



INVERTER DC MMA ARC WELDING MACHINE

OPERATION MANUAL

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Safety precautions



- Please read this instruction carefully for correct use.
- The objective of the precautions listed in this instruction is to ensure the safe use of machine and prevent you and others from being harmed or injured.
- Safety consideration for the welding machine in design and manufacture. Work to the precautions in this instruction, otherwise it will cause major accident.
- If used incorrectly, the harm and damage will occur in three different ways. So the caution symbol and warning labels are listed in this instruction.

Caution symbols	Warning labels	Content
	High danger	If used incorrectly, potential major harm will result in death or serious injury and major danger accident once it occurs.
	Danger	If used incorrectly, potential scourge harm will result in death or serious injury and danger accident once it occurs.
	Caution	If the welding machine is used incorrectly, the harm with mild degree, slight wound and other dangerous accidents and the damage of articles will be caused.

*The symbol above is applicable to the general occasion.

The serious injury mentioned above refers to eyesight damage, trauma, harm, electric shock, fracture and poisoning and so on which will leave sequel and is in need of making treatment in need of making treatment in hospital of going to hospital for long period, slight wound refers to burn and electric shock and so on which is not in need of being in hospital but treatment for long period. The damage of articles refers to the loss of property and damage of machine.

On the usage of machine, the symbols shown as following indicate [must do] and [forbid doing].

	Compulsion	Must do For example [grounding]
	Forbidden	Forbid doing

*The symbols above are used in the general occasions



Danger Work to the following items in case of the major personal

Accident

1. Safety consideration for the welding machine in design and manufacture.
Work to the precautions in this instruction, otherwise it will cause death, serious injury and other major personal accident.
2. For the construction power source of input, the choice of equipment location, the application keeping and configure of high pressure gas, the keeping of workpiece after welding and the treatment of rejection and so on, please observe the relative regulations and the standards inside your company.
3. The unconcerned personnel never go in the welding working location.
4. The person using heart pacemaker do not be close to the welding machine in operation and the surrounding of welding operation location without permission of doctor. The produced magnetic field when the welding machine is electrified will produce the bad effect on the action of pacemaker.
5. Invite the professional or expert person to install, examine and repair and maintain the welding machine.
6. To ensure safety, please correctly understand the content in this instruction and invite the personnel with safety usage knowledge and skill to operate this machine.
7. Do not use machine in the work except the welding.



Danger: Work to the following items in case of electric shock



*Once contact the position with electricity, the fatal electric shock or heat injury will be caused.

1. Never contact electrified position.
2. Invite electric personnel to earth welding machine and parent metal according to regulations.
3. In installation and examination and repair, must turn off the power of electric switch box first, then the operation was made after 5 minutes.
4. Never use the cable which lacks of capacity of where conductor exposes for the damage of insulation jacket.
5. For cable connection part, please ensure insulation.
6. Never use welding machine on the condition of dismounting machine shell.
7. Please use dry insulation glove.
8. Please use safety net at high place operation.

9. Make maintenance and examination and repair, only the damaged part can be used until it is repaired well.
10. Please shut off all input powers when the machine is unused.
11. When use AC arc welding machine in the confined place or high place, please use electric shock-proof device.



*Arc light will cause the inflammation of eye or heat injury of skin and other personal damages.

*Splashing and weld slag will burn eye or skin

*Noise will be harmful to hearing



1. When make welding or supervise welding, please use the safety appliance with enough shading degree.
2. Please emphasize particularly on wearing protective glasses.
3. Please wear protective glove, long sleeve clothes, welding spats, apron and other safety appliances in welding, which are made of leather.
4. Protective barrier are set around the welding location to prevent arc light from endangering others.
5. When noise is great, please use sound insulation apparatus.



Caution: To avoid weld dust and gas endanger you and others, please use safety appliance

*Weld dust and gas endanger health

*In operation in the confined location, lack of oxygen will result in suffocation.



1. To prevent gas poisoning and suffocation and other accidents, please use regulated exhaustion facilities, and breath protection appliance is coordinated for use.
2. In operation in the confined location, please accept the examination by supervision personnel and fully change gas and coordinate in using breath protection appliance.
3. Never make weld within degrease, cleaning and atomization working area.
4. When weld the steel plate with electroplate or coating, the harmful dust and gas will produce, please use protection appliance for breath.



