



**IN ARC-IC Series
Inverter Arc Welding Machines**

Operating Manual

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Safety Precautions

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH.

KEEP CHILDREN AWAY FROM ALL WELDING ACTIVITIES. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING NEW TECHNOLOGY WELDING MACHINES AND EQUIPMENT.

BE SURE THAT ONLY QUALIFIED INDIVIDUALS PERFORM ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURE.



For Engine Powered equipments

- 1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.
- 1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.
- 1.c. 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.
- 1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.
- 1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- 1.f. 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.
- 1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS may be dangerous

- 2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields(EMF). Welding current creates EMF fields around welding cables and welding machines.
- 2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- 2.c. Exposure to EMF fields in welding may have other health effects which are now not known.
- 2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
- 2.d.1. Route the electrode and work cables together-Secure them with tape when possible.
- 2.d.2. Never coil electrode lead around your body.
- 2.d.3. Do not place your body between your electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
- 2.d.4. Connect the work cable to the work piece as close as possible to the area being welded.
- 2.d.5. Do not work next to welding power source.



ELECTRIC SHOCK can kill

- 3.a. 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.
- 3.b. 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.
- In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or wearing wet clothing; on metal

structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the work piece or ground) use the following equipment:

Semiautomatic DC Constant Voltage (Wire) Welder

DC Manual (Stick) Welder

AC Welder with Reduced voltage control

- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.
- 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
- 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- 3.g. Never dip the electrode in water for cooling.
- 3.h. 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.
- 3.i. When working above floor level, use a safety belt to protect yourself from a fall



ARC RAYS can burn.

- 4.a. 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. Head shield and filter lens should conform to ANSI Z87.1 standard.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. 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 material.

**FUMES AND GASES can be dangerous**

- 5.a. 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 (see instructions on container or on lead or cadmium and plated steel and other materials or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values (TLV) 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.
- 5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.
- 5.c. 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.
- 5.d. 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.
- 5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used.
- 5.f. Also see item 1.b.

**WELDING AND CUTTING SPARKS can cause fire or explosion.**

- 6.a. Remove fire hazardous 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.

- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations.
- 6.c. 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.
- 6.d. 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”.
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, 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.
- 6.g. 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 cable until they fail.
- 6.h. Also see item 1.c.
- 6.i. Do not use a welding power source for pipe thawing.



CYLINDER may explode if damaged.

- 7.a. 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.
- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. 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.

- 7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should be always be in place and hand tight expect when the cylinder is in use or connected for use.



FOR ELECTRICALLY powered equipment

- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local cedes and the manufacturer’s recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer’s recommendations.

Principle & Technical data

INARC-IC series Block diagram of principle

Input 3-phase 415V/50Hz

Output

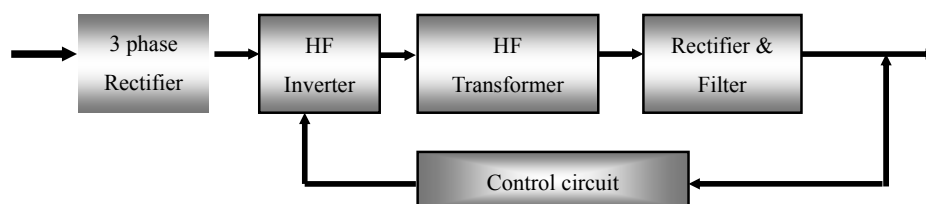


Figure 1: Block diagram of principle

This series welding machines apply IGBT soft switch inverter technology. 3- phase 415V input volt are rectified by rectifier, inverted into HF AC, reduced by HF transformer, rectified and filtered by HF rectifier, then output DC power suitable for welding. After this process, the welder's dynamical responsive speed has been greatly increased, so the welder size and weight are reduced noticeably result in energy saving. Power source enjoy sound anti-fluctuating ability and high-quality performance during external context changes (As to fluctuation in input power supply and extended welding cables). Easy to arc start, stable arc length, pretty weld formation and capability of continuous regulation of welding current and arc force current. Inverter DC arc welding machines output characteristic curve is as follows:

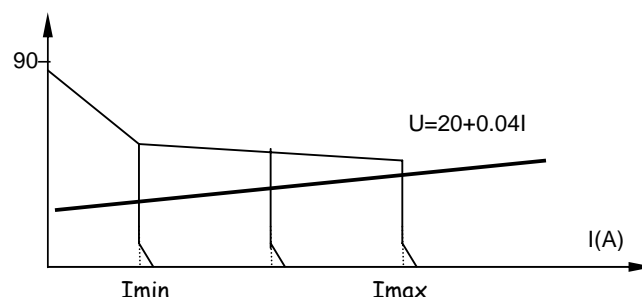


Figure 2: Volt-Ampere curve

1. Main technical parameters

Description	Parameters	
	400	500
Rated input voltage	3 phase 415V±10%/50Hz	
Rated output capacity	14.4KW	20KW
Rated input current	25A	35A
Rated duty cycle	60%	
Range of output current	20 ~ 400A	20 ~ 500A
Rated open load voltage	70V	82V
Full-load efficiency	89%	
Power factor (full-load)	0.95	
Welding electrode diameter	2 ~ 6mm	2 ~ 6mm
Weight	29Kg	30Kg
Dimension	501×232×495 mm	
Insulation grade	H/B	

Table1: Parameter Specification

2. Main circuit diagram

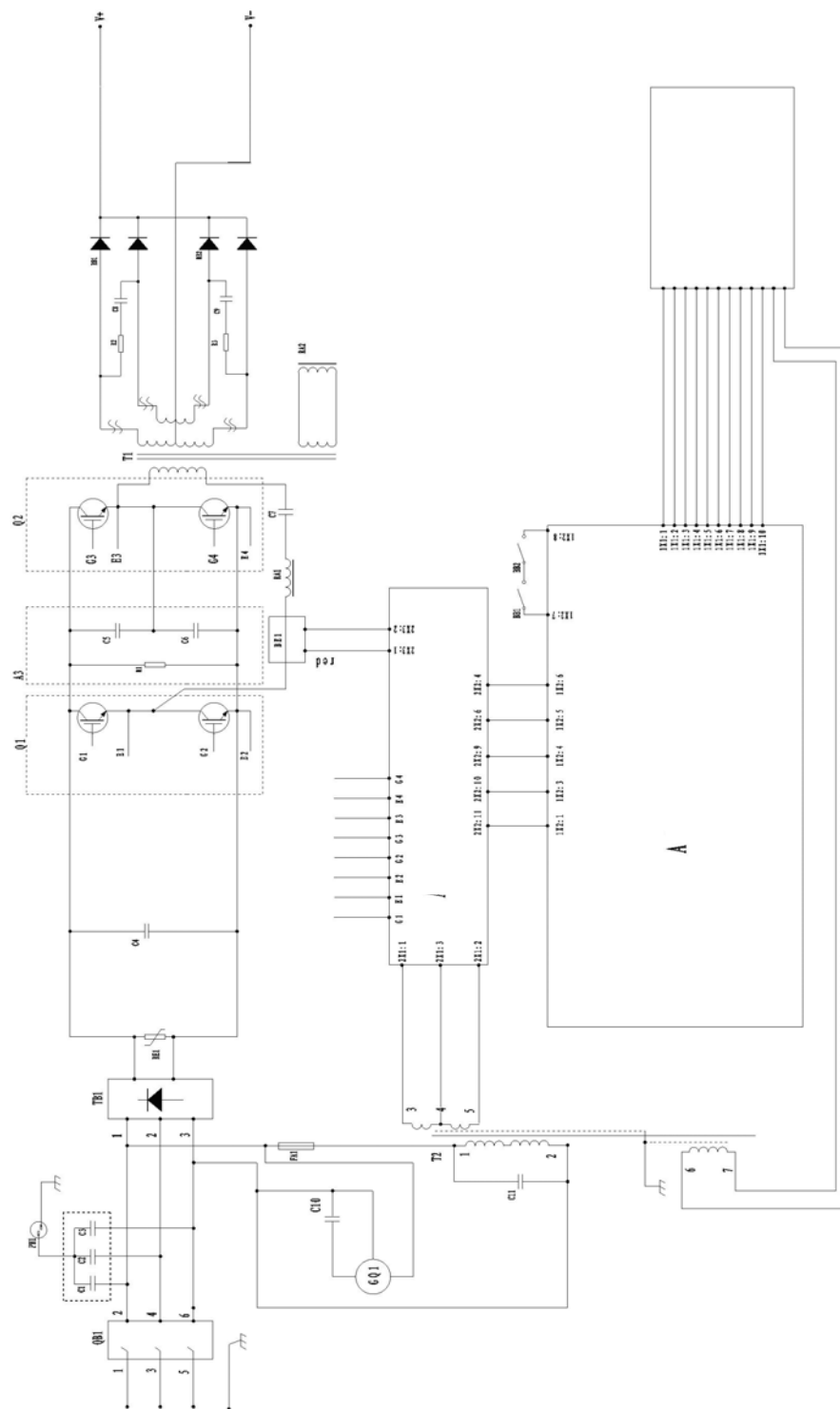


Figure 3: Main Circuit Diagram

3. Components List

● INARC-400IC

No.	Tab	Item	Stock No.	Quantity
1	QB1	Circuit breaker	745011-00049	1
2	C1 ~ C3	Polypropylene capacitor	722001-00023	3
3	Q1、 Q2	IGBT module	735007-00046	2
4	TB1	3-phase rectifier module (small)	735005-00009	1
5	RE1	Varistor	720021-00017	1
6	C4	Polypropylene capacitor	722001-00070	1
7	A3	IGBT protection board	220005-00056	1
8	BE1	Power Inductor	220149-00070	1
9	RA1	Resonance Inductor	220521-00037	1
10	C7	Polypropylene capacitor	722001-00073	1
11	T1	Main transformer	220629-00090	1
12	RA2	Current exchange inductor	220281-00021	1
13	RB1、 RB2	Fast recovery diode module	735006-00027	2
14	GQ1	Fan	746001-00014	1
15	FA1	Fuse	745007-00012	1
16	T2	Transformer for ZKB/QDB	763001-00155	1
17	A1	Main control board	210580-00362	1
18	A2	Drive board	210310-00069	1
19	BB1	Thermal	745008-00006	1
20	BB2	Thermal	745008-00008	1
21		Digital displayer	755001-00003	1
22		Potentiometer	720031-00030	1
23		Potentiometer	720031-00042	2

Table 2: Components List for INARC-400IC

Features & Applications

This series machines are SMAW machines with different specifications of rated current: 315A, 400A, 500A, which are novelty high-efficient and energy-saving DC Arc welders, not only are used in carbon steel and low alloy steel welding, but also used in stainless steel, high alloy steel, copper, silver, molybdenum and titanium welding.

