ET 201i DC

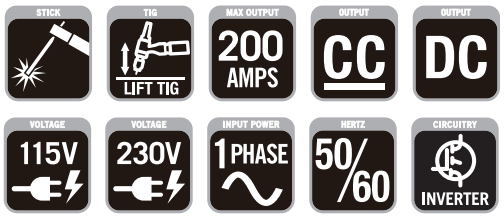
Inverter Arc Welder

Operating Manual

Art # A-13034

English

Canadien Français



C ETL LISTED US
Intertek
3163339

Revision: AA	Issue Date: March 30, 2016	Manual No.: 0-5452

esab.com

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 Welding 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.

Welding Power Supply
Operating Manual Number 0-5452 for:

ESAB ET 201i DC Power Source Arc Welder	Part No. W1003806
ESAB ET 201i DC System with Stick/TIG Kit & Case	Part No. W1003807

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

www.esab.com

For Printing Material Specification refer to document 47x1909.

Publication Date: March 30, 2016
Revision Date:

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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

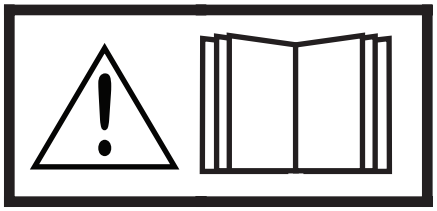
CAUTION

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 0-5407. 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!

ASSUREZ-VOUS QUE CETTE INFORMATION EST DISTRIBUÉE À L'OPÉRATEUR.
VOUS POUVEZ OBTENIR DES COPIES SUPPLÉMENTAIRES CHEZ VOTRE FOURNISSEUR.

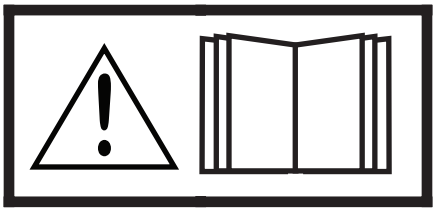
ATTENTION

Les INSTRUCTIONS suivantes sont destinées aux opérateurs qualifiés seulement. Si vous n'avez pas une connaissance approfondie des principes de fonctionnement et des règles de sécurité pour le soudage à l'arc et l'équipement de coupage, nous vous suggérons de lire notre brochure « Precautions and Safe Practices for Arc Welding, Cutting and Gouging, » Formulaire 0-5407. Ne permettez PAS aux personnes non qualifiées d'installer, d'opérer ou de faire l'entretien de cet équipement. Ne tentez PAS d'installer ou d'opérer cet équipement avant de lire et de bien comprendre ces instructions. Si vous ne comprenez pas bien les instructions, communiquez avec votre fournisseur pour plus de renseignements. Assurez-vous de lire les Règles de Sécurité avant d'installer ou d'opérer cet équipement.

RESPONSABILITÉS DE L'UTILISATEUR

Cet équipement opérera conformément à la description contenue dans ce manuel, les étiquettes d'accompagnement et/ou les feuillets d'information si l'équipement est installé, opéré, entretenu et réparé selon les instructions fournies. Vous devez faire une vérification périodique de l'équipement. Ne jamais utiliser un équipement qui ne fonctionne pas bien ou n'est pas bien entretenu. Les pièces qui sont brisées, usées, déformées ou contaminées doivent être remplacées immédiatement. Dans le cas où une réparation ou un remplacement est nécessaire, il est recommandé par le fabricant de faire une demande de conseil de service écrite ou par téléphone chez le Distributeur Autorisé de votre équipement.

Cet équipement ou ses pièces ne doivent pas être modifiés sans permission préalable écrite par le fabricant. L'utilisateur de l'équipement sera le seul responsable de toute défaillance résultant d'une utilisation incorrecte, un entretien fautif, des dommages, une réparation incorrecte ou une modification par une personne autre que le fabricant ou un centre de service désigné par le fabricant.



ASSUREZ-VOUS DE LIRE ET DE COMPRENDRE LE MANUEL D'UTILISATION AVANT D'INSTALLER OU D'OPÉRER L'UNITÉ.

PROTÉGEZ-VOUS ET LES AUTRES!

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

This Page Intentionally Blank

SECTION 1: SAFETY

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 welding 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

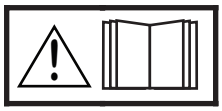
Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility of class A equipment in those locations, due to conducted as well as radiated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

CAUTION

This product is solely intended for welding. 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:
INTRODUCTION

2.01 How to Use This Manual

This Manual usually applies to the 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 word WARNING, CAUTION 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.

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

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

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.

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

2.02 Equipment Identification

The unit's identification number (specification or part number), model, and serial number usually appear on a nameplate attached to the machine. Equipment which does not have a nameplate attached to the machine is identified only by the specification or part number printed on the shipping container. Record these numbers 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.

2.04 Description

The ET 201i DC is a compact inverter welding machine that has infinitely adjustable welding current from 10 to 200 amps. It has LIFT TIG (GTAW) and HF TIG (GTAW) welding modes that offer stable TIG welding characteristics with an optimized start TIG sequence to initiate the welding arc when used with a suitable TIG torch and shielding gas.

This model has advanced TIG features including an 8 Pin Amp Plug for remote control devices, down slope, 2T / 4T controls, and gas solenoid operation. It also has a STICK (SMAW) welding mode which uses standard general purpose STICK (SMAW) 3/32" (2.5mm) electrodes for light gauge work, generally less than 1/8" (3.2mm) thick and STICK (SMAW) 1/8" (3.2mm) electrodes for heavier material.

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 Duty Cycle

The rated duty cycle of a Welding Power Source, is the percentage of a ten minute time period that it may be operated at its rated output current without exceeding the temperature limits of the insulation of the component parts. To explain the 10 minute duty cycle period, suppose a Welding Power Source is designed to operate with a 30% duty cycle at 160 amperes and 26.4 volts. This means that it has been designed and built to provide the rated amperage (160A) for 3 minutes, i.e. arc welding time, out of every 10 minute period (30% of 10 minutes is 3 minutes). During the other 7 minutes of the 10 minute period the Welding Power Source must idle and be allowed to cool.

2.07 Specifications

Power Source Part Number	W1003806	
Mains Power		
Nominal Supply Voltage	AC 115V	AC 208/230V
Number of Phases	Single Phase	Single Phase
Input Voltage Range	AC 104- 127V	AC 187- 253V
Nominal Supply Frequency	50/60 Hz	50/60 Hz
Effective Input Current (I1eff) for STICK (SMAW) Welding	18.3 Amps	15.8/14.2 Amps
Effective Input Current (I1eff) for LIFT TIG/HF TIG (GTAW) Welding	16.4 Amps	12.3/11.1 Amps
Maximum Input Current (I1 max) for STICK (SMAW) Welding	Δ 27.2 Amps	Δ 35.2/31.6 Amps
Maximum Input Current (I1 max) for LIFT TIG/HF TIG (GTAW) Welding	Δ 23.2 Amps	Δ 24.6/22.1 Amps
Single Phase Generator Requirements [Continuous rating at nominal supply voltage with maximum output for STICK (SMAW) welding]	4 KVA	7.3 KVA
Welding Output		
Welding Current Range	Stick: 10 - 125 Amps TIG: 10 - 160 Amps	Stick/TIG: 10 - 200 Amps
Nominal DC Open Circuit Voltage (OCV)	71V	71V
Welding Output, 104° F (40° C), 10 min. (Quoted figures refer to STICK (SMAW) output)	100A @ 45%, 24.0V 87A @ 60%, 23.5V 68A @ 100%, 22.7V	200A @ 20%, 28V 116A @ 60%, 24.6V 90A @ 100%, 23.6V
Rated Input Current (A) For STICK (SMAW) Welding	27.2A Io = 100A @ 24.0V	35.2/31.6A Io = 200A @ 28V
Rated Input Current (A) For LIFT TIG (GTAW) Welding	23.2A Io = 125A @ 15.0V	24.6/22.1A Io = 200A @ 18V
Rated Output for STICK (SMAW) Welding	24.0V, 100A @ 45%	28V, 200A @ 20%
Rated Output for LIFT TIG/HF TIG (GTAW) Welding	15.0V, 125A @ 50%	18V, 200A @ 25%
Duty Cycle (%)	45% @ 100A	20% @ 200A
Welder Type	Inverter Power Source	
Output Terminal Type	Heavy Duty Dinse™ 50	
Classification		
Protection Class	IP21S	
Standards	CSA E60974-1 EN50199	
Cooling Method	Fan Cooled	
Dimensions and Weight		
Welding Power Source Mass	22 lb. (10 kg)	
Welding Power Source Dimensions (Height x Width x Depth)	H 9.0" x W 5.3" x D 17.7"	
	(H230mm x W135mm x D450mm)	

NOTE!

The recommended time delay fuse or circuit breaker size is 30 amp. An individual branch circuit capable of carrying 30 amperes and protected by fuses or circuit breaker is recommended for this application. Fuse size is based on not more than 200 percent of the rated input amperage of the welding power source (Based on Article 630, National Electrical Code).

ESAB continuously strives to produce the best product possible and therefore reserves the right to change, improve or revise the specifications or design of this or any product without prior notice. Such updates or changes do not entitle the buyer of equipment previously sold or shipped to the corresponding changes, updates, improvements or replacement of such items.

The values specified in the table above are optimal values, your values may differ. Individual equipment may differ from the above specifications due to in part, but not exclusively, to any one or more of the following; variations or changes in manufactured components, installation location and conditions and local power grid supply conditions.

The Welding power source is of a drooping characteristic. The thermal protection switch is rated at 75° C.

This Page Intentionally Blank

SECTION 3:
INSTALLATION

3.01 Environment

This unit is designed for use in environments with increased hazard of electric shock. Examples of environments with increased hazard of electric shock are:

A. 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.

B. 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.

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

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

This equipment can't be operated in rain or snow.

3.02 Location

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

- In areas, free from moisture and dust.
- Ambient temperature between 14°F (-10°C) to 104° F (40° C).
- In areas, free from oil, steam and corrosive gases.
- In areas, not subjected to abnormal vibration or shock.
- In areas, not exposed to direct sunlight or rain.
- Place at a distance of 12” (300mm) or more from walls or similar that could restrict natural air flow for cooling.

WARNING
ESAB advises that this equipment be electrically connected by a qualified electrician.

3.03 Electrical Input Connections

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 supply 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.

Refer to Figure 3-1:

1. Connect end of ground (GREEN or GREEN/YELLOW) conductor to a suitable ground. Use a grounding method that complies with all applicable electrical codes.
2. Connect ends of line 1 (BLACK) and line 2 (WHITE) input conductors to a de-energized line disconnect switch.
3. Use Table 3-1 as a guide to select line fuses for the disconnect switch.

Input Voltage	Circuit Breaker or Fuse Size
115V	30A
208-230V	50A

Table 3-1: Fuse Guide

CAUTION
The time-delay fuses or circuit breaker of an individual branch circuit may have nuisance tripping when welding with this product due to the amperage rating of the time-delay fuses or circuit breaker.

