华远焊机
HUAYUAN WELDER

LGK-40/63IGBT

IGBT INVETER AIR PLASMA CUTTING MACHINE

OPERATOR'S MANUAL

(PLEASE READ IT CAREFULLY BEFORE OPERATION)

CHENGDU HUAYUAN ELECTRIC EQUIPMENT CO., LTD.

Safety Depends on You

HUAYUAN arc welding and cutting equipments are designed and built with ample safety consideration. However, proper installing and operating can ensure your safety.

DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT CASUALLY WITHOUT READING THIS MANUAL THROUGHOUT.

Special Notes (Very Important):

1. Pay attention to avoiding the machine falling down when it is placed on the gradient ground.

2. It is forbidden to unfreeze the pipeline by the cutter.

3. The shield rank of this series of cutter is IP21S, so working in rain is not suitable.

4. The cutter has external static characteristic with rated duty cycle 60%, which means the machine can work 6 minutes and rest 4 minutes at the rated cutting current in 10 minutes. The machine has the function of thermal protection.When the internal temperature exceeds a set temperature, thermal protection moves on and the abnormity indicator lamp on the panel turns ON, then there is no output in cutter. The machine can become normal and work only after the internal temperature drops down and the abnormity indicator lamp on the panel turns OFF.

Purchase Date: _____

Serial Number: _____

Machine Model: _____

Purchase Place: _____

Cautions	Arc and arc rays can hurt.

All performing welding workers ought to have health qualification from the authority organization to prevent you and others from arc radiation and burn. It should be prevented for children to enter into dangerous area as well.
Be careful reading the following important items and the welder safety byelaw from the authority organization. Be sure that qualified professionals perform all installation, maintenances and repair procedures.

■ **1.Electric shock：The welding circuits are not insulated when welding. If you touch the two output electrodes of the machine with your bare skin at the same time, it will lead to electric shock, sometimes even fatal dangers. Users need to follow the items below to avoid electric shocks:**

■ **If possible, lay some insulating materials, which are dry and large enough, in your working field. Otherwise, use the automatic or semiautomatic welding machine, DC welding machine as possible as you can.**

■ **Components in the automatic and semiautomatic welding machine such as the welding wire reel, feed wheel, contact tip and welding head are all electric components. .**

■ **Always be sure the machine has been connected perfectly to the work piece with the work cables and should be as close as possible to the working area.**

■ **The work piece should be grounded perfectly.**

■ **Make sure that the insulating material of the electrode holder, the grounding clamp, the welding cable and the welding head are not affected by damp, mildewed or spoilt, and be replaced momentarily.**

■ **Never dip the electrode in water for cooling.**

■ **Never touch electric components of two welding machines at the same time, because this voltage is supposed to be two times of welding voltage while the grounding mode is not clear.**

■ **While working high above the ground or other places having the risk of falling, please be sure to wear safety belt to avoid losing balance caused by electric shock.**

■ **2 Arc： Use an arc welding mask to protect your eyes and skin from sparks and the rays of the arc, pay special attention to the filter glass, which must be conformable to the national standard.**

■ **Use clothing made from durable flame-resistant material or sailcloth to protect your skin from hurting by the arc rays.**

■ **Remind other nearby personnel before working lest arc rays hurt them by accident.**

■ **3 Fumes and Gases： Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. While working in limited room, use enough ventilation and/or exhaust to keep fumes and gases away from the breathing zone, or use the respirator. Do not weld at the same time when using of degreasing, cleaning or spraying operations. The heat and rays of the arc can react with these gases to form phosgene, a highly toxic gas,**

■ **Some protective gases used in welding might displace the oxygen in the air, and can lead to**

hurt or even death.

- **Read and understand the manufacturer's instructions for this equipment, and validate the health certification of consumptive materials, make sure they are innocuous.**

- **4 Spatter：Spatter can cause fire or explosion.**
- **Remove fire hazards from the welding area. Remember that spatter from welding can easily go through small cracks and touch fire hazards. Protect all kinds of lines going though welding area, including hydraulic lines in the wild.**
- **Where compressed gases are to be used in the field, special precautions should be used to prevent explosion.**
- **When welding stops, make certain that no live part is touching the work piece or the work stage. Accidental contact can create a fire hazard.**
- **Do not weld containers or lines, which are not proved to be innocuous.**
- **It is very dangerous to heat, cut or weld tanks or containers at entry holes. Does not start work until the proper steps have been taken to insure that there is no flammable or toxic gas.**
- **Spatter might cause burn. Wear leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair to prevent from burning by spatter. Wear the ear shield when performing sideways or face up welding. Always wear safety glasses with side shields when being in a welding area.**
- **The welding cables should be as close to the welding area as possible, and the short, the better. Avoid welding cables going through the building framework, lifting chains, AC or DC cables of other welding machines and appliances. The welding current is strong enough to damage them while having short circuit with them.**

- **5 Cylinder：Damage of it might cause explosion.**
- **Make sure that the gas in the storage cylinder is qualified for welding, and the decompression flow-meter, the adapter and the pipe are all in good condition.**
- **Make sure that the installation of cylinder is by the wall and bundled tightly by a chain.**
- **Be sure to put the cylinder in the working space with no crash or shake, and far from welding area.**
- **It is forbidden to touch cylinder with the welding clamp or the work cables.**
- **Avoid facing the cylinder while installing the decompression flow-meter or the gasometer.**
- **When not working, please tighten the valve.**

- **6 Power： (For electrically powered welding and cutting equipment) Turn off input power before installation, maintenances and repair, so that avoid accident.**
- **HUAYUAN welding equipment is I class safeguard equipment; please install the equipment in accordance with the manufacturer's recommendations by specific persons.**
- **Ground the equipment perfectly in accordance with the manufacturer's recommendations.**

