MAGMATE™

MIG 150

OPERATING MANUAL

Welcome to a better way of welding

Congratulations on purchasing a MagMate™ MIG 150 welding machine.

The products in BOC's manual MIG range perform with reliability and have the backing of one of South Pacific's leading welding suppliers.

This operating manual provides the basic knowledge required for MIG welding, as well as highlighting important areas of how to operate the MagMate machine.

With normal use, and by following these recommended steps, your MagMate machine can provide you with years of trouble-free service.

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

Contents

1.0 Recommended Safety Guidelines

Some safety precautions BOC recommends are as follows:

- Repair or replace defective cables immediately.
- Never watch the arc except through lenses of the correct shade.
- In confined spaces, adequate ventilation and constant observation are essential.
- Leads and cables should be kept clear of passageways.
- Keep fire extinguishing equipment at a handy location in the shop.
- Keep primary terminals and live parts effectively covered.
- Never strike an arc on any gas cylinder.
- Never use oxygen for venting containers.

Diagram and safety explanation	
Electrical safety alert	
Welding electrode causing electric shock	
Fumes and gases coming from welding process	
Welding arc rays	
Read instruction manual	
Become trained	

Diagram and safety explanation	
Wear dry, insulated gloves	
Insulate yourself from work and ground	
Disconnect input power before working on equipment	
Keep head out of fumes	
Use forced ventilation or local exhaust to remove fumes	
Use welding helmet with correct shade of filter	

2.0 Recommended Safety Precautions

2.1 Health Hazard Information

The actual process of MIG 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.

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.

2.2 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 could have an adverse effect on your health. 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 sufficient.

Eye protection

A welding helmet with the appropriate welding filter lens 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 MIG 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

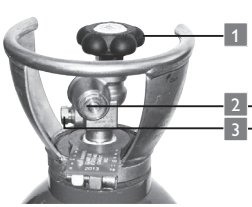
*Use one shade darker for aluminium

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.

Cylinder Safety

1	Cylinder valve hand-wheel
2	Back-plug
3	Bursting disc



Back view of typical cylinder valve

Operator wearing personal protective equipment (PPE) in safe position

Ten Points about Cylinder Safety	
1	Always read the labels and Safety Data Sheet (SDS) before use.
2	Store cylinders upright and use in well-ventilated, secure areas away from pedestrian or vehicle thoroughfares.
3	Ensure cylinders are appropriately secured and guarded against being knocked violently or being allowed to fall.
4	Wear safety shoes, glasses and gloves when handling, connecting and using cylinders.
5	Ensure cylinders are appropriately restrained to mechanical lifting/handling devices prior to movement.
6	Keep in a cool, well-ventilated area, away from heat sources, sources of ignition and combustible materials, especially flammable gases.
7	Keep full and empty cylinders separate.
8	Keep ammonia-based leak detection solutions, oil and grease away from cylinders and valves.
9	Never use force when opening or closing valves.
10	Never repaint or disguise markings and damage on cylinders. If damaged, return cylinders to BOC immediately.

Cylinder Valve Safety

When working with cylinders or operating cylinder valves, ensure that you wear appropriate protective clothing – gloves, boots and safety glasses.

Ensure cylinder value is closed before moving or disconnecting equipment.

Before operating a cylinder valve:

- Ensure that the system you are connecting the cylinder into is suitable for the gas and pressure involved.
- Cylinder valves should not be open unless a pressure regulator has been fitted.
- Ensure that any accessories (such as hoses attached to the cylinder valve, or the system being connected to) are securely connected. A hose, for example, can potentially flail around dangerously if it is accidentally pressurised when not restrained at both ends.
- Stand to the side of the cylinder so that neither you nor anyone else is in line with the back of the cylinder valve. This is in case a back-plug is loose or a bursting disc vents. The correct stance is shown in the diagram above.

When operating the cylinder valve:

- Open it by hand by turning the valve hand-wheel anti-clockwise. Use only reasonable force.
- Ensure that no gas is leaking from the cylinder valve connection or the system to which the cylinder is connected. DO NOT use ammonia-based leak detection fluid as this can damage the valve. Approved leak detection fluid, can be obtained from a BOC Gas & Gear centre.
- When finished with the cylinder, close the cylinder valve by hand by turning the valve hand-wheel in a clockwise direction. Use only reasonable force.

Remember NEVER tamper with the valve. If you suspect the valve is damaged, DO NOT use it. Report the issue to BOC and arrange for the cylinder to be returned to BOC.

