

IGBT Inverter Plasma Cutter



MODELS

CUT-40 & CUT-60

Operation Manual



Please carefully read this manual before installing, operating and maintaining the machine



Description: This machine is used to cut ferrous or nonferrous metals.

Disclaimer: The information, illustrations and instructions described in this manual are based on the latest product information available at the time of publication. The manufacturer and distributors reserve the right to modify the contents of this manual at any time. Modifications may result following product modifications and the manufacturer and distributors are not obliged to notify any organization or individual of such modifications. Cutting work must be executed only by professionally trained and qualified individuals. Therefore, the manufacturer and distributors will only accept responsibility for product quality. No liability, joint or several, shall be accepted for incidents including but not limited to loss of profit resulting from omissions or misdirection that may be printed in this operation manual. This manual will contain as far as possible preventive and safe operation measures related to the equipment but cannot exclude the occurrence of accidents. Therefore, the manufacturer and distributors shall not be liable for any direct or indirect, joint or several liability for any incidental or consequential damages which may occur. For detailed health and safety information, the relevant professional agencies and manufacturers of consumables such as welding materials and flux should be contacted.

Warranty Exclusions:

- ✓ Consumable items such as cutting nozzles, electrodes and current dividers.
- ✓ Machine damages caused by incorrect voltage input or power surges.
- ✓ Machine or parts malfunction owing to incorrect connections or user operation.
- ✓ Illegal disassembly or re-fitment of the machine without permission of the manufacturer, resulting in damage or malfunction.
- ✓ Accidental damage during shipment, transportation and storage.
- ✓ Damage owing to incorrect handling, natural disaster and other force majeure occurrences.

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Safety Precautions

The equipment is designed for use by qualified personnel who have completed professional training and have obtained a qualification certificate as a welder/cutter. The operator shall have sufficient professional knowledge of welding, cutting and circuitry. The machine should be operated only after having read and fully understood all the safety precautions and warnings contained in this manual and those generally applicable to welding operations. The risk of personal injury and damage to equipment is reduced by safety precautions being followed when using tools and equipment. This machine is easy to operate and the selection of its functions is straight forward. Improper use and maintenance will reduce the safe operation of the machine and the following safety precautions must be followed:

1. The operator must be suitably qualified and certificated before operating the equipment.
2. A qualified professional should be employed to ensure that the machine and all cables are properly connected, grounded and installed.
3. Personal protective equipment approved by the local safety authority must be used. All relevant safety procedures must be adhered to.
4. Before operation, insulation layers on wires and cables as well as connection sequences should be inspected and corrected if required.
5. Repairs and maintenance should be carried out by qualified technicians only after the machine has been disconnected from the electricity supply.
6. Operating the machine in a humid environment may result in a short circuit or may cause an electric shock to the operator.
7. Modifications to the machine or equipment are not allowed.
8. The disposal of scrap machine parts and equipment must comply with local regulations.

Warnings

Welding and cutting operations are specialised operations which present a certain degree of risk. Professional training, correct operating procedures and protective measures reduce the accident risk and damage to equipment.

Personal Safety Protection



Welding and cutting operations generate noise, bright light and high-temperature sparks which will cause harm to human hearing, eyes and skin unless personal protective measures are implemented and proper operational instructions are adhered to.

1

Wear flame retardant personal protective equipment (PPE) such as gloves, overalls, shoes and aprons to protect against thermal radiation, sparks and hot metal particles.

2

Hot sparks and metal fragments can cause skin damage. Avoid clothes with front pockets and button-up sleeves and collars.

3

Use appropriate flame-retardant shields or curtains to protect bystanders from arc radiation and high temperature sparks. Bystanders also need to wear a protective helmet/spectacle with a shading filter to protect the face and eyes.

4

Avoid burns and scalds by not touching a welded work piece with bare hands.

Fire and Explosion Hazards



Welding and cutting operations generate high-temperature flames and arc which can cause fires and explosions. The same applies to welding slag and sparks.

