

IGBT Inverter Plasma Cutter

Operation Manual

CUT-70I

CUT-80I

CUT-100I

CUT-120I



Read this manual carefully before installing, operating and maintaining the machine.



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

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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 have the relevant certificate 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 is a special type of work, with a certain degree of danger. Professional training, correct operation and necessary protective measures can effectively avoid and reduce the damage and loss caused by machine accidents.

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 A helmet with the correct shading filter will protect eyes, face, neck and ears from bright (radiating) light and arc sparks. This applies to the operator as well as any person observing the welding or cutting operation.
- 2 Wear flame retardant gloves, overalls, shoes and aprons to protect against thermal radiation, sparks and hot metal particles.
- 3 Hot sparks and metal fragments can cause skin damage. Avoid clothes with front pockets and button-up sleeves and collars.
- 4 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 fitted with a shading filter to protect face and eyes or a pair of spectacles fitted with shading filters if only eye protection is a requirement.
- 5 Avoid burns and scalds by not touching a welded work piece with bare hands.

Fire and explosion precaution



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, seek help from a firefighter.

Electricity hazards



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.

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



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 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	Users 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 part of 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 is 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-70I	CUT-80I	CUT-100I	CUT-120I
Item	Value			
Rated input voltage:	AC 3PH-380V±15% 50/60Hz			
Rated input power:	10.0KVA	14.0KVA	16.5KVA	20KVA
Rated input current:	13.9A	21.5A	25.5A	32.5A
Rated duty cycle:	60%			
Output current range:	30-70A	30-80A	30-100A	30-120A
Open circuit voltage:	285V	285V	300V	300V
Insulation grade:	F			
IP grade:	IP21S			
Max. cutting thickness :	25mm	30mm	40mm	45mm
Package dimensions :	595*315*530 (mm)	710*385*630 (mm)		
N.W./G.W. (kg) :	23.5/30.0	30.0/38.7	31.3/40.0	32.3/41.0

Product Description

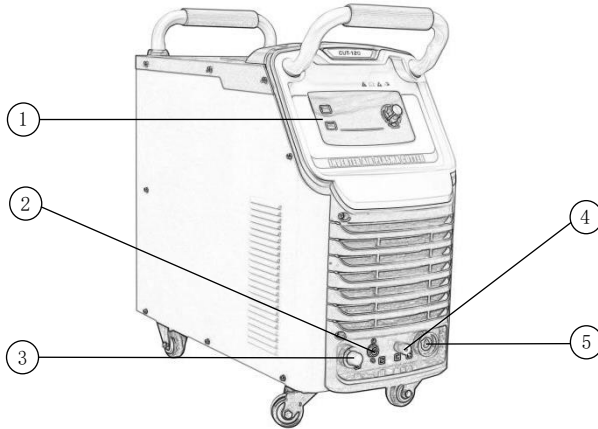
The plasma cutting machines in this range invert 50Hz power supply to a high-frequency, high-voltage power supply of up to 200KHz. The inversion process is facilitated by a powerful IGBT device followed by step-down rectification and pulse-width modulation (PWM) technology producing a high-power DC output suitable for cutting. The advanced inverter technology allows the construction of a smaller volume and light-weight, stable and reliable transformer with a 30% improved efficiency. This series of plasma cutting machines produce a concentrated, stable, powerful and fast-cutting arc at an ionized state of 10000-15000°C. The result is a super-smooth cutting surface on a reduced heat affected area which facilitates further processing.

The machine can be used for cutting various metals including stainless steel, aluminium, copper, cast iron and carbon steel. A narrow and clean-cut seam is produced with less effort and low deformation. The machines are suitable for use in the manufacturing industry, installation and maintenance, plate cutting, cutting holes, patching, beveling, pipe cutting and various other metal cutting applications. The machines in this series are manufactured in accordance with IEC60974-1<Arc Welding Equipment-Part 1: Welding Power Sources>, Safety Requirements for Arc Welding Equipment.

