PRODUCTS THAT PERFORM

BOC INVERWELD™ 110VRD/140/140VRD

OPERATING MANUAL

Welcome to a better way of welding

Congratulations on purchasing a BOC Inverweld MMA and GTAW welding machine.

The BOC manual metal arc range are Products that Perform with reliability and the backing of Australia's leading welding supplier.

This manual provides the basic knowledge required for MMA and TIG welding, as well as highlighting important areas of how to operate the machine. By following these steps, your BOC Inverweld machine will provide years of trouble-free service,

Access to a wealth of experience and technical information, accumulated over the years makes the BOC range of equipment a world leader.

BOC equipment and technical support is available through our national BOC Customer Service Centre or contact your local Gas & Gear outlet.

BOC Customer Service Centre

AUSTRALIA

131 262

Email: **contact@boc.com**
Website: **www.boc.com.au**

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Website: **www.boc.co.nz**

Contents

1. Safety Precautions

1.0 Health Hazard Information

The actual process of MMA and TIG welding is one that can cause a variety of hazards. All appropriate safety equipment should be worn at all times, i.e. headwear, hand and body protection. Electrical equipment should be used in accordance with the manufacturer's recommendations as "electric shock can kill".

Eyes:

The process produces ultra violet rays that can injure and cause permanent damage. Fumes can cause irritation.

Skin:

Arc rays are dangerous to uncovered skin.

Inhalation:

Welding fumes and gases are dangerous to the health of the operator and to those in close proximity. The aggravation of pre–existing respiratory or allergic conditions may occur in some workers. Excessive exposure may cause conditions such as nausea, dizziness, dryness and irritation of eyes, nose and throat. Shielding Gases (Carbon Dioxide or inert gases) in high concentrations when working in confined spaces may lead to dangerous low levels of oxygen, resulting in asphyxiation.

Ventilation and fume extraction should be used to maintain exposure levels and are in accordance with Australian Standards. The operator should be trained to work in a manner that minimises the exposure.

1.1 Personal Protection

Respiratory

Confined space welding should be carried out with the aid of a fume respirator or air supplied respirator as per AS/NZS 1715 and AS/NZS 1716 Standards.

- You must always have enough ventilation in confined spaces. Be alert to this at all times.
- Keep your head out of the fumes rising from the arc.
- Fumes from the welding of some metals are bad for you. Don't breathe them in. If you are welding on material such as stainless steel, nickel, nickel alloys or galvanised steel, further precautions are necessary.
- Wear a respirator when natural or forced ventilation is not good enough.

Eye protection

A welding helmet with the appropriate welding filter for the operation must be worn at all times in the work environment. The welding arc and the reflecting arc flash gives out ultraviolet and infrared rays. Protective welding screen and goggles should be provided for others working in the same area.

Recommended filter shades for arc welding

Less than 150 amps	Shade 10*
150 to 250 amps	Shade 11*
250 to 300 amps	Shade 12
300 to 350 amps	Shade 13
Over 350 amps	Shade 14

*Use one shade darker for aluminium

Clothing

Suitable clothing must be worn to prevent excessive exposure to UV radiation and sparks. An adjustable helmet, flameproof loose fitting cotton clothing buttoned to the neck, protective leather gloves, spats, apron and steel capped safety boots are highly recommended.

1.2 Electrical Shock

- Never touch "live" electrical parts.
- Always repair or replace worn or damaged parts.
- Disconnect power source before performing any maintenance or service.
- Earth all work materials.
- Never work in moist or damp areas.

Avoid electric shock by:

- Wearing dry insulated boots.
- Wearing dry leather gloves.
- Never changing electrodes with bare hands or wet gloves.
- Never cooling electrode holders in water.
- Working on a dry insulated floor where possible.
- Never hold the electrode and holder under your arm.

1.3 Use of Gas Cylinders

- Always use the recommended shielding gas for the application.
- Always store cylinders in upright position and securely chained to a trolley or support.
- Keep electrically "hot" parts away from cylinders at all times.
- Cylinders must be at a safe distance away from sparks or from any other heat source.
- Keep head and face away from the cylinder valve when opening.
- Read and follow instructions on compressed gas cylinders and associated equipment AS2030 Parts1 & 2.

1.4 User Responsibility

- Read the Operating Manual prior to installation of this machine.
- Unauthorised repairs to this equipment may endanger the technician and operator and will void your warranty. Only qualified personnel approved by BOC should perform repairs.
- Always disconnect mains power before investigating equipment malfunctions.
- Parts that are broken, damaged, missing or worn should be replaced immediately.
- Equipment should be cleaned periodically. When necessary, vacuum inside of wire feeder and gearbox section.

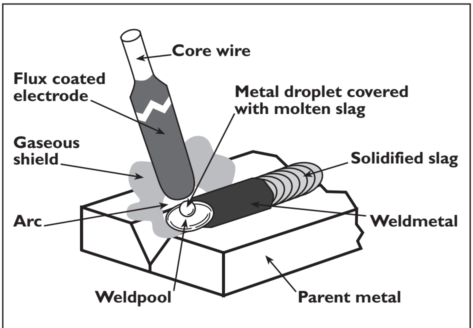
PLEASE NOTE that under no circumstances should any equipment or parts be altered or changed in any way from the Standard specification without written permission given by BOC. To do so, will void the Equipment Warranty.

Further information can be obtained from Welding Institute of Australia (WTIA) Technical Note No.7 "Health and Safety Welding" TN7-98. Published by WTIA, PO Box 6165 Silverwater NSW 2128 Phone (02) 9748 4443.

