



Warrior 300i CC/CV

Operating Manual



Art# A-13462



Revision: AA

Issue Date: 07-11-17

Manual No.: 0-5506



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.eu**.

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.

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

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

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



WARNING

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

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

Operating Manual Number 0-5506 for:
ESAB Warrior 300i CC/CV

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

www.esab.eu

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Original Publication Date: 07-11-17

Revision Date:

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Power Supply Serial #: _____

Torch Serial #: _____

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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 cutting protection and accessories.

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WARNING

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

ELECTRIC SHOCK - Can kill.

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

FUMES AND GASES - Can be dangerous to health.

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

ARC RAYS - Can injure eyes and burn skin.

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

FIRE HAZARD

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

NOISE - Excessive noise can damage hearing.

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

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

READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

PROTECT YOURSELF AND OTHERS!

WARNING

Do not use the power source for thawing frozen pipes.

CAUTION

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



CAUTION

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

CAUTION

Read and understand the instruction manual before installing or operating.






SECTION 2: INTRODUCTION

2.01 How To Use This Manual

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

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

	WARNING A WARNING gives information regarding possible personal injury.
	CAUTION A CAUTION refers to possible equipment damage.
	NOTE! A NOTE offers helpful information concerning certain operating procedures.

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



2.02 Equipment Identification

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

2.03 Receipt of Equipment

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

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

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

2.04 Description

The ESAB Warrior 300i CC/CV is a welding power source incorporating to provide Lift TIG, MIG & FCAW, Stick, and Gouging welding process.

The units are also fully compliant to CSA E 60974-1 and UL 60974-1.

The following instructions detail how to correctly and safely set up the machine and give guidelines on gaining the best efficiency and quality from the Power Source. Please read these instructions thoroughly before using the unit.

2.05 User Responsibility

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

This equipment or any of its parts should not be altered from standard specification without prior written approval of ESAB. The user of this equipment shall have the sole responsibility for any malfunction which

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results from improper use or unauthorized modification from standard specification, faulty maintenance, damage or improper repair by anyone other than appropriately qualified persons approved by ESAB.

2.06 Transporting Methods



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.

2.07 Packaged Items

Warrior 300i CC/CV Inverter Power Source (Part No. 0558102558)

- Warrior 300i CC/CV Inverter Power Source w/10 ft input power cable
- 50mm male Dinse connector × 2
- Operating Manual, English
- CD - Operating Manual (Eng/Fr/Sp)

2.08 Duty Cycle

The rated duty cycle of a Welding Power Source, is a statement of the time it may be operated at its rated welding current output without exceeding the temperature limits of the insulation of the component parts. To explain the 10 minute duty cycle period the following example is used. Suppose a Welding Power Source is designed to operate at a 40% duty cycle, 170 amperes at 26.8 volts. This means that it has been designed and built to provide the rated amperage (170A) for 4 minutes, i.e. arc welding time, out of every 10 minute period (40% of 10 minutes is 4 minutes). During the other 6 minutes of the 10 minute period the Welding Power Source must idle and be allowed to cool. The thermal cut out will operate if the duty cycle is exceeded.

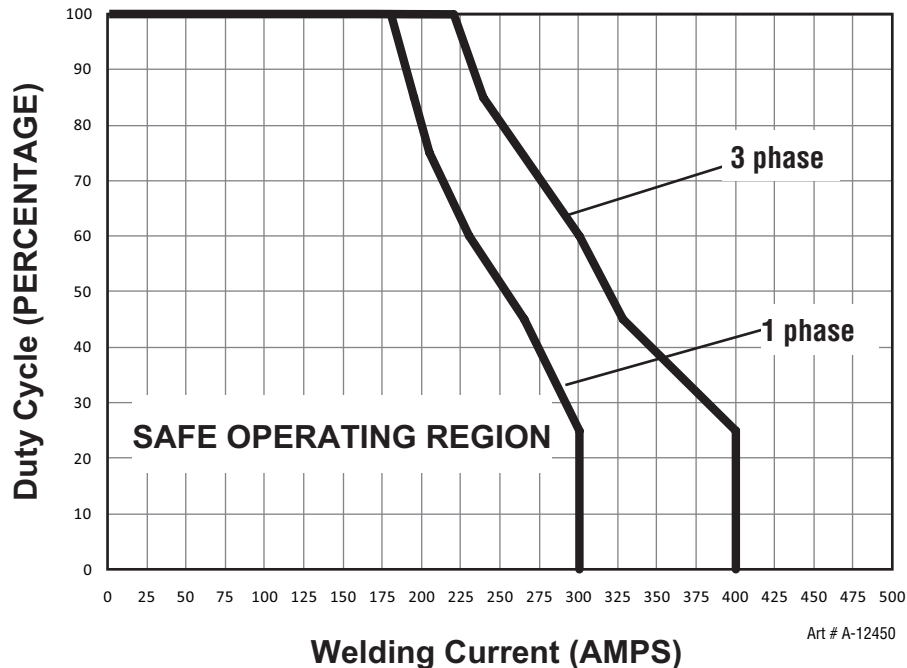


Figure 2-1: Duty Cycle

2.09 Specifications

Description	Warrior 300i CC/CV	
Power Source Part Number	0558102558	
Power Source Mass	55lb (25kg)	
Power Source Dimensions	16.5"(H) x 8.3"(W) x 17.7(D) H420mm x W210mm x D450mm	
Cooling	Fan Cooled	
Welder Type	Inverter Power Source	
Output Terminal Type	Dinse™ 50	
Standards	CSA E 60974-1 UL 60974-1	
Number of Phases	1/3 phase	
Nominal Supply Voltage	208-230/460VAC (1 phase) +/-15%	208-230/460VAC (3 phase) +/-15%
Nominal Supply Frequency	50/60Hz	
Welding Current Range	10 - 300A (1 phase)	10 - 400A, (3 phase)
Effective Input Current (I_{1eff}) (note2)	40A (208V, 1 phase) 38.1A (230V, 1 phase) 20A (460V, 1 phase)	26.6A (208V, 3 phase) 24.6A (230V, 3 phase) 14.3A (460V, 3 phase)
Maximum Input Current (I_{1max})	84.7A (208V, 1 phase) 76.2A (230V, 1 phase) 40.1A (460V, 1 phase)	53.2A (208V, 3 phase) 49.1A (230V, 3 phase) 28.6A (460V, 3 phase)
Generator Requirement (note4)	14.40kW	
STICK (SMAW) Welding Output, 40°C, 10 min.	300A @ 22%, 32V (1 phase) 230A @ 60%, 29.2V (1 phase) 180A @ 100%, 27.2V (1 phase)	400A @ 25%, 36V (3 phase) 300A @ 60%, 32V (3 phase) 230A @ 100%, 29.2V (3 phase)
Lift TIG (GTAW) Welding Output, 40°C, 10 min.	300A @ 25%, 22V (1 phase) 230A @ 60%, 19.2V (1 phase) 180A @ 100%, 17.2V (1 phase)	400A @ 25%, 26V (3 phase) 300A @ 60%, 22V (3 phase) 230A @ 100%, 19.2V (3 phase)
MIG & FCAW (GMAW FCAW) Welding Output, 40°C, 10 min.	300A @ 25%, 29V (1 phase) 230A @ 60%, 25.5V (1 phase) 180A @ 100%, 23V (1 phase)	400A @ 25%, 34V (3 phase) 300A @ 60%, 29V (3 phase) 230A @ 100%, 25.5V (3 phase)
Open Circuit Voltage	80V DC	
Protection Class	IP23S	

Table 2-1: Specification



NOTE!

Note 1: Due to variations that can occur in manufactured products, claimed performance, voltages, ratings, all capacities, measurements, dimensions and weights quoted are approximate only. Achievable capacities and ratings in use and operation will depend upon correct installation, use, applications, maintenance and service.

Note 2: The Effective Input Current should be used for the determination of cable size & supply requirements.

Note 3: Motor start fuses or thermal circuit breakers are recommended for this application. Check local requirements for your situation in this regard.

Note 4: Generator Requirements at the Maximum Output Duty Cycle.

Due to large variations in performance and specifications of different brands and types of generators, ESAB cannot guarantee full welding output power or duty cycle on every brand or type of generator. ESAB recommends that when selecting a generator, that the particular power source / generator combination be adequately tested to ensure the combination performs to the users expectations.

Note 5: ESAB reserves the right to change product performance and specifications without notice.

SECTION 3: INSTALLATION, OPERATION AND SETUP

3.01 Environment

These units are designed for use in environments with increased hazard of electric shock as outlined in IEC 60974-1.

- A. Examples of environments with increased hazard of electric shock are:
1. In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts.
 2. In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator.
 3. In wet or damp hot locations where humidity or perspiration considerable reduces the skin resistance of the human body and the insulation properties of accessories.
- B. Environments with increased hazard of electric shock do not include places where electrically conductive parts in the near vicinity of the operator, which can cause increased hazard, have been insulated.


3.02 Location

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

- A. In areas, free from moisture and dust.
- B. Ambient temperature between 32 to 104°F.
- C. In areas, free from oil, steam and corrosive gases.
- D. In areas, not subjected to abnormal vibration or shock.
- E. In areas, not exposed to direct sunlight or rain.
- F. Place at a distance of 300mm or more from walls or similar that could restrict natural air flow for cooling.
- G. The enclosure design of this power source meets the requirements of IP23S as outlined in IEC 60529. This provides adequate protection against solid objects (greater than 1/2", 12mm), and direct protection from vertical drops. Under no circumstances should the unit be operated or connected in a micro environment that


will exceed the stated conditions. For further information please refer to IEC 60529.

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



WARNING
This equipment should be electrically connected by a qualified electrician.

3.03 Ventilation




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

3.04 Mains Supply Voltage Requirements


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

The Welding Power Source must be:

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



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



WARNING
ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE is present after removal of input power.

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DO NOT TOUCH live electrical parts.

SHUT DOWN welding power source, disconnect input power employing lockout/tagging procedures. Lockout/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 or three-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.



NOTE!

This unit is equipped with a three-conductor with earth power cable that is connected at the welding power source end for single or three-phase electrical input power.

Do not connect an input (WHITE, BLACK or RED) conductor to the ground terminal.

Do not connect the ground (GREEN) conductor to an input line terminal.

Refer to Figure 3-1 and:

1. Connect end of ground (GREEN) conductor to a suitable ground. Use a grounding method that complies with all applicable electrical codes.
2. For 3- phase operation, connect ends of line 1 (BLACK) and line 2 (WHITE) and line 3 (RED) input conductors to a de-energized line disconnect switch.

For 1- phase operation, connect BLACK and WHITE input conductors. Insulate the RED Conductor.

3. Use Table 3-1 as a guide to select line fuses for the disconnect switch.

Input Voltage	Fuse Size	
	1 Phase	3 Phase
208 VAC	100 Amps	60 Amps
230 VAC	80 Amps	50 Amps
460 VAC	50 Amps	30 Amps

Table 3-1 Electrical Input Connections



NOTE!

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).

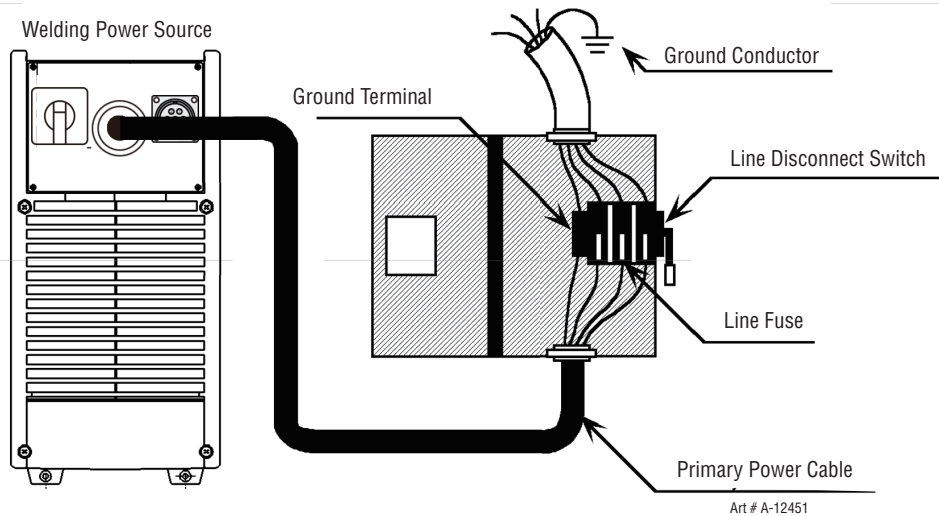


Figure 3-1 Electrical Input Connections

Input Power

Each unit incorporates an INRUSH circuit and input voltage sensing circuit. When the MAIN SWITCH is turned ON, the inrush circuit provides a pre-charging of the input capacitors. A relay in the Main Power PCB2 will turn on after the input capacitors have charged to operating voltage (after approximately 5 seconds).