Features and Benefits:

- High duty cycle. Small size, light weight.
- Welding current can be adjustable in very wide range.
- Low welding spatter.
- Easy to arc-starting and molten pool control
- Digital display for accurate parameter preset.
- Soft switch technology, high efficiency.

Applications:

- Shipbuilding and offshore engineering
- Maintenance and repair
- Industry plant construction
- Pipeline industry

Installation Guide

1 . Pre-installation

1.1 Installation Environment

The INARC-IC series is designed for use in adverse environments. Examples of environments with increased adverse conditions are:

- In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts;
- In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator;

- In wet or damp hot locations where humidity or perspiration considerably reduces the skin resistance of the human body and the insulation properties of accessories.
- Environments with adverse conditions do not include places where electrically conductive parts, in the near vicinity of the operator, which can cause increased hazard, have been insulated.
- The gradient of ground must be no more than 10°
- Ensure no wind at the welding position, or use screen to block the wind.
- When using water-cooled torch, must be care of not being frozen.
- Welding power sources with degree of protection IP21S may be stored, but are not intended to be used outside during precipitation unless sheltered.

1.2. Installation Location

Be sure to locate the welder according to the following guidelines:

- In areas, free from moisture and dust.
- Ambient temperature between 0 degrees C to 40 degrees C.
- In areas, free from oil, steam and corrosive gases.
- In areas, not subjected to abnormal vibration or shock.
- In areas, not exposed to direct sunlight or rain.
- Place at a distance of 12" (304.79mm) or more from walls or similar boundaries that could restrict natural airflow for cooling.

