CUTTING EDGE WELDING

USER'S MANUAL

TIG/MMA dual function
IGBT inverter technology
AC/DC welding power source

TIG 2400 AC/DC PFC

QUICKSILVER

Introduction

First of all, thank you for choosing an IWELD welding or cutting machine!

Our mission is to support your work with the most up-to-date and reliable tools both for DIY and industrial application.

We develop and manufacture our tools and machines in this spirit.

All of our welding and cutting machines are based on advanced inverter technology, reducing the weight and dimensions of the main transformer.

Compared to traditional transformer welding machines the efficiency is increased by more than 30%.

As a result of the technology used and the use of quality parts, our welding and cutting machines are characterized by stable operation, impressive performance, energy efficient and environmentally friendly operation.

By activating the microprocessor control and welding support functions, it continuously helps maintain the optimum character of welding or cutting.

Read and use the manual instructions before using the machine please!

The user's manual describes the possible sources of danger during welding, includes technical parameters, functions, and provides support for handling and adjustment but keep in mind it doesn't contain the welding knowledge!

If the user's manual doesn't provide you with sufficient information, contact your distributor for more information!

In the event of any defect or other warranty event, please observe the „General Warranty Terms".

The user manual and related documents are also available on our website at the product data sheet.

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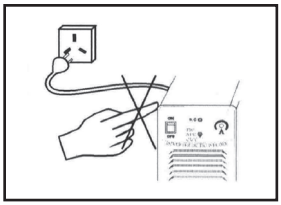
1. WARNING!

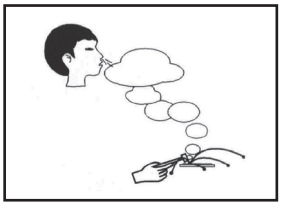
Welding is a dangerous process! The operator and other persons in the working area must follow the safety instructions and are obliged to wear proper Personal Protection Items. Always follow the local safety regulations! Please read and understand this instruction manual carefully before the installation and operation!

- The switching of the machine under operation can damage the equipment.
- After welding always disconnect the electrode holder cable from the equipment.
- Always connect the machine to a protected and safe electric network!
- Welding tools and cables used with must be perfect.
- Operator must be qualified!



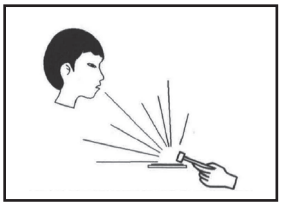
ELECTRIC SHOCK: may be fatal

- Connect the earth cable according to standard regulation.
- Avoid bare hand contact with all live components of the welding circuit, electrodes and wires. It is necessary for the operator to wear dry welding gloves while he performs the welding tasks.
- The operator should keep the working piece insulated from himself/herself.



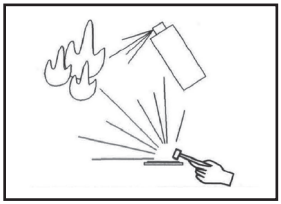
Smoke and gas generated while welding or cutting can be harmful to health.

- Avoid breathing the welding smoke and gases!
- Always keep the working area good ventilated!



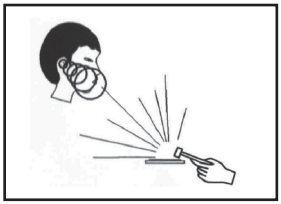
Arc light-emission is harmful to eyes and skin.

- Wear proper welding helmet, anti-radiation glass and work clothes while the welding operation is performed!
- Measures also should be taken to protect others in the working area.



FIRE HAZARD

- The welding spatter may cause fire, thus remove flammable materials from the working area.
- Have a fire extinguisher nearby in your reach!

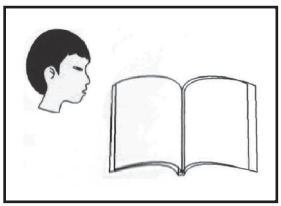


Noise can be harmful for your hearing

- Surface noise generated by welding can be disturbing and harmful. Protect your ears if needed!

Malfunctions

- Check this manual first for FAQs.
- Contact your local dealer or supplier for further advice.



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PRECAUTIONS TO ELECTROMAGNETIC COMPATIBILITY

1 General

Welding may cause electromagnetic interference.

The interference emission of arc welding equipment can be minimized by adopting proper installation method and correct use method.

The products described in this manual belong to the limit of class A equipment (applies to all occasions except the residential areas powered by public low-voltage power system).

Warning: Class A equipment does not apply to the residential areas powered by public low-voltage power system. Because the electromagnetic compatibility cannot be guaranteed in these areas owing to conducted and radiated disturbances.

2 Environmental assessment suggestions

Before installing the arc welding equipment, user shall assess the potential electromagnetic disturbance problems in the surrounding environment. The following matters shall be considered:

- Whether there are other service cables, control cables, signal and telephone wires, etc. above, under or around the welding equipment;
- Whether there are radio and television transmitting and receiving devices;
- Whether there are computers and other control equipment;
- Whether there are high-security level equipment, such as industrial protective equipment;
- Consider the health of staff at the site, for example, where there are workers wearing hearing aid or pacemaker;
- Whether there are equipment used for calibration or inspection;
- Pay attention to the noise immunity of other equipment around. The user should ensure that the equipment is compatible with the surrounding equipment, which may require extra protective measures;
- Time for welding or other activities;

The range of environment shall be determined according to the building structure and other possible activities, which may exceed the boundary of building.

3 Methods to reduce emission

- Public power supply system

The arc welding equipment shall be connected to the public power supply system according to the method recommended by the manufacturer. If there is interference, additional preventive measures shall be taken, such as access with filter in the public power supply system. For fixed arc welding equipment, the service cables shall be shielded by metal pipe or other equivalent methods. However, the shield shall ensure electrical continuity and shall be connected with the case of welding source to ensure the good electrical contact between them.

- Maintenance of arc welding equipment

The arc welding equipment must be regularly maintained according to the method recommended by the manufacturer. When the welding equipment is running, all entrances, auxiliary doors and cover plates shall be closed and properly tightened. The arc welding equipment shall not be modified in any form, unless the change and adjustment are permitted in the manual. Particularly, the spark gap of arc striker and arc stabilizer shall be adjusted and maintained according to the manufacturer's suggestions.

- Welding cable

The welding cable shall be as short as possible and close to each other and to the ground line.

- Equipotential bonding

Pay attention to the bonding of all metal objects in surrounding environment. The overlapping of metal object and workpiece can increase the risk of work, as operators may suffer from electric shock when touch the metal object and electrode simultaneously. Operators shall be insulated from all these metal objects.

- Grounding of the workpiece

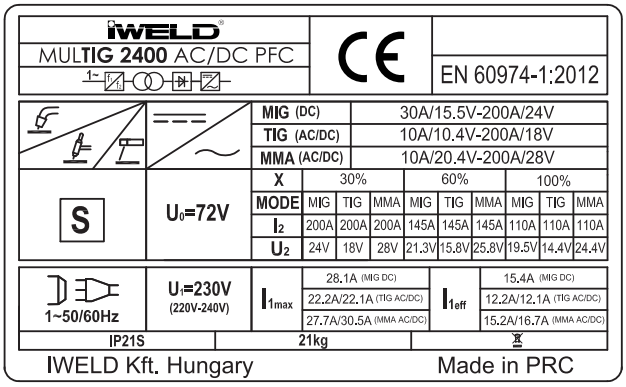
For electrical safety or workpiece location, size and other reasons, the workpiece may not be grounded, such as the hull or structural steelwork. Grounding of workpieces sometimes can reduce the emission, but it is not always the case. So be sure to prevent the increasing risk of electric shock or damage of other electrical equipment caused by grounded workpieces. When necessary, the workpiece should be directly connected with the ground. But direct grounding is forbidden in some countries. In such case, use appropriate capacitor in accordance with regulations of the country.

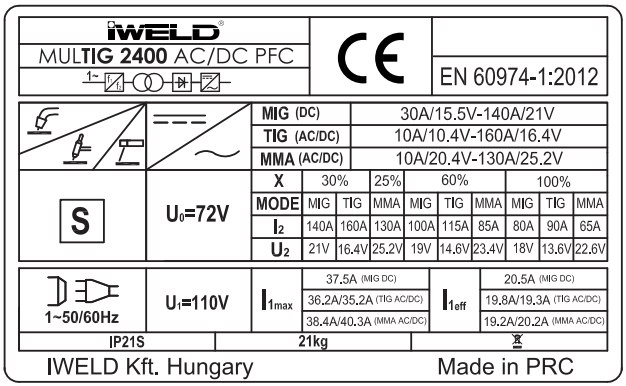
- Shielding

Selectively shield the surrounding equipment and other cables to reduce the electromagnetic interference. For special applications, the whole welding area can be shielded.

