



# TIG-250P

## IGBT INVERTER WELDER

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Sep, 2020



### OPERATOR'S MANUAL

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**Thanks for your purchase of this series of welder products!** This series of products are safe, reliable, firm, durable, convenient to maintain, and capable of greatly raising the welding productivity. This user's manual contains important information on use, maintenance and safety of the product. See technical parameters of the equipment in Technical Parameter in this manual. Please go through this manual for the first use. In order to ensure the personal safety of the operator and the safety of the working environment, please read the safety attentions in this manual carefully, and operate according to the instructions. For more details of our products, please contact us, consult authorized dealers.

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## DECLARATION

Operate after reading this manual carefully.

1. Information in this manual is accurate and complete. The company will not be responsible for any mistakes and omissions due to the operation out of this manual.
2. We has the right to modify this manual at any time without prior notice.
3. Though contents in this manual have been carefully checked, inaccuracies might have occurred. For any inaccuracy, please contact us.
4. Any copy, record, reprint or spread of the contents in this manual without preauthorization of YESWELDER is prohibited.
5. This manual was released in Sep, 2020.

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### Notes:

**To avoid loss and personal injury, please be careful with the parts with “NOTE!”. Go through these chapters and articles, and operate according to this manual.**

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# 1. SAFETY

Welding may result in injury to you and others, so please implement protection during welding. See more details in Safety Protection Guidebook for Operator which meets the requirements to manufactures on accident prevention.



## **Operate this equipment by trained professional only!**

- Use welding labor protection supplies with approval of safety supervisory authority.
- Operators must be the special workers with valid work permits of “Metal Welding (Gas Cutting) Operation”.
- Do not maintain and repair welder with power.



## **Electric shock-may result in serious injury or even death!**

- Install grounding device according to application standard.
- Do not touch live parts with naked skin, wet gloves or wet clothes.
- Be sure you are insulated from ground and workpiece.
- Confirm the safety of your working position.



## **Smoke-may be harmful to your health!**

- Keep your head away from the smoke to avoid inhalation of waste gas in welding.
- Keep the working environment well ventilated with exhaust or ventilation equipment when welding.



## **Arc radiation-may hurt your eyes and burn your skin!**

- Use proper welding mask and wear protective clothing to protect your eyes and body.
- Use proper mask or curtain to protect onlooker from being injured.



## **Improper use and operation may result in fire or explosion**

- Welding spark may result in fire, so please make ensure there are no inflammables near the welding position, and pay attention to fire safety.
- Ensure there is fire extinguisher nearby, and make sure someone has been trained to operate the fire extinguisher.
- Do not weld closed container.
- Do not use this machine for pipe thawing.



**Hot workpiece can cause severe scald.**

- Do not touch hot workpiece with bare hands.
- Cool the welding torch for a while after continuously working.



**Excessive noise does great harm to people's hearing.**

- Wear ear covers or other hearing protectors when welding.
- Give warning to onlooker that noise may be potentially hazardous to hearing.



**Magnetic field can make cardiac pacemaker a bit wonky.**

- People with cardiac pacemaker should stay away from the welding spot without first talking to a doctor.



**Moving parts may injure your body.**

- Please keep away from moving parts (like fan).
- Each door, panel, cover, baffle plate, and protective device the like should be closed and located correctly.



**Seek professional support when trouble strikes.**

- When trouble strikes in installation and operation, please inspect according to related contents in this manual.
- If you still cannot understand fully, or you still cannot solve the problem, please contact the dealer or the service center of YSEWELDER to obtain professional support.

## 2. SYMBOL EXPLANATION

**WARNING**



Cautions in operation



See more details in DVD



Items need special instruction



It's forbidden to dispose electric waste together with other ordinary waste. Please take care of our environment.

### 3. PRODUCT OVERVIEW

Unique electric structure and air channel design in this series of machines can speed up the heat rejection of the power device as well as improving the duty cycles of the machines. The unique heat rejection efficiency of the air channel can effectively prevent the power devices and control circuits from being damaged by the dust absorbed by the fan, and the reliability of the machine is greatly improved thereby.

The whole machine is in form of coherent streamline, the front and rear panels are naturally integrated via large-radian transition manner. The front panel and the rear panel of the machine and the handle are coated with **rubber oil(1)**, so the machine has soft texture, good hand feeling, and seems warm and pleasant.



**(1) Not every piece of machine has the same design. Differences may exist upon customers' requirements.**

This is a digital inverter DC pulse TIG welding machine with perfect function, excellent performance and advanced technology. It has various welding functions such as SMAW, DC TIG, pulsed TIG and TIG spot welding (DC or pulsed), etc., and it can be widely used in fine welding of various metals. The foresighted design and advanced and mature technologies of this machine would protect users' investment to the maximum extent.

#### **Advanced digital control**

¶ This machine adopts advanced MCU intelligent digital control technology, and all its major parts are performed through software. It is a digital control welding machine, improved a lot in its function and performance when compared with the traditional welding machine.

#### **Advanced IGBT inverter technology**

¶ This machine adopts advanced IGBT inverter technology. The inverting frequency is 36~43KHz, which greatly reduces the volume and weight of the welder. Great reduction in magnetic and resistance loss obviously enhances the welding efficiency and energy saving effect. Beside, the noise pollution is almost eliminated, since the working frequency is beyond audio range.

#### **Perfect auto-protection function**

¶ Perfect automatic protection function is available for this machine. When the mains voltage fluctuates greatly, welding will stop automatically, and the error information will be displayed. After the mains voltage becomes stable, welding will recover automatically. When overcurrent or overheating occurs, the machine will also stop working automatically with the error information displayed. Such comprehensive protection function greatly improves the life span of the machine.

- **Good consistency and stable performance**

This machine adopts intelligent digital control, so it is insensitive to the change of parameters of components. That is, the performance of welding machine will not be affected by the change of the parameters of certain components. Besides, it is insensitive to the change of the working environment such as temperature and humidity, etc. Therefore, the consistency and stability of digital control welder is better than that of traditional welder.

- **Parameter easy to adjust and software easy to update**

Generally speaking, for a welding machine with analogue circuit control or with analogue circuit & digital circuit control, the adjustment of most parameters should be achieved through the corresponding circuit, so if more parameters to be adjusted, the circuit would be more complicated and more difficult to be achieved. However, for a welding machine with intelligent digital control, the adjustment of parameters is much easier and more accurate, because its main function is achieved through software. To change the function or some of the parameters, you do not need to change the circuit, and the only thing you have to do is to download the updated software.

- **User-friendly interface**

This machine adopts international standard graphic language interface, which is simple, vivid, intelligible, and convenient for users' operation.

- **Voice prompt (customized)**

This machine adopts user interface with voice prompt, which make the operator feel friendlier. Users can get voice prompts for every operating step.

- **High-quality MMA welding**

MMA welding performance is significantly improved with excellent control algorithm: easier to ignite arc, stable welding current, little spatter, no electrode sticking, good shaping, and automatically adaptable to the change of length or section of welding cable.

- **Remote control available (customized)**

The machine offers two remote control modes, namely torch control mode and foot control mode, which can meet different application requirements of users.

- **Perfect automatic recording function**

All data such as cumulative startup times, cumulative running time, cumulative welding time, cumulative TIG welding time, accumulative MMA welding time, cumulative times of alarm, cumulative times of over current, cumulative times of overheating and cumulative times of under-voltage can be calculated and stored in FLASH memory. And also, these data can be obtained through digital display.

## 4.FUNCTION OVERVIEW

### Various function designs

- The operating panel consists of keys, LEDs, digital tubes and a rotary encoder, and it is convenient for users to operate.
- The operating panel adopts 3-digit digital tube for the display of parameter setting, current value and alarm information.
- 2T, 4T and spot welding function are available.



- Upslope time, downslope time, pre-flow time and post-flow time are adjustable.
- Self-adaptive arc force technology: obviously improve the performance of the machine in long-cable welding and contribute to long-distance welding.
- HF arc ignition with high reliability is available.
- All functional parameters are adjustable.
- DC TIG, Pulsed TIG and MMA are available.
- Pre-flow time, post-flow time, initial current, pilot arc current, upslope time, downslope time and preset current are adjustable in DC TIG.
- Pre-flow time, post-flow time, initial current, pilot arc current, upslope time, downslope time, peak current, base current, pulse frequency and pulse duration ratio are adjustable in pulsed TIG.
- Arc ignition time, preset current and arc force current are adjustable.
- Overcurrent, under-voltage and overheating protection functions are available.
- Parameter setting memory function is available.
- Fault memory function and statistical function are available, and the cumulative times of fault can be obtained.

