120 Turbo
140 Turbo

Operation Manual

Version No:1 **Issue Date: Dec 22, 2006** **Manual No: 719527**

Operating Features

LEADER IN ARC WELDING TECHNOLOGY

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.

YOU ARE IN GOOD COMPANY

The Brand of Choice for Contractors and Fabricators. 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 brands that have stood the test of time, technical innovation, competitive prices, excellent delivery, superior customer service and technical support, together with excellence in sales and marketing expertise.

We are committed to develop technologically advanced products to achieve a safer working environment for industry operators.

WARNING 1

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

Welding Power Supply
Instruction Manual Number 719527 for:

120 Turbo	Manual Metal Arc Welder	Spec Number	W1002000
140 Turbo	Manual Metal Arc Welder	Spec Number	W1002100

Published by:
CIGWELD Pty Ltd
71 Gower Street
Preston, Victoria, Australia, 3072

www.cigweld.com.au

Publication Date: **Dec 21, 2006**

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Equipment Serial #: _____

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SECTION 1: Arc Welding Safety Instructions and Warnings

WARNING 2

ARC WELDING can be hazardous.

Protect yourself and others from possible serious injury or death. Keep children away. Pace maker 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. Anyone not having extensive training in welding and cutting practices should not attempt to weld. Certain practices apply to equipment connected to power lines; other practices apply to engine driven equipment.
Safe practices are out lined in the American National Standard Z49.1 entitled: SAFETY IN WELDING AND CUTTING. 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.

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 terminal 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 10 cal codes.

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.

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, under sized 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.

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI 249.1 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 earplugs or earmuffs if noise level is high.

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
	Under 5/32 to ¼ in., 4 to 6.4mm	12	Medium	300 to 400 Amp	12
	Over ¼ in., 6.4 mm	14	Heavy	Over 400 Amp	14

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 (MSDS) 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 re moved 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.

WELDING can cause fire or explosion.

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

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

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.

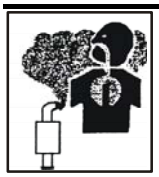
CYLINDERS can explode if damaged.

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 3

ENGINES can be dangerous.



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.

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 fuelling. If possible, check and add fuel to cold engine before beginning job.
4. Do not overfill tank - allow room for fuel to expand away from any building air intakes.

MOVING PARTS can cause injury.

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

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.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.
6. Re-install panels or guards and close doors when servicing is finished and before starting engine.

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.

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 can 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 work place, use the following procedures:

1. Keep cables close together by twisting or taping them.
2. Do not coil or drape cables around the body.
3. Arrange cables to one side and away from the operator.
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.

1.01 Declaration of Conformity

Manufacturer and Merchandiser of Quality Consumables and Equipment: CIGWELD

Address: 71 Gower St, Preston
Victoria 3072
Australia

Description of equipment: Welding Equipment (MMAW). CIGWELD 120 Turbo & 140 Turbo 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:

* AS60974.6 2006 applicable to welding equipment and associated accessories.
* AS/NZS 3652-(EMC Directive EN50199) applicable to arc welding equipment - generic emissions and regulations.
* EN60974-1 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.

1.02 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 – July 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 non-excludable 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 – January 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.

CIGWELD ARC WELDING EQUIPMENT	***WARRANTY PERIOD***
120 Turbo, 140 Turbo	
Main Power Magnetics	1 year
All other circuits and components including, but not limited to, relays, switches, contactors, solenoids, fans, power switch semi-conductors	1 year
ACCESSORIES	
Electrode Holder and Work Clamp	3 months
Hand shield	3 months

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

WARNING 4

For the purpose of safety and performance and to protect your CIGWELD Equipment Warranty always use genuine CIGWELD replacement parts and accessories.

SECTION 2: Introduction

2.01 How to Use This Manual

This Owner's Manual usually applies to just the underlined specification or part numbers listed on the page 3. If none are underlined, they are all covered by this manual.
To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.
Throughout this manual, the word **WARNING, CAUTION** and **NOTE** may appear. Pay particular attention to the in formation provided under these headings. These special annotations are easily recognized as follows:

WARNING

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

CAUTION

Refers to possible equipment damage. Cautions will be shown in bold type.

NOTE

Offers helpful information concerning certain operating procedures. Notes will be shown in italics.

2.02 Equipment Identification

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

2.03 Receipt of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to:
CIGWELD, Customer Care Department, 71 Gower St, Preston, Victoria, Australia, 3072.
Include all equipment identification numbers as described above along with a full description of the parts in error.

Additional copies of this manual may be purchased by contacting CIGWELD, Customer Care Department, at the address given above. Include the Owner's Manual number and equipment identification numbers.

SECTION 3: Electromagnetic Compatibility

WARNING 5

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

3.01 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 1. 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 1

The welding circuit may or may nor 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).

3.02 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

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

ii) Radio and television transmitters and receivers.

iii) Computer and other control equipment.

iv) Safety critical equipment, e.g. guarding of industrial equipment.

v) The health of people around, e.g. the use of pacemakers and hearing aids.

vi) Equipment used for calibration and measurement.

vii) The time of day that welding or other activities are to be carried out.

viii) 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.

