



INDUSTRIAL EQUIPMENTS PVT. LTD.

# OPERATION MANUAL

## ARC400iS

Inverter Arc Welding Machine (MMA)

400 A | IGBT Inverter | DC | 3-Phase Input



## WELDING MACHINE



Please read carefully before using the machine!

Cruxweld Industrial Equipments Pvt. Ltd.  
5, Sector 29, Faridabad - 121008 (Haryana), India  
Phone: +91 8800 882 983 | +91 (129) 489 2868  
Email: sales@cruxweld.com | Service: support@cruxweld.com  
[www.cruxweld.com](http://www.cruxweld.com)

# CONTENTS

1. Safety Precautions
2. Electromagnetic Compatibility Considerations
3. Usage and Features
4. Working Principle
5. Function Introduction
6. Installation
7. Operation
8. Technical Data
9. Maintenance and Troubleshooting

**Please read these operating instructions carefully before using the machine.**

1. To ensure safety, please arrange qualified personnel or personnel with in-depth knowledge of the welding machine for installation, maintenance, inspection and repair.
2. Please operate the welding machine after fully understanding the contents of this manual.
3. After reading this manual, please put it in a place where relevant personnel can easily access it and keep it properly. Please read again if needed.

# 1. Safety Precautions



## General safety precautions

- Be sure to follow the precautions specified in this manual, otherwise an accident may occur.
- The design and construction, installation, site selection, and use of high-pressure gas of the input power supply should be carried out in accordance with relevant standards and regulations.
- Unrelated personnel are not allowed to enter the cutting workplace.
- Please have qualified professionals to install, maintain and use the cutting machine.
- This welding machine cannot be used for purposes other than cutting (such as charging, heating, freezing of pipes, etc.).
- If the ground is uneven, care should be taken to prevent the welding machine from tipping over.



## To prevent electric shock or burns from electric shock

- The welding machine is electrified, and it is forbidden to touch the electrified gas and bare metal parts of the cutting torch.
- Ask professional electrical personnel to ground the copper wire welding machine according to regulations.
- Ask professional electrical personnel to connect the copper wire cutting machine to the power supply according to the regulations, and the insulating sheath must not be damaged.
- Work in damp and limited activities to ensure the insulation between the body and the base metal.
- When working at heights, please use a safety net.
- When not in use, please turn off the input power.



## Avoid the harm of welding fumes and gases to the human body

- Please use exhaust equipment to avoid gas poisoning and suffocation accidents.
- When working at the bottom of the container, harmful gas will be deposited around, causing suffocation. Special attention should be paid to ventilation.



## Avoid the harm of welding arc, spatter and welding slag to human body

- Please wear protective glasses with sufficient shading. Arc light can cause eye irritation, and splashes and welding slag can burn eyes.
- Please use leather protective gloves, long-sleeved clothes, hats, foot protectors, aprons and other protective equipment for welding to avoid arc light, splashing, and welding slag burns and scald the skin.



## Prevent fire, explosion and other accidents

- Combustible materials should not be placed in the welding place. Splashes and hot welding seams may cause fire.

- The welding cable and the base metal must be connected tightly, otherwise it will generate heat and cause a fire.
- Do not weld in flammable gas or on containers containing flammable substances, otherwise it will cause an explosion.
- Do not weld airtight containers or they will rupture.
- A fire extinguisher should be prepared, just in case.



#### **Prevent injuries from rotating moving parts**

- Prevent injuries from rotating moving parts
- Do not place fingers, hair, clothes, etc. near rotating parts such as cooling fans and wire feed rollers.
- When feeding the welding wire, keep the end of the welding torch away from your eyes, face and body to prevent the welding wire from hurting people.



#### **Prevent the welding machine from hurting people during movement**

- When using a lift forklift or crane to transport the welding machine, personnel should not be under the welding machine or in front of the movement to prevent the welding machine from falling and being injured.
- When hoisting, the rope should be able to bear enough tension and not break. The included angle of the rope at the hook is less than 30°.