1

Operators and bystanders must be protected from arc, sparks and metal fragments.

2


The welding/cutting area should be free from flammable and explosive materials. Should these materials be required in the welding/cutting process, flame retardant covers should be applied.

3

Care should be taken to avoid fire hazards from cracked floors and walls.


4	Welding and cutting on sealed gas tanks will cause explosions. These operations are prohibited.
5	Welding and cutting areas must be provided with adequate fire extinguishing equipment. Regular testing for efficiency of this equipment is compulsory as is training of staff in the use of the equipment.
6	Once the welding/cutting operation is completed, check for any high temperature spark or metal which might cause a fire and immediately dispose of it. If necessary, employ the assistance of a firefighter.

Electricity Hazards

	<p>Electric shock can cause serious injury or even death to the individual when contact is made with live wires. Humid conditions can add to the risk and great care should be taken when welding or cutting machines are used in these conditions.</p>
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1	Reliable grounding of machine and work piece as well as a secure ground clamp, is important.
2	Insulation layers of electric wires and cables must be checked regularly for wear and replaced if necessary.
3	All equipment used and clothing worn during the welding/cutting operation should be free from moist and kept dry.
4	Do not make direct body contact with any live electrical parts.
5	Wearing rubber-insulated shoes and standing on an insulated platform greatly reduce the risk of accidental shock.
6	Refrain from replacing the ground cable on the machine with wires not suitable for the task.
7	The machine operates on high voltage and capacitors remain charged even after power is switched off. Removing covers for maintenance procedures must only be executed by qualified professionals.

Effects of Electromagnetic Fields

	<p>Electric current flowing through a conductor produces magnetic fields (EMF). The discussion on the topic of the effects of EMF on the human body is ongoing worldwide and up to the present no evidence has been forthcoming proving negative effects on health. However, it would be wise to limit exposure to EMF as far as</p>
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possible and the following procedures are suggested:

1	Welders and cutters with cardiac pacemaker implants should obtain medical advice on the effects of EMF on the implant.
2	Cutters should minimise the possibility of electromagnetic field damage through the following methods.
2.1	Route the electrode and ground cables together and, where possible, secure them with tape.
2.2	Do not wrap wires and cables around arms or coil power cables around body parts. If possible, keep cables away from the body.
2.3	Keep the distance between the ground clamp to the workpiece and the electrode as short as possible.
2.4	Keep a safe distance between the operator and the welding/cutting machine.

Protection from Fumes and Gases



During the welding or cutting process, fumes can be produced which may be detrimental to health.

1	The working area should be well ventilated and welding/cutting activities should not be executed in confined spaces. Eye, nose or throat discomfort can be the result of inadequate ventilation.
2	Welding and cutting in or near locations where chlorinated hydrocarbon vapours are produced such as degreasing, cleaning and spraying operations, should not be undertaken since phosgene, a highly toxic gas as well as other irritants can be reaction products.
3	The industry offers a variety of respiratory masks and must be used in conditions where clean breathing air is required.

Gas Cylinder Safety





Gas leaks can occur on cylinders connected to welding/cutting operations if the system is not properly managed and maintained. A ruptured cylinder or relief valve can cause serious injury or can even be fatal.

1	Gas cylinders should be kept away from extreme temperatures and fire sources. Scratching on cylinder walls with hard objects should be avoided.
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2	A pressure regulator should be installed on the gas cylinder in use in accordance with the manufacturer's operating instructions. Quick-coupling connectors must not be used and gas hose fitting should be tested for leaks.
3	Gas cylinders must always be kept upright and chained or belted to a cylinder trolley, base, wall, post or shelf. Never fix a gas cylinder to a worktable or machine: It can become party to an electrical circuit and explode.
4	Ensure that the cylinder valve is closed when not in use. If there is no hose connected to the cylinder regulator then cover the outlet with a dust cap.

