211i

FABRICATOR®

MULTI PROCESS WELDING INVERTER

Art # A-10934

Operating Manual

Revision: AB
Issue Date: February 29, 2012
Manual No.: 0-5225
Operating Features:

CE

INVERTER | GMAW FCAW | GTAW | MMAW | DC | 200 AMP | CC CV | 110 230 V | 1 PHASE | 50 60 Hz

WE APPRECIATE YOUR BUSINESS!

Congratulations on your new Thermal Arc product. We are proud to have you as our customer and will strive to provide you with the best service and reliability in the industry. This product is backed by our extensive warranty and world-wide service network. To locate your nearest distributor or service agency call +44 (0) 1257 261 755, or visit us on the web at **www.Thermalarc.com.**

This Operating Manual has been designed to instruct you on the correct use and operation of your Thermal Arc product. Your satisfaction with this product and its safe operation is our ultimate concern. Therefore please take the time to read the entire manual, especially the Safety Precautions. They will help you to avoid potential hazards that may exist when working with this product.

We have made every effort to provide you with accurate instructions, drawings, and photographs of the product(s) while writing this manual. However errors do occur and we apologize if there are any contained in this manual.

Due to our constant effort to bring you the best products, we may make an improvement that does not get reflected in the manual. If you are ever in doubt about what you see or read in this manual with the product you received, then check for a newer version of the manual on our website or contact our customer support for assistance.

YOU ARE IN GOOD COMPANY!

The Brand of Choice for Contractors and Fabricators Worldwide.

Thermal Arc is a Global Brand of Arc Welding Products for Thermadyne Industries Inc. We manufacture and supply to major welding industry sectors worldwide including; Manufacturing, Construction, Mining, Automotive, Aerospace, Engineering, Rural and DIY/Hobbyist.

We distinguish ourselves from our competition through market-leading, dependable products that have stood the test of time. We pride ourselves on technical innovation, competitive prices, excellent delivery, superior customer service and technical support, together with excellence in sales and marketing expertise.

Above all, we are committed to develop technologically advanced products to achieve a safer working environment within the welding industry.

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 judgment, the Manufacturer assumes no liability for its use.

Operating Manual Number 0-5225 for:
Thermal Arc Fabricator 211i Inverter Power Supply — Part Number W1004206
Thermal Arc Fabricator 211i Inverter System — Part Number W1004207

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Publication Date: December 23, 2011
Revision AB Date: February 29, 2012

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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TABLE OF CONTENTS

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 European Standard EN60974-1 entitled: Safety in welding and allied processes Part 2: Electrical. 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.
6. Never wear contact lenses while welding.

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.

WARNING

FUMES AND GASES can be hazardous to your health.

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 vapours 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 travelling 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 fuelling. 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 fuelling 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.

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 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.

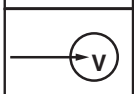
Safe Practices for Occupation and Educational Eye and Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018.

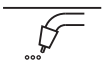
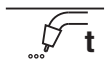
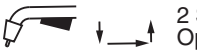
Cutting and Welding Processes, NFPA Standard 51B, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

1.03 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
A	Amperage
V	Voltage
Hz	Hertz (cycles/sec)
f	Frequency
—	Negative
+	Positive
⎓	Direct Current (DC)
	Protective Earth (Ground)
	Line
	Line Connection
	Auxiliary Power
115V 15A ~	Receptacle Rating- Auxiliary Power

1 ~	Single Phase
3 ~	Three Phase
	Three Phase Static Frequency Converter-Transformer-Rectifier
	Remote
X	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
	Spot Time
	Preflow Time
	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.
	Burnback Time
IPM	Inches Per Minute
MPM	Meters Per Minute
	See Note
	See Note
	Art # A-10663

1.04 Declaration Of Conformity

Manufacturer: Thermadyne Industries
Address: 82 Benning Street
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEC as amended by Council Directive 93/68/EEC) and to the National legislation for the enforcement of this Directive.

The equipment described in this manual conforms to all applicable aspects and regulations of the "EMC Directive" (European Council Directive 89/336/EEC) and to the National legislation for the enforcement of this Directive.

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

National Standard and Technical Specifications

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

- CENELEC EN50199 EMC Product Standard for Arc Welding Equipment.
- ISO/IEC 60974-1 (BS 638-PT10) (EN 60974-1) (EN50192) (EN50078) applicable to welding equipment and associated accessories.
- For environments with increased hazard of electrical shock, Power Supplies bearing the S mark conform to EN50192 when used in conjunction with hand torches with exposed cutting tips, if equipped with properly installed standoff guides.
- 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.
- 2002/95/EC RoHS directive.

WARNING

This equipment does not comply with IEC 61000-3-12. If it is connected to a public low voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

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

Manufacturers responsible representative:

Steve Ward
Operations Director
Thermadyne Europe
Europa Building
Chorley N Industrial Park
Chorley, Lancashire,
England PR6 7BX

RoHS CE

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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. 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 i 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 inside 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 Thermal Arc Fabricator 211i is a self contained single phase multi process welding inverter that is capable of performing MIG (GMAW/FCAW), STICK (MMA) and LIFT TIG (GTAW) welding processes. The unit is equipped with an integrated wire feed unit, digital voltage and amperage meters, and a host of other features in order to fully satisfy the broad operating needs of the modern welding professional. The unit is also fully compliant to Standard EN 60974.1.

The Thermal Arc Fabricator 211i 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 Thermal Arc. Advice in this regard can be obtained by contacting an Accredited Thermal Arc Distributor.

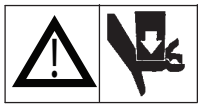
This equipment or any of its parts should not be altered from standard specification without prior written approval of Thermal Arc. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use or unauthorized modification from standard specification,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

2.06 Transportation 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 handles built into the top of the front and rear moulded panels.

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

Fabricator 211i Power Source (Part No. W1004206)

- Fabricator 211i Inverter Power Source
- Shielding Gas hose assembly
- Operating Manual

Fabricator 211i System Part No. (W1004207**)**

- Fabricator 211i Inverter Power Source
- Feedrolls 0.6/0.8mm "V" groove (fitted),
  0.9/1.2mm "V" groove,
  1.0/1.2mm "U" groove,
  0.8/0.9mm "V" knurled,
- MIG gun 3m long
- Electrode Holder with 4m lead
- Work Clamp with 4m lead
- Shielding Gas hose assembly
- Operating Manual

Figure 2-1: Fabricator 211i System Packaged W1004207

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, 210 amperes at 24.5 volts. This means that it has been designed and built to provide the rated amperage (210A) 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 allowed to cool. The thermal cut out will operate if the duty cycle is exceeded.

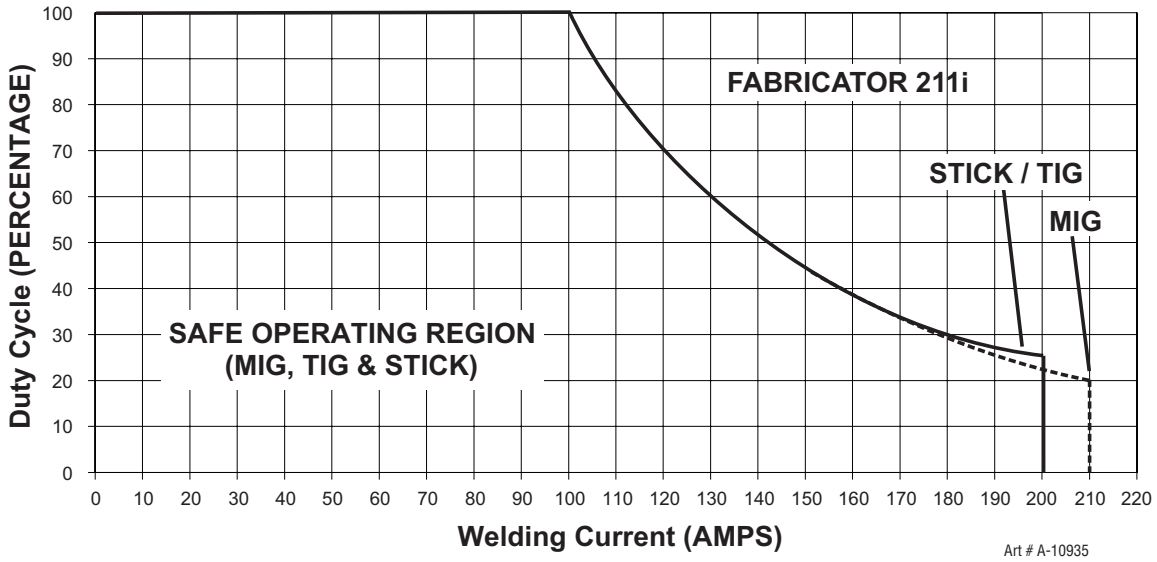


Figure 2-2: Fabricator 211i Duty Cycle on 230VAC

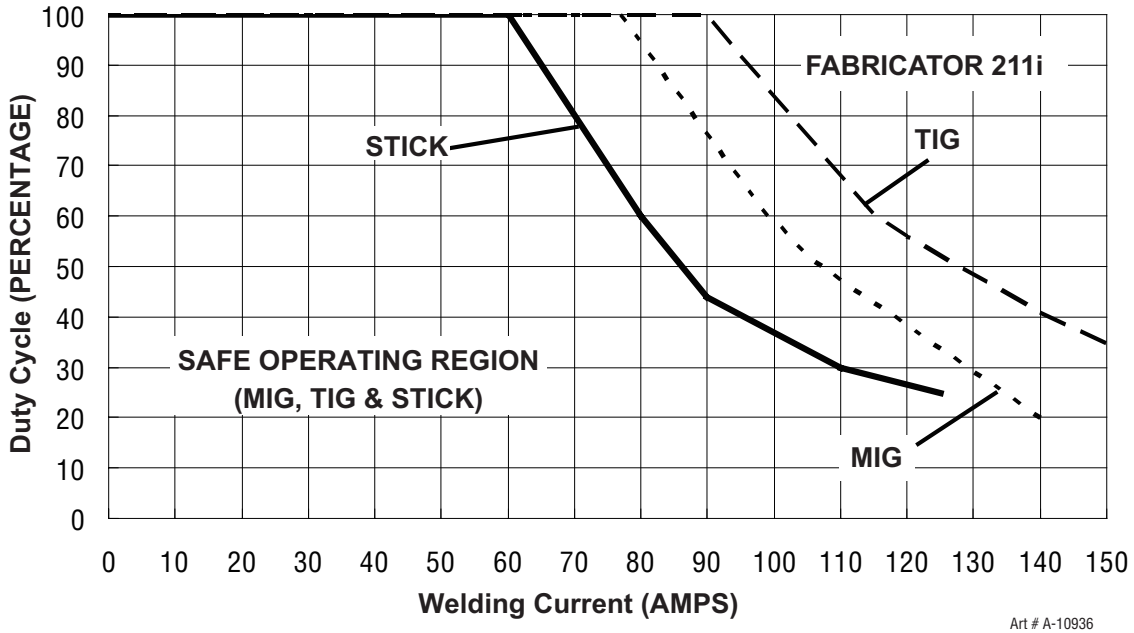


Figure 2-3: Fabricator 211i Duty Cycle on 110VAC

2.09 Specifications

Description	Fabricator 211i Multi Process Welding Inverter	
Power Source Plant Part No.	W1004206	
Power Source Dimensions	H435mm x W266mm x D617mm	
Power Source Mass	26kg	
Cooling	Fan Cooled	
Welder Type	Multi Process Inverter Power Source	
Applicable Standard	EN 60974-1	
Number of Phases	Single Phase	
Nominal Supply Voltage	230V±15%	110V±15%
Nominal Supply Frequency	50/60Hz	50/60Hz
Welding Current Range (MIG Mode)	10-210A	10-140A
Wirefeed Speed Range	2.5 - 18 MPM	2.5 - 18 MPM
Effective Input Current (I1eff)	15 Amps	19.6 Amps
Maximum Input Current (I1max)	30 Amps	39 Amps
Single Phase Generator Requirement	7 k VA	4.5 k VA
MIG (GMAW/FCAW) Welding Output, 40ºC, 10 min	210A @ 20%, 24.5V 130A @ 60%, 20.5V 101A @ 100%, 19.1V	140A @ 20%, 21.0V 99A @ 60%, 19.0V 77A @ 100%, 17.9V
STICK (MMA) Welding Output, 40ºC, 10 min.	200A @ 25%, 28.0V 130A @ 60%, 25.2V 101A @ 100%, 24.0V	125A @ 25%, 25.0V 80A @ 60%, 23.2V 60A @ 100%, 22.4V
TIG (GTAW) Welding Output, 40ºC, 10 min.	200A @ 25%, 18.0V 130A @ 60%, 15.2V 101A @ 100%, 14.0V	150A @ 35%, 16.0V 115A @ 60%, 14.6V 90A @ 100%, 13.6V
Open circuit voltage	79V	
Protection Class	IP23S	

Table 2-1: Fabricator 211i Specifications

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

Note 2: Motor start fuses or thermal circuit breakers are recommended for this application. Check local requirements for your situation in this regard.

Note 3: Generator Requirements at the Maximum Output Duty Cycle.

NOTE

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.

Due to variations that can occur in manufactured products, claimed performance, voltages, ratings, all capacities, measurements, dimensions and weights quoted are approximate only. Achievable capacities and ratings in use and operation will depend upon correct installation, use, applications, maintenance and service.

2.10 Optional Accessories

26V TIG Torch (4 m) ..... Part No. **310.090.001**

Tweco TWE2 (3 m) 250A MIG Gun ..... Part No. **161.550.307**

Tweco WeldSkill 220A MIG Gun (3 m) ..... Part No. **WS220XE-10-3035**

Professional 4 Wheel Cart, Dual Cylinder..... Part No. **W4015002**

Professional 4 Wheel Cart, Single Cylinder..... Part No. **W4015001**

Cart, Single Cylinder ..... Part No. **W4014700**

Roll Cage..... Part No. **W4015104**

Foot Control..... Part No. **10-4016**

Pendant Control ..... Part No. **10-4014**

Tweco WeldSkill Helmet ..... Part No. **WHF41001**

Feed Roll 0.6/0.8mm V groove (hard), (fitted) .... Part No. **62020**

Feed Roll 0.9/1.2mm V groove (hard) ..... Part No. **62022**

Feed Roll 0.8/0.9mm U groove (soft) ..... Part No. **62179**

Feed Roll 1.0/1.2mm U groove (soft) ..... Part No. **62024**

Feed Roll 0.8/0.9mm V knurled (flux cored) ..... Part No. **62028**

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SECTION 3: INSTALLATION OPERATION AND SETUP

3.01 Environment

This unit is designed for use in environments with increased hazard of electric shock as outlined in EN 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 considerably 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 (32°F) to 40°C (104°F).

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

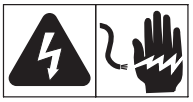
D. In areas, not subjected to abnormal vibration or shock.

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

F. Place at a distance of 1 foot 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 EN 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

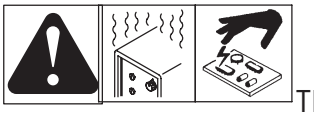
This equipment should be electrically connected by a qualified electrician.

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



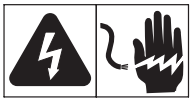
The Mains supply voltage should be within ± 15% of the rated Mains supply voltage. Too low of a supply voltage may cause poor welding performance or wirefeeder malfunction. Too high of a supply voltage will cause components to overheat and possibly fail.

WARNING

The Fabricator 211i must be electrically connected by a qualified electrical tradesperson. Damage to the PCA (Power Control Assembly) could occur if 276 VAC or higher is applied to the Primary Power Cable

50/60 Hz Single Phase	Primary Supply Lead Size	Minimum Primary Current Circuit Size (Vin/Iin)	Minimum Plug Size	Current & Duty Cycle		
				MIG	TIG	STICK
Yes	2.5mm²	230V/15A	15A	20%@210A	25%@200A	25%@200A
Yes	2.5mm²	110V/32A	20A	20%@140A	35%@150A	25%@125A

Table 3-1: Input Power Source Leads for Fabricator 211i



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.