## **2. Electromagnetic Compatibility Considerations**

### **1. Overview**

Welding can cause electromagnetic interference. The interference emission of arc welding equipment can be minimized by adopting proper installation method and correct use method. The products described in this manual are Class A equipment (applicable to all occasions except residential areas powered by public low-voltage power systems).

**WARNING:** Class A equipment is not intended for use in residential dwellings powered by a public low voltage supply system. Electromagnetic compatibility is difficult to guarantee in these locations due to conducted and radiated disturbances.

## **2. Environmental assessment recommendations**

Before installing arc welding equipment, the user should evaluate potential electromagnetic disturbance problems in the surrounding environment. Consider the following:

- (1) Are there other power supply cables, control cables, signal and telephone lines etc., on and around the arc welding equipment.
- (2) Whether there are radio and television transmitting and receiving equipment.
- (3) Whether there is a computer and other control equipment.
- (4) Whether there is high security level equipment, such as industrial protective equipment.
- (5) Consider the health of the surrounding staff, such as those with or without hearing aids and those with pacemakers.
- (6) Whether there is any equipment for calibration or testing.
- (7) Pay attention to the immunity of other surrounding equipment. Users should ensure that other equipment in use around is compatible, which may require additional protection.
- (8) Time for welding or other activities.

The scope of the environment considered depends on the building structure and other possible activities. This range may extend beyond the boundaries of the building itself.

## **3. Ways to reduce emissions**

### **(1) Public power supply system**

Arc welding equipment shall be connected to the public power supply system in the manner recommended by the manufacturer. If interference occurs, additional precautions should be taken, such as inserting filters in the utility power system. For the fixed installation of arc welding equipment, the shielding of the power supply cable should be considered, which can be shielded by metal pipes or other equivalent methods. Shielding maintains electrical continuity. The shield should also be connected to the welding power supply shell to ensure good electrical contact between the two.

### **(2) Maintenance of arc welding equipment**

Arc welding equipment should be routinely maintained as recommended by the manufacturer. When the welder is running, all inlets, auxiliary doors and covers on the equipment should be closed and properly tightened. Arc welding equipment should not be modified in any form, unless the instructions allow for corresponding changes and adjustments. In particular, adjust and maintain the spark gap of the arc ignition and arc stabilization devices according to the manufacturer's recommendations.

### **(3) Welding cable**

Welding cables should be as short and close to each other as possible, and run close to and close to the ground.

### **(4) Equipotential bonding**

Be sure to pay attention to the overlap of all metal objects in the surrounding environment. Metal objects overlapping the workpiece will increase the risk of work, and the operator may receive electric shock

when touching these metal objects and electrodes at the same time. Operators should be insulated from all these metal objects.

#### (5) Grounding of the workpiece

Workpieces, such as ship hulls or construction steel frames, may not be grounded for reasons of electrical safety or workpiece location, size, etc. The connection of the workpiece to ground can sometimes reduce launch, but not always. Therefore, it is necessary to prevent the user from increasing the risk of electric shock or damage to other electrical equipment caused by the grounding of the workpiece. When necessary, the workpiece should be directly connected to the ground, but in some countries, direct grounding is not allowed, and it can only be achieved by selecting an appropriate capacitor according to the regulations of the host country.

#### (6) Shield

Selective shielding of surrounding equipment and other cables can reduce electromagnetic interference. Shielding of the entire welding area may be considered for special applications.

### 3. Usage and Features

The manufacture of this series of inverter DC arc welding machines complies with the standard IEC 60974-1 "Arc Welding Equipment Part 1: Welding Power Sources".

#### **Usages:**

Cruxweld ARC series inverter DC arc welding machines are widely used in petroleum, chemical industry, machinery, shipbuilding, construction, boiler, pressure vessel, military industry, industrial installation, aviation and other industries.

