

# OPERATOR'S MANUAL

## Inverter DC TIG /MMA Arc Welding Machine

***Jefferson***<sup>®</sup>  
**JEFTIG 2000/DV**



2009.11

**IMPORTANT: Read this Owner's Manual Completely** before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. Contact your distributor if you do not fully understand this manual.

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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.

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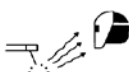
The connection should be as close as possible to the area being welded.

- 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,

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operating or repairing equipment.

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



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



### **WELDING SPARKS can cause fire or explosion**

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



### **Rotating parts may be dangerous**

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

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

### **§1.3 The knowledge of Electric and Magnetic Fields**

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

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

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

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## §2 SUMMARY

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

### § 2.1 Brief Introduction

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

GT- series welding machine has good performance: constant current output, fast response, HF striking arc, and the welding current can be adjusted steplessly and pre-set (The method of lifting arc can reduce the waste of tungsten electrode. Meanwhile, this machine has the functions of long or short TIG welding、 current down-slope, arc force、 hot-start and short-circuit protection).

GT- series welding machine can be applied to 110V/220V input and has the Power Factor Corrector technology. The machine uses the APFC instrument to make the current wave approaching the sine wave, which make the welder's power factor to 0.99. So it is non-pollution to the power net, and it improves the quality of the power supply. The welding machine possesses additional function with remote controller. The remote can control the welding torch switch from the top of remote box, and it also can adjust the welding current.

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

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

TIG——Tungsten Insert Gas welding;

MMA——Manual Metal Arc welding;

PWM——Pulse-Width Modulation;

IGBT——Insulation Gate Bipolar Transistor;

PFC——Power Factor Correction.

### §2.2 Working Principle

The working principle of GT- series welding machines is shown as the following figure. Single phase work frequency AC 220V (AC177-265V) or 110V (AC98-133V) (50/60 Hz) is

rectified into DC (about 380V) with PFC, then is converted to medium frequency AC (about 50KHz) by inverter device (IGBT module), after reducing voltage by medium transformer (the main transformer) and rectifying by medium frequency rectifier (fast recovery diodes), and is output 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.