Electrical Input Requirements

Operate the welding power source from a single-phase 50/60 Hz, AC power source. 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, fuse and primary supply lead based on Table 3-1.

WARNING

Any electrical work must be carried out by a qualified Electrical Tradesperson.

3.05 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, signalling 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. Mains Supply

   Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains 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.

3.06 Power Source Controls, Indicators and Features

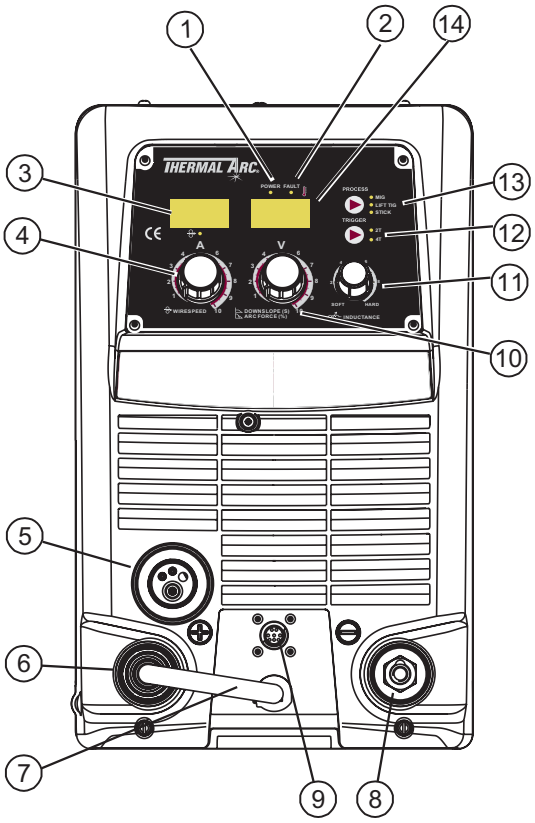


Figure 3-1: Fabricator Front and Control Panel

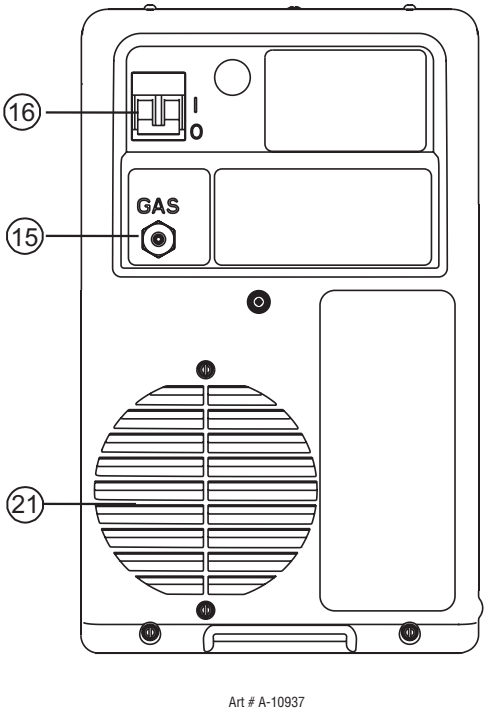


Figure 3-2: Fabricator Front Connections

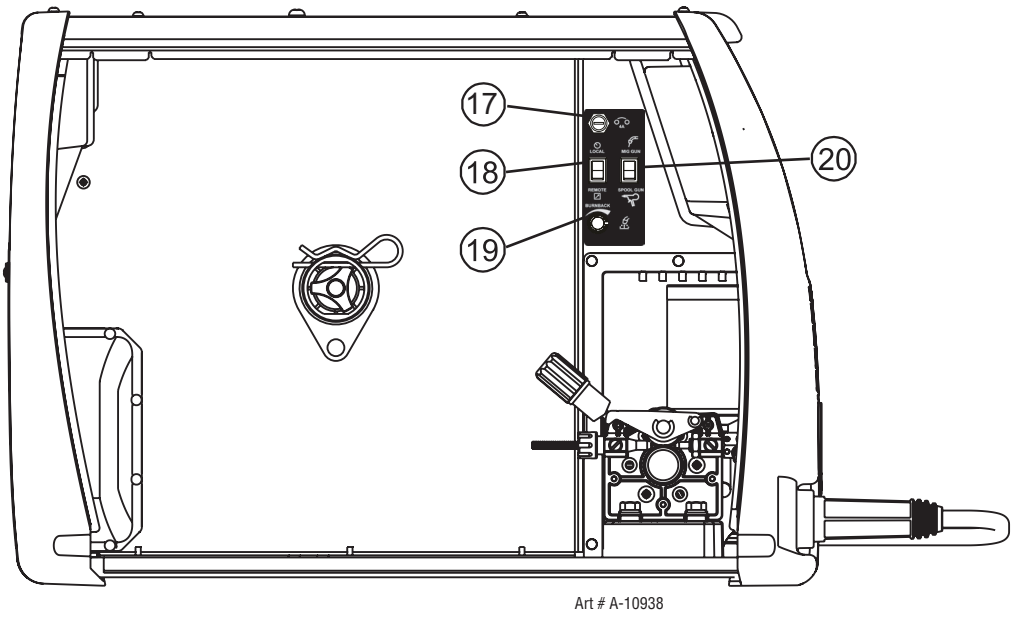


Figure 3-3: Wire Feed Compartment Control

1. Power Indicator

The power indicator is illuminated when the correct mains power is applied to the power source and when the ON/OFF switch located on the rear panel is in the ON position.

2. Thermal Overload Indicator (Fault Indicator)

This welding power source is protected by a self resetting thermostat. The indicator will illuminate if the duty cycle of the power source has been exceeded. Should the thermal overload indicator illuminate the output of the power source will be disabled. Once the power source cools down this light will go OFF and the over temperature condition will automatically reset. Note that the mains power switch should remain in the on position such that the fan continues to operate thus allowing the unit to cool sufficiently. Do not switch the unit off should a thermal overload condition be present.

3. Digital Amps Meter (Left Digital Display)

MIG Mode

This digital meter is used to display the pre-set (preview) Wirefeed Speed in Meters Per Minute (MPM) in MIG mode and actual welding amperage of the power source when welding. At times of non-welding, the digital meter will display a pre-set (preview) value of Wirefeed Speed. This value can be adjusted by varying the Amperage Control Knob (4).

STICK and LIFT TIG Modes

The digital meter is used to display the pre-set (preview) amperage in STICK / LIFT TIG modes and actual welding amperage of the power source when welding. At times of non-welding, the amperage meter will display a pre-set (preview) value in both STICK and LIFT TIG modes. This value can be adjusted by varying the Amperage Control Knob (4).

When welding, this digital meter will display actual welding amperage in all modes.

At the completion of welding, the digital meter will hold the last recorded amperage value for a period of approximately 10 seconds in all modes. The amperage meter will hold the value until; (1) any of the front panel controls are adjusted in which case the unit will revert to preview mode, (2) welding is recommenced, in which case actual welding amperage will be displayed, or (3) a period of 10 seconds elapses following the completion of welding in which case the unit will return to preview mode.

NOTE

The preview functionality provided on this power source is intended to act as a guide only. Some differences may be observed between preview values and actual welding values due to factors including the mode of welding, differences in consumables/gas mixtures, individual welding techniques and the transfer mode of the welding arc (ie dip versus spray transfer). Where exact settings are required (in the case of procedural work), it is recommended that alternate measurement methods be utilized to ensure output values are accurate.

4. Amperage Control (Wirespeed)

The amperage control knob adjusts the amount of welding current delivered by the power source. In STICK (MMA) and LIFT TIG (GTAW) modes, the amperage control knob directly adjusts the power inverter to deliver the desired level of output current. In MIG (GMAW/FCAW) mode, the amperage knob adjusts the speed of the wire feed motor (which in turn adjusts the output current by varying the amount of MIG wire delivered to the welding arc). The optimum wire speed required will dependent on the type of welding application. The setup chart on the inside of the wire feed compartment door provides a brief summary of the required output settings for a basic range of MIG welding applications.

NOTE

The preview functionality provided on this power source is intended to act as a guide only. Some differences may be observed between preview values and actual welding values due to factors including the mode of welding, differences in consumables/gas mixtures, individual welding techniques and the transfer mode of the welding arc (ie dip versus spray transfer). Where exact settings are required (in the case of procedural work), it is recommended that alternate measurement methods be utilized to ensure output values are accurate.

5. MIG Gun Adaptor (Euro Style)

The MIG gun adaptor is the connection point for the MIG welding gun. Connect the gun by pushing the gun connector into the brass gun adaptor firmly and screwing the plastic nut clockwise to secure in position. To remove the MIG gun simply reverse these directions.

6. Positive Welding Output Terminal

The positive welding terminal is used to connect the welding output of the power source to the appropriate welding accessory such as the MIG gun (via the MIG polarity lead), electrode holder lead or work lead. Positive welding current flows from the power source via this heavy duty bayonet type terminal. 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.

7. MIG Polarity Lead

The polarity lead is used to connect the MIG gun to the appropriate positive or negative output terminal (allowing polarity reversal for different welding applications). In general, the polarity lead should be connected in to the positive welding terminal (+) when using steel, stainless steel or aluminium electrode wire. When using gasless wire, the polarity lead is generally connected to the negative welding terminal (-). If in doubt, consult the manufacturer of the electrode wire for the correct polarity. 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.

8. Negative Welding Output Terminal

The negative welding terminal is used to connect the welding output of the power source to the appropriate welding accessory such as the MIG gun (via the MIG polarity lead), TIG torch or work lead. Negative welding current flows to the power source via this heavy duty bayonet type terminal. 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.

9. Remote Control Socket

The 8 pin Remote Control Socket is used to connect remote control devices to the welding power source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

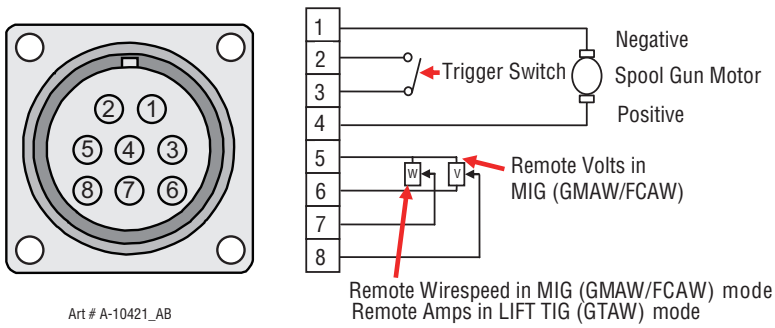


Figure 3-4: Remote Control Socket

Socket Pin	Function
1	Spool Gun Motor Negative
2	Trigger Switch Input
3	Trigger Switch Input
4	Spool Gun Motor Positive
5	5k ohm (maximum) connection to 5k ohm remote control potentiometer.
6	Zero ohm (minimum) connection to 5k ohm remote control potentiometer.
7	Wiper arm connection to 5k ohm remote control Wirespeed MIG (GMAW/FCAW) mode potentiometer. Wiper arm connection to 5k ohm remote control Amps LIFT TIG (GTAW) mode potentiometer.
8	Wiper arm connection to 5k ohm remote control Volts MIG (GMAW/FCAW) mode potentiometer.

Table 3-2

Note that the remote local switch (item 18) located in the wirefeed compartment should be set to remote for the amperage/voltage controls to be operative.

10. Multifunction Control - Voltage, Down Slope & Arc Force

The multifunction control knob is used to adjust Voltage (MIG Mode), Down slope (LIFT TIG Mode) and Arc Force (STICK Mode) depending on the welding mode selected.

NOTE

The preview functionality provided on this power source is intended to act as a guide only. Some differences may be observed between preview values and actual welding values due to factors including the mode of welding, differences in consumables/gas mixtures, individual welding techniques and the transfer mode of the welding arc (ie dip versus spray transfer). Where exact settings are required (in the case of procedural work), it is recommended that alternate measurement methods be utilised to ensure output values are accurate.

When MIG (GMAW/FCAW) Mode is Selected

In this mode the control knob is used to adjust the output voltage of the unit. The welding voltage is increased by turning the knob clockwise or decreased by turning the knob anti-clockwise. The optimum voltage level required will dependent on the type of welding application. The setup chart on the inside of the wire feed compartment door provides a brief summary of the required output settings for a basic range of MIG welding applications.

When STICK (MMA) Mode is Selected

In this mode the multifunction control knob is used to adjust arc force. Arc force control provides an adjustable amount of welding force (or “dig”) control. This feature can be particularly beneficial in providing the operator the ability to compensate for variability in joint fit-up in certain situations with particular electrodes. In general increasing the arc force control toward ‘10’ (maximum arc force) allows greater penetration control to be achieved. Arc force is increased by turning the control knob clockwise or decreased by turning the knob anti-clockwise

When LIFT TIG Mode is Selected

In this mode the multifunction control knob is used to adjust down slope. Down slope allows the user to select the ramp down time at the completion of the weld. The main function of down slope is to allow the welding current to be gradually reduced over a pre-set time frame such that the welding pool is given time to cool sufficiently.

Note that when in 2T normal mode (refer item 12), the unit will enter down slope mode as soon as the trigger switch is released (ie if the multifunction control knob is set to 5, the unit will ramp down from the present welding current to zero over 5 seconds). If no down slope time is selected then the welding output will cease immediately. If the unit is set to 4T latch mode, to enter down slope mode the trigger must be held in for the selected time period (ie press and release trigger to commence welding, then press and hold trigger again to enter down slope mode). Should the trigger be released during the down slope phase (4T only), the output will cease immediately.

11. Arc Control (Inductance)

The arc control operates in MIG (GMAW/FCAW) mode only and is used to adjust the intensity of the welding arc. Lower arc control settings make the arc softer with less weld spatter. Higher arc control settings give a stronger driving arc which can increase weld penetration.

12. Trigger Mode Control (MIG and LIFT TIG Mode only)

The trigger mode control is used to switch the functionality of the 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.

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 realised, thus eliminating the need for the operator to hold the torch trigger.

Note that when operating in LIFT TIG (GTAW) mode, the power source will remain activated until the selected downslope time has elapsed (refer Item 10).

13. Process Selection Control

The process selection control is used to select the desired welding mode. Three modes are available, MIG (GMAW/FCAW), LIFT TIG (GTAW) and STICK (MMA) modes. Refer to section 3.14, 3.15 or 3.16 for MIG (GMAW/FCAW) set up details, section 3.17 for LIFT TIG (GTAW) set-up details or section 3.18 for STICK (MMA) set-up details.

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

14. Digital Voltage Meter (Right Digital Display)

MIG Mode

This digital meter is used to display the pre-set (preview) Voltage in MIG mode and actual welding voltage of the power source when welding. At times of non-welding, the digital meter will display a pre-set (preview) value of Voltage. This value can be adjusted by varying the Multifunction Control Knob (10).

STICK and LIFT TIG Modes

This digital meter is used to display the Welding Output Terminal Voltage in STICK / LIFT TIG modes during non-welding or welding. This value cannot be adjusted by varying the Multifunction Control Knob (10).

When welding, this digital meter will display actual welding voltage in all modes.

At the completion of welding, the digital meter will hold the last recorded voltage value for a period of approximately 10 seconds in all modes. The voltage meter will hold the value until; (1) any of the front panel controls are adjusted in which case the unit will revert to preview mode, (2) welding is recommenced, in which case actual welding amperage will be displayed, or (3) a period of 10 seconds elapses following the completion of welding in which case the unit will return to preview mode.

NOTE

The preview functionality provided on this power source is intended to act as a guide only. Some differences may be observed between preview values and actual welding values due to factors including the mode of welding, differences in consumables/gas mixtures, individual welding techniques and the transfer mode of the welding arc (ie dip versus spray transfer). Where exact settings are required (in the case of procedural work), it is recommended that alternate measurement methods be utilized to ensure output values are accurate.

