Foreword

Thank you for choosing the WS-M Series DC Inverter Argon Arc Welder of Delixi (Hangzhou) Drives Co., Ltd.

Before use WS-M Series DC Inverter Argon Arc Welder, please carefully read this Manual to ensure correct use. Incorrect use may lead to abnormal operation, failure and reduction of service life of and even personal injury accidents. Therefore, WS-M Series DC Inverter Argon Arc Welder you must carefully read this Manual and strictly follow it. This Manual is a standard Annex, which is must be properly kept after reading for overhauling and maintaining the WS-M Series DC Inverter Argon Arc Welder in future.

Except Operating Instructions stated herein, this Manual also provides the circuit diagram for your information. If you have any questions or special requirements on this products, please contact our local offices or distributors, you also can phone the Customer Service Center of our headquarters directly, we are at your service.

The contents of this Manual are subject to change without prior notice.

Before unpacking, please carefully read the following contents:

1. Whether the products are damaged, the spare parts are broken and fall off or main body is scratched during the transportation.
2. Whether the rated value stated on the nameplate of this machine is consistent with your ordering requirements, as well as the machine ordered, Product Certificate, User's Manual and Warranty are within the carton.

Our company has strict Quality Assurance System on the manufacturing and packaging of the products, in case of any inspection omitted, please immediately contact our Company or your supplier to deal with it.

Warning

Table of Contents

I. Product introduction

WS-M series inverter welder are proven product with stable performance which is manufactured with advanced invert welding technology. Its operating principle is that converts operating frequency of 50/60 Hz to direct current, then invert to high frequency at approximate 100 kHz, and performs voltage dropping and rectification by PWM and high power MOS field effect transistor (MOSFET), and then output high power DC power for welding by PWM. The weight and size of welder has been reduced and with the efficiency improvement of more than 30% due to invert technology.

Automatic compensation for network voltage fluctuation may enhance its performance for fluctuation resistance. It has the following features of easy to arc, stable welding current, rapid dynamic response, no welding noise, little splashing, no magnetic deviation and artistic welding seam.

WS-M Series DC Inverter Argon Arc Welder has the following features of stable and reliable operation, high efficiency, small size, light weight and portability.

DC pulse welding will produce artistic and uniform welding seam like fish scales and with excellent welding effect and little splashing.

II. Notice for Safety

	**IMPORTANT:** • **Do not cut off power in order to prevent damage of machine during welding.** • **Turn off control switch for cutting torch in order to ensure disconnection of cutting torch and base metal to prevent burning by electric arc before welding.** • **It is necessary to install safety protection switch for electric leakage.** • **The labor protection appliances must be approved by department of state administration of work safety supervision.** • **Operator must be with effective qualification "Welding (gas cutting) operation for metal" for special operation.** • **Do not perform operation with electricity for maintenance and repair of welding machine!**

Electric shock – may cause serious injury

- Install grounding device according to relevant requirements.
- Do not contact live component or electric welding rodwhile skin is exposed, wearing with wet gloves or in wet clothes.
- Ensure the insulation among you, ground and work piece.
- Ensure your operating position is safe.

Flue gas – it is harmful to health

- Keep head away from flue gas.
- Operator must use ventilation device or air extraction device to prevent breathing of flue gas while operate manual metal arc welding or manual argon arc welder.

Arc radiation – may damage your eyes and burn your skin

- Wear appropriate mask, optical filter and protective cloth to protect your eyes and body.
- Protect observer by appropriate mask or curtain.

Fire – welding sparks may cause fire. Ensure there is no inflammable material approach to cutting area and keep safe.

Noise – excessive noise may damage your hearing

- Protect your ears by ear muff or other hearing protective device.
- Warn observers that noise may damage their hearing.

Fault – seek professional service for fault.

