heavy cold plate.	A Use larger electrodes and preheat the plate.
	B Welding current is too low.	B Increase welding current.
	C Wrong electrode angle.	C Adjust angle so the welding arc is directed more into the base metal.
	D Travel speed of electrode is too high.	D Reduce travel speed of electrode.
	E Scale or dirt on joint surface.	E Clean surface before welding.
 Figure 2: Example of Lack of Fusion		
6 Gas pockets or voids in weld metal (porosity)	A High levels of sulphur in steel.	A Use an electrode that is designed for high sulphur steels.
	B Electrodes are damp.	B Dry electrodes before use.
	C Welding current is too high.	C Reduce welding current.
	D Surface impurities such as oil, grease, paint, etc.	D Clean joint before welding.
	E Welding in a windy environment.	E Shield the weld area from the wind.
	F Electrode damaged i.e. flux coating incomplete.	F Discard damaged electrodes and only use electrodes with a complete flux coating.

FAULT	CAUSE	REMEDY
7 Crack occurring in weld metal soon after solidification commences	A Rigidity of joint.	A Redesign to relieve weld joint of severe stresses or use crack resistance electrodes.
	B Insufficient throat thickness.	B Travel slightly slower to allow greater build up in throat.
	C Weld current is too high.	C Decrease welding current.



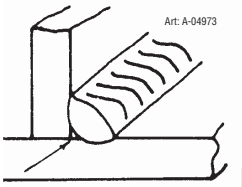


Figure 3: Example of Slag Inclusion

Table 4-2: Welding Problems SMAW (STICK)

4.03 TIG (GTAW) Basic Welding Technique

Gas Tungsten Arc Welding (GTAW) or TIG (Tungsten Inert Gas) as it is commonly referred to, is a welding process in which fusion is produced by an electric arc that is established between a single tungsten (non-consumable) electrode and the work piece. Shielding is obtained from a welding grade shielding gas or welding grade shielding gas mixture which is generally Argon based. A filler metal may also be added manually in some circumstances depending on the welding application.

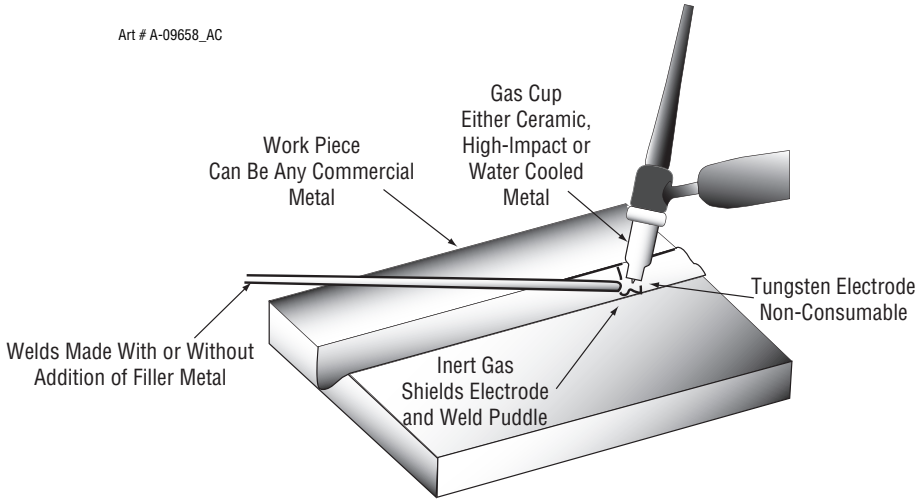


Figure 4-28: TIG Welding Application Shot

Tungsten Electrode Current Ranges

Electrode Diameter	DC Current (Amps)
0.040" (1.0mm)	30-60
1/16" (1.6mm)	60-115
3/32" (2.4mm)	100-165
1/8" (3.2mm)	135-200
5/32" (4.0mm)	190-280
3/16" (4.8mm)	250-340

Table 4-3: Current Ranges for Various Tungsten Electrode Sizes

Guide for Selecting Filler Wire Diameter

Filler Wire Diameter	DC Current Range (Amps)
1/16" (1.6mm)	20-90
3/32" (2.4mm)	65-115
1/8" (3.2mm)	100-165
3/16" (4.8mm)	200-350

