Welding Machine Instruction Manual

© Tokentools Pty Ltd
9-11 Willow Tree Rd • Suite 6
Wyong, NSW 2259 Australia
Phone 1300 881 991 • Fax +612 4353 5420

METALMASTER 210S SYNERGIC MIG TIG STICK WELDER

SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING

scm 2011–10

Protect yourself and others from injury — read, follow, and save these important safety precautions and operating instructions.

1-1. Symbol Usage

DANGER! – Indicates a hazardous situation which, if not avoided, will result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.

Indicates a hazardous situation which, if not avoided, could result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.

NOTICE *– Indicates statements not related to personal injury.*

☞ *Indicates special instructions.*

This group of symbols means Warning! Watch Out! ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.

1-2. Arc Welding Hazards

The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard. The safety information given below is only a summary of the more complete safety information found in the Safety Standards listed in Section 1-5. Read and follow all Safety Standards.

Only qualified persons should install, operate, maintain, and repair this unit.

During operation, keep everybody, especially children, away.

ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

- Do not touch live electrical parts.
- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.
- Do not use AC output in damp areas, if movement is confined, or if there is a danger of falling.
- Use AC output ONLY if required for the welding process.
- If AC output is required, use remote output control if present on unit.
- Additional safety precautions are required when any of the following electrically hazardous conditions are present: in damp locations or while wearing wet clothing; on metal structures such as floors, gratings, or scaffolds; when in cramped positions such as sitting, kneeling, or lying; or when there is a high risk of unavoidable or accidental contact with the workpiece or ground. For these conditions, use the following equipment in order presented: 1) a semiautomatic DC constant voltage (wire) welder, 2) a DC manual (stick) welder, or 3) an AC welder with reduced open-circuit voltage. In most situations, use of a DC, constant voltage wire welder is recommended. And, do not work alone!
- Disconnect input power or stop engine before installing or servicing this equipment. Lockout/tagout input power according to OSHA 29 CFR 1910.147 (see Safety Standards).
- Properly install, ground, and operate this equipment according to its Owner's Manual and national, state, and local codes.
- Always verify the supply ground – check and be sure that input power cord ground wire is properly connected to ground terminal in disconnect box or that cord plug is connected to a properly grounded receptacle outlet.
- When making input connections, attach proper grounding conductor first – double-check connections.
- Keep cords dry, free of oil and grease, and protected from hot metal and sparks.
- Frequently inspect input power cord for damage or bare wiring – replace cord immediately if damaged – bare wiring can kill.
- Turn off all equipment when not in use.
- Do not use worn, damaged, undersized, or poorly spliced cables.
- Do not drape cables over your body.
- If earth grounding of the workpiece is required, ground it directly with a separate cable.
- Do not touch electrode if you are in contact with the work, ground, or another electrode from a different machine.
- Do not touch electrode holders connected to two welding machines at the same time since double open-circuit voltage will be present.
- Use only well-maintained equipment. Repair or replace damaged parts at once. Maintain unit according to manual.
- Wear a safety harness if working above floor level.
- Keep all panels and covers securely in place.
- Clamp work cable with good metal-to-metal contact to workpiece or worktable as near the weld as practical.
- Insulate work clamp when not connected to workpiece to prevent contact with any metal object.
- Do not connect more than one electrode or work cable to any single weld output terminal. Disconnect cable for process not in use.

SIGNIFICANT DC VOLTAGE exists in inverter welding power sources AFTER removal of input power.

- Turn Off inverter, disconnect input power, and discharge input capacitors according to instructions in Maintenance Section before touching any parts.

HOT PARTS can burn.

- Do not touch hot parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.

FUMES AND GASES can be hazardous.

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

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use local forced ventilation at the arc to remove welding fumes and gases.
- If ventilation is poor, wear an approved air-supplied respirator.
- Read and understand the Material Safety Data Sheets (MSDSs) and the manufacturer's instructions for metals, consumables, coatings, cleaners, and degreasers.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watch-person nearby. Welding fumes and gases can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.
- Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
- Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

ARC RAYS can burn eyes and skin.

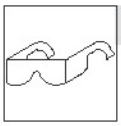
Arc rays from the welding process produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin. Sparks fly off from the weld.

- Wear an approved welding helmet fitted with a proper shade of filter lenses to protect your face and eyes from arc rays and sparks when welding or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).
- Wear approved safety glasses with side shields under your helmet.
- Use protective screens or barriers to protect others from flash, glare and sparks; warn others not to watch the arc.
- Wear protective clothing made from durable, flame-resistant material (leather, heavy cotton, or wool) and foot protection.

WELDING can cause fire or explosion.

Welding on closed containers, such as tanks, drums, or pipes, can cause them to blow up. Sparks can fly off from the welding arc. The flying sparks, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode to metal objects can cause sparks, explosion, overheating, or fire. Check and be sure the area is safe before doing any welding.

- Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Do not weld where flying sparks can strike flammable material.
- Protect yourself and others from flying sparks and hot metal.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not weld on containers that have held combustibles, or on closed containers such as tanks, drums, or pipes unless they are properly prepared according to AWS F4.1 and AWS A6.0 (see Safety Standards).
- Do not weld where the atmosphere may contain flammable dust, gas, or liquid vapors (such as gasoline).
- Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock, sparks, and fire hazards.
- Do not use welder to thaw frozen pipes.
- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
- Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding.
- After completion of work, inspect area to ensure it is free of sparks, glowing embers, and flames.
- Use only correct fuses or circuit breakers. Do not oversize or by-pass them.
- Follow requirements in OSHA 1910.252 (a)(2)(iv) and NFPA 51B for hot work and have a fire watcher and extinguisher nearby.



FLYING METAL or DIRT can injure eyes.

- Welding, chipping, wire brushing, and grinding cause sparks and flying metal. As welds cool, they can throw off slag.
- Wear approved safety glasses with side shields even under your welding helmet.

BUILDUP OF GAS can injure or kill.

- Shut off compressed gas supply when not in use.
- Always ventilate confined spaces or use approved air-supplied respirator.

ELECTRIC AND MAGNETIC FIELDS (EMF) can affect Implanted Medical Devices.

- Wearers of Pacemakers and other Implanted Medical Devices should keep away.
- Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations.

NOISE can damage hearing.

Noise from some processes or equipment can damage hearing.

- Wear approved ear protection if noise level is high.

CYLINDERS can explode if damaged.

Compressed gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

- Protect compressed gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flames, sparks, and arcs.
- Install cylinders in an upright position by securing to a stationary support or cylinder rack to prevent falling or tipping.
- Keep cylinders away from any welding or other electrical circuits.
- Never drape a welding torch over a gas cylinder.
- Never allow a welding electrode to touch any cylinder.
- Never weld on a pressurized cylinder – explosion will result.
- Use only correct compressed gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
- Turn face away from valve outlet when opening cylinder valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Use the right equipment, correct procedures, and sufficient number of persons to lift and move cylinders.
- Read and follow instructions on compressed gas cylinders, associated equipment, and Compressed Gas Association (CGA) publication P-1 listed in Safety Standards.

1-3. Additional Symbols For Installation, Operation, And Maintenance

FIRE OR EXPLOSION hazard.

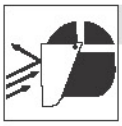
- Do not install or place unit on, over, or near combustible surfaces.
- Do not install unit near flammables.
- Do not overload building wiring – be sure power supply system is properly sized, rated, and protected to handle this unit.

FALLING EQUIPMENT can injure.

- Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift and support unit.
- If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.
- Keep equipment (cables and cords) away from moving vehicles when working from an aerial location.
- Follow the guidelines in the Applications Manual for the Revised NIOSH Lifting Equation (Publication No. 94–110) when manually lifting heavy parts or equipment.

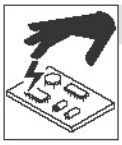
OVERUSE can cause OVERHEATING

- Allow cooling period; follow rated duty cycle.
- Reduce current or reduce duty cycle before starting to weld again.
- Do not block or filter airflow to unit.



FLYING SPARKS can injure.

- Wear a face shield to protect eyes and face.
- Shape tungsten electrode only on grinder with proper guards in a safe location wearing proper face, hand, and body protection.
- Sparks can cause fires — keep flammables away.



STATIC (ESD) can damage PC boards.

- Put on grounded wrist strap BEFORE handling boards or parts.
- Use proper static-proof bags and boxes to store, move, or ship PC boards.

MOVING PARTS can injure.

- Keep away from moving parts.
- Keep away from pinch points such as drive rolls.

WELDING WIRE can injure.

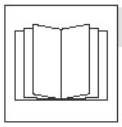
- Do not press gun trigger until instructed to do so.
- Do not point gun toward any part of the body, other people, or any metal when threading welding wire.

BATTERY EXPLOSION can injure.

- Do not use welder to charge batteries or jump start vehicles unless it has a battery charging feature designed for this purpose.

MOVING PARTS can injure.

- Keep away from moving parts such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.
- Have only qualified persons remove doors, panels, covers, or guards for maintenance and troubleshooting as necessary.
- Reinstall doors, panels, covers, or guards when maintenance is finished and before reconnecting input power.



READ INSTRUCTIONS.

- Read and follow all labels and the Owner's Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.
- Use only genuine replacement parts from the manufacturer.
- Perform maintenance and service according to the Owner's Manuals, industry standards, and national, state, and local codes.

H.F. RADIATION can cause interference.

