

Jefferson[®]
PROFESSIONAL TOOLS & EQUIPMENT

TP SERIES

Inverter DC Pulsed TIG /MMA Arc Welding Machine

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§1 SAFETY

§1.1 Signal Explanation



• The above signals mean warning! Notice! Running parts and getting an electric shock or thermal parts will take damage for your body or others. The corresponding notices are as follows. It is quite a safe operation after taking several necessary protection measures.

§1.2 Arc Welding Damage

- The following signals and word explanations are to some damages for your body or others happening on the welding operation. While seeing these, please remind of yourself or others to be dangerous.
- Only ones who are trained professionally can install, debug, operate, maintain and repair the equipment.
- During the operation, non-concerned people should be lift, especially for children.
- After shut off the machine power, please maintain and examine the equipment according to §5 because of the DC voltage existing in the electrolytic capacitors.



ELECTRIC SHOCK CAN KILL.

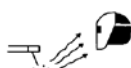
- Never touch electrical parts.
- Wear dry, hole-free gloves and clothes to insulate yourself.
- Insulate yourself from workpiece and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with workpiece and ground.
- Take carefully when using the equipment in small place, falling-off and wet circumstance.
- Never close the machine power before installation and adjustment.
- Ensure to install the equipment correctly and ground the work or metal to be welded to a good electrical (earth) ground according to the operation manual.
- The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.

- Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- Never dip the electrode in water for cooling.
- Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.



FUMES AND GASES CAN BE DANGEROUS.

- Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. When welding with electrodes which require special ventilation such as stainless or hard facing or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.
- Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the material safety data sheet and follow your employer’s safety practices.



ARC RAYS CAN BURN.

- Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding.
- Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- Protect other nearby personnel with suitable, non-flammable screening and /or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



SELF-PROTECTION

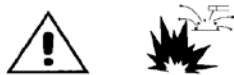
- Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands,

hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

- Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.



DO NOT add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.



WELDING SPARKS can cause fire or explosion.

- Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.
- Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situation.
- When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”.
- Vent hollow castings or containers before heating, cutting or welding. They may explode.
- Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuff less trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.



Rotating parts may be dangerous.

- Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.
- Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

§1.3 The knowledge of Electric and Magnetic Fields

Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). The discussion on the effect of EMF is ongoing all the world. Up to now, no material evidences show that EMF may have effects on health. However, the research on damage of EMF is still ongoing. Before any conclusion, we should minimize exposure to EMF as few as possible.

In order to minimize EMF, we should use the following procedures:

- Route the electrode and work cables together – Secure them with tape when possible.
- All cables should be put away and far from the operator.
- Never coil the power cable around your body.
- Make sure welding machine and power cable to be far away from the operator as far as possible according to the actual circumstance.
- Connect the work cable to the workpiece as close as possible to the area being welded.
- The people with heart-pacemaker should be away from the welding area.

§2 SUMMARY

This operation manual is suitable for the models of TP-1600, TP-2000.

§ 2.1 Brief Introduction

TP- series welding machine is an excellent DC pulsed TIG arc welder which adopts the latest pulse width modulation (PWM) technology and insulated gate bipolar transistor (IGBT) inverter technology, which can realize TIG operation and change work frequency to medium frequency so as to replace the traditional hulking work frequency transformer with the cabinet medium frequency transformer. Thus, it is characterized with portable, small size, light weight, low consumption and etc.

TP- series welding machine has good performance: constant current output, fast response, HF striking arc, and the welding current can be adjusted steplessly and pre-set (The method of lifting arc can reduce the waste of tungsten electrode. Meanwhile, the welder has the function of long and short welding, current up/down-slope, arc force, hot start and short-circuit protection etc.).

TP- series welding machines also have automatic protection functions with intelligent to over-voltage, less-voltage, over-current, and over-heat. If any one of the above problems happens, the alarm lamp on the front panel will be lighted and output current will be shut off automatically to protect itself and prolong the equipment using life.

TP- series welding machine has MMA operation with hot start and arc force function. They are suitable for all positions welding for various plates made of stainless steel, carbon steel, alloyed steel, titanium, etc, which is also applied to pipe installment, mould mend, petrochemical, architecture decoration, car repair, bicycle, handicraft and common manufacture.

TP- series Welder Characteristics:

- ★ **DC Pulsed TIG and MMA, adopt IGBT and advanced PWM technology ;**
- ★ **High performance MCU, digital control, digital display;**
- ★ **Preset all parameters with hold function;**
- ★ **More simple and intuitionistic parameter adjustment;**
- ★ **HF ignition, current down slope and up slope, gas pre-flow and post-flow;**
- ★ **Intelligent protection: over-voltage, low-voltage, over-current, over-heat ;**
- ★ **Wider voltage flexibility (220V±10%).**

TIG——Tungsten Inert Gas welding;

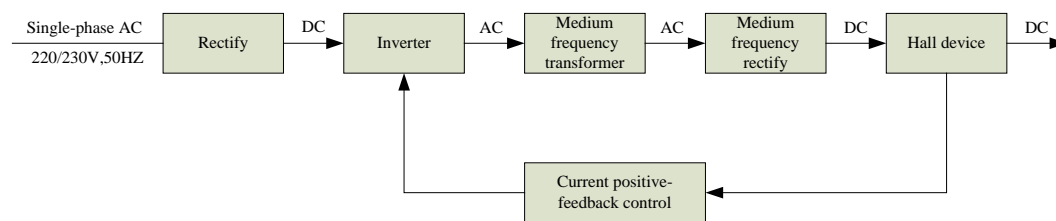
MMA——Manual Metal Arc welding;

PWM——Pulse Width Modulation;

IGBT——Insulated Gate Bipolar Transistor;

§2.2 Working Principle

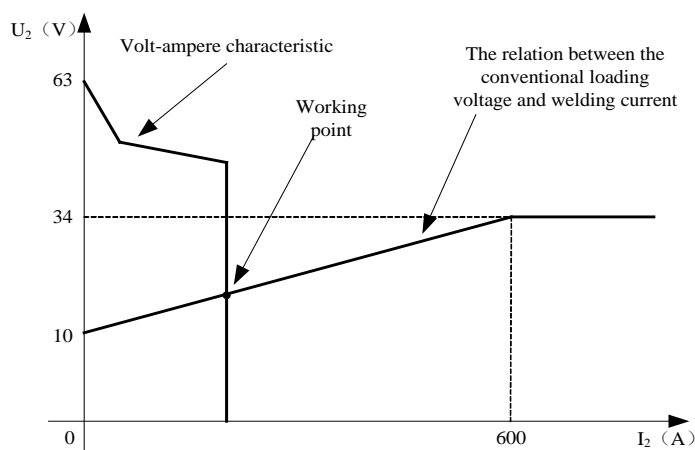
The working principle of TP- series welding machines is shown as the following figure. Single phase work frequency AC 220V or 230V (50 Hz) is rectified into DC (about 300V), then is converted to medium frequency AC (about 20KHz) by inverter device (IGBT), after reducing voltage by medium transformer (the main transformer) and rectifying by medium frequency rectifier (fast recovery diode), and is outputted by inductance filtering. The circuit adopts current feedback control technology to insure current output stably. Meanwhile, the welding current parameter can be adjusted continuously and steplessly to meet with the requirements of welding craft.