Protection Against Moving and Rotating Parts

		Moving parts, such as fans, rotors and belts, can be hazardous.
1	Ensure that all protective covers, doors and panels on the machine are closed or securely intact before starting an operation.	
2	Ensure that maintenance on machines are only carried out by qualified technicians.	
3	Ensure that hands, hair, clothing and tools are safely out of range from moving and rotating parts.	

Packaging, Transportation and Handling

1. Pay attention to and comply with packaging, storage and transportation instructions which are clearly identified on the containers.
2. Always handle all containers with care.
3. Equipment must be stored in waterproof, moisture proof and well-ventilated facilities within the temperature range -25°C - 55°C.

Parameters

Model	CUT-40	CUT-60
Parameters	Value	
Rated input voltage:	AC220V±10% 50/60Hz 1PH	
Rated input power:	6.2kVA	6.6kVA
Rated input current:	28.0A	41.1A
Rated duty cycle:	60%	60%
Output current range:	15-40A	20-55A
Open circuit voltage:	270V	290V
Power factor:	≥0.93	≥0.93
Efficiency:	≥85%	≥85%
Insulation grade:	F	F
IP grade:	IP21S	IP21S
Max. Cutting thickness:	12mm	25mm
Package dimensions:	422*156*275mm	500*215*380mm
N.W. :	8.13kg	15.0kg

Product Description

This inverter plasma cutting machine inverts 50/60Hz power supply into a high-frequency, high-voltage power supply of up to 21KHz. The inversion process is facilitated by a powerful IGBT device followed by step-down rectification and pulse-width modulation (PWM) technology producing a high-power DC output suitable for cutting. The advanced inverter technology allows the construction of a smaller volume and light-weight, stable and reliable transformer with a 35% improved efficiency with stable and reliable quality features. This cutting machine has good dynamic characteristics, produces a concentrated, stable arc for good quality cutting, ease of control with no electromagnetic noise. It can be used in elevated areas and positions in a variety of industries, indoor or outdoor decorating as well as field operations .

The machine can be used for cutting various metals including low-alloy steels, stainless steel, carbon steel, aluminium, copper, aluminium alloys and other metals.

Using compressed air as cutting medium, it is an economic operation with negligible risk.

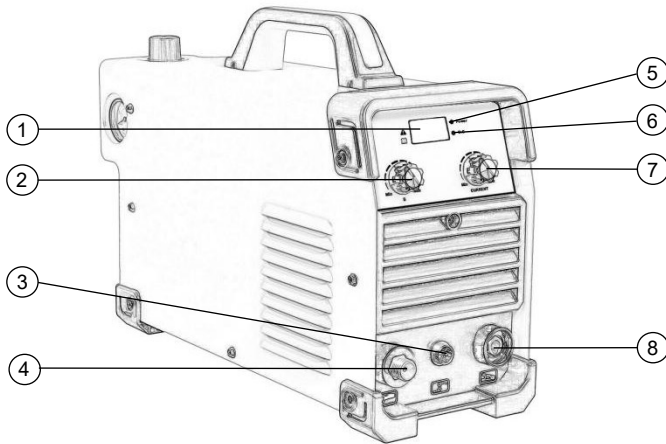
This series of cutting machines are manufactured in accordance with IEC60974-1 <Arc Welding Equipment -- Part 1: Welding Power Sources>, Safety Requirements for Arc Welding Equipment.

1. Features of this Cutting Machine:

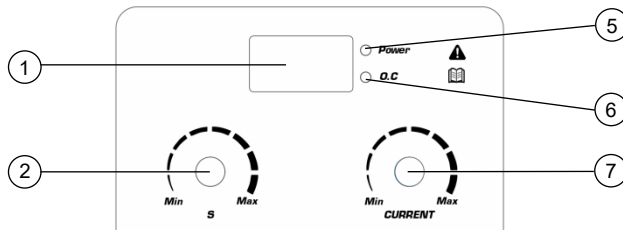
- 1.1. Small size, light weight, extended cutting time, easy to move and especially suited for applications requiring mobility and working at elevated areas.
- 1.2. Intergrated filtered pressure regulator and water trap.
- 1.3. Reliable overheat, over-current and over-voltage protection.
- 1.4. Easy arc striking and stable arc allow easy arc control by the plasma-cutting trolley (optional).
- 1.5. Accurate preset current ensures a clean cut, energy-saving performance on workpieces of differing thickness.
- 1.6. Narrow cutting seam, clean cutting edge and no deformation.
- 1.7. The IP21S protection grade ensures reliability even under harsh environmental conditions.