15. Gas Inlet (MIG mode only)

The Gas Inlet connection is used to supply the appropriate MIG welding gas to the unit. Refer to section 3.15 set up details.

WARNING

Only Inert Shielding Gases specifically designed for welding applications should be used.

16. On / Off Switch

This Single Phase circuit breaker performs a dual function.

It is used to turn the unit on/off and it will also trip in the event of a fault.

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.

17. Wiredrive Motor Circuit Breaker

The 4A Circuit Breaker protects the unit from electrical faults and will operate in the event of a motor overload.

NOTE

If a circuit breaker trips, a short cooling period must be allowed before an attempt is made to reset the unit by pressing the circuit breaker reset button.

18. Local / Remote Switch (located in wirefeed compartment)

The remote / local switch is used only when a remote control device (such as a TIG torch with remote current control) is fitted to the unit via the remote control socket (item 9). When the local/remote switch is in the remote position, the unit will detect a remote device and work accordingly. When in the local mode, the unit will not detect the remote device and will operate from the power source controls only. Note that the trigger will operate at all times on the remote control socket irrespective of the position of the local remote switch (ie in both local and remote modes).

Should a remote device be connected and the remote/local switch set to remote, 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 front panel control must be set to 100%, in which case the remote device will then be able to control between 0-100% output.

19. Burnback Control (located in wirefeed compartment)

The burnback control is used to adjust the amount of MIG wire that protrudes from the MIG gun after the completion of MIG welding (commonly referred to as stick out). To decrease the burnback time (or lengthen the amount of wire protruding from the MIG gun at the completing of welding), turn the burnback control knob anti clockwise. To increase the burnback time (or shorten the amount of wire protruding from the MIG gun at the completing of welding), turn the Burnback Control knob clockwise.

20. MIG Gun/ SPOOL Gun Switch (located in wirefeed compartment)

The MIG Gun / SPOOL Gun switch is used to switch welding mode between MIG Gun functionality and SPOOL Gun functionality.

21. Cooling Fan

The Fabricator 211i is fitted with a fan as needed feature. Fan as needed automatically switches the cooling fan off when it is not required. This has two main advantages; (1) to minimize power consumption, and (2) to minimise the amount of contaminants such as dust that are drawn into the power source.

Note that the fan will only operate when required for cooling purposes and will automatically switch off when not required.

3.07 Attaching MIG Gun

Fit the MIG gun to the power source by pushing the MIG gun connector into the MIG gun adaptor and screwing the plastic nut clockwise to secure the MIG gun to the MIG gun adaptor.

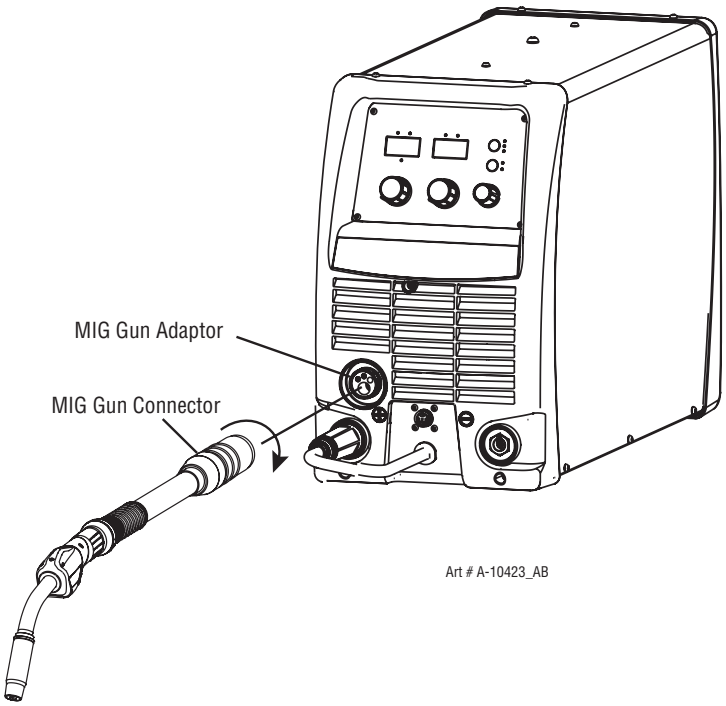


Figure 3-5: Attaching MIG Gun

3.08 Installing 15kg Spool (300mm diameter)

As delivered from the factory, the unit is fitted with a Wire Spool Hub which accepts a Spool of 300mm diameter. Remove the locking pin from the spool hub. Install the wire spool over the spool hub, locating the hole in the spool, with the alignment pin on the spool hub.Insert the locking pin back into the spool hub.

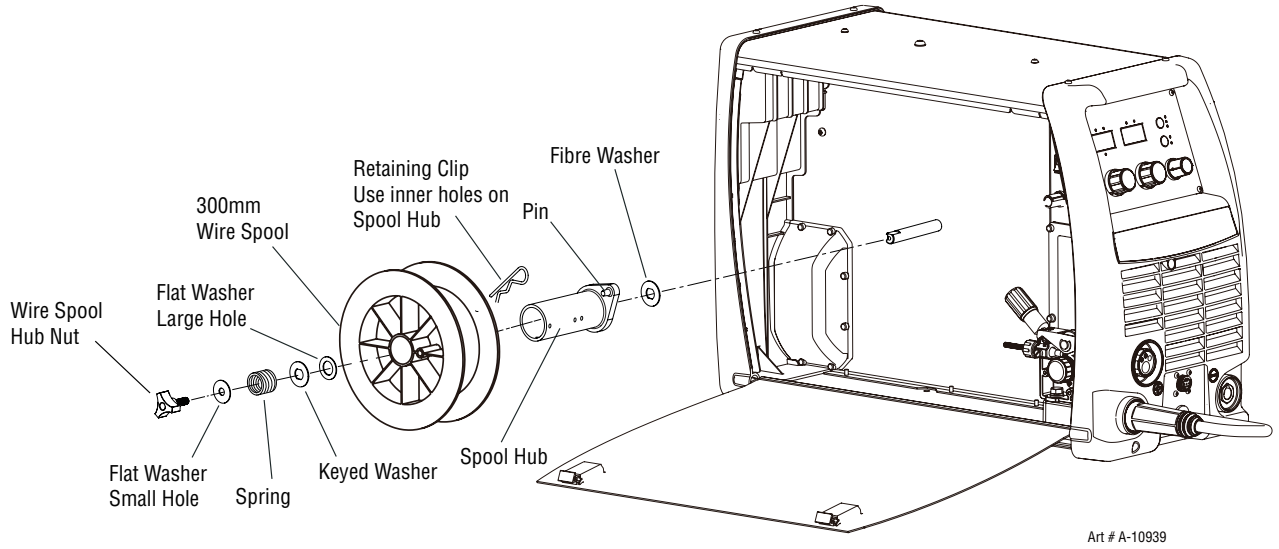


Figure 3-6: 300mm 15kg Spool Installation

3.09 Installing 5kg Spool (200mm diameter)

Remove the locking pin from the spool hub.

Install the 5kg Spool over the spool hub, locating the hole in the 5kg Spool, with the alignment pin on the Spool Hub.

Insert the locking pin back into the spool hub, in the “rear” position, as shown, ensuring the wire spool is firmly secured in position.

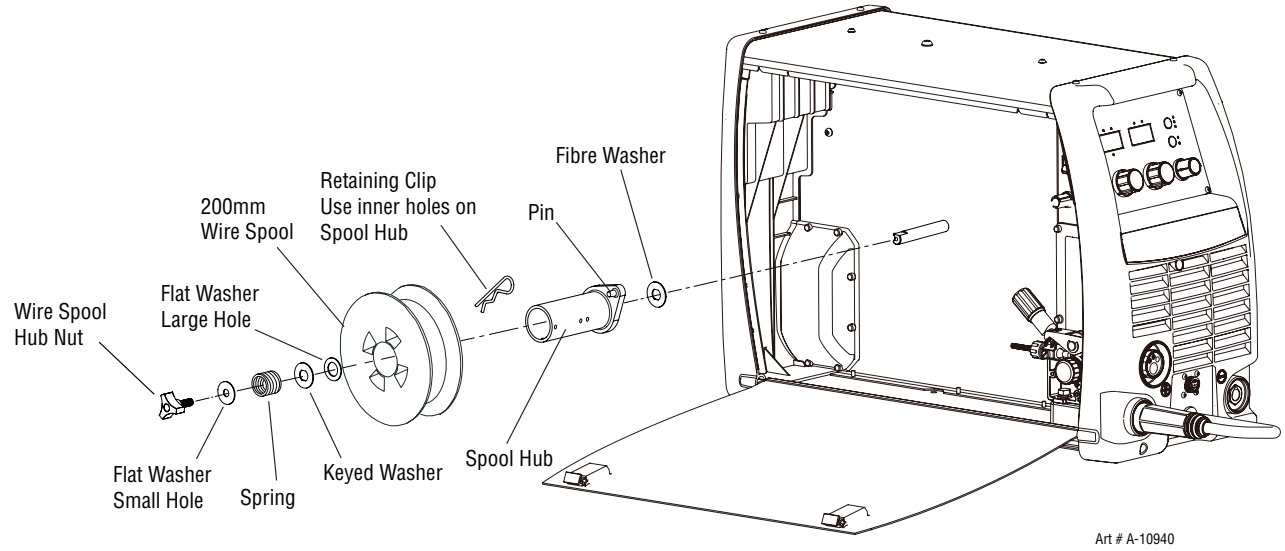


Figure 3-7: 200mm 5kg Spool Installation

3.10 Inserting Wire into the Wire Feed Mechanism

Release the tension from the pressure roller by turning the adjustable wire drive tension screw in an anti-clockwise direction. Then to release the pressure roller arm push the tension screw toward the front of the machine which releases the pressure roller arm (Figure 3-8). With the MIG welding wire feeding from the bottom of the spool (Figure 3-9) pass the electrode wire through the inlet guide, between the rollers, through the outlet guide and into the MIG gun. Re-secure the pressure roller arm and wire drive tension screw and adjust the pressure accordingly (Figure 3-8). Remove the contact tip from the MIG gun. With the MIG gun lead reasonably straight, feed the wire through the MIG gun by depressing the trigger switch. Fit the appropriate contact tip.

WARNING

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

The electrode wire will be at welding voltage potential while it is being feed through the system.

Keep MIG gun away from eyes and face.

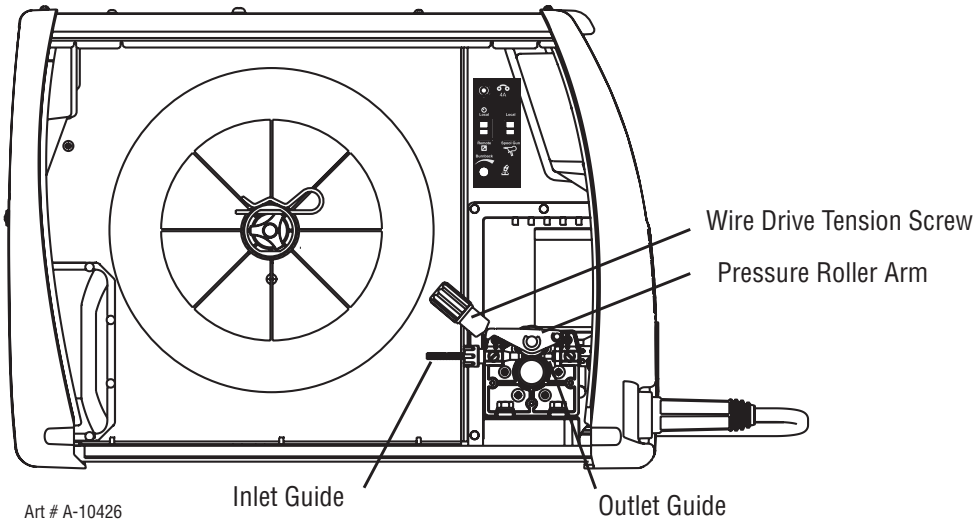


Figure 3-8: Wire Drive Assembly Components

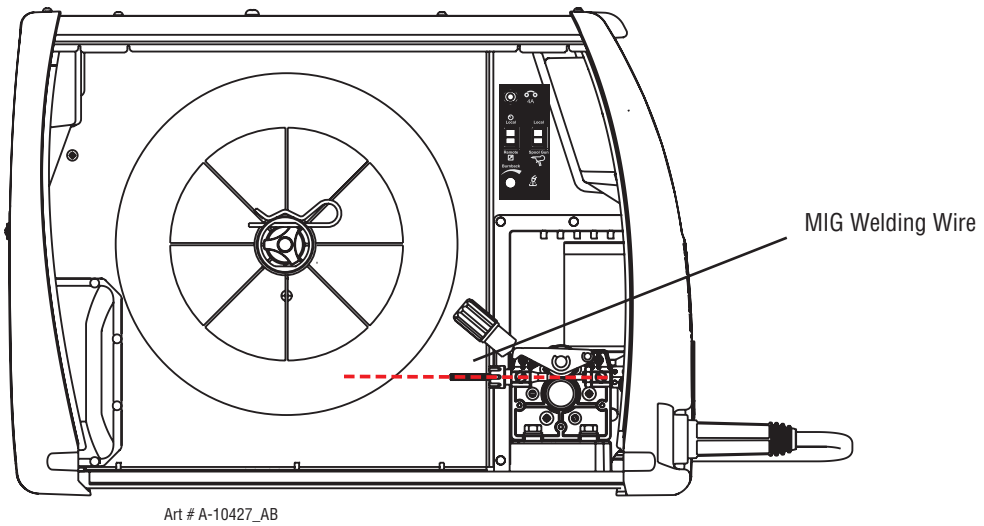


Figure 3-9: MIG Welding Wire - Installation

3.11 Feed Roller Pressure Adjustment

The pressure (top) roller applies pressure to the grooved feed roller via an adjustable pressure screw. These devices should be adjusted to a minimum pressure that will provide satisfactory WIREFEED without slippage. If slipping occurs, and inspection of the wire contact tip reveals no wear, distortion or burn back jam, the conduit liner should be checked for kinks and clogging by metal flakes and swarf. If it is not the cause of slipping, the feed roll pressure can be increased by rotating the pressure screw clockwise.

WARNING

Before changing the feed roller ensure that the mains supply to the power source is switched off.

CAUTION

The use of excessive pressure may cause rapid wear of the feed rollers, shafts and bearing.

3.12 Changing the Feed Roll

To change feed roll remove the feed roll retaining screw by turning in an anticlockwise direction. Once the feed roll is removed then to replace feed roll simply reverse these directions.

A dual groove feed roller is supplied as standard. It can accommodate 0.6/0.8mm diameter hard wires. Select the roller required with the chosen wire size marking facing outward.

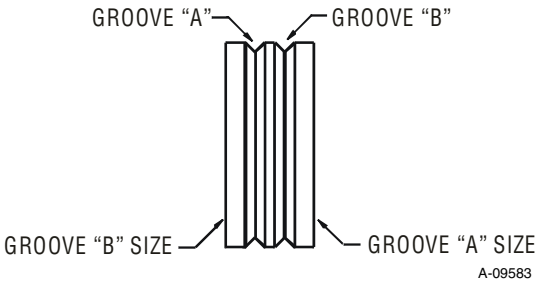


Figure 3-10: Dual Groove Feed Roller

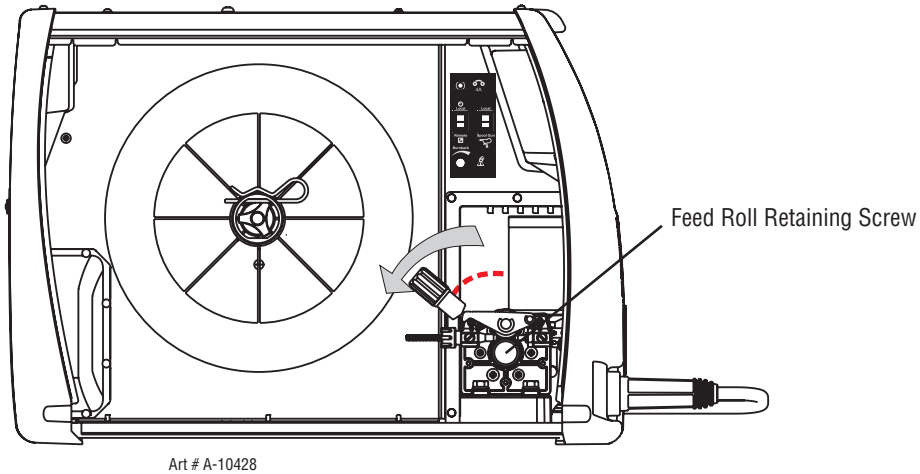


Figure 3-11: Changing the Feed Roll

3.13 Wire Reel Brake

The wire reel hub incorporates a friction brake which is adjusted during manufacture for optimum braking.