3.03 Methods of Reducing Electromagnetic Emissions

a) 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 it's length. The shielding should be connected to the Welding Power Source so that good electrical contact is maintained between the conduit and the Welding Power Source enclosure.

b) 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.

c) 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.

d) 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.

e) 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.

f) 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.

SECTION 4: General Information

4.01 120 Turbo

This compact, portable, home handyman arc welder has infinitely adjustable welding current from 40 to 100 amps and is designed to operate from a domestic 240V, 10 amp outlet. It runs standard general purpose 2.5mm electrodes for light gauge work, generally less than 3.0mm thick.

4.02 140 Turbo

This compact heavy duty, fan cooled, portable, home handyman arc welder has infinitely adjustable welding current from 50 to 130 amps and is designed to operate from a 240V, 15 amp outlet 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.

4.03 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.

4.04 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.

SECTION 5: Safe Practices For The Use Of Welding Equipment

In many situations the “striking” voltage can be hazardous. Any person touching simultaneously the electrode lead/terminal and the work lead/terminal may receive a serious electrical shock. Additional precautions must be exercised where two Welding Power Sources are being used close to each other because, under certain conditions, the voltages between the welding terminals of the two Welding Power Sources could be two times the specified open circuit voltage.

It is essential that the Welding Power Source is correctly installed, if necessary, by a qualified electrician and maintained in sound mechanical and electrical condition. It is also important that the Welding Power Source be switched off when not in use.

5.01 Precautions to be Taken by Operators

- Whenever practicable, all parts of the welding circuit should be isolated from earth and other conducting material and under no circumstances should any earthing conductor of the electrical installation be used in place of the work lead.
- The Mains supply voltage should be switched off before connecting or disconnecting welding leads. Welding lead connections must have clean contact surfaces and must be securely tightened. Poor connections will result in overheating and loss of welding current. All parts of the welding circuit, including the return paths, are to be considered electrically alive, so the operator must ensure that no part of the body is placed in such a position that it will provide a path for an electric current.
- Welding operators should avoid direct contact with the work to be welded or against any metal in contact with the work. When this cannot be avoided the operator must not touch any exposed portion of the electrode holder with any part of the body. Should this occur, the operator will risk completing the electrical circuit through the body.
- When welding in confined spaces, where reasonable movement is restricted, particular care must be taken to ensure that the area is well ventilated and the operator is under constant observation by a person who can immediately switch off the power and give assistance in an emergency.
- The flux covering of an electrode cannot be assumed to provide effective insulation, consequently an insulating glove must be worn when placing an electrode into its holder, or should it be necessary to handle an electrode once it is in contact with its holder.
- During pauses between welding runs, electrode holders should be so placed that they cannot make electrical contact with persons or conductive objects.
- The welding leads, both the electrode lead and the work lead, must be protected from damage. Damaged leads must not be used.
- Keep combustible materials away from the welding area. Have a suitable fire extinguisher handy.
- Do not stand on damp ground when welding.

5.02 Personal Protection

The radiation from an electric arc during the welding process can seriously harm eyes and skin. It is essential that the following precautions be taken:

- Gloves should be flameproof gauntlet type to protect hands and wrists from heat burns and harmful radiations. They should be kept dry and in good repair.
- Protective clothing must protect the operator from burns, spatter and harmful radiation. Woollen clothing is preferable to cotton because of its greater flame resistance. Clothing should be free from oil or grease. Wear leggings and spats to protect the lower portion of the legs and to prevent slag and molten metal from falling into boots or shoes.
- Welding handshield

  It is a requirement to use a welding handshield, complying to a relevant standard, when electric arc welding. Use a welding handshield in serviceable condition and fitted with an eye filter lens to safely reduce harmful radiation from the arc as per Table 1.

Welding current range	Electrode Diameter	Suggested Filter Lens
40 to 70A	2.0mm	Shade 8
55 to 90A	2.5mm	Shade 8
90 to 135A	3.2mm	Shade 10
135 to 200A	4.0mm	Shade 10

Table 1 - Filter lens size verses welding current/electrode size

Protective filter lenses are provided to reduce the intensity of radiation entering the eye thus filtering out harmful infra-red, ultra-violet radiation and a percentage of the visible light. Such filter lenses are incorporated within welding handshields. To prevent damage to the filter lenses from molten or hard particles an additional hard clear glass or special plastic external cover lens is provided. This cover lens should always be kept in place and replaced before the damage impairs your vision while welding.

Notes:

- Recognised standards for recommended practices for occupational eye protection include AS/ANZ 1336 and EN 175.
- For maximum possible protection, the use of full helmet equipment is recommended.
- The indicated filter lens shade numbers are minimum. If any discomfort is felt, higher shade numbers (i.e. darker filters) should be used.

SECTION 6: Resuscitation For Electric Shock Victims

Electric shock may kill immediately. Early resuscitation is required if a life is to be saved. Every Second Counts! Electrical currents may:

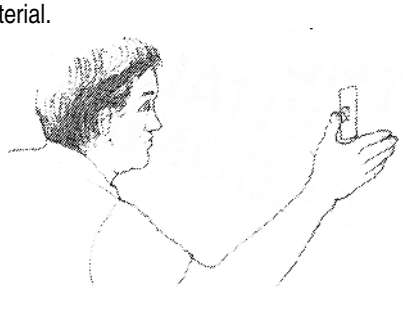
- Stop the heart;
- Cause contraction of the muscles of the body;
- Paralyse breathing due to paralysis of the centre of respiration in the brain;
- Cause burns.