- High-frequency (H.F.) can interfere with radio navigation, safety services, computers, and communications equipment.
- Have only qualified persons familiar with electronic equipment perform this installation.
- The user is responsible for having a qualified electrician promptly correct any interference problem resulting from the installation.
- If notified by the FCC about interference, stop using the equipment at once.
- Have the installation regularly checked and maintained.
- Keep high-frequency source doors and panels tightly shut, keep spark gaps at correct setting, and use grounding and shielding to minimize the possibility of interference.

ARC WELDING can cause interference.

- Electromagnetic energy can interfere with sensitive electronic equipment such as computers and computer-driven equipment such as robots.
- Be sure all equipment in the welding area is electromagnetically compatible.
- To reduce possible interference, keep weld cables as short as possible, close together, and down low, such as on the floor.
- Locate welding operation 100 meters from any sensitive electronic equipment.
- Be sure this welding machine is installed and grounded according to this manual.
- If interference still occurs, the user must take extra measures such as moving the welding machine, using shielded cables, using line filters, or shielding the work area.

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Preface

Congratulations on your choice of a Tokentools welding machine. Reliable and durable, Tokentools welding products are affordable to own, easy to maintain, and may help to increase your work productivity.

This user manual contains important information on the use, maintenance, and safety of your Tokentools product. The technical specifications of the device can be found at the end of the manual. Please read this manual carefully before using the equipment for the first time. For your safety and that of your working environment, pay particular attention to the safety instructions in the manual.

This manual is a living document and subject to change without prior notice therefore it is recommended to visit www.tokentools.com.au for updates when they occur.

Important notes

Items in the manual that require particular attention in order to minimise damage and personal harm are indicated with the ***'NOTE!'*** notation. Please read these sections carefully and follow their instructions.

Before First Use

Tokentools products are packed into durable packages especially designed for them. Always make sure before use that the products have not been damaged during transportation. Check also, that you have received the products ordered and read this manual completely. Product packing material is recyclable however it may be prudent to keep it for long-term storage of your product when not in use.

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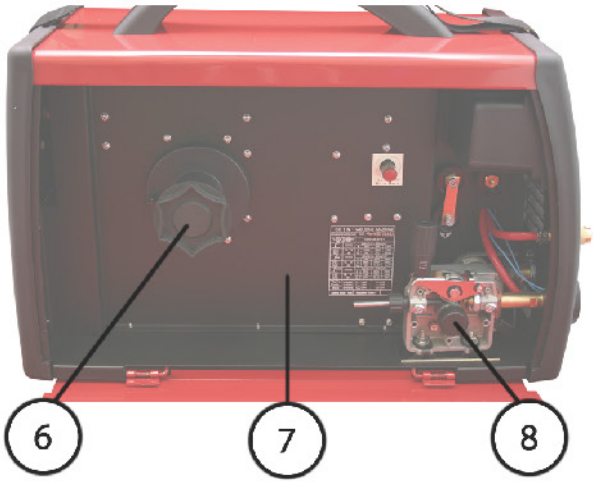
Transportation

The machine should only be transported in an upright position.

NOTE! *Always move the welding machine by the handle, never pull it by the power cord or welding torch cables. Disconnect welding & gas leads when transporting.*

Know Your Machine

Take a moment to familiarise yourself with critical the major components, these will be referred to in greater detail within the manual.



Welding Machine Parts

1. Wire Feeder Access Panel
2. Control Panel
3. Welding Cable Connections
4. Carry Handle
5. Rear Panel
6. Welding Wire Spindle
7. Wire Feeder Compartment
8. Wire Feeder


Job Clamp


MIG Welding
Torch

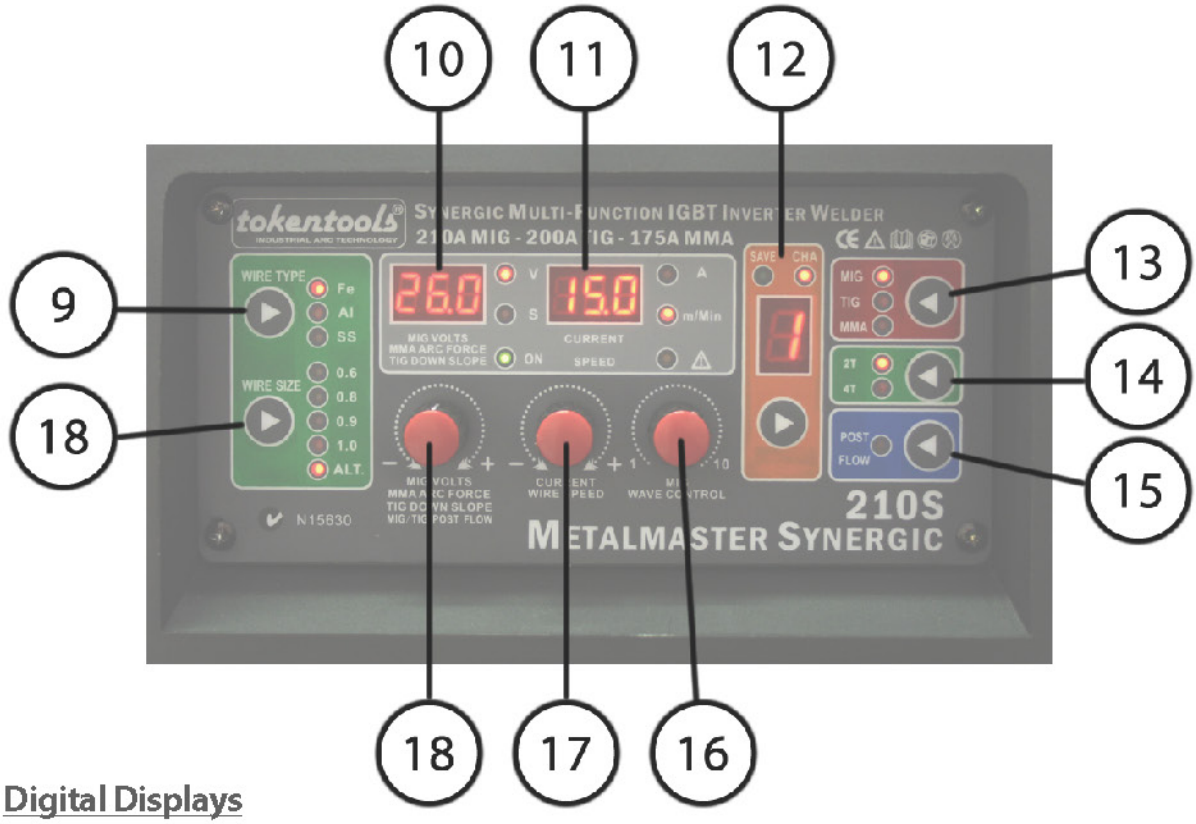

MMA / Stick
Welding
Torch


TIG Welding
Torch

Control Panel

The control panel allows the welding operator easy selection of parameters to accomplish the many welding tasks this product offers.

> ***NOTE!*** Turn knobs for x1 adjustment of parameters, push knobs in while turning for faster 10x adjustment of parameters.



Digital Displays

Display (10) shows MIG welding voltage for MIG welding operations. In MMA welding mode it will show the amount of arc force and in TIG welding mode it will show the amount of down.

Display (11) will show the wire speed or amperage. A small LED adjacent to this display will illuminate indicating to the operator which parameter is being displayed.

Display (12) indicates the current digital memory.

Welding Modes

To select a welding mode briefly push button (13) to cycle through MIG – TIG – MMA welding modes. The LED adjacent to each welding mode will cycle indicating your selection.

Trigger Latch 2T/4T

Pressing the selector button at (14) will toggle either 2T or 4T trigger modes. Each "T" represents a change in state of the welding torch trigger. When you push the torch button a change of state occurs. For example, pushing and releasing the torch button will result in 2 changes of state or 2T. Pushing / releasing then pushing / releasing will result in 4 changes of state or 4T.

The reason behind this is it will allow a welding operator to include additional welding parameters such as upslope / downslope or latch power on so that the trigger can be released for long welding runs resulting in greater operator comfort.

TIG Welding Mode - To set TIG welding downslope select 4T and then adjust downslope time by turning knob (18)

MIG Welding Mode – To enable the welding power to stay on for long runs without the need to hold the Mig torch trigger select 4T.

Welding Post Flow Gas

Pressing the selector button at (15) will allow the operator to adjust the post flow via knob (18). Post flow is the amount of time in seconds that shielding gas will continue to flow after the welding arc has ceased.

TIG Welding Mode – Used to shield the hot tungsten electrode from atmospheric oxygen until it has sufficiently cooled.

MIG Welding Mode – May be used to protect the last part of the weld bead from atmospheric oxygen until it has sufficiently cooled. Beneficial but not mandatory.

MIG Wave Control

Knob (16) is MIG Wave Control and adjusts the welding current rise time during short circuit MIG operation. The point at which the current has increased sufficiently to burn back the wire after the wire has touched the work piece "short circuited" is called the "pinch point". This is the point at which the wire will begin to once again melt and transfer. In simpler terms, the welding operator will see that the wire is sticking out more or less from the MIG nozzle before it burns away. This setting affects spatter,

penetration and bead pro-file. When changing this setting from minimum to maximum, the welding operator will observe a more aggressive arc with increased spatter and narrow bead profile. Bead profile changes will occur as well. At minimum setting the arc will be more fluid and the bead will be wider. A wide bead will result in a shallow weld, usually with an improved bead appearance and less spatter. On older style transformer machines this setting was related to inductance control and usually had a separate take off for the work piece clamp.

Current / Wire Speed

Knob (17) has a dual use and can control welding amperage or mig wire feed rate.

