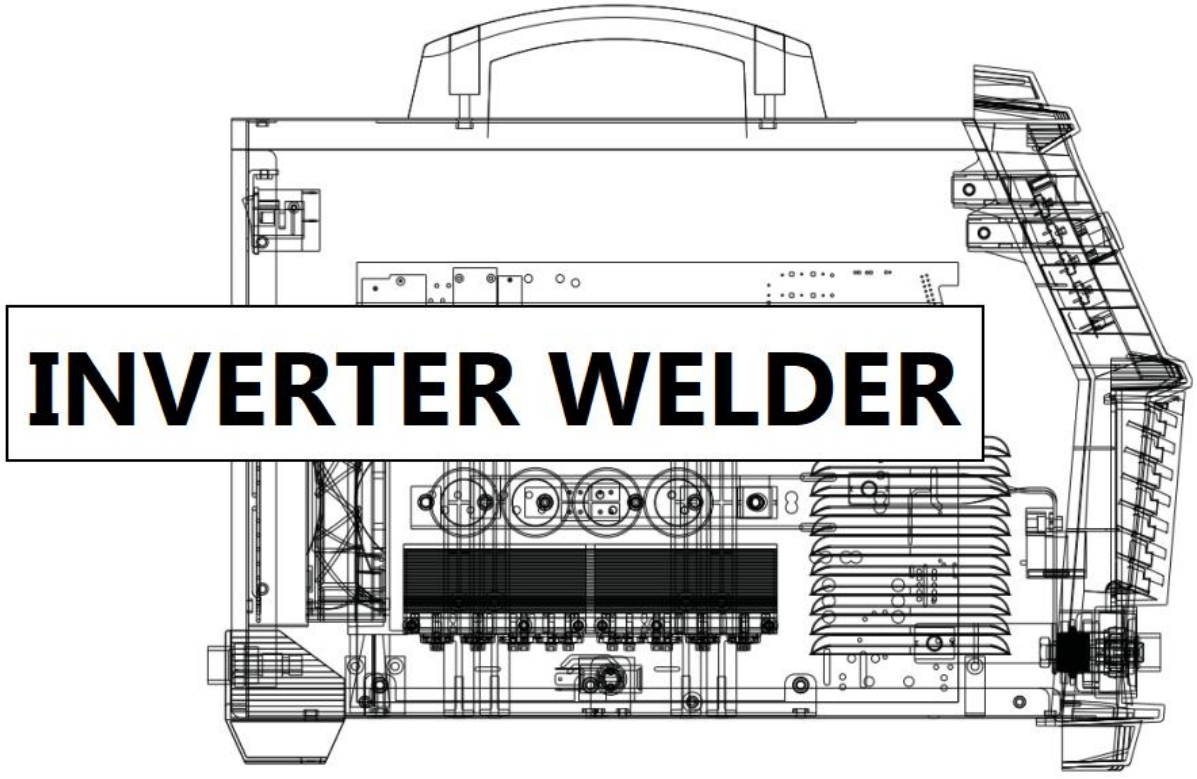
ARCCAPTAIN®

Inverter Welding Machine

TIG200P ACDC



User Manual

www.arccaptain.com

Dear Valued Customer,

Thank you very much for being our valued customer. ARCCAPTAIN welder was built by high quality components, every single unit machine was passed multiple industry leading laboratory tests to provide a great welding experience and performance.

For your safety, please read and understand this manual carefully before using this product. Your satisfaction is our priority! For any question or concerns, please do not hesitate to contact ARCCAPTAIN for SUPPORT : service@arccaptain.com

www.arccaptain.com

Contents

1. Safety Precautions

1.1 Installation Precautions

Warning: It is important that operators of this machine protect yourselves and others from harm or even death. For details, please refer to the operator's safety protection guide that meets the manufacturer's accident prevention requirements.

	**Electric shock!** • Install the grounding device according to the applicable standards. • Do not touch live parts when the skin is exposed, wearing wet gloves or wearing wet clothes. • Make sure you are insulated from the ground and the weldment. • Do not use the machine with the covers removed. • Make sure your station is safe.
	**Fire!** • Install the welder in a dry indoor environment, and ensure that the machine is at least 30 cm away from walls or other objects. • Ensure that there is no flammable material near the welding station; otherwise, there will be a fire hazard. • Ensure that there are fire extinguishing devices nearby and that a trained person can skillfully use the fire extinguisher.
	**Explosion!** • The welder can be installed in the environment with waste gas and dust generated by general welding, but cannot be installed in the environment with flammable gas or metal dust; otherwise, welding sparks may cause explosion.

Moving the welder may be dangerous

- Please turn off the power of distribution box before moving the welder.
- When moving the welder with lifting device, please ensure the lifting eye screws are tightened and the welder cover is installed properly.
- When the welder is damaged or missing parts, do not open or use it; otherwise, it may cause fire or personal injury.

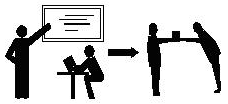
Changing parts can be dangerous

- Only professional personnel can change the machine parts. When replacing parts, do not to drop foreign objects such as conductor trace lines, screws, washers, metal rods, etc. into the inside of the machine.
- When replacing the circuit board, ensure that the wiring is correct and the machine works normally; otherwise, it may cause property damage.

Installation environment.

- Avoid installing the machine in an environment with dust or metal powder;
- Avoid installing the machine in an environment with corrosive or explosive gas;
- Ensure that the working environment is between -10°C and 40°C. If it is used in an environment higher than +40℃, additional forced cooling measures or derating should be taken;
- It should be used in an environment where the humidity is less than 90% and there are no condensation water beads;
- Please make sure that there is no wind on the welding side. Use a windshield if necessary; otherwise, it will affect the welding quality.
- Please consult and confirm with experienced personnel first for any special Installation requirements.

1.2 Operation Precautions

	**Only qualified personnel should operate this machine!** • Always use the appropriate personal protective equipment. • The operator shall be a special operator with a valid "Metal Welding (Oxygen Cutting) Operation" certificate. • Do not carry out any maintenance with the power on the machine
	**Fumes and gases may be hazardous to your health!** ● Welding may produce hazardous fumes and gases. Do not breathe the welding fume. ● Keep your head out of the welding fume, and ensure the welding zone is provided with ventilation or fume extraction system.
	**Arc rays may injure the eyes and burn the skin!** ● Use a suitable welding helmet and wear protective clothing to protect your eyes and body. ● Use adequate helmet or protective screens to protect others from injury.
	**Magnetic field affects cardiac pacemaker** ● Pacemaker users should consult a doctor before performing welding operations. ● Stay away from welding power source to reduce electromagnetic interference.
	**Improper use and operation may cause fire or explosion** ● Welding sparks may cause fire. Please confirm that there are no combustibles near the welding station and pay attention to safety and fire prevention. ● Ensure that there are fire extinguishers nearby and that a trained person can skillfully use the fire extinguisher. ● Do not weld closed containers. ● It is forbidden to use the machine for pipeline thawing.
	**Hot weldments can cause severe burns** ● Do not touch any hot surfaces or parts bare handed. ● Always allow the welding gun to cool down when using it continuously.

	**Moving parts may cause personal injury** ● Keep away from moving parts (such as fans). ● Protective devices such as doors, panels, covers and baffles shall be tightly closed and in place.
	**Seek professional help when encountering problems** ● If you still do not fully understand or cannot solve the problem after reading the instructions in this manual, you should contact the supplier service center immediately for professional help.

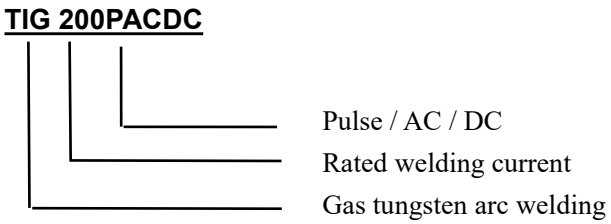
1.3 Scrap Disposal

Please pay attention to the following when scraping the welder:

- Igniting electrolytic capacitors on the main circuit or circuit board can cause an explosion;
- The machine belongs to industrial waste.

2. Product Overview

2.1 Product Model Description



2.2 Product Feature

2.2.1 Machine Overview

TIG200PACDC is a fully digital 7 in 1 inverter AC/DC welder with complete functions, excellent performance and advanced technology. It supports AC TIG (square wave/triangular wave), AC pulse TIG, DC TIG, DC pulse TIG, SMAW (DC), argon arc spot welding (DC/AC), etc.

It can be widely used in precise welding of carbon Steel, Stainless Steel, Aluminum etc, good performance in thin Aluminum plate.

The unique “Dash-Arc” technology patent improve arc striking speed from 200ms to 40ms, 99.99% arc striking success rate.

Digital control system makes TIG200PACDC more reliability and stability, it could adjust more parameter to promote good performance within one LED display, such as adjustable pre-flow\Initial current\ Up-slope\ Peak current\ Down-slope\ Crater current \ Post-flow\ AC frequency\ AC balance\ Pulse frequency. LED display show real-time dynamic output current, easily know the output state of welder.

Automatically Parameters storage: parameters saved even after the welder is turned off and on again.

New electrical structure and “Dust free” air passage can effectively prevent damage to power devices and control circuits from dust drawn in by the fan, thus greatly improving the reliability of the machine. Support remote control function, could match foot pedal/analog TIG torch.

2.2.3 Performance Features

Advanced IGBT inverter technology

- The inverter frequency is 43KHz, which significantly reduces the loss of copper and iron, improves the efficiency of the whole machine, and saves energy.
- The main power electronics use spike withstanding IGBT, smaller volume and high reliability.

Leading digital control method

- Adopt the internationally-leading MCU intelligent digital control technology, welding functions, performance and welding procedure requirements all have been greatly improved.
- New software controlled, easy to upgrade and maintain.

Excellent welding ability in TIG&MMA

- Achievable high-quality MMA welding: easier arc ignition, stable welding current, little spatter, and well-formed weld, support acid/alkaline electrodes.
- The unique “Dash-Arc” technology patent improve arc striking speed from 200ms to 40ms, 99.99% arc striking success rate. Digital constant current regulation technology ensures low noise and high stable arc quality in the full specification.
- TIG weld supports three typical TIG operation methods: two-step, four-step and spot welding, providing a good way for users to meet special process requirements.
- AC TIG can be widely used in welding of various aluminum alloys, magnesium alloys and other non-ferrous metals, and has various waveform options.
- DC TIG welding can be used for welding of various stainless steels and carbon steels.

Friendly human-computer interface and beautiful structure design

- Big size LED display provide a simple, intuitive and understandable human-computer interface. The layout of the operation panel is convenient to operation.
- TIG200PACDC’s front and back panels are made of high-strength engineering plastics, to ensure the machine works efficiently under harsh conditions such as high impact and drop.
- Enjoy excellent insulation performance.
- Adopt moisture-proof, dust-proof, and anti-static design and have good corrosion resistance.

