MAGMATE™

180P

OPERATING MANUAL

Welcome to a better way of welding

Congratulations on purchasing a MagMate 180P welding machine.

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.

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1.0 Recommended Safety Precautions

1.1 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.

1.2 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.

1.3 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.

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.

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.

2.0 MIG Operating Manual

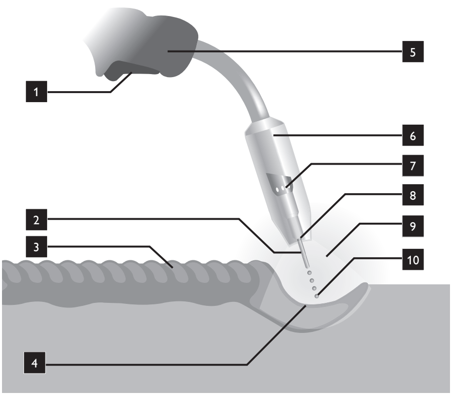
2.1 Introduction to Metal Inert Gas (MIG)

MIG welding embraces a group of arc welding processes in which a continuous electrode (the wire) is fed by powered feed rolls (wire feeder) into the weld pool. An electric arc is created between the tip of the wire and the weld pool. The wire is progressively melted at the same speed at which it is being fed and forms part of the weld pool. Both the arc and the weld pool are protected from atmospheric contamination by a shield of inert (non-reactive) gas, which is delivered through a nozzle that is concentric with the welding wire guide tube.

Operation

MIG welding is usually carried out with a handheld gun as a semi-automatic process. The MIG process can be suited to a variety of job requirements by choosing the correct shielding gas, electrode (wire) size and welding parameters. Welding parameters include the voltage, travel speed, arc (stick-out) length and wire feed rate. The arc voltage and wire feed rate will determine the filler metal transfer method.

1	Gun trigger	6	Shroud
2	Welding wire	7	Gas diffuser
3	Weld	8	Contact tip
4	Weld pool	9	Shielding
5	Gun	10	Droplets



This application combines the advantages of continuity, speed, comparative freedom from distortion and the reliability of automatic welding with the versatility and control of manual welding. The process is also suitable for mechanised set-ups, and its use in this respect is increasing.

MIG welding can be carried out using solid wire, flux cored, or a copper-coated solid wire electrode. The shielding gas or gas mixture may consist of the following:

- Argon
- Carbon dioxide
- Argon and carbon dioxide mixtures
- Argon mixtures with oxygen or helium mixtures

Each gas or gas mixture has specific advantages and limitations. Other forms of MIG welding include using a flux-cored continuous electrode and carbon dioxide shielding gas, or using self-shielding flux-cored wire, requiring no shielding.

2.2 Introduction to Flux Cored Arc Welding (FCAW)

How it Works

Flux-cored arc welding (FCAW) uses the heat generated by a DC electric arc to fuse the metal in the joint area, the arc being struck between a continuously fed consumable filler wire and the workpiece, melting both the filler wire and the workpiece in the immediate vicinity. The entire arc area is covered by a shielding gas, which protects the molten weld pool from the atmosphere.

FCAW is a variant of the MIG process and while there are many common features between the two processes, there are also several fundamental differences.

As with MIG, direct current power sources with constant voltage output characteristics are normally employed to supply the welding current. With flux-cored wires the terminal that the filler wire is connected to depends on the specific product being used, some wires running electrode positive, others running electrode negative. The work return is then connected to the opposite terminal. It has also been found that the output characteristics of the power source can have an effect on the quality of the welds produced.

The wire feed unit takes the filler wire from a spool, and feeds it through the welding gun, to the arc at a predetermined and accurately controlled speed. Normally, special knurled feed rolls are used with flux-cored wires to assist feeding and to prevent crushing the consumable.

Unlike MIG, which uses a solid consumable filler wire, the consumable used in FCAW is of tubular construction, an outer metal sheath being filled with fluxing agents plus metal powder. The flux fill is also used to provide alloying, arc stability, slag cover, de-oxidation, and, with some wires, gas shielding.

In terms of gas shielding, there are two different ways in which this may be achieved with the FCAW process.

- Additional gas-shielding supplied from an external source, such as a gas cylinder
- Production of a shielding gas by decomposition of fluxing agents within the wire, self-shielding

Gas shielded wires are available with either a basic or rutile flux fill, while self-shielded wires have a broadly basic-type flux fill. The flux fill dictates the way the wire performs, the properties obtainable, and suitable applications.