2. Manual Metal Arc Welding (MMAW)

2.0 MMA Welding Principle

Manual Metal Arc (MMA*) welding is a fusion welding process which uses the heat of an arc formed between the consumable electrode and the workpiece to melt the joint area. The arc and the weld pool are shielded by gases and slags that result from the decomposition of the coating material that surrounds the electrode. The electrode material is transferred across the arc to fill the joint and must be continuously fed forward by the operator to maintain a constant arc length. The principle of the process is illustrated below.



MMA welding applications

Manual metal arc welding is used for:

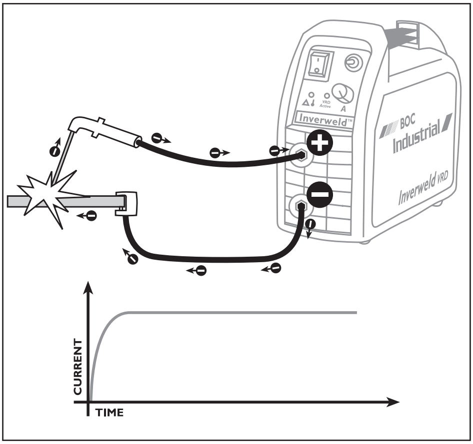
- structural steel work
- steel bridges
- pressure vessels
- tanks
- general fabrication
- earth moving equipment

2.1 Fundamental Equipment Requirements

The basic arrangement of the MMA welding system is shown in figure 2 and consists of:

- a welding power source
- electrode holder
- welding cables

Basic arrangement of DC MMAW equipment



Note:

The electrode may be connected to either the positive (+) or the negative (–) connection on the BOC Inverweld front panel.

Connecting the electrode to the positive (DCEP) and the work clamp to the negative will result in deeper weld metal penetration. Connecting the electrode to the negative (DCEN) and the work clamp to the positive will result in a flatter and wider weld bead profile with less penetration than the electrode positive connection.

*Commonly referred to as Stick Welding.

2.2 Control of the Process

The main control parameters for the MMA process are:

• current and
• operator technique

The current range is determined by the electrode type and size. Deposition rate increases with current for a given electrode diameter but the maximum current is limited by the coating material and the ability to control both the weld pool and the molten slag.

Increasing the current also increases the level of fume and the arc radiation. A high level of manual dexterity is required to coordinate the movement of the electrode to match the burn-off rate and maintain a constant arc length. Some electrodes are designed for 'touch' or contact welding (the electrode coating rests on the workpiece during welding) and this simplifies the production of fillet welds. Additional skills are required to control fusion characteristics and bead profile (electrode angle, travel speed and weave patterns must be carefully chosen), particularly for positional welding.

2.3 Features of the Process

The most important characteristic of the MMAW process is its overall flexibility. The wide range of electrode types allows the weld metal to be matched to the application, which may be particularly useful in repair and jobbing shop environments. Relatively simple equipment is required and the capital cost is low.

The quality of the welded joint depends almost entirely on the welder, and availability of suitably qualified welders may cause production bottlenecks. In addition the process is intermittent, as the electrode must be changed at regular intervals, placing a natural limit on the productivity of the process.

2.4 Applications of MMA Welding

The process is applied widely in the fabrication and repair of plain carbon and low alloy steels. It has been used in the construction of power stations, pipelines and offshore structures.

Stainless steel, inconel, nickel and a wide range of surfacing electrodes are available, and these may be used in low volume production, maintenance and repair situations.

2.5 MMA Electrode Characteristics

The characteristics of the MMAW process are largely determined by the electrode coating material that controls the following important features:

Arc

Certain chemicals may be added to the coating material to stabilise the arc (e.g. rutile or potassium silicate), improve metal transfer and reduce spatter. These additions also provide a useful reduction in the operating voltage required for the electrode.

Shielding

Shielding is provided by gases generated by the decomposition of constituents such as calcium carbonate or cellulose and by liquid slags which protect the weld pool surface.

Weld pool control

The slag fluidity is usually the factor that determines the ease of positional welding. Rapidly freezing slags may be used to provide support for the weld pool in vertical and overhead welding.

Alloying

The coating material can provide a useful source of alloying elements or additions that control the weld metal chemistry (such as deoxidisers). This enables a wide range of weld metal properties to be achieved by modifying the coating whilst using a standard core wire.

2.6 Electrode Types

A range of well established electrode types are available for the welding of ferrous materials, and these are usually classified in the following groups:

- cellulosic
- rutile
- basic, iron powder,
- others

Cellulosic electrodes contain over 30% organic material (e.g. cellulose) in the coating. This decomposes in the arc to generate hydrogen and carbon dioxide. High arc forces are formed in the arc and these depress the weld pool and produce deep penetration characteristics. The arc force may also be used to generate a 'keyhole' effect that may be used to complete single sided root runs, particularly in pipe. It is usually these types of electrodes that are use in the "Stovepipe" method of welding.

Rutile electrodes contain the principal alloying element titanium dioxide (TiO_2 i.e. rutile). This addition gives excellent arc stability, low voltages, low spatter and easily controlled self-detaching slag. These characteristics make the rutile electrode the most common general-purpose electrode type.

Basic (Low Hydrogen) electrodes usually contain calcium carbonate ($CaCO_3$) and calcium fluoride (CaF_2). The hydrogen content of the coating is controlled by the absence of minerals containing combined water and careful baking procedures. In general, the arc running characteristics of these electrodes are inferior to those of the rutile types described above, but the mechanical properties of the weld metal are superior. These electrodes are used on ferritic steels when resistance to hot and cold cracking is required.