Table 4-4: Filler Wire Selection Guide

Tungsten Electrode Types

Electrode Type (Ground Finish)	Welding Application	Features	Color Code
Thoriated 2%	DC welding of mild steel, stainless steel and copper	Excellent arc starting, Long life, High current carrying capacity	Red
Zirconated 1%	High quality AC welding of aluminium, magnesium and their alloys.	Self cleaning, Long life, Maintains balled end, High current carrying capacity.	White
Ceriated 2%	AC & DC welding of mild steel, stainless steel, copper, aluminium, magnesium and their alloys	Longer life, More stable arc, Easier starting, Wider current range, Narrower more concentrated arc.	Grey

Table 4-5 Tungsten Electrode Types

Base Metal Thickness	AC Current for Aluminium	Tungsten Electrode Diameter	Filler Rod Diameter (if required)	Argon Gas Flow Rate	JOINT TYPE
1/16" 1.6mm	60-80 70-90	1/16" 1.6mm	1/16" 1.6mm	15 CFM 7 LPM	Butt/Corner Lap/Fillet
1/8" 3.2mm	125-145 140-160	3/32" 2.4mm	1/16"-3/32" 1.6mm - 2.4mm	17 CFM 8 LPM	Butt/Corner Lap/Fillet

Table 4-6 Aluminium Welding Material

Base Metal Thickness	DC Current for Mild Steel	DC Current for Stainless Steel	Tungsten Electrode Diameter	Filler Rod Diameter (if required)	Argon Gas Flow Rate	Joint Type
0.040" 1.0mm	35-45 40-50	20-30 25-35	0.040" 1.0mm	1/16" 1.6mm	10 CFH(5 LPM)	Butt/Corner Lap/Fillet
0.045" 1.2mm	45-55 50-60	30-45 35-50	0.040" 1.0mm	1/16" 1.6mm	13 CFH(6 LPM)	Butt/Corner Lap/Fillet
1/16" 1.6mm	60-70 70-90	40-60 50-70	1/16" 1.6mm	1/16" 1.6mm	15 CFH(7 LPM)	Butt/Corner Lap/Fillet
1/8" 3.2mm	80-100 90-115	65-85 90-110	1/16" 1.6mm	3/32" 2.4mm	15 CFH(7 LPM)	Butt/Corner Lap/Fillet
3/16" 4.8mm	115-135 140-165	100-125 125-150	3/32" 2.4mm	1/8" 3.2mm	21 CFH(10 LPM)	Butt/Corner Lap/Fillet
1/4" 6.4mm	160-175 170-200	135-160 160-180	1/8" 3.2mm	5/32" 4.0mm	21 CFH(10 LPM)	Butt/Corner Lap/Fillet

Table 4-7: Welding Rate

TIG Welding is generally regarded as a specialised process that requires operator competency. While many of the principles outlined in the previous Arc Welding section are applicable a comprehensive outline of the TIG Welding process is outside the scope of this Operating Manual. For further information please refer to www.firepower.com or contact Firepower.

4.04 TIG (GTAW) Welding Problems

	FAULT		CAUSE		REMEDY
1	Excessive bead build up or poor penetration or poor fusion at edges of weld.		Welding current is too low		Increase weld current and/or faulty joint preparation.
2	Weld bead too wide and flat or undercut at edges of weld or excessive burn through.		Welding current is too high		Decrease weld current.
3	Weld bead too small or insufficient penetration or ripples in bead are widely spaced apart.		Travel speed too fast		Reduce travel speed.
4	Weld bead too wide or excessive bead build up or excessive penetration in butt joint.		Travel speed too slow		Increase travel speed.
5	Uneven leg length in fillet joint		Wrong placement of filler rod		Re-position filler rod.
6	Electrode melts or oxidises when an arc is struck.	A	Torch lead connected to positive welding terminal.	A	Connect torch lead to negative welding terminal.
		B	No gas flowing to welding region.	B	Check the gas lines for kinks or breaks and gas cylinder contents.
		C	Torch is clogged with dust or dirt.	C	Clean torch.
		D	Gas hose is cut.	D	Replace gas hose.
		E	Gas passage contains impurities.	E	Disconnect gas hose from the rear of Power Source then raise gas pressure and blow out impurities.
		F	Gas regulator turned off.	F	Turn on.
		G	The electrode is too small for the welding current.	G	Increase electrode diameter or reduce the welding current.
		H	Power source is set for STICK welding.	H	Set Power Source to LIFT TIG or HF TIG mode.