§2.3 Volt-Ampere Characteristic

TP- series welding machine has an excellent volt-ampere characteristic, whose graph is shown as the following figure. The relation between the conventional rated loading voltage U_2 and the conventional welding current I_2 is as follows:

When $I_2 \leq 600A$, $U_2 = 10 + 0.04I_2 (V)$; When $I_2 > 600A$, $U_2 = 34 (V)$.



§3 Installation and Adjustment

§3.1 Parameters

Model	TP-1600		TP-2000		
Power Source	1~220V ± 10%, 50/60Hz				
Rated Input Power (KW)	3.3(TIG)/5.3(MMA)		4.7(TIG)/5.5(MMA)		
Rated Input Current (A)	23(TIG)/34(MMA)		31(TIG)/36.5(MMA)		
Power Factor	0.8				
Duty Cycle (40°C, 10 minutes)		TIG	MMA	TIG	MMA
	25%	160A	160A	200A	
	30%				170A
	60%	100A	100A	130A	130A
	100%	80A	80A	100A	100A
Max no-load Voltage(V)	58		63		
Welding Current(Peak Current) Range(A)	5~160		5~200(TIG)/5~170(MMA)		
Base Current Range (A)	5~160		5~200		
Start Current Range(A)	5~160		5~200		
Crater Current Range(A)	5~160		5~200		
Pulse Frequency Range(Hz)	0.5~100				
Pulse Width Range (%)	5~100				
Up Slope Time(S)	0~5.0				
Down Slope Time (S)	0~5.0				
Pre Flow(S)	0~1.0				
Post Flow(S)	3.0~10.0				
Efficiency (%)	≥80				
Protection class	IP23				
Insulation class	F				
Weight (Kg)	7.5		8		
Dimensions of Machine (mm) (L×W×H) (mm)	400*140*230				

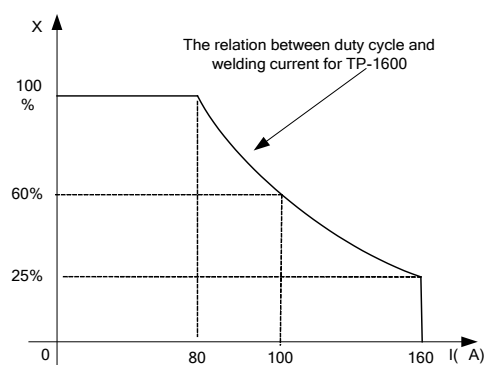
§3.2 Duty cycle & Over heat

The letter “X” stands for duty cycle, which is defined as the proportion of the time that a machine can work continuously within a certain time (10 minutes). The rated duty cycle means the proportion of the time that a machine can work continuously within 10 minutes when it outputs the rated welding current.

The relation between the duty cycle “X” and the output welding current “I” is shown as the right figure.

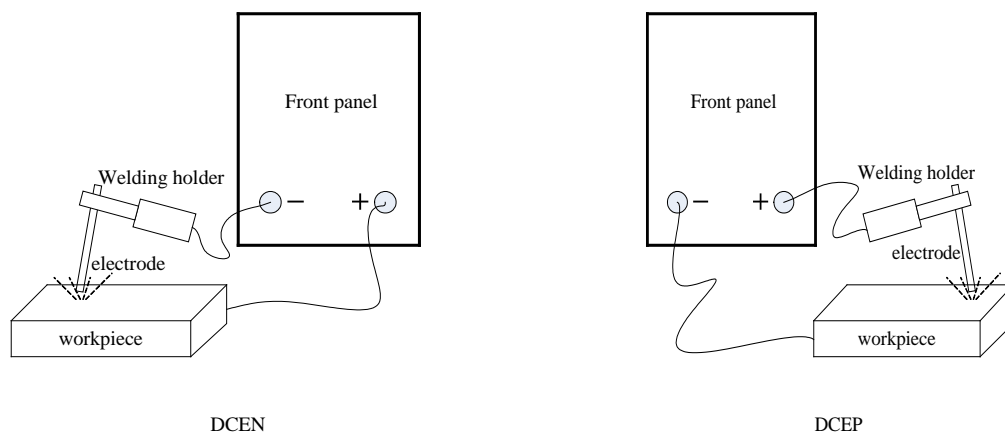
If the welder is over-heat, the IGBT over-heat protection unit inside it will output an instruction to cut output welding current, and brighten the over-heat pilot

lamp on the front panel. At this time, the machine should be relaxed for 10 minutes to cool the fan. When operating the machine again, the welding output current or the duty cycle should be reduced



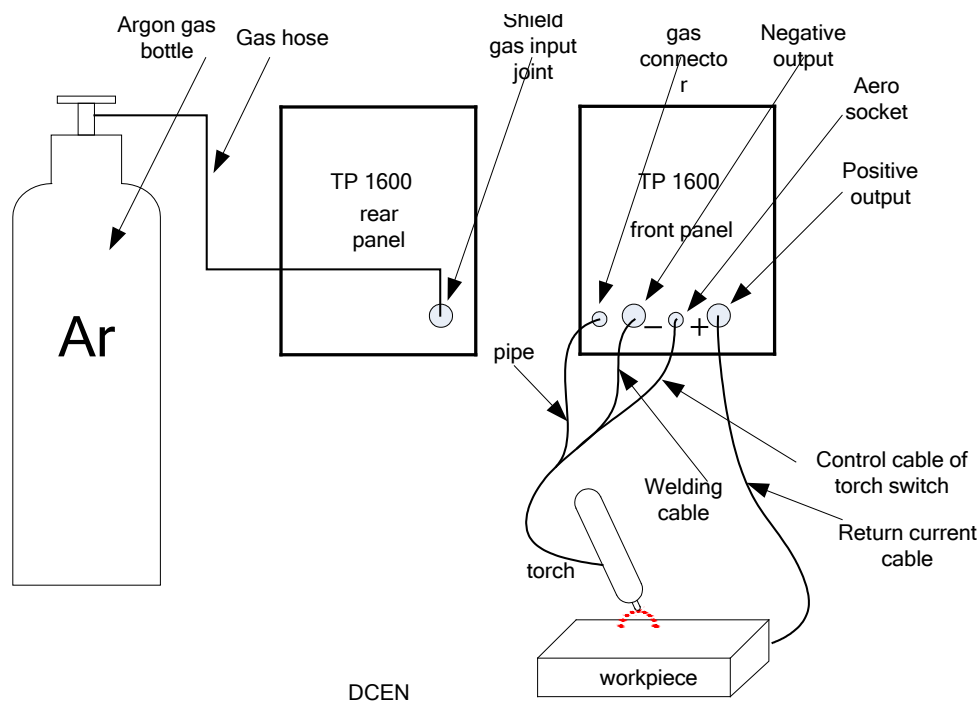
§3.3 Polarity Connection

§3.3.1 MMA operation



- Choosing the connection of DCEN or DCEP according to the arc stable burning condition. The different electrodes need different connection method. Please refer to the electrode manual.
- Put the ‘welding mode selection switch’ of the front panel on MMA shelf before doing MMA welding.

