

RONCH™

RONCH WELD **SERIES**

// USER MANUAL



315MAX

STICK · TIG

ENGLISH

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1. SAFETY

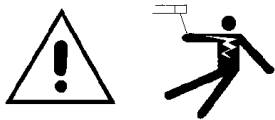
1.1. SIGNAL EXPLANATION



• 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.

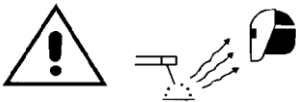
- Never touch electrical parts.
- Wear dry, hole-free gloves and clothes to insulate yourself.
- Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.
- Take carefully when using the equipment 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.

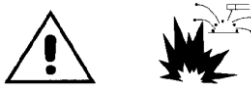


SELF-PROTECTION

- 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 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.

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 arc.

2. SUMMARY

2.1. BRIEF INTRODUCTION

MMA- series (discrete) welder is a MMA arc welder which adopts the latest pulse width modulation (PWM) technology and the insulated gate bipolar transistor (IGBT) power module. It can 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.

MMA- series (discrete) has excellent performance: constant current output makes welding arc more stable; fast dynamic response speed reduces the impact from the arc length fluctuation to the current; accurate stepless current adjustment and pre-setting function. There are also some automatic protection functions for under voltage, over current, over heat, etc. inside the welder, when the problems listed before occurred, the alarm light on the front panel is on and at the same time the output current will be cut off. It can self-protect and prolong the using life and greatly improved the reliability and practicability of the welder.

For MMA- series (discrete) , welding current, arc force and hot start can be adjusted by the adjustment knob, which can satisfy with several kinds of welding technologies. They can also realize high quality welding especially for using basic electrode, acid electrode and cellulose electrode. When using cellulose electrode, they can also realize downward welding for butt joint in all position.

MMA- series (discrete) is widely used in Petroleum, chemical, mechanical, shipbuilding, architecture, boiler, pressure container, war industry and installation and so on.

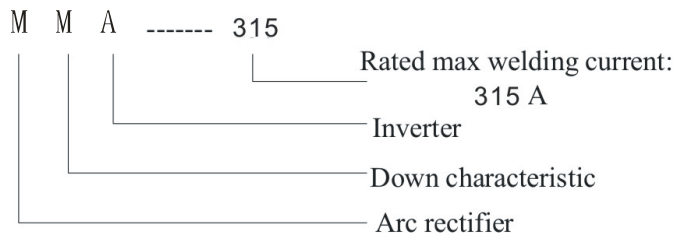
MMA—Manual Metal Arc welding;

PWM—Pulse Width Modulation;

IGBT—Insulated Gate Bipolar Transistor

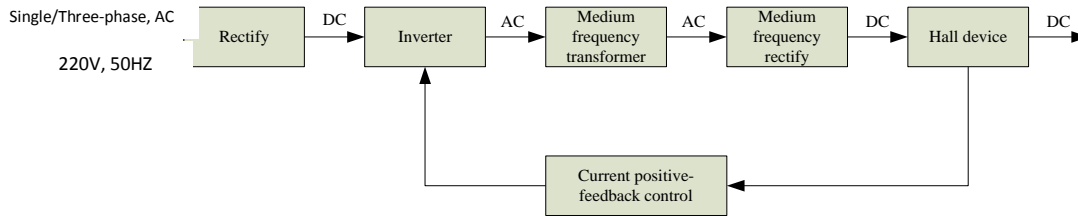
2.2. MODEL EXPLANATION

The model explanation of arc welding machine is as follows.(Take MMA -315 as an example)



2.3. WORKING PRINCIPLE

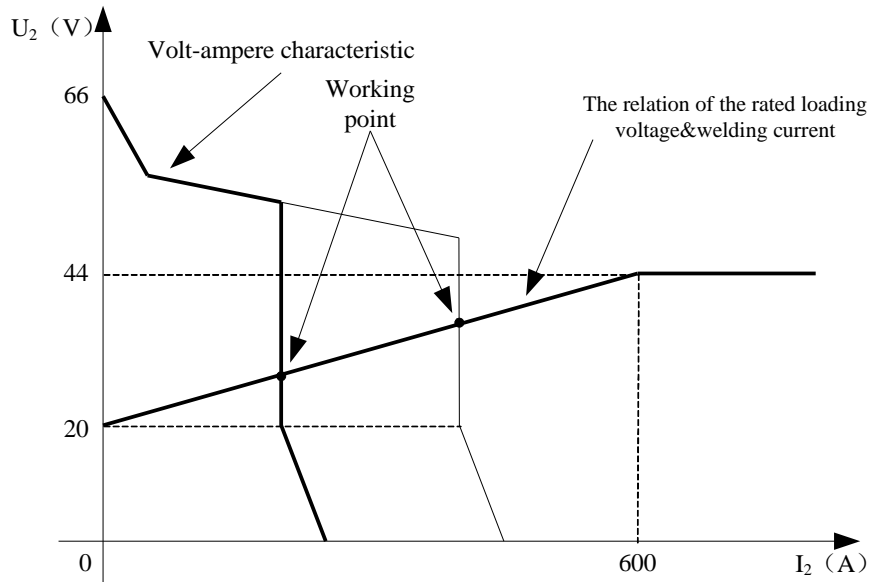
The working principle of MMA- series (discrete) welder is shown as the following figure. Single/Three-phase 220V work frequency AC is rectified into DC (about 310V), then is converted to medium frequency AC (about 40KHz) by inverter device (IGBT), after reducing voltage by medium transformer (the main transformer) and rectified 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.