1.3 Power Source Connections

Warning

Thermal Arc advises that this equipment be electrically connected by a qualified electrician.

ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE is present after removal of input power.

DO NOT TOUCH live electrical parts.

- SHUT DOWN welding power source, disconnect input power employing lockout/tagging procedures.

- Lockout/tagging procedures consist of padlocking line disconnect switch in open position.
- Removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1.4 . Power Supply Requirements

- Input volt must be standard sine wave, effective value 415V, 50Hz.
- Unbalance degree of 3- phase volt must be no more than 5%.
- Power supply:

Product model		INARC 400 IC	INARC 500 IC
Power supply		3 phase AC 415V	
Min. power capacity		28KVA	38KVA
Input protection	Fuse	50A	63A
	Breaker	63A	100A
Min. Cable size	Input side	2.5mm ²	4mm ²
	Output side	50mm ²	70mm ²
	Earth lead	2.5mm ²	4mm ²

Table 3: Power supply connection

Note: The size of fuse and breaker in the table are for reference only.

2. Installation

The machines are portably designed, can be effortlessly moved by operators without fix-up. But it should be settled in even and dry places with well ventilation.

- (1) Ensure the welding cable be connected to the power source firmly.
- (2) Adjust every knobs, and switches on the front panel to proper position in line with selected mode.
- (3) Turn on the circuit breaker on the power source.
- (4) Connect input 3 phase primary power cable to switch box.

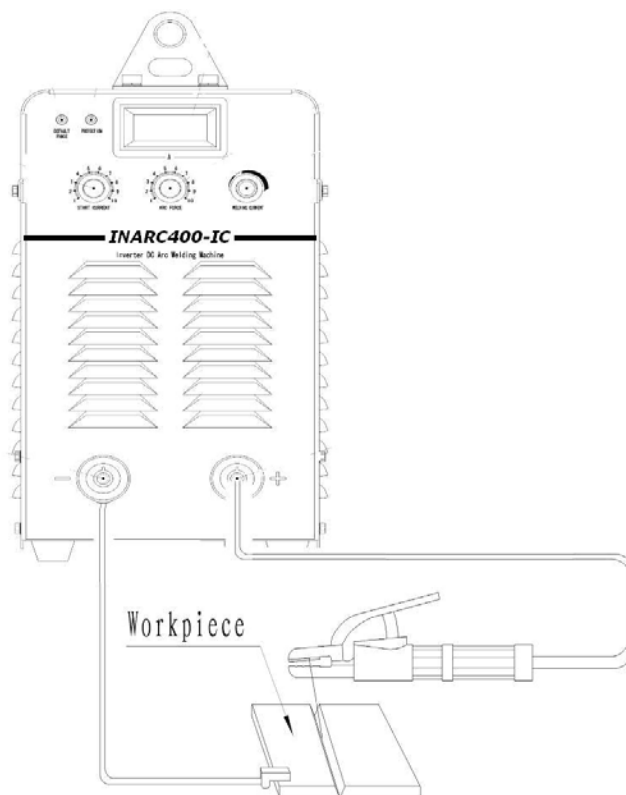


Figure 4: Outside connection diagram of INARC-400IC

Attention: Before you plug the welding cable, please turn off the power and rightly calibrate the plug key to the socket slot at first, then insert and turn the plug clockwise until it firmly seated. Make sure the plug and the socket are well-connected to be sound conductivity in case that they are burnt out by over resistance heat.