§3.3.2 Assembling the equipment (TIG)



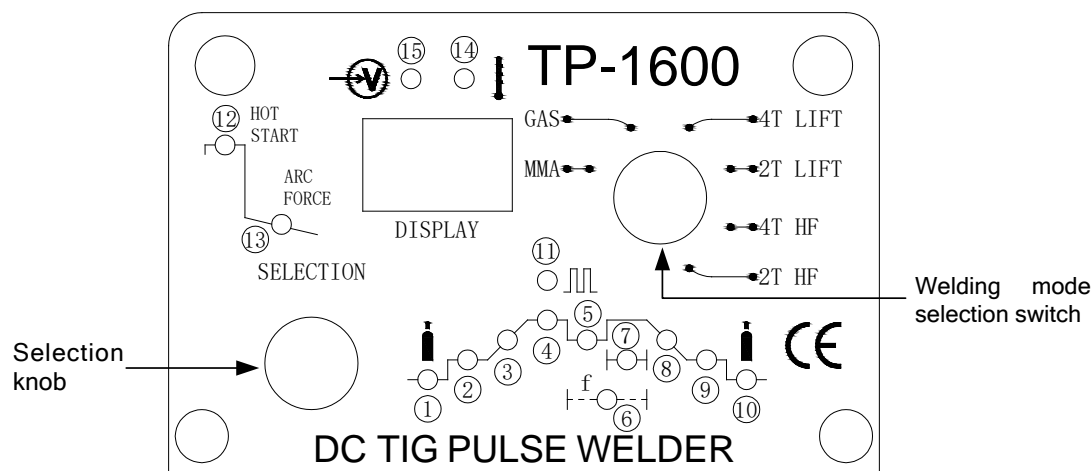
- Workpiece is connected to the positive electrode of welding machine, and welding torch is connected to the negative electrode, which is called DC POSITIVE CONNECTION; otherwise, that is called DC NEGATIVE CONNECTION. Generally, it is usually operated in

DC POSITIVE CONNECTION in TIG welding mode.

- Packing list, such as welding torch, ground cable, gas hose, please refer to packing list in details.
- Those two pipe holder in packing list are used to connect strength pipe with argon gas bottle and shield gas connector.
- The control cable of torch switch consists of 2 wires, and the aero socket has 3 leads. Refer to electrical principle drawing for detailed connection.
- Consumable parts for TIG torch, such as tungsten electrode, tip, gas nozzle, electrode shield(short/long) , please enquire us by mail or phone according to the accessory codes.
- When TP- series welding machines are operated in HF ignition method, the ignition spark can cause interferences in equipment near the welding machine. Be sure to take specially safety precautions or shielding measures.
- Put the 'welding mode selection switch' on front panel in 4T shelf or 2T shelf before doing TIG welding.
- It is better for the welding cable not to exceed 20M.

§4 Operation

§4.1 Layout for the front panel and the rear panel (take TP-1600 for an example)



I 、 Introduction the pilot light of TP-1600 operation panel:

- 1.——Pre Flow Time (L1)
- 2.——Start Current (L2)
- 3.——Up Slope Time (L3)
- 4.——Welding Current (Peak Current) (L4)
- 5.——Base Current (L5)
- 6.——Pulse Frequency (L6)
- 7.——Pulse Width (L7)
- 8.——Down Slope Time (L8)
- 9.——Crater Current (L9)
- 10.——Post Flow Time (L10)
- 11.——Pulse Selection light (L11)
- 12.——Hot Start (L12)
- 13.——Arc Force (L13)
- 14.——Alarm Pilot Light (L14)
- 15.——Power Pilot Light (L15)

II 、 The function of ‘welding mode selection switch’:

1. GAS——Gas test function; In GAS shelf, the gas is given all the time and the welding is stopped.
2. 4T_LIFT——TIG Lifting arc, long welding function.
3. 2T_LIFT——TIG Lifting arc, short welding function.
4. 4T_HF——TIG HF striking arc, long welding function.
5. 2T_HF——TIG HF striking arc, short welding function.
6. MMA——MMA function.

III、 Operations:

1. MMA parameters adjustment

Adjust the ‘welding mode selection switch’ to MMA function. In MMA mode, only three parameters (welding current, hot start, arc force) can be adjusted.

MMA parameters adjustment: Turn on the welder, the welding current can be adjusted directly; If adjust the selection knob, the welding current LED (L4) and the digital scale display

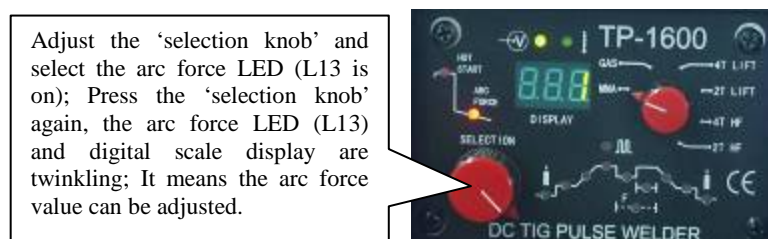
are twinkling; It means the welding current can be adjusted. If the adjustment is completed, confirm the parameter by pressing the 'selection knob' or the system will confirm the parameter automatically after 3 seconds.