The victims often cannot free themselves from the current and may not be able to breathe due to fixation of the chest.

6.01 Resuscitation

Efficient resuscitation requires training which is available from the St John's Ambulance Association, Red Cross and other sources.

1 Don't become a victim. Switch off power if possible. If not, remove victim from contact, using some insulating material.



2 If unconscious, place victim on their side and clear vomit and other foreign matter from mouth. Check for breathing by look, listen and feel. If not breathing, commence expired air resuscitation (E.A.R.). This should take no longer than 3 or 4 seconds.

3 Place victim flat on their back on a hard surface, open airway - using head tilt and jaw support as shown.

4 Begin artificial breathing - 5 full breaths in 10 seconds, sealing nostrils with cheek or holding nose closed.

5 Check carotid pulse in neck. If pulse is present, continue E.A.R.
15 breaths per minute for adults.
20 breaths per minute for children.

6 If pulse is absent and you have been trained, begin cardio pulmonary resuscitation (C.P.R).
Cardiac Compression - depress lower end of breast bone (sternum) 4cm to 5cm, less for small children.
<u>One rescuer</u> - 2 breaths, 15 compressions in 15 seconds, i.e. 4 cycles per minute.
<u>Two rescuers</u> - 1 breath, 5 compressions in 5 seconds, i.e. 12 cycles per minute.

7 Check for return of pulse and breathing after 1 minute and at least every 2 minutes. Continue uninterrupted until trained assistance is available. When breathing and pulse return, turn on side and continue observation.

SECTION 7: Specifications

7.01 120 Turbo and 140 Turbo Specifications

Description (Refer NOTE 2)	120 Turbo	140 Turbo
Product Part Number	W1002000	W1002100
Cooling	Fan Cooled	Fan Cooled
Welder Type & Welding process	Light Duty, Leakage reactance, Manual Metal Arc Welding	Medium Duty, Leakage reactance, Manual Metal Arc Welding
Welding Power Source mass	15.5kg	16kg
Dimensions	H 400mm x W 220mm x D 280mm	H 470mm x W 215mm x D 295mm
Manufactured to Australian Standard	AS60974.6-2006	AS60974.6-2006
Number of Phases	Single phase	Single phase
Nominal Supply Voltage	240V	240V
Nominal Supply Frequency	50Hz	50Hz
Effective Input Current	∇ 9.5 Amps	∇ 12 Amps
Flexible Supply Cable Size	10A Heavy Duty	15A Heavy Duty
Thermal Protection	Yes; Self Resetting	Yes; Self Resetting
Maximum Input Current ($I_{1\ max}$)	21.7 Amps	30 Amps
Single Phase Generator Requirement	5.3kVA	7.2kVA
Recommended Rated Outlet	10 Amps	15 Amps
Recommended Wire Fuse Size	✦ 16A	✦ 16A
Welding Current Range	40 - 100A	50 - 130A
Welding Current @ 25% duty cycle	50A	80A
Welding Current @ 5% duty cycle	120A	140A
Open Circuit Voltage	47V	48V

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

✦ Motor start fuses or thermal circuit breakers are recommended for this application. Check local requirements for your situation in this regard.
Generator Requirements at the Maximum Output Duty Cycle.

NOTE 2

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.

7.02 Plant Contents

Description	120 Turbo	140 Turbo
Welding Power Source	✓	✓
Electrode lead (fitted)	✓	✓
Work lead (fitted)	✓	✓
Face shield	✓	✓
Wire brush/Chipping hammer	✓	✓
Operating Manual	✓	✓

SECTION 8: Installation Recommendations

8.01 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 -

i) 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;

ii) 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, or

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

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

8.02 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^{o} C to 40^{0} 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.

8.03 Ventilation

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

8.04 Mains Supply Voltage Requirements

The Mains supply voltage should be within ± 10% 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 pages 15.

8.05 Welding Handshield Assembly

- Remove the main face shield assembly and the hand grip from the packaging.
- Hook the handle into the main face shield assembly as shown in Figure 1 below.
- Clip the welding lense supplied into position as shown in Figure 2 below.

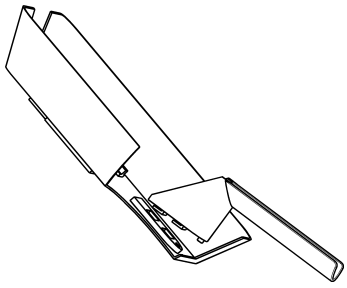


Figure 1 - Hook handle into the main face shield assembly

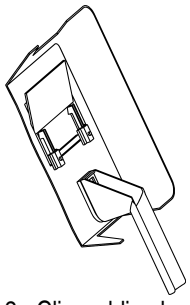


Figure 2 - Clip welding lense into position as shown

SECTION 9: Operation

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. Wide safety margins provided by the coil design ensure that the Welding Power Source will withstand short term overload without adverse effects. The welding current range values should be used as a guide only. Current delivered to the arc is dependent on the welding arc voltage, and as welding arc voltage varies between different classes of 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.