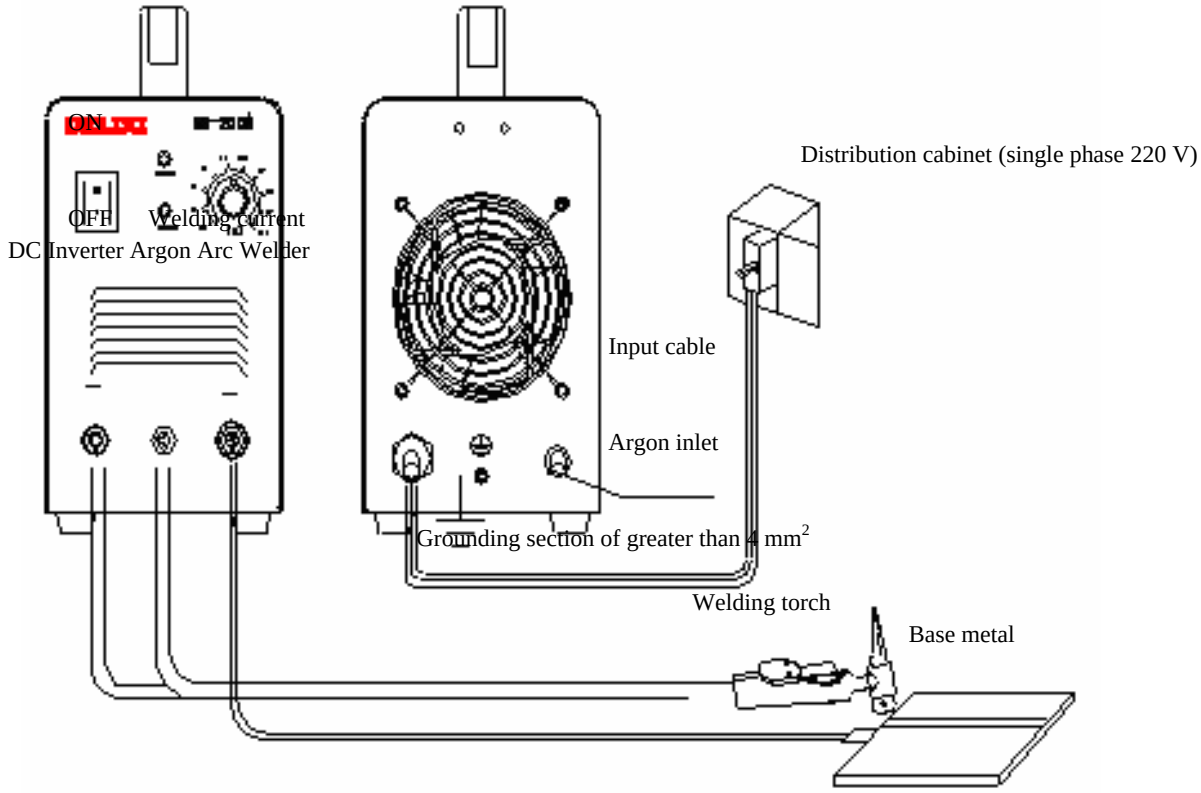
- Troubleshoot according to relevant items of this manual while there are difficulties for installing and operating.
- If you still not understood after reading or not troubleshoot according to this manual, please contact your distributor or our service center for professional service immediately.