## 5. PERFORMANCE CHARACTERISTICS

### Advanced IGBT inverter technology

- Inverting frequency of 36~43 KHz greatly reduces the volume and weight of the welder.
- Great reduction in magnetic and resistance loss obviously enhances the welding efficiency and energy saving effect.
- Working frequency is beyond audio range, which almost eliminates noise pollution.

### Leading control mode

- Advanced control technology meets various welding applications and greatly improves the welding performance.
- It can be widely used in acid and basic electrode welding.
- Easy arc starting, less spatter, stable current and good shaping.

### Nice shape and structure design

- Front and rear panels in shape of streamline make the whole shape nicer.
- Front and rear panels made of high-intensity plastics can effectively ensure the machine to efficiently work in severe conditions.
- Excellent insulating property.

## 6. ORDER INFORMATION

Current	Function Configuration
200A	Arc force, 2T/4T, downslope, post-flow, HF arc ignition, with MMA function
250A	Arc force, 2T/4T, downslope, post-flow, HF arc ignition, with MMA function

## 7. TECHNICAL PARAMETERS

Technical Parameter		Unit	Current	
			200A	250A
Rated input voltage		V	AC220V±15%; 50/60HZ	
Rated input power	MMA	KVA	8.2	9.4
	TIG		6.0	8.2
Welding current range	MMA	A	10~180	10~200
		V	20.4~27.2	20.4~28
	TIG	A	10~200	10~250
		V	10.4~18	10.4~20
Rated duty cycle(1)		%	35	35
No-load voltage	MMA	V	65	65
	TIG		65	65
Downslope time		s	0~10	0~10
Post-flow time		s	0~15	0~15
Overall efficiency		%	85	85
Housing protection grade		IP	21S	21S
Power factor		cosø	0.7	0.7
Insulation grade			F	F
Arc ignition mode			HF arc ignition	HF arc ignition
Standard			IEC60974-1	IEC60974-1
Noise		db	<70	<70
Size	Without handle	mm	420×195×340	
	With handle(2)		485×265×405	
Weight		kg	6.3	

(1) under the environment temperature of 40°C

(2) Not every piece of machine has the same design. Differences may exist upon customers' requirements.

### Parameters of welding torch

Model	WP-26
Maximum current	200A
Rated current	160A
Cooling mode	Air cooling
Gas connector	M10×1.0
Rated duty cycle	40%

## 8. WELDING SOURCE DESCRIPTION

### General description

1. Operating panel: To set the parameters.
2. "+" output terminal
3. "-" output terminal
4. Control terminal: To connect the signal wire of the TIG torch trigger.
5. Gas terminal: To connect the gas hose tie-in of the TIG torch.
6. Handle
7. Power switch: Power ON/OFF switch.
8. Warning sign
9. Power input: Power input cable.
10. Cooling fan
11. Gas inlet: For shield gas input.

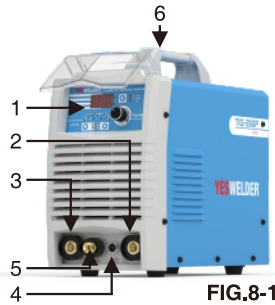


FIG.8-1

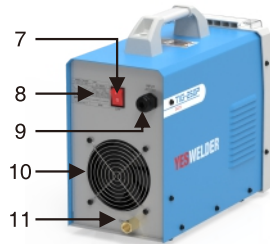
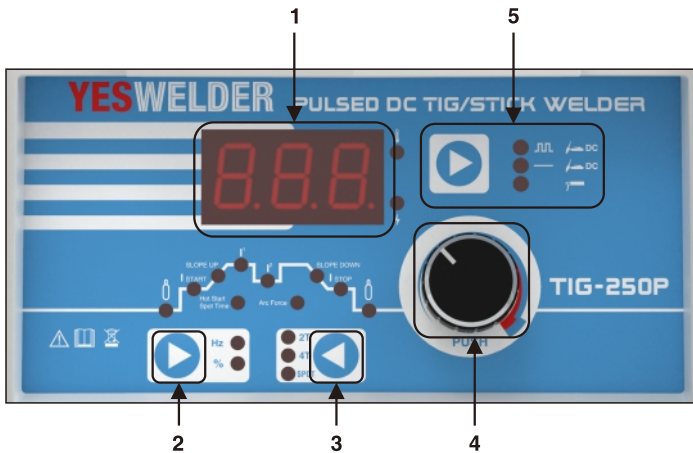
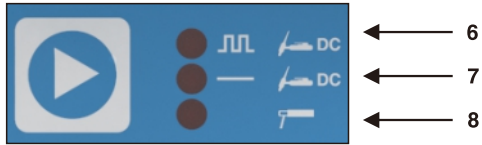


FIG.8-2

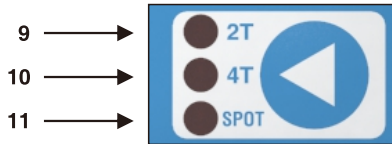
### Panel description



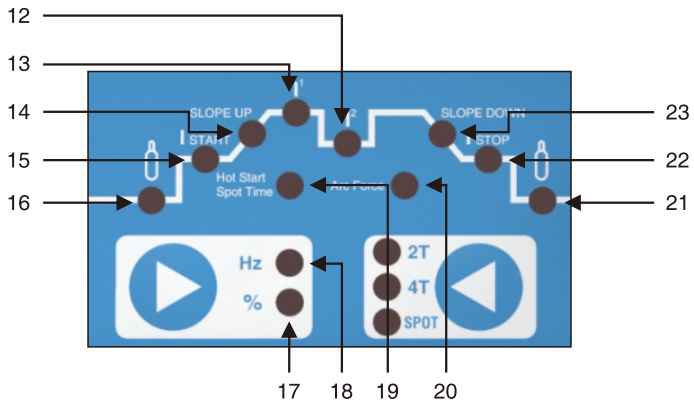
1. Display screen
2. Welding parameter selecting key
3. Operation mode selecting key
4. Welding parameter adjusting knob: The parameter adjusting encoder is used to adjust the parameters, and parameters can be adjusted by turning the knob clockwise or counterclockwise.
5. Welding mode selecting key



- 6.Indicator for pulsed TIG
- 7.Indicator for DC TIG
- 8.Indicator for MMA

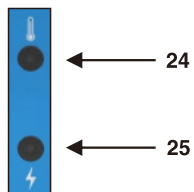


- 9.Indicator for 2T
- 10.Indicator for 4T
- 11.Indicator for spot welding



- 12.Indicator for base current
- 13.Indicator for welding current
- 14.Indicator for upslope
- 15.Indicator for initial current
- 16.Indicator for pre-flow
- 17.Indicator for pulse duration ratio
- 18.Indicator for frequency
- 19.Indicator for arc ignition/spot welding time
- 20.Indicator for arc force current
- 21.Indicator for post-flow

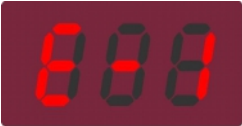



- 22.Indicator for end arc current
- 23.Indicator for downslope
- 24.Protection indicator
- 25.Indicator for output voltage (customized)



### Parameter autosaving

The parameters having been adjusted will be autosaved in the parameter group currently used (no autosaving will be done in the case that no operation is done after parameters are adjusted and the machine was turned off in 5s' time). When the machine is turned on next time, the parameters in this parameter group are just the parameters used last time. When the welding mode and operation mode are reselected, autosaving will be done in 10s. No special save key and manual saving operation is available for this machine.

