

130

170

WELDSKILL®

INVERTER

ARC WELDING MACHINES



Operating Manual

Version No: AE

Issue Date: September 21, 2007

Manual No.: 0-5048

Operating Features:





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 service agency call +1300 654 674, or visit us on the web at www.cigweld.com.au.

This Operating 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.

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CIGWELD is the Market Leading Brand of Arc Welding Products for Thermadyne Industries Inc. 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.



WARNINGS

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

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

Cigweld Weldskill 130 and 170 Inverter Arc Welders
Instruction Manual Number 0-5048 for:
Part Numbers W1001900, W1001901, W1002801 and W1002901

Published by:
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Publication Date: September 21, 2007
Revision AE Date November 30, 2007

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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CIGWELD LIMITED WARRANTY

Terms of Warranty – 2007

Warranty Schedule – 2007

GLOBAL CUSTOMER SERVICE CONTACT INFORMATION Inside Rear Cover

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

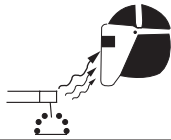
ELECTRIC SHOCK can kill.

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.

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13. In confined spaces or damp locations, do not use a welder with AC output unless it is equipped with a voltage reducer. Use equipment with DC output.
14. Wear a safety harness to prevent falling if working above floor level.
15. Keep all panels and covers securely in place.



WARNING

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

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

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Side shields recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Use approved ear plugs or ear muffs if noise level is high.



WARNING

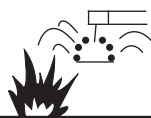
FUMES AND GASES can be hazardous to your health.

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

1. Keep your head out of the fumes. Do not breathe the fumes.
2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals, consumables, coatings, and cleaners.
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.

Eye protection filter shade selector for welding or cutting (goggles or helmet), from AWS A 8.2-73					
Welding or Cutting operation	Electrode size Metal Thickness or Welding Current	Filter shade no.	Welding or Cutting operation	Electrode size Metal Thickness or Welding Current	Filter shade no.
Torch soldering	All	2	Gas metal arc welding		
Torch brazing	All	2 or 3	Non Ferrous base metal	All	11
Oxygen cutting			Ferrous base metal	All	12
Light	Under 1 in., 25 mm	3 or 4	Gas tungsten arc welding (TIG)	All	12
Medium	1 – 6 in., 25 – 150 mm	4 or 5	Atomic Hydrogen welding	All	12
Heavy	Over 6 in., 150 mm	5 or 6	Carbon Arc welding	All	12
Gas welding			Plasma arc Welding	All	12
Light	Under 1/8 in., 3 mm	4 or 5	Carbon Arc Gouging		
Medium	1/8 – 1/2 in., 3 – 12 mm	5 or 6	Light		12
Heavy	Over 1/2 in., 12 mm	6 or 8	Heavy		14
Shielded metal-arc welding (stick) electrodes			Plasma arc cutting		
	Under 5/32 in., 4 mm	10	Light	Under 300 Amp	9
	Over 5/32 to 1/4 in., 4 to 6.4mm	12	Medium	300 to 400 Amp	12
	Over 1/4 in., 6.4 mm	14	Heavy	Over 400 Amp	14

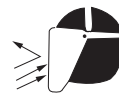
- Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes 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.

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

- Wear approved face shield or safety goggles. Side shields recommended.
- 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.

- Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
- Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
- Keep cylinders away from any welding or other electrical circuits.
- Never allow a welding electrode to touch any cylinder.
- Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
- Turn face away from valve outlet when opening cylinder valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.



WARNING

Engines can be dangerous.



WARNING

ENGINE EXHAUST GASES can kill.

Engines produce harmful exhaust gases.

1. Use equipment outside in open, well-ventilated areas.
2. If used in a closed area, vent engine exhaust outside and away from any building air intakes.



WARNING

ENGINE FUEL can cause fire or explosion.

Engine fuel is highly flammable.

1. Stop engine before checking or adding fuel.
2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Allow engine to cool before fueling. If possible, check and add fuel to cold engine before beginning job.
4. Do not overfill tank — allow room for fuel to expand.
5. Do not spill fuel. If fuel is spilled, clean up before starting engine.



WARNING

MOVING PARTS can cause injury.

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

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



WARNING

SPARKS can cause BATTERY GASES TO EXPLODE; BATTERY ACID can burn eyes and skin.

Batteries contain acid and generate explosive gases.

1. Always wear a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and -) on batteries.

**WARNING**

STEAM AND PRESSURIZED HOT COOLANT can burn face, eyes, and skin.

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.
3. Allow pressure to escape before completely removing cap.

**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.

ABOUT PACEMAKERS:

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

1.02 PRINCIPAL SAFETY STANDARDS

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

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

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

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

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

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

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

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

Safety in welding and allied processes Part 2: Electrical, AS1674.2-2007 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 130, 170 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 73/23/EU, as recently changed in Directive 93/68/EU 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:

- AS/NZS 3652-(EMC Directive EN50199) applicable to arc welding equipment - generic emissions and regulations.
- EN60974-1 applicable to welding equipment and associated accessories.
- AS60974.1 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 Owner's Manual applies to just specification or part numbers listed on page i.

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

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



A WARNING gives information regarding possible personal injury.



A CAUTION refers to possible equipment damage.

NOTE

A NOTE offers helpful information concerning certain operating procedures.

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 uncrating the unit. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.





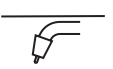
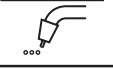
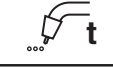






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2.04 Symbol Chart

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
	Voltage Input

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

Art # A-04937

2.05 Description

Weldskill 130

This compact, portable, inverter welding machine has infinitely adjustable welding current from 5 to 130 amps. It runs standard general purpose 2.5mm electrodes for light gauge work, generally less than 3.0mm thick and 3.2mm electrodes for heavier materials. The unit also has a lift TIG function that offers stable TIG welding characteristics when used with a suitable TIG torch and shielding gas.

