ESAB Fabricator® 141i

3-IN-1 Multi Process Welding Systems

Operating Manual

3 IN 1 MIG • STICK • TIG

C ETL US LISTED Intertek 3163339

MIG · STICK · TIG · LIFT TIG · DC · 140 AMPS · 115V · 1 PHASE · 50/60 · 3 YEAR

Révision : AA	Issue Date: September 10, 2015	Manual No.: 0-5420

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WE APPRECIATE YOUR BUSINESS!

Congratulations on your new ESAB 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, visit us on the web at **www.esab.com**.

This Operating Manual has been designed to instruct you on the correct use and operation of your ESAB 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.

YOU ARE IN GOOD COMPANY!

The Brand of Choice for Contractors and Fabricators Worldwide.

ESAB is a Global Brand of manual and automation Plasma Cutting Products.

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 developing technologically advanced products to achieve a safer working environment within the welding industry.

WARNING
Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.
While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Plasma Cutting Power Supply
ESAB Fabricator® 141i 3-in-1 Multi Process Welding Systems™
Operating Manual Number 0-5420

Published by:
ESAB
2800 Airport Rd.
Denton, TX 76208

www.esab.com

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Original Publication Date: September 10, 2015
Revision Date:

Record the following information for Warranty purposes:

Where Purchased:_____ _____

Purchase Date:_____ _____

Power Supply Serial #:_____ _____

Torch Serial #:_____

Be sure this information reaches the operator.
You can get extra copies through your supplier.

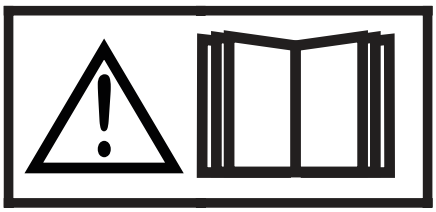
CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc welding and cutting equipment, we urge you to read our booklet, "Precautions and Safe Practices for Arc Welding, Cutting, and Gouging," Form 52-529. Do NOT permit untrained persons to install, operate, or maintain this equipment. Do NOT attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions before installing or operating this equipment.

USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Malfunctioning or poorly maintained equipment should not be used. Parts that are broken, missing, worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, the manufacturer recommends that a telephone or written request for service advice be made to the Authorized Distributor from whom it was purchased.

This equipment or any of its parts should not be altered without the prior written approval of the manufacturer. The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than the manufacturer or a service facility designated by the manufacturer.



READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.
PROTECT YOURSELF AND OTHERS!

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1.0 Safety Precautions

Users of ESAB welding and plasma cutting equipment have the ultimate responsibility for ensuring that anyone who works on or near the equipment observes all the relevant safety precautions. Safety precautions must meet the requirements that apply to this type of welding or plasma cutting equipment. The following recommendations should be observed in addition to the standard regulations that apply to the workplace.

All work must be carried out by trained personnel well acquainted with the operation of the welding or plasma cutting equipment. Incorrect operation of the equipment may lead to hazardous situations which can result in injury to the operator and damage to the equipment.

1. Anyone who uses welding or plasma cutting equipment must be familiar with:
   - its operation
   - location of emergency stops
   - its function
   - relevant safety precautions
   - welding and / or plasma cutting
2. The operator must ensure that:
   - no unauthorized person stationed within the working area of the equipment when it is started up.
   - no one is unprotected when the arc is struck.
3. The workplace must:
   - be suitable for the purpose
   - be free from drafts
4. Personal safety equipment:
   - Always wear recommended personal safety equipment, such as safety glasses, flame proof clothing, safety gloves.
   - Do not wear loose fitting items, such as scarves, bracelets, rings, etc., which could become trapped or cause burns.
5. General precautions:
   - Make sure the return cable is connected securely.
   - Work on high voltage equipment **may only be carried out by a qualified electrician**.
   - Appropriate fire extinguishing equipment must be clearly marked and close at hand.
   - Lubrication and maintenance **must not** be carried out on the equipment during operation.

Dispose of electronic equipment at the recycling facility!
In observance of European Directive 2002/96/EC on Waste Electrical and Electronic Equipment and its implementation in accordance with national law, electrical and/or electronic equipment that has reached the end of its life must be disposed of at a recycling facility.
As the person responsible for the equipment, it is your responsibility to obtain information on approved collection stations.
For further information contact the nearest ESAB dealer.

ESAB can provide you with all necessary cutting protection and accessories.

WARNING	**Arc welding and cutting can be injurious to yourself and others. Take precautions when welding and cutting. Ask for your employer's safety practices which should be based on manufacturers' hazard data.**

ELECTRIC SHOCK - Can kill.

- Install and earth (ground) the welding or plasma cutting unit in accordance with applicable standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing.
- Insulate yourself from earth and the workpiece.
- Ensure your working stance is safe.

FUMES AND GASES - Can be dangerous to health.

- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to take fumes and gases away from your breathing zone and the general area.

ARC RAYS - Can injure eyes and burn skin.

- Protect your eyes and body. Use the correct welding / plasma cutting screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

FIRE HAZARD

- Sparks (spatter) can cause fire. Make sure therefore that there are no inflammable materials nearby.

NOISE - Excessive noise can damage hearing.

- Protect your ears. Use earmuffs or other hearing protection.
- Warn bystanders of the risk.

MALFUNCTION - Call for expert assistance in the event of malfunction.

READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

PROTECT YOURSELF AND OTHERS!

WARNING	**Do not use the power source for thawing frozen pipes.**

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

CAUTION	**This product is solely intended for metal removal. Any other use may result in personal injury and / or equipment damage.**

CAUTION	**Read and understand the instruction manual before installing or operating.**	

SECTION 2 SYSTEM: INTRODUCTION

2.01 How To Use This Manual

This Owner's Manual applies to just specification or part numbers listed on page i.
To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.
Throughout this manual, the words WARNING, CAUTION, DANGER, and NOTE may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

NOTE!
An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION
A procedure which, if not properly followed, may cause damage to the equipment.

WARNING
A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

WARNING
Gives information regarding possible electrical shock injury. Warnings will be enclosed in a box such as this.

DANGER
Means immediate hazards which, if not avoided, will result in immediate, serious personal injury or loss of life.

Additional copies of this manual may be purchased by contacting ESAB at the address and phone number in your area listed on back cover of this manual. Include the Owner's Manual number and equipment identification numbers.
Electronic copies of this manual can also be downloaded at no charge in Acrobat PDF format by going to the ESAB web site listed below

http://www.esab.com

2.02 Equipment Identification

The unit's identification number (specification or part number), model, and serial number usually appear on a data tag attached to the rear panel. Equipment which does not have a data tag such as torch and cable assemblies are identified only by the specification or part number printed on loosely attached card or 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 ESAB Fabricator 141i is a self contained single phase multi process welding system that is capable of performing MIG (GMAW/FCAW), STICK (SMAW) and LIFT TIG (GTAW) welding processes. The Power Source 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 Power Source is also fully compliant to Standard CSA E60974-1-00 and UL 60974.1.
The Fabricator 141i MIG 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 this equipment.

2.05 Transportation Methods

WARNING

Disconnect input power conductors from de-energized supply line before moving the welding Power Source.

Lift Power Source with handle on top of case. Use handcart or similar device of adequate capacity. If using a fork lift vehicle, secure the Power Source on a proper skid before transporting.

2.06 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 ESAB. Advice in this regard can be obtained by contacting an Accredited ESAB Distributor.

This equipment or any of its parts should not be altered from standard specification without prior written approval of ESAB. 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 ESAB.

2.07 Fabricator 141i Portable System Package (Part No. W1003141)

Comes Complete With:

- Fabricator 141i Power Source
- 140 Amp MIG Gun
- Regulator/Flowmeter & Hose
- ESAB Electrode Holder & Ground Clamp
- Drive Rolls & Contact Tips
- Sample Electrodes & Shoulder Strap
- 20A to 15A Power Cord Adapter
- Operator Manual & CD

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, 100 amperes at 19 volts. This means that it has been designed and built to provide the rated amperage (100 A) for 2 minutes, i.e. arc welding time, out of every 10 minute period (20% of 10 minutes is 2 minutes). During the other 8 minutes of the 10 minute period the Welding Power Source must idle and be allowed to cool.

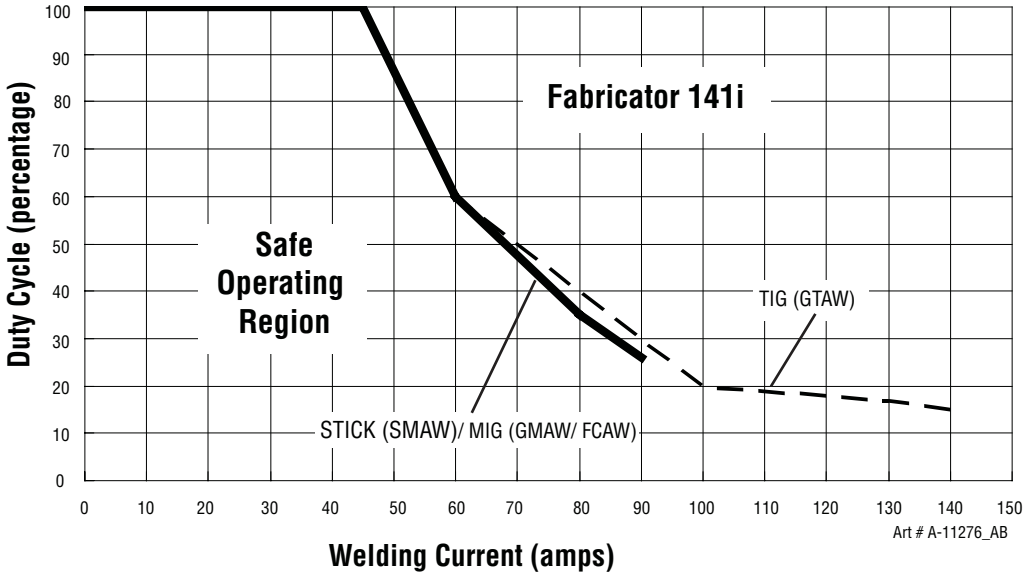

Figure 2-1: Fabricator 141i Duty Cycle

2.09 Specifications

DESCRIPTION	FABRICATOR 141i MULTI PROCESS 3 IN 1 WELDER
Power Source Part No.	W1003140
Power Source Dimensions	H16.14” x W8.27” x D17.72” (410mm x 210mm x 450mm)
Power Source Weight	32.2lb(14.6kg)
Cooling	Fan Cooled
Welder Type	Multi Process Welding System
Output Terminal Type	DinseTM 25
Standards	CSA E60974-1-00 / UL60974-1 / IEC 60974-1
Number of Phases	Single Phase
Nominal Supply Voltage	115V AC
Supply Voltage Range	95-140V AC
Supply Frequency	50/60Hz
Welding Current Range (MIG Mode)	10- 90A
Welding Current Range (LIFT TIG Mode)	10- 140A
Welding Current Range (STICK Mode)	10- 90A
Wirefeed Speed Range	95-390 IPM
MIG Welding Voltage Range	10-19V DC
Nominal OCV	53V DC

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SECTION 3: INSTALLATION, OPERATION AND SETUP

3.01 Environment

This Power Source is designed for use in environments with increased hazard of electric shock.

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

1. In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts.
2. In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator.
3. In wet or damp hot locations where humidity or perspiration considerable reduces the skin resistance of the human body and the insulation properties of accessories.

B. Environments with increased hazard of electric shock do not include places where electrically conductive parts 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 32 to 104° F (0 to 40° C).

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

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

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

F. Place at a distance of 12"(300mm) 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. This provides adequate protection against solid objects (greater than 1/2", 12mm), and direct protection from vertical drops. Under no circumstances should the Power Source be operated or connected in a micro environment that will exceed the stated conditions. For further information please refer to 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 Electricity Supply Voltage

CAUTION
The Electricity Supply voltage should be within 95-140V AC. Too low a voltage may cause poor welding performance in STICK mode. Too high a supply voltage will cause components to overheat and possibly fail. The Welding Power Source must be:

- Correctly installed, if necessary, by a qualified electrician.
- Correctly earthed (electrically) in accordance with local regulations.
- Connected to the correct size power point and fuse as per the Specifications on page 2-4.

WARNING
The Fabricator 141i must be electrically connected by a qualified electrical trades-person. Damage to the PCA (Power Control Assembly) could occur if 140 VAC or higher is applied to the Primary Power Cable.

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 supply. The input voltage must match one of the electrical input voltages shown on the input data label on the unit nameplate. Contact the local electric utility for information about the type of electrical service available, how proper connections should be made, and inspection required. The line disconnect switch provides a safe and convenient means to completely remove all electrical power from the welding power

source whenever necessary to inspect or service the unit.
Do not connect an input (WHITE or BLACK) conductor to the ground terminal.
Do not connect the ground (GREEN) conductor to an input line terminal.

- 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. Refer to Table 3-1.

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

	50 / 60 Hz Single Phase Supply
Supply Voltage	115V AC
Input Current at Maximum Output	28.4 Amps
Maximum Recommended Fuse or Circuit Breaker Rating* **Time Delay Fuse, UL class RK5. Refer to UL248* *Maximum Recommended Fuse^ or Circuit Breaker Rating* *^Normal Operating , UL class K5. Refer to UL248*	*30 Amps* *30 Amps*
Single Phase Generator Requirement	*5 KW*
Minimum Recommended Input Cable Size	*12AWG*
Maximum Recommended Input Cable Length	*10ft (3m)*
Minimum Recommended Grounding Cable Size	*12AWG*

Table 3-1: Electrical Service Guide

NOTE!
Welding arc outs may be experienced if an extension cord is used when STICK welding when operating the Power Source on 95 VAC due to the lack of DC voltage at the STICK electrode.

Input Power
Each unit incorporates an INRUSH circuit. When the MAIN CIRCUIT SWITCH is turned on, the inrush circuit provides pre-charging for the input capacitors. A relay in the Power Control Assembly (PCA) will turn on after the input capacitors have charged to operating voltage (after approximately 5 seconds)

NOTE!
Damage to the PCA could occur if 140V AC or higher is applied to the Primary Power Cord.

Model	Primary Supply Cord Size (Factory Fitted)	Minimum Primary Current Circuit Size (Vin/Amps)	Current & Duty Cycle		
			MIG (GMAW/ FCAW)	STICK (SMAW)	LIFT TIG (GTAW)
Fabricator 141i	12AWG (3.3mm^2)	115V/20A	90A@20%	80A@35%	100A@20%
	10AWG (5mm^2)	115V/30A	140A@15%	90A@15%	140A@15%

Table 3-2: Primary Circuit Sizes to Achieve Maximum Current

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. Further guidance is given in EN 60974-13 Arc Welding Equipment - Installation and use (under preparation)..

B. Assessment of Area

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

1. Other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment.
2. Radio and television transmitters and receivers.
3. Computer and other control equipment.
4. Safety critical equipment, e.g. guarding of industrial equipment.
5. The health of people around, e.g. the use of pacemakers 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 compatibility of other equipment in the environment: the user shall ensure that other equipment being used in the environment is compatible: this may require additional protection measures.

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

C. Methods of Reducing Electromagnetic Emissions

1. Electricity Supply
   Welding equipment should be connected to the Electricity Supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the Electricity Supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment in metallic conduit or equivalent. Shielding should be electrically continuous throughout it's 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. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.
3. Welding Cables
   The welding cables should be kept as short as possible and should be positioned close together, 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 of the Workpiece
   Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of it's size and position, e.g. ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should

be made by direct connection to the workpiece, 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 Victor Flowmeter/ Regulator

Flowmeter/ Regulator (Figure 3-1) attached to the cylinder valve reduces high cylinder pressures to suitable low working pressures for welding, cutting, and other applications.

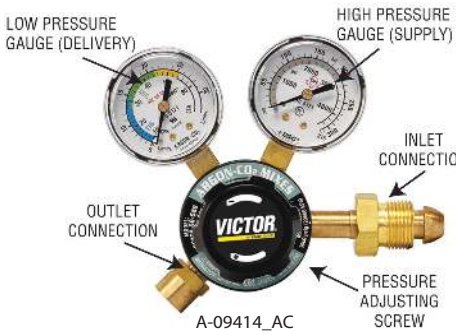


Figure 3-1: Victor CS Flowmeter/ Regulator

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

NOTE!
Flowmeters/ Regulators supplied with 5/8" -18 standard inert gas connections. Flowmeters/ Regulators purchased with open 1/8", 1/4", 3/8", or 1/2" NPT ports must be assembled to their intended system.

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

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

4. Be sure that the flowmeter/ regulator has the correct pressure rating and gas service for the cylinder used.
5. Carefully inspect the flowmeter/ regulator for damaged threads, dirt, dust, grease, oil, or other flammable substances. Remove dust and dirt with a clean cloth. Be sure the inlet swivel filter is clean and in place. Attach the flowmeter/ regulator (Figure 3-2) to the cylinder valve. Tighten securely with a wrench.

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

Figure 3-2: Flowmeter/ Regulator to Cylinder Valve

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

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

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

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

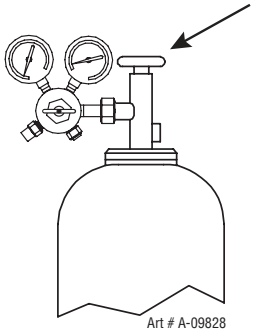


Figure 3-3: Open Cylinder Valve

9. On all cylinders, open the valve completely to seal the valve packing. On gaugeless flowmeters/ regulators, the indicator will register the cylinder contents open.

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

10. Attach the desired downstream equipment.

3.07 Leak Testing the System

Leak test the system before putting into operation.