■ **7 Power： (For engine driven welding and cutting equipment)**

■ **Work in ventilated place or outdoors.**

■ **Do not add fuel near to fire or during engine starting or welding. When not working, add fuel after engine is cooling down; otherwise, the evaporation of hot fuel would result in dangers. Do not splash fuel out of the fuel tank, and do not start the engine until complete evaporation of the outside fuel.**

■ **Make sure that all the safeguard equipments, machine cover and devices are all in a good condition. Be sure that arms, clothes and all the tools do not touch all the moving and rotating components including V belt, gear and fan etc.**

■ **Sometimes having to dismantle some parts of the device during maintenance, but must keep safety awareness strongly every time.**

■ **When engine is hot, it is forbidden to open the airtight cover of the radiator water tank to avoid hurt by the hot vapor.**

■ **8 Electromagnetic ： Welding current going though any area can generate electromagnetic, as well as the welding equipment itself.**

■ **Electromagnetic would affect cardiac pacemaker, the cardiac pacemaker users should consult one's doctor first.**

■ **The effect of electromagnetic to one's health is not confirmed, so it might have some negative effect to one's health.**

■ **Welders may use following method to reduce the hazardous of electromagnetic:**

■ **a. Bundle the cable connected to the work piece and the welding cable together.**

■ **b. Do not enwind partially or entirely your body with the cable.**

■ **c. Do not place yourself between the welding cable and the ground (work piece) cable, if the welding cable is by your left side, then the ground cable should be by your left side too.**

■ **d. The Welding cable and the ground cable are as short as possible.**

■ **e. Do not work near to the welding power source.**

■ **9 Lift Equipment：carton or wooden boxes package the welding machines supplied by HUAYUAN. There is no lifting equipment in its wrapper. Users can move it to the prospective area by a fork-lift truck, and then open the box.**

■ **If having rings, the machine can be transited using rings. While HUAYUAN Welding Machine Manufacture reminds users, there is possible risk to damage the welding machine. It is better to push the welding machine moving in use of its rollers unless special situations.**

■ **Be sure that the appurtenances are all removed off when lifting.**

■ **When lifting, make sure that there is no person below the welding machine, and remind people passing by at any moment.**

Do not move the hoist too fast.

10 Noise：HUAYUAN Welding Machine Manufacture reminds users: Noise beyond the limit (over 80 db) can cause injury to vision, heart and audition depending on oneself. Please consult local medical institution. Use the equipment with doctor's permission would help

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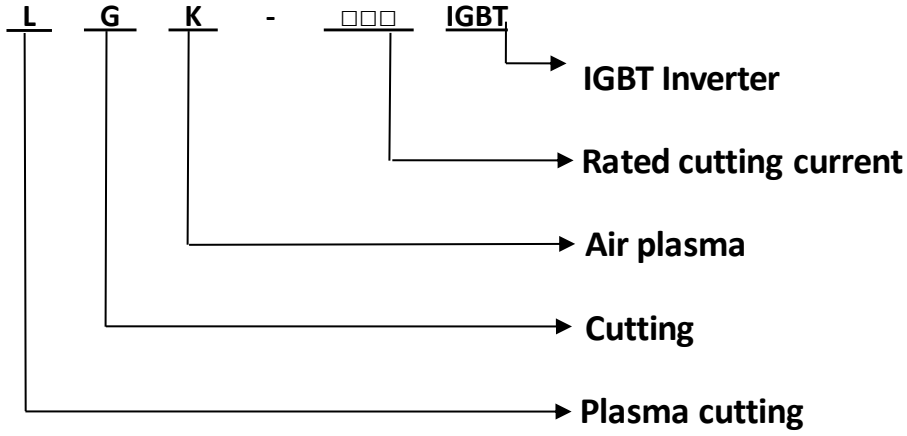
◆ Summary

1. Model description



2. Characteristics

LGK-40/63IGBT inverter air plasma cutting machine is the latest development cutter in our company. It has good characteristics as following:

1) **This cutting machine adopts IGBT inverter technology which has high reliability and efficiency. It is light weight.**
2) **Stepless adjustable cutting current, suitable for cutting various thickness workpiece. To ensure cutting quality and save energy, low current is applied to cut thin plate, and high current is applied to cut thick plate.**
3) **External and dynamic characteristics cutter are significantly better than leakage-reactance typed cutter. High success rate in striking arc. Stable cutting current. Good arc stiffness. Clean and smooth incision. Excellent technology performance.**
4) **The cutting current is very stable and it will not be influenced by grid voltage fluctuation.**
5) **There is over-voltage protection function.**
6) **Fast cutting speed, high production efficiency, and the speed is 2-5 times higher than flame cutting speed.**
7) **Compressed air as cutting gas is low cost.**

3. Usage

It is suitable for cutting kinds of metal materials like low carbon steel, alloy steel and non-ferrous metal and is widely applied in the manufacturing of boiler pressure container, chemical container, industrial power station construction, metallurgy, aerospace industry, automobiles, building an so on.

◆ Safety and Attention

Please follow the notes for the safety of you and others.

- **It is forbidden to unfreeze the pipe line by cutting power or other usages except for cutting.**
- **The cutter casing should ground reliably. Please make sure the grounding bolts of power ground reliably in case of electric shock.**
- **Cutter is the equipment with high voltage. Please wear insulated protective shield**

when cutting.