NOTE!

Note the available input power. Damage to the PCB could occur if 529VAC or higher is applied.

3.05 High Frequency Introduction

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



WARNING EXPLOSIVES

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



WARNING COMPUTER

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

3.06 High Frequency Interference

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

1. **Direct Radiation:** Radiation from the machine can occur if the case is metal and is not properly grounded. It can occur through apertures such as open access panels. The shielding of the high frequency unit in the Power Source will prevent direct radiation if the equipment is properly grounded.
2. **Transmission via the Supply Lead:** Without adequate shielding and filtering, high frequency energy may be fed to the wiring within the installation (mains) by direct coupling. The energy is then transmitted by both radiation and conduction. Adequate shielding and filtering is provided in the Power Source.
3. **Radiation from Welding Leads:** Radiated interference from welding leads, although pronounced in the vicinity of the leads, diminishes rapidly with distance. Keeping leads as short as possible will minimise this type of interference. Looping and suspending of leads should be avoided wherever possible.

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

3.07 Electromagnetic Compatibility



WARNING

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

A. Installation and Use - Users Responsibility

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



NOTE!

The welding circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorised by a person who is competent to assess whether the changes will increase the risk of injury, e.g. by allowing parallel welding current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC 60974-10 Arc Welding Equipment - Installation and use (under preparation).

B. Assessment of Area

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

1. Other supply cables, control cables, signalling and telephone cables; above, below and adjacent to the welding equipment.

2. Radio and television transmitters and receivers.
3. Computer and other control equipment.
4. Safety critical equipment, e.g. guarding of industrial equipment.
5. The health of people around, e.g. the use of 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 insulation 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. Main Power 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 stabilising devices should be adjusted and maintained according to the manufacturer's recommendations.

3. Welding Cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

4. Equipotential Bonding

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

5. Grounding of the Workpiece

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

6. Screening and Shielding

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

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3.08 Warrior 300i CC/CV Power Source Controls, Indicators and Features

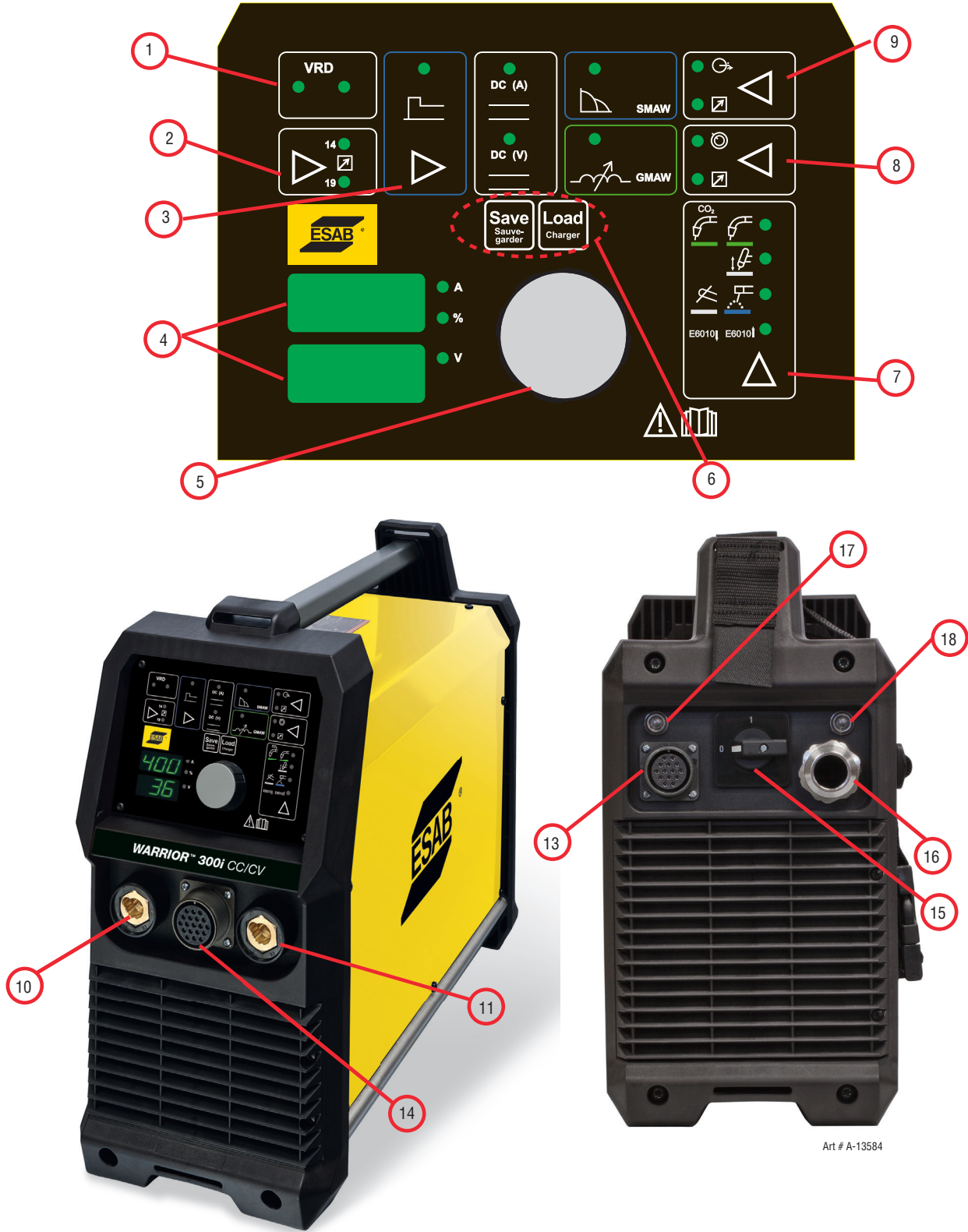


Figure 3-2

1 VRD (Voltage Reduction Device) Indicator Lights

A VRD (voltage reduction device) is a hazard reducing device designed to reduce electric shock hazards present on the output of welding power source when operating in SMAW (STICK) mode. Note that the presence of VRD should not be used as a substitute for the use of appropriate safety practices as indicated in section one of this manual.

Please Note: VRD is factory set to OFF on the 300i CC/CV. The red LED will be on when unit is powered up. To enable, turn VRD switch on Control PCB5 (refer to Figure 3-3) to the "ON" position. If VRD is active, green LED will be on (standby below 12V). When arc is established, red LED will blink (above 12V).

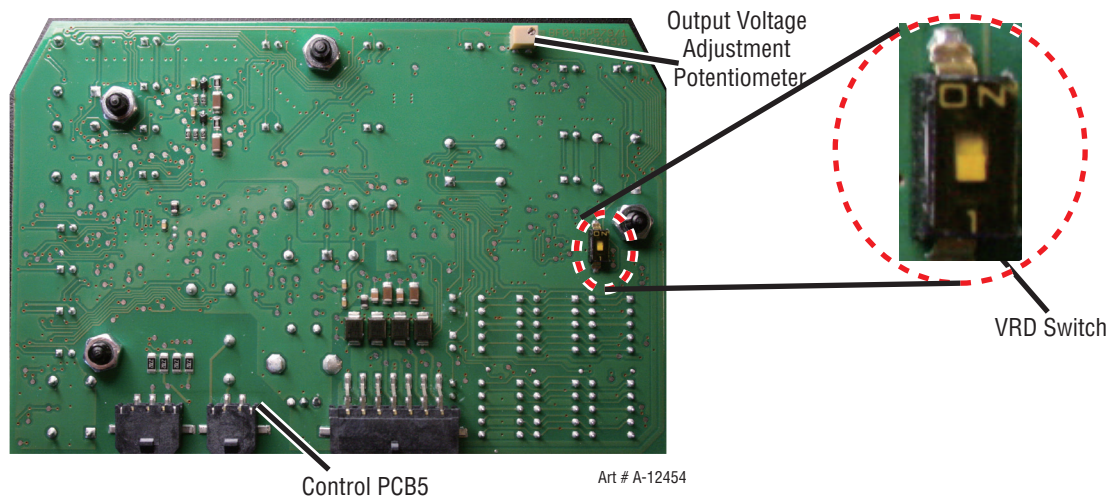


Figure 3-3

2 Amphenol Selector (14 PIN / 19 PIN Remote Button)

This button is used to select 14 PIN or 19 PIN mode of operation. Refer to 3.14 Special Function for more info.

When in 14 PIN Remote mode, the 14 PIN control socket is active and remote voltage controls will be active.

When in 19 PIN Remote mode, the 19 PIN control socket is active and remote voltage controls will be active.

Both 14 pin and 19 pin connectors work in all modes.

3 Parameter Selection Button

This button is used to select between HOT START, WELDING CURRENT, and ARC FORCE while in SMAW (STICK) mode and select between WELDING VOLTAGE and INDUCTANCE CONTROL while in GMAW (MIG) mode. This button is also used in conjunction with the Save/Load buttons to save and load welding programs. Refer to 3.14 Special Function for more info.

4 Digital Meter Volt & Ammeter

Welding amperage, Voltage and parameter values are displayed in this window. Internal warnings such as over temperature, low or high input voltage applied are signaled to the operator by error message on the screen. When welding, it displays average welding current. After weld has been completed, it displays average welding current for 10 seconds.

5 Encoder Control

It allows the operator to adjust the weld parameters within the entire range of the power source, also used to set each parameter value. This control sets the selected weld parameter, rotating it clockwise increases the parameter value and counterclockwise to decrease. A selected weld parameter can be adjusted at any time even while welding. Refer to 3.14 Special Function for more info.

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6 Save/Load Buttons

By using the Save & Load buttons the operator can easily save up to 10 welding parameter programs (including welding process, current/ voltage and other parameters such as arc force, inductance and hot start).

To Save a program

- Press and HOLD the SAVE button for 2 seconds.
- Select a job number by rotating the Encoder Control, with job number displayed on the lower meter.
- After selecting the desired job number (i.e. 1 to 10), press Parameter Selection Button (Item 3) to save the job.

To Load a program

- Press and HOLD the LOAD button for 2 seconds.
- Select a job number by rotating the Encoder Control, with job number displayed on the meter.
- After selecting the desired job number(i.e. 1 to 10), press Parameter Selection Button (Item 3) to load the job.

7 Process Selection Button



The process selection control is used to select the desired welding mode. There are seven modes available for the 300i CC/CV. In modes where there is more than one symbol, the symbol on the right will be enabled when the light is illuminated. By pressing and holding the process selection button, the light will blink indicating the secondary function, symbol to the left, is enabled. Pressing the button a second time will return to the primary function.

The MIG function has two modes: MIG (GMAW/FCAW)-The Process light is illuminated; CO₂ (GMAW/FCAW)-The Process light is blinking.

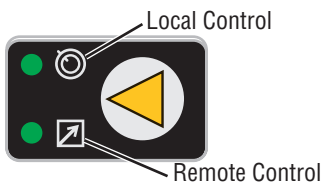
Lift TIG (GTAW)- The Process light is illuminated.

The Stick function has two modes: Stick (SMAW)- The Process light is illuminated; Arc Gouging (CAC-A)- The Process light is blinking.

The 6010 Stick function has two modes: 6010 Vertical Up - The process light is illuminated; 6010 Vertical Down - The process light is blinking.

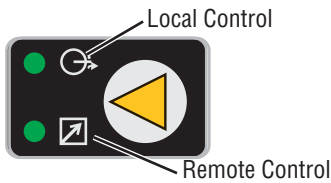
The standard mode will be MIG with argon or argon mixes. The LED for MIG will be on. The other mode will be dedicated for straight CO₂ gas operation. The same LED will be on, but will blink instead.

8 Remote Control



The remote control A/V is for both Current or Voltage depending on the process selected. This control toggles between Local and Remote. Refer to 3.14 Special Function for more info.

9 Contactor Control



Contactor Control either enables the weld output or assigns this function to a remote device. Refer to 3.14 Special Function for more info.

10 Positive Welding Terminal

Welding current flows from the Power Source via heavy duty Dinse type terminal. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

11 Negative Welding Terminal

Welding current flows from the Power Source via heavy duty Dinse type terminal. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

	<p>CAUTION Loose welding terminal connections can cause overheating and result in the male plug being fused in the terminal.</p>
--	---

12 Intelligent Fan Control

The intelligent cooling system is designed to reduce dust and foreign material build-up, while providing optimum cooling. Fan speed reduces approximately 30 seconds after machine is turned on and increases when internal components reaches operating temperature.