Iron powder may be added to any of the above coating types to increase the 'recovery' or the amount of filler material produced when the electrode is used. The addition of iron powder also increases the deposition rate and usually reduces the arc voltage requirement.

Iron oxide/silicate electrode formulations may be used for general purpose mild steel welding in the flat and HV positions but these types have largely been superseded by rutile coatings.

In addition to electrodes for plain carbon, low alloy and high alloy steels a range of surfacing and non-ferrous alloy electrodes are available.

2.7 Care of Electrodes

The performance of MMA electrodes and the quality of the resultant weld depend on the type of electrode and its condition. If the mineral coating is damaged or chipped, poor arc stability and inadequate shielding may result. Most coating materials absorb moisture if not properly protected and this may result in deterioration of the coating and hydrogen pick up in the weld bead. Particular care must be taken with controlled hydrogen electrodes that should be stored and if necessary re-dried according to the manufacturers instructions. Poor electrode condition will often be indicated by increased spatter, striking difficulties, weld bead porosity, and 'harsh' arcing characteristics.

3. Gas Tungsten Arc Welding (GTAW)

3.0 Gas Tungsten Arc Welding (TIG) Principle

Gas Tungsten Arc Welding (GTAW) utilises the heat of an arc that is formed between a non-consumable tungsten electrode and the workpiece to fuse the joint material. The arc area is shrouded in inert gas that protects the weld pool and the electrode from contamination while allowing a stable arc to be maintained.

TIG welding applications

- light fabrication
- general engineering
- welds most metals, particularly stainless steel and other non-ferrous metals

3.1 Equipment Requirements

The basic requirements for the GTAW process are:

- a welding power source
- TIG torch
- a gas supply system

TIG power sources may have an alternating or direct current output, and depending on the application and provision for controlling the gas flow, initiating the arc is usually required. The BOC Inverweld has a direct current output.

The torch design will depend on the application but it is required to provide a uniform shield or inert gas and is often water cooled to reduce size and protect the operator.

Equipment set-up

- Install the welding machine as near as possible to the mains power to keep the primary power cable short. The primary power cable carries dangerously high voltages.
- Inspect all cables for damage
- Use welding cables that are fully insulated
- Make sure the electrode holder is insulated from the bench. Hang it on an insulated hook
- Switch off when not in use

3.2 Modes of Operation

The process may be operated in one of the following modes

- DC electrode negative
- DC electrode positive

DC electrode negative

In this mode the electrode remains relatively cool whilst the workpiece is effectively heated. (The normal estimate of heat distribution in the GTAW process is 1/3 at the negative (cathode) and 2/3rds at the positive (anode). This is the most common mode of operation for ferrous materials, copper, nickel and titanium alloys.

DC electrode positive

With DC electrode positive there is a tendency for the electrode to overheat and fusion, of the workpiece is poor. The advantage of this mode of operation is the cathodic cleaning effect that removes the tenacious oxide film from the surface of aluminium alloys.

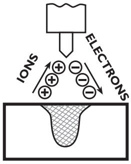
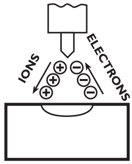
CURRENT TYPE	DCEN	DCEP
Electrode polarity	Negative	Positive
Electron & ion flow Penetration characteristics		
Oxide cleaning action	No	Yes
Heat balance in the arc (approx.)	70% at work end 30% at electrode end	30% at work end 70% at electrode end
Penetration	Deep, narrow	Shallow, wide
Electrode capacity	Excellent e.g. 3.2mm, 400A	Poor e.g. 6.4mm, 120A

Figure 3. Effects of current type.

3.3 Electrode Types and Preparation

Originally, pure tungsten was used as the electrode material. Tungsten is a refractory metal, with a high melting point (3380°C) and has relatively good electrical and thermal conductivity. It was discovered, however, that arc stability, tip shape retention and arc initiation could be improved by adding small amounts of thorium oxide, thoria, or zirconium oxide, zirconia, to the electrode.

More recently, it has been found that improved performance can be obtained by alloying the electrodes with oxides of lanthanum, yttrium or cerium, particularly in automatic or orbital TIG welding where consistency of operation is important.

Traditionally, 'thoriated' electrodes have tended to be used for DC operation and 'zirconiated' electrodes for AC. However, scares regarding the potential health effects due to inhalation of radioactive thorium oxide dust have resulted in some users changing to 'ceriated' or 'lanthaniated' electrodes in place of 'thoriated'.

Whilst not 'consumed' to form weld metal, tungsten electrodes are used up over a period of time due to repeated grinding of tips and due to some erosion by the arc during welding. They may also be accidentally consumed by being dipped into the weld pool and melting into it.

The electrode diameter is determined by the current and polarity. Recommended diameters are given in the table below.