- **When exchanging torch and wearing parts, please turn off the supply power first.**
- **Protective shield should be worn.**
  In order to avoid any hurt to eyes from ultraviolet radiation and strong light and to skin from spatter, please wear protective shield according to related rules and regulations of labor protection.
- **It is forbidden to inhale harmful gases.**
  The fumes and gases produced during cutting is hazardous to health. Please wear protective shields and install aerator according to related rules and regulations of labor protection.
- **Cutting cannot proceed in closed container.**
- **The workpiece just after being cut is at high temperature. Please prevent from scald.**
- **Protective gas cylinder and air compressor must be placed in a fixed position and prevented from collision.**
- **Cutter and cutting place should be far away from flammable materials.**
- **Prevent foreign bodies from entering inside the machine. And protect the cable from sharp materials.**
- **Protect the machine from fall or collision.**
- **In case of fall or collision, it can be used only after professional checking.**
- **In the surface or inside of the cutting workpiece, there should be no flammable and explosive materials or chemical materials harmful to human.**
- **Installation and repair person must have state-authorized electrician operation certificate.**
- **Cutting operation person should read this manual carefully and know the operation method well.**

◆ Work Environment Requirements

Welding performance may not meet technique standards without the following conditions.

- **It should be placed with small dust, no corrosive gases and no flammable and explosive materials. Avoid vertical sunshine and rain;**
- **Air relative humidity is no more than 90% at 20℃ and no more than 50% at 40℃**
- **When using air cooling torch, the ambient temperature should be from -10℃ to 40℃.**
- **It should avoid metal foreign bodies entering into the cutting power.**
- **Cutting power should be 30cm away from the wall or other sealed-in objects. The distance between two sets should be above 30cm.**
- **The operation height should be less than 1000m.**

◆ Technique Parameters

1. Main technique parameters:

	LGK-40IGBT	LGK-63IGBT

Rated input voltage	3～50Hz 380V	
Rated input capability	6.0KVA	9.9KVA
Open circuit voltage	222VDC	260VDC
Rated output current	40A	63A
Current adjusting range	20～40A	30～63A
Rated output voltage	96V	105.2V
Rated duty cycle	60%	60%
Insulation level	F	F
Quality cutting thickness（steel）	0.1～7mm	0.1～12mm
Max cutting thickness（steel）	12mm	20mm
Applied plasma air	Compressed air	Compressed air
Cooling model	Air-cooling	Air-cooling
Dimension(L×W×H)	585×280×485mm	
Weight	25Kg	26Kg
Shell shield rank	IP21S	

2．Plasma gas conditions

- **Work pressure range：0.3MPa～0.5MPa**
- **Gas supply pipe compression strength：≥1MPa**
- **Gas supply pipe inner dimension：≥Φ8**
- **Gas supply flux：≥40L/min**
- **Filter water from gas and then put it into cutter**

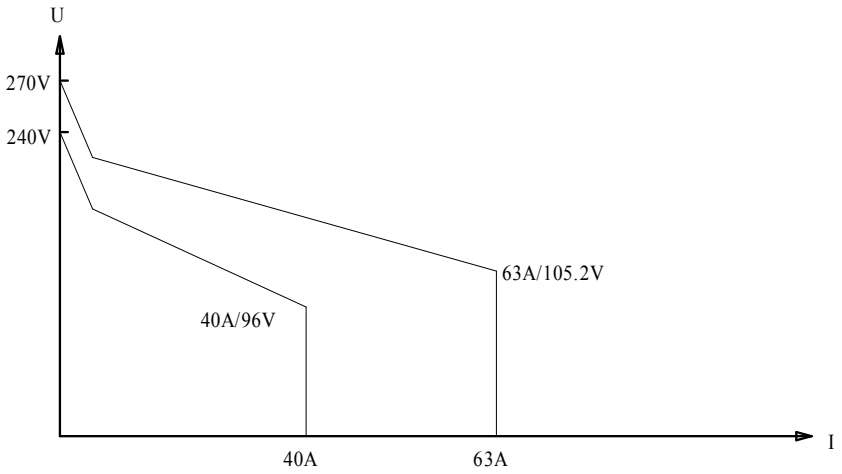


Figure 1 External characteristic

◆ Work principles

The control circuit of cutting machine adopts advanced electronic part IGBT as the main inverter switch component. Three-phase AC power is converted to 20KHz high-frequency DC current after being rectified by three phase rectifier. Then under the function of IGBT inverter the DC current is inverted to AC high frequency current, which is inverted to DC current after experiencing voltage reduction in high frequency transformer, current rectifying in fast recovery diode. This DC current is filtered through reactor, and the output cutting current is obtained. Control circuit can control output current by controlling driven pulse width. The real time cutting current, which is obtained through

current sensor connected to output terminal in series, is used as negative feedback control signal. After comparing with current adjusting signal, the negative control signal is sent to PWM adjusting integrated circuit, then a controlled driving pulse is output to control IGBT. Thereby a constant output current can be maintained, and a steep dropping & constant current external characteristic is obtained. Striking arc adopts high-frequency striking model. The main circuit refers to appendix figure1， and principle diagram of control circuit is shown as figure 2.