Cruxweld ARC series inverter DC arc welding power source is a general inverter DC manual arc welding machine. The welding machine adopts advanced IGBT power module and PWM automatic control inverter technology to convert power frequency into intermediate frequency, so that the welding machine can be compact. The intermediate frequency transformer replaces the bulky power frequency transformer in the traditional welding machine, improves the heat dissipation capacity of the power device, and makes the welding machine have the advantages of small size, light weight, low noise, low power consumption, and easy portability.

#### **Features:**

This series of welding machines have ideal static and external characteristics, good dynamic characteristics, and complete control functions. The main features are as follows:

- The machine has good electrical performance, such as constant current output, so that the output arc is stable.

- Fast dynamic response and automatic compensation for power grid fluctuations.
- Precise stepless current preset setting, digital display.
- The welding machine is equipped with functions such as thrust, arc length and anti-sticking of electrodes to meet various welding process requirements.
- The welding seam is beautifully formed, and it also has automatic protection functions such as overcurrent, overheating, overvoltage, and undervoltage. When the above fault occurs in the welding machine, it will display an alarm signal and automatically stop welding, which greatly improves the welding quality and production efficiency making the whole machine easier to master.
- In particular, a variety of electrodes such as alkaline, acid, and cellulose can be used to achieve high-quality welding.

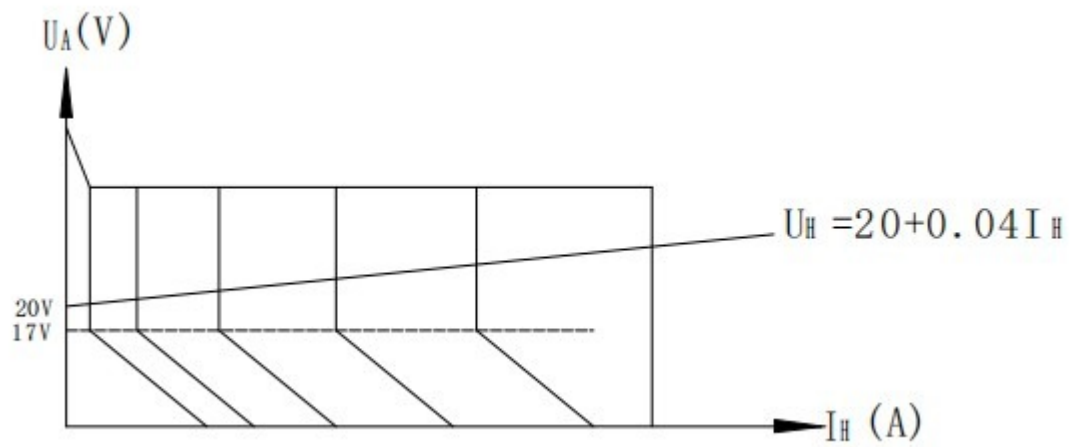
## 4. Working Principle

This series of arc welding machines is a new generation of digital inverter manual welding machines.

Using IGBT technology, capacitor voltage doubler, dual power supply three-phase 415V 50HZ, double closed-loop feedback control circuit, through rectification and filtering, high frequency inverter output suitable welding direct current.

Improve the dynamic response speed of the welding machine, greatly reduce the volume and weight of the transformer are reduced, and the energy saving and consumption reduction of the whole machine are realized.