2. The Main Parameters

		QUICK**SILVER**	MU**LTIG 2400** AC/DC PFC
		Art. Nr.	800MLTG2400PFC
FUNCTIONS	GENERAL	Inverter type	IGBT
		Water Cooling Unit	Op.
		Arc Ignition	HF/ LT
		Number of programs	10
		Wireless Remote Control	✕
		Remote Control from TIG Torch	✓
		LCD	✓
		PFC	✓
	AWI	AC AWI	✓
		AC PULSE AWI	✓
		DC AWI	✓
		DC PULSE AWI	✓
		2T/4T	✓
		Number of Waveforms	3
	MIG	Synergic Control	✓
		FCAW	✓
		2T/4T	✓
		Number of Wire Feeder Rols	2
	MMA	AC MMA	✓
		DC MMA	✓
		Adjustable Arc Force	✓
		Adjustable Hot Start	✓





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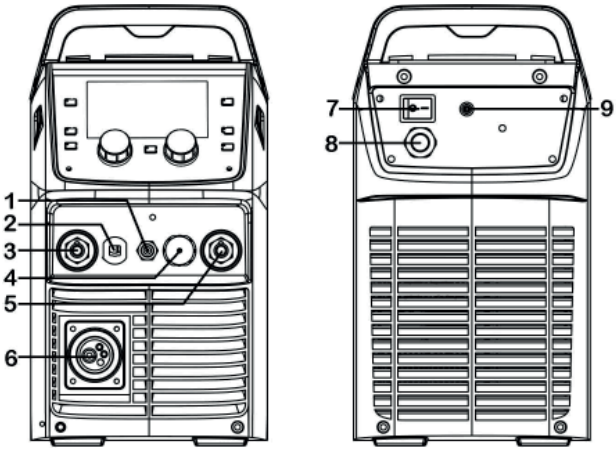
3 Panel Functions & Descriptions

3.1 Machine Layout Description

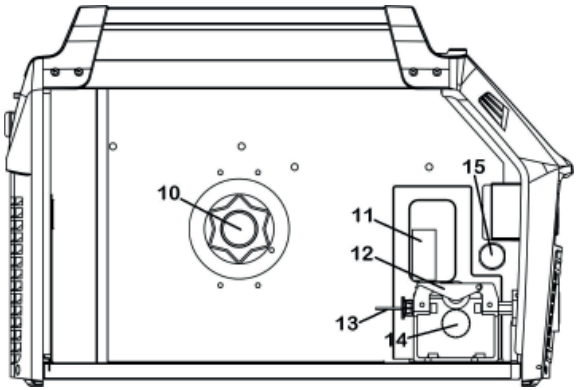
Front and rear panel layout of welding machine

1. TIG torch gas connector.
2. Polarity change power connection.
3. Positive (+) welding power output connection socket.
4. 12 core air socket for TIG.
5. Negative (-) welding power output connection socket.
6. MIG torch euro connector.
7. Power switch.
8. Input power cable.
9. Gas inlet connector.



Wire Feeder of welding machine

10. Spool holder.
11. Wire feed tension adjustment.
12. Wire feed tension arm.
13. Wire feeder inlet guide.
14. Wire drive roller.
15. 9 core air socket for Spool Gun.



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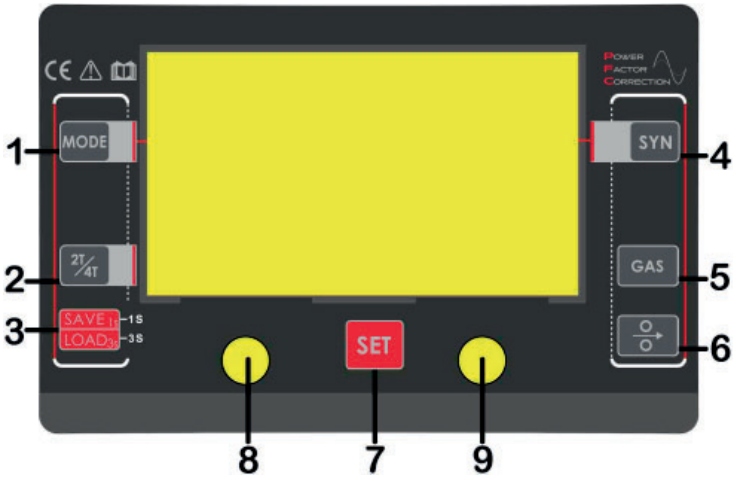
3.2 Layout for Control panel

3.2.1 Control panel



1. **Welding mode button**: Press it to select Stick DC/ Stick AC/ TIG HF/ TIG Lift/ MIG Manual/ MIG Synergic welding mode.
2. **Trigger mode button**: Press it to select 2T or 4T trigger mode.
3. **JOB button**: Press it for 3s to open JOB program and press it for 1s to save parameters into JOB number.
4. **SYN system button**: Press it to select wire material, wire diameter and type of gas.
5. **Air check button**: Press it to check whether the machine isn't air-connected or the gas passage isn't smooth.
6. **Manual wire feed button.**
7. **Function button**: Press it to select parameters or enter the function interface.
8. **L parameter knob**: Press it to select parameters and turn it to adjust values, such as welding current. In function interface, turn it to select parameters.
9. **R parameter knob**: Press it to select parameters and turn it to adjust values.

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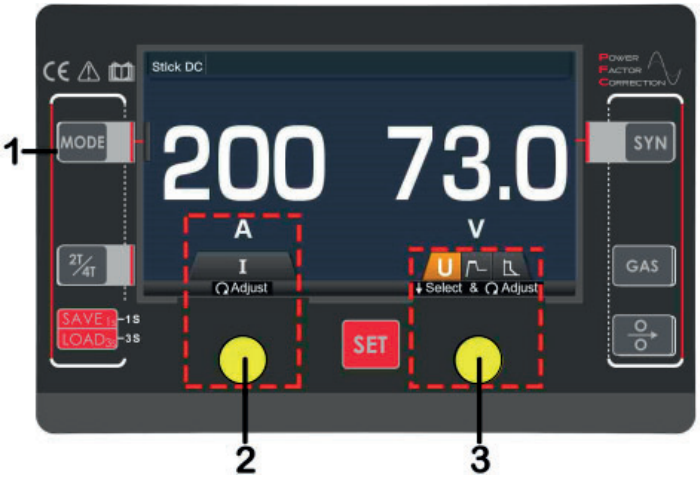
3.2.2 MMA AC/DC display introduction



1. **Welding mode button**: Press it to select Stick DC or Stick AC welding mode.
2. **L parameter knob**: Turn it to welding current.
3. **R parameter knob**: Press it to select Hot Start or Arc Force and turn it to adjust values.

Hot start

Hot start provides extra power when the weld starts to counteract the high resistance of the electrode and workpiece as the arc is started. Setting range: 0~10.

Arc force

An MMA welding power source is designed to produce constant output current. This means with different types of electrode and arc length; the welding voltage varies to keep the current constant. This can cause instability in some welding conditions as MMA welding electrodes will have a minimum voltage they can operate with and still have a stable arc.

Arc Force control boosts the welding power if its senses the welding voltage is getting too low. The higher the arc force adjustment, the higher the minimum voltage that the power source will allow. This effect will also cause the welding current to increase. 0 is Arc Force off, 10 is maximum Arc Force. This is practically useful for electrode types that have a higher operating voltage requirement or joint types that require a short arc length such as out of position welds.

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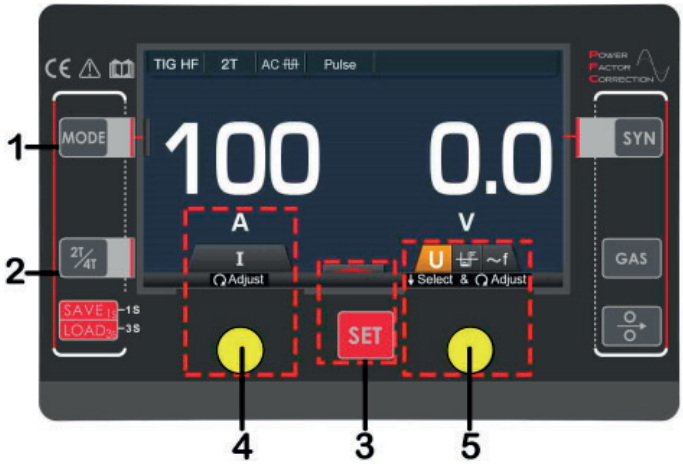
3.2.3 TIG HF/Lift display introduction



1. **Welding mode button**: Press it to enter TIG HF or TIG Lift welding mode.
2. **Trigger mode button**: Press it to select 2T or 4T trigger mode.
3. **Function button**: Press it to enter the function interface.
4. **L parameter knob**: Turn it to adjust welding current. In function interface, turn it to select parameters, such as trigger mode and Post Flow time.
5. **R parameter knob**: Turn it to select AC Balance (-5~5) or AC Frequency (50~250Hz) and turn it to adjust values. (Available only in AC mode.) In function interface, turn it to select parameters, such as trigger mode and Post Flow time. *****

***Denotes more detailed explanation of function to follow.**

Further Controls Explained

AC Balance

Only be available in AC welding mode. Adjust the balance as a percentage between the forward and reverse current cycles when welding in AC output mode. The reverse part of the AC cycle gives the 'cleaning' effect on the weld material, while the forward cycle melts the weld material. Neutral setting is 0. Increased reverse cycle bias will give greater cleaning effect, less weld penetration and more heat in the torch tungsten, which gives the disadvantage of reducing the output current that can be used for a given tungsten size, to prevent the tungsten overheating. Increased forward cycle bias will give the opposite effect, less cleaning effect, greater weld penetration and less heat in the tungsten.

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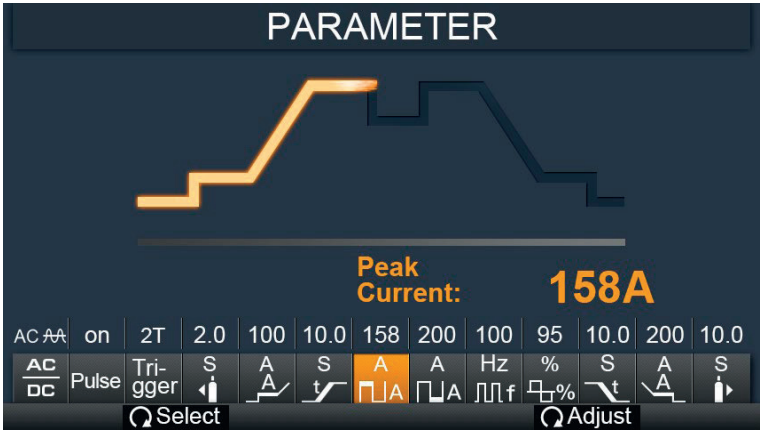
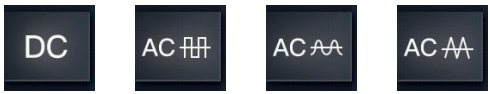
AC Frequency

Only be available in AC welding mode. Increasing AC frequency will focus the shape of the arc, resulting in a tighter, more controlled arc causing increased penetration and less heated affected area for the same current setting. Slower frequency will result in a wider, softer arc shape.

Function interface:



1. **Output waveform**: Press it to select DC output or AC wave output.