Mig Welding Mode – When used in standard Mig welding mode **without** Synergic control this knob will adjust the speed at which the mig wire is deposited to the weld pool. The limit is 15 metres per minute. When the welding arc exceeds 210A the welding power source will automatic slow the feed rate in order to cap the upper welding current and protect the welding machine power source.

Synergic Mig Welding Mode – When used in Synergic Mig Welding Mode this knob will adjust the amperage at which the welding operator determines the arc should occur. Wire feed is adjusted automatically based on Synergic intelligence programmed into the microprocessor on the main control board.

Tig Welding Mode – When used in TIG mode this knob controls welding current.

MMA Welding Mode – When used in MMA mode this knob controls welding current.

Volts / Arc Force / Slope / Post Flow

Knob (18) has 4 uses subject to welding mode.

Mig Welding Mode – When used in standard Mig welding mode **without** Synergic control this knob will adjust the arc voltage. The arc voltage is the distance between the tip of the welding wire and the work piece. A higher arc voltage results in a longer welding arc and an increase in welding power. Conversely a lower arc voltage results in a shorter welding arc and less power.

NOTE! The MIG welding arc is affected by the diameter of the welding wire used. At lower voltage settings a 0.9mm steel wire will produce less heat than a 0.6mm wire. Conversely a 0.6mm wire cannot provide as much heat as a 0.9mm wire as it's cross sectional area is too small to provide an adequate pathway for the welding current. Use a 0.6mm wire up to 3mm material thickness and 0.8mm/0.9mm in excess of 3mm.

MMA Welding Mode – When used in MMA welding mode this knob will adjust the arc force of the stick welding arc. Under normal arc length conditions, a Stick electrode operates at about 20 volts. However, some welding situations demand shorter arc lengths, such as when the operator has to push the rod into a tight corner or into a deep bevel of an open root joint. In these situations, Stick electrodes are prone to living up to their namesake and "sticking the rod" (e.g., the voltage drops so low that the arc extinguishes itself). Arc force control overcomes this problem by increasing current when the voltage levels drop below about 20 volts. The boost of current increases total power, keeps the weld puddle molten, prevents the rod from sticking and eliminates a lot of operator frustration

TIG Welding Mode – When used in TIG welding mode this knob will adjust the down slope of the arc in seconds. Down slope is the amount of time the arc decays or reduces from it's welding amperage setting to it's minimum state. This is useful to allow a weld pool to gradually cool and not crater with the sudden removal of heat. In order to adjust the down slope you first need to select 4T by pushing button (14).

All MIG & TIG Welding Modes – When used in both Synergic and Non Synergic Mig welding modes this knob will adjust the shielding gas post flow after first pressing the post flow button (15).

Standard MIG Welding Mode – Non Synergic

If you are an experienced welding operator you may prefer to take full control of your welding power source and use both the MIG welding volts and MIG wire speed controls manually. To select the standard MIG welding mode press button (18) repeatedly until the LED illuminates adjacent to the "ALT" setting. In alternate "ALT" mode the synergic settings are ignored, knob (18) controls MIG welding volts and knob (17) control MIG welding wire speed.

Synergic MIG Welding Mode

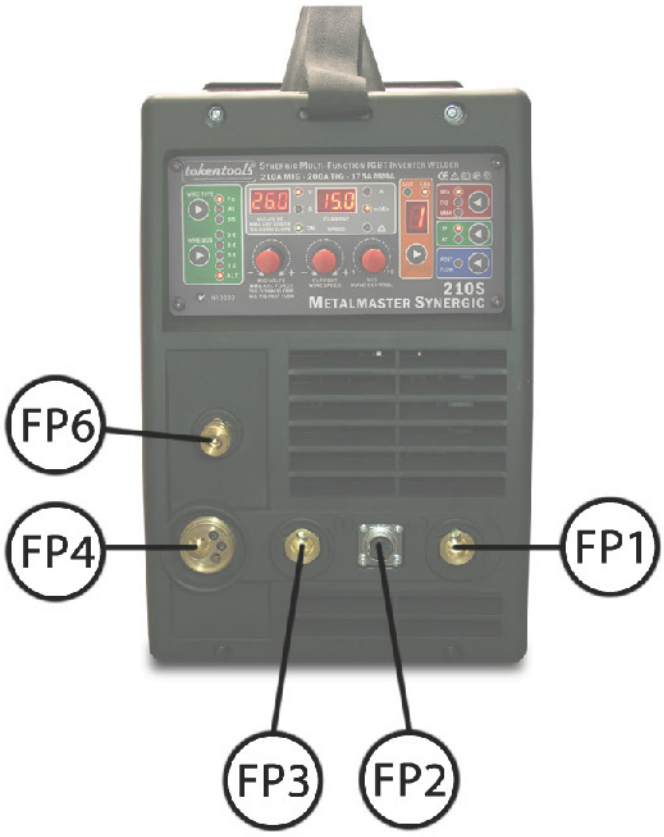
Synergic MIG welding machines provide incremental current pulses which form small droplets of similar sized molten material on the tip of the welding wire combined with the other specific relationships necessary for stable wire burn off. These droplets detach and fall into the weld pool. Incremental current pulses are unique to a given material and wire diameter and their details are programmed into the synergic welder control board. This modern Synergic MIG welder contains a variety of consumable and wire diameter combinations to aid you in fast set up of your MIG welding machine.

To enable Synergic MIG welding mode simply select the wire type that has been loaded into the wire feeder compartment (7) by pushing button (9) until the corresponding LED lights adjacent to the wire type. Then select the diameter of the welding wire by pushing button (18) until the corresponding LED lights adjacent to the welding diameter. Set required amperage by adjusting knob (17).

Using The Digital Memory

Once a welding mode has been set up it can be saved into the digital memory for easy recall at a future time. To save a memory simply press and hold the button at (12) until the green LED illuminates indicating it has been saved. Pressing the button at (12) briefly will increment the memory channel number.

Welding Cable Connections



MIG Welding
(FP1 or FP3) are used for connection of the work clamp subject to the polarity of MIG welding wire. If MIG wire is positively charged plug the work clamp into FP1. If MIG wire is negatively charged plug the work clamp into FP3.

(FP2) used for the connection of optional MIG welding spool gun.

(FP4) used for the connection of the MIG welding torch or optional MIG welding spool gun.

TIG Welding
(FP3) used for connection of the work clamp.

(FP2) used for connection of the TIG torch trigger.

(FP1) used for connection of the TIG torch power dinse connector.

(FP6) used for the connection of the TIG torch shielding gas line fitting.

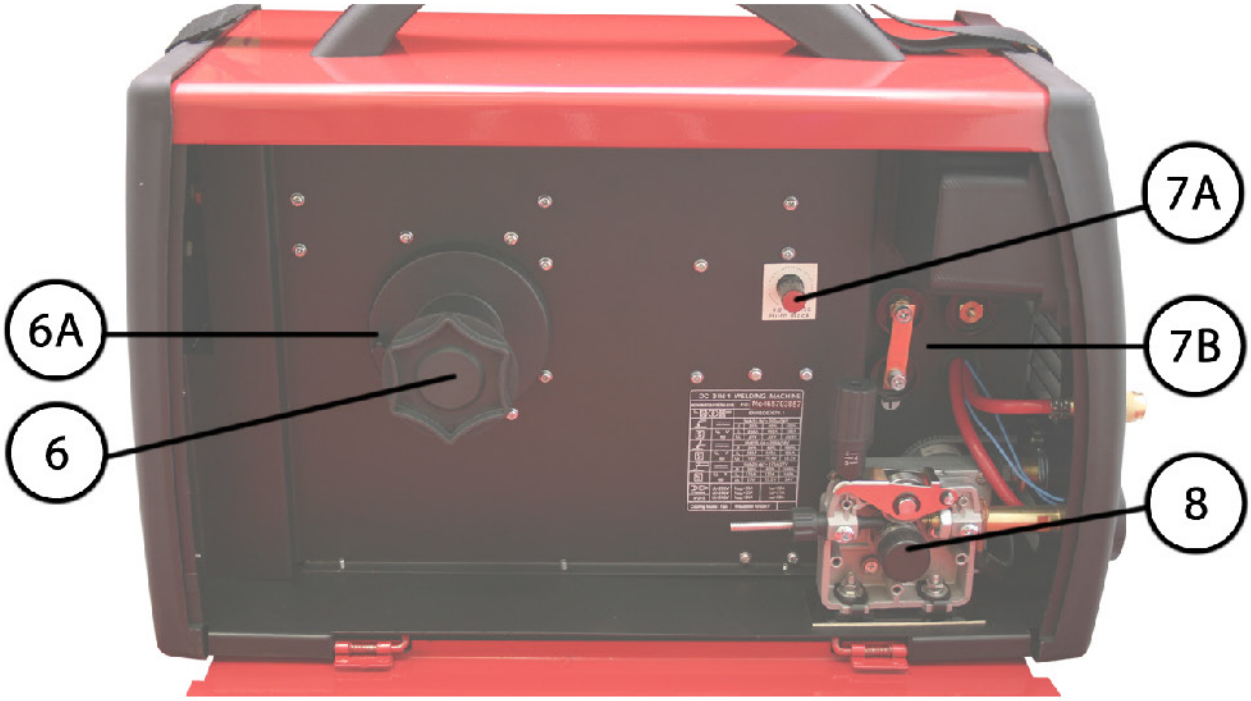
MMA Welding
(FP1) used for connection of the work clamp to the work piece.