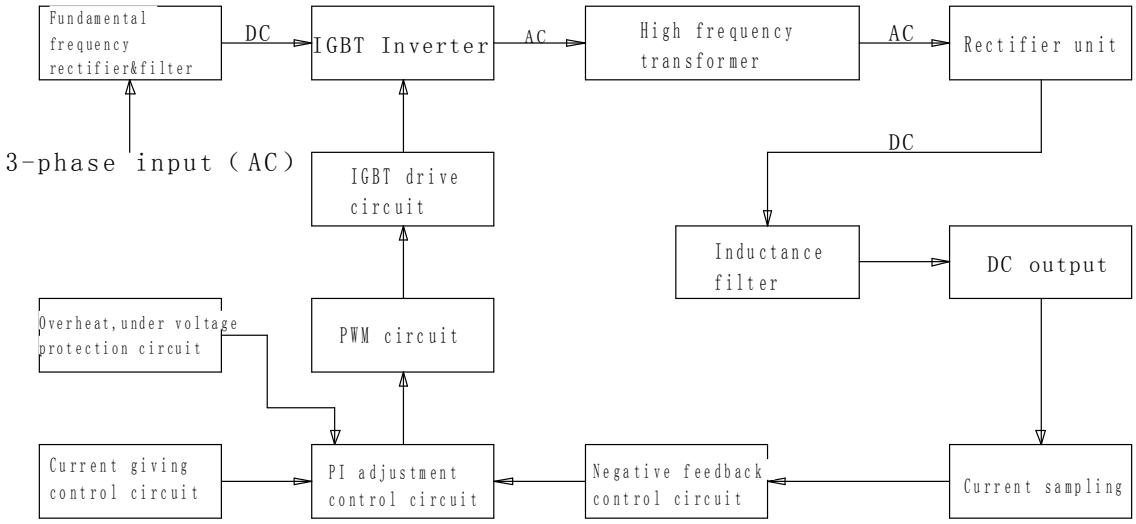


Figure 2 Principle diagram

- **Common component list as diagram1**

No.	Symbol	Components name	Model	Remark
1	V1	Three phase rectifier	MDS40C-12	
2	V2～V5	IGBT module	IKW25N120T2	LGK-40IGBT
			IKW40N120T2	LGK-63IGBT
3	V6、V7	Diode module	DWM2F60N060	
4	TA1	Hall current sensor	TKC-100BS	
5	QF1	Breaker	DZ47-63/3P D25	
6	R5	Resistor	RXG7-10Ω/50W	
7	YV1	Magnetic gas valve	DF2-B-3/36V AC	
8	EV1	Cooling fan	2123XSL	
9	RP1	Potentiometer	WH118-2W-4.7K	
10	KT1	Temperature relay	JUC-6F-75℃ normally close	
11	BP1	Pressure controller	YKC 0.2/0.15	
12	AP1	Main control board	LGK4063IGBT-AP1	
13	AP3	HF board	LGK7-63AP3	

14	AP5	Filter board	LGK63IGBT-AP5	
15		Air filter regulator	GFR-200-08	

Diagram Common component list

◆ Panel and its functions（see Figure 3）

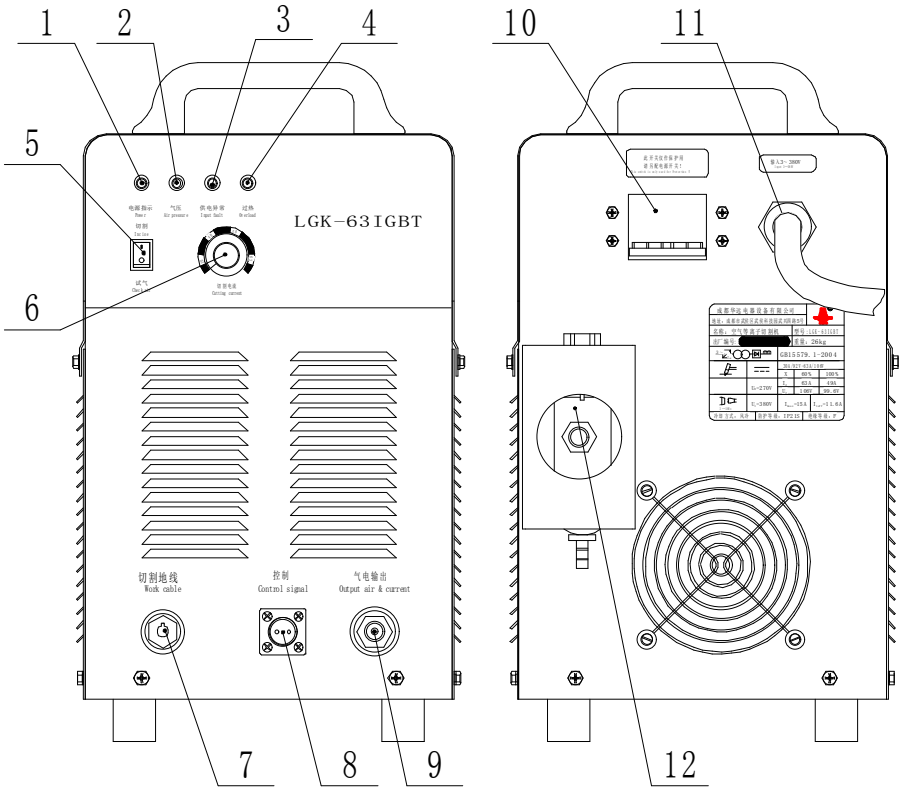


Figure 3 Function of panel

1. **Power indicator lamp: Indicating if the cutter is energized.**
2. **Air pressure indicator lamp： It is ON when the pressure of compressed air exceeds 0.2Mpa. It is OFF when the pressure is less than 0.15Mpa.**
3. **Power supply abnormality indicator lamp: It is ON when power supply is more than 440VAC or less than 300VAC;**
4. **Overload indicator lamp: It is ON when the cutter is over loaded (generally it is on when cooling fan is damaged.)**
5. **Gas control selection switch: When it switches to Check air, gas valve opens to test gas flux. When it switches to Cutting, the gas valve opens during cutting automatically.**
6. **Cutting current adjusting knob: Adjusting cutting current;**
7. **Cutting ground wire outlet: To connect cutting ground wire;**
8. **Torch control outlet: To connect torch control signal wire;**
9. **Air & Power output terminal: the current output terminal is also the compressed air output terminal. It is gas pipe connector to connect water-cooled torch when the water-cooled torch is used, and it is connector to connect torch air-cooled cable when air-cooled torch is used.**
10. **Power source switch: Control the ON/OFF of 3-phase power supply of cutter.;**
11. **Power source line： For connecting 3-phase power supply. The green-yellow line is used for protecting ground line, and it must be connected to the ground firmly;**