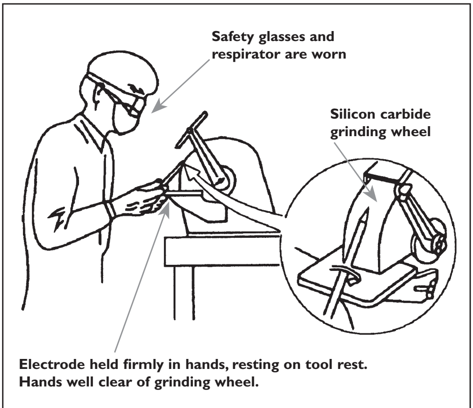
Recommended diameter for electrodes

ELECTRODE DIAMETER (mm)	CURRENT DC –	DC +
0.5	0 – 20	
1.0	21 – 80	
1.6	81 – 150	0 – 17
2.4	151 – 230	18 – 25
3.2	231 – 350	26 – 35
4.0	351 – 475	36 – 50
4.8	476 – 650	51 – 67
6.3	651 – 950	68 – 100
8.0		

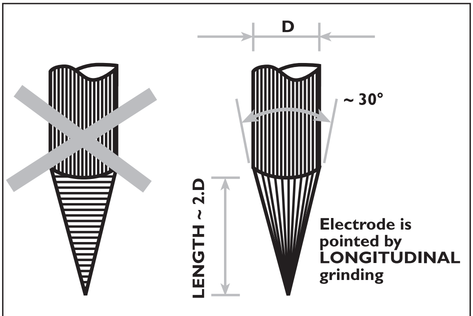
Electrode Sharpening

Tungsten alloy electrodes offer improved
- arc striking
- arc stability
- current capacity

Tungsten alloy electrodes for DCEN
- Thoriated, AWS colour code RED (2%)
- Lanthanium, AWS colour code BLACK (1%)
- Cerium oxide, AWS colour code ORANGE (2%)



Shape of tungsten electrode tip – DCEN



3.4 Consumables

The consumables used in the GTAW process include the shielding gas and the filler material. The shielding gas must be essentially inert (i.e. argon or helium) although very small amounts of active gases may be used in certain applications.

This is because active (oxidising) gases like CO_2 and Oxygen react to tungsten.

The process may be used without filler material addition, but if a filler is required this is added in the form of a rod that is introduced into the leading edge of the weld pool, either manually or by a wire feed mechanism

A filler is added in the form of a rod introduced into the leading edge of the weld pool, either manually or by a wire feed mechanism.

3.5 Control of the Process

The main control parameters for the GTAW process are:
- current
- travel speed
- filler wire addition

The current is increased to enable higher travel speeds to be obtained (for a given plate thickness or weld size) although at high current levels the arc may become very fierce and undercut may occur. In single electrode GTAW applications the occurrence of undercut limits the maximum speed and current. Filler wire may be used to cool the weld pool and this may be beneficial for complex positional joints and for surfacing applications.

3.6 Features of the Process

The most important characteristics of the GTAW process are that:

- it is chemically inert,
- the energy density of the arc is high,
- the process is very controllable,
- joint quality is usually high, and
- joint completion rates are usually low.

In spite of the low speed of the process its ability to produce high quality joints in a wide range of materials has made it an attractive proposition for more demanding applications. The process is not normally considered economics for thicker sections or for low integrity joints in plain carbon steels.

3.7 Application of GTAW

Common applications of the process include high quality fabrications in stainless steel, aluminium alloys, copper and nickel alloys and reactive metals such as titanium and zirconium. GTAW is used extensively in the nuclear and aerospace industries as well as in the fabrication of chemical process plant, pipework, brewery and food processing vessels.

Notes

1) The process is also known by several other names, i.e.: Argonarc and Heliarc, the original trade names for the process. GTAW is the Australian and New Zealand terminology that is also used in many other countries, although the acronym TIG (Tungsten Inert Gas) welding is also used.

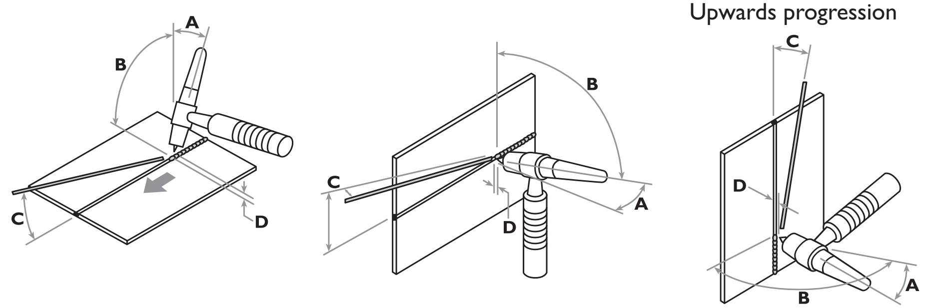
2) The terms 'straight' and 'reverse' polarity are sometimes used to describe the mode of operation of the process. These terms are best avoided and the actual polarity of the tungsten electrode should be stated.

3.8 Technique

The filler wire and torch needs to be at differing angles depending on the position of the-weld. See diagrams below.

Torch and filler metal manual control guidelines

Flat position (1G) | **Horizontal position (2G)** | **Vertical position (3G)** Upwards progression



A = Torch travel angle – forehand technique – push angle 10°-20° (to the vertical)

B = Work angle: 90°

C = Filler metal feed angle: 10°-20°

D = Arc length: 1-1.5 x electrode diameter

4. Shielding Gases

4.0 Overview

Shielding gases for TIG welding are important for keeping the arc stable and protecting the molten weld metal from contamination during welding. The major function of a shielding gas is to surround the weld zone with a protective shroud of non-reactive shielding medium. This removes harmful elements from the atmosphere (oxygen, nitrogen gas) which would give a poor quality weld deposit if they contacted the molten metal.

The TIG process cannot use a shielding gas that has an oxidising agent in it i.e. CO_2 or O_2. This is due to the reaction with tungsten and will cause immediate particle disintegration of the tungsten.

The gases that can be used are Argon by itself or additions of helium. The use of helium has the effect of increasing the heat in the arc, or molten pool and therefore more penetration and a molten pool that remains fluid for longer periods of time and allows contaminants to 'boil' off before freezing. The recommended flow rate is from 5 l/min to 10 l/min depending on the amperage being used.