Gas-shielded Operation

Many cored wire consumables require an auxiliary gas shield in the same way that solid wire MIG consumables do. These types of wire are generally referred to as 'gas-shielded'.

Using an auxiliary gas shield enables the wire designer to concentrate on the performance characteristics, process tolerance, positional capabilities, and mechanical properties of the products.

In a flux cored wire the metal sheath is generally thinner than that of a self-shielded wire. The area of this metal sheath surrounding the flux cored wire is much smaller than that of a solid MIG wire. This means that the electrical resistance within the flux cored wire is higher than with solid MIG wires and it is this higher electrical resistance that gives this type of wire some of its novel operating properties.

One often quoted property of fluxed cored wires are their higher deposition rates than solid MIG wires. What is often not explained is how they deliver these higher values and whether these can be utilised. For example, if a solid MIG wire is used at 250 amps, then exchanged for a flux cored wire of the same diameter, and welding power source controls are left unchanged, then the current reading would be much less than 250 amps, perhaps as low as 220 amps. This is because of Ohms Law that states that as the electrical resistance increases if the voltage remains stable then the current must fall.

To bring the welding current back to 250 amps it is necessary to increase the wire feed speed, effectively increasing the amount of wire being pushed into the weld pool to make the weld. It is this affect that produces the 'higher deposition rates' that the flux cored wire manufacturers claim for this type of product. Unfortunately in many instances the welder has difficulty in utilising this higher wire feed speed and must either increase the welding speed or increase the size of the weld. Often in manual applications neither of these changes can be implemented and the welder simply reduces the wire feed speed back to where it was and the advantages are lost. However, if the process is automated in some way then the process can show improvements in productivity.

It is also common to use longer contact tip to workplace distances with flux cored arc welding than with solid wire MIG welding and this also has the effect of increasing the resistive heating on the wire further accentuating the drop in welding current. Research has also shown that increasing this distance can lead to an increase in the ingress of nitrogen and hydrogen into the weld pool, which can affect the quality of the weld.

Flux cored arc welding has a lower efficiency than solid wire MIG welding because part of the wire fill contains slag forming agents. Although the efficiency varies differs by wire type and manufacturer it is typically between 75–85%.

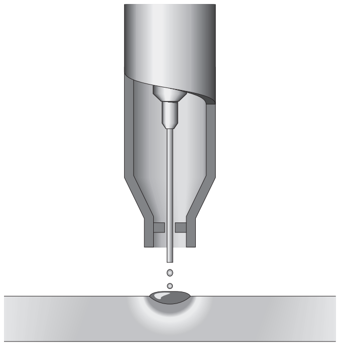
Flux cored arc welding does, however, have the same drawback as solid wire MIG in terms of gas disruption by wind, and screening is always necessary for site work. It also incurs the extra cost of shielding gas, but this is often outweighed by gains in productivity.

Self-shielded Operation

There are also self-shielded consumables designed to operate without an additional gas shield. In this type of product, arc shielding is provided by gases generated by decomposition of some constituents within the flux fill. These types of wire are referred to as 'self-shielded'.

If no external gas shield is required, then the flux fill must provide sufficient gas to protect the molten pool and to provide de-oxidisers and nitride formers to cope with atmospheric contamination. This leaves less scope to address performance, arc stabilisation, and process tolerance, so these tend to suffer when compared with gas shielded types.

Wire efficiencies are also lower, at about 65%, in this mode of operation than with gas-shielded wires. However, the wires do have a distinct advantage when it comes to site work in terms of wind tolerance, as there is no external gas shield to be disrupted.



Extended self shielded flux cored wire nozzle

When using self-shielded wires, external gas supply is not required and, therefore, the gas shroud is not necessary. However, an extension nozzle is often used to support and direct the long electrode extensions that are needed to obtain high deposition rates.

2.3 Introduction to Metal Cored Arc Welding (MCAW)

How it Works

Metal-cored arc welding (MCAW) uses the heat generated by a DC electric arc to fuse metal in the joint area, the arc being struck between a continuously fed consumable filler wire and the workpiece, melting both the filler wire and the workpiece in the immediate vicinity. The entire arc area is covered by a shielding gas, which protects the molten weld pool from the atmosphere.

As MCAW is a variant of the MIG welding process there are many common features between the two processes, but there are also several fundamental differences.

As with MIG, direct current power sources with constant voltage output characteristics are normally employed to supply the welding current. With metal-cored wires the terminal the filler wire is connected to depends on the specific product being used, some wires designed to run on electrode positive, others preferring electrode negative, and some which will run on either. The work return lead is then connected to the opposite terminal. Electrode negative operation will usually give better positional welding characteristics. The output characteristics of the power source can have an effect on the quality of the welds produced.