Other parameters such as arc force adjustment: press the 'selection knob'; Adjust the 'selection knob' and select the arc force LED(L13 is on); Press the 'selection knob' again, the arc force LED(L13) and digital scale display are twinkling; It means the arc force can be adjusted. If the adjustment is completed, press the 'selection knob' and confirm the parameter; Or the system will confirm the parameter automatically after 3 seconds. Operation flow as follows:

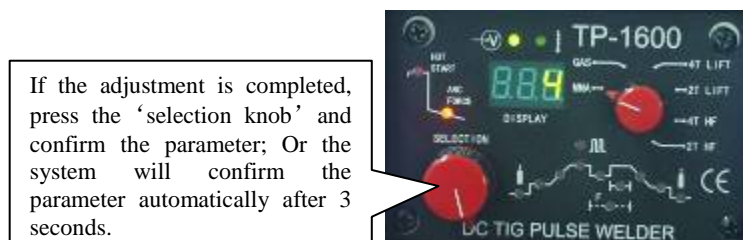
Step one: 'Welding mode selection switch' selects MMA mode, press the 'selection knob';



Step two: Adjust the 'selection knob' and select the arc force LED(L13 is on); Press the 'selection knob' again, the arc force LED(L13) and digital scale display are twinkling; It means the arc force can be adjusted.



Step three: If the adjustment is completed, press the 'selection knob' and confirm the parameter; Or the system will confirm the parameter automatically after 3 seconds.



2. TIG parameters adjustment

Adjust 'welding mode selection switch' to TIG mode. If in TIG 4T mode and the output pulse function is turned on, all parameters (L1~L11) of TIG can be adjusted. If in TIG 2T mode and the output pulse function is turned on, the start current and crater current is 5A; If the pulse function is closed, the parameter of base current(L5), pulse frequency(L6) and pulse width(L7) can not be adjusted.

TIG parameters adjustment: The welding current (L4) can be adjusted directly when the welder is tune on. Adjust the 'selection knob', the welding current LED (L4) and the digital scale display are twinkling; It means the welding current can be adjusted. If the adjustment is completed, confirm the parameter by pressing the 'selection knob' or the system will confirm the parameter automatically after 3 seconds.

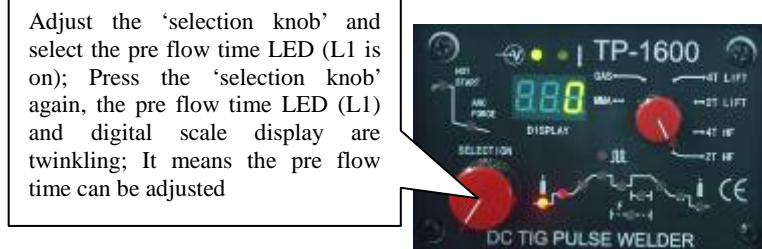
Other parameters adjustment: Take 'pre flow time' for an example. Press the 'selection knob'; Adjust the 'selection knob' and select the pre flow time LED (L1 is on); Press the 'selection knob' again, the pre flow time LED (L1) and digital scale display are twinkling; It means the pre flow time can be adjusted. If the adjustment is completed, confirm the parameter by pressing the

‘selection knob’; or the system will confirm the parameter automatically after 3 seconds.
 Operation flow as follows:

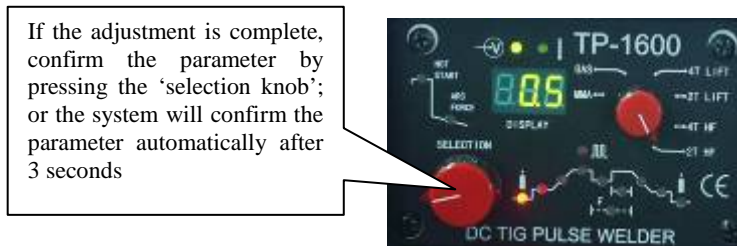
Step one: ‘Welding mode selection switch’ select TIG 4T or 2T. Press the ‘selection knob’;



Step two: Adjust the ‘selection knob’ and select the pre flow time LED (L1 is on); Press the ‘selection knob’ again, the pre flow time LED (L1) and digital scale display are twinkling; It means the pre flow time can be adjusted.



Step three: If the adjustment is completed, confirm the parameter by pressing the ‘selection knob’; or the system will confirm the parameter automatically after 3 seconds.



Output pulse selection: Press the ‘selection knob’. Adjust the ‘selection knob’ and select the pulse LED (L11 is on); press the ‘selection knob’ again, the pulse LED (L11) and digital scale display are twinkling; It means the output pulse function can be turned on or turned off. If the digital scale display is “ON”, the output pulse function is turned on; if the digital scale display is “OFF”, the output pulse function is turned off. When the pulse LED (L11) and digital scale display are twinkling, press the ‘selection knob’ again, the output pulsed conditions transform by “ON” into “OFF” or transform by “OFF” into “ON”. Operation flow as follows:

Step one: ‘Welding mode selection switch’ select TIG 4T or 2T. Press the ‘selection knob’;



Step two: Adjust the ‘selection knob’ and select the output pulse LED (L11 is on); press the ‘selection knob’ again, the pulse LED (L11) and digital scale display are twinkling; It means the output pulse function can be turned on or turned off.

Adjust the 'selection knob' and select the pulse pilot LED (L11 is on); Press the 'selection knob' again, the pulse pilot LED (L11) and digital scale display are twinkling; It means the output pulse function can be turned on or turned off.