One of the major causes of contaminated welds/tungstens is the operator removing or turning off the gas flow before cooling past the critical level has taken place. For example when finishing a weld the torch should be held at the end until the pool has cooled past the 'red' stage. This is also the case for the tungsten, as it will turn to a blue colour (oxide) if shielding is removed prior to cooling.

4.1 General Instructions for Pressure Regulators

Before mounting the regulator

1. Step aside and open the cylinder valve. This is called "cracking the cylinder" and by doing this you will release any dirt that may be trapped in the valve of the bottle.

Regulator connection

1. Fit the regulator "bull-nose" into the cylinder valve and tighten the nut (do not over tighten)
2. Turn the regulator bonnet in an anti clockwise rotation, so that there is no pressure on the regulator diaphragm. This is the fully off/no flow position.
3. Attach hose nut/nipple to the regulator outlet.
4. Connect the gas hose to the nipple with the supplied hose clamp.
5. Connect the other end of the hose into the machine wire feeder quick connection nipple.

Setting the regulator

1. Open the valve of bottle slowly
2. The high pressure gauge will show the pressure in the bottle.
3. Open the regulator bonnet until the desired pressure is achieved on the low pressure gauge (12 to 20 L/min usually).
4. Pull the torch trigger to simulate a welding condition, and readjust the regulator bonnet to the desired pressure that will be required while welding (it is normal for the gas delivery gauge to drop back while in use due to pressure drop when in the static position).

Close the valve of the cylinder after welding has stopped. If the machine will be out of use for a long period of time, you should unscrew the regulator bonnet screw to act as a secondary valve.

5. Plant Specifications

DESCRIPTION		INVERWELD 110 VRD	INVERWELD 140	INVERWELD 140 VRD
Part No.		B610211101	B6102141	B610214101
Welding Application		General MMA and TIG* fabrication, repair and maintenance.		
Standards		IEC 60974-1 / EN 50199		
Input Voltage		1 Phase 50/60Hz 240 V		
Duty Cycle	35%	-	140A	140A
	50%	110A	-	-
	100%	80A	100A	100A
Primary plug		10 A	15 A	15 A
Welding current range (MMA)		10A / 20.5V to 110A / 24.4V	10A /20.5V to 140A / 25.6V	10A /20.5V to 140A / 25.6V
Electrode diameter (mm)		1.5 to 2.5	1.5 to 3.5	1.5 to 3.5
Voltage step capacity		Stepless		
Open-circuit (no-load) voltage		< 31V	90 V	< 31V
Power factor		0.60 (110A / 24.4V)	0.60 (140A / 25.5V)	0.60 (140A / 25.5V)
Protection		IP23		
Temperature class		B (130°C) / H (180°C)		
Range of working temperature		- 20 to + 40 °C		
Range of storage temperature		- 40 to + 60 °C		
VRD built-in factory fitted		Yes	No	Yes
VRD peak to no-load time		100ms	N/A	100ms
VRD on load voltage		< 31V	N/A	< 31V
VRD welding circuit activation resistance		20ohms	N/A	20ohms
Power generator minimum capacity		6 kVA		
External dimensions LxHxW (mm)		305 x 250 x 123 mm		
Weight (kg)		4.2 kg		

* Additional equipment not supplied with the Inverweld required for TIG welding.

This package includes:

- BOC Inverweld
- Electrode holder
- Welding cable
- Work cable
- Work clamp
- Primary power cable

6. Operating Controls

6.0 Diagram A

ITEM	DESCRIPTION
1	Negative (–) dines connection
2	Positive (+) dines connection
3	Overload protection indicator
4	Welding current regulator
5	Main power switch and signal light
6	Carry strap
7	Selector switch for welding process
8	Machine body
9	Workclamp and cable
10	Electrode holder and cable
11	VRD fitted as standard on 110 VRD and 140 VRD

6.1 BOC Inverweld 110 VRD and 140 VRD Operation

General

The new BOC Inverweld 110 VRD and 140 VRD welding machines are fitted with an internal VRD (Voltage reducing device) circuit fulfilling AS 1674.2 safety requirements for VRD operation.

The no-load voltage is required to be reduced to 35V DC (peak) or less within 300ms time after the weld when the load resistance exceeds 20ohms. The BOC Inverweld with VRD fitted does this and more. The Inverweld VRD automatically reduces the no-load voltage to below 31volts in 100ms when the external welding circuit resistance is 20ohms.

The green LED-light on the front panel indicates that the VRD is active and the unit is in the safe mode. If the light is on the no-load voltage is safe. During welding the green light may flicker, which is normal.

Actual operation

The Inverweld VRD is designed as an integral part of the unit and therefore the performance of the Inverweld is not compromised by the VRD functionality.
The VRD function is fully automatic and should the green light not be on or flash in the on-load state (i.e. when the power is on you are not welding) please contact your nearest BOC or BOC service technician.

7. Periodic Maintenance

The working environment or amount of use the machine receives should be taken into consideration when planning maintenance frequency of your BOC welder.