(FP2) used for connection of the MMA or Stick welding torch

Wire Feeder Compartment

Wire Roll Spindle

The welding wire spindle (6) accepts 200mm diameter mig welding wire reels and secures them against free spinning via a locating pin at (6A). To install a roll of wire remove the cap at (6) and load the wire ensuring it can unwind in an anti-clockwise direction. Be certain to locate the plastic pin at (6A) with the corresponding mate on the wire reel. There is a brake built into the wire roll spindle that can be adjusted by tightening an Allen key bolt beneath the cap at (6).



Burn Back Control

Burn back control (7A) is used to adjust the amount of time power is applied to the MIG welding wire after the MIG welding torch trigger is released. The benefit of burning back the wire is that it prevents it from sticking in the molten weld pool should it cool too quickly. It also prevents too much wire from protruding beyond the MIG torch nozzle due to inertial feed of the wire drive motor after power is cut from it. The burn back releases the operator from trimming the MIG wire between restarts.

MIG Wire Polarity Selection

The polarity of the MIG wire can be changed by re-arranging the copper link located at (7B) in either a vertical or horizontal arrangement.

Positive MIG Wire Charge – To charge the MIG wire positively arrange the copper link in a **vertical** orientation.

Negative MIG Wire Charge – To charge the MIG wire negatively arrange the copper link in a **horizontal** orientation.

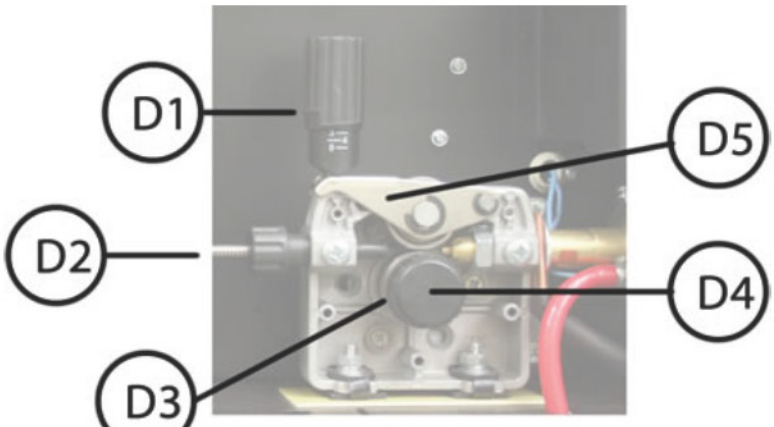
> ***NOTE!*** After changing the MIG wire polarity please ensure your job clamp is plugged into a front socket (FP1) or (FP3) with an opposite charge to the MIG wire charge. This will encourage electrons to flow in the welding circuit due to a potential difference between MIG wire and work piece.

Wire Feeder

The wire feeder (8) is used to push MIG welding wire along the MIG welding torch and to the MIG welding contact tip and into the welding arc. The wire feeder is comprised of a gear driven drive wheel with a spring loaded idler wheel above it. The MIG welding wire is sandwiched between these two rollers. A groove on the drive roller allows the MIG welding wire to stay true and also aids in friction to prevent wire slip.

Drive Roller Installation

Remove drive roller retention cap (D4) by turning anti-clockwise, loosen and then pull drive roller tensioner (D1) to the left and flip up the idler wheel arm (D5) to the open position. At this point the drive roller (D3) can be removed by sliding it out towards the welding machine operator. It may be replaced with a different roller or flipped over to use a different sized groove. All drive rollers feature two grooves of different sizes.



DRIVE ROLLER ASSEMBLY

Loading The Wire Drive With Mig Wire

Loosen the drive roller tensioner (D1) by turning anti-clockwise and pull to the left and flip up the idler wheel arm (D5) to the open position. Feed the wire into the spring guide tube (D2) and bring it across the roller followed by insertion into the brass guide tube opposite and feed a small amount of wire so that it exits the MIG torch socket on the front of the machine. Close the idler wheel arm (D5) and whilst holding it in place pull the drive roll tensioner (D1) to the right and lock it in.

Rear Panel

Rear Panel Layout

The rear panel contains the main power switch, MIG drive motor protection fuse, 240V mains powered input supply cord, shielding gas input barb, cooling fan intake vent

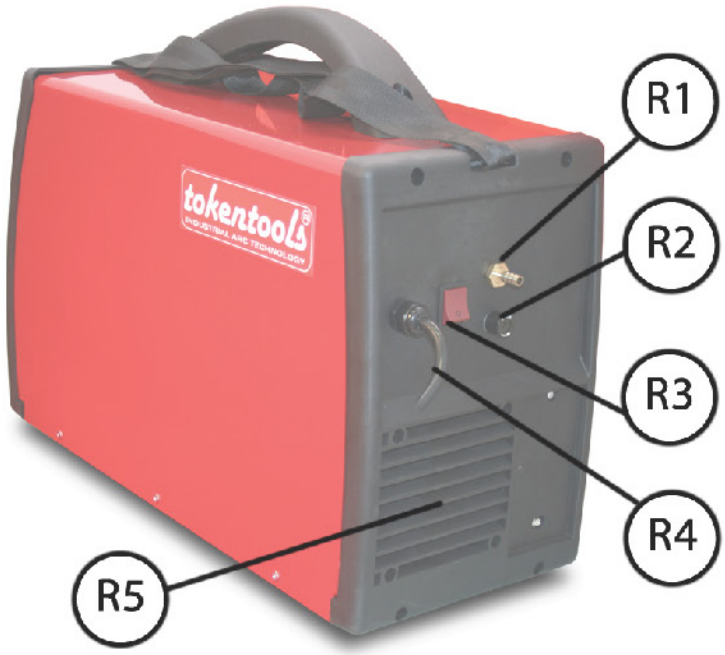
Shielding gas is supplied to the machine from the regulator via input gas barb located at (R1)

The motor protection fuse for the MIG drive roller motor is located at (R2) and is rated at 4A.

The main on / off switch is a double pole isolator and is located at (R3)

The 240V mains electrical cord is fitted with a 15A plug and is located at (R4)

The cooling fan intake vent is located at (R5)



NOTE! Ensure the cooling fan intake vent is clear to allow adequate air flow to keep the welding machine cool. Avoid ingress of debris by keeping the machine off the floor.

Welding Torches

MIG Welding Torch

The supplied MIG welding torch is 3M in length and is compatible with accessories and parts designed to fit the Binzel MB15 torch.

MIG Torch Parts

(T1) Torch Trigger

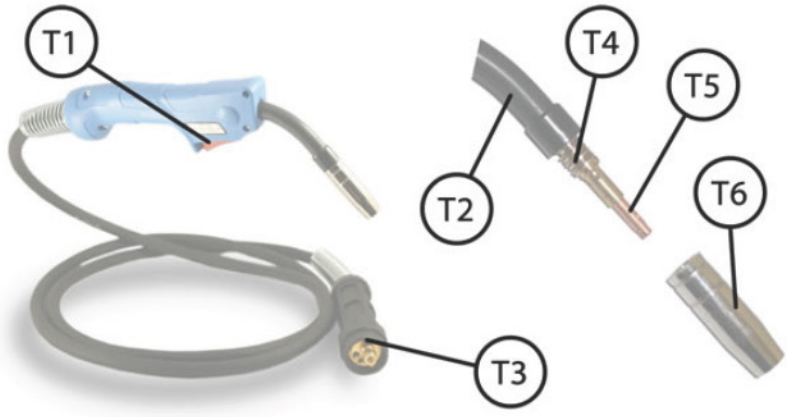
(T2) Goose Neck

(T3) Torch Euro Plug

(T4) Nozzle Spring

(T5) MIG Torch Contact Tip

(T6) MIG Torch Nozzle

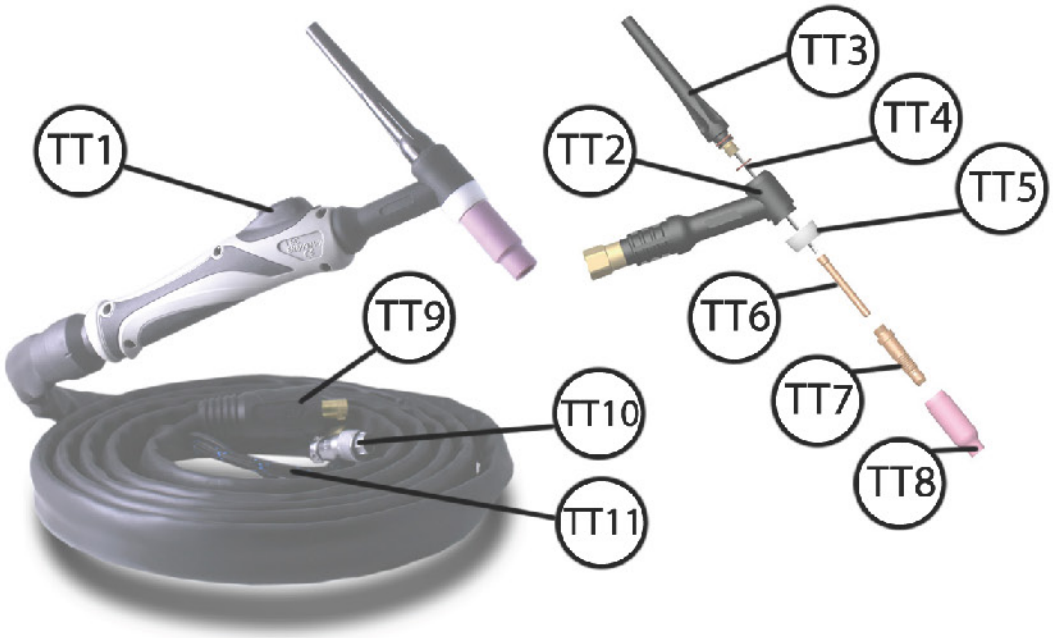


Installing The MIG Torch

Gently connect the MIG welding torch Euro plug (T3) to the Euro connector at (FP4) on the welding machine ensuring the MIG welding wire enters the torch plug. After setting up the machine for MIG welding operation you may feed the wire through the MIG welding torch until it appears from the torch end. If you have already connected the shielding gas and regulator to the machine first check the gas bottle is turned off. Unscrew and remove the mig welding contact tip from the end of the torch, activate the machine power switch on the rear panel (R3) and press the MIG welding torch trigger (T1). The wire drive assembly (8) should now start feeding the wire and after a short period the MIG welding wire will appear out of the torch end. Turn off the main power switch on the rear panel of the welder and replace the MIG torch contact tip.