13 14 Pin Remote Control Socket

The 14 pin Remote Control Socket is used to connect Remote Control devices or wire feeders that use a 14 pin connection to the welding Power Source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

Pin	Function	Description
A	24VAC	
B	24VAC Contactor	Connect A&B -> contactor enable
C	+10VDC Remote Ctrl (Max)	10 VDC for remote potentiometer supply
D	Remote Ctrl return/common (Min)	Common
E	Remote Demand/Wiper	Remote control demand signal. Voltage: 0<=Vin<=10V
F	Amperage output signal	Output current signal. 1Vout/100Aout
G	24/115VAC Common	24/115VAC common and chassis ground
H	Output voltage signal	Voltage feedback. 1Vout/10Varc
I	115VAC	
J	115VAC Contactor Enable	Connect I&J --> contactor enable
K	Chassis ground	
M	Arc established	Relay contact between M & N will close while welding is active
N	Arc established	

Table 3-2 14 Pin Interconnection Control Plug Configuration, 300i CC/CV

ESAB WARRIOR 300i CC/CV

14 19 Pin Remote Control Socket

The 19 pin Remote Control Socket is used to connect Remote Control devices or wire feeders that use a 19 pin connection to the welding Power Source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

Pin	Function	Description
A	+16VDC contactor	16 VDC supply voltage for contactor. Connect A & B for contactor enable
B	Contactor in	Contactor input. Connect A & B for contactor enable
C	Volt Meter	Voltage feedback. 1Vout/10Varc
D	24VAC	
E	115VAC	
F	24/115VAC neutral	VAC neutral
G	Ground	
H	+10VDC remote ctrl	10 VDC for remote potentiometer supply
J	Remote Input	$0 \leq V_{in} \leq 10V$
K	Remote ctrl ground/common	Also control circuit common
L	Control PCB5 ground / common	
M	12VDC arc established	+12 VDC while welding active, otherwise off
N	Ground / common	
P	24VAC	
R	N VAC	24/115VAC neutral and chassis ground
S	CAN_high	CAN bus; positive signal
T	CAN_low	CAN bus; negative signal
U	Amp Meter	Current feedback. 1Vout/100Aout
V	+24VDC	+ 24VDC CAN supply

Table 3-3 19 Pin Interconnection Control Plug Configuration, 300i CC/CV

15 ON/OFF Switch

This switch connects the Primary supply voltage to the inverter when in the ON position. This enables the Power Supply.



CAUTION

When the welder is connected to the Primary supply voltage, the internal electrical components may be at 500v potential with respect to earth.

16 Input Cable

The input cable connects the Primary supply voltage to the equipment.

17.2.5A Circuit Breaker

2.5A Circuit Breaker is for the 115 VAC auxiliary power connected to 14 pin or 19 pin remote control socket.

18.10A Circuit Breaker

10A Circuit Breaker is for the 24 VAC auxiliary power connected to 14 pin or 19 pin remote control socket.

3.09 Welding Parameters





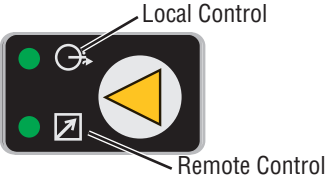
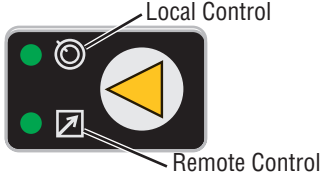

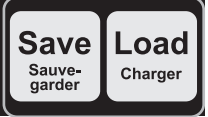
Parameter	Description
 <p>Arc Force</p>	<p>This parameter provides an adjustable short circuit current in STICK welding to improve electrode sticking and arc stability.</p>
 <p>Hot Start</p>	<p>This parameter operates in STICK weld mode and is used to improve the start characteristics for stick electrodes. e.g. low hydrogen electrodes. This parameter also works in TIG mode allowing a softer or harder arc start. It sets the peak start current on top of the (WELD) current.</p>
	<p>Weld Current (Amperage) - when lit Encoder Control sets the STICK and TIG WELD current.</p>
	<p>Weld Voltage (Volt) – when lit Encoder Control sets the MIG voltage.</p>
 <p>Contactor Control</p>	<p>Contactor operates in MIG, TIG , and Stick modes. When the local Control LED is illuminated the output is enabled, and when the Remote Control is illuminated the output is enabled by a remote control.</p>
 <p>Remote Control</p>	<p>Selects either local or remote amperage or voltage control depending on the selected process. Local Control allows the voltage or current to be adjusted on the front panel, while Remote Control is used if you have a remote control connected to the welder.</p>
 <p>Inductance</p>	<p>This parameter, similar to the Arc Force in Stick mode. In MIG mode, inductance allows for the adjustment of the dynamic property of the arc. As the inductance is increased the output voltage may need to be adjusted to achieve the desired weld characteristics.</p>
	<p>The SAVE/LOAD buttons are used to save and retrieve a total number of 10 jobs into the 300i CC/CV memory.</p>

Table 3-4 Welding Parameters Description

ESAB WARRIOR 300i CC/CV

Weld Process Selection

Weld Parameter	Weld Mode				Description
	STICK/ GOUGING	6010 VERTICAL UP/ 6010 VERTICAL DOWN	MIG	LIFT TIG	
WELD (V)	×	×	√	×	Weld voltage MIG Mode.
INDUCTANCE	×	×	√	×	Inductance control in MIG Mode.
HOT START	√	√	×	√	Start current in amps is added or subtracted. In STICK mode the Hot Start is 100% to 200%, factory default 125%; while in TIG mode the range is 50% to 200%, factory default 50%.
WELD (A)	√	√	×	√	WELD (A) current for STICK or LIFT TIG.
ARC FORCE	√	√	×	×	Adjusts percentage increase in welding current and is proportional to arc length (arc voltage).

Table 3-5 Weld Process Selection versus Weld Mode

Weld Parameter Descriptions

WELD (V)

This parameter operates the MIG weld arc voltage in MIG mode.

INDUCTANCE

This parameter operates the INDUCTANCE when MIG welding. It controls the dynamic properties of the arc in dip transfer welding mode. When this parameter is set to 0%, i.e. minimum inductance, the arc has a fast response with a resulting crisp arc noise and coarse spatter. When this parameter is set to 200%, i.e. maximum inductance, the arc has a slow response with a resulting soft arc and fine spatter.



NOTE!

As the INDUCTANCE is increased, the WELD (V) may need to be adjusted to achieve the desired weld characteristic.

HOT START

This parameter operates in Stick and TIG modes. Hot start can subtract 50% of the weld current during arc starts some times desirable in TIG welding, or add up to 200% of weld current during arc starts, helping with low hydrogen electrode ignition.

WELD (A)

This parameter operates the Stick, Gouging, and TIG weld current.

ARC FORCE CONTROL

This parameter operates in STICK mode only and is used to adjust percentage increase in welding current and is proportional to arc length (arc voltage). This control provides an adjustable amount of arc control (or dig). This feature can be particularly beneficial in providing the operator with the ability to compensate for variability in joint fit up in certain situations with particular electrodes, e.g. cellulose and hydrogen controlled electrodes. In all welding processes, the amount of penetration obtained is dependent on the welding current; i.e. the greater the penetration, the greater the current.

Arc Force Position	Effect on Welding Performance
Minimum (0)	Soft arc, Low spatter, Low penetration
Medium (100%)	Normal arc, Improved fusion characteristics, Normal penetration
Maximum (200%)	Hard arc, Deep penetration

Table 3-6 Weld Parameter Descriptions

In general, having the Arc Force set at 200% (maximum) allows greater penetration to be achieved. With the ARC set at 0% (minimum) the Power Source has a constant current characteristic. In other words, varying the arc length does not significantly affect the welding current. When the Arc Force is set to 100%, it is possible to control the welding current by varying the arc length. This is very useful for controlling penetration and side wall wash on vertical up fillet welds.

i) Root runs

During root runs the weld pool forms a “keyhole” shape. If too much weld current is used, the hole blows out and the weld collapses. If too little weld current is used, the hole closes up and penetration is lost. The size of the hole also determines the arc length; i.e. as the hole gets bigger, the arc gets longer.

If arc force is used, the increase in the arc length causes the weld current to decrease until the hole starts to close up but if the hole closes up to much then the arc length decreases which causes the weld current to increase. Too little or too much arc force makes this process unstable. The operator must adjust the arc force until a happy medium is reached.

ii) Vertical up welding

When welding vertical up with arc force on, the operator can control the amount of current by changing arc length, i.e. voltage. Weld metal is deposited by “digging” the electrode into the side of the base metal joint and then increasing the arc length with a flicking motion, to allow the weld pool to freeze, before digging the electrode into the other side of the base metal joint.

Without arc force, increasing the arc length does not decrease the weld current sufficiently and the operator has to manually decrease the current via a Remote Control to freeze the weld pool. This welding current reduction also reduces the penetration.

The arc force allows the weld pool to freeze during the “flick” phase without decreasing the amount of weld current available during the “dig” phase thus maximizing penetration.

Weld Parameter	Parameter Range	Factory Setting	Incremental Unit
WELD (V) MIG	10.0 to 38V	20V	0.1V
INDUCTANCE	0 to 200%	100%	1%
HOT START (TIG)	50 to 200%	50%	1%
HOT START (STICK)	100 to 200%	125%	1%
WELD (A) (1 phase) TIG or STICK	10 to 300A	100A	1A
WELD (A) (3 phase) TIG or STICK	10 to 400A	100A	1A
ARC FORCE	0 to 200%	100%	1%

Table 3-7 Weld Parameter Setting

3.10 Setup for LIFT TIG (GTAW) Welding

For TIG welding a TIG torch with valve is required for this power source.

- A. Remove all packaging materials. Do not block the air vents at the front or rear of the Power Source.
- B. Connect the work lead to the positive welding terminal (+). Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.
- C. Connect the optional TIG Torch to the negative welding terminal (-). Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.



CAUTION

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



WARNING

Before connecting the work clamp to the work piece make sure the mains power supply is switched off. Secure the welding grade shielding gas cylinder in an upright position by chaining it to a suitable stationary support to preventing falling or tipping.

- D. Ensure that the gas cylinder is secured to a building pillar, wall bracket or otherwise securely fixed in an upright position.
- E. Select TIG mode by pressing Process Selection Button until TIG indicator lights up.
- F. Connect the TIG Torch trigger switch / remote control to the 14 pin or 19 pin socket on the Power Source as applicable. It will operate in lift TIG mode with either a remote connected to the 14 or 19 pin connector, or the contactor enabled on the panel. The TIG Torch will operate in LIFT TIG mode.
- G. Fit the Flowmeter/ Regulator to the gas cylinder then connect the gas hose from the TIG Torch to the Flowmeter outlet. The Power Source is not fitted with a shielding gas solenoid to control the gas flow in LIFT TIG mode, therefore the TIG Torch will require a gas valve.