9.01 120 Turbo and 140 Turbo Controls

a) ON/OFF Switch

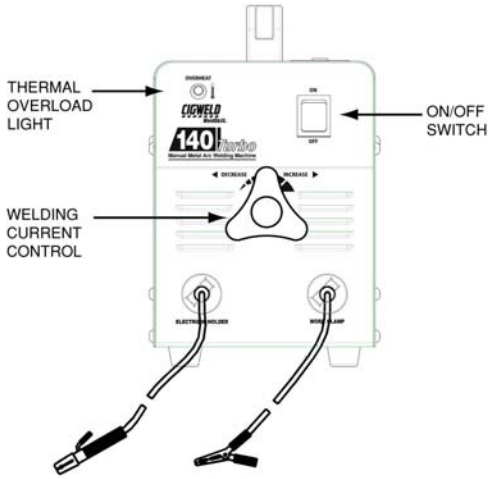
This switch connects the Mains supply voltage to the welding transformer when in the ON position which enables the user to commence welding.

b) Thermal Overload Light

The welding transformer is protected by a self resetting thermostat. If the overload light illuminates then wait for the overload light to extinguish before resuming your arc welding.

c) Welding Current Control

The welding current is increased by turning the Current Control clockwise or decreased by turning the Current Control anti-clockwise.



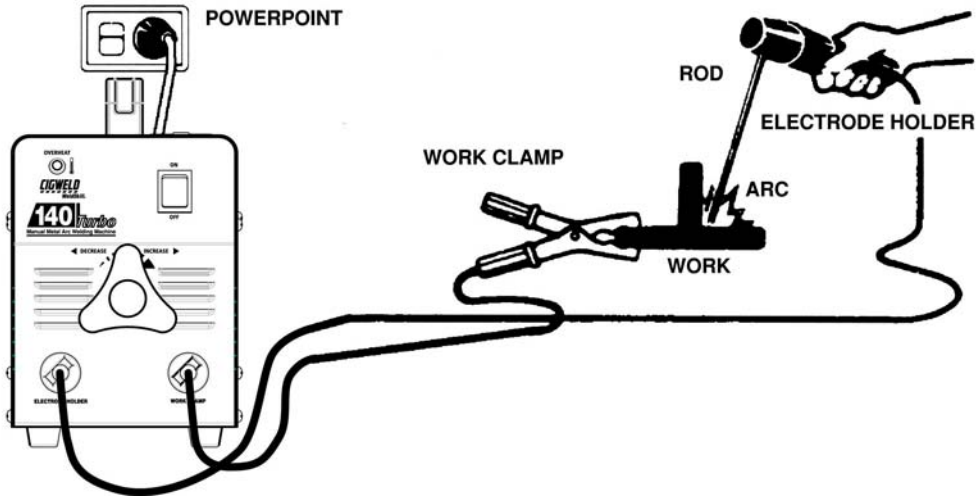
SECTION 10: Setup For Arc Welding

WARNING 6

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 1

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



SECTION 11: 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.

11.02 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	

Table 2 - Types of Electrodes

11.03 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.

11.04 Storage of Electrodes

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

11.05 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.

11.06 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.

SECTION 12: Arc Welding Practice

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

12.01 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 Figure 3 to Figure 10.