III. Technical Parameters

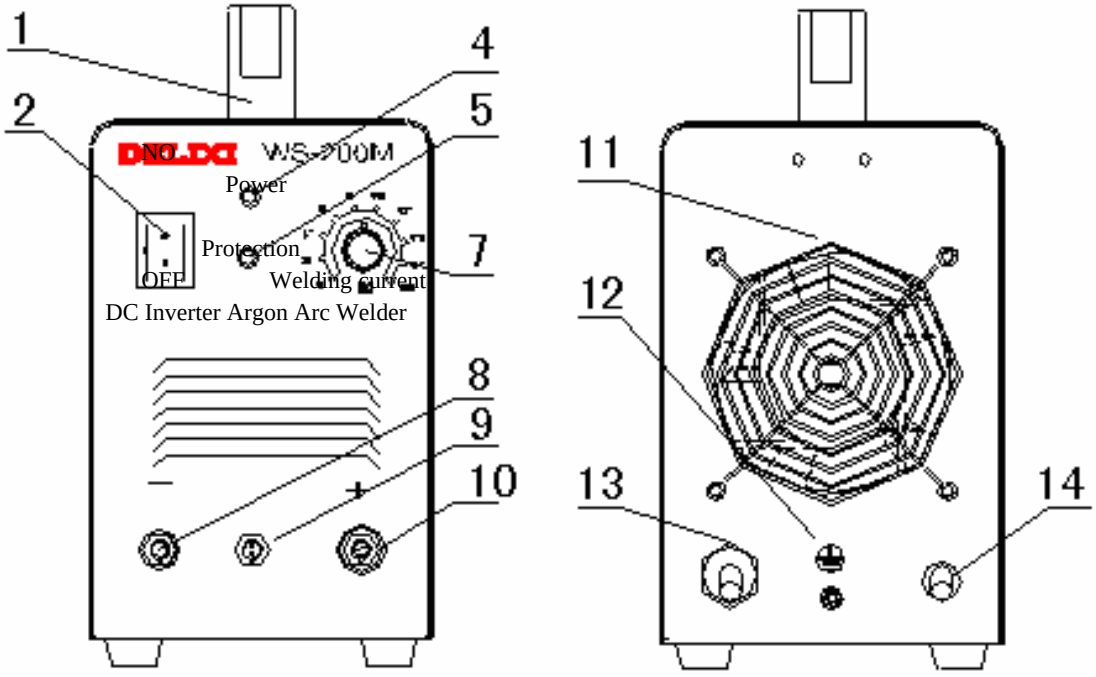
Model	WS-160M	WS-200M
Input power	Single-phase, AC 220V±10% 50/60Hz	Single-phase, AC 220V±10% 50/60Hz
Output current (A)	18	30
No-load Voltage (V)	43	43
Output current range (A)	10～160	10～200
Rated operating voltage (V)	16.4	18
Load succession rate (%)	35	35
Loss for no load (W)	40	40
Arcing method	High frequency arcing	High frequency arcing
Efficiency (%)	85	85
Power factor	0.93	0.93
Insulation Level	F	F
Shell Protection Level	IP21S	IP21S
Dimension (W×D×H)mm	155 x 295 x 375	155 x 295 x 375
Weight (kg)	9	10

Model	WS-250M	WS-315M	WS-400M
Input power	Three-phase, AC380V±10% 50/60Hz		
Output current (A)	7.5	9	18
No-load Voltage (V)	56	56	56
Output current range (A)	10～250	10～315	10～400
Rated operating voltage (V)	20	22.6	26
Load succession rate (%)	60	60	60
Loss for no load (W)	40	40	40
Arcing method	High frequency arcing	High frequency arcing	High frequency arcing
Efficiency (%)	85	85	85
Power factor	0.93	0.93	0.93
Insulation Level	F	F	F
Shell Protection Level	IP21S	IP21S	IP21S
Dimension (W×D×H)mm	205 x 360 x 480	355 x 470 x 580	355 x 470 x 580
Weight (kg)	16	20	30

IV. Installation and Operation



Argon arc welding connection schematic diagram



Front (rear) panel

No.	Name of Part	Function Description
1	Handle	For moving welding machine by operator.
2	Switch	Power switch
3		
4	Indicator lamp for power	Indicating for power ON/OFF
5	Indicator lamp for abnormal condition	Indicator lamp for abnormal condition is lighted when over-temperature is happened inside the welder, and the welder is out of work at this point of time. The welder will restart when the temperature return to normal and the indicator lamp will be off automatically.Cut off power when it is over current. The indicator lamp for over current will be off after power on.
6		
7	Current adjustment	Adjustment for welding current
8	Interface to welding torch	Interface to argon arc welding torch
9	Control socket for welding torch	Socket for controlling welding torch
10	Output positive electrode	Output positive electrode of welding machine, which connects with welding torch by inverted polarity connection method, otherwise it connects with work piece by positive polarity connection method.
11	Fan guard	Prevent the ingress of debris
12	Grounding mark	To ensure the safety of person, must make sure the bolt is grounded securely.
13	Waterproof connector	It is used to fix cable
14	Argon interface	Argon inlet for argon arc welding

It is recommended to select cable with larger section in order to reduce voltage drop while using longer output cable. If welding cable is too long, it may affect the arcing performance and other system performance of welding machine (e.g. high frequency arcing performance is reduced or system operation is abnormal). Therefore you should select the cable with recommended length.

(I) Connection for input cable

1) Each welding machine is equipped with one power cable. Connect the power cable to corresponding power voltage according to the input voltage of welding machine. Do not make wrong connection.

Power system will be switched into over voltage protection status due to welding operator's negligence to connect single phase AC 220V to AC 380V. Please cut off and reconnect power cable to AC 220V then restart the machine.

The input voltage for WS160/200M is single phase 220V.