Weldskill 170

This compact heavy duty, inverter welding machine has infinitely adjustable welding current from 5 to 170 amps. It runs standard general purpose 2.5mm electrodes for light gauge work, generally less than 3.0mm thick, and 3.2mm 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 Items

Description	Weldskill 130	Weldskill 170
Welding Power Source	✓	✓
Electrode Lead	✓	✓
Work Lead	✓	✓
Operating Manual	✓	✓

NOTE:

Part numbers W1002801 and W1002901 come complete with a plastic tool case.

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.

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2.10 Specifications

Description	Weldskill 130	Weldskill 170
Power Source Part Number	W1002800	W1002900
Cooling	Fan Cooled	Fan Cooled
Welder Type	Inverter Power Source	Inverter Power Source
Welding Power Source Mass	5.5kg	6.5kg
Dimensions	H 280mm x W 120mm x D 220mm	H 330mm x W 130mm x D 230mm
Manufactured to Australian Standard	AS60974.1-2006	AS60974.1-2006
Number of Phases	Single Phase	Single Phase
Nominal Supply Voltage	240V ±15%	240V ±15%
Nominal Supply Frequency	50Hz	50Hz
Welding Current Range	5 - 130 Amps	5 - 170 Amps
Factory Fitted Supply Plug Rating	10 Amps	15 Amps
Effective Input Current (I _{1eff})	10 Amps	15 Amps
Maximum Input Current (I _{1max})	23 Amps	31 Amps
Single Phase Generator Requirement	6 KVA	8.2 KVA
Welding Output, 40°C ,10 min. (quoted figures refer to MMAW output)	130A @ 20%, 25.2V 75A @ 60%, 23.1V 58A @ 100%, 22.3V	170A @ 25%, 26.8V 110A @ 60%, 24V 85A @ 100%, 23.2V
Protection Class	IP23S	IP23S

NOTE

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

2.11 Options and Accessories

Description	Part Number
TIG Torch Weldskill 130 Inverter	W7003006
TIG Torch Weldskill 170 Inverter	W7003021
TIG torch Accessory Kit	BGSAK2
Flow Meter/Regulator	210254

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

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

3.02 Location

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

- A. In areas, free from moisture and dust.
- B. Ambient temperature between 0° C 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 $\pm 15\%$ of the rated Mains supply voltage. Too low a voltage may cause poor welding performance. Too high a supply voltage will cause components to overheat and possibly fail.

The Welding Power Source must be:

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

IMPORTANT NOTE

This product has been fitted with a supply plug as indicated in Section 2.11. Note that the welding output range applicable with the fitted supply plug is detailed in Section 2.11.

In order to achieve maximum welding output and duty cycle it is recommended to increase the rating of the Supply Plug as detailed in Section 2.12



WARNING

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

3.05 Electromagnetic Compatibility



WARNING

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

A. Installation and Use - Users Responsibility

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

NOTE

The welding circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be 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 its size and position, e.g. ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

6. Screening and Shielding

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

3.06 Setup For Manual Arc Welding



WARNING

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



CAUTION

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

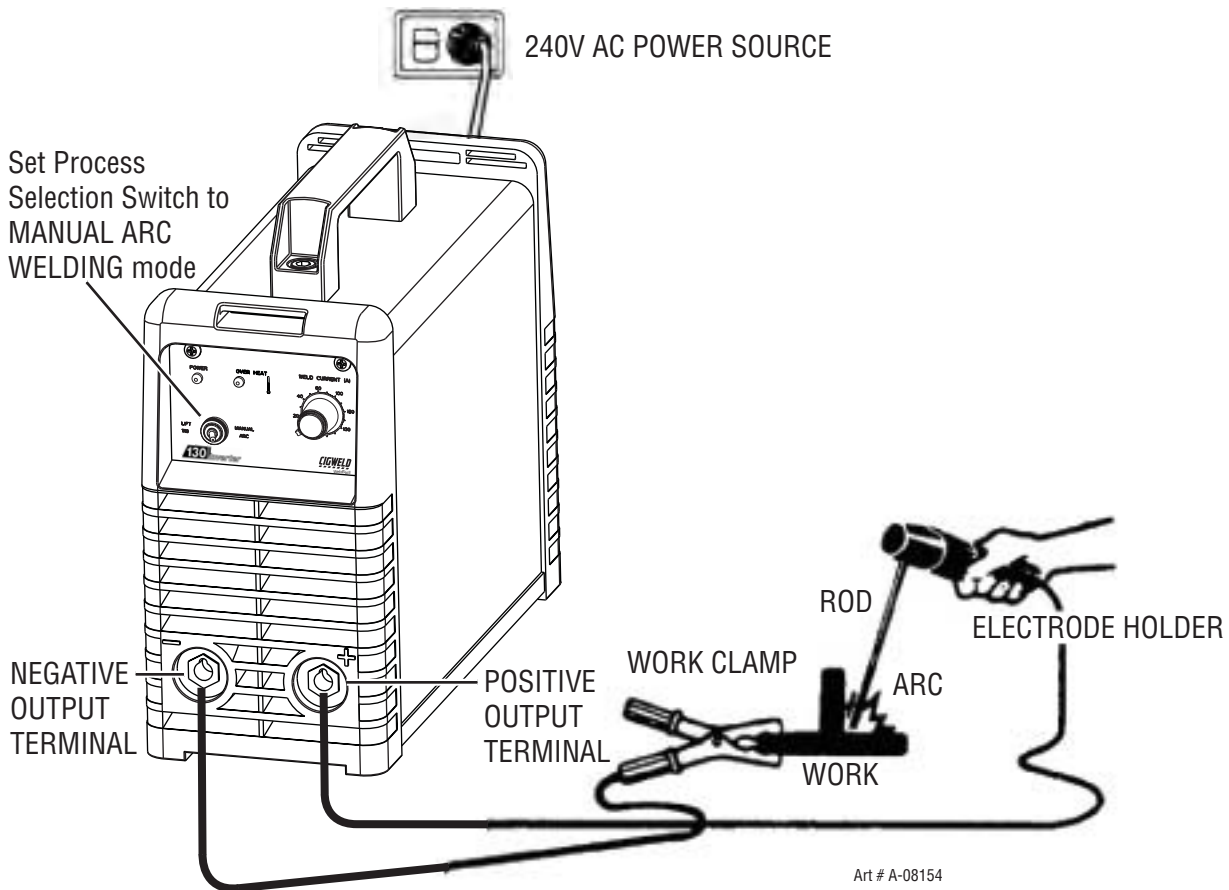


Figure 3-1: Set-up for Arc Welding

3.07 Setup For TIG Welding



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.