TIG Welding Torch

The supplied TIG welding torch is 4M in length and is compatible with accessories and parts designed to fit the Binzel 26 torches.



NOTE! Always install the collet so that the split end points to the welding the tip of the tungsten

Assembly Of The TIG Torch

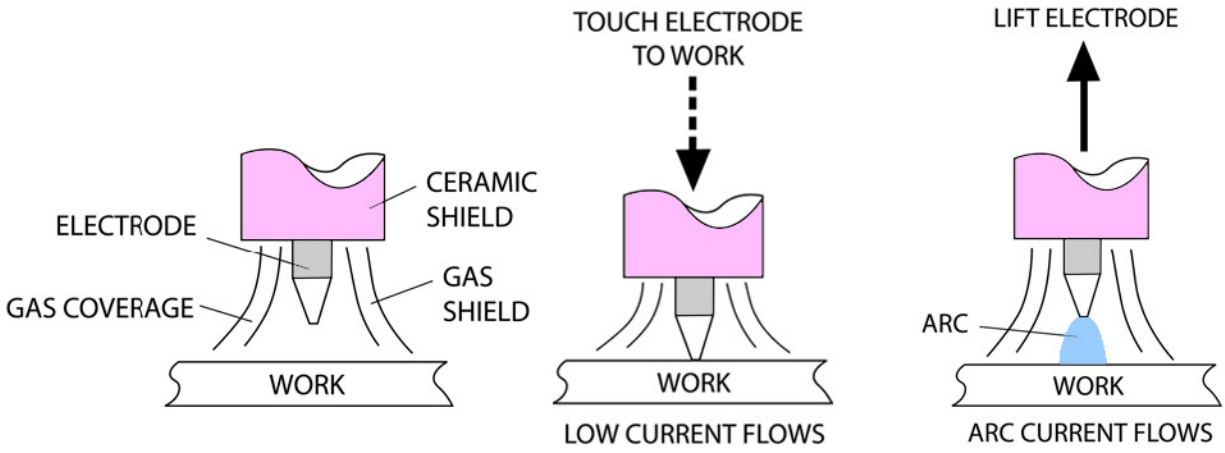
Supplied with the TIG torch is a TIG torch accessories kit. Inside you will receive a back cap (TT3), several collets (TT6), a collet body (TT7) and several ceramic nozzles (TT8). Before TIG welding may be undertaken the TIG torch will require assembly. Install the collet body into the TIG torch (TT2) head by screwing it in firmly. Install the desired ceramic nozzle onto the collet holder ensuring it presses firmly against the cup gasket insulator (TT5). Install your collet (TT6) onto the tungsten electrode (TT4) and insert both into the rear of the torch head. Install the back cap (TT3) over the tungsten and tighten gently. Allow the tungsten to slip past the ceramic nozzle approximately 3-6mm and firm up the back cap so that the pressure on the collet locks the tungsten into place.

Connecting The TIG Torch

TIG welding operations are undertaken with a negatively charged tungsten electrode, therefore the TIG torch dinse connector (TT9) must be plugged into the front panel negative socket (FP1) and the welding job clamp must be plugged into (FP3). The brass gas connector on the TIG torch (TT11) is plugged into the female gas coupling on the front panel (FP6). The TIG torch push button control connector (TT10) is connected to the 7 pin female socket on the front panel (FP2).

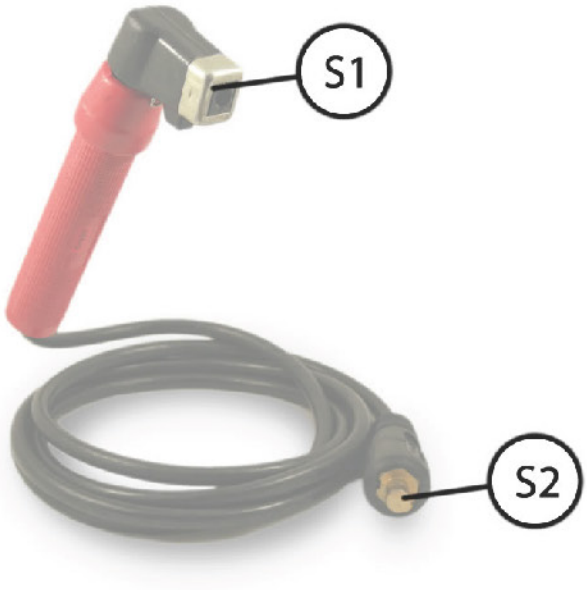
Striking A TIG Arc

In order to strike a TIG welding arc, once set up in TIG welding mode, the operator will need to press the TIG torch push button (TT1) and strike an arc using the lift arc starting procedure detailed below.



MMA Welding Torch

The MMA welding torch is used for performing stick welding operations. The Australian style stick welding torch is easy to use and durable.



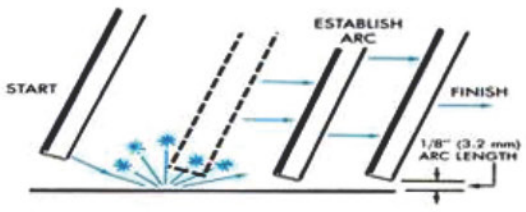
Stick Torch Connection

Insert an MMA electrode by twisting torch head (S1) anti-clockwise until the tongue lifts. Insert the electrode and lock it into place by turning the head clockwise.

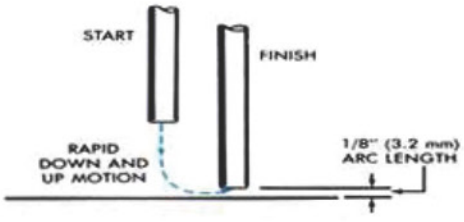
The MMA torch dinse plug (S2) must be plugged into (F3) on the front panel so that it may be positively charged.

Arc Starting Method

There are two ways to start an arc welding arc. The first way is to scratch the MMA electrode across the work piece. The second way is to tap the electrode against the work piece. Inverter welders provide excellent arc start capability due to their high open circuit voltage and DC welding current output.



Scratch



Tap

Using Shielding Gas

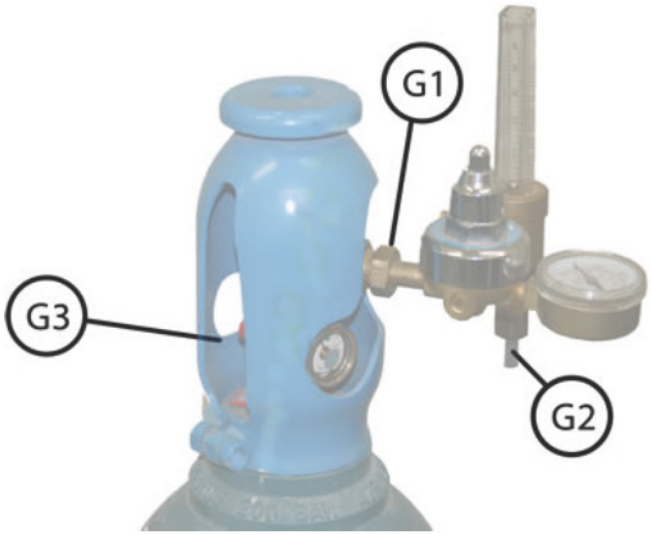
Selection Shielding Gas

Welding process	Appropriate Gas
MIG (GMAW) STEEL	80/20 Ar/CO2 or 75/25 Ar/CO2
MIG (GMAW) STAINLESS	98/2 Ar/O2
MIG (GMAW) ALUMINUM	100% Argon
DC TIG (GTAW)	100% Argon

Flow rates will depend on the type of material being welded and the type of shielding gas being used. Please reference the "Welding – Getting Started" section in this manual.

The Shielding Gas Regulator

If you have separately purchased a gas regulator you will find it enclosed within your welding machine package.



Install the shielding gas regulator to the gas bottle at (G1), use a shifter to tighten it.

Connect the shielding gas hose to the outlet barb on the gas regulator at (G2)

When ready to weld, activate the shielding gas cylinder by opening the main gas valve at (G3) and adjust your flow rate at required.

NOTE! The solenoid built into the welder will activate and deactivate shielding gas as required during TIG and MIG welding operations. At the conclusion of welding it is ***STRONGLY*** recommended to deactivate the gas supply at the main gas bottle valve (G3). Failure to do so may result in minute leakage from the solenoid which over a prolonged period of time will empty the shielding gas cylinder.

Welding – Getting Started

The welding processes and information contained within this manual are of a general nature and may be referenced when selecting a welding process to be used on this welding machine. Welding is a broad topic and welding operators are encouraged to undertake tertiary education to achieve a deeper level of technical skill & knowledge.