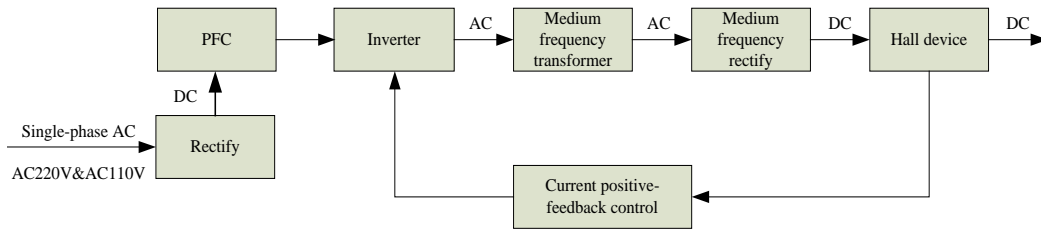


Fig 2.1 working principle diagram

### §2.3 Volt-Ampere Characteristic

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

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

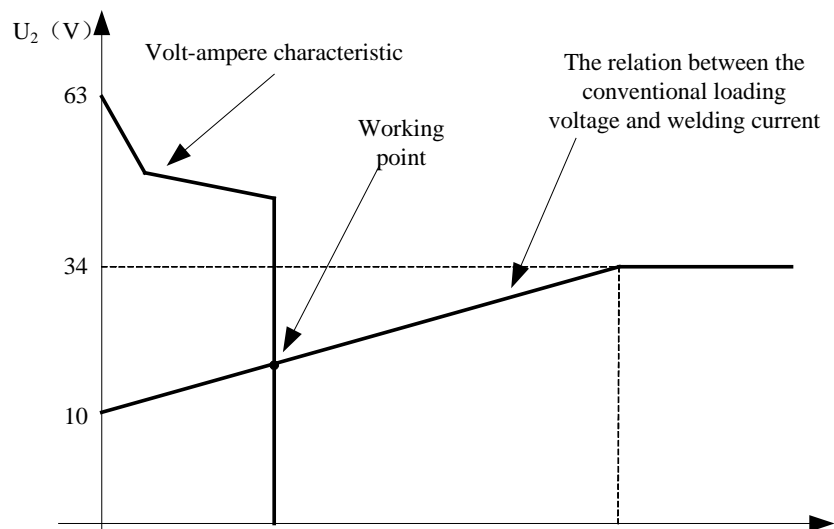


Fig2.2 output characteristic of GT-series



# §3 INSTALLATION AND ADJUSTMENT

## §3.1 Parameters

Model		GT-1600				GT-2000			
Parameters									
Power source		Single phase 110V/115V AC 50 Hz		Single phase 220V/230V AC 50 Hz		Single phase 110V/115V AC 50 Hz		Single phase 220V/230V AC 50 Hz	
		TIG	MMA	TIG	MMA	TIG	MMA	TIG	MMA
Rated input current (A)		30	38	15	25	30	38	20.7	33
Rated input power (KW)		3.5	4.2	3.5	5.6	3.5	4.2	4.5	7.2
Power factor		0.98							
Welding current adjustment range (A)		5-160	5-125	5-160	5-160	5-160	5-125	5-200	5-200
No-load voltage(V)		55V							
Down Slope time (S)		0-10							
Efficiency		≥75%							
Duty cycle (40°C 10 minutes)	25%							200A	200A
	30%		125A				125A		
	35%	160A		160A	160A	160A			
	60%	120A	95A	130A	130A	120A	95A	130A	130A
	100%	100A	80A	100A	100A	100A	80A	100A	100A
Protection class		IP23S							
Insulation class		F							
Dimensions of Machine (L×W×H) (mm)		440*140*230							
Weight (Kg)		9.5							
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.

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

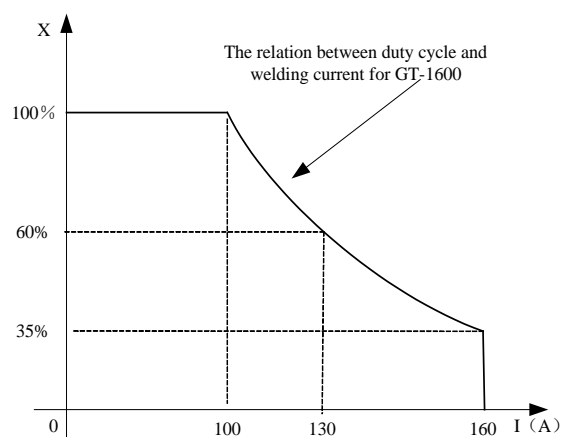


Fig 3.1 the relation between duty cycle and welding current for GT-1600 (Input: 220V MMA)

If the welder is over-heat, the IGBT over-heat protection unit inside it will output an instruction to cut output welding current, and brighten the over-heat pilot lamp on the front panel. At this time, the machine should be relaxed

for 10 minutes to cool the fan. When operating the machine again, the welding output current or the duty cycle should be reduced.

### §3.3 Polarity Connection

#### §3.3.1 MMA operation

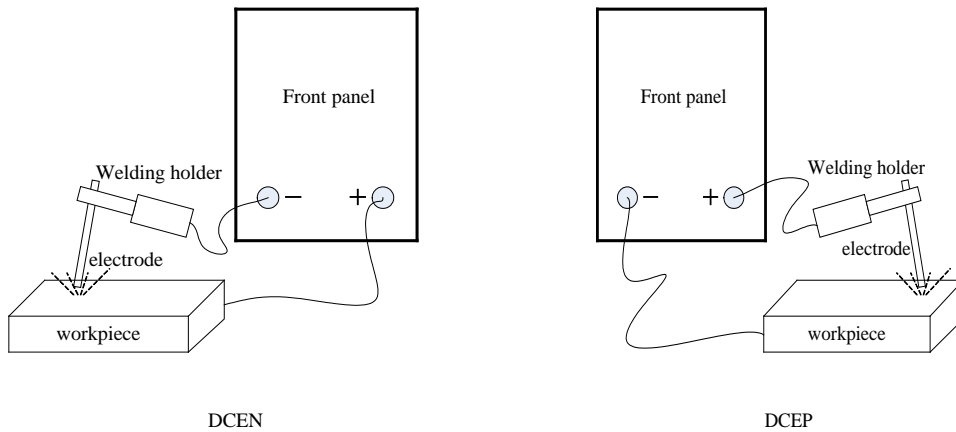


Fig 3.2 welding polarity connection of MMA

- Choosing the connection of DCEN or DCEP according to the arc stable burning condition. The different electrodes need different connection. Please refer to the electrode manual.
- Put the switch (4T/2T/MMA) of the front panel on MMA shelf before doing MMA welding.