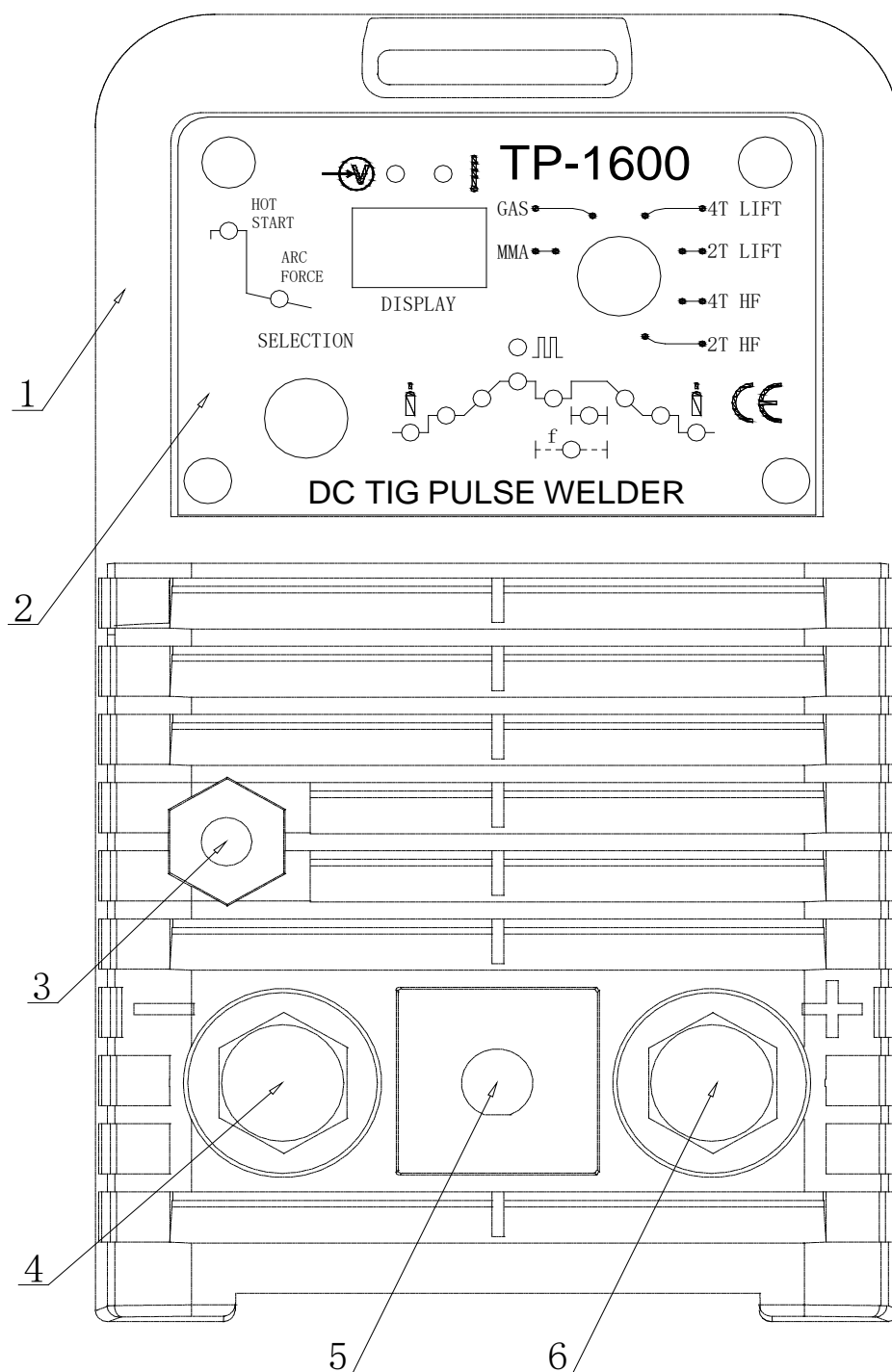
Step three: Press the 'selection knob' again, the output pulsed conditions transform by "ON" into "OFF" or transform by "OFF" into "ON".

Press the 'selection knob' again, the output pulse function is turned off.



Complete the adjustment after 3 seconds, the operation panel will return to original condition; welding current LED (L4) is on. If the welding mode is TIG and the output pulse function is turned on, the pulse pilot light (L11) is on. If the output pulse function is turned off, the pulse pilot light (L11) is off. In MMA mode, the pulse pilot light (L11) is off. All preset parameters with hold function.

§4.2 Layout for the front panel

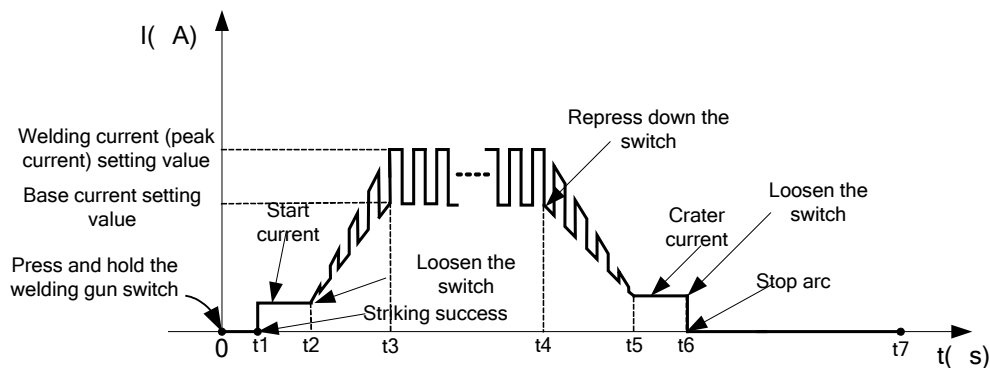


1. **Front panel**
2. **Operation panel**
3. **Shield gas connector** is connected to the gas input pipe of torch.
4. **Connector** the welder's negative polarity output.
5. **Aero socket** is connected to torch switch control wire (3 leads).
6. **Connector** The welder's positive polarity output.

§4.3 Welding Operation

§ 4.3.1 Argon Arc Welding Operation

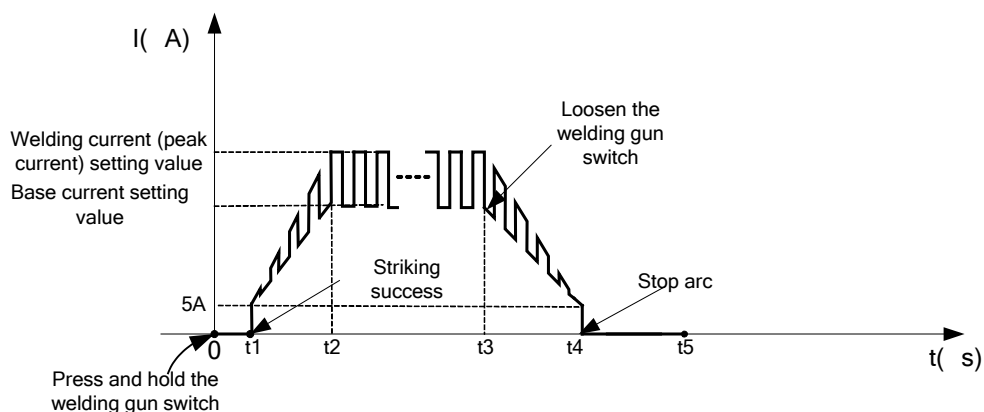
TIG long welding (4T):



Introduction:

- 0: Press and hold the gun switch, Electromagnetic gas valve is turned on. The shielding gas starts to flow;
 - 0~t1: Pre flow time, adjustment range of pre flow time :0~1.0S;
 - t1: Striking success, adjustment range of start current: 5~160A (200A);
 - t2: Loosen the gun switch, the output current slopes up from start current; if the output pulse function is turned on, the output current is pulsed;
 - t2~t3: Output current slopes up to the setting current value; adjustment range of up slope time 0~5.0S ;
 - t3~t4: Welding process. During this period, the gun switch is loosen;
- Note: If the output pulse function is turned on, the output current is pulsed. If the output pulse function is turned off, the output current is DC current;
- t4: Repress down the gun switch, the output current slopes down to crater current; if the output pulse function is turned on, the slope down current is pulsed;
 - t4~t5: Down slope time, adjustment rang of down slope time: 0~5.0S;
 - t5~t6: Crater current holds time; adjustment range of crater current: 5~160A (200A);
 - t6: Loosen the gun switch, stop arc, and keep on argon flowing;
 - t6~t7: Post flow time, adjustment range of post flow time: 3.0~10.0S;
 - t7: Electromagnetic valve is closed and stop argon flowing. Welding is finished.