12. **Air pressure regulation filter： For adjusting work pressure of compressed air and filtrating water from air.**

◆ Protection function of the cutter

➢ **Air pressure protection**

1. When the indicated value of the pressure meter, which is fixed on the back of the cutter, is lower than 0.2 MPa, the protection circuit starts working and the cutter cannot start.

2. When the indicated value is lower than 0.15 MPa during cutting, the cutting arc will extinguish.

➢ **Note: When adjust the air pressure, the panel function must be set to Check air.**

➢ **Over load protection**

When the ambient temperature is too high or the cooling fan is broken, the cutter will be over heated under the rated current, and heat protection circuit starts working, the cutting arc will extinguish automatically.

➢ **Power supply abnormal protection**

1. When the 3 phase power supply is higher than 440VAC, protection circuit starts working and there will be no arc striking.

2. When the 3 phrase power supply is lower than 300VAC, protection circuit starts working and there will be no arc striking.

◆ Installation and Operation

1. Transport and Lift
- ✧ **Power source should be shut off before moving the cutter.**
- ✧ **The cutter bottom should be kept downwards during transportation. It is forbidden to have cutter placed transversely or upended.**
- ✧ **When lifting, it must be lifted vertically.**
- ✧ **During the long-distance transportation, it must prevent the cutter from raining and moving back and forth inside box. Shock absorption foam should be placed around cutter.**

2. Installation and Connection
- ✧ **A . Power source should be shut off before installation and connection.**
- ✧ **B. Installation environment details refers to the point "Work Environment Requirements".**
- ✧ **C. If cutting power source is placed in a slanted surface, it must be prevented from falling down.**
- ✧ **D. Shield rank for cutting power is IP21S. The installation and operation cannot be proceeded in the rain.**

3. Power supply requirements
- ✧ **Voltage fluctuation≤±10％;**
- ✧ **Frequency fluctuation≤±1％;**
- ✧ **Asymmetry rate of three-phase supply system≤5％;**

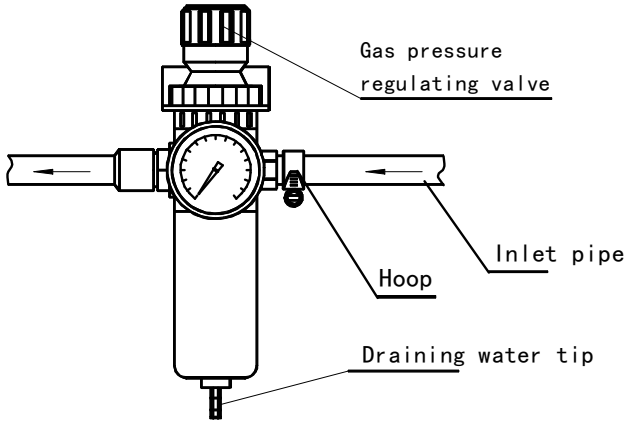
✧ **Power supply wire cross profile, ground wire cross profile, breaker and fuse should refer to the diagram below.**

Items	LGK-40IGBT	LGK-63IGBT
Power supply wire cross profile（mm^2）	2.5-4	4-6
Ground wire cross profile（mm^2）	2.5-4	4-6
Breaker capacity（A）	20	30
Fuse capacity（A）	20	30

4. Installation of power wire

Shut off the power switch first. Connect the power input wire of cutter back panel to distribution box which meets the parameters in the diagram above. The green-yellow wire is protection ground wire, which must be connected to earth reliably. Earth connecting method should follow state standard.

5. Connection of compressed gas and the usage of air filter regulator



The compressed gas should meet the requirement mentioned in point "Plasma gas conditions". Connect the gas pipe with the gas inlet of air filter on the back panel and hoop it tightly.

The usage of air filter regulator is as follows. When it is to adjust pressure, lift up air pressure regulating valve, and rotate it. Left rotation aims to reduce outlet gas pressure, right rotation aims to increase outlet gas pressure. After the gas pressure is adjusted properly, press down regulating valve.

The air filter regulator should be checked periodically. If the water level reaches two-thirds of filter glass, it must be drained, or this will affect incision quality. The gas supply valve should be closed during water draining, and Check air function is selected on panel. When the indicated valve of gas pressure meter is zero, water will drain out from drainage mouth automatically.

6. Connection of cutting torch

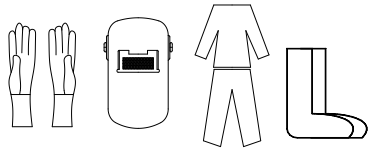
Firstly connect the torch cable connector M16 nut with the copper nozzle marked with Air & Power Output on the front panel, and screw down the nut, then put on insulation sleeve; Connect the torch control plug to the outlet marked with Control on the front panel and screw down the nut.

7. Connection of cutting ground wire

Connect the fast connector of cutting ground wire with the outlet marked with Cutting Ground Wire on the front panel and screw down it clockwise. The other end of the cutting ground wire is connected to workpiece firmly.