Torch Polarity Based On Welding Process

Welding Process	Torch	Work Piece
MIG (GMAW)	+	-
FLUX CORE (FCAW)	-	+
TIG (GTAW)	-	+
STICK (SMAW)	+	-

MIG Welding Data – Wire + Material + Gas Flow Rate

Wire Diameter	Amperage	Material Thickness	Gas Flow Rate
0.6 mm	25-110	0.75 mm - 1.60 mm	7-10 Litres / Per Minute
0.8 mm	45-200	1.30 mm - 4.00 mm	10-14 Litres / Per Minute
0.9 mm	55-230	1.60 mm - 3.50 mm	10-16 Litres / Per Minute
1.0 mm	65-270	2.00 mm - 6.00 mm+	15+ Litres / Per Minute
1.2 mm	85-380	6.00 mm – 10.00 mm+	18+ Litres / Per Minute

Mig Volts Vs Welding Amps Vs Wire Speed

When welding in non Synergic MIG mode, please use the table below to reference the MIG welding volts required. You will need to adjust wire speed manually until your welding arc is stable with a sound described as crackling. At low MIG welding volts the welding operator will need to use a lower wire feed rate. When welding at higher voltages the welding operator will need to use a faster wire feed rate. A few test welds performed on some off cuts of the material to be welded is the best way to set up. Wire diameter affects wire feed rate so for thin wires it is best to increase it a little.

Desired Welding Amperage	MIG Welding Volts	Wire Speed Metres / Minute
30A – 70A	15.5V – 17.5V	0.1 – 3.0
70A – 110A	17.5V – 19.5V	3.0 – 6.0
110A – 150A	19.5V – 21.5V	6.0 – 9.0
150A – 190A	21.5V – 23.5V	9.0 – 12.0
190A – 230A	23.5V – 25.5V	12.0 – 15.0

DC TIG Welding Data

Tungsten	Amperage	Material Thickness	Gas Flow Rate
1.6 mm	5 – 120A	0.20 mm – 4.50 mm	7-12 Litres / Per Minute
2.4 mm	120 – 200A	4.50 mm – 8.00 mm	12-20 Litres / Per Minute

DC MMA Welding Data

MMA Rod	Amperage	Material Thickness
1.5 mm	20 – 50A	1.00 mm – 3.00 mm
2.0 mm	40 – 90A	2.50 mm – 4.00 mm
3.2 mm	75 – 125A	3.00 mm – 6.00 mm
4.0 mm	125 – 160A	4.50 mm – 7.00 mm
5.8 mm	140 – 210A	6.50 mm – 8.00 mm

MIG Welding

Overview

The MIG welding machine uses a DC Constant Voltage (CV) power supply (different from that of an arc welder), connected to a wire feeder, which holds a spool of the type of wire needed to do the job. The feeder will push the wire down MIG torch. This is done by feeding the wire through a set of rollers driven by an electric motor. A suitable gas mixture is also supplied via the MIG torch to the shielding gas nozzle at the end. Different gases are used for different types of wire. Basically, the MIG process uses a gas or gas mixture to displace the air around the arc that is being formed between the wire being used and the base metal. The electrode is still being melted with an electric arc, but in the case of MIG it is a special wire which is mechanically fed into the arc. The feed rate is adjusted depending on the thickness of the material being welded. The voltage of the electric power source is also adjusted depending on the material thickness being welded.

Direction Of Travel & Welding Angle

When MIG/MAG welding the direction of travel is based upon operator preference. Travel using the push method will result in a weld that is wider, flatter and has less penetration and better appearance than the drag method. (Fig. 1.) The dragging method will result in a narrower, higher crown and a deeper penetrating weld. (Fig. 1.) The angle to the direction of travel should be 10 - 15 degrees (Fig. 1.) If a fillet joint is being welded the hand piece should be a 45 degree to each plate. (Fig. 2.) In the down hand position (flat) the hand piece should be 90 degrees to the flat joint. (Fig. 3.)

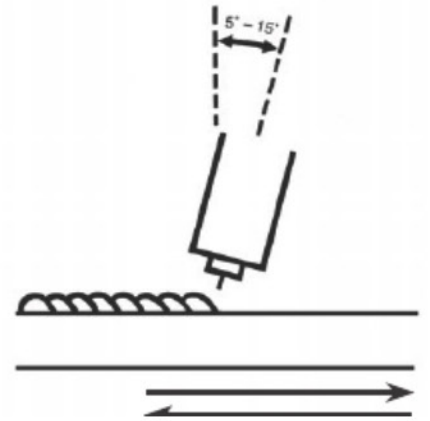


Fig. 1. Direction of Travel

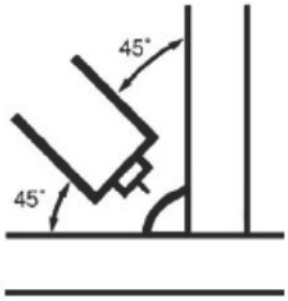


Fig. 2. Fillet Angle

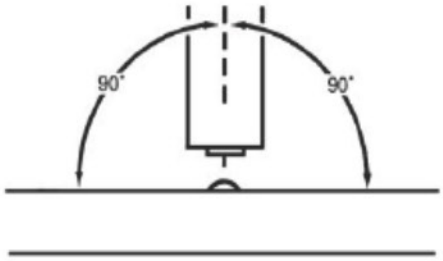


Fig. 3. Work Angle - Flat Position (front view)

Stick Out

Stick out is the distance of the contact tip to the work piece. Changing the stick out will change the resistance that is present between the contact tip and the work piece. (Fig. 10.)

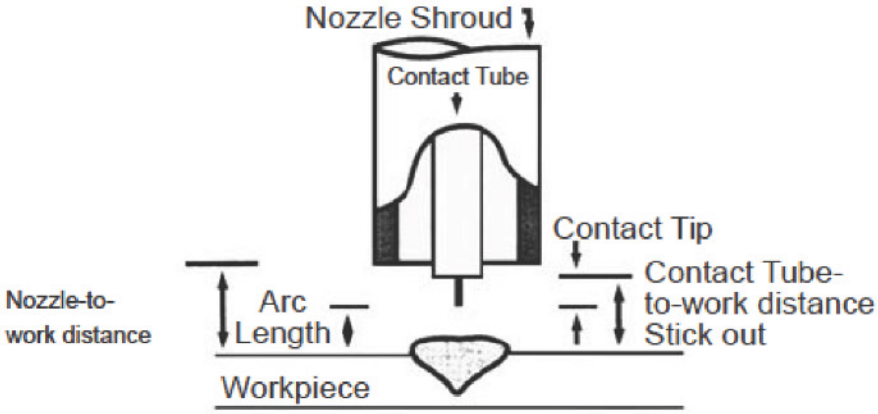


Fig. 10

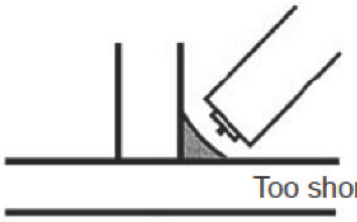


Fig. 11

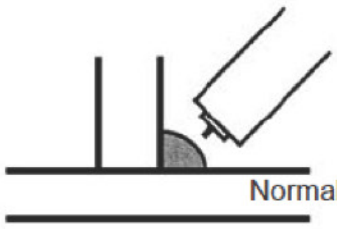


Fig. 12

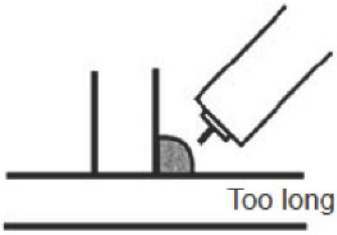


Fig. 13

Increasing the stick out will increase the resistance and both the voltage and amperage will be lessened. This will lessen penetration and the weld will achieve less heat.

Once the stick out becomes too long a poor weld can result caused by a shallow penetration and possible lack of fusion between the weld metal and the base metal.

A short stick out can help give a good start but can make the weld profile becoming concave, thus making a lower strength weld. (Fig. 11.)

MIG Welding Short Circuit Transfer

Short circuiting transfer is a method of metal transfer in which metal is deposited only when the wire actually touches the work piece. Metal is not transferred across an open arc. The short circuit transfer has a lower current than other methods of metal transfer (spray and globular). This means lower heat input and therefore more suitable for welding thinner materials. It is also suitable for welding out-of-position.

The principle of dip transfer can be further explained as follows. On touching the work piece a short circuit is formed back through to the power source *(a)*. Welding current will flow, thus heating up the wire electrode, this will cause the wire electrode to pinch (b), the wire will separate (c) and a little of the electrode wire is left in the weld puddle (d). The heat of the arc then flattens out the molten pool (e), the wire feed will overcome the heat of the welding arc and come down, touch the work piece and the cycle starts all over again. The sound that is produced from short circuit transfer should be smooth and consistent and have a sound very much like frying bacon.

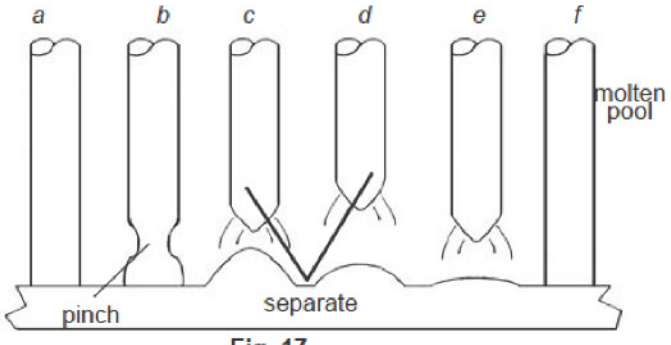


Fig. 17

MIG Welding Globular Transfer

The globular method of metal transfer is formed when the voltage is increased over the short circuitry method. As the voltage is increased an arc length is formed (a gap between the end of the wire electrode and the work piece). The voltage fits into the area between short circuitry transfer and spray transfer.