1. Be sure that there is a valve in the downstream equipment to turn off the gas flow.
2. With the cylinder valve open, adjust the Flowmeter/ regulator to deliver the maximum required delivery pressure.
3. Close the cylinder valve.
4. Turn the adjusting screw/knob counterclockwise one turn.
   a) If the high-pressure gauge reading drops, there is a leak in the cylinder valve, inlet fitting, or high-pressure gauge.
   b) If the low-pressure gauge drops, there is a leak in the downstream equipment, hose, hose fitting, outlet fitting or low-pressure gauge. Check for leaks using an approved leak detector solution.
   c) If the high-pressure gauge drops and the low-pressure gauge increases at the same time, there is a leak in the flowmeter/ regulator seat.
   d) If the flowmeter/ regulator requires service or repair, take it to a qualified repair technician.
5. Once leak testing has been performed and there are no leaks in the system, slowly open the cylinder valve and proceed.

WARNING
If a leak has been detected anywhere in the system, discontinue use and have the system repaired. DO NOT use leaking equipment. Do not attempt to repair a leaking system while the system is under pressure.

3.08 When You Finish Using the Flowmeter/ Regulator

1. Close the cylinder valve.
2. Open the valve on the downstream equipment. This drains all pressure from the system.
3. Close the valve on the downstream equipment.
4. Turn the adjusting screw counterclockwise to release the tension on the adjusting spring.
5. Check the gauges after a few minutes for verification that the cylinder valve is closed completely.

3.09 Storage of the Flowmeter/ Regulator

When the regulator is not in use and has been removed from the cylinder, it should be stored in an area where it will be protected from dust, oil, and grease. The inlet and outlet should be capped to protect against internal contamination and prevent insects from nesting.

3.10 Power Source Controls, Indicators and Features

Figure 3-4: Front Panel

Figure 3-5: Rear Panel

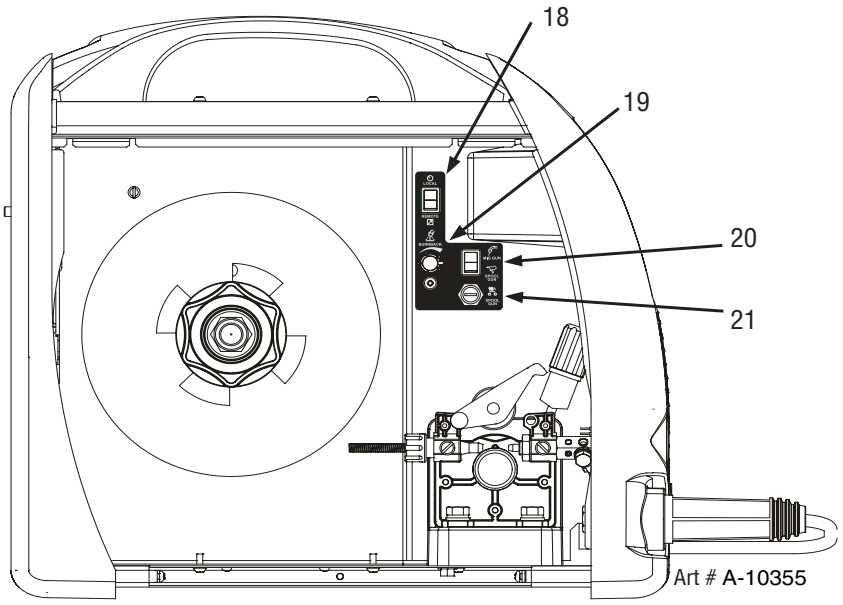


Figure 3-6: Wire Feed Compartment Control

1. Power Indicator

The power indicator is illuminated when the Electricity Supply is applied to the Power Source and when the ON/OFF switch located on the rear panel is in the ON position.

2. Digital Wirespeed/Amperage Meter (Left Digital Display)

This digital meter displays preview Wirespeed in MIG mode only then actual amperage (weld current) once an arc has been established. It also displays preview amperage in both the STICK and LIFT TIG modes only then actual amperage (weld current) once an arc has been established.

At times of non-welding, the amperage meter will display a preview value in both STICK and LIFT TIG modes. This value can be adjusted by varying the Wire speed / Amperage potentiometer (Control No. 3). At times of non-welding, the amperage meter will preview a wirefeed speed value (Inches Per Minute) in MIG mode only. This can be identified as preview wirefeed speed by a decimal point at the lower right hand side of the display.

When welding, the amperage meter will display actual amperage (weld current) in all modes.

At the completion of welding, the amperage 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 Power Source 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 Power Source 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.

3. Wirespeed/Amperage Control

In MIG mode, the Wirespeed/Amperage control 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 depends upon the material type and the welding application. The setup chart on the inside of the wire feed compartment door provides a brief summary of the required settings for a basic range of MIG (GMAW/FCAW) welding applications.

In STICK and LIFT TIG modes, the Wirespeed/Amperage control knob adjusts the amount of amperage (weld current) delivered to the welding arc by the Power Source. It directly adjusts the Power Source to deliver the desired level of weld current.

4. MIG Gun Adapter (ESAB Style)

The MIG Gun adapter is standard ESAB connection with an 8 pin gun trigger for the Fusion MIG Gun. Connect the MIG Gun by pushing the MIG Gun connector into the brass MIG Gun Adapter firmly and screw the locking screw in the MIG Gun Adapter within the Wire Feed Compartment to secure the Fusion MIG Gun in position. Failure to properly lock the Fusion MIG Gun into the MIG Gun Feedplate will result in the MIG Gun being pushed out of the MIG Gun Feedplate by the MIG welding wire or lack of shielding gas (porosity in the weld) at the weld zone.

5. 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 Gun polarity lead), electrode holder lead or work lead. Positive welding current flows from the Power Source via 25mm Dinse style connector. It is essential, however, that the Dinse adapter and male plug are 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 Dinse connector.

6. MIG Gun 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 aluminum electrode wire. When using flux cored (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 Dinse adapter and male plug are 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 Dinse connector..

7. 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 Gun polarity lead), TIG Torch or work lead. Negative welding current flows to the Power Source via 25mm Dinse style connector. It is essential, however, that the Dinse adapter and male plug are 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 Dinse connector..

8. Remote Control and Spool Gun Socket

The 8 pin socket is used to connect the Fusion MIG Gun, remote control device or spool gun plug to the welding Power Source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

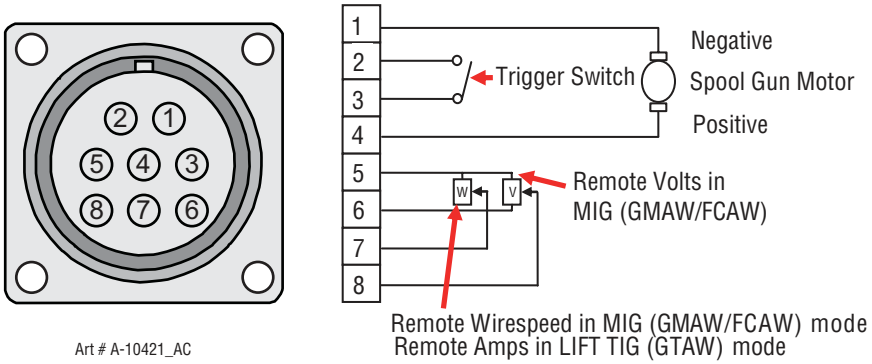


Figure 3-7: Remote Control Socket

Socket Pin	Function
1	Spool gun motor (0V)
2	Trigger Switch Input
3	Trigger Switch Input
4	Spool gun motor (+24V DC)
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 potentiometer for the remote control of the Wirespeed in MIG mode. Wiper arm connection to 5k ohm potentiometer for the remote control of the Amperage (Weld Current) in LIFT TIG mode.
8	Wiper arm connection to 5k ohm remote control Volts MIG mode potentiometer.

Table 3-3

Note that the Local/ Remote Switch (Control No. 18) located in the wirefeed compartment should be set to Remote for remote amperage/voltage controls to operate.

9. 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 utilized to ensure output values are accurate.

When MIG Mode is Selected

In this mode the control knob is used to adjust the MIG welding voltage of the Power Source. The welding voltage is increased by turning the knob clockwise or decreased by turning the knob counterclockwise. The optimum voltage level required will depend 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 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 counterclockwise.

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 of the amperage 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 (Control No. 11), the Power Source will enter down slope mode as soon as the trigger switch is released (ie if the multifunction control knob is set to 5, the Power Source will ramp down from the present welding current to zero over 5 seconds). If no down slope time is set then the welding output will cease immediately. If the Power Source 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.

10. Arc Control (Inductance)

The arc control operates in MIG 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. Soft means maximum inductance while Hard means minimum inductance.

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

The trigger mode control is used to switch the functionality of the of the MIG or TIG Trigger Switch between 2T (normal) and 4T (latch mode)

2T (Normal Mode)

In this mode, the MIG or TIG Trigger Switch must remain depressed for the welding output to be active. Press and hold the MIG or TIG Trigger Switch to activate the Power Source (weld). Release the MIG or TIG 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 MIG or TIG Trigger Switch and the output will remain active. To deactivate the Power Source, the trigger switch must again be depressed and released, thus eliminating the need for the operator to hold the MIG or TIG Trigger Switch

Note that when operating in LIFT TIG mode, the Power Source will remain activated until the selected Downslope time has elapsed (refer Control No. 9).

12. Process Selection Control

The process selection control is used to select the desired welding mode. Three modes are available, MIG, LIFT TIG and STICK modes. Refer to section 3.20 or 3.21 for MIG (GMAW/FCAW) set up details, section 3.22 for LIFT TIG (GTAW) set-up details or section 3.23 for STICK (SMAW) set-up details.

Note that when the Power Source 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 Power Source and mistakenly be in contact with the work piece during power up.

13. Digital Voltage Meter (Right Digital Display)

The digital voltage meter is used to display the both the preview voltage (MIG mode only) and actual output voltage (all modes) of the Power Source.

At times of non-welding, the voltage meter will display a preview value in MIG mode. This value can be adjusted by varying the multifunction control knob (Control No. 9). Note that in STICK and LIFT TIG modes, the voltage meter will not preview welding voltage but will display Open Circuit Voltage in STICK mode and 0V in LIFT TIG mode.

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

At the completion of welding, the digital voltage 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 Power Source 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 Power Source 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.

14. 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 or if a fault is detected in the Inverter. Should the Fault 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 power switch should remain in the on position such that the fan continues to operate thus allowing the Power Source to cool sufficiently. Do not switch the Power Source off should a thermal overload condition be present. If the fault condition does not extinguish, then the Power Supply will need to be taken to an authorized repair center for analysis.

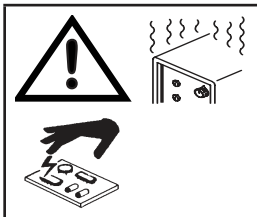
15. Gas Inlet (MIG mode only for MIG Gun or Spool Gun operation)

The Gas Inlet connection is used to supply the appropriate MIG welding gas to the Power Source. Refer to section 3.19 to 3.20 for MIG (FCAW/GMAW) set up details.

WARNING
Only Welding Shielding Gases specifically designed for arc welding applications should be used.

16. On / Off Switch

This switch is used to turn the Power Source on/off.



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. Intelligent Fan Control

When Power Supply is first turned on it will default in MIG Mode. The Fan will operate for approximately 10 seconds, then shut down.

When triggered in MIG mode, fan will not turn on until Power Supply reaches temperatures in which cooling is required. When in Lift TIG mode, as soon as output is enabled, the fan will come on immediately and will not shut down until welding has ceased and Power Supply is at proper operating temperature. When set to Stick mode, fan will turn on immediately and will not turn off until welding has ceased and Power Supply is at proper operating temperature.

Note in STICK mode the fan operates continuously.

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

The local/ remote switch is used only when a remote control device (such as a TIG Torch with remote current control) is fitted to the Power Source via the remote control socket (8 Pin Remote Socket). When the local/remote switch is in the remote position, the Power Source will detect a remote device and work accordingly. When in the local mode, the Power Source 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 local/ remote 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 Power Source 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 counterclockwise. 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

The MIG Gun / Spool Gun switch is used to switch welding mode between MIG Gun function and Spool Gun function.

21. 10A Fuse

The 10A fuse is used to protect both the spool gun motor and internal motor.

3.11 Attaching the Fusion 140A MIG Gun

Fit the MIG Gun to the Power Source by pushing the MIG Gun connector into the MIG Gun Adapter and tightening the Locking Screw to secure the MIG Gun in the MIG Gun Adapter.
Connect the 8 pin plug by aligning the keyway then inserting the 8 pin plug into the 8 pin socket and rotate threaded collar fully clockwise to lock the plug into position.

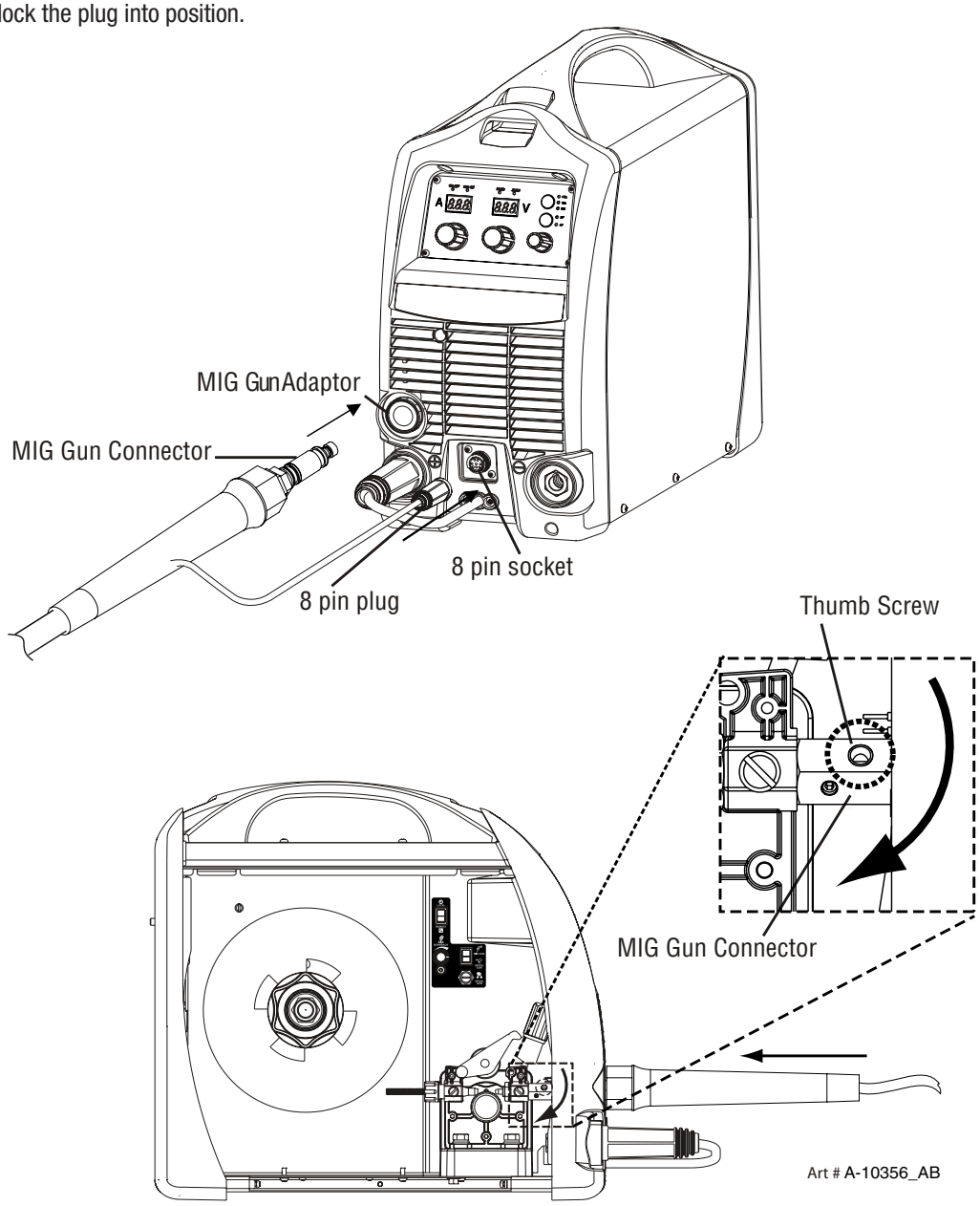


Figure 3-8: Attaching MIG Gun

3.12 Inserting Wire into the Wire Feed Mechanism

Release the tension from the Pressure Roller Arm by turning the adjustable Wire Drive Tension Screw in a counterclockwise. Then to release the pressure roller arm push the tension screw toward the front of the machine which releases the pressure roller arm. With the MIG welding wire feeding from the bottom of the spool (Figure 3-10) 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 3-9). Remove the nozzle and 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 piece, make sure you have ceased feeding wire so premature arcing will not occur.
The electrode wire will be at welding voltage potential while it is being fed through the system.
Keep MIG Gun away from eyes and face.