Caution: To prevent fire, explosion, cracking and other accidents from taking place, please be sure to observe the following regulations.

*Splashing or heat parent metal just welded will cause fire.

*When current loop produce non full contact on the bad connection of cable and steel bar and other parent metals, the heat after electrifying will be caused.

*Never weld on the container filling combustibility substance, otherwise explosion will be caused.

*Never weld seal container, for example groove (box), pipe, otherwise cracking will be caused.



1. Never place combustible in the weld location.
2. Never weld near combustible gas.
3. Never close to the combustible when the heat parent metal is just welded.
4. When weld dooryard, ground and wall, please eliminate the combustible on the back.
5. The connection of cable shall surely be insulation.
6. The connection of cable of parent metal side shall approach welding position as possible.
7. Never weld the gas pipe and seal groove and so on which stores gas.
8. The fire extinguisher shall be placed near weld work location to protect against accident.



Caution: To prevent gas bottle from dumping, gas adjustor from cracking and other accidents, please be sure to observe the following regulations.

*The dumping of gas bottle will result in personal accident.

*If gas bottle stores high pressure gas, incorrect use will cause the ejection, thus causing personal accident.

1. Please use gas bottle correctly according to regulations.
2. Please use the gas adjustor equipped or recommended by our company.
3. Please read the operation instruction for gas adjustor before use, observe precautions.
4. Please use the special gas bottle support structure to fix gas bottle.
5. Never put gas bottle in the place where temperature is high or sunlight shines directly.
6. Make sure you face keep away from the outlet of gas when the valve of gas bottle is opened.
7. Please install the gas bottle protecting jacket when the gas bottle is unused.
8. Never put welding torch on the gas bottle, electrode cannot contact gas bottle.



Caution: Contact of rotation position will cause injury, please observe the following regulations



*Never finger, hair, clothes, etc approach cooling fan and the electrode wheel of electrode feeding machine and other rotation positions.

1. Never use welding machine on the condition of dismounting machine shell.
2. Invite the professional or expert person to install, examine and repair and maintain the welding machine.
3. Never finger, hair, clothes, etc approach cooling fan and the electrode wheel of electrode feeding machine and other rotation positions.



Caution :The end of welding wire will cause injury, please be sure to observe the following regulations

*If the welding wire emits from welding torch, the eye, face and other exposure parts of the body will be stabbed.



1. In affirming whether the welding wire is fed, do not peek into the small hole of current contact nozzle. Otherwise welding wire will prick eye and face.
2. When welding wire is fed by hand or welding torch is opened, please do not put the end of welding torch dose to eye, face and other exposure parts of the body.



Caution: Plasma weld will result in burn, please be sure to observe the following regulations



*Never put such any part of body as finger close to plasma work, otherwise burn will cause.

1. In cutting work, the finger shall leave the nozzle and electrode on the end of cutting torch.
2. Never make cutting work near place where parent metal is held by hand.
3. When change nozzle and electrode, please first turn off power.



Caution: To prevent fire caused by the deterioration of insulation of welding power, please be sure to observe the following regulations.



* If splashing produced in welding and iron powder produced in snagging work go in the power, the deterioration of insulation will be produced, thus causing fire

1. To prevent splashing and iron powder and so on from going in the power, please separate weld power from weld work and snagging work.
2. To prevent insulation deterioration caused by powder accumulation, please be sure to maintain and examine and repair regularly.
3. If splashing, iron powder, etc go in the power, please be sure to turn off power switch of welding machine and switch of distributor case, then blow off with air.

Working Directions

■ Load Duration Factor

Load duration factor refers to the ratio that practical work time accounts for the whole work time (10 minutes is 1 cycle). For example, 60% load duration factor means that weld is made for 6 minutes and then zero load is for 4 minutes. Rating load duration rate compares with rating current. When the equipment is used below rating current, if even the equipment may be used in case of high load duration factor. At this time the calculation equation of load duration rate as following:

$$\text{Load duration factor of current used in practice} = \frac{(\text{Output voltage rating})^2 \times \text{Rated load succession rate}}{(\text{Actual available output current})^2}$$

■ Placement of Welding Machine

In placement, please pay attention to the following items:

- (a) Lay in the place as possible where the ground is flat and vibration is little and which is more than 20cm far from wall.
- (b) Please put it in the clean and dry place where iron powder, dust, paint are little.
- (c) Please put the machine in the place where rain pouring can be avoided and which is not subject to the erosion of sea water

■ Connection

■ 1. Grounding

The grounding terminal is set on the bottom of side plate of back of machine shell, please earth with copper wire with above 4m² area.