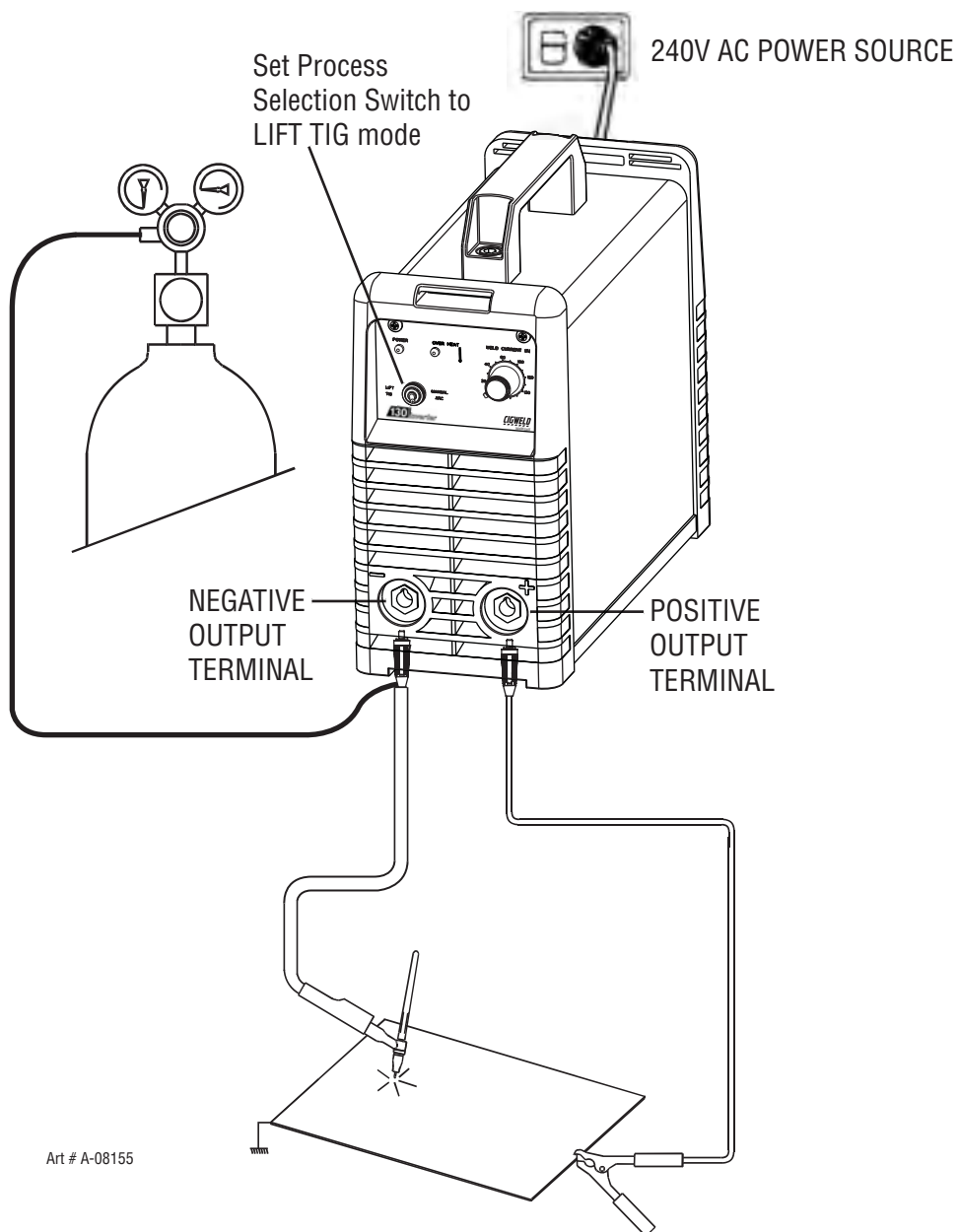


Figure 3-2: Set-up for TIG Welding

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. 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 Front Panel

A. Process Selection Switch

Switches between Lift TIG and Manual Arc Welding modes. Refer to Section 3.06 Setup for Manual Arc Welding and 3.07 Setup for TIG Welding.

B. Power ON Indicator

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

C. Over Heat Indicator

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

D. Welding Current Control

The welding current is increased by turning the Weld Current (A) control knob clockwise or decreased by turning the Weld Current (A) control knob anti-clockwise. The welding current should be set according to the specific application. Refer to application notes in this section for further information.