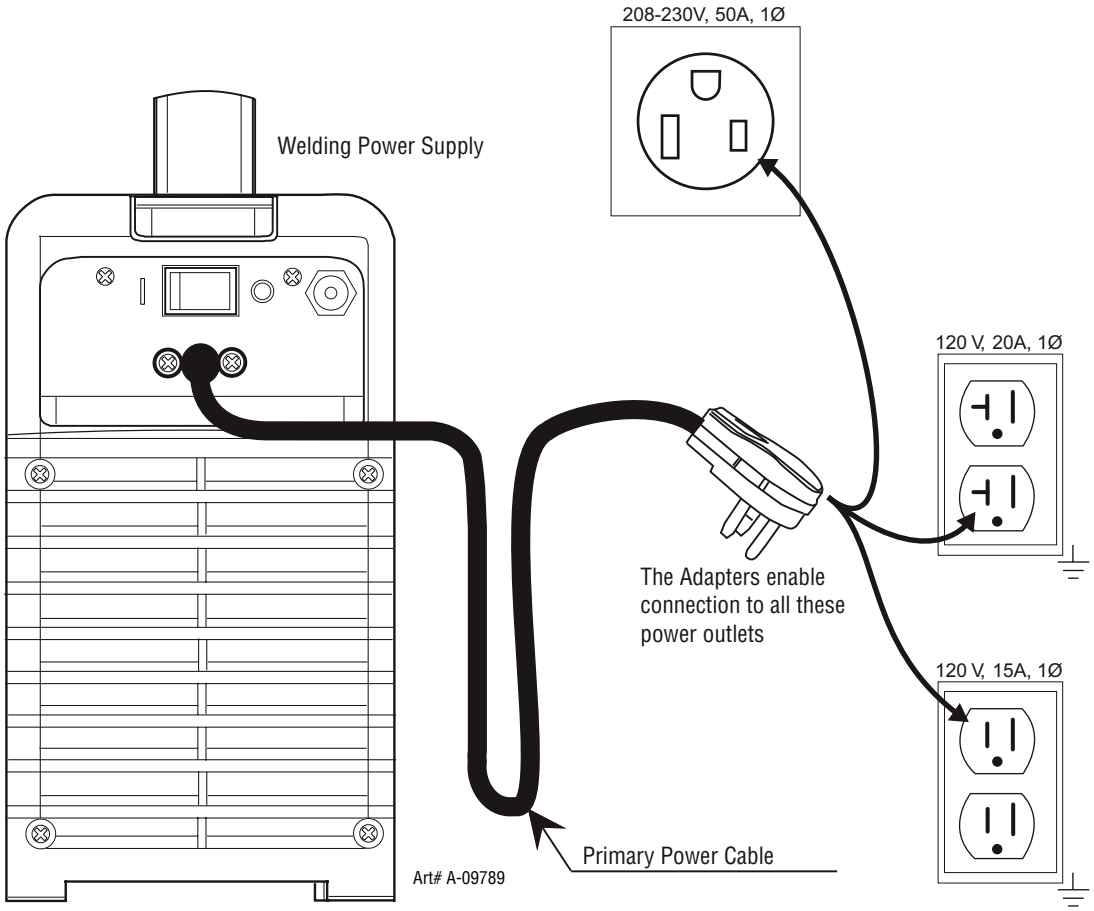


Figure 3-1: Electrical Input Connections

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 253 VAC or higher is applied to the Primary Power Cable.

Model	Primary Supply Lead Size (Factory Fitted)	Minimum Primary Current Circuit Size (Vin/Amps)	Current & Duty Cycle	
			LIFT TIG/ HF TIG (GTAW)	STICK (SMAW)
ET 201i DC	12 AWG (3.3mm²)	115V/30A	-	100A @ 45%
		115V/30A	150A @ 35%	-
		208-230V/25A	-	200A @ 20%
		208-230V/25A	200A @ 25%	-

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

3.04 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.

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

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

C. Methods of Reducing Electromagnetic Emissions

1. Mains Supply

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

2. Maintenance of Welding Equipment

   The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendation

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 Work Piece

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

6. Screening and Shielding

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

3.05 Setup for Welding

NOTE!
Conventional operating procedures apply when using the Welding Power Source, i.e. connect work lead directly to work piece and electrode lead is used to hold electrode. Wide safety margins provided by the design ensure that the Welding Power Source will withstand short-term overload without adverse effects. The welding current range values should be used as a guide only. Current delivered to the arc is dependent on the welding arc voltage, and as welding arc voltage varies between different classes of electrodes, welding current at any one setting would vary according to the type of electrode in use. The operator should use the welding current range values as a guide then fine tune the welding current to suit the application..

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

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

3.06 STICK (SMAW) Setup

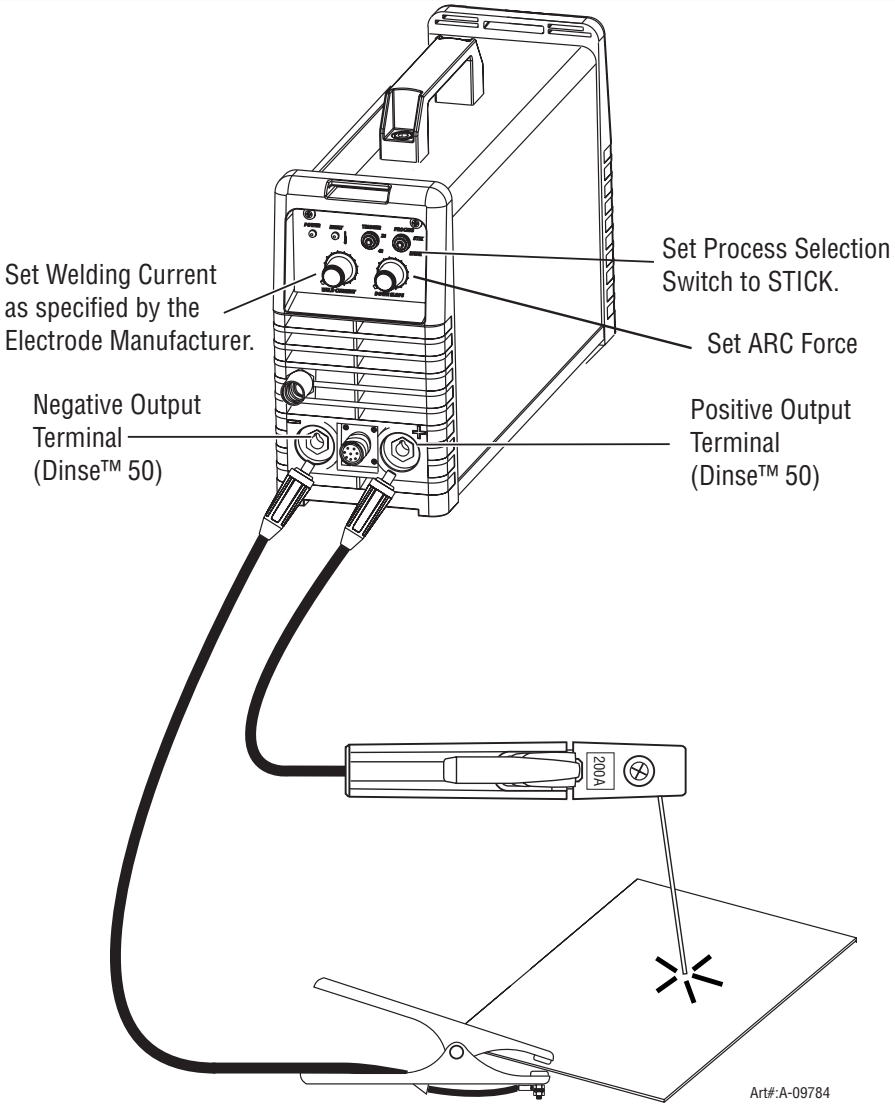


Figure 3-2: Setup for STICK (SMAW) Welding

STICK (SMAW) Mode Sequence of Operation

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

1. Switch the ON/OFF Switch (located on the rear panel) to OFF.
2. Connect the ground (work) clamp cable to the negative output terminal, and the electrode holder cable to the positive output terminal. It is essential that the male plug is inserted and turned fully clockwise until connector locks in place to achieve reliable electrical connection.

NOTE!
This set up is known as DC Electrode Positive or reverse polarity. Please consult with the stick electrode manufacturer for specific polarity recommendations.

3. Connect the ground (work) clamp to your workpiece.
4. Plug the power cable into the appropriate outlet, and turn the switch to the “ON” position. The power LED light should illuminate.
5. Set the “Process Selection Switch” to STICK.
6. Set the weld current control knob to the desired amperage.
7. Set the ARC FORCE control knob to 2.

   Minimum (0) provides a soft arc, low spatter & low penetration.

   Medium (2) provides a normal arc, improved fusion & normal penetration.

   Maximum (10) provides a hard arc & deep penetration.
8. Install a stick electrode in the electrode holder.
9. You are now ready to begin STICK Welding

NOTE!
Gently strike the electrode on the work piece to generate a welding arc, and slowly move along the work piece while holding a consistent arc length above base metal.

3.07 Victor Regulator

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

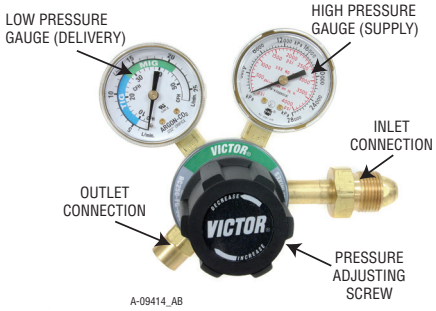


Figure 3-3: Victor CS Regulator

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

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

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

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

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

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

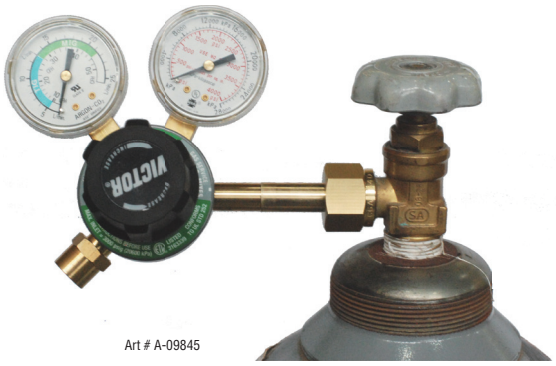


Figure 3-4: Regulator to Cylinder Valve

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

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

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

9. Slowly and carefully open the cylinder valve (Figure 3-5) until the maximum pressure shows on the high pressure gauge.

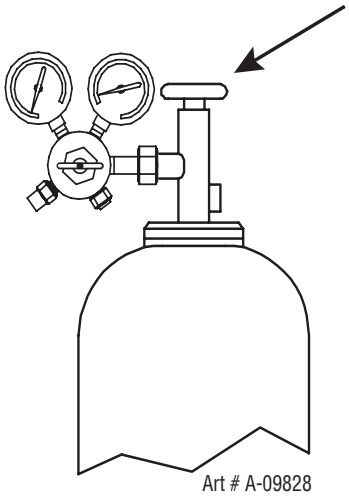


Figure 3-5: Open Cylinder Valve

10. On all cylinders, except acetylene, open the valve completely to seal the valve packing. On gaugeless regulators, the indicator will register the cylinder contents open.

11. On acetylene cylinders, open the valve 3/4 of a turn and no more than 1-1/2.

WARNING
Acetylene delivery pressure must not exceed 15 PSIG (103 kPa) or 30 PSIG (207 kPa). Acetylene can dissociate (decompose with explosive violence) above these pressure limits.

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

12. Attach the desired downstream equipment.

3.08 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 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 regulator seat.
   d) If the 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.