### Protection function

<p>When the overcurrent indicator illuminates and the digital meter displays “E-1”, it indicates that overcurrent occurs. Restart the machine, and welding can be continued.</p>	
<p>When the under-voltage indicator illuminates and the digital meter displays “E-2”, it indicates that the mains voltage is overly low, and welding can be recovered when the mains voltage goes into normal.</p>	
<p>When the overheating indicator illuminates and the digital meter displays “E-3”, it indicates that welding is forced to stop because the main circuit of the machine gets overheated. In this condition, it is unnecessary to turn off the machine, but just wait a few minutes, and then welding can be continued.</p>	
<p>When the current sensor fails and the digital meter displays “E-4”, welding may still be carried out. However, the current value at this time is inaccurate.</p>	

## 9. INSTALLATION AND OPERATION

**Note:** Please install the machine strictly according to the following steps.

Turn off the power supply switch before any electric connection operation.

The housing protection grade of this machine is IP21S, so do not use it in rain.

Connect the power input terminal(AC230V INPUT)on the back panel of the machine to provisions of the Voltage and with a power cord of appropriate specification through a fuse with a capacity of 40A or more

Locate the welding source near the socket, and keep it well ventilated. To ensure good dissipation, the space around the welding source should not be less than 250mm.



Please protect the circuit with delay fuse of corresponding specifications to ensure normal work.

### **Grounding requirements:**

**In order to ensure normal work and personal safety and reduce the EMI, the welding source should be grounded reliably.**

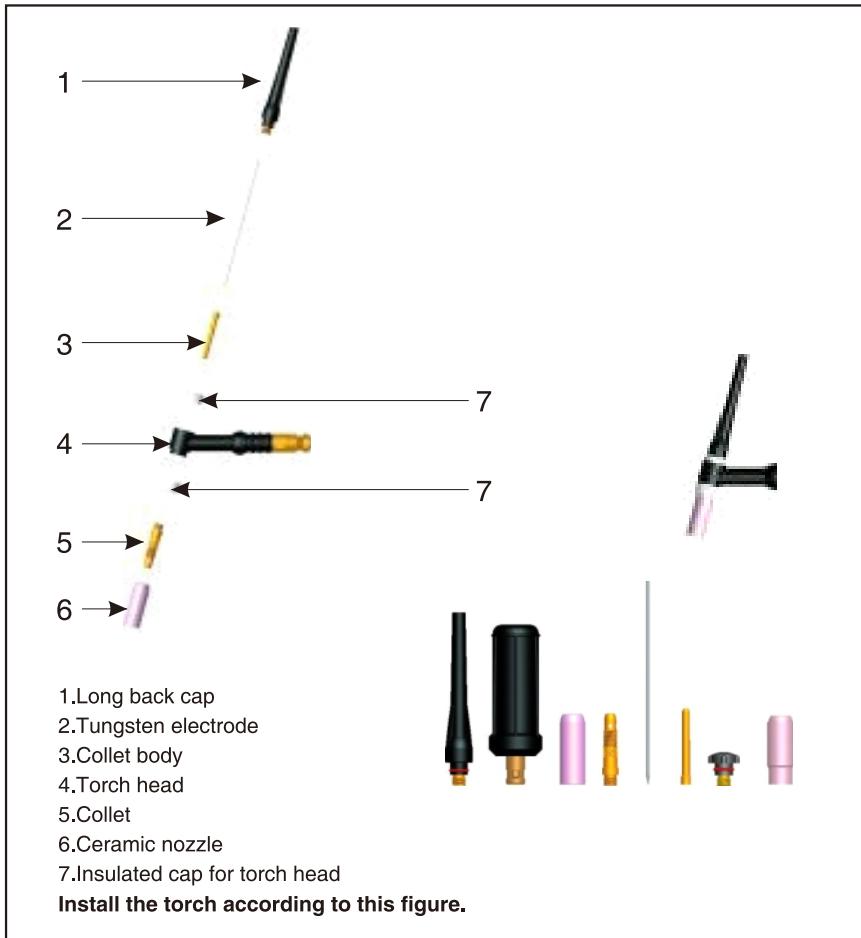
### 9.1 Installation method



#### **TIG:**

- 1) Connect the TIG torch correctly according to Fig. 9-1. Connect the connector of the TIG torch to the “-” quick socket on the machine panel, and tighten it clockwise.
- 2) Connect the aviation plug on the TIG torch to the corresponding socket on the machine panel, and tighten it clockwise.
- 3) Insert the quick plug on the earth cable into the “+” quick socket on the machine panel, and tighten it clockwise. Clamp the workpiece with the work clamp at the other end of the earth cable.
- 4) Tightly connect the gas hose to the gas inlet on the back panel of the machine. The gas path should include the cylinder, gas regulator and gas hose. The joint with the hose should be tightened with a hoop to prevent gas leakage and air mixing. Otherwise, weld bead cannot be well protected.
- 5) The enclosure of the machine must be grounded reliably.

**TIG torch:**



### MMA:

- 1) Insert the cable plug with electrode holder into the “+” socket on the front panel of the welding machine, and tighten it clockwise.
- 2) Insert the cable plug with work clamp into the “-” socket on the front panel of the welding machine, and tighten it clockwise.
- 3) Ground connection is needed for safety purpose.

The connection as mentioned above in 4) and 5) is DCEP connection. Operator can choose DCEN connection according to workpiece and electrode application requirement. Generally, DCEP connection is recommended for basic electrode, while there is no special requirement for acid electrode.

### Electrode holder:



## 9.2 Operation method

### MMA:

Pay attention to the connection polarity. Generally, DCEP and DCEN are available in DC MMA.

DCEP: Connect the electrode holder to “+” output terminal, and the work clamp to “-” output terminal.

DCEN: Connect the electrode holder to “-” output terminal, and the work clamp to “+” output terminal.

Operators may choose connection mode according to workpiece and electrode application requirement. Phenomena such as unstable arc, excessive spatter, and electrode sticking will occur when improper connection mode is selected. Change the polarity by exchanging the quick connectors to solve the problem.

★ Anti-sticking function is available for this machine. ★

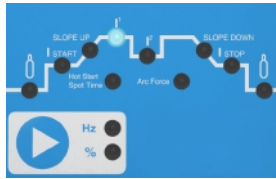


Select MMA mode by pressing the welding mode selecting key, and MMA can be carries out. There is voltage output at both output terminals.

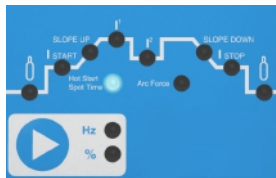




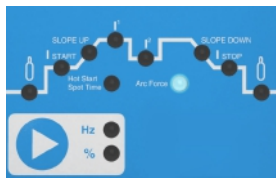
At this time, the voltage indicator illuminates, and welding can be carried out. (customized)



Select welding current setting function by pressing the welding parameter selecting key, and welding current in MMA can be set. Besides, welding current setting can be carried out during welding.



Select arc ignition time setting function (This function changes into spot welding time setting function in TIG spot welding mode,) by pressing the welding parameter selecting key, and arc ignition time in MMA can be set. Besides, arc ignition time setting can be carried out during welding.



Select arc force current setting function by pressing the welding parameter selecting key, and arc force current in MMA can be set. Besides, arc force current setting can be carried out during welding.

If the secondary cables (welding cable and earth cable) are long, select cable with larger cross-section to reduce the voltage drop.


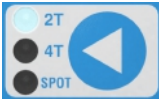
Preset the welding current according to the type and size of the electrode, clip the electrode and then welding can be carried out by short circuit arc ignition. For welding parameters, please refer to the below table.

**Welding parameters table (for reference only)**

Electrode Dia (mm)	Recommended Welding Current(A)	Recommended Welding Voltage(V)
1.0	20~60	20.8~22.4
1.6	44~84	21.76~23.36
2.0	60~100	22.4~24.0
2.5	80~120	23.2~24.8
3.2	108~148	23.32~24.92
4.0	140~180	24.6~27.2
5.0	180~220	27.2~28.8
6.0	220~260	28.8~30.4

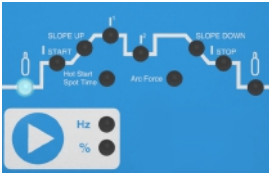

Note: This table is suitable for mild steel welding. For other materials, consult related materials and welding process for reference.