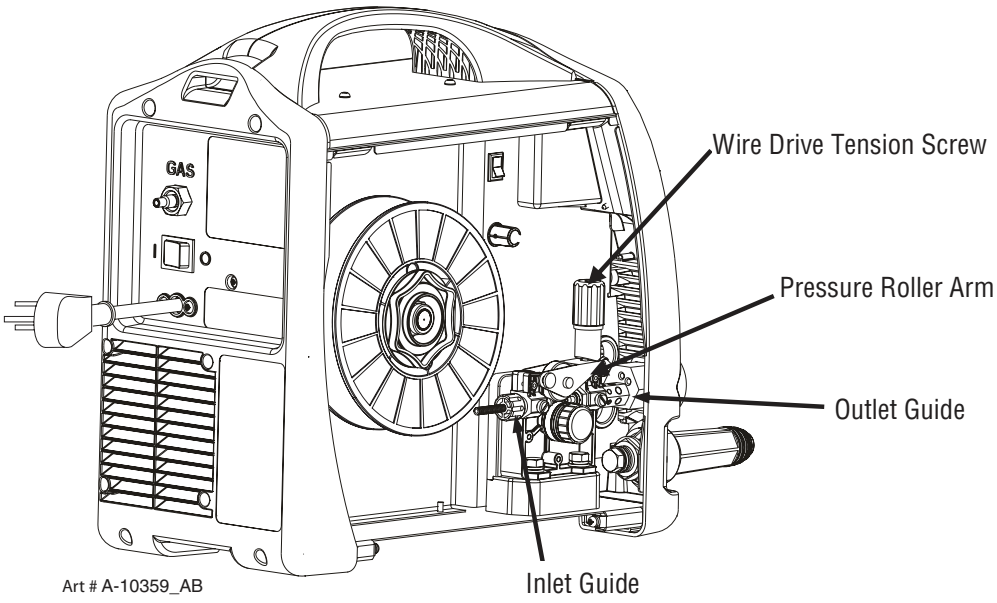


Figure 3-9: Wire Drive Assembly Components

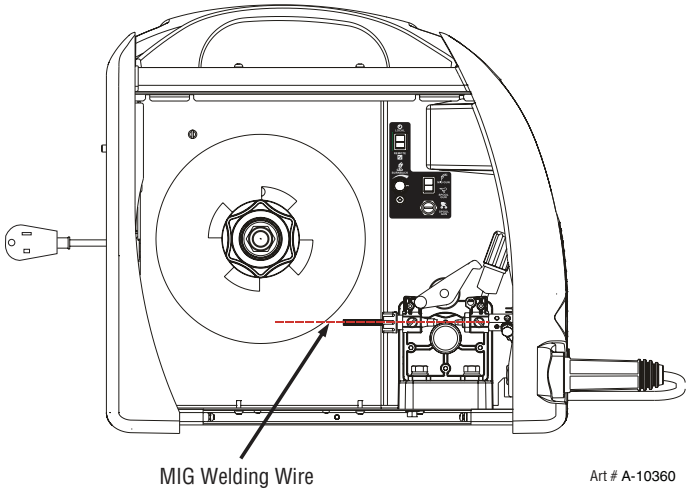


Figure 3-10: MIG Welding Wire - Installation

3.13 Installing 4" (100mm) Diameter Spool

As delivered from the factory, the Power Source is fitted with a Wire Spool Hub which accepts a 8" (200mm) diameter spools. In order to fit a 4" (100mm) diameter spool assemble parts in the sequence shown below in Figure 3-11.
Adjustment of the nut with nylon insert will control the MIG Wire Spool Brake. Clockwise rotation of this nut with nylon insert tightens the brake. The brake is correctly adjusted when the spool stops within 4" (100mm) to 8" (200mm) (measured at the outer edge of the spool) after MIG Gun trigger is released. Wire should be slack without becoming dislodged from the spool.

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

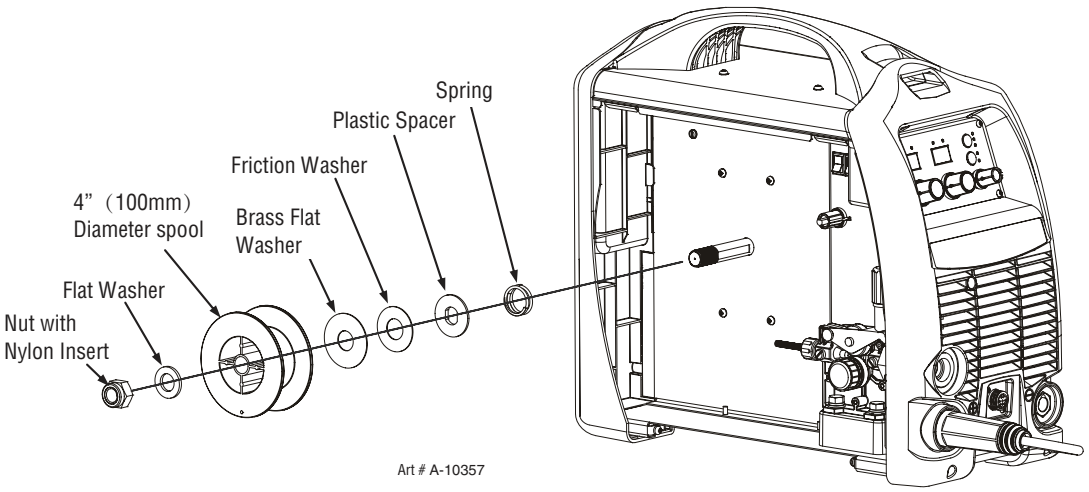


Figure 3-11: 4" (100mm)Diameter Spool Installation

3.14 Installing 8" (200mm) Diameter Spool

As delivered from the factory, the Power Source is set for a 8" (200mm) diameter spool.
In order to re-fit a 8" (200mm) spool assemble parts in the sequence shown below in Figure 3-12.
Adjustment of the nut with nylon insert will control the MIG Wire Spool Brake. Clockwise rotation of this nut with nylon insert tightens the brake. The Brake is correctly adjusted when the spool stops within 3/8" (10mm) to 3/4" (20mm) (measured at the outer edge of the spool) after MIG Gun trigger is released. Wire should be slack without becoming dislodged from the spool.

CAUTION
Overtension of brake will cause rapid wear of mechanical WIRE FEED parts, overheating of electrical components and possibly an increased incidence of electrode wire Burnback into contact tip.
Ensure that the alignment pin on the wire spool hub aligns with the hole allocated in 8" (200mm) diameter spool..

NOTE!
This alignment pin can be removed by unscrewing in an counterclockwise direction and locating in the appropriate position..

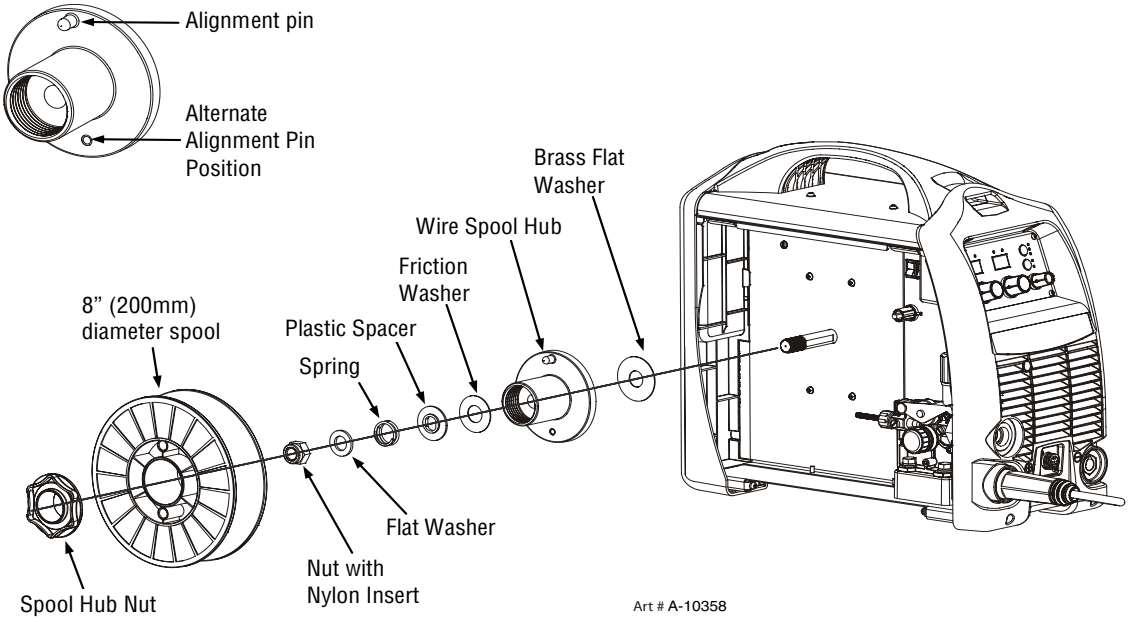


Figure 3-12: 8" (200mm) Diameter Spool Installation

3.15 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 wire feed 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 debris. 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 Electricity 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.

3.16 Changing the Feed Roll

To change feed roll remove the feed roll retaining screw by turning in an counterclockwise 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 023"(0.6mm) -.030" (0.8mm) diameter hard wires. Select the roller required with the chosen wire size marking facing outward.

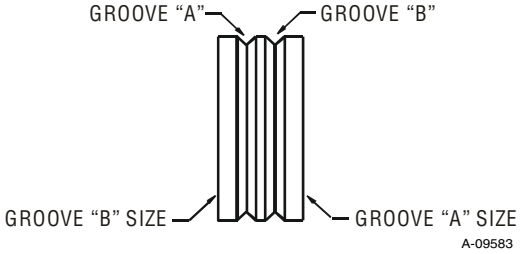


Figure 3-13: Dual Groove Feed Roller

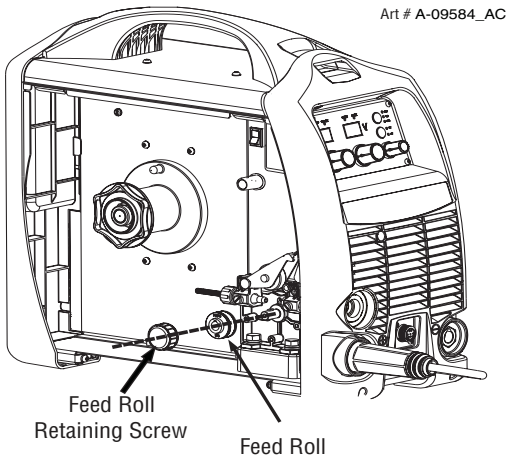


Figure 3-14: Changing the Feed Roll

3.17 Wire Reel Brake

The wire reel hub incorporates a friction brake which is adjusted during manufacture for optimum breaking. If it is considered necessary, adjustment can be made by turning the large nut 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 3/8" (10mm) - 3/4" (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 components and possibly an increased incidence of electrode wire Burnback into contact tip..

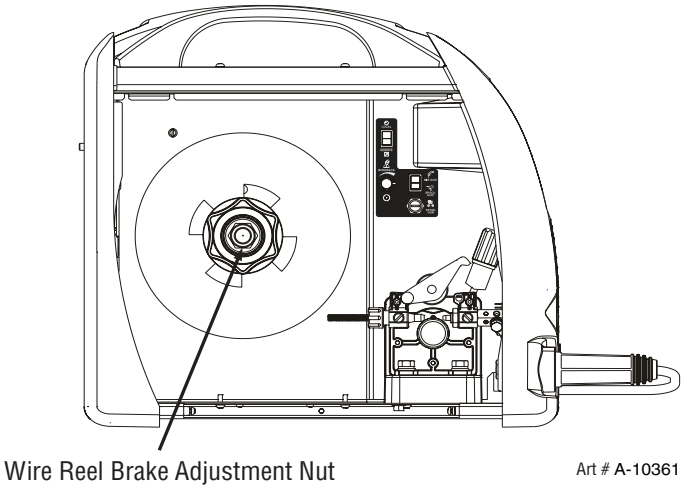


Figure 3-15: Wire Reel Brake

3.18 Flowmeter/ Regulator Operation

With the flowmeter/ regulator connected to cylinder or pipeline, and the adjustment screw/knob fully disengaged, pressurize as follows:

1. Stand to one side of flowmeter/ regulator and slowly open the cylinder valve. If opened quickly, a sudden pressure surge may damage internal parts.
2. With valves on downstream equipment closed, adjust flowmeter/ regulator to approximate working pressure. It is recommended that testing for leaks at the flowmeter/ regulator connection points be carried out using a suitable leak detection solution or soapy water.
3. Purge air or other unwanted welding grade shielding gas from equipment connected to the flowmeter/ regulator by individually opening then closing the equipment control valves. Complete purging may take up to ten seconds or more, depending upon the length and size of the hose being purged.

Adjusting Flow Rate

With the flowmeter/ regulator ready for operation, adjust working flow rate as follows:

1. Adjust the gas flow rate. The recommended rate for MIG welding is 15-25 CFH. The recommended rate for LIFT TIG welding is 10-25 CFH.

NOTE!
It may be necessary to re-check the shielding gas flowmeter/ regulator flow rate following the first weld sequence due to back pressure present within shielding gas hose assembly.

Shutdown

Close cylinder valve whenever the flowmeter/ regulator is not in use. To shut down for extended periods (more than 30 minutes).

1. Close cylinder or upstream valve tightly.
2. Open downstream equipment valves to drain the lines. Bleed gas into a well ventilated area and away from any ignition source.
3. After gas is drained completely, disengage adjusting screw and close downstream equipment valves.
4. Before transporting cylinders that are not secured on a cart designed for such purposes, remove flowmeters/ regulators. Put caps on all cylinders that do not have flowmeters/ regulators on them.

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

A. Select MIG mode with the process selection control. (Refer to Section 3.10 for further information)

B. Connect the MIG Gun Polarity Lead to the positive welding terminal (+). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via Dinse style connectors. 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 3.11 Attaching the Fusion 140A 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 Dinse style connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

E. Fit the flowmeter/ regulator to the shielding gas cylinder (Refer to Section 3.06) then connect the shielding gas hose from the rear of the Power Source to the flowmeter/ regulator outlet.

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

G. Switch the LOCAL/REMOTE switch inside the wire feed compartment to LOCAL to use the Power Sources Wirespeed and Voltage controls.

H. Switch the MIG GUN/SPOOL GUN switch inside the wire feed compartment to MIG GUN.

WARNING
Before connecting the work clamp to the work piece, make sure you have ceased feeding wire so premature arcing will not occur.
Secure the 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.

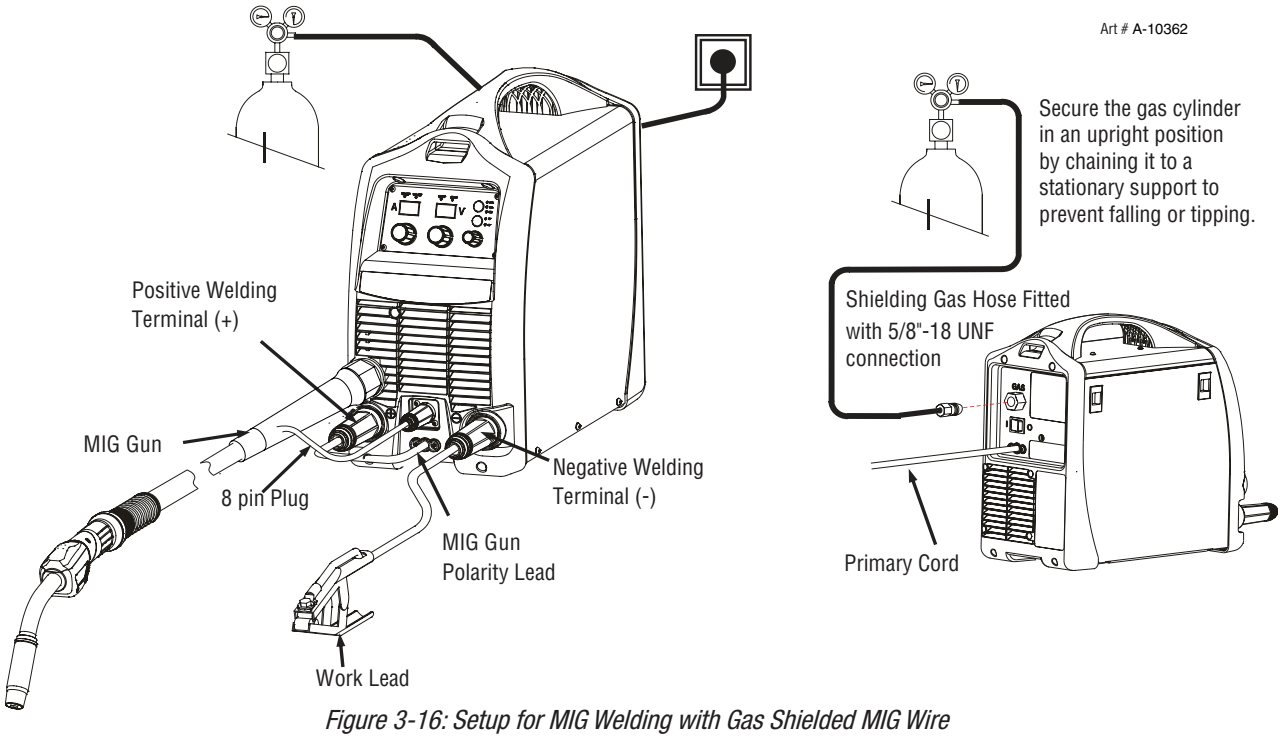


Figure 3-16: Setup for MIG Welding with Gas Shielded MIG Wire

3.20 Setup for MIG (FCAW) Welding with Flux Core (Gasless) Wire

A. Select MIG mode with the process selection control (refer to Section 3.10.12 for further information).

B. Connect the MIG Gun Polarity Lead to the negative welding terminal (-). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via Dinse style connectors. 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 Dinse style connectors. 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.

E. Switch the LOCAL/REMOTE switch inside the wire feed compartment to LOCAL to use the Power Sources Wirespeed and Voltage controls.

F. Switch the MIG GUN/SPOOL GUN switch inside the wire feed compartment to MIG GUN.

WARNING
Before connecting the work clamp to the work piece, make sure you have ceased feeding wire so premature arcing will not occur.

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.