2.4. VOLT-AMPERE CHARACTERISTIC

MMA- series (discrete) welder has excellent volt-ampere characteristic, seeing the following graph (Take MMA-315 as an example). In MMA welding, the relation between the rated loading voltage U_2 and welding current I_2 is as follows:

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



3. INSTALLATION & ADJUSTMENT

3.1. PARAMETERS

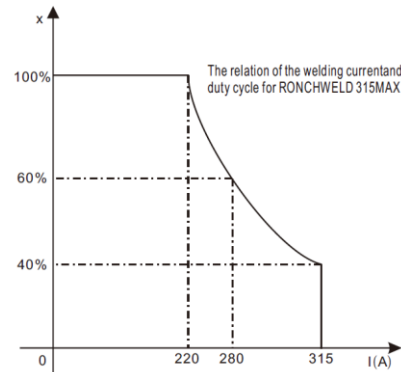
Model Parameters	RONCHWELD 315MAX			
Power source	Single -phase, 220V±10%		Three-phase, 220V±10%	
	50/60Hz			
	TIG	MMA	TIG	MMA
Rated input current (A)	40	55	17	23
Rated input power (KW)	6.0	9.1	9.0	12.5
Welding current range (A)	10-250		10-315	
Max no load voltage (V)	14.5	105	14.5	93
Duty cycle (40°C,10mins)	40% 250A		40% 315A	
	60% 225A		60% 280A	
	100% 180A		100% 220A	
Electrode Diameter	φ1.6~φ5.0			
Electrode Type	6013.7018 ect			
Power factor	0.70			
Efficiency	≥85			
Protection class	IP23			
Insulation class	H			
Cooling	AF			
Weight (Kg)	15			
Dimensions (mm)	480×190×340			

Note: The above parameters are subject to change with the improvement of machines.

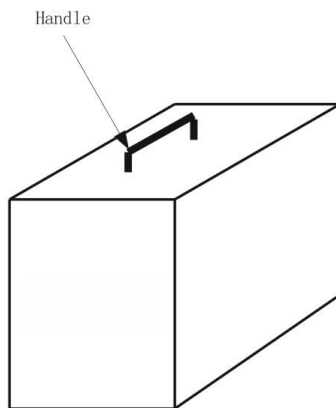
3.2. DUTY CYCLE & OVER HEAT

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.

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 15 minutes to cool the fan. When operating the machine again, the welding output current or the duty cycle should be reduced.



3.3. MOVEMENT AND PLACEMENT



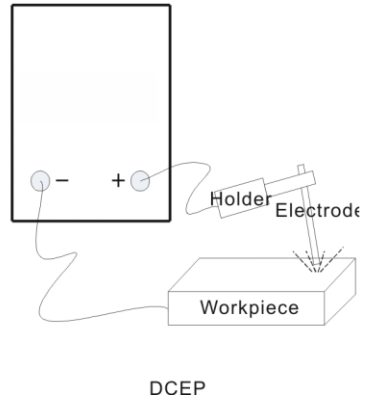
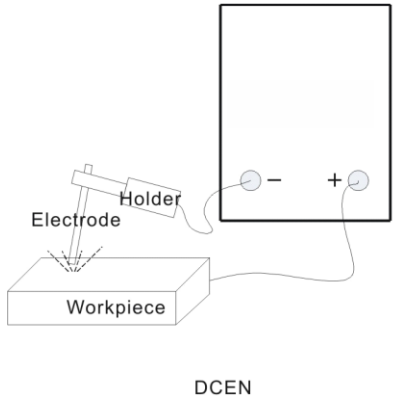
For MMA- series (discrete) arc welding machine, the handles are installed at the top of machine to move it. The machine needs immobile equipment to fix to avoid sliding.

When using forklift, its arm length must be long enough to reach the outside so as to ensure lifting safely.

The movement may result in the potential danger or substantive hazard, so please make sure that the machine is on the safe position before using it.

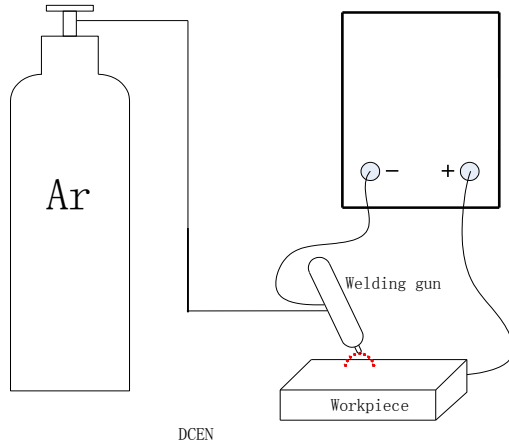
3.4. WELDING POLARITY CONNECTION WAY

3.4.1. MMA



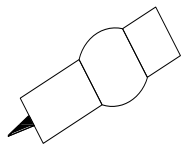
Choosing the connection of DCEN or DCEP is based on the arc stable burning condition. The different electrodes need different connection way. Please refer to the electrode manual.