#### §3.3.2 Assembling the equipment (TIG)

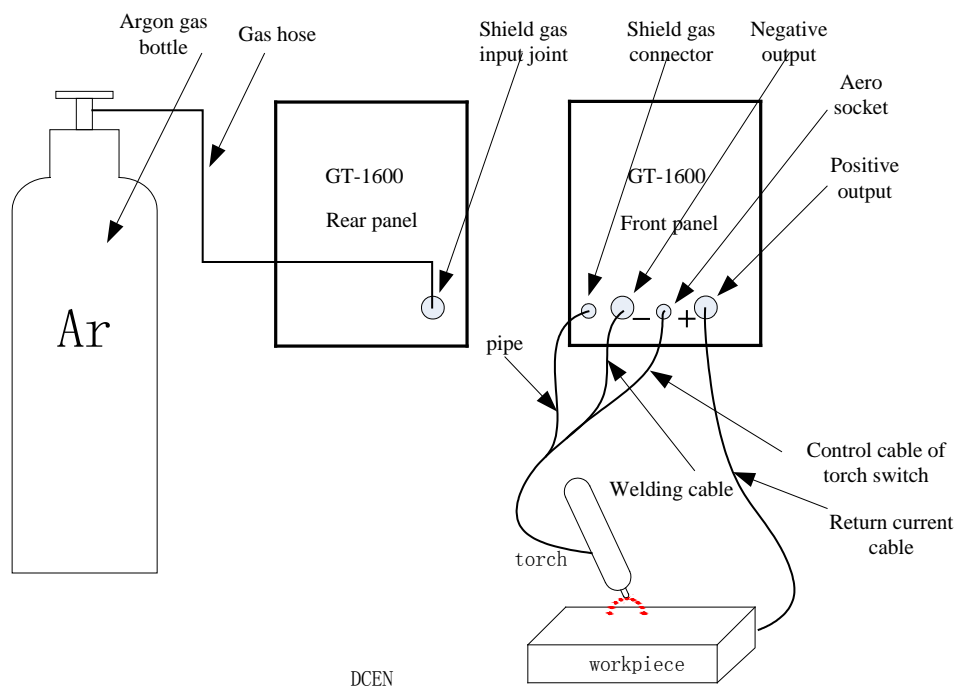


Fig 3.3 welding polarity connection of TIG

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- Workpiece is connected to the positive electrode of welding machine, and welding torch is connected to the negative electrode, which is called DC POSITIVE CONNECTION; otherwise, that is called DC NEGATIVE CONNECTION. Generally, it is usually operated in DC POSITIVE CONNECTION in TIG welding mode.
  - Packing list, such as welding torch、 ground cable、 gas hose, please refer to §5.3 in details.
  - The control cable of torch switch consists of 2 wires, and the aero socket has 3 leads. Refer to §5.4 for detailed connection.
  - Those two pipe holder in packing list §5.3 are used to connect strength pipe with argon gas bottle and shield gas connector.
  - Consumable parts for TIG torch, such as tungsten electrode、 tip、 gas nozzle、 electrode shield(short/long) , please enquire us by mail or phone according to the accessory codes.
  - When GT- series welding machines are operated in HF ignition method, the ignition spark can cause interferences in equipment near the welding machine. Be sure to take specially safety precautions or shielding measures.
  - Put the switch on front panel in 4T shelf or 2T shelf before doing TIG welding.
  - It is better for the welding cable not to exceed 20M.