TIG Welding Current	Range	Factory setting
Welding current I1	10 to 300 A (1 phase)	100
	10 to 400 A (3 phase)	

Table 3-8 TIG Welding Current

- H. Arc Ignition. Open the valve 19 on the TIG welding torch. Briefly touch the workpiece with the tip of the electrode at the point to be welded. Lift the electrode a little. The arc burns between the workpiece and the electrode

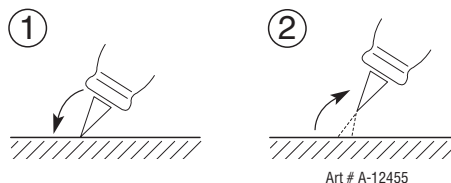


Figure 3-4 Arc Ignition

Graphic for TIG

- I Current
- I1 Welding current
- ISt Hot start current
- Iz Short circuit
- t Time
- tSt Hot start

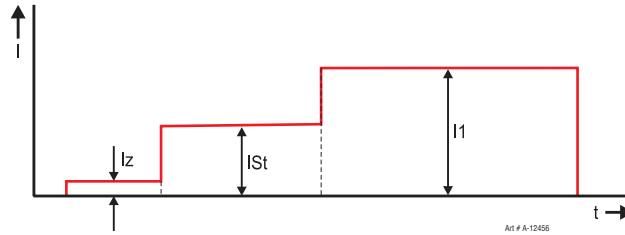


Figure 3-5 TIG Current Routing Diagram

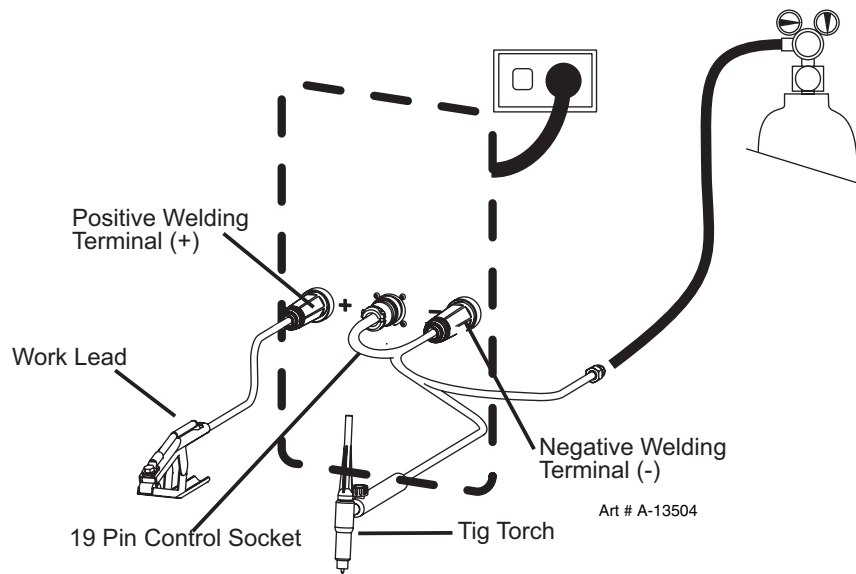




Figure 3-6 Setup for TIG (GTAW) Welding

ESAB WARRIOR 300i CC/CV

3.11 Setup for STICK (SMAW) Welding

- A. Remove all packaging materials. Do not block the air vents at the front or rear of the Power Source.
- B. Connect the Electrode Holder to the positive welding terminal (+) (or negative welding terminal (-)). If in doubt, consult the electrode manufacturer. Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.
- C. Connect the work lead to the negative welding terminal (-) (or positive welding terminal (+)). If in doubt, consult the electrode manufacturer. Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

WARNING
 The polarity of the electrode depends on the type of electrode and the welding process. Please follow the manufacturer's instructions on the electrode packaging for this purpose.

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

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

- D. Select STICK mode by pressing Process Selection Button until the STICK/Gouging and 6010 Process LEDs are lit (Please refer to Page 3-8 for detailed info).

STICK Welding Current	Range	Factory setting
Welding current I1	10 to 300 A (1 phase)	100
	10 to 400 A (3 phase)	

Table 3-9 STICK Welding Current

- E. Arc ignition. Briefly touch the workpiece at the point to be welded using the electrode and lift the electrode a little. The arc burns between the workpiece and the electrode.

Graphic for SMAW (STICK)

- I Current
- I1 Welding current
- ISt Hot start current
- t Time
- tSt Hot start time

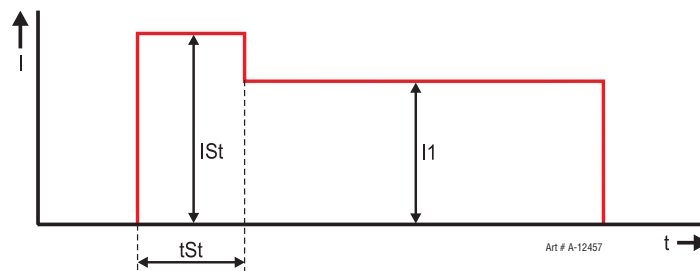


Figure 3-7 STICK Current Routing Diagram

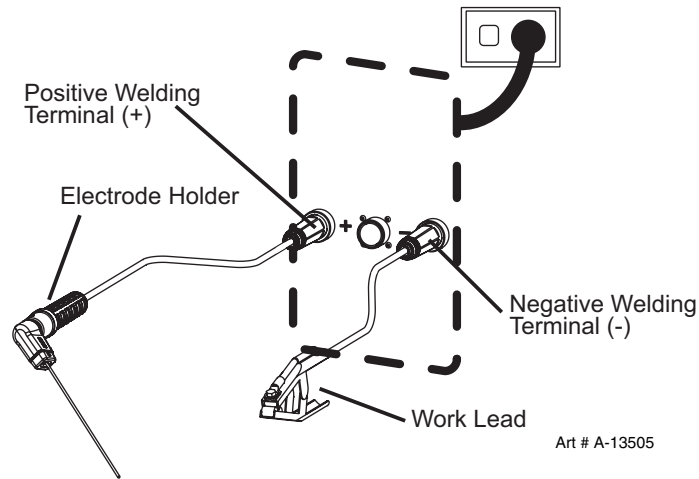


Figure 3-8 Setup for STICK (SMAW) Welding

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

A wire feeder (optional) is required for MIG welding.



NOTE!

NOTE 1: The operations required may differ depending on the version and the configuration of the wirefeeder!

NOTE 2: Please read the wirefeeder operating manual!

Power Source Connections

- A. Remove all packaging materials. Do not block the air vents at the front or rear of the Power Source.
- B. Connect the work lead to the negative welding terminal (-) [positive welding terminal(+) for flux cored electrode wire]. If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.



CAUTION

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



WARNING

Before connecting the work clamp to the work piece make sure the mains power supply is switched off.
Secure the welding grade shielding gas cylinder in an upright position by chaining it to a suitable stationary support to prevent falling or tipping.

- C. Ensure that the gas cylinder is secured to a building pillar, wall bracket or otherwise securely fixed in an upright position.
- D. Select MIG mode by pressing Process Selection Button until MIG/ CO₂ symbol lights up (Please refer to Page 3-8 for detailed info).

ESAB WARRIOR 300i CC/CV

Wirefeeder Connections

- A. Connect the welding power cable to the positive welding terminal (+) [negative welding terminal (-) for flux cored wire]. If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.
- B. Connect the control cable from the Wirefeeder to the 14 PIN or 19 PIN socket on the Power Source as applicable. Select appropriate connector by pressing the button on front panel.

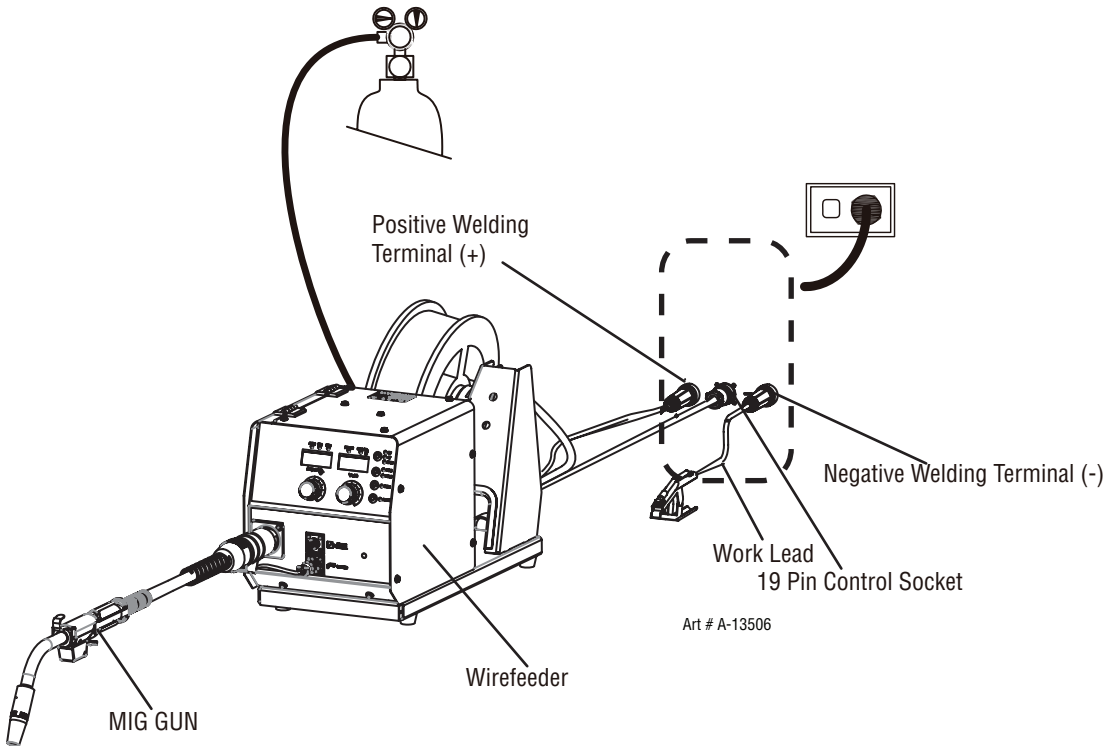


Figure 3-9 Setup for MIG (GMAW) Welding with Gas Shielded MIG Wire

3.13 Setup for FCAW Flux Core Arc Welding

A wire feeder (optional) is required for MIG welding.



NOTE!

NOTE 1: The operations required may differ depending on the version and the configuration of the wirefeeder!

NOTE 2: Please read the wirefeeder operating manual!

Power Source Connections

- A. Remove all packaging materials. Do not block the air vents at the front or rear of the Power Source.
- B. Connect the work lead to the positive welding terminal (+). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.



CAUTION

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

**WARNING**

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

- C. Select MIG mode by pressing Process Selection Button until MIG/ CO₂ symbol lights up (Please refer to Page 3-8 for detailed info).

WIREFEEDER CONNECTIONS

- A. Connect the welding power cable to the negative welding terminal (-). If in doubt, consult the electrode wire manufacturer. Welding current flows from the Power Source via dinse type connectors. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.
- B. Connect the control cable from the Wirefeeder to the 14 PIN or 19 PIN socket on the Power Source as applicable.

**WARNING**

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

**NOTE!**

Welding Setup Program Storage (10 programs) applies to MIG, Stick and Lift Tig modes.

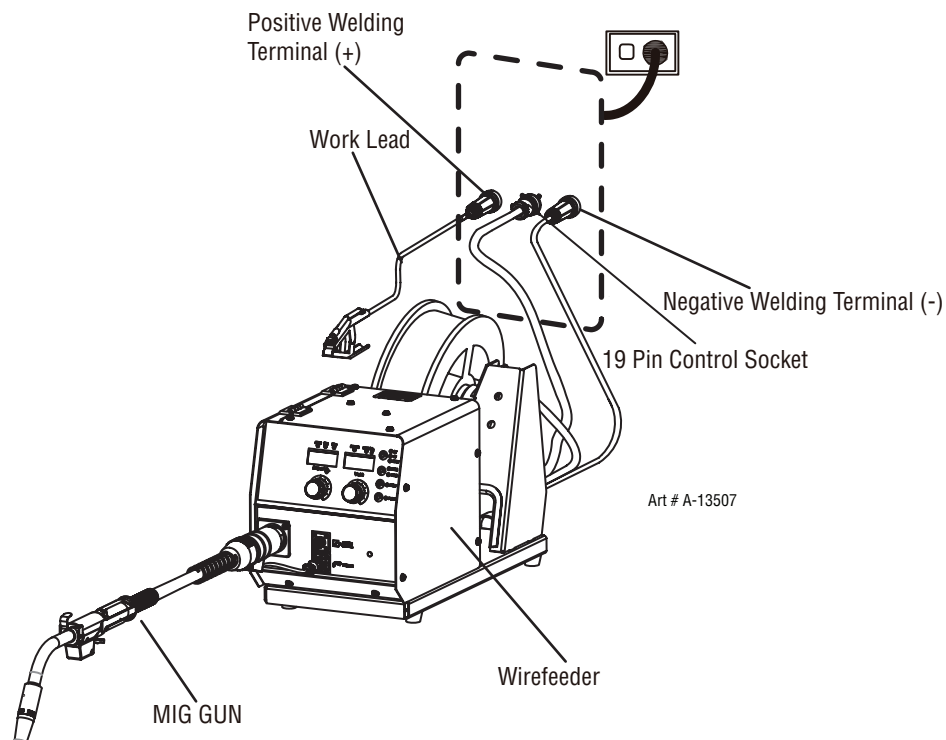


Figure 3-10 Setup for FCAW Flux Core Arc Welding

3.14 Special Function

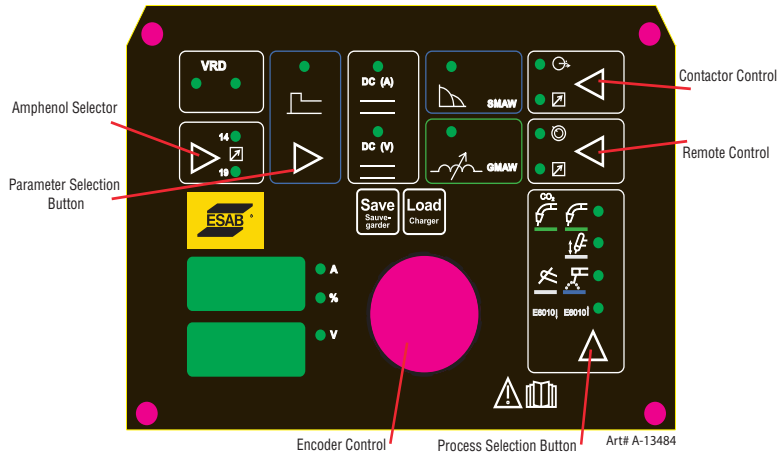


Figure 3-11

MIG CO₂, Gouging and 6010 Vertical Down

There are three special functions that can be accessed by pressing the selection button for 2 seconds: MIG CO₂, Gouging and 6010 Vertical Down.