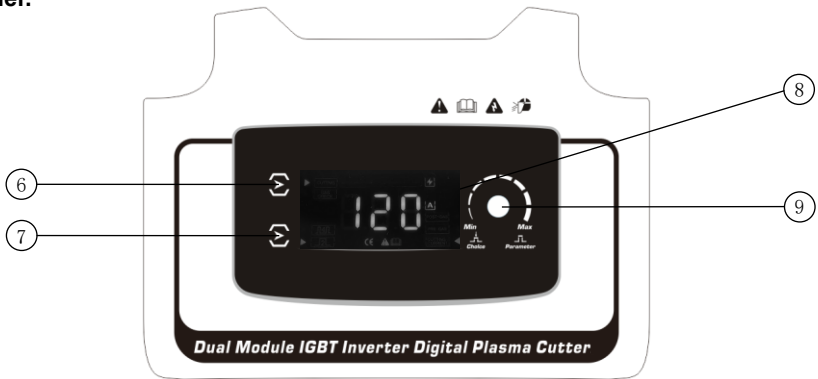
1. Features of this cutting machine series:

- 1.1. Arc ignition system uses high-frequency oscillation to create a pilot arc which allows an easy non-contact start arc.
- 1.2. Air flow detection ensures that a sufficient volume is delivered before cutting is commenced.
- 1.3. Accurate preset cutting currents ensure energy efficiency and allow for cutting various material thicknesses.
- 1.4. Overheat, over-current and over-voltage protection facility.
- 1.5. Adjustable Pre-flow and post-flow cooling.
- 1.6. The IP21S protection grading guarantees reliable operation even under harsh environmental conditions.

2. Appearance Diagram:



Panel:

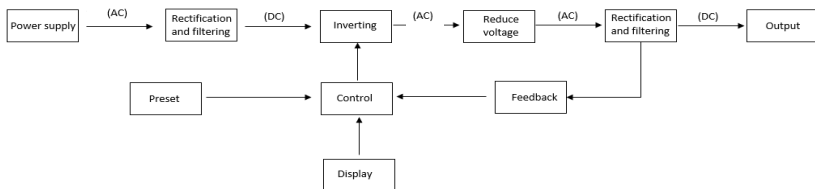


1	Control panel
2	Cutting torch control socket: Connects the control line of the cutting torch switch.
3	Air and electric hybrid socket: Connects to the air and electric plug to the cutting torch.
4	Pilot arc terminal block: Connects to the pilot arc line of the cutting torch.
5	Cutting cable coupling device (positive pole): Connects to the workpiece via the earth clamp.

6	<p>Gas check & cut selection button: When the 'AIR' 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. When restarting the machine, it is advisable to remove overnight condensation from the torch by blowing for approximately 30 seconds through the cutter handle in the 'TEST' position. This action will facilitate the starting process and extend the life of the cutter nozzle. Selection of the 'Cut' mode allows normal cutting.</p>
7	<p>2T/4T selection: Switch between 2t and 4T modes.</p> <p>2T - two-stroke mode: When this mode is selected, press the button on the torch handle, ignite the arc and continue cutting with the button depressed. Release the button when the cut is complete.</p> <p>4T - four-stroke cutting mode: When this mode is selected, press the button on the torch handle, ignite the arc, release the button, complete the cut and press the button again.</p>
8	<p>LED display: Shows real-time current output and values during parameter settings</p>
9	<p>Parameter selection and adjustment knob: Press the knob to select pre flow time, post flow time or cutting current for adjustment. Once the corresponding indicator lights up to your selection, turn the knob to set the parameter.</p>

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 20kHz 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 degrees.
- 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. Requirements of power input

The power supply waveform should be the standard sine wave with rated voltage AC380V±15% 50Hz. Three phase, phase unbalance voltage should be ≤5%.

Model	CUT- 70I	CUT- 80I	CUT- 100I	CUT- 120I
Parameters	Value			
Power supply:	AC 3PH-380V±15% 50/60Hz			
Rated input current:	13.9A	21.5A	25.5A	32.5A
Input cable:	≥2.5mm ²	≥2.5mm ²	≥4.0mm ²	≥4.0mm ²
Output cable:	10mm ²	10mm ²	16mm ²	16mm ²
Ground cable:	≥2.5mm ²	≥2.5mm ²	≥4.0mm ²	≥4.0mm ²

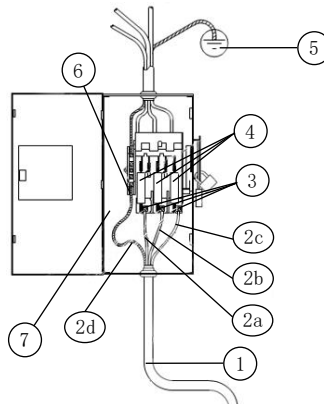
3. Main Power Supply Connection

		
	Pay attention to prevent electric shock	Wear goggles

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. The yellow green earth wire of the machine must be reliably connected with the grounding cable.
- 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:

Wiring of three phase 50/60Hz welding machine



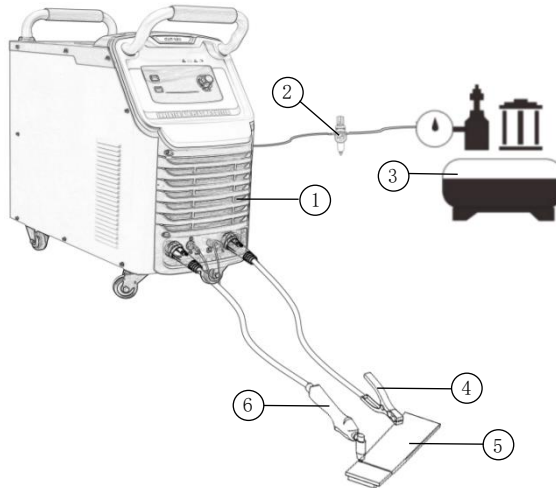
No.	Item	No.	Item
1	Cutting machine	3	Terminal block
2	Power cord	4	Electric control box
2a	Live wire L1	5	Earth wire terminal block
2b	Live wire L2	6	GND
2d	Earth wire		

Brief instruction 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



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

3. Setting cutting parameters

Cutting current	Max cutting thickness(mm)	Quality cutting thickness(mm)
40A	10	6
50A	15	10
60A	20	15
70A	25	20
80A	30	20
100A	40	25
120A	45	30

Maintenance

Safe operation of the machine is dependent on regular maintenance and replacement of parts, if required.

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 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 is off. No digital display. Fan doesn't work. No no-load output.	Power switch was turned off or damaged	Check or replace the power switch
		Power supply phase missing	Check power input if phase loss
		Whether there is electricity in the grid connected to the output cable	Check the grid voltage
		Filter capacitor and bridge rectifier have been damaged, resulting in failure to start the machine	Replace filter capacitor and bridge rectifier
		Control board damaged	Replace control board
2	No digital display or the "machine on" light not active. Fan operational. No load output.	Digital display meter damaged.	Replace meter or indicator light.
		Loose wire connection.	Check and reconnect the wire.
		Control board damaged.	Check problem on control board or replace control board.

No.	Problem	Root cause	What to do
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 activated. 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.
4	Fan, digital display meter and solenoid valve operational. No pilot arc output. Error indicator light off. No high-frequency discharge sound.	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.
		Damaged high-frequency arc ignition device.	Determine which parts are damaged and replace.
		Poor contact of high temperature wire terminal of main transformer.	Tighten the terminal blocks.
5	Fan, digital display meter and solenoid valve operational. No pilot arc output. High-frequency discharge sound.	Poor interface contact of pilot arc wire on torch.	Fasten the connection of pilot arc wire
		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

No.	Problem	Root cause	What to do
6	The "machine on" light is lit. Digital display meter and fan operational. No high-frequency discharge sound when torch trigger is pressed. Gas out. No load output.	Poor contact on primary wire of arc ignition coil.	Fasten the connecting wire.
		Oxidation of the spark-gap assembly or spark gap too great.	Remove oxide layer from spark gap surface or re-adjust the gap to 1mm.
		Damaged high-frequency arc ignition device.	Determine which parts are damaged and replace.
		Poor contact of high temperature wire terminal of main transformer.	Tighten the terminal blocks.
7	The "machine light" is lit. Digital display 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
		Secondary rectifier damaged.	Replace IGBT tube.
		Failure of feedback circuit. Control board problem.	Replace control board.
8	During the cutting process the current is unstable or not controlled by the potentiometer.	Current regulating potentiometer faulty.	Replace the potentiometer.
		Bad contact at the connecting wire of the current regulating potentiometer or a loose terminal of the connecting wire.	Check the connecting wire and fasten the terminal.

No.	Problem	Root cause	What to do
9	The "machine light" is lit. Digital display and fan operational. Error indicator light off. High frequency discharge sound and no-load output. No gas flow.	No air discharge from the air-inlet hose.	Check the integrity of the air inlet hose.
		Press the torch trigger. If the solenoid valve does not respond and its wiring terminals are intact, the solenoid valve may be faulty.	Replace the solenoid valve.
		If the problem remains after replacement of the solenoid valve, the problem lies with the control circuit.	Replace the control board.
		Air and electricity socket hole is blocked.	Check the air and electricity socket hole.