3.4.2. TIG

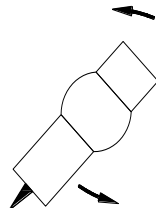


● When TIG operation, the shielded gas is input to welding gun directly, and the method of lifting arc is *scrapping arc*

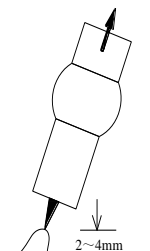
1、Place the welding gun aslant.



2、Scrape the electrode with the workpiece.



3、Lift arc.



Steps of scrapping arc

Striking arc of TIG operation : when tungsten electrode touches the workpiece, the short-circuit current is only 28A. After generating arc, current can rise to the setting welding current. If the tungsten electrode touches the workpiece when welding, the current will drop to 5A within 2s, which can reduce the tungsten spoilage farthestly, prolong the using life of the tungsten electrode, and prevent tungsten clipping.

▪ 3.5. CONNECTION TO THE MAINS SUPPLY

MMA- series (discrete) arc welder power supply input connection as the right illustration. Separately connect the 3 pcs live wire of the brown, black & blue color to the power switch on the rear panel of welder (no phase requirement), connect the earth cable of yellow & green color to the power cable input of welder.

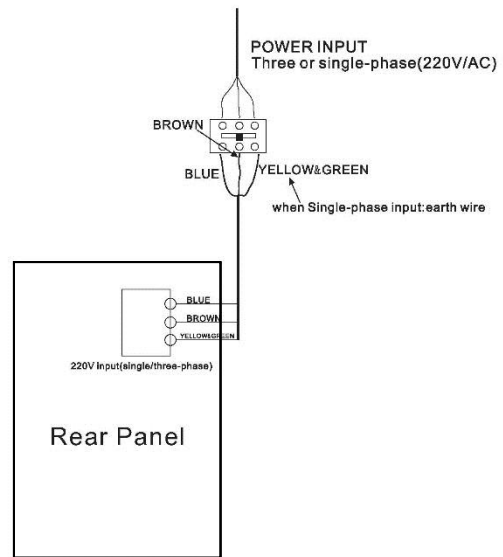
When the power supply voltage is over the safe work voltage, there are over voltage and under voltage protection inside the welder, the alarm light will on, at the same time, the current output will be cut off.

If the power supply voltage continually goes beyond the safe work voltage range, it will shorten the welder life-span. The below measures can be used:

Change the power supply input net. Such as, connect the welder with the stable power supply voltage of distributor;

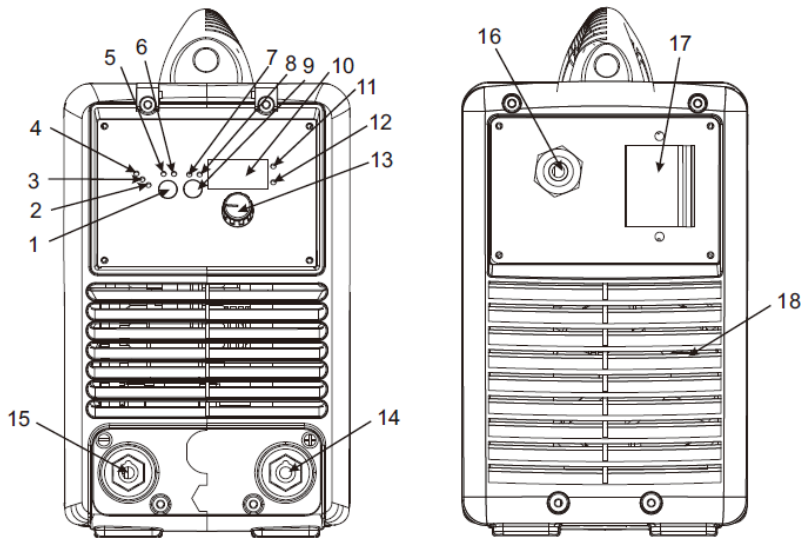
Induce the machines using power supply in the same time;

Set the voltage stabilization device in the front of power cable input.



4. PARAMETERS

4.1. LAYOUT FOR FRONT & REAR PANEL



Function select key: Select MMA or LIFT TIG.

ARC FORCE light: This light when lit indicates that the added arc force value can be set by the adjustment knob.

MMA current adjust: This light when lit indicates that the welding current value of MMA can be set by the adjustment knob.

HOT START light: This light when lit indicates that the added hot start current value can be set by the adjustment knob.

MMA light: This light when lit indicates that the machine start MMA welding method.