**DC TIG:**

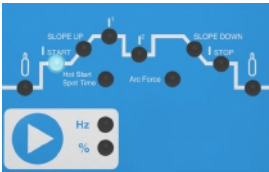

Select DC TIG mode by pressing the welding mode selecting key, and select 2T mode by pressing the operation mode selecting key.

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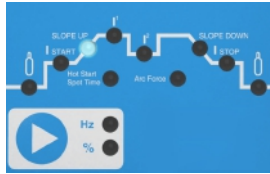



Select pre-flow time setting function by pressing the welding parameter selecting key, and set the pre-flow time.

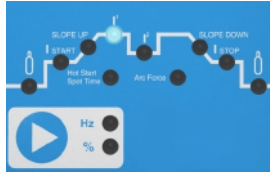
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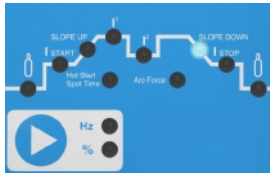
Select initial current setting function by pressing the welding parameter selecting key, and set the initial current.



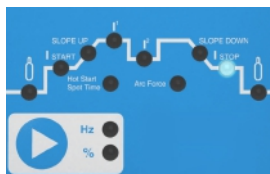
Select upslope time setting function by pressing the welding parameter selecting key, and set the upslope time.



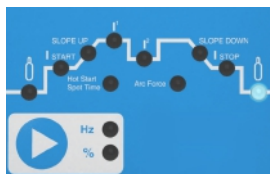
Select welding current setting function by pressing the welding parameter selecting key, and set the welding current.



Select downslope time setting function by pressing the welding parameter selecting key, and set the downslope time.



Select end arc current setting function by pressing the welding parameter selecting key, and set the end arc current.



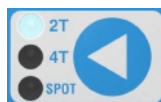
Select post-flow time setting function by pressing the welding parameter selecting key, and set the post-flow time.

After the parameters are set appropriately, open the gas valve of the cylinder, and adjust the gas regulator to the desired value.

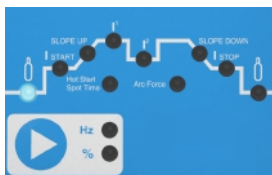
Press the torch trigger, the solenoid valve works. There is gas output firstly, and then HF output.

Keep the torch 2~4mm away from the workpiece, and then press the torch trigger. After arc is ignited, the HF discharge rustling disappears, the current rises up to the preset value, and welding can be carried out. After releasing the torch trigger, the current begins to decrease automatically to the end arc value. Then, arc stops with gas keeping flowing for the post-flow time, and welding ends.

### Pulsed TIG:



Select pulsed TIG mode by pressing the welding mode selecting key, and select 2T mode by pressing the operation mode selecting key.



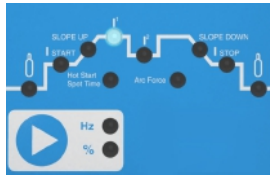
Select pre-flow time setting function by pressing the welding parameter selecting key, and set the pre-flow time.



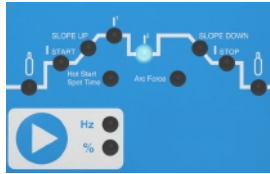
Select initial current setting function by pressing the welding parameter selecting key, and set the initial current.



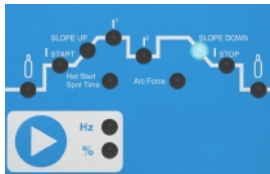
Select upslope time setting function by pressing the welding parameter selecting key, and set the upslope time.



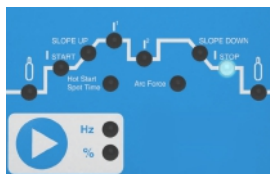
Select peak welding current setting function by pressing the welding parameter selecting key, and set the peak welding current.



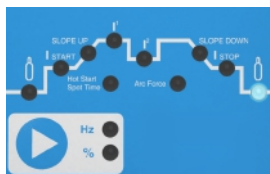
Select base current setting function by pressing the welding parameter selecting key, and set the base current.



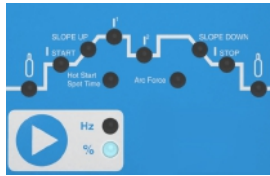
Select downslope time setting function by pressing the welding parameter selecting key, and set the downslope time.



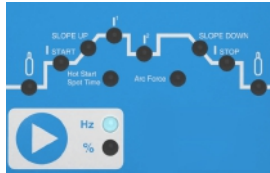
Select end arc current setting function by pressing the welding parameter selecting key, and set the end arc current.



Select post-flow time setting function by pressing the welding parameter selecting key, and set the post-flow time.



Select pulse duration ratio setting function by pressing the welding parameter selecting key, and set the pulse duration ratio.



Select pulse frequency setting function by pressing the welding parameter selecting key, and set the pulse frequency.

After the parameters are set appropriately, open the gas valve of the cylinder, and adjust the gas regulator to the desired value.

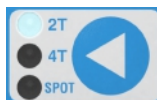
Press the torch trigger, the solenoid valve works. There is gas output firstly, and then HF output.

Keep the torch 2~4mm away from the workpiece, and then press the torch trigger. After arc is ignited, the HF discharge rustling disappears, the current rises up to the preset value, and welding can be carried out. After releasing the torch trigger, the current begins to decrease automatically to the end arc value. Then, arc stops with gas keeping flowing for the post-flow time, and welding ends.

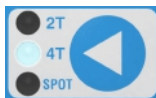
### Operation mode function



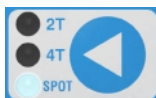
The operation mode function is available in pulsed TIG mode and DC TIG mode, and it includes 2T, 4T and spot welding.



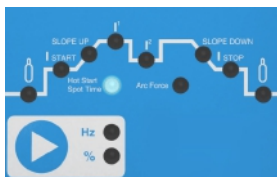
Select 2T mode by pressing the operation mode selecting key. Operation steps in 2T: Press the torch trigger, gas valve opens, and HF arc ignition starts; Keep the torch 2~4mm away from the workpiece to ignite the arc, HF stops, and current rise to the preset value; Release the torch trigger, current decreases to the end arc value, and then arc stops; Gas keeps flowing for the post-flow time, and welding ends.



Select 4T mode by pressing the operation mode selecting key. Operation steps in 4T: Press the torch trigger, gas valve opens, and HF arc ignition starts; Keep the torch 2~4mm away from the workpiece to ignite the arc, HF stops, and current rise to the pre-set value; Release the torch trigger, and welding continues under the preset current; Press the torch trigger again and release it, current begins to decrease to the end arc value, and then arc stops; Gas keeps flowing for the post-flow time, and welding ends.



Select spot welding mode by pressing the operation mode selecting key.



Select spot welding time setting function by pressing the welding parameter selecting key, and set the spot welding time. Besides, the spot welding time setting can be carried out during welding. Operation steps in spot welding: Press the torch trigger, gas valve opens, and HF arc ignition starts; Keep the torch 2~4mm away from the workpiece to ignite the arc, HF stops, and current turns to the preset value; Welding begins, and it ends when the spot welding time is up. There is no current upslope and downslope in spot welding mode.