- **Operation method**

1. Security notes

Notes:	**Operation strictly accordant with the following steps**		
	Notice **Electric shock may hurt or even kill man.** • Shut off the power during connection •Do not touch the conducted parts		**Cutting may cause fire or explosion** • Splashes may ignite flammable materials nearby. Those materials should be 10m away from the working place.
	Fume & dust is harmful. •Do not breathe in the fume and dust caused by cutting •Clean up the oil spot on work piece. •Keep fresh air in working place • Fume extraction equipment should be prepared.		**Arc may hurt your eyes and skin.** •Strong arc may hurt your eyes. •Ultraviolet radiation generated by arc may hurt skin and eyes. Please wear shielded guard when cutting.
	Overheated part may hurt your skin. •Do not touch the overheated part on the work piece. •Do not touch hot cable or torch just by hands.		**Fast moving thing may injure you.** •Do not put your hands or other things into the fan shield. •Cover the opened case shell well during cutting operation.
	**In case of injury for your skin and eyes, please wear required guards according to Labor Security and Hygiene rules. Electrode and nozzle should be replaced only after the cutter is power off.** **Operation should proceed according to related Labor and Security regulations.**		

2. Turn on the power switch after installation and connection. Then the power indicator lamp is ON.

3. Start gas supply equipment and turn on the gas supply switch, the power indicator lamp on the panel is ON. If the gas pressure is less than 0.25Mpa, the lamp will be OFF, then the gas source should be checked.

4. Gas control switch switches to Check air. Adjust the pressure Adjusting knob of gas filter on

the back panel to make the pressure and flux fit cutting condition. After adjusting, set the switch to Cutting position.

5. **Set the cutting current to required value.**
6. **Let the nozzle axes plumb the workpiece and cling to it firmly, press down the torch switch and start to cut by striking arc from the edge of workpiece. To punch hole by plasma arc in the middle of workpiece is not proposed, because the nozzle would be damaged easily. It is better to punch a hole in the arc-striking position first, then strike arc from the edge of the hole.**
7. **If want to stop cutting, please loosen the torch switch, cutting arc extinguishes, and gas supply will stop in 5-8S automatically.**

◆ Operation Caution

1. **Before operation, operator must put on insulating shoes and wear insulating gloves & protection glasses. The earth line must be connected reliably.**
2. **If to use contact arc striking method, firstly press down torch switch, then have nozzle contact workpiece edge quickly, this will be beneficial for arc striking cutting. If it is difficult to strike arc, the gas pressure can be adjusted to lower limit.**
3. **The water in reducing valve and air compressor should be drained out frequently. The cutting speed should not be too fast, so that it can avoid molten slag and arc reflection caused by incomplete cutting, but the cutting speed should not be too slow too, it will have workpiece red-hot and affect cutting quality. When the cutting stops, firstly loosen torch switch, then lift up torch. To follow above can have nozzle work life improved a lot.**
4. **The status of gas pressure, voltage, electrode and nozzle should be observed closely during cutting. Do not have electrode and conductive tip short circuit caused by copper spraying after using up hafnium wire in electrode, and damage cutting torch. The hafnium wire in each electrode is about 3mm in length. After nozzle aperture is enlarged, cutting quality and thickness will decrease seriously, so the nozzle must be replaced immediately.**
5. **If the cutting seam is deviated seriously, the nozzle must be checked if it flanges and deviates. Or the nozzle and electrode must be replaced. Notice: the roughness of cutting surface is related to cutting plate surface. If the plate surface is rough and not clear, cutting moving is uneven, then the incision is big and surface quality decreases seriously.**
6. **The work life of electrode and nozzle is related to plate thickness and operation technology. Normally every electrode can keep using for 1 hour continuously.**

◆ Maintenance

1. **The cutter cannot be operated and placed in strong sunshine.**
2. **The cutter cannot be operated and placed in moist environment.**
3. **The vent hole should not be covered when the cutter is operated.**
4. **The cutter should be operated and placed in drafty environment.**
5. **The cutter casing should be opened once a year at least. Clean up the dust and metal scraps inside the machine by use of compressed gas.**
6. **Check regularly if the cable insulation cover is damaged. If there is any damage, repair it or change it.**
7. **Check regularly if the electric connection is loose and then tighten it.**

8. Drain out regularly the water and impurities from filtering reducing valve.

Notes: When maintaining the cutter, professional electrician is required to dismantle the power wire from distribution box and open the machine casing.

◆ Cutting technology instruction

1. The related main technical parameters

- **Cutting material and thickness**

  The selection of cutting technical parameters is based on the cutting material and thickness. If the material is thick, it should adopt large current and nozzle with big aperture. For different material under the same thickness, the parameter should also be different.

- **Air flow Q**

  The arc voltage increases as the increase of air flow, that is, the arc power, the cutting speed, as well as the cutting capacity and quality is improved accordingly. Because the arc compression level increases, the energy is more concentrated, the arc beam temperature, the arc spraying speed, as well as the arc current impulsion increases. But overlarge current may cause the instability of the plasma arc. Usually no change is made to air flow for one torch. But it can be adjusted a little when the cutting torch or cutting thickness is different.

- **Cutting speed**

  The cutting speed is related with many parameters. The main parameters determining cutting speed include workpiece thickness, cutting current, air flux and nozzle aperture. A proper drag is allowed during cutting. The cutting speed should be increased as much as possible, but the incision quality must be guaranteed.

2. Eliminate the cutting burr

- **The characteristics of the incision burr**

  The ordinary cutting surface is smooth and clean, but if the parameter selection is not suitable, and electrode centering is not good, then burr may be formed on the cutting surface.