## §4 OPERATION

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

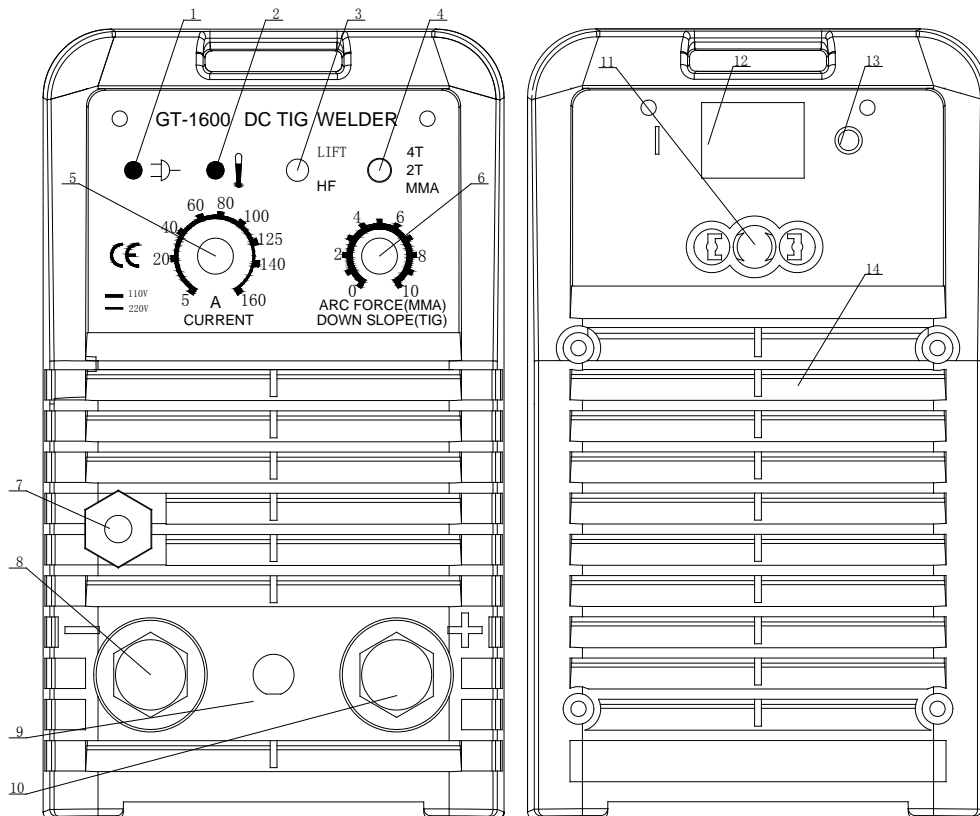


Fig 4.1 schematic drawing of the front panel and rear panel

- 1 **Power pilot lamp** putting through the power source switch, the power pilot lamp is on; switching off the switch, the lamp is off.
- 2 **Alarm pilot lamp** When the welder is over voltage, less voltage, over current or over heated, the alarm pilot lamp will be on.
- 3 **LIFT/HF** Select **LIFT** or **HF** operation mode.
- 4 **4T/2T/MMA** Select 4T、2T or MMA operation mode.
- 5 **Adjustment of welding current**
- 6 **Adjustment of down-slope time (for TIG)** adjustment of arc force (for MMA).
- 7 **Shield gas connector** is connected to the gas input pipe of torch.
- 8 **Connector** The welder's negative polarity output.
- 9 **Aero socket** is connected to torch switch control wire. (3 leads)

- 
- 10 **Connector** The welder's positive polarity output.
  - 11 **Power cable clip** To fix power cable.
  - 12 **Power source switch** Switch to "ON", the welder is turned on, while switch to "OFF", the welder is turned off.
  - 13 **Shield gas input joint** To connect one head of the gas hose while the other head of which is connected to argon gas cylinder.
  - 14 **Fan** When the power is on, the fan operates. It is used for cooling the components and parts inside the welder.

## §4.2 Welding current adjustment

Take GT-1600 for an example:

The adjusted welding current range is 5~160A.

GT- series welders have the function of pre-set welding current. Having this function is not only convenient to adjust the parameter, but also convenient to reach accurate regulation.

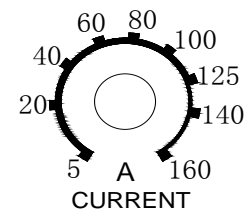


Fig 4.2

## §4.3 Down-slope time (for TIG)/Arc force (for MMA) adjustment

When choosing TIG welding, this knob is used to adjust the down slope time from 0-12s.

When choosing MMA welding, this knob is used to adjust the arc force.

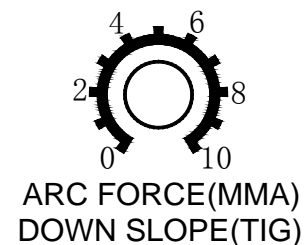


Fig 4.3

## §4.4 Welding Operation

### §4.4.1 TIG operation

4T operation:

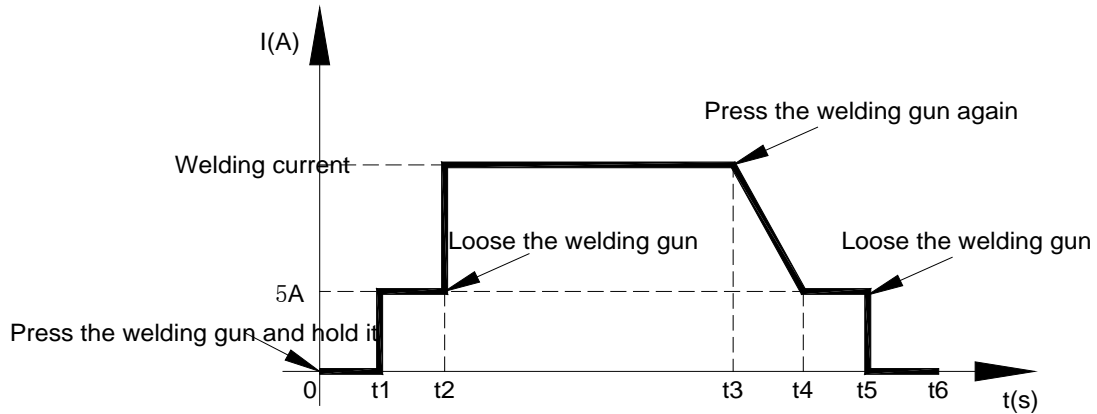


Fig 4.4 the flow chart of the 4T operation

Introduction :

- 0: Press and hold the gun switch, Electromagnetic gas valve is turned on. The shielding gas starts to flow.
- 0~t1: Pre-gas time(0.1S)
- t1: Striking arc and output start current (the setting value is 5A).
- t2: Loosen the gun switch and output welding current.
- t3~t4: Press the gun switch again. The output current will drop to 5A within the pre-set time.
- t4~t5: Output crater current (the setting value is 5A).
- t5: Loosen the gun switch, stop arc and argon still keeps on.
- t5~t6: Post-gas time. It can adjust automatically according to the welding current.
- t6: Argon stops to flow. Welding is finished.

2T operation:

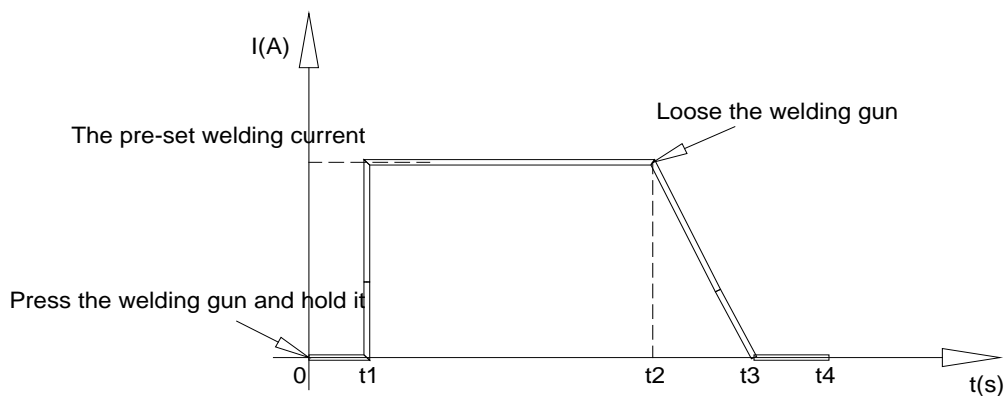


Fig 4.5 the flow chart of the 2T operation

Introduction :

- 0: Press and hold the gun switch, Electromagnetic gas valve is turned on. The shielding gas starts to flow;
- 0~t1: Pre-gas time(0.1S)

- t1: Striking arc and output start current (the setting value is 5A).
- t2~t3: Loosen the gun switch and the output current will drop according to the pre-set time.
- t3: Stop arc and argon still keeps on;
- t3~t4: Post-gas time. It can adjust automatically according to the welding current.
- t4: Argon stops to flow. Welding is finished.

### The operation step of scraping arc:

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

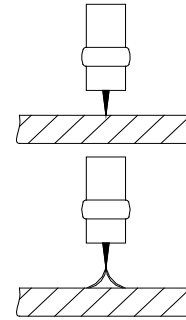


Fig 4.6 the operation of lift arc

### Anti-electrode pickup:

- ① TIG: During the welding operation, if the tungsten electrode touches the workpiece to form short-circuit, the protection mode will be transferred automatically and the welding current will drop to the protection current to reduce the waste of tungsten electrode and prolong its usage time.
- ② MMA: During the welding operation, if the electrode touches the workpiece to form short circuit, after 2s, the welding current will drop to 0A to void the electrode getting red.
- Automatically gas test function: When TIG welding, turn on the machine switch and open the gas valve to output shielded gas and maintain 10 seconds.