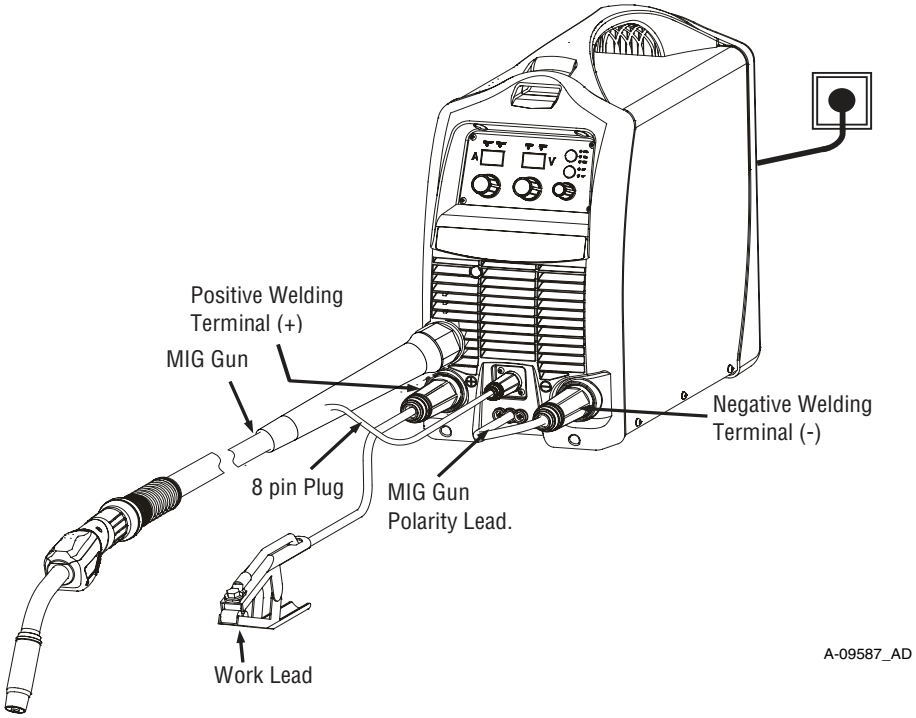


Figure 3-17: Setup for MIG (FCAW) Welding with Flux Cored (Gasless) Wire

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

Set the Process Selection Control to MIG for Spool Gun welding.

For setup and operation of the spool gun, please refer to the spool gun operations manual.

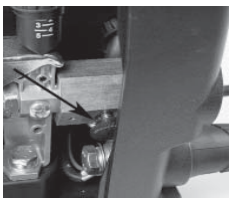
Switch the MIG GUN/SPOOL GUN switch inside the wire feed compartment to SPOOL GUN.

Connect the Argon shielding gas to the Shielding Gas Inlet on the rear panel of the Power Source.

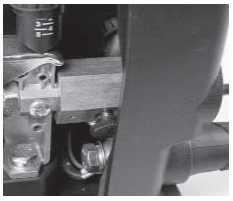
1. Make sure the welding power source is turned OFF before connecting the welding gun.

Art # A-10363

2. Open side panel and loosen thumb screw.
3. Insert the back end of the Spool gun into the gun receiving bushing.



4. Tighten thumb screw and replace side panel.



5. Connect gas supply fitting and tighten with a wrench.
6. Connect the 8 pin plug by aligning the keyway then inserting the 8 pin plug into the 8 pin socket and rotate threaded collar fully clockwise to lock the plug into position.

3.22 Setup for LIFT TIG (GTAW) Welding

A. Select LIFT TIG mode with the process selection control (refer to Section 3.10.12 for further information).

B. Using the supplied 50mm to 25mm DINSE adapter, connect the TIG torch to the negative welding terminal (-). Welding current flows from the Power Source via Dinse style connectors. 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 Dinse style 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. The TIG torch will require a trigger switch to weld in LIFT TIG Mode.

NOTE!
A ESAB 17V TIG torch with an 8 pin plug must be used to turn the weld current on/off via the TIG torch trigger switch to TIG weld OR a ESAB Foot Control with an 8 pin plug must be used to turn the weld current on/off as well as providing remote control of the weld current. Please refer to "2.10 Options and Accessories".

E. Fit the flowmeter/ regulator to the shielding gas cylinder (refer to Section 3.06) then connect the shielding gas hose from the TIG torch to the flowmeter/ regulator outlet. Note that the TIG torch shielding gas hose is connected directly to the flowmeter/ regulator. 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 piece, make sure you have ceased feeding wire so premature arcing will not occur.
Secure the 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.

F. Switch the LOCAL/REMOTE switch inside the wire feed compartment to LOCAL to use the Power Sources Amperage control or REMOTE for remote amperage using a Foot Control.

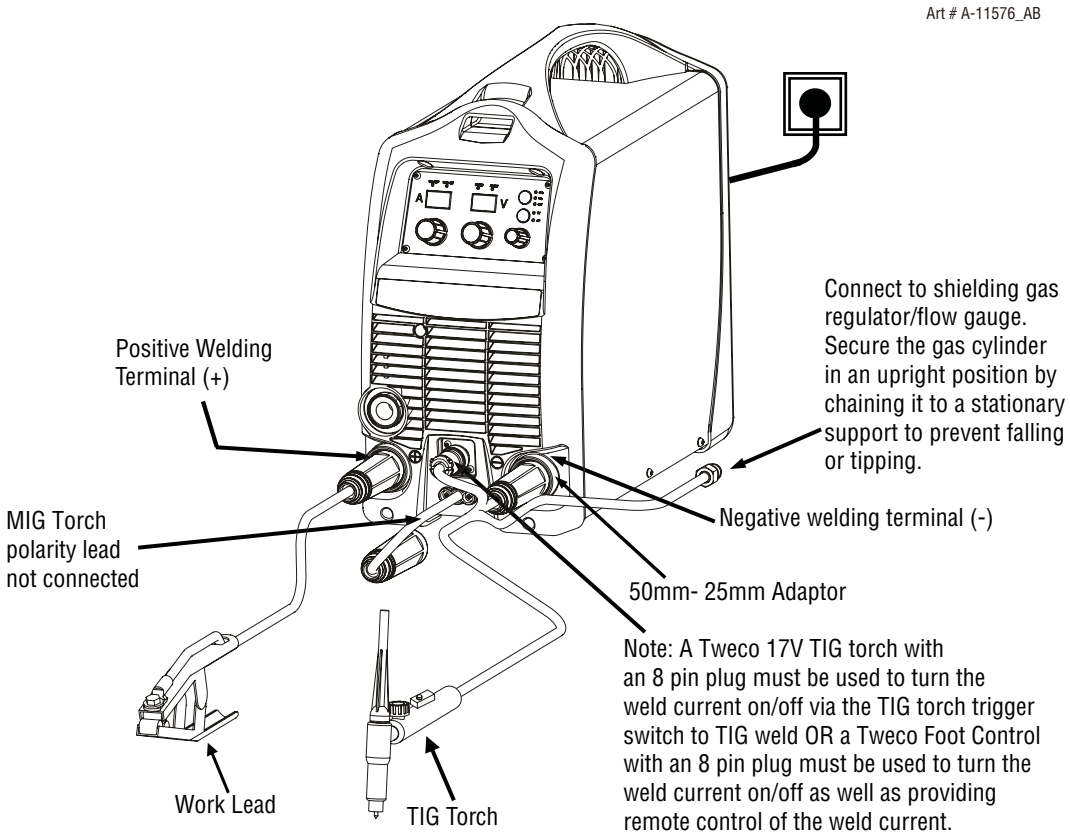


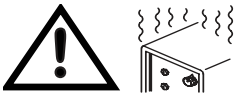
Figure 3-18: Setup for TIG Welding

3.23 Setup for STICK (SMAW) Welding

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

WARNING
Before connecting the work clamp to the work and inserting the electrode in the electrode holder make sure the Electricity Supply is switched off..



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

C. Switch the LOCAL/REMOTE switch inside the wire feed compartment to LOCAL to use the Power Sources Amperage control or REMOTE for remote amperage control using a Hand Pendant Control.

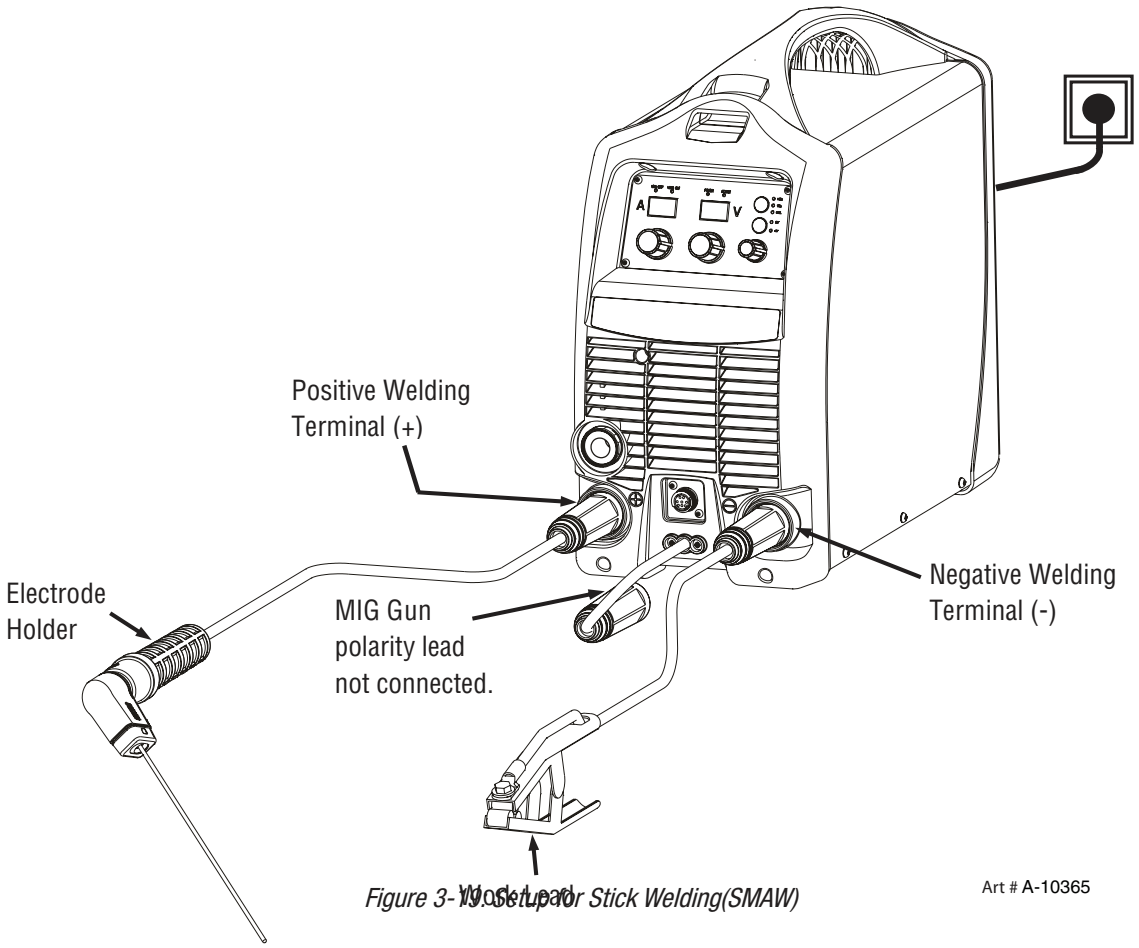


Figure 3-19. Setup for Stick Welding(SMAW)

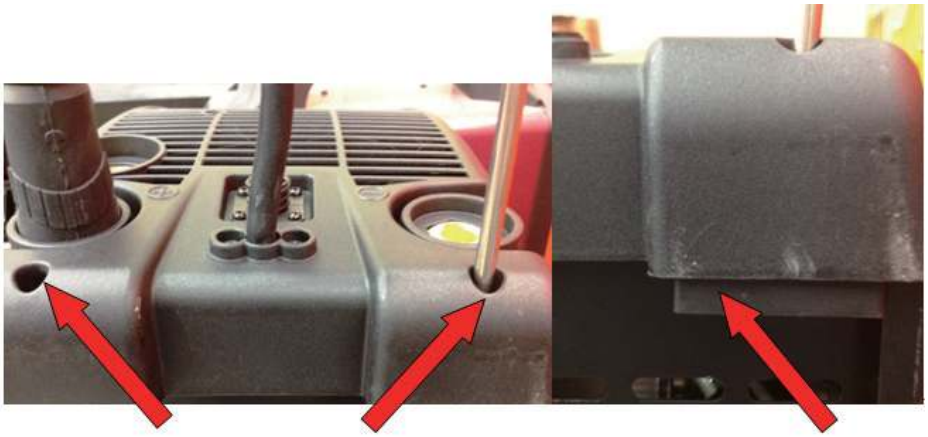
3.24 Torch Adapter Thumb Screw Replacement

WARNING
All power to unit should be removed.

1. Place unit on its back.

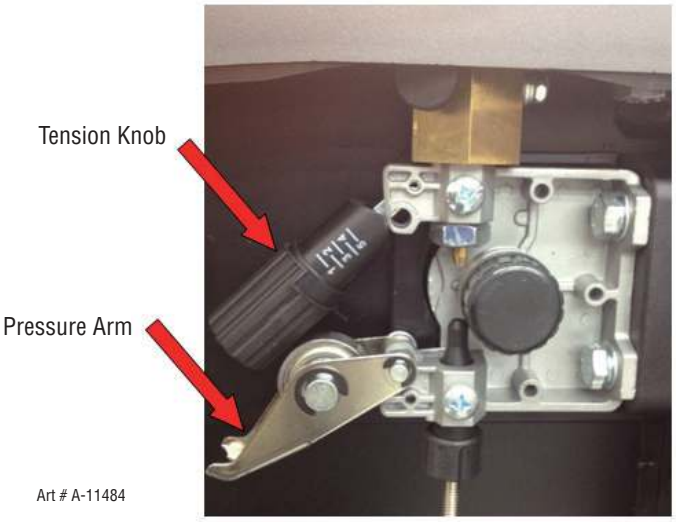
A-12958

2. Remove 2 screws in bottom of the front panel. A securing block will become detached and fall free from the front panel as you turn each screw out. Set these aside for reassembly. Leave screws sitting in the pockets of the panel.



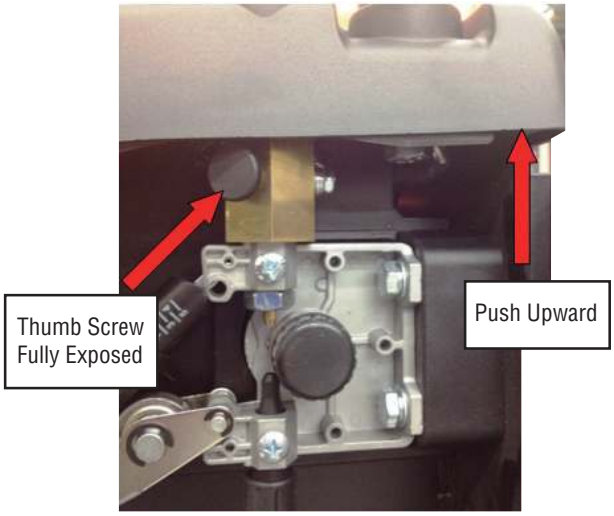
Art # A-11483

3. Open the wire compartment door and release the tension knob so the pressure arm and tension knob hang downwardly.



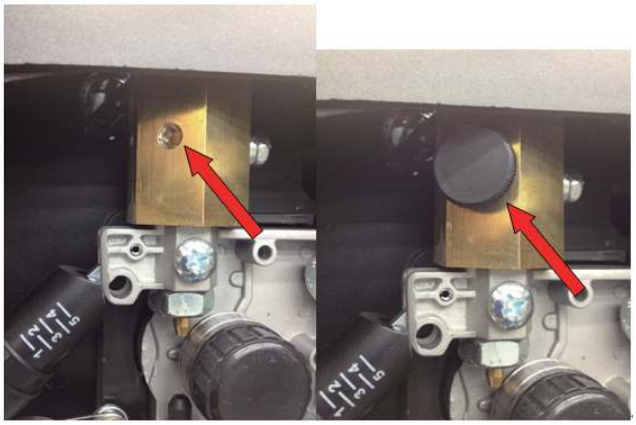
Art # A-11484

4. Gently push the bottom of the front panel upward until the thumb screw is fully exposed.



Art # A-11485_AB

5. Remove damaged thumb screw and replace with new one.



Art # A-11486

6. To reassemble, reverse steps 1 through 4.

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 MIG 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.

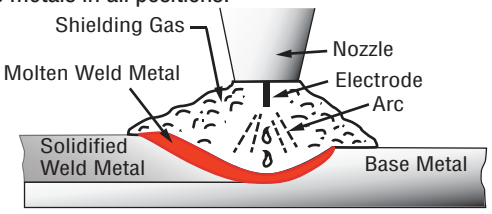


Figure 4-1

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.

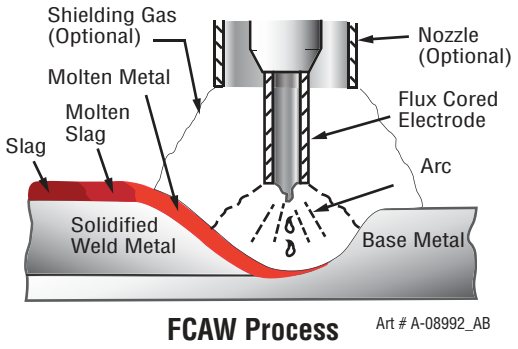


Figure 4-2

Position of MIG Gun

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

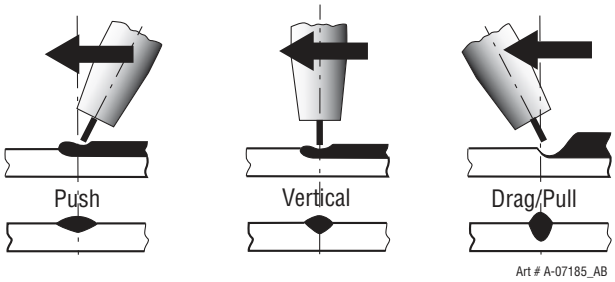


Figure 4-3

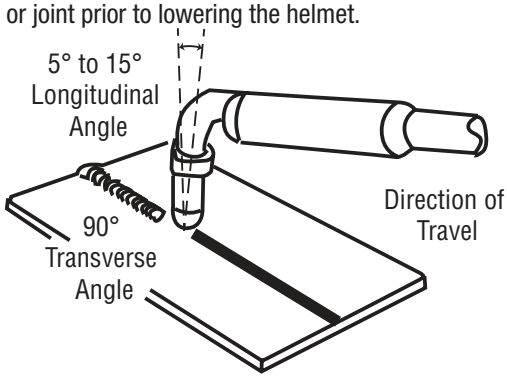
The welding Gun should be held at an angle to the weld joint. (see Secondary Adjustment Variables below)

Hold the MIG 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

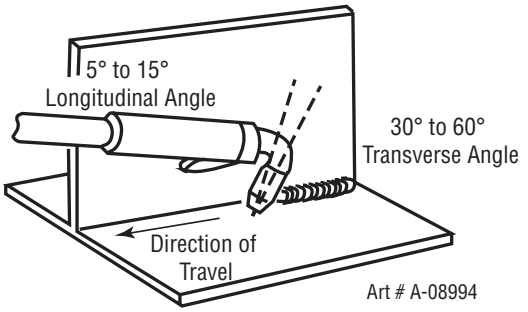
Do NOT pull the welding MIG Gun back when the arc is established. This will create excessive wire extension (stick-out) and make a very poor weld.