FAULT	CAUSE	REMEDY
7 Dirty weld pool	A Electrode contaminated by contact with work piece or filler rod material.	A Clean the electrode by grinding off the contaminates.
	B Work piece surface has foreign material on it.	B Clean surface.
	C Gas contaminated with air.	C Check gas lines for cuts and loose fitting or change gas cylinder.
8 Poor weld finish	Inadequate shielding gas.	Increase gas flow or check gas line for gas flow problems.
9 Arc start is not smooth.	A Tungsten electrode is too large for the welding current.	A Select the right size tungsten electrode. Refer to Table 4-3 Tungsten Electrode Selection Chart.
	B The wrong electrode is being used for the welding job.	B Select the right tungsten electrode type. Refer to Table 4-5 Tungsten Electrode Selection Chart.
	C Gas flow rate is too high.	C Select the right rate for the welding job. Refer to Table 4-7.
	D Incorrect shielding gas is being used.	D Select the right shielding gas.
	E Poor work clamp connection to work piece.	E Improve connection to work piece.
10 Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the right size tungsten electrode. Refer to Table 4-3 Tungsten Electrode Selection Chart.

SECTION 5: POWER SOURCE PROBLEMS AND ROUTINE SERVICE REQUIREMENTS

5.01 Basic Troubleshooting

WARNING

There are extremely dangerous voltage and power levels present inside this product. Do not attempt to open or repair unless you are a qualified electrical tradesperson and you have had training in power measurements and troubleshooting techniques.

If major complex subassemblies are faulty, then the Welding Power Source must be returned to an accredited Firepower Service Provider for repair. The basic level of troubleshooting is that which can be performed without special equipment or knowledge. Refer also to section 4 for solving welding problems.

5.02 Power Source Problems

	FAULT		CAUSE		REMEDY
1	Mains supply voltage is ON, power indicator is illuminated however unit will not commence welding when the torch trigger switch is depressed.	A	Power source is not in the correct mode of operation.	A	Set the power source to the correct mode of operation with the process selection switch.
		B	Faulty torch trigger.	B	Repair or replace torch trigger switch/lead.
2	Mains supply voltage is ON. Indicator light is not lit and welding arc cannot be established.	A	Primary control fuse is blown.	A	Replace primary control fuse.
		B	Broken connection in primary circuit.	B	Have an Accredited Firepower Service Provider check primary circuit.
3	Fault Indicator is illuminated and unit will not commence welding when the torch trigger switch is depressed.		Duty cycle of power source has been exceeded.		Leave the power source switched ON and allow it to cool. Note that fault indicator must be extinguished prior to commencement of welding.
4	Welding output continues when torch trigger released	A	Trigger mode selection is in 4T (LATCH) mode	A	Change to 2T (NORMAL) mode
		B	Torch trigger leads shorted	B	Repair or replace Torch / trigger lead
5	Welding output voltage is present when the torch trigger switch is depressed but arc cannot be established.		Poor or no work lead contact.		Clean work clamp area and ensure good electrical contact.
6	Welding output voltage is not present when torch trigger depressed		Faulty trigger switch / lead		Repair or replace Torch / trigger lead
7	TIG electrode melts when arc is struck.		TIG torch is connected to the (+) VE terminal.		Connect the TIG torch to the (-) VE terminal.
8	Arc flutters during TIG welding.		Tungsten electrode is too large for the welding current.		Select the correct size of tungsten electrode.
9	No HF output in HF mode		HF Circuit faulty		Have an Accredited Firepower Service Provider check HF circuit.

FAULT	CAUSE	REMEDY
Error Code “Err 001” is displayed on the digital displays in conjunction with the Fault Indicator Illuminating.	A Thermal Overload	This is due to the duty cycle of the power source being exceeded. Once the power source cools sufficiently it will automatically reset and the Fault Indicator and Err 001 will go off and the power source is then able to continue welding. During the time of cooling the power source should remain ON such that the fan continues to operate allowing the unit to cool sufficiently. If after 30 minutes with the fan running the Fault Indicator has not gone OFF then have an Accredited Firepower Service Provider check the power source.