2. Appearance Diagram

CUT- 40

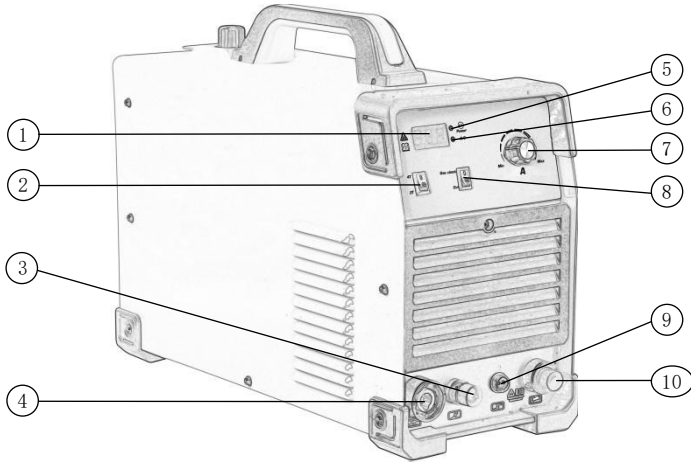


Panel:

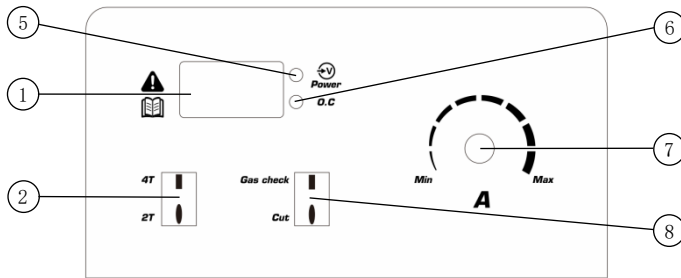


1	LED display: Shows real-time current output and values during parameter settings.
2	Post-flow adjustment knob: Rotate to adjust the post-flow time.
3	Cutting torch control socket: Connects the control line of the cutting torch switch.
4	Air and electric hybrid socket: Connects to the air and electric plug to the cutting torch.
5	AC220V power indicator.
6	Error indicator: Will light up when an abnormal condition occurs. The light is always off when the machine is functioning normally.
7	Current adjustment knob: Regulates the cutting current output.
8	Cutting cable coupling device (positive pole): Connects to the workpiece via the earth clamp.

CUT- 60



Panel:

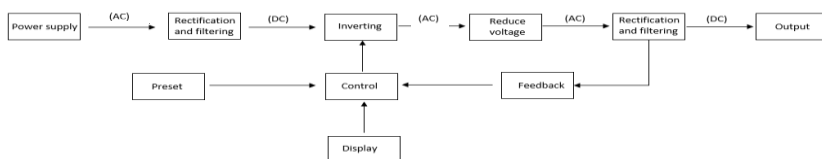


1	LED display: Shows real-time current output and values during parameter settings.
2	2T/4T selection: Switch between 2t and 4T modes.
3	Pilot arc terminal block: Connects to the pilot arc line of the cutting torch.
4	Cutting cable coupling device (positive pole): Connects to the workpiece via the earth clamp.
5	AC220V power indicator.
6	Error indicator: Will light up when an abnormal condition occurs. The light is always off when the machine is functioning normally.
7	Current adjustment knob: Regulates the cutting current output.
8	Gas check & cut selection button: When the 'gas check' mode is selected, air is ejected from the torch head and it is determined automatically whether the air volume is sufficient to ensure a smooth cutting process. This action will

	facilitate the starting process and extend the life of the cutter nozzle. Selection of the 'Cut' mode allows normal cutting.
9	Cutting torch control socket: Connects the control line of the cutting torch switch.
10	Air and electric hybrid socket: Connects to the air and electric plug to the cutting torch.