2.3 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.
- Working on a dry insulated floor where possible.

2.4 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.

BOC stocks a huge range of personal protective equipment. This, combined with BOC's extensive Gas and Gear network, ensures fast, reliable service throughout the South Pacific.

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' Published by WTIA, PO Box 6165 Silverwater NSW 2128 Phone (02) 9748 4443.

3.0 Basic Welding Techniques

3.1 Fundamentals of Manual Metal Arc (MMA) Welding

Welding Technique

Successful MMA welding depends on the following factors:

- Selection of the correct electrode.
- Selection of the correct size of the electrode for the job.
- Correct welding current.
- Correct arc length.
- Correct angle of electrode to work.
- Correct travel speed.
- Correct preparation of work to be welded.

Electrode selection

As a general rule, the selection of an electrode is straight forward, in that it is only a matter of selecting an electrode of similar composition to the parent metal. However, for some metals there is a choice of several electrodes, each of which has particular properties to suit specific classes of work. Often, one electrode in the group will be more suitable for general applications due to its all round qualities.

Electrode size

The size of the electrode generally depends on the thickness of the section being welded, and the thicker the section the larger the electrode required. In the case of light sheet, the electrode size used is generally slightly larger than the work being welded. This means that, if 2.0 mm sheet is being welded, 2.5 mm diameter electrode is the recommended size.

Welding current

Correct current selection for a particular job is an important factor in arc welding. With the current set too low, difficulty is experienced in striking and maintaining a stable arc. The electrode tends to stick to the work, penetration is poor and beads with a distinct rounded profile will be deposited.

Excessive current is accompanied by overheating of the electrode. It will cause undercut and burning through of the material, and will give excessive spatter. Normal current for a particular job may be considered as the maximum, which can be used without burning through the work, over-heating the electrode or producing a rough spattered surface (i.e. the current in the middle of the range specified on the electrode package is considered to be the optimum).

Arc length

To strike the arc, the electrode should be gently scraped on the work until the arc is established. There is a simple rule for the proper arc length; it should be the shortest arc that gives a good surface to the weld. An arc too long reduces penetration, produces spatter and gives a rough surface finish to the weld. An excessively short arc will cause sticking of the electrode and rough deposits that are associated with slag inclusions.

For down hand welding an arc length not greater than the diameter of the core wire will be most satisfactory. Overhead welding requires a very short arc so that a minimum of metal will be lost.

Electrode angle

The angle that the electrode makes with the work is important to ensure a smooth, even transfer of metal.

Correct travel speed

The electrode should be moved along in the direction of the joint being welded at a speed that will give the size of run required. At the

same time, the electrode is fed downwards to keep the correct arc length at all times.

Correct travel speed for normal welding applications varies between approximately 100 and 300 mm per minute, depending on electrode size, size of run required and the amperage used. Excessive travel speeds lead to poor fusion, lack of penetration etc, while too slow a rate of travel will frequently lead to arc instability, slag inclusions and poor mechanical properties.

Correct work preparation

The method of preparation of components to be welded will depend on equipment available and relative costs. Methods may include sawing, punching, shearing, machining, flame cutting and others.

In all cases edges should be prepared for the joints that suit the application.

Generally Recommended Current Range for MMA electrodes

Size of Electrode (mm)	Current Range (Amp)
2.5	60–95
3.2	110–130
4.0	140–165
5.0	170–260

3.2 Fundamentals of Metal Inert Gas (MIG) Welding

Welding technique

Successful MIG welding depends on the following factors:

- Selection of correct consumables.
- Selection of the correct power source.
- Selection of the correct shielding gas.
- Selection of the correct application techniques:
  - Correct angle of electrode to work
  - Correct electrical stick-out
  - Correct travel speed
- Selection of the welding preparation.

Selection of correct consumables

Chemical composition

As a general rule, the selection of a wire is straightforward, in that it is only a matter of selecting an electrode of similar composition to the parent material. However, there are certain applications for which electrodes will be selected on the basis of mechanical properties or the level of residual hydrogen in the weld metal. Solid MIG wires are all considered to be of the 'low hydrogen type' consumables.

The following table gives a general overview of some of the BOC range of MIG wires for the most common materials. The welding wire must be free from any surface contamination, including mechanical damage such as scratch marks.