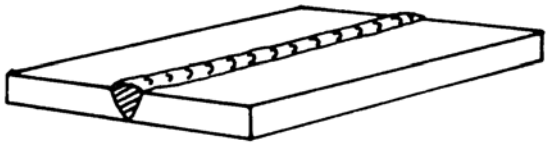


Figure 3 – Flat position, down hand butt weld

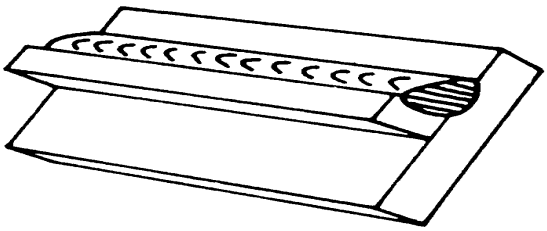


Figure 4 - Flat position, gravity fillet weld

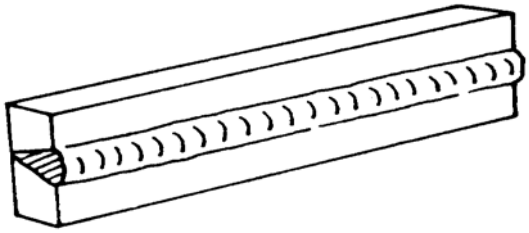


Figure 5 - Horizontal position, butt weld

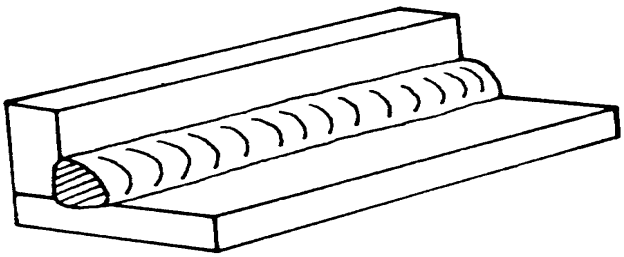


Figure 6 - Horizontal - Vertical (HV) position

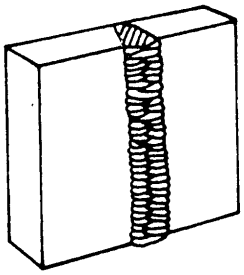


Figure 7 -Vertical position, butt weld

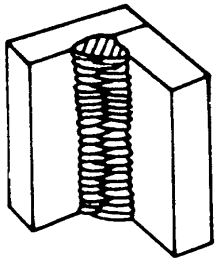


Figure 8 - Vertical position, fillet weld

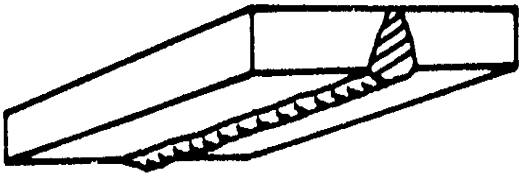


Figure 9 - Overhead position, butt weld

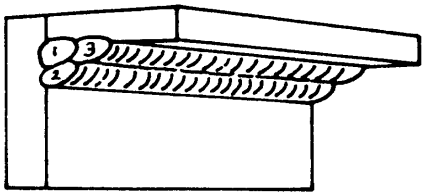


Figure 10 - Overhead position fillet, weld

12.02 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 11.

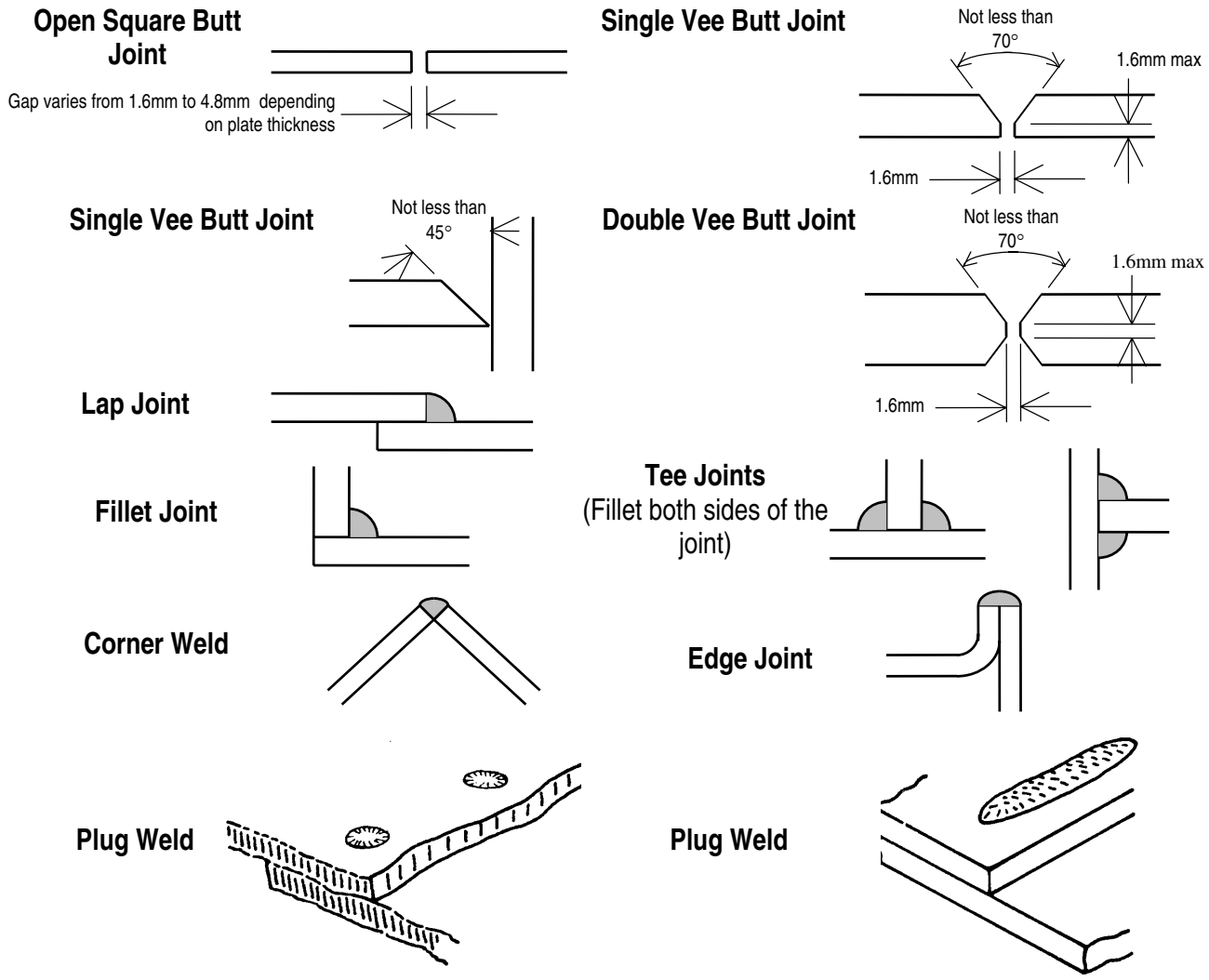


Figure 11 - Typical joint designs for arc welding

SECTION 13: Arc Welding Technique

13.01 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.