Working Principle

1. Working principle diagram



- 1.1. A bridge rectifier converts AC to DC;
- 1.2. Controlled by PWM, the IGBT inverts the DC to 33Khz AC and transmits it through a high-frequency transformer;
- 1.3. After secondary rectification the output cutting current is sufficient to meet the cutting requirements;
- 1.4. The in-time protection circuit provides signals to the PWM warning for overheat and over-current situations;
- 1.5. A closed-loop control system ensures a good anti-grid fluctuation ability and an excellent cutting performance.

Installation and Wiring

1. Location Requirements

- 1.1 The machine should not be installed in an area where it is exposed to direct sunlight or rain but where the humidity is as low as possible and the ambient temperature is within the range of -10°C - 40°C.
- 1.2 The machine should be installed on a flat, preferable level surface but, in any case not on a surface with an inclination of more than 10 °.
- 1.3 The machine should not be operated in a work station exposed to wind. Should a

windy environment be unavoidable, suitable screening should be installed.




1.4 In order to allow for efficient ventilation, a clear space of at least 20cm should be allowed in front of and behind the machine as well as at least 10cm at each side.

2. Power Input Requirements

The power supply waveform should be the standard sine wave with rated voltage AC220V±15% 50Hz. Three phase, phase unbalance voltage should be ≤5%.

Model	CUT- 40	CUT- 60
Parameters	Value	
Power supply:	AC220V±10% 50/60Hz 1PH	
Rated input current:	28A	41.1A
Input cable:	≥2.5mm ²	≥4.0mm ²
Output cable:	10mm ²	10mm ²
Ground cable:	≥2.5mm ²	≥4.0mm ²

3. Main Power Supply Connection

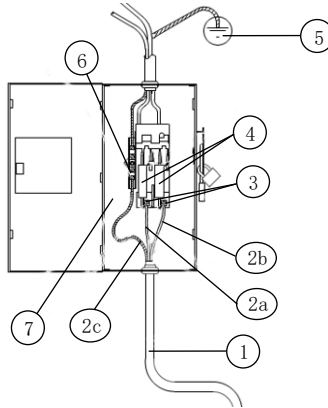
		
	<p>Pay attention to prevent electric shock</p>	<p>Wear goggles</p>

Warning: Take note of the following when the cutting machine is connected to the main power supply:

- 3.1. The connection must be carried out by a qualified electrician or technician.
- 3.2. The connection must be in compliance with national and local regulations.
- 3.3. Before the connection is carried out, the main power supply to the control box must be switched off.
- 3.4. An earth cable set must be securely connected from the machine to the work-piece. The machine must be earthed.
- 3.5. Ensure that the required power supply of the machine (as printed on its nameplate) corresponds to the main power supply.

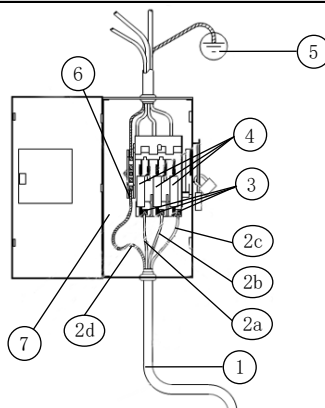
- 3.6. The connection screws on the terminal block must be tight ensuring a solid connection between the machine cable wires and the main power supply.
- 3.7. The correct wiring procedure is explained in the following diagram:

4. Wiring of Single-phase AC, 50/60Hz Cutting Machine



No.	Item	No.	Item
1	Power cord	4	Overcurrent protection device
2a	Live wire L	5	GND
2b	Neutral wire N	6	Earth wire terminal block
2c	Earth wire	7	Electric control box
3	Terminal block		