MIG CO₂ - In MIG mode hold the Process Selection Button for 2 seconds and the LED will blink indicating MIG CO₂ mode is enabled.

6010 Down - In 6010 mode hold the process Selection Button for 2 seconds and the LED will blink indicating 6010 Vertical Down mode is enabled.

Lock/ Unlock User Interface (UI)

UI Lock Function can be enabled or disabled by pressing Encoder Control for 5 seconds.



NOTE!

The function lock setting is saved! If the machine is switched off with the function lock activated, the control panel is still locked when the machine is switched back on.

LED Test

Press Amphenol Selector or Parameter Selection Button for 2 seconds to start LED test. The test will last for about 5 seconds. During the test all LEDs are lit.

Enable Calibration in MIG Mode

In MIG mode, the adjustment to output voltage can be enabled or disabled as below:

1. Press Contactor Control and Process Selection Button at the same time for 2 seconds.
2. Rotate Encoder Control to select CAL ON/OFF.
 - 2a. Adjust the output voltage with the potentiometer on Control PCB 5 by +/- 5% (refer to Figure 3-3).
3. Press Encoder Button Encoder Control to save the setting.

Display Software Version

Press Remote Control and Contactor Control buttons at the same time for 2 seconds and it will display the software version of User Interface (UI), master and process.

Master Reset**WARNING**

All personal settings will be lost.

The 300i CC/CV can have master reset. All the jobs saved will be deleted and all parameters will be set back to factory setting. This function is accessed by pressing Parameter Selection Button and Remote Control Button at the same time for 2 seconds.

3.15 Shielding Gas Flowmeter/ Regulator Operating Instructions**WARNING**

This equipment is designed for use with welding grade (inert) shielding gases only.

Shielding Gas Flowmeter/ Regulator Safety

Designed to reduce and control high pressure gas from a cylinder or pipeline to the working pressure required for the equipment using it.

If the equipment is improperly used, hazardous conditions are created that may cause accidents. It is the users responsibility to prevent such conditions. Before handling or using the equipment, understand and comply at all times with the safe practices prescribed in this instruction.

SPECIFIC PROCEDURES for the use of flowmeter/ regulators are listed below.

1. NEVER subject the flowmeter/ regulator to inlet pressure greater than its rated inlet pressure.
2. NEVER pressurize a flowmeter/ regulator that has loose or damaged parts or is in a questionable condition. NEVER loosen a connection or attempt to remove any part of a flowmeter/ regulator until the gas pressure has been relieved. Under pressure, gas can dangerously propel a loose part.
3. DO NOT remove the flowmeter/ regulator from a cylinder without first closing the cylinder valve and releasing gas in the flowmeter/ regulator high and low pressure chambers.
4. DO NOT use the flowmeter/ regulator as a control valve. When downstream equipment is not in use for extended periods of time, shut off the gas at the cylinder valve and release the gas from the equipment.
5. OPEN the cylinder valve SLOWLY. Close after use.

User Responsibilities

This equipment will perform safely and reliable only when installed, operated and maintained, and repaired in accordance with the instructions provided. Equipment must be checked periodically and repaired, replaced, or reset as necessary for continued safe and reliable performance. Defective equipment should not be used. Parts that are broken, missing, obviously worn, distorted, or contaminated should be replaced immediately.

The user of this equipment will generally have the sole responsibility for any malfunction, which results from improper use, faulty maintenance, or by repair by anyone other than an accredited repairer.

**CAUTION**

Match flowmeter/ regulator to cylinder. NEVER CONNECT a flowmeter/ regulator designed for a particular gas or gases to a cylinder containing any other gas.

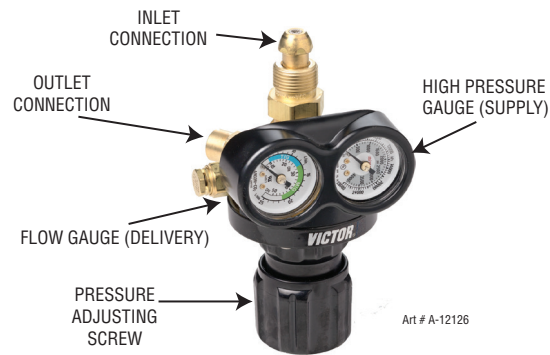


Figure 3-12 Adjusting Flow Rate



NOTE!

The flowmeter/ regulator used with argon based and carbon dioxide shielding gases are different. The flowmeter/ regulator supplied is for argon based shielding gases. If carbon dioxide is to be used a suitable carbon dioxide flowmeter/ regulator will need to be fitted.



NOTE!

All valves downstream of the flowmeter/ regulator must be opened to obtain a true flow rate reading on the outlet gauge. (Welding power source must be triggered) Close the valves after the pressure has been set.

Installation

1. Remove cylinder valve plastic dust seal. Clean the cylinder valve outlet of impurities that may clog orifices and damage seats before connecting the flowmeter/ regulator.
Crack the valve (open then close) momentarily, pointing the outlet away from people and sources of ignition. Wipe with a clean lint free cloth.
2. Match flowmeter/ regulator to cylinder. Before connecting, check that the flowmeter/ regulator label and cylinder marking agree and that the flowmeter/ regulator inlet and cylinder outlet match. NEVER CONNECT a flowmeter/ regulator designed for a particular gas or gases to a cylinder containing any other gas.
3. Connect the flowmeter/ regulator inlet connection to cylinder or pipeline and tighten it firmly but not excessively, with a suitable spanner.
4. Connect and tighten the outlet hose firmly and attach down-stream equipment.
5. To protect sensitive down-stream equipment a separate safety device may be necessary if the flowmeter/ regulator is not fitted with a pressure relief device.

Operation

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

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

Adjusting Flow Rate

Figure 3-13 Adjust Flow Rate

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

1. Slowly turn adjusting screw/knob in (clockwise) direction until the outlet gauge indicates the required flow rate.

**NOTE!**

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

2. To reduce flow rate, allow the welding grade shielding gas to discharge from flowmeter/ regulator by opening the downstream valve. Bleed welding grade shielding gas into a well ventilated area and away from any ignition source. Turn adjusting screw counter clockwise, until the required flow rate is indicated on the gauge. Close downstream valve.

Shutdown

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

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

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SECTION 4: BASIC WELDING GUIDE

4.01 Stick (SMAW) Basic Welding Technique

Size of Electrode

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

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

Storage of Electrodes

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

Electrode Polarity

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

Effects of Arc Welding Various Materials

A. High tensile and alloy steels

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

Low Hydrogen Electrodes must be used for this application.

B. Austenitic manganese steels

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

C. Cast Iron

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

D. Copper and alloys

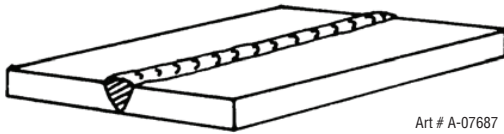
The most important factor is the high rate of heat conductivity of copper, making preheating of heavy sections necessary to give proper fusion of weld and base metal.

Arc Welding Practice

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

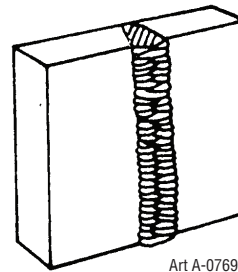
Welding Position

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



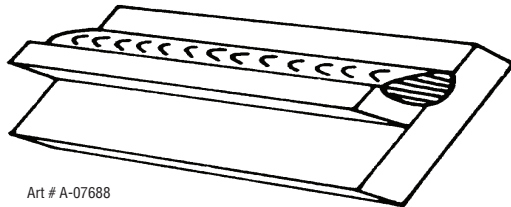
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Figure 4-1: Flat Position, Down Hand Butt Weld



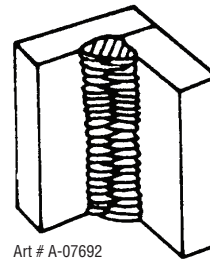
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Figure 4-5: Vertical Position, Butt Weld



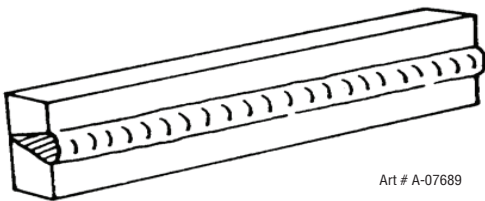
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Figure 4-2: Flat Position, Gravity Fillet Weld



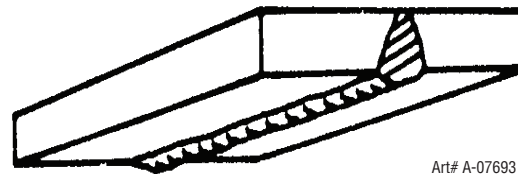
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Figure 4-6: Vertical Position, Fillet Weld



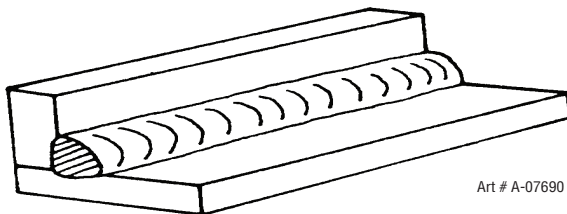
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Figure 4-3: Horizontal Position, Butt Weld



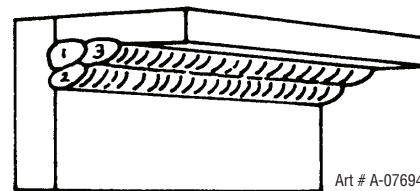
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Figure 4-7: Overhead Position, Butt Weld



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



Art # A-07694

Figure 4-8: Overhead Position, Fillet Weld

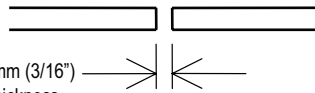
Joint Preparations

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

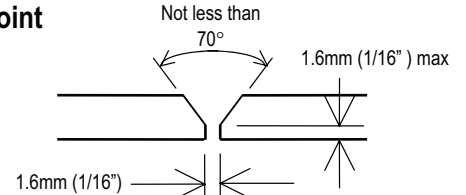
In general, surfaces being welded should be clean and free of rust, scale, dirt, grease, etc. Slag should be removed from oxy-cut surfaces. Typical joint designs are shown in Figure 4-9.

Open Square Butt Joint

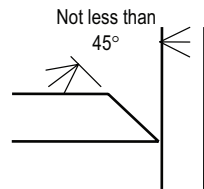
Gap varies from 1.6mm (1/16") to 4.8mm (3/16") depending on plate thickness



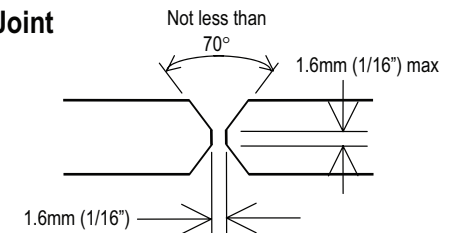
Single Vee Butt Joint



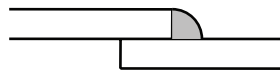
Single Vee Butt Joint



Double Vee Butt Joint



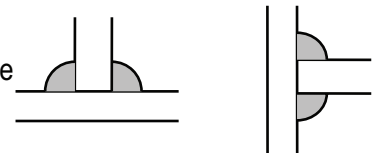
Lap Joint



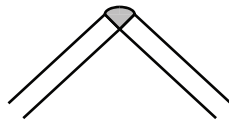
Fillet Joint



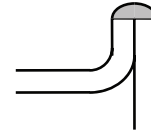
Tee Joints
(Fillet both sides of the joint)



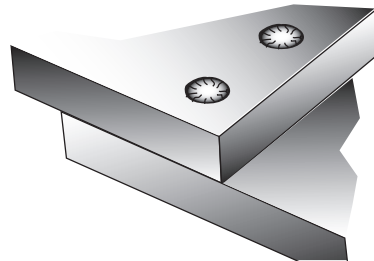
Corner Weld



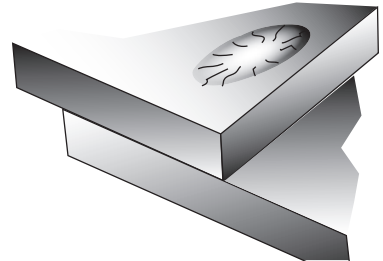
Edge Joint



Plug Weld



Plug Weld



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Figure 4-9: Typical Joint Designs for Arc Welding

Arc Welding Technique - A Word to Beginners

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

The Weldor

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

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

Striking the Arc

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

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

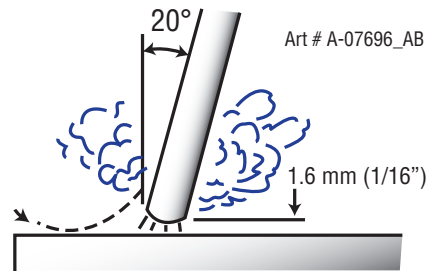


Figure 4-10: Striking an Arc

Arc Length

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

Rate of Travel

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

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

Making Welded Joints

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

A. Butt Welds

Set up two plates with their edges parallel, as shown in Figure 4-11, allowing 1/16" to 3/32" 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" should have their mating edges bevelled to form a 70° to 90° included angle. This allows full penetration of the weld metal to the root. 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.