### Parameters for TIG welding on titanium and its alloy (for reference only)

Plate thickness (mm)	Groove type	Welding layers	Electrode diameter (mm)	Wire diameter (mm)	Welding current (A)	Gas flow (L/min)			Nozzle diameter (mm)
0.5	Square groove	1	1.5	1.0	30~50	8~10	6~8	14~16	10
1.0		1	2.0	1.0~2.0	40~60	8~10	6~8	14~16	10
1.5		1	2.0	1.0~2.0	60~80	10~12	8~10	14~16	10~12
2.0		1	2.0~3.0	1.0~2.0	80~110	12~14	10~12	16~20	12~14
2.5		1	2.0~3.0	2.0	110~120	12~14	10~12	16~20	12~14
3.0	Single V groove with root face	1~2	3.0	2.0~3.0	120~140	12~14	10~12	16~20	14~18
4.0		2	3.0~4.0	2.0~3.0	130~150	14~16	12~14	20~25	18~20
5.0		2~3	4.0	3.0	130~150	14~16	12~14	20~25	18~20
6.0		2~3	4.0	3.0~4.0	140~180	14~16	12~14	25~28	18~20
7.0		2~3	4.0	3.0~4.0	140~180	14~16	12~14	25~28	20~22
8.0	3~4	4.0	3.0~4.0	140~180	14~16	12~14	25~28	20~22	
10	Double V groove with root face	4~6	4.0	3.0~4.0	160~200	14~16	12~14	25~28	20~22
20		12	4.0	4.0	200~240	12~14	10~12	20	18
22		12	4.0	4.0~5.0	230~250	15~18	18~20	18~20	20
25		15~16	4.0	3.0~4.0	200~220	16~18	20~26	26~30	22
30		17~18	4.0	3.0~4.0	200~220	16~18	20~26	26~30	22

### Parameters for TIG welding on stainless steel sheet (for reference only)

Plate thickness (mm)	Welding joint	Electrode diameter (mm)	Wire diameter (mm)	Current type	Welding current (A)	Gas flow (L/min)	Welding speed (cm/min)
1.0	Butt Joint	2	1.6	DCEN	7~28	3~4	12~47
1.2		2	1.6		15	3~4	25
1.5		2	1.6		5~19	3~4	8~32

## 10. CAUTION

### 10.1 Working Environment

- 1) Welding should be carried out in dry environment with humidity of 90% or less.
- 2) The temperature of the working environment should be between -10°C and 40°C.
- 3) Avoid welding in the open air unless sheltered from sunlight and rain. Keep it dry at all times and do not place it on wet ground or in puddles.
- 4) Avoid welding in dusty area or environment with corrosive chemical gas.
- 5) Gas shielded arc welding should be operated in environment without strong airflow.
- 6) Place the machine directly on a secure, level surface. Do not place or operate this machine on a surface with an incline greater than 15° from horizontal. The machine may topple over if this procedure is not followed.
- 7) The machines level of electro magnetic compatibility is class A. Equipment shall not apply to public low-voltage power supply system power supply of residential environment. Because of conduction and radiation harassment, in these environments are difficult to ensure electromagnetic compatibility.

### 10.2 Safety Tips

Overcurrent/Overvoltage/Overheating protection circuit is installed in this machine. When the mains voltage, output current or inner temperature exceeds the set standard, the machine will stop automatically. However, excessive use (e.g. too high voltage) of machine will lead to welder damage. Therefore, please note:

#### 1) Ventilation

This welder can create powerful welding current that has strict cooling requirements that cannot be met with natural ventilation. Therefore the internal fan is very important in enabling the machine to work steadily with effective cooling. The operator should make sure that the louvers be uncovered and unblocked. The minimum distance between the machine and nearby objects should be 30cm. Good ventilation is of critical importance to the normal performance and lifespan of the machine.

- 2) Welding operation is forbidden while the machine is overload. Remember to observe the max load current at any moment (refer to the corresponding duty cycle). Make sure that the welding current should not exceed the maximum load current. Overload could obviously shorten the machine's lifespan, or even damage the machine.

#### 3) Over-voltage is forbidden.

Regarding the power supply voltage range of the machine, please refer to "Technical Parameters" table. This machine is of automatic voltage compensation, which enables the maintaining of the voltage range within the given range. In case that the input voltage exceeds the stipulated value, it would possibly damage the components of the machine.



- 4) An earth terminal is available for the machine. Connect it with an earth cable to avoid the static and electric shock.
- 5) A sudden halt may occur with the overheating indicator on the front panel on while the machine is of overload status. Under this circumstance, it is unnecessary to restart the machine. Keep the built-in fan working to lower the temperature inside the machine. Welding can be continued after the inner temperature falls into the standard range and the overheating indicator is off.

## 11. BASIC KNOWLEDGE OF WELDING

### 11.1 General description of argon arc welding

Argon arc welding is a kind of gas shielded arc welding using argon as shield gas, and the process of argon arc welding is shown in Fig.11-1. Tightly close protective layer is formed in the arc zone by the argon gas flow output from the torch nozzle. Thus, the metal molten pool can be protected and separated from the air. Meanwhile, the filler wire and base metal is molten by the heat generated from arc. After the liquid molten pool cools down, weld bead is formed.

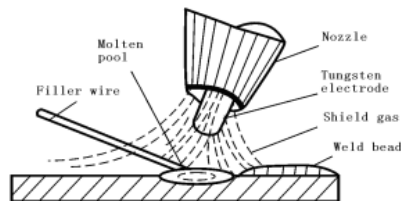


Fig.11-1 Sketch map of argon arc welding

Since argon is a kind of inert gas and it does not react with metals, the alloying elements in the weld metal will not be burned out and the metal molten pool can be fully protected from oxidation. Besides, because argon is insoluble in liquid metal at high temperature, air holes can be avoided in weld bead. Therefore, the protective effect of argon is effective and reliable, and better welding quality can be obtained.

### 11.2 Characteristics of argon arc welding

Compared with other arc welding methods, argon arc welding has the following features.

- 1) Argon has excellent protective performance, so corresponding flux is not needed when welding. It is basically a simple process of metal melting and crystallization, and pure weld bead of high quality can be obtained.
- 2) Due to the compression and cooling effect of argon flow, the heat of arc is concentrated with high temperature. Therefore, the heat affected zone is very narrow, and there is little welding deformation stress and crack tendency. Thus, argon arc welding is suitable for thin plate welding especially.
- 3) Argon arc welding is a kind of open flame welding and is easy to operate and observe, so the mechanization and automation of welding process can be achieved easily. Besides, welding at various spatial locations can be carried out under certain conditions.
- 4) Argon arc welding can be applied to welding a wide range of welding materials. Almost all metal materials can be welded by argon arc welding, and it is especially suitable for welding chemically active metals and alloys. Generally, it is used in the welding of aluminum, titanium, copper, low alloy steel, stainless steel and refractory steel, etc.

With the increasing of product structure of non-ferrous metals, high alloy steel and rare metals, common gas welding methods and arc welding methods are difficult to obtain the required welding quality. However, argon arc welding are being more and more widely used due to its remarkable characteristics above.

### 11.3 Gas tungsten arc welding (GTAW)

#### Welding torch:

The function of welding torch for GTAW is to clamp the electrode, conduct current and carry argon flow. For manual welding, ON/OFF button is mounted on the handle of the welding torch. Generally, welding torches can be divided into three categories, large-type, medium-type and small-type. For small-type welding torch, the maximum welding current is 100A. And the welding current can reach up to 400~600A for large-type welding torch with water cooling. The torch body is pressed from nylon, so it is light, small-sized, insulated and heat-resistant.

The torch nozzle plays an important part in the protective performance of argon. The common nozzle shapes are shown in Fig.11-2. Cylindrical nozzle with cone-shaped or spherical end has the best protective effect, since the argon flow speed is uniform, and laminar flow is easy to hold. The protective effect of coniform nozzle is worse, because the argon flow speeds up. However, this kind of nozzle is easy to operate and the visibility of the molten pool is good, so it is also commonly use in welding.

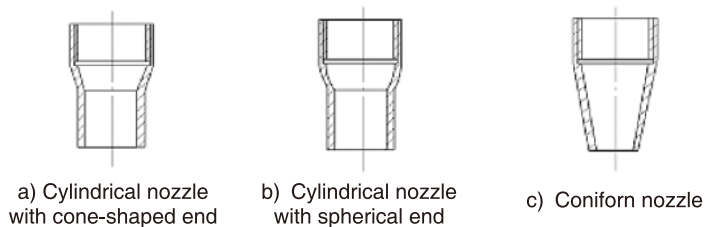


Fig. 11-2 Sketch map of nozzle shape

#### GTAW process:

##### 1) Pre-weld cleaning

Clean the electrode and the zone near the weld joint of the workpiece, and remove impurities such as oil pollution and the oxidized film on the surface of the metal before carrying out argon arc welding to ensure good quality of weld bead. The methods for pre-weld cleaning are: mechanical cleaning, chemical cleaning and chemical & mechanical cleaning.

A. Mechanical cleaning: This method is simple with good effect, and it is suitable for large-sized workpiece. Generally, remove the oxidized film by grinding with a small-diameter stainless steel wire brush or by shoveling with a scraper to make the welding position appearing with metal luster, and then clean the weld joint zone with organic solvent for eliminating oil pollution.