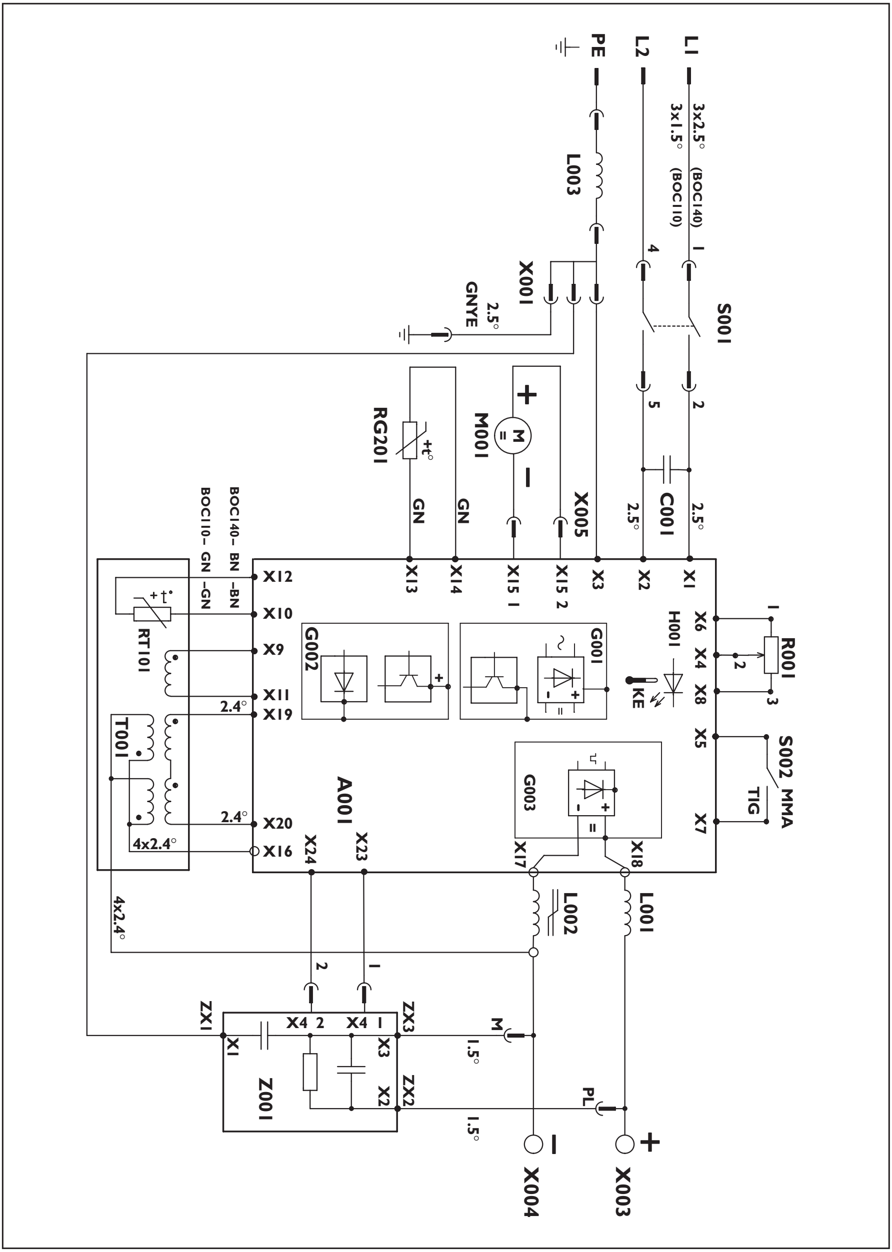
Preventative maintenance will ensure trouble-free welding and increase the life of the machine and its consumables.

7.0 Power Source

- Check electrical connections of unit at least twice a year.
- Clean oxidised connections and tighten.
- Inner parts of machine should cleaned with a vacuum cleaner and soft brush.
- Do not use any pressure-washing devices.
- Do not use compressed air as pressure may pack dirt even more tightly into components.
- Only authorised electricians should carry out repairs.