If it is considered necessary, adjustment can be made by turning the Thumb Screw inside the open end of the hub clockwise to tighten the brake. Correct adjustment will result in the wire reel circumference continuing no further than 10-20mm after release of the trigger. The electrode wire should be slack without becoming dislodged from wire spool.

CAUTION

Overtension of brake will cause rapid wear of mechanical WIREFEED parts, overheating of electrical componentry and possibly an increased incidence of electrode wire Burnback into contact tip.

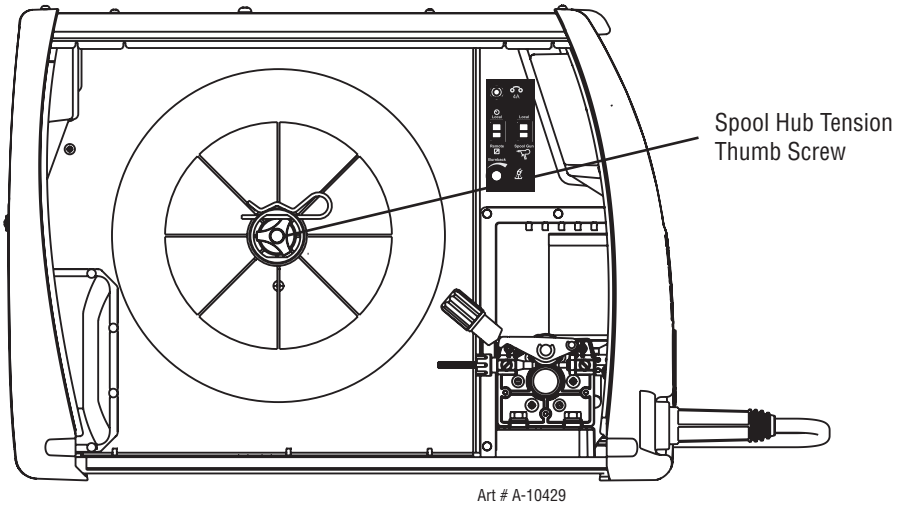


Figure 3-12: Wire Reel Brake

3.14 Setup for MIG (GMAW) Welding with Gas Shielded MIG Wire

A. Select MIG mode with the process selection control. (refer to Section 3.06.13 for further information)

B. Connect the MIG polarity lead to the positive welding terminal (+). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

C. Fit the MIG gun to the power source. (Refer to section 3.07 Attaching MIG gun).

D. Connect the work lead to the negative welding terminal (-). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

E. Fit the welding grade shielding gas regulator/flowmeter to the shielding gas cylinder, then connect the shielding gas hose from the rear of the power source to the regulator/flowmeter outlet.

F. Refer to the Weld Guide located on the inside of the wirefeed compartment door for further information.

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.

CAUTION

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

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

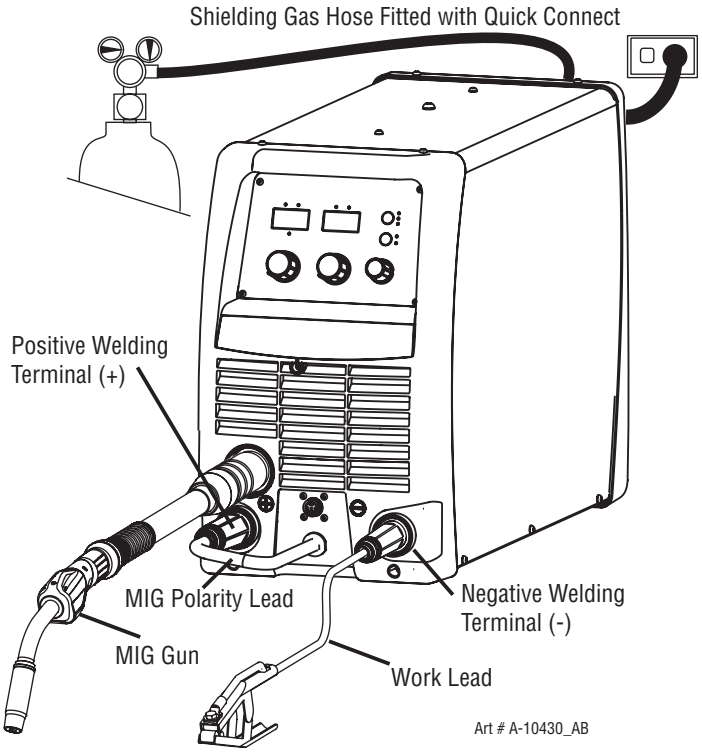


Figure 3-13: Setup for MIG Welding with Gas Shielded MIG Wire

3.15 Setup for MIG (FCAW) Welding with Gasless MIG Wire

A. Select MIG mode with the process selection control (refer to Section 3.06.13 for further information).

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

D. Refer to the Weld Guide located on the inside of the wirefeed compartment door for further information.

WARNING

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

CAUTION

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

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

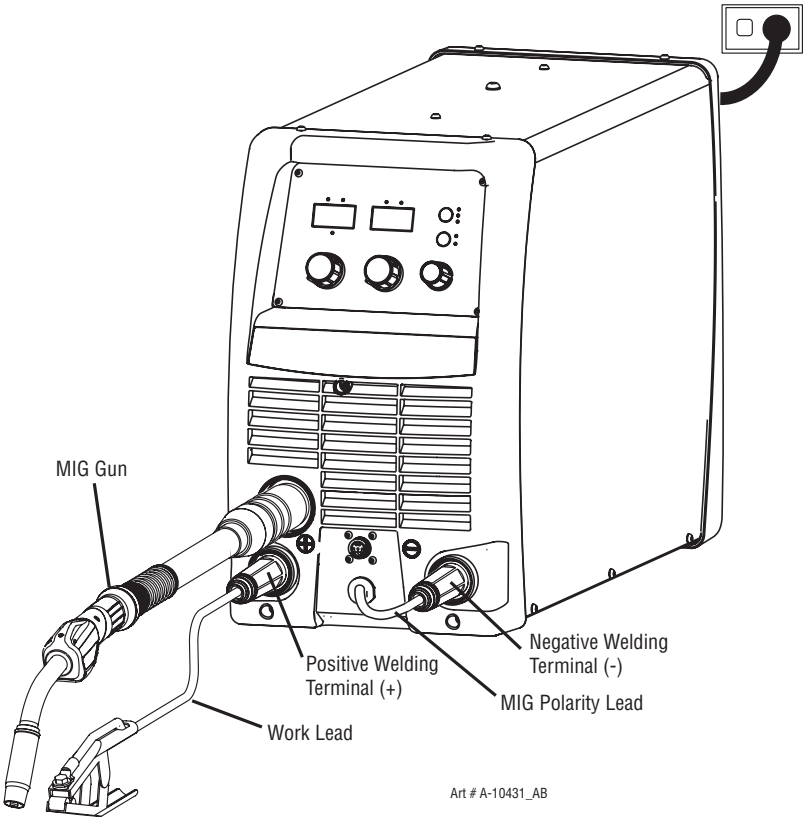


Figure 3-14: Setup for MIG Welding with Gasless MIG Wire

3.16 Setup for SPOOL GUN MIG (GMAW) Welding with Gas Shielded MIG Wire

A. Select MIG mode with the process selection control (refer to Section 3.06.13 for further information).

B. Connect the MIG polarity lead to the positive welding terminal (+). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

C. Fit the Euro Spool Gun to the power source using the front panel EURO adaptor (refer also to section 3.07 Attaching MIG gun). Connect the 8 pin Remote Control Plug to the 8 pin Remote Control Socket on the power source.

D. Connect the work lead to the negative welding terminal (-). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

E. Fit the welding grade shielding gas regulator/flowmeter to the shielding gas cylinder, then connect the shielding gas hose from the rear of the power source to the regulator/flowmeter outlet.

F. Refer to the Weld Guide located on the inside of the wirefeed compartment door for further information.

G. Select MIG mode with the process selection control (refer to section 3.06.13 for further information).

H. Set the Spool Gun Switch located inside the wire drive compartment, to SPOOL GUN.

WARNING

Before connecting the work clamp to the work make sure the main 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.

CAUTION

Loose welding terminal connections can cause overheating and result in the male plug being fused in the terminal. Remove any packing material prior to use. Do not block the air vents at the front or rear of the Welding Power Source.

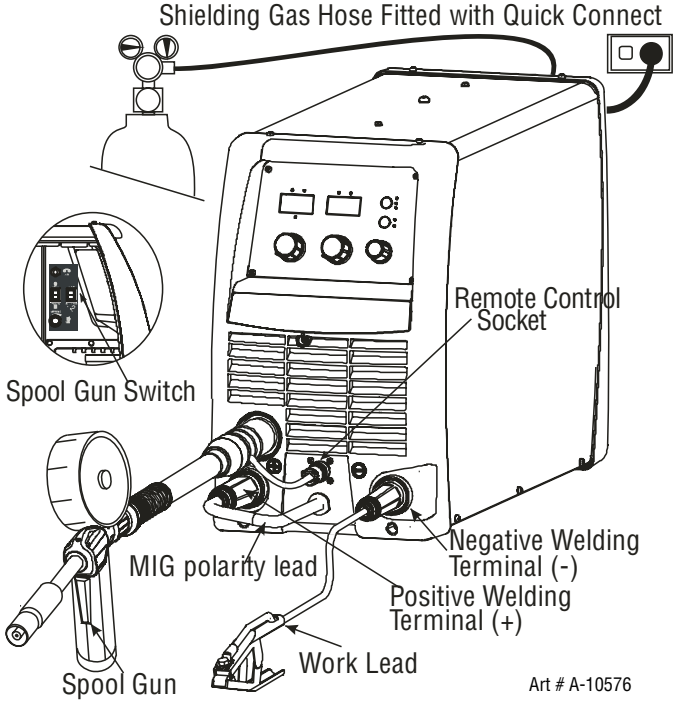


Figure 3-15: Setup for Spool Gun Welding with Gas Shielded MIG Wire

3.17 Setup for TIG (GTAW) Welding

A. Select LIFT TIG mode with the process selection control (refer to Section 3.06.13 for further information).

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

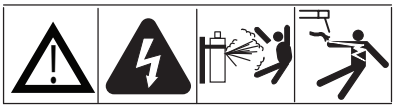
C. Connect the work lead to the positive welding terminal (+). Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

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 Mode.

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 3.06.9 Remote Control Socket for further information).

E. Fit the welding grade shielding gas regulator/flowmeter to the shielding gas cylinder (refer to Section 3.14) then connect the shielding gas hose from the TIG torch to the regulator/flowmeter outlet. Note that the TIG torch shielding gas hose is connected directly to the regulator/flowmeter. The power source is not fitted with a shielding gas solenoid to control the gas flow in LIFT TIG mode therefore the TIG torch will require a gas valve.



WARNING

Before connecting the work clamp to the work and inserting the electrode in the TIG Torch 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 stationary support to prevent falling or tipping.

CAUTION

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

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

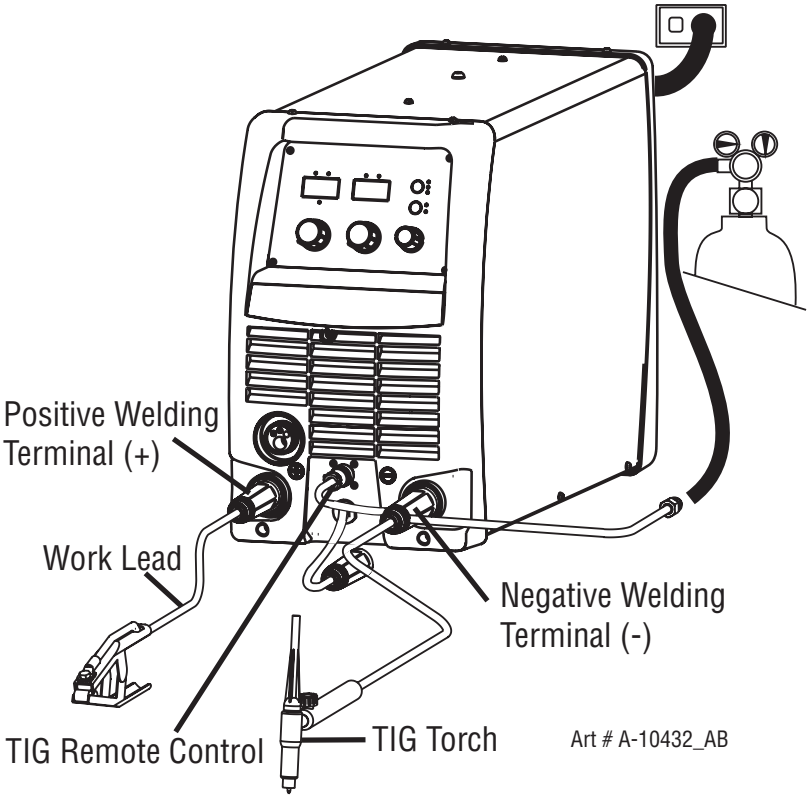


Figure 3-16: Setup for TIG Welding

3.18 Setup for STICK (MMA) 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 heavy duty bayonet 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 heavy duty bayonet 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 3.06.13 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.

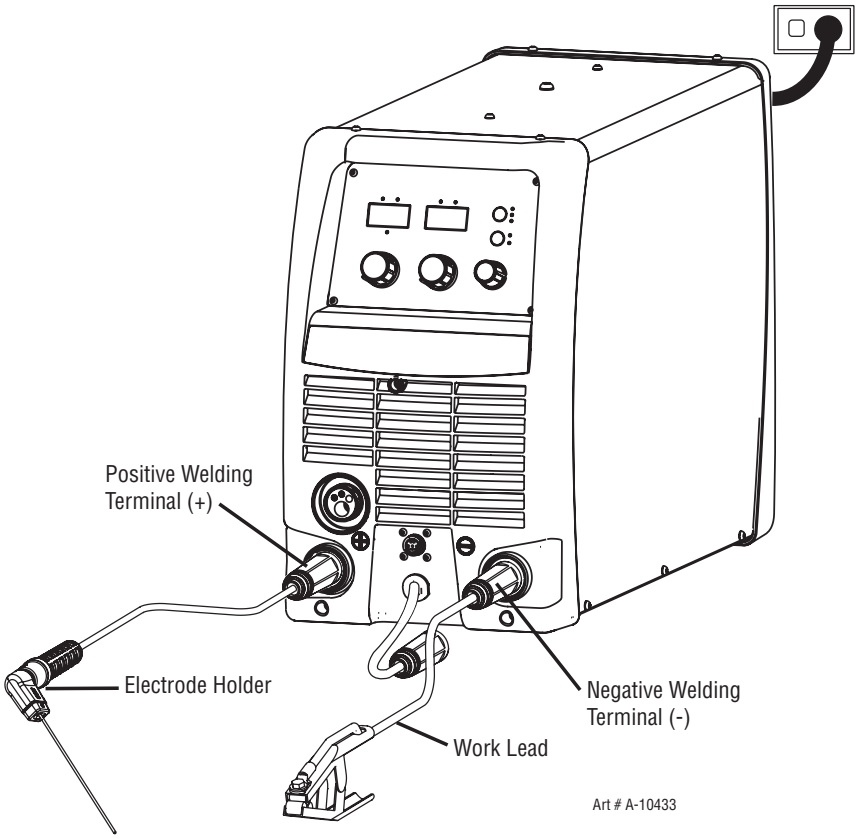


Figure 3-17: Setup for Manual Arc Welding.