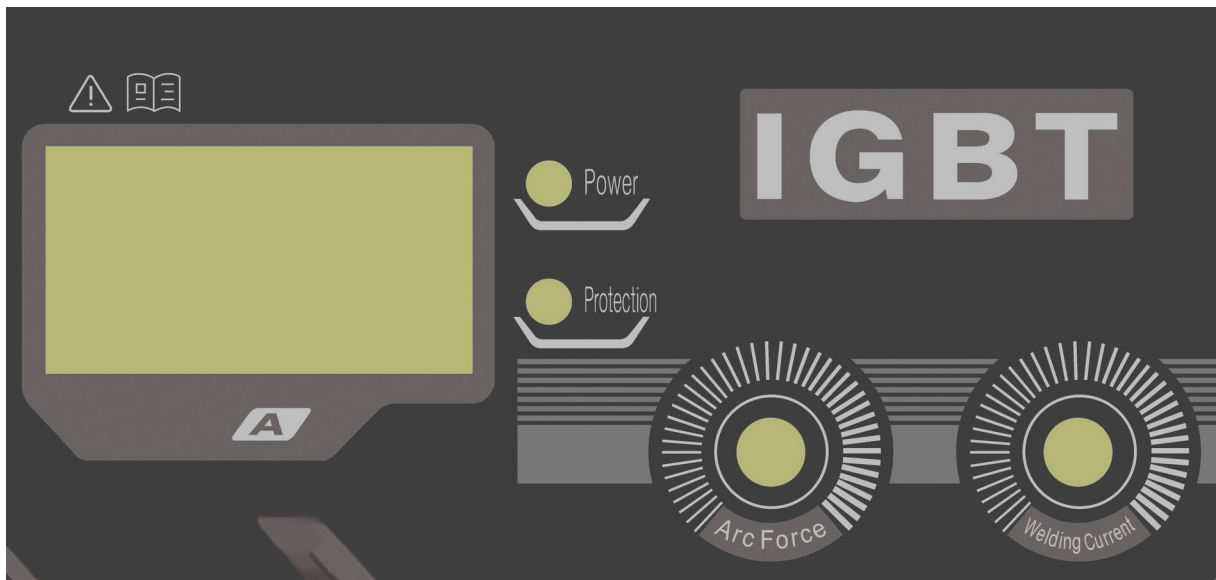
**The output characteristic of the machine:**



Static and external characteristics of welding power output

## 5. Function Introduction

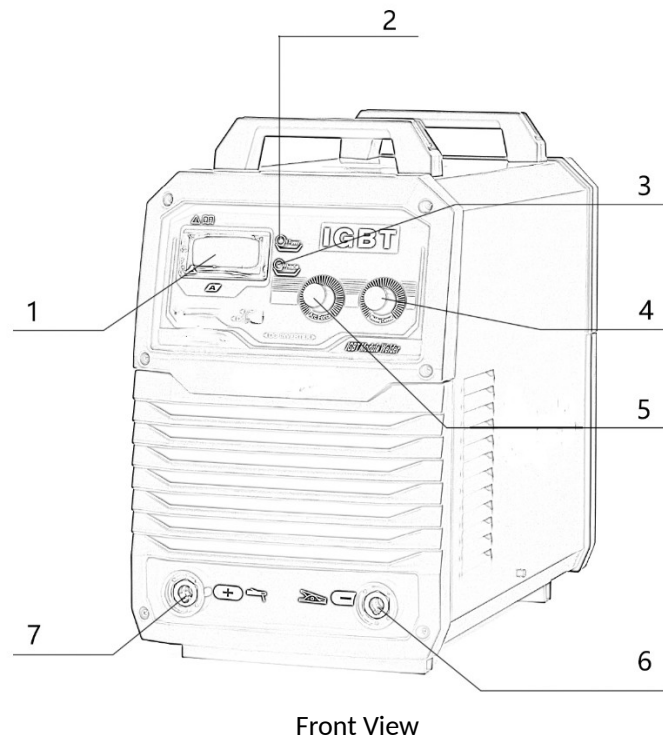
### 1. Front panel



### 2. Introduction of function icons

#### 1.1 Welding machine front panel

The front panel of arc welding power source is shown in the figure below:



**(1) Current display (A)**

Displays the current given value when there is no load.

**(2) Power indicator**

When the input power is 415V, the 415V indicator is on.

**(3) Protection indicator light**

When the temperature in the welding machine is too high, the temperature control switch will act and the welding machine will stop working. The protection light is on.

**(4) Welding current adjustment knob**

Adjust the welding current.