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

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

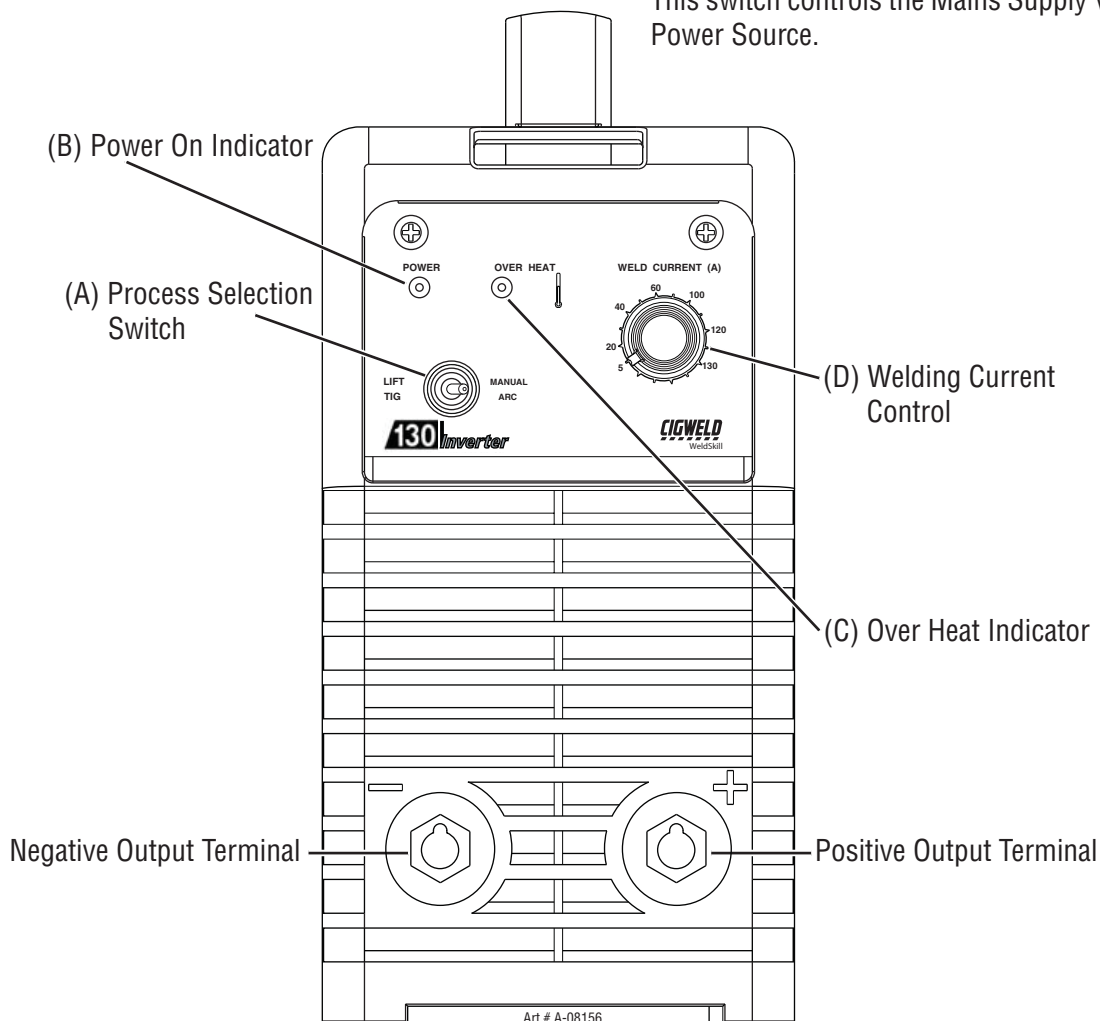


Figure 4-1: Front Panel

4.03 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.

4.04 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	Handipak	322135	General purpose electrode suitable for the all positional welding of mild and galvanised steel.
	2.5mm	2.5kg	612182	
	3.2mm	Handipak	322136	
	3.2mm	2.5kg	612183	
Ferrocraft 12XP	2.0mm	Handipak	322128	General purpose, Xtra performance electrode recommended for the all positional (inc. vertical down) welding of mild and galvanised steel.
	2.0mm	2.5kg	612231	
	2.5mm	1kg	322129	
	2.5mm	2.5kg	612232	
	3.2mm	1kg	322138	
	3.2mm	2.5kg	612233	
Speedex 12	2.5mm	1kg	SP12251	User friendly GP electrode for welding thin section mild and galvanised steels. Excellent for vertical down fillet welding applications.
	2.5mm	2.5kg	SP12125	
	3.2mm	1kg	SP12321	
	3.2mm	2.5kg	SP1325	
Speedex 13	2.5mm	2.5kg	SP1325	User friendly GP electrode producing a quiet smooth arc and a flat mitred fillet weld.
	3.2mm	5kg	SP1332	

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Table 4-1: Types of Electrodes

4.05 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.

4.06 Storage of Electrodes

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

4.07 Electrode Polarity

Electrodes are generally connected to the ELECTRODE HOLDER and the WORK LEAD to the work piece but if in doubt consult your nearest accredited CIGWELD Distributor.

4.08 Effects of Arc Welding Various Materials

A. High tensile and alloy steels

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

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

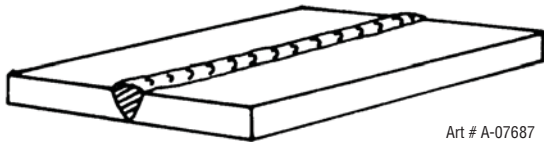
The most important factor is the high rate of heat conductivity of copper, making preheating of heavy sections necessary to give proper fusion of weld and base metal.

4.09 Arc Welding Practice

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

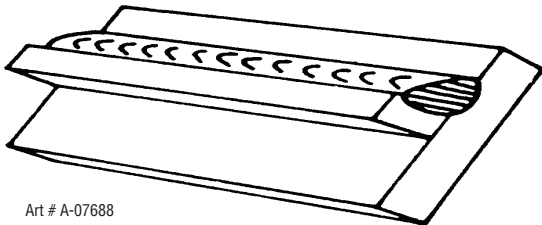
4.10 Welding Position

The electrodes dealt with in this publication can be used in most positions, i.e. they are suitable for welding in flat, horizontal, vertical and overhead positions. Numerous applications call for welds to be made in positions intermediate between these. Some of the common types of welds are shown in Figures 4-2 through 4-9.



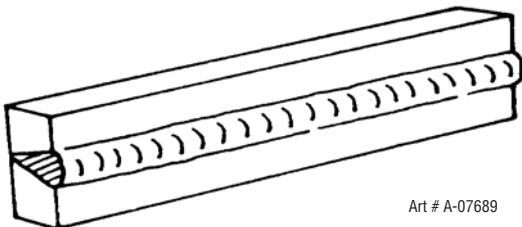
Art # A-07687

Figure 4-2: Flat position, down hand butt weld



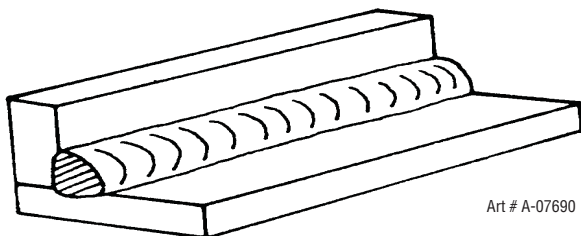
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Figure 4-3: Flat position, gravity fillet weld



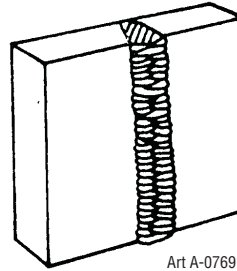
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Figure 4-4: Horizontal position, butt weld