SECTION 4:
BASIC WELDING GUIDE

4.01 MIG (GMAW/FCAW) Basic Welding Technique

Two different welding processes are covered in this section GMAW and FCAW, with the intention of providing the very basic concepts in using the MIG mode of welding, where a welding gun is hand held, and the electrode (welding wire) is fed into a weld puddle, and the arc is shielded by an inert welding grade shielding gas or inert welding grade shielding gas mixture.

GAS METAL ARC WELDING (GMAW): This process, also known as MIG welding, CO_2 welding, Micro Wire Welding, short arc welding, dip transfer welding, wire welding etc., is an electric arc welding process which fuses together the parts to be welded by heating them with an arc between a solid continuous, consumable electrode and the work. Shielding is obtained from an externally supplied welding grade shielding gas or welding grade shielding gas mixture. The process is normally applied semi automatically; however the process may be operated automatically and can be machine operated. The process can be used to weld thin and fairly thick steels, and some non-ferrous metals in all positions.

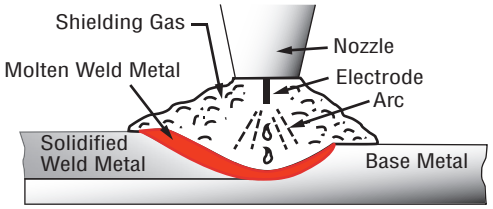


Figure 4-1

FLUX CORED ARC WELDING (FCAW): This is an electric arc welding process which fuses together the parts to be welded by heating them with an arc between a continuous flux filled electrode wire and the work. Shielding is obtained through decomposition of the flux within the tubular wire. Additional shielding may or may not be obtained from an externally supplied gas or gas mixture. The process is normally applied semi automatically; however the process may be applied automatically or by machine. It is commonly used to weld large diameter electrodes in the flat and horizontal position and small electrode diameters in all positions. The process is used to a lesser degree for welding stainless steel and for overlay work.

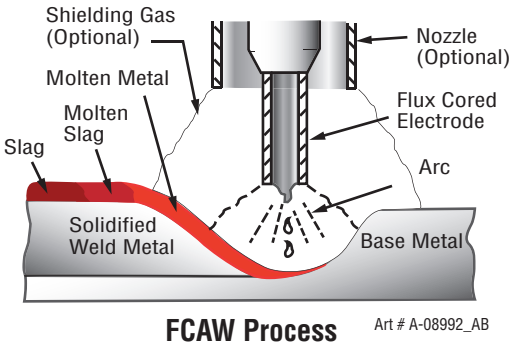


Figure 4-2

Position of MIG Gun

The angle of MIG gun to the weld has an effect on the width of the weld.

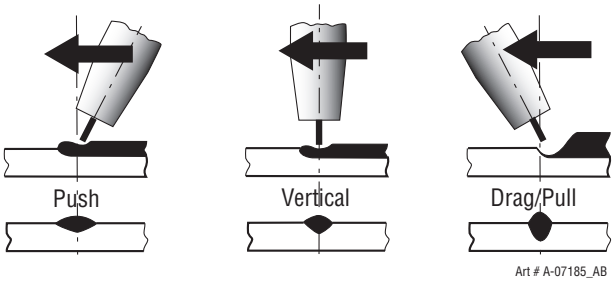


Figure 4-3

The welding gun should be held at an angle to the weld joint. (see Secondary Adjustment Variables below) Hold the gun so that the welding seam is viewed at all times. Always wear the welding helmet with proper filter lenses and use the proper safety equipment.

CAUTION

Do not pull the welding gun back when the arc is established. This will create excessive wire extension (stick-out) and make a very poor weld.

The electrode wire is not energized until the gun trigger switch is depressed. The wire may therefore be placed on the seam or joint prior to lowering the helmet.

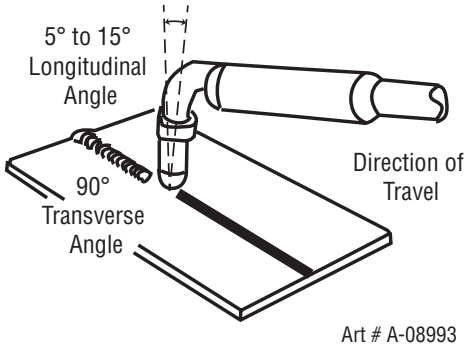


Figure 4-4

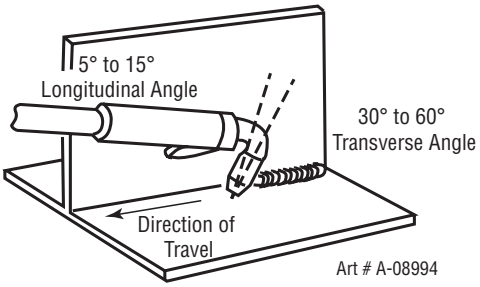
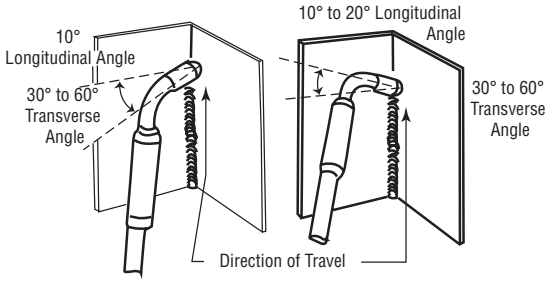
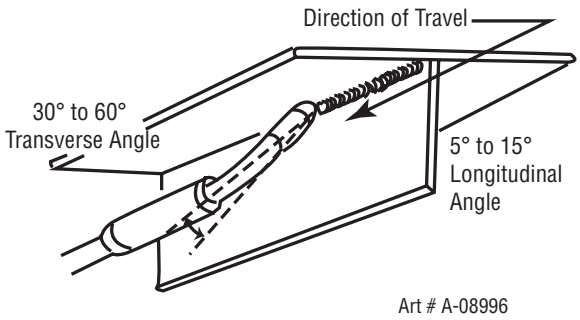


Figure 4-5



Vertical Fillet Welds Art # A-08995

Figure 4-6



Art # A-08996

Figure 4-7

Distance from the MIG Gun Nozzle to the Work Piece

The electrode wire stick out from the MIG gun nozzle should be between 10mm to 20.0mm. This distance may vary depending on the type of joint that is being welded.

Travel Speed

The speed at which the molten pool travels influences the width of the weld and penetration of the welding run.

MIG Welding (GMAW) Variables

Most of the welding done by all processes is on carbon steel. The items below describe the welding variables in short-arc welding of 24gauge (0.024", 0.6mm) to ¼" (6.4mm) mild sheet or plate. The applied techniques and end results in the GMAW process are controlled by these variables.

Preselected Variables

Preselected variables depend upon the type of material being welded, the thickness of the material, the welding position, the deposition rate and the mechanical properties. These variables are:

- Type of electrode wire
- Size of electrode wire
- Type of gas (not applicable to self shielding wires FCAW)
- Gas flow rate (not applicable to self shielding wires FCAW)

Primary Adjustable Variables

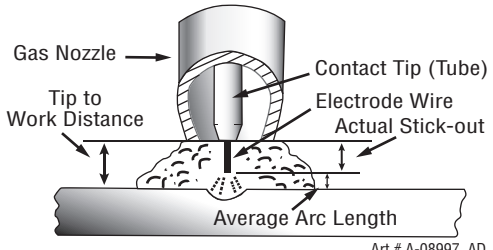
These control the process after preselected variables have been found. They control the penetration, bead width, bead height, arc stability, deposition rate and weld soundness. They are:

- Arc Voltage
- Welding current (wire feed speed)
- Travel speed

Secondary Adjustable Variables

These variables cause changes in primary adjustable variables which in turn cause the desired change in the bead formation. They are:

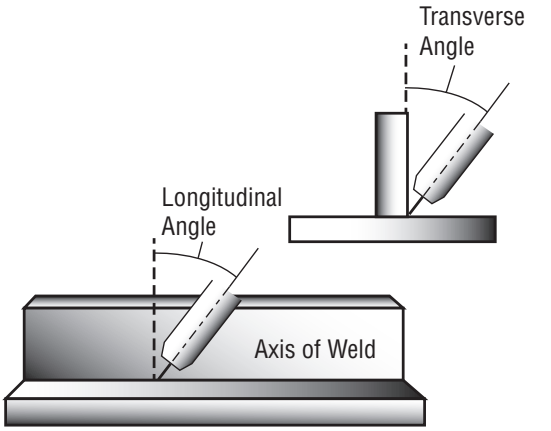
1. Stick-out (distance between the end of the contact tube (tip) and the end of the electrode wire). Maintain at about 10mm stick-out
2. Wire Feed Speed. Increase in wire feed speed increases weld current, Decrease in wire feed speed decreases weld current.



Electrode Stick-Out

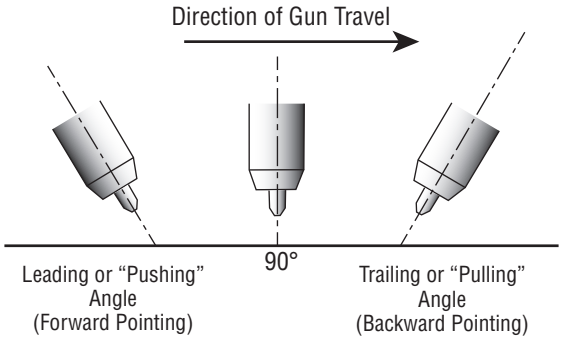
Figure 4-8

3. Nozzle Angle. This refers to the position of the welding gun in relation to the joint. The transverse angle is usually one half the included angle between plates forming the joint. The longitudinal angle is the angle between the centre line of the welding gun and a line perpendicular to the axis of the weld. The longitudinal angle is generally called the Nozzle Angle and can be either trailing (pulling) or leading (pushing). Whether the operator is left handed or right handed has to be considered to realize the effects of each angle in relation to the direction of travel.



Transverse and Longitudinal
Nozzle Axes

Figure 4-9



Nozzle Angle, Right Handed Operator

Figure 4-10

Establishing the Arc and Making Weld Beads

Before attempting to weld on a finished piece of work, it is recommended that practice welds be made on a sample metal of the same material as that of the finished piece.

The easiest welding procedure for the beginner to experiment with MIG welding is the flat position. The equipment is capable of flat, vertical and overhead positions.

For practicing MIG welding, secure some pieces of 16 gauge(1.6mm) or 18 gauge (1.2mm) mild steel plate 150 x 150mm. Use 0.8mm flux cored gasless wire or a solid wire with shielding gas.

Setting of the Power Source

Power source setting requires some practice by the operator, as the welding plant has two control settings that have to balance. These are the Wirespeed control (refer to section 3.06.4) and the welding Voltage Control (refer to section 3.06.10). The welding current is determined by the Wirespeed control, the current will increase with increased Wirespeed, resulting in a shorter arc. Less wire speed will reduce the current and lengthen the arc. Increasing the welding voltage hardly alters the current level, but lengthens the arc. By decreasing the voltage, a shorter arc is obtained with a little change in current level.

When changing to a different electrode wire diameter, different control settings are required. A thinner electrode wire needs more Wirespeed to achieve the same current level.

A satisfactory weld cannot be obtained if the Wirespeed and Voltage settings are not adjusted to suit the electrode wire diameter and the dimensions of the work piece.

If the Wirespeed is too high for the welding voltage, “stubbing” will occur as the wire dips into the molten pool and does not melt. Welding in these conditions normally produces a poor weld due to lack of fusion. If, however, the welding voltage is too high, large drops will form on the end of the wire, causing spatter. The correct setting of voltage and Wirespeed can be seen in the shape of the weld deposit and heard by a smooth regular arc sound. Refer to the Weld Guide located on the inside of the wirefeed compartment door for setup information.

Electrode Wire Size Selection

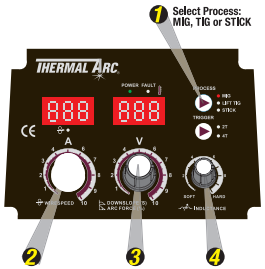
The choice of Electrode wire size and shielding gas used depends on the following

- Thickness of the metal to be welded
- Type of joint
- Capacity of the wire feed unit and Power Source
- The amount of penetration required
- The deposition rate required
- The bead profile desired
- The position of welding
- Cost of the wire

Fabricator® 211i Set-up Guide

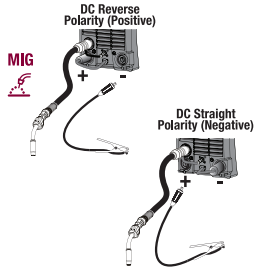
THERMAL ARC

Easy Steps For Welding



2	3	4
Set Wirespeed (MIG)	Set Voltage (MIG)	Set Inductance
Set Amperage (TIG)	Set Down Slope (TIG)	
Set Amperage (STICK)	Set Arc Force Control (STICK)	

Set Polarity
(Refer to Operating Manual for further information.)
Note: If in doubt consult the electrode data sheet or your nearest accredited Thermal Arc Distributor.



MIG Set-Up Guide

Note: MIG set-up guide parameters are given as a reference. Optimal settings may vary depending upon welding position, joint design, and wire/gas compositions.

1 SELECT PROCESS	a MATERIAL SELECTION	b WELDING WIRE	c SHIELDING GAS	d MATERIAL THICKNESS	0.8 mm	1.6 mm	2.0 mm	3.0 mm	4.0 mm	5.0 mm	6.0 mm	8.0 mm	10.0 mm
MIG	Mild Steel	LW1-6 0.6 mm (Hard)	<3.0 mm 93% Ar, 5% CO_2, 2% O_2	2 Wirespeed Display	6.2	9.6	15.5	18.0	-	-	-	-	-
				3 Voltage Display	14.2	17.1	18.0	20.0	-	-	-	-	-
			>3.0 mm 86% Ar, 12% CO_2, 2% O_2	4 Inductance Control	5	5	7.5	7.5	-	-	-	-	-
				Polarity Selection	DC Reverse Polarity (Positive)								
	Mild Steel	LW1-6 0.8 mm (Hard)	<3.0 mm 93% Ar, 5% CO_2, 2% O_2	2 Wirespeed Display	5.4	9.6	9.4	11.1	12.8	15.7	16.3	-	-
				3 Voltage Display	13	15.9	18.0	19.6	21.2	24.9	25.5	-	-
			>3.0 mm 86% Ar, 12% CO_2, 2% O_2	4 Inductance Control	9	7.5	5	7	7	5	5	-	-
				Polarity Selection	DC Reverse Polarity (Positive)								
	Mild Steel	LW1-6 0,9 mm (Hard)	<3.0 mm 93% Ar, 5% CO_2, 2% O_2	2 Wirespeed Display	4.7	5.6	6.9	8.1	9.5	11.1	12.3	12.3	-
				3 Voltage Display	15.3	15.5	17.4	18.8	20.9	24.5	26	26	-
			>3.0 mm 86% Ar, 12% CO_2, 2% O_2	4 Inductance Control	3	5	5	5	7	7.5	7.5	7.5	-
				Polarity Selection	DC Reverse Polarity (Positive)								
	Mild Steel	0,9 mm (Flux Cored)	Not Required	2 Wirespeed Display	-	6.1	6.2	7.2	8.1	9.3	10.2	11.3	12.6
				3 Voltage Display	-	18.3	18.4	19.1	20.4	22.2	23.6	26.0	26.0
				4 Inductance Control	-	5	5	5	5	5	5	5	5
				Polarity Selection	DC Straight Polarity (Negative)								
	Mild Steel	1,2 mm (Flux Cored)	Not Required	2 Wirespeed Display	-	2.5	4.2	4.3	5.4	5.7	6.6	7.7	8.1
				3 Voltage Display	-	13.6	15.5	17.3	18.5	20.0	21.5	22.9	25.1
				4 Inductance Control	-	5	5	7.5	7.5	7.5	7.5	7.5	7.5
				Polarity Selection	DC Straight Polarity (Negative)								
	Stainless Steel	316LSi 0,9 mm (Hard)	98.5% Ar, 1.5% O_2	2 Wirespeed Display	4.6	5.0	5.9	9.8	10.8	11.7	12.5	13.6	13.6
				3 Voltage Display	13.7	14.7	15.9	18.1	20.8	23.2	26.0	26.0	26.0
				4 Inductance Control	5	5	5	2	2	2	5	5	5
				Polarity Selection	DC Reverse Polarity (Positive)								
	Aluminium	AL5356 1.0 mm (Soft)	100% Argon	2 Wirespeed Display	-	10.8	11.2	12.0	15.6	17.2	17.5	-	-
				3 Voltage Display	-	15.6	16.7	17.8	20.0	22.6	23.8	-	-
				4 Inductance Control	-	5	5	5	2	2	2	-	-
				Polarity Selection	DC Reverse Polarity (Positive)								