**(5) Arc Force knob**

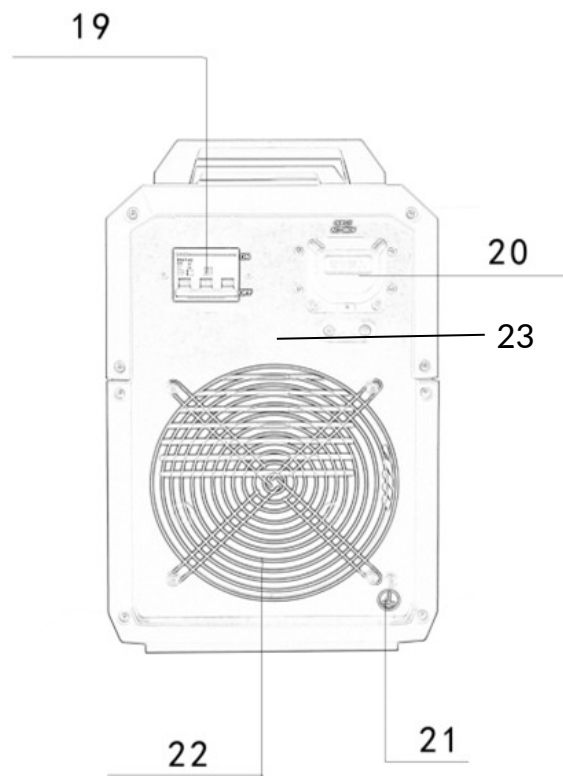
Adjust arc force current.

**(6)Welder output "-"**

Connect the output negative pole of the welding machine and the workpiece to be welded through the grounding cable.

**(7)Welder output "+"**

Connect with electrode holder.



Back View

**(19) Air switch**

The three-phase power supply supplies power to the welding machine through this switch, and its main function is to automatically cut off the power when the welding machine is overloaded or fails to protect the welding machine. In general, this switch is pushed up to the ON position, the power switch on the user's switchboard (cabinet) should be used to start and stop the welding machine, and this switch should not be used as a power switch.

**(20) Input cable junction box**

Used to access three-phase 415V AC cables.

**(21) Grounding bolt**

In order to ensure personal safety and normal use of the equipment, be sure to use the wires for reliable grounding.

**(22) Fan**

It is used to cool the heating device in the welding machine.

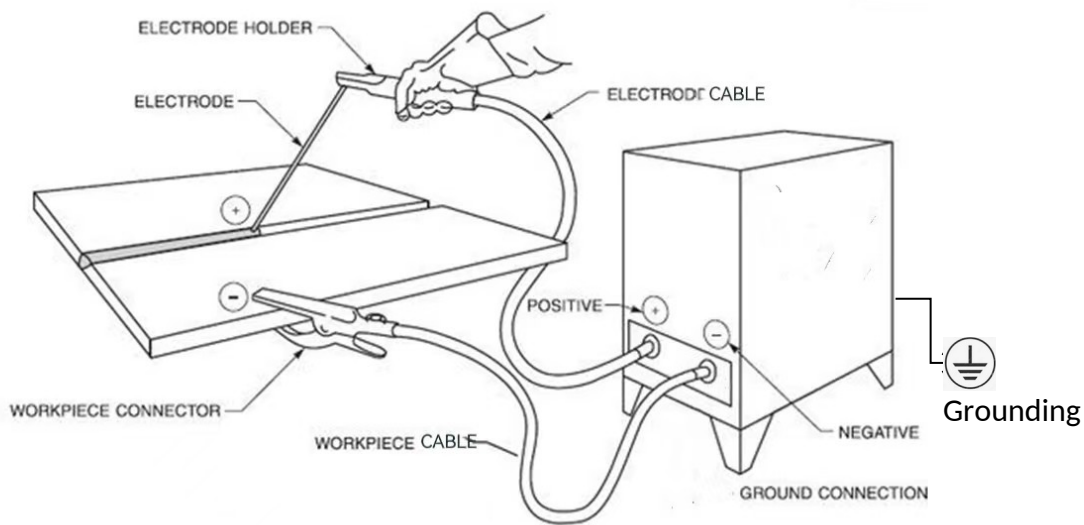
Note: The fan does not run after the power is turned on, and the fan starts to run when welding; the fan will automatically stop running after 5 minutes of stopping welding.