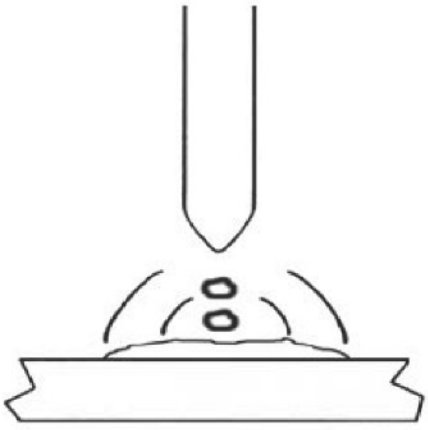


Fig. 18

The globular method of metal transfer is very rarely used as the metal droplets travelling across the arc are unstable and can be described as wobbly. The resulting weld has a lot of spatter and the welding is not pretty, as the weld pool is unstable because of the bad metal transfer across the welding arc. Globular transfer has poor weld appearance and cannot be used out of position.

MIG Welding Spray Transfer

The spray method of metal transfer occurs when the voltage is increased over both the short circuiting method and the globular method. As the voltage is increased a good arc length should form and the metal droplets should become uniform in shape as they cross the arc in a consistent manner. Once the correct setting for the spray transfer mode is found the arc sound will become smooth.

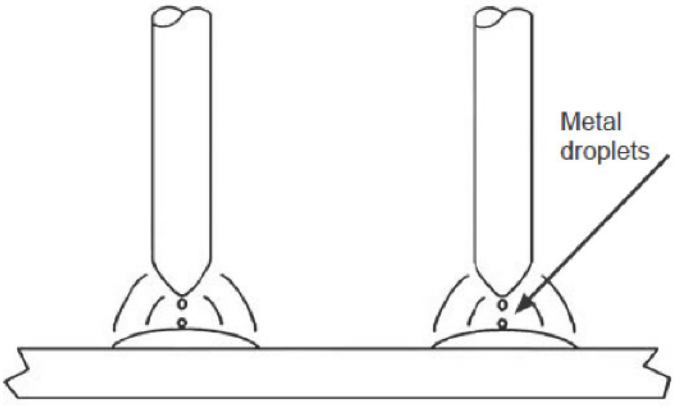


Fig. 19

To obtain a good spray mode, welding shielding gases containing a blend of argon are used. (Please see your gas supplier for their correct mixture.) The spray method of metal transfer can be used with most of the common welding wire electrodes (e.g. mild steel, aluminium, stainless steel).

The advantages of metal spray transfer are

- High deposition rates
- Good travel speeds
- Good looking weld appearance
- Little weld spatter
- Good weld fusion
- Very good on heavy sections

The disadvantages of the spray mode are

- Higher capacity power source needed
- Weld position is limited to flat and horizontal fillet
- The cost of using a more expensive mixed gas
- Higher radiated heat is produced so extra protection is needed

TIG Welding

Overview

TIG welding is a process that uses a constant current (CC) power source, a shielding gas and a TIG torch fitted with a tungsten electrode. An electric arc is formed between the tungsten electrode and the work piece. The tungsten and the welding zone is protected from the surrounding air by a gas shield comprised of inert gas. The electric arc can produce temperatures in excess of 8000 Degrees celcius and this heat can be very focused and localized to a very small weld pool area. The weld pool can be used to join the base metal with or without additional filler material.

Selecting A Gas Nozzle

The diameter of a TIG welding alumina cup exit port (diameter closest to the arc where the shielding gas exits) is available in a variety of sizes. The exit port diameter for any alumina cup is specified with a number that represents the diameter in 1.6 mm increments or 1/16ths of an inch. A number 5 cup is therefore 5/16ths of an inch or 8 mm in diameter. A number 6 cup is 6/16ths of an inch or 9.6 mm in diameter and so on.

TIG welding alumina cups are also available in various lengths from short nozzles to extra-long nozzles and widths to accommodate collet bodies or gas lenses.

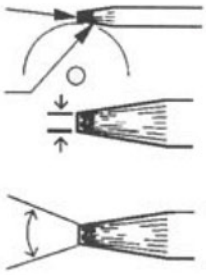
Alumina cups are the most commonly used gas nozzles in TIG Welding. Alumina cups are made from alumina oxide which has a very high melting point. The diameter for any nozzle must be large enough to allow the entire weld area to be covered by the shielding gas. The exit diameter can be neither too large nor too small, or poor shield gas coverage will result.

Using The Right Tungsten

The output current within this TIG welder is DC only therefore suitable tungsten electrodes include, pure tungsten, or alloyed tungstens such as thoriated 2%, ceriated 2% or lanthanated 2%. Suitable tungsten diameters for this machine are 1.6mm and 2.4mm in either 175mm or 150mm lengths.

Sharpening The Tungsten

Tungsten must be sharpened along it's long axis so that any scratches left on the surface will run toward the tip.



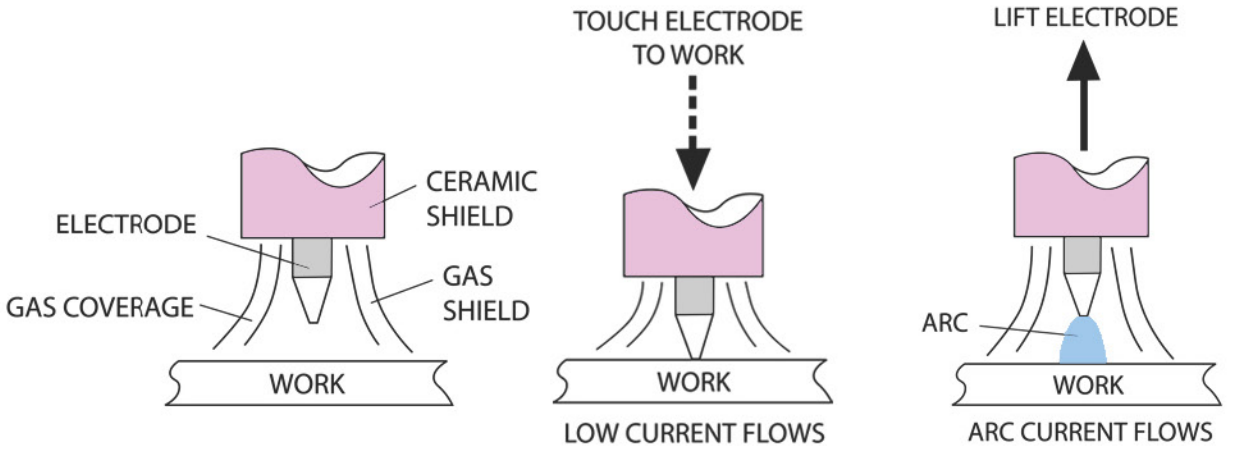
Shape by grinding longitudinally (never radially). Remove the sharp point to leave a truncated point with a flat spot. Diameter of flat spot determines amperage capacity.

The included angle determines weld bead shape and size. Generally, as the included angle increases, penetration increases and bead width decreases.

Use a medium (60 grit or finer) aluminium oxide wheel.

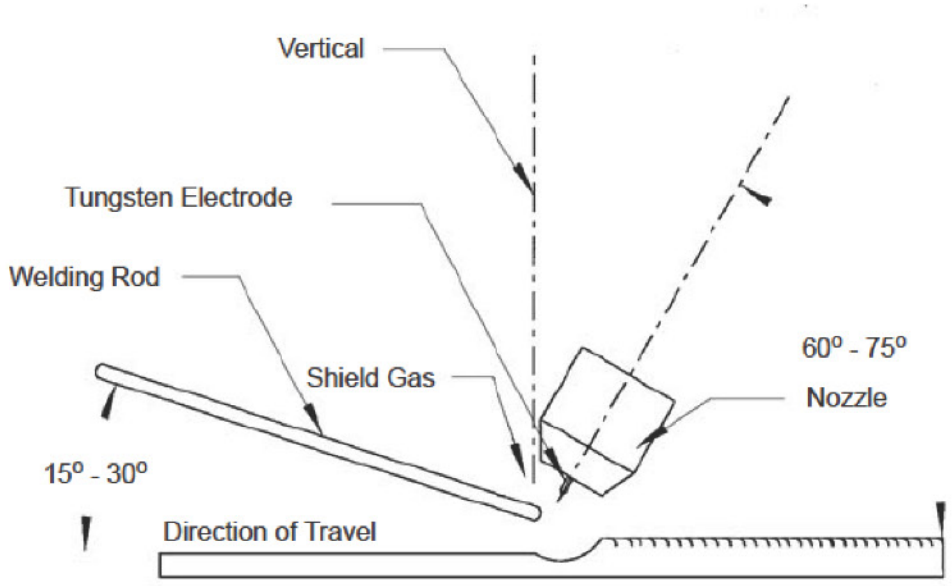
Striking A TIG Arc

In order to strike a TIG welding arc, once set up in TIG welding mode, the operator will need to press the TIG torch push button (TT1) and strike an arc using the lift arc starting procedure detailed below.



Correct TIG Torch & Filler Rod Position

The suggested electrode and welding rod angles for welding a bead on plate are indicated in the image below. The same angles are used when making a butt weld. The torch is held 60o -75o from the material surface. This is the same as holding the torch 15o - 30o from the vertical. Take special note that the rod is in the shielding gas during the welding process.