Rated input voltage 300 ~ 600 V and grounding resistance 10 Ω.

✘ Please entrust full-time staff (electrician) to earth.

1. Connection of power

One welding machine is equipped with one distribution box including switch, fuse and other current protectors, whose output end is connected with input end of welding machine. As for the capacity of distribution box and cable section, please refer to table

2. Especially for fuse and other current protectors, for the sake of safety, please use the protector with proper capacity rather than the protector with the too great capacity.

3. Connection of welding end

One end connects with the cable of welding tongs, another end connects with welded object by connection cable. To ensure safety, in operation the welded object must be earthed.

. Technical Performance

1. Performance Characteristic

A new generation Inverter DC Argon Arc Welding machine adopts the advanced soft switching inverter based on the core fitting of imported IGBT and microcrystal magnetic cores with the 20KHZ inverter frequency. The product owns high load duty cycle with arc igniting current and current thrust control function. It owns the advantages of automatic compensation function for voltage fluctuation, stable arc, even weld crater, little splash and good weld formation. And on the other hand, it first applies the digital circuit control technique for the purpose of quality of welding, which not only reduces the weight and volume much and improves the portability but simplifies the operation of facility, getting good arc ignition and welding performance to improve the welding precision.

Due to adopting the digital circuit control, the pre-welding set value can be displayed by the number. The actual value is displayed during the welding, and the value is locked automatically after welding, which makes convenience for presetting and control of welding criterion.

Its top inverting frequency of 20KHZ reduces the current fluctuation influence for arc much, which makes arcing and arc static current very low(20a) . The arc burns steadily and quietly with dense arc and small heat affected zone. Considering all aspects of factors' influence for the welding machine in designing, the advanced design is adopted in some minutiae. The inner bare line adopts the insulating varnish with high insulating strength, and the shell adopts the waterproof design for protection that can cope with rugged environment. In addition, fully considering the economy of welding machine use in the design, the power consumption efficiency of all digital TIG welding machines reaches 90%, and the power factor reaches 0.89. finally these serials advanced design passes the strictest test and reaches the following standard: shell protection grade: IP21S, suitable for field use, insulation grade: F, waterproof and preventing foreign materials.

Brief introduction to characteristics:

- Striking current continuously adjustable
- Thrust current continuously adjustable
- Welding current continuously adjustable
- Digital display current and voltage
- Overheat indication and overload protection

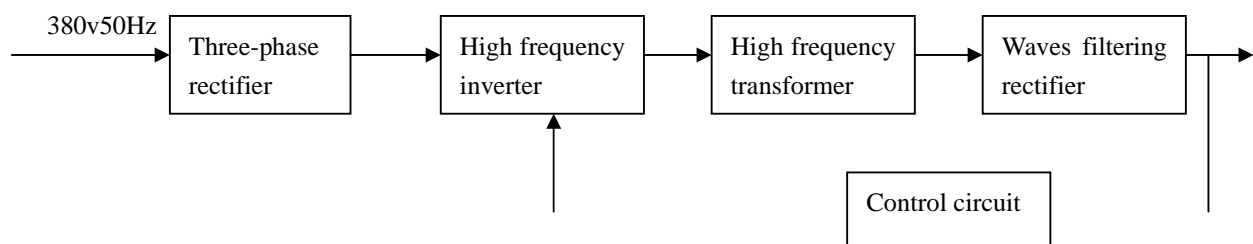
2. Main Parameters

(Form 1) Performance Parameters

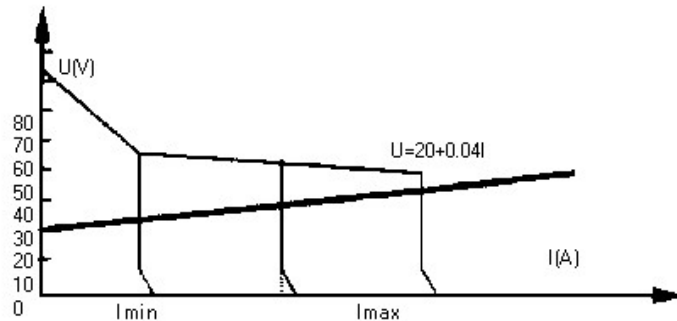
Content of Parameters		Unit	IN ARC 400 IH
Output	On-load voltage	V	70±5%
	Rated Current output	A	400
	Rated Load voltage	V	36
	Regulation range Of welding current	A	20-400
	Load continuous rate	%	60%
Input	Power parameters	Three-phase 380V 50/60Hz	
	Rated capacity input	KVA	18
	Rated current input	A	28
Efficiency		≥90%	
Power factor		≥0.89	
Grade shell protection		IP21S	
Insulation grade		F	
Overall dimension	mm	570×320×530	
Weight	Kg	34	