Perfect automatic protection function

- The machine has a perfect protection function which provides a corresponding code prompt when providing protection.
- When the ambient temperature is too high or the machine is used overloaded, the overheat protection can prevent the high temperature from damaging the welder.

Support remote control

- The machine provides gun control and foot switch options for users to select as required.

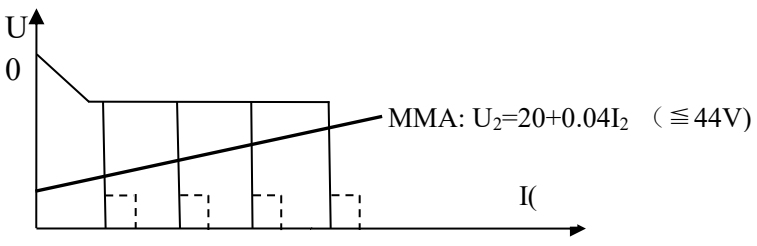
3. Technical Parameters

3.1 Technical Parameters

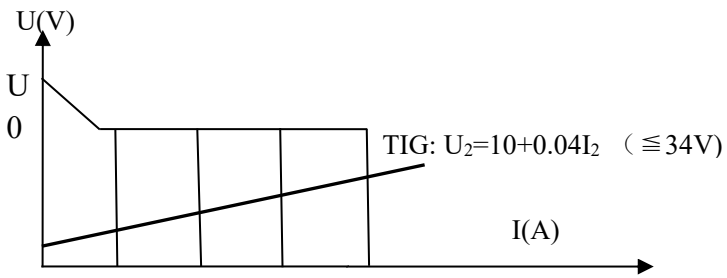
SN	Project Name	Unit	Value	
1	Power voltage	VAC	AC110V±15%	AC220V±15%
2	Input frequency	Hz	50	
3	Rated input current	A	33@TIG 35@MMA	
4	Capacity of power supply	KVA	6.0@TIG 7.5@MMA	
5	Output current range (TIG)	A	10~120	10~200
6	Output current range (MMA)	A	10~110	10~160
7	Arc force range	A	0~40	
8	Hot start current range	A	0~80	
9	No-load voltage	V	60	
10	Rated working voltage	V	18@TIG 26.4@MMA	
11	AC output frequency	Hz	20~250	
12	AC balance	%	20~60	
13	Background level	A	10~200	
14	Pulse frequency	Hz	0.5~200 (DC) 0.5~25(AC)	
15	Pulse duty factor	%	5~95	
16	Pre-flow time	S	0~5	
17	Post-flow time	S	0~15	
18	Rising time	S	0~15	
19	Fall time	S	0~15	
20	Remote control	-	Yes	
21	Arc start mode	-	HF arc starter	
22	Efficiency (%)	%	80	
23	Duty cycle (%)	%	TIG: 200@25% - MMA: 160@25%	
24	Power factor	-	0.70	
25	Type of cooling	-	Air cooled	
26	Working temperature range	°C	—10~+40	
27	Storage temperature range	°C	—25~+55	
28	Protection class	-	IP21S	
29	Insulation class	-	B	

3.2 External (Static) Characteristic Curve

MMA electrode welding has drop characteristic, and outputs the external (static) characteristic curve as shown in the right figure:



Simple TIG has drop characteristic, and outputs the external (static) characteristic curve as shown in the right figure:

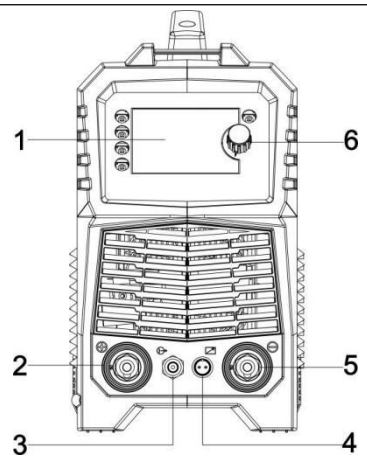


4.FUNCTION AND DESCRIPTION

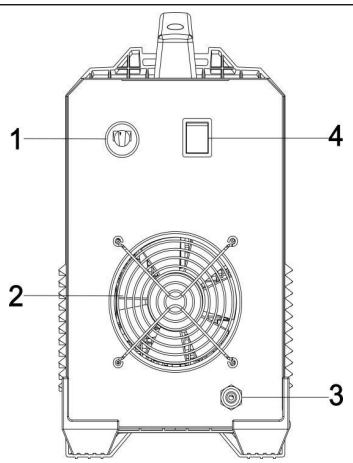
4.1 Panel Structure and Description

Pic1:
1. Digital plastic display panel
2.Positive output fast socket
3.TIG outlet interface
4.Gun control aviation socket
5. Negative output fast socket
6. Encoder

Pic2:
1. Input power cord
2.Cooling fan
3. TIG inlet nozzle
4.Power switch



Pic 1



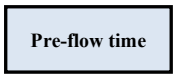
Pic 2

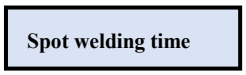
4.2 TIG200PACDC Panel

Pic 3 Plastic display panel

Function table of plastic display panel

1	Protection indicator		Overheat indicator, indicating that the temperature of internal components is too high and the welder displays overheat protection.

			Alarm indicator, indicating that the welder works abnormally.
2	Data display		The table header shows the specific value of the parameters; "**A**" is current unit indicator. The indicator will flash when there is current; "**S**" is time unit indicator. The indicator will be on when the time is displayed. "**%**" is percentage indicator. The indicator will be on when the percentage is displayed. "**Hz**" is frequency unit indicator. The indicator will be on when the frequency is displayed;
3	TIG Parameters		**Pre-flow time** indicator**.** When the indicator is on, it indicates the pre-flow protection time.
			**Initial current** indicator. When the indicator is on, it indicates the initial current.
			**Up-slope time** indicator. When the indicator is on, it indicates the time when the initial current reaches the peak current.
			**Peak current** indicator. When the indicator is on, it indicates the welding current.
			**Background level** indicator. When the indicator is on, it indicates the background level if there is pulse.
			**Down-slope** time indicator. When the indicator is on, it indicates the time when the peak current drops to the crater current.
			**Crater current** indicator. When the indicator is on, it indicates the current when stopping arc.
			**Post-flow** time indicator. When the indicator is on, it indicates the delayed air-off time.
		 	**AC frequency** indicator. When the indicator is on, it indicates the AC frequency. **AC balance** indicator. When the indicator is on, it indicates the ratio of tungsten anode time to AC cycle.

		 	**Duty-cycle** indicator. When the indicator is on, it indicates the ratio of peak current time to pulse period. **Pulse frequency** indicator. When the indicator is on, it indicates the pulse frequency.
			**Spot welding** time indicator. When the indicator is on, it indicates the spot welding time.
4	Encoder		Parameter setting function. 1. Rotate encoder to select the parameter to be set. 2. After pressing the encoder, the selected parameter indicator flashes, and rotate encoder to set the parameter. 3. After setting, press the encoder to exit settings.
5	Function Selection		1. Press the welding mode button to switch the welding mode. 2. **MMA** indicator. When the indicator is on, it indicates that the machine is in MMA mode. 3. **DC TIG** indicator. When the indicator is on, it indicates that the machine is in DC TIG mode. DC output is suitable for welding carbon steel, copper and stainless steel. 4. **AC TIG** indicator. When the indicator is on, it indicates that the machine is in AC TIG mode. AC output is suitable for welding aluminum, magnesium and their alloys.
			1. Press the operation mode key to switch the operation mode. **Spot** welding indicator. When the indicator is on, it indicates that the machine is in spot welding mode. In spot welding mode, press the torch trigger will reach the preset current state after the pre-flow time. Spot welding will turn off the output after the set running time. 2. **Four-step** indicator. When the indicator is on, it indicates that the machine is in four-step mode. In four-step mode, press the torch trigger, the machine will stop at the initial current phase after the pre-flow time; release the torch trigger, the machine will reach the peak current phase after the up-slope time from initial current to peak current; press the torch trigger again, the machine will stop at the final current phase after the down-slope time from peak current to crater current; and then release the torch trigger, the machine will start gas supply after the crater current extinguishes. 3. **Two-step** indicator. When the indicator is on, it indicates that

			the machine is in two-step mode. In two-step mode, press the torch trigger, the machine will reach the peak current after the pre-flow time and up-slope time from initial current to preset current; release the torch trigger, the machine will start gas supply after the preset current drops to crater current and then extinguishes.
			1. Press **pulse** key to switch between pulse and no pulse.Pulse indicator. When the indicator is on, it indicates the pulse state. 2.Generally, the low-frequency pulse frequency is 0.5-10Hz. The interactive effect of heating and cooling can reduce deformation by reducing the average current. Low-frequency pulse current, coupled with proper welding speed, can form fish-scale welds. Besides, it is convenient to use wire filling device under low-frequency pulse to optimize the weld formation. Pulse can oscillate the molten pool and improve the microstructure of weld. High-frequency pulse can enhance the concentration and stiffness of the arc. Stable arc can increase the depth of molten pool and improve welding speed. 3. **No-pulse** indicator. When the indicator is on, it indicates there is no pulse.
			1. Press the waveform selection key to switch the output waveform in AC mode. 2. **Triangular wave** indicator. When the indicator is on, it indicates that triangular wave is selected. The triangular wave reduces the heat input, so the weld can form rapidly, reducing the welding deformation. It is suitable for thin-plate welding. 3. **Square wave** indicator. When the indicator is on, it indicates that the machine selects square wave. Standard AC square wave can quickly switch the polarity, enjoying high arc stability, good dynamic characteristics, and strong ability to clean aluminum oxide film. It is suitable for a wide range of aluminum and aluminum alloy welding.
			1. Press the **MMA** parameter key to switch the function selection. 2. **Hot start** indicator. When the indicator is on, it indicates that hot start current of MMA is selected. 3. **Arc-force** current indicator. When the indicator is on, it indicates that the arc-force current of MMA is selected. 4. Welding current indicator. When the indicator is on, it indicates that the welding current of MMA is selected.

4.3 Functional Description

Warning! Select the welding function according to requirements. The welding mode and parameters should be selected according to the technical requirements of the weldment. If the welding mode or parameters are not appropriate, there will be unstable arc, big spatter, sticking electrode, etc.