2) Ensure the connections between power cable and power switch or terminals are good and prevent the effect of oxidation. Measure the power voltage whether it is in the range of fluctuation as necessary.

(II) Connection for output cable

WS-160M/200M/250M/315M/400M：

Connection for argon arc welding:

1) Gas source: connect argon pipe with the copper nozzle of argon which is located at the back of welding machine. Gas supply pipeline consists of gas bottle, relief flow meter and pipe. Connecting part for gas pipe should be fixed by clamp or other matters in order to prevent leakage and the ingress of air.
2) The conductive section of grounding cable for body shell should be not less than 4 mm^2. Connect a cable to ground at the grounding screw which is located at the back of welding machine in order to prevent static electricity or leak electricity.
3) Connect argon arc welding torch according to attached figure.
4) Fix quick plug of grounding cable with the quick socket on welding machine panel with the mark of “+” by screwing in clockwise, the other end of cable clamps with work piece.

V. Preparation and operating for welding

5.1 Operating instruction for argon arc welding

1) The indicator lamp for power will be on while turning power switch on front panel to position "ON". Turn function switch on the front panel to position of "Argon arc welding".
2) Turn on the valve of argon bottle and adjust the flow meter to required value.
3) The axial flow fan in the machine will operate and then press control button on welding torch to activate solenoid valve. Operator may hear the sound of spark discharging caused by high frequency arcing and see the argon outlet from welding torch.
4) Set appropriate welding current according to the thickness of welding work piece.
5) The distance between tungsten electrode of welding machine and work piece is 2 to 4 mm. Press control button on welding torch to arc and the sound of spark discharging caused by high frequency arcing may disappear; then operator may perform welding.

Caution

Do not insert or draw cables or connectors while welder is in operation, otherwise it may be harmful for personnel safety and damage machine. Cut off power first if it is necessary to do this.

Schedule: Parameters selection of manual tungsten electrode argon arc welding for stainless steel sheet (only for information)

Thickness (mm)	Welding joint	Diameter of tungsten electrode (mm)	Diameter of welding wire (mm)	Current	Welding current (A)	Argon flow (L/min)	Welding speed (cm/min)
1.0	Butt joint	2	1.6	DC positive polarity connection	7～28	3～15	12～47
1.2	Butt joint	2	1.6	DC positive polarity connection	15	3～15	25
1.5	Butt joint	2	1.6	DC positive polarity connection	5～19	3～15	8～32

Schedule: Parameters selection of manual tungsten electrode argon arc welding for titanium and titanium alloy (only for information)

（mm） Thickness (mm)	Groove	Welding layer	Diameter of tungsten electrode	Diameter of welding wire	Welding current	Argon flow (L/min)			Nozzle diameter
0.5	I Groove	1	1.5	1.0	30～50	8～10	6～8	14～16	10
1.0		1	2.0	1.0～2.0	40～60	8～10	6～8	14～16	10
1.5		1	2.0	1.0～2.0	60～80	10～12	8～10	14～16	10～12
2.0		1	2.0～3.0	1.0～2.0	80～110	12～14	10～12	16～20	12～14
2.5		1	2.0～3.0	2.0	110～120	12～14	10～12	16～20	12～14
3.0	Y Groove	1～2	3.0	2.0～3.0	120～140	12～14	10～12	16～20	14～18
4.0		2	3.0～4.0	2.0～3.0	130～150	14～16	12～14	20～25	18～20
5.0		2～3	4.0	3.0	130～150	14～16	12～14	20～25	18～20
6.0		2～3	4.0	3.0～4.0	140～180	14～16	12～14	25～28	18～20
7.0		2～3	4.0	3.0～4.0	140～180	14～16	12～14	25～28	20～22
8.0		3～4	4.0	3.0～4.0	140～180	14～16	12～14	25～28	20～22
10	Dual Y Groove	4～6	4.0	3.0～4.0	160～200	14～16	12～14	25～28	20～22
20		12	4.0	4.0	200～240	12～14	10～12	20	18
22		12	4.0	4.0～5.0	230～250	15～18	18～20	18～20	20
25		15～16	4.0	3.0～4.0	200～220	16～18	20～26	26～30	22
30		17～18	4.0	3.0～4.0	200～220	16～18	20～26	26～30	22

Schedule: Parameters selection of manual tungsten electrode argon arc welding for aluminum and aluminum alloy (only for information)