- B. Chemical cleaning: Chemical cleaning is commonly used for cleaning the filling electrode and small-sized workpiece. Compared with mechanical cleaning, this method has such characteristics as high cleaning efficiency, uniform and stable quality and long duration of clean state. The chemical solutions and processes used in chemical cleaning should be chosen according to the welding materials and welding requirements.
- C. Chemical & mechanical cleaning: Use chemical cleaning method when cleaning firstly, and clean the welding position with mechanical cleaning method before welding. This combined cleaning method is suitable for the high quality welding.

## 2) Protective effect of gas

Argon is ideal protective gas. The boiling point of argon is  $-186^{\circ}\text{C}$ , which is between that of helium and oxygen. Argon is a byproduct when the oxygen installation gets oxygen by fractionating the liquid air. Bottled argon is used for welding in our country. The filling pressure is 15MPa under room temperature, and the cylinder is painted gray and marked with "Ar". The chemical composition requirements of pure argon are:  $\text{Ar} \geq 99.99\%$ ;  $\text{He} \leq 0.01\%$ ;  $\text{O}_2 \leq 0.0015\%$ ;  $\text{H}_2 \leq 0.0005\%$ ;  $\text{C} \leq 0.001\%$ ;  $\text{H}_2\text{O} \leq 30\text{mg/m}^3$ .

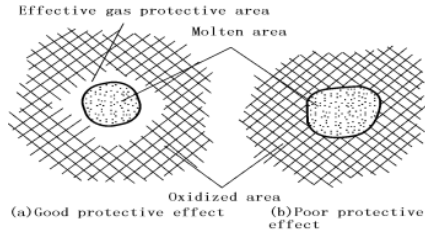
Welding arc can be better protected and the consumption of shield gas can be reduced in flat position welding. As inert gas, argon does not react with metal chemically even under high temperature. Thus, the alloying elements will not be oxidized or burned out, and problems caused accordingly will be avoided. Meanwhile, argon is insoluble in liquid metal, so air holes can be avoided. Argon is a kind of monatomic gas, existing in atomic state, without molecular decomposition and atomic endotherm under high temperature. Besides, the specific heat capacity and heat conductivity is low, so the arc heat is not easy to lose. Accordingly, the welding arc can burn stably and heat can be concentrated, which is advantageous to welding.

The disadvantage of argon is that its ionization potential is high. When the arc space is fully filled with argon, arc is hard to ignite. However, arc will become stable once it is successfully ignited.

The gas protective effect of argon can be affected by various process factors during welding. Therefore, special attention should be paid to the effective protection of argon in GTAW to avoid interference and damage. Otherwise, satisfactory welding quality is hard to obtain.

Welding process factors such as gas flow, shape and diameter of nozzle, distance between nozzle and workpiece, welding speed and weld joint form may affect the gas protective effect, so all these should be fully considered and chosen correctly.

The gas protective effect can be judged by welding spot testing method through measuring the size of the effective gas protective area. For example, keep all welding process factors fixed when carrying out spot welding on aluminum plate with AC manual TIG, maintain the torch in the fixed position after arc is ignited, and cut off the power after the 5~10s, there will be a molten welding spot left on the aluminum plate. Due to the cathode cleaning action against the area around the welding spot, the oxidized film on the surface of the aluminum plate is eliminated, and a gray area with metallic luster appears. As shown in Fig.11-3, this area is called effective argon protective area. The greater the diameter of the effective gas protective area, the better is the gas protective effect.



**Fig.11-3 Effective protective area of argon**

In addition, the gas protective effect can be judged by directly observing the color of the weld bead surface. Take stainless steel welding for example. If the weld bead surface appears silvery white or golden, it indicates that the gas protective effect is good. However, if the weld bead surface appears gray or black, it indicates that the gas protective effect is poor.

### 3) Welding process parameters

The gas protective effect, welding stability and weld bead quality of GTAW has direct relationship with the welding process parameters. Therefore, select appropriate welding process parameters to ensure high quality weld joint.

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

- A. The type and polarity of current for GTAW should be chosen according to the workpiece material and also the operation mode.
- B. Select tungsten electrode with proper diameter mainly according to the thickness of workpiece. Besides, when the thickness of workpiece is the same, tungsten electrodes with different diameters should be chosen due to the different current types and polarities and different allowable current ranges for the tungsten electrode. Improper tungsten diameter will lead to unstable arc, serious burn and tungsten in weld bead.
- C. Select proper welding current after the tungsten diameter is determined. Overly high or overly low welding current will cause poor weld bead or welding defects. For the allowable current ranges for thorium-tungsten/cerium tungsten electrodes with different diameters, please refer to the table below.

**Parameters for TIG welding on titanium and its alloy (for reference only)**

Tungsten dia. (mm)	DCEN (A)	DCEP (A)	AC (A)
1.0	15~80	-	20~60
1.6	70~150	10~20	60~120
2.4	150~250	15~30	100~180
3.2	250~400	25~40	160~250
4.0	400~500	40~55	200~320
5.0	500~750	55~80	290~390
6.0	750~1000	80~125	340~525

- 4) The argon gas flow is selected mainly according to the tungsten diameter and nozzle diameter. For a nozzle with a certain aperture, the argon gas flow should be appropriate. If the gas flow is too high, the gas flow speed will increase. Thus, it is difficult to maintain stable laminar flow, and the welding zone can not be well protected. Meanwhile, more arc heat will be taken away, which will affect the arc stability. If the gas flow is too low, the gas protective effect will be affected due to the interference of the environmental airflow. Generally, the argon gas flow should be within 3~20L/min.
- 5) Under the condition of fixed tungsten diameter, welding current and argon gas flow, overly high welding speed will make the protective gas flow deviate from the tungsten electrode and molten pool, and the gas protective effect will be affected accordingly. Besides, the welding speed affects the weld bead shape significantly. Therefore, it is very important to select appropriate welding speed.
- 6) Process factors mainly refer to the shape and diameter of nozzle, the distance between nozzle and workpiece, stick-out and the diameter of filling wire, etc. Although the change of these factors is not big, it takes more or less influence on the welding process and gas protective effect. Therefore, all factors should be selected according to specific welding requirements.  
Generally, the nozzle diameter should be within 5~20mm, the distance between the nozzle and workpiece should not be greater than 15mm, the stick-out should be 3~4mm, and the filling wire diameter should be selected according to the thickness of workpiece.

#### **11.4 General requirements for GTAW**

- 1) The control of gas: Pre-flow and post-flow are required in GTAW. Argon is a kind of inert gas that can be broken down easily. Fill the space between workpiece and tungsten electrode with argon firstly, and then arc can be easier to ignite. Keep the gas flow after welding ends, and the workpiece will not cool down too quickly. Thus, the oxidization of workpiece can be avoided, and good welding effect can be ensured.
- 2) The manual switch control of current: When the manual switch is switched on, the current supply should be delayed for the pre-flow time. After the manual switch is switched off and welding ends, the current supply should be cut off first and the gas flow maintains according to the post-flow time.
- 3) The generation and control of high voltage: The GTAW machine adopts high voltage arc ignition mode. It is required that there should be high voltage when igniting arc and there should be no high voltage after arc is successfully ignited.
- 4) Protection from interference: The high voltage for arc ignition in GTAW is accompanied with high frequency, which produces serious interference to the machine circuit. Thus, good anti-interference ability is required for the circuit.

#### **11.5 Manual metal arc welding (MMA)**

Manual metal arc welding, MMA for short, is an arc welding mode by manually operating electrode. Equipment for MMA is simple, convenient and flexible to operate, and with high adaptability. MMA is applied to various metal materials with thickness more than 2mm and various structures, in particular to workpiece with complex structure and shape, short weld joint or bending shape, as well as weld joints in various spatial locations.

### Welding process of MMA:

Connect the two output terminals of the welder to the workpiece and electrode holder respectively, and then clamp the electrode by the electrode holder. When welding, arc is ignited between the electrode and the workpiece, and the end of the electrode and part of the workpiece is fused to form a weld crater under the high-temperature arc. The weld crater is quickly cooled and condensed to form weld joint which can firmly integrally connect two separate pieces of workpiece. The coating of the electrode is fused to produce slag to cover the weld crater. The cooled slag can form slag crust to protect the weld joint. The slag crust is removed at last, and the joint welding is finished.