LIFT TIG light: This light when lit indicates that the machine start LIFT TIG welding method.

VRD ON light

VRD OFF light

VRD select key: Choose VRD ON or OFF.

Welding current and other parameters display: Welding current and other parameters display when machine is working.

Power light: Power indicator, power on light on.

Alarm light: This alarm light when lit indicates that occurred over voltage, over current, or overheating inside the machine, is protected.

Parameter select and adjust key: Control the parameter select and adjust.

Positive polarity output: Connect with welding electrode or connect to earth clamp when use TIG function.

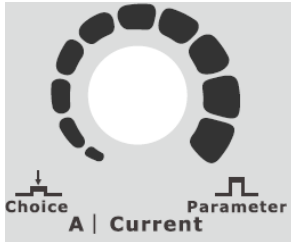
Negative polarity output: Connect with earth clamp or connect to TIG gun when use TIG function.

Power source input: To connect power source.

On/off switch: Control power through and break

FAN: Cooling the machine.

4.2. WELDING CURRENT ADJUSTMENT



Adjustment knob position multi circle potentiometer, next to no mark the specific welding current value size, clockwise rotation set value increased.

Welding current range is 10~315A.

MMA- series (discrete) has the function of welding current pre-setting. Before welding, adjusting welding current, the welding current display will show the ampere. It is convenient to set parameters and adjust accurately.

4.3. ARC FORCE ADJUSTMENT

Refer to §2.4 section of volt-ampere characteristic graph (under 20V graph part), when the MMA-315 load voltage is under 20V, there is arc force output. The arc length is shorter, the arc force is bigger. It can prevent sticking and increase the depth of penetration.

When the arc force LED is on, you can use adjustment knob to set the arc force, the arc force (0~10) will be displayed on the digital tube.

The number "0~10" on the digital tube is not actual arc force, but a proportion concept.

When the digital tube shows "0" (the minimum of the arc force), the operation of arc force is not in use.

Operation remark

On the digital tube of 0 (soft arc), application range: acid electrode; in the middle & high current, using basic electrode.

On the digital tube of 10 (hard arc), application range: welding in the low current range (vertical up welding, surfacing welding, overhead welding, etc.)

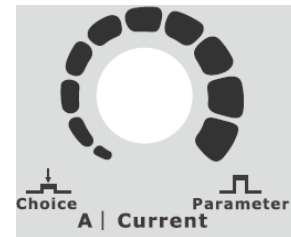
Increase the arc force:

Easy to striking arc;

Increase spatter

Good root meltability

In welding thin plate, increase the dangers of penetration.



Welding position		Flat welding for flat plate butt joint	Vertical welding for flat plate butt joint	Horizontal fix welding for pipe butt joint	Vertical fix welding for pipe butt joint
Workpiece thickness/mm		8~12	8~12	Φ114×7	Φ114×7
Continuous welding	Gap/mm	2.5~3.2	2.5~3.2	2.5~3.2	2.5
	Root face size /mm	~	~	~	~

	Electrode diameter/mm	3.2	3.2	2.5	2.5
	Backing welding current/A	70~80	75~85	60~70	70~80
Intermittent welding	Gap/mm	3.2~4	3.2~4	3.2~4	2.5~3.2
	Root face size /mm	1~1.5	1~1.5	1~1.5	1~1.5
	Electrode diameter/mm	3.2~4	3.2~4	3.2	3.2
	Backing welding current/A	80~110	100~110	90~110	90~110

Notice: the above parameters originate from “Welding Dictionary” P71, Volume 1 of Edition 2.

▪ 4.4. HOT START ADJUSTMENT

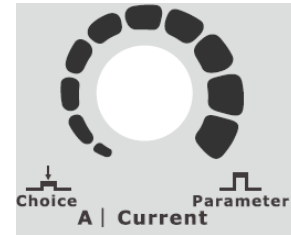
The number “0~10” on the digital tube is not actual hot start, but a proportion concept. More welding current pre-set value, more hot start current addition. Clockwise turning the adjustment knob when hot start LED is on, the hot start added current lasts long time, the striking is more easy.

There are no actual added current value around the knob. Hot start adjustment is chosen to be based on the electrode diameter and workpiece thickness.

Operation remark :

It is available in the striking arc only.

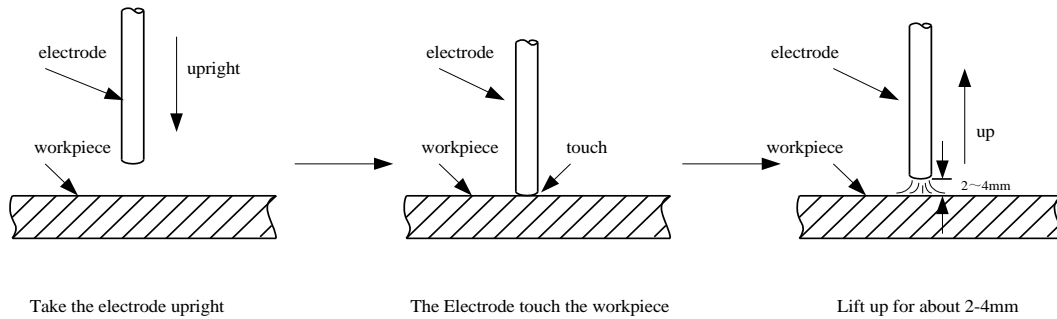
The interval time for hot start is 3 sec.