Wiring of Three Phase 50/60Hz Cutting Machine



No.	Item	No.	Item
1	Cutting machine	3	Terminal block
2	Power cord	4	Electric control box
2a	Live wire L1	5	Earth wire terminal block
2b	Live wire L2	6	GND
2d	Earth wire		

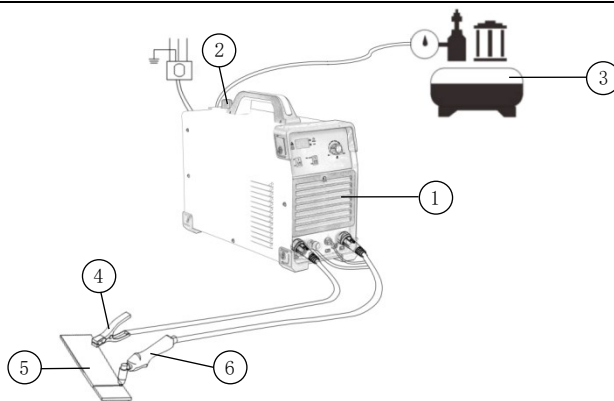
Brief Procedure for Cutting Operation

1. Before Cutting

- 1.1. Wear the necessary and approved personal protective equipment (PPE) required for the task: Such as helmet, mask, goggles, earplugs, protective clothing, gloves and insulating shoes.
- 1.2. Ensure that the electrical grid connected to the cutting machine complies with the allowable power supply of the machine.
- 1.3. Ensure that insulating layers of all wires and cables are sound and correctly connected to the machine.
- 1.4. Ensure that the machine is freely vented and that the vents on the machine are not obstructed.
- 1.5. Connect and tighten the air hose to the inlet on the rear panel of the machine. Ensure the air source provides dry air with sufficient pressure and flow rate.
- 1.6. Install and tighten the air and electricity connectors of the cutting torch to the corresponding interfaces on the cutting machine panel. Connect the air plug and pilot arc wire securely to the corresponding interfaces on the machine panel. Insert the quick-plug of the work cable into the panel socket and tighten clockwise. Secure the workpiece to the other end with the ground clamp.
- 1.7. Turn the machine on - the LED lights up and the fan becomes operational.
- 1.8. Set the parameters for the cutting job and commence cutting.
- 1.9. Complete the cutting operation following the normal procedure. During the operation the cutting parameters can be adjusted to suit the situational demands.
- 1.10. After completion of the cutting operation, turn off the power using the switch on

the rear panel of the machine. Then switch off the power at the main distribution box.

2. Schematic Diagram of Cutting Machine



No.	Item	No.	Item
1	Cutting power supply	4	Earth clamp
2	Air pressure reducing valve	5	Workpiece
3	Air compressor	6	Torch

Maintenance

Safe operation of the machine is dependent on regular maintenance and the replacement of worn and defective parts where necessary.


1. Daily Precautionary Checks:

- 1.1. Abnormal vibrations, sounds or odours.
- 1.2. Signs of overheating on cable connections.
- 1.3. Smooth fan operation.
- 1.4. Power switch efficiency.
- 1.5. Proper cable connection, insulation and damage.
- 1.6. Cable integrity and insulation.

2. Three to Six Monthly Check List

Remove the side cover plate and clean off all parts with dry compressed air. Since the effective cooling of the machine is dependent on a designed air flow pattern, it is important to return the side cover plate after the cleaning operation. Not paying attention to this detail, will result in over-heating of and consequent damage to the transformer and semi-conductor parts.