2. **Pulse mode**: ON or OFF.
3. **Trigger mode**: 2T/ 4T/ Spot weld. (Spot is only available in TIG HF welding mode.) *
4. **Pre Flow**: 0~2s.
5. **Pre Current**: 10~200A.
6. **Up Slope**: 0~10s.
7. **Peak Current**: 10~200A.
8. **Base Current**: 10~200A. (Only available in Pulse mode.)
9. **Pulse Frequency**: 0.5~999Hz. (Only available in Pulse mode.) *
10. **Duty Cycle**: 5~95%. (Only available in Pulse mode.) *
11. **Down Slope**: 0~10s.
12. **Post Current**: 10~200A.
13. **Post Flow**: 0~10s.

***Denotes more detailed explanation of function to follow.**

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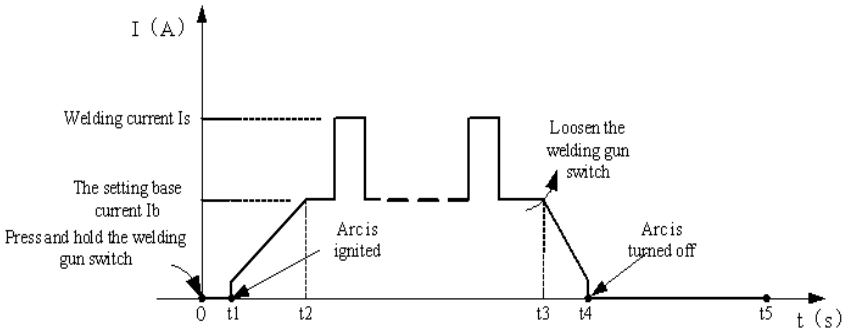
Further Controls Explained

2T Mode (3)

The trigger is pulled and held on to activate the welding circuit, when the trigger is released, the welding circuit stops.

This function without the adjustment of start current and crater current is suitable for the Re-tack welding、transient welding、thin plate welding and so on.

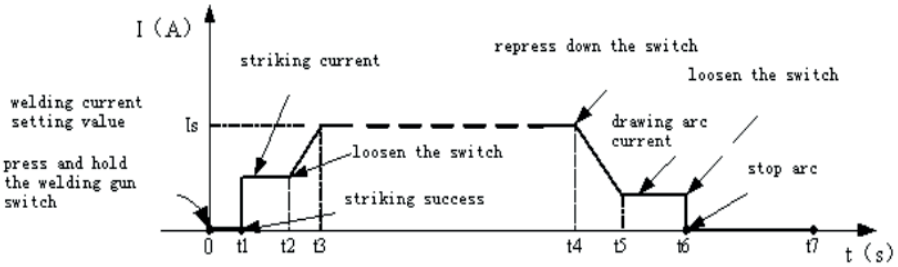


Introduction:

- 0: Press the gun switch and hold it. Electromagnetic gas valve is turned on. The shielding gas stars to flow.
- 0～t1: Pre-gas time (0.1~2.0s)
- t1～t2: Arc is ignited and the output current rises to the setting welding current (I_w or I_b) from the min welding current.
- t2～t3: During the whole welding process, the gun switch is pressed and held without releasing.
- **Note**: Select the pulsed output, the base current and welding current will be outputted alternately; otherwise, output the setting value of welding current;
- t3: Release the gun switch, the welding current will drop in accordance with the selected down-slope time.
- t3～t4: The current drops to the minimum welding current from the setting current (I_w or I_b), and then arc is turned off.
- t4～t5: Post-gas time, after the arc is turned off. You can adjust it (0.0~10s) through turnning the knob on the front panel.
- t5: Electromagnetic gas valve turned off, the shield gas stops to flow, and welding is finished.

4T Mode (3)

The start current and crater current can be pre-set. This function can compensate the possible crater that appears at the beginning and end of the welding. Thus, 4T is suitable for the welding of medium thickness plates.



Introduction:

(1) 0: Press and hold the gun switch, Electromagnetic gas valve is turned on. The shielding gas stars to flow;

(2) 0～t1: Pre-gas time (0.1~2.0S);

(3) t1～t2: Arc is ignited at t1 and then output the setting value of start current;

(4) t2: Loosen the gun switch, the output current slopes up from the start current;

(5) t2～t3: The output current rises to the setting value (I_w or I_b), the upslope time can be adjusted;

(6) t3～t4: Welding process. During this period, the gun switch is loosen;

Note: Select the pulsed output, the base current and welding current will be outputted alternately; otherwise, output the setting value of welding current;

(7) t4: Press the torch switch again, the welding current will drop in accordance with the selected down-slope time.

(8) t4～t5: The output current slopes down to the crater current. The downslope time can be adjusted;

(9) t5～t6: The crater current time;

(10) t6: Loosen the gun switch, stop arc and keep on argon flowing;

(11) t6～t7: Post-gas time can be set by the post-gas time adjustment knob on the front panel (0.0～10S);

(12) t7: Electromagnetic valve is closed and stop argon flowing. Welding is finished.

Pulse frequency (9)

Only be available when pulse mode is selected. Set the rate that the welding output alternates between the peak and base current settings.

Duty Cycle (10)

Only be available when pulse mode is selected. Set the time proportion as a percentage between the peak current and base current when using pulse mode. Neutral setting is 50%, the time period of the peak current and base current pulse is equal. Higher pulse duty setting will give greater heat input, while lower pulse duty will have the opposite effect.

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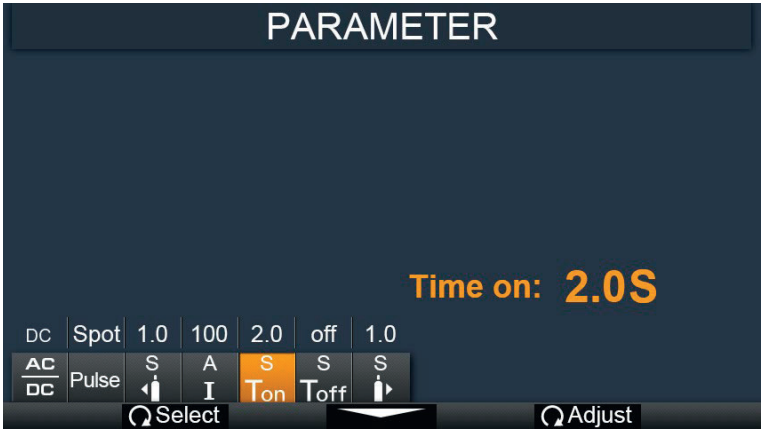
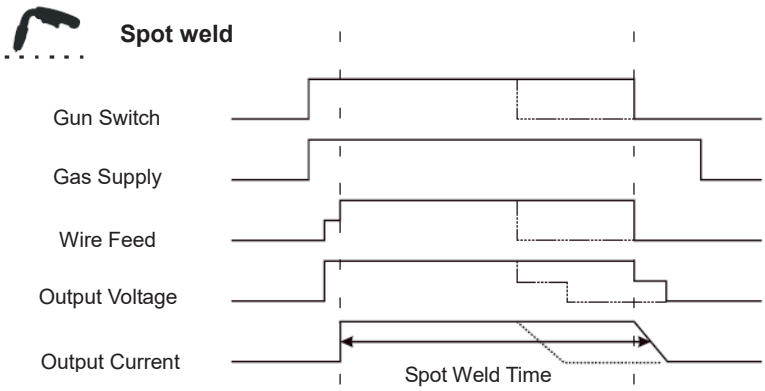
Function interface of Spot weld:



1. **Post Flow**: 0.1~2s.
2. **Welding current**: 10~200A.
3. **T_{on} time**: 0.2~1s.
4. **T_{off} time**: 0~10s.
5. **Post Flow**: 0.1~10s.

Spot Weld trigger mode:



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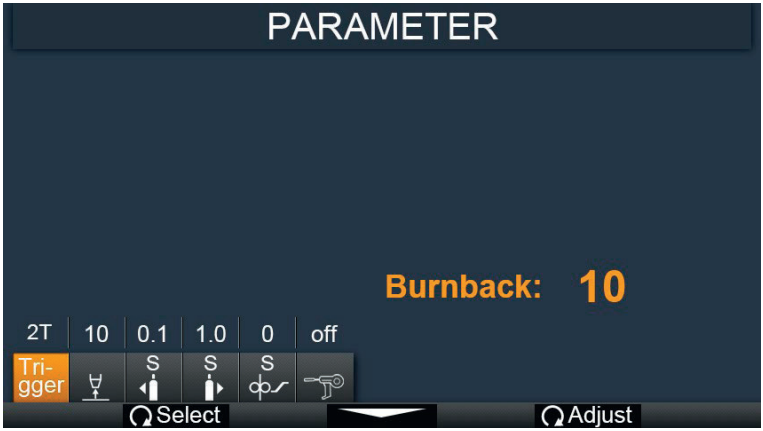
3.2.4 MIG Manual display introduction

1. **Welding mode button**: Press it to select MIG Manual welding mode.
2. **Trigger mode button**: Press it to select 2T or 4T trigger mode.
3. **Function button**: Press it to enter the function interface.
4. **L parameter knob**: Turn it to adjust wire feeding speed. In function interface, turn it to select parameters, such as Pre Flow, Post Flow.
5. **R parameter knob**: Press it to select welding voltage or inductance. Turn it to adjust value.
6. **Air check button.**
7. **Manual wire button.**

Function interface:



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1. **Trigger mode**: 2T or 4T.
2. **Burnback**: 0~10.
3. **Pre Flow**: 0.1~10s.
4. **Post Flow**: 0.1~10s.
5. **Slow Feed**: 0~10.
6. **Spool Gun**: off/ on.

