

# **OPERATING INSTRUCTIONS**

## **Berlin2400 Welding Machine**



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- ◆ **Number 1 in the prices**
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More than 30,000 enthusiastic customers trust our equipment in the welding and plasma technology. They confirm the success of these trendsetting strategy. In addition to the stringent quality test and the test in the production, we subject the equipment a thorough inspection before delivery. We guarantee delivery of spare parts and repair of all equipment. The customer is served during and after the warranty period from us. In case of problems, call us , we are always available. You are also welcome to visit us. Highly qualified employees are dedicated to carrying out their various tasks with expertise and passion. Our motivated team will always find a positive solution for you. Everyone is welcome to test our equipment in detail under the guidance of our experts.

Private gardening, industry or professional, in every area you win if you rely on technology of welding equipment from **VECTOR**.

**For questions or suggestions, please contact us [www.smart-iwm.com](http://www.smart-iwm.com)**



**WARNINGS**

Read and understand this entire Manual and your employer’s safety practices before installing, operating ,or servicing the equipment. While The operating instructions provide an introduction to the safe use of the products.

- Read the operating instructions for all system components!
- Observe accident prevention regulations!
- Observe all local regulations!
- Confirm with a signature where appropriate.

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**Record the following information for Warranty purposes:**

Where Purchased: \_\_\_\_\_

Purchase Date: \_\_\_\_\_

Serial NO.: \_\_\_\_\_

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### WARNING

**PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR. DO NOT LOSE THESE INSTRUCTIONS. READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.**

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Some of these practices apply to equipment connected to power lines; other practices apply to engine driven equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld.

Safe practices are outlined in the European Standard EN60974-1 entitled: Safety in welding and allied processes Part 2: Electrical HAVE ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR WORK PERFORMED ONLY BY QUALIFIED PEOPLE.

## 1.1 Arc Welding Damage



### WARNING ELECTRIC SHOCK can kill.

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

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Insulate yourself from work and ground using dry insulating mats or covers.
4. Disconnect input power or stop engine before installing or servicing this equipment. Lock input power disconnect switch open, or remove line fuses so power cannot be turned on accidentally.
5. Properly install and ground this equipment according to its Owner's Manual.

**WARNING**

**ARC RAYS can burn eyes and skin,  
NOISE can damage hearing.**

Arc rays from the welding process produce intense heat and strong ultraviolet rays that can burn eyes and skin. Noise from some processes can damage hearing.

1. Wear a welding helmet fitted with a proper shade of filter to protect your face and eyes when welding or watching;
2. Wear approved safety glasses. Side shields recommended;
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc;
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection;
5. Use approved ear plugs or ear muffs if noise level is high;
6. Never wear contact lenses while welding.

**WARNING**

**FUMES AND GASES can be hazardous  
to your health.**

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

1. Keep your head out of the fumes. Do not breathe the fumes.
2. If inside, ventilate the area and/or use exhaust at the arc to remove welding fumes and gases.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air causing injury or death. Be sure the breathing air is safe.
5. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapours to form highly toxic and irritating gases.
6. Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes if welded.

**WARNING**

**WELDING can cause fire or explosion.**

Sparks and spatter fly off from the welding arc. The fly sparks and hot metal, weld spatter, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

1. Protect yourself and others from flying sparks and hot metal.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables far away from the welding arc. If this is not possible, tightly cover them with approved covers.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire, and keep a fire extinguisher nearby.

6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Do not weld on closed containers such as tanks or drums.
8. Connect work cable to the work as close to the welding area as practical to prevent welding current from travelling long, possibly unknown paths and causing electric shock and fire hazards.
9. Do not use welder to thaw frozen pipes.
10. Remove stick electrode from holder or cut off welding wire at contact tip when not in use.

**WARNING**

**FLYING SPARKS and HOT METAL  
can cause injury.**

Chipping and grinding cause flying metal. As welds cool, they can throw off slag.

1. Wear approved face shield or safety goggles. Side shields recommended.
2. Wear proper body protection to protect skin.

**WARNING**

**CYLINDERS can explode if damaged.**

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

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinder is in use or connected for use.
8. Read and follow instructions on compressed gas cylinders, associated equipment.

**WARNING**

**ENGINE FUEL can cause fire or explosion.**

Engine fuel is highly flammable.

1. Stop engine before checking or adding fuel.
2. Do not add fuel while smoking or if unit is near any sparks or open flames.
3. Allow engine to cool before fuelling. If possible, check and add fuel to cold engine before beginning job.
4. Do not overfill tank — allow room for fuel to expand.
5. Do not spill fuel. If fuelling is spilled, clean up before starting engine.



**WARNING MOVING PARTS** can cause injury.

Moving parts, such as fans, rotors, and belts can cut fingers and hands and catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and securely in place.
2. Stop engine before installing or connecting unit.
3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. To prevent accidental starting during servicing, disconnect negative (-) battery cable from battery.
5. Keep hands, hair, loose clothing, and tools away from moving parts.
6. Reinstall panels or guards and close doors when servicing is finished and before starting engine.



**WARNING SPARKS** can cause battery gases to explode; **BATTERY ACID** can burn eyes and skin.

Batteries contain acid and generate explosive gases.

1. Always wear a face shield when working on a battery.
2. Stop engine before disconnecting or connecting battery cables.
3. Do not allow tools to cause sparks when working on a battery.
4. Do not use welder to charge batteries or jump start vehicles.
5. Observe correct polarity (+ and -) on batteries.



**WARNING STEAM AND PRESSURIZED HOT COOLANT** can burn face, eyes, and skin.

The coolant in the radiator can be very hot and under pressure.