The wire feed unit takes the filler wire from a spool or bulk pack, and feeds it through the welding gun, to the arc at a predetermined and accurately controlled speed. Normally, special knurled feed rolls are used with metal-cored wires to assist feeding and to prevent crushing the consumable.

Unlike MIG, which uses a solid consumable filler wire, the consumable used in MCAW is of tubular construction, an outer metal sheath being filled entirely with metal powder except for a small amount of non-metallic compounds. These are added to provide some arc stability and de-oxidation.

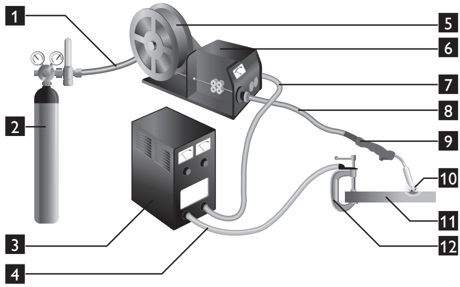
MCAW consumables always require an auxiliary gas shield in the same way that solid MIG wires do. Wires are normally designed to operate in argon-carbon dioxide or argon-carbon dioxide-oxygen mixtures or carbon dioxide. Argon rich mixtures tend to produce lower fume levels than carbon dioxide.

As with MIG, the consumable filler wire and the shielding gas are directed into the arc area by the welding gun. In the head of the gun, the welding current is transferred to the wire by means of a copper alloy contact tip, and a gas diffuser distributes the shielding gas evenly around a shroud which then allows the gas to flow over the weld area. The position of the contact tip relative to the gas shroud may be adjusted to limit the minimum electrode extension.

Modes of metal transfer with MCAW are very similar to those obtained in MIG welding, the process being operable in both 'dip transfer' and 'spray transfer' modes. Metal-cored wires may also be used in pulse transfer mode at low mean currents, but this has not been widely exploited.

Process Schematic Diagram for MIG / FCAW and MCAW

1	Gas hose	7	Power cable
2	Gas cylinder	8	Gun conduit
3	Power source	9	Welding gun
4	Return cable	10	Arc
5	Continous wire	11	Workpiece
6	Wire feed unit	12	Earth clamp



Circuit diagram of MIG process

Modes of Metal Transfer

The mode or type of metal transfer in MIG welding depends upon the current, arc voltage, electrode diameter and type of shielding gas used. In general, there are four modes of metal transfer.

Modes of metal transfer with FCAW are similar to those obtained in MIG welding, but here the mode of transfer is heavily dependent on the composition of the flux fill, as well as on current and voltage.

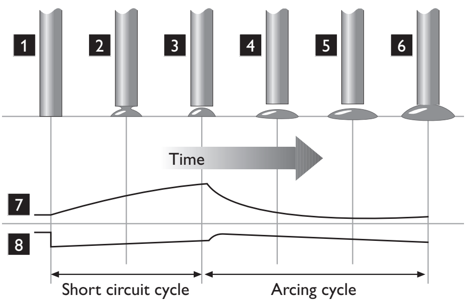
The most common modes of transfer in FCAW are:

- Dip transfer
- Globular transfer
- Spray transfer
- Pulsed arc transfer operation has been applied to flux-cored wires but, as yet, is not widely used because the other transfer modes are giving users what they require, in most cases.

Dip Transfer

Also known as short-circuiting arc or short-arc, this is an all-positional process, using low heat input. The use of relatively low current and arc voltage settings cause the electrode to intermittently short-circuit with the weld pool at a controlled frequency. Metal is transferred by the wire tip actually dipping into the weld pool and the short-circuit current is sufficient to allow the arc to be re-established. This short-circuiting mode of metal transfer effectively extends the range of MIG welding to lower currents so thin sheet material can readily be welded. The low heat input makes this technique well-suited to the positional welding of root runs on thick plate, butt welds for bridging over large gaps and for certain difficult materials where heat input is critical. Each short-circuit causes the current to rise and the metal fuses off the end of the electrode. A high short-circuiting frequency gives low heat input. Dip transfer occurs between ±70-220A, 14–23 arc volts. It is achieved using shielding gases based on carbon dioxide and argon.