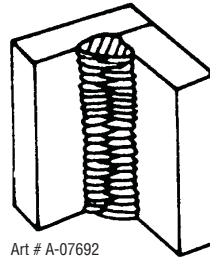
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Figure 4-5: Horizontal - Vertical (HV) position



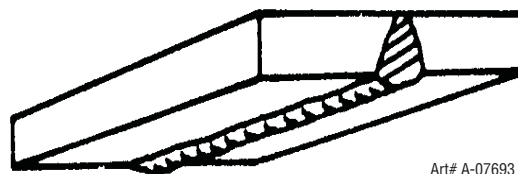
Art A-07691

Figure 4-6: Vertical position, butt weld



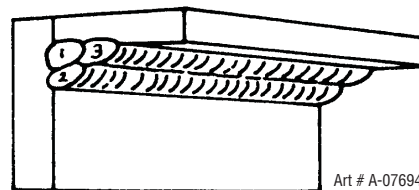
Art # A-07692

Figure 4-7: Vertical position, fillet weld



Art# A-07693

Figure 4-8: Overhead position, butt weld



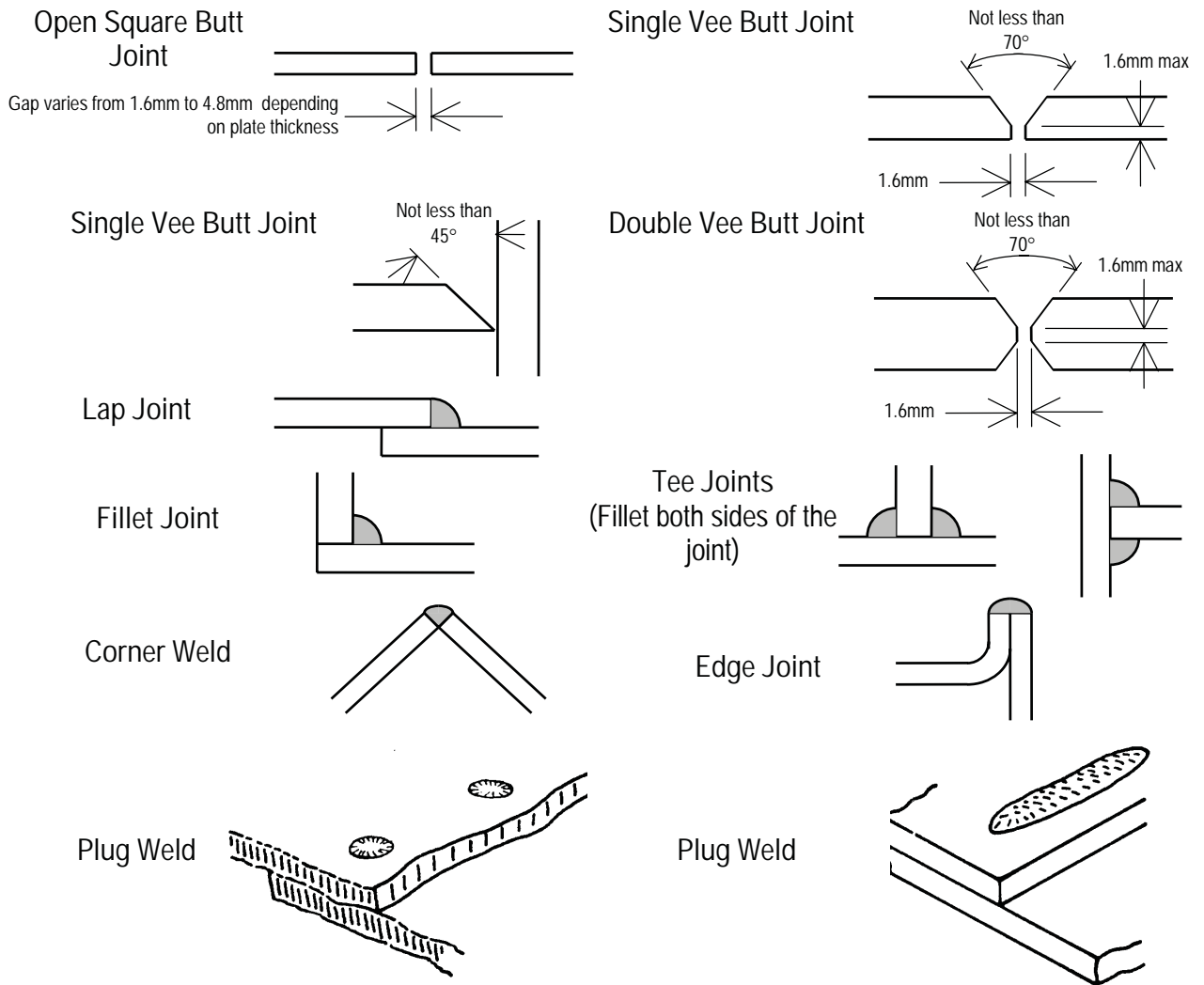
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Figure 4-9: Overhead position fillet, weld

4.11 Joint Preparations

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

In general, surfaces being welded should be clean and free of rust, scale, dirt, grease, etc. Slag should be removed from oxy-cut surfaces. Typical joint designs are shown in Figure 4-10.



Art # A-07695

Figure 4-10: Typical joint designs for arc welding

4.12 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.

4.13 The Welder

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

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

4.14 Striking the Arc

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

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

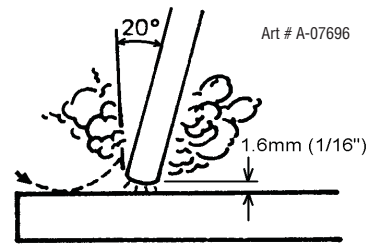


Figure 4-11: Striking an arc

4.15 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 Ferrocrafter 21 do not stick in this way, and make welding much easier.

4.16 Rate of Travel

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

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

4.17 Making Welded Joints

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

A. Butt Welds

Set up two plates with their edges parallel, as shown in Figure 4-12, 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 Ferrocrafter 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.