1. Do not remove radiator cap when engine is hot. Allow engine to cool.
2. Wear gloves and put a rag over cap area when removing cap.
3. Allow pressure to escape before completely removing cap.

**NOTE**

**1.2 Effects Of Low Frequency Electric and Magnetic Fields**

Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). The discuss 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.

**To reduce magnetic fields in the workplace, use the following procedures.**

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cable around the body.
4. Keep welding Power Source and cables as far away from body as practical.
5. The people with heart-pacemaker should be away from the welding area.

**1.3 Symbol Chart**

Note that only some of these symbols will appear on your model.

	ON		Single Phase		Wire Feed Function
	OFF		Three Phase		Wire Feed Towards Workpiece With Output Voltage OFF.
	Dangerous Voltage		Three Phase Static Frequency Converter-Transformer-Rectifier		Welding Gun
	Increase/Decrease		Remote		Purging Of Gas
	Circuit Breaker		Duty Cycle		Continuous Weld Mode
	AC Auxiliary Power		Percentage		Spot Weld Mode
	Fuse		Panel/Local		Spot Time
	Amperage		Shielded Metal Arc Welding (SMAW)		Prewlow Time
	Voltage		Gas Metal Arc Welding (GMAW)		Postflow Time
	Hertz (cycles/sec)		Gas Tungsten Arc Welding (GTAW)		2 Step Trigger Operation Press to initiate wirefeed and welding, release to stop.
	Frequency		Air Carbon Arc Cutting (CAC-A)		4 Step Trigger Operation Press and hold for preflow, release to start arc. Press to stop arc, and hold for preflow.
	Negative		Constant Current		Burnback Time
	Positive		Constant Voltage Or Constant Potential		Inches Per Minute
	Direct Current (DC)		High Temperature		Meters Per Minute
	Protective Earth (Ground)		Fault Indication		See Note
	Line		Arc Force		See Note
	Line Connection		Touch Start (GTAW)		Pulse Welding
	Auxiliary Power		Variable Inductance		
	115V 15A Receptacle Rating-Auxiliary Power		Voltage Input		

## 2.1 Brief Introduction

Berlin2400 welding machines adopts the latest pulse width modulation (PWM) technology and insulated gate bipolar transistor (IGBT) power module, which can change work frequency to medium frequency so as to replace the traditional hulking ork frequency transformer with the cabinet medium frequency transformer. Thus, its characterized with portable, small size, light weight, low consumption and etc.

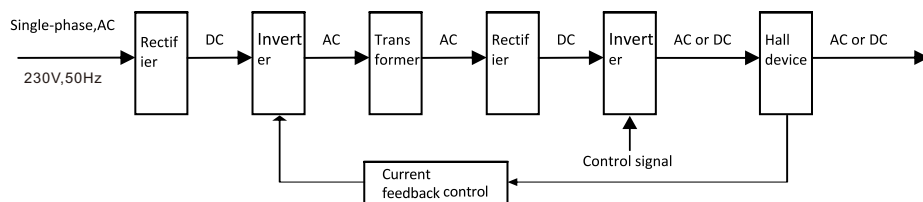
The parameters of on the front panel all can be adjusted continuously and steplessly, such as start current, crater arc current, welding current, base current, duty ratio, upslope time, downslope time, pre-gas, post-gas, pulse frequency, AC frequency, balance, hot start, arc force and length etc. When welding, it takes high frequency and high voltage for arc igniting to ensure the success ratio of igniting arc.

### Berlin2400 machines Characteristics:

- ◆MCU control system, responds immediately to any changes.
- ◆High frequency and high voltage for arc igniting to ensure the success ratio of igniting arc, the reverse polarity ignition ensures good ignition behavior in TIG-AC welding.
- ◆Avoid AC arc-break with special means, even if arc-break occurs the HF will keep the arc stable.
- ◆Pedal control the welding current.
- ◆In DC TIG without HFoperation, If the tungsten electrode touches the workpiece when welding, the current will drop to short-circuit current to protect tungsten.
- ◆Intelligent protection: over-current, over-heat, when the mentioned problems occurred, the alarm lamp on the front panel will be on and the output current will be cut off. It can self-protect and prolong the using life.
- ◆Double purposes: AC inverter TIG and DC inverter TIG/MMA, Excellent performance on AL-alloy, carbon steel, stainless steel, titanium.

## 2.2 Working Principle

The working principle of Berlin2400 welding machines is shown as the following figure. Single-phase 230V work frequency AC is rectified into DC (about 312 V), then is converted to medium frequency AC (about 20-40KHz) by inverter device (IGBT module), after reducing voltage by medium transformer (the main transformer) and rectifying by medium frequency rectifier (fast recovery diodes), then is outputted DC or AC by selecting IGBT module. 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.



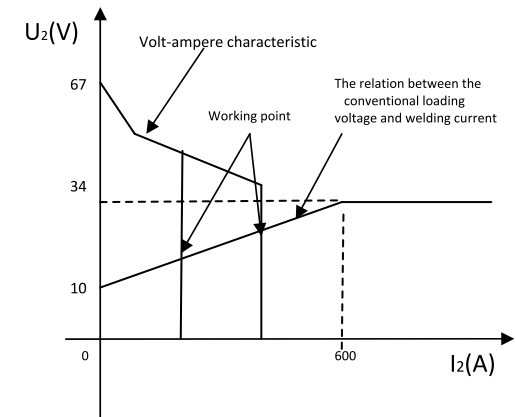
## 2.3 Volt- Ampere Characteristic

Berlin2400 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:

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

**MMA**  
When  $I_2 \leq 600A$ ,  $U_2 = 20 + 0.04I_2 (V)$ ;  
When  $I_2 > 600A$ ,  $U_2 = 44 (V)$ .

**CUT**  
When  $I_2 \leq 600A$ ,  $U_2 = 80 + 0.4I_2 (V)$ ;



## 2.4 Specifications

Description	SIWM DIGITAL Berlin2400
Weight	8.62 kg
Power Source Dimensions	H405mmxW160mmxD380mm
Cooling	Fan Cooled
Welder Type	Inverter Power Source
European Standards	EN 60974-1 / IEC 60974-1
Number of Phases	1
Nominal Supply Voltage	230V +/- 15%
Nominal Supply Frequency	50/60Hz
Welding Current Range (MMA Mode)	10 - 170A
Welding Current Range (TIG Mode)	10 - 200A
Welding Current Range (CUT Mode)	20 - 50A
Effective Input Current	15.4A
Maximum Input Current	30.9A
Single Phase Generator Requirement	10KVA
MMA Welding Output, 40°C, 10 min.	170A @ 25%, 26.8V / 85A @ 100%, 23.4V
TIG Welding Output, 40°C, 10 min.	200A @ 40%, 18V / 126A @ 100%, 15V
CUT Welding Output, 40°C, 10 min.	50A @ 40%, 100V / 25A @ 100%, 90V
Open circuit voltage (MMA/TIG)	73V DC
Open circuit voltage (CUT)	265V DC
Protection Class	IP23

NOTE

Note 1: The Effective Input Current should be used for the determination of cable size & supply requirements.

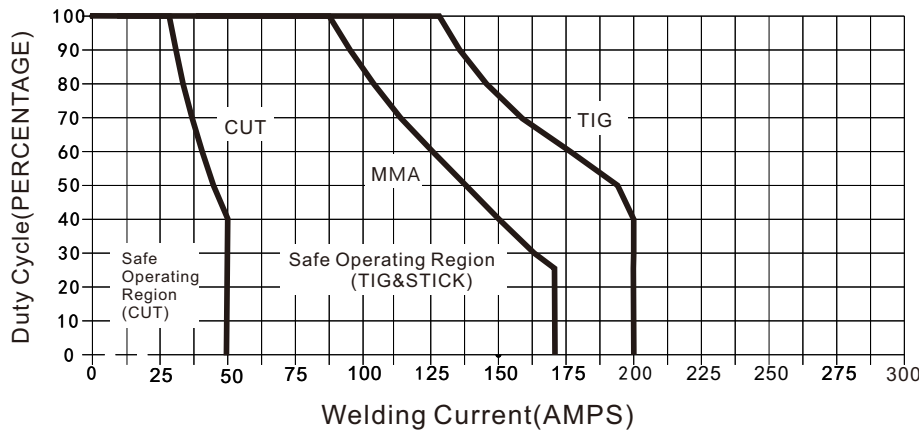
Note 2: Generator Requirements at the Maximum Output Duty Cycle.

Note 3: Motor start fuses or thermal circuit breakers are recommended for this application. Check local requirements for your situation in this regard.

Due to variations that can occur in manufactured products, claimed performance, voltages, ratings, all capacities, measurements, dimensions and weights quoted are approximate only. Achievable capacities and ratings in use and operation will depend upon correct installation, use, applications, maintenance and service.

2.5 Duty Cycle

The rated duty cycle of a Welding Power Source, is a statement of the time it may be operated at its rated welding current output without exceeding the temperature limits of the insulation of the component parts. To explain the 10 minute duty cycle period the following example is used. Suppose a Welding Power Source is designed to operate at a 50% duty cycle, 200 amperes at 28 volts. This means that it has been designed and built to provide the rated amperage (200A) for 5 minutes, i.e. arc welding time, out of every 10 minute period (50% of 10 minutes is 5 minutes). During the other 5 minutes of the 10 minute period the Welding Power Source must be idle and be allowed to cool. The thermal cut out will operate if the duty cycle is exceeded.



2.6 Packaged Items

- ◆ 2.5m Power cable
- ◆ 200 Amp Electrode Holder With 2.5m cable
- ◆ 200 Amp Earth Clamp With 2.5m cable
- ◆ 4m TIG Torch WP-17
- ◆ Plasma Torch 4m PT-31
- ◆ Air Regulator
- ◆ 3m Gas Hose
- ◆ Operating Manual

3.1 Layout For The Panel

Front



## Behind

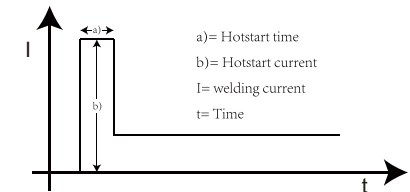


## 1. Digital Ammeter / Parameter meter

The digital Ammeter is used to display the actual output current of the power source. It is also used to display Parameters in Programming Mode. Depending on the Programming Parameter selected, the status indicator adjacent to the Ammeter will illuminate to show the units of the programming parameter. When welding, the Ammeter will display actual welding current.

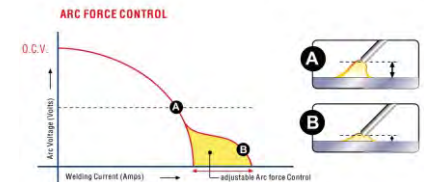
## 2. Hot Start

**Hot Start** Function reliably ignites the electrode and melts perfectly to ensure the best quality even at the start of the seam. this solution makes lack of fusion and cold welds a thing of the past and significantly reduces weld reinforcement. Adjust the hot start current here and the time here.



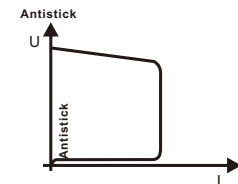
## Arcforce Correction

During the welding process, arcforce prevents the electrode sticking in the weld pool with increases in current. this makes it easier to weld large-drop melting electrode types at low current strengths with a short arc in particular.