1	Short circuit	5	Arc gap shortens
2	Necking	6	Short circuit
3	Arc re-ignition	7	Current (A)
4	Arc established	8	Voltage (V)



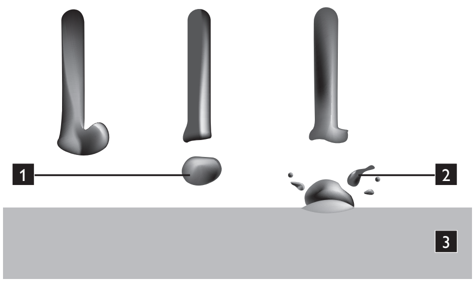
Schematic of Dip Transfer

Metal-cored wires transfer metal in dip mode at low currents just like solid MIG wires. This transfer mode is used for all positional work with these types of wire.

Globular Transfer

Metal transfer is controlled by slow ejection resulting in large, irregularly-shaped 'globs' falling into the weld pool under the action of gravity. Carbon dioxide gas drops are dispersed haphazardly. With argon-based gases, the drops are not as large and are transferred in a more axial direction. There is a lot of spatter, especially in carbon dioxide, resulting in greater wire consumption, poor penetration and poor appearance. Globular transfer occurs between the dip and spray ranges. This mode of transfer is not recommended for normal welding applications and may be corrected when encountered by either decreasing the arc voltage or increasing the amperage. Globular transfer can take place with any electrode diameter.

1	Large droplet
2	Splatter
3	Workpiece



Schematic of Globular Transfer

Basic flux-cored wires tend to operate in a globular mode or in a globular-spray transfer mode where larger than normal spray droplets are propelled across the arc, but they never achieve a true spray transfer mode. This transfer mode is sometimes referred to as non-axial globular transfer.

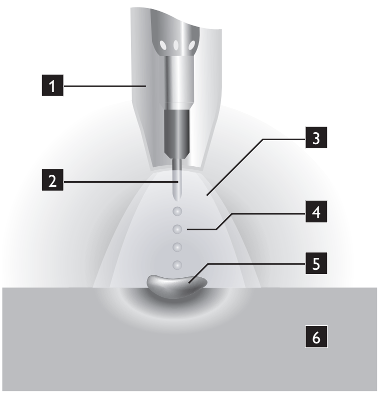
Self-shielded flux-cored wires operate in a predominantly globular transfer mode although at high currents the wire often 'explodes' across the arc.

Spray Transfer

In spray transfer, metal is projected by an electromagnetic force from the wire tip in the form of a continuous stream of discrete droplets approximately the same size as the wire diameter. High deposition rates are possible and weld appearance and reliability are good. Most metals can be welded, but the technique is limited generally to plate thicknesses greater than 6mm. Spray transfer, due to the tendency of the large weld pool to spill over, cannot normally be used for positional welding. The main exception is aluminium and its alloys where, primarily because of its low density and high thermal conductivity, spray transfer in position can be carried out.

The current flows continuously because of the high voltage maintaining a long arc and short-circuiting cannot take place. It occurs best with argon-based gases.

1	Gas shroud	4	Droplets
2	Wire	5	Weld
3	Shielding gas	6	Workpiece



Schematic of Spray Transfer

In solid wire MIG, as the current is increased, dip transfer passes into spray transfer via a transitional globular transfer mode. With metal-cored wires there is virtually a direct transition from dip transfer to spray transfer as the current is increased.

For metal cored wire spray transfer occurs as the current density increases and an arc is formed at the end of the filler wire, producing a stream of small metal droplets. Often the outside sheath of the wire will melt first and the powder in the centre flows as a stream of smaller droplet into the weld pool. This effect seems to give much better transfer of alloying elements into the weld.

In spray transfer, as the current density increases, an arc is formed at the end of the filler wire, producing a stream of small metal droplets. In solid wire MIG this transfer mode occurs at higher currents. Flux-cored wires do not achieve a completely true spray transfer mode but a transfer mode that is almost true spray may occur at higher currents and can occur at relatively low currents depending on the composition of the flux.

Rutile flux-cored wires will operate in this almost-spray transfer mode, at all practicable current levels. They are also able to operate in this mode for positional welding too. Basic flux-cored and self-shielded flux-cored wires do not operate in anything approaching true spray transfer mode.

Pulsed Transfer

Pulsed arc welding is a controlled method of spray transfer, using currents lower than those possible with the spray transfer technique, thereby extending the applications of MIG welding into the range of material thickness where dip transfer is not entirely suitable. The pulsed arc equipment effectively combines two power sources into one integrated unit. One side of the power source supplies a background current which keeps the tip of the wire molten. The other side produces pulses of a higher current that detach and accelerate the droplets of metal into the weld pool. The transfer frequency of these droplets is regulated primarily by the relationship between the two currents. Pulsed arc welding occurs between ±50-220A, 23–35 arc volts and only with argon and argon-based gases. It enables welding to be carried out in all positions.