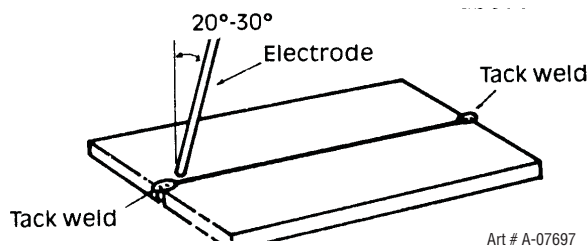


Figure 4-12: Butt weld

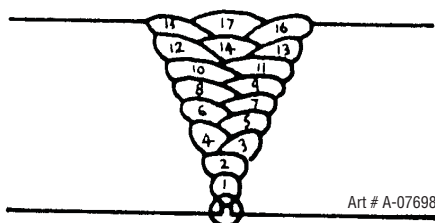


Figure 4-13: Weld build up sequence

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 4-13. 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 4-5.

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 Ferrocrafter 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 4-14. 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 4-15. Weaving in HV fillet welds is undesirable.

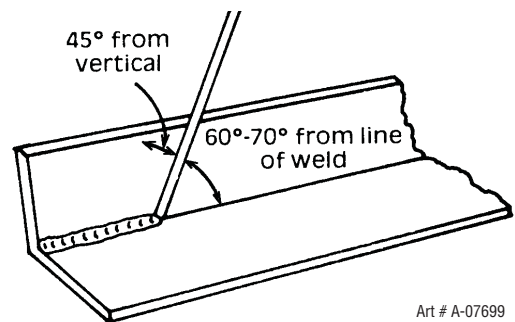


Figure 4-14: Electrode position for HV fillet weld

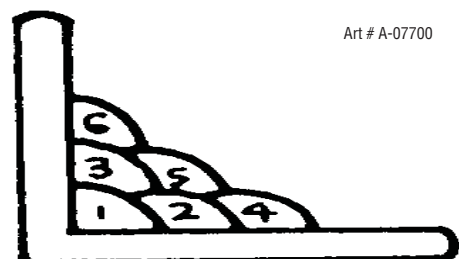


Figure 4-15: Multi-runs in HV fillet weld

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 Ferrocrafft 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 4-16. 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 4-17 illustrates multi-run technique and Figure 4-18 shows the effects of pausing at the edge of weave and of weaving too rapidly.

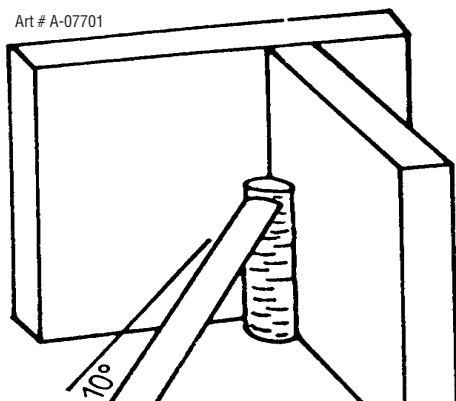


Figure 4-16: Single run vertical fillet weld

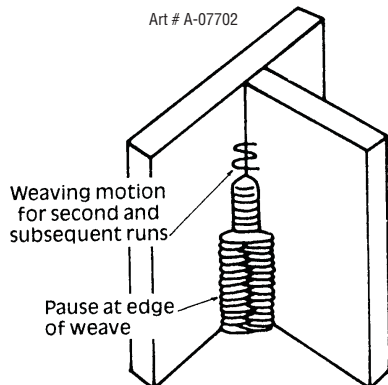


Figure 4-17: Multi run vertical fillet weld

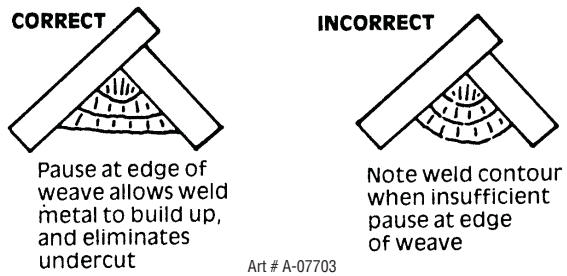


Figure 4-18: Examples of vertical fillet welds

2. Vertical Down

The Ferrocrafft 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 than downhand welding. Set up a specimen for overhead welding by first tacking a length of angle iron at right angles to another piece of angle iron or a length of waste pipe. Then tack this to the work bench or hold in a vice so that the specimen is positioned in the overhead position as shown in the sketch. The electrode is held at 45° to the horizontal and tilted 10° in the line of travel (Figure 4-19). 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 Ferrocrafft 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.

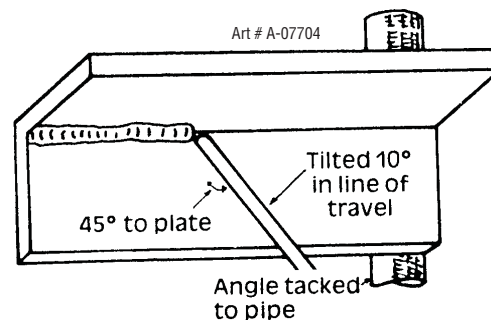


Figure 4-19: Overhead fillet weld

4.18 Distortion

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

4.19 The Cause of Distortion

Distortion is caused by:

A. Contraction of Weld Metal:

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

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

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

The metal in the weld area is stretched (plastic deformation), the job may be pulled out of shape by the powerful contraction stresses (distortion), or the weld may crack, in any case, there will remain “locked-up” stresses in the job. Figures 4-20 and 4-21 illustrate how distortion is created.

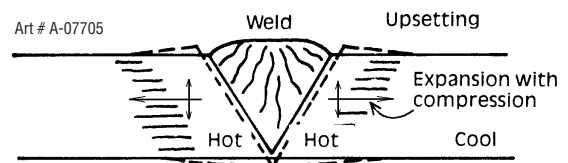


Figure 4-20: Parent metal expansion

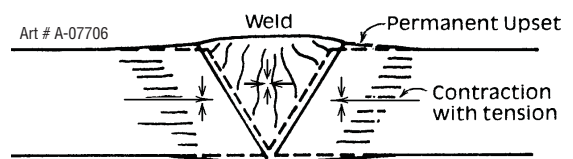


Figure 4-21: Parent metal contraction

4.20 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 4-25 through 4-28 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 pre-setting of the components to be welded, constructional stresses can be made to pull the parts into correct alignment. A simple example is shown in Figure 4-22.