3.09 LIFT TIG (GTAW) Setup

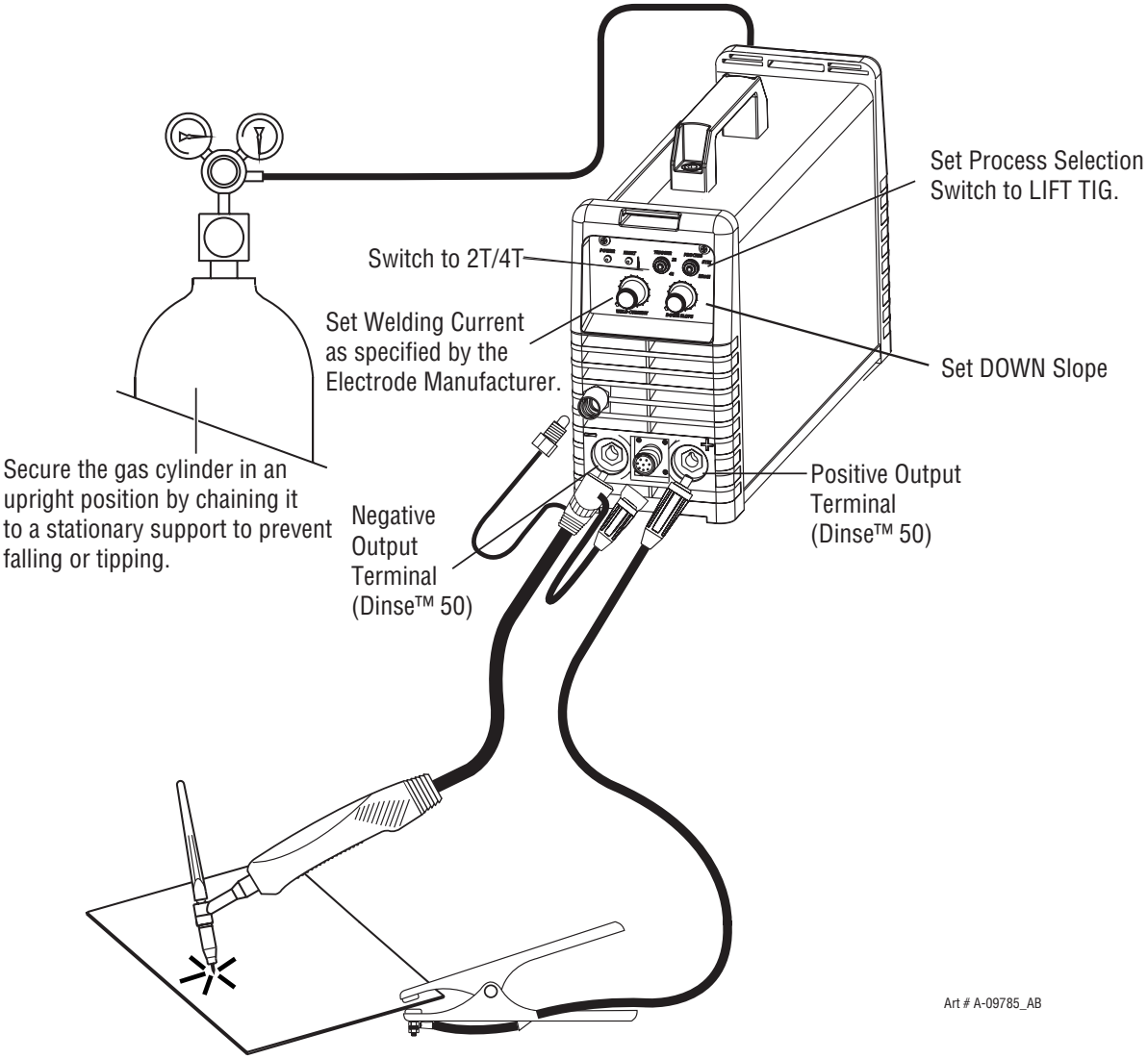


Figure 3-6: Setup for LIFT TIG (GTAW) Welding

LIFT TIG (GTAW) Sequence of Operation

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

1. Switch the ON/OFF Switch (located on the rear panel) to OFF.
2. Connect the ground (work) clamp cable to positive output terminal. It is essential that the male plug is inserted and turned fully clockwise until connector locks in place to achieve reliable electrical connection.
3. Connect the TIG torch as follows:
   a) Place the power cable into the negative output terminal. It is essential that the male plug is inserted and turned fully clockwise until connector locks in place to achieve reliable electrical connection;
   b) Place the 8 pin plug into the 8 pin socket. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.
   c) Place the TIG torch gas hose to the gas outlet and tighten with a wrench. Caution: DO NOT over tighten.
4. Using a secured Argon cylinder, slowly crack open then close the cylinder valve while standing off to the side of the valve. This will remove any debris that may be around the valve & regulator seat area.
5. Install the regulator (for details of VICTOR regulator, please refer to 3.07) and tighten with a wrench.
6. Connect one end of the supplied gas hose to the outlet of the Argon regulator and tighten with a wrench. Caution: DO NOT over tighten.
7. Connect the other end of the supplied gas hose to the gas inlet fitting on the rear panel of the welder and tighten with a wrench. Caution: DO NOT over tighten.
8. Open the Argon Cylinder Valve to the fully open position.
9. Connect the ground (work) clamp to your work piece.
10. Set the DOWN SLOPE control knob to the desire weld current ramp down time. Refer to Section 4.01.
11. Set the weld current control knob to the desired amperage.
12. The tungsten must be ground to a blunt point in order to achieve optimum welding results. It is critical to grind the tungsten electrode in the direction the grinding wheel is turning.
13. Install the tungsten with approximately 1/8" to ¼" sticking out from the gas cup, ensuring you have correct sized collet.
14. Tighten the back cap then open the valve on the torch.
15. Plug the power cable into the appropriate outlet, and turn the switch to the "ON" position. The power LED light should illuminate. Set the "Process Selection Switch" to LIFT TIG.
16. You are now ready to begin TIG Welding.

3.10 HF TIG (GTAW) Setup

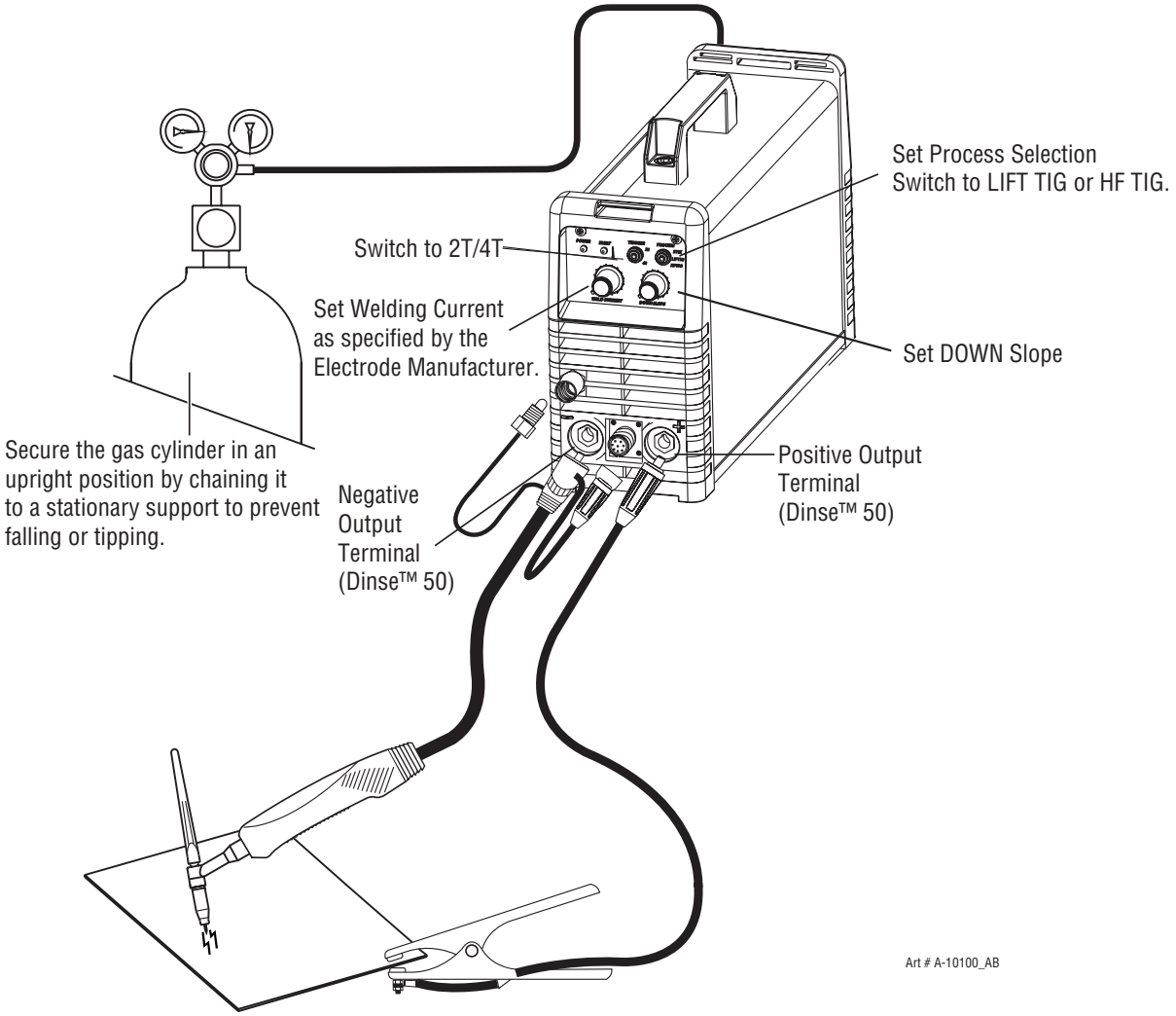


Figure 3-7: Setup for HF TIG (GTAW) Welding of ET 201i DC

HF TIG (GTAW) Sequence of Operation

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

1. Switch the ON/OFF Switch (located on the rear panel) to OFF.
2. Connect the ground (work) clamp cable to positive output terminal. It is essential that the male plug is inserted and turned fully clockwise until connector locks in place to achieve reliable electrical connection.
3. Connect the TIG torch as follows:
   a) Place the power cable into the negative output terminal. It is essential that the male plug is inserted and turned fully clockwise until connector locks in place to achieve reliable electrical connection;
   b) Place the 8 pin plug into the 8 pin socket. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.
   c) Place the TIG torch gas hose to the gas outlet and tighten with a wrench. Caution: DO NOT over tighten.
4. Using a secured Argon cylinder, slowly crack open then close the cylinder valve while standing off to the side of the valve. This will remove any debris that may be around the valve & regulator seat area.
5. Install the regulator (for details of VICTOR regulator, please refer to 3.07) and tighten with a wrench.
6. Connect one end of the supplied gas hose to the outlet of the Argon regulator and tighten with a wrench. Caution: DO NOT over tighten.
7. Connect the other end of the supplied gas hose to the gas inlet fitting on the rear panel of the welder and tighten with a wrench. Caution: DO NOT over tighten.
8. Open the Argon Cylinder Valve to the fully open position.
9. Connect the ground (work) clamp to your work piece.
10. Set the DOWN SLOPE control knob to the desire weld current ramp down time. Refer to Section 4.01.
11. Set the weld current control knob to the desired amperage.
12. The tungsten must be ground to a blunt point in order to achieve optimum welding results. It is critical to grind the tungsten electrode in the direction the grinding wheel is turning.
13. Install the tungsten with approximately 1/8” to ¼” sticking out from the gas cup, ensuring you have correct sized collet.
14. Tighten the back cap then open the valve on the torch.
15. Plug the power cable into the appropriate outlet, and turn the switch to the “ON” position. The power LED light should illuminate. Set the “Process Selection Switch” to HF TIG
16. You are now ready to begin HF TIG Welding.

3.11 When You Finish Using the 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.

3.12 Storage of the 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.

SECTION 4:
OPERATION

4.01 Instruction

Conventional operating procedures apply when using the Welding Power Source, i.e. connect work lead directly to work piece and electrode lead is used to hold the electrode. The welding current range values should be used as a guide only. Current delivered to the arc is dependent on the welding arc voltage, and as welding arc voltage varies between different classes of electrode, welding current at any one setting would vary according to the type of electrode in use. The operator should use the welding current range values as a guide then fine tune the welding current to suit the specific application. Refer to the electrode manufacture's literature for further information.