**(23) Blanking plate**

Used to fix three-phase 415V AC cables.

## 6. Installation

### 1.Installation:



External Wiring Diagram

(1) Connect the three-phase 415V/50Hz AC power to the input cable junction box on the rear panel of the welding machine through the air switch, and ensure the welding machine is reliably grounded.

(2) Use the electrode holder to connect the output positive pole of the welding machine.

(3) Connect the output negative pole of the welding machine and the workpiece to be welded with a grounding cable.

**Note:** When connecting the welding cable, cut off the power first and connect the boss on the plug to the socket.

The notch on the seat is aligned, after inserting, tighten it clockwise until it stops until it moves. Be sure to ensure good contact between the plug and the socket, otherwise, it is easy to produce high heat burns out plugs and sockets. Remember!

### 1. Installation environment

(1) It should be placed in a room without direct sunlight, rainproof, low humidity and less dust, the

ambient air temperature range is -10°C~ +40°C.

- (2) The slope of the ground should not exceed 10°.
- (3) There should be no wind in the welding station, and if so, it should be shielded.
- (4) The distance between welding machines is more than 20cm from the wall, and the distance between welding machines is more than 10cm.

## 2. Supply voltage quality

- (1) The waveform should be a standard sine wave with an effective value of 415V  $\pm$  15% and frequency of 50Hz/60Hz.
- (2) The unbalance of three-phase voltage is less than or equal to 5%.

## 7. Operation

- (1) Turn on the power and turn on the machine air switch
- (2) Preset thrust current.
- (3) Preset welding current.
- (4) Welding.

**Note: Users can refer to the welding specifications in Table when using electrode arc welding.**

Welding Procedure Specification for Electrode Arc Welding (Reference)

| Workpiece thickness<br>( mm) | < 1    | 2      | 3       | 4~ 5    | 6~ 12    | ≥13      |
|------------------------------|--------|--------|---------|---------|----------|----------|
| Electrode<br>diameter( mm)   | 1.5    | 2      | 3.2     | 3.2~ 4  | 4~ 5     | 5~ 6     |
| Welding current( A)          | 20~ 40 | 40~ 50 | 90~ 120 | 90~ 120 | 160~ 250 | 250~ 400 |

## 8. Technical Data

|                      |                      |
|----------------------|----------------------|
| Model                | ARC400iS             |
| Input voltage        | 3 ph 415V $\pm 20\%$ |
| Rated input capacity | 14 kVA               |
| Rated input current  | 19.5A                |
| Non-load voltage     | 85V                  |
| Duty cycle           | 60%                  |
| Current range        | 20-400A              |
| Electrode diameter   | 2.5-5.0mm            |
| Efficiency           | 85%                  |
| Insulation class     | H                    |
| Weight               | 28kg                 |

## 1. Graphic symbols and technical data

$U_0$ .....V This symbol shows the secondary no-load voltage (in volts).

X This symbol shows the rated duty cycle.

$I_2$ .....A This symbol shows the welding current in AMPS.

$U_2$ .....V This symbol shows the welding voltage in VOLTS.

$U_1$  This symbol shows the rated supply voltage.

$I_{1max}$ ·A This symbol shows the welding unit's maximum absorbed current in AMP.

$I_{1eff}$ ·A This symbol shows the welding unit's maximum absorbed current in AMP.

IP23S This symbol shows the welding unit's protection class.



This symbol shows that the welding unit is suitable for use in environments where there is a high risk of electric shocks.



This symbol shows read the operating instructions carefully before operation.



This symbol shows the welding unit is a single phased D.C. welder.



This symbol shows the supply power phase and line frequency in Hertz.



This symbol shows the welding unit is an MMA welder.

## 9. Maintenance and Troubleshooting

The maintenance of the welding machine should be the responsibility of professionals. When the user encounters problems that cannot be solved, they should contact Cruxweld service in time.