Burnback

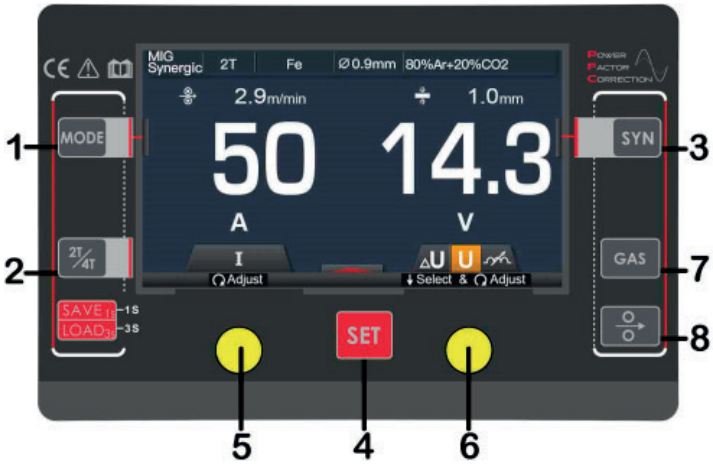
Short-circuit between welding wire and molten pool leads to the increase of current, which leads to the melting speed of welding wire too fast, and the wire feeding speed cannot keep up with, which makes the welding wire and workpiece disconnected. This phenomenon is called "burn back". This function is to ensure the welding seam is not beautiful after welding. Range: 0-10.

Slow feed

This function is used to regulate the speed of wire feeding increasing. Range: 0-10s.

3.2.5 MIG SYN display introduction

The operator simply sets the welding current like MIG welding and the machine calculates the optimal voltage and wire speed for the material type, wire type and size and shielding gas being used. Obviously other variables such as welding joint type and thickness, air temperature affect the optimal voltage and wire feed setting, so the program provides a voltage fine tuning function for the synergic program selected. Once the voltage is adjusted in a synergic program, it will stay fixed at this variation when the current setting is changed. To reset the voltage for a synergic program back to factory default, change to another program and back again.



1. **Welding mode button**: Press it to select MIG Manual welding mode.
2. **Trigger mode button**: Press it to select 2T or 4T trigger mode.
3. **SYN system button**: Press it to enter SYN item. Select wire material/ wire diameter and shield gas by using R parameter knob.
4. **Function button**: Press it to enter the function interface.
5. **L parameter knob**: Turn it to adjust wire feeding speed. In function interface, rotate it to select parameters, such as Pre Flow, Post Flow.
6. **R parameter knob**: Press it to select welding voltage or inductance. Turn it to adjust value. In SYN item, turn to select and press to confirm.
7. **Air check button.**
8. **Manual wire button.**

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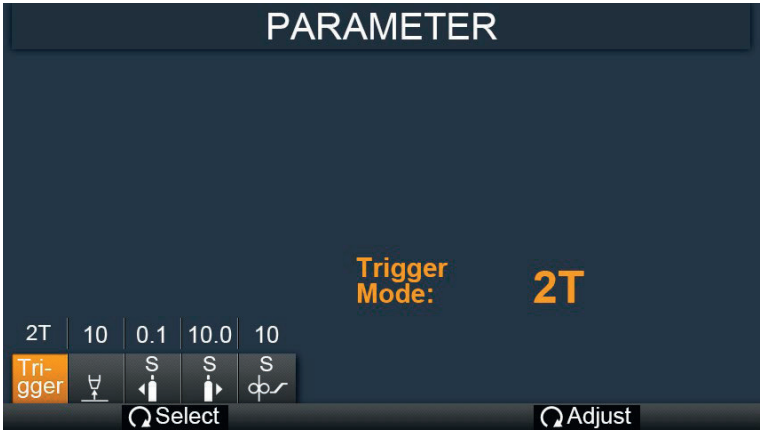
Function interface:



1. **Trigger mode**: 2T or 4T.
2. **Burnback**: 0~10.
3. **Pre Flow**: 0.1~10s.
4. **Post Flow**: 0.1~10s.
5. **Slow Feed**: 0~10.

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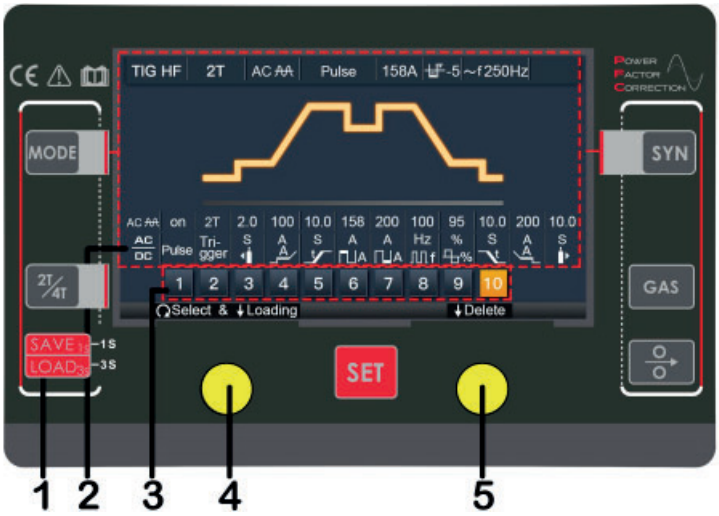
3.2.6 JOB display introduction



1. **JOB button**: Press it for 3s to enter JOB programs and press it for 1s to save parameters.
2. **Parameters display**: Here are all the selected parameter that you settings.
3. **JOB number display**.
4. **L parameter knob**: Turn it to turn the page and press it to delete the parameters.
5. **R parameter knob**: Turn it to select JOB program number and press it to load the selected JOB program number.

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4 Installation & Operation

4.1 Installation & Operation for MMA Electrode Welding

4.1.1 Set-Up Installation

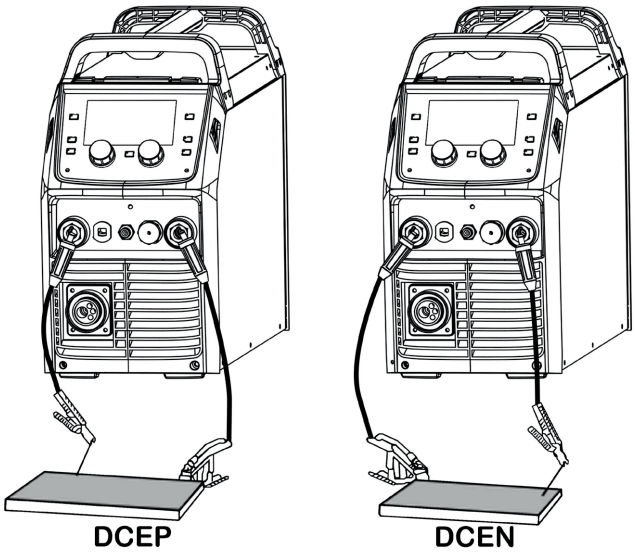
Two sockets are available on this welding machine, One Positive (+) and one Negative (-) polarity, to connect MMA/Electrode holder cable and earth clamp cable. Various electrodes require different polarity for optimum results and careful attention should be paid to the polarity, refer to the electrode manufacturers information for the correct polarity.

DCEP: Electrode connected to Positive (+) output socket.

DCEN: Electrode connected to Negative (-) output socket.

MMA (DC): Choosing the connection of DCEN or DCEP according to the different electrodes. Please refer to the electrode manual.

MMA (AC): No requirements for polarity connection.



(1) Turn the power source on and press the welding mode key to MMA welding mode.

(2) Set the welding current relevant to the electrode type and size being used as recommended by the electrode manufacturer.

(3) Set the Hot Start and Arc Force as required using knobs and buttons.

(4) Place the electrode into the electrode holder and clamp tight.

(5) Strike the electrode against the work piece to create and arc and hold the electrode steady to maintain the arc.

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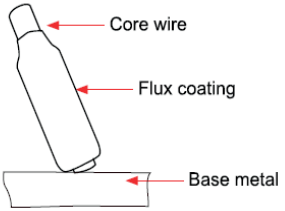
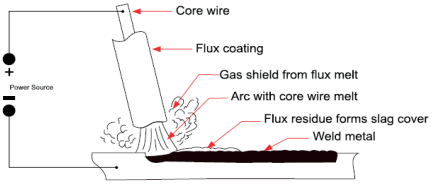
4.1.2 MMA/Stick Electrode Welding

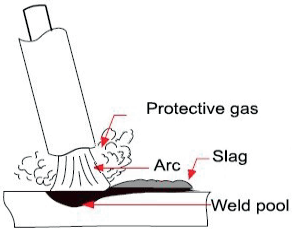
One of the most common types of arc welding is manual metal arc welding (MMA) or stick welding. An electric current is used to strike an arc between the base material and a consumable electrode rod or 'stick'. The electrode rod is made of a material that is compatible with the base material being welded and is covered with a flux that releases a gaseous vapor that serve as a shielding gas and providing a layer of slag, both of which protect the weld area from atmospheric contamination. The electrode core itself acts as filler material the residue from the flux that forms slag covering over the weld metal must be chipped away after welding.





MMA / Stick Electrode

- The arc is initiated by momentarily touching the electrode to the base metal.
- The melted electrode metal is transferred across the arc into the molten pool and becomes weld metal.
- The deposit is covered and protected by slag from the electrode flux coating.



Flux Properties

- producing a protective gas around the weld area
- providing fluxing elements and deoxidizer
- creating a protective slag coating over the weld
- establishing arc characteristics
- adding alloying elements

Stick electrodes serve many purposes in addition to filler metal to the molten pool. These

additional functions are provided mainly by the various coverings on the electrode.

4.1.3 MMA Welding Fundamentals

Electrode Selection

As a general rule, the selection of an electrode is straight forward, in that it is only a matter of selecting an electrode of similar composition to the parent metal. However, for some metals there is a choice of several electrodes, each of which has particular properties to suit specific classes of work. It is recommend to consult your welding supplier.

Average Thickness of Material	Max Recommended Electrode Diameter
1.0-2.0 mm	2.5 mm
2.0-5.0 mm	3.2 mm
5.0-8.0 mm	4.0 mm
>8.0 mm	5.0 mm

The size of the electrode generally depends on the thickness of the section being welded, and the thicker the section the larger the electrode required. The maximum size of electrodes that may be used for various thicknesses based on a general purpose type 6013 electrode.