4.02 Front Panel

Front Panel

The welding power source is protected by a self re-setting thermostat. The indicator will illuminate if the duty cycle of the power source has been exceeded. If the FAULT light illuminates wait for the FAULT light to extinguish before resuming welding.

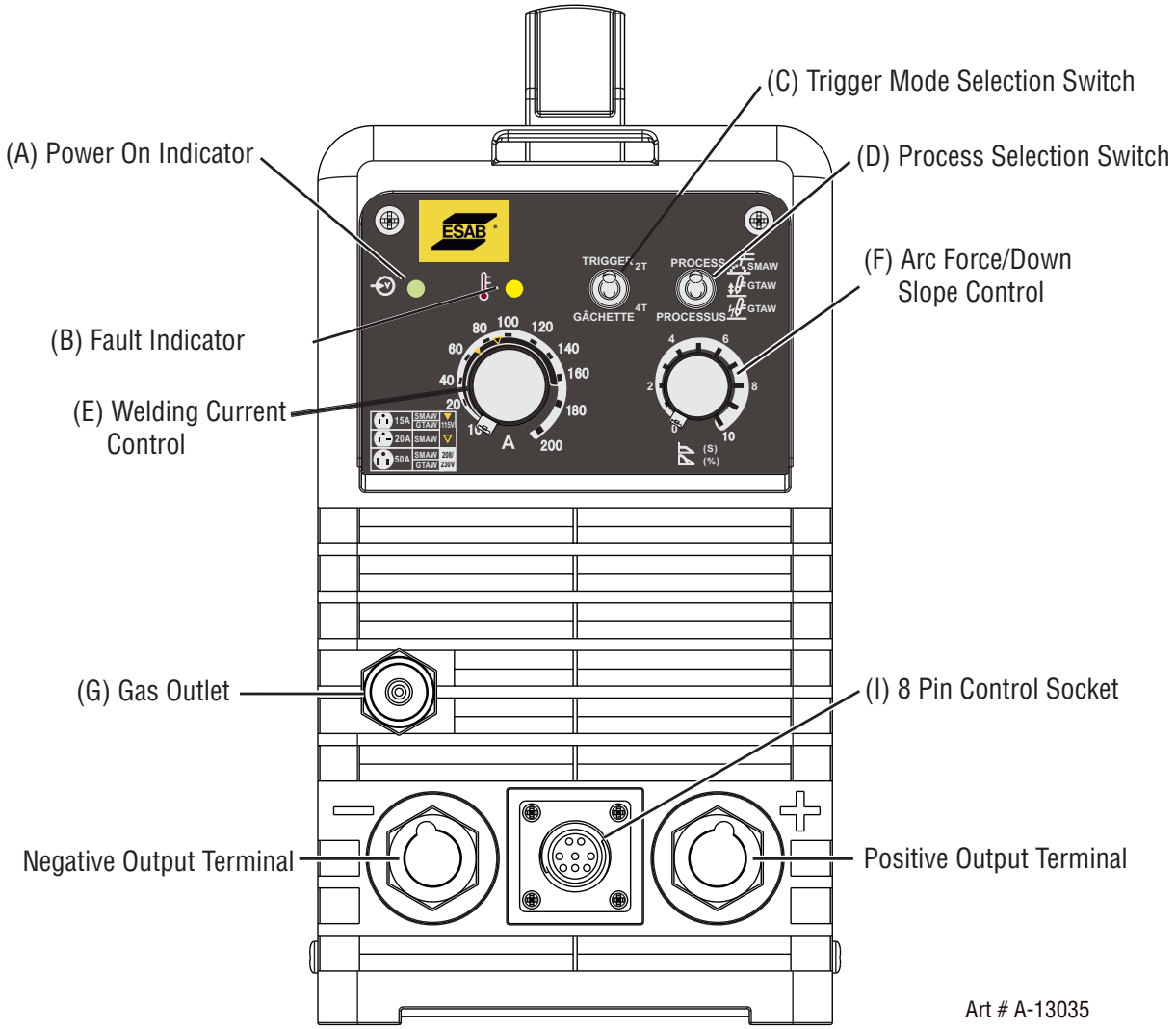


Figure 4-1: ET 201i DC Controls

A. POWER Indicator

The POWER Indicator illuminates when the ON/OFF switch is in the ON position and the correct mains voltage is present.

B. FAULT Indicator

If Fault indicator lights up continuously then that is an Overcurrent Condition and needs to be serviced by an Authorized ESAB Technician.

C. TRIGGER Mode Switch (LIFT TIG Mode Only)

2T (Normal) Mode

Press the TIG Torch Trigger Switch or Foot Control and hold depressed to weld. Release the TIG Torch Trigger Switch or Foot Control to stop welding. Down Slope operates in LIFT TIG/HF TIG (GTAW) mode only. While welding if the TIG Torch Trigger Switch is released, the welding current ramps down to zero current over a defined period of time. The time period is determined by the Down Slope Control Knob (F).

4T (Latch) Mode

This mode of welding is mainly used for long weld runs. The operator need only to press the TIG Torch Trigger Switch to activate and then release the TIG Torch Trigger Switch to continue to weld, then press the TIG Torch Trigger Switch again and release the TIG Torch Trigger Switch to stop welding. This eliminates the need for the operator to depress the TIG Torch Trigger Switch for the complete length of the weld. The 4T mode incorporates a current slope function which includes a fixed current up slope of 1 second and an adjustable current down slope. Current slope operates in TIG Mode only. Up Slope is not adjustable and activates automatically in 4T mode when the TIG torch trigger is depressed. To activate the Down Slope function in 4T mode while welding, the TIG Torch Trigger Switch must be depressed and held while welding which will ramp the Welding Current down to zero over a defined period of time. The time period is determined by the Down Slope Control Knob (F). At any time while welding if the TIG Torch Trigger Switch is depressed and released the arc will extinguish immediately.

D. Process Selection Switch-

Switches between STICK (SMAW), LIFT TIG (GTAW) and HF TIG (GTAW) modes. Refer to Section 3.06 Setup for STICK (SMAW) Welding, 3.07 Setup for LIFT TIG (GTAW)Welding and 3.08 Setup for HF TIG (GTAW)Welding.

E. Welding Current Control

The welding current is increased by turning the Weld Current Control Knob clockwise or decreased by turning the Weld Current Control Knob counterclockwise. The welding current should be set according to the specific application. Refer to application notes in this section for further information.

F. Arc Force/Down Slope Control

Arc Force is effective when in STICK (SMAW) Mode only. Arc Force control provides an adjustable amount of Arc 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. Down Slope operates in TIG mode only. It is used to set the time for weld current to ramp down. Refer to Item C (Trigger Mode Selection Switch) for further information regarding Downslope operation.

G. Gas Outlet

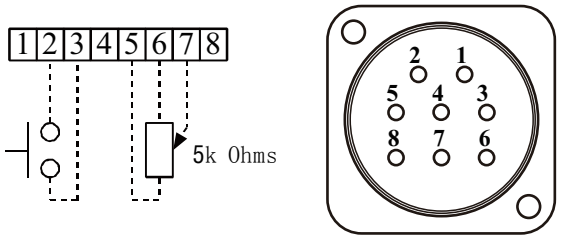
The Gas Outlet is a 5/8”-18 UNF female gas fitting and is utilized for the connection of a suitable TIG Torch.

H. Post Gas Flow (weld current dependant)

Post Gas Flow is the time Gas flows after the arc has extinguished. The gas flow time is proportional to weld current. This is used to cool and reduce oxidization of the Tungsten Electrode. For example if the Welding Current is set to 10 amps the Post Gas Flow time will be approximately 3 seconds. For a Welding Current set to 160 Amps the Post Gas Flow time will be approximately 10 seconds. The Post Gas Flow time cannot be adjusted independently of the Welding Current.

I. 8 Pin Remote Socket

The 8 pin remote socket is used to connect the TIG Torch Trigger Switch to the welding Power Source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.



Front View of 8 Pin Socket

Art # A-09815_AB

Plug Pin	Function
1	
2	Torch Switch Input (24V) to energize weld current. (connect pin 2&3 to turn on welding current)
3	Torch Switch Input (0V) to energize weld current. (connect pin 2&3 to turn on welding current)
4	
5	5k ohm (maximum) connection to 5k ohm remote control potentiometer
6	Zero ohm (minimum) connection to 5k ohm remote control potentiometer
7	Wiper arm connection to 5k ohm remote control potentiometer
8	

NOTE!
Remote Welding Current Control is available through the front panel of this unit. The remote will only go to the maximum value that is set at the panel. If the panel is set to 100 amps, the remote can't go above 100 amps when fully adjusted.

J. ON/OFF Switch (located on rear panel not shown)

This switch controls the Mains Supply Voltage to the Power Source.

4.03 Welding Current Control Explanation

15 Amp Outlet

The mains power 15 Amp circuit breaker or fuse should not trip at this Weld Current value when STICK welding.

The environmental conditions that may cause the mains power 15 Amp circuit breaker or fuse to trip are:

a) High ambient temperature

b) Worn parts in circuit breaker

c) Using an extension cable

d) Low line mains power voltage

20 Amp Outlet

The mains power 20 Amp circuit breaker or fuse should not trip at this Weld Current value when STICK welding.

The environmental conditions that may cause the mains power 20 Amp circuit breaker or fuse to trip are:

a) High ambient temperature

b) Worn parts in circuit breaker

c) Using an extension cable

d) Low line mains power voltage

Output Scale for 115V

The inside number scale identifies the available output weld current for STICK or LIFT TIG weld modes.

STICK Mode: ▼ Identifies the STICK weld point for 15 Amp outlet.

▼ Identifies the STICK weld point for 20 Amp outlet.

Exceeding these points will cause nuisance tripping of the circuit breaker or fuse.

LIFT TIG Mode/HF Mode: A 15 Amp outlet is capable of supplying enough input power for all TIG (GTAW) output weld current values.

NOTE!
Nuisance tripping should not occur on a 15 Amp outlet.

Output Scale for 208/230V

The outside number scale identifies the available output weld current for STICK or LIFT TIG/HF TIG weld modes.

Nuisance tripping should not occur on a 50A 208/230V outlet for both STICK & LIFT TIG/HF TIG Modes.

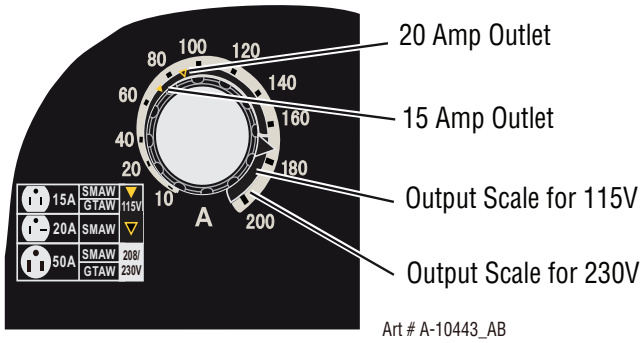


Figure 4-2: Current Control for ET 201iDC

4.04 STICK (SMAW) Electrode Polarity

Stick electrodes are generally connected to the "+" Positive Output Terminal and the work lead to the "–" Negative Output Terminal but if in doubt consult the electrode manufacturers literature for further information.

4.05 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 gen-

eral work. These include some low hydrogen types for high tensile steel, cellulose types for welding large diameter pipes, etc The range of electrodes dealt with in this publication will cover the vast majority of applications likely to be encountered; are all easy to use.

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

4.06 GTAW Electrode Polarity

Connect the TIG torch to the "-" Negative Output Terminal and the work lead to the "+" Positive Output Terminal for direct current straight polarity. Direct current straight polarity is the most widely used polarity for DC TIG welding. It allows limited wear of the electrode since 70% of the heat is concentrated at the work piece.