### Tools for MMA:

Common tools for MMA include electrode holder, welding mask, slag hammer, wire brush (see Fig.11-4), welding cable and labor protection supplies.

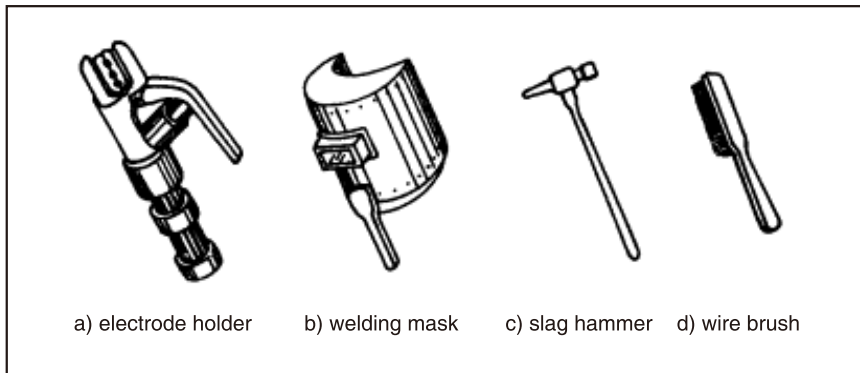


Fig.11-4 Tools for MMA

- a) **Electrode holder:** a tool for clamping electrode and conducting current, mainly including 300A type and 500A type.
- b) **Welding mask:** a shielding tool for protecting eyes and face from injuring due to arc and spatter, including handholding type and helmet type. Colored chemical glass is installed on the viewing window of the mask to filter ultraviolet ray and infrared ray. Arc burning condition and weld crater condition can be observed from the viewing window during welding. Thus, welding can be carried out by operators conveniently.
- c) **Slag hammer (peen hammer):** for the use of removing slag crust on the surface of weld joint.
- d) **Wire brush:** for the use of removing dirt and rust at the joints of the workpiece before welding, as well as cleaning the surface of weld joint and the spatter after welding.
- e) **Welding cable:** generally cables formed from many fine copper wires. Both YHH type arc welding rubber sleeve cable and THHR type arc welding rubber sleeve extra-flexible cable can be used. Electrode holder and welding machine are connected via a cable, and this cable is named as welding cable (live wire). Welding machine and workpiece are connected via another cable (earth wire). The electrode holder is covered with insulating material performing insulation and heat insulating.

## Basic operation of MMA:

### 1) Welding joint cleaning

Rust and greasy dirt at the joint should be removed completely before welding in order to implement arc igniting and arc stabilizing conveniently as well as ensure the quality of weld joint. Wire brush can be used for condition with low requirement on dust removal; grinding wheel can be used for condition with high requirement on dust removal.

### 2) Posture in operating

Take flat welding of butt joint and T-shaped joint from left to right as an example. (See Fig.11-5) The operator should stand at the right side of the working direction of weld joint with mask in the left hand and electrode holder in the right hand. The left elbow of the operator should be put on his left knee to prevent his upper body from following downwards, and his arm should be separated from the costal part so as to stretch out freely.

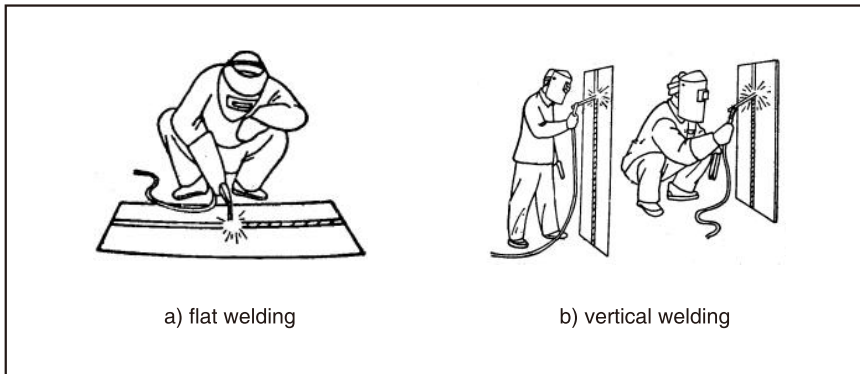
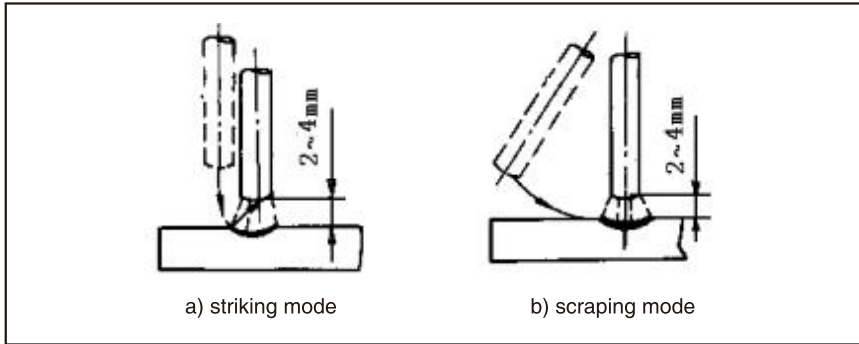


Fig.11-5 Posture in welding

### 3) Arc igniting

Arc igniting is the process for producing stable arc between electrode and workpiece in order to heat them to implement welding. Common arc ignition mode includes scraping mode and striking mode. (See Fig.11-6) During welding, touch the surface of the workpiece with the end of the electrode by scraping or light striking to form short circuit, and then quickly lift the electrode 2-4mm away to ignite arc. If arc ignition fails, it is probably because there is coating at the end of the electrode, which affects the electric conduction. In this case, the operator can strongly knock the electrode to remove the insulation material until the metal surface of the core wire can be seen.



**Fig.11-6 Arc igniting modes**

#### 4) Tack weld

For fixing the relative positions of the two pieces of weldment and welding conveniently, 30~40mm short weld joints are welded every certain distance in order to fix the relative positions of the workpiece during welding assembly. This process is named as tack weld.

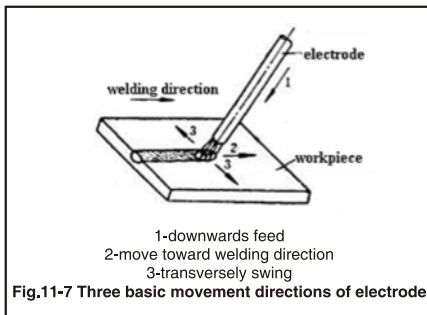
#### 5) Electrode manipulation

The electrode manipulation actually is a resultant movement in which the electrode simultaneously moves in three basic directions: the electrode gradually moves along the welding direction; the electrode gradually moves toward the weld crater; and the electrode transversely swings. (See Fig.11-7) Electrode should be correctly manipulated in three movement directions after arc is ignited. In butt welding and flat welding, the most important is to control the following three aspects: welding angle, arc length and welding speed.

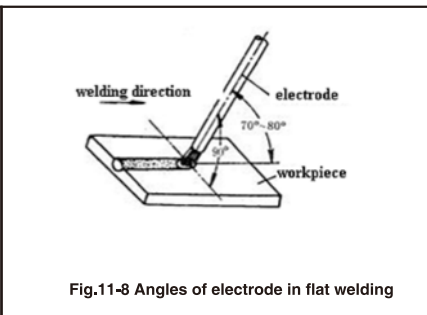
(1) Welding angle: the electrode should be inclined in 70°~80° forwards. (See Fig.11-8)

(2) Arc length: the proper arc length is equal to the diameter of electrode in general.

(3) Welding speed: proper welding speed should make the crater width of the weld bead about twice the diameter of the electrode, and the surface of the weld bead should be flat with fine ripples. If the welding speed is too high, and the weld bead is narrow and high, the ripples are rough, and the fusion is not well implemented. If the welding speed is too low, the crater width is excessive, and the workpiece is easy to be burned through. Besides, current should be proper, electrode should be aligned, arc should be low, and welding speed should not be too high and should be kept uniform during the whole welding process.