Welding Current (Amperage)

Electrode Size ø mm	Current Range (Amps)
2.5 mm	60-95
3.2 mm	100-130
4.0 mm	130-165
5.0 mm	165-260

Correct current selection for a particular job is an important factor in arc welding. With the current set too low, difficulty is experienced in striking and maintaining a stable arc. The electrode tends to stick to the work, penetration is poor and beads with a distinct rounded profile will be deposited. Too high current is accompanied by overheating of the electrode resulting undercut and burning through of the base metal and producing excessive spatter. Normal current for a particular job may be considered as the maximum, which can be used without burning through the work, over-heating the electrode or producing a rough spattered surface. The table shows current ranges generally recommended for a general purpose type 6013 electrode.

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Arc Length

To strike the arc, the electrode should be gently scraped on the work until the arc is established. There is a simple rule for the proper arc length; it should be the shortest arc that gives a good surface to the weld. An arc too long reduces penetration, produces spatter and gives a rough surface finish to the weld. An excessively short arc will cause sticking of the electrode and result in poor quality welds. General rule of thumb for down hand welding is to have an arc length no greater than the diameter of the core wire.

Electrode Angle

The angle that the electrode makes with the work is important to ensure a smooth, even transfer of metal. When welding in down hand, fillet, horizontal or overhead the angle of the electrode is generally between 5 and 15 degrees towards the direction of travel. When vertical up welding, the angle of the electrode should be between 80 and 90 degrees to the work piece.

Travel Speed

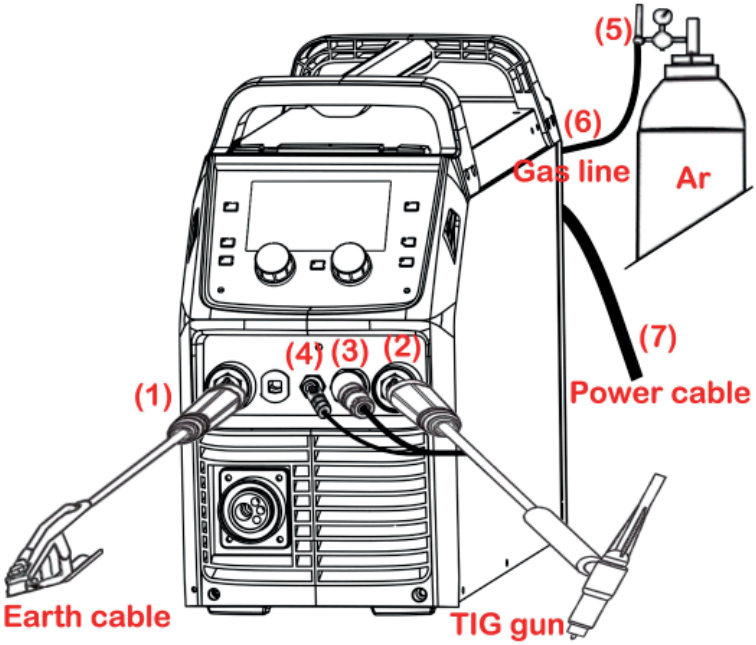
The electrode should be moved along in the direction of the joint being welded at a speed that will give the size of run required. At the same time, the electrode is fed downwards to keep the correct arc length at all times. Excessive travel speeds lead to poor fusion, lack of penetration etc, while too slow a rate of travel will frequently lead to arc instability, slag inclusions and poor mechanical properties.

Material and Joint Preparation

The material to be welded should be clean and free of any moisture, paint, oil, grease, mill scale, rust or any other material that will hinder the arc and contaminate the weld material. Joint preparation will depend on the method used include sawing, punching, shearing, machining, flame cutting and others. In all cases edges should be clean and free of any contaminates. The type of joint will be determined by the chosen application.

4.2 Installation & Operation for TIG Welding

4.2.1 Set-Up for TIG Welding



(1) Insert the earth cable plug into the positive socket on the front of the machine and twist to lock in place.

(2) Plug the welding torch into the negative socket on the front panel and twist to lock.

(3) Connect the control cable of torch switch to 12-pin socket on the front of the machine.

(4) Connect the gas line of TIG torch to outlet gas connector on the front of the machine.

(5) Connect the gas regulator to the gas cylinder and the gas line to the gas regulator.

(6) Connect the gas line to the machine inlet gas connector located on the rear panel.

(7) Connect the power cable of welding machine to the electrical outlet.

(8) Carefully open the valve of the gas cylinder, set the required gas flow rate.

(9) Select TIG function on the front panel.

(10) Set torch operation for 2T, 4T or Spot trigger mode.

(11) Select welding current as required. The selected welding current will show on display. Set down slope time as required. The down slope time will show on the digital display.

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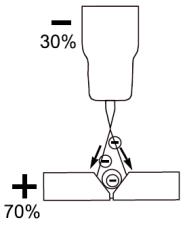
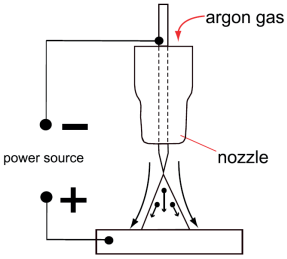
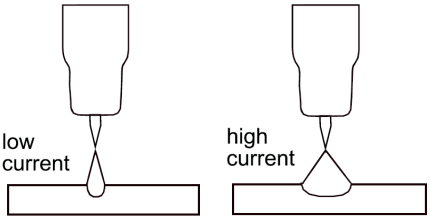
4.2.2 DCTIG Welding



The DC power source uses what is known as DC (direct current) in which the main electrical component, known as electrons, flow in only one direction from the negative terminal (-) to the positive terminal (+). In the DC electrical circuit there is an electrical principle at work which provides that, in a DC circuit, 70% of the energy (heat) is always on the positive side. This is important because it determines what terminal to connect the TIG torch.



DC TIG welding is a process in which an arc is struck between a tungsten electrode and the metal workpiece. The weld area is shielded by an inert gas flow to prevent contamination of the tungsten, molten pool and weld area. When the TIG arc is struck the inert gas is ionized and superheated changing its' molecular structure which converts it into a plasma stream. This plasma stream that flows between the tungsten and the work piece is the TIG arc and can be as hot as 19,000°C. It is a very pure and concentrated arc which provides the controlled melting of most metals into a weld pool. TIG welding offers the user the greatest amount of flexibility to weld the widest range of materials, thickness and profiles. DC TIG welding is also the cleanest weld with no sparks or spatter.

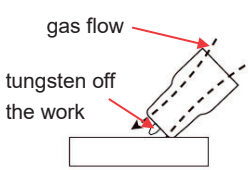


The intensity of the arc is proportional to the current that flows from the tungsten. The welder regulates the welding current to adjust the power of the arc. Typically thin material requires a less powerful arc with less heat to melt the material so less current (amps) is required, thicker material requires a more powerful arc with more heat so more current (amps) are necessary to melt the material.

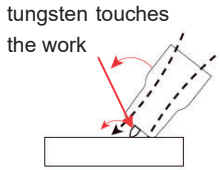
LIFT ARC IGNITION for TIG Welding

Lift Arc is a form of arc ignition where the machine has voltage on the electrode to only a few volts, with a current limit of one or two amps (well below the limit that causes metal to transfer

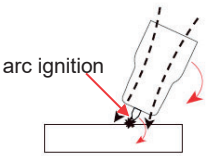
and contamination of the weld or electrode). When the machine detects that the tungsten has left the surface and a spark is present, it immediately (within microseconds) increases power, converting the spark to a full arc. It is a simple, safe lower cost alternative arc ignition process to HF (high frequency) and a superior arc start process to scratch start.



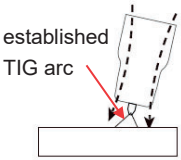
Lay the nozzle on the job without the tungsten touching the work.



Rock the torch sideways so that the tungsten touches the work & hold momentarily.

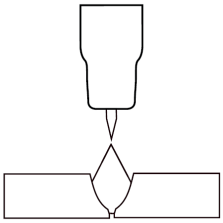


Rock the torch back in the opposite direction, the arc will ignite as the tungsten lifts off.

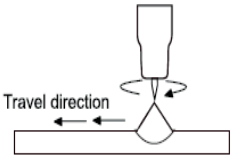


Lift the torch to maintain the arc.

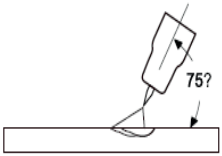
4.2.3 TIG Welding Fusion Technique



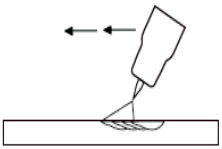
Manual TIG welding is often considered the most difficult of all the welding processes. Because the welder must maintain a short arc length, great care and skill are required to prevent contact between the electrode and the workpiece. Similar to Oxygen/Acetylene torch welding, TIG welding normally requires two hands and in most instances requires the welder to manually feed a filler wire into the weld pool with one hand while manipulating the welding torch in the other. However, some welds combining thin materials can be accomplished without filler metal like edge, corner, and butt joints. This is known as Fusion welding where the edges of the metal pieces are melted together using only the heat and arc force.