Thickness (mm)	Groove	Welding layer (front/back)	Diameter of tungsten electrode (mm)	Diameter of welding wire	Preheating temperature (℃)	Welding current	Argon flow	Nozzle diameter (mm)
1.5 2	I Groove	1/0 1/0	2 2～3	1.6～2.0 2～2.5	_ _	50～80 50～80	7～9 8～12	8 8～12
3 4 5 8 10 12 16 20	Y Groove	1/0 1～2/1 1～2/1 2/1 3～4/1～2 3～4/1～2 4～5/1～2 4～5/1～2	3 4 4 5 5 5～6 6 6	2～3 3 3～4 4～5 4～5 4～5 5～6 5～6	_ _ _ 100 100～150 150～200 200～220 200～260	15～180 180～200 180～240 260～320 280～340 300～360 340～380 360～400	8～12 10～15 10～15 16～20 16～20 18～22 20～24 25～30	8 8～12 8～12 10～12 14～16 14～16 16～20 20～22
16～20 22～25	Dual Y Groove	2～3/2～3 2～3/2～3	6 6～7	5～6 5～6	200～260 200～260	300～380 360～400	25～30 30～35	16～20 20～22

Possible problems in welding process

Following phenomenon may be related to the accessories, gas, environmental factor and power supply condition used. Please improve operating condition to prevent theses phenomenon occurrence.

A. Welding point darkening

——This phenomenon indicates that welding joint is oxidized without taking effective protection measures. You can check as follow:

1. Confirm valve of argon bottle is opened and with sufficient pressure. Generally, refill argon if internal pressure of argon bottle is less than 0.5 MPa.
2. Check the flow valve for argon whether is opened and with sufficient pressure. In order to save argon, you may select different flow according to the actual welding current, but lower flow may cause welding point not covered by protective gas completely. It is recommended that the argon flow should be not less than 5 L/min regardless of the current.
3. The simplest method for checking gas flow is that feel the gas on the nozzle of welding torch by hand and check whether the pipeline of welding torch is blocked.
4. Bad sealing performance of pipeline or lower purity may affect welding quality.
5. Strong air flow in operating condition may affect welding quality as well.
6. Adjustment for duty ratio is too low.

B. It is difficult to arc and easy to break.

1. Confirm the quality of tungsten electrode is good. The discharge performance of tungsten electrode in bad quality may not meet relevant requirement.
2. The tungsten electrode without sharp treatment is not easy to arc and may cause arc to be unstable.

C. The current may be unstable during machine operation.

This condition may be related to following factors: 1. Change of network voltage. 2. Interference by network or other electrical equipments.

Precaution or preventive measures

1. Environment

1) Welding operation must be preformed in a dry condition with air humidity of not greater than 90%.
2) Ambient temperature range between -10℃ to 40℃.
3) Do not operate welder in sunshine or in the rain to prevent the ingress of water or rainwater.
4) Do not operate welder in the environment with dust or corrosive gas.
5) Do not perform gas protective welding in the environment with strong air flow.

2. Keys to Safety

This welder is equipped with protection circuits for over current and over heating. System will shut down if network voltage, output current and inside temperature exceed setting value. Excessive operation may damage welder as well (e.g. voltage is higher), therefore you must be in accordance with following:

1) Good ventilation!

During the operation of WS-M series welding machine, nature ventilation may not meet the cooling requirements of welder due to the larger current. Therefore it is necessary to set a fan inside to cool and ensure its stable operation.

In order to ensure good ventilation, welding operator must ensure air vent is not covered or blocked and the distance between welder and surrounding objects should be not less than 0.3 meter. Above items are important for the operation and service life of welder.

2) Do not overload!

Welding operator should observe the max. allowable load current (relative to load succession rate) and maintain welding current not greater than max. allowable load current.

Over current may shorten service life of welder obviously or even burn it out.

3) Do not over voltage!

Power voltage listed in “main performance parameters list”. Generally, automatic compensation circuit in welder may maintain welding current within allowable range required for normal operation. However, it may damage welder if power voltage exceeds power voltage. Operator must observe above condition and take proper preventive measures.