13.02 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.

13.03 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.

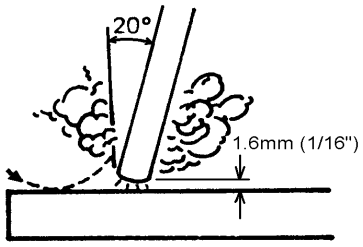


Figure 12 - Striking an arc

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.

13.04 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.

13.05 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.

13.06 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 13, 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.

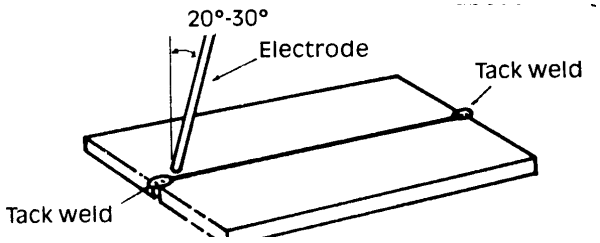


Figure 13 - Butt weld

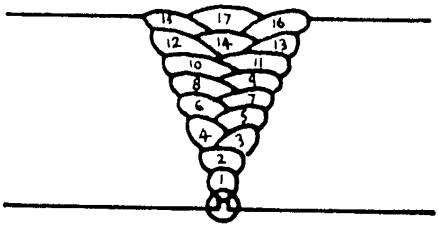


Figure 14 - Weld build up sequence

Heavy plate will require several runs to complete the joint. After completing the first run, chip the slag out and clean the weld with a wire brush. It is important to do this to prevent slag being trapped by the second run. Subsequent runs are then deposited using either a weave technique or single beads laid down in the sequence shown in Figure 14. The width of weave should not be more than three times the core wire diameter of the electrode. When the joint is completely filled, the back is either machined, ground or gouged out to remove slag which may be trapped in the root, and to prepare a suitable joint for depositing the backing run. If a backing bar is used, it is not usually necessary to remove this, since it serves a similar purpose to the backing run in securing proper fusion at the root of the weld.

b) Fillet Welds

These are welds of approximately triangular cross-section made by depositing metal in the corner of two faces meeting at right angles. Refer to Figure 6.

A piece of angle iron is a suitable specimen with which to begin, or two lengths of strip steel may be tacked together at right angles. Using a 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 15. 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 16. Weaving in HV fillet welds is undesirable.

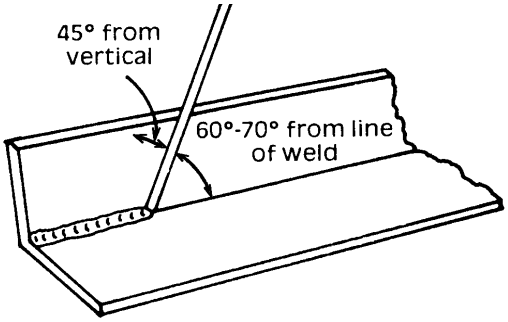


Figure 15 - Electrode position for HV fillet weld

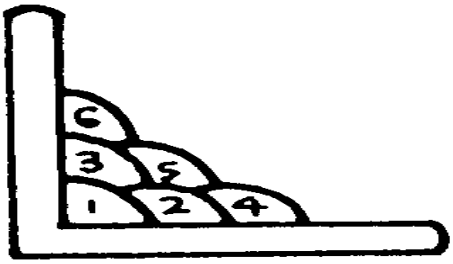


Figure 16 - Multi-runs in HV fillet weld

c) Vertical Welds

i) 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 17. Use a short arc, and do not attempt to weave on the first run. When the first run has been completed deslag 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 18 illustrates multi-run technique and Figure 19 shows the effects of pausing at the edge of weave and of weaving too rapidly.

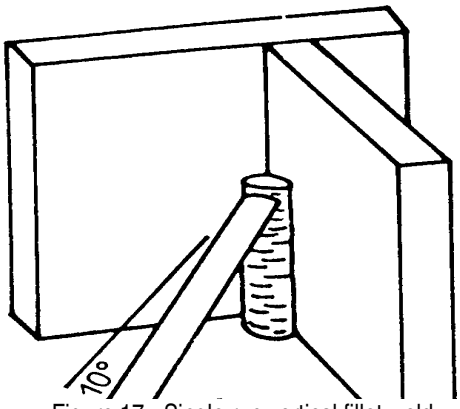


Figure 17 - Single run vertical fillet weld

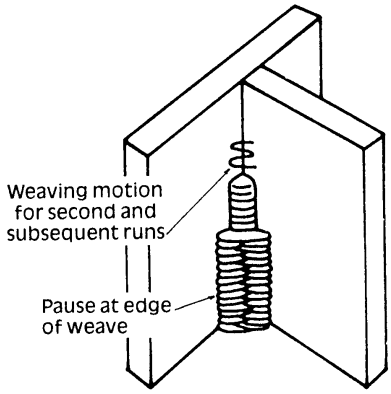


Figure 18 - Multi run vertical fillet weld

ii) 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°.