Process	Dip Transfer	Globular Transfer	Spray Transfer	Pulsed Transfer
Metal Inert Gas (MIG)	●		●	●
Flux Cored (Gas Shielded)	●	●	*	
Flux Cored (Self Shielded)	●	●		
Metal Cored	●		●	●

* Not True Spray

2.4 Fundamentals of MIG, FCAW and MCAW

Welding Technique

Successful welding depends on the following factors:

1 Selection of correct consumables
2 Selection of the correct power source
3 Selection of the correct polarity on the power source
4 Selection of the correct shielding gas
5 Selection of the correct application techniques
  a Correct angle of electrode to work
  b Correct electrical stickout
  c Correct travel speed
6 Selection of the welding preparation

Selection of Correct Consumable

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. It will be found, however, that there are certain applications that electrodes will be selected on the basis of its mechanical properties or level of residual hydrogen in the weldmetal. Solid MIG wires are all considered to be of the 'low Hydrogen type' consumables.

The following table gives a general overview of the selection of some of the BOC range of MIG wires for the most common materials.

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
BS3100 AW1,A2,A3	BOC Mild Steel MIG Wire
BS1504-430,480,540	BOC Mild Steel MIG Wire
ASTM A36,A106,EN8,8A	BOC Mild Steel MIG Wire
Stainless Steel	
Grade 304	BOC Stainless Steel 308LSi
Grade 309	BOC Stainless Steel 309LSi
Grade 316	BOC Stainless Steel 316LSi

Physical condition

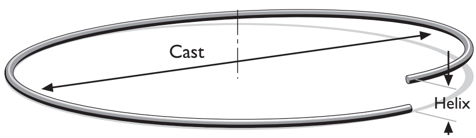
Surface condition

The welding wire must be free from any surface contamination including mechanical damage such as scratch marks.

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

Cast and Helix

The cast and helix of the wire has a major influence on the feedability of MIG wire.



Cast – Diameter of the circle

Helix – Vertical height

If the cast is too large the wire will move in an upward direction from the tip when welding and if too small the wire will dip down from the tip. The result of this is excessive tip wear and increased wear in the liners.

If the helix is too large the wire will leave the tip with a corkscrew effect.

Selection of the Correct Power Source

Power sources for MIG 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
1.2 mm	120–340

Selection of the Correct Polarity on the Power Source

Many power sources are fitted with an optional reverse polarity dinse connector.

To achieve the optimum welding it is important to adhere to the consumable manufacturer's instruction to select the polarity.

As a general rule all solid and metal cored wires are welded on electrode positive. (Work return lead fitted to the negative connector.)
Some grades of self shielded flux cored wires (i.e. E71T-11, E71T-GS etc) needs to be welded on electrode negative. (Work return lead fitted to the positive connector.)

Selection of the Correct Shielding Gas

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

The thickness of the material to be welded will determine the type of shielding gas that has to be selected. As a general rule the thicker the material (C-Mn and Alloy steels) are 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 steel.

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

More detailed selection charts, including recommendations for welding parameters (voltage, amperage, electrical stickout, travelspeed and gasflow rate) can be found in the following pages.

3.0 General Welding Information

3.1 Recommended Welding Parameters

Argoshield Light Gas Code 060 (Australia) 500 (New Zealand)

Indicative Welding Parameters

	Dip Transfer				Spray Transfer
Material thickness (mm)	1–1.6	2	3	4	3
Welding position	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical	Horizontal
Wire diameter (mm)	0.8–0.9	0.8–0.9	0.8–0.9	0.9–1.0	0.8
Current (amps)	45–80	60–100	80–120	80–150	160–180
Voltage (volts)	14–16	16–17	16–18	16–18	23–25
Wire feed speed (m/min)	3.5–5.0	4.0–7.0	4.0–7.0	4.0–7.0	7.5–9.0
Gas rate flow (L/min)	15	15	15	15	15
Travel speed (mm/min)	350–500	350–500	320–500	280–450	800–1000

Stainshield Gas Code 075 (Australia)
Stainshield Light Gas Code 503 (New Zealand)

Indicative Welding Parameters

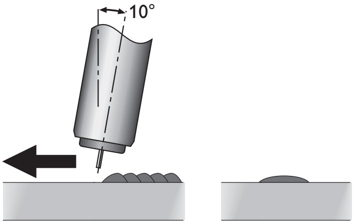
	Dip Transfer		
Material thickness (mm)	4	6	8
Welding position	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical
Wire diameter (mm)	0.9–1.0	0.9–1.0	0.9–1.0
Current (amps)	100–125	120–150	120–150
Voltage (volts)	17–19	18–20	18–20
Wire feed speed (m/min)	5.0–6.5	6.0–7.5	6.0–8.0
Gas flow rate (L/min)	15	15	18
Travel speed (mm/min)	400–600	280–500	280–450