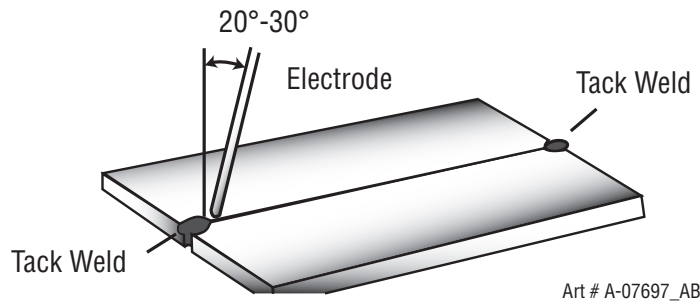


Figure 4-11: Butt Weld

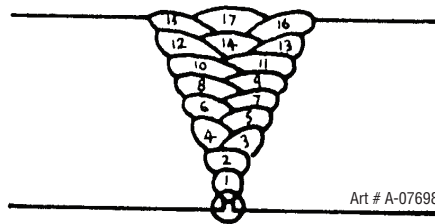


Figure 4-12: Weld Build up Sequence

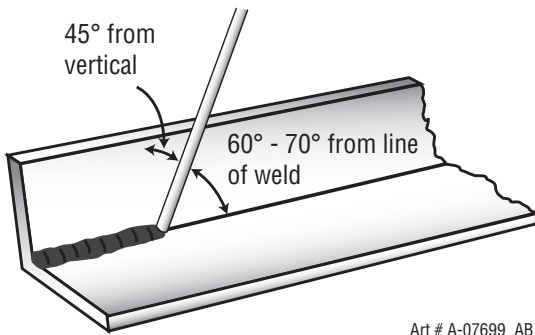
Heavy plate will require several runs to complete the joint. After completing the first run, chip the slag out and clean the weld with a wire brush. It is important to do this to prevent slag being trapped by the second run. Subsequent runs are then deposited using either a weave technique or single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

B. Fillet Welds

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

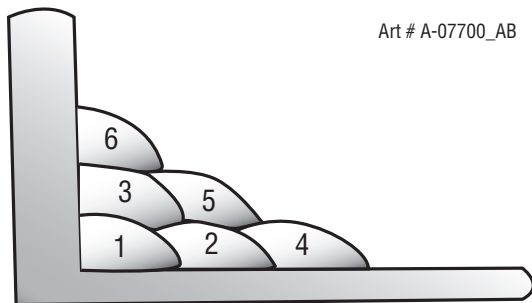
A piece of angle iron is a suitable specimen with which to begin, or two lengths of strip steel may be tacked together at right angles. Position angle iron with one leg horizontal and the other vertical. This is known as a horizontal-vertical (HV) fillet. Strike the arc and immediately bring the electrode 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 4-13. Do not attempt to build up much larger than width with a electrode, otherwise the weld metal tends to sag towards

the base, and undercut forms on the vertical leg. Multi-runs can be made as shown in Figure 4-14. Weaving in HV fillet welds is undesirable.



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Figure 4-13: Electrode Position for HV Fillet Weld



Art # A-07700_AB

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

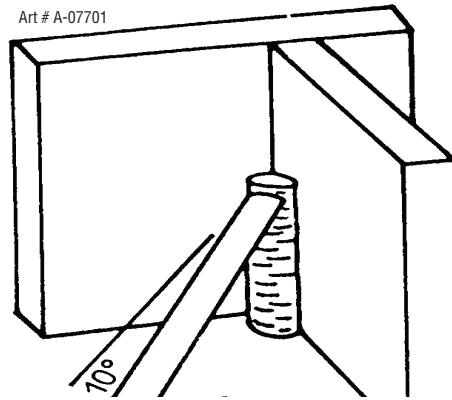
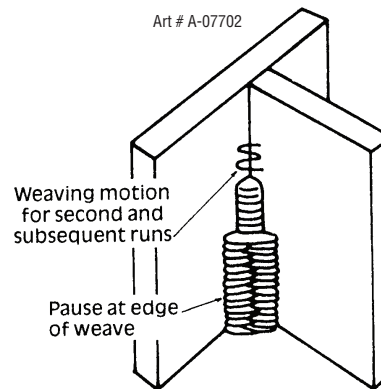


Figure 4-15: Single Run Vertical Fillet Weld



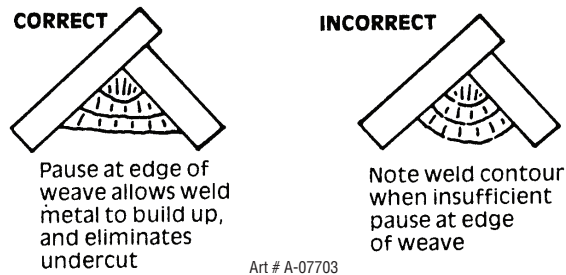
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Figure 4-16: Multi Run Vertical Fillet Weld

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 electrode and set the current. 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 4-15. Use a short arc, and do not attempt to weave on the first run. When the first run has been completed de-slag the weld deposit and begin the second run at the bottom. This time a slight weaving motion is necessary to cover the first run and obtain good fusion at the edges. At the completion of each side motion, pause for a moment to allow weld metal to build up at the edges, otherwise undercut will form and too much metal will accumulate in the centre of the weld. Figure 4-16 illustrates multi-run technique and Figure 4-17 shows the effects of pausing at the edge of weave and of weaving too rapidly.



Art # A-07703

Figure 4-17: Examples of Vertical Fillet Welds

2. Vertical Down

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 than 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 4-18). The tip of the electrode may be touched lightly on the metal, which helps to give a steady run. A weave technique is not advisable for overhead fillet welds. 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.

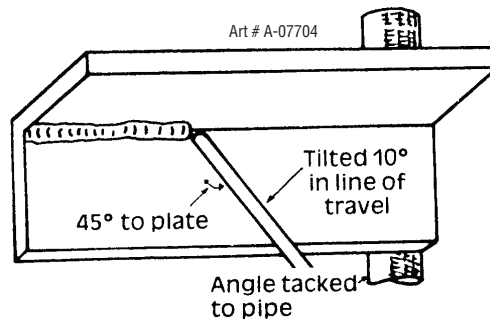


Figure 4-18: Overhead Fillet Weld

Distortion

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

The Cause of Distortion

Distortion is caused by:

A. Contraction of Weld Metal:

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

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

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

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

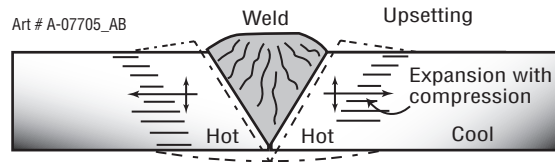


Figure 4-19: Parent Metal Expansion

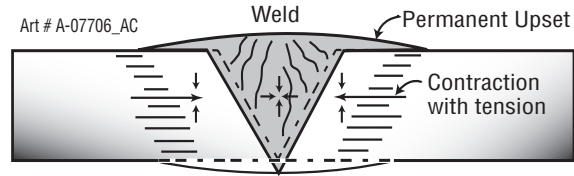


Figure 4-20: Parent Metal Contraction

Overcoming Distortion Effects

There are several methods of minimizing distortion effects.

A. Peening

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

B. Distribution of Stresses

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

C. Restraint of Parts

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

D. Presetting

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

E. Preheating

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

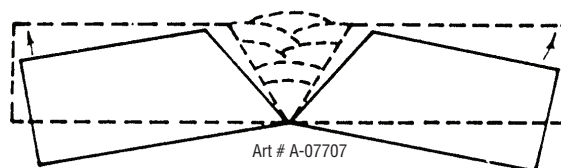
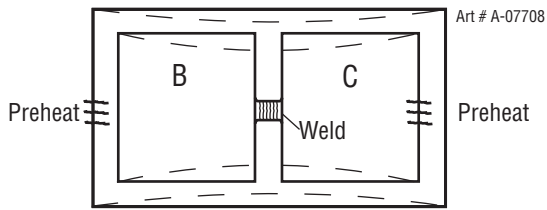


Figure 4-21: Principle of Presetting



Dotted lines show effect if no preheat is used
 Figure 4-22: Reduction of Distortion by Preheating

Figure 4-26: Chain Intermittent Welding

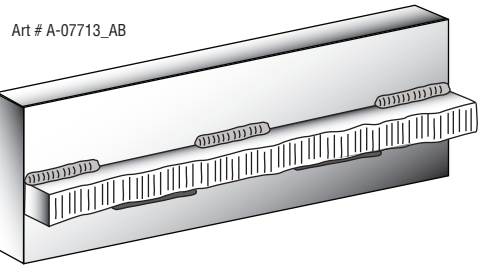


Figure 4-27: Staggered Intermittent Welding

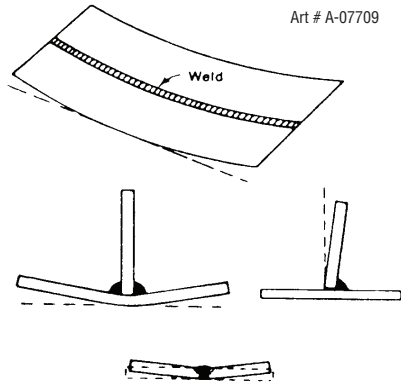


Figure 4-23: Examples of Distortion

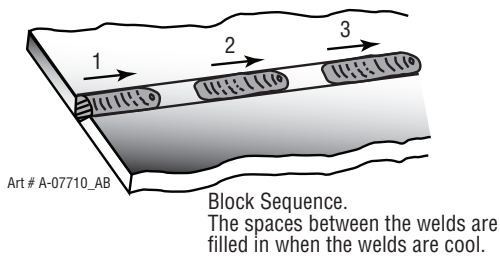


Figure 4-24: Welding Sequence

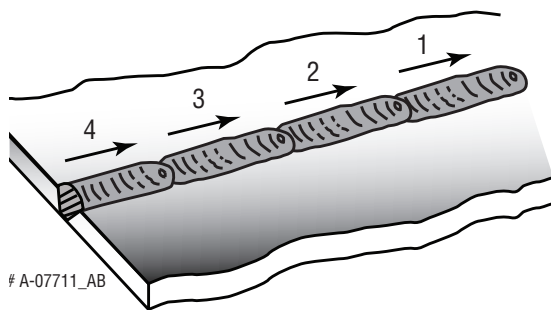
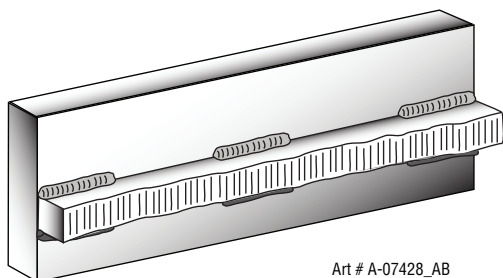


Figure 4-25: Step back Sequence



4.02 Stick (SMAW) Welding Troubleshooting

FAULT	CAUSE	REMEDY
1 Welding current fluctuations	ARC FORCE parameter is set at a value that causes the welding current to vary excessively with the arc length.	Reduce the ARC FORCE parameter until welding current is reasonably constant while prohibiting the electrode from sticking to the work piece when you "dig" the electrode into the workpiece.
2 A gap is left by failure of the weld metal to fill the root of the weld.	A Welding current too low B Electrode too large for joint. C Insufficient gap.	A Increase welding current. B Use smaller diameter electrode. C Allow wider gap.
3 Non-metallic particles are trapped in the weld metal.	A Non-metallic particles may be trapped in undercut from previous bead. 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 a bad undercut is present clean slag out and cover with a run from a smaller gauge 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 comers. E Clean joint before welding. F Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.

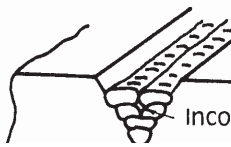
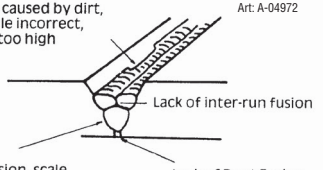
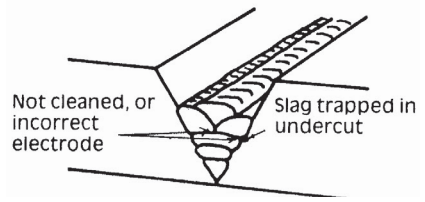


Figure 1-Example of insufficient gap or incorrect sequence

FAULT	CAUSE	REMEDY
<p>4 A groove has been formed in the base metal adjacent to the toe of a weld and has not been filled by the weld metal (undercut).</p>	<p>A Welding current is too high. B Welding arc is too long. C Angle of the electrode is incorrect. D Joint preparation does not allow correct electrode angle. E Electrode too large for joint. F Insufficient deposit time at edge of weave.</p>	<p>A Reduce welding current. B Reduce the length of the welding arc. C Electrode should not be inclined less than 45° to the vertical face. D Allow more room in joint for manipulation of the electrode. E Use smaller gauge electrode. F Pause for a moment at edge of weave to allow weld metal buildup.</p>
<p>5 Portions of the weld bead do not fuse to the surface of the metal or edge of the joint.</p>	<p>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.</p>	<p>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.</p>
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>Lack of fusion caused by dirt, electrode angle incorrect, rate of travel too high</p>  <p>Art: A-04972</p> </div> <div style="flex: 1; text-align: center;"> <p>Figure 2: Example of Lack of Fusion</p> </div> </div>		
<p>6 Gas pockets or voids in weld metal (porosity)</p>	<p>A High levels of sulphur in steel. B Electrodes are damp. C Welding current is too high. D Surface impurities such as oil, grease, paint, etc. E Welding in a windy environment. F Electrode damaged ie flux coating incomplete.</p>	<p>A Use an electrode that is designed for high sulphur steels. B Dry electrodes before use. C Reduce welding current. D Clean joint before welding. E Shield the weld area from the wind. F Discard damaged electrodes and only use electrodes with a complete flux coating.</p>

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FAULT	CAUSE	REMEDY
7 Crack occurring in weld metal soon after solidification commences	A Rigidity of joint. B Insufficient throat thickness. C Weld current 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 Decrease welding current.



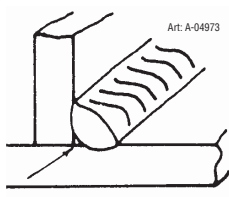


Figure 3: Example of Slag Inclusion

Table 4-1: Welding Problems SMAW (Stick)

4.03 TIG (GTAW) Basic Welding Technique

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

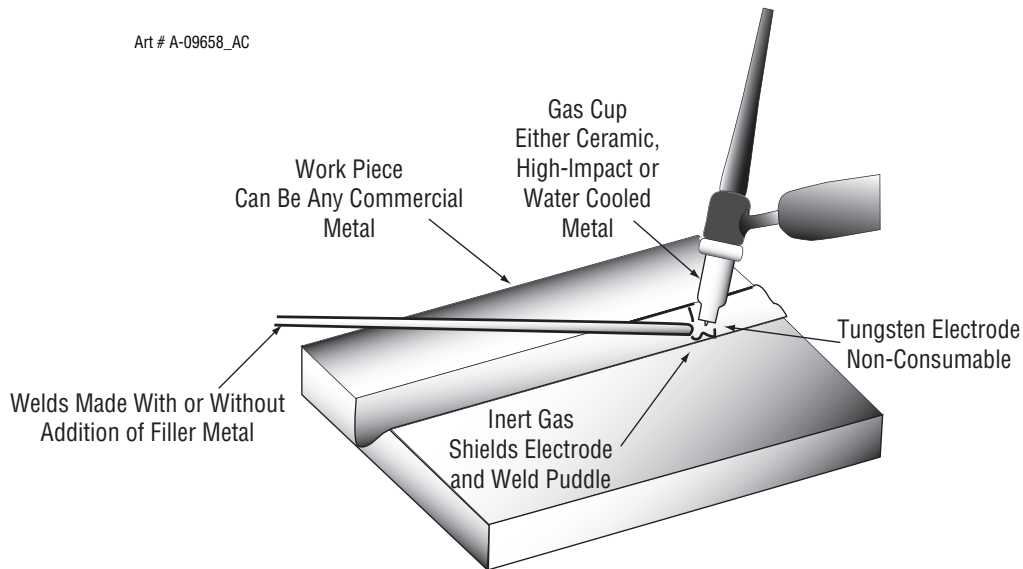


Figure 4-28: TIG Welding Application Shot

Tungsten Electrode Current Ranges

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

Table 4-2: Current Ranges for Various Tungsten Electrode Sizes

Guide for Selecting Filler Wire Diameter

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

Table 4-3: Filler Wire Selection Guide

Tungsten Electrode Types

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

Table 4-4: Tungsten Electrode Types

TIG Welding Filler Rods

AWS Std	Type/Application
ER70S-4 ER70S-6 ER70S-2	For mild-medium strength steels. Pipes, tubing, roll cages, etc.
ER80S-B2 ER90S-B3	For welding of high strength Cr-Mo steels used at elevated temperatures.
ER308L ER309L ER316L	For stainless steels. Stainless pipes, tubing, architectural uses, etc.

Table 4-5: TIG Welding Filler Rods

ESAB WARRIOR 300i CC/CV

Base Metal Thickness	DC Current for Mild Steel	DC Current for Stainless Steel	Tungsten Electrode Diameter	Filler Rod Diameter (if required)	Argon Gas Flow Rate CFH	Joint Type
0.040" 1.0mm	35-45 40-50	20-30 25-35	0.040" 1.0mm	1/16" 1.6mm	11-15	Butt/Corner Lap/Fillet
0.045" 1.2mm	45-55 50-60	30-45 35-50	0.040" 1.0mm	1/16" 1.6mm	11-15	Butt/Corner Lap/Fillet
1/16" 1.6mm	60-70 70-90	40-60 50-70	1/16" 1.6mm	1/16" 1.6mm	15	Butt/Corner Lap/Fillet
1/8" 3.2mm	80-100 90-115	65-85 90-110	1/16" 1.6mm	3/32" 2.4mm	15	Butt/Corner Lap/Fillet
3/16" 4.8mm	115-135 140-165	100-125 125-150	3/32" 2.4mm	1/8" 3.2mm	21	Butt/Corner Lap/Fillet
1/4" 6.4mm	160-175 170-200	135-160 160-180	1/8" 3.2mm	5/32" 4.0mm	21	Butt/Corner Lap/Fillet

Table 4-6: Welding Rate

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

4.04 TIG (GTAW) Welding Problems

FAULT	CAUSE	REMEDY
1 Excessive bead build up or poor penetration or poor fusion at edges of weld.	Welding current is too low	Increase weld current and/or faulty joint preparation.
2 Weld bead too wide and flat or undercut at edges of weld or excessive burn through.	Welding current is too high	Decrease weld current.
3 Weld bead too small or insufficient penetration or ripples in bead are widely spaced apart.	Travel speed too fast	Reduce travel speed.
4 Weld bead too wide or excessive bead build up or excessive penetration in butt joint.	Travel speed too slow	Increase travel speed.
5 Uneven leg length in fillet joint	Wrong placement of filler rod	Re-position filler rod.

FAULT	CAUSE	REMEDY
6 Electrode melts or oxidizes when an arc is struck.	A Torch lead connected to positive welding terminal. B No gas flowing to welding region. C Torch is clogged with dust or dirt. D Gas hose is cut. E Gas passage contains impurities. F Gas regulator turned off. G The electrode is too small for the welding current. H Power source is set for STICK welding.	A Connect torch lead to negative welding terminal. B Check the gas lines for kinks or breaks and gas cylinder contents. C Clean torch. D Replace gas hose. E Disconnect gas hose from the rear of Power Source then raise gas pressure and blow out impurities. F Turn on. G Increase electrode diameter or reduce the welding current. H Set Power Source to a GTAW operating mode.
7 Dirty weld pool	A Electrode contaminated by contact with work piece or filler rod material. B Work piece surface has foreign material on it. C Gas contaminated with air.	A Clean the electrode by grinding off the contaminates. B Clean surface. C Check gas lines for cuts and loose fitting or change gas cylinder.
8 Poor weld finish	Inadequate shielding gas.	Increase gas flow or check gas line for gas flow problems.
9 Arc start is not smooth.	A Tungsten electrode is too large for the welding current. B The wrong electrode is being used for the welding job. C Gas flow rate is too high. D Incorrect shielding gas is being used. E Poor work clamp connection to work piece.	A Select the right size tungsten electrode. Refer to Table 4-3 ESAB Tungsten Electrode Selection Chart. B Select the right tungsten electrode type. C Select the right rate for the welding job. Refer to Table 4-6. D Select the right shielding gas. E Improve connection to work piece.
10 Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the right size tungsten electrode.

Table 4-7

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SECTION 5: POWER SOURCE PROBLEMS AND ROUTINE SERVICE REQUIREMENTS

5.01 Maintenance and Repair



WARNING

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

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

The machine requires a minimum of care and maintenance. Only a few items need to be checked to ensure trouble-free long-term operation.

Check the following points for damage before starting up the welding machine,

- Mains plug and cable
- Welding torch and connections
- Keyboard membrane and control panel

Check the dust filter every two months.

- Switch the machine off
- Disconnect the mains plug
- Unscrew the ventilation grid on the rear side
- Check the dust filter for pollution
- Replace the dust filter if it is polluted (dust filter)

Use only original ESAB spare parts for maintenance and repair.

If you experience problems or need repairs, contact a dealer authorised by Victor. Never make repairs or technical changes yourself. In this case the manufacturer's warranty is no longer valid.

5.02 Power Source Status Messages

An error code is displayed in the digital displays in the event of a malfunction. You can switch over between error code and sub-error (sub code) in the digital displays by pressing Process Selection Button.

After the message has been displayed, the machine will only function to a limited extent; the error must be corrected as quickly as possible.

The status message can be deleted by pressing Encoder Control.

Code	Note	Cause	Possible Remedy
H08	Short-circuit	Short-circuit in the output circuit	Eliminate the short-circuit (pick up electrode holder, ...)
H30	Configuration	Component group recognition faulty	Take to an accredited ESAB Service Center for repair

Table 5-1 Power Source Status Messages

ESAB WARRIOR 300i CC/CV

5.03 Error Messages



WARNING

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

An error code is displayed in the digital displays in the event of a malfunction. You can switch over between error code and sub-error (sub code) in the digital displays by pressing any button. As long as there is an error code on display welding is not possible.

Code	Error	Cause	Possible Remedy
E01	Excessive Temperature	Duty cycle exceeded	Allow switched-on machine to cool down for a few minutes
		Dust filter contaminated	Replace dust filter
E02	Overtoltage	Mains voltage too high	Check mains voltage
E06	Overtoltage Secondary	Initial voltage too high	Take to an accredited ESAB Service Center for repair
E07	EEPROM	Communication with EEPROM defective	Switch machine off and on and execute Master reset. If error code returns take to an accredited ESAB Service Center for repair.
E08-1	Excess Wirefeeder Voltage	Wirefeeder voltage too high	Take to an accredited ESAB Service Center for repair
E08-2	Wirefeeder Motor	Error in Wirefeeder Motor	Take to an accredited ESAB Service Center for repair
E08-3	Overcurrent on Wirefeeder	Wirefeeder current continuously too high	Reduce motor load
E08-10	Torch Connection	Torch/torch connection error	Check torch and torch connection. Switch the equipment off and on again
E08-11	V/I Acquisition	Voltage/current measuring systems faulty	Take to an accredited ESAB Service Center for repair
E08-13	CAN Identification	Unknown device connected	Check connected devices and CAN connections
E09	Output Voltage	Voltage measuring system faulty	Take to an accredited ESAB Service Center for repair
E12	Power Section	Power section start-up faulty	Take to an accredited ESAB Service Center for repair
E13	Temperature Sensor	Temperature sensor not ready for operation	Take to an accredited ESAB Service Center for repair
E14	Supply Voltage	Internal supply voltage too low	Check mains voltages
E15	Current Detection	Error during current measurement	Take to an accredited ESAB Service Center for repair
E18	Overload Protection	Safety switch device to protect electrical components	Take to an accredited ESAB Service Center for repair
E22	Mains Undervoltage	Mains voltage on power unit is too low	Check mains voltages
E25	Idle Generator	Idle generator faulty	Take to an accredited ESAB Service Center for repair

Code	Error	Cause	Possible Remedy
E30	Error Configuration	Faulty or wrong pc-board, wrong software system installed	Take to an accredited ESAB Service Center for repair
E31	Communications Fault	CAN bus communication faulty	Switch the equipment off and on again
E32	FPGA	FPGA faulty	Take to an accredited ESAB Service Center for repair
E33	Power Section	Power module not symmetrical	Take to an accredited ESAB Service Center for repair
E34	Fans	Fan current faulty	Take to an accredited ESAB Service Center for repair
E39	Protective Earth Conductor Monitoring	Fault current to protective earth conductor	Connect the welding earth lead
E40	Voltage Detection	Voltage measurement faulty at the socket	Take to an accredited ESAB Service Center for repair
E41	Phase Loss	The primary DSP detected a loss of at least one phase of the mains.	Take to an accredited ESAB Service Center for repair
E47	Undefined Mains	Mains voltage between permitted ranges	Check mains

Table 5-2 Power Source Error Messages



NOTE!