MMA (Stick) Welding

Overview

Manual Metal Arc (MMA) is commonly known as Stick Welding and is really a melting and casting process in miniature. The various components of the welding process (base metal, weld metal slag, etc.) form the crucible and contents of a tiny electric furnace.

The electric arc, with a temperature of at least 6,000 Degrees Celsius is a concentrated and efficient source of heat. This heat is utilised in the metal arc welding process by employing a flux-coated electrode to provide filler metal.

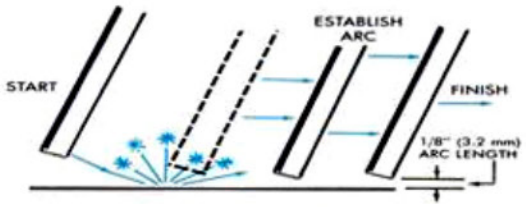
The electrode and parent metal act as poles of the arc, the core wire of the electrode melting and being transferred across the arc to coalesce with the molten parent metal and form a bond which in most cases, is stronger than the parent metal. The flux covering melts more slowly than the core wire and a cup is formed at the electrode tip which assists in directing the molten droplets to the required spot.

The weld metal itself, as deposited, has a cast structure, its composition is determined by the core wire and coating of the electrode, and by the amount of pick-up of parent metal during welding. For example, a deposit of alloy steel, say, stainless steel on mild steel, no longer has just the properties expected of that alloy, due to dilution with the parent metal. This effect, in many cases, is not important, but, if desired, it may be eliminated by using multi-layer welds.

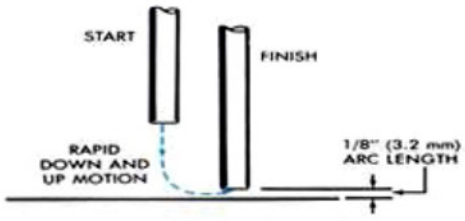
Welding on materials that have been strengthened by heat-treatment or cold-working generally creates a zone of lower strength along the weld boundary. This may not affect the serviceability of the welded joint, but sometimes it is necessary to restore this strength by further heat-treatment or cold-work.

Arc Starting Method

There are two ways to start an arc welding arc. The first way is to scratch the MMA electrode across the work piece. The second way is to tap the electrode against the work piece. Inverter welders provide excellent arc start capability due to their high open circuit voltage and DC welding current output.



Scratch



Tap

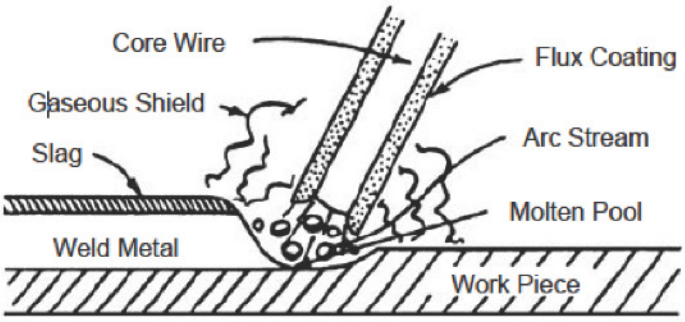
ARC Blow

Arc blow is peculiar to DC MMA welding. The welding arc, instead of playing steadily on one spot, is deflected away from the point of welding due to the influence of surrounding magnetic fields created by welding currents flowing in the work. To overcome such a situation try repositioning the welding job clamp to another part of the work piece.

Running Beads

If you have not yet done any welding, the simplest way to commence is to run beads on a piece of scrap plate. Use mild steel plate about 12 mm thick and a 4.0 mm electrode. Clean any paint, loose scale or grease off the plate and set it firmly on the work bench so that welding can be carried out in the down hand position. Make sure that the earth clamp is making good electrical contact with the work, either directly or through the work table. For light gauge material, always clamp the earth lead directly to the job, otherwise a poor circuit will probably result.

It is important to understand how the MMA process works and practice on scrap material so that you may quickly gain the skills required to produce strong penetrating welds with excellent bead appearance.



MMA Welding Current

Suitable amperages for the various sizes of electrodes are usually printed on the packets. These amperages may be varied to suit conditions — welds on thin plate require low amperages to prevent burn-through, while high welding rates or deep penetration of the weld metal require higher amperages. For 4.0 mm rods set the machine at about 160 Amps.

There are several effects produced by incorrect amperage setting. If it is too high, spatter becomes excessive, and the weld pool becomes very hot, producing a flattened bead with elongated ripple marks, and the electrode overheats.

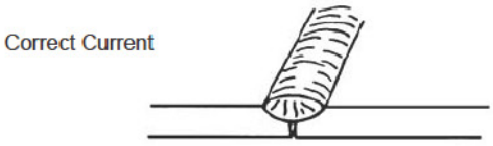


Fig. 3

Fig. 4

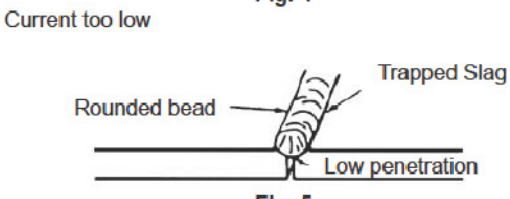


Fig. 5

If the current is too low, it is difficult to maintain the arc and prevent the electrode from sticking, the bead is high and rounded, with poor edge fusion, and penetration is slight. Figures 3, 4 and 5 show the effects of different amperages.

Welding Machine Specification

Brand:

- ☑ Tokentools
- ☑ Registered Australian Trademark - YES

Power Requirement:

- ☑ 1 x 240 Volt 15 Amp Supply - Single Phase

Welding Process:

- ☑ DC Tig Welding – Lift Arc Start
- ☑ DC MMA Welding
- ☑ MIG Welding

At A Glance :

- ☑ 2T / 4T Trigger Latching
- ☑ Welds Aluminium in MIG mode only
- ☑ Welds Stainless Steel in MIG or TIG modes
- ☑ Welds Other Metals Excluding Aluminium in TIG mode
- ☑ Welds Other Metals Including Aluminium in MIG mode
- ☑ Arc Force
- ☑ Post Flow Shielding Gas Timer
- ☑ Preset Amps Control / Display

Inverter Type:

- ☑ IGBT - Siemens / Infineon Power Transistors

Dimensions and weight:

- ☑ L57cm x W23cm x H37cm
- ☑ Weight - 26 Kilograms

Supported Spools:

- ☑ 200 mm Spool (also known as 5 kilo for steel wire)
- ☑ 300 mm Spool (also known as 15 kilo for steel wire) ** NOTE ** 300mm Spools can ONLY be used in conjunction with a Tokentools remote wire feeder available as an optional accessory.

Synergic Welder Functionality:

- ☑ Synergic Welder
- ☑ Synergic Override - Allows normal MIG welding

Mig Welding Amps Range:

- ☑ 20 to 210 Amps

Mig Welding Voltage Range:

- ☑ 15 to 26 Volts DC
- ☑ Adjustable in 0.1V increments (For faster adjustment, push adjuster knob while turning to increase adjustment to 1V increments)

Gas & Gasless Use:

- ☑ Yes - Adjustable Polarity
- ☑ +ve electrode for gas and aluminium
- ☑ -ve electrode for gasless wires

Mig Wire Feed Rate:

- ☑ 0.1 to 12 Metres Per Minute

Burnback:

- ☑ Yes
- ☑ Up to 0.5 Seconds via potentiometer

Wire Drive Rollers:

- ☑ 0.6mm / 0.8mm V Groove x 30mm Diameter - Optional
- ☑ 0.8mm / 1.0mm V Groove x 30mm Diameter - Included
- ☑ 1.0mm / 1.2mm U Groove x 30mm Diameter - Optional

TIG Arc Ignition:

- ☑ Lift Arc

Gas Control:

- ☑ Electric Solenoid activates when torch trigger is pressed
- ☑ Post flow - 1 to 5 seconds Tig Welding Amps Range:
- ☑ DC Amps 20 to 200

Tig Welding Waveform:

☑ DC

Remote Amps Control Capable:

☑ No

Crater Current:

☑ Available by selecting 4T mode
☑ Start Crater - Fixed @ 10 Amps DC
☑ Finish Crater - Fixed @ 10 Amps DC

MMA Welding Amps Range:

☑ 20 to 175 Amps

MMA Current Waveform:

☑ DC

Mig Welding Duty Cycles:

☑ 130 Amps @ 100% Duty
☑ 160 Amps @ 60% Duty
☑ 200 Amps @ 35% Duty

Tig Welding Duty Cycles:

☑ 130 Amps @ 100% Duty
☑ 160 Amps @ 60% Duty
☑ 200 Amps @ 35% Duty

MMA Welding Duty Cycles:

- ☑ 100 Amps @ 100% Duty
- ☑ 130 Amps @ 60% Duty
- ☑ 175 Amps @ 35% Duty

What is in the box?

All items listed are included in the standard package:

- ☑ 1 x Metalmaster 210S Inverter Synergic MTS Welding Power Supply
- ☑ 1 x 3 Metre MB15-AK Binzel Mig Torch
- ☑ 1 x 4 Metre Binzel Compatible 26 Series Ergonomic Tig Torch
- ☑ 1 x 3 Meter MMA Twist Lock Torch and Cable
- ☑ 1 x 3 Meter Job Clamp and Cable
- ☑ 1 x Reinforced gas Line
- ☑ 1 x Mig Accessory Kit (Tip spanner + 2 spare tips)
- ☑ 1 x Tig Torch Accessory Kit
- ☑ 1 x Instruction Manual