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

TIG Set-Up Guide

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

1 MATERIAL SELECTION	a SELECT PROCESS	b TUNGSTEN DIAMETER	c Filler Rod (If Required)	d SHIELD GAS	e AMPERAGE RANGE		
TIG	Mild Steel & Stainless Steel	1.6 mm	1.6 mm	Argon	2 Amperage Display	(MS)	Min-115
						(SS)	Min-70
		2,4 mm	2,4 mm	Argon	2 Amperage Display	(MS)	115-170
						(SS)	65-150
		3.2 mm	3.2 mm	Argon	2 Amperage Display	(MS)	160-200
						(SS)	135-180

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

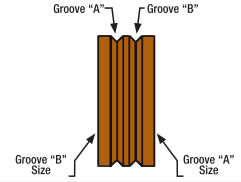
STICK Set-Up Guide

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

1 SELECT PROCESS	a ELECTRODE SELECTION	b ELECTRODE DIAMETER	2.4 mm Range	2.4 mm Optimum	3.2 mm Range	3.2 mm Optimum	4.0 mm Range	4.0 mm Optimum
STICK	E6010 E6011	2 Amperage Display	60-85	70	90-125	100	125-170	150
		3 Arc Force Knob	-	50%	-	50%	-	50%
		Polarity Selection	DC Reverse Polarity (Positive)					
	E6013	2 Amperage Display	55-90	75	90-135	115	135-180	160
		3 Arc Force Knob	-	50%	-	50%	-	50%
		Polarity Selection	DC Reverse Polarity (Positive)					
	E7018	2 Amperage Display	65-100	85	95-150	125	145-220	175
		3 Arc Force Knob	-	50%	-	50%	-	50%
		Polarity Selection	DC Reverse Polarity (Positive)					
	E7014	2 Amperage Display	55-100	80	95-140	120	140-195	165
		3 Arc Force Knob	-	50%	-	50%	-	50%
		Polarity Selection	DC Reverse Polarity (Positive)					
	E7024	2 Amperage Display	85-120	100	130-170	150	185-200	200
		3 Arc Force Knob	-	50%	-	50%	-	50%
		Polarity Selection	DC Reverse Polarity (Positive)					
	E300 Series	2 Amperage Display	40-70	60	75-110	90	110-150	130
		3 Arc Force Knob	-	50%	-	50%	-	50%
		Polarity Selection	DC Reverse Polarity (Positive)					

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

Drive Rolls



Part Number	Feed Roll Type
62020	0.6/0.8 mm Hard Wire
62022	0.9/1.2 mm Hard Wire
62179	0.8/0.9 mm Soft Wire
62024	1.0/1.2 mm Soft Wire
62028	0.8/0.9 mm Cored Wire

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Art # A-10941

4.02 MIG (GMAW/FCAW) Welding Troubleshooting

Solving Problems Beyond the Welding Terminals

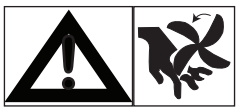
The general approach to fix Gas Metal Arc Welding (GMAW) problems is to start at the wire spool then work through to the MIG gun. There are two main areas where problems occur with GMAW, Porosity and Inconsistent wire feed

Solving Problems Beyond the Welding Terminals - Porosity

When there is a gas problem the result is usually porosity within the weld metal. Porosity always stems from some contaminant within the molten weld pool which is in the process of escaping during solidification of the molten metal. Contaminants range from no gas around the welding arc to dirt on the work piece surface. Porosity can be reduced by checking the following points.

	FAULT		CAUSE
1	Shielding gas cylinder contents and flow meter.		Ensure that the shielding gas cylinder is not empty and the flow meter is correctly adjusted to 15 litres per minute.
2	Gas leaks.		Check for gas leaks between the regulator/cylinder connection and in the gas hose to the Power Source.
3	Internal gas hose in the Power Source.		Ensure the hose from the solenoid valve to the Euro adaptor has not fractured and that it is connected to the Euro adaptor.
4	Welding in a windy environment.		Shield the weld area from the wind or increase the gas flow.
5	Welding dirty, oily, painted, oxidised or greasy plate.		Clean contaminates off the work piece.
6	Distance between the MIG gun nozzle and the work piece.		Keep the distance between the MIG gun nozzle and the work piece to a minimum.
7	Maintain the MIG gun in good working order.	A	Ensure that the gas holes are not blocked and gas is exiting out of the MIG gun nozzle.
		B	Do not restrict gas flow by allowing spatter to build up inside the MIG gun nozzle.
		C	Check that the MIG gun O-rings are not damaged.

Table 4-2: Solving Problems beyond the Welding Terminals-Porosity



WARNING

Disengage the feed roll when testing for gas flow by ear.

Solving Problems Beyond the Welding Terminals - Inconsistent Wire Feed

Wire feeding problems can be reduced by checking the following points.

	FAULT		CAUSE
1	Feed roller driven by motor in the cabinet slipped.		Wire spool brake is too tight.
2	Wire spool unwinded and tangled.		Wire spool brake is too loose.
3	Worn or incorrect feed roller size	A	Use a feed roller matched to the size you are welding.
		B	Replace feed roller if worn.
4	Wire rubbed against the mis-aligned guides and reduced wire feedability.		Mis-alignment of inlet/outlet guides
5	Liner blocked with swarf	A	Increased amounts of swarf are produced by the wire passing through the feed roller when excessive pressure is applied to the pressure roller adjuster.
		B	Swarf can also be produced by the wire passing through an incorrect feed roller groove shape or size.
		C	Swarf is fed into the conduit liner where it accumulates thus reducing wire feedability.
6	Incorrect or worn contact tip	A	The contact tip transfers the weld current to the electrode wire. If the hole in the contact tip is too large then arcing may occur inside the contact tip resulting in the wire jamming in the contact tip
		B	When using soft wire such as aluminium it may become jammed in the contact tip due to expansion of the wire when heated. A contact tip designed for soft wires should be used.
7	Poor work lead contact to work piece		If the work lead has a poor electrical contact to the work piece then the connection point will heat up and result in a reduction of power at the arc.
8	Bent liner		This will cause friction between the wire and the liner thus reducing wire feedability

Table 4-3: Wire Feeding Problems

Basic MIG (GMAW/FCAW) Welding Troubleshooting

FAULT	CAUSE	REMEDY
1 Undercut	A Welding arc voltage too high.	A Decrease voltage or increase the wire feed speed.
	B Incorrect MIG gun angle	B Adjust angle.
	C Excessive heat input	C Increase the MIG gun travel speed and/or decrease welding current by decreasing the voltage or decreasing the wire feed speed.
2 Lack of penetration	A Welding current too low	A Increase welding current by increasing wire feed speed and increasing voltage.
	B Joint preparation too narrow or gap too tight	B Increase joint angle or gap.
	C Shielding gas incorrect	C Change to a gas which gives higher penetration.
3 Lack of fusion	Voltage too low	Increase voltage.
4 Excessive spatter	A Voltage too high	A Decrease voltage or increase the wirespeed control.
	B Voltage too low	B Increase the voltage or decrease wirespeed.
5 Irregular weld shape	A Incorrect voltage and current settings. Convex, voltage too low. Concave, voltage too high.	A Adjust voltage and current by adjusting the voltage control and the wirespeed control.
	B Wire is wandering.	B Replace contact tip.
	C Incorrect shielding gas	C Check shielding gas.
	D Insufficient or excessive heat input	D Adjust the wirespeed control or the voltage control.
6 Weld cracking	A Weld beads too small	A Decrease travel speed
	B Weld penetration narrow and deep	B Reduce current and voltage and increase MIG gun travel speed or select a lower penetration shielding gas.
	C Excessive weld stresses	C Increase weld metal strength or revise design
	D Excessive voltage	D Decrease voltage.
	E Cooling rate too fast	E Slow the cooling rate by preheating part to be welded or cool slowly.
7 Cold weld puddle	A Loose welding cable connection.	A Check all welding cable connections.
	B Low primary voltage	B Contact supply authority.
	C Fault in power source	C Have an Accredited Thermal Arc Service Provider to test then replace the faulty component.
8 Arc does not have a crisp sound that short arc exhibits when the wirefeed speed and voltage are adjusted correctly.	The MIG gun has been connected to the wrong voltage polarity on the front panel.	Connect the MIG Polarity Cable to the positive (+) welding terminal for solid wires and gas shielded flux cored wires. Refer to the electrode wire manufacturer for the correct polarity.

Table4-4: MIG (GMAW/FCAW) Welding Problems

4.03 STICK (MMA) 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 Thermal Arc Distributor.

Effects of Arc 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 may result. 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. Austenitic 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 preheating of heavy sections necessary to give proper fusion of weld and base metal.

Arc Welding Practice

The techniques used for arc welding are almost identical regardless of what types of metals are being joined. Naturally enough, different types of electrodes would be used for different metals as described in the preceding section.

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 4-15 through 4-22.

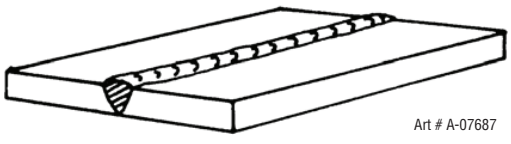


Figure 4-11: Flat Position, Down Hand Butt Weld

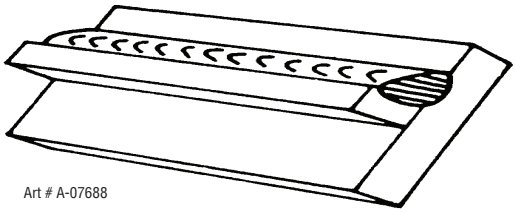


Figure 4-12: Flat Position, Gravity Fillet Weld

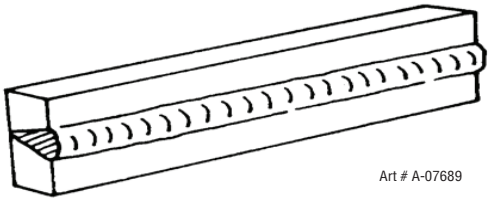


Figure 4-13: Horizontal Position, Butt Weld

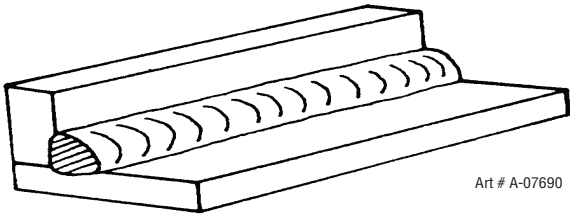


Figure 4-14: Horizontal-Vertical (HV) Position

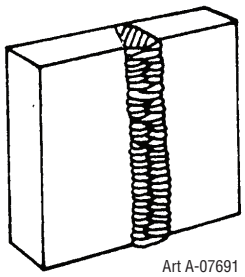


Figure 4-15: Vertical Position, Butt Weld

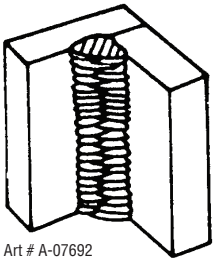


Figure 4-16: Vertical Position, Fillet Weld

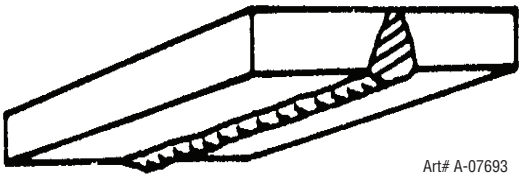


Figure 4-17: Overhead Position, Butt Weld

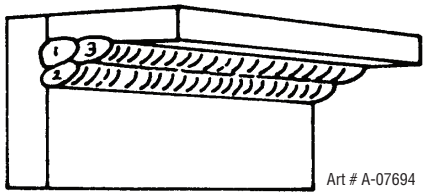


Figure 4-18: Overhead Position, Fillet Weld

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 4-19.

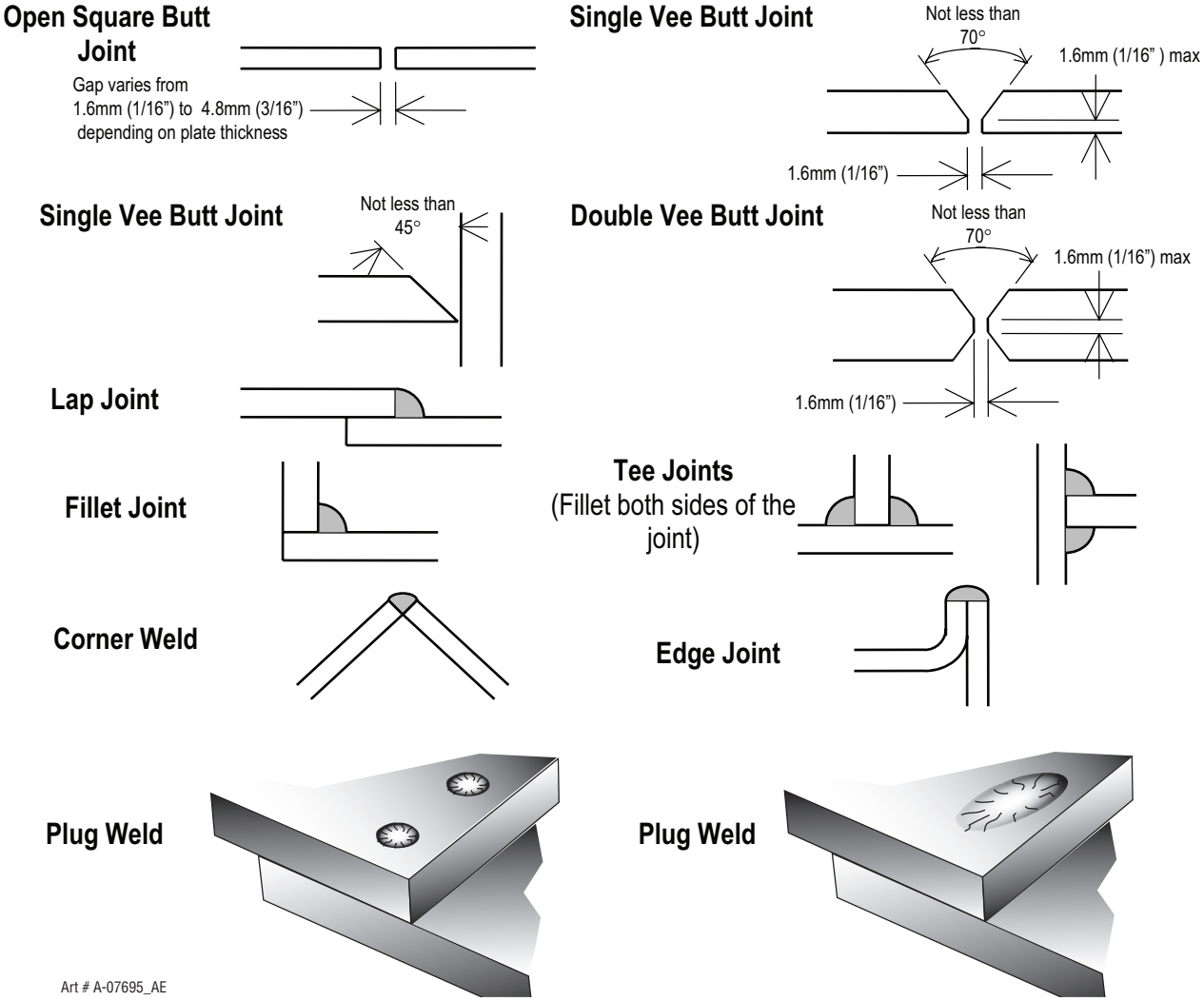


Figure 4-19: Typical Joint Designs for Arc Welding

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 6.0mm thick and a 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. Don't hold your body tense. A taut attitude of mind and a tensed body will soon make you feel tired. Relax and you will find that the job becomes much easier. You can add much to your peace of mind by wearing a leather apron and gauntlets. You won't be worrying then about being burnt or sparks setting alight to your clothes.