Form a weld pool



Angle torch



Move the torch slowly and evenly forward

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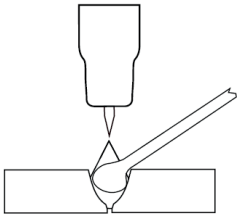
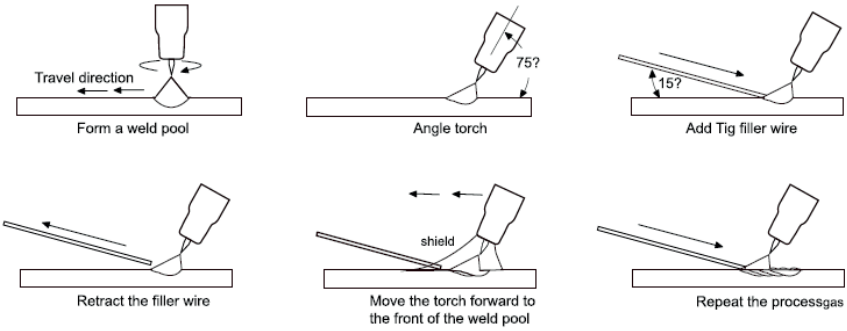
TIG Welding with Filler Wire Technique



It is necessary in many situations with TIG welding to add a filler wire into the weld pool to build up weld reinforcement and create a strong weld. Once the arc is started the torch tungsten is held in place until a weld pool is created, a circular movement of the tungsten will assist is creating a weld pool of the desired size. Once the weld pool is established tilt the torch at about a 75° angle and move smoothly and evenly along the joint. The filler metal is introduced to the leading edge of the weld pool. The filler wire is usually held at about a 15° angle and fed into the leading edge of the molten pool, the arc will melt the filler wire into the weld pool as the torch is moved forward. A "dabbing" technique can be used to control the amount of filler wire added. The wire is fed into the molten pool and retracted in a repeating sequence as the torch is moved slowly and evenly forward. It is important during the welding to keep the molten end of the filler wire inside the gas shield as this protects the end of the wire from being oxidized and contaminating the weld pool.



4.2.4 Tungsten Electrodes

Tungsten is a rare metallic element used for manufacturing TIG welding electrodes. The TIG process relies on tungsten's hardness and high-temperature resistance to carry the welding current to the arc. Tungsten has the highest melting point of any metal, 3,410 degrees Celsius. Tungsten electrodes are a consumable and come in a variety of sizes, they are made from pure tungsten or an alloy of tungsten and other rare earth elements. Choosing the correct tungsten depends on the material being welded, amps required and whether you are using AC or DC welding current. Tungsten electrodes are color-coded at the end for easy identification.

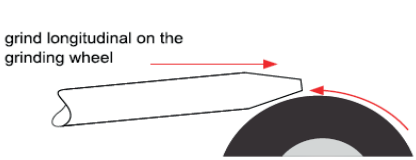
Tungsten Electrodes Rating for Welding Currents

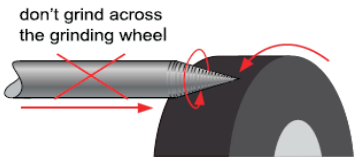
Tungsten Diameter mm	DC Current Amps Torch Negative 2% Thoriated	AC Current Amps Un-Balanced Wave 0.8% Zirconiated	AC Current Amps Balanced Wave 0.8% Zirconiated
1.0mm	15-80	15-80	20-60
1.6mm	70-150	70-150	60-120
2.4mm	150-250	140-235	100-180
3.2mm	250-400	225-325	160-250
4.0mm	400-500	300-400	200-320

4.2.5 Tungsten Preparation

Always use **DIAMOND** wheels when grinding and cutting. While tungsten is a very hard material, the surface of a diamond wheel is harder, and this makes for smooth grinding. Grinding without diamond wheels, such as Aluminum oxide wheels, can lead to jagged edges, imperfections, or poor surface finishes not visible to the eye that will contribute to weld inconsistency and weld defects.

Always ensure to grind the tungsten in a longitudinal direction on the grinding wheel. Tungsten electrodes are manufactured with the molecular structure of the grain running lengthwise and thus grinding crosswise is "grinding against the grain". If electrodes are ground crosswise, the electrons have to jump across the grinding marks and the arc can start before the tip and wander. Grinding longitudinally with the grain, the electrons flow steadily and easily to the end of the tungsten tip. The arc starts straight and remains narrow, concentrated and stable.





Electrode Shape & Angle

The shape of the tungsten electrode tip is an important process variable in precision arc welding. A good selection of tip/flat size will balance the need for several advantages. The bigger the flat, the more likely arc wander will occur and the more difficult it will be to arc start. However,

increasing the flat to the maximum level that still allows arc start and eliminates arc wonder will improve the weld penetration and increase the electrode life. The included angle determines weld bead shape and size. Generally, as the included angle increases, penetration increases and bead width decreases.

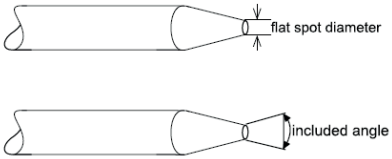
Some welders still grind electrodes to a sharp point, which makes arc starting easier. However, they risk decreased welding performance from melting at the tip.

Electrode Included Angle/Taper - DC Welding

Tungsten electrodes for DC welding should be ground longitudinally and concentrically with diamond wheels to a specific included angle in conjunction with the tip/flat preparation. Different angles produce different arc shapes and offer different weld penetration capabilities.

Blunter electrodes with larger included angle provide:

- Last Longer
- Have better weld penetration
- Have a narrower arc shape
- Can handle more amperage without eroding.



Sharper electrodes with smaller included angle provide:

- Offer less arc weld
- Have a wider arc
- Have a more consistent arc

Tungsten Diameter	Diameter at the Tip - mm	Constant Included Angle - Degrees	Current Range Amps	Current Range Pulsed Amps
1.0mm	.250	20	05 - 30	05 - 60
1.6mm	.500	25	08 - 50	05 - 100
1.6mm	.800	30	10 - 70	10 - 140
2.4mm	.800	35	12 - 90	12 - 180
2.4mm	1.100	45	15 - 150	15 - 250
3.2mm	1.100	60	20 - 200	20 - 300
3.2mm	1.500	90	25 - 250	25 - 350

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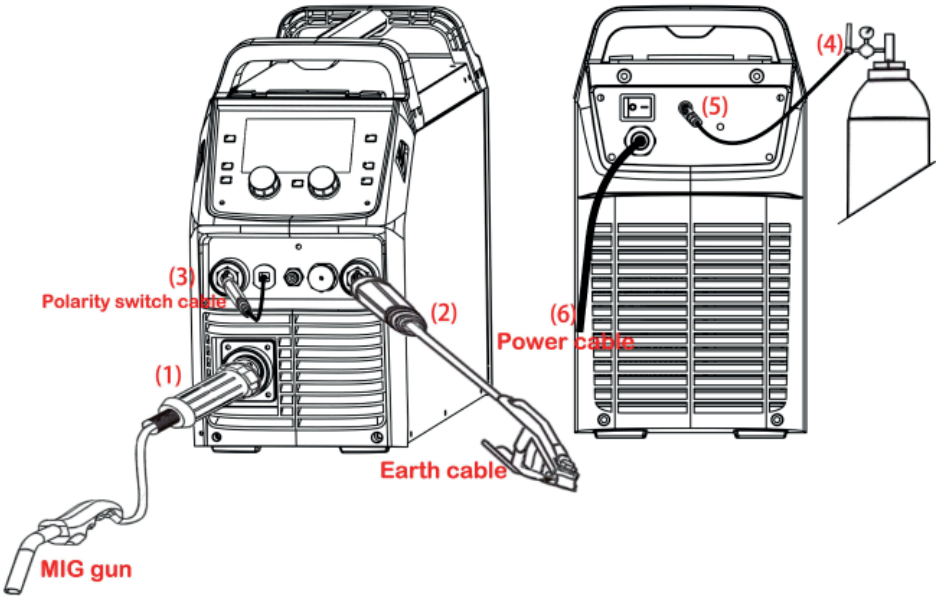
4.3 Installation & Operation for MIG Welding

4.3.1 Set up installation for MIG Welding



(1) Insert the earth cable plug into the Negative (-) socket and twist to tighten.

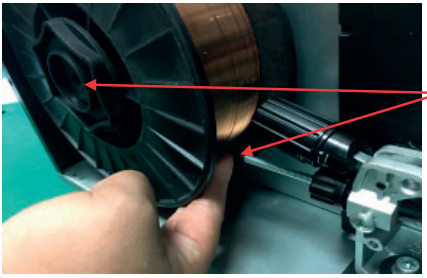
(2) Plug the MIG welding gun into MIG torch euro-connector on the front panel and tighten locking nut securely.

(3) Insert the polarity switch cable plug into the positive socket on the front of the machine and tighten it.

(4) Connect the gas regulator to the gas cylinder and connect the gas line to the regulator.

(5) Connect the gas line to gas connector on the rear panel.

(6) Connect the power cord of welding machine with the outlet on electrical box.



(7) Place wire onto spool holder - (spool retaining nut is left hand thread) Feed wire through the inlet guide tube on to the drive roller.

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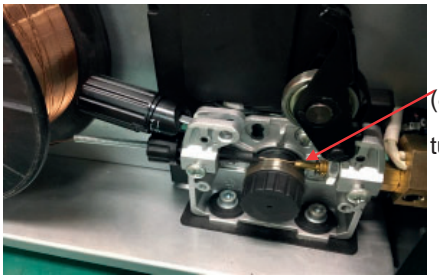
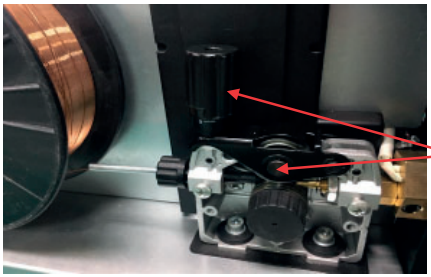
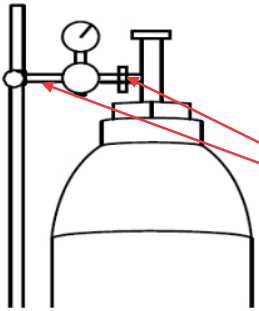


(8) Feed wire over drive roller into outlet guide wire tube, push wire through approximately 150mm.



(9) Close down the top roller bracket and clip the pressure arm into place with a medium amount of pressure applied.



(10) Carefully open the valve of the gas cylinder, set the required gas flow rate.

(11) Remove the gas nozzle and contact tip from the torch neck.

(12) Press and hold the manual wire button to feed the wire through to the torch neck, release the manual wire button when the wire exits the torch neck.

(13) Fit the correct sized contact tip and feed the wire through it, screw the contact tip into the tip holder of the torch neck and nip it up tightly.