### §4.4.2 Striking arc way for MMA

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

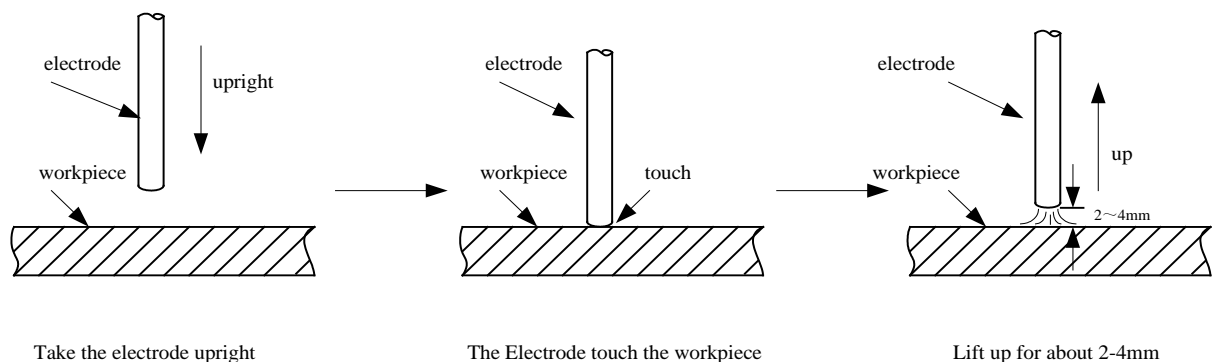


Fig 4.7 the method of knocking arc

- 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.

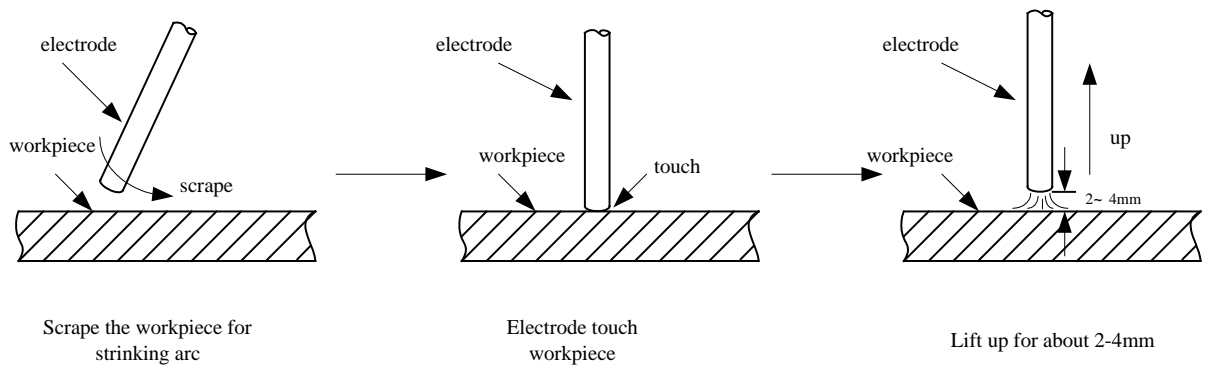


Fig 4.8 the method of lifting arc

### §4.4.3 Manipulation of electrode

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

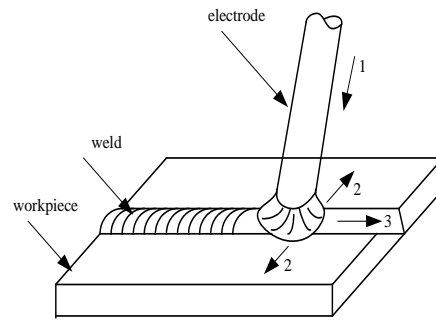


Fig 4.9 the rule of welding motions

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.

## §4.5 Welding Parameters

### §4.5.1 Joint forms in TIG/MMA

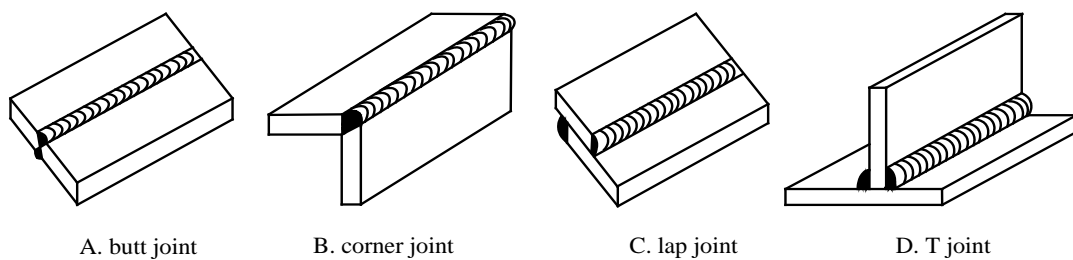


Fig 4.10 joint forms of welding



## §4.5.2 The explanation of welding quality

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

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

## §4.5.3 TIG Parameters Matching

The corresponding relationship between gas nozzle diameter and electrode diameter

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

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

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 shape and the welding current range (DCEP)

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

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

TIG of stainless steel (single run welding)

Workpiece thickness /mm	Joint form	tungsten electrode diameter/mm	welding wire diameter/mm	Argon gas flow rate/ L • min <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	Corner joint	1.6	1.6	7	75~125	25
2.4	Butt joint	1.6	2.4	7	85~125	30
2.4	Corner joint	1.6	2.4	7	95~135	25
3.2	Butt joint	1.6	2.4	7	100~135	30
3.2	Corner joint	1.6	2.4	7	115~145	25
4.8	Butt joint	2.4	3.2	8	150~225	25
4.8	Corner joint	3.2	3.2	9	175~250	20

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

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

#### §4.5.4 Electrode selection

The welding current reference for different electrode diameter				
Electrode diameter /mm	1.6	2.0	2.5	3.2
welding current /A	25~40	40~60	50~80	100~130

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

Notice: the above parameters originate from《Welding Dictionary》P66~P67, Volume 1 of Edition2.

#### §4.6 Operation Environment

- Height above sea level is below 1000m.
- Operation temperature range:-10<sup>0</sup>C~+40<sup>0</sup>C.
- Relative humidity is below 90 % (20<sup>0</sup>C).
- Preferably site the machine some angles above the floor level, the maximum angle does not exceed 15<sup>0</sup>.
- 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.

#### **§4.7 Operation Notices**

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

# §5 MAINTENANCE & TROUBLESHOOTING

## §5.1 Maintenance

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

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

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

	Observe that Whether the current output cable is damaged. If it is damaged, it should be wrapped up, insulated or changed.
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, IGBT module, 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 1MΩ, insulation is thought to be damaged and need to change, and need to change or strengthen insulation.

## §5.2 Troubleshooting

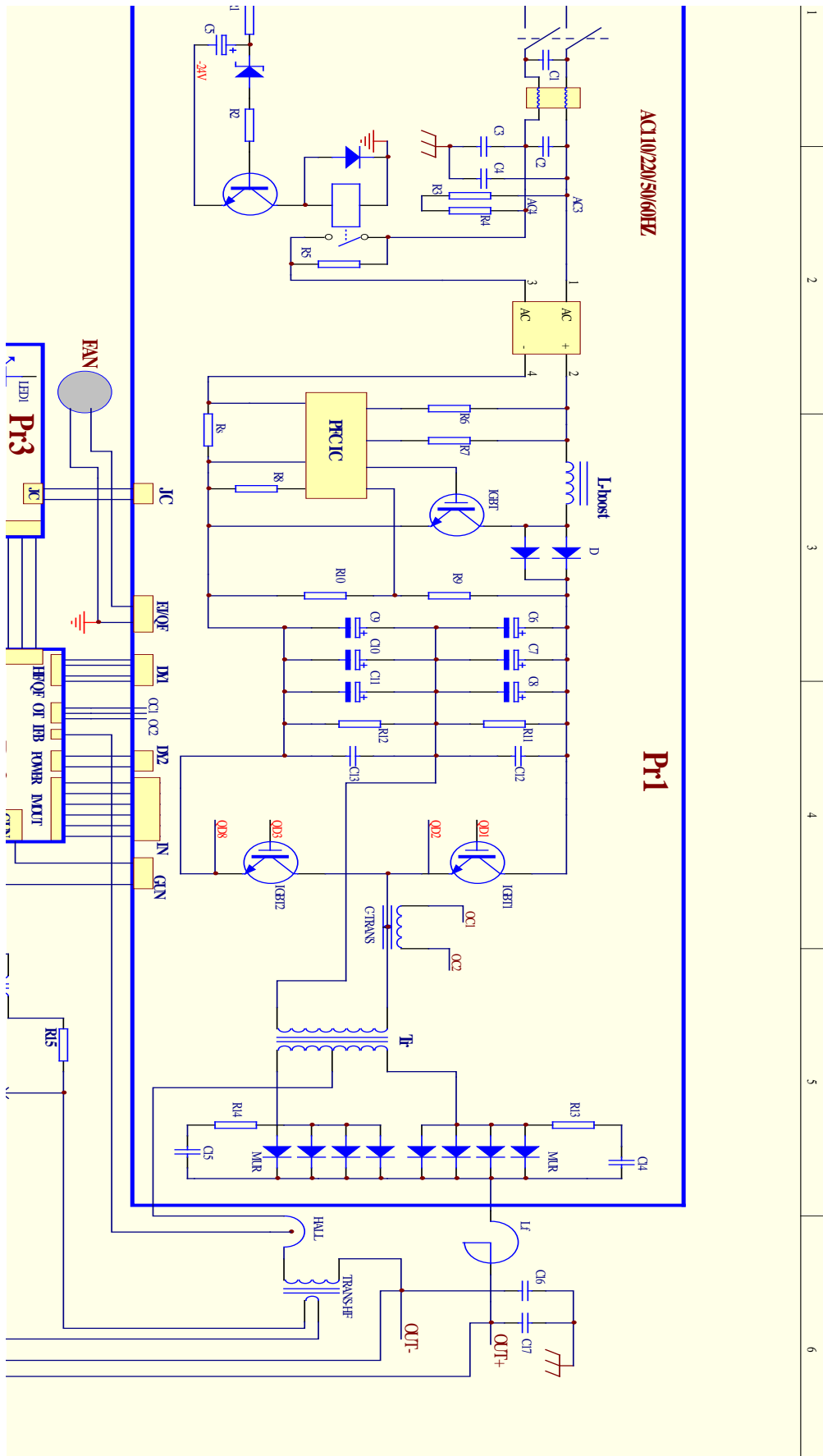
- Before arc welding machines are dispatched from the factory, they have already been debugged accurately. So forbid anyone who is not authorized by our company to do any change to the equipment!
- Maintenance course must be operated carefully. If any wire becomes flexible or is misplaced, it maybe potential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

If there are some simple troubles of GT- series 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.	The power light damaged or connection is not good	Test and repair the inside circuit of power light
		The transformer of power is broken	Repair or change the transformer
		Control PCB failures	Repair or change the control PCB
2	Turn on the power source, and the power light is on, but fan doesn't work.	There is something in the fan, Clear out	

S/N	Troubles		Reasons	Solution	
			The fan motor damaged	Change fan	
3	Turn on the power source, and the power light is not on and fan doesn't work.		No power supply input	Test the power supply input	
			The power supply resistance is broken	Change the resistance (4Ω)	
4	No no-load voltage output (MMA)		The machine is damaged	Check the main circuit and the PCBs	
5	Arc can not be ignited (TIG)	There is spark on the HF igniting board.	The welding cable is not connected with the two output of the welder.	Connect the welding cable to the welder's output.	
			The welding cable damaged.	Repair or change it.	
			The earth cable connected unstably.	Check the earth cable.	
			The welding cable is too long.	Use an appropriate welding cable.	
			There is oil or dust on the workpiece.	Check and remove it.	
			The distance between tungsten electrode and workpiece is too long.	Reduce the distance (about 3mm).	
			The distance between the discharger is too short.	Adjust this distance (about 0.7mm).	
		The malfunction of the welding gun switch.	Check the welding gun switch, control cable and aero socket.		
6	HF striking arc can not be stopped		Check the main PCB and control PCB	Repair or change it.	
7	No gas flow (TIG)		Gas cylinder is close or gas pressure is low	Open or change the gas cylinder	
			Something in the valve	Remove it	
			Electromagnetic valve is damaged	Change it	
8	When welding, it is hard to strike arc or easy to stick.(MMA)		Connector is loose or connection is not good.	Check and screw it.	
			There is oil or dirty on the workpiece.	Check and clear it.	
9	The welding current can not be adjusted		The welding current potentiometer on the front panel connection is not good or damaged	Repair or change the potentiometer	
			Not short the 2pin and 3pin of J-MB on the front panel	Short it	
10	The penetration of molten pool is not enough.		The welding current is adjusted too low	Increase the welding current	
			The arc is too long in the welding process	Use the short-arc operation	
11	Arc deflection.		Air interference	Keep out air	
			Electrode deflection	Change new electrode.	
				Adjust another angle to weld	
			Magnetic field	Use the short-arc operation	
				Change the position of earth cable	
Change welding direction					
12	The alarm light on the front panel is on		Over heat protection	Two much welding current	Reduce the welding current output
				Working time too long	Reduce the duty cycle (work interally)
			Over-voltage protection	Power supply fluctuates	Using the stable power supply
			Low-voltage protection	Power supply fluctuates	Using the stable power supply
				Too many machines using power supply in the same time	Reduce the machines using power supply in the same time
Over-current protection	Unusual current in the main circuit	Check and repair the main circuit and control PCB			

# APPENDIX 1: Electrical principle drawing





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APPENDIX 2: The electric drawing of Gun Switch