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. If the lead is slung over your shoulder, it allows greater freedom of movement and takes a lot of weight off your hand. 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 1.6mm to 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.

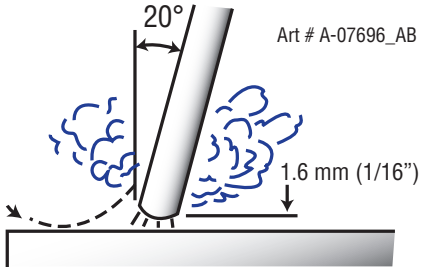


Figure 4-20: Striking an Arc

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. Contact or "touch-weld" electrodes such as E7014 do not stick in this way, and make welding much easier.

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 20º 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 4-21, allowing 1.6mm to 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 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. Using a 3.2mm E7014 electrode at 100 amps, deposit a run of weld metal on the bottom of the joint.

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.

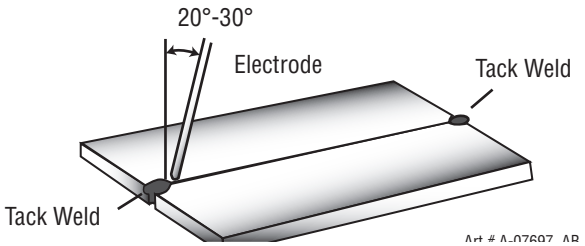


Figure 4-21: Butt Weld

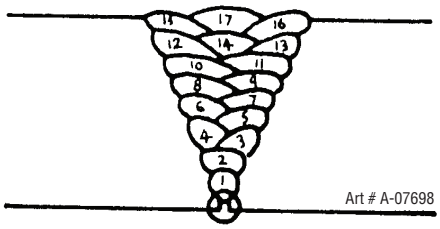


Figure 4-22: Weld Build up Sequence

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 4-22. 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 4-14.

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. Using a 3.2mm E7014 electrode at 100 amps, position angle iron with one leg horizontal and the other vertical. 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 4-23. Do not attempt to build up much larger than 6.4mm width with a 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 4-24. Weaving in HV fillet welds is undesirable.

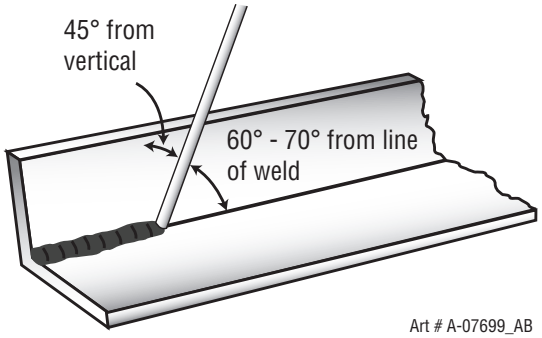


Figure 4-23: Electrode Position for HV Fillet Weld

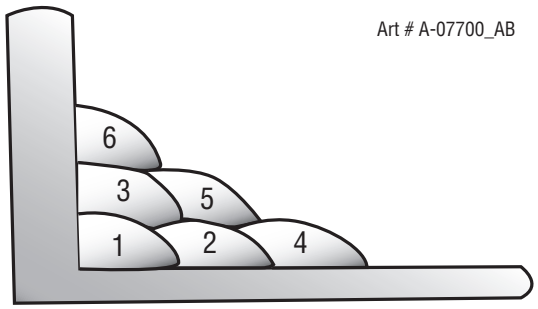


Figure 4-24: Multi-runs in HV Fillet Weld

C. Vertical Welds

1. Vertical Up

Tack weld a three feet length of angle iron to your work bench in an upright position. Use a 3.2mm E7014 electrode and set the current at 100 amps. 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 10° from the horizontal to enable a good bead to be deposited. Refer Figure 4-25. 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 4-26 illustrates multi-run technique and Figure 4-27 shows the effects of pausing at the edge of weave and of weaving too rapidly.

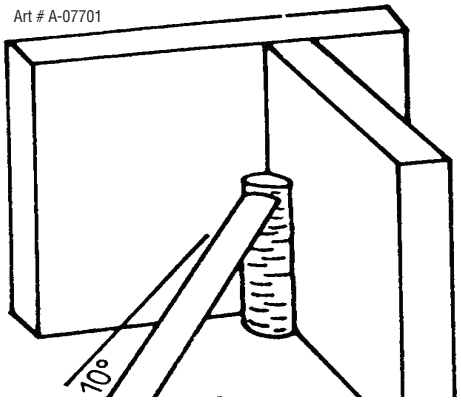


Figure 4-25: Single Run Vertical Fillet Weld

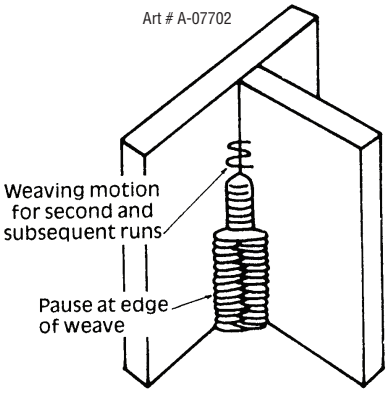


Figure 4-26: Multi Run Vertical Fillet Weld

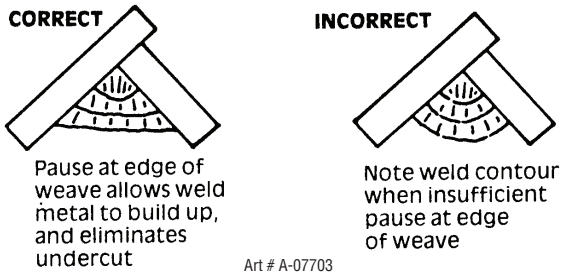


Figure 4-27: Examples of Vertical Fillet Welds

2. Vertical Down

The E7014 electrode makes welding in this position particularly easy. Use a 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 4-28). 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. Use a 3.2mm E6013 electrode at 100 amps, and deposit the first run by simply drawing the electrode along at a steady rate. You will notice that the weld deposit is rather convex, due to the effect of gravity before the metal freezes.

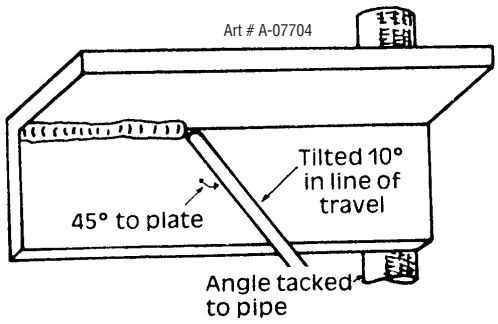


Figure 4-28: Overhead Fillet Weld

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 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 4-29 and 4- 30 illustrate how distortion is created.

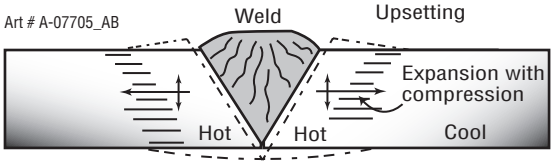


Figure 4-29: Parent Metal Expansion

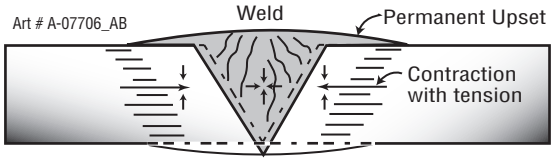


Figure 4-30: Parent Metal Contraction

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 4-30 through 4-33 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 4-31.

E. Preheating

Suitable preheating of parts of the structure other than the area to be welded can be sometimes used to reduce distortion. Figure 4-32 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.

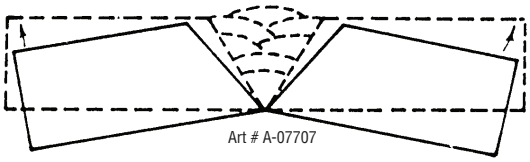
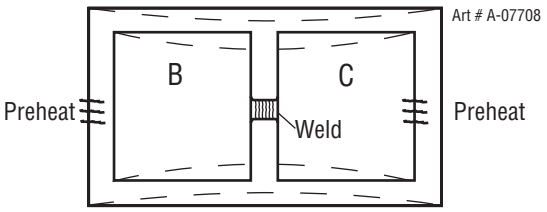


Figure 4-31: Principle of Presetting



Dotted lines show effect if no preheat is used

Figure 4-32: Reduction of Distortion by Preheating

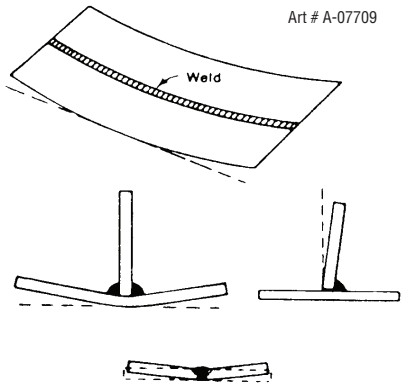
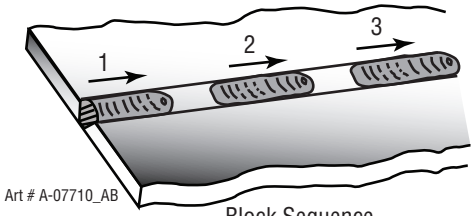


Figure 4-33: Examples of Distortion



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

Figure 4-34: Welding Sequence

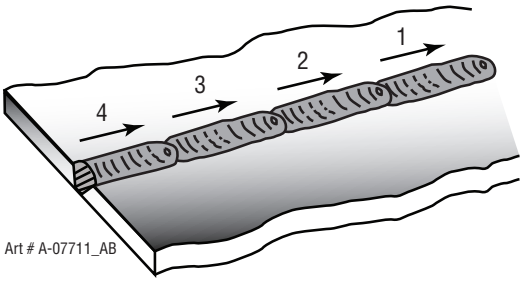


Figure 4-35: Step back Sequence

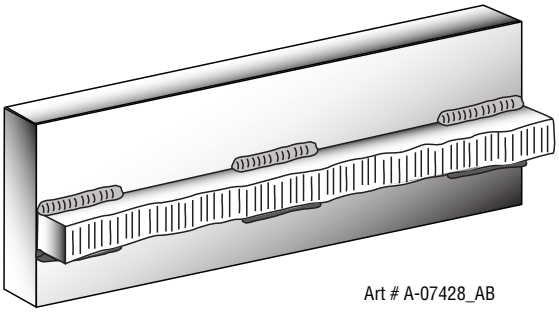


Figure 4-36: Chain Intermittent Welding

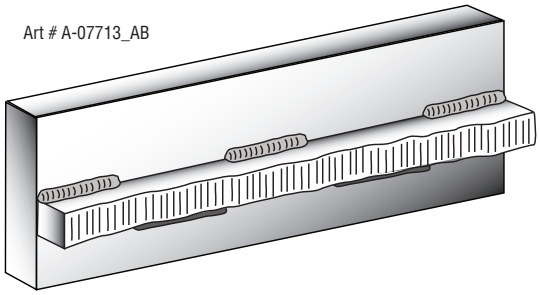


Figure 4-37: Staggered Intermittent Welding

4.04 STICK (MMA) 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.

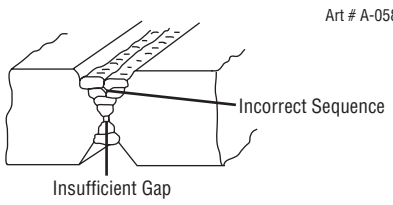


Figure 1-Example of insufficient gap or incorrect sequence

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.
		G Power source is set for MIG (GMAW/FCAW) welding.	G Set power source to STICK (MMA) mode.

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.

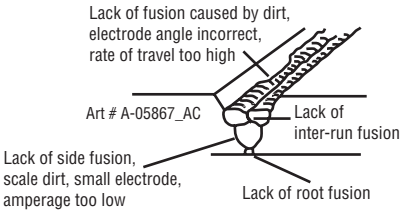


Figure 2: Example of Lack of Fusion

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 ie flux coating incomplete.	F Discard damaged electrodes and only use electrodes with a complete flux coating.
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.

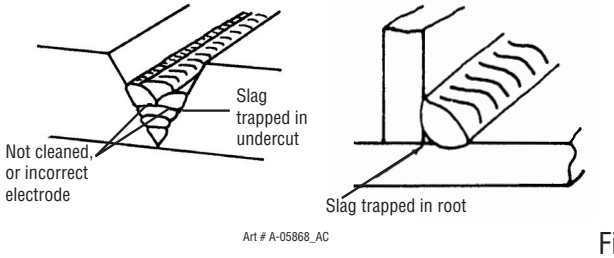


Figure 3: Example of Slag Inclusion

Table 4-5: Welding Problems STICK (MMA)

4.05 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.

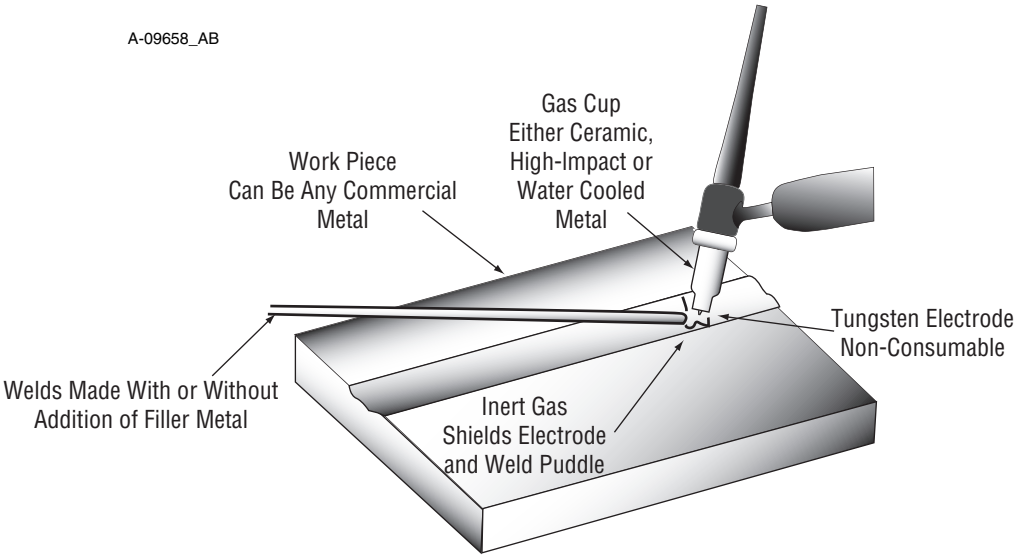


Figure 4-38: TIG Welding Application Shot

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 4-6: 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 4-7: Filler Wire Selection Guide

Tungsten Electrode Types

Electrode Type (Ground Finish)	Welding Application	Features	Colour 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 4-8

NOTE

The Fabricator 211i Inverter is not suited for AC TIG welding.