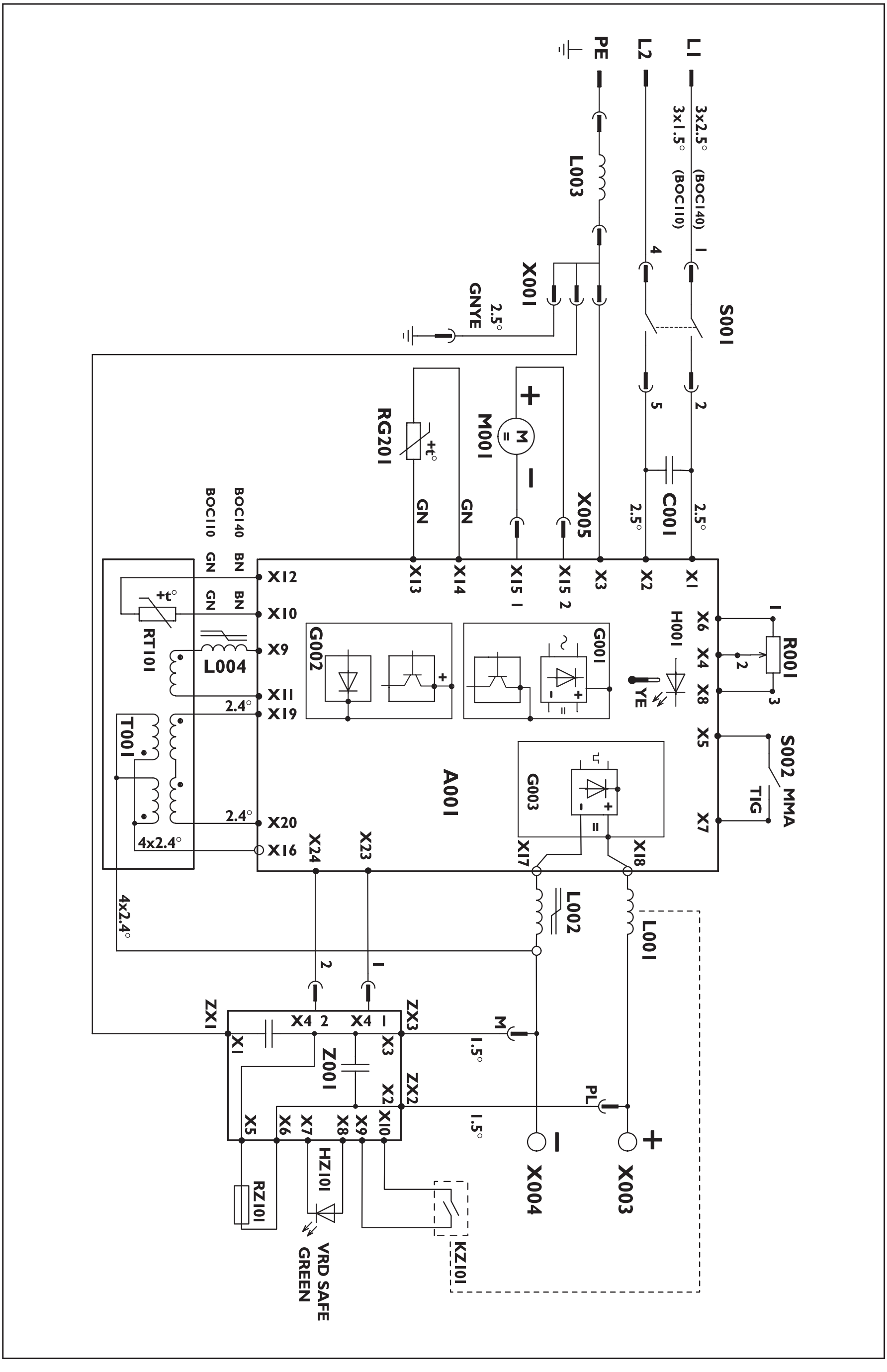
8. Electrical Diagram

8.0 Diagram B – Inverweld 140



Only authorised electricians should carry out repairs

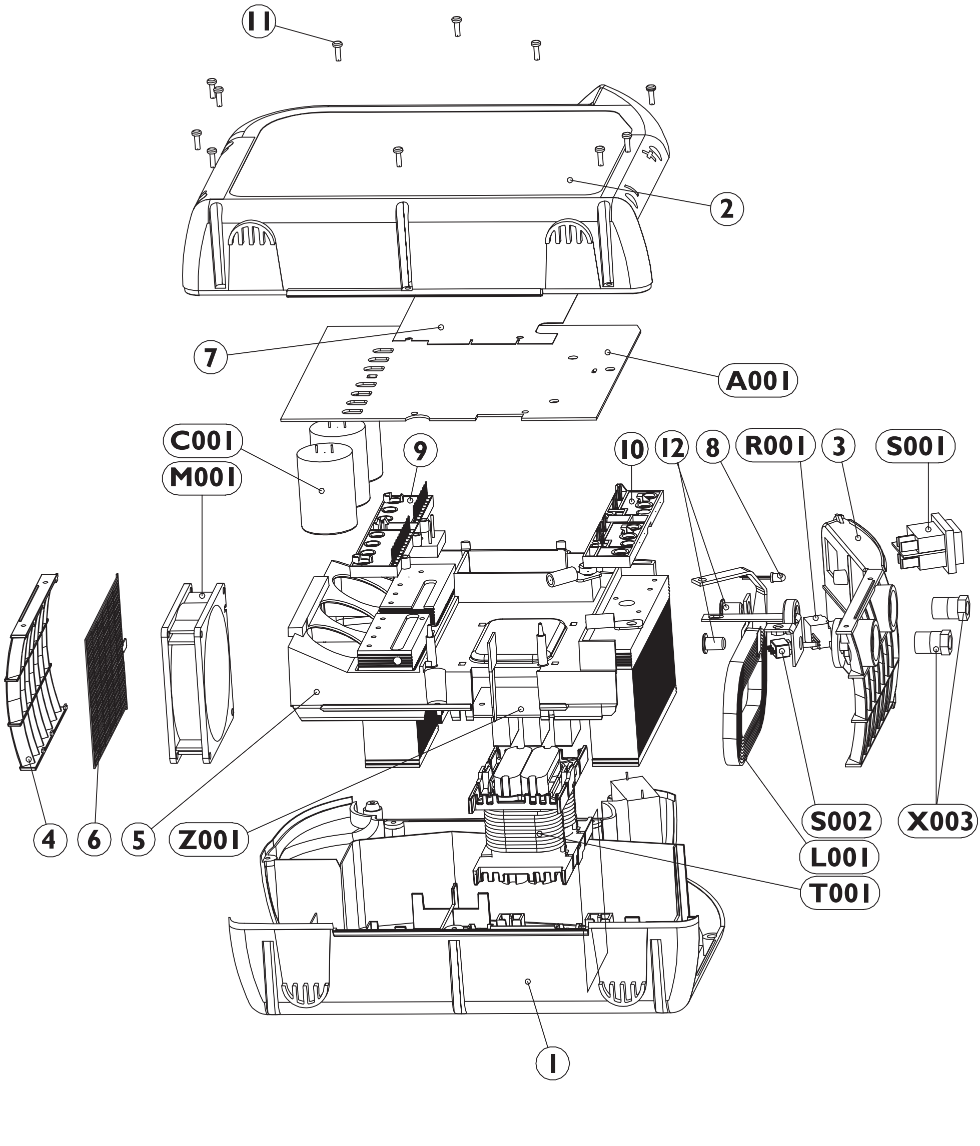
8.1 Diagram C – Inverweld 110 VRD / 140 VRD