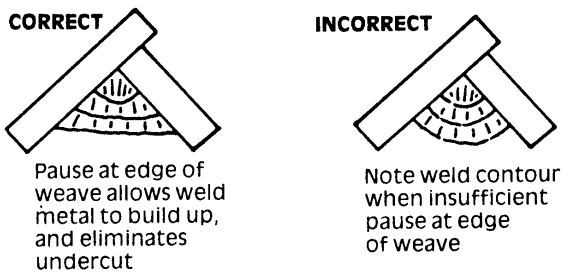


Figure 19 - Examples of vertical fillet welds

iii) 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 20). The tip of the electrode may be touched lightly on the metal, which helps to give a steady run. A weave technique is not advisable for overhead fillet welds. Use a 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.

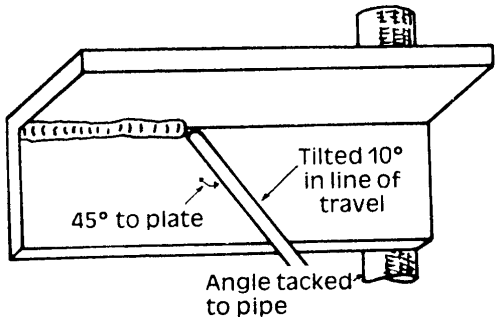


Figure 20 - Overhead fillet weld

SECTION 14: 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.

14.01 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. Figure 21 and Figure 22 illustrate how distortion is created.

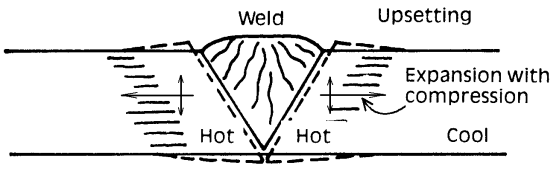


Figure 21 - Parent metal expansion

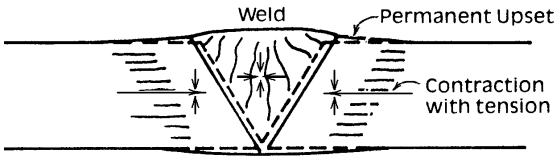


Figure 22- Parent metal contraction

14.02 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 Figure 26 to Figure 29 for various weld sequences. Choice of a suitable weld sequence is probably the most effective method of overcoming distortion, although an unsuitable sequence may exaggerate it. Simultaneous welding of both sides of a joint by two welders is often successful in eliminating distortion.

c) Restraint of Parts:

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

d) Presetting:

It is possible in some cases to tell from past experience or to find by trial and error (or less frequently, to calculate) how much distortion will take place in a given welded structure. By correct pre-setting of the components to be welded, constructional stresses can be made to pull the parts into correct alignment. A simple example is shown in Figure 23.

e) Preheating:

Suitable preheating of parts of the structure other than the area to be welded can be sometimes used to reduce distortion. Figure 24 shows a simple application. By removing the heating source from *b* and *c* as soon as welding is completed, the sections *b* and *c* will contract at a similar rate, thus reducing distortion.