3. Summary of Principle

The invention of inverter arc welding benefits from appearance of the inverter theory and device. The inverter arc welding power source works rectifying 50/60HZ working frequency to direct current, inverting to HF by the high power switching device IGBT(the frequency can reach 20KHZ), then reduce voltage and rectification, output the dc high-power supply by PWM, the weight and volume of main transformer are remarkable decreased, and the efficiency is raised over 30%.



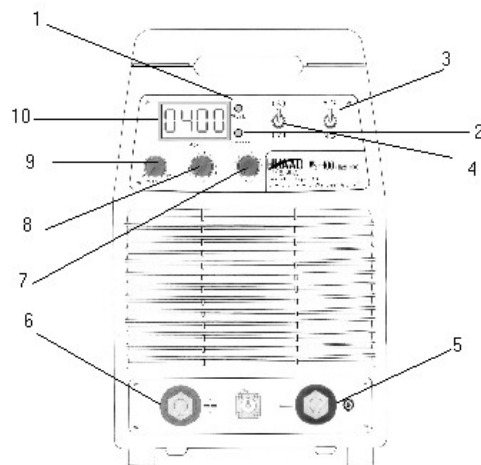
Welding machine Principle Block Diagram (Picture 1)



Welding machine Output Characteristic (Picture 2)

. Plank structure and statement

1. Front panel structure and statement



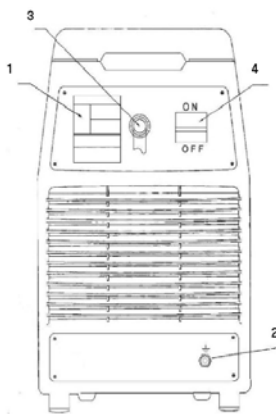
- (A): Current
- (V): Voltage
- ON: Remote Control (REM)
- OFF: Near Control (REM)
- A: Welding Current (A)
- ARC FORCE
- HOT START: Arc Striking Current

Front panel (Picture3)

- (1) Power light: indicate whether the power is connected or not, the light is on when connecting.
- (2) Over load light: the welding machine stops working when the temperature in the welding machine is too high when the light is on. The light is on.
- (3) Off and on of REM: when the switch is not the welding standard can be regulated only by the button of remote control package; when the switch is off, the welding standard can be regulated only by the button of welding machine panel.
- (4) Display option switch: the digital millimeter will display the current or voltage parameters according to marking.

- (5) Negative electrode output: the socket connecting welded work pieces via output cable at manual welding.
- (6) Positive electrode output: the socket connecting soldering tongs at manual welding.
- (7) ARC FORCE: it can change the time of arc stopping of argon arc welding to adjust the button.
- (8) HOT START: arc striking current.
- (9) A: regulate the welding current.
- (10) Digital multimeter: display the current setting value at the time of current parameters on-load, display the actual current value at the time of welding. Display the no-load voltage at the time of voltage parameters on-load, display the actual current value at the time of welding.

2. Back panel structure and statement



ON: Switch on
 OFF: Switch off

Back panel (Picture 4)

- (1) Nameplate: indicate all indexes of power.
- (2) Grounding screw: to ensure personal safety and normal use of arc welding power source, please make sure connect the screw to ground reliably by the conductor, or connect the grounding line in the input cable to ground reliably.
- (3) Power cord: the cable is four core cables. The effect yarn is used for zero terminating, and the left 3 wires are connected to the three-phase 380V/50HZ power.
- (4) Power switch: the switch is connected to the position of incoming line of three-phase power. The switch works for protecting the welding machine by automatic power off in case of the welding machine overload or any faults. In general case, the switch is pushed upward to the position of connection, starting and stopping of welding machine shall be controlled by the power switch on the user distribution panel or cabinet as possible , and don't use the switch as the power switch.