Operating Instruction

1. Functional introduction

1.1 Front panel illustration and parts number reference

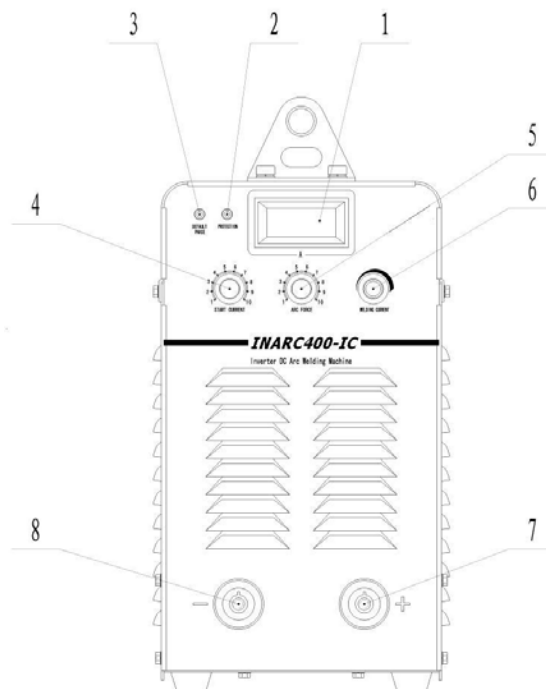


Figure 5: Front Panel

(1) Amp LCD

(2) Protection on LED

Welding machine will automatically stop working when it is overheat, and the LED will be light up.

(3) Default Phase on LED

It indicates whether the input voltage is phase missing, if default phase, the LED will be light up.

(4) Arc-starting current regulation knob

Used to adjust the arc-starting current

(5) Arc force current regulation knob

Used to adjust arc force current

(6) Welding current regulation knob

Used to adjust welding current on panel

(7) Welding cable (+) quick socket

Connect to electrode holder.

(8) Welding cable (-) quick socket

Connect to work piece.

1.2 The rear panel and parts number reference

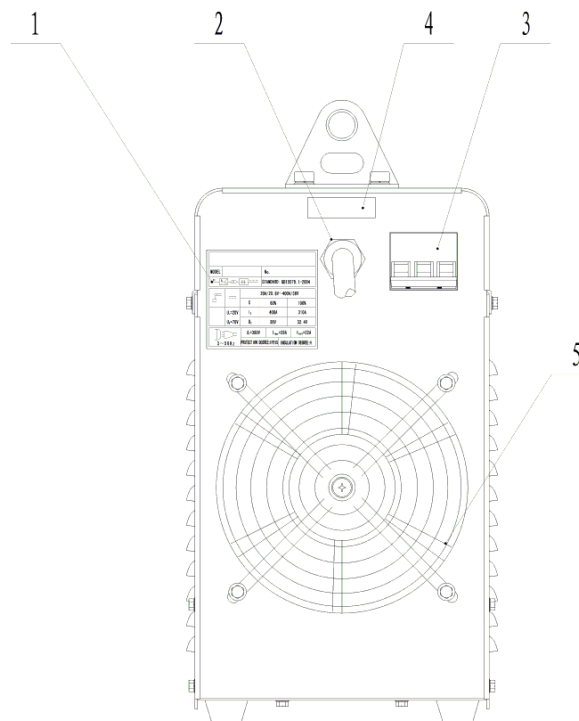


Figure 6: Rear panel

(1) Specification plate

(2) Input power cable

It is 4-pin cable. The mixed-colored wire must be firmly grounded, the rest wires connect to corresponding 3-phase power supply.

(3) Circuit breaker

The function of circuit breaker is to protect welding machine by automatic trip to turn-off power supply while in machine overload or failure. Normally, the switch flipped to upward means power-on. Use switch on the switch box to start or stop welding machine.

Don't use this air switch as power switch.

(4) Input warning mark

(5) Cooling fan

2. Operating instruction

Turn on the air switch on the switch box, the “Normal” indication lamp will light on and cooling fan rotates. Before welding normally, set up parameters by adjusting knobs and switches on the front panel according to the selected mode. Customer should refer to parameters defined in table 4 showing below:

Work piece thickness(mm)	< 1	2	3	4 ~ 5	6 ~ 12	≥13
Electrode diameter (mm)	1.5	2	3.2	3.2 ~ 4	4 ~ 5	5 ~ 6
Welding current (A)	20 ~ 40	40 ~ 50	90 ~ 110	90 ~ 130	160 ~ 250	250 ~ 400

Table 4: SMAW welding parameters

Repair & Maintenance

WARNING: Have a qualified electrician do the maintenance and trouble shooting work. Turn the input power off, using the disconnect switch at the fuse box before working inside the machine.