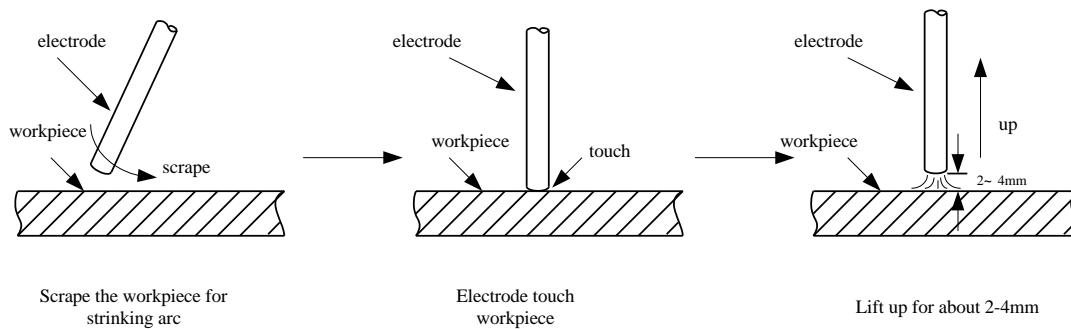
▪ 4.5. WELDING OPERATION

▪ 4.5.1. STRIKING ARC WAY

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.

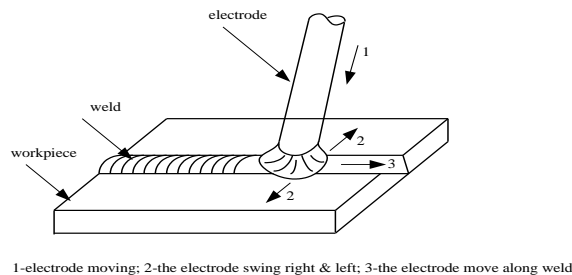


4.5.2. MANIPULATION OF ELECTRODE

In MMA welding, there are three motions to being 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.

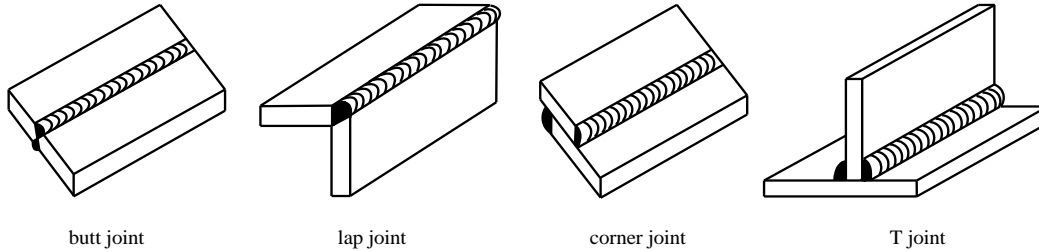
The details please refer to 《Welding Dictionary》 P69, Volume 1 of Edition 2.



4.6. WELDING PARAMETERS

4.6.1. JOINT FORM IN MMA

In MMA welding, the common basic joint form: butt joint, lap joint, corner joint & T joint.



4.6.2. ELECTRODE SELECTION

The electrode diameter selection is based on the workpiece thickness, welding position, joint form, welding layer, etc. Please refer to the following table.

The relation between the electrode diameter & workpiece thickness							
Workpiece thickness/mm	2	3	4~5	6~12		>13	
Electrode diameter/mm	2	3.2	3.2~4	4~5		4~6	
The welding current reference for different electrode diameter							
Workpiece thickness/mm	1.6	2.0	2.5	3.2	4.0	5.0	5.8
Welding current/A	25~40	40~60	50~80	100~130	160~210	200~270	260~
The relation between the welding current(I)' factor(K) & electrode diameter(d) (I=K*d: Carbon electrode)							
Electrode diameter/mm	1.6		2~2.5		3.2		4~6
Factor/K	20~25		25~30		30~40		40~50

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

Electrode should be drying according to user manual before using. For reducing the hydrogen of the molten pool and welding seam, and avoiding the blowhole and cold crack.

In the welding process, the arc must not be too long; otherwise, it will cause unstable arc burning, large spatter, light penetration, undercut, blowhole, etc. If the arc is too short, it will cause electrode stick.

In MMA welding the arc length is usually equal to 0.5~1.0 time of the electrode diameter. The basic electrode's arc length is not beyond the electrode diameter, it's better to choose the short arc welding; the acid electrode's arc length is equal to the electrode diameter.