4.07 Guide for Selecting Filler Wire

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

4.08 Tungsten Electrode Current Ranges

Electrode Diameter	DC Current
.040” (1.0mm)	25 - 85
1/16” (1.6mm)	50 - 160
3/32” (2.4mm)	135 - 235

4.09 Shielding Gas Selection

Alloy	Shielding Gas
Carbon Steel	Welding Argon
Stainless Steel	Welding Argon
Nickel Alloy	Welding Argon
Copper	Welding Argon
Titanium	Welding Argon

4.10 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
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

4.11 TIG Welding Parameters for Steel

Base Metal Thickness	DC Current		Electrode Diameter	Filler Rod Diameter	Argon Gas Flow Rate	Joint / Type
	Mild Steel	Stainless Steel				
0.040" (1.0mm)	35-45	20-30	0.040" (1.0mm)	1/16" (1.6mm)	10 CFH (5 LPM)	Butt/Corner
	40-50	25-35				Lap/Filler
0.045" (1.22mm)	45-55	30-45	0.040" (1.0mm)	1/16" (1.6mm)	13 CFH (6 LPM)	Butt/Corner
	50-60	35-50				Lap/Filler
1/16" (1.6mm)	60-70	40-60	1/16" (1.6mm)	1/16" (1.6mm)	15 CFH (7 LPM)	Butt/Corner
	70-90	50-70				Lap/Filler
1/8" (3.2mm)	80-100	65-85	1/16" (1.16mm)	3/32" (2.4mm)	15CFH (7 LPM)	Butt/Corner
	90-115	90-110				Lap/Filler
3/16" (4.8mm)	115-135	100-125	3/32" (2.4mm)	1/8" (3.2mm)	21CFH (10 LPM)	Butt/Corner
	140-165	125-150				Lap/Filler
1/4" (6.4mm)	160-175	135-160	1/8" (3.2mm)	5/32" (4.0mm)	21CFH (10 LPM)	Butt/Corner
	170-200	160-180				Lap/Filler

4.12 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.

4.13 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 4-3 through 4-10.

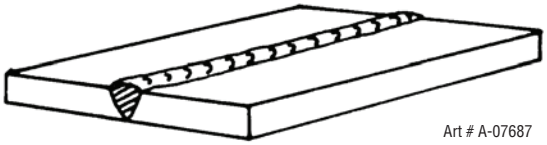


Figure 4-3: Flat position, down hand butt weld

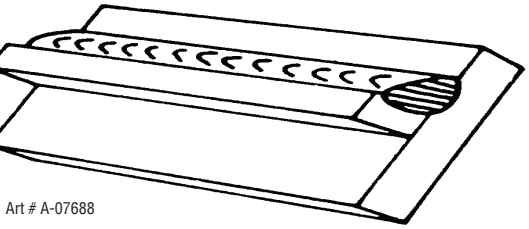


Figure 4-4: Flat position, gravity fillet weld

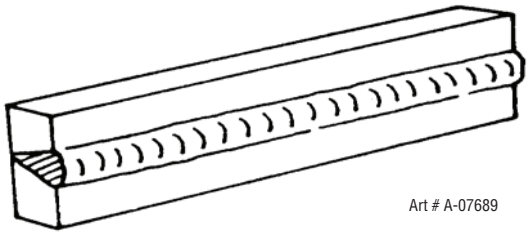


Figure 4-5: Horizontal position, butt weld

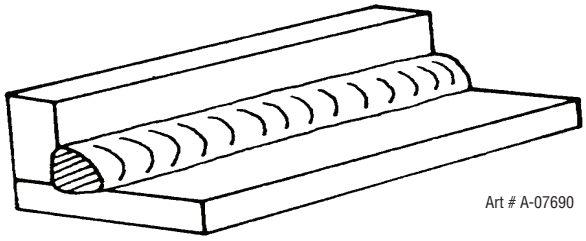


Figure 4-6: Horizontal - Vertical (HV) position

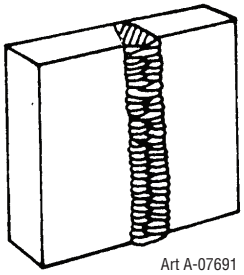


Figure 4-7: Vertical position, butt weld

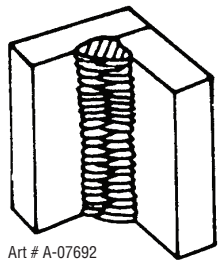


Figure 4-8: Vertical position, fillet weld

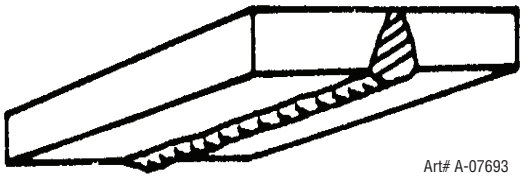


Figure 4-9: Overhead position, butt weld

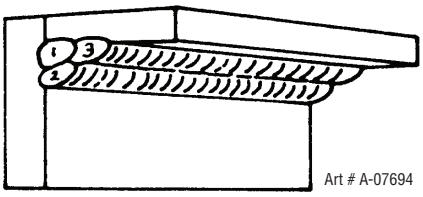


Figure 4-10: Overhead position, fillet weld

4.14 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 4-11.

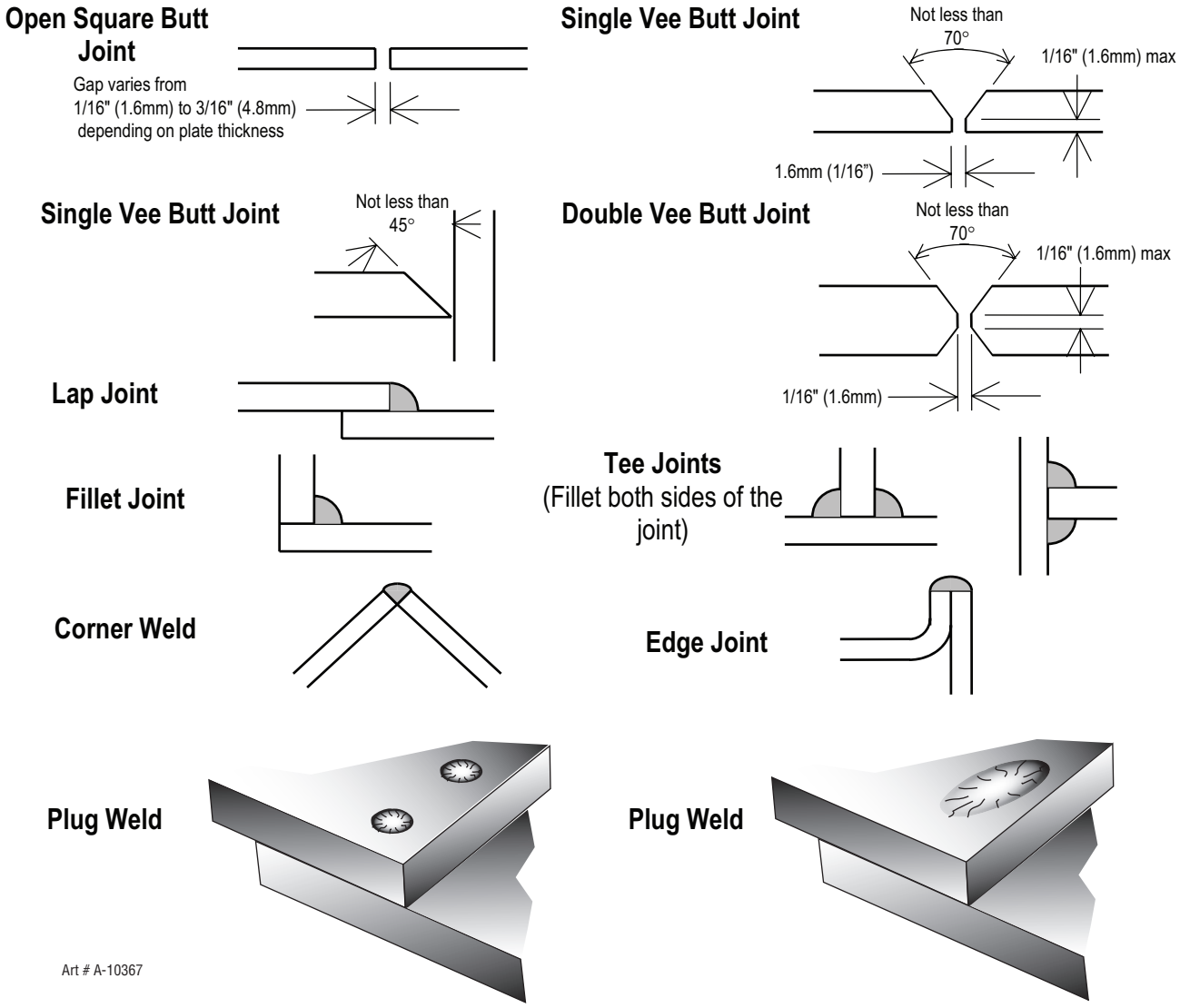


Figure 4-11: Typical joint designs for arc welding

4.15 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.

4.16 The Welder

Place yourself in a comfortable position before beginning to weld. Get a seat of suitable height and do as much work as possible sitting down. Don't hold your body tense. A taut attitude of mind and a tensed body will soon make you feel tired. Relax and you will find that the job becomes much easier. You can add much to your peace of mind by wearing a leather apron and gauntlets. You won't be worrying then about being burnt or sparks setting alight to your clothes.

Place the work so that the direction of welding is across, rather than to or from, your body. The electrode holder lead should be clear of any obstruction so that you can move your arm freely along as the electrode burns down. If the lead is slung over your shoulder, it allows greater freedom of movement and takes a lot of weight off your hand. Be sure the insulation on your cable and electrode holder is not faulty, otherwise you are risking an electric shock.

4.17 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.

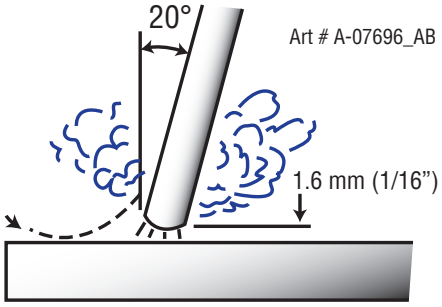


Figure 4-12: Striking an arc

4.18 Arc Length

The securing of an arc length necessary to produce a neat weld soon becomes almost automatic. You will find that 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 electrode do not stick in this way, and make welding much easier.

4.19 Rate of Travel

After the arc is struck, your next concern is to maintain it, and this requires moving the electrode tip towards the molten pool at the same rate as it is melting away. At the same time, the electrode has to move along the plate to form a bead. The electrode is directed at the weld pool at about 20° 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.

4.20 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 4-13, 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 70° to 90° included angle. This allows full penetration of the weld metal to the root. Using a 1/8" (3.2mm) E7014 electrode at 120 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 20° 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.

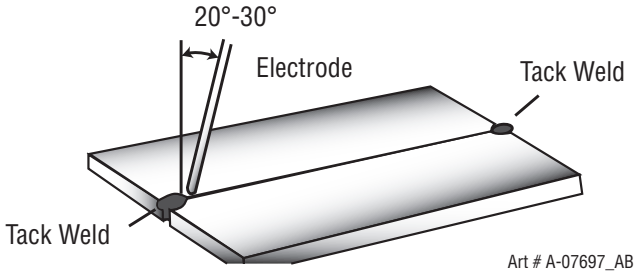


Figure 4-13: Butt weld

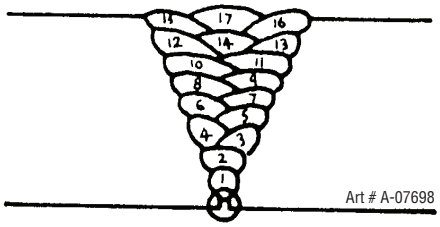


Figure 4-14: Weld build up sequence

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 4-14. 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 4-6.