**Note: The maximum voltage inside the machine is 600V. In order to ensure safety, it is strictly forbidden to open the casing at will, the air switch should be cut off during maintenance, and safety protection work such as preventing electric shock should be done.**

### 1. Precautions for use

(1) The equipment number plate should be riveted at the specified place on the upper cover of the casing, otherwise it will be damaged internal components.

(2) The connection between the welding cable and the welding machine should be tight and reliable. Otherwise, it will burn out the head and cause instability during welding.

(3) To avoid damage and disconnection of welding cables and control cables, and prevent the welding machine from outputting short circuit.

(4) To prevent the welding machine from being deformed by impact, do not stack heavy objects on the welding machine.

(5) Ensure smooth ventilation.

(6) When working with high current for a long time at high temperature, the welding machine may stop working.

The thermal protection indicator is on. At this point, let it run for a few minutes without load, and it will automatically recover return to normal.

(7) When working with high current for a long time at high temperature, the air switch on the rear panel trips brake. At this time, the power switch on the power distribution cabinet should be turned off, and then turn on again after five minutes.

When starting up, first close the air switch on the welding machine, and then use the air switch on the power distribution cabinet.

Turn on the power switch, and let the welding machine run without load for a period of time before using it.

(8) After welding, the power supply should be cut off.

## 2. Regular inspection and maintenance of welding machine

- (1) Clean the welder with compressed air every 3 to 6 months by professional maintenance personnel. Dust once, and pay attention to check whether there are loose fasteners in the machine.
- (2) Always check whether the control cable is damaged, whether the adjustment knob is loose, whether the components on the panel are damaged.
- (3) The output cable should be checked regularly, if it is found that the connector is loose or the plug is changed. It should be dealt with in time, otherwise, the plug socket will be burnt.

## 3. Welding machine faults and troubleshooting, do the following checks before overhauling the welding machine:

- (1) Whether the panel switch and potentiometer position are appropriate.
- (2) Whether the line voltage of the three-phase power supply is within the range of 350~480V, and whether there is any defect Mutually.
- (3) Check whether the wiring of the power input cable is correct and reliable.
- (4) Whether the welding cable is connected correctly and the contact is good.

## 4. Common faults and troubleshooting methods, see Table:

| No | Phenomenon                                                                             | Cause                                                                                                               | Methods                                                                                                                    |
|----|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1  | The welding machine is powered on and the air switch is tripped                        | ① Three-phase rectifier bridge damaged<br>② Three-phase rectifier bridge parallel capacitor damage<br>③ IGBT damage | ① Replace the rectifier bridge<br>② Replace the capacitor<br>③ Replace IGBT                                                |
| 2  | The power-on indicator is off, and there is no preset current indication               | ① Welding machine power supply fuse is blown<br>② lack of phase<br>③ Damaged control board                          | ① Replace the fuse<br>② Check input power<br>③ Replace the control board                                                   |
| 3  | The power-on indicator is on, but there is no preset current indication                | ① Damaged control board<br>② Ammeter damaged                                                                        | ① Replace the control board<br>② Replace ammeter                                                                           |
| 4  | The welding machine has no no-load voltage, and there is abnormal noise in the machine | ① The fast recovery diode of the main circuit of the welding machine is damaged                                     | ① Replacing fast recovery diodes                                                                                           |
| 5  | No-load is normal after starting up, but there is arc break during welding             | ① Three-phase power supply voltage is too low or phase loss                                                         | ① Check the power supply                                                                                                   |
| 6  | There is no welding current suddenly during welding                                    | ① Poor contact between welding cable and workpiece<br>② Power control fuse blown                                    | ① Check welding cables<br>② Replace the fuse                                                                               |
| 7  | The welding machine has no action, and the overheating indicator light is on           | ① Cooling fan damaged<br>② Overload use<br>③ Damaged control board                                                  | ① Replace cooling fan<br>② Stop welding and let the welder run without load for ten minutes<br>③ Replace the control board |