E. Preheating

Suitable preheating of parts of the structure other than the area to be welded can be sometimes used to reduce distortion. Figure 4-23 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.

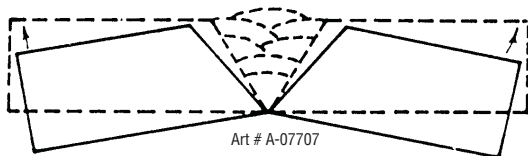
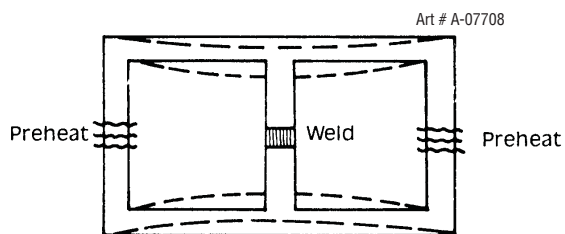


Figure 4-22: Principle of presetting



Dotted lines show effect if no preheat is used

Figure 4-23: Reduction of distortion by preheating

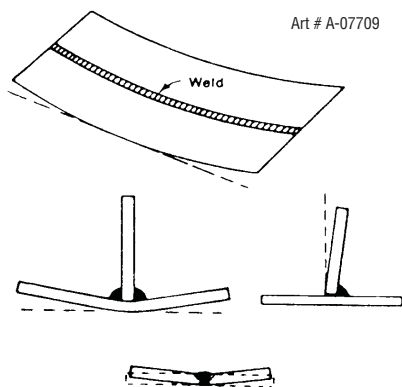
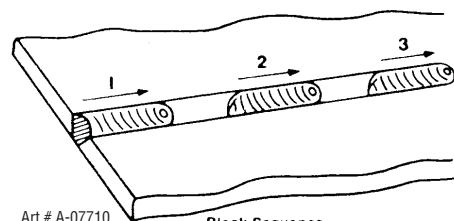


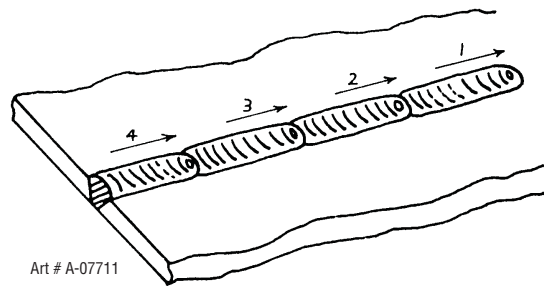
Figure 4-24: Examples of distortion



Art # A-07710

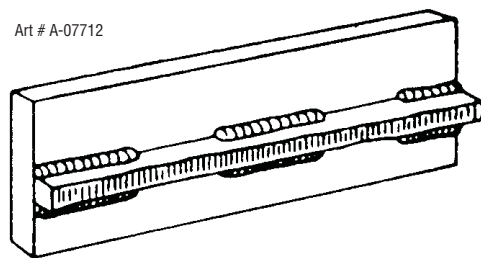
Block Sequence.
The spaces between the welds are filled in when the welds are cool.

Figure 4-25: Welding sequence



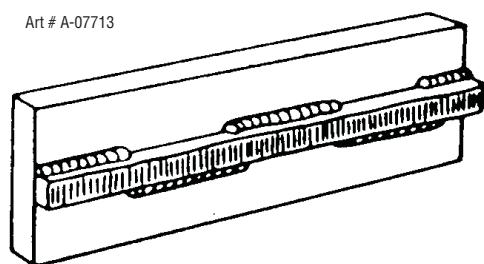
Art # A-07711

Figure 4-26: Step back sequence



Art # A-07712

Figure 4-27: Chain intermittent welding



Art # A-07713

Figure 4-28: Staggered intermittent welding

SECTION 5: SERVICE

5.01 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.

5.02 Cleaning the Welding Power Source



WARNING

Refer to WARNING on page 3-2.

To clean the Welding Power Source, open the enclosure and use a vacuum cleaner to remove any accumulated dirt, metal filings, slag and loose material. Keep the shunt and lead screw surfaces clean as accumulated foreign material may reduce the welders output welding current.



CAUTION

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

5.03 Face Shield Maintenance

The face shield and lens should be cleaned after use with a soft cloth.

5.04 Basic Troubleshooting



WARNING

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

If major complex subassemblies are faulty, then the Welding Power Source must be returned to an Accredited CIGWELD Service Agent for repair.

The basic level of troubleshooting is that which can be performed without special equipment or knowledge.

5.05 Welding Problems

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

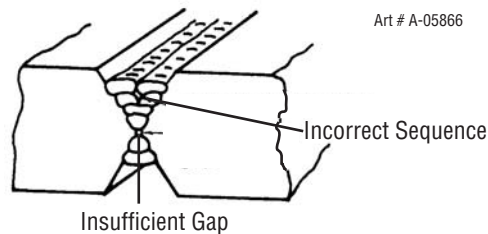


Figure 5-1: Example of Insufficient Gap or Incorrect Sequence

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 B Welding current is too low C Wrong electrode angle D Travel speed of electrode is too high E Scale or dirt on joint surface	A Use larger electrodes and preheat the plate B Increase welding current C Adjust angle so the welding arc is directed more into the base metal D Reduce travel speed of electrode E Clean surface before welding