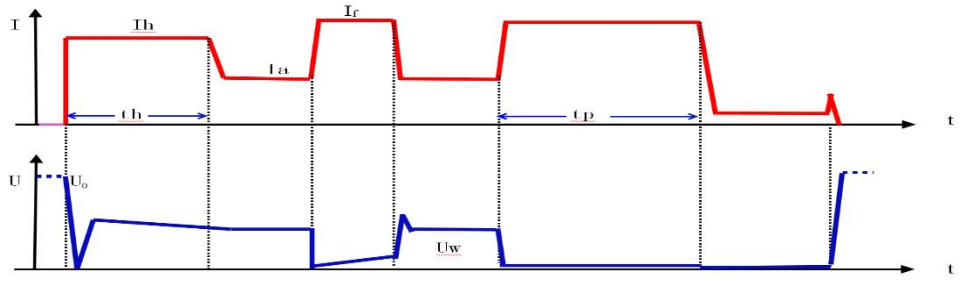
4.3.1 TIG200PACDC Function Table

Rotate the encoder to select different welding parameters according to actual requirements. Regardless in no-load or welding mode, the parameter selection and adjustment can be carried out without affecting the welding. The mode is switched by rolling mode. "●" indicates that the parameter is optional, and "×" means that the parameter is not optional.

Welding mode	Torch trigger mode	MMA current	Hot start current	Arc-force current
MMA	None	●	●	●

Welding mode	Torch trigger mode	Pre-flow time	Initial current	Up-slope time	Peak current	Background level	Down-slope time	Crater current	Post-flow time	Spot welding time	AC frequency	AC balance	Pulse frequency	Pulse duty factor
DC TIG	Two-step	●	●	●	●	×	●	●	●	×	×	×	×	×
	Four-step	●	●	●	●	×	●	●	●	×	×	×	×	×
	Spot welding	●	×	×	●	×	×	×	●	●	×	×	×	×
DC pulse TIG	Two-step	●	●	●	●	●	●	●	●	×	×	×	●	●
	Four-step	●	●	●	●	●	●	●	●	×	×	×	●	●
	Spot welding	×	×	×	×	×	×	×	×	×	×	×	×	×
AC TIG	Two-step	●	●	●	●	×	●	●	●	×	●	●	×	×
	Four-step	●	●	●	●	×	●	●	●	×	●	●	×	×
	Spot welding	●	×	×	●	×	×	×	●	●	×	×	×	×
AC TIG pulse	Two-step	●	●	●	●	●	●	●	●	×	●	●	●	●
	Four-step	●	●	●	●	●	●	●	●	×	●	●	●	●
	Spot welding	×	×	×	×	×	×	×	×	×	×	×	×	×

4.3.2 MMA Function



Pic 4 Welding process of manual electrode

1. I_h (hot start current) = $I_{\Delta h}$(arc ignition current)+ I_a (welding current); the hot start time is fixed at t_h, which is conducive to arc starting, and reduce the sticking tendency of welding electrode and weldment during arc ignition.

The magnitude of hot start current is generally determined based on the type, specification, and welding current of welding electrode. For welding rods with sound arc start performance and small diameter, generally select small hot start current; large welding current also has little requirement for hot start current.

The hot start time is correlated with the arc starting current. The greater the hot starting current is, the shorter the arc start time will be.

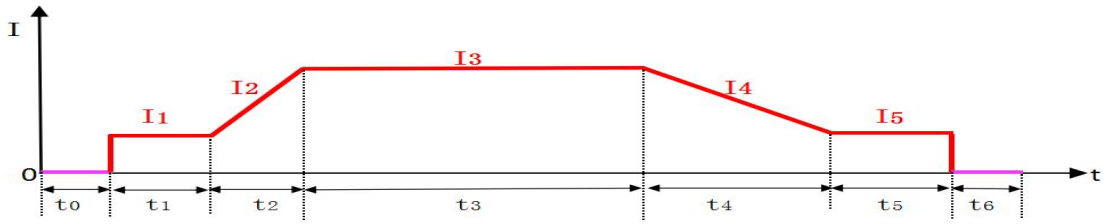
2. I_f (plus arc-force current) = $I_{\Delta f}$ (arc-force current)+I_a (welding current); the arc-force current shall be determined according to electrode diameter, set current and process requirements. High arc force settings lead to a faster metal transfer and non-sticking electrode but with some spatter. Lower arc force settings provide a smooth arc with lower spatter and a good weld seam formation, but sometimes the arc is soft or the welding rod can stick. In particular, heavy welding electrodes shall be welded at low currents with increased arc force. Generally, the arc force is 20~70A when welding.

3. After the short-circuit time exceeds Tp, it will enter the anti-sticking electrode current, which is small current until the electrode is separated from the weldment.

4. U_0 is open circuit voltage and Uw is working voltage. When MMA is not working, the welder outputs the open circuit voltage is U_0.

4.3.3 TIG Function

1) DC TIG



Pic 5 Current change waveform of DC TIG

t0-Pre-flow time

I1-Initial current

t1-Initial current period

I2-Current corresponding to the up-slope time

t2-Up-slope time

I3-Peak current t3-Peak current period

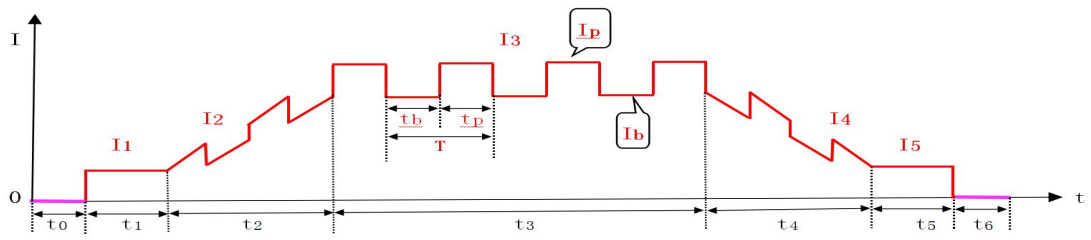
I4-Current corresponding to down-slope time t4-Down-slope time

I5-Crater current t5-Crater current period

t6-Post-flow time

- Initial current (I1): The initial current is the current after the gun torch trigger is pressed to ignite the arc, which should be determined according to the process requirements. Large initial current is easy to ignite the arc, but it should not be too large when welding the thin plate; otherwise, it is easy to burn through the weldment. After the arc is ignited in some operations, the current stays at the initial current and does not go upslope to achieve the purpose of preheating the workpiece or lighting.
- Up-slope time (t2): The up-slope time refers to the time when the current slowly rises from the initial current to the peak current, which can be determined according to the use and process requirements.
- Peak current (I3): The parameter is set by the user according to the process requirements.
- Down-slope time (t4): Down-slope time refers to the time when the current drops from the peak current to the crater current, which can be determined according to the use and process requirements.
- Crater current (I5): In some operating modes, the arc is not extinguished after down-slope of current and maintains in a state of continuous arc. The operating current in this state is called the crater current, which can avoid weld defect or large crater caused by immediate cutting off the output. The current shall be determined according to the process requirements.
- Pre-flow time (t0): It refers to the time from pressing the torch trigger to send argon gas to arc ignition. Generally, it should be greater than 0.5s to ensure that the argon gas has been sent to the welding gun at normal flow when discharging arc initiation, especially when the gas pipe is long, the pre-flow time should be increased.
- Post-flow time (t6): It refers to time from cutting off welding current to turning off gas valve in welder. Too long time will cause waste of argon gas, but too short time will cause oxidation of weld. The time shall be longer for AC TIG and special material welding.

2) DC Pulse TIG



Pic 6 Current change waveform of DC Pulse TIG

I1-Initial current t0-Pre-flow time

I2-Current corresponding to the up-slope time t1-Initial current period tb-Pulse base time

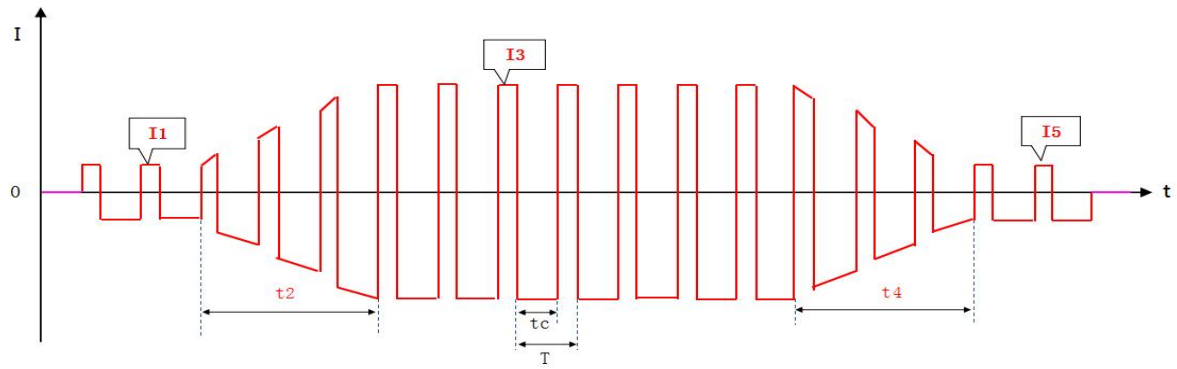
I3-Set pulse current t2-Up-slope time tp-Pulse peak time

I4-Current corresponding to down-slope time	t3-Peak current running period	T-Pulse period
I5-Crater current	t4-Down-slope time	
IP-Pulse peak current	t5-Crater current period	
Ib-Pulse background level	t6-Post-flow time	

Pulse TIG includes all parameters of DC TIG, except that the parameters are set differently. The same parameters will not be repeated here. In addition, there are 4 adjustable parameters, which are explained separately in conjunction with the figure:

- Peak current (Ip): It is adjusted according to the process requirements.
- Background level (Ib): It is adjusted according to the process requirements.
- Pulse frequency (1/T): T=tp+tb, adjusted according to the process requirements.
- Duty cycle (100%*tp/T): Duty cycle is the percentage of peak current duration in the pulse cycle, which is adjusted according to the process requirements.