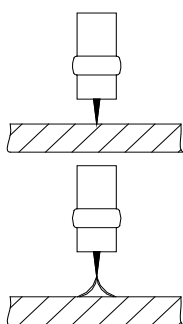
TIG short welding (2T):



Introduction:

- 0: Press and hold the gun switch, Electromagnetic gas valve is turned on. The shielding gas starts to flow;
- 0~t1: Pre flow time, adjustment range of pre flow time :0~1.0S;
- t1~t2: Striking success, the output current slopes up to the setting current from minimum current (5A); if the output pulse function is turned on, the slope up current is pulsed;
- t2~t3: During the whole welding process, the gun switch is pressed and held without releasing;
Note: If the output pulse function is turned on, the output current is pulsed. If the output pulse function is turned off, the output current is DC current;
- t3: Loosen the gun switch, the output current slopes down; if the output pulse function is turned on, the slope down current is pulsed;
- t3~t4: The output current slopes down to minimum current (5A), stop arc; adjustment range of down slope time: 0~5.0S;
- t4~t5: Post flow time, adjustment range of post flow time: 3.0~10.0S;
- t5: Electromagnetic valve is closed and stop argon flowing. Welding is finished.

The operation step of lifting arc:



1. Touch the tungsten electrode with workpiece.
2. Press the welding gun.
3. Lift the welding gun and strike arc.

Output protect function:

In MMA mode, the no-load voltage is 20V; when the welding is beginning, the output voltage will rise to welding voltage immediately. When the welding is finished, the output voltage will drop to 20V.

Parameter storage function:

All preset parameters will be held.

Short circuit protect function:

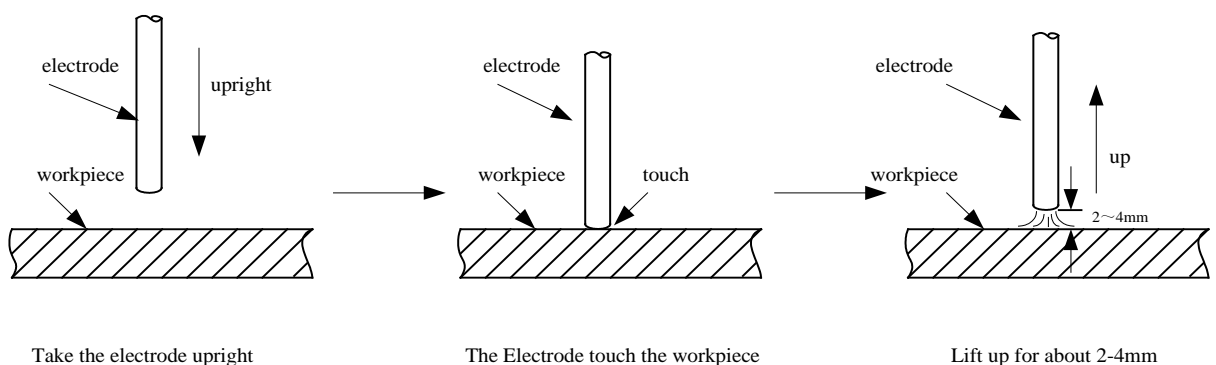
- ① TIG_LIFT 4T or 2T: If the tungsten electrode touches the workpiece when welding, the current will drop to 20A, which can reduce the tungsten spoilage farthestly, prolong the using life of the tungsten electrode, and prevent tungsten clipping.
- ② TIG_HF 4T or 2T: If the tungsten electrode touches the workpiece when welding, the current will drop to 0 within 1second, which can reduce the tungsten spoilage farthestly, prolong the using life of the tungsten electrode, and prevent tungsten clipping.
- ③ MMA: If the electrode touches workpiece over two seconds, the welding current will drop to 0 automatically to protect the electrode.

Automatically purify gas function:

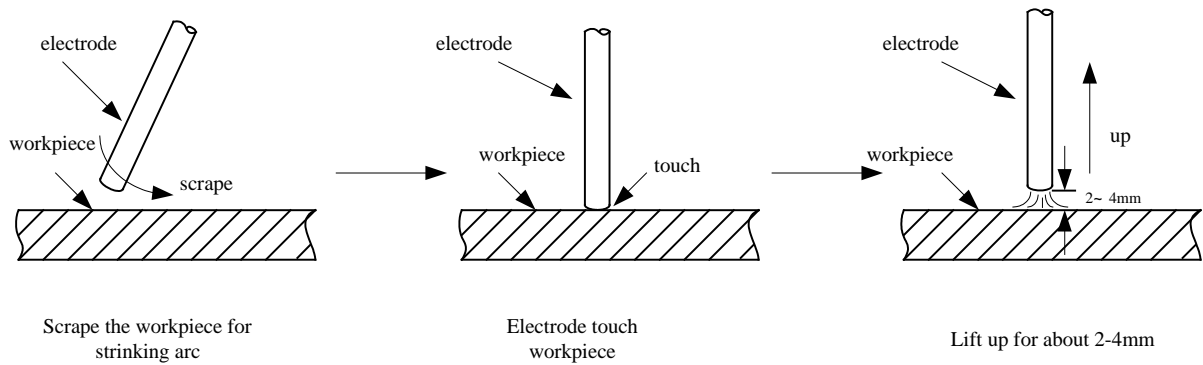
When TIG welding, turn on the welder and the gas valve is open to output shield gas and maintain 10 seconds. Eliminate the air and purify the shield gas of the pipe.

§4.3.2 Striking arc way for MMA

- Knocking arc: take the electrode upright to touch the workpiece, after forming short circuit, quickly lift up about 2~4 mm, and arc will be ignited. This method is difficult to master. But in the welding for the brittle or hard steel, it is better to use knocking way.



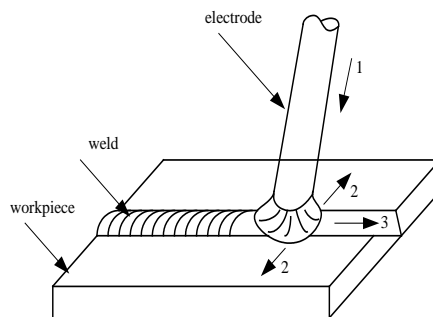
- Lifting arc: take the electrode to scrape the workpiece for striking arc. But it may cause the arc scratch, so must to lift arc in the groove.



§4.3.3 Manipulation of electrode

In MMA welding, there are three motions to be matched in the end of electrode: the electrode moving to the molten pool along axes; the electrode swing right and left; the electrode moving along welding way.