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



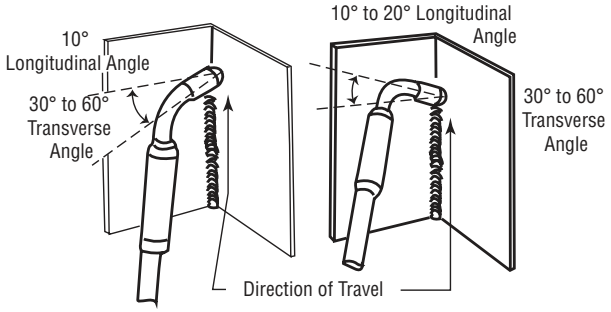
Butt & Horizontal Welds

Figure 4-4



Horizontal Fillet Weld

Figure 4-5



Vertical Fillet Welds Art # A-08995

Figure 4-6

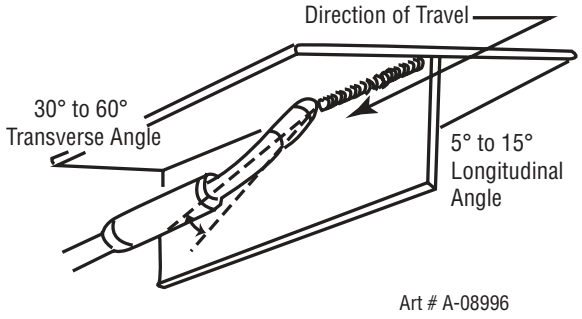


Figure 4-7

Distance from the MIG Gun Nozzle to the Work Piece

The electrode wire stick-out from the MIG Gun nozzle should be between 3/8" (10mm) to 3/4" (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 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 24 ga. (0.6mm) to ¼" (6.4mm) mild sheet or plate. The applied techniques and end results in the MIG 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

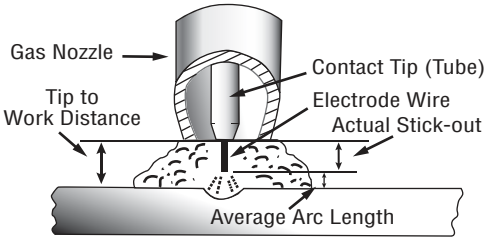
These control the process after preselected variables have been found. They control the penetration, bead width, bead height, arc stability, deposition rate and weld soundness. They are:

- 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:

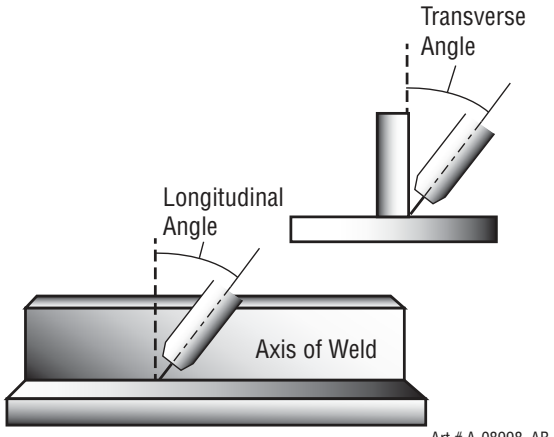
1. Stick-out (distance between the end of the contact tube (tip) and the end of the electrode wire). Maintain at about 3/8" (10mm) stick-out
2. Wire Feed Speed. Increase in wire feed speed increases weld current, Decrease in wire feed speed decreases weld current.



Electrode Stick-Out

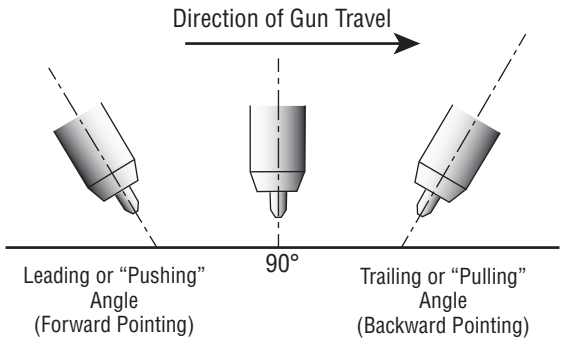
Figure 4-8

3. Nozzle Angle. This refers to the position of the welding MIG 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 MIG 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 ga. (1.6mm) or 1/8" (3.2mm) mild steel plate 6" (150mm) x 6" (150mm). Use 0.035" (0.9mm) gas shielded steel or gasless flux cored wire.

Setting of the Power Source

Power source and Wirefeeder 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 3.10.3) and the welding Voltage Control (refer to section 3.10.9). 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

ESAB MIG, Lift TIG, Stick Wire Selection Chart

Fabricator® 141i 3-IN-1 WELDING SYSTEM

MIG SET-UP GUIDE

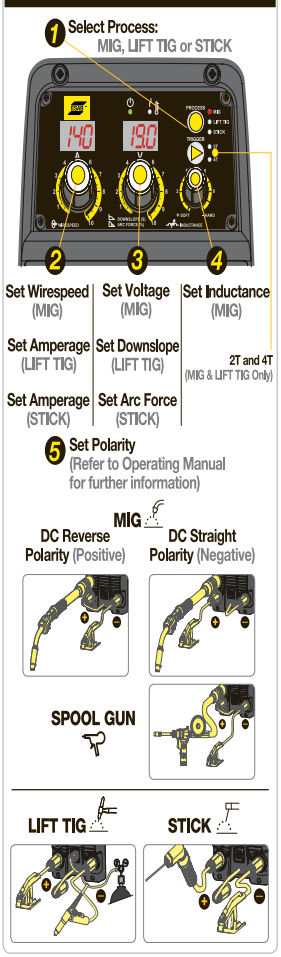
Note: MIG set-up guide parameters are given as a reference. Optimal settings may vary depending upon welding position, joint design, and wire/gas compositions.

*Power cord upgrade required for 30A operation, refer to manual for details.

115 VAC / 30A Electrical Outlet Thru 3/16"
115 VAC / 20A Electrical Outlet Thru 1/8"
115 VAC / 15A Electrical Outlet Thru 16 ga.

1 SELECT PROCESS	a MATERIAL PROCESS	b WELDING WIRE TYPE	c SHIELD GAS TO BE USED	d MATERIAL THICKNESS	24 ga. (0.6mm)	22 ga. (0.8mm)	18 ga. (1.2mm)	16 ga. (1.6mm)	1/8" (3.2mm)	3/16" (4.7mm)
MIG	Mild Steel (Gas Shielded)	ER 70S-6 .023" (0.6 mm)	75% Ar, 25% CO_2	2 Wirespeed Display	200	194	250	260	390	-
				3 Voltage Display	11	13.8	15.8	16.9	19	-
				4 Inductance Knob	10	10	8	6	10	-
				5 Polarity Selection	DC Reverse Polarity (Positive)					
	Mild Steel (Gas Shielded)	ER 70S-6 .030" (0.8 mm)	75% Ar, 25% CO_2	2 Wirespeed Display	95	116	160	220	268	250
				3 Voltage Display	12.5	12.5	15.5	16	18	19
				4 Inductance Knob	10	10	10	10	10	8
				5 Polarity Selection	DC Reverse Polarity (Positive)					
	Mild Steel (Gas Shielded)	ER 70S-6 .030" (0.8 mm)	100% CO_2	2 Wirespeed Display	-	168	184	197	277	-
				3 Voltage Display	-	12.9	14.8	17	19	-
				4 Inductance Knob	-	10	10	10	10	-
				5 Polarity Selection	DC Reverse Polarity (Positive)					
	Stainless Steel (Gas Shielded)	ER 308L .030" (0.8 mm)	Tri-Mix 90% Ar, 7.5% CO_2 2.5% CO_2	2 Wirespeed Display	-	150	162	181	-	-
				3 Voltage Display	-	13	17	17.8	-	-
				4 Inductance Knob	-	10	6	6	-	-
				5 Polarity Selection	DC Reverse Polarity (Positive)					
	Mild Steel (Gasless)	E71T-11 .030" (0.8 mm)	Not Required	2 Wirespeed Display	-	-	95	144	205	250
				3 Voltage Display	-	-	13.3	14.5	17.2	18.8
				4 Inductance Knob	-	-	10	10	10	10
				5 Polarity Selection	DC Straight Polarity (Negative)					
	Mild Steel (Gasless)	E71T-11 .035" (0.9 mm)	Not Required	2 Wirespeed Display	-	-	95	95	170	195
				3 Voltage Display	-	-	13.8	14.2	16.5	16.9
				4 Inductance Knob	-	-	10	10	10	10
				5 Polarity Selection	DC Straight Polarity (Negative)					
	Aluminum (Gas Shielded) Use Spool Gun	ER 4043 .030" (0.8 mm)	100% Ar	2 Wirespeed Display	-	-	-	-	390	-
				3 Voltage Display	-	-	-	-	18.5	-
				4 Inductance Knob	-	-	-	-	10	-
				5 Polarity Selection	DC Reverse Polarity (Positive)					

EASY STEPS FOR WELDING

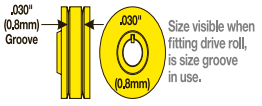


LIFT TIG SET-UP GUIDE

Note: LIFT TIG set-up guide parameters may vary depending upon welding position, joint design. Shield gas pure Argon. Polarity setting should be set to DC Straight Polarity (NEGATIVE) for all materials.
MS=Mild Steel SS=Stainless Steel

1 SELECT PROCESS	a MATERIAL PROCESS	b TUNGSTEN DIAMETER	c FILLER ROD (If Required)	d BASE METAL THICKNESS		24 ga. (0.6mm)	22 ga. (0.8mm)	18 ga. (1.2mm)	16 ga. (1.6mm)	1/8" (3.2mm)	3/16" (4.7mm)
LIFT TIG	Mild Steel & Stainless Steel	1/16" (1.6 mm)	1/16" (1.6 mm)	2 Amperage Display (Range)	(MS)	20-30A	30-50A	45-60A	60-90A	-	-
					(SS)	15-20A	20-35A	30-55A	40-70A	-	-
		3/32" (2.4 mm)	3/32" (2.4 mm)	2 Amperage Display (Range)	(MS)	-	-	-	60-90A	100-130A	140A
					(SS)	-	-	-	40-70A	90-120A	140A

DRIVE ROLLS



Part No.	Drive Roll Description
7977036	.023" - .023" Hard Wire (0.6 mm - 0.8 mm)
7977732	.030" - .035" Cored Wire (0.8 mm / 0.9 mm)

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

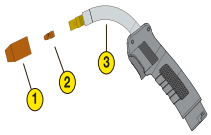
A-12918

STICK SET-UP GUIDE

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

1 SELECT PROCESS	a MATERIAL SELECTION	b ELECTRODE SELECTION	c ELECTRODE DIAMETER	3/32" (2.4mm)
STICK	Mild Steel	E6013, E7018	2 Amperage Display (Range)	70-90A
			3 Arc Force Knob	0
			4 Polarity Selection	DC Reverse Polarity (Positive)
	Stainless Steel	E308	2 Amperage Display (Range)	45-80A
			3 Arc Force Knob	0
			4 Polarity Selection	DC Reverse Polarity (Positive)

CONSUMABLE PARTS - 140A MIG GUN



Item	Part No.	Torch Parts Description
1	1220-1204	Velocity Nozzle, 3/8" (9.5mm) Flush
	1220-1200	Velocity Nozzle, 1/2" (12.7mm) Flush
	1220-1202	Velocity Nozzle, 5/8" (15.9mm) Flush
2	1110-1308	Velocity Contact Tip, .023" (0.6mm)
	1110-1309	Velocity Contact Tip, .030" (0.8mm)
	1110-1310	Velocity Contact Tip, .035" (0.9mm)
3	1620-1108	Conductor Tube
-	1017-1321	Tweco Fusion 140 MIG Gun

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Table 4-1: MIG, Lift TIG, Stick Welding Set up Chart

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 MIG, 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	Limited or no shielding gas flows out of the MIG Gun nozzle.		Check that the MIG Gun connection is fully engaged into the MIG Gun Adapter. The o-rings in the MIG Gun connection must seal the shielding gas within the MIG Gun Adapter so the shielding gas flows into the MIG Gun and out thru the MIG Gun nozzle.
2	No shielding gas flow.		Ensure that the shielding gas cylinder is not empty and the flow meter is correctly adjusted to workshop welding: 15-25 CFH or outdoors welding: 35-46 CFH.
3	Gas leaks.		Check for gas leaks between the regulator/cylinder connection and in the gas hose to the Power Source.
4	Welding in a windy environment.		Shield the weld area from the wind or increase the gas flow.
5	Welding dirty, oily, painted, oxidized 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. Refer to section 4.01
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 or drive roll tension not tight enough.
2	Wire spool unwinds and tangles		Wire spool brake is too loose.
3	Wire slipping	A	Worn or incorrect feed roller size. 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 debris	A	Increased amounts of debris are produced by the wire passing through the feed roller when excessive pressure is applied to the pressure roller adjuster.
		B	Debris can also be produced by the wire passing through an incorrect feed roller groove shape or size.
		C	Debris 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 aluminum it may become jammed in the contact tip due to expansion of the wire when heated. A Velocity 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 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	Welding current too low	Increase welding current.
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 travel speed settings. Convex, voltage too low. Concave, voltage too high.	A Adjust voltage and travel speed by adjusting the voltage control and the wirespeed control.
	B Wire is wandering.	B Check to see if it is near the end of the roll of wire and replace when necessary. If the problem continues, tighten the nozzle to see if this corrects the problem. Then 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.
	E Incorrect gun manipulation or angle	E Manipulate the gun correctly or place it in correct angle.

FAULT	CAUSE	REMEDY
6 Weld cracking	A Weld high carbon steel without pre/post heat treatment	A Have sufficient pre/post heat treatment before welding high carbon steel.
	B Incompatible filler metal used to the base metal	B Use correct filler metal.
	C Weld beads too small	C Decrease travel speed.
	D Weld penetration narrow and deep	D Reduce current and voltage and increase MIG Gun travel speed or select a lower penetration shielding gas.
	E Excessive weld stresses	E Increase weld metal strength or revise design
	F Excessive voltage	F Decrease voltage.
	G Cooling rate too fast	G Slow the cooling rate by preheating part to be welded or cool slowly.
7 Cold weld puddle	A Welding voltage too high	A Decrease voltage or increase the wirespeed control.
	B Loose welding cable connection	B Check all welding cable connections.
	C Low primary voltage	C Contact supply authority.
	D Fault in power source	D Have an Accredited ESAB 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 Gun to the positive (+) welding terminal for solid wires and gas shielded flux cored wires. Refer to the electrode wire manufacturer for the correct polarity.
9 Poor weld result from setup chart parameters	A Incorrect welder setup, polarity, shielding gas, wire type and size	A Check to make sure that the welder is set up correctly; also check polarity, shielding gas, wire type and size.
	B Contact tip has arc marks in the bore causing excessive drag on the wire	B Replace the contact tip with only a Genuine Velocity contact tip.

Table 4-4: MIG Welding Problems

4.03 Stick (SMAW) Basic Welding Technique

Size of Electrode

The electrode size is determined by the thickness of metals being joined and can also be governed by the type of welding machine available. Small welding machines will only provide sufficient current (amperage) to run the smaller size electrodes.
For thin sections, it is necessary to use smaller electrodes otherwise the arc may burn holes through the job. A little practice will soon establish the most suitable electrode for a given application.

Storage of Electrodes

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

Electrode Polarity

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

4.04 Effects of Stick Welding Various Materials

High Tensile and Alloy Steels

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

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.

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.

Copper and Alloys

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

Types of Electrodes

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

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 4-11 through 4-18.