4.0 Correct Application Techniques

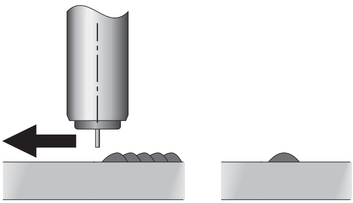
Correct Application Techniques

Direction of welding.

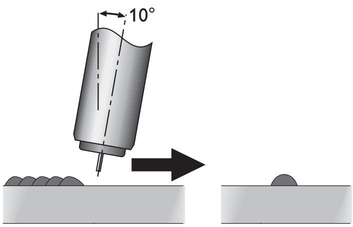
MIG welding with solid wires takes place normally with a push technique. The welding gun is tilted at an angle of 10° towards the direction of welding. (Push technique)



The influence of changing the torch angle and the welding direction on the weld bead profile can be seen below.

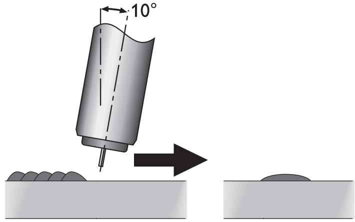


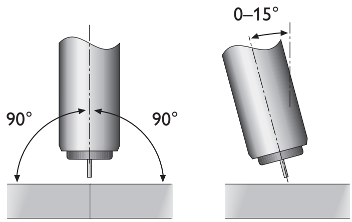
Torch perpendicular to workpiece Narrow bead width with increased reinforcement.



Torch positioned at a drag angle of 10° Narrow bead with excessive reinforcement.

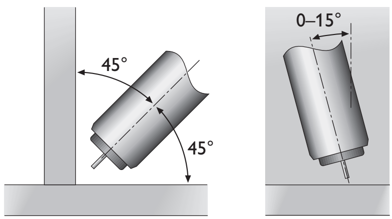
Flux cored welding with cored wires takes place normally with the drag technique ("when there is slag in your drag"). The welding gun is tilted at an angle of 10° away from the direction of welding. For all other applications the gun angle remains the same.





Torch position for butt welds

When welding butt welds the torch should be positioned within the centre of the groove and tilted at an angle of ±15° from the vertical plane. Welding is still performed in the push technique.

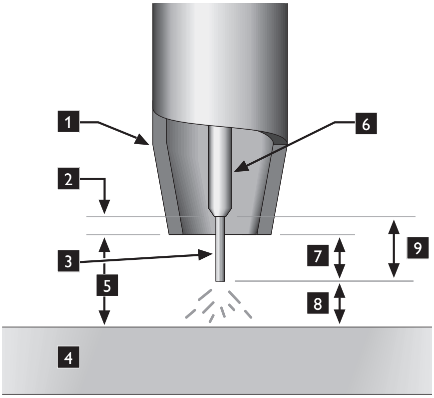


Torch position for fillet welds

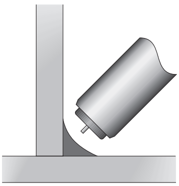
When welding fillet welds the torch should be positioned at an angle of 45° from the bottom plate with the wire pointing into the fillet corner. Welding is still performed in the push technique.

Electrical stickout

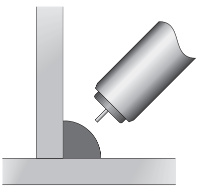
1	Gas Nozzle	6	Contact Tube
2	Contact Tube Setback	7	Visible Stickout
3	Consumable Electrode	8	Arc length
4	Workpiece	9	Electrical Stickout
5	Standoff Distance		



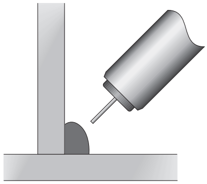
The electrical stickout is the distance between the end of the contact tip and the end of the wire. An increase in the electrical stickout results in an increase in the electrical resistance. The resultant increase in temperature has a positive influence in the melt-off rate of the wire that will have an influence on the weldbead profile.



Short



Normal

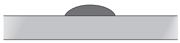


Long

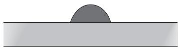
Influence of the change in electrical stickout length on the weldbead profile.

Travel speed

Slow



Normal



Fast

The travel speed will have an influence on the weldbead profile and the reinforcement height.