## Anti-stick prevents the electrode from annealing.

If the electrode sticks in spite of the arcforce device, the machine automatically switches over to the minimum current within about 1 second to prevent the electrode from overheating. In order to easily separate the electrode and electrode holder to protect the welder.



## 3. JOB and SAVE

You can press JOB to select the memory records that you have saved before from 1-9. For the new setting of present current Amps ,just press SAVE.

## 4. Current adjusting button/functions choosing

Clockwise rotate to enlarge the current, and anti-clockwise rotate to reduce the current. If you need to choose different programming parameters (the eighth mark), press the button and release it to choose different functions.

## 5. Time Indicator (s)

Time indicator , when setting programm in gas pre-flow, up slope, down slope and gas post-flow, this indicator will be on.

## 6. Current Indicator

When setting programm in the peak current, base current, ending current and rem , this current indicator will be on.

## 7. Percentage Indicator(%)

Percentage indicator, when setting programm in pulse duty cycle , this indicator will be on .



**8. Frequency Indicator (Hz)**

Frequency indicator, when the setting programm in pulse frequency ,this indicator will be on.

**9. Power ON Indicator**

The POWER ON indicator illuminates when the ON/OFF switch is in the ON position and the correct mains voltage is present.

**10. Thermal Overload Indicator Light**

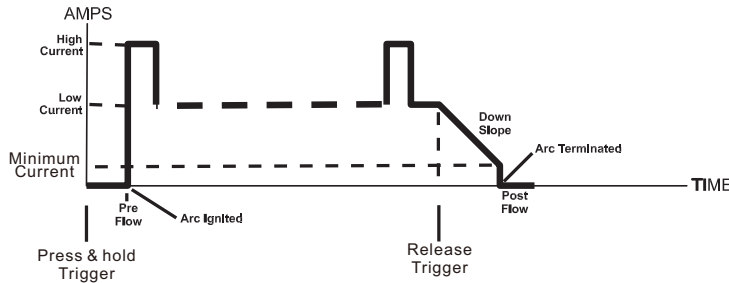
This welding power source is protected by a self resetting thermostat. The indicator will illuminate if the duty cycle of the power source has been exceeded. Should the thermal overload indicator illuminate the output of the power source will be disabled. Once the power source cools down this light will go OFF and the over temperature condition will automatically reset. Note that the mains power switch should remain in the on position such that the fan continues to operate thus allowing the unit to cool sufficiently. Do not switch the unit off should a thermal overload condition be present.

**11. Trigger Mode Control Button (HF TIG and LIFT TIG Mode only)**

The trigger mode control is used to switch the functionality of the torch trigger between 2T and 4T.

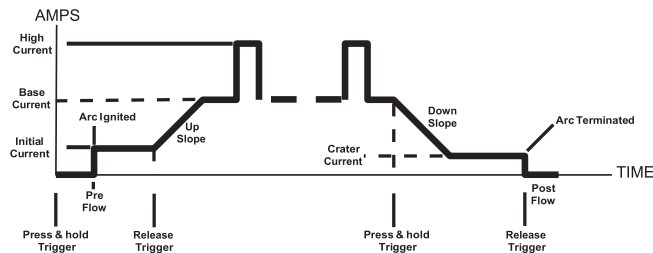
**2T Normal Mode** In this mode, the torch trigger must remain pressed for thewelding output to be active.

Press and hold the torch trigger to activate the power source (weld). Release the torch trigger switch to cease welding.



**4T Latch mode** this mode of welding is mainly used for long welding runs to reduce operator fatigue. In this mode the operator can press and release the torch trigger and the output will remain active. To deactivate the power source, the trigger switch must again be pressed and released, thus eliminating the need for the operator to hold the torch trigger.

Note: that when operating in GTAW (HF and LIFT TIG modes), the power source will remain activated until the selected down slope time has elapsed

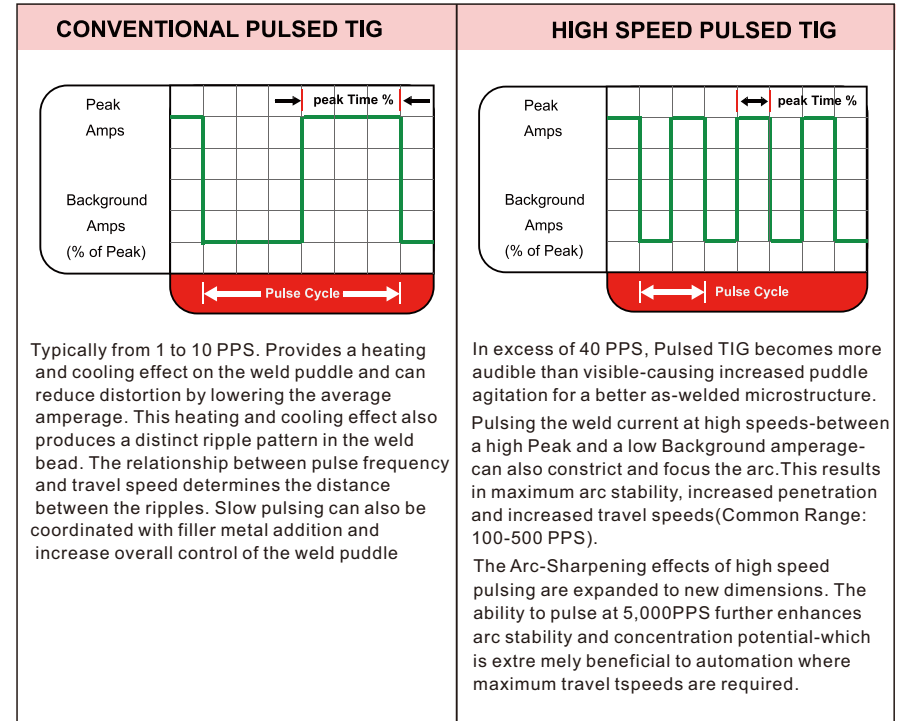


**12. Process Selection Button**

The process selection control is used to select the desired welding mode. Three modes are available, MMA (Stick),GTAW (TIG) and CUT modes.

**13. Pulse Button**

Press the PULSE button to toggle Pulse On and OFF.



**14. Programming Parameter Indicators**

These indicator lights will illuminate when programming.

**15. Positive Welding Terminal**

Positive Welding Terminal. Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

**16. Negative Welding Terminal**

Negative Welding Terminal. Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

**17. 5 Pin Control Socket**

The 5 pin receptacle is used to connect a trigger switch or remote control to the welding Power Source circuitry:

To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.

**18. Shielding Gas Outlet**

The Shielding Gas Outlet located on the front panel is a fast connection of a suitable TIG Torch.

**19. Power switch**

before using the machine. Pull the switch to the closure state of "AN" to operate the machine, and pull the switch to "AUS" after use. Turn off the power input, and the machine will stop operating.

**20. Gas input port**

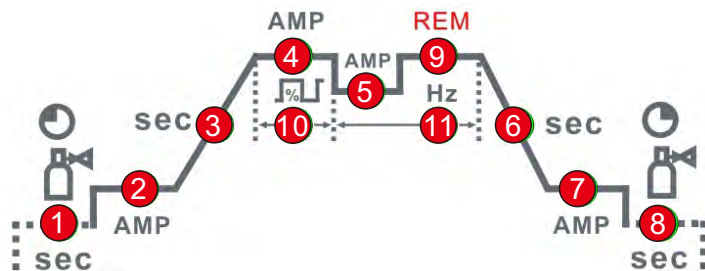
The gas port is connected with the gas valve output port. After connection, check whether there is gas leakage.

**21. Program downloading port**

Change the program downloading connection port, and use the plastic cover to prevent the dust from polluting and oxidizing the port after use.

**CAUTION**

Loose welding terminal connections can cause overheating and result in the male plug being fused in the terminal.

**3.2 Control Panel****1. Gas Pre-Flow**

**Absolute setting range 0.1s to 5s (0.1S increments)**

This parameter operates in TIG modes only and is used to provide gas to the weld zone prior to striking the arc, once the torch trigger switch has been pressed. This control is used to dramatically reduce weld porosity at the start of a weld.

**2. Initial Current**

**The main current Setting range 10AMP to 200AMP**

This parameter operates in (4T) TIG modes only and is used to set the start current for TIG. The Start Current remains on until the torch trigger switch is released after it has been depressed.

Note: The maximum initial current available will be limited to the set value of the base

**3. Up Slope**

**Setting ranges :0.1S-10S (0.1S increments)**

This parameter operates in (2T and 4T) TIG modes only and is used to set the time for the weld current to ramp up, after the torch trigger switch has been pressed then released, from Initial Current to High or base current.

**4. Peak Current**

**Setting ranges**

10AMP to 200AMP (DC TIG mode), 10 to 200A (AC HF TIG mode)

This parameter sets the TIG WELD current. This parameter also sets the STICK weld current.

**5. Base Current**

**Setting ranges**

10AMP to 200AMP (DC TIG mode), 10AMP to 200AMP (AC HF TIG mode)

Secondary current (TIG)/pulse pause current.

**6. Down Slope**

**Setting ranges 0.1-10s**

This parameter operates in TIG modes only and is used to set the time for the weld current to ramp down, after the torch trigger switch has been pressed to end current. This control is used to eliminate the crater that can form at the completion of a weld.

**7. End current**

**Setting ranges 10A-200A**

This parameter operates in (4T) TIG modes only and is used to set the finish current for TIG. The end Current remains ON until the torch trigger switch is released after it has been depressed.

Note: The maximum crater current available will be limited to the set value of the base current.

**8. Post Flow**

**Setting ranges 1-10S**

This parameter operates in TIG modes only and is used to adjust the post gas flow time once the arc has extinguished. This control is used to dramatically reduce oxidation of the tungsten electrode.

**9. Remote Control**

The system independently identifies the remote control, and when the indicator light is on, the welding current can be adjusted by remote (foot or welding gun).

**10. Pulse Width**

**Setting ranges 10%-90%**

This parameter sets the percentage on time of the PULSE FREQUENCY for High weld current when the PULSE is ON.

**11. Pulse Frequency**

**Setting ranges 1HZ -200HZ**

This parameter sets the PULSE FREQUENCY when the PULSE is ON.

### 3.3 Setup For STICK (MMA) Welding

For Alkaline Electrode, connect the electrode holder to the positive welding terminal and connect the work lead to the negative welding terminal, while for the Acid Electrode, please connect the electrode holder to the negative welding terminal and connect the work lead to the positive welding terminal. If in doubt consult the electrode manufacturer. Welding current flows from the Power Source via heavy duty bayonet type terminals. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection. Select STICK mode with the process selection control.



**WARNING**

Before connecting the work clamp to the work and inserting the electrode in the electrode holder make sure the mains power supply is switched off.



**CAUTION**

Remove any packaging material prior to use. Do not block the air vents at the front or rear of the Welding Power Source.



**CAUTION**

Loose welding terminal connections can cause overheating and result in the male plug being fused in the bayonet terminal.



### 3.4 Set-up For LIFT TIG (GTAW) Welding



**WARNING**

Before any welding is to begin, be sure to wear all appropriate and recommended safety equipment.

**NOTE**

The following set up is known as Straight Polarity or DC electrode positive. This is commonly used for DC LIFT TIG welding on most materials such as steel and stainless steel.

1. Switch the ON/OFF Switch (located on the rear panel) to OFF.
2. Connect the work lead cable to the positive output terminal, and the LIFT TIG Torch cable to the negative output terminal.
3. Connect the gas line/hose to the proper shielding gas source.
4. Slowly open the Argon Cylinder Valve to the fully open position.
5. Connect the work lead clamp to your work piece.
6. The tungsten must be ground to a blunt point (similar to a pencil) in order to achieve optimum welding results. See illustration. It is critical to grind the tungsten electrode in the direction the grinding wheel is turning. Grind at a 30 degree angle and never to a sharp point.
7. Install the tungsten with approximately 1.6mm to 3.2mm sticking out from the gas cup, ensuring you have correct sized collet.
8. Tighten the back cap.
9. Turn the switch to the "ON" position. The power L.E.D. light should illuminate.
10. Set the welding process to LIFT TIG.
11. Set the Weld Current Control Knob to the desired amperage.
12. You are now ready to begin LIFT TIG Welding.



### 3.5 Setup For Cutting

In order for the unit to function correctly, it must be installed properly. Follow the procedure given below for correct installation:

1. Read the safety rules given in this manual carefully.

2. Check on receiving the unit that there are no defective parts or parts damaged during transportation.
3. Set your unit up in an area which is adequately ventilated and make sure that the air vents are not obstructed.
4. Connect the power supply cable to a socket located as near as possible to the work area, so that the unit can be switched off quickly in case of emergency.
5. Your machine has a 16 amp plug fitted, before use check that the green/yellow earth is connected to the earth pin socket of fitted plug.
6. Make sure that the mains supply switch and any fuses have a value which  $\pm 15\%$  the maximum current absorbed by the unit. All fuses should be the slow-blow type.
7. Any extensions of power supply cable should have the same cross-section as the power supply cable. The extension leads, however, should only be used when absolutely necessary. It is important to note that any extension of mains cables or torch cables will possibly affect the cutting performance of this cutting equipment, due to the fact that the resistance of the cable will reduce voltage input, which is determined by the length of the cable. The supplied length of main cables and torch cables is recommended.
8. Fasten the earth clamp to the piece to be cut, If the surface of the piece to be cut is painted, rusty or covered with insulating material, clean the surface so that satisfactory contact between the piece and the earth clamp can be obtained.
9. Make sure that the torch has been assembled with the correct components and that the cutting tip is suitable for the cutting current.
10. Connect air to regulator and adjust regulator to deliver 5-6 bar 90ltr/min
11. Switch the unit on using the main switch located on the back side.
12. Contact the copper tip of the torch to the work piece, press the button of the torch until the arc-starting and raise the cutting torch about 1mm above the work piece, and perform the cutting operation.
13. Once cutting is over, release the torch button to put out the arc. A period of post-flow time 45 to 75 seconds (required for torch cooling) will follow. Do not disconnect air until this cooling period has been completed. Failure to do this will result in torch head damage.

**CAUTION**

Do not point the torch jet at foreign bodies.

**CAUTION**

Avoid unnecessary lighting of the pilot arc to prevent excessive consumption of the electrode and nozzle.

**CAUTION**

During cutting the speed of the torch movement should be in accordance with the thickness of the piece to be cut. Excessive speed causes a return of incandescent towards the torch which shortens the life of the parts of the torch most subject to wear and tear. The metal fouling on the nozzle should be removed as soon as possible.

**3.6 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% ( $20^{\circ}\text{C}$ ).
- ◆ Preferably site the machine some angles above the floor level, the maximum angle does not exceed  $15^{\circ}$ .
- ◆ 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.

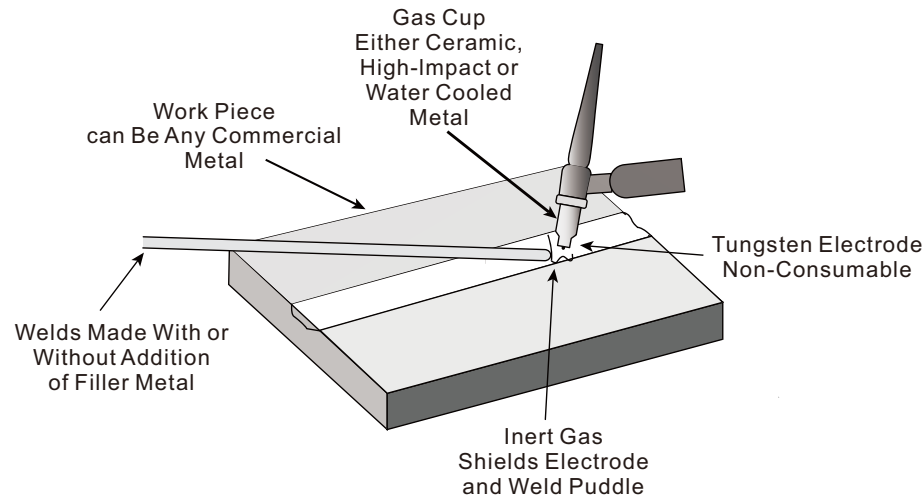
**3.7 Operation Notices**

- ◆ Read safety instruction and Chapter 1 carefully before attempting to use this equipment.
- ◆ Connect the ground wire 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 until problem is resolved.
- Otherwise, the range of problem will be extended.

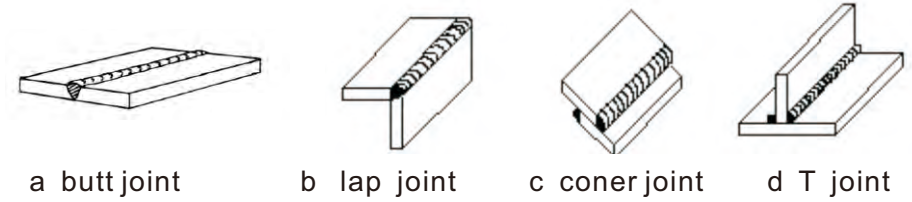
### 4.1 TIG Basic Welding Technique

Gas Tungsten Arc Welding (GTAW) or TIG (Tungsten Inert Gas) as it is commonly referred to, is a welding process in which fusion is produced by an electric arc that is established between a single tungsten (non-consumable) electrode and the work piece. Shielding is obtained from a welding grade shielding gas or welding grade shielding gas mixture which is generally Argon based. A filler metal may also be added manually in some circumstances depending on the welding application.



TIG Welding Application Shot

### 4.2 Joint forms in TIG



### 4.3 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
Protect effect	best	better	good	bad	worst

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 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.

Gas nozzle and the shield gas flow rate

Welding current range/A	DC positive connection		AC	
	Gas nozzle diameter/mm	Gas flow rate/L·min <sup>-1</sup>	Gas nozzle diameter/mm	Gas flow rate/L·min <sup>-1</sup>
10~100	4~9.5	4~5	8~9.5	6~8
101~150	4~9.5	4~7	9.5~11	7~10
151~200	6~13	6~8	11~13	7~10
201~300	8~13	8~9	13~16	8~15

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

## Tungsten Electrode

Tungsten Electrode Diameter/mm	Sharpened of the Electrode Diameter/mm	Angle of Cone(°)	Background Current/a
1.0	0.125	12	2~15
1.0	0.25	20	5~30
1.6	0.5	25	8~50
1.6	0.8	30	10~70
2.4	0.8	35	12~90
2.4	1.1	45	15~150
3.2	1.1	60	20~200
4.0	1.5	90	20~300

## 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 <sup>-1</sup>	welding current (DCEP)	Welding speed/ cm·min <sup>-1</sup>
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	Comer joint	1.6	1.6	7	75~125	25
2.4	Butt joint	1.6	2.4	7	85~125	30
2.4	Comer joint	1.6	2.4	7	95~135	25
3.2	Butt joint	1.6	2.4	7	100~135	30
3.2	Comer joint	1.6	2.4	7	115~145	25
4.8	Butt joint	2.4	3.2	8	150~225	25
4.8	Comer joint	3.2	3.2	9	175~250	20
6.0	Butt joint	4.0	4.0	10-12	220~300	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	Welding current/A	Arc voltage/V	Argon flow rate/L·min <sup>-1</sup>	Welding rate/cm·min <sup>-1</sup>
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.

## Parameters of AC TIG(MMA) for Aluminm and its alloy

Steet thickness /mm	Welding wire diameter /mm	Tungsten eletrode diameter /mm	Pre-heat Temper-ature/°C	Welding current/A	Argon flow rate/L·min <sup>-1</sup>	Gas nozzle diameter /mm	Remark
1	1.6	2	—	45~60	7~9	8	Flange welding
1.5	1.6~2.0	2	—	50~80	7~9	8	Flange or butt welding by one side
2	2~2.5	2~3	—	90~120	8~12	8~12	Butt welding
3	2~3	3	—	150~180	8~12	8~12	V-groove butt welding
4	3	4	—	180~200	10~15	8~12	
5	3~4	4	—	180~240	10~15	10~12	
6	4	5	—	240~280	16~20	14~16	
8	4~5	5	100	260~320	16~20	14~16	X-groove butt welding
10	4~5	5	100~150	280~340	16~20	14~16	
12	4~5	5~6	150~200	300~360	18~22	16~20	
14	5~6	5~6	180~200	340~380	20~24	16~20	
16	5~6	6	200~220	340~380	20~24	16~20	
18	5~6	6	200~240	360~400	25~30	16~20	
20	5~6	6	200~260	360~400	25~30	20~22	
16~20	5~6	6	200~260	300~380	25~30	16~20	
22~25	5~6	6~7	200~260	360~400	30~35	20~22	

Notice: the above parameters originate from 《Welding Dictionary》 P538, Volume 2 of Edition 2.

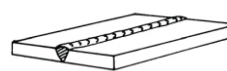
## 4.5 MMA Basic Welding Technique

## Arc Welding Practice

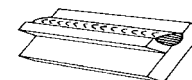
The techniques used for arc welding are almost identical regardless of what types of metals are being joined. Naturally enough, different types of electrodes would be used for different metals as described in the preceding section.

## Welding Position

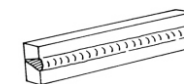
The electrodes dealt with in this publication can be used in most positions, i.e. they are suitable for welding in flat, horizontal, vertical and overhead positions. Numerous applications call for welds to be made in positions intermediate between these. Some of the common types of welds are shown



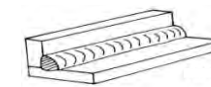
Flat Position,  
Down Hand Butt Weld



Flat Position,  
Gravity Fillet Weld



Horizontal Position,  
Butt Weld



Horizontal-Vertical  
(HV) Position



Vertical Position, Butt Weld



Vertical Position, Fillet Weld



Vertical Position, Fillet Weld



Overhead Position, Fillet Weld

### Joint Preparations

In many cases, it will be possible to weld steel sections without any special preparation. For heavier sections and for repair work on castings, etc., it will be necessary to cut or grind an angle between the pieces being joined to ensure proper penetration of the weld metal and to produce sound joints.

In general, surfaces being welded should be clean and free of rust, scale, dirt, grease, etc. Slag should be removed from oxy-cut surfaces.

### Arc Welding Technique - A Word to Beginners

For those who have not yet done any welding, the simplest way to commence is to run beads on a piece of scrap plate. Use mild steel plate about 6.4mm (1/4") thick and a 3.2mm (1/8") electrode. Clean any paint, loose scale or grease off the plate and set it firmly on the work bench so that welding can be carried out in the downhand position. Make sure that the work clamp is making good electrical contact with the work, either directly or through the work table. For light gauge material, always clamp the work lead directly to the job, otherwise a poor circuit will probably result.

### The Welder

Place yourself in a comfortable position before beginning to weld. Get a seat of suitable height and do as much work as possible sitting down. Don't hold your body tense. A taut attitude of mind and a tensed body will soon make you feel tired. Relax and you will find that the job becomes much easier. You can add much to your peace of mind by wearing a leather apron and gauntlets. You won't be worrying then about being burnt or sparks setting alight to your clothes.

Place the work so that the direction of welding is across, rather than to or from your body. The electrode holder lead should be clear of any obstruction so that you can move your arm freely along as the electrode burns down. If the lead is slung over your shoulder, it allows greater freedom of movement and takes a lot of weight off your hand. Be sure the insulation on your cable and electrode holder is not faulty, otherwise you are risking an electric shock.

## 5.1 Troubleshooting

- ◆ Before arc welding machines are dispatched from the factory, they have already been debugged accurately. So forbid anyone who is not authorized by us 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 us 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, please contact local agent or the branch company!  
If there are some simple troubles of welding machine, you can consult the following overhauling chart:

Nr.	Troubles	Reasons	Solution
1	Turn on the power source, power indicator is lit, fan is not working.	Fan is broken	Change fan
		There is something in the fan	Clean it
		The start capacitor of fan damaged	Change capacitor
2	Turn on the power source, fan is working, power indicator is not lit	The power light damaged or connection is not good	Change the power light
		The power board is broken	Change it
		Display panel is broken	Change it
3	Turn on the power source, power indicator is lit, fan is working, there is no welding output.	Control board is broken	Change it
		1 <sup>st</sup> inverter circuit damaged	Replace it
		2 <sup>nd</sup> feedback circuit is fault	Change it
4	Turn on the power source, fan is not working, power indicator is not lit	The power cable connected not good	Connect correctly
		The power cable is broken	Repair or change it
		Power on switch is damaged	Change it
		The light of the power indicator is broken and the problems mentioned in Nr. 2	Change the light of the power indicator or refer to the solution in Nr. 2
		The power board is broken	Change it
5	The number of the display is not intact	The display panel is damaged	Change the display panel
		Digital tube is broken	Change it
6	No no-load voltage output (MMA)	If the overheat indicator is on	Wait a few minutes, the machine can be operated normal
		The main circuit is broken	Check and repair
		The machine is broken	Consult the dealer or the manufacturer

Nr.	Troubles	Reasons	Solution
7	Arc can not be ignited (TIG) , there is spark on the HF igniting board	The welding cable is not connected with the two output if the welder	Connect the welding cable to the welder's output
		The welding cable is 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 ,less than 5mm)
		There is no Argon flow or the connection is poor	Check and reconnect
		Input voltage not stable	Check the power supply
8	Arc can not be ignited (TIG) , there is no spark on the HF igniting board	The HF igniting board does not work	Repair or change it
		The distance between discharger is too short or too long	Adjust the distance (about 0.8mm)
		The malfunction of the welding gun switch	Check the welding torch switch, control cable and aero socket.
		No argon gas flow or the air tube connect not good	Check and reconnect
9	Turn on the power source, everything is normal , but no HF igniting	Check if the function selected MMA	Change the function to TIG
		Check the HF funtion is selected	Select the HF funtion
		HF board is broken	Repair or change it
		Earth clamp connect not stable	Check the earth clamp
		No argon gas flow or the air tube connect not good	Check and reconnect
10	Gas always flows	Something is in the valve	Remove it
		Electromagnetic valve is damaged	Change it
11	No gas flow (TIG)	Gas cylinder is close or gas pressure is low	Open or change the gas cylinder
		Something is in the valve	Remove it
		Electromagnetic valve is damaged	Change it
		Air tube is brocken	Change it
		Pressure too high or air regulator is broken	Check gas
12	The welding current cannot be adjusted	Checking if the electorde stick to the work piece that the anti-stick function is on	Separate the electrode and work piece
		Control board is broken	Repair or change it
		Shut off the power when changing the torch	
13	The welding current displayed isn't accordant with the actual value	The min value displayed isn't accordant with the actual value	Adjust potentiometer Imin on the control board
		The max value displayed isn't accordant with the actual value	Adjust potentiometer Imax on the control board

Nr.	Troubles	Reasons	Solution
14	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	Adjust the distance from torch to work piece
		The power cable or the welding cable is too long	Use the suitable length from manufacturer
		AC Width adjustment is not correct	Change to suitable setting
15	Thermal overload indicator light is on	Over-heat protection ,too much welding current	Reduce the welding current
		Over-heat protection ,working too much time	Reduce the welding time
		Over-current protection, current in the main circuit is out of control	Check and repair main circuit and drive board
		Input voltage is too low	Check the power supply
16	Tig electrode melts when welding	Fan is broken	Change the fan
		Tig torch is connected to the positive terminal	Connect the tig torch to negative terminal
17	Arc flutters during Tig welding	Tungsten electrode is too big for the welding current	Select the correct size of tungsten electrode
		Check the earth clamp position on the work piece	Adjust the position of earth clamp
18	When Cut function is selected ,there is HF but cannot cutting	Check the welding circuit is correct, for example the earth clamp is connected to work piece	Connect the circuit correctly
		Air flow is not correctly connected	Check the air flows
		Machine is broken	Consult the dealer or the manufacturer



## 6.1 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 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 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> <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>
Monthly examination	<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>