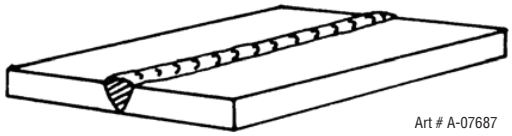


Figure 4-11: Flat Position, Down Hand Butt Weld

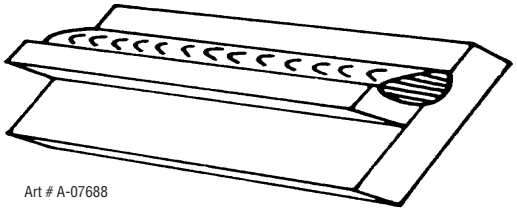


Figure 4-12: Flat Position, Gravity Fillet Weld

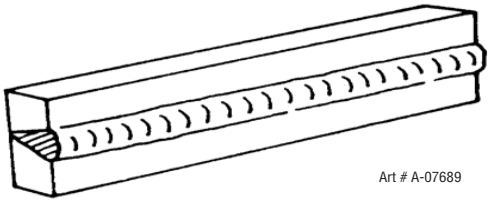


Figure 4-13: Horizontal Position, Butt Weld

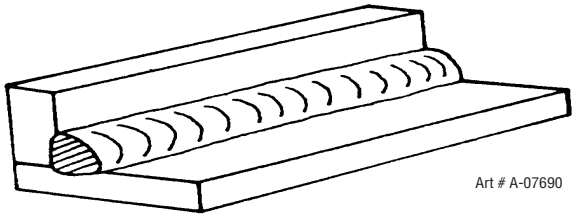


Figure 4-14: Horizontal-Vertical (HV) Position

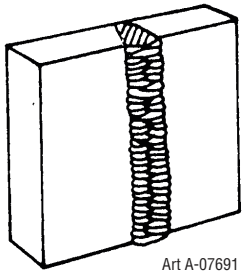


Figure 4-15: Vertical Position, Butt Weld

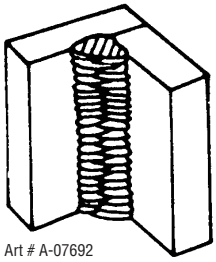


Figure 4-16: Vertical Position, Fillet Weld

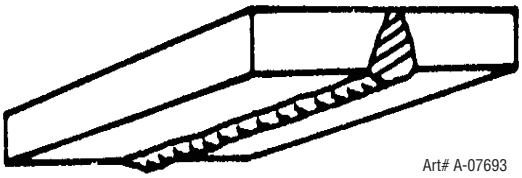


Figure 4-17: Overhead Position, Butt Weld

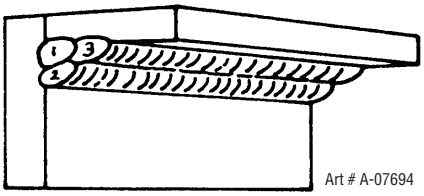


Figure 4-18: Overhead Position, Fillet Weld

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.

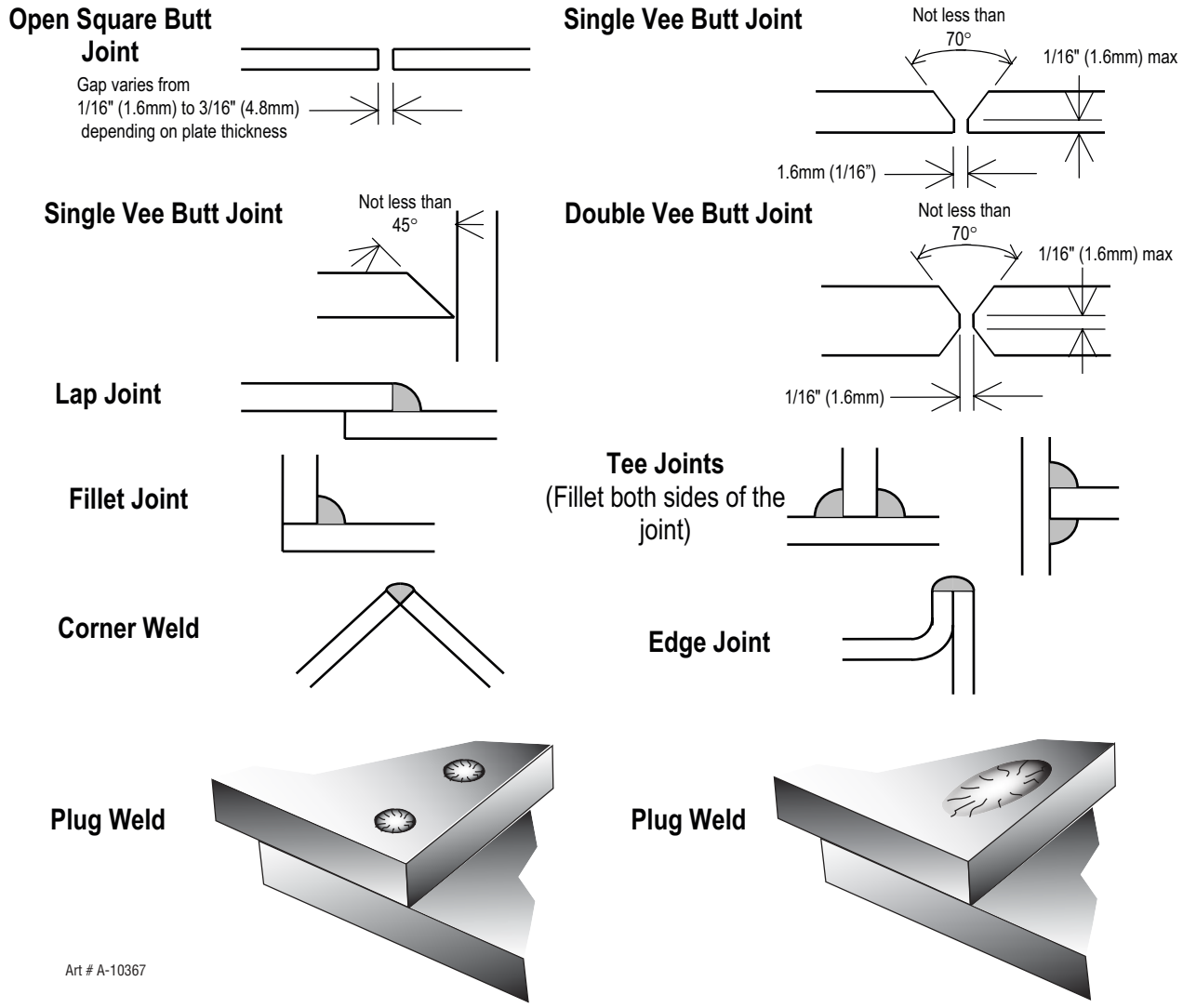


Figure 4-19: Typical Joint Designs for Arc Welding

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 1/4" (6.4mm) thick and a 1/8"(3.2mm) electrode. Clean any paint, loose scale or grease off the plate and set it firmly on the work bench so that welding can be carried out in the downhand position. Make sure that the work clamp is making good electrical contact with the work, either directly or through the work table. For light gauge material, always clamp the work lead directly to the job, otherwise a poor circuit will probably result.

Striking the Arc

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

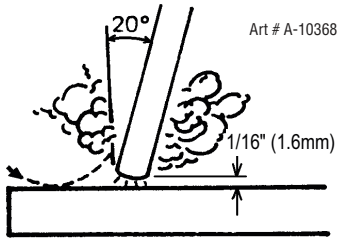


Figure 4-20: Striking an Arc

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 Stick electrodes 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 1/16"(1.6mm) to 3/32"(2.4mm) gap between them and tack weld at both ends. This is to prevent contraction stresses from the cooling weld metal pulling the plates out of alignment. Plates thicker than 1/4" (6.4mm) should have their mating edges beveled to form a 70º to 90º included angle. This allows full penetration of the weld metal to the root. Using a 1/8"(3.2mm) E7014 Stick 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.

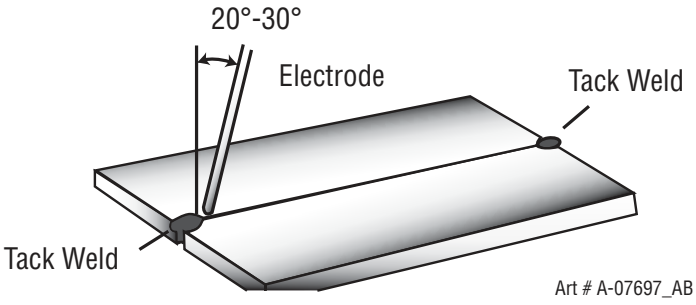


Figure 4-21: Butt Weld

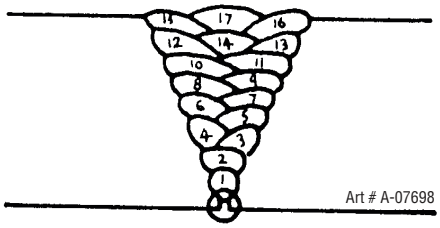


Figure 4-22: Weld Build up Sequence

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 1/8"(3.2mm) E7014 Stick 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 1/4"(6.4mm) width with a 1/8"(3.2mm) electrode, otherwise the weld metal tends to sag towards the base, and undercut forms on the vertical leg. Multi-runs can be made as shown in Figure 4-24. Weaving in HV fillet welds is undesirable.

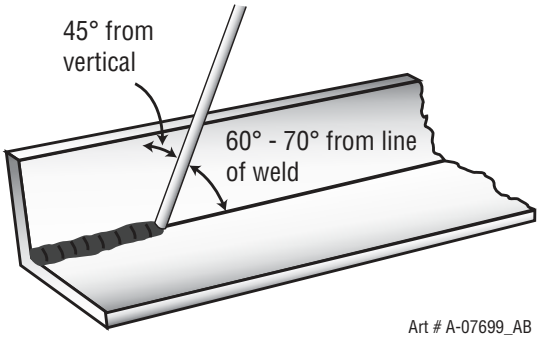


Figure 4-23: Electrode Position for HV Fillet Weld

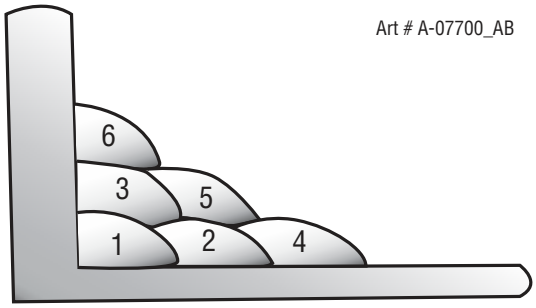


Figure 4-24: Multi-runs in HV Fillet Weld

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 1/8"(3.2mm) E7014 Stick 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 10º 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.

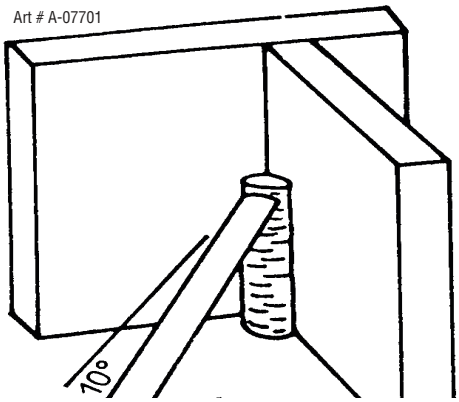


Figure 4-25: Single Run Vertical Fillet Weld

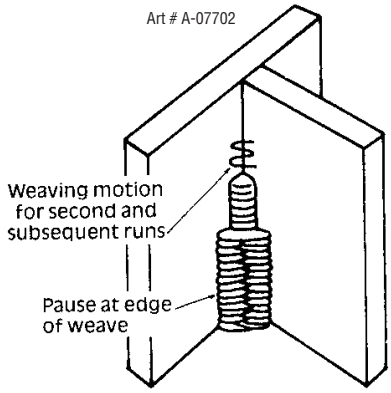


Figure 4-26: Multi Run Vertical Fillet Weld

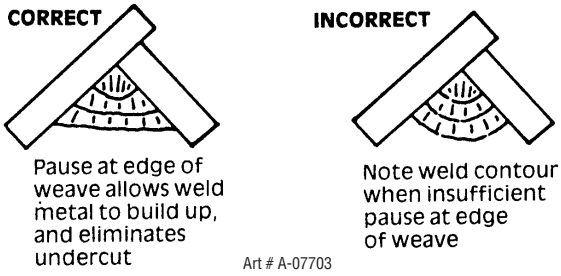


Figure 4-27: Examples of Vertical Fillet Welds

2. Vertical Down

The E7014 Stick electrode makes welding in this position particularly easy. Use a 1/8"(3.2mm) electrode at 100 amps. The tip of the electrode is held in light contact with the work and the speed of downward travel is regulated so that the tip of the electrode just keeps ahead of the slag. The electrode should point upwards at an angle of about 45º.

3. Overhead Welds

Apart from the rather awkward position necessary, overhead welding is not much more difficult that downhand welding. Set up a specimen for overhead welding by first tacking a length of angle iron at right angles to another piece of angle iron or a length of waste pipe. Then tack this to the work bench or hold in a vice so that the specimen is positioned in the

overhead position as shown in the sketch. The electrode is held at 45º to the horizontal and tilted 10º in the line of travel (Figure 4-28). 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 1/8"(3.2mm) E6013 Stick 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.

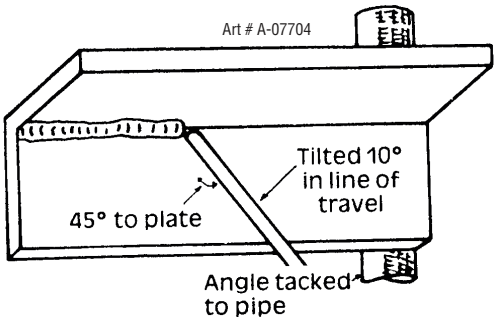


Figure 4-28: Overhead Fillet Weld

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 5/64" (2.0mm) sheet, the contracting weld metal may cause the sheet to become distorted.

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

While welding is proceeding, a relatively small volume of the adjacent plate material is heated to a very high temperature and attempts to expand in all directions. It is able to do this freely at right angles to the surface of the plate (i.e., "through the weld", but when it attempts to expand "across the weld" or "along the weld", it meets considerable resistance, and to fulfill 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.

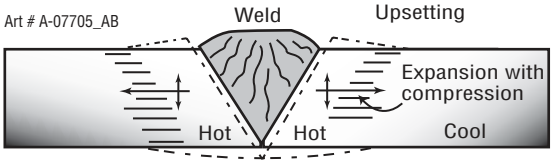


Figure 4-29: Parent Metal Expansion

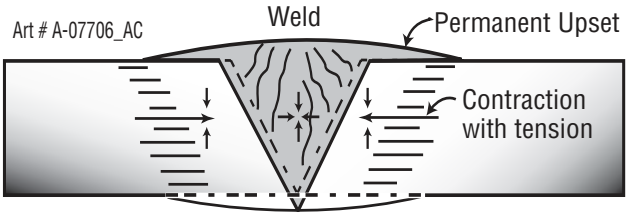


Figure 4-30: Parent Metal Contraction

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 4-31 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.

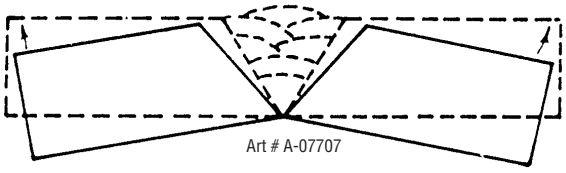
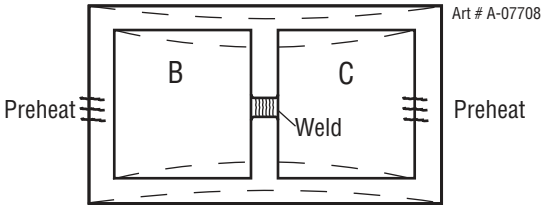


Figure 4-31: Principle of Presetting



Dotted lines show effect if no preheat is used

Figure 4-32: Reduction of Distortion by Preheating

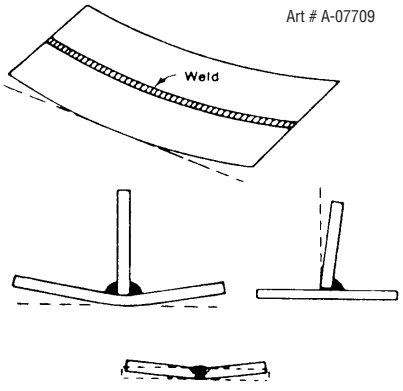
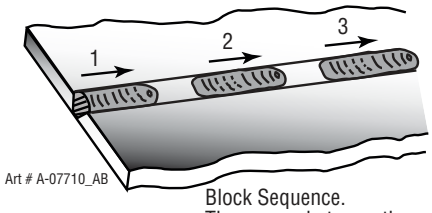


Figure 4-33: Examples of Distortion



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

Figure 4-34: Welding Sequence

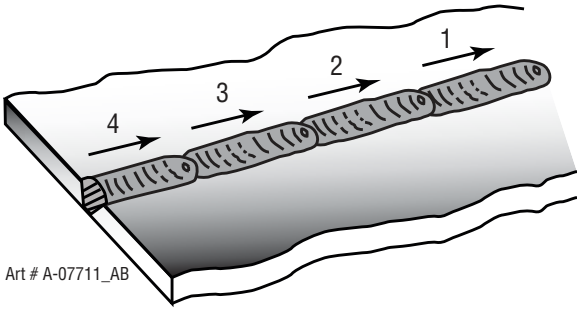


Figure 4-35: Step back Sequence

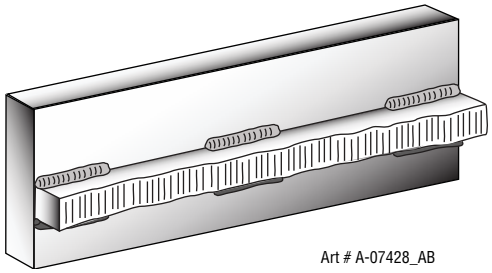


Figure 4-36: Chain Intermittent Welding

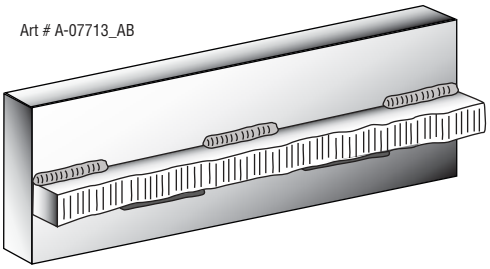


Figure 4-37: Staggered Intermittent Welding

4.05 Stick (SMAW) Welding Troubleshooting

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

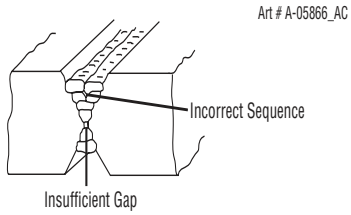
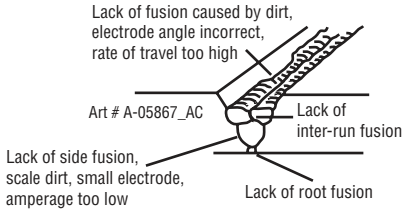


Figure 1- Example of insufficient gap or incorrect sequence

FAULT	CAUSE	REMEDY
4 A groove has been formed in the base metal adjacent to the toe of a weld and has not been filled by the weld metal (undercut).	A Welding current is too high.	A Reduce welding current.
	B Welding arc is too long.	B Reduce the length of the welding arc.
	C Angle of the electrode is incorrect.	C Electrode should not be inclined less than 45° to the vertical face.
	D Joint preparation does not allow correct electrode angle.	D Allow more room in joint for manipulation of the electrode.
	E Electrode too large for joint.	E Use smaller gauge electrode.
	F Insufficient deposit time at edge of weave.	F Pause for a moment at edge of weave to allow weld metal buildup.
	G Power Source is set for MIG (GMAW) welding.	G Set Power Source to STICK (SMAW) 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 sulfur in steel.	A Use an electrode that is designed for high sulfur 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.