(14) Fit the gas nozzle to the torch head.

(15) Carefully open the gas cylinder valve, set the required gas flow rate on the regulator.

(16) Select the desired MIG function, Select program number to suit the wire diameter and gas type being used as shown on the display.

(17) Select torch switch mode: 2T/ 4T/ Spot weld.

(18) Set the required welding parameters to suit the material thickness being welded.

4.3.2 Wire Feed Roller Selection

The importance of smooth consistent wire feeding during MIG welding cannot be emphasized enough. Simply put the smoother the wire feed then the better the weld.

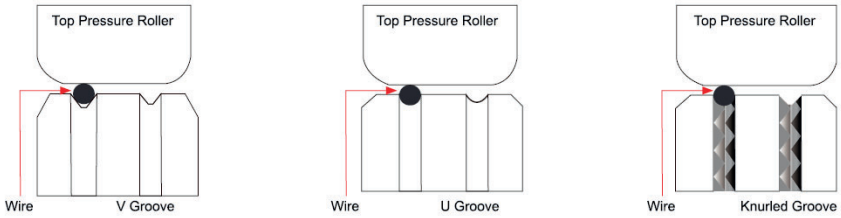
Feed rollers or drive rollers are used to feed the wire mechanically through the length of the welding gun cable. Feed rollers are designed to be used for certain types of welding wire and they have different types of grooves machined in them to accommodate the different types of wire. The wire is held in the groove by the top roller of the wire drive unit and is referred to as the pressure roller, pressure is applied by a tension arm that can be adjusted to increase or decrease the pressure as required. The type of wire will determine how much pressure can be applied and what type of drive roller is best suited to obtain optimum wire feed.

Solid Hard Wire - like Steel, Stainless Steel requires a drive roller with a "V" shape groove for optimum grip and drive capability. Solid wires can have more tension applied to the wire from the top pressure roller that holds the wire in the groove and the "V" shape groove is more suited for this. Solid wires are more forgiving to feed due to their higher cross-sectional column strength, they are stiffer and don't deflect so easily.

Soft Wire – Such as aluminum, require a "U" shape groove. Aluminum wire has a lot less column strength, can bend easily and is therefore more difficult to feed. Soft wires can easily buckle at the wire feeder where the wire is fed into inlet guide tube of the torch. The U-shaped roller offers more surface area grip and traction to help feed the softer wire. Softer wires also require less tension from the top pressure roller to avoid deforming the shape of the wire, too much tension will push the wire out of shape and cause it to catch in the contact tip.

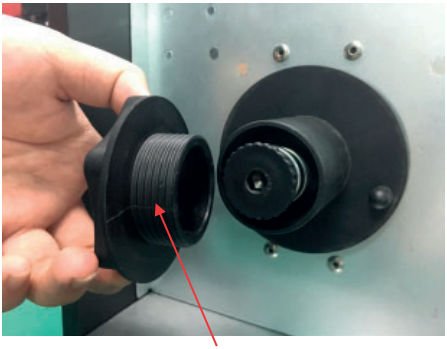
Flux Core/ Gasless Wire - These wires are made up of a thin metal sheath that has flux and metal compounds layered onto the surface and then rolled into a cylinder to form the finished wire. The wire cannot take too much pressure from the top roller as it can be crushed and deformed if too much pressure is applied. A knurled-V drive roller has been developed and it has small serrations in the groove, the serrations grip the wire and assist to drive it without too much pressure from the top roller. The down side to the knurled wire feed roller on flux cored wire is it will slowly over time bit by bit eat away at the surface of the welding wire, and these small pieces will eventually go down into the liner. This will cause clogging in the liner and added friction that will lead to welding wire feed problems. A U groove wire can also be used for flux core wire without the wire particles coming off the wire surface. However, it is considered that the knurled roller will give a more

positive feed of flux core wire without any deformation of the wire shape.

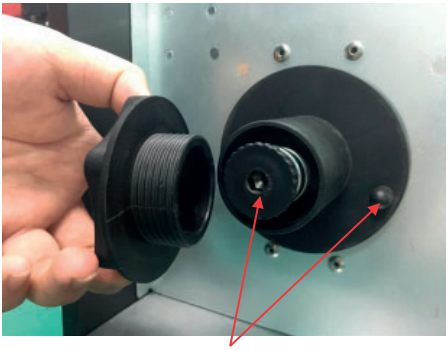


4.3.3 Wire Installation and Set-Up Guide

Again the importance of smooth consistent wire feeding during MIG welding cannot be emphasized enough. The correct installation of the wire spool and the wire into the wire feed unit is critical to achieving an even and consistent wire feed. A high percentage of faults with MIG welders emanate from poor set up of the wire into the wire feeder. The guide below will assist in the correct setup of your wire feeder.



(1) Remove the spool retaining nut.



(2) Note the tension spring adjuster and spool locating pin.

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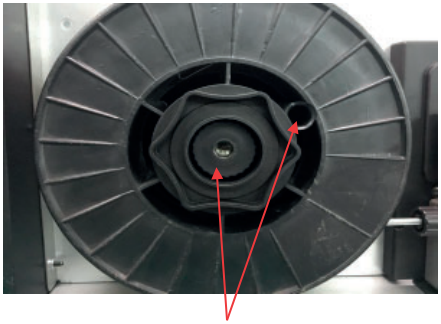
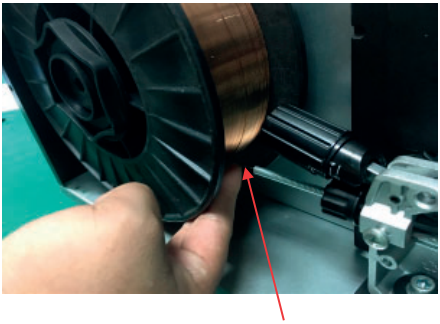
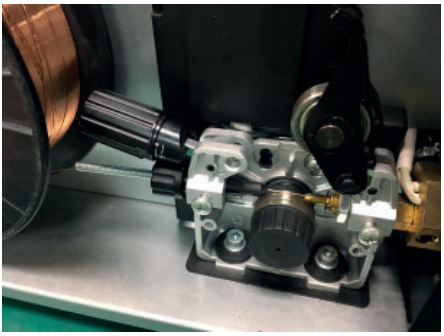


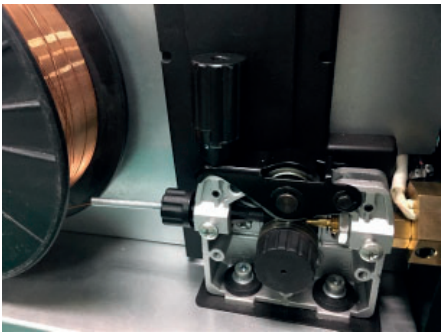
(3) Fit the wire spool onto the spool holder fitting the locating pin into the location hole on the spool. Replace the spool retaining nut tightly.



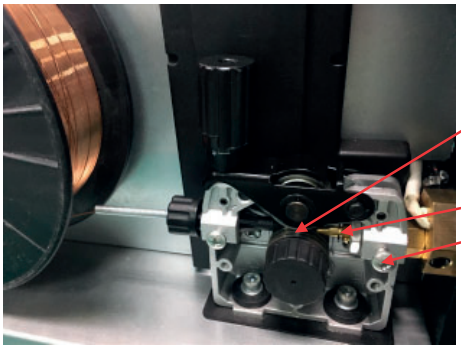
(4) Snip the wire carefully, be sure to hold the wire to prevent the spool uncoiling. Carefully feed the wire into the inlet guide tube of the wire feed unit.



(5) Feed the wire through the drive roller and into the outlet guide tube of the wire feeder.



(6) Lock down the top pressure roller and apply a medium amount of pressure using the tension adjustment knob.



(7) Check that the wire passes through the center of the outlet guide tube without touching the sides. Loosen the locking screw and then loosen the outlet guide tube retaining nut too make adjustment if required. Carefully retighten the locking nut and screw to hold the new position.

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4.3.4 MIG Torch Liner Types and Information

MIG Torch Liners

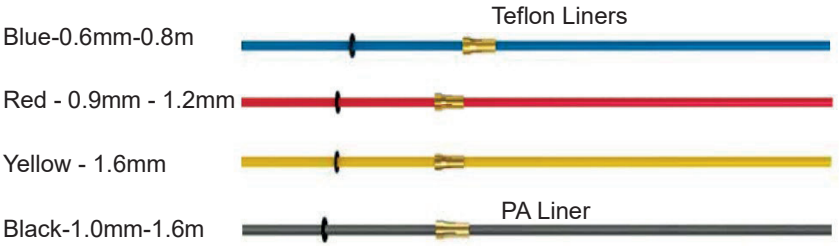
The liner is both one of the simplest and most important components of a MIG gun. Its sole purpose is to guide the welding wire from the wire feeder, through the gun cable and up to the contact tip.

Steel Liners

Most MIG gun liners are made from coiled steel wire also known as piano wire, which provides the liner with good rigidity and flexibility and allows it to guide the welding wire smoothly through the welding cable as it bends and flex during operational use. Steel liners are primarily used for feeding of solid steel wire, other wires such as Aluminum, Silicon Bronze, Etc. will perform better using a Teflon or Polyamide line. The internal diameter of the liner is important and relative to the wire diameter being used. The correct inside diameter and will assist in smooth feeding and prevention of the wire kinking and bird-nesting at the drive rollers. Also bending the cable too tightly during welding increases the friction between the liner and the welding wire making it more difficult to push the wire through the liner resulting in poor wire feeding, premature liner wear and bird-nesting. Dust, grime and metal particles can accumulate inside the liner over time and cause friction and blockages, it is recommended to periodically blow out the liner with compressed air. Small diameter welding wires, 0.6mm through 1.0mm have relatively low columnar strength, and if matched with an oversized liner, can cause the wire to wander or drift within the liner. This in turn leads to poor wire feeding and premature liner failure due to excessive wear. By contrast, larger diameter welding wires, 1.2mm through 2.4mm have much higher columnar strength but it is important to make sure the liner has enough internal diameter clearance. Most manufacturers will produce liners sized to match wire diameters and length of welding torch cable and most are color coded to suit.