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 electrode at 120 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 45° from the vertical. Some electrodes require to be sloped about 20° away from the perpendicular position to prevent slag from running ahead of the weld. Refer to Figure 4-15. 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 4-16. Weaving in HV fillet welds is undesirable.

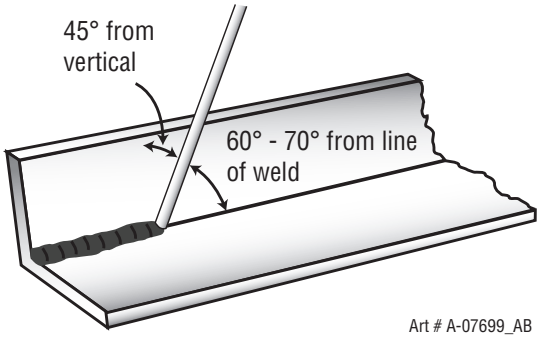


Figure 4-15: Electrode position for HV fillet weld

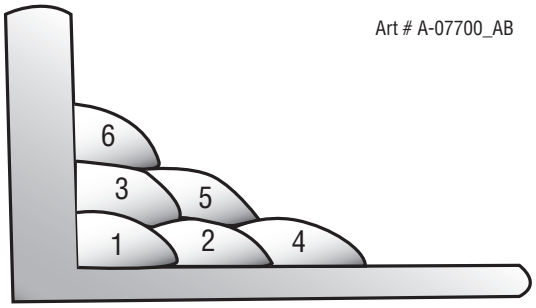


Figure 4-16: Multi-runs in HV fillet weld

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 electrode and set the current at 120 amps. Make yourself comfortable on a seat in front of the job and strike the arc in the corner of the fillet. The electrode needs to be about 10° from the horizontal to enable a good bead to be deposited. Refer Figure 4-17. 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 4-18 illustrates multi-run technique and Figure 4-19 shows the effects of pausing at the edge of weave and of weaving too rapidly.

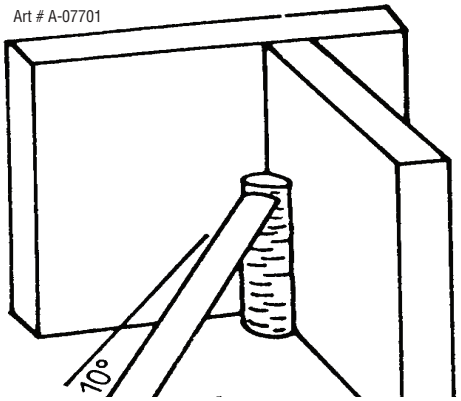


Figure 4-17: Single run vertical fillet weld

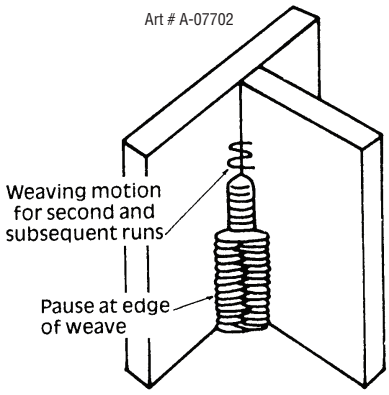


Figure 4-18: Multi run vertical fillet weld

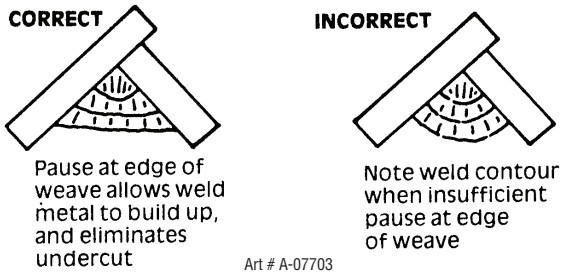


Figure 4-19: Examples of vertical fillet welds

2. Vertical Down

The E7014 electrode makes welding in this position particularly easy. Use a 1/8" (3.2mm) electrode at 120 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 45°.

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 45° to the horizontal and tilted 10° in the line of travel (Figure 4-20). 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) E6012 electrode at 120 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.

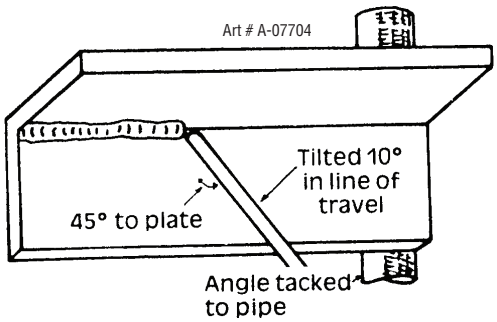


Figure 4-20: Overhead fillet weld

4.21 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.

4.22 The Cause of Distortion

Distortion is cause 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 his 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 4-21 and 4- 22 illustrate how distortion is created.

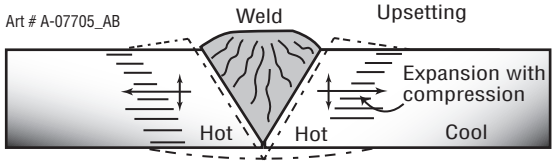


Figure 4-21: Parent metal expansion

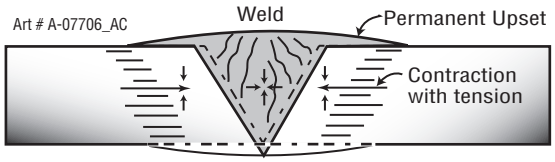


Figure 4-22: Parent metal contraction

4.23 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 4-26 through 4-29 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 4-23.

E. Preheating

Suitable preheating of parts of the structure other than the area to be welded can be sometimes used to reduce distortion. Figure 4-24 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.

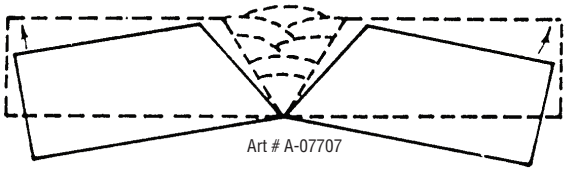
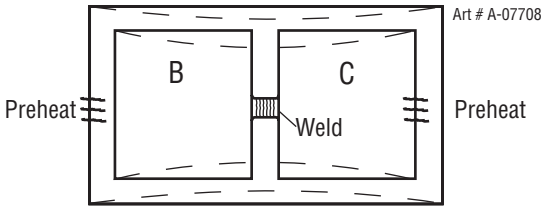


Figure 4-23: Principle of presetting



Dotted lines show effect if no preheat is used

Figure 4-24: Reduction of distortion by preheating

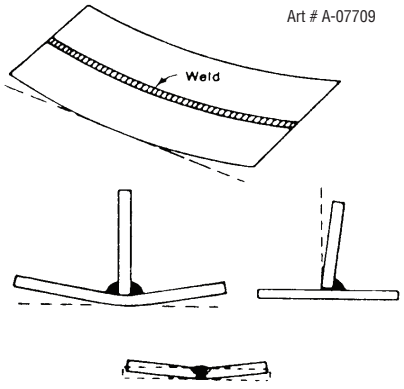
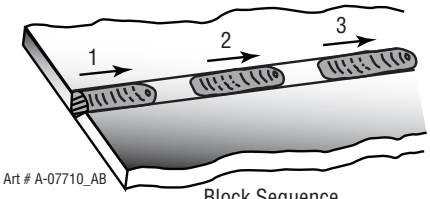


Figure 4-25: Examples of distortion



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

Figure 4-26: Welding sequence

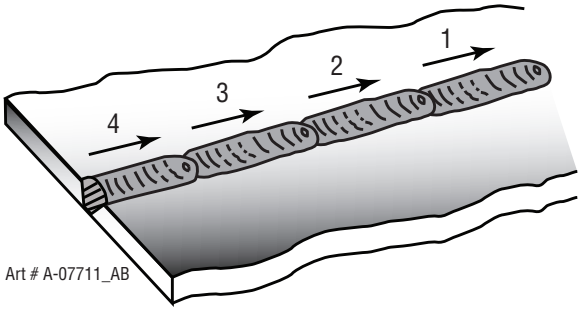


Figure 4-27: Step back sequence

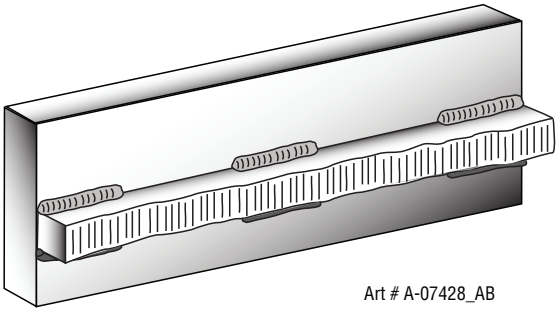


Figure 4-28: Chain intermittent welding

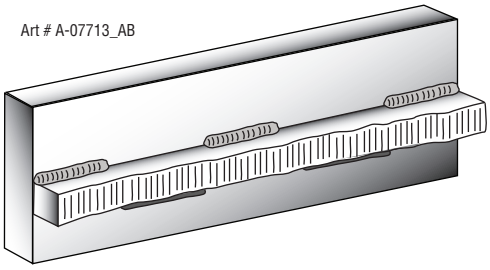


Figure 4-29: Staggered intermittent welding

This Page Intentionally Blank

SECTION 5: SERVICE

5.01 Maintenance and Inspection

The only routine maintenance required for the power supply is a thorough cleaning and inspection, with the frequency depending on the usage and the operating environment.

WARNING
There are extremely dangerous voltages and power levels present inside this product. Disconnect primary power at the source before opening the enclosure. Wait at least two minutes before opening the enclosure to allow the primary capacitors to discharge.

To clean the unit, open the enclosure and use a vacuum cleaner to remove any accumulated dirt and dust. The unit should also be wiped clean, if necessary; with solvents that are recommended for cleaning electrical apparatus.

CAUTION
Do not blow air into the power supply during cleaning. Blowing air into the unit can cause metal particles to interfere with sensitive electrical components and cause damage to the unit.

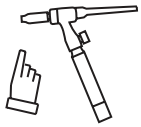
Warning!
Disconnect input power before maintaining.

Maintain more often if used under severe conditions

Each Use

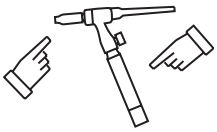
Visual check of regulator and pressure

Visual check of torch Consumable parts

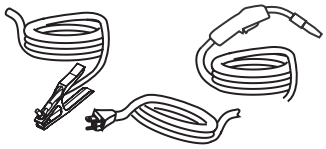


Week ly

Visually inspect the torch body and consumables

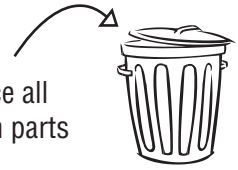


Visually inspect the cables and leads. Replace as needed

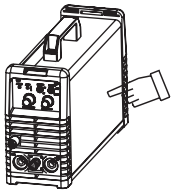


3 Months

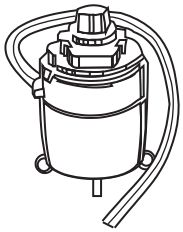
Replace all broken parts



Clean exterior of power supply

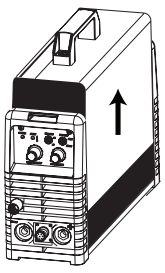


6 Months

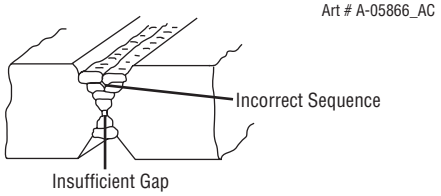
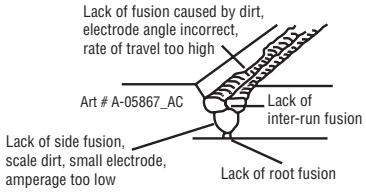
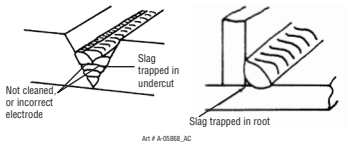


Art # A-13036

Bring the unit to an authorized ESAB Service Center to remove any accumulated dirt and dust from the interior. This may need to be done more frequently under exceptionally dirty conditions.