1. Cautions:

- Rivet equipment name tag on the specified area of the case, otherwise the inside parts will possibly be damaged.
- Connect welding cable to terminals firmly, otherwise the terminals will be burn out which will cause the instability of welding process.
- Avoid welding cable and control cable being broken, and prevent welding machine from being short circuit.
- Never let welding machine be bumped into or stacked up by heavy objects.
- Ensure good ventilation
- Under high temperature, if work with large current for long period, welder may shut down automatically due to thermal protection acts. At this point, let the machine runs under open-load for a few minutes, and it will be automatically recover.
- Under high temperature, if work with large current for long period, welder may shut down automatically due to air switcher trips. Cut off the power supply to the electricity switchboard on frame, and wait for 5 minutes to turn on the circuit breaker on the power source fist then connect the power supply to the electricity switchboard on frame. And leave the machine runs under open-load condition for a while.
- After welding, cut off power supply.

2. General maintenance

- Remove dust from power resource with pressure air by qualified individuals every 3-6 months. Check if the jointers are loose.
- Check regularly if cables are worn out, knobs are loose, and components of panel are damaged.
- Check regularly if cables are tightly connected to cable connecting terminals in case of terminals being burnt out.

3. Procedure for regular checking prior to maintenance

- Check if all front panel switches are on the proper positions.
- Check if the input volt has the phase missing and range are in $415V \pm 10\%$.
- Check if the input cable is connected correctly and firmly with the power source.
- Check if the welding cables are connected correctly and firmly.

WARNING: Have a qualified electrician do the maintenance and trouble shooting work. Turn the input power off, using the disconnect switch at the fuse box before working inside the machine. Don't open up case uninstructed, the max volt inside machine is 600V. Never discharge high voltage to welder case with welding torch! Shut down power source before changing or repairing welding cable or torch

№	TROUBLE	CAUSES	WHAT TO DO
1	After power on, the machine does not work.	(1) Phase missing in power source (2) Fuse(2A)in welder is broken. (3) Cable is broken	(1) Check power source (2) Check if cooling fan, transformer for ZKB/QDB and main control board are good or not. (3) Check connection
2	Circuit breaker on back panel trips while the machine is working normally.	(1) The following components may be damaged: IGBT module, 3-phase rectify module, outputting diode module, or other components (2) Drive board is damaged. (3) Short circuit between lines.	(1) Check and replace. (2) When IGBT module is damaged.
3	Welding current is unstable.	(1) Phase missing (2) The following components may be damaged: Potentiometers, switches on front panel. (3) Main control board is damaged	(1) Check power source. (2) Check and replace.
4	Welding current is not adjustable.	(1) Potentiometer of welding current adjustment is damaged. (2) Main control board is damaged.	Check and replace.

Table 5::Trouble Shooting Table

Appendix A**1. General**

The user is responsible for installing and using the arc welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected, then it shall be the responsibility of the user of the arc welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the welding circuit, see note. In other cases it could involve constructing an electromagnetic screen enclosing the welding power source and the work complete with associated input filters. In all cases electromagnetic disturbances shall be reduced to the point, where they are no longer troublesome.

NOTE: The welding circuit may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury.

2. Assessment of area

Before installing arc welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- 1) Other supply cables, control cables, signaling and telephone cables, above, below and adjacent to the arc welding equipment;
- 2) Radio and television transmitters and receivers;
- 3) Computer and other control equipment;
- 4) Safety critical equipment, for example guarding of industrial equipment;
- 5) The health of the people around, for example the use of pacemakers and hearing aids;
- 6) Equipment used for calibration or measurement;
- 7) The immunity of other equipment in the environment is compatible. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- 8) The time of day that welding or other activities are to be carried out.

3. Methods of reducing emissions

1) Public supply system

Arc welding equipment should be connected to the public supply system according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the public supply system. Consideration should be given to shielding the supply cable of permanently installed arc welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

2) Maintenance of the arc welding equipment

The arc welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the arc welding equipment is in operation. The arc welding equipment should not be modified in any way, except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

3) Welding cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

4) Equipotent bonding

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive an electric shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

5) Earthling of the work piece

Where the work piece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example ships hull or building steelwork, a connection bonding the work piece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthling of the work piece increasing the risk of injury to

users, or damage to other electrical equipment. Where necessary, the connection of the work piece to earth should be made by a direct connection to the work piece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

6) Screening and shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications.