CIGWELD

AN ESAB® BRAND

STICK

TIG

Art # A-13053

WeldSkill 180

SERVICE MANUAL

OUTPUT CURRENT 180A DC

INPUT SUPPLY 240V 15A

STICK ELECTRODE 4.0mm MAX

LIFT TIG

WARRANTY* 3 YEAR

180 Inverter

Version No: AA | **Issue Date:** February 24, 2016 | **Manual No:** 0-5461

CIGWELD
AN ESAB® BRAND

WE APPRECIATE YOUR BUSINESS!

Congratulations on your new CIGWELD 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 accredited service provider call +1300 654 674, or visit us on the web at www.cigweld.com.au

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

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

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 If you are ever in doubt about what you see or read in this manual with the product you received, then check for a newer version of the manual on our website or contact our customer support for assistance.

YOU ARE IN GOOD COMPANY!

The Brand of Choice for Contractors and Fabricators Worldwide.

CIGWELD is a Market Leading Brand of Arc Welding Products for ESAB. We are a mainline supplier to major welding industry sectors in the Asia Pacific and emerging global markets including; Manufacturing, Construction, Mining, Automotive, Engineering, Rural and DIY.

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

Above all, we are committed to develop technologically advanced products to achieve a safer working environment for industry operators.

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.

CIGWELD WeldSkill 180 Welding Inverters
Service Manual Number 0-5461 for:
Part Numbers W1008180 and W1008181

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Publication Date: February, 2016
Revision Date:

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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

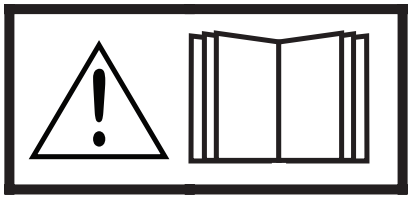
CAUTION

These INSTRUCTIONS are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc welding and cutting equipment, we urge you to read our booklet, "Precautions and Safe Practices for Arc Welding, Cutting, and Gouging," Booklet 0-5407. Do NOT permit untrained persons to install, operate, or maintain this equipment. Do NOT attempt to install or operate this equipment until you have read and fully understand these instructions. If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety Precautions before installing or operating this equipment.

USER RESPONSIBILITY

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

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



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

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SECTION 1:
ARC WELDING SAFETY INSTRUCTIONS AND WARNINGS

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

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

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

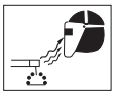
Safe practices are outlined in the Australian Standard AS1674.2-2007 entitled: Safety in welding and allied processes Part 2: Electrical. This publication and other guides to what you should learn before operating this equipment are listed at the end of these safety precautions. **HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.**

1.01 Arc Welding Hazards

WARNING
ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

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



WARNING
ARC RAYS can burn eyes and skin; NOISE can damage hearing.

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

1. Use a Welding Helmet or Welding Faceshield fitted with a proper shade of filter (see ANSI Z49.1 and AS 1674 listed in Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Use approved ear plugs or ear muffs if noise level is high.
6. Never wear contact lenses while welding.

Recommended Protective Filters for Electric Welding

Description of Process	Approximate Range of Welding Current in Amps	Minimum Shade Number of Filter(s)
Manual Metal Arc Welding - covered electrodes (MMAW)	Less than or equal to 100	8
	100 to 200	10
	200 to 300	11
	300 to 400	12
	Greater than 400	13
Gas Metal Arc Welding (GWAW) (MIG) other than Aluminium and Stainless Steel	Less than or equal to 150	10
	150 to 250	11
	250 to 300	12
	300 to 400	13
	Greater than 400	14
Gas Metal Arc Welding (GMAW) (MIG) Aluminium and Stainless Steel	Less than or equal to 250	12
	250 to 350	13
Gas Tungsten Arc Welding (GTAW) (TIG)	Less than or equal to 100	10
	100 to 200	11
	200 to 250	12
	250 to 350	13
	Greater than 350	14
Flux-cored Arc Welding (FCAW) -with or without shielding gas.	Less than or equal to 300	11
	300 to 400	12
	400 to 500	13
	Greater than 500	14
Air - Arc Gouging	Less than or equal to 400	12
Plasma - Arc Cutting	50 to 100	10
	100 to 400	12
	400 to 800	14
Plasma - Arc Spraying	—	15
Plasma - Arc Welding	Less than or equal to 20	8
	20 to 100	10
	100 to 400	12
	400 to 800	14
Submerged - Arc Welding	—	2(5)
Resistance Welding	—	Safety Spectacles or eye shield

Refer to standard AS/NZS 1338.1:1992 for comprehensive information regarding the above table.

WARNING
FUMES AND GASES can be hazardous to your health.

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

1. Keep your head out of the fumes. Do not breath the fumes.
2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapours to form highly toxic and irritating gases.
7. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

WARNING
WELDING can cause fire or explosion.

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

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

WARNING
FLYING SPARKS AND HOT METAL can cause injury.

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

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

WARNING
CYLINDERS can explode if damaged.

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

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.

6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinder is in use or connected for use.
8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.

WARNING
MOVING PARTS can cause injury.

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

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

WARNING
This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety code Sec. 25249.5 et seq.)

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

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

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

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

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

1.02 PRINCIPAL SAFETY STANDARDS

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

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

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

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

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

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

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

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

Safety in welding and allied processes Part 1: Fire Precautions, AS 1674.1-1997 from SAI Global Limited, www.saiglobal.com.

Safety in welding and allied processes Part 2: Electrical, AS 1674.2-2007 from SAI Global Limited, www.saiglobal.com.

Filters for eye protectors - Filters for protection against radiation generated in welding and allied operations AS/NZS 1338.1:1992 from SAI Global Limited, www.saiglobal.com.

1.03 DECLARATION OF CONFORMITY

Manufacturer: CIGWELD
Address: 71 Gower St, Preston
Victoria 3072

Australia

Description of equipment: Welding Equipment (MMAW, GTAW) including, but not limited to CIGWELD Weldskill 140, 180 inverters and associated accessories.

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

The equipment conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (Directive 2006/95/EC) and to the National legislation for the enforcement of the Directive.

National Standard and Technical Specifications

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

- IEC 60974-10 applicable to Industrial Equipment - generic emissions and regulations.
- AS 60974.1 / IEC 60974-1 applicable to welding equipment and associated accessories.

Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process, to ensure the product is safe and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

CIGWELD has been manufacturing and merchandising an extensive equipment range with superior performance, ultra safe operation and world class quality for more than 30 years and will continue to achieve excellence.

SECTION 2: INTRODUCTION

2.01 How To Use This Manual

This Service Manual only applies to the Part Numbers listed on page i.

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

Throughout this manual, the 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:

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

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

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

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

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

Additional copies of this manual may be purchased by contacting CIGWELD at the address and phone number for your location listed in the inside back cover of this manual. Include the Owner's Manual number and equipment identification numbers.

Electronic copies of this manual can also be downloaded at no charge in Acrobat PDF format by going to the CIGWELD web site listed below and clicking on the Literature Library link:

http://www.cigweld.com.au

2.02 Equipment Identification

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

2.03 Receipt Of Equipment

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

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

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

2.04 Symbol Chart

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

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

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

	Wire Feed Function
	Wire Feed Towards Workpiece With Output Voltage Off.
	Welding Gun
	Purging Of Gas
	Continuous Weld Mode
	Spot Weld Mode
t	Spot Time
t1	Preflow Time
t2	Postflow Time
	2 Step Trigger Operation Press to initiate wirefeed and welding, release to stop.
	4 Step Trigger Operation Press and hold for preflow, release to start arc. Press to stop arc, and hold for preflow.
t	Burnback Time
	Disturbance In Ground System
IPM	Inches Per Minute
MPM	Meters Per Minute

Art # A-04937

2.05 Description

WeldSkill 180 Inverter

This compact heavy duty, inverter welding machine has infinitely adjustable welding current from 10 to 180 amps. It runs standard general purpose 2.5mm electrodes for light gauge work, generally less than 3.0mm thick, and 4.0mm electrodes for heavier material. The unit also has a lift TIG function that offers stable TIG welding characteristics when used with a suitable TIG torch and shielding gas.

2.06 User Responsibility

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

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

2.07 Packaged Item

WeldSkill 180 Inverter with Toolbox (Part No. W1008180)

- WeldSkill 180 Inverter Power Source
- 4m Lead with Twistlock Electrode Holder
- 4m Lead with Work Clamp
- Shoulder Strap
- Toolbox
- Operating Manual

Art # A-12886

2.08 Transporting Methods

These units are equipped with a handle for carrying purposes.

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

WARNING
FALLING EQUIPMENT can cause serious personal injury and equipment damage.

Lift unit with handle on top of case.

Use handcart or similar device of adequate capacity.

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

2.09 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 15% duty cycle, 90 amperes at 23.6 volts. This means that it has been designed and built to provide the rated amperage (90A) for 1.5 minutes, i.e. arc welding time, out of every 10 minute period (15% of 10 minutes is 1.5 minutes). During the other 8.5 minutes of the 10 minute period the Welding Power Source must idle and allowed to cool.

2.10 Specifications

Description	WeldSkill 180
Toolbox Plant Part No	W1008180
Power Source Dimensions	H220mmxW130mmxD340mm
Power Source Mass	5.8 KG
Cooling	Fan Cooled
Welder Type	Stick and Lift TIG Multi Process Inverter Power Source
Australian Standard	AS 60974.1-2006 / IEC 60974-1
Number of Phases	Single Phase
Nominal Supply Voltage	240V AC ± 10%
Nominal Supply Frequency	50/60 Hz
Welding Current Range	10 - 180 A
Nominal DC Open Circuit Voltage	78 V
Factory Fitted Supply Plug Rating	15 Amps
Effective Input Current (I_{1eff}) refer Note 2	15 Amps
Maximum Input Current (I_{1max})	33.8 Amps
Minimum Single Phase Generator Recommendation (refer Note 4)	7.6 kW (9.5 kVA @ 0.8 PF)
STICK (MMAW) Welding Output, 40ºC, 10 min.	180 A @ 20%, 27.2 V
	147 A @ 30%, 25.9V
	110 A @ 60%, 24.4 V
	90 A @ 100%, 23.6 V
TIG (GTAW) Welding Output, 40ºC, 10 min.	180 A @ 40%, 17.2 V
	150 A @ 60%, 16 V
	115 A @ 100%, 14.6 V
Protection Class	IP21S

Table 2-1: Specifications

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
Minimum Generator Recommendation at the Maximum Output Duty Cycle.

Due to large variations in performance and specifications of different brands and types of generators, CIGWELD cannot guarantee full welding output power or duty cycle on every brand or type of generator.

Some small generators incorporate low cost circuit breakers on their outputs. These circuit breakers usually will have a small reset button, and will trip much faster than a switchboard type circuit breaker. This may result in not being able to achieve full output or duty cycle from the power source / generator combination. For this reason we recommend a generator that incorporates switchboard type circuit breakers.

CIGWELD recommends that when selecting a generator, that the particular power source / generator combination be adequately trialled to ensure the combination performs to the users expectations.

NOTE 5
CIGWELD reserves the right to change product performance and specifications without notice.

2.11 Optional Accessories

We recommend genuine CIGWELD products.

The biggest range and best quality with guaranteed performance.

Part Number	Description
W7003021	TIG Torch 17V, 3m lead with 50mm^2 dinse
BGSAK2	TIG Torch Accessory Kit for 17, 26 & 18 TIG Torches
210254	WeldSkill Regulator/Flowmeter
WS42550	WeldSkill Welding Leadset 4m, 25mm^2 cable, 50mm^2 dinse, 250A Twistlock Electrode Holder
WS53550	WeldSkill Welding Leadset 5m, 35mm^2 cable, 50mm^2 dinse, 400A Twistlock Electrode Holder

Table 2-2

2.11 Optional Accessories (Cont'd)

TIG Torch Consumables

Part Number	Description
BG10N49/R	Nozzle Alumina 8mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N48/R	Nozzle Alumina 10mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N47/R	Nozzle Alumina 11mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N46/R	Nozzle Alumina 12.5mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N22/R	Collet 1.0mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N23/R	Collet 1.6mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N24/R	Collet 2.4mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N25/R	Collet 3.2mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N30/R	Collet Body 1.0mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N31/R	Collet Body 1.6mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N32/R	Collet Body 2.4mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG10N28/R	Collet Body 3.2mm, for 17, 26 & 18 TIG Torches (pkt of 5)
BG57Y02/R	Back Cap – Long for 17, 26 & 18 TIG Torches (pkt of 2)
BG57Y04/R	Back Cap – Short for 17, 26 & 18 TIG Torches (pkt of 2)

Table 2-3

TIG Electrodes

Part Number	Description
699846	Ceriated Electrode 1.6mm x 175mm AC/DC Grey (Pkt of 10)
699847	Ceriated Electrode 2.4mm x 175mm AC/DC Grey (Pkt of 10)
699848	Ceriated Electrode 3.2mm x 175mm AC/DC Grey (Pkt of 10)

Table 2-4

Related Products

Part Number	Description
646754	WeldSkill TIG Welding Gloves
646755	WeldSkill Heavy Duty Welding Gloves
454304	WeldSkill Auto Darkening Welding Helmet Fixed Shade 11 Black
454305	WeldSkill Auto Darkening Welding Helmet Variable Shade 9-13 Blue
454314	WeldSkill Auto Darkening Welding Helmet Variable Shade 9-13 Carbon Fibre
454321	WeldSkill Auto Darkening Welding Helmet Variable Shade 9-13 Racer
454322	WeldSkill Auto Darkening Welding Helmet Variable Shade 9-13 Tribal
454323	WeldSkill Auto Darkening Welding Helmet Variable Shade 9-13 White Carbon
454324	WeldSkill Auto Darkening Welding Helmet Variable Shade 9-13 Oz Flag
Note: CIGWELD Electrodes see pages 5-2 and 5-3	

Table 2-5

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SECTION 3: INSTALLATION

3.01 Environment

These units are designed for use in environments with increased hazard of electric shock.

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

1. In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts.
2. In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator.

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

3.02 Location

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

A. In areas, free from moisture and dust.

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

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

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

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

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

3.03 Ventilation

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 ± 10% of the rated Mains supply voltage. If actual Mains Supply Voltage is outside this range Welding Current may not be available and may cause internal components to fail.

Refer to Specifications on page 2-5 for Supply Voltage information.

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 2-5.

IMPORTANT NOTE!
This product has been fitted with a supply plug as indicated in Section 2.10. Note that the welding output range applicable with the fitted supply plug is detailed in Section 2.10.

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

3.05 Generators

Refer to Note 4 on page 2-6 for recommendations when using with a Generator.

3.06 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 974-13 Arc Welding Equipment - Installation and use (under preparation).

B. Assessment of Area

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

1. Other supply cables, control cables, 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 immunity of other equipment in the environment: the user shall ensure that other equipment being used in the environment is compatible: this may require additional protection measures.

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

C. Methods of Reducing Electromagnetic Emissions

1. Mains Supply

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

2. Maintenance of Welding Equipment

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

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

6. Screening and Shielding

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

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SECTION 4: OPERATION

4.01 Overview

Conventional operating procedures apply when using the Welding Power Source, i.e. connect work lead directly to workpiece and electrode lead is used to hold electrode (Consult the electrode manufacturers information for the correct polarity). The welding current range values should be used as a guide only. Current delivered to the arc is dependent on the welding arc voltage, and as welding arc voltage varies between different classes of electrode, welding current at any one setting would vary according to the type of electrode in use. The operator should use the welding current range values as a guide, then finally adjust the current setting to suit the application.

4.02 Power Source Controls, Indicators and Features

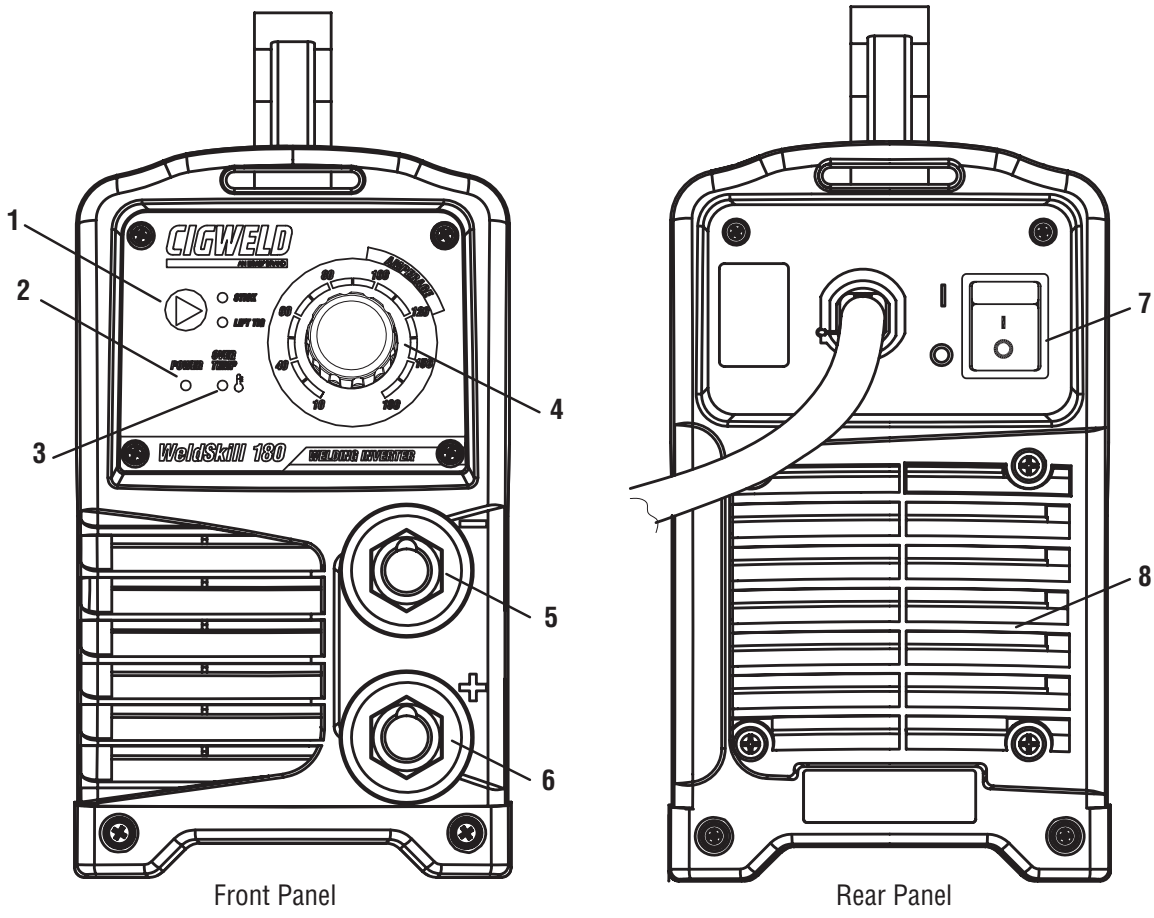

Figure 4-1

1. Process Selection Control

The process selection control is used to select the desired welding mode. Two modes are available, Stick (MMAW) and Lift TIG (GTAW) modes. Refer to section 5.01 for Stick (MMAW) set-up details or section 6.01 for Lift TIG (GTAW) set-up details.

2. Power Indicator

The power indicator is illuminated when nominal 240V AC mains power is applied to the power source and the ON/OFF switch located on the rear panel is in the ON position.

3. Over Temp Indicator

This welding power source is protected by a self resetting thermostat. The Over Temp indicator will illuminate if the machine has over heated which normally occurs if the duty cycle of the power source has been exceeded. Should the Over Temp indicator illuminate the output of the power source will be disabled. Leave the power source turned On to allow the internal components to cool down. Once the power source cools down sufficiently the Over Temp indicator will automatically go off. Note that the On/Off switch should remain in the On position such that the fan continues to operate thus allowing the power source to cool sufficiently. Do not switch the power source Off if an Over Temp condition is present.

4. Amperage Control (Welding Current)

The amperage control knob adjusts the amount of welding current delivered by the power source. The amperage is increased by turning the amperage clockwise or decreased by turning the amperage control knob anti-clockwise. The amperage should be set according to the electrode type and the specific application. Refer to application notes in this manual for further information.

5. Negative Welding Output Terminal

The negative welding terminal is used to connect the welding output of the power source to the work lead. Most General Purpose electrodes are connected with work lead to negative. Consult the electrode manufacturer's information for the correct polarity.

Welding current flows from the workpiece via this Dinse type terminal to the power source. It is essential, however, that the male dinse type plug is inserted and turned securely to achieve a sound electrical connection. Do not over tighten.

CAUTION 1
Loose welding terminal connections can cause overheating and result in the male plug being fused in the Dinse terminal.

6. Positive Welding Output Terminal

The positive welding terminal is used to connect the welding output of the power source to the electrode holder lead. Most General Purpose electrodes are connected with electrode to positive. Consult the electrode manufacturer's information for the correct polarity.

Positive welding current flows from the power source via this Dinse type terminal. It is essential, however, that the male Dinse type plug is inserted and turned securely to achieve a sound electrical connection. Do not over tighten.

CAUTION 2
Loose welding terminal connections can cause overheating and result in the male plug being fused in the Dinse terminal.

7. On/Off Switch

This switch is used to turn the unit ON/OFF. When this switch is turned ON the Power Indicator on the front panel will illuminate.

8. Fan

The Fan is turned ON/OFF by the Power Switch on the rear panel of the machine.

9. Hot Start Feature (Not Shown)

This feature operates in Stick (Manual Arc) mode. The Hot Start feature improves the arc start characteristics by momentarily increasing the welding current to a level above the preset amperage (Welding Current). This is a preset feature and is not adjustable.

10. Arc Force Feature (Not Shown)

This feature operates in Stick (Manual Arc) mode.

Stick electrodes can sometimes ‘stick’ to the work piece when pushed into a tight corner or joint fit-up with particular stick electrodes. The Arc force feature can be particularly beneficial in helping to overcome this by automatically increasing current when the machine senses a decrease in voltage levels. This is a preset feature and is not adjustable.

11. Anti Stick Feature (Not Shown)

This feature operates in Stick (Manual Arc) mode.

The anti stick feature senses when the electrode sticks and automatically reduces the current to prevent the Stick Electrode from sticking to the work piece. This is a preset feature and is not adjustable.

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SECTION 5:
STICK (MMAW) WELDING

5.01 Setup For STICK (MMAW) Welding

A. Select Stick mode with the process selection control (refer to Section 4.02.1 for further information).

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

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

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

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

NOTE!
Consult the electrode manufacturer's information for the correct polarity.-

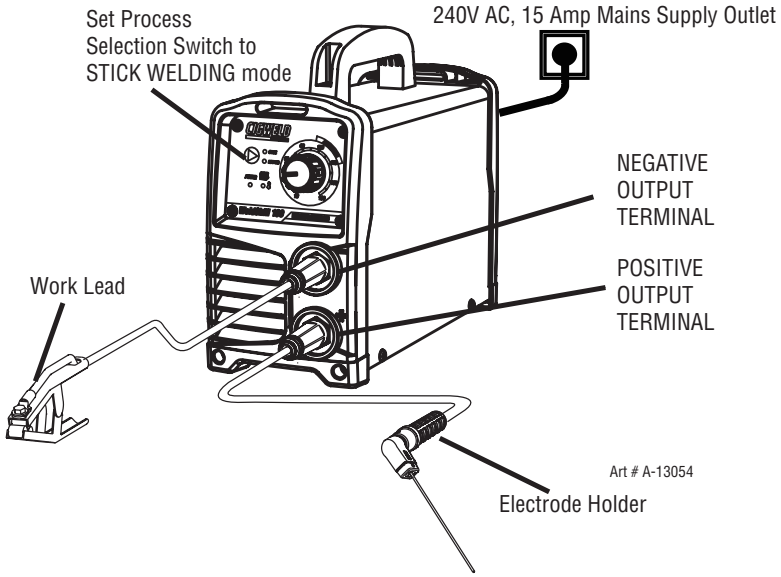


Figure 5-1: Setup For STICK (MMAW) Welding

5.02 Arc Welding Electrodes

Metal arc welding electrodes consist of a core wire surrounded by a flux coating. The flux coating is applied to the core wire by an extrusion process.

The coating on arc welding electrodes serves a number of purposes:

A. To provide a gaseous shield for the weld metal, and preserve it from contamination by the atmosphere whilst in a molten state.

B. To give a steady arc by having 'arc stabilisers' present, which provide a bridge for current to flow across.

C. To remove oxygen from the weld metal with 'deoxidisers'.

D. To provide a cleansing action on the work piece and a protective slag cover over the weld metal to prevent the formation of oxides while the metal is solidifying. The slag also helps to produce a bead of the desired contour.

E. To introduce alloys into the weld deposits in special type electrodes.

5.03 Types of Electrodes

Arc Welding electrodes are classified into a number of groups depending on their applications. There are a great number of electrodes used for specialised industrial purposes which are not of particular interest for everyday general work. These include some low hydrogen types for high tensile steel, cellulose types for welding large diameter pipes, etc.

The range of electrodes dealt with in this publication will cover the vast majority of applications likely to be encountered; are all easy to use and all will work on even the most basic of welding machines.

CIGWELD Electrode Selection Chart

Description	Diameter	Pack	Part No.	Application
Satincraft 13	2.5mm 2.5mm 3.2mm 3.2mm 4.0mm	1kg 2.5kg 1kg 2.5kg 5kg	322135 612182 322136 612183 611184	General purpose electrode suitable for all positional welding and galvanised steel.
Ferrocraft 12XP	2.0mm 2.0mm 2.5mm 2.5mm 3.2mm 3.2mm 4.0mm	1kg 2.5kg 1kg 2.5kg 1kg 2.5kg 5kg	322128 612231 322129 612232 322138 612233 611234	General purpose, extra performance electrode recommended for all positional (inc. Vertical down) welding of mild and galvanised steel.
WeldSkill GP	2.0mm 2.0mm 2.5mm 2.5mm 2.5mm 3.2mm 3.2mm 3.2mm 4.0mm	1 kg 2.5 kg 1 kg 2.5 kg 5 kg 1 kg 2.5 kg 5 kg 5 kg	WEG1020 WEG2520 WEG1025 WEG2525 WEG5025 WEG1032 WEG2532 WEG5032 WEG5040	User-friendly GP electrode for welding thin section mild and galvanised steels. Excellent for vertical down fillet welding applications.
Ferrocraft 16 Twincoat	2.5mm 3.2mm 4.0mm	5 kg 5 kg 5 kg	611752 611753 611754	Hydrogen Controlled type offering exceptional AC/DC performance in all welding positions.
Satincrome 308L-17	2.5mm 3.2mm 4.0mm	2.5 kg 2.5 kg 2.5 kg	611602 611603 611604	Stainless Steel type for 19Cr/10Ni stainless grades including 201, 202, 301, 302, 303, 304, 304L, 305, 308, etc

Cigweld Electrode Selection Chart continued over page

CIGWELD Electrode Selection Chart cont'd				
Description	**Diameter**	**Pack**	**Part No.**	**Application**
Satincrome 309Mo-17	2.5mm 3.2mm 4.0mm	2.5 kg 2.5 kg 2.5 kg	611692 611693 611694	Stainless Steel type for 309 and 309L grades. It is also suitable for welding of dissimilar welding of other 300 series stainless steels.
Satincrome 316L-17	2.0mm 2.5mm 3.2mm 2.5/3.2mm 4.0mm	2,5 kg 2.5 kg 2.5 kg Blisterpack 2.5 kg	611661 611662 611663 322215 611664	Stainless Steel type for welding of matching Mo bearing grades, 316 and 316L.
Weldall	2.5mm 3.2mm 2.5/3.2mm 4.0mm	2.5 kg 2.5 kg Blisterpack 2.5 kg	611702 611703 322216 611704	High alloy stainless steel type for welding of unknown steels, repair of die or tool steels and for joining dissimilar steels. (Not recommended for cast iron).
Castcraft 55	3.2mm	2.5 kg	611723	For repair and maintenance welding of S.G. cast iron, meehanite and other cast irons. It produces a higher strength weld than Castcraft 100.
Castcraft 100	2.5mm 3.2mm Blisterpack 4.0mm	2.5 kg 2.5 kg Blisterpack 2.5 kg	611732 611733 322217 611734	Soft, Ductile Nickel type electrode for repair and maintenance welding of a wide range of cast irons. It has better “wetting” action than Castcraft 55.

Table 5-1 Types of Electrodes

5.04 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 most work, a 2.5mm electrode will be quite sufficient. A 2.5mm electrode will give just as strong a joint but may require a few more weld runs to be put down to fill the joint.

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.

5.05 Storage of Electrodes

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

5.06 Electrode Polarity

Electrodes are connected to the Electrode Holder, and the Work Lead is connected to the work piece. Consult the Electrode manufacturer's information for the correct polarity.

5.07 Effects of Arc Welding Various Materials

A. High tensile and alloy steels

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

B. Austenitic manganese steels

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

C. Cast Iron

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

D. Copper and alloys

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

5.08 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.

5.09 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 5-2 through 5-9.

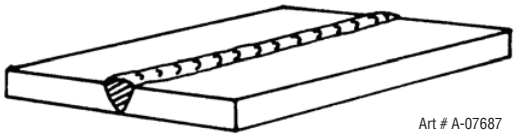


Figure 5-2: Flat position, down hand butt weld

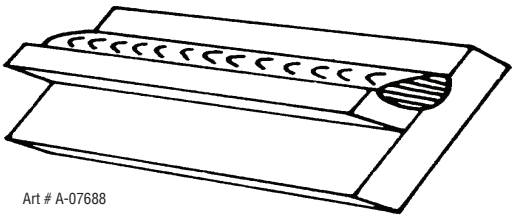


Figure 5-3: Flat position, gravity fillet weld

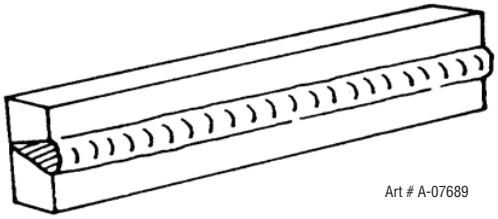


Figure 5-4: Horizontal position, butt weld

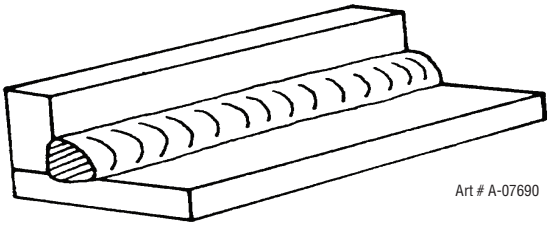


Figure 5-5: Horizontal - Vertical (HV) position

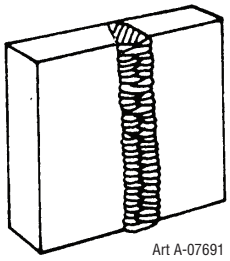


Figure 5-6: Vertical position, butt weld

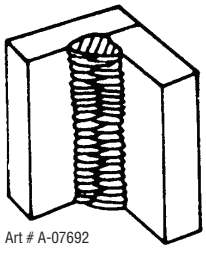


Figure 5-7: Vertical position, fillet weld

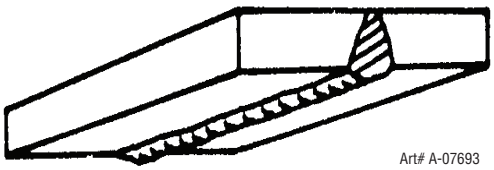


Figure 5-8: Overhead position, butt weld

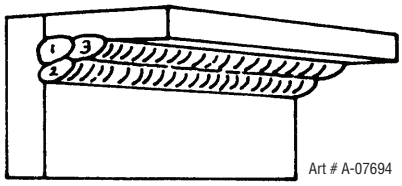


Figure 5-9: Overhead position fillet, weld

5.10 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 5-10.

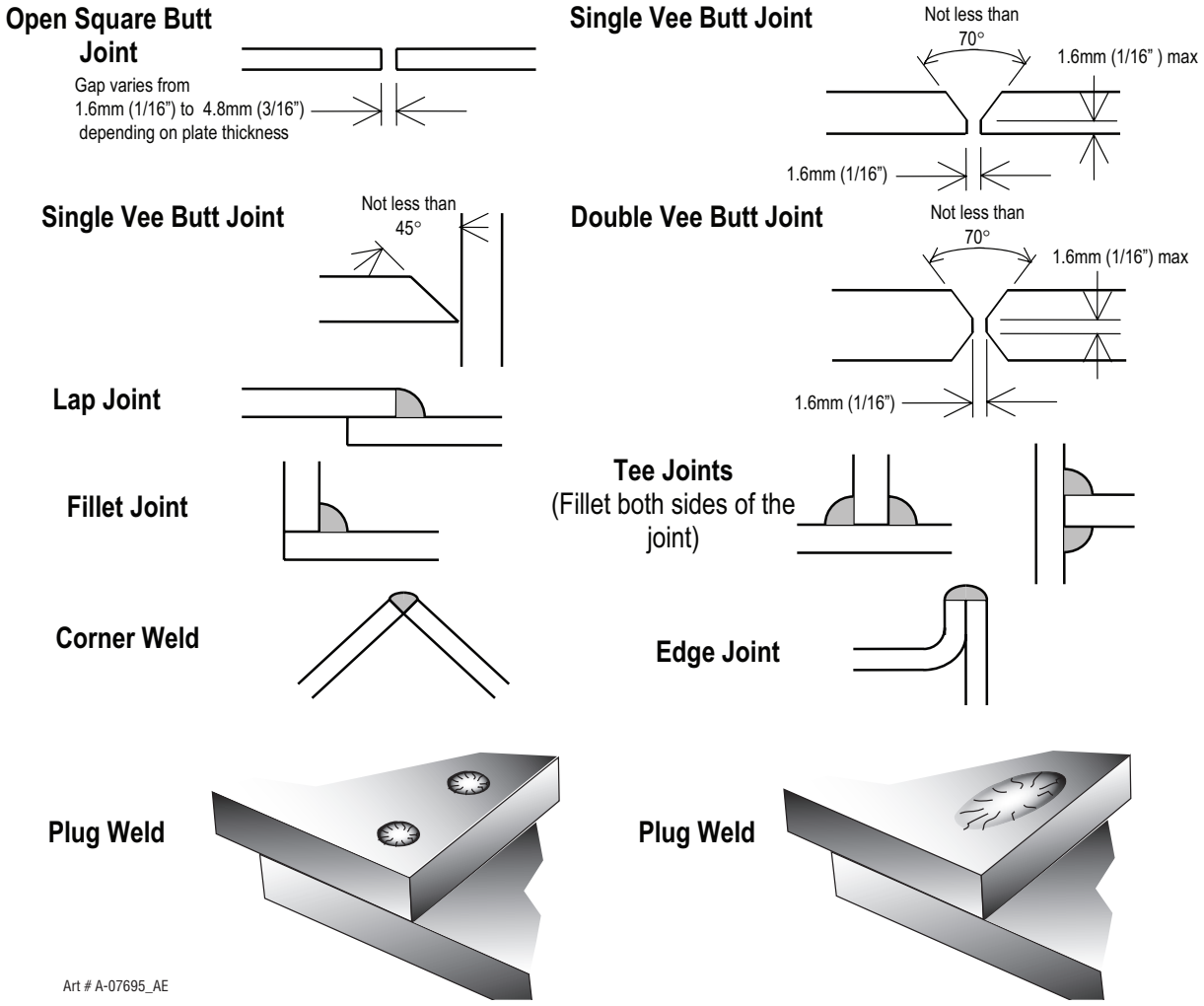


Figure 5-10: Typical joint designs for arc welding

5.11 Arc Welding Technique

A Word to Beginners

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

5.12 The Welder

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

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

5.13 Striking the Arc

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

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

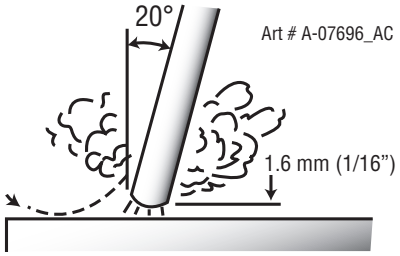


Figure 5-11: Striking an arc

5.14 Arc Length

The securing of an arc length necessary to produce a neat weld soon becomes almost automatic. You will find that a long arc produces more heat. A very long arc produces a crackling or spluttering noise and the weld metal comes across in large, irregular blobs. The weld bead is flattened and spatter increases. A short arc is essential if a high quality weld is to be obtained although if it is too short there is the danger of it being blanketed by slag and the electrode tip being solidified in. If this should happen, give the electrode a quick twist back over the weld to detach it. Contact or "touch-weld" electrodes such as Ferrocraft 21 do not stick in this way, and make welding much easier.

5.15 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.

5.16 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.

NOTE!
The welding current range values should be used as a guide only. Current delivered to the arc is dependent on the welding arc voltage, and as welding arc voltage varies between different classes of electrode, welding current at any one setting would vary according to the type of electrode in use. The operator should use the welding current range values as a guide, then finally adjust the current setting to suit the application.

A. Butt Welds

Set up two plates with their edges parallel, as shown in Figure 5-12, allowing 1.6mm to 2.4mm gap between them and tack weld at both ends. This is to prevent contraction stresses from the cooling weld metal pulling the plates out of alignment. Plates thicker than 6.0mm should have their mating edges bevelled to form a 70° to 90° included angle. This allows full penetration of the weld metal to the root. Using a 3.2mm Ferrocraft 21 electrode at 100 amps, deposit a run of weld metal on the bottom of the joint.

Do not weave the electrode, but maintain a steady rate of travel along the joint sufficient to produce a well-formed bead. At first you may notice a tendency for undercut to form, but keeping the arc length short, the angle of the electrode at about 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.

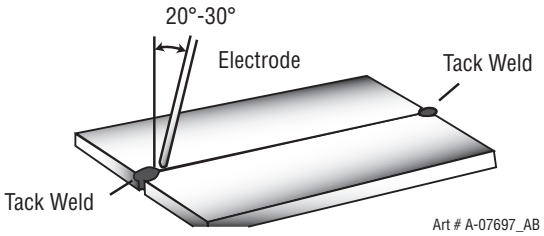


Figure 5-12: Butt weld

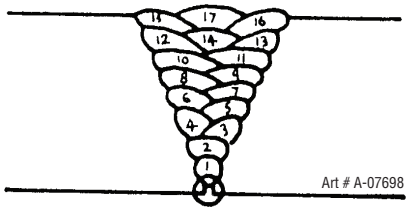


Figure 5-13: Weld build up sequence

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 5-13. 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 5-3.

A piece of angle iron is a suitable specimen with which to begin, or two lengths of strip steel may be tacked together at right angles. Using a 3.2mm Ferrocraft 21 electrode at 100 amps, position angle iron with one leg horizontal and the other vertical. This is known as a horizontal-vertical (HV) fillet. Strike the arc and immediately bring the electrode to a position perpendicular to the line of the fillet and about 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 5-14. Do not attempt to build up much larger than 6.4mm width with a 3.2mm electrode, otherwise the weld metal tends to sag towards the base, and undercut forms on the vertical leg. Multi-runs can be made as shown in Figure 5-15. Weaving in HV fillet welds is undesirable.

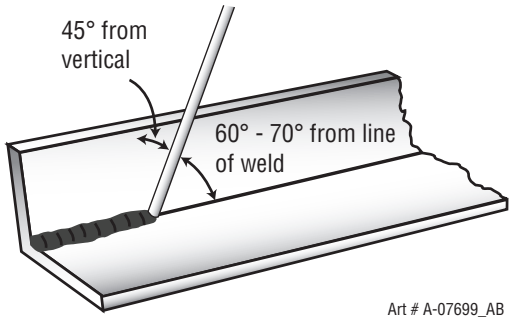


Figure 5-14: Electrode position for HV fillet weld

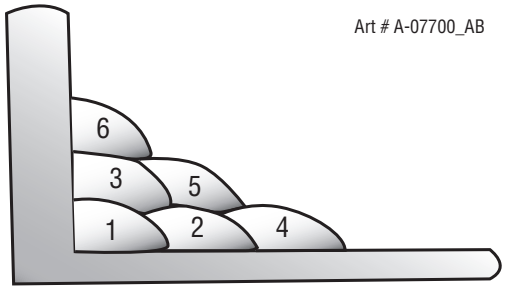


Figure 5-15: Multi-runs in HV fillet weld

C. Vertical Welds

1. Vertical Up

Tack weld a three feet length of angle iron to your work bench in an upright position. Use a 3.2mm Ferrocraft 21 electrode and set the current at 100 amps. Make yourself comfortable on a seat in front of the job and strike the arc in the corner of the fillet. The electrode needs to be about 10° from the horizontal to enable a good bead to be deposited. Refer Figure 5-16. 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 5-17 illustrates multi-run technique and Figure 5-18 shows the effects of pausing at the edge of weave and of weaving too rapidly.

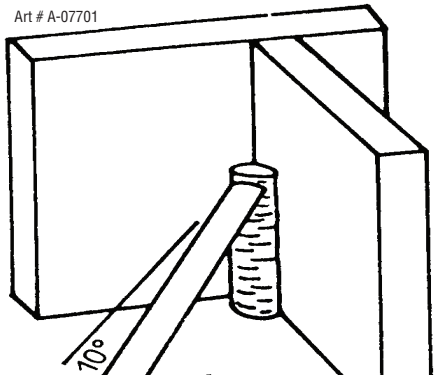


Figure 5-16: Single run vertical fillet weld

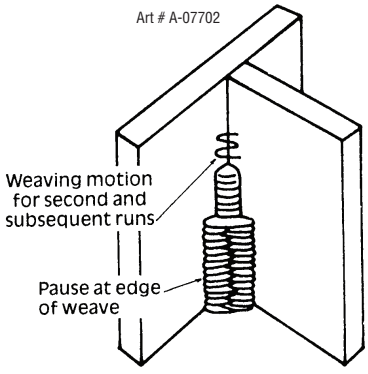


Figure 5-17: Multi run vertical fillet weld

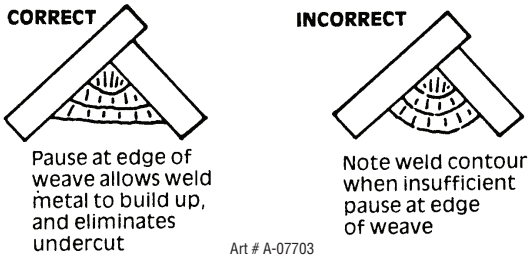


Figure 5-18: Examples of vertical fillet welds

2. Vertical Down

The Ferrocraft 21 electrode makes welding in this position particularly easy. Use a 3.2mm electrode at 100 amps. The tip of the electrode is held in light contact with the work and the speed of downward travel is regulated so that the tip of the electrode just keeps ahead of the slag. The electrode should point upwards at an angle of about 45°.

3. Overhead Welds

Apart from the rather awkward position necessary, overhead welding is not much more difficult that downhand welding. Set up a specimen for overhead welding by first tacking a length of angle iron at right angles to another piece of angle iron or a length of waste pipe. Then tack this to the work bench or hold in a vice so that the specimen is positioned in the overhead position as shown in the sketch. The electrode is held at 45° to the horizontal and tilted 10° in the line of travel (Figure 5-19). The tip of the electrode may be touched lightly on the metal, which helps to give a steady run. A weave technique is not advisable for overhead fillet welds. Use a 3.2mm Ferrocraft 12XP electrode at 100 amps, and deposit the first run by simply drawing the electrode along at a steady rate. You will notice that the weld deposit is rather convex, due to the effect of gravity before the metal freezes.

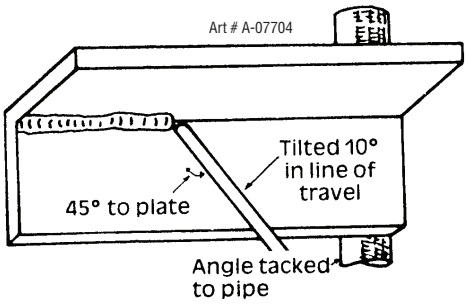


Figure 5-19: Overhead fillet weld

5.17 Distortion

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

5.18 The Cause of Distortion

Distortion is cause by:

A. Contraction of Weld Metal:

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

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

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

The metal in the weld area is stretched (plastic deformation), the job may be pulled out of shape by the powerful contraction stresses (distortion), or the weld may crack, in any case, there will remain "locked-up" stresses in the job. Figures 5-20 and 5-21 illustrate how distortion is created.

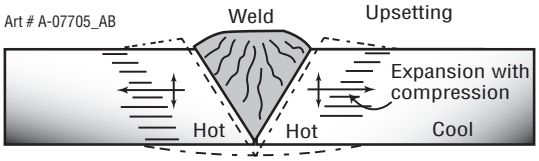


Figure 5-20: Parent metal expansion

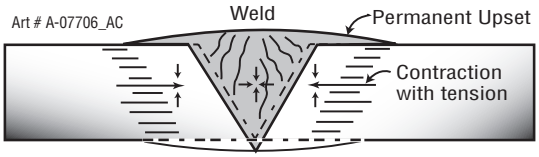


Figure 5-21: Parent metal contraction

5.19 Overcoming Distortion Effects

There are several methods of minimising 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 5-25 through 5-28 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 presetting 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 5-22.

E. Preheating

Suitable preheating of parts of the structure other than the area to be welded can be sometimes used to reduce distortion. Figure 5-23 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.

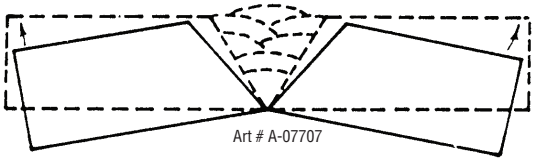
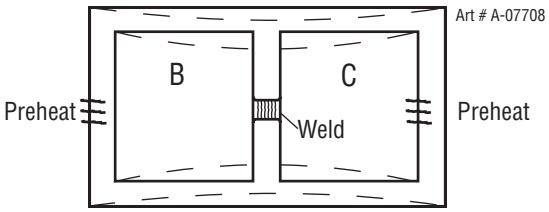


Figure 5-22: Principle of presetting



Dotted lines show effect if no preheat is used

Figure 5-23: Reduction of distortion by preheating

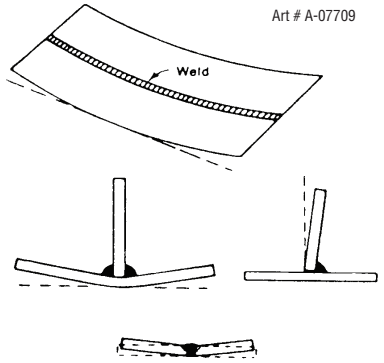
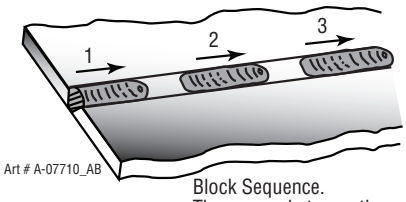


Figure 5-24: Examples of distortion



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

Figure 5-25: Welding sequence

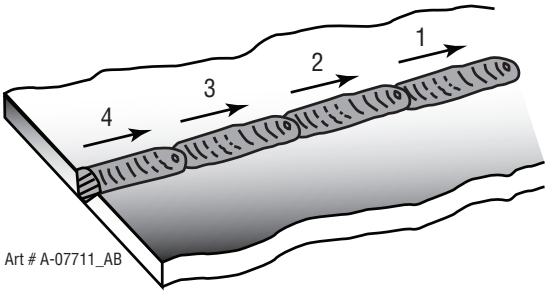


Figure 5-26: Step back sequence

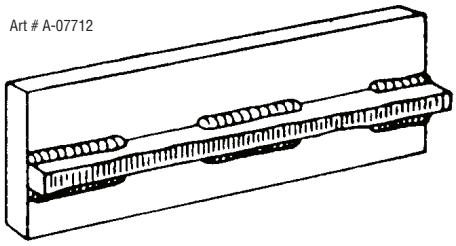


Figure 5-27: Chain intermittent welding

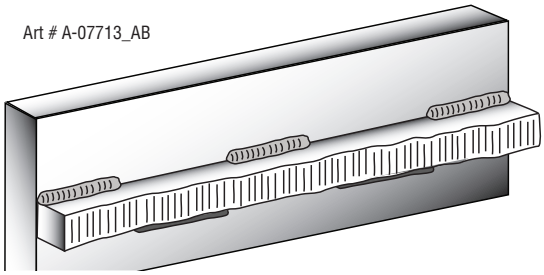


Figure 5-28: Staggered intermittent welding

5.20 Welding Problems

Description	Possible Cause	Remedy
1 Gas pockets or voids in weld metal (Porosity)	A Electrodes are damp	A Dry electrodes before use
	B Welding current is too high	B Reduce welding current
	C Surface impurities such as oil, grease, paint, etc	C Clean joint before welding
2 Crack occurring in weld metal soon after solidification commences	A Rigidity of joint	A Redesign to relieve weld joint of severe stresses or use crack resistance electrodes
	B Insufficient throat thickness	B Travel slightly slower to alloy greater build-up in throat
	C Cooling rate is too high	C Preheat plate and cool slowly
3 A gap is left by failure of the weld metal to fill the root of the weld	A Welding current is too low	A Increase welding current
	B Electrode too large for joint	B Use smaller diameter electrode
	C Insufficient gap	C Allow wider gap
	D Incorrect sequence	D Use correct build-up sequence

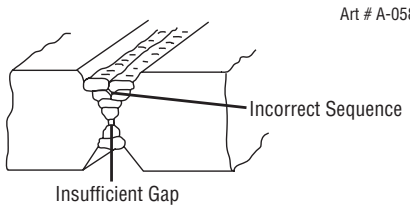


Figure 5-29: Example of Insufficient Gap or Incorrect Sequence

Description	Possible Cause	Remedy
4 Portions of the weld run do not fuse to the surface of the metal or edge of the joint	A Small electrodes used on heavy cold plate	A Use larger electrodes and preheat the plate
	B Welding current is too low	B Increase welding current
	C Wrong electrode angle	C Adjust angle so the welding arc is directed more into the base metal
	D Travel speed of electrode is too high	D Reduce travel speed of electrode
	E Scale or dirt on joint surface	E Clean surface before welding

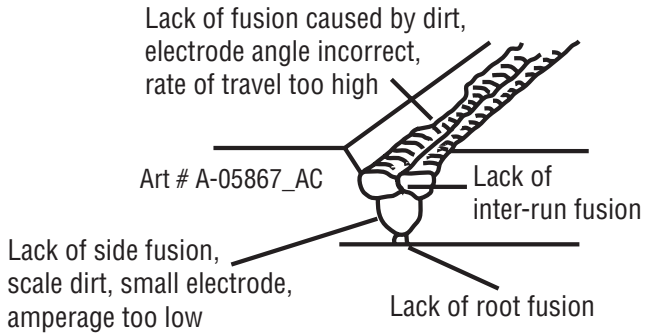


Figure 5-30: Example of Lack of Fusion

Description	Possible Cause	Remedy
5 A groove has been formed in the base metal adjacent to the toe of a weld and has not been filled by the weld metal (undercut).	A Welding current is too high.	A Reduce welding current
	B Welding arc is too long.	B Reduce the length of the welding arc
	C Angle of the electrode is incorrect.	C Electrode should not be inclined less than 45° to the vertical face
	D Joint preparation does not allow correct electrode angle.	D Allow more room in joint for manipulation of the electrode.
	E Electrode too large for joint.	E Use smaller gauge electrode.
	F Insufficient deposit time at edge of weave.	F Pause for a moment at edge of weave to allow weld metal build-up.

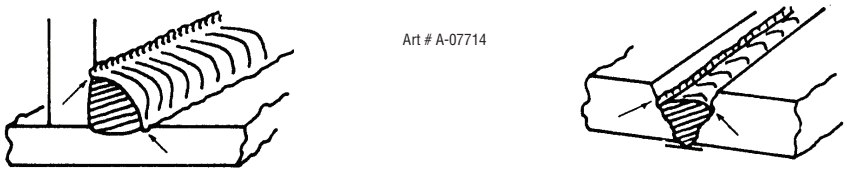


Figure 5-31: Examples of undercut

Description	Possible Cause	Remedy
6 Non-metallic particles are trapped in the weld metal (slag inclusion)	A Non-metallic particles may be trapped in undercut from previous run	A If bad undercut is present, clean slag out and cover with a run from a smaller diameter electrode
	B Joint preparation too restricted	B Allow for adequate penetration and room for cleaning out the slag
	C Irregular deposits allow slag to be trapped	C If very bad, chip or grind out irregularities
	D Lack of penetration with slag trapped beneath weld bead	D Use smaller electrode with sufficient current to give adequate penetration. Use suitable tools to remove all slag from corners
	E Rust or mill scale is preventing full fusion	E Clean joint before welding
	F Wrong electrode for position in which welding is done	F Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult

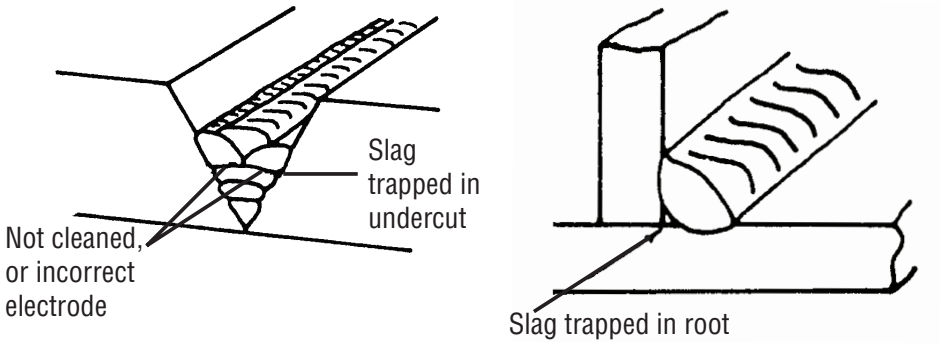


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Figure 5-32: Examples of Slag Inclusion

Table 5-2: Welding Problems

SECTION 6:
TIG (GTAW) WELDING

6.01 Shielding Gas Regulator/Flowmeter Operating Instructions

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

Shielding Gas Regulator/Flowmeter Safety

This regulator/flowmeter is 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 handing or using the equipment, understand and comply at all times with the safe practices prescribed in this instruction.

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

1. NEVER subject the regulator/flowmeter to inlet pressure greater than its rated inlet pressure.
2. NEVER pressurize a regulator/flowmeter that has loose or damaged parts or is in a questionable condition. NEVER loosen a connection or attempt to remove any part of a regulator/flowmeter until the gas pressure has been relieved. Under pressure, gas can dangerously propel a loose part.
3. DO NOT remove the regulator/flowmeter from a cylinder without first closing the cylinder valve and releasing gas in the regulator/flowmeter high and low pressure chambers.
4. DO NOT use the regulator/flowmeter 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 regulator/flowmeter to cylinder. NEVER CONNECT a regulator/flowmeter designed for a particular gas or gases to a cylinder containing any other gas.

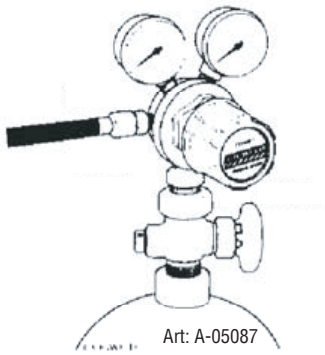

Figure 6-1: Fit Regulator/flowmeter to Cylinder

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 regulator/flowmeter.

   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 regulator/flowmeter to cylinder. Before connecting, check that the regulator/flowmeter label and cylinder marking agree and that the regulator/flowmeter inlet and cylinder outlet match. NEVER CONNECT a regulator/flowmeter designed for a particular gas or gases to a cylinder containing any other gas.

3. Connect the regulator/flowmeter 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 regulator/flowmeter is not fitted with a pressure relief device.

Operation

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

1. Stand to one side of regulator/flowmeter and slowly open the cylinder valve. If opened quickly, a sudden pressure surge may damage internal regulator/flowmeter parts.

2. With valves on downstream equipment closed, adjust regulator/flowmeter to approximate working pressure. It is recommended that testing for leaks at the regulator/flowmeter 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 regulator/flowmeter 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

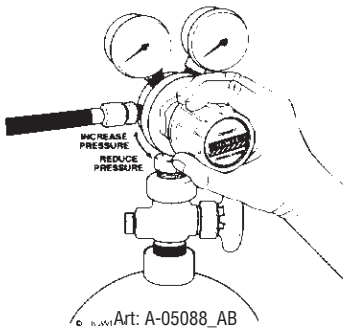

Figure 6-2: Adjust Flow Rate

With the regulator/flowmeter 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 regulator/flowmeter 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 regulator/flowmeter 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 regulator/flowmeter 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 regulators/flowmeters.

6.02 Setup For Lift TIG (GTAW) Welding

A. Select Lift TIG mode with the process selection control (refer to Section 4.02.1 for further information).

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

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

D. Connect an Argon Regulator/Flowmeter (not supplied) to the Argon Shielding Gas Cylinder then connect the TIG Torch gas hose to regulator. Before turning on shielding gas check that all fittings are tight and the gas valve on the TIG torch is turned off. Before commencing to TIG weld open TIG torch gas valve to allow sufficient shielding gas flow when welding. Refer to Section 6.03 for recommended Shielding Gas flow rates and other TIG Welding information.

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

Open Gas Cylinder Valve carefully.

WARNING
Before connecting the work clamp to the work and inserting the electrode in the TIG torch make sure the Mains power supply is switched off.

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

NOTE!
The TIG Torch is NOT supplied. It is an optional accessory. Refer to Table 2-2 on Page 2-6 for optional accessory information.

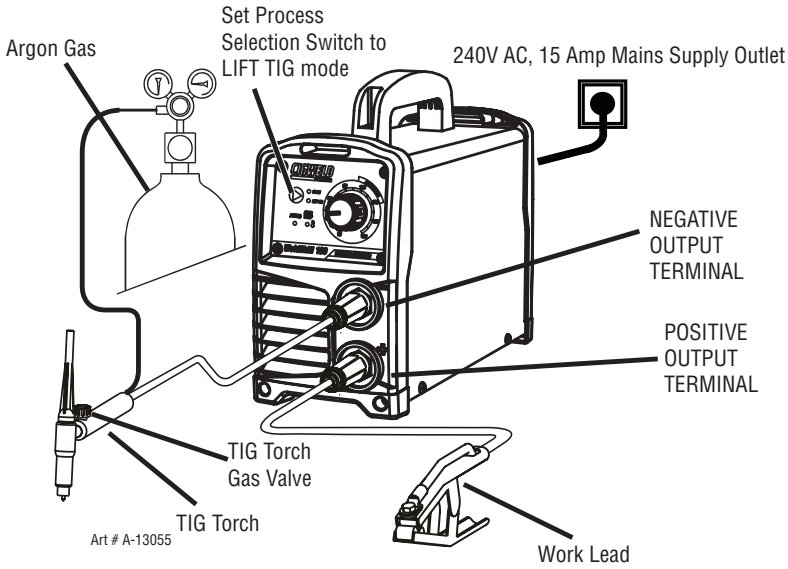

Figure 6-3: Setup For Lift TIG (GTAW) Welding

6.03 TIG (GTAW) Basic Welding Technique

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

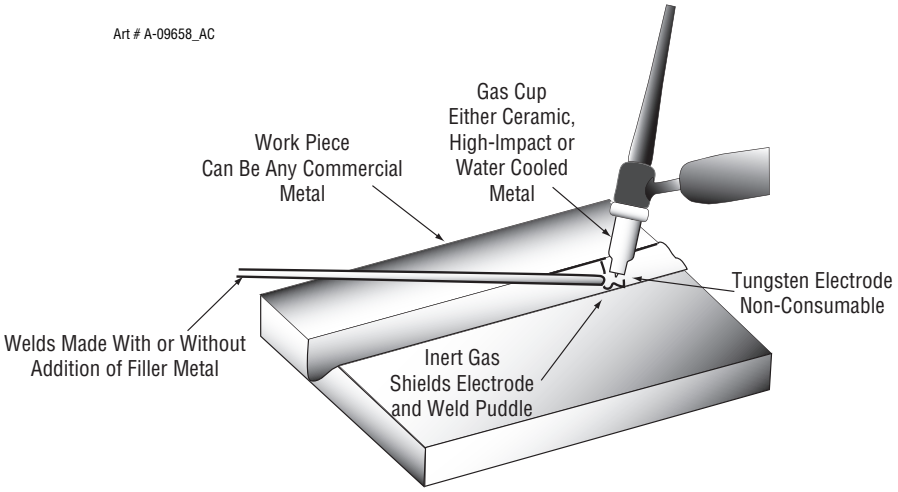

Figure 6-4: TIG Welding Application Shot

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 6-1: 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 6-2: Filler Wire Selection Guide

NOTE!
The operator should use the welding current range values as a guide only, then finally adjust the current setting to suit the application.

Tungsten Electrode Types

Electrode Type (Ground Finish)	Welding Application	Features	Colour Code
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 6-3

TIG Welding Filler Rods

Comweld Rod	Aust Std	AWS Std	Part No. 1.6mm	Part No. 2.4mm	Part No. 3.2mm	Type/Application
LW1 LW1-6 Supersteel	R4 R6 R2	ER70S-4 ER70S-6 ER70S-2	321411 321417 321370	— — —	— — —	For mild-medium strength steels. Pipes, tubing, roll cages, etc.
CrMo1 CrMo2	RB2 RB3	ER80S-B2 ER90S-B3	— —	321379 321383	— —	For welding of high strength Cr-Mo steels used at elevated temperatures.
308L 309L 316L	R308L R309L R316L	ER308L ER309L ER316L	321406 321403 321400	321407 321404 321401	— — —	For stainless steels. Stainless pipes, tubing, architectural uses, etc.

Table 6-4

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

Table 6-5

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

6.04 TIG (GTAW) Welding Problems

FAULT	CAUSE	REMEDY
1 Excessive bead build up or poor penetration or poor fusion at edges of weld.	Welding current is too low	Increase weld current and/or faulty joint preparation.
2 Weld bead too wide and flat or undercut at edges of weld or excessive burn through.	Welding current is too high	Decrease weld current.
3 Weld bead too small or insufficient penetration or ripples in bead are widely spaced apart.	Travel speed too fast	Reduce travel speed.
4 Weld bead too wide or excessive bead build up or excessive penetration in butt joint.	Travel speed too slow	Increase travel speed.
5 Uneven leg length in fillet joint	Wrong placement of filler rod	Re-position filler rod.
6 Electrode melts or oxidises when an arc is struck.	A Torch lead connected to positive welding terminal.	A Connect torch lead to negative welding terminal.
	B No shielding gas flowing to welding region.	B Check the shielding gas lines for kinks or breaks and shielding gas cylinder contents.
	C Torch is clogged with dust or dirt.	C Clean torch.
	D Shielding gas hose is damaged.	D Replace shielding gas hose.
	E Shielding gas regulator turned off.	E Turn On Shielding Gas and adjust Shielding Gas flow rate for the welding job. Refer to Table 6-5 on Page 6-7.
	F The electrode is too small for the welding current.	F Increase electrode diameter or reduce the welding current.
7 Dirty weld pool	A Electrode contaminated by contact with work piece or filler rod material.	A Clean the electrode by grinding off the contaminates.
	B Work piece surface has foreign material on it.	B Clean surface.
	C Shielding gas contaminated with air.	C Check shielding gas lines for cuts and loose fitting or change shielding gas cylinder.
8 Poor weld finish	Inadequate shielding gas.	Increase shielding gas flow or check shielding gas line for shielding gas flow problems.

FAULT	CAUSE	REMEDY
9 Arc start is not smooth.	A Tungsten electrode is too large for the welding current.	A Select the right size tungsten electrode. Refer to Table 6-1 Cigweld Tungsten Electrode Selection Chart.
	B The wrong electrode is being used for the welding job.	B Select the right size tungsten electrode type. Refer to Table 6-3 Cigweld Tungsten Electrode Selection Chart.
	C Shielding gas flow rate is too high.	C Select the right shielding gas flow rate for the welding job. Refer to Table 6-5 on page 6-7
	D Incorrect shielding gas is being used.	D Select the correct shielding gas.
	E Poor work clamp connection to work piece.	E Improve connection to work piece.
10 Arc flutters during TIG welding.	Tungsten electrode is too large for the welding current.	Select the right size tungsten electrode. Refer to Table 6-1 Cigweld Tungsten Electrode Selection Chart.

Table 6-6: GTAW (TIG) Welding Problems

SECTION 7:
ROUTINE SERVICE REQUIREMENTS

7.01 Routine Maintenance & Inspection

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. Disconnect the Welding Power Source from the Mains Supply Voltage before disassembling.

Welding equipment should be regularly checked by a qualified electrical tradesperson to ensure that:

- The main earth wire of the electrical installation is intact.
- Power point for the Welding Power Source is effectively earthed and of adequate current rating.
- Plugs and cord extension sockets are correctly wired.
- Flexible cord is of the 3-core tough rubber or plastic sheathed type of adequate rating, correctly connected and in good condition.
- Welding terminals are shrouded to prevent inadvertent contact or short circuit.
- The frame of the Welding Power Source is effectively earthed.
- Welding leads and electrode holder are in good condition.
- The Welding Power Source is clean internally, especially from metal filing, slag, and loose material. If any parts are damaged for any reason, replacement is recommended.

Routine Inspection, Testing & Maintenance

The inspection and testing of the power source and associated accessories shall be carried out in accordance with Section 5 of AS 1674.2 - 2007: 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 Cigweld's original specifications.

If equipment is to be used in a hazardous location or environments with a high risk of electrocution as outlined in AS 1674.2 - 2007, then the above tests should be carried out prior to entering this location.

A. Testing Schedule

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

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

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

B. Insulation Resistance

Minimum insulation resistance for in-service Cigweld Inverter Power Sources shall be measured at a voltage of 500V between the parts referred to in Table 7-1 below. Power sources that do not meet the insulation resistance requirements set out below shall be withdrawn from service and not returned until repairs have been performed such that the requirements outlined below are met.

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

Table 7-1: Minimum Insulation Resistance Requirements: Cigweld Inverter Power Sources

C. Earthing

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

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

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

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

D. General Maintenance Checks

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

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

E. Accessories

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

F. Repairs

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

G. Calibrate Power Source

This Power Source has no calibration potentiometers on the Control or Inverter PCBs. The firmware within the Control PCB set the maximum output current for the power source.

If the welding current can't be controlled by the Amperage Control (Welding Current) knob on the front panel then:

- Check for a DC signal on JP1 pins 14 & 7 in the Control PCB.

  If no sign then check Current Transformer, M1, on the primary tap of the main transformer, D16, D17, D18, D19, R59, R60, R61, and ribbon cable between PCBs.

- If all components test OK then replace the Control PCB.

7.02 Cleaning the Welding Power Source

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. 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.

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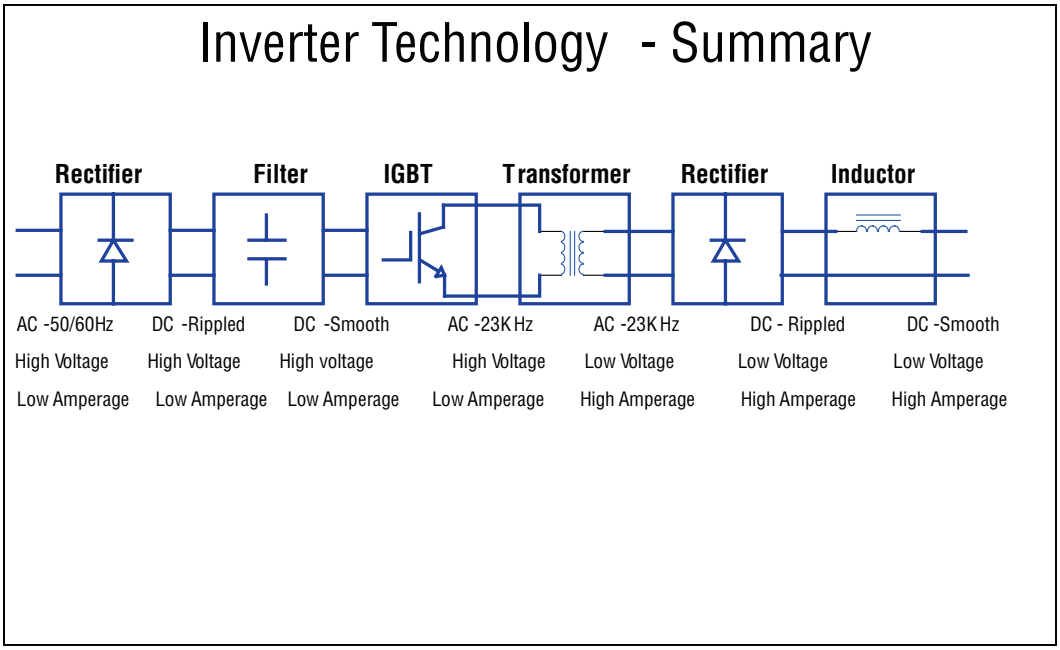
SECTION 8:
THEORY OF OPERATION

Inverter Design

What does the word inverter mean?

The term inverter refers to the ability to change DC power into AC. Inverter power supplies immediately rectify the incoming AC to DC, and then the transistors create a higher frequency AC. The higher frequency AC then goes on to a much smaller main transformer than in a conventional power supply. The AC is then rectified to extremely smooth DC. The diagram to the below shows the basic electrical wiring of a DC output inverter power supply.



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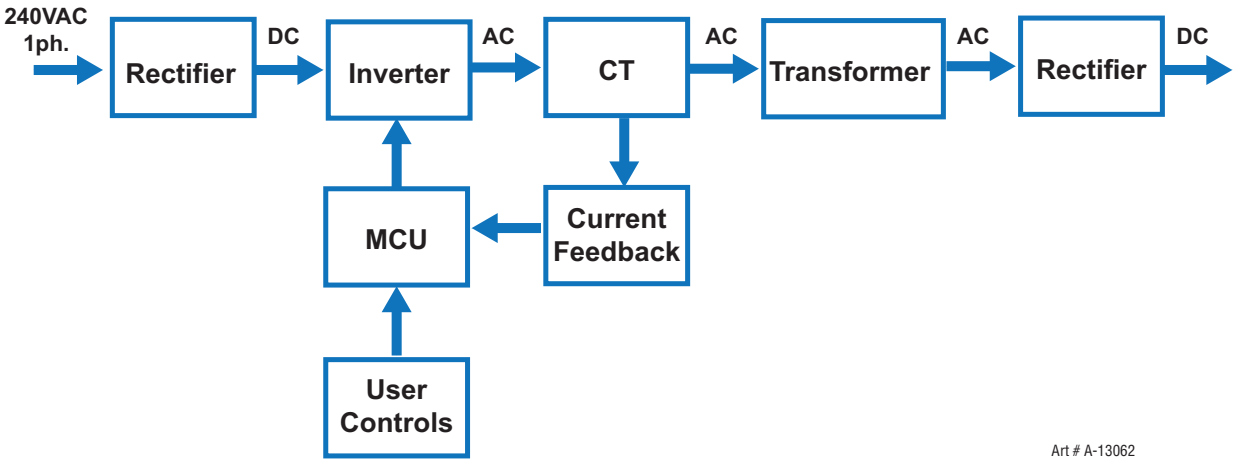

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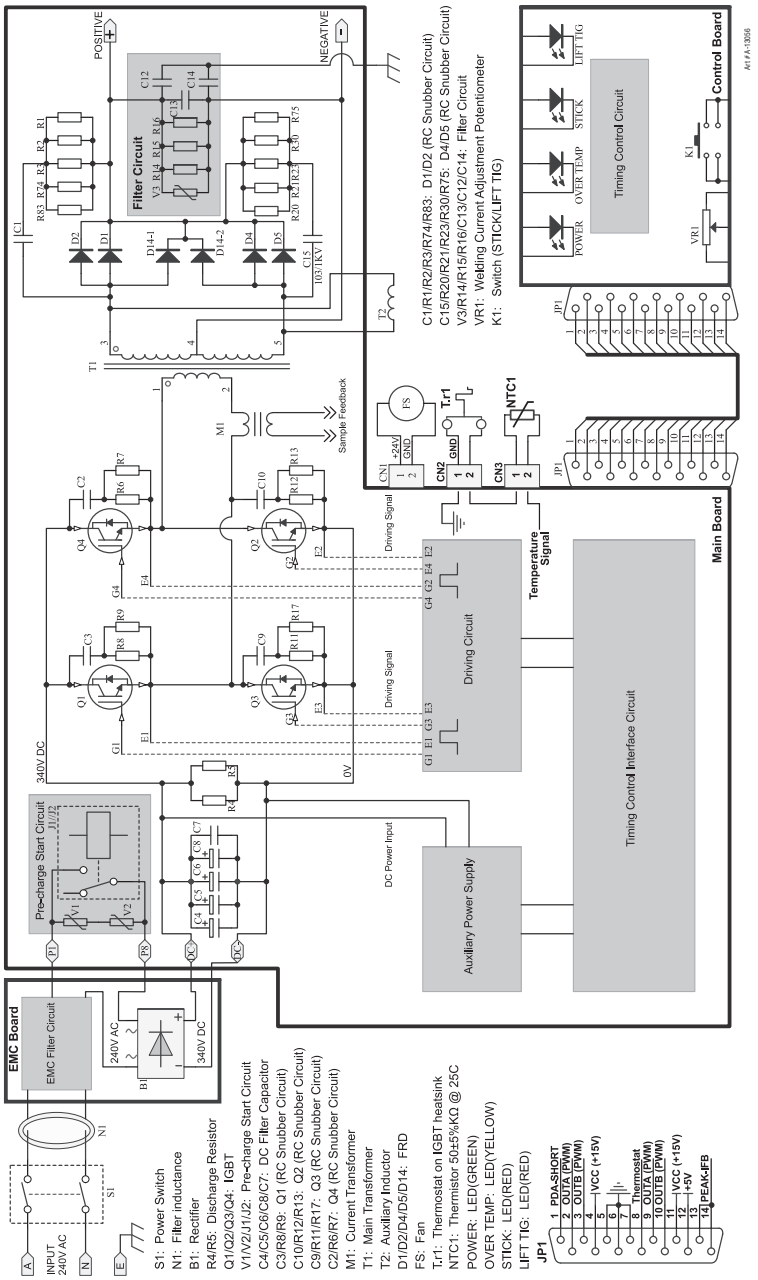
SECTION 9:
MAIN CIRCUIT DESCRIPTION

WARNING

Turn off power and disconnect mains supply plug from receptacle before working on the unit. Allow two minutes for capacitors to discharge and check that the DC bus voltage has discharged to less than 5VDC, refer to Section 10.04, after disconnection from mains supply voltage.



The 240VAC mains supply voltage is connected via a double pole switch to the input rectifiers on the Main Inverter Board through an EMC Filter Circuit on the EMC Board. Overvoltage protection is provided by a varistor, 20D511K, rated at 320VAC/220J in the EMC Board.

Rectifier, B1, output charges the main capacitor bank (C4, C5, C6, C8) to a high DC voltage, 340VDC once J1// J2 closes, through the Pre-charge Start Circuit. Inrush current limiting is provided by V1 & V2 which are short circuited by relay J1//J2 after a few seconds.

The primary IGBT transistors (Q1, Q2, Q3, Q4) are configured as an H-bridge circuit and switch the transformer primary at high frequency and varying duty cycle.

Secondary output voltage from the transformer is rectified by the fast recovery diodes (D1, D2, D4, D5, D14-1, D14-2) to DC then the DC voltage is connected to the welding output terminals. This DC voltage is controlled by the PWM of the primary side IGBT transistors. The auxiliary inductor T2 provides the inductance to the weld current.

Two thermal overload devices are mounted in this inverter, a thermostat fixed to the IGBT heatsink and a NTC Thermistor mounted in transformer T1. When an over temperature occurs, the control circuit inhibits the triggering of the IGBTs which results in zero welding output. The yellow thermal overload indicator LED on the front panel is illuminated.

The current transformer M1 provides a signal to the control circuit to indicate both transformer primary current, and provides a voltage signal proportional to the output welding current to allow the control circuit to regulate welding current.

SECTION 10:
PRELIMINARY TROUBLESHOOTING – POWER SOURCE

If the problem cannot be solved by the basic (external) troubleshooting guide, the Power Source covers will have to be removed to allow the technician to analyse failures with a few common tools.

WARNING

Turn off power and disconnect mains supply plug from receptacle before working on the unit. Allow two minutes for capacitors to discharge and check that the DC bus voltage has discharged to less than 5VDC, refer to Section 10.04, after disconnection from mains supply voltage.

10.01 Test Equipment and Tools

- Digital Multimeter
- DC clip-on ammeter
- Screwdrivers and spanners
- CRO (20 MHz bandwidth) & isolating transformer

10.02 How to Remove Cover

- Remove the four screws holding the cover to the machines base and the upper screws in the control panel.

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- Remove the three screws that hold the rear panel to the machine, two on the top and two at the bottom of the rear panel.
- Move the rear panel approx. 10mm away from the machine.
- Slide the cover approx. 10mm towards the rear panel then lift up the cover to clear the front panel. Be careful when lifting up the cover as an earth is connected between the cover & the main earth stud.

10.03 Visually Inspect

Visually inspect the inside of the Power Source. The levels of current present in these units can cause burning or arcing of PCB, transformers, switches, or rectifier when a failure occurs. Carefully inspect all components within these units.

Look in particular for the following:

a) Loose or broken wires or connectors.

b) Burned or scorched parts or wires or evidence of arcing.

c) Any accumulation of metal dust or filings that may have caused shorting or arcing.

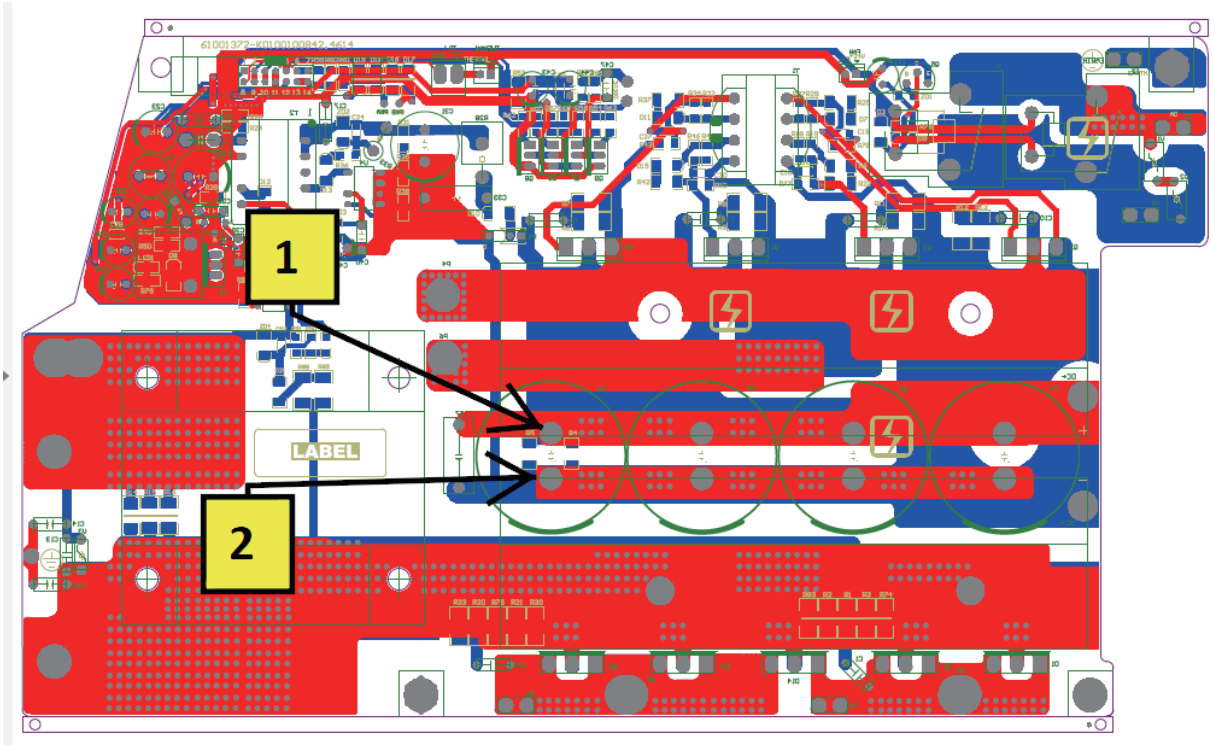
If any parts are damaged, they must be replaced. Refer to the Spare Parts section for a complete list of components used in the Power Source.

Locate the faulty component(s) then replace where necessary.

10.04 DC Bus Preliminary Measurement in Inverter PCB

WARNING

Check DC bus voltage has discharged to less than 5VDC before servicing. Ensure the mains supply plug is disconnected from 240VAC receptacle.



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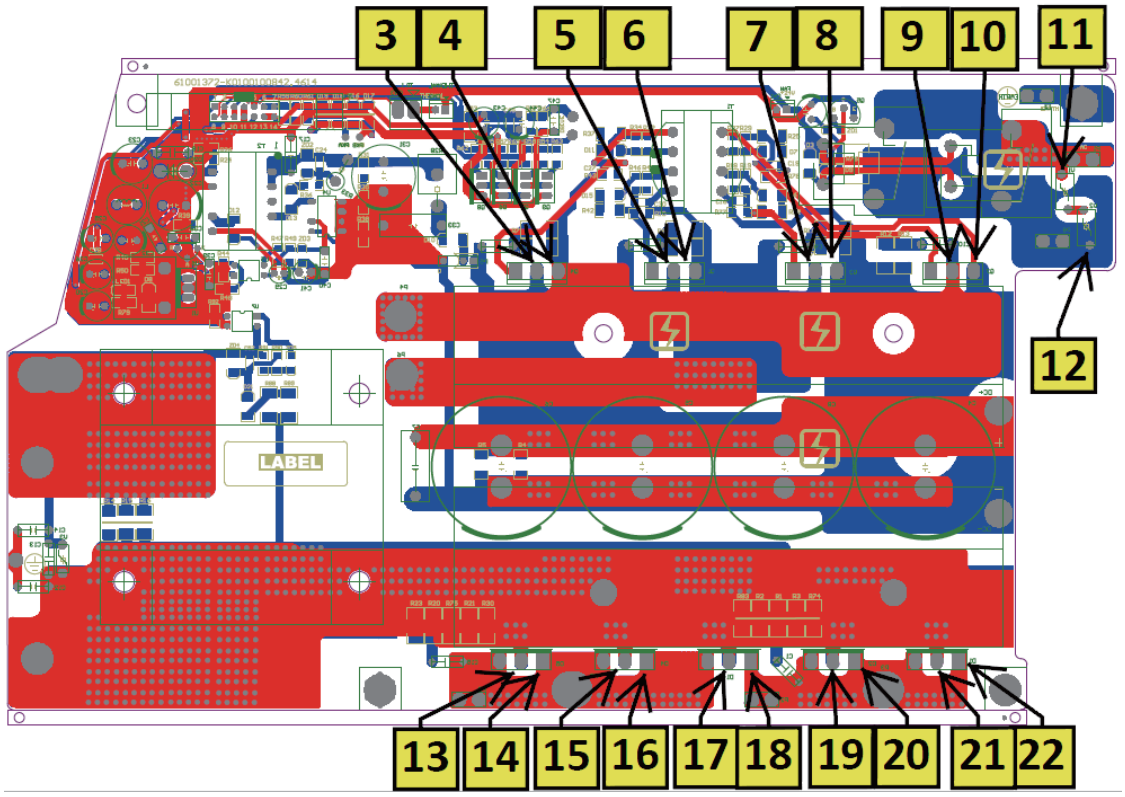
Testpoint No.	DC Bus Capacitor Test	Multimeter Lead Placement	Voltage with Supply voltage OFF (Multimeter set for DC volts)
1	C4, C5, C6, C8	Positive (red) meter lead to testpoint 1	0 VDC
2		Negative (black) meter lead to testpoint 2	

Table 10-1 DC BUS, Multimeter set to measure DC volts

10.05 IGBTs Preliminary Check in Inverter PCB



Art # A-13059

Testpoint No.	IGBT Testing	Multimeter Lead Placement	Testing	Diode Voltage VDC Acceptable Results
3 4	IGBT Q4	Negative (black) meter lead to testpoint 3 Positive (red) meter lead to testpoint 4	Q4 CE Diode	0.2 – 0.8 VDC
5 6	IGBT Q1	Negative (black) meter lead to testpoint 5 Positive (red) meter lead to testpoint 6	Q1 CE Diode	0.2 – 0.8 VDC
7 8	IGBT Q3	Negative (black) meter lead to testpoint 7 Positive (red) meter lead to testpoint 8	Q3 CE Diode	0.2 – 0.8 VDC
9 10	IGBT Q2	Negative (black) meter lead to testpoint 9 Positive (red) meter lead to testpoint 10	Q2 CE Diode	0.2 – 0.8 VDC

Table 10-2 IGBT's, Multimeter set to measure Diode Voltage

Testpoint No.	IGBT Testing	Multimeter Lead Placement	Testing	Diode Voltage VDC Acceptable Results
4 3	IGBT Q4	Negative (black) meter lead to testpoint 4 Positive (red) meter lead to testpoint 3	Q4 CE Resistance	>150 Ω
6 5	IGBT Q1	Negative (black) meter lead to testpoint 6 Positive (red) meter lead to testpoint 5	Q1 CE Resistance	>150 Ω
8 7	IGBT Q3	Negative (black) meter lead to testpoint 8 Positive (red) meter lead to testpoint 7	Q3 CE Resistance	>150 Ω
10 9	IGBT Q2	Negative (black) meter lead to testpoint 10 Positive (red) meter lead to testpoint 9	Q2 CE Resistance	>150 Ω

Table 10-3 IGBT's, Multimeter set to measure ohms (Ω)

Testpoint No.	Inrush Resistor	Multimeter Lead Placement	Ohms (Ω) Acceptable Results
11 12	PTC Resistor MZ71 18RM270	Negative (black) meter lead to testpoint 11 Positive (red) meter lead to testpoint 12	36+/-20% Ω

Table 10-4 Inrush PTC, Multimeter set to measure ohms (Ω)

Testpoint No.	DIODE Testing	Multimeter Lead Placement	Testing	Diode Voltage VDC Acceptable Results
13 14	DIODE D5	Negative (black) meter lead to testpoint 13 Positive (red) meter lead to testpoint 14	D5 anode-cathode	0.2 – 0.8 VDC
15 16	DIODE D4	Negative (black) meter lead to testpoint 15 Positive (red) meter lead to testpoint 16	D4 anode-cathode	0.2 – 0.8 VDC
17 18	DIODE D14	Negative (black) meter lead to testpoint 17 Positive (red) meter lead to testpoint 18	D14 anode-cathode	0.2 – 0.8 VDC
19 20	DIODE D2	Negative (black) meter lead to testpoint 19 Positive (red) meter lead to testpoint 20	D2 anode-cathode	0.2 – 0.8 VDC
21 22	DIODE D1	Negative (black) meter lead to testpoint 21 Positive (red) meter lead to testpoint 22	D1 anode-cathode	0.2 – 0.8 VDC

Table 10-5 Diodes, Multimeter set to measure Diode Voltage

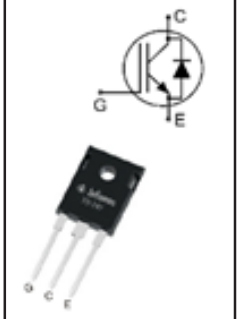
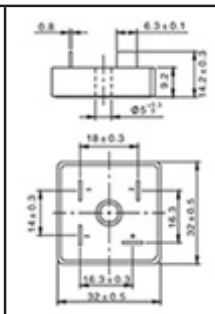
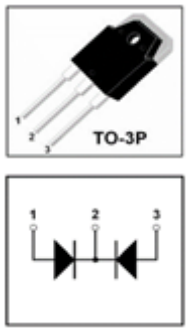
IGBT Q4, Q1, Q3, Q2		Bridge Rectifier B1		DIODE D5, D4, D14, D2, D1	
Type: IKW50N65H5 Vce: 650V Ic: 50A		Type: BR6010-7 Vr: 1000V If: 60A		Type: MM60F060PC Vr: 600V If: 60A per package	

Table 10-6 Primary Bridge Rectifier / IGBT / Secondary Diode specifications

10.06 DC Bus Voltage Measurement in Inverter PCB

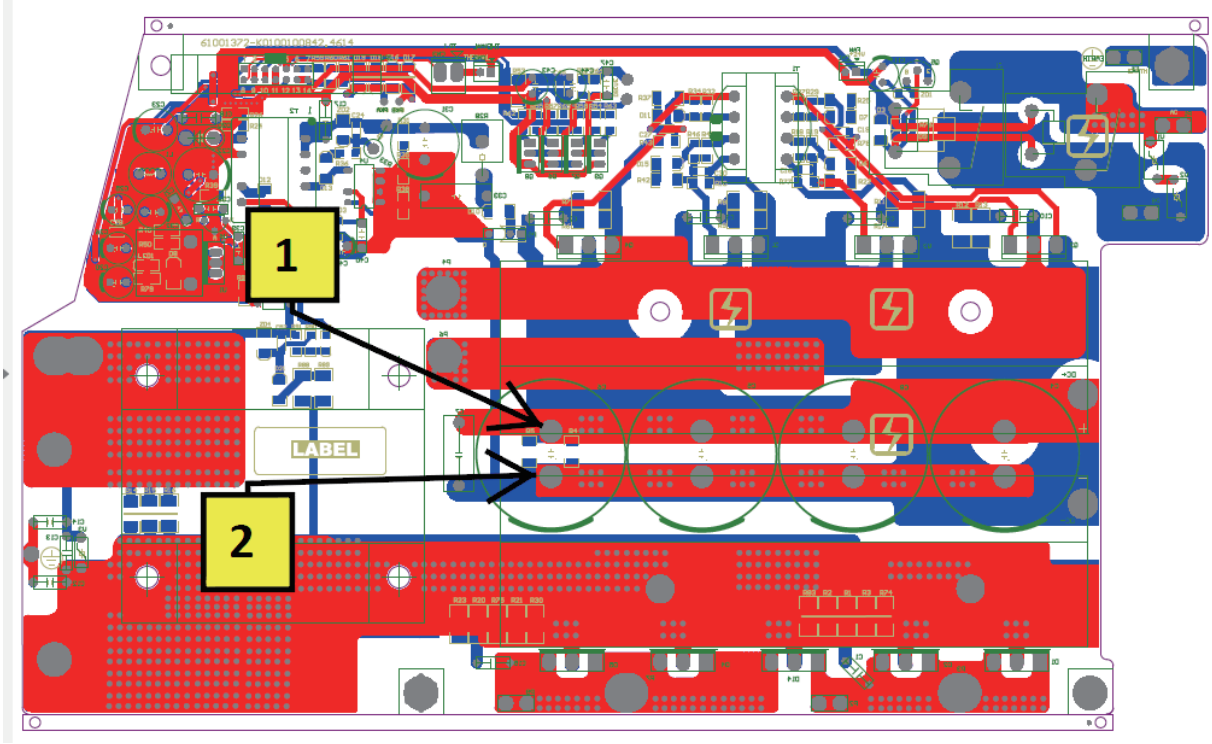
Apply voltage to the Power Source.

WARNING

There are extremely dangerous voltage and power levels present inside these Power Sources. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques. DO NOT TOUCH ANY LIVE PARTS.

Once power is applied to the Power Source, there are extremely hazardous voltage and power levels present.

Do not touch any live parts.



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Testpoint No.	DC Bus Capacitor Test	Multimeter Lead Placement	DC Bus Voltage (Multimeter set for DC volts)
1	C5, C6, C8	Positive (red) meter lead to testpoint 1	340 VDC
2		Negative (black) meter lead to testpoint 2	

Table 10-8 DC BUS, Multimeter set to measure DC volts

Note: These DC voltages are at nominal mains supply voltage of 240VAC.

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SECTION 11:
ADVANCED TROUBLESHOOTING – POWER SOURCE

The following tables are guides for analysing problems and making repairs to the Power Source.

11.01 Recommendations when Replacing Primary Bridge Rectifier / IGBT / Secondary Diode

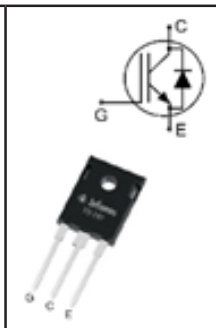
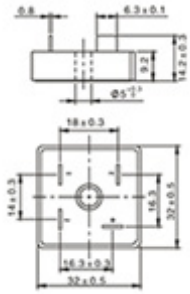
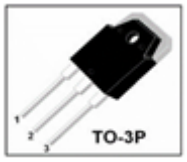
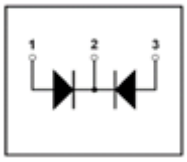
IGBT Recommendations (Q4, Q1, Q3, Q2)		Bridge Rectifier Recommendations (B1)		DIODE Recommendations (D5, D4, D14, D2, D1)	
• If one IGBT fails then all IGBTs should be replaced. • The Control PCB normally does not need to be replaced if the IGBTs fail.		• If bridge rectifier fails then the Inverter PCB should be replaced.		• If one diode fails then the all diodes should be replaced. • The Inverter PCB should operate after the diodes are replaced.	
Type: IKW50N65H5 Vce: 650V Ic: 50A		Type: BR6010-7 Vr: 1000V If: 60A		Type: MM60F060PC Vr: 600V If: 60A per package	 

Table 11-1 Recommendations when replacing Primary Bridge Rectifier / IGBT / Secondary Diode

11.02 Power Source Issues, High OCV, No Fan or Abnormal Inverter Frequency

	Fault		Possible Cause		Remedy
1	The Power Indicator is FLASHING when primary lead is plugged into Mains Power and the outlet switch is switched ON.	A	Frequent switching input switch in power source over 6 times may cause power indicator to flash.	A	Switch off machine for 10 minutes then switch on power source once, power indicator should not flash.
2	Machine powers up OK and has OCV but when an arc is struck the Power Indicator is FLASHING and it cannot maintain the arc.	A	The soft start circuit or relay J1/ J2 have failed.	A	Fix soft start circuit, replace relay J1/ J2 or replace Inverter PCB.
3	OCV (open circuit voltage) is greater than 90VDC	A	Check that Mains Supply Voltage is greater than 276VAC.	A	Disconnect the machine from the Mains Supply Voltage because input voltages greater than 276VAC will cause component failures with this machine.
		B	Check snubber circuit components for secondary diodes on Inverter PCB have failed open circuit: C1, R74, R1, R2, R3, R83 C15, R75, R20, R21, R23, R30	B	Replace defective components.
		C	Check filter circuit components across the output terminals on Inverter PCB have failed open circuit: C13, R14, R15, R16, V3	C	Replace defective components.
		D	Component failure in Control PCB.	D	Replace Control PCB.
		E	Ribbon cable has bad electrical connections.	E	Check ribbon cable for continuity, replace if faulty.
4	Fan does operate then stops operating 30 seconds after switch on	A	Fan has an intermittent fault or has a mechanical problem.	A	Replace fan
5	No air been blown out of the front panel louvres	A	Airflow inlet duct next to fan or outlet duct next to front panel/side panel are blocked with foreign material.	A	Remove the foreign material from airflow air inlet and/or outlets.
		B	Inverter PCB connector CN1 pins 1 & 2 do not have 24VDC.	B	Check R31 / R35 / R38 are connected between R28 & U4 pin 1, if open circuit replace R31/R35 /R38. If no 24VDC then replace U6 (TL431) then replace U5 (PC817B).
		C	Fan is faulty.	C	Replace fan.
6	Mode switch does not change welding mode	A	Faulty push button switch or Control PCB.	A	Replace Control PCB.

7	Inverter frequency is abnormal	A	Control PCB is malfunctioning and snubber circuit components for secondary diodes on Inverter PCB have failed open circuit, Check components: C1, R74, R1, R2, R3, R83 C15, R75, R20, R21, R23, R30	A	Replace Control PCB and replace defective components.
		B	Check that Mains Supply Voltage is greater than 276VAC.	B	Disconnect the machine from the Mains Supply Voltage because input voltages greater than 276VAC will cause component failures with this machine.
8	Excessive welding current is supplied to the welding arc, i.e. welding current can't be controlled by the Amperage Control on front panel	A	No DC current feedback signal on JP1 pins 14 & 7 from the Control PCB. If no signal then check Current Transformer, M1, on the primary tap of the main transformer, D16, D17, D18, D19, R59, R60, R61 and ribbon cable between PCBs.	A	Replace defective components. If no defective components then replace the Control PCB.

Table 11-2

11.03 Power Indicator Not ON or No Output Power from Machine

Power indicator is not ON or no output from the machine

Is 240VAC at input switch of power source?

No

1. Check Circuit Breaker or fuse is working, repair CB or fuse
2. Check the continuity of input power cable, replace cable
3. Check input switch in power source works, replace switch

No faults found

Yes

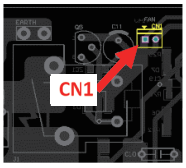
Does AC input rectifier terminals of power source have 240VAC in Inverter PCB 15 seconds after switch on?

No

1. Check the connections to input of EMC PCB, output of EMC PCB and 240VAC cables.
2. Replace EMC PCB or 240VAC cables if faulty.

No faults found

Yes



Does fan operate constantly after power on or CN1 has 24VDC?

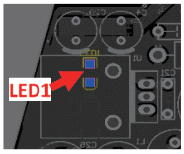
No

Unplug fan wires from CN1 & measure pins 1 & 2 for 24VDC.
<u>If no 24VDC then check auxiliary circuit of Inverter PCB</u>:

1. Check R31 / R35 / R38 are connected between R28 & U4 pin 1, if open circuit replace R31/R35/R38
2. Replace U6 (TL431) then U5 (PC817B) to get 24VDC.

No 24VDC at CN1

Yes



Is LED1 in Inverter PCB on/flashing?

No

Check regulator U1 pins 2 & 3 for 15VDC in Inverter PCB; Replace U1 to get LED1 to turn on.

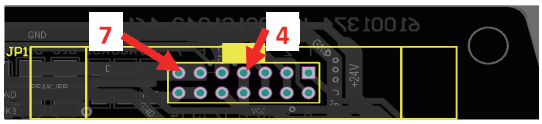
Yes

LED1 not on / flashing or no output from machine

Remove ribbon cable from JP1 in Inverter PCB; Does JP1 Pins 4 & 7 have 15VDC? Replace ribbon cable; Does Pins 1 & 2 of U1 (7805) in Control PCB have 15VDC?

No

1. If no 15VDC replace U1 (7815) in Inverter PCB to get LED1 to turn on.
2. If JP1 Pins 4 &7 have 15VDC but U1 (7805) in Control PCB does not have 15VDC then fix or replace ribbon cable or JP1 solder joints on Inverter & Control PCBs.



Yes

No output from machine

Are any IGBTs collector/ emitter resistances GREATER THAN 150 ohms?

No

Replace all IGBTs then check IGBT driver circuit components or replace the Inverter PCB

Yes

No output from machine

Must be a fault in Inverter PCB and/or Control PCB.

1. Check voltages from controller IC, U3, in Control PCB or replace the Control PCB & check for output from the machine
2. If new Control PCB does not fix fault then replace Inverter PCB
3. **If new Inverter PCB does not fix fault then check all power cables for fault**

Art # A-13047

11.04 IGBT Control IC Voltage Checks in Control PCB

11.05 Over Temperature Indicator ON & No Output from Machine

Over Temperature indicator turns ON & no output from the machine

Is ambient temperature -24°C or warmer?

No → **Circuit will not work in -25°C, make sure the ambient temperature is warmer than -25°C**

Yes

Is the IGBT heatsink thermostat contacts open circuit at 25C (contacts should be normally closed) ?

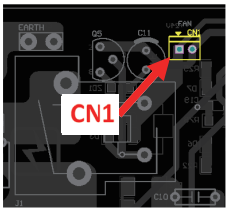
No → **Replace IGBT heatsink thermostat with normally closed contacts**

Yes

Does the resistance of NTC thermistor mounted in main transformer have 50±5%KΩ @ 25C ?

No → **Change NTC thermistor**

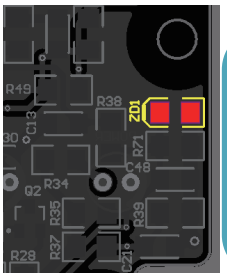
Yes



Does CN1 pins 1 & 2 have 24VDC in the Inverter PCB?

No →
Change the following in Inverter PCB:
1. **Check R31 / R35 / R38 are connected between R28 & U4 pin 1, if open circuit replace R31/R35 /R38**
2. **Replace U6 (TL431) then replace U5 (PC817B)**
3. **If IGBT collector/ emitter resistances less than 150 ohms, replace all IGBTs or replace Inverter PCB.**

Yes



Does voltage across ZD1 in Control PCB = 4.6VDC (can use pin 2 of U1 as ground)?

No → **Replace the Control PCB**

Yes

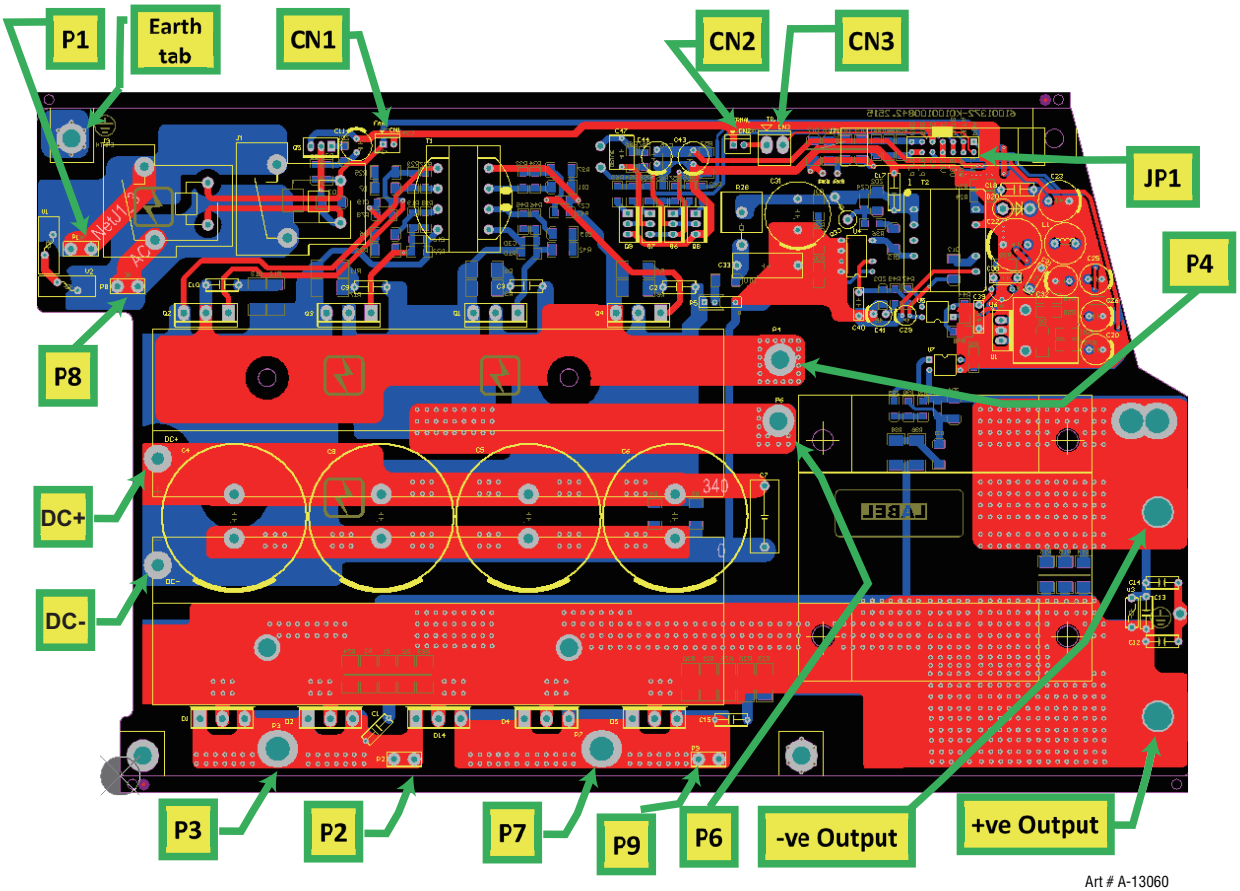
Must be a fault in the ribbon cable or Control PCB or Inverter PCB.
1. **Replace the ribbon cable & check for output from the machine**
2. **If new ribbon cable does not fix fault then replace Control PCB**
3. **If new Control PCB does not fix fault then replace Inverter PCB**
4. **If new Inverter PCB does not fix fault then check all power cables for fault**

Over Temp LED on or no output from machine

Art # A-13049

SECTION 12:
PCB CONNECTORS

12.01 Inverter PCB



Art # A-13060

CN1 Header Pin	Pin function	Signal
1	+24V supply for cooling fan, 24V = Fan ON (also used to supply J1/ J2 relay)	24 VDC
2	0V supply for cooling fan	0 VDC

Table 12-1 CN1 Header pin function (connects fan to Inverter PCB)

CN2 Header Pin	Pin function	Signal
1	Lead 1 from the normally closed contacts of the Thermostat mounted to the IGBT heatsink	0 VDC
2	Lead 2 from the normally closed contacts of the Thermostat mounted to the IGBT heatsink	0 VDC (closed contacts) 5 VDC (open contacts)

Table 12-2 CN2 Header pin function (connects Thermostat on IGBT heatsink to Inverter PCB)

CN3 Header Pin	Pin function	Signal
1	Lead 1 from the NTC thermistor mounted in the main transformer	0 VDC (Tr.1 closed) 5 VDC (Tr.1 open)
2	Lead 2 from the NTC thermistor mounted in the main transformer	2.5 VDC (Tr.1 closed) 5 VDC (Tr.1 open)

Table 12-3 CN3 Header pin function (connects NTC thermistor in main transformer to Inverter PCB)

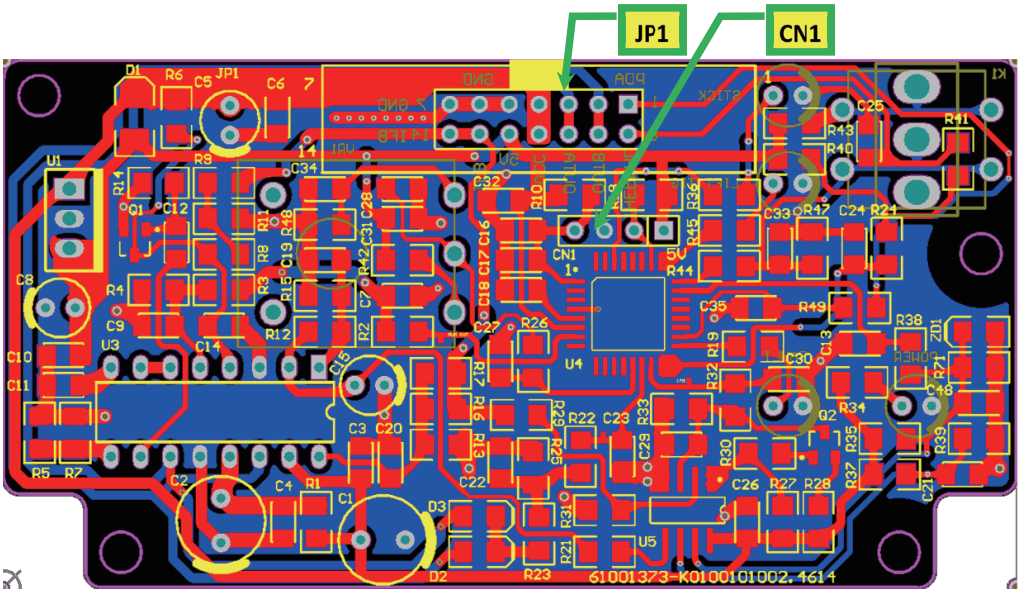
JP1 Header Pin	Pin function	Signal
1	PDA signal which is used to detect a short circuit at the welding terminals 5V = No short at welding terminals; 0.2V = Short at welding terminals	5 VDC
2	OUTA IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
3	OUTB IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
4	Vcc = +15V supply	+15 VDC
5	0V	0 VDC
6	0V	0 VDC
7	0V	0 VDC
8	Thermostat signal to Control PCB	2.5 VDC (Tr.1 closed) 5 VDC (Tr.1 open)
9	OUTA IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
10	OUTB IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
11	Vcc = +15V supply	15 VDC
12	+5V supply from Control PCB	+5 VDC
13	PEAK-IFB Primary current feedback signal to control weld current	
14	PEAK-IFB Primary current feedback signal to control weld current	

Table 12-4 JP1 Header pin function (connects to MB header on control PCB)

Power Terminal Name	Pin function	Signal
P1	Active 240 VAC connection, 6.35mm QC tab, to soft start circuit	240 VAC
P8	Active 240 VAC connection, 6.35mm QC tab, from soft start circuit	240 VAC
DC+	Rectified DC+ **Mains voltage** from EMC/Rectifier PCB	+340VDC
DC-	Rectified DC- **Mains voltage** from EMC/Rectifier PCB	0VDC
EARTH tab	Mains Earth connection to Mains Earth stud on Inverter PCB	0 VAC
P3	Main Transformer Secondary start tap wrt Secondary centre tap	80 V peak
P7	Main Transformer Secondary finish tap wrt Secondary centre tap	80 V peak
P2	Secondary Inductance connection, 6.35mm QC tab, to Secondary start tap	80 V peak
P9	Secondary Inductance connection, 6.35mm QC tab, to Secondary finish tap	80 V peak
P4	Main Transformer Primary start tap	340 V peak
P6	Main Transformer Primary finish tap	340 V peak
+ve Output	Positive Welding Terminal Connection	80 VDC ± 15%
-ve Output	Negative Welding Terminal Connection and Main Transformer Secondary centre tap	0 VDC

Table 12-5 Power Terminal function (connects to various components from the Inverter PCB)

12.02 Control PCB



Art # A-13051

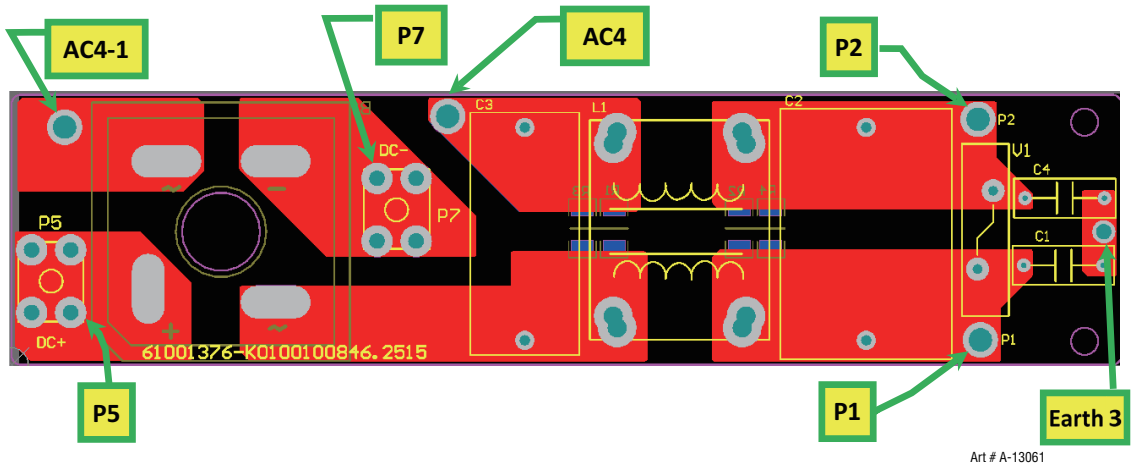
JP1 Header Pin	Pin function	Signal
1	PDA-SHORT signal which is used to detect a short circuit at the welding terminals 5V = No short at welding terminals; 0.2V = Short at welding terminals	5 VDC
2	OUTA IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
3	OUTB IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
4	Vcc-A = +15V supply	+15 VDC
5	0V	0 VDC
6	0V	0 VDC
7	0V	0 VDC
8	Thermostat signal from Inverter PCB	2.5 VDC (Tr.1 closed) 5 VDC (Tr.1 open)
9	OUTA IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
10	OUTB IGBT 1/2/3/4 PWM drive signal, 15V p-p square wave signal	15 VDC pk
11	Vcc-A = +15V supply	15 VDC
12	+5V supply to Inverter PCB	+5 VDC
13	PEAK-IFB Primary current feedback signal from Inverter PCB	
14	PEAK-IFB Primary current feedback signal from Inverter PCB	

Table 12-6 JP1 Header pin function (connects to JP1 header on Inverter PCB)

CN1 Header Pin	Pin function	Signal
1	+5V supply	+5 VDC
2	Programming pin	Digital Signal
3	0V	0 VDC
4	Reset pin	Digital Signal

Table 12-7 CN1 Header pin function (used for uploading program to Control PCB)

12.03 EMC PCB



Power Terminal Name	Terminal function	Signal
P1	Neutral 240 VAC connection into EMC filter	240 VAC Between Terminal P1 & P2
P2	Active 240 VAC connection into EMC filter	
EARTH 3	Mains Earth connection to EMC PCB	0 VAC
AC4	Active 240 VAC out of EMC filter to P1 (pre-charge start circuit) in the inverter PCB	240 VAC Between Terminal AC4 / P1 and AC4-1 / P1
AC4-1	Active 240 VAC into the bridge rectifier from the inverter PCB pre-charge start circuit	
P5	DC+ voltage out of the bridge rectifier	340VDC
P7	DC- voltage out of the bridge rectifier	0VDC

Table 12-8 Power Terminal function (connects to EMC PCB)

Input Bridge Rectifier Check in EMC PCB

Testpoint No.	Input Rectifier Testing	Multimeter Lead Placement	Testing	Diode Voltage
P5 P1	**DC+** to ~ (AC)	Negative (black) meter lead to P5 Positive (red) meter lead to testpoint P1	cathode -anode	0.2 – 0.8 VDC
P5 AC4-1	**DC+** to ~ (AC)	Negative (black) meter lead to P5 Positive (red) meter lead to testpoint AC4-1	cathode -anode	0.2 – 0.8 VDC
P7 P1	**DC-** to ~ (AC)	Positive (red) meter lead to testpoint P7 Negative (black) meter lead to testpoint P1	anode -cathode	0.2 – 0.8 VDC
P7 AC4-1	**DC-** to ~ (AC)	Positive (red) meter lead to testpoint P7 Negative (black) meter lead to testpoint AC4-1	anode -cathode	0.2 – 0.8 VDC

Table 12-9 Input Rectifier, Multimeter set to measure Diode Voltage

SECTION 13: KEY SPARE PARTS

13.01 WeldSkill 180 Key Spare Parts

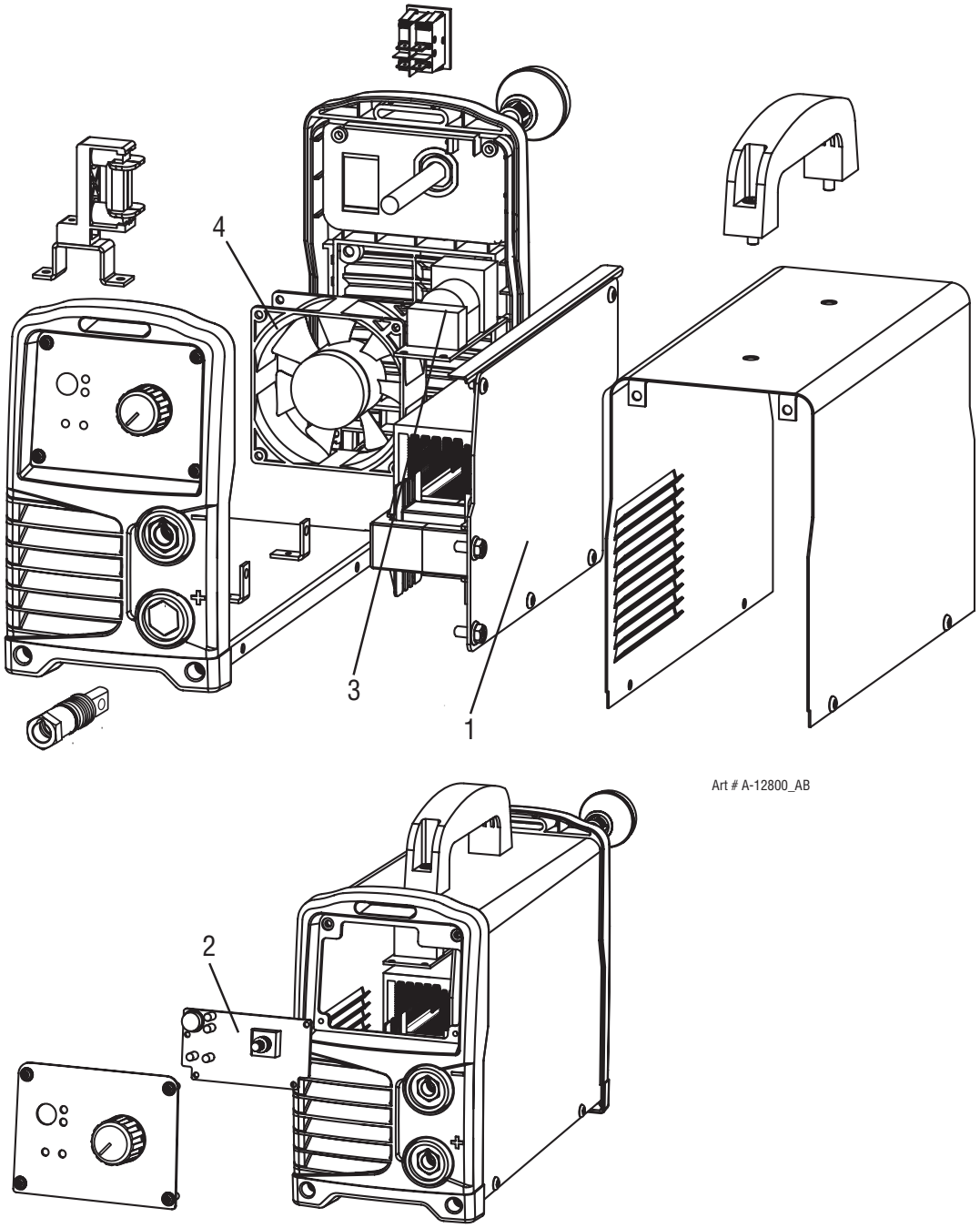


Figure 13-1

WELDSKILL 180 POWER SOURCE KEY SPARE PARTS		
ITEM	PART NUMBER	DESCRIPTION
1	W7006824	PCB Power Inverter
2	W7006825	PCB Front Panel
3	W7006826	PCB Primary Rectifier/EMC Filter
4	W7006809	Fan Assembly

Table 13-1

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CIGWELD - LIMITED WARRANTY TERMS

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

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

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

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

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

Any claim under this warranty must be made within the warranty period which commences on the date of purchase of the product. To make a claim under the warranty, take the product (with proof of purchase from a Cigweld Accredited Seller) to the store where you purchased the product or contact Cigweld Customer Care 1300 654 674 for advice on your nearest Service Provider. CIGWELD reserves the right to request documented evidence of date of purchase. CIGWELD or our Accredited Distributor must be notified in writing of its claim within seven (7) days of becoming aware of the basis thereof, and at its own expense returning the goods which are the subject of the claim to CIGWELD or nominated Accredited Distributor/Accredited Service Provider

This warranty is given.

Cigweld Pty Ltd

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This warranty is provided in addition to other rights and remedies you have under law: Our goods come with guarantees which cannot be excluded under the Australian Consumer Law. You are entitled to replacement or refund for a major failure and to compensation for other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

Please note that the information detailed in this statement supersedes any prior published data produced by CIGWELD.

WARRANTY SCHEDULE – WeldSkill 180 Inverters

WARRANTY	WARRANTY PERIOD – (Parts and Labour)
WeldSkill 180 Inverter Power Source	3 Years
Electrode Holder Lead and Work Lead	3 Months

CIGWELD Limited Warranty does not apply to;

- Obsolete goods sold at auction, second-hand goods and prototype goods.
- Consumable Parts for MIG, TIG, Plasma welding, Plasma cutting and Oxy fuel torches, O-rings, fuses, filters or other parts that fail due to normal wear.

Note:

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

* This warranty is void, and seller bears no liability hereunder, if purchaser used replacement parts or accessories which, in CIGWELD's sole judgment, impaired the safety or performance of any CIGWELD product and if the unit is altered or serviced by an unauthorised CIGWELD Service Provider. Purchaser's rights under this warranty are void if the product is sold to purchaser by unauthorized persons.

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