If the travel speed is too slow a wide weldbead with excessive rollover will result. Contrary if the travel speed is too high a narrow weldbead with excessive reinforcement will result.

Recommendation about travel speed are contained in the detailed gases datasheets found on page 14 of this manual.

5.0 Troubleshooting and Fault Finding

Power source

Component	Fault symptom	Cause
Primary cable	No or low welding output	Bad or incorrect primary connection, lost phase
Earth cable and clamp	Arc will not initiate	Damaged, loose or undersized cables and clamps
Connectors and lugs	Overheating of connectors and lugs	Loose or badly crimped connectors
Switches	Erratic or no output control	Switches damaged or incorrectly set for the application

Wire feeder

Component	Fault symptom	Cause
Gas solenoid valve	No gas flow or gas flows continuously	Gas valve faulty or sticking in open position
Wire feed rolls	Wire slippage, wire deformation	Incorrect feed roll size, incorrect tension adjustment, misalignment
Inlet, outlet guides	Wire shaving or snarling	Incorrect wire guide sizes, misalignment
Universal adaptor	Wire restriction, gas leaks, no trigger control	Universal adaptor not correctly mounted or secured, incorrect size of internal guide, bent contact pins
Wire feed speed control	No control over wire feed speed, no amperage control	Faulty wire speed feed potentiometer, wire feed motor in overload or trip condition
Wire inch switch	Wire live when feeding through cable and gun before welding	Faulty wire inch switch, inappropriate use of gun trigger switch
Spindle	Wire spool drags or overruns	Spindle brake set too tight or too loose, spool not properly located on spindle

Welding gun

Component	Fault symptom	Cause
Type	Welding gun overheats	Welding gun underrated for welding application
Liners	Erratic wire feed, wire snarls up at outlet guide	Liner of incorrect type and size for wire in use, worn or dirty liner, liner too long or too short
Gas distributor	Inadequate gas flow, contaminated or porous weld	Damaged or blocked distributor
Nozzle	Inadequate gas cover, restricted joint accessibility	Nozzle too large or too small, incorrect length or shape
Contact tip	Erratic feeding, wire shudder, wire burnback, unstable arc, spatter	Incorrect size of contact tip, incorrect contact tip to nozzle distance for metal transfer mode, inferior contact tip material
Nozzle insulator	Arcing between contact tip and nozzle and between nozzle and workpiece	No nozzle insulator fitted

Regulator / flowmeter

Component	Fault symptom	Cause
Inlet stem	No gas flow, gas leaks at regulator body or cylinder valve	Blocked inlet stem, leaking inlet stem to body thread, bullnose not properly seated in cylinder case
Gas hose and fitting	Leaks at connections or in the hose, porosity in the weld	Poorly fitted "o" clips, damaged hose, air drawn into gas stream

Shielding gas

Component	Fault symptom	Cause
Cylinder, MCPs	No gas flow, porosity in the weld	Gas cylinder closed or empty, faulty cylinder valves
Bulk	No gas flow, change in welding conditions	Bulk tank empty, incorrectly set mixing panel

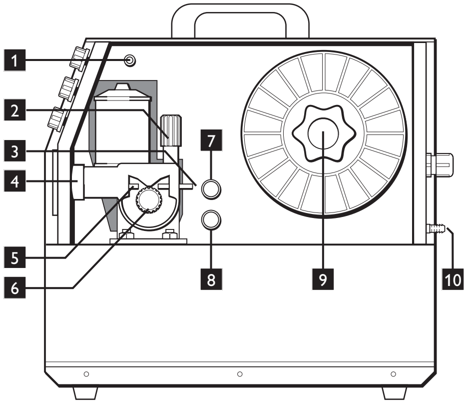
Welding wire

Component	Fault symptom	Cause
Wire basket and spool	Erratic wire feeding or wire stoppages	Damaged wire basket, loose spooling, random-wound wire
Wire	Wire sticks in contact tip, erratic feeding	Varying wire diameter, copper flaking, surface damage
Wire	Weld has excessive amount of spatter	Wrong polarity has been selected