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 Litres/min	Joint Type
0.040” 1.0mm	35-45 40-50	20-30 25-35	0.040” 1.0mm	1/16” 1.6mm	5-7	Butt/Corner Lap/Fillet
0.045” 1.2mm	45-55 50-60	30-45 35-50	0.040” 1.0mm	1/16” 1.6mm	5-7	Butt/Corner Lap/Fillet
1/16” 1.6mm	60-70 70-90	40-60 50-70	1/16” 1.6mm	1/16” 1.6mm	7	Butt/Corner Lap/Fillet
1/8” 3.2mm	80-100 90-115	65-85 90-110	1/16” 1.6mm	3/32” 2.4mm	7	Butt/Corner Lap/Fillet
3/16” 4.8mm	115-135 140-165	100-125 125-150	3/32” 2.4mm	1/8” 3.2mm	10	Butt/Corner Lap/Fillet
1/4” 6.4mm	160-175 170-200	135-160 160-180	1/8” 3.2mm	5/32” 4.0mm	10	Butt/Corner Lap/Fillet

Table 4-9

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.thermadyne.com or contact Thermal Arc.

4.06 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 Torch valve is turned off.	G Turn on.
	H The electrode is too small for the welding current.	H Increase electrode diameter or reduce the welding current.
	I Power source is set for MIG welding.	I Set Power Source to LIFT TIG mode.

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 electrode. Refer to Table 4-6.
	B The wrong electrode is being used for the welding job.	B Select the right electrode type. Refer to Table 4-8.
	C Gas flow rate is too high.	C Select the right rate for the welding job. Refer to Table 4-9.
	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 electrode. Refer to Table 4-6.

Table 4-10: TIG (GTAW) Welding Problems

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SECTION 5: POWER SOURCE PROBLEMS AND ROUTINE SERVICE REQUIREMENTS

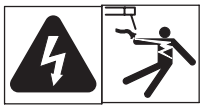
5.01 Power Source Problems

	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	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.
3	Unit will not feed wire in MIG mode.	A Electrode wire stuck in conduit liner or contact tip (burn-back jam).	A Check for clogged / kinked MIG gun conduit liner or worn contact tip. Replace faulty components.
		B Internal fault in power source	B Have an Accredited Thermal Arc Service Provider investigate the fault.
4	Welding wire continues to feed when torch trigger is released.	A Trigger mode selection switch is in 4T latch mode.	A Change the trigger mode selection switch from 4T latch mode to 2T normal mode.
		B Torch trigger leads shorted.	B Repair or replace torch trigger switch/lead.
5	Welding arc cannot be established in MIG mode.	A MIG gun polarity lead is not connected into a welding output terminal.	A Connect the MIG gun polarity lead to either the positive welding output terminal or the negative welding output terminal as required.
		B Poor or no work lead contact.	B Clean work clamp area and ensure good electrical contact.
6	Inconsistent wire feed.	A Worn or dirty contact tip.	A Replace if necessary.
		B Worn feed roll.	B Replace.
		C Excessive brake tension on wire reel hub.	C Reduce brake tension on spool hub
		D Worn, kinked or dirty conduit liner	D Clean or replace conduit liner
7	No gas flow in MIG mode.	A Gas hose is damaged.	A Replace or repair.
		B Gas passage contains impurities.	B Disconnect gas hose from the rear of power source and blow out impurities.
		C Gas regulator turned off.	C Turn on regulator.
		D Empty gas cylinder.	D Replace gas cylinder.

8	Gas flow continues after the trigger switch has been released (MIG mode).	Gas valve has jammed open due to impurities in the gas or the gas line.	Have an accredited Thermal Arc service provider repair or replace gas valve.
9	Power indicator will not illuminate and welding arc cannot be established.	The mains supply voltage has exceeded voltage limits of the power source.	Ensure that the mains supply voltage is within 230VAC ± 15%.
10	TIG electrode melts when arc is struck.	TIG torch is connected to the (+) VE terminal.	Connect the TIG torch to the (-) VE terminal.
11	Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the correct size of tungsten electrode. Refer to Table 4-6.

Table 5-1: Power Source Problems

5.02 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 Thermal Arc 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 by a licensed electrician. This includes an insulation resistance test and an earthing test to ensure the integrity of the unit is compliant with Thermal Arc's original specifications.

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.

NOTE

Please refer to local guidelines for further information.

B. Insulation Resistance

Minimum insulation resistance for in-service Thermal Arc 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 (MΩ)
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: Thermal Arc Inverter Power Sources

C. Earthing

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 Thermal Arc 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 Thermal Arc 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 Thermal Arc Service Provider.

Power Source Calibration

A. Schedule

Output testing of all Thermal Arc 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 EN 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 6-3 below shall be conducted by an accredited Thermal Arc service agent.

Testing Requirements
Output current (A) to be checked to ensure it falls within applicable Thermal Arc power source specifications
Output Voltage (V) to be checked to ensure it falls within applicable Thermal Arc power source specifications
Motor Speed (RPM) of wire drive motors to be checked to ensure it falls within required Thermal Arc power source / wire feeder specifications
Accuracy of digital meters to be checked to ensure it falls within applicable Thermal Arc power source specifications

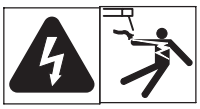
Table 5-3: Calibration Parameters

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.

5.03 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.

5.04 Cleaning the Feed Rolls

Clean the grooves in the drive rolls frequently. This can be done by using a small wire brush. Also wipe off, or clean the grooves on the upper feed roll. After cleaning, tighten the feed roll retaining knobs.

CAUTION

Do NOT use compressed air to clean the Welding Power Source. Compressed air can force metal particles to lodge between live electrical parts and earthed metal parts within the Welding Power Source. This may result in arcing between these parts and their eventual failure.

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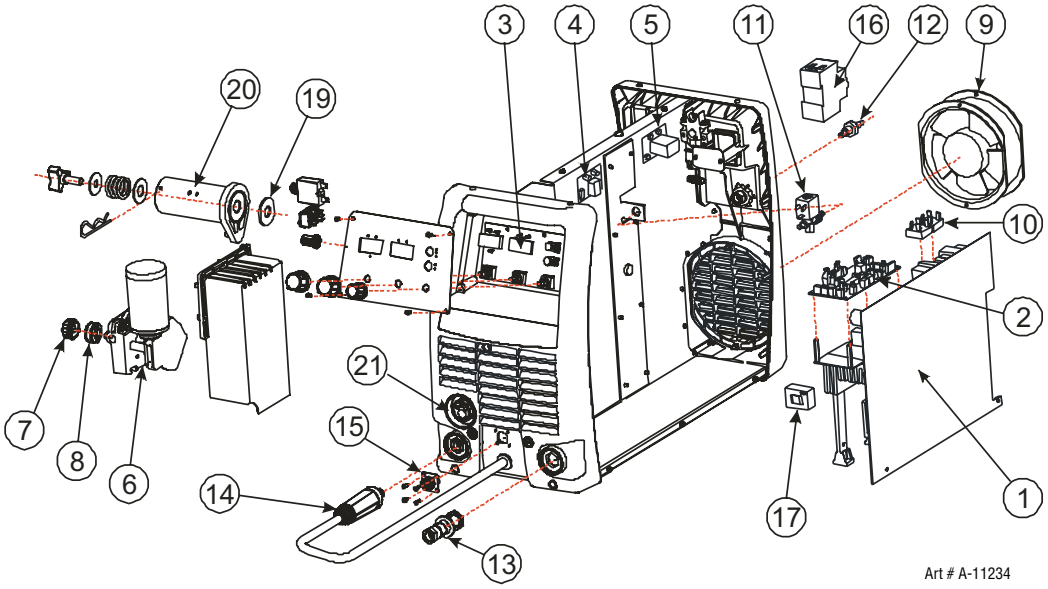
SECTION 6:
KEY SPARE PARTS

6.01 Power Source Spare Parts



Item	Part Number	Description
1	W7005600	PCB Power
2	W7005601	PCB Control
3	W7005602	PCB Display
4	W7005607	PCB Spool Gun
5	W7004902	PCB EMC Filter
6	W7005603	Wiredrive Assembly
7	W7004906	Feed Roll Retaining Thumbscrew
8	62020	Feed Roll 0.6/0.8mm V groove (fitted as standard) (Refer to options and accessories table for other feed rolls available).
9	W7005604	Fan
10	W7003010	Input Rectifier (2 required)
11	W7003033	Gas Solenoid Valve Assembly
12	W7005605	Gas Inlet Fitting
13	W7004909	Dinse Socket 50mm²
14	W7004955	Dinse Plug Male 50mm²
15	W7004942	Control Socket 8 pin (Note that 8 pin control plug part number is UOA706900).
16	W7005606	Supply Circuit Breaker / Mains Supply Switch
17	W7004911	CT, Output
18	W7004930	Shielding Gas Hose Assembly (not shown)
19	W7005608	Friction Washer for Spool Hub
20	W7005609	Spool Hub
21	W7005618	Euro Outlet Adaptor, 211i
22	W7005619	inlet Guide, 211i (not shown)

Table 6-1 Key Spare Parts

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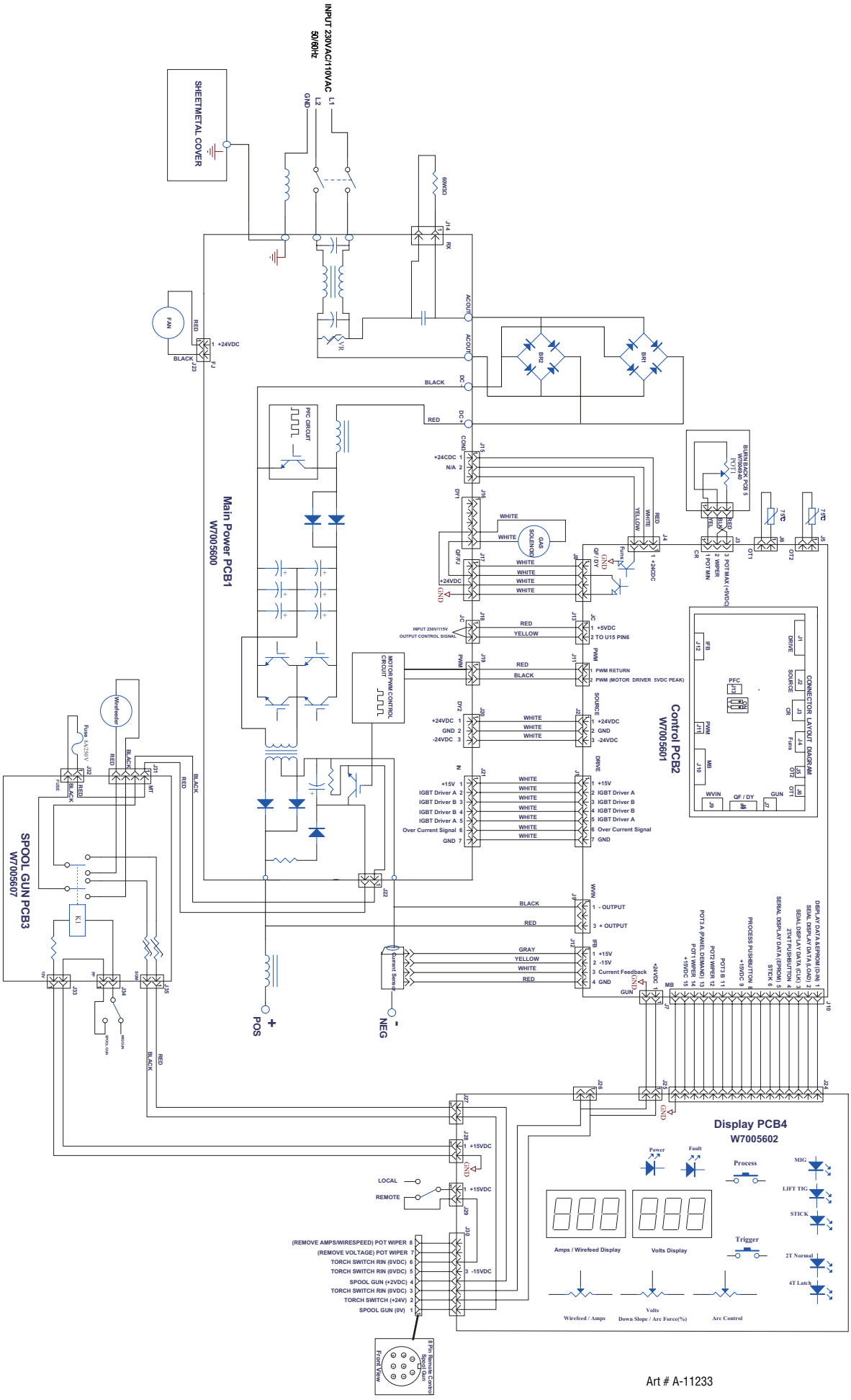
APPENDIX: FABRICATOR 211i CIRCUIT DIAGRAM



THERMAL ARC - LIMITED WARRANTY TERMS

LIMITED WARRANTY: Thermal Arc ®, Inc, A Thermadyne Company, hereafter, “Thermal Arc” warrants to customers of its authorized distributors hereafter “Purchaser” that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal Arc products as stated below, Thermal Arc shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal Arc’s specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal Arc’s sole option, of any components or parts of the product determined by Thermal Arc to be defective.

THERMAL ARC MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED. THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHERS, INCLUDING, BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: THERMAL ARC SHALL NOT UNDER ANY CIRCUMSTANCES BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, SUCH AS, BUT NOT LIMITED TO, LOST PROFITS AND BUSINESS INTERRUPTION. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal Arc with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal Arc whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based. No employee, agent, or representative of Thermal Arc is authorized to change this warranty in any way or grant any other warranty.

PURCHASER’S RIGHTS UNDER THIS WARRANTY ARE VOID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH IN THERMAL ARC’S SOLE JUDGEMENT MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL ARC PRODUCT. PURCHASER’S RIGHTS UNDER THIS WARRANTY ARE VOID IF THE PRODUCT IS SOLD TO PURCHASER BY NON-AUTHORIZED PERSONS.

The warranty is effective for the time stated below beginning on the date that the authorized distributor delivers the products to the Purchaser. Notwithstanding the foregoing, in no event shall the warranty period extend more than the time stated plus one year from the date Thermal Arc delivered the product to the authorized distributor.

TERMS OF WARRANTY – JANUARY 2011

In accordance with the warranty periods stated below, Thermadyne guarantees the proposed product to be free from defects in material or workmanship when operated in accordance with the written instructions as defined in this operating manual.

Thermadyne welding products are manufactured for use by commercial and industrial users and trained personnel with experience in the use and maintenance of electrical welding and cutting equipment.

Thermadyne will repair or replace, at its discretion, any warranted parts or components that fail due to defects in material or workmanship within the warranty period. The warranty period begins on the date of sale to the end user.

Thermal Arc Fabricator 211i	
Component	Warranty Period
Power Source	2 Years
MIG Gun, Electrode Holder / Lead & Work Lead	3 Months
MIG Gun Consumables	NIL

If warranty is being sought, Please contact your Thermadyne product supplier for the warranty repair procedure.

Thermadyne warranty will not apply to:

- Equipment that has been modified by any other party other than Thermadyne's own service personnel or with prior written consent obtained from Thermadyne Service Department.
- Equipment that has been used beyond the specifications established in the operating manual.
- Installation not in accordance with the installation/operating manual.
- Any product that has been subjected to abuse, misuse, negligence or accident.
- Failure to clean and maintain (including lack of lubrication, maintenance and protection), the machine as set forth in the operating, installation or service manual.

Within this operating manual are details regarding the maintenance necessary to ensure trouble free operation.

This manual also offers basic troubleshooting, operational and technical details including application usage.

You may also wish to visit our web site www.thermadyne.com select your product class and then select literature. Here you will find documentation including:

- Operator manuals
- Service manuals
- Product guides

Alternatively please contact your Thermadyne distributor and speak with a technical representative.

NOTE

Warranty repairs must be performed by either a Thermadyne Service Centre, a Thermadyne distributor or an Authorised Service Agent approved by the Company.

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