Table 5-1: Power Source Problem

5.03 Routine Service and Calibration Requirements

WARNING

There are extremely dangerous voltage and power levels present inside this Inverter Power Source. Do not attempt to open or repair unless you are an accredited Firepower Service Provider. Disconnect the Welding Power Source from the Mains Supply Voltage before disassembling.

Routine Inspection, Testing & Maintenance

The inspection and testing of the power source and associated accessories shall be carried out in accordance with Section 5 of IEC/ANSI 60974-1: Safety in Welding and Allied Processes-Part 2 Electrical. This includes an insulation resistance test and an earthing test to ensure the integrity of the unit is compliant with Firepower original specifications.

If equipment is to be used in a hazardous location or environments with a high risk of electrocution as outlined in EN 60974.1, then the above tests should be carried out prior to entering this location.

A. Testing Schedule

1. For transportable equipment, at least once every 3 months; and
2. For fixed equipment, at least once every 12 months.

The owners of the equipment shall keep a suitable record of the periodic tests and a system of tagging, including the date of the most recent inspection.

A transportable power source is deemed to be any equipment that is not permanently connected and fixed in the position in which it is operated.

B. Insulation Resistance

Minimum insulation resistance for in-service Firepower Inverter Power Sources shall be measured at a voltage of 500V between the parts referred to in Table 5-2 below. Power sources that do not meet the insulation resistance requirements set out below shall be withdrawn from service and not returned until repairs have been performed such that the requirements outlined below are met.

Components to be Tested	Minimum Insulation Resistance (M Ω)
Input circuit (including any connected control circuits) to welding circuit (including any connected control circuits)	5
All circuits to exposed conductive parts	2.5
Welding circuit (including any connected control circuits) to any auxiliary circuit which operates at a voltage exceeding extra low voltage	10
Welding circuit (including any connected control circuits) to any auxiliary circuit which operates at a voltage not exceeding extra low voltage	1
Separate welding circuit to separate welding circuit	1

Table 5-2: Minimum Insulation Resistance Requirements: Firepower Inverter Power Sources

C. Earth Grounding

The resistance shall not exceed 1Ω between any metal of a power source where such metal is required to be earthed, and -

1. The earth terminal of a fixed power source; or
2. The earth terminal of the associated plug of a transportable power source

Note that due to the dangers of stray output currents damaging fixed wiring, the integrity of fixed wiring supplying Firepower welding power sources should be inspected by a licensed electrical worker in accordance with the requirements below -

1. For outlets/wiring and associated accessories supplying transportable equipment - at least once every 3 months; and
2. For outlets/wiring and associated accessories supplying fixed equipment - at least once every 12 months.

D. General Maintenance Checks

Welding equipment should be regularly checked by an accredited Firepower Service Provider to ensure that:

1. Flexible cord is of the multi-core tough rubber or plastic sheathed type of adequate rating, correctly connected and in good condition.
2. Welding terminals are in suitable condition and are shrouded to prevent inadvertent contact or short circuit.
3. The Welding System is clean internally, especially from metal filing, slag, and loose material.

E. Accessories

Accessory equipment, including output leads, electrode holders, torches, wire feeders and the like shall be inspected at least monthly by a competent person to ensure that the equipment is in a safe and serviceable condition. All unsafe accessories shall not be used.

F. Repairs

If any parts are damaged for any reason, it is recommended that replacement be performed by an accredited Firepower Service Provider.

Power Source Calibration

A. Schedule

Output testing of all Firepower Inverter Power Sources and applicable accessories shall be conducted at regular intervals to ensure they fall within specified levels. Calibration intervals shall be as outlined below -

1. For transportable equipment, at least once every 3 months; and
2. For fixed equipment, at least once every 12 months.

If equipment is to be used in a hazardous location or environments with a high risk of electrocution as outlined in IEC/ANSI 60974-1, then the above tests should be carried out prior to entering this location.

B. Calibration Requirements

Where applicable, the tests outlined in Table 5-3 below shall be conducted by an accredited Firepower service provider.

Testing Requirements
Output current (A) to be checked to ensure it falls within applicable Firepower power source specifications
Output Voltage (V) to be checked to ensure it falls within applicable Firepower power source specifications
Accuracy of digital meters to be checked to ensure it falls within applicable Firepower power source specifications

Table 5-3: Calibration Parameters

Periodic calibration of other parameters such as timing functions are not required unless a specific fault has been identified.