  Slag is formed by molten metal and its oxide which is adhesive to the bottom edge of incision and solidified. The reason for forming this slag is that the molten metal adhesive strength is bigger than the gravity and blow strength of metal oxide.

  When cutting the alloy steel, the molten metal is difficult to be blown away because of its bad fluidity, in addition, the alloy steel have bad thermal conductivity, the incision bottom is over-heated easily, the left molten metal and incision bottom melts into one, thereby the irremovable and tough burr is formed.

  On the contrary, the incision bottom is difficult to be melted together with molten metal, and the burr formed under incision is come off easily.

- **The factors affecting the forming of burr**

  - **The fluidity of the molten metal is not good, when the power is too small or the plasma arc compression effect is not good, the temperature of molten metal during the cutting process is low, fluidity is weak, even if the air current blow force is strong, it is still difficult to blow away the metal completely, so the burr is formed.**
  - **When cutting the thick plate, the burr is caused by the drag of overlarge cutting seam. During the cutting process, the heat received by different parts of metal is different, the heat on the upper incision is larger than that of the lower incision, so the upper part melting speed is faster than that of lower part, thereby a distance between them is formed, it is called drag L of cutting seam. The drag size is related to plasma arc shape and cutting**

speed. When the flame is short while the cutting speed is too fast, drag L increases, so the vertical and horizontal blow force of the arc is formed, the vertical one helps to blow away the molten metal, while the horizontal one makes the molten metal flow backward along with incision bottom, this over-heated metal will melt parts of the bottom metal again, then the burr is formed when they cool down and melt together.

- **The burr is caused by overheat bottom. When the cutting speed is too slow, but the incision bottom is so over-heated that it melts, the liquid metal flows to bottom metal and combines into one which makes the difficulty to blow away molten metal by air current, and then the burr is formed.**
- **The air current blow force is not enough. When cutting with plasma, the arc blow force consists of the air current blow force and the arc electromagnetic force, the air current blow force acts the main function. If the air current blow force is not strong enough, it cannot ensure all the burr is flown away, then the burr is formed.**

- **The measurement to eliminate burr**
  - **Ensure the centering between electrode and nozzle precisely, so that the compression of the plasma arc is not damaged, the concentration of flame and cutting capacity can be guaranteed.**
  - **Enough power to ensure the fluidity of molten metal, as well as increase the stability of the cutting speed and operation. This makes it possible to adopt large air flux to enlarge the air blow force, and beneficial for eliminating burr.**
  - **Adjust suitable air flux and cutting speed. If the air flux is too small, the blow force is not enough, while if too big, the plasma arc will be shorten, the incision will be "V" shape, the drag enlarge. The burr can be formed under both conditions. When cutting speed is too slow, the incision is large and rough, the bottom is easy to be over-heated, while the cutting speed is fast, the drag is enlarged, this is not beneficial for eliminating burr.**
  - **So under certain circumstance, there exists a proper selection range for air flux and cutting speed.**
- **Diminish the cutting surface slanting and rounding problem**

The incision surface is a little slant and the upper side is a little round during cutting with air plasma. Though the slanting range is acceptable during the cutting process, in order to improve the cutting quality, people begins to pay attention to this problem. Usually slowing down the cutting speed properly can avoid the slanting, but this may enlarge the effect zone and incision width, as well as decrease the production capacity, so this measurement is not wildly used. Recently, people can avoid the slanting by improving the nozzle structure, this is called super cutting method. By adopting multi-hole nozzle during the cutting process, the air current from the small hole is parallel with that from the main hole, this can avoid the dispersing of the plasma flame on metal top, and then a parallel incision, square upper side and no metal slag seam on the lower side is obtained.

◆ Troubleshooting & repair

1. **If there is trouble caused by high voltage in the machine, a professional electrician or serviceman of our company is required to repair it.**
2. **Please check following first when there is trouble.**
   1) **The three-phase power should be 380±40VAC，check if it misses phase or voltage fluctuation exceeds its required range of power supply；**
   2) **Check if the supply abnormity indicator lamp is ON. If it is ON, check if the three-phase**

power switch of distribution box is damaged, and if the fuse and the machine power wire are well equipped. Otherwise it will cause phase missing or bad contact, which makes the machine work abnormally;

3) **Check if the torch switch and its wire are damaged or short-circuit, and if the nozzle and electrode are damaged;**
4) **Check if the cutting ground wire is well connected;**
5) **Check if the water in compressed air filter fixed at the back of machine is drained regularly;**
6) **Check if the gas pressure indicator lamp on the panel is ON. If it is not ON, check if compressed gas pipe is well connected , and if the gas pressure is normal. When the gas pressure is less than 0.3Mpa, the lamp is not ON.**
7) **Open the machine top cover to check if the lead-typed fuse next to the control transformer has been fused;**