If the output is short circuited (torch touching work piece) when machine is switched on, E12 or E09 might display, although machine is not broken. Removing short circuit on output would solve the problem.

5.04 Routine Inspection, Testing & Maintenance

The inspection and testing of the power source and associated accessories shall be carried out by a licensed electrician. Safety in Welding and Allied Processes-Part 2 Electrical. This includes an insulation resistance test and an earthing test to ensure the integrity of the unit is compliant with ESAB original specifications.

A. Testing Schedule

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

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

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

B. General Maintenance Checks

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

1. Flexible cord is of the multi-core tough rubber or plastic sheathed type of adequate rating, correctly connected and in good condition.
2. Welding terminals are in suitable condition and are shrouded to prevent inadvertent contact or short circuit.

ESAB WARRIOR 300i CC/CV

3. The Welding System is clean internally, especially from metal filing, slag, and loose material.

C. Accessories

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

D. Repairs

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

5.05 Cleaning the Welding Power Source



WARNING

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

To clean the Welding Power Source, open the enclosure and use a vacuum cleaner to remove any accumulated dirt, metal filings, slag and loose material. Keep the surfaces clean.

SECTION 6: KEY SPARE PARTS

6.01 300i CC/CV Power Source Spare Parts

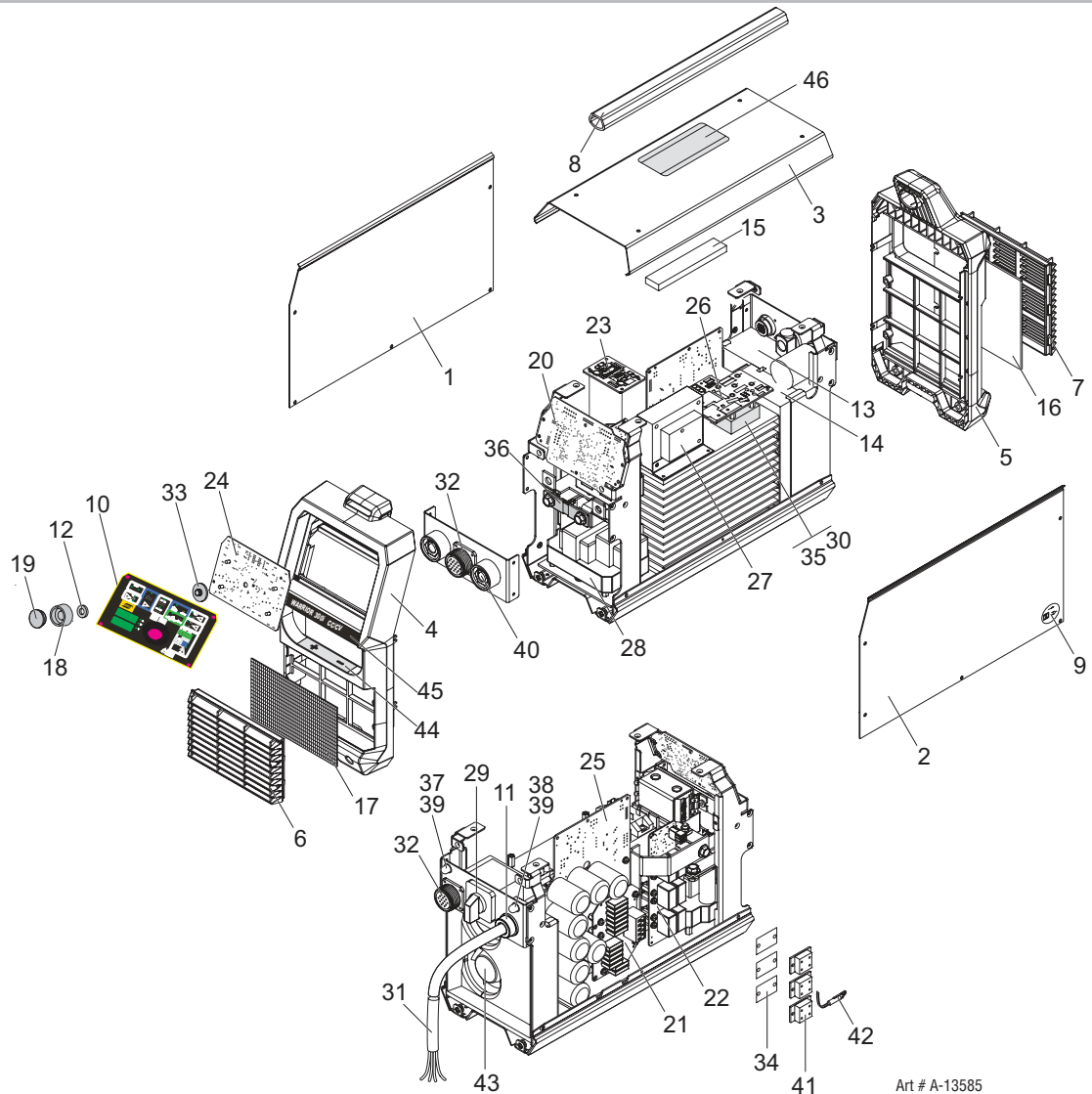


Figure 6-1 Warrior 300i CC/CV Spare Parts

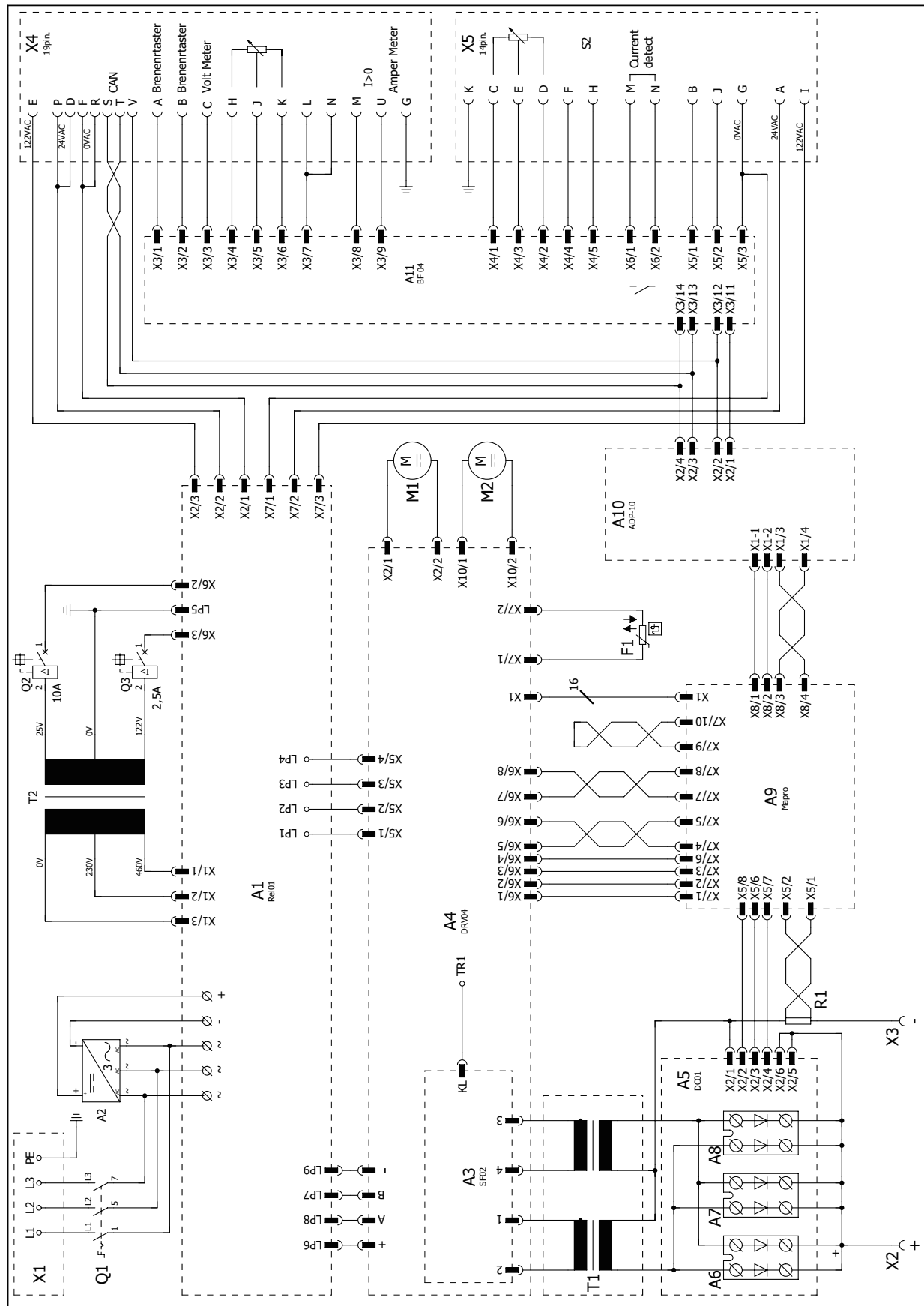
Warrior 300i CC/CV Spare Parts				
Item	Description	Des. Ref.	Quantity	Part Number
1	Side Panel Left		1	W7006700
2	Side Panel Right		1	W7006701
3	Top Panel with Display Sheet		1	W7006702
4	Front Panel		1	W7006703
5	Rear Panel		1	W7006704
6	Front Grill		1	W7006705
7	Rear Grill		1	W7006706
8	Handle Tube		1	W7006707
9	Mains Label		1	W7006708

ESAB WARRIOR 300i CC/CV

Item	Description	Des. Ref.	Quantity	Part Number
10	Display Panel Overlay		1	W7006709
11	Strain relief		1	W7006710
12	Foam Spacer		1	W7006711
13	Foam inlay		1	W7006712
14	Foam inlay		1	W7006713
15	Foam Plate Self-adhesive		1	W7006714
16	Rear Filter		1	W7006715
17	Wire Gauze		1	W7006716
18	Knob Body		1	W7006717
19	Knob Cap		1	W7006718
20	Control PCB	PCB 5	1	W7006719
21	Capacitor PCB	PCB 3	1	W7006720
22	Output PCB	PCB 7	1	W7006721
23	ADP10 PCB	PCB 6	1	W7006722
24	Front Panel PCB	PCB 4	1	W7006723
25	Main Power PCB	PCB 2	1	W7006724
26	Input PCB	PCB 1	1	W7006725
27	Aux. Transformer	T2	1	W7006726
28	Main Transformer	T1	1	W7006727
29	ON/OFF Switch	SW1	1	W7006728
30	Bridge Rectifier	BR1	1	W7006729
31	Input Mains Cable		1	W7006730
32	14 pin Remote Socket with Harness		1	W7006731
33	Insulating Bush		1	W7006732
34	Insulation Foil		3	W7006733
35	Insulation Foil		1	W7006734
36	Shunt		1	W7006735
37	Circuit breaker 2.5A 240V (115VAC)	CB1	1	W7006736
38	Circuit breaker 10A 240V (24VAC)	CB2	1	W7006737
39	Protection cover IP64		1	W7006738
40	50 mm Dinse Output Terminal		2	W7006739
41	Output Diode	D1, D2, D3	3	W7006740
42	Unit Thermal Sensor	TS1	1	W7006741
43	Cooling Fan	M1	1	W7006742
44	Label +/- ESAB		1	W7006744
45	Label 300i CC/CV		1	W7006745
46	Warning Sticker		1	W7006746
47	Sticker ESAB261 x 93 (not shown)		1	W7006748

Table 6-1 Warrior 300i CC/CVspart Parts

APPENDIX A: CIRCUIT DIAGRAM



Art # A-12461_AB

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