■ 4.7. ARC WELDING DEFECT AND PREVENT METHOD

Defect name	Caused reasons	Prevent methods
Welding seam doesn't meet the requirement	The groove angle is not proper The root face and assembly gap is not equal Welding technics parameters are unreasonable The welder's operation skill is lower	Choosing the proper groove angle & assembly gap, improve the assembly quality Choosing the proper welding parameters Improve the operation skill of welders
Undercut	Over current Arc length is too long The electrode angle is wrong Manipulation of electrode is not proper	Choosing the proper welding current & speed The arc can't be drawn too long The electrode angle should be proper Manipulation of electrode should be correct
Incomplete penetration	The groove angle or gap is too small, the root face is too big Welding parameters are not suitable, or the assembly is not good The welder's operation skill is lower	Correctly to choose and process the groove size Correctly to assemble and ensure clearance Choosing the suitable welding current & speed Improve the operation skill of welders
Incomplete fusion	The welding thermal input is too low The arc direction is lean There are rust & dust on the side of groove The slag between the layers is not cleared well	Correctly to choose the welding parameters Operation seriously Enhance the clearness of layers
Overlap	The temperature of molten pool is too high The liquid metal concretes slowly	Choosing parameters based on the welding different position Strictly to control the molten hole size
Crater	The crater time lasts too short Over current in the welding of thin plate	In the crater, electrode should be stayed for a short time or round to manipulate electrode after the molten pool is filled in by metal, take to the side for crater

Defect name	Caused reasons	Prevent methods
Welding seam doesn't meet the requirement	<p>The groove angle is not proper</p> <p>The root face and assembly gap is not equal</p> <p>Welding technics parameters are unreasonable</p> <p>The welder's operation skill is lower</p>	<p>Choosing the proper groove angle & assembly gap, improve the assembly quality</p> <p>Choosing the proper welding parameters</p> <p>Improve the operation skill of welders</p>
Undercut	<p>Over current</p> <p>Arc length is too long</p> <p>The electrode angle is wrong</p> <p>Manipulation of electrode is not proper</p>	<p>Choosing the proper welding current & speed</p> <p>The arc can't be drawn too long</p> <p>The electrode angle should be proper</p> <p>Manipulation of electrode should be correct</p>
Incomplete penetration	<p>The groove angle or gap is too small, the root face is too big</p> <p>Welding parameters are not suitable, or the assembly is not good</p> <p>The welder's operation skill is lower</p>	<p>Correctly to choose and process the groove size</p> <p>Correctly to assemble and ensure clearance</p> <p>Choosing the suitable welding current & speed</p> <p>Improve the operation skill of welders</p>
Incomplete fusion	<p>The welding thermal input is too low</p> <p>The arc direction is lean</p> <p>There are rust & dust on the side of groove</p> <p>The slag between the layers is not cleared well</p>	<p>Correctly to choose the welding parameters</p> <p>Operation seriously</p> <p>Enhance the clearness of layers</p>
Blowhole	<p>There are some dust like oil, rust or water on the work piece surface and groove</p> <p>The coating of electrode is damped& is not drying</p> <p>Under current or over speed in the welding</p> <p>The arc is too long or lean burning, the molten pool protection is not good</p> <p>Over current, the coating of electrode falls off and lose protection</p> <p>Manipulation of electrode is not proper</p>	<p>Clear out the dust around groove for about 20~30mm</p> <p>Strictly to dry the electrode according to manual</p> <p>Correctly to choose parameters and to operate</p> <p>Using the short arc operation</p> <p>Welding operation in the field should have anti-wind protection</p> <p>Don't use the invalid electrode</p>

Defect name	Caused reasons	Prevent methods
Welding seam doesn't meet the requirement	The groove angle is not proper The root face and assembly gap is not equal Welding technics parameters are unreasonable The welder's operation skill is lower	Choosing the proper groove angle & assembly gap, improve the assembly quality Choosing the proper welding parameters Improve the operation skill of welders
Undercut	Over current Arc length is too long The electrode angle is wrong Manipulation of electrode is not proper	Choosing the proper welding current & speed The arc can't be drawn too long The electrode angle should be proper Manipulation of electrode should be correct
Incomplete penetration	The groove angle or gap is too small, the root face is too big Welding parameters are not suitable, or the assembly is not good The welder's operation skill is lower	Correctly to choose and process the groove size Correctly to assemble and ensure clearance Choosing the suitable welding current & speed Improve the operation skill of welders
Incomplete fusion	The welding thermal input is too low The arc direction is lean There are rust & dust on the side of groove The slag between the layers is not cleared well	Correctly to choose the welding parameters Operation seriously Enhance the clearness of layers
Inclusion & slag inclusion	The slag clears bad in the middle layer in the welding process Under current or over speed in the welding Welding operation is not proper The welding material can not match the work piece The groove design & processing are not proper	Choosing the electrode of good slag detachability Strictly to clear the slag in the layers Correctly to choose the welding parameters Adjusting the electrode angle and manipulation way
Hot crack	In the process of solidification, the inter crystal segregation is seriously caused. At the same time, with the effect of welding stress, the hot crack is formed.	Strictly control the percentage of S and P in welding material. Adjust the structure of welding material. Adopt the basic electrode.