Common Machine Malfunctions and Solutions

 **Warning: Machine maintenance and repair must be carried out by qualified technical individuals. The operating voltage in the machine can be up to 600V and it is important that power be cut at the machine and at the control box before covers are removed and repairs carried out. A cooling-down period of at least 5 minutes is required before commencement of any inspection and repairs. This will allow the capacitor to fully discharge.**

1. Inspection Before Overhaul

- 1.1. Check if the line voltage on the single-phase power supply is within the range of 200V – 240V. For three-phase, check if the line voltage is within the range of 360V - 440V and, that all phases on a three-phase system are intact.
- 1.2. Check if the power cable as well as the earth wire is firmly connected.
- 1.3. Check whether the wiring connections are correct and firmly connected.

2. Common Machine Problems and Troubleshooting

No.	Problem	Root cause	What to do
1	The "machine-on" light not lit. No digital display. Fan not operational. No no-load output.	Power switch turned off or damaged.	Repair or replace the power switch.
		Power supply phase missing.	Check power input for phase loss.
		No power in the grid.	Check grid voltage.
		Damaged filter capacitor or bridge rectifier resulting in start failure.	Replace filter capacitor and bridge rectifier.
		Power frequency transformer damaged.	Replace power frequency transformer.
		Damaged control board.	Replace control board.
2	No digital display or the "machine-on" light not lit. Fan operational. Error indicator light not active. No load output	Digital display meter or indicator light damaged.	Replace meter or indicator light.
		Loose wire connection.	Check and tighten or reconnect the wire.
		Control board damaged.	Check problem on control board or replace board.
3	The "machine-on" light is lit. Digital display meter functional and fan operational. Error indicator light is off. No high-frequency discharge sound when torch trigger is pressed. No no-load output.	Insufficient torch-trigger contact and the torch-trigger connecting wire is loose.	Re-connect the torch trigger and fasten the torch-trigger connecting wire.
		Control wire on the cutting torch broken or torch trigger damaged.	Replace torch trigger.
		Problems with control circuit.	Check control circuit.

No.	Problem	Root cause	What to do
4	The "machine-on" light is lit. Digital display meter functional and fan operational.	Arc ignition coil primary wire has poor contact.	Fasten the connecting wire.
		Oxidation of spark gap or spark gap too great.	Remove the oxide film on spark gap surface and/or adjust gap to 1mm.
	Error indicator light is off. No high-frequency discharge sound when torch trigger is activated. Air out. No no-load output.	Damaged high-frequency arc ignition device.	Determine which parts are damaged and replace.
		Poor contact of high temperature wire with terminal on main transformer.	Tighten the terminal blocks
5	When cutting, the output current is unstable or not controlled by the potentiometer.	Damaged potentiometer.	Replace the potentiometer.
		Poor or loose contact at the connecting wire of the potentiometer,	Fasten the connecting wire.
6	Fan, digital display meter and solenoid valve operational. No pilot arc output.	Poor contact between the primary wire of the arc ignition coil and the arc ignition plate.	Fasten the connecting wire.
		Oxidized spark gap.	Remove oxide film on spark gap surface.
	Error indicator light off. No high-frequency discharge sound.	Damaged high-frequency arc ignition device.	Determine which parts are damaged and replace.
		Poor contact of high temperature wire with terminal on main transformer.	Tighten the terminal blocks.

No.	Problem	Root cause	What to do
7	Fan, digital display meter and solenoid valve operational. No pilot arc output. Error indicator light off. High-frequency discharge sound.	Poor interface contact of pilot arc wire on torch.	Fasten the pilot arc wire connection.
		Poor connection of the connecting wire inside the machine.	Check and re-tighten the connecting wire inside the machine.
		High-frequency board or control board damaged.	Replace high-frequency board or control board.
8	The "machine-on" light is lit. Digital display meter and fan operational. Overheating and over-current lights are lit. No no-load output.	Over-current protection.	Shut off the machine and reboot.
		Overheating protection.	Auto-recovery after 5 to 10 minutes.
		Failure of inverter circuit.	Replace IGBT tube.
		Secondary rectifier damaged.	Replace the rectifier with the same type.
		Failure of feedback circuit. Control board problem.	Replace control board.
		Gas and electricity socket hole obstructed.	Check the gas and electricity socket hole and remove obstruction.