C. Calibration Equipment

All equipment used for Power Source calibration shall be in proper working condition and be suitable for conducting the measurement in question. Only test equipment with valid calibration certificates (NATA certified laboratories) shall be utilized.

5.04 Cleaning the Welding Power Source

WARNING

There are dangerous voltage and power levels present inside this product. Do not attempt to open or repair unless you are a qualified electrical tradesperson. Disconnect the Welding Power Source from the Mains Supply Voltage before disassembling.

To clean the Welding Power Source, open the enclosure and use a vacuum cleaner to remove any accumulated dirt, metal filings, slag and loose material. Keep the shunt and lead screw surfaces clean as accumulated foreign material may reduce the welders output welding current.

SECTION 6:
KEY SPARE PARTS

6.01 Power Source

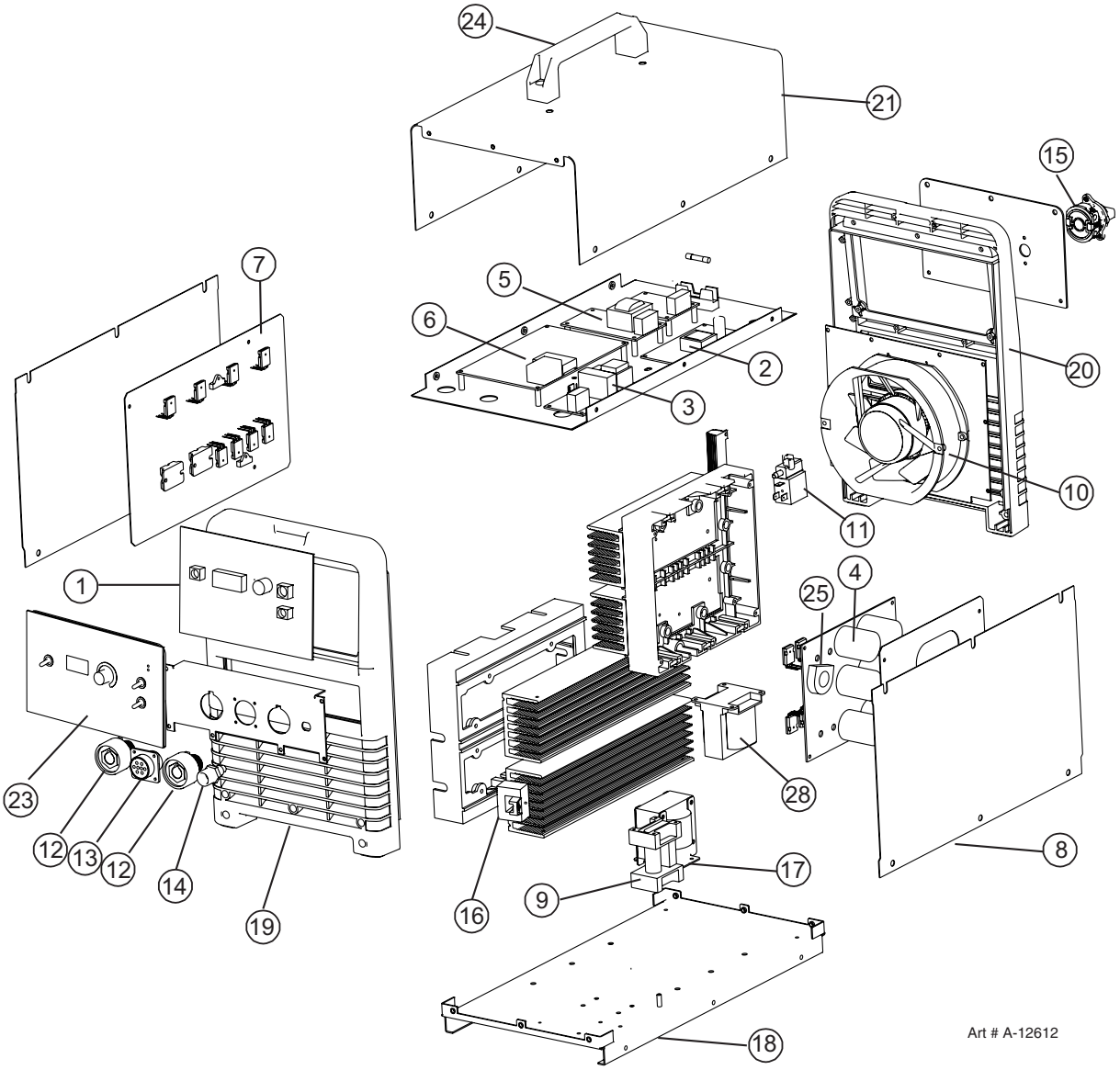
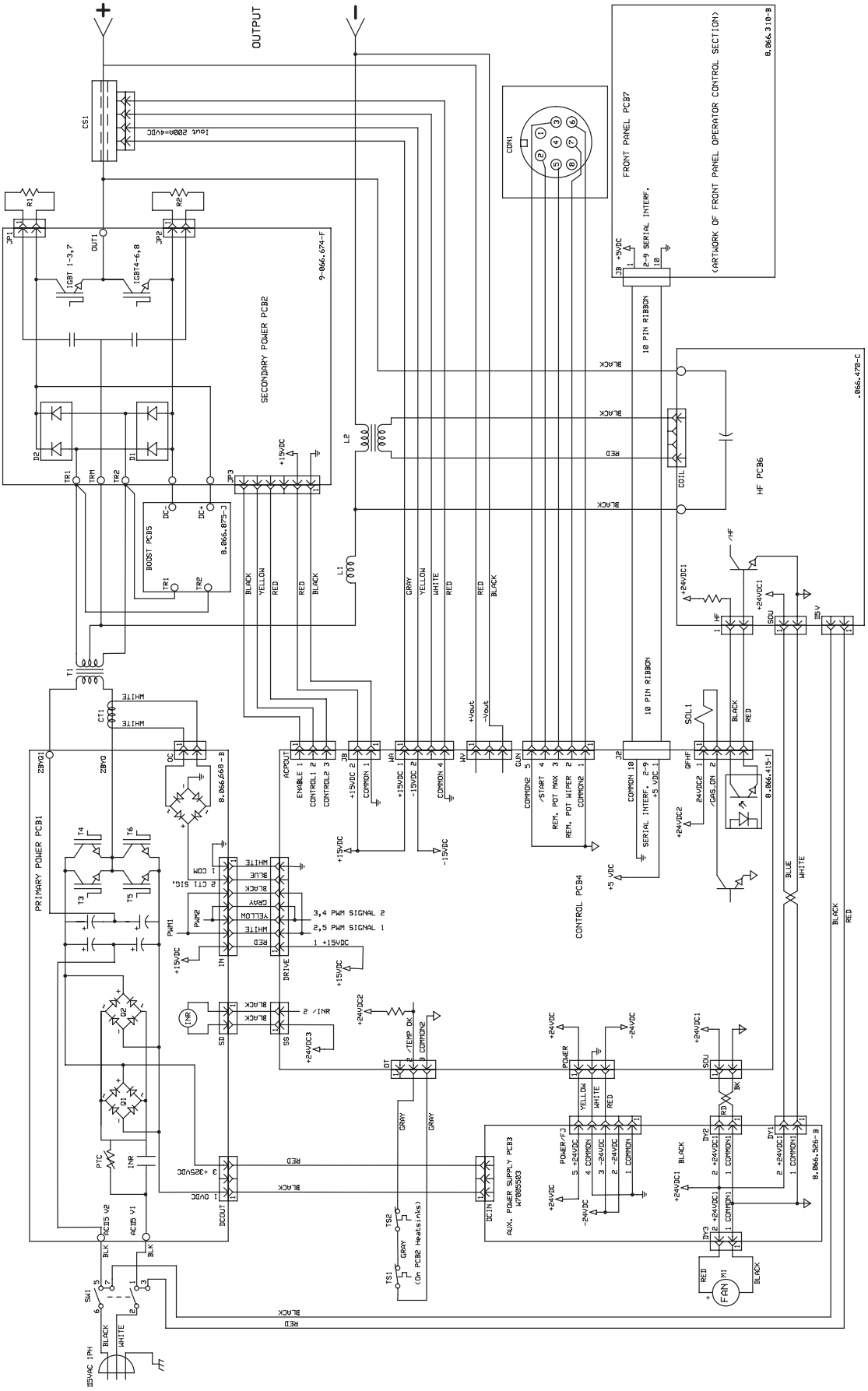