The operator can choose the manipulation of electrode based on welding joint sharp, welding position, electrode spec, welding current and operation skill, etc.

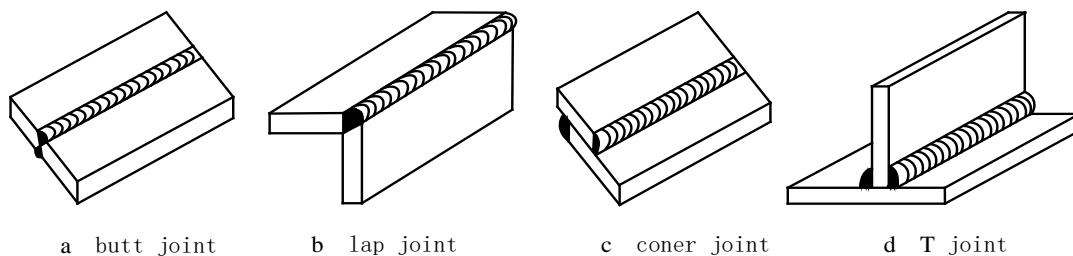


1-electrode moving; 2-the electrode swing right & left; 3-the electrode move along weld

The details please refer to 《Welding Dictionary》 P69, Volume 1 of Edition 2.

§4.4 Welding Parameters

§4.4.1 Joint forms in TIG/MMA



§4.4.2 The explanation of welding quality

The relation of welding area color & protect effect of stainless steel

Welding area color	argent , golden	blue	red-grey	grey	black
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OPERATION

Protect effect	best	better	good	bad	worst
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The relation of welding area color & protect effect of Ti-alloy

Welding area color	bright argent	orange-yellow	blue-purple	caesious	white powder of titanium oxid
Protect effect	best	better	good	bad	worst

§4.4.3 TIG Parameters Matching

The corresponding relationship between gas nozzle diameter and electrode diameter

Gas nozzle diameter/mm	Electrode diameter/mm
6.4	0.5
8	1.0
9.5	1.6 or 2.4
11.1	3.2

Notice: the above parameters originate from 《Welding Dictionary》 P142, Volume 1 of Edition 2.

Welding current range/A	DC positive connection	
	Gas nozzle diameter/mm	Gas flow rate/L • min ⁻¹
10~100	4~9.5	4~5
101~150	4~9.5	4~7
151~200	6~13	6~8

Tungsten electrode shape and the welding current range (DCEP)

tungsten electrode diameter /mm	sharpened of the electrode diameter/mm	angle of cone (°)	background current/A	pulse current
1.0	0.125	12	2~15	2~25
1.0	0.25	20	5~30	5~60
1.6	0.5	25	8~50	8~100
1.6	0.8	30	10~70	10~140
2.4	0.8	35	12~90	12~180
2.4	1.1	45	15~150	15~250
3.2	1.1	60	20~200	20~300

Notice: the above parameters originate from 《Welding Dictionary》 P149, Volume 1 of Edition 2.

TIG of stainless steel (single run welding)

Workpiece thickness /mm	Joint form	tungsten electrode diameter/mm	welding wire diameter/mm	Argon gas flow rate/ L · min ⁻¹	welding current (DCEP)	Welding speed/ cm · min ⁻¹
0.8	Butt joint	1.0	1.6	5	20~50	66
1.0	Butt joint	1.6	1.6	5	50~80	56
1.5	Butt joint	1.6	1.6	7	65~105	30
1.5	Corner joint	1.6	1.6	7	75~125	25
2.4	Butt joint	1.6	2.4	7	85~125	30
2.4	Corner joint	1.6	2.4	7	95~135	25
3.2	Butt joint	1.6	2.4	7	100~135	30
3.2	Corner joint	1.6	2.4	7	115~145	25

Notice: the above parameters originate from 《Welding Dictionary》 P150, Volume 1 of Edition 2.

Parameters of piping back sealing welding for mild steel (DCEP)

Piping diameter Φ/mm	Tungsten electrode diameter/mm	Gas nozzle diameter/mm	Welding wire diameter/mm	Welding current/A	Arc voltage/V	Argon flow rate / L · min ⁻¹	Welding rate / cm · min ⁻¹
38	2.0	8	2	75~90	11~13	6~8	4~5
42	2.0	8	2	75~95	11~13	6~8	4~5
60	2.0	8	2	75~100	11~13	7~9	4~5
76	2.5	8~10	2.5	80~105	14~16	8~10	4~5
108	2.5	8~10	2.5	90~110	14~16	9~11	5~6
133	2.5	8~10	2.5	90~115	14~16	10~12	5~6
159	2.5	8~10	2.5	95~120	14~16	11~13	5~6
219	2.5	8~10	2.5	100~120	14~16	12~14	5~6
273	2.5	8~10	2.5	110~125	14~16	12~14	5~6
325	2.5	8~10	2.5	120~140	14~16	12~14	5~6

Notice: the above parameters originate from 《Welding Dictionary》 P167, Volume 1 of Edition 2.

§4.4.4 Electrode selection

The welding current reference for different electrode diameter				
Electrode diameter /mm	1.6	2.0	2.5	3.2

welding current /A	25~40	40~60	50~80	100~130
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The relation between the welding current(I) factor(K) & electrode diameter(d) ($I=K \times d$: Carbon electrode)			
Electrode diameter /mm	1.6	2~2.5	3.2
Factor/K	20~25	25~30	30~40

Notice: the above parameters originate from 《Welding Dictionary》P66~P67, Volume 1 of Edition 2.

§4.5 Operation Environment

- Height above sea level is below 1000m.
- Operation temperature range: $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$.
- Relative humidity is below 90 % (20°C).
- Preferably site the machine some angles above the floor level, the maximum angle does not exceed 15° .
- Protect the machine against heavy rain or in hot circumstance against direct sunshine.
- The content of dust, acid, corrosive gas in the surrounding air or substance can not exceed normal standard.
- Take care that there is sufficient ventilation during welding. There is at least 30cm free distance between the machine and wall.

§4.6 Operation Notices

- Read §1 carefully before attempting to use this equipment.
- Connect the ground wire with the machine directly.
- In case closing the power switch, no-load voltage may be exported. Do not touch the output electrode with any part of your body.
- Before operation, no concerned people should be left. Do not watch the arc in unprotected eyes.
- Ensure good ventilation of the machine to improve duty ratio.
- Turn off the engine when the operation finished to economize energy source.
- When power switch shuts off protectively because of failure. Don't restart it until problem is resolved. Otherwise, the range of problem will be extended.
- If there is any problem and has no the authorized professional maintenance personal of our company, please contact local our company agent or the branch company!