Only authorised electricians should carry out repairs

9. Machine Spare Parts

9.0 Diagram D – Machine Spare Parts



Only authorised electricians should carry out repairs

9.1 Machine Spare Parts List (refer to Diagrams B, C, D, page 18-20)

DIAGRAM NO.	110 VRD PART NO.	140 PART NO.	140 VRD PART NO.	DESCRIPTION		QTY
A001	4301880	4298870	4298870	CONTROL CARD		1
C001	9755615	9755615	9755615	CAPACITOR	470 UF	3
	9750191	9750191	9750191	RECTIFIER UNIT	30A / 600V	1
L001	W000170	3146110	W000170	SECONDARY CHOKE	L001	1
M001	3146100	3146100	3146100	COOLING FAN		1
R001	9754153	9754153	9754153	POTENTIOMETER	10K ohm Cermet	1
S001	9761221	9761221	9761221	FLIP-FLOP SWITCH	With pilot lamp	1
S002	9761380	9761380	9761380	LEVER SWITCH		1
T001	2073070	2073060	2073060	MAIN TRANSFORMER		1
X003	9771509	9771509	9771509	MACHINE SOCKET	DIX 25	1
Z001	4306570	4298600	4306570	FILTER CARD		1
1	W000190	4299490	W000190	COVER RIGHT		1
2	W000189	4299500	W000189	COVER LEFT		1
3	W000374	4299510	W000188	FRONT PLATE		1
4	2071220	2071220	2071220	REAR GRILL		1
5	1028540	1028540	1028540	SHIELD PLATE		1
6	3146690	3146690	3146690	PROTECTIVE GRILL		1
7	9730125	9730125	9730125	INSULATOR		2
8	9775757	9775757	9775757	LED LAMP YELLOW		1
9	4297750	4297750	4297750	SPARE PART IGBT SET		1
10	4297740	4297740	4297740	SECONDARY RECTIFIER		1
11	9449401	9449401	9449401	PT SCREW BLACK	3 x 12 TORX15	1
12	9441090	9441090	9441090	HEX SOCKET SCREW	M8 x 12 BN1206	1
13	9775762		9775762	LED LAMP GREEN		1
14	9775758		9775758	LED MOUNTING PARTS		1
15	9766204		9766204	REED RELAY		1
16	9753547		9753547	LOAD RESISTOR		1
	9753590	9753590	9753590	VARISTOR	95V 14mm	1
	9753588	9753588	9753588	VARISTOR	175V 14mm	1
	9722314AU	9722315AU	9722315AU	CONNECTION CABLE		1
	9761381	9761381	9761381	PROTECTION SWITCHES	Lever	1
	9766230	9766230	9766230	RELAY		1
	4306680		4306680	CIRCUIT DIAGRAM		0

10. Terms of Warranty

10.0 Terms of Warranty

BOC provides a warranty for the Inverweld sold by it against defects in manufacture and materials.

- Valid for two years from date of purchase
- An authorised BOC Service Agent must carry out Warranty repairs
- Freight, packaging and insurance costs are to be paid for by the claimant
- No additional express warranty is given unless in writing signed by an authorised manager of BOC
- This Warranty is in addition to any other legal rights you may have
- Welding guns and their consumables, feed, drive rollers and feeder guide tubes are not covered.

10.1 Limitations on Warranty

The following conditions are not covered:

- Non compliance with operating and maintenance instructions such as connection to incorrect faulty voltage supply including voltage surges outside equipment specs, and incorrect gas pressure overloading
- Natural wear and tear, and accidental damage
- Transport or storage damage

The Warranty is void if:

- Changes are made to the product without the approval of the manufacturer
- Repairs are carried out using non- approved spare parts
- A non-authorised agent carries out repairs.

10.2 Warranty Repairs

BOC or their Authorised Service Agent must be informed of the Warranty defects, and the product returned within the Warranty Period.

- Before any Warranty work is undertaken, the customer must provide proof of purchase and serial number of the equipment in order to validate the Warranty.
- The parts replaced under the terms of the Warranty remain the property of BOC.

11. Glossary

ASEA
Australian Standard Equal Angle

Ar
Argon shielding gas

CO_2
Carbon dioxide

Current density
The current for a given filler wire diameter

Deposition rate
The weight of metal deposited in a unit of time, expressed as kg/hr

Duty cycle
Percentage of time, for a test period during which power supply can be operated at its rated output without overloading

Flow meter
A gas flow measuring device connected to the regulator to adjust operating flow rates

GTAW
Gas tungsten arc welding or TIG

Inert gas
Shielding gas consisting of argon or helium or a mixture of the two

MMA
Manual metal arc welding

Rectifier
A power source developed to supply direct current (DC) for welding from an alternating (AC) mains power supply

Short arc transfer
Metal transfer in which fused particles of wire electrode are detached in rapid succession during the repeated short circuiting contacts the weld pool

Spatter
The metal particles which are expelled during welding on to the surface of the parent metal or a weld and which do not form a part of the weld

TIG
Tungsten inert gas welding or GTAW

Variables
Operating conditions such as volts, wire speed, travel speed gas flow rate, that are adjustable before and during welding

Weld time
Total time involved between the start and finish of welding current during the make of one weld

For more information on any BOC Industrial™ product or service call the **BOC Customer Service Centre** on:

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131 262

Email: **contact@boc.com**
Website: **www.boc.com.au**

NEW ZEALAND

0800 111 333

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