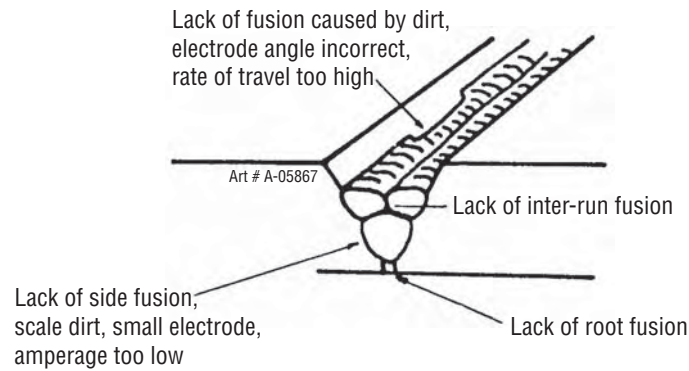


Figure 5-2: Example of Lack of Fusion

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

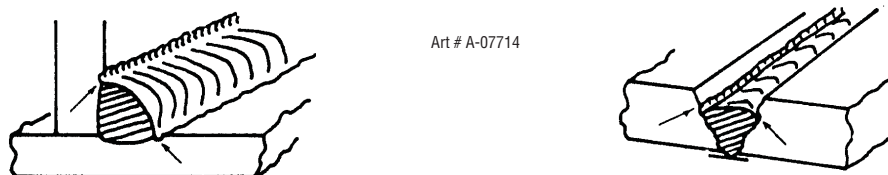


Figure 5-3: Examples of undercut

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

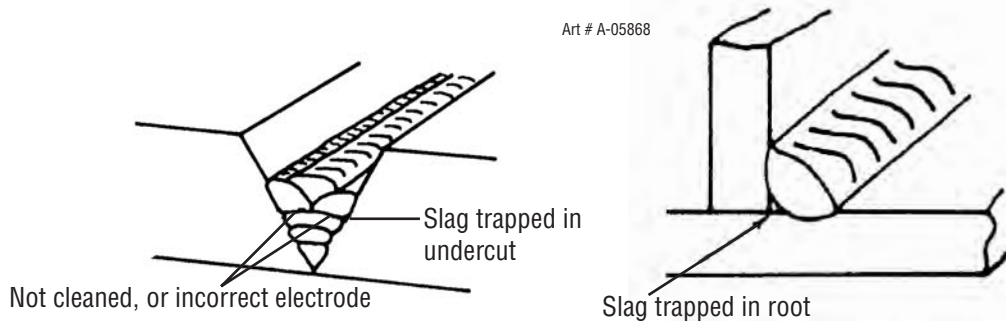


Figure 5-4: Examples of Slag Inclusion

5.06 Welding Power Source Problems

Description	Possible Cause	Remedy
1 The welding arc cannot be established	A The Primary supply voltage has not been switched ON B The Welding Power Source switch is switched OFF C Loose connections internally	A Switch ON the Primary supply voltage B Switch ON the Welding Power Source C Have an Accredited Cigweld Service Provider repair the connection
2 Maximum output welding current cannot be achieved with nominal Mains supply voltage	Defective control circuit	Have an Accredited Cigweld Service Provider inspect then repair the welder
3 Welding current reduces when welding	Poor work lead connection to the work piece	Ensure that the work lead has a positive electrical connection to the work piece
4 TIG electrode melts when arc is struck	TIG torch is connected to the (+) VE terminal	Connect the TIG torch to the (-) VE terminal
5 Arc flutters during TIG welding	Tungsten electrode is too large for the welding current	Select the correct size of tungsten electrode

CIGWELD LIMITED WARRANTY

LIMITED WARRANTY: CIGWELD, A Thermadyne Company, 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.

Terms of Warranty – 2007

1. The Trade Practices Act 1974 (Commonwealth) and similar State Territory legislation relating to the supply of goods and services, protects consumers' interests by ensuring that consumers are entitled in certain situations to the benefit of various conditions, warranties, guarantees, rights and remedies (including warranties as to merchantability and fitness for purpose) associated with the supply of goods and services. A consumer should seek legal advice as to the nature and extent of these protected interests. In some circumstances, the supplier of goods and services may legally stipulate that the said conditions, warranties, guarantees, rights and remedies are limited or entirely excluded. The warranties set out in Clause 2 shall be additional to any nonexcludable warranties to which the Customer may be entitled pursuant to any statute.
2. Subject to Clause 3. CIGWELD gives the following warranties to the Customer:

Insofar as they are manufactured or imported by CIGWELD, goods will upon delivery be of merchantable quality and reasonably fit for the purpose for which they are supplied by CIGWELD.

CIGWELD will repair or, at its option, replace those of the goods which, upon examination, are found by CIGWELD to be defective in workmanship and/or materials.

CIGWELD reserves the right to request documented evidence of date of purchase.
3. The Warranty in Clause 2;

Is conditional upon:

The Customer notifying CIGWELD or our Accredited Distributor 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. The goods being used in accordance with the Manufacturer's Operating Manuals, and under competent supervision.

Does not apply to:

Obsolete goods sold at auction, second-hand goods and prototype goods.

Breakdown or malfunction caused by accident, misuse or normal wear and tear.

Repairs or replacement made other than by CIGWELD or Accredited Service Providers, unless by prior arrangement with CIGWELD.

Replacement parts or accessories which may affect product safety or performance and which are not manufactured, distributed or approved by CIGWELD.
4. CIGWELD declares that, to the extent permitted by law, it hereby limits its liability in respect of the supply of goods which are not of a kind ordinarily acquired for personal, domestic or household use or consumption to any one or more of the following (the choice of which shall be at the option of CIGWELD).

The replacement of the goods or the supply of equivalent goods.

The repair of goods.

The payment of cost of replacing the goods or acquiring equivalent goods.

The payment of the cost of having goods repaired.
5. Except as provided in Clauses 2 to 4 above, to the extent permitted by statute, CIGWELD hereby excludes all liability for any loss, damage, death or injury of any kind whatsoever occasioned to the Customer in respect of the supply of goods including direct, indirect, consequential or incidental loss, damage or injury of any kind.

Warranty Schedule – 2007

These warranty periods relate to the warranty conditions in clause 2. All warranty periods are from date of sale from the Accredited Distributor of the equipment. 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 Accredited Distributor. Unless otherwise stated the warranty period includes parts and labour. CIGWELD reserves the right to request documented evidence of date of purchase.

	WARRANTY PERIOD
<u>INVERTER ARC WELDING POWER SOURCE</u>	
Weldskill 130 and 170	1 year
Control P.C. Boards	1 year
All other circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semiconductors.....	1 year
<u>ACCESSORIES</u>	
Electrode holder and work lead.....	3 Months

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



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