Common Materials Welded with BOC Mig Wire

Material	BOC Mig Wire
AS2074 C1,C2,C3,C4-1,C4-2,C5,C6	BOC Mild Steel MIG Wire
AS/NZS1163 C250	BOC Mild Steel MIG Wire
AS/NZS3678 200,250,300	BOC Mild Steel MIG Wire
ASTM A36,A106	BOC Mild Steel MIG Wire
Stainless Steel	
Grade 304/L	BOC Stainless Steel 308LSi
Grade 309	BOC Stainless Steel 309LSi
Grade 316/L	BOC Stainless Steel 316LSi

A simple test for checking the surface condition is to run the wire through a cloth that has been dampened with acetone for 20 seconds. If a black residue is found on the cloth, the surface of the wire is not properly cleaned.

Selection of the correct power source

Power sources for MIG / MAG welding is selected on a number of different criteria, including:

1. Maximum output of the machine.
2. Duty cycle.
3. Output control (voltage selection, wire feed speed control).
4. Portability.

The following table gives an indication of the operating amperage for different size wires.

Wire Size	Amperage Range (A)
0.8 mm	60–180
0.9 mm	70–250
1.0 mm	90–280

Selection of the correct shielding gas

The selection of the shielding gas has a direct influence on the appearance and quality of the weld bead.

The type and thickness of the material to be welded will determine the type of shielding gas that is selected. As a general rule, the thicker the material (C-Mn and Alloy Steels), the higher the percentage of CO_2 in the shielding gas mixture.

Different grades of shielding are required for materials such as stainless steel, aluminium and copper.

The following table gives an indication of the most common shielding gases used for carbon manganese and alloy steels:

Material thickness	Recommended shielding gas
1-8 mm	Argoshield Light
5–12 mm	Argoshield Universal
>12 mm	Argoshield Heavy

Correct application techniques

Direction of welding

MIG welding with solid wires takes place normally with a push technique. The welding torch is tilted at an angle of 10° towards the direction of welding (push technique).

3.3 Fundamentals of Flux and Metal Cored Arc Welding

Welding technique

Successful flux and metal cored arc welding depends on the following factors:

- Selection of correct consumables.
- Selection of the correct power source.
- Selection of the correct shielding gas.
- Selection of the correct application techniques:
  - Correct angle of electrode to work
  - Correct electrical stick-out
  - Correct travel speed
- Selection of the welding preparation.

Selection of correct consumables

Chemical composition

As a general rule, the selection of a wire is straight forward, in that it is only a matter of selecting an electrode of similar composition to the parent material. However, there are certain applications for which electrodes will be selected on the basis of mechanical properties or the level of residual hydrogen in the weld metal.

The classification system for flux cored wires will provide an indication of the residual hydrogen level that can be expected in the weld metal.

Physical condition

Surface condition

BOC flux and metal cored wires are supplied as an in-line baked product and therefore have a typical dark surface appearance.

The wire must, however, be free from any surface contamination, including surface rust. Most flux and metal cored wires have a thin film of graphite on the surface of the wire to assist with feedability.

Selection of power source

Power sources for flux and metal cored welding are selected on a number of different criteria, including:

- Maximum output of the machine.
- Duty cycle.
- Output control (voltage selection, wire feed speed control).
- Portability.

The correct shielding gas

The selection of the shielding gas has a direct influence on the appearance and quality of the weld bead.

Flux cored wires are manufactured to be welded with either 100% CO_2 or an Argon/CO_2 gas mixture. Mostly, these mixtures will contain 25% CO_2 as is the case with BOC Argoshield 52.

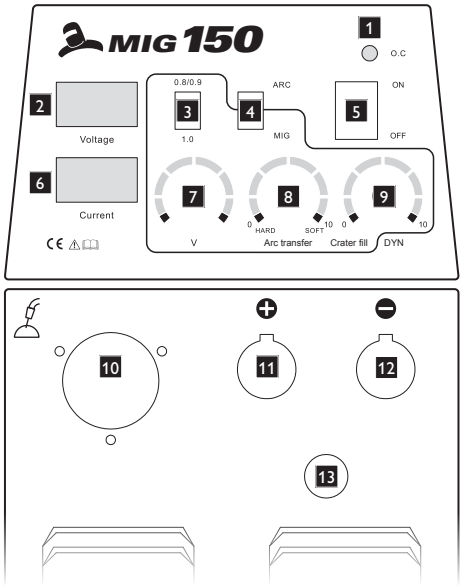
Correct application techniques

Direction of travel

Flux cored welding is normally performed using a drag technique. The welding torch is tilted to a 50-60° backhand angle. If, however, a flatter bead profile is required the backhand angle can be reduced.