5.02 STICK (SMAW) Welding Problems

Description	Possible Cause	Remedy
1. Gas pockets or voids in weld metal (Porosity).	A. Electrodes are damp. B. Welding current is too high. C. Surface impurities such as oil, grease, paint, etc.	A. Dry electrodes before use. B. Reduce welding current. C. Clean joint before welding
2. Crack occurring in weld metal soon after solidification commences.	A. Rigidity of joint. B. Insufficient throat thickness. C. Cooling rate is too high.	A. Redesign to relieve weld joint of severe stresses or use crack resistance electrodes. B. Travel slightly slower to allow greater build up in throat. C. Preheat plate and cool slowly.
3. A gap is left by failure of the weld metal to fill the root of the weld. Art # A-05866_AC  	A. Welding current is too low. B. Electrode too large for joint. C. Insufficient gap. D. Incorrect sequence.	A. Increase welding current B. Use smaller diameter electrode. C. Allow wider gap. D. Use correct build-up sequence.
4. 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. B. Welding current is too low. C. Wrong electrode angle. D. Travel speed of electrode is too high. E. Scale or dirt on joint surface.	A. Use larger electrodes and preheat the plate. B. Increase welding current C. Adjust angle so the welding arc is directed more into the base metal D. Reduce travel speed of electrode E. Clean surface before welding.
5. Non-metallic particles are trapped in the weld metal (slag inclusion).  	A. Non-metallic particles may be trapped in undercut from previous run. B. Joint preparation too restricted. C. Irregular deposits allow slag to be trapped. D. Lack of penetration with slag trapped beneath weld bead. E. Rust or mill scale is preventing full fusion. F. Wrong electrode for position in which welding is done.	A. If bad undercut is present, clean slag out and cover with a run from a smaller diameter electrode. B. Allow for adequate penetration and room for cleaning out the slag. C. If very bad, chip or grind out irregularities. D. Use smaller electrode with sufficient current to give adequate penetration. Use suitable tools to remove all slag from corners. E. Clean joint before welding. F. Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.

5.03 TIG Welding Problems

Weld quality is dependent on the selection of the correct consumables, maintenance of equipment and proper welding technique.

Description	Possible 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 change 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 welding 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 is too slow.	Increase travel speed.
5. Uneven leg length in fillet joint.	Wrong placement of filler rod.	Re-position filler rod.
6. Electrode melts when arc is struck.	Electrode is connected to the "+" Positive Output Terminal.	Connect the electrode to the "-" Negative Output Terminal.
7. Dirty weld pool.	A. Electrode contaminated through contact with work piece or filler rod material. B. Gas contaminated with air.	A. Clean the electrode by grinding contaminates off. B. 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 problems
9. Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the right size electrode. Refer to section Tungsten Electrode Current Ranges.
10. Welding arc cannot be established.	A. Work clamp is not connected to the work piece or the work/torch leads are not connected to the correct welding terminals. B. Torch lead is disconnected. C. Gas flow incorrectly set, cylinder empty or the torch valve is off.	A. Connect the work clamp to the work piece or connect the work/torch leads to the correct welding terminals. B. Connect it to the "-" Negative Output Terminal. C. Select the right flow rate, change cylinder or turn torch valve on.
11. Electrode melts or oxidizes when an arc is struck.	A. No gas is flowing to welding region. B. Torch is clogged with dust. C. Gas hose is cut. D. Gas passage contains impurities. E. Gas regulator turned off. F. Torch valve is turned off. G. The electrode is too small for the welding current.	A. Check the gas lines for kinks or breaks or cylinder contains gas. B. Clean torch. C. Replace gas hose. D. Disconnect gas hose from torch then raise gas pressure and blow out impurities. E. Turn on. F. Turn on. G. Increase electrode diameter or reduce the welding current.

TIG Welding Problems (Continued)

Description	Possible Cause	Remedy
12. Arc start is not smooth.	A. Tungsten electrode is too large for the welding current. B. The wrong electrode is being used for the welding job. C. Gas flow rate is too high. D. Incorrect shield gas is being used. E. Poor work clamp connection to work piece.	A. Refer to section Tungsten Electrode Current Ranges for the correct size. B. Refer to section Tungsten Electrode Types for the correct electrode type. C. Select the correct flow rate for the welding job. D. Use 100% argon for TIG welding. E. Improve connection to work piece.

WARNING
There are extremely dangerous voltages and power levels present inside this product. Do not attempt to repair unless you are an Accredited ESAB Service Agent and you have had training in power measurements and troubleshooting techniques. If major complex subassemblies are faulty, then the Welding Power Source must be returned to an Accredited ESAB Service Agent for repair.

5.04 Power Source Problems

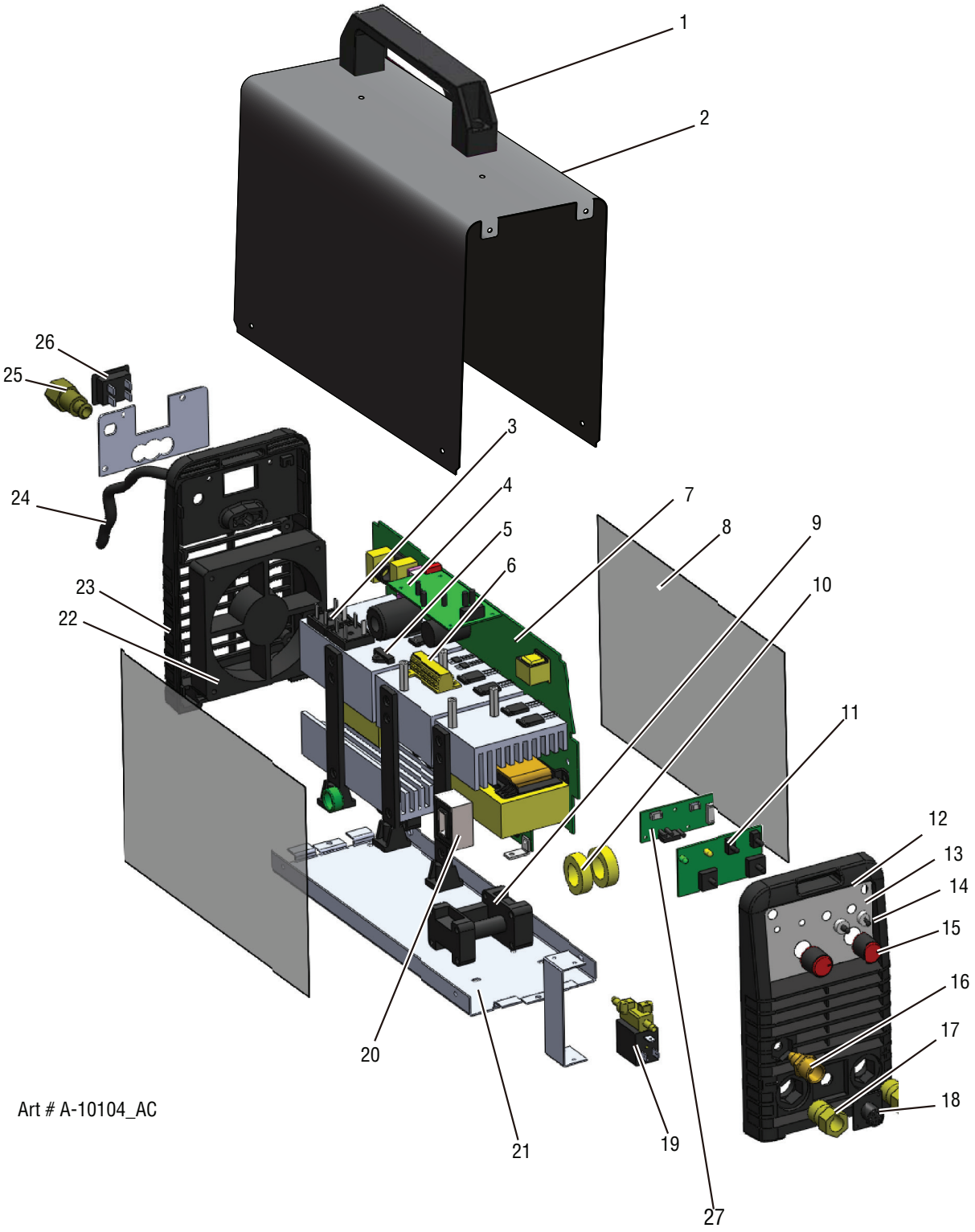
Description	Possible Cause	Remedy
1. The welding arc cannot be established.	A. The Primary supply voltage has not been switched ON. B. The Welding Power Source switch is switched OFF. C. Loose connections internally.	A. Switch ON the Primary supply voltage. B. Switch ON the Welding Power Source. C. Have an Accredited ESAB Service Provider repair the connection.
2. The welding arc cannot be established when the Warning Indicator lights up continuously	The machines duty cycle has been exceeded	Wait for the Warning Indicator to extinguish before resuming welding
3. Maximum output welding current cannot be achieved with nominal Mains supply voltage.	Defective control circuit	Have an Accredited ESAB Service Provider inspect then repair the welder.
4. Welding current reduces when welding.	Poor work lead connection to the work piece.	Ensure that the work lead has a positive electrical connection to the work piece.
5. Circuit breaker (or fuse) trips during welding.	The circuit breaker (or fuse) is under size.	The recommended circuit breaker (or fuse) size is 30 amp. An individual branch circuit capable of carrying 30 amperes and protected by fuses or circuit breaker is recommended for this application.
6. The welding arc cannot be established when Fault Indicator is flashing.	The input current to the main transformer has been exceeded.	Have an Accredited ESAB Service Provider inspect then repair the welder.

SECTION 6:
KEY SPARE PARTS

6.01 Replacement Parts

Item No	Description	Part No.	Reference Designator
1	Handle	W7003040	
2	Panel, Cover	W7003200	
3	Rectifier 1000V,50A	W7003010	
4	PCB, Control	W7003222	PCB2
5	Thermostat	W7003016	THC1, THC2
6	Resistor,4 ohm,60W	W7003055	R1
7	PCB, Power	W7003230	PCB1
8	Insulation Sheet	W7003214	
9	Points, HF Starter	W7003034	
10	Output Inductor Magnetic Core	W7003210	
11	Front Control PCB3	W7003218	PCB3
12	Front Panel	W7003205	
13	Front Panel Label CSA	W7003231	
14	Rubber Boot	W7003064	
15	Knob, Control, Red, 21 ODx6 ID	W7003079	
16	Connector,Gas Outlet	W7003212	
17	Output Terminal, 50mm dinse	W7003020	
18	Socket,8 Pin,Cable	W7003220	
19	Gas Solenoid	W7003033	
20	Current Sensor	W7003076	Current Sensor
21	Base Panel	W7003209	
22	Fan,24V DC	W7003090	
23	Rear Panel	W7003227	
24	Cable Cord,12AWG,10ft,6-50P CSA	W7003228	
25	Connector,Gas Inlet	W7003215	
26	ON/OFF Switch	W7003053	SW1
27	PCB, Remote	W7003221	PCB4

WARNING
There are extremely dangerous voltages and power levels present inside this product. Do not attempt to repair unless you are an Accredited ESAB Service Agent and you have had training in power measurements and troubleshooting techniques. If major complex subassemblies are faulty, then the Welding Power Source must be returned to an Accredited ESAB Service Agent for repair.