WTL service hot line : 021-50425040 ; 021-68923300-852

§5 Maintenance & Troubleshooting

§5.1 Maintenance

In order to guarantee that arc welding machine works high-efficiently and in safety, it must be maintained regularly. Let customers understand the maintenance methods and means of arc welding machine more , enable customers to carry on simple examination and safeguarding by oneself, try one's best to reduce the fault rate and repair times of arc welding machine, so as to lengthen service life of arc welding machine .Maintenance items in detail are in the following table.

- **Warning: For safety while maintaining the machine, please shut off the supply power and wait for 5 minutes, until capacity voltage already drop to safe voltage 36V!**

date	Maintenance item
Daily examination	<p>Observe that whether panel knob and switch in the front and at the back of arc welding machine are flexible and put correctly in place. If the knob has not been put correctly in place, please correct; If you can't correct or fix the knob , please replace immediately;</p> <p>If the switch is not flexible or it can't be put correctly in place, please replace immediately; Please get in touch with our company maintenance service department if there are no accessories.</p> <p>After turn-on power, watch/listen to that whether the arc welding machine has shaking, whistle calling or peculiar smell. If there is one of the above problems, find out the reason to get rid of; if you can't find out the reason, Please contact local this area our company agent or the branch company.</p> <p>Observe that whether the display value of LED is intact. If the display number is not intact, please replace the damaged LED. If it still doesn't work, please maintain or replace the display PCB.</p> <p>Observe that whether the min/max value on LED accords with the set value. If there is any difference and it has affected the normal welding craft, please adjust it.</p> <p>Check up that Whether fan is damaged and is normal to rotate or control. If the fan is damaged, please change immediately. If the fan does not rotate after the arc welding machine is overheated , observe that whether there is something blocked in the blade, if it is blocked, please get rid of ; If the fan does not rotate after getting rid of the above problems, you can poke the blade by the rotation direction of fan. If the fan rotates normally, the start capacitor should be replaced ; If not, change the fan.</p> <p>Observe that whether the fast connector is loose or overheated. if the arc welding machine has the above problems, it should be fastened or changed.</p> <p>Observe that Whether the current output cable is damaged. If it is damaged, it should be wrapped up, insulated or changed.</p>

Monthly examination	<p>Using the dry compressed air to clear the inside of arc welding machine. Especially for clearing up the dusts on radiator, main voltage transformer, inductance, IGBT module, the fast recover diode and PCB, etc.</p> <p>Check up the bolt in arc welding machine, if it is loose, please screw down it. If it is skid, please replace. If it is rusty, please erase rust on bolt to ensure it works well.</p>
Quarter-yearly examination	<p>Whether the actual current accords with the displaying value. If they does not accord, they should be regulated. The actual current value can be measured by the adjusted plier-type ampere meter.</p>
Yearly examination	<p>Measure the insulating impedance among the main circuit, PCB and case, if it below 1MΩ, insulation is thought to be damaged and need to change, and need to change or strengthen insulation.</p>

§5.2 Troubleshooting

- Before arc welding machines are dispatched from the factory, they have already been debugged accurately. So forbid anyone who is not authorized by our company to do any change to the equipment!
- Maintenance course must be operated carefully. If any wire becomes flexible or is misplaced, it maybe potential danger to user!
- Only professional maintenance personal who is authorized by our company could overhaul the machine!
- Guarantee to shut off the arc welding machine’s power before turn on the outline of the equipment!
- If there is any problem and has no the authorized professional maintenance personal of our company, please contact local our company agent or the branch company!

If there are some simple troubles of TP- series welding machine, you can consult the following overhauling chart:

S/N	Troubles	Reasons	Solution
1	Turn on the power source, and fan doesn’t work, but the power light is not on.	The power light damaged or connection is not good	Test and repair the inside circuit of power light
		The transformer of power is broken	Repair or change the transformer
		Control PCB failures	Repair or change the control PCB
2	Turn on the power source, and the power light is on, but fan doesn’t work.	There is something in the fan	Clear out
		The start capacitor of fan damaged	Change capacitor
		The fan motor damaged	Change fan

S/N	Troubles		Reasons	Solution	
3	Turn on the power source, and the power light is not on and fan doesn't work.		No power supply input	Test the power supply input	
			The fuse on the rear panel is broken	Change the fuse (3A)	
4	No no-load voltage output (MMA)		The machine is damaged	Check the main circuit and the PCBs(Pr1)	
5	Arc can not be ignited (TIG)	There is spark on the HF igniting board.	The welding cable is not connected with the two output of the welder.	Connect the welding cable to the welder's output.	
			The welding cable damaged.	Repair or change it.	
			The earth cable connected unstably.	Check the earth cable.	
			The welding cable is too long.	Use an appropriate welding cable.	
			There is oil or dust on the workpiece.	Check and remove it.	
			The distance between tungsten electrode and workpiece is too long.	Reduce the distance (about 3mm).	
			The distance between the discharger is too short.	Adjust this distance (about 0.7mm).	
		The malfunction of the welding gun switch.	Check the welding gun switch, control cable and aero socket.		
6	HF striking arc can not be stopped		Check Pr2	Repair or change it.	
7	No gas flow (TIG)		Gas cylinder is close or gas pressure is low	Open or change the gas cylinder	
			No controlling electromagnetic valve signal	Repair or change the pulse board	
			Something in the valve	Remove it	
			Electromagnetic valve is damaged	Change it	
8	When welding, it is hard to strike arc or easy to stick.(MMA)		Connector is loose or connection is not good.	Check and screw it.	
			There is oil or dirty on the workpiece.	Check and clear it.	
9	The welding current can not be adjusted		The welding current potentiometer on the front panel connection is not good or damaged	Repair or change the potentiometer	
			The control signal of the pulse board is wrong	Repair or change the pulse board	
10	The penetration of molten pool is not enough.		The welding current is adjusted too low	Increase the welding current	
			The arc is too long in the welding process	Use the short-arc operation	
11	Arc deflection.		Air interference	Keep out air	
			Electrode deflection	Change new electrode.	
				Adjust another angle to weld	
			Magnetic field	Use the short-arc operation	
				Change the position of earth cable	
		Change welding direction			
12	The alarm light on the front panel is on		Over heat protection	Too much welding current	Reduce the welding current output
				Working time too long	Reduce the duty cycle (work intervally)

S/N	Troubles	Reasons		Solution
		Over-voltage protection	Power supply fluctuates	Using the stable power supply
		Low-voltage protection	Power supply fluctuates	Using the stable power supply
			Too many machines using power supply in the same time	Reduce the machines using power supply in the same time
		Over-current protection	Unusual current in the main circuit	Check and repair the main circuit and drive PCB (Pr2)

§5.3 Electrical principle drawing