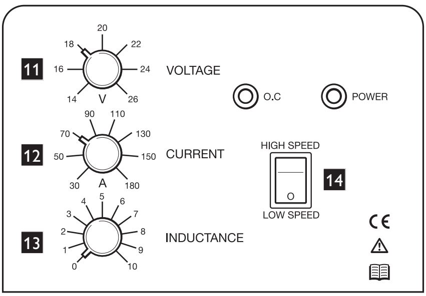
6.0 Machine Specifications

	MagMate 180P
Part No.	MAG180P
Input Power (V) 240 ± 15%	Single Phase
Frequency (Hz)	50 / 60
Rated input current (A)	20.3
Output current adjustment (A)	50–180
Output voltage adjustment (V)	14–26
Duty Cycle (%)	60
Power Factor	0.73
Efficiency (%)	80
Type of wirefeeder machine	Compact
Wire speed (m / min)	2–15
Post flow (s)	1
Maximum spool size (mm)	200
Wire diameter (mm)	0.6/0.8/0.9
Housing shielding grade	IP21
Insulation grade	F
Suitable thickness (mm)	Above 0.6
Weight (kg)	20
Dimensions (mm)	482 x 197 x 466

7.0 Operating Controls and Contents



1	Wire Inch Switch
2	Pressure Adjusting Knob
3	Flexible Conduit
4	Torch Connector
5	Conduit
6	Roller
7	Posititive Terminal
8	Negative Terminal
9	Spool Holder
10	Gas Inlet



11	Wire speed (voltage control) 14–26V
12	Fully adjustable current setting from 20–180A
13	Fully adjustable, infinitely controllable inductance
14	High/low speed adjustment. Extends the wire feed speed capability for larger diameter wires

7.1 Machine Setup

1. Connect the MIG welding torch (supplied) to the machine by connecting the backend to the universal fitting on the machine. Ensure that the torch is screwed in tight.
2. The MagMate 180P is designed for D200 (5 kg) spools maximum. Fit the spool onto the spool holder and ensure that the locating nut is replaced and tightened.
3. Feed the wire through the system by utilising the Wire Inch Switch. An inbuilt safety override will ensure that the wire feed speed is not excessive.
4. Adjust the pressure adjusting knob to ensure that the wire is fed evenly. Over tightening the adjusting knob will cause undue strain on the wire feed motor.
5. Select the wire speed selector switch to high speed for 0.6 and 0.8 mm wires and at low speed for 0.9 and 1.0 mm wires.
6. If a solid gas-assisted wire is used, connect the gas hose to the gas inlet connection situated at the back of the machine.
7. Using the table supplied in this manual, adjust the voltage and amperage depending on the diameter of the wire.

Improved arc characteristics can be obtained by changing the infinite variable inductance. If welding certain grades of flux-cored wires that require the polarity of the machine to be changed, this can be achieved by changing the wire positions on the positive/negative terminals.

WARNING: When changing the polarity on the machine, it needs to switched off and the primary cable unplugged from the mains socket.

For solid wires, the wires and terminals are clearly marked (red on positive terminal).

8.0 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.

8.1 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.

9.0 Warranty Information

9.1 Terms of Warranty

The MagMate™ machine has a limited warranty that covers manufacturing and material defects only. The warranty is affected on the day of purchase and does not cover any freight, packaging and insurance costs. Verbal promises that do not comply with terms of warranty are not binding on warrantor.

9.2 Limitations on Warranty

The following conditions are not covered under terms of warranty: loss or damage due to or resulting from natural wear and tear, non-compliance with operating and maintenance instructions, connection to incorrect or faulty voltage supply (including voltage surges outside equipment specs), incorrect gas pressure overloading, transport or storage damage or fire or damage due to natural causes (e.g. lightning or flood). This warranty does not cover direct or indirect expenses, loss, damage of costs including, but not limited to, daily allowances or accommodation and travelling costs.

Note

Under the terms of warranty, welding guns and their consumables, feed, drive rollers and feeder guide tubes are not covered. Direct or indirect damage due to a defective product is not covered under the warranty. The warranty is void if changes are made to the product without approval of the manufacturer, or if repairs are carried out using non-approved spare parts. The warranty is void if a non-authorised agent carries out repairs.

9.3 Warranty Period

The warranty is valid for 18 months from date of purchase provided the machine is used within the published specification limits.

9.4 Warranty Repairs

Your service provider must be informed within the warranty period of any warranty defect. The customer must provide proof of purchase and serial number of the equipment when making a warranty claim. Warranty repairs may only be carried out by approved BOC service providers. Please contact your local BOC Gas & Gear for a directory of BOC approved service providers in your area.

10.0 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.

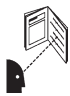
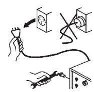
Diagram and safety explanation	
Electrical safety alert	
Welding electrode causing electric shock	
Fumes and gases coming from welding process	
Welding arc rays	
Read instruction manual	
Become trained	

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	

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

Email: **customer-service-nz@boc.com**
Website: **www.boc.co.nz**

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