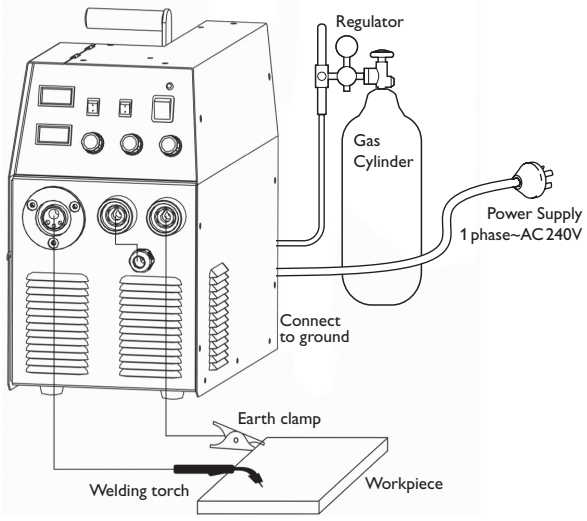
4.0 Operating Controls and Contents

4.1 Control Panel



1	Overtemperature control
2	Voltage meter
3	Wire diameter selection
4	MMA/MIG selection switch
5	Power switch
6	Current meter
7	Welding voltage adjustment
8	Arc transfer adjustment
9	Crater fill arc current adjustment
10	Universal torch connector
11	Positive output terminal
12	Negative output terminal
13	Polarity conversion socket

4.2 Installation



4.3 Operating Controls and Contents

The machine needs to be placed in a well-ventilated area ensuring that air vents are not covered.

For MIG welding.

Fit the supplied MIG torch to the euro connection 10. Select the welding polarity from positive (+) to negative (-) as per the requirement of the consumable manufacturer. Negative polarity is only used in the case of some self-shielded flux cored wires. The polarity changeover can be achieved by plugging the polarity conversion socket 13 into either the negative (-) or positive (+) output terminal 11 and 12.

The MIG process must be selected on the front panel of the machine using the MMA/MIG selection switch 4. Select the wire size using the wire diameter selection switch 3. The welding parameters are set by selecting the voltage using the welding voltage adjustment knob 7 and the welding current using the current adjustment knob 9. In addition to this, the arc transfer can be adjusted using the arc transfer adjustment knob 8. Increasing the arc transfer knob position will result in reduced spatter.

Connecting the shielding gas.

Fit the supplied shielding gas regulator to the appropriate shielding gas cylinder ensuring safety steps are followed as outlined on page 6 of this manual.

Open the cylinder and set the required gas flow using the pressure adjustment knob on the regulator.

NOTE:
When changing either the MIG torch or the MMA electrode holder the machine should be switched off using the power switch on the machine. In addition, the main supply must be turned off and the plug removed from the outlet socket.

For MMA welding.

The electrode holder and work return leads should be fitted to the positive (+) or negative (-) output terminal depending on the polarity as required by the electrode manufacturer. The MMA/MIG selection switch 4 must be switched to MMA. The welding current is selected by turning the current adjustment knob 9.

5.0 Machine Specifications

	MagMate™ MIG 150	
Part No.	MAGMIG150	
Power voltage (V)	Single phase AC 240V ± 15%	
Frequency (Hz)	50 / 60	
Rated input plug (A)	15A	
	MIG	MMA
Output current adjustment (A)	40–150	30–150
Output voltage (V)	24	
Duty cycle (%)	60	
Power factor	0.73	
Efficiency (%)	80	
Type of wirefeeder machine	Compact	
Wire feed speed (m / min)	3–13	
Post flow time (s)	1.0 ± 0.5	
Welding-wire diameter (mm)	0.8/1.0	
Insulation grade	F	
Housing shielding grade	IP21	
Weight (kg)	21	
Overall dimensions (mm)	467 x 243 x 447	
KVa	15	
Standards	IEC 60974.1	

6.0 Periodic Maintenance

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

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

6.1 Power Source

- Check electrical connections of unit at least twice a year.
- Clean oxidised connections and tighten.
- Inner parts of machine should be 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 and internal servicing.

7.0 Terms of Warranty

Warranty for MagMate™ MIG 150

7.1 Terms of Warranty

BOC provides a warranty for the MagMate MIG 150 sold by it against defects in manufacture and materials.

Machines under warranty will be exchanged and not repaired.

- Valid for 18 months from date of purchase.
- 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.
- Electrode holders and torches are not covered.

7.2 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 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.

For more information on MagMate products or service, call the **BOC Customer Service Centre** on:

AUSTRALIA

131 262

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

NEW ZEALAND

0800 111 333

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