Figure 6-1

FIREPOWER TIG 140 AC/DC Spare Parts		
Item	**Part Number**	**Description**
1	W7006773	PCB display
2	W7006771	PCB aux power supply
3	W7006775	PCB HF
4	W7006776	PCB primary inverter
5	W7005505	PCB AC output drive
6	W7006772	PCB control
7	W7005507	PCB secondary rectifier
8	1442-0041	Side Panel
9	W7006761	Coil coupling HF
10	W7006764	Fan assembly
11	W7003033	Gas solenoid assembly
12	W7006763	Dinse Socket 50mm²
13	W7003606	Control socket 8 pin (including wire harness)
14	W7006767	Gas outlet, front panel
15	W7005515	Switch, On/Off
16	W7003076	CT, output
17	W7006769	Inductor 140 AC/DC
18	1442-0042	Base Panel
19	W7006765	Front panel
20	W7006777	Rear panel
21	1442-0043	Panel, Top Cover
22	W7006766	Gas inlet fitting(not shown)
23	1442-0044	Front Control Panel
24	W7006768	Handle
25	W7004952	CT, primary
26	W7005501	Shroud, Knob, Front Panel (not shown)
27	W7004930	Shielding Gas Hose Assy (not shown)
28	W7005511	Transformer
29	831761	Set-Up Guide, English (not shown)
30	831762	Set-Up Guide, French (not shown)
Not shown	W7006774	PCB EMC filter

Table 6-1

APPENDIX 1 : CIRCUIT DIAGRAM



Art # A-12613

APPENDIX 2 : FIREPOWER TIG 140 AC/DC SETUP GUIDE

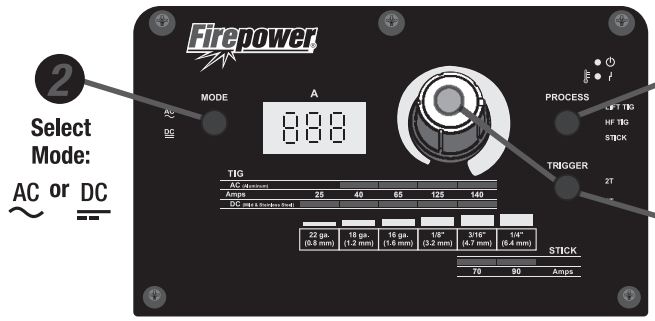
LIFT TIG / HF TIG Set-Up Guide

1 SELECT PROCESS	2 MODE SELECTION	a MATERIAL SELECTION	b BASE METAL SIZE	c JOINT TYPE	d TUNGSTEN / FILLER ROD SIZE*	3 WELD CURRENT	SELECT TIG CUP SIZE	SHIELD GAS TO BE USED
LIFT TIG /HF TIG	AC ~	Aluminum	16 ga. (1.6 mm)	Butt	1/16" (1.6 mm)	65A	4, 5, 6	Argon
			16 ga. (1.6 mm)	Fillet	1/16" (1.6 mm)	85A	4, 5, 6	Argon
			1/8" (3.2 mm)	Butt	3/32" (2.4 mm)	135A	6, 7	Argon
			1/8" (3.2 mm)	Fillet	3/32" (2.4 mm)	150A	6, 7	Argon
LIFT TIG /HF TIG	DC (-) ⎓	Stainless Steel	16 ga. (1.6 mm)	Butt	1/16" (1.6 mm)	50A	4, 5, 6	Argon
			16 ga. (1.6 mm)	Fillet	1/16" (1.6 mm)	60A	4, 5, 6	Argon
			1/8" (3.2 mm)	Butt	3/32" (2.4 mm)	125A	6, 7	Argon
			1/8" (3.2 mm)	Fillet	3/32" (2.4 mm)	125A	6, 7	Argon
LIFT TIG /HF TIG	DC (-) ⎓	Mild Steel	16 ga. (1.6 mm)	Butt	1/16" (1.6 mm)	30A	4, 5, 6	Argon
			16 ga. (1.6 mm)	Fillet	1/16" (1.6 mm)	40A	4, 5, 6	Argon
			1/8" (3.2 mm)	Butt	3/32" (2.4 mm)	100A	6, 7	Argon
			1/8" (3.2 mm)	Fillet	3/32" (2.4 mm)	120A	6, 7	Argon

Note: LIFT TIG / HF TIG set-up guide parameters may vary depending upon welding position and joint design.