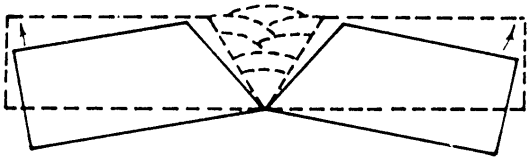


Figure 23 - Principle of presetting

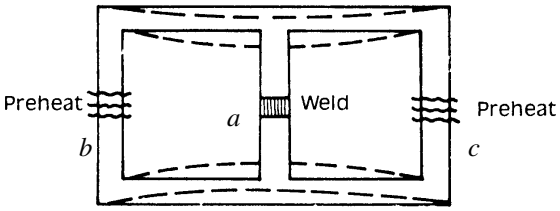


Figure 24 - Reduction of distortion by preheating

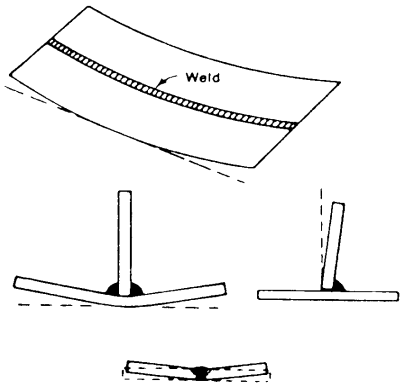


Figure 25 - Examples of distortion

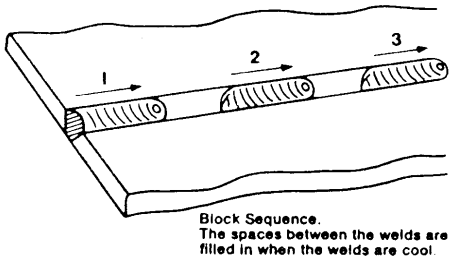


Figure 26 - Welding sequence

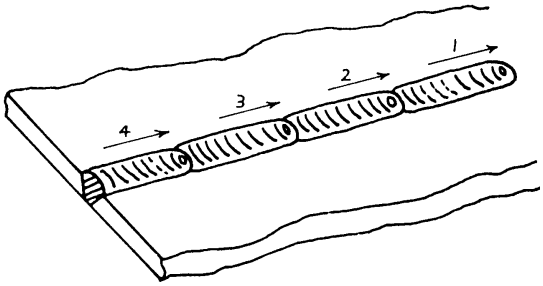


Figure 27 - Step back sequence

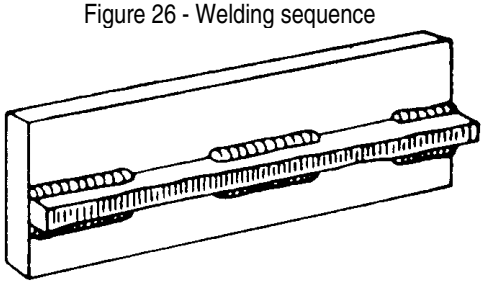


Figure 28 - Chain intermittent welding

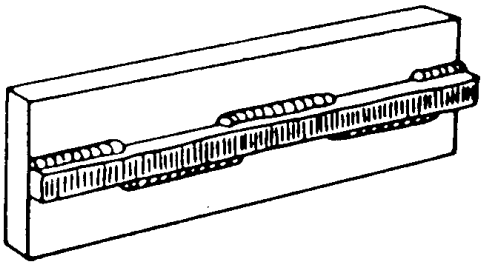


Figure 29 - Staggered intermittent welding

SECTION 15: Routine Maintenance & Inspection

WARNING 7

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.

15.01 Cleaning the Welding Power Source

Refer to *WARNING 5*. 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 2

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

15.02 Face Shield Maintenance

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

SECTION 16: Basic Troubleshooting

WARNING 8

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.

16.01 Welding Problems

FAULT	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.

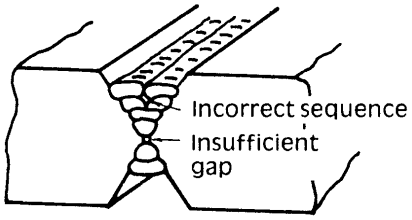


Figure 30 - Example of insufficient gap or incorrect sequence

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

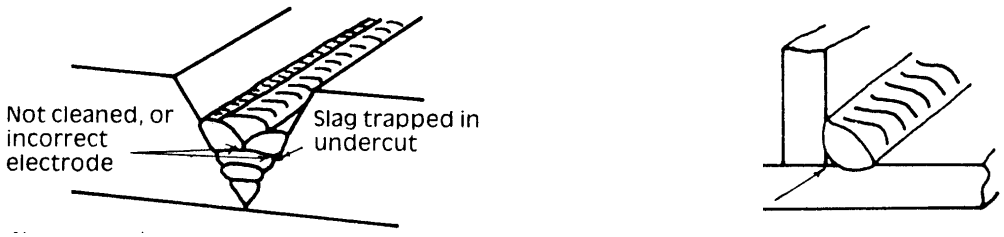


Figure 31 - Examples of slag inclusion

Welding Problems (continued)

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

Figure 32 - Examples of undercut

FAULT	CAUSE	REMEDY
6 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 pre-heat 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.

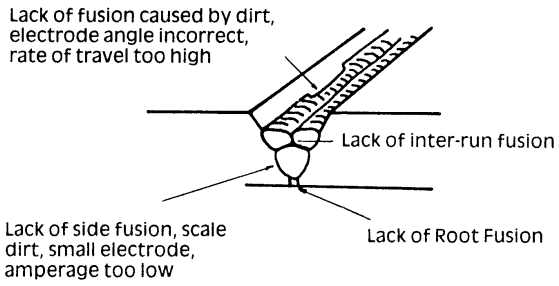


Figure 33 - Example of lack of fusion

16.02 Welding Power Source Problems

FAULT	CAUSE	REMEDY
1 The welding arc cannot be established. The overload light is not illuminated.	A The Mains supply voltage has not been switched ON. B The Welding Power Source switch is switched OFF. C The transformer secondary has poor electrical connections.	A Switch ON the Mains supply voltage. B Switch ON the Welding Power Source. C Have an Accredited CIGWELD Service Agent repair the connection.
2 The Mains supply voltage is ON, the overload light is illuminated and the welding arc cannot be established.	The Welding Power Source's duty cycle has been exceeded.	Wait for the overload light to extinguish before resuming your arc welding.
3 The Mains supply voltage is ON, the overload light is illuminated, the Welder has not been used for more than one hour and the welding arc cannot be established.	The Welding Power Source's thermostat has malfunctioned.	Have an Accredited CIGWELD Service Agent repair or replace the thermostat.
4 Maximum output welding current can not be achieved with 240V Mains supply voltage.	The shunt and/or lead screw surfaces have accumulated dust and dirt.	Clean off the accumulated dust and dirt from the shunt and/or lead screw surfaces.
5 The Mains supply voltage has been switched ON but the FAN does not operate.	A The fan has failed or it has a poor electrical connection.	A Have an Accredited CIGWELD Service Agent repair or replace the fan.
6 Welding current reduces when welding.	A Poor connection to the work piece or electrode holder. B Poor electrical connection within the power source.	A Ensure that the work lead has a good electrical connection to the work piece and the electrode is secure within the electrode holder. B Have an Accredited CIGWELD Service Agent repair the connection.

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