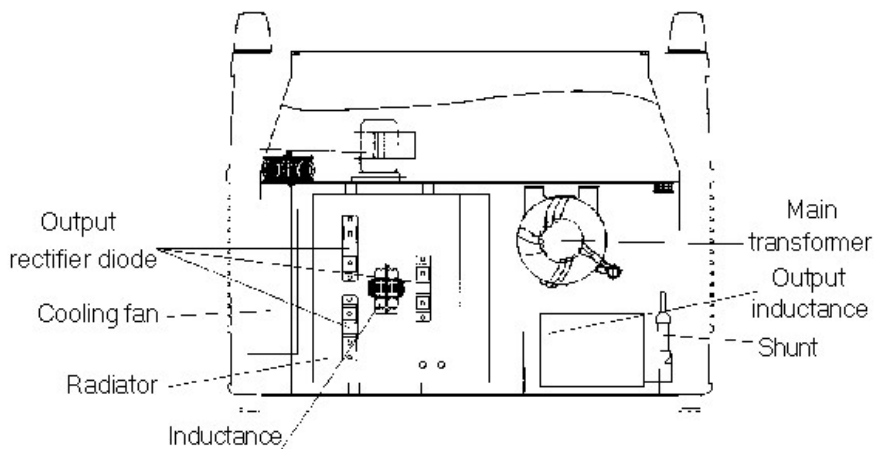
. Check the welding machine before using

1. Examination under power off

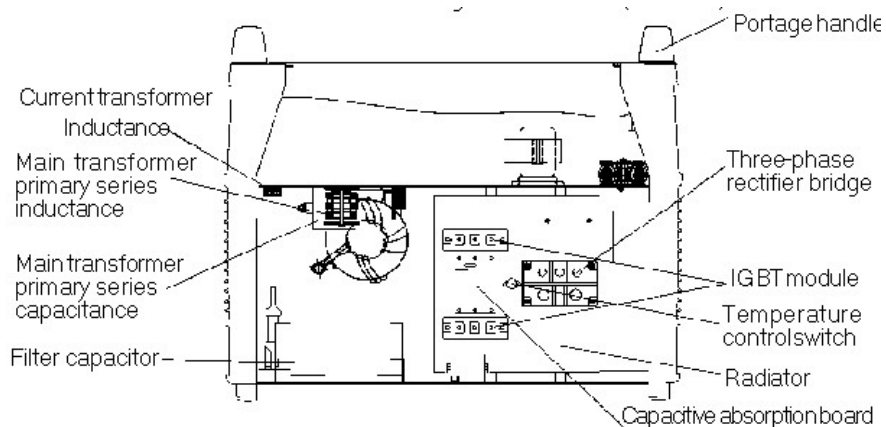
- (1) Check whether circuit and gas path make a correct and reliable connection or not.

- (2) Check whether the automatic air switch is put upward onto the position of connection or not.
 - (3) Check whether option switches regulating operating mode and control mode on the front panel are in the right position.
2. Examination under power-supply and no load
- (1) If power-on is successful, the indicating lamps of power lights up.
 - (2) The digital ampere meter on the front pane of the welding power shows preset value and the fan rotates in the specified direction
- Only if all these steps are finished without any problems can the equipment, a normal one, be used in welding.

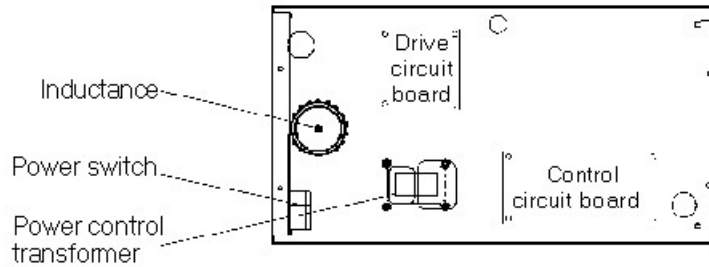
. Inside Structure and Statement



Internal schematic diagram for left side (Picture)



Internal structure images for right side (Picture6)



Schematic diagram for intermediate plates (Picture 7)

. Installation and debugging

1. Environment

(1) The welding operation shall be operated in a relatively dry environment, and the air humidity should not exceed 90 percent.

(2)The ambient temperature should be between -10°C and 40°C .

(3)Do not weld under the sunlight or in the rain, and do not let water or rain go into welding machine.