*** - If Required**

Panel Set-Up Guide



2 Select Mode: AC ~ or DC ⎓

1 Select Process: LIFT TIG, HF TIG, or STICK

3 Adjust Parameters

LIFT TIG & HF TIG		
2T Mode (AC or DC)	4T Mode (AC or DC)	(AC
Weld Current	Weld Current	We

Tungsten Electrode Types

Electrode Type (Ground Finish)	Welding Application	
Thoriated 2%	DC welding of mild steel, stainless steel and copper.	Excellent arc starting, Lo
Ceriated 2%	DC welding of mild steel, stainless steel, copper, aluminum, magnesium and their alloys	Longer life, More stable a range, Narrower more co

GAS TO SED	SELECT GAS FLOW
on	15 cfh (7 lpm)
on	15 cfh (7 lpm)
on	17 cfh (8 lpm)
on	17 cfh (8 lpm)
on	15 cfh (7 lpm)
on	15 cfh (7 lpm)
on	17 cfh (8 lpm)
on	17 cfh (8 lpm)
on	15 cfh (7 lpm)
on	15 cfh (7 lpm)
on	17 cfh (8 lpm)
on	17 cfh (8 lpm)

LIFT TIG / HF TIG Notes
Gas is 100% Pure Argon.

This set-up information is intended to act as a guide only. Please refer to operating manual for further information.

STICK Set-Up Guide

1 SELECT PROCESS	2 MODE SELECTION	a ELECTRODE SELECTION	b ELECTRODE DIAMETER		3/32" (2.4 mm) Range	3/32" (2.4 mm) Optimum
STICK	DC (+) ⎓	E6013	3	Weld Current (Range)	55-90A	75A
				Polarity Selection	DC Reverse Polarity (Positive)	
STICK	DC (+) ⎓	E308L-16 E316L-16	3	Weld Current (Range)	40-70A	60A
				Polarity Selection	DC Reverse Polarity (Positive)	

Note: STICK set-up guide parameters may vary depending upon welding position, joint design.

TIG 140 ACDC
PORTABLE WELDING MACHINE
Set-Up Guide

STICK
C or DC)
ld Current

Tungsten Electrode Types

Tungsten Electrode Diameter Size	DC Current Range (Amps)
0.040" (1.0 mm)	30 – 60
1/16" (1.6 mm)	60 – 115
3/32" (2.4 mm)	100 – 165
1/8" (3.2 mm)	135 – 200

Features	Colour Code
ng life, High current carrying capacity.	Red
arc, Easier starting, Wider current oncentrated arc.	Grey

Filler Wire Diameter Selection Guide

Filler Wire Diameter Size	DC Current Range (Amps)
1/16" (1.6 mm)	20 - 90
3/32" (2.4 mm)	65 - 115
1/8" (3.2 mm)	100 - 165

Note: The filler wire diameter specified is a guide only, other diameter wires may be used according to the welding application.

832071_AB

Art# A-12643

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WARRANTY SCHEDULE

2 Years Parts* and Labor

* 2 years on the Original Main Power Transformer and Inductors not mounted on PC Boards.

* 2 years on Power Supply Components

2 Years Parts / No Labor

Auto-Darkening Welding Helmet (electronic Lens), ** 1 Month Harness Assy

Firepower Regulator for Firepower MST 220i (No labor)

90 days parts / No Labor

Remote Controls

MIG and TIG Torches (Supplied with power sources)

Replacement repair parts

Victor Technologies limited warranty shall not apply to:

Consumable Parts for MIG, TIG, Plasma welding, Plasma cutting and Oxy fuel torches, O-rings, fuses, filters or other parts that fail due normal wear.

* Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Victor Technologies repair facility within thirty (30) days of the repair.

* No employee, agent, or representative of Victor Technologies is authorized to change this warranty in any way or grant any other warranty, and Victor Technologies shall not be bound by any such attempt. Correction of non-conformities, in the manner and time provided herein, constitutes fulfillment of Victor Technologies's obligations to purchaser with respect to the product.

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