4) Each welder is equipped with a grounding bolt behind machine and grounding mark. Select a cable with the section of not less than 4 mm^2 to discharge static electricity or prevent electric leakage for **grounding** of welder before operating.
5) Welder will enter **into protection status** and stop operating if it exceeds the standard load succession rate. It indicates that excessive heat activates the temperature control switch to stop operating of welder, and red indicator lamp is on at front panel. During this condition, do not remove power plug and maintain cooling fan inside to operate to cool the power device. If yellow indicator lamp is off, it indicates that temperature is drop to normal range, system is back to normal.

VI. Maintenance

1) Purge inside by dry and clean compressed air regularly. Remove dust every month if welder is operated in the environment of heavy smoke and serious air pollution.

2) Pressure of compressed air should be maintained within a applicable range in order to prevent damage of small element inside.

3) Check circuit connections inside regularly in order to ensure correct connection and firm connectors (especially for inserted connector or element). Remove rust and oxidation film by abrasive paper if they are rusty and looseness, and then reconnect and fix.

4) Prevent the ingress of water or water vapor for welder. Dry it if there is water or water vapor. And then measure the insulation condition of cutting machine by megameter (including space between connecting points and space between connecting point and body shell). Perform welding operation after ensure they are normal.

5) Store welder in the original package and place it in dry condition if it is not used for long time.

VII Troubleshooting

1. Free maintenance assurance may be failure if customer repair any fault of welding machine by themselves without our authorization during warranty period.

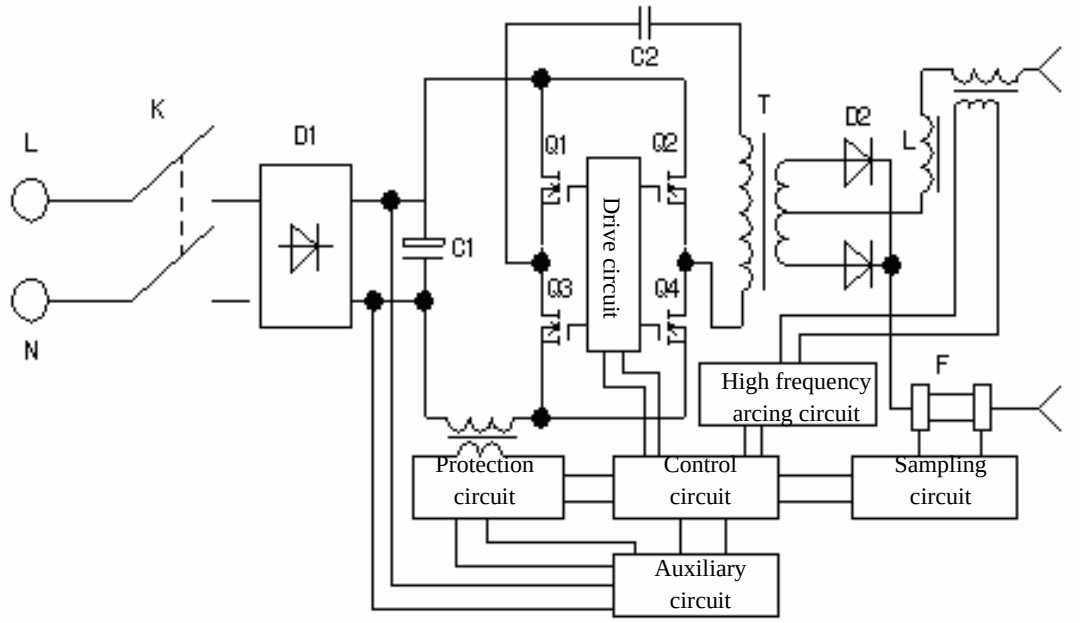
2. Following operations require enough professional knowledge on electric and comprehensive knowledge on safety. Operator should be with required knowledge and relevant qualification.