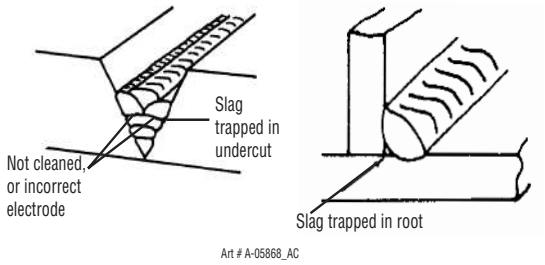
FAULT	CAUSE	REMEDY
7 Crack occurring in weld metal soon after solidification commences	A Rigidity of joint.	A Redesign to relieve weld joint of severe stresses or use crack resistance electrodes.
	B Insufficient throat thickness.	B Travel slightly slower to allow greater build up in throat.
	C Weld current is too high.	C Decrease welding current.
 Figure 3: Example of Slag Inclusion		
8 The Stick electrode is difficult to run with multiple arc-outs when welding	The Stick electrode being used is not suitable for use with this machine.	Use E6013 or E7018 Stick electrodes for steel or 300 series stainless steel Stick electrodes for 300 series stainless steel.

Table 4-5: Welding Problems - Stick (SMAW)

4.06 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.

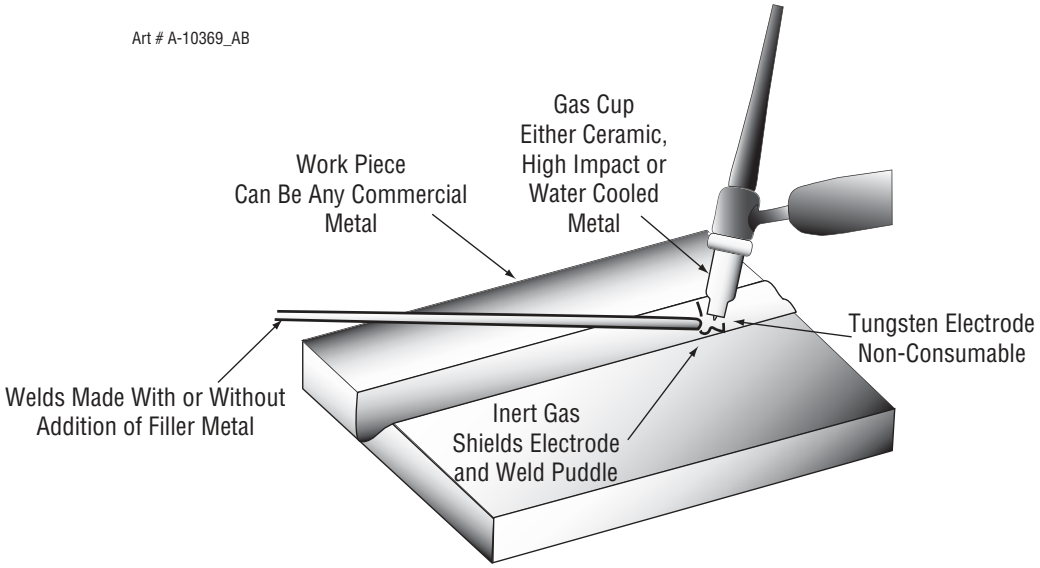


Figure 4-38: TIG Welding Application Shot

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	Color Code
Thoriated 2%	DC welding of mild steel, stainless steel and copper	Excellent arc starting, Long life, High current carrying capacity	Red
Zirconated 1%	High quality AC welding of aluminum, magnesium and their alloys.	Self cleaning, Long life, Maintains balled end, High current carrying capacity.	Brown
Ceriated 2%	AC & DC welding of mild steel, stainless steel, copper, aluminum, 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 141i 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 CFH	Joint Type
0.040” 1.0mm	35-45 40-50	20-30 25-35	0.040” 1.0mm	1/16” 1.6mm	10-15	Butt/Corner Lap/Fillet
0.045” 1.2mm	45-55 50-60	30-45 35-50	0.040” 1.0mm	1/16” 1.6mm	10-15	Butt/Corner Lap/Fillet
1/16” 1.6mm	60-70 70-90	40-60 50-70	1/16” 1.6mm	1/16” 1.6mm	15	Butt/Corner Lap/Fillet
1/8” 3.2mm	80-100 90-115	65-85 90-110	1/16” 1.6mm	3/32” 2.4mm	15	Butt/Corner Lap/Fillet
3/16” 4.8mm	115-135 140-165	100-125 125-150	3/32” 2.4mm	1/8” 3.2mm	20	Butt/Corner Lap/Fillet
1/4” 6.4mm	160-175 170-200	135-160 160-180	1/8” 3.2mm	5/32” 4.0mm	20	Butt/Corner Lap/Fillet

Table 4-9

TIG Welding is generally regarded as a specialized 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.victortechnologies.com or contact ESAB.

4.07 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.

FAULT	CAUSE	REMEDY
6 Electrode melts or oxidizes when an arc is struck.	A TIG Torch lead connected to positive welding terminal.	A Connect TIG Torch lead to negative welding terminal.
	B No gas flowing to welding region.	B Turn TIG Torch gas valve ON. Check the gas lines for kinks or breaks and gas cylinder contents.
	C TIG Torch is clogged with dust or dirt.	C Clean TIG 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 or cylinder shut off.	F Turn on.
	G TIG 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.

FAULT	CAUSE	REMEDY
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 4-7 Current Ranges for Various Tungsten Electrode Size.
	B The wrong electrode is being used for the welding job.	B Select the right electrode type. Refer to Table 4-9 Tungsten Electrode Types.
	C Gas flow rate is too high.	C Select the right rate for the welding job. Refer to Table 4-10.
	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.
	F Tungsten not properly sharpened.	F Grind tungsten to proper shape.
10 Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the right size electrode. Refer to Table 4-7 Current Ranges for Various Electrode Size.
11 Tungsten blackens due to lack of shielding gas or wrong shield gas.	A Gas valve on the TIG Torch has not be turned on.	A Turn on TIG Torch gas valve before you commence welding.
	B Gas cylinder valve off or TIG Torch hose not connected to regulator	B Turn on gas cylinder valve or connect TIG Torch hose to regulator.
	C Incorrect shielding gas is being used.	C Select the right shielding gas.

Table 4-10: TIG (GTAW) Welding Problems

SECTION 5:
POWER SOURCE PROBLEMS AND ROUTINE SERVICE REQUIREMENTS

5.01 Power Source Problems

	FAULT		CAUSE		REMEDY
1	Primary Power Supply is ON, power indicator is illuminated however the Power Source 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	Welding leads, or polarity cable not connected.	B	Connect welding leads or polarity cable.
		C	Faulty torch trigger.	C	Repair or replace torch trigger switch/lead.
2	Fault Indicator is illuminated and the Power Source 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	The Power Source 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, loose nozzle or worn contact tip. Replace faulty components.
		B	8 pin gun connector not connected.	B	Connect 8 pin gun connector.
		C	MIG GUN/SPOOL GUN switch is switched to SPOOL GUN.	C	Switch the MIG GUN/SPOOL GUN switch to MIG GUN.
		D	Faulty torch trigger.	D	Repair or replace torch trigger.
		E	Wire tension too loose.	E	Tighten wire tension.
		F	Brake tension too tight.	F	Loosen brake tension.
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.

	FAULT		CAUSE		REMEDY
6	Inconsistent wire feed.	A	Fouled contact tip.	A	Replace Velocity contact tip if necessary.
		B	Drive roll tension not tight enough.	B	Tighten drive roll tension.
		C	Worn feed roll.	C	Replace.
		D	Excessive brake tension on wire reel hub.	D	Reduce brake tension on spool hub
		E	Worn, kinked or dirty conduit liner.	E	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 debris.	B	Disconnect gas hose from the rear of Power Source and blow out debris.
		C	Shielding gas cylinder valve shut off.	C	Turn on the cylinder.
		D	Flowmeter/ Regulator turned off.	D	Turn on flowmeter/ regulator.
		E	Empty gas cylinder.	E	Replace gas cylinder.
8	Gas flow continues after the torch trigger switch has been released (MIG mode).		Gas valve has jammed open due to debris in the gas or the gas line.		Have an accredited ESAB service provider repair or replace gas valve.
9	Power indicator will not illuminate and welding arc cannot be established.		The Electricity supply is inadequate.		Ensure that the Electricity Supply voltage is within 95-140 VAC.
10	TIG electrode melts when arc is struck.		TIG Torch is connected to the (+) polarity terminal.		Connect the TIG Torch to the (-) polarity 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 4-7.

Table 5-1

5.02 Routine Service

WARNING

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

Routine Inspection, Testing & Maintenance

The inspection and testing of the Power Source and associated accessories shall be carried out in accordance with Section 5 of EN 60974-1: Safety in Welding and Allied Processes-Part 2 Electrical. This includes an insulation resistance test and an earthing test to ensure the integrity of the Power Source is compliant with ESAB's original specifications.
If equipment is to be used in a hazardous location or environments with a high risk of electrocution as outlined in EN 60974-1, then the above tests should be carried out prior to entering this location.

A. Testing Schedule

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

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

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

NOTE!
Please refer to local guidelines for further information.

B. General Maintenance Checks

Welding equipment should be regularly checked by an accredited ESAB 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.

C. 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.

D. Repairs

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

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 Electricity Supply Voltage before disassembling.

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 this parts and their eventual failure.

5.05 Volt-Ampere Curves

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

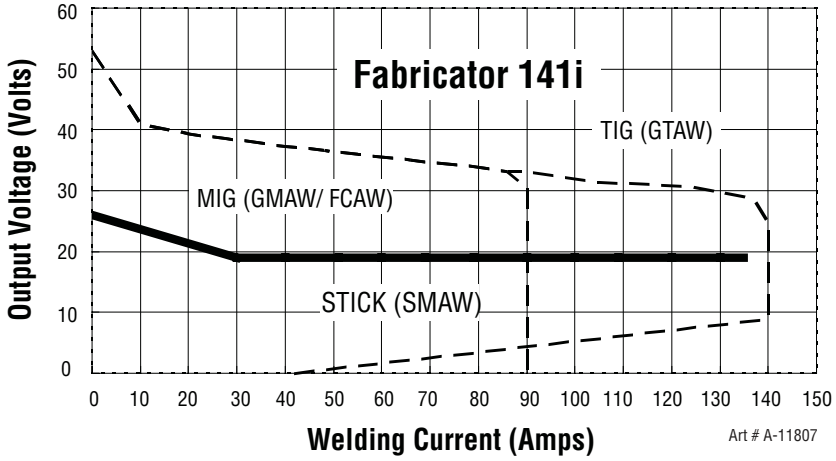


Figure 5-1: Fabricator 141i Volt-Ampere Curves

SECTION 6: KEY SPARE PARTS

6.01 Tweco Fusion 140A MIG Gun Parts

Torch Part No: 1017-1321

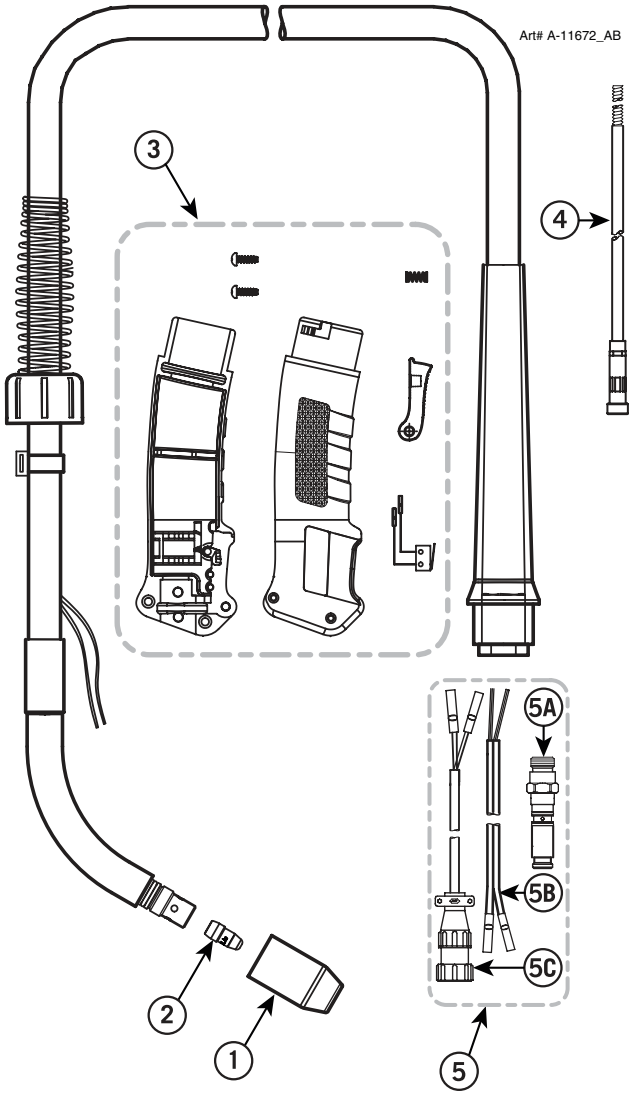


Figure 6-1

Item No.		Description	Part No.	
1		Velocity Nozzle**	VNS-50	1220-1201
			VNS-50F	1220-1200
			VNS-62	1220-1203
			VNS-62F	1220-1202
			VNS-37	1220-1206
			VNS-37F	1220-1204
			VNS-75FAS	1220-1205
2		Velocity Contact Tip**	VTS-23	1110-1308
			VTS-30	1110-1309
			VTS-35	1110-1310
			VTS-40	1110-1311
			VTS-45	1110-1312
			VTS-52	1110-1314
			VTS-116	1110-1315
			VTSA-116	1110-1317
			VTSA-364	1110-1313
			VTS-564	1110-1316
3		Handle / Trigger Repair Kit	F8	2020-2025
4		Conduit Assembly*	WS42-3035-15	1420-1140
5	5A	ESAB Rear Connector	350-174H	2035-2110
	5B	ESAB Control Wire	35K-350-1	2000-2352
	5C	ESAB Control Wire & Plug	WS-354-TA-LC	2060-2141

Table 6-1: Tweco Fusion 140A MIG Gun Parts

** Patent Pending

* Refer to ESAB Catalog No. 64-2103 for additional options.