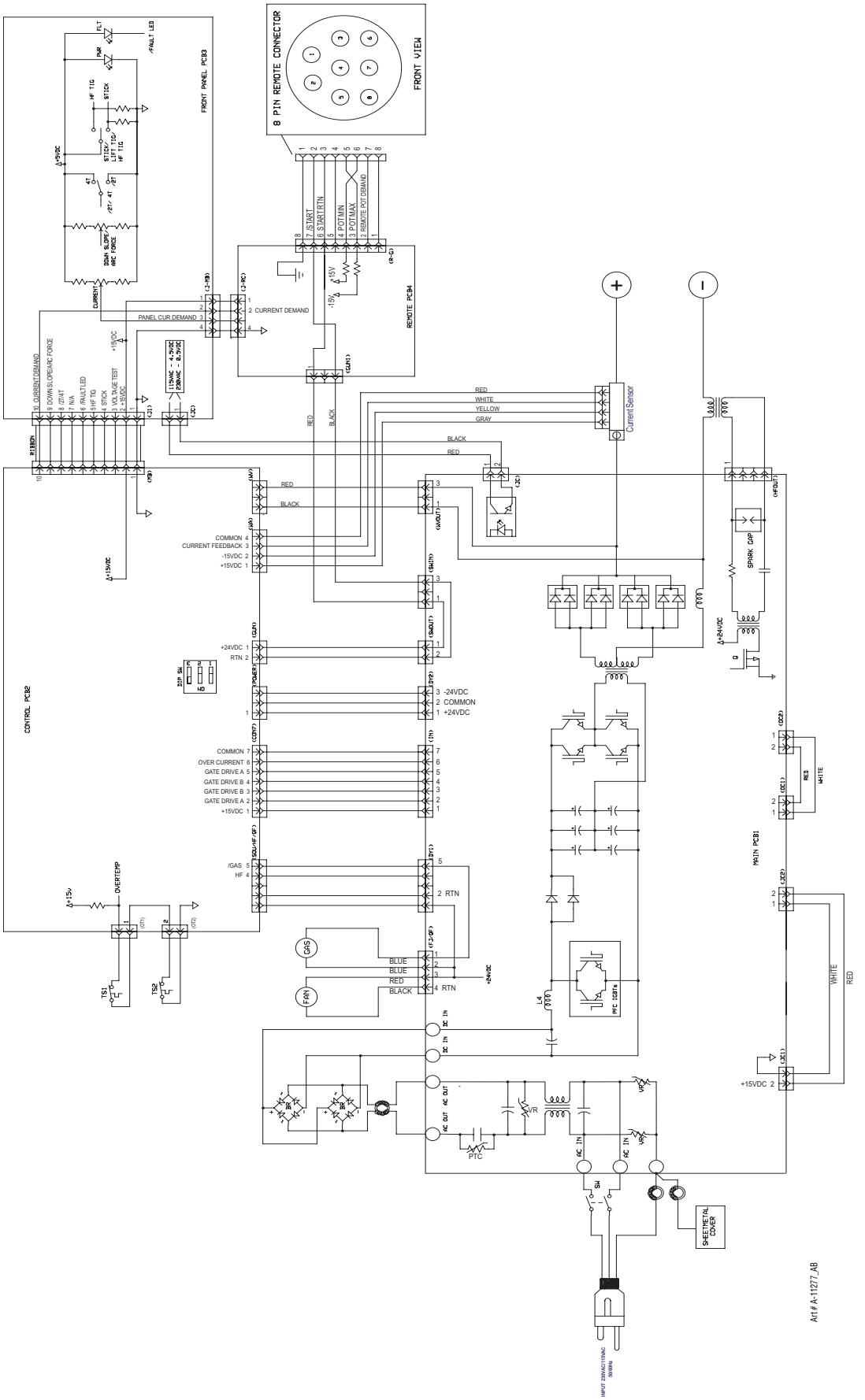


Art # A-10104_AC

APPENDIX 1: OPTIONS AND ACCESSORIES

Description	Part Number
17 style TIG Torch with 12.5ft lead, finger remote control, 50mm dinse connection and accessory kit with 1/16", 3/32", 1/8" thoriated tungstens; 1/16", 3/32", 1/8" collets; 1/16", 3/32", 1/8" collet bodies; No.5, 6, 7 Alumina nozzle; short back cap; long back cap	W4012701
26 style TIG Torch with 12.5ft lead, finger remote control, 50mm dinse connection and accessory kit with 1/16", 3/32", 1/8" thoriated tungstens; 1/16", 3/32", 1/8" collets; 1/16", 3/32", 1/8" collet bodies; No.5,6,7 Alumina nozzle; short back cap; long back cap	W4013600
Foot Control, 8 pin amphenol, 15ft	600285
Slider Current Control with Torch Switch, 15ft, suits 7/8” to 1-1/8” dia. 17 TIG Torch Handle	10-4009
Slider Current Control with Torch Switch, 15ft, suits 1-1/8” to 1-3/8" dia. 26 TIG Torch Handle	10-4010
VICTOR AF210-580 Regulator, Argon-CO2 Flowgauge with 5/8" - 18 UNF connection	0781-4169
Power Adapter-230V,50A Socket (Nema 6-50R) to 115V, 15A Plug (Nema 5-15P)	W4014000
USA Graphics Auto-Darkening welding helmet, spare cover lens and operating manual	W4011700
Canadian Graphics Auto-Darkening welding helmet, spare cover lens and operating manual	W4011800
Stick Lead, 200A, 13ft, 50mm Dinse	WS200E13
Ground Lead, 200A,10ft, 50mm Dinse	WS200GC10
Accessory Kit for TIG Torch with 1/16", 3/32", 1/8" thoriated tungstens; 1/16", 3/32", 1/8" collets; 1/16", 3/32", 1/8" collet bodies; No. 5, 6, 7 Alumina nozzle; short back cap; long back cap	P062900010

APPENDIX 2: SYSTEM SCHEMATIC



This Page Intentionally Blank

ESAB subsidiaries and representative offices

Europe

AUSTRIA
ESAB Ges.m.b.H
Vienna-Liesing
Tel: +43 1 888 25 11
Fax: +43 1 888 25 11 85

BELGIUM
S.A. ESAB N.V.
Heist-op-den-Berg
Tel: +32 70 233 075
Fax: +32 15 257 944

BULGARIA
ESAB Kft Representative Office
Sofia
Tel/Fax: +359 2 974 42 88

THE CZECH REPUBLIC
ESAB VAMBERK s.r.o.
Vamberk
Tel: +420 2 819 40 885
Fax: +420 2 819 40 120

DENMARK
Aktieselskabet ESAB
Herlev
Tel: +45 36 30 01 11
Fax: +45 36 30 40 03

FINLAND
ESAB Oy
Helsinki
Tel: +358 9 547 761
Fax: +358 9 547 77 71

FRANCE
ESAB France S.A.
Cergy Pontoise
Tel: +33 1 30 75 55 00
Fax: +33 1 30 75 55 24

GERMANY
ESAB GmbH
Solingen
Tel: +49 212 298 0
Fax: +49 212 298 218

GREAT BRITAIN
ESAB Group (UK) Ltd
Waltham Cross
Tel: +44 1992 76 85 15
Fax: +44 1992 71 58 03
ESAB Automation Ltd
Andover
Tel: +44 1264 33 22 33
Fax: +44 1264 33 20 74

HUNGARY
ESAB Kft
Budapest
Tel: +36 1 20 44 182
Fax: +36 1 20 44 186

ITALY
ESAB Saldatura S.p.A.
Bareggio (Mi)
Tel: +39 02 97 96 8.1
Fax: +39 02 97 96 87 01

THE NETHERLANDS
ESAB Nederland B.V.
Amersfoort
Tel: +31 33 422 35 55
Fax: +31 33 422 35 44

NORWAY
AS ESAB
Larvik
Tel: +47 33 12 10 00
Fax: +47 33 11 52 03

POLAND
ESAB Sp.zo.o.
Katowice
Tel: +48 32 351 11 00
Fax: +48 32 351 11 20

PORTUGAL
ESAB Lda
Lisbon
Tel: +351 8 310 960
Fax: +351 1 859 1277

ROMANIA
ESAB Romania Trading SRL
Bucharest
Tel: +40 316 900 600
Fax: +40 316 900 601

RUSSIA
LLC ESAB
Moscow
Tel: +7 (495) 663 20 08
Fax: +7 (495) 663 20 09

SLOVAKIA
ESAB Slovakia s.r.o.
Bratislava
Tel: +421 7 44 88 24 26
Fax: +421 7 44 88 87 41

SPAIN
ESAB Ibérica S.A.
Alcalá de Henares (MADRID)
Tel: +34 91 878 3600
Fax: +34 91 802 3461

SWEDEN
ESAB Sverige AB
Gothenburg
Tel: +46 31 50 95 00
Fax: +46 31 50 92 22
ESAB international AB
Gothenburg
Tel: +46 31 50 90 00
Fax: +46 31 50 93 60

SWITZERLAND
ESAB AG
Dietikon
Tel: +41 1 741 25 25
Fax: +41 1 740 30 55

UKRAINE
ESAB Ukraine LLC
Kiev
Tel: +38 (044) 501 23 24
Fax: +38 (044) 575 21 88

North and South America

ARGENTINA
CONARCO
Buenos Aires
Tel: +54 11 4 753 4039
Fax: +54 11 4 753 6313

BRAZIL
ESAB S.A.
Contagem-MG
Tel: +55 31 2191 4333
Fax: +55 31 2191 4440

CANADA
ESAB Group Canada Inc.
Missisauga, Ontario
Tel: +1 905 670 02 20
Fax: +1 905 670 48 79

MEXICO
ESAB Mexico S.A.
Monterrey
Tel: +52 8 350 5959
Fax: +52 8 350 7554

USA
ESAB Welding & Cutting Products
Florence, SC
Tel: +1 843 669 44 11
Fax: +1 843 664 57 48

Asia/Pacific

AUSTRALIA
ESAB South Pacific
Archerfield BC QLD 4108
Tel: +61 1300 372 228
Fax: +61 7 3711 2328

CHINA
Shanghai ESAB A/P
Shanghai
Tel: +86 21 2326 3000
Fax: +86 21 6566 6622

INDIA
ESAB India Ltd
Calcutta
Tel: +91 33 478 45 17
Fax: +91 33 468 18 80

INDONESIA
P.T. ESABindo Pratama
Jakarta
Tel: +62 21 460 0188
Fax: +62 21 461 2929

JAPAN
ESAB Japan
Tokyo
Tel: +81 45 670 7073
Fax: +81 45 670 7001

MALAYSIA
ESAB (Malaysia) Snd Bhd
USJ
Tel: +603 8023 7835
Fax: +603 8023 0225

SINGAPORE
ESAB Asia/Pacific Pte Ltd
Singapore
Tel: +65 6861 43 22
Fax: +65 6861 31 95

SOUTH KOREA
ESAB SeAH Corporation
Kyungnam
Tel: +82 55 269 8170
Fax: +82 55 289 8864

UNITED ARAB EMIRATES
ESAB Middle East FZE
Dubai
Tel: +971 4 887 21 11
Fax: +971 4 887 22 63

Africa

EGYPT
ESAB Egypt
Dokki-Cairo
Tel: +20 2 390 96 69
Fax: +20 2 393 32 13

SOUTH AFRICA
ESAB Africa Welding & Cutting Ltd
Durbanvill 7570 - Cape Town
Tel: +27 (0)21 975 8924

Distributors
For addresses and phone numbers to our distributors in other countries, please visit our home page www.esab.eu

ESAB®

www.esab.com