Defect name	Caused reasons	Prevent methods
Welding seam doesn't meet the requirement	<p>The groove angle is not proper</p> <p>The root face and assembly gap is not equal</p> <p>Welding technics parameters are unreasonable</p> <p>The welder's operation skill is lower</p>	<p>Choosing the proper groove angle & assembly gap, improve the assembly quality</p> <p>Choosing the proper welding parameters</p> <p>Improve the operation skill of welders</p>
Undercut	<p>Over current</p> <p>Arc length is too long</p> <p>The electrode angle is wrong</p> <p>Manipulation of electrode is not proper</p>	<p>Choosing the proper welding current & speed</p> <p>The arc can't be drawn too long</p> <p>The electrode angle should be proper</p> <p>Manipulation of electrode should be correct</p>
Incomplete penetration	<p>The groove angle or gap is too small, the root face is too big</p> <p>Welding parameters are not suitable, or the assembly is not good</p> <p>The welder's operation skill is lower</p>	<p>Correctly to choose and process the groove size</p> <p>Correctly to assemble and ensure clearance</p> <p>Choosing the suitable welding current & speed</p> <p>Improve the operation skill of welders</p>
Incomplete fusion	<p>The welding thermal input is too low</p> <p>The arc direction is lean</p> <p>There are rust & dust on the side of groove</p> <p>The slag between the layers is not cleared well</p>	<p>Correctly to choose the welding parameters</p> <p>Operation seriously</p> <p>Enhance the clearness of layers</p>
Cold crack	<p>Three reasons will cause cold crack:</p> <p>The structure turned from the marten site</p> <p>The residual stress caused by big restraint intensity</p> <p>The residual hydrogen in welding gap.</p>	<p>Adopt low hydrogen type basic electrode.</p> <p>Bake under the instruction before use.</p> <p>Remove the feculence before use, reduce the percentage of hydrogen</p> <p>Adopt appropriate parameters and heat input</p> <p>After welding, do dehydrogenation at once.</p>
Reheat crack	<p>When the corona strain at grain boundary is unable to support the strain that engendered in the process of stress relaxation, hot crack was caused again</p>	<p>Adopt low intensity electrode</p> <p>Reduce the residual stress and stress concentration</p> <p>Control the heat input and adopt appropriate temperature of heat treatment</p> <p>Avoid the temperature in the sensitive area</p>

■ 4.8. OPERATION ENVIRONMENT

- Height above sea level is below 1000m.
- Operation temperature range:-10°C~+40°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.

■ 4.9. OPERATION NOTICES

- Read §1 carefully before attempting to use this equipment.
- Connect the ground wire with the machine directly, and refer to §3.5.
- Input power must be AC as three phases, 50Hz, 220V. Forbid working in lacking any phase.
- 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 sources.
- 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.

5. OPERATION CONTROL & CONNECTORS

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 drops to safe voltage 36V.**

Date	Maintenance items
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 capacity 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	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, discrete IGBT, the fast recover diode and PCB, etc. 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.
Quarter-yearly examination	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.
Yearly examination	Measure the insulating impedance among the main circuit, PCB and case, if it below 1M Ω , insulation is thought to be damaged and need to change , and need to change or strengthen insulation.

■ 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 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 of our company, please contact local agent or the branch company!

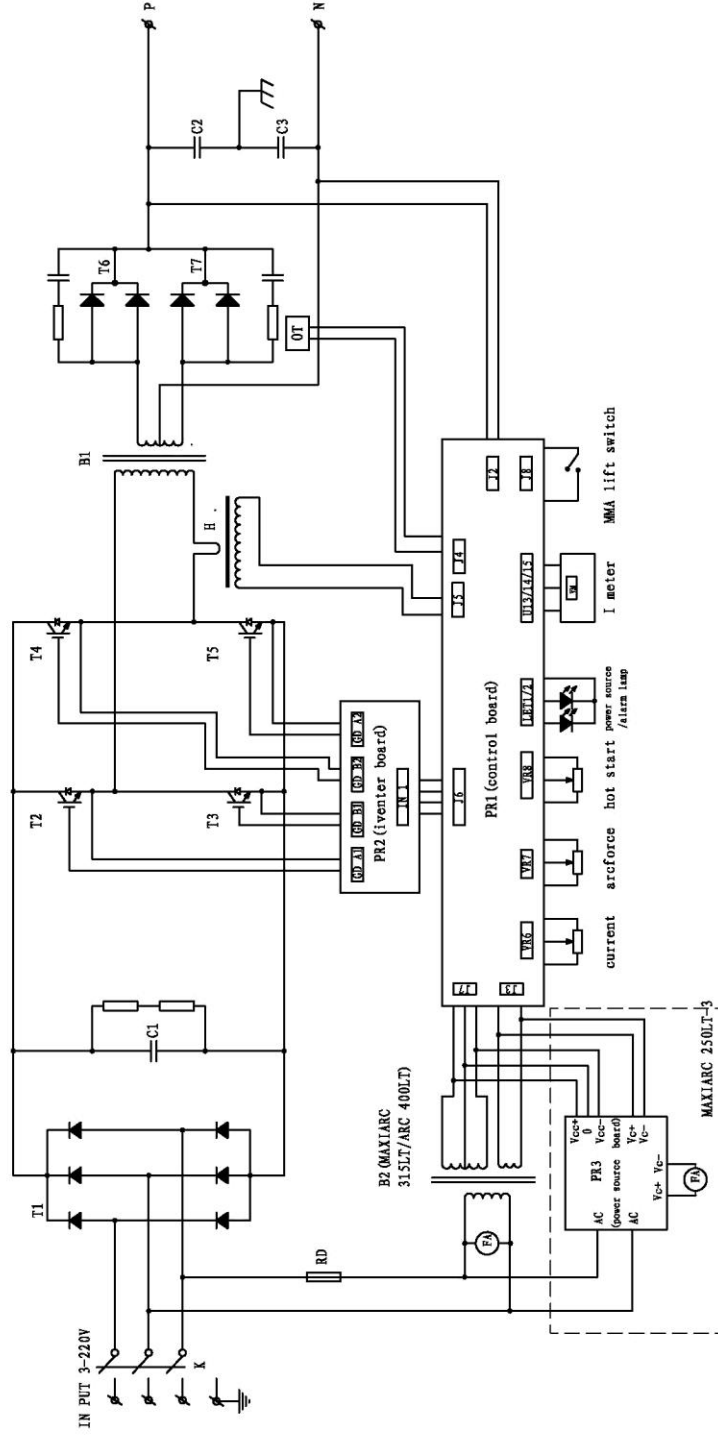
If there are some simple troubles with the welding machine, you can consult the following overhauling chart:

S/N	Troubles	Reasons	Solution
1	Turn on the power source, and fan works, but the power light is not on.	No power supply input	Test the power supply input
		The fuse on the rear panel is broken	Change the fuse (3A)
		The power light damaged or connection is not good	Test and repair the inside circuit of power light
		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
3	The number on the display is not complete	The digital pipe in the display is broken	Change the digital pipe
4	The minimum & maximum on the current	The minimum current is not accordant (Please refer to 3.1)	The minimum current is not to Adjust on the current meter

S/N	Troubles	Reasons	Solution
	display disaccord with the setting current	The maximum current is not accordant (Please refer to 3.1)	Adjust the potentiometer VR5 (RT1) on the current meter
5	No no-load voltage output	The machine is damaged	Check the main circuit and the PCBs
6	No current output in the welding	Welding cable is not connected with the two output of the welder.	Connect the welding cable to the welder's output
		Welding cable is broken	Wrap, repair or change the welding cable
		Earth cable is not connected or loosen	Check the earth clamp
7	Not easy to start arc in the welding, or easy to cause sticking	The plug loosen or connect not well	Check and tighten the plug
		Oil or dust covered the workpiece	Check and clear out
		MMA/TIG welding selection is wrong	Selecting the MMA welding
8	The arc is not stable in the welding process	The welding current adjusted too low	Increase the welding current
		The arc is too long in the welding	Use the short arc operation
9	The welding current can not be adjusted	The welding current potentiometer in the front panel connection not so good or damaged	Repair or change the potentiometer
10	The minimum & maximum on the current display disaccord with the actual current	The minimum current is not accordant (Please refer to 3.1)	Adjust the potentiometer VR3 (RT1) on the PCB
		The maximum current is not accordant (Please refer to 3.1)	Adjust the potentiometer VR4 (RT1) on the PCB
11	The penetration of molten pool is not enough	The welding current adjusted too low	Increase the welding current
		The arc is too long in the welding	Use the short arc operation
		The arc force adjusted too small	Increase the arc force
12	Arc blow	Airflow disturbance	Use the shelter from airflow
		The electrode eccentricity	Adjust the electrode angle
		Magnetic effect	Change the electrode
			Incline the electrode to the opposite way of the magnetic blow

S/N	Troubles	Reasons		Solution
				Change the position of earth clamp or add earth cable in the two side of workpiece
				Use the short arc operation
13	The alarm light is on	Over heat protection	Over welding current	Induce the welding current output
			Working time too long	Induce the duty cycle (interval work)
		Over voltage	Power supply fluctuated	Using the stable power supply
		Under voltage protection	Power supply fluctuated	Using the stable power supply
			Too many machines using power supply in the same time	Induce the machines using power supply in the same time
		Over current protection	unusually current in the main circuit	Test and repair the main circuit and inverter PCB (Pr2)

5.3. ELECTRICAL PRINCIPLE DRAWING



K	current circuit breaker	T1	rectifier bridge	C1	condenser	OT	protection	T2 T3 T4 T5	IGBT module	T6 T7	fast recovery diode
B1	main transformer	B2	control transformer	C2 C3	condenser	FA	fan	H	electric current mutual	P	positive polarity
						N	negative polarity				N

MMA-series (discrete) electrical principle drawing

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