6.02 Power Source

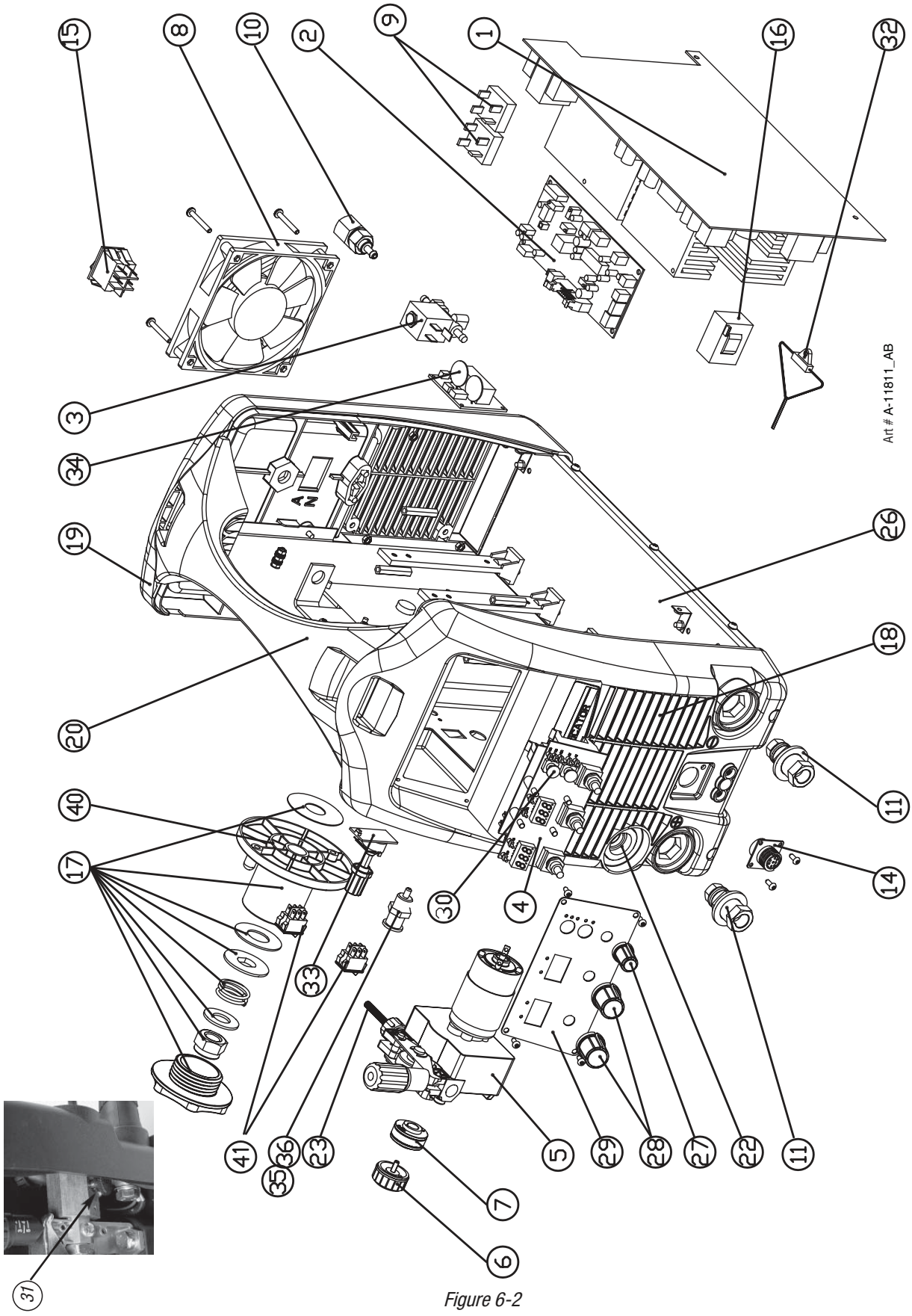


Figure 6-2

FABRICATOR 141i POWER SOURCE SPARE PARTS		
ITEM	**PART NUMBER**	**DESCRIPTION**
1	W7006216	PCB,Power,141i
2	W7006227	PCB,Control,141i
3	W7003033	Solenoid,Valve,24VDC
4	W7006226	PCB, Remote Interface Integrated with Display, 141i
5	W7006209	Wiredrive Assy,w/ Motor,141i
6	W7004906	Feedroll retaining thumb screw
7	7977036	Feed Roll .024(0.6mm)-.030"(0.8mm) V groove Installed
8	W7004947	Fan,24VDC,4.75"x4.75"x1",141i
9	W7003010	Rectifier Bridge,1000V,50A
10	W7003215	Connector,Gas Inlet,5/8"-18UNF
11	W7006210	Dinse,Socket,141i
12	W7004983	Shoulder strap, 141i (not shown)
13	W7006224	Input Power Cable (not shown)
14	W7004942	Socket,8 Pin,w/ Harness
15	W7003053	Switch,On/Off,250V
16	W7004911	CT Sensor,Output,141i
17	W7004912	Wire Hub Assy,141i
18	W7006220	Panel, Front
19	W7006223	Panel, Rear
20	W7004922	Handle,141i
21	W7006222	Side and Top Panels (not shown)
22	W7004966	Adapter,ESAB 4,141i
23	W7004925	Guide,Inlet,.023-.045,141i
24	W7004967	Guide,Outlet,.023-.045,141i
25	W7006221	Panel,Door (not shown)
26	W7006208	Panel,Base,141i
27	870734	Knob,1/4" IDx.72" ODx.9" H
28	W7004972	Knob,1/4" IDx1" ODx0.9" H
29	W7006211	Panel,Front Control,141i
30	W7004953	Push Button Actuator
31	OTWAK/1S	Screw,Locking,MIG Gun
32	W7004961	Thermistor,NTC,K45 47K,141i
33	W7004940	PCB Burnback Potentiometer
34	W7006214	PCB,Spool Gun,141i
35	W7004979	Fuse Holder,141i
36	W7006217	Fuse,10 Amp
37	W7006218	Label,Setup Chart,141i,English (not shown)
38	W7006219	Label,Setup Chart,141i,French (not shown)
39	W7006212	Inductor,141i (not shown)
40	W7004951	Spool Hub,141i
41	W7004943	Remote/Local and MIG/ Spool Gun Switch
42	W4017500	Dinse Adapter, 50mm- 25mm (not shown)

Table 6-2

6.03 Hardware List

ITEM	DESCRIPTION	WHERE USED	Qty
1	Nut Lock, M20	25mm Dinse	2
2	Screw Hexagon, M10 × 1.5-20 ST ZP	25mm Dinse	2
3	Washer, M4, ET Lock	Handle	2
		Side Panel	3
4	SC PHCR M4 × 0.7-10 ST ZP	Handle	2
		Rear Panel	2
		Front Panel	3
		Side Panel	3
		Door Assy	2
5	SC PHCR M4 × 0.7-16 ST BK	Front Panel	2
		Rear Moulding	2
6	SC PHCR ST 6G × 3/8 STBK	8 Pin Remote Socket	2
		Front PCB	4
7	Nut Hexagon M4 × 0.7 ST ZP	Fan	4
8	SC PHSL M4 × 0.7-30 ST ZP	Fan	4
9	Nut Hexagon M12 × 1.75 ST ZP	Gas Adaptor Inlet	1
10	Washer Flat, 7.91 D (M8)	Wirefeeder Plate	2
11	Washer Spring, 7.91 D	Wirefeeder Plate	2
12	Screw Hexagon M8 × 1.25-30 ST ZP	Wirefeeder Plate	2
13	Nut Hexagon M8 × 1.25 ST ZP	Wirefeeder Plate	2
14	Screw Hexagon HD 9/32 × 16 ×19	Wirefeeder Plate	2
15	Screw Skt Set M4 × 0.7	ESAB No. 4 Torch Adaptor	1
16	Screw Hexagon M6 × 1.0-10 ST ZP	ESAB No. 4 Torch Adaptor	1
17	Nut Hexagon M10 × 1. 5 ST ZP	ESAB No. 4 Torch Adaptor	1

Table 6-3

NOTE!
All the hardware can be purchased from local store.

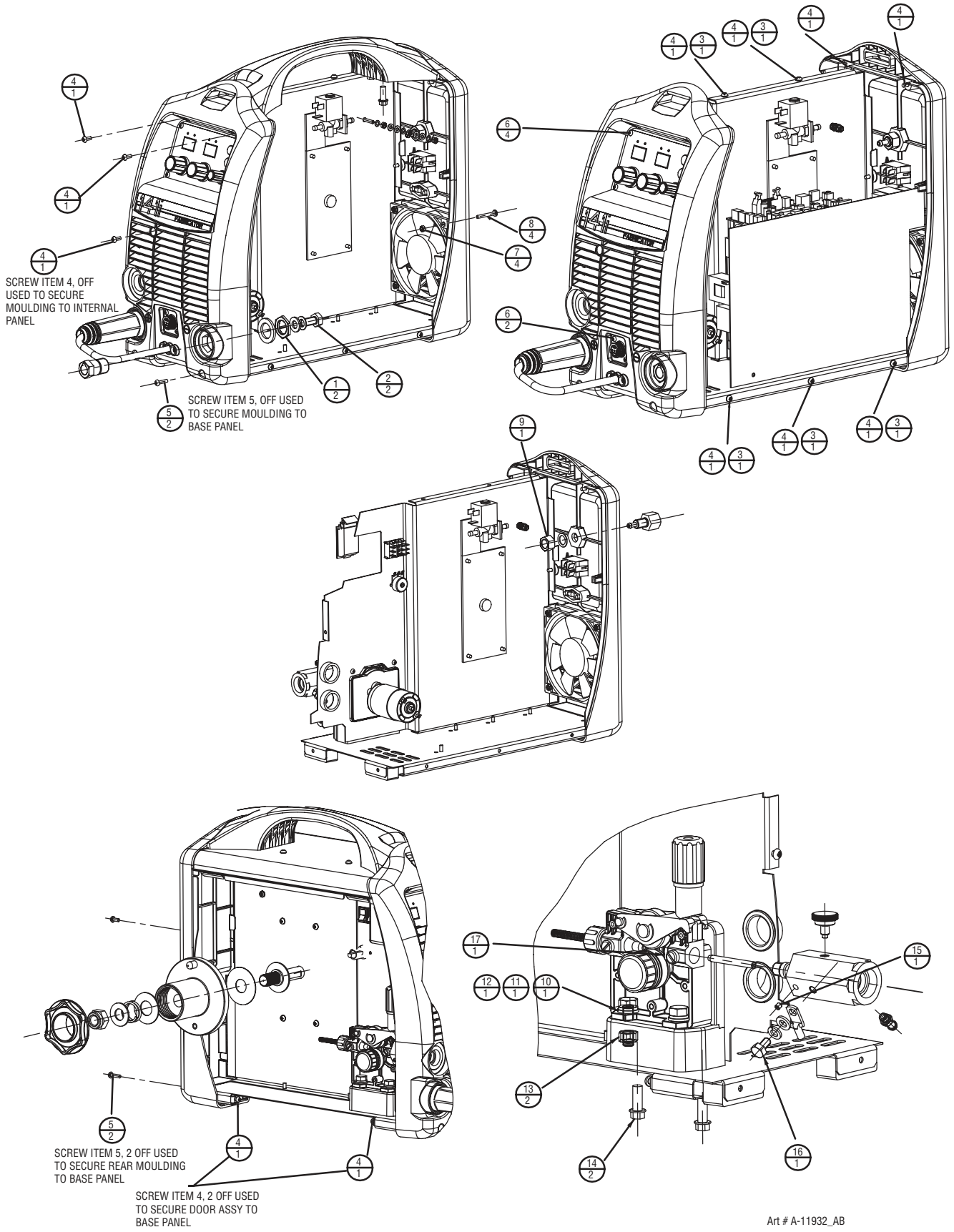

SCREW ITEM 4, OFF USED TO SECURE MOULDING TO INTERNAL PANEL
SCREW ITEM 5, OFF USED TO SECURE MOULDING TO BASE PANEL
SCREW ITEM 5, 2 OFF USED TO SECURE REAR MOULDING TO BASE PANEL
SCREW ITEM 4, 2 OFF USED TO SECURE DOOR ASSY TO BASE PANEL
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Figure 6-3

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APPENDIX

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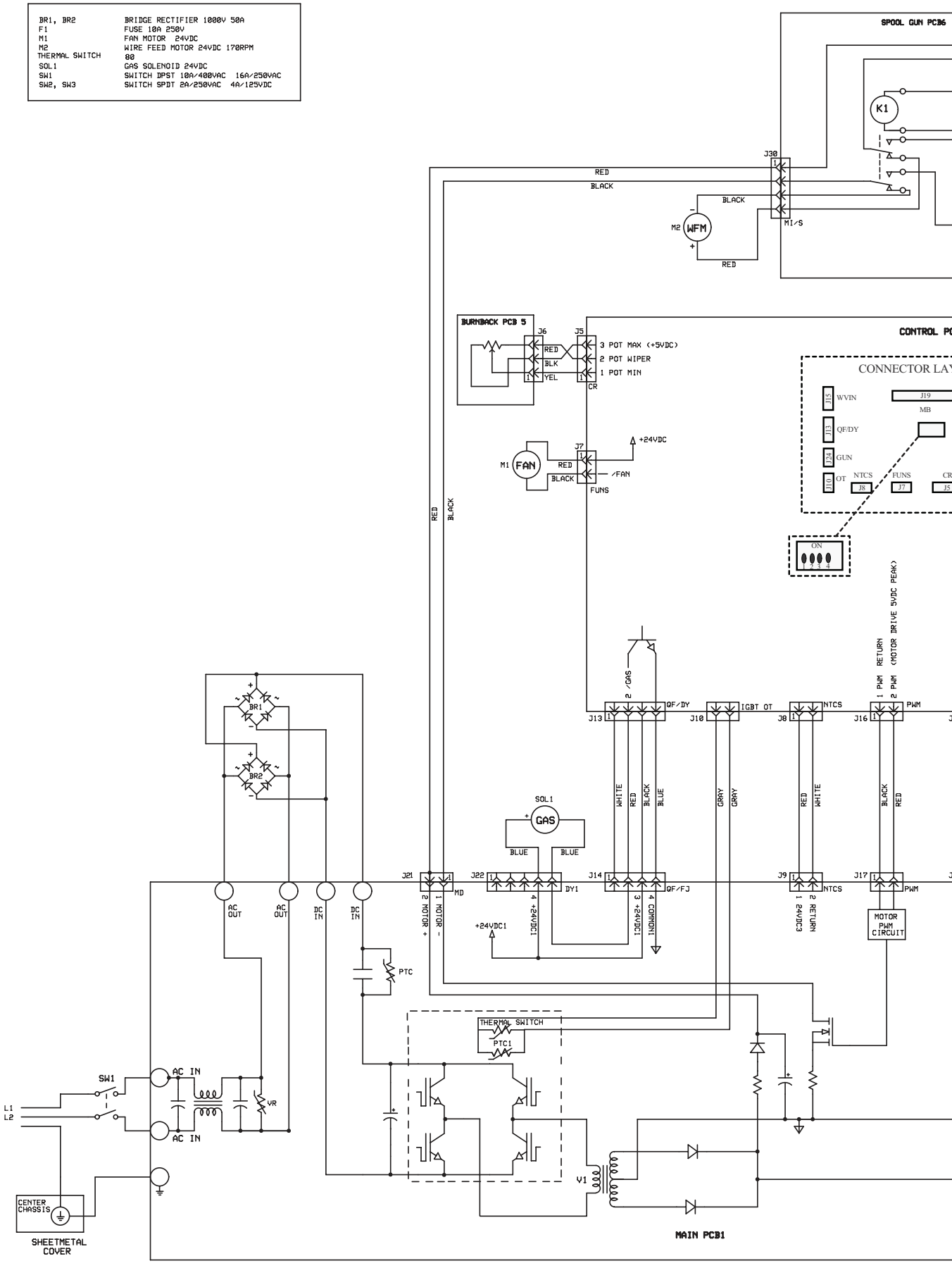
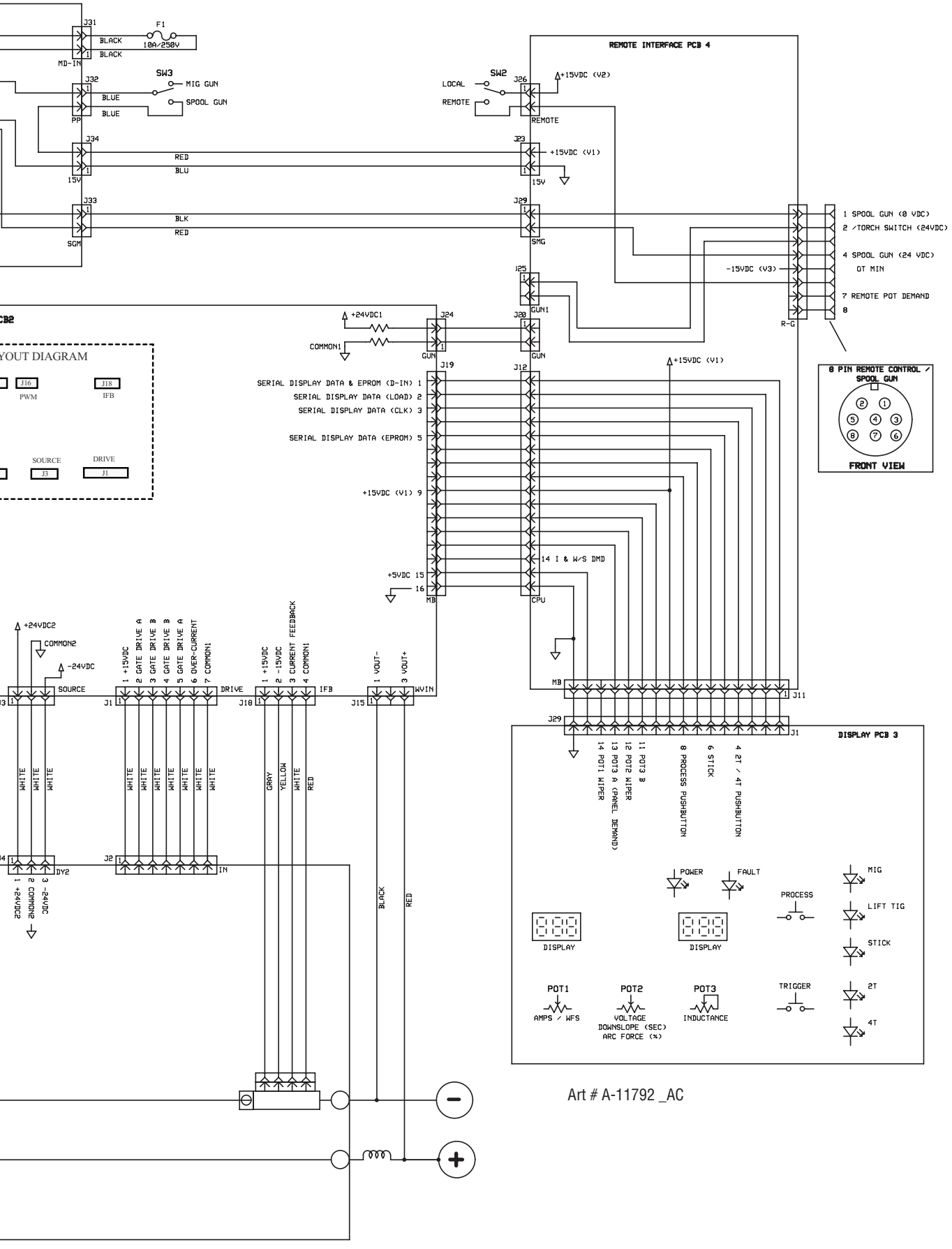
APPENDIX: FABRICATOR 141i CIRCUIT DIAGRAM

BR1, BR2	BRIDGE RECTIFIER 1000V 50A
F1	FUSE 10A 250V
M1	FAN MOTOR 24VDC
M2	WIRE FEED MOTOR 24VDC 170RPM
THERMAL SWITCH	80
SOL1	GAS SOLENOID 24VDC
SW1	SWITCH DPST 10A/400VAC 16A/250VAC
SW2, SW3	SWITCH SPDT 2A/250VAC 4A/125VDC





Art # A-11792 _AC

Revision History

Date	Rev	Description
09/10/2015	AA	Manual release

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