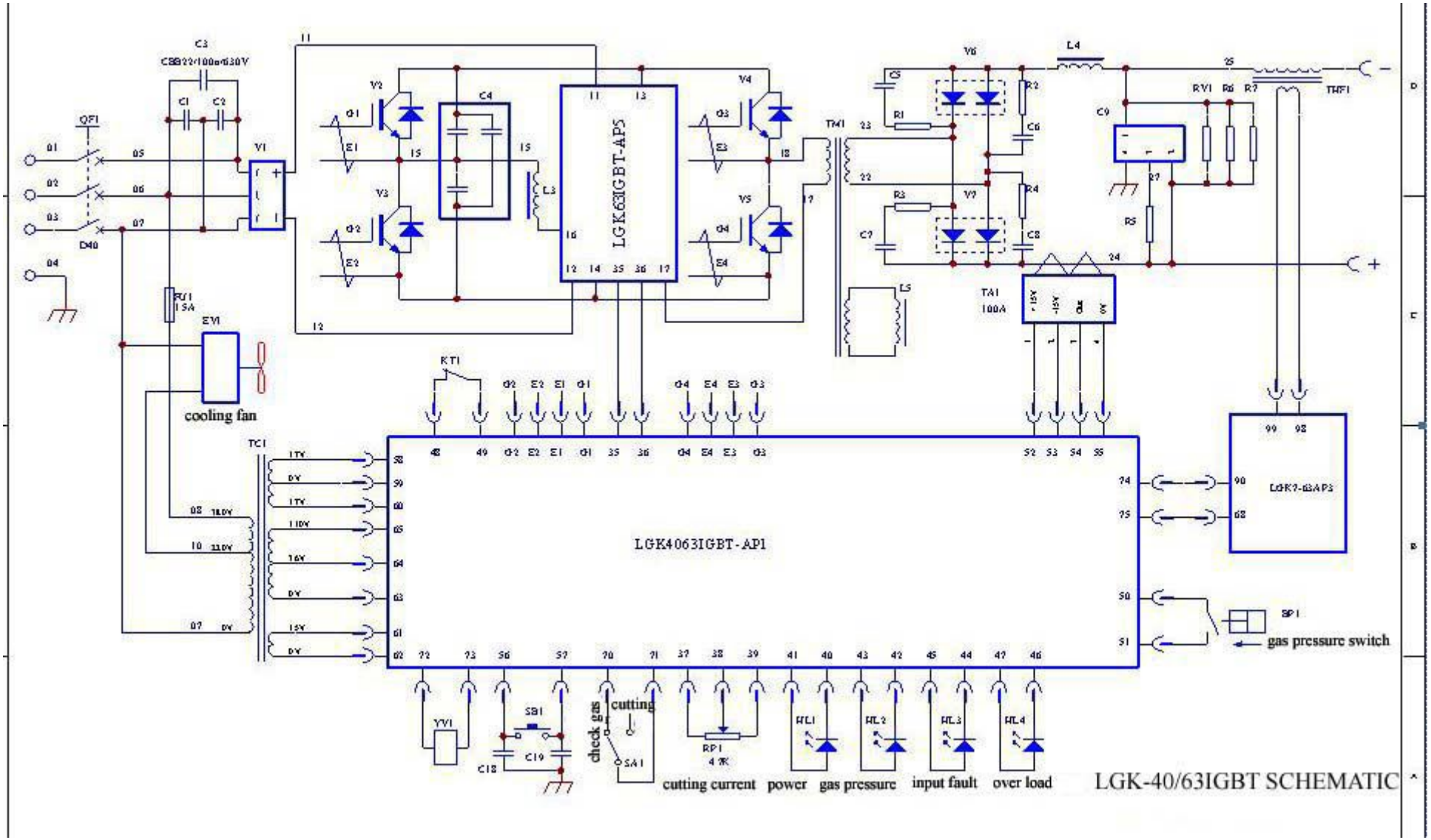
➢ **Ordinary trouble and repair as following diagram**

Trouble	Reasons	Solutions
1. When the power is switched on, the lamp and the digital meter are not ON.	1.Three-phase power misses phase 2.Supply power is damaged 3.Power control fuse 1.5A is broken	1.Check three-phase power source 2.Change power switch 3.Change power control fuse
2. Supply abnormity indicator lamp is ON without arc striking	1. Three-phase power misses phase 2. Three-phase power over voltage or under voltage	Check three-phase power source to ensure the supply voltage accordance with the supply requirements.
3. No arc striking or arc breaking during cutting. Overheat indicator lamp is ON.	1. The ambient temperature is too high. 2. When cutting, cooling fan rotates slowly or do not rotate, so the cooling effect is bad. 3. Temperature relay is damaged	1. Let the cutter rest for a while, and will come to work normally later. 2. Check fan power source or change cooling fan 3. Change temperature relay
4. It cannot start. Gas pressure lamp is not ON.	1. No gas pressure 2. The pressure of gas supply is too low	1. Connect the gas source 2. Adjust gas supply pressure.
5. Without arc striking, cutting indicator lamp, gas pressure lamp are ON, and supply abnormity indicator lamp and overheat lamp are not ON.	1. Cutting ground wire is not well connected. 2. Gas pressure is too high. 3. Torch electrode and nozzle are badly broken. 4. Torch is damaged.	1. Connect the cutting ground wire well 2. Lower the pressure of gas supply 3. Change the electrode and nozzle 4. Change the torch
6. Weak cutting quality	1. Gas pressure is too high or too low. 2. Workpiece is too thick 3. Torch electrode and nozzle are broken 4. Plasma arc is not perpendicular to the workpiece 5. Cutting speed is too fast or too slow	1. Adjust gas pressure 2. The thickness of workpiece should be within the quality cutting range. 3. Change electrode and nozzle 4. Adjust torch angle 5. Adjust cutting speed

If the troubles cannot be resolved, please inform our local agent of the specific problems or contact us directly.

◆ Accessories

1. **Cutting power source** **1set**
2. **Cutting torch** **1pc**
3. **Ground cable 3m(with DJK-16 red connector and ground clamp)** **1pc**
4. **Product certificate** **1pc**
5. **Instruction manual** **1pc**


LGK63IGBT-AP5
LGK4063IGBT-AP1
LGK2-63AP3
cooling fan
gas pressure switch
check gas
cutting
cutting current
power
gas pressure
input fault
over load
LGK-40/63IGBT SCHEMATIC