**Fig.11-7 Three basic movement directions of electrode**



**Fig.11-8 Angles of electrode in flat welding**



## 6) Arc extinguishing

Arc extinguishing is unavoidable during welding. Poor arc extinguishing may bring shallow weld crater and poor density and strength of weld metal by which cracks, air holes, slag inclusion and shortage the like are easy to be produced. Gradually pull the end of the electrode to the groove and raise the arc when extinguishing arc, in order to narrow the weld crater and reduce the metal and heat. Thus, defects such as cracks and air holes can be avoided. Pile up the weld metal of the crater to make the weld crater sufficiently transferred. Then, remove the excessive part after welding. The operation modes of arc extinguishing are shown in the figure below.

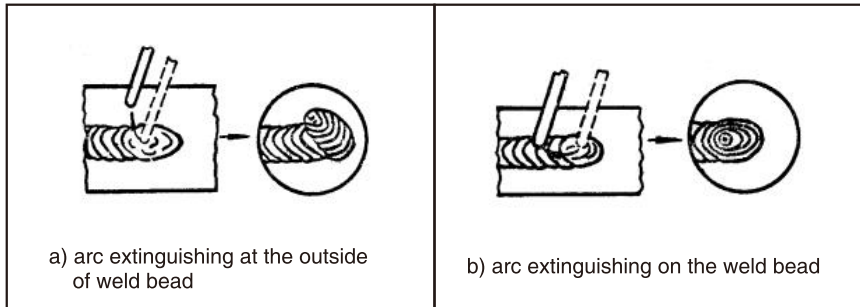


Fig.11-9 Arc extinguishing modes

## 7) Weldment cleaning

Clean welding slag and spatter with wire brush and similar tools after welding.

# 12. MAINTENANCE

### WARNING



The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

- 1) Check periodically whether inner circuit connection is in good condition (esp. plugs). Tighten the loose connection. If there is oxidization, remove it with sandpaper and then reconnect.
- 2) Keep hands, hair and tools away from the moving parts such as the fan to avoid personal injury or machine damage.
- 3) Clean the dust periodically with dry and clean compressed air. If welding environment with heavy smoke and pollution, the machine should be cleaned daily. The pressure of compressed air should be at a proper level in order to avoid the small parts inside the machine being damaged.

- 4) Avoid rain, water and vapor infiltrating the machine. If there is, dry it and check the insulation of the equipment (including that between the connections and that between the connection and the enclosure). Only when there are no abnormal phenomena anymore, can the machine be used.
- 5) Check periodically whether the insulation cover of all cables is in good condition. If there is any dilapidation, rewrap it or replace it.
- 6) Put the machine into the original packing in dry location if it is not to be used for a long time.

## 13. TROUBLESHOOTING

### WARNING



The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

### 13.1 Common Malfunction Analysis and Solution:

Malfunction Phenomena	DCEN (A)
Turn on the machine, the power indicator does not illuminate, the fan doesn't work, and no welding output.	<ol style="list-style-type: none"> <li>(1) Check if the power switch is closed.</li> <li>(2) No input power.</li> </ol>
Turn on the machine, the fan works, but the output current is unstable and can't be controlled by potentiometer when welding.	<ol style="list-style-type: none"> <li>(1) The current potentiometer fails. Replace it.</li> <li>(2) Check if any loose contact exists inside the machine. If any, reconnect.</li> </ol>
Turn on the machine, the power indicator illuminates, the fan works, but no welding output.	<ol style="list-style-type: none"> <li>(1) Check if any loose contact exists inside the machine.</li> <li>(2) Open circuit or loose contact occurs at the joint of output terminal.</li> <li>(3) The overheating LED illuminates.               <ol style="list-style-type: none"> <li>a) The machine is under overheating protection status. It can recover automatically after the welding machine is cooled.</li> <li>b) Check if the thermal switch is ok. Replace it if damaged.</li> <li>c) Check if the thermal switch is loosely connected, and reconnect it if necessary.</li> </ol> </li> </ol>
The electrode holder becomes very hot.	The rated current of the electrode holder is smaller than its actual working current. Replace it with a bigger rated current.

Excessive spatter in MMA welding.	The output polarity connection is incorrect. Exchange the polarity.
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**This product is being improved unceasingly, so differences may appear in parts except for functions and operation. Thanks for understanding.**

## **APPENDIX A: PACKING, TRANSPORTATION AND STORAGE**

### **A1. Packing**

<b>No.</b>	<b>Name</b>	<b>Unit</b>	<b>Quantity</b>
1	User's manual for TIG series (English)	Volume	1
2	Quick plug fittings	Pack	1

**“ \* ” - Not all products have this part.**

### **A2. Transportation**

Equipment should be handled with care in transportation to avoid severe impact. Equipment should be prevented from being affected with damp and caught in the rain in transportation.

### **A3. Storage**

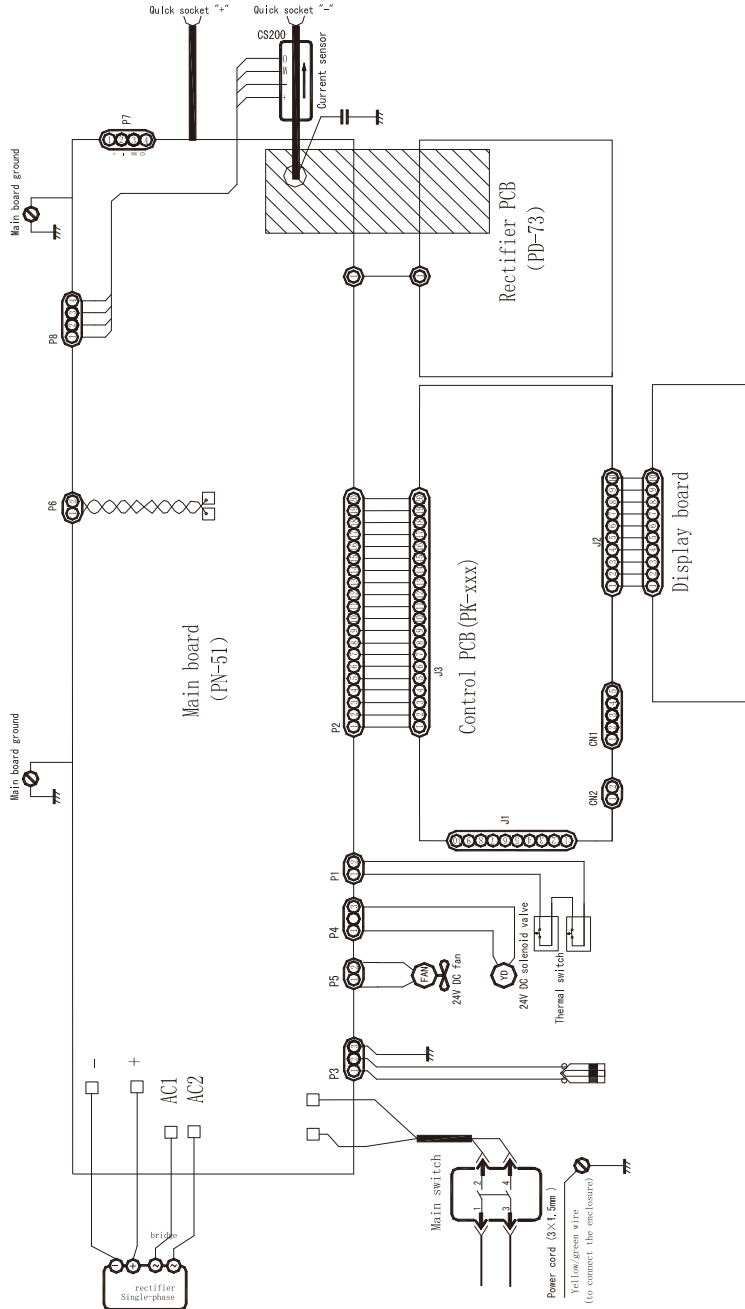
Temperature for storage: -25°C~+50°C

Humidity for storage: relative humidity ≤90%

Storage life: 12 months

Place for storage: ventilated indoor place without corrosive gas

# APPENDIX B: WIRING DIAGRAM OF COMPLETE MACHINE



Wiring Diagram