(4)Do not weld in dust or under the environment containing corrosive gases.

(5)Do not weld at the vibrant and easy-collision places.

2. Security key points

The welding machine has been installed protection circuit against over current and overheat, which will automatically stop working when the temperature is higher than the standard and welding machine will enter the state of protection when the flow is excessive. But excessive use (such as welding current excessive) would have still caused damage to the welding machine, so you need to pay attention to the followings:

(1) To keep good ventilation!

Since the size of the welding machine is small, natural ventilation can not meet the need of cooling it when strong current goes through it, we use a cooling fan to make it work smoothly.

User should confirm the ventilation is not covered or blocked. The distance between the machine and the surrounding objects must be kept no less than 0.3 meters. The user should always keep it good ventilation, which is very important to work efficiency and service life of the machine.

(2) To prohibit electric current from overloading!

User should observe the strongest load current (relatively to the selected load sustained rate) at any time, so as to ensure the welding current against exceeding the allowed maximum.

The life expectancy of welding machine will be significantly shorten, or even be burned, by overload current.

(3) To prohibit over voltage!

The power voltage is listed in the main technique parameters such as these in form 1, in normal conditions; the voltage auto-compensation circuit in the welder limits the welding current within normal range. If the power voltage exceeds the normal range, the welding machine will be damaged. As a result, the operator should be fully aware of the situation and proper protective measures should be taken.

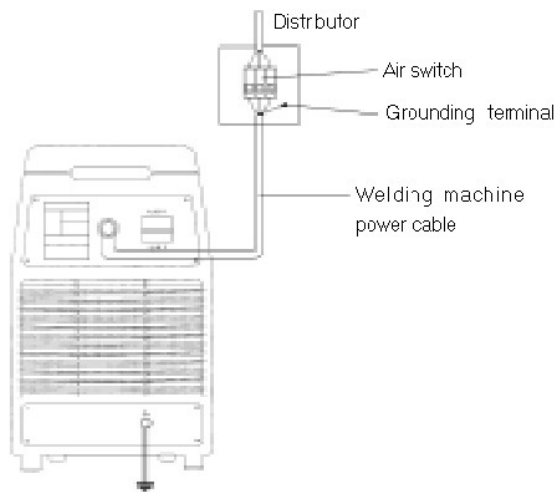
There is one grounding screw on the back of every welder with the grounding mark.

Before use, selecting one cable with the cross section of more than 4m^2 , connect the shell of welding machine to ground to discharge electrostatic or avoid possible accidents due to current leakage.

(4) If the welding machine exceeds the standard continuous loading time, the welding machine would enter protective state and stop working. If this situation happens, it indicates that the welding machine exceeds sustained rate of standard load. And excessive heat trigger the temperature detect switch, which make the welder stop working. At the same time, the yellow dictator at the front board goes out.

In this case, do not plug of the power so that the cooling fan starts to cool the welding machine. When the yellow indicator lit up, it indicates the temperature lower down to the normal range and welding work can be continued.

3. Equipping circuit configuration





Equipping circuit configuration of arc welding (Picture8)

4. Installation and Debugging

- (1) After opening the case, check the types and quantity in the case according to contents of packaging card.
- (2) INARC IH series welding machine adopts three-phase four wire system AC380 (50Hz) network sources, and the connecting wire is shown as Picture 8.

Among them the yellow/ blue double-color line is the protection grounding line, connecting with the shell in the power, please make sure connect the protection line to the protective grounding terminal on the installment site; Or the professional electrician can connect M6 connecting bolt with grounding mark on the inferior of the back panel to the protective grounding terminal by the cable with the proper specification

Form 2 Power equipment and connection power

	INARC -400 IH
Input power(v)	Three-phase 380±10%
Power equipment Capacity(KVA)	20
Input cable wire(mm 2)	3×5+1
Output cable wire(mm 2)	35
Grounding line(mm 2)	6
Automatic air (release current)(A)	40

- (3) Select the phase sequence properly to make the fan keep rotating (The wind direction is the back panel in and the panel out).
- (4) According to the welding technological requirements and species of electrode, select the straight polarity DC (The work pieces connect **+** end) or the reverse connection method (The work pieces connect **-** end).

5. Welding operation

- (1) Turn on the power and switch on the welding machine the power light will shine and the fan start to work regularly.

Note: The power light rather than protection light will shine.