3) AC TIG



Pic 7 Current change waveform of AC TIG

I1-Initial current	t2-Up-slope time
I3-Set AC peak current	t4-Down-slope time
I5-Crater current	tc-Clearing current time
T-AC period	

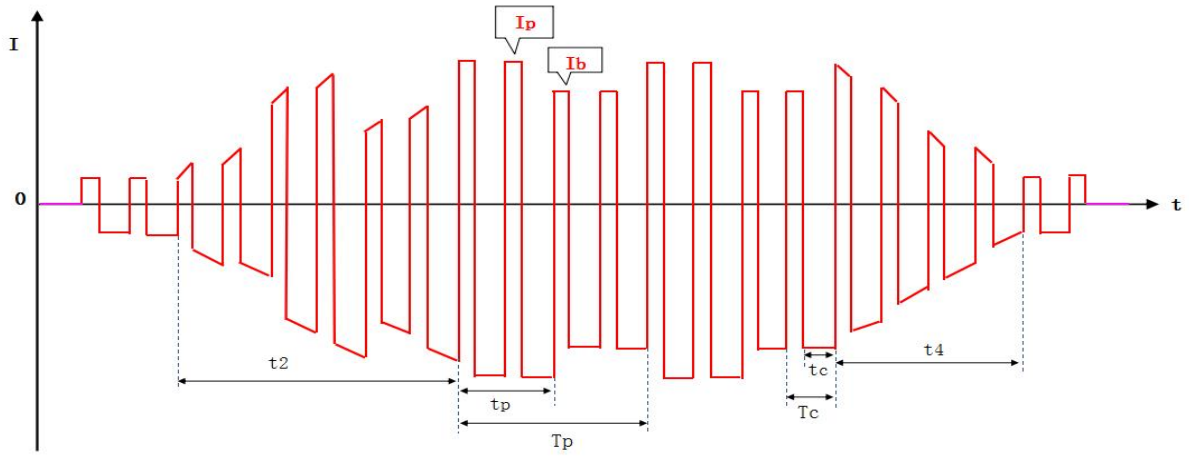
AC TIG supports square wave, triangular wave and sine wave, but the output waveforms are different. Except for the same pre-flow time and post-flow time for AC TIG and DC TIG, other parameters are explained separately in conjunction with the figure:

● Initial current (I1), peak current (I3) and crater current (I5): The set values of these three parameters are approximately equal to the effective values of the actual welding current, which can be adjusted according to the process requirements.

● AC frequency (1/T): It can be adjusted according to the process requirements.

● Ac balance (100%*tc/T): Generally, the current of positive tungsten electrode in AC welding is called the cleaning current. Its main function is to break the dense oxide layer of the workpiece, and the AC balance represents the proportion of the cleaning current. The parameter is generally 10-40%. When the value is small, the arc is concentrated, the fusion depth is large, and the fusion width is small, vice versa.

4) AC Pulse TIG



Pic 8 Current change waveform of AC pulse TIG

tc-Clearing current time	Tc-AC period
tp-Pulse peak time	Tp-Pulse period
t2-Up-slope time	t4-Down-slope time
Ip-Peak current	Ib-Background level

- AC frequency (1/Tc): It is adjusted according to the process requirement.
- Pulse frequency (1/Tp): It is adjusted according to the process requirement.
- Duty cycle (100%*tp/Tp): It is adjusted according to the process requirement.
- AC balance (100%*tc/Tc): It is adjusted according to the process requirement.
- AC pulse TIG supports square wave, triangular wave and sine wave, but the output waveforms are different. AC pulse TIG is basically same as the AC square wave TIG, but its welding current is controlled by a low-frequency pulse. Therefore, the welding current changes with pulse value to form peak and background current, and the set peak and background current are the peak value (average value) and background value (average value) of low-frequency pulse.
- In AC pulse mode, the pulse frequency range is affected by AC frequency and frequency division factor. The minimum frequency division factor is 10, and the maximum value is 2 times the AC frequency. Therefore, the pulse frequency range is 0.5Hz to AC frequency/10Hz, and the user can choose any frequency in the range. When the AC frequency changes, the AC frequency/actual frequency of the current pulse is equal to the frequency division factor and updated. When the frequency division factor is determined, the current AC frequency/frequency division factor is equal to the actual frequency of the current pulse and saved, so the pulse frequency does not change. After setting the AC frequency and pulse frequency, the frequency division factor is determined, which is equal to AC frequency/pulse frequency. For example: When AC frequency is set to 100Hz, the pulse frequency range is 0.5-10Hz. If the AC frequency is set to 100Hz and the pulse frequency is set to 5Hz for the first time, the current frequency division factor is 100/5=20. When the AC frequency is changed to 70Hz, the frequency division factor is 70/5=14, that is, the frequency division factor is variable, but the pulse frequency is constant. **In other words, the AC frequency affects the pulse frequency range. But when the pulse frequency is determined, it will no longer be affected by the AC frequency.**

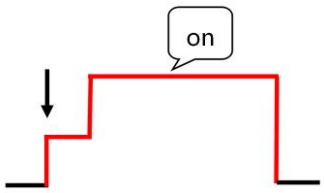
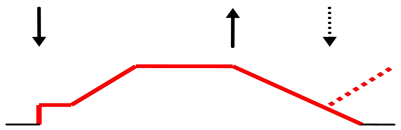
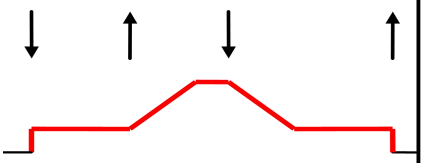
5) Welding Mode Description of TIG Welding Gun

TIG operation mode has a special convention, which specifies the mode or method of controlling the welding current change by different operations of torch trigger during TIG (DC, pulse, AC TIG, mixed TIG)

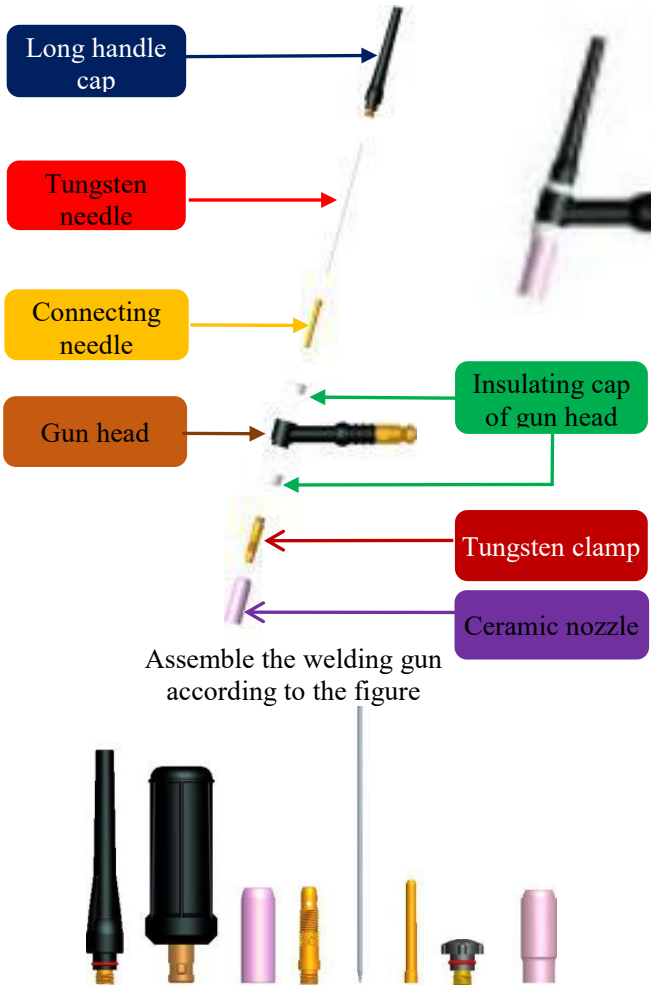
welding. The introduction of TIG operation strengthens the application of torch trigger remote control function, so users can obtain a practical welder remote control without increasing investment.

TIG mode should be determined according to the process requirements and users' operation habit. The symbols in the diagram are described as follows:

Operation legend of commonly used torch trigger			
↓	Press the torch trigger	↑	Release the torch trigger

Mode No.	Agreed Operation	Torch trigger operation and typical DC TIG current curve
1	Spot welding mode: 1. Press the torch trigger to start the arc to the set value 2. The arc extinguishes after the spot welding finishes the set running time	
2	"Two-step" mode: 1. Press the torch trigger to start the arc slowly to the set peak value 2. Release the torch trigger to slowly drop to the quenching of arc 3. If the gun switch is pressed again before quenching of arc, it will slowly rise to the peak value	
3	"Four-step" mode: 1. Press the torch trigger to start the arc to the initial value 2. Release the torch trigger to slowly rise to the peak value 3. Press the torch trigger to slowly drop to the stopping arc 4. Release the torch trigger to extinguish the arc	

6) TIG Welding Gun Description



Standard welding gun parameters
Gun type: gas-electric integrated
Maximum current: 200A
Rated current: 200A
Type of cooling: Air cooled
Gas connector: M16.5

Pic 9 Accessories

5.INSTALLATION AND CONNECTION

Warning! Electric shock may cause death! After power failure, there is still a high voltage on the equipment, do not touch the live parts on the equipment.

Warning! The power supply connection of the machine must be operated by experienced and qualified electricians.

Warning! Do not ground the live wire (blue, brown, black) of the power cord, and do not connect the earth lead (yellow-green) to the live wire.

Warning! Incorrect input voltage may damage the equipment.

5.1 Connection of Power Cord

1) This machine is equipped with a power voltage compensation system. Therefore, it can be used in the range of rated voltage ±15%.

2) Connect the power source to the suitable power distribution box according to the voltage grade of welder. Meanwhile, ensure that the supply voltage deviation is within the allowable range.

3) When extension cord is required, it is recommended to use cables with larger cross-sectional area to

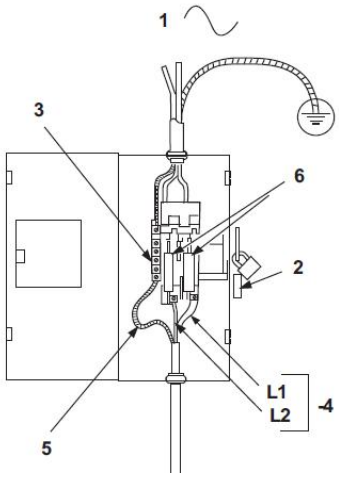
reduce the voltage drop. An excessively long cable may affect arc starting performance and normal operation of system. Therefore, please use the recommended cable length.

4) YZ 3X2.5mm² 300/500V power cord is recommended for TIG200PACDC.

⚠Ensure that the switch of the power distribution box is turned off when connecting the input power cord.

⚠Connect the input power cord of the welder to the output of the power distribution box reliably.

5.2 Connection of power distribution box



Wiring diagram of single-phase power distribution box

1. Single-phase AC power input: 110V/220V;
2. Power switch of power distribution box;
3. Earth terminal strip;
4. Welder power cable or socket adapter cable: 200A machine shall use cable of 3*2.5mm2 or above;
5. Yellow-green earth lead (connect to the ground);
6. Fuse: 200A machine shall use fuse of no less than 60A.

Please connect the cables according to the way shown or other correct ways with the main power switch being turned off.

Note: Do not operate with electricity.

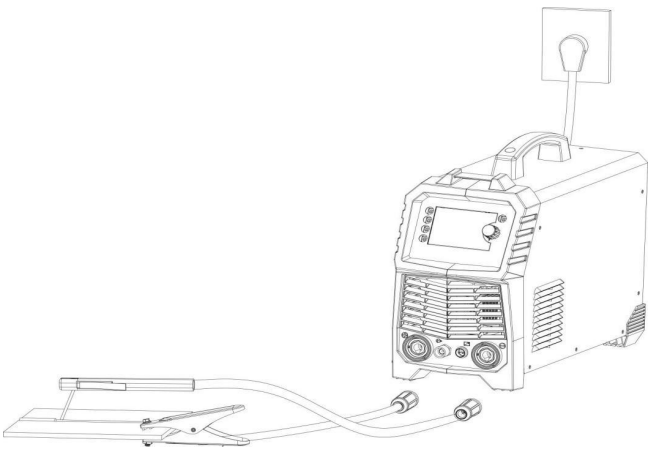
- **The wiring of the machine can only be carried out by professional electricians.**
- **Please distinguish the input voltage 380V and 220V for single-phase machine.**
- **Do not connect two welders to the same distribution box.**

If the enclosure is grounded, line 5 is not grounded.

5.3 Welder Installation

Warning! All connections shall be made with the power supply being turned off. The correct steps are: first, ground the welder reliably and ensure correct wiring without missing correction; and then connect the input power cable.

1)MMA Installation



Pic 10 MMA Installation diagram

How to use:

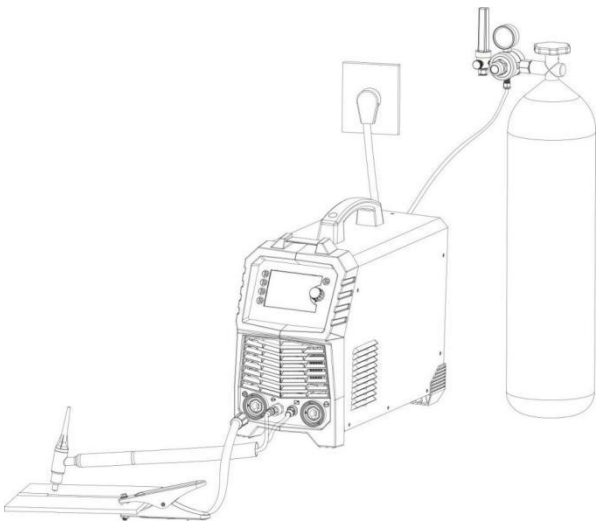
- Turn the power switch to "ON" position after correct Installation. At this time, the panel indication is on, the fan starts rotation (which is controlled by temperature and may stop after rotation), and then the fan starts to work normally.
- Pay attention to the polarity of wiring before MMA. Generally, there are two connection methods of DC welder: Electrode positive and electrode negative connection.

Positive connection: the welding electrode holder is connected to the negative polarity, and the weldment is connected to the positive polarity;

Negative connection: the electrode holder is connected to the positive polarity, and the weldment is connected to the negative polarity.

- The connection method is selected according to the process requirements of the weldment. If the selection is wrong, it will result in unstable arc, large spatter and sticking electrode, etc. At this time, the operators can easily exchange the fast plug to change the polarity.
- Select the corresponding electrode according to the current, clamp the electrode, and start welding by short-circuit arc starting.

2)TIG Installation



Pic 11 TIG Installation diagram

How to use:

- Connect the earth clamp to the positive polarity of welder and joint of welding gun to the negative polarity of welder before TIG. The welding cannot be started if connected wrongly; connect the control cable of welding gun to the control interface; select the proper welding mode according to the material of weldment and check whether the selected tungsten electrode matches the panel parameters and whether the current parameters match the requirements. In AC welding mode, improper AC balance parameter may cause abnormal welding.
- If the workpiece is far away from the welder. The secondary wire (welding cable and ground wire) used is relatively long, so it is suggested that the cross-sectional area of the wire should be appropriately larger to reduce the voltage drop of the cable.
- The welding output line cannot be coiled, as this will cause the machine to work abnormally.
- Select the corresponding tungsten electrode according to the current, and start welding by lift TIG or high-frequency arc starting.

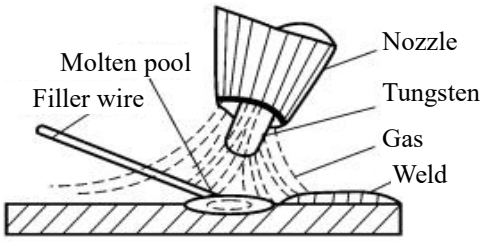
6.Function and Operation

6.1 TIG Introduction

Warning! Do not disconnect the plug or cable in use during welding, otherwise it will cause electric shock or damage to the machine!

6.1.1 TIG Overview and Characteristics

TIG is a gas shielded arc welding that uses argon as the protective gas. TIG welding process is as shown in the figure. It uses the argon gas flow ejected from the nozzle of the welding gun to form a tightly closed protector in the arc area to isolate the metal molten pool from the air, so as to prevent air intrusion. Besides, it uses the heat generated by the arc to melt the filler wire and base metal, and the liquid metal molten pool will form weld after cooling.



Pic 12 TIG diagram

Argon is an inert-gas and does not react chemically with metal, so it will not burn the alloy elements in the metal being welded and can fully protect the metal molten pool from oxidation. Moreover, argon is insoluble in liquid metal at high temperature, so it is not easy to cause gas pores in the weld. Therefore, argon can provide effective and reliable protection effect, thus obtaining higher welding quality.

6.1.2 TIG Characteristics

Compared with other stud arc welding methods, TIG enjoys the following characteristics:

① Argon has excellent protection performance, and there is no need to prepare corresponding flux during welding. It is basically a simple process of metal melting and crystallization, which can obtain relatively pure and high-quality welds.

② Because the arc is compressed and cooled by the argon gas flow, the heat of arc is concentrated, and the temperature of the argon arc is very high. Therefore, the heat-affected zone is very narrow, the welding deformation and stress are small, and the crack tendency is small. It is especially suitable for welding of thin plates.

③ TIG is open arc welding, which is convenient to operate and observe, making it easy to realize the mechanization and automation of the welding process. In addition, welding in various spatial positions can be performed under certain conditions.

④ TIG supports a wide range of weldable materials, including almost all metal materials, especially suitable for welding chemically active metals and alloys.

It is generally used for welding aluminum, titanium, copper and their low alloy steels, stainless steels and heat resistant steels, etc.

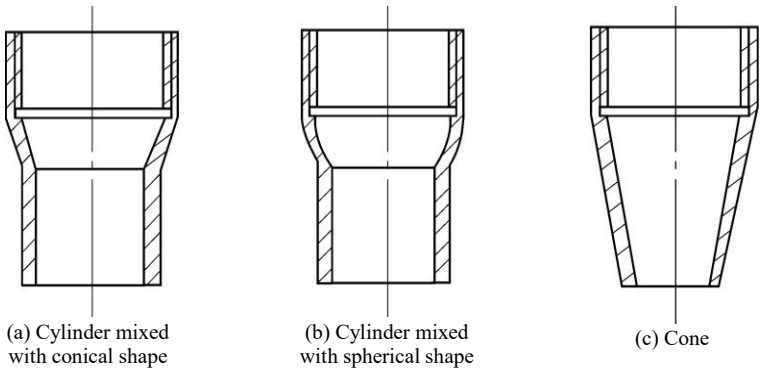
Because of these outstanding characteristics of TIG, with the increasing product structure of non-ferrous

metals, high alloy steels and rare metals, and unattainable welding quality requirements by the common gas welding or arc welding methods, TIG welding is more and more widely used.

6.1.3 TIG Welding Gun

The TIG welding gun is used to clamp the electrode, conduct electricity and transport argon gas flow, which are controlled by the start and stop buttons on the holder. The welding gun comprises three types, the maximum welding current for small type is 100A, and for large type is 400-600A, all adopting water cooling. The welding gun body is pressed by nylon, featuring with light weight, small volume, good insulation and heat resistance.

The welding gun nozzle serves as an important component that determines the gas shield protection performance, and the common nozzle shapes are as shown in the figure. The cylindrical nozzle with conical or spherical tail has the best protection effect, as the argon gas flow rate is uniform, which makes it easy to maintain laminar flow. The conical nozzle has poorer protection effect because of the rapid argon airflow speed, but it is easy to operate and has good visibility of molten pool, and is often used in welding.



Pic 13 Welding gun nozzle diagram

6.1.4 TIG Process

1) Cleaning before welding

Before carrying out TIG, the joint of the welded material and the welding wire must be cleaned to remove the oxide film and oil stains on the metal surface to ensure the quality of the weld. The cleaning methods include mechanical cleaning, chemical cleaning, and chemical mechanical cleaning.

① Mechanical cleaning: This method is simple and effective. It is suitable for cleaning weldments with large size and long welding cycle. Usually use a stainless steel wire brush and other tools with a small diameter for polishing, or use a spatula to remove the surface oxide film to expose the metal luster of the welding part, and then use an organic solvent to remove oil stains to clean the vicinity of the weldment joints.

② Chemical cleaning: This method is often used for cleaning filler wire and small weldments. Compared with the mechanical cleaning method, this method has the characteristics of high cleaning efficiency, stable and uniform quality, and long retention time. The chemical solution and process used in the chemical cleaning should be determined according to the material to be welded and welding requirements

③ Chemical mechanical cleaning: First use chemical cleaning, and then use mechanical cleaning at the welding parts before welding. This combined cleaning method is suitable for weldments with higher quality requirements.

2)Gas protection effect

Argon is an ideal protective gas, with a boiling point of -186℃, between the boiling points of oxygen and helium. It is a by-product of fractional distillation of liquid air in an oxygen plant to produce oxygen. In China, bottled argon is used for welding, and its filling pressure is 15MPa at room temperature. The cylinder is painted gray and marked with the word "Argon". The chemical composition requirements of pure argon are: Ar ≥ 99.99%; He ≤ 0.01%; O2 ≤ 0.0015%; H2 ≤ 0.0005%; total carbon content ≤ 0.001%; moisture ≤ 30mg/m3.

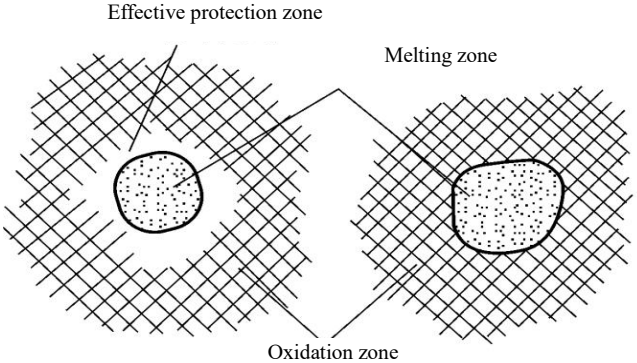
It is beneficial to protect welding arc and reduce the consumption of protective gas during flat position welding. Argon is a chemically inactive gas and does not chemically react with metals even at high temperatures, so there is no oxidation and burning of alloying elements and a series of problems caused by it. Argon is also insoluble in liquid metal, so it does not cause gas pores. Argon is a monatomic gas that exists in atomic state and has no molecular decomposition or atomic endothermic phenomena at high temperatures. Argon has small specific heat capacity and heat conduction capacity, that is, small heat absorption and less heat transfer. Therefore, the heat in the arc is not easy to lose, making the welding arc combustion stable and the heat concentrated, which are conducive to welding.

The disadvantage of argon is its high ionization potential. When the arc space is filled with argon, it is difficult to ignite the arc, but the arc is very stable once ignited.

In the process of welding, the protection effect of argon is affected by many technological factors. Therefore, it is necessary to pay attention to the effective protection of argon during TIG welding to prevent interference and damage to the protection effect of argon; otherwise, it is difficult to obtain required welding quality.

The welding technology factors affecting the argon protection effect include gas flow rate, nozzle shape and diameter, distance between nozzle and weldment, welding speed, welding joint form, etc., which should be considered comprehensively and selected correctly.

The quality of the argon protection effect is often evaluated by the welding spot test method by measuring the range of effective argon protection zone. For example, use AC manual tungsten electrode TIG to conduct spot welding on the aluminum plate, and the welding process conditions remain the same during welding; after striking arc, hold the welding gun for 5-10s before turning off the power. At this time, a melting point will be left on the aluminum plate. The "cathode crushing" around the welding spot will remove the oxide film on the surface of the aluminum plate, and a grayish-white area with metallic luster will appear. This part where the oxide film is removed is the effective argon protection zone, as shown in the figure. The larger the diameter of the effective protection zone, the better the protection effect.



(a) Good protection effect (b) Bad protection effect

Pic 14 Argon protection effect diagram

In addition, the argon protection effect can be evaluated by directly observing the color of the weld face. Taking welding on stainless steels as an example, if the weld metal surface is silvery white or golden yellow, it means that the protection effect is good; if the color is grey or black, it means that the protection effect is bad.

6.1.5 Welding Parameters

The gas protection effect, welding process stability and weld quality of TIG are directly related to welding parameters. Therefore, reasonable selection of welding parameters is an important guarantee for obtaining high-quality welded joints.

The welding parameters for TIG include: current type and polarity, tungsten electrode diameter, welding current, argon flow, welding speed and process factors, etc.

① Current type and polarity: The current type and polarity of TIG should be selected according to the material to be welded and the operation method.

② Tungsten electrode diameter: It is mainly selected according to the thickness of the weldment. In addition, when the thickness of the material to be welded is equal, the allowable current of the tungsten electrode is different due to the different types and polarities of the current used, so the diameter of the tungsten electrode used is also different. If the diameter of the tungsten electrode is not selected properly, it will cause unstable arc, severe burnout and tungsten inclusion in the weld.

③ Welding current: After the diameter of the tungsten electrode is selected, select the applicable welding current. Too large or too small welding current will cause poor weld formation or welding defects.

④ Argon flow: It is mainly selected according to the tungsten electrode diameter and the nozzle diameter. For nozzles with a certain aperture, the selected argon flow rate should be appropriate.

If the flow rate is too large, the gas flow rate will increase, and it will be difficult to maintain a stable laminar flow, which is not good for the protection of the welding zone. Besides, it will take away a lot of heat from the arc zone, which will affect the stable combustion of the arc. However, if the flow rate is too small, it is easy to be interfered by the outside air flow, so as to reduce the argon protection effect. Usually the flow of argon is in the range of 3-20L/min.

⑤ Welding speed: Under certain conditions of tungsten electrode diameter, welding current and argon gas flow, too fast welding speed will cause the shielding gas flow to deviate from the tungsten electrode and the molten pool, thereby affecting the argon protection effect. Moreover, the welding speed significantly affects the shape of the weld. Therefore, an appropriate welding speed should be selected.

⑥ Process factors: Mainly include the shape and diameter of the nozzle, the distance from the nozzle to the weldment, the length of the tungsten electrode, the diameter of the filler wire, etc. These process factors do not change much, but they have different degrees of influence on the welding process and argon protection effect. Therefore, they should be selected according to specific welding requirements.

Generally, the nozzle diameter can be selected within 5-20 mm; the distance from the nozzle to the weldment shall not exceed 15 mm; the length of tungsten electrode out of the nozzle shall be 3-4 mm; and the diameter of filler wire shall be selected according to the thickness of weldment.

6.1.6 General Requirements of TIG

1. Control requirements of gas: It is required that the gas is supplied first and exhausted last. Argon is an inert-gas which is easy to be broken down. First fill argon between the workpiece and the electrode needle, which is conducive to arc starting; after welding, keeping on supplying argon can prevent the workpiece from

oxidation due to rapid cooling and ensure good welding effect.
2. Current manual switch control requirements: When the manual switch is pressed, the current is delayed compared to the gas. After the manual switch is turned off (after the welding is completed), and the gas supply current is cut off first according to the requirements.
3. High-voltage generation and control requirements: TIG adopts the high-voltage arc starting mode, which requires to have high voltage when arcing, and no high voltage after arcing.
4. Interference protection requirements: High frequency is accompanied by high voltage of arcing in TIG, which causes serious interference to the whole circuit and requires the circuit to have good anti-interference ability.

6.2 MMA Introduction

Warning! Do not disconnect the plug or cable in use during welding, otherwise it will cause electric shock or damage to the machine!

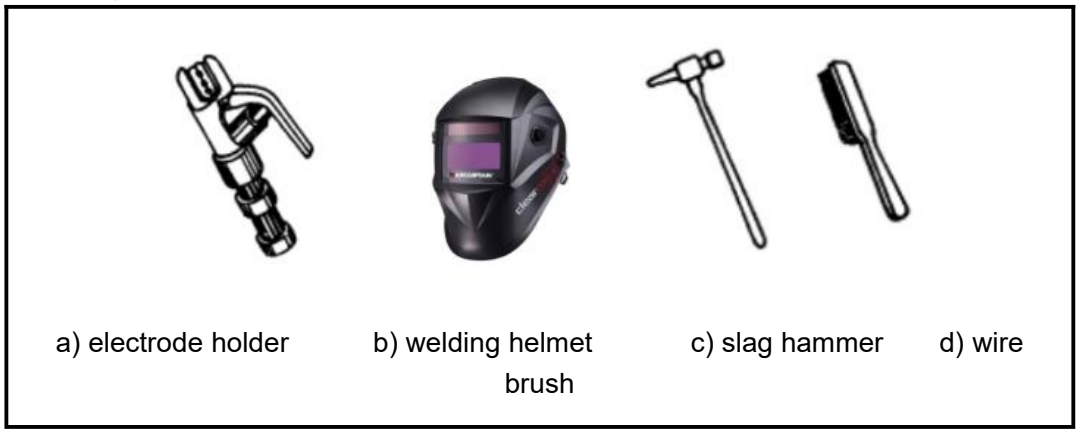
The arc welding in which the welding electrode is manually operated is called manual electric arc welding, or MMA for short. The MMA machine is simple, easy to operate, flexible and adaptable. It is suitable for welding of various metal materials of various shapes and structures with a thickness of more than 2mm, especially for weldments with complex structure shapes, short or curved welds and welds of different spatial positions.

6.3 MMA Welding

First, connect the output polarities of the welder with the weldment and the electrode holder respectively, and then hold the electrode with the electrode holder. When welding, it will generate arc between the welding electrode and weldment, and high-temperature arc will melt the electrode end and the weldment locally and form a molten pool. The pool is then cooled and solidified rapidly to form a weld, so that the two separated weldments are firmly connected as a whole. The covering of the electrode melts to form molten slag covering the molten pool, and the slag cools to form a slag shell to protect the weld. Finally, the slag shell is removed, and the welding of the joint is completed.

6.3.1 MMA Tools

The commonly used MMA tools include electrode holder, helmet, slag removal hammer and wire brush, etc., as well as welding cables and labor protection products.



a) electrode holder b) welding helmet c) slag hammer d) wire brush

Pic 15 Common MMA tools

a) Electrode holder: It is a tool holding the electrode and conducting current. 300A and 500A are the most

commonly used two types.

b) Helmet: It is a shielding tool that protects your eyes and face from arcs and metal spatters, including hand-held and helmet-mounted types. The observation window of the helmet is equipped with colored chemical glass, which can filter ultraviolet and infrared rays Therefore, the users can observe the arc burning and molten pool through the observation window, which is convenient for operation.

c) Slag removal hammer (pointed hammer): It is a tool used to remove the slag shell on the weld face.

d) Wire brush: It is a tool used to remove the dirt and rust from weldment joints prior to welding, and weld face and welding spatter after welding.

e) Welding cable: Multi-strand fine copper cable is often used. YHH type electric welding rubber sheathed cable or THHR type electric welding rubber sheathed flexible cable can be used. A cable connecting the electrode holder and the welder is called the welding cable (live wire). Another cable (earth lead) is used to connect the welder and weldment. The outside of electrode holder is made of insulating material, which has the function of insulation and heat insulation.

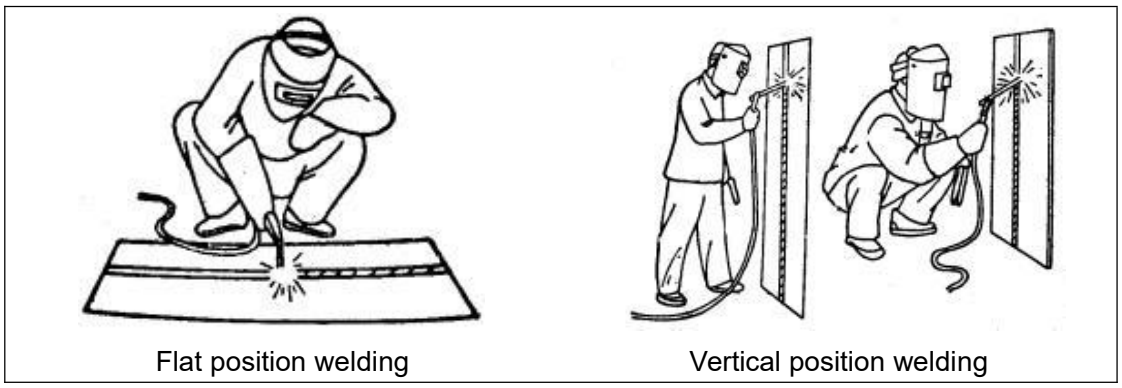
6.3.2 Basic MMA Operations

a. Cleaning of welding joint

Before welding, the joint should be removed from rust and oil, so as to facilitate arc initiation, arc stability and ensure the quality of welds. When the rust removal requirements are not strict, wire brushes can be used; when the requirements are strict, grinding wheels should be used.

b. Operation posture

Take the flat position welding of butt joint and t-joint from left to right as an example, as shown in the figure. The operator should stand on the right side of the weld's forward direction; hold the helmet in the left hand and the electrode holder in the right hand; place the left elbow on the left knee to control the upper part of the body not to follow downward movement; the forearm must be away from the ribs without support, and should be stretched freely.



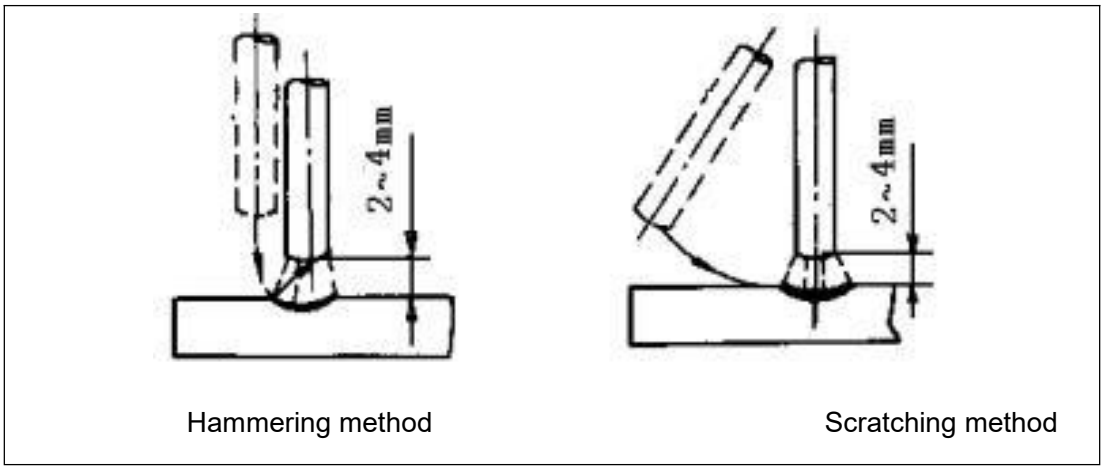
Flat position welding Vertical position welding

Pic 16 Welding posture

c. Striking arc

Striking arc is the process of generating a stable arc between the electrode and the weldment to heat the electrode and the weldment for welding. There are two commonly used striking arc methods: scratch method and hammering method, as shown in the figure. During welding, the end of the welding electrode contacts the weldment face through scratching or hammering to form short circuit, and then lift the welding electrode quickly for a distance of 2 to 4 mm, and the arc is ignited. If the welding electrode contacts the weldment face without arcing, it is often that the end of the welding electrode has a covering that hinders the conduction. At this time,

you can hit a few times to remove these insulators until the metal surface of the core wire is exposed.



Pic 17 MMA striking arc method

d. Tacking

In order to fix the relative position of the two welds for welding, during welding assembly, short welds of 30 ~ 40mm are welded every certain distance so that the weldments are fixed in each other's position, which is called tacking.

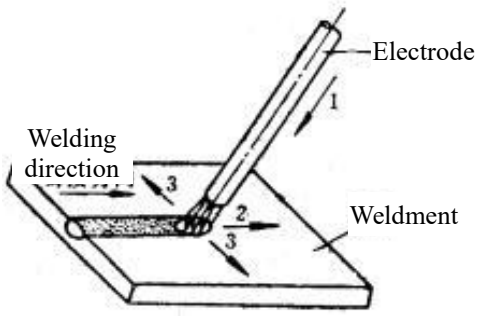
e. Electrode manipulation

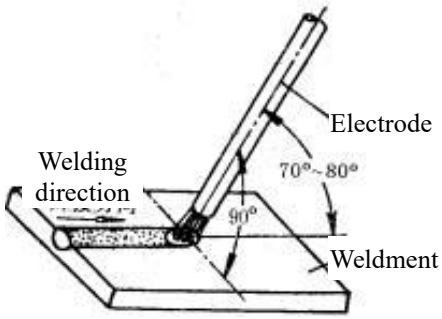
The operation movement of electrode is called electrode manipulation. It is actually a combined movement, that is, the electrode completes the movement in three directions simultaneously: the electrode moves gradually along the welding direction; the electrode is gradually fed to the molten pool direction; the electrode swings laterally, as shown in figure. After striking arc, manipulate the electrode in three directions and put forward operation requirements for the most widely used butt welding to master the welding angle, arc length and welding speed.

(1) Welding angle: As shown in the figure, the electrode shall be tilted forward 70-80º.

(2) Arc length: Generally, a reasonable arc length is approximately equal to the core diameter.

(3) Welding speed: The proper welding speed should make the weld width of the welding bead approximately equal to twice the core diameter, with a smooth surface and fine ripples. When the welding speed is too high, the welding bead is narrow and high, the ripple is rough, and the fusion is bad. When the welding speed is too low, the weld width is too large and the weldment is easy to burn through. Also note that the current should be appropriate, the welding electrode must be aligned, the arc must be low, the welding speed must be even rather than too fast.





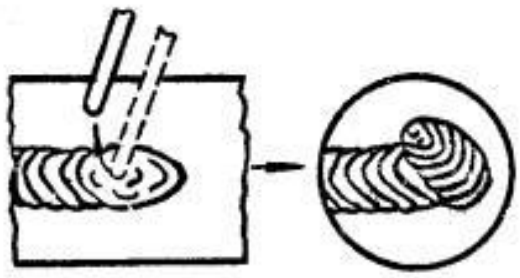
1. Feed down 2. Move along the welding direction 3. Swing laterally

Welding electrode angle in flat position welding

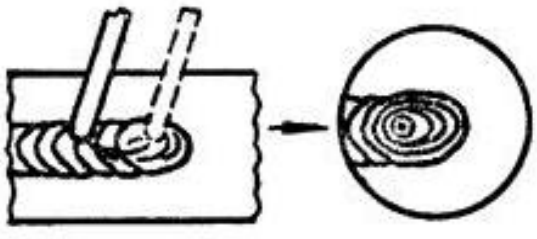
Pic 18 MMA electrode manipulation diagram

f. Quenching of arc

During welding, quenching of arc is inevitable. If the quenching of arc is poor, it will form a very shallow molten pool, and the density and strength of the weld metal are poor, so it is easy to form such defects as cracks, pores and slag inclusion. When the arc is quenching, gradually pull up the end of the electrode to the groove, and raise the arc to narrow the molten pool and reduce the amount of metal and heat, so that quenching of arc does not cause defects such as cracks and pores; besides, pile up the weld metal of the crater to smoothly pass the molten pool. After welding, file or shovel off the excess part. The arc quenching operation method is shown in the figure.



Quenching of arc outside the bead



Quenching of arc on the bead

Pic 19 MMA arc quenching diagram

g. Cleaning of weldment

After welding, use wire brush and other tools to clean up solidified slag and spatter.

7. Precautions & Maintenance

7.1 Precautions

Warning! Dropping may cause machine damage or personal injury. Please operate in accordance with the transportation and placement labels on the machine, and use a cart or similar tools with corresponding load-bearing capacity for transportation.

1. Welder lifting method: The welder can be lifted by fork lift or crane. As the welder is not equipped with lifting rings, special attention should be paid to fixing method when using crane for lifting.

2. Input cable specification: Adopt 3×2.5 mm 2 cable to connect the power distribution box and welder, and the power distribution box must be equipped with breaker or fuse of no less than 60A.

3. Protective earth lead connection: Be sure to connect the yellow-green wire in input cable of the welder to the protective ground of the welding place.

4. Welder cooling type: The welder adopts air cooling, and the air inlet and outlet of the welder cannot be blocked when using to ensure smooth ventilation.

5. Protection class of the welder: IP21S.

6. Duty cycle of the welder: The duty cycle of MMA is 30%, and of TIG is 25%. The welder has the overheat protection function, which will automatically cut off the output in case of overheat protection.

7. Inclination of welding power source: The inclination should not exceed 15°, otherwise it is easy to tip.

8. Using environment of welder: It should meet the following requirements:

a. Ambient air temperature range: -10℃~+40℃ during welding, and -25℃~+55℃ during transportation and storage

Note: When using a water cooler, pay attention to prevent it from being used or stored at the solidification temperature of the coolant; when storing at a low temperature, the coolant should be drained first!

b. Relative air humidity: no more than 50% at 40°C, no more than 90% at 20°C

c. The dust, acid, corrosive gas or substances in the surrounding air shall not exceed the normal content, except for these substances produced in the welding process.

9. Do not use welding power source for thawing of pipes.

10. Do not put hands, hair, tools, etc. near the live devices in the machine when it is energized, such as fans, so as to avoid personal injury or damage to the machine.

11. Avoid water or water vapor from entering the inside of the welder. If such condition occurs, the inside of the welder should be dried. Then, the insulation of the welder (including between the connection nodes and between the connection points and the enclosure. shall be measured with a megohmmeter. Only when it is confirmed that there is no abnormal situation can the welding work be continued.

12. The welder and welding gun can only be operated according to their duty cycle.

13. Use proper welding cable: When the cable is thin, the current is insufficient, the arc stability is poor, the rated output power cannot be obtained, and the cable is easily burned.

14. Correct connection is the premise to ensure good welding effect. Do not connect the positive and negative output ends of the welder inversely.

15. Use water-cooled welding gun: To prevent the welding gun from burning out, cooling water with a water pressure of 1-2kg/cm^2 is required. Even when the water-cooled welding gun is used under low current, the water must be cooled; otherwise, the gun cannot be used.

16. Unobstructed air hose and water hose: When a heavy object is placed on the air hose or water hose or the hose is bent, the flow of gas and water may stop, which can cause the welding gun to burn out and cause weld defects.

17. Protect welding gun: rough operation of welding gun is easy to cause wire breakage, water leakage (air leakage., and nozzle damage.

18. Poor flow meter or gas hose connection will lead to gas leakage or reduced gas flow at the front of the nozzle, so the gas protection effect will be reduced, and the weld gas pores are prone to appear. Please use soapy water to check for gas leakage.

19. Reliable connection: The connection between the welder and power supply, welding gun, electrode holder, or earth lead as well as various control cables shall be reliable. If the connection is improper and the contact is poor, it will cause malfunction, resulting in abnormal welder status, or burnout, etc.

20. Connection with weldment: If someone uses the steel plate and rebar to replace the cable of weldment, it will cause large resistance and unstable welding current. Besides, overheating may lead to fire. Therefore, please connect the base metal with regular insulated cables reliably.

21. There should be windproof measures in windy workplaces, otherwise it will blow away the protective gas and form gas pores.

22. Clean the oil, rust, paint, water and other conductive substances attaching on the base metal surface to be welded; otherwise, it will become pores and cracks, and cannot obtain good welding effect.

Warning! The machine is provided with overcurrent and overheat protection circuit. When the grid voltage, output current or internal temperature exceed the limit, the machine will stop operation automatically. In addition, high input grid voltage will cause welder damage.

7.2 Maintenance

Warning! All operations can only be carried out with the welder power source being turned off. Check and confirm that the input cable of the welder is disconnected from the power system before open the machine cover.

1. Regularly clean the dust inside the power source: Excessive dust inside the power source will reduce the insulation performance of the welder, which directly threatens the safety of the human body and the welder. The power source must be cleaned at least twice a year. If the welder is used in an environment with serious smoke and air pollution, the welder should be dusted daily. Before cleaning, turn off the power switch first, remove the side and top covers, and blow off the dust with dry compressed air from top down. The pressure of compressed air shall be at a reasonable level so as not to damage the small components in the welder. Wipe with a cloth if it is attached with grease.
2. Regularly check the internal circuit connection of the welder, make sure that the circuit connection is correct and the connector is firm (especially the inserted connector or component. If rust and looseness are found, grind off the rust layer or oxide film with sand paper, reconnect and tighten it.
3. Periodically check whether the insulating skin of all cables of the welder is damaged, and wrap it or replace the cable.
4. Regularly check the insulation resistance of welder: Mainly check the insulation resistance between the power input and output of the welder, and the power input and the enclosure, which should be greater than 10 megohm.
5. If the welder is not used for a long time, the welder shall be put back in the original packing box and stored in a dry environment.

8. Troubleshooting

Warning! The following operations can only be carried out by operators with sufficient electrical expertise and comprehensive safety knowledge, and with valid qualification documents to demonstrate their ability and expertise. Check and confirm that the input cable of the welder is disconnected from the power system before open the machine cover.

8.1 Common Malfunction Analysis and Solution

Symptom		Reasons	Measures taken by users
The LED display shows "EXX"	E30	· Power input phase loss;	· Check if the power cord is connected well. If the problem still exists, please contact the after-sales department of the company.
	E60	· Overheat protection	· It will automatically recover after the welder is cooled

8.2 TIG Problems and Elimination

Symptom	Analysis	Corrective Action
The panel has no display after startup	The power cord is not connected properly The welder fails	· Check again and connect the power cord properly · Contact the customer-service personnel of the company and seek professional help
No arc is started in MMA mode	· The welding circuit is abnormal · The output port of the welder has no output voltage	· Check whether the earth clamp and electrode holder are properly connected · Contact the customer-service personnel of the company and seek professional help
The arc is difficult to start in MMA mode	· The hot start parameter is set too small	· Reset the hot start parameter
Arc is easily interrupted in MMA mode	· The mains voltage is too low	· Use after the mains voltage is normal
No arc is started after pressing the gun in TIG mode	· The welding gun does not release the high frequency · The welding circuit is abnormal	· Start the arc again after replacing the welding gun · Check whether the earth clamp and welding gun are connected well
The tungsten needle burns out in TIG mode	· The welding gun polarity is connected wrongly · The AC balance is too large	· Connect the welding gun to the negative polarity of the machine · Reduce the AC balance appropriately
The TIG arc is unstable	· The tungsten needle clamp of the welding gun deforms and the gas flow is unstable · The gas hose of welding gun is abnormal	· Replace the tungsten needle clamp of the TIG welding gun · Sort out the welding gun circuit to avoid blockage and squeeze of the gas hose
The weld is not bright	· The tungsten needle clamp of the welding gun deforms and the gas flow is unstable · The gas hose of welding gun is abnormal · There are impurities on the workpiece surface	· Replace the tungsten needle clamp of the TIG welding gun · Sort out the welding gun circuit to avoid blockage and squeeze of the gas hose · Clean the surface impurities of workpiece
The tungsten needle becomes black after quenching of arc	· The tungsten needle is burnt out	· Delay the post-flow time

Note: The phenomena listed here may be related to the accessories you use, gas, environmental factors and power supply. Please try to improve the environment and avoid such situations.

Warning! Inexperienced or careless maintenance can lead to greater failure of the machine, making formal inspection and maintenance more difficult. After the welder is energized, there will be life-threatening voltage in the exposed parts of the welder. Any direct or indirect contact will cause electric shock, and serious electric shock can even be fatal.

8.3 Welding Procedure Checklist (for reference only.

The selection of welding current and arc voltage directly affects the stability, welding quality and productivity of the welding process. To guarantee welding quality, it is required that the welding current and arc voltage match each other well. They are usually selected according to the diameter of the used, the required form of metal transfer and the requirements of productivity.

8.4 SMAW Process Parameters

Welding line space position	Weldment thickness or leg dimension		Weld in gline of layer			Welding line of other layers			Back sealing welding line		
			Core diameter		Welding current/A	Core diameter		Welding current/A	Core diameter		Welding current/A
	mm	inch	mm	inch		mm	inch		mm	inch	
Flat butt weld	2	0.08	2	0.08	55~60	~	~	~	2	0.08	55~60
	2.5~3.5	0.1-0.14	3.2	0.12	90~120	~	~	~	3.2	0.12	90~120
	4~5	0.16-0.2	3.2	0.12	100~130	~	~	~	3.2	0.12	100~130
			4	0.16	160~200				4	0.16	160~210
			5	0.2	200~260				5	0.2	220~250
	5~6	0.2-0.24	4	0.16	160~210	~		~	3.2	0.12	100~130
									4	0.16	180~210
	≥6	≥0.24	4	0.16	160~210	4	0.16	160~210	4	0.16	180~210
						5	0.2	220~280	5	0.2	220~260
	0.12	0.47	4	0.16	160~210	4	0.16	160~210	~	~	~
						5	0.2	220~280	~	~	~
Vertical butt weld	2	0.08	2	0.08	50~55	~		~	2	0.08	50~55
	2.5~4	0.1-0.16	3.2	0.12	80~110	~		~	3.2	0.12	80~110
	5~6	0.2-0.24	3.2	0.12	90~120	~		~	3.2	0.12	90~120
	7~10	0.28-0.4	3.2	0.12	90~120	4	0.16	120~160	3.2	0.12	90~120
			4	0.16	120~160						
	≥11	≥0.43	3.2	0.12	90~120	4	0.16	120~160	3.2	0.12	90~120
			4	0.16	120~160	5	0.2	160~200			
	12~18	0.48-0.71	3.2	0.12	90~120	4	0.16	120~160	~	~	~
			4	0.16	120~160						
	≥19	≥0.75	3.2	0.12	90~120	4	0.16	120~160	~	~	~

			4	0.16	120~160	5	0.2	160~200			
Horizontal butt weld	2	0.08	2	0.08	50~55	~	~	~	2	0.08	50~55
	2.5	0.1	3.2	0.12	80~110	~	~	~	3.2	0.12	80~110
	3~4	0.12-0.16	3.2	0.12	90~120	~	~	~	3.2	0.12	90~120
			4	0.16	120~160	~	~	~	4	0.16	120~160
	5~8	0.2-0.31	3.2	0.12	90~120	3.2	0.12	90~120	3.2	0.12	90~120
						4	0.16	140~160	4	0.16	120~160
	≥9	≥0.36	3.2	0.12	90~120	4	0.16	140~160	3.2	0.12	90~120
			4	0.16	140~160				4	0.16	120~160
	14~18	0.55-0.71	3.2	0.12	90~120	4	0.16	140~160	~		
			4	0.16	140~130						
	≥19	≥0.75	4	0.16	140~160	4	0.16	140~160	~		
Overhead butt weld	2	0.08	~	~	~	~	~	~	2	0.08	50-65
	2.5	0.1	~	~	~	~	~	~	3.2	0.12	80-110
	3~5	0.12-0.2	~	~	~	~	~	~	3.2	0.12	90-110
									4	0.16	120-100
	5~8	0.2-0.31	3.2	0.12	90-120	3.2	0.12	90~120	~	~	~
						4	0.16	140~160			
	≥9	≥0.36	3.2	0.12	90-120	4	0.16	140~160	~	~	
			4	0.16	140-160						
	12~18	0.48-0. 71	3.2	0.12	90-120	4	0.16	140~160	~	~	
			4	0.16	140-160						
	≥19	≥0.75	4	0.16	140-160	4	0.16	140~160			
Fillet weld in the horizontal position	2	0.08	2	0.08	55-65	~	~	~			
	3	0.12	3.2	0.12	100~120	~	~	~			
	4	0.16	3.2	0.12	100~120	~	~	~			
			4	0.16	160~200	~	~	~			
	5~6	0.2-0.24	4	0.16	160~200	~	~	~			
			5	0.2	220~280	~	~	~			
	≥7	≥0.28	4	0.16	160~200	5	0.2	220~230			
			5	0.2	220~280						
	~	~	4	0.16	160~200	4	0.16	160~200	4	0.16	160~220
						5	0.2	220~280			
Fillet weld in th evertical position	2	0.08	2	0.08	50~60	~	~	~			
	3~4	0.12-0.16	3.2	0.12	90~120	~	~	~			
	5~8	0.2-0.31	3.2	0.12	90~120	~	~	~			
			4	0.16	120~160						
	9~12	0.36-0.48	3.2	0.12	90~120	4	0.16	120~160			
			4	0.16	12~0160						
	~	~	3.2	0.12	90~120	4	0.16	120~160	3.2	0.12	90~120
			4	0.16	120~160						
Fillet weld	2	0.08	2	0.08	50~60	~	~	~			

in the overhead position	3~4	0.12-0.16	3.2	0.12	90~120	~	~	~			
	5~6	0.2-0.24	4	0.16	120~160	~	~	~			
	≥7	≥0.28	4	0.16	140~160	4	0.16	140~160			
	~	~	3.2	0.12	90~120	4	0.16	140~160	3.2	0.12	90~120
			4	0.16	140~160				4	0.16	140~160

Current range of thorium (cerium）tungsten electrode of various diameters

Tungsten diameter		DC positive polarity	DC negative polarity	AC
mm	inch	A	A	A
1	0.04	15~80	—	20~60
1.6	0.06	70~150	10~20	60~120
2.4	0.09	150~250	15~30	100~180
3.2	0.12	250~400	25~40	160~250
4	0.16	400~500	40~55	200~320

When the welding conditions do not meet the requirements, the phenomenon described in the following table will occur.

Common welding problems

Unsuitable Welding Conditions	Influence	Unsuitable Welding Conditions	Influence
The welding gun is far away from the workpiece	The arc becomes long	The welding gun is too close to the workpiece	The arc becomes shorter
	The welding bead becomes narrow		Welding spatter will occur
	The gas protection effect is reduced		
The welding current is too large	The welding bead becomes narrow	The welding speed is too fast	The bead becomes short
	The depth of penetration and excess weld metal becomes greater		The depth of penetration and excess weld metal becomes smaller