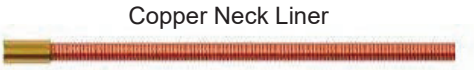
Teflon and Polyamide (PA) Liners

Teflon liners are well suited for feeding soft wires with poor column strength like aluminum wires. The interiors of these liners are smooth and provide stable feeding, especially on small diameter welding wire Teflon can be good for higher heat applications that utilize water-cooled torches and brass neck liners. Teflon has good abrasion resistance characteristics and can be used with a variety of wire types such as silicon bronze, stainless steel as well as aluminum. A note of caution to carefully inspect the end of the welding wire prior to feeding it down the liner. Sharp edges and burrs can score the inside of the liner and lead to blockages and accelerated wear. Polyamide Liners (PA) are made of carbon infused nylon and are ideal for softer aluminum, copper alloy welding wires and push pull torch applications. These liners are generally fitted with a floating collet to allow the liner to be inserted all the way to the feed rollers.



Copper - Brass Neck Liners

For high heat applications fitting brass or copper wound jumper or neck liner on the end of the liner at the neck end will increase the working temperature of the liner as well as improve the electrical conductivity of the welding power transfer to the wire. It is recommended for all Aluminum and Silicone Bronze welding applications.



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4.3.5 Torch & Wire Feed Set-Up for Aluminum Wire

The same method is used for Teflon and/or Polyamide Liners (PA).

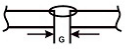
4.4 Installation & Operation for Spool Gun

4.4.1 Set up installation for Spool Gun

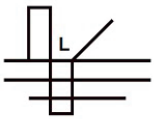
1) Insert the earth cable plug into the negative (-) socket on the front of the machine and twist to tighten.
2) Insert the polarity switch cable plug into the positive socket on the front of the machine and tighten it.
3) Plug the Spool Gun into the euro-connect socket on the front panel and tighten.
4) **IMPORTANT: When connecting the torch be sure to tighten the adaptor nut completely tight. A loose connection can result in arcing between the gun and machine connector and that causes serious damage to both the torch and machine connections.**
5) Connect the Spool Gun control cable to the 9-pin receptacle on the side panel.
6) Insert the polarity switching cable plug into the positive socket on the front of the machine and tighten it.
7) Connect the gas regulator to the gas cylinder and connect the gas line to the regulator.
8) Connect the gas line to gas connector on the rear panel.
9) Connect the power cord of welding machine with the outlet on electrical box.
10) Carefully open the gas cylinder valve and set the required gas flow rate.
11) Set welding parameters using the knobs as shown on digital displays.

4.5 Welding Parameters

Process reference for CO_2 butt welding of low carbon steel solid welding wire

	Material thickness (MM)	Root gap G(MM)	Wire diameter (MM)	Welding current (A)	Welding voltage (V)	Welding speed (CM/MIN)	Gas-flow rate (L/MIN)
Butt-joint 	0.8	0	0.8	60-70	16-16.5	50-60	10
	1.0	0	0.8	75-85	17-17.5	50-60	10-15
	1.2	0	0.8	80-90	17-18	50-60	10-15
	2.0	0-0.5	1.0/1.2	110-120	19-19.5	45-50	10-15
	3.2	0-1.5	1.2	130-150	20-23	30-40	10-20
	4.5	0-1.5	1.2	150-180	21-23	30-35	10-20
	6	0	1.2	270-300	27-30	60-70	10-20
	6	1.2-1.5	1.2	230-260	24-26	40-50	15-20

Process reference for CO_2 corner welding of low carbon steel solid welding wire

	Material thickness (MM)	Wire diameter (MM)	Welding current (A)	Welding voltage (V)	Welding speed (CM/MIN)	Gas-flow rate (L/MIN)
Corner joint 	1.0	0.8	70-80	17-18	50-60	10-15
	1.2	1.0	85-90	18-19	50-60	10-15
	1.6	1.0/1.2	100-110	18-19.5	50-60	10-15
	1.6	1.2	120-130	19-20	40-50	10-20
	2.0	1.0/1.2	115-125	19.5-20	50-60	10-15
	3.2	1.0/1.2	150-170	21-22	45-50	15-20
	3.2	1.2	200-250	24-26	45-60	10-20
	4.5	1.0/1.2	180-200	23-24	40-45	15-20
	4.5	1.2	200-250	24-26	40-50	15-20
	6	1.2	220-250	25-27	35-45	15-20
	6	1.2	270-300	28-31	60-70	15-20
	8	1.2	270-300	28-31	60-70	15-20
	8	1.2	260-300	26-32	25-35	15-20
	8	1.6	300-330	25-26	30-35	15-20
	12	1.2	260-300	26-32	25-35	15-20

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4.6 Operation Environment

▲ Height above sea level ≤1000 M.

▲ Operation temperature range 14 ~ 104°F (-10 ~ +40°C).

▲ Air relative humidity is below 90%.

▲ Preferable site the machine some angles above the floor level does not exceed 15°.

▲ Protect the machine against high moisture, water and against direct sunshine.

▲ Take care that there is sufficient ventilation during welding. There must be at least 1-1/2" (38cm) free distance between the machine and wall.

4.7 Operation Notices

▲ Read Section 1 carefully before starting to use this equipment.

▲ Ensure that the input is 110V/230V AC, single-phase: 50/60Hz.

▲ Before operation, clear the working area. Do not watch the arc in unprotected eyes.

▲ Ensure good ventilation of the machine to improve duty cycle and life.

▲ Turn off power supply when the operation finished for energy consumption efficiency.

▲ When power switch shuts off protectively because of failure. Don't restart it until problem has been resolved. Otherwise, permanent damage could occur.

▲ In case of problems, contact your local dealer.

5 List of Error Codes

Error Type	Code	Description
Thermal relay	E01	Over-heating (1st thermal relay)
	E02	Over-heating (2nd thermal relay)
	E03	Over-heating (3rd thermal relay)
	E04	Over-heating (4th thermal relay)
	E09	Over-heating (Program default)
Welding machine	E10	Phase loss
	E11	N/A
	E12	No gas
	E13	Under voltage
	E14	Over voltage
	E15	Over current
	E16	Wire feeder over load
Switch	E20	Button fault on operating panel when switch on the machine
	E21	Other faults on operating panel when switch on the machine
	E22	Torch fault when switch on the machine
	E23	Torch fault during normal working process
Accessory	E30	Cutting torch disconnection
	E31	N/A
Communication	E40	Connection problem between wire feeder and power source
	E41	Communication error

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Precautions

Workspace

1. Welding equipment free of dust, corrosive gas, non-flammable materials, up to 90% humidity for use!
2. Avoid welding outdoors unless protected from direct sunlight, rain, snow, work area temperature must be between -10 °C and +40°C.
3. Wall to position the device at least 30 inches away.
4. Well-ventilated area to perform welding.

Safety requirements

Welding provides protection against overvoltage / overcurrent / overheating. If any of the above events occurs, the machine stops automatically. However, over- stress damage to the machine , keep the following guidelines :

1. Ventilation . When welding a strong current going through the machine , so the machine is not enough natural ventilation for cooling . The need to ensure adequate cooling, so the distance between the plane and any object around it at least 30 cm . Good ventilation is important to normal function and service life of the machine.
2. Continuously , the welding current does not exceed the maximum allowable value. Current overload may shorten its life or damage to the machine .
3. Surge banned ! Observance of tension range follow the main parameter table . Welding machine automatically compensates for voltage , allowing the voltage within permissible limits of law. If input voltages exceed the specified value , damaged parts of the machine .
4. The machine must be grounded! If you are operating in a standard, grounded AC pipeline in the event of grounding is provided automatically . If you have a generator or foreign , unfamiliar , non-grounded power supply using the machine , the machine is required for grounding connection point earth to protect against electric shock .
5. Suddenly stopping may be during welding when an overload occurs or the machine overheats . In this case, do not restart the computer , do not try to work with it right away, but do not turn off the power switch , so you can leave in accordance with the built-in fan to cool the welding machines .

WARNING!

If the welding equipment is used with the welding parameters above 180 amperes, the standard 230V electrical socket and plug for 16 amp circuit breaker is not sufficient for the required current consumption, it is necessary to use the welding equipment with 20A, 25A or even to the 32A industrial fuses! In this case, both the plug and the plug socket fork have to be replaced to 32A single phase fuse socket in compliance with all applicable rules. This work may only be carried out by specialists!

Maintenance

1. Remove power unit before maintenance or repair!
2. Ensure that proper grounding!
3. Make sure that the internal gas and electricity connections are perfect and tighten, adjust if necessary, if there is oxidation, remove it with sandpaper and then reconnect the cable.
4. Hands, hair, loose clothing should be kept away under electric parts, such as wires, fan.
5. Regularly dust from the machine clean, dry compressed air, a lot of smoke and polluted air to clean the machine every day!
6. The gas pressure is correct not to damage components of the machine.
7. If water would be, for example. rain, dry it in the machine and check the insulation properly! Only if everything is all right, go after the welding!

8 When not in use for a long time, in the original packaging in a dry place.

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CERTIFICATE OF EUROPEAN STANDARD

Manufacturer:	IWELD Ltd. 2314 Halásztelek II. Rákóczi Ferenc street 90/B Tel: +36 24 532-625 info@iweld.hu www.iweld.hu
Item:	MUL**TIG 2400** AC/DC PFC TIG/MIG/MMA dual function IGBT inverter technology AC/DC welding power source
Applied Rules (1):	EN 60204-1:2005 EN 60974-10:2014, EN 60974-1:2018

(1) References to laws, rules and regulations are to be understood as related to laws, rules and regulations in force at present.
Manufacturer declares that the above specified product is complying with all of the above specified rules and it also complying with the essential requirements as specified by the Directives 2014/35/EU, 2014/30/EU, 2006/42/EU and 2011/65/EU

Serial No.:

CE

Halásztelek (Hungary), 14/03/20

Managing Director:
András Bódi