I. Fault and Troubleshooting

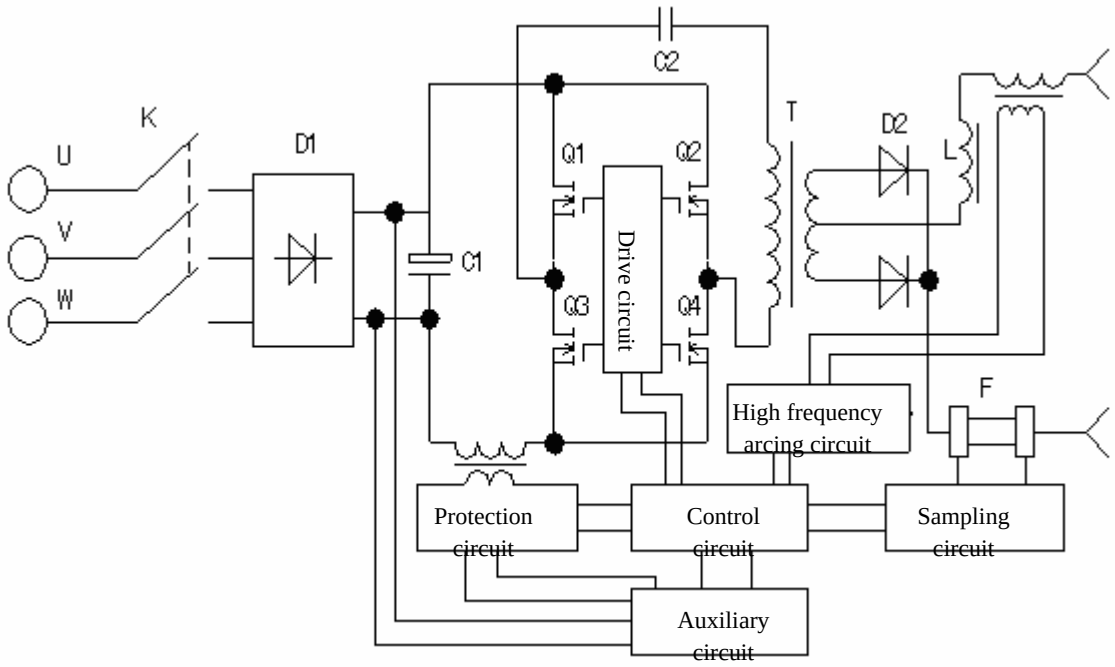
Fault	Troubleshooting
1. Indicator lamp for power is off, fan is not operating and without welding output	1. Power switch is damaged 2. Ensure network connected with input cable is live or not. 3. Ensure input cable is open or not.
2. Indicator lamp for power is on, fan is not operating or operating for a while and without welding output.	1. Connect with 380V power by mistake to cause it activate over voltage protection circuit. Reconnect with 220V power and restart. 2. 220V power is unstable (input cable is too long) or connect with network to cause it activate over voltage protection circuit. Increase the diameter of input cable or joint for fixing input cable. Shut down and restart after 2 to 3 minutes. 3. Connect power switch for on and off in short time to cause it activate over voltage protection circuit. Shut down and restart after 2 to 3 minutes. 4. Wire between switch and power panel is looseness and fix them again. 5. 24 V relay in main circuit is not engaged or damaged. Check 24 V power and relay. Replace it by same model one if relay is damaged.
3. Fan is operating and indicator lamp for fault is off, without rustle caused by high frequency discharging. No arcing when struck.	1. The voltage between positive and negative poles of VH-70 plug on MOS plate and power plate should be DV 308 V measured by multimeter. (1) Whether there is open circuit or bad wire connection of silicon bridge. (2) Whether there is creepage to one or any of four big electrolytic capacitor (470UF/400Vapprox.) on the power plate, replace it if any. 2. Auxiliary power is fault if the green indicator lamp for auxiliary power on MOS plate is off. Check fault point and contact distributor. 3. Check any poor contact for each wire. 4. Control circuit is fault. Check reason and contact distributor. 5. Control cable of welder is broken.
4. Indicator lamp for fault is off and with rustle caused by high frequency discharging. No welding output.	1. Cable of welder is damaged. 2. Grounding cable is damaged or not connects with work piece to be welded. 3. Connections for positive output terminals or gas and electric output terminals of welding torch are looseness.

5. Indicator lamp for fault is off and with rustle caused by high frequency discharging. Arcing when struck.	1. Poor contact between primary wire of arcing transformer and power plate. Refix it. 2. Discharge nozzle is oxidized or too long. Remove the surface oxidation film of discharge nozzle or adjust the distance of discharge nozzle to 1 mm. 3. Changeover switch of manual and argon arc welding is damaged. It is need to be replaced. 4. Some elements of high frequency arcing circuit are damaged. Check and replace.
6. Indicator lamp for fault is on but without output.	1. Over current protection. Shut down and restart after indicator lamp for fault is off. 2. Overheating protection. Do not shut