- (2) With regard to short-range welding, electrical current and thrust force can be adjusted on the panel by shifting the remote switch to short-range. For long-range welding, as it is inconvenient to regulate current and thrust force, you are recommended to use a remote controller designated by the Company.

Note: If such a remote controller is needed, please place an order of it together with the welding machine.

- (3) In consideration of thickness of the material to be welded and electrode diameter, adjust the current to an appropriate level in reference of data shown in form 3.
- (4) Thrust current can be regulated at a range from 0 to 200A and superposed on the welding current. If current is too high, intensified splashing may lead to inferior formation of weld; on the contrary, if the magnitude is too low, the melted welding stick becomes fluid and drop transfer is not proceeding smoothly.
- (5) Advise to use larger stiffness arc when welding with cellulose type coating electrode (clockwise turn thrust current knob to the right-of-center position).
- (6) In order to make non-splash welding, adopt small stiffness arc when welding on stainless steel or dominant mode filling materials (clockwise turn thrust current knob to the left-of-center position).
- (7) Striking current: when welding current is lower than 200A, adjust striking current according to the requirements of welding technique in order to improve the success rate of striking arc.

Note: Do not force too strongly when adjusting knob to avoid damaging the welding machine or components.

(Form 3) Option of the welding wire with welding current

Diameter of electrode (mm)	Welding current(A)	Diameter of electrode(mm)	Welding current(A)
2.0	30-60	4.0	120-180
2.5	50-100	5.0	180-250
3.2	80-120	6.0	250-400

VII. Routine Maintenance and Repair

Regular maintenance and inspection are done to ensure the machine to work safely and efficiently. Check whether the power of the welding machine is off before checking the external connectors. Check the internal wiring five minutes after the power of the welding machine is turned off, so that the capacitors of the machine are fully discharged to avoid electric shock accidents and ensure the safety of the staff.

(Form 4) Reference Guide for Maintenance

Line maintenance items	A regular maintenance is done every one or two months
1.The function of the power switch 2.Whether the cooling fan is rotating normally 3.Whether the abnormal vibration, noise or smell exists 4.Whether the cable connector is overheated 5.Whether welded cable is abnormally hot 6.Whether a wire connector is loose	1.Remove dirt: Compressed air is used to remove dirt, in particular the dirt on inductor, transformers, power transistors and printed circuit boards. 2.Maintenance of the circuit connectors Check whether the input terminal, the output connector, the external connections are loose or rusty. Tighten the loose places and remove the rust to ensure good contact 3. Check whether the grounding line is well

. Troubleshooting

Troubleshooting workers can check first and then make maintenance according to form 5. if the faults can not be cleared please contact with the distributor or the producer.

Note:

1. Before checking the inner circuit of machine, make sure shut off the three-phase power of welding machine to guard against electric shock because the inner circuit can produce high voltage.
2. Before the machine leaves the factory, the control circuit has been connected precisely. When connecting, do not overexert, do not change the position of adjustable device on the circuit board at random to avoid accident.

(Form5) Maintenance form

Faults phenomena	Faults cause/ measures
The current indicator light is off. The fan does not rotate and the digital multimeter does not display.	<input type="checkbox"/> Whether the power switch closed or not <input type="checkbox"/> Check whether the input cable and the connecting power network have electric or not <input type="checkbox"/> Check whether the input cable has open circuit point or not
The protection indicator light is on.	Long-time overload situation, thermal protection circuit starts, decrease the welding current and improve the working environment. Too strong welding current, too long and thin output cable. Decease the welding current, and shorten the input cable or increase its cross sectional area.
The output current is not steady or controlled by the potentiometer, and the current intensity frequently changes.	The potentiometer is damaged and shall be changed, the output cable joint is loosening, and the input three-phase cable line has a bad contact.
The switch of power cannot be closed.	IGBT module burns out, and the input three-phase rectifier is damaged.
The volume of welding current is nonadjustable.	Current rockwork is damaged or cast off wire, and the main control board is damaged.
The current indicator light is on and the fan no rotate	The fan does not work, the input power is normal or not, and the connecting wire of fan is split or not.
Sodium hydroxide electrode has big spattering.	The polarity is mistakenly connected, and exchanges the polarities of grounding line and handing wire.

Note: 1. People other than maintenance personnel of professional electricians of our company shall not open the shell.

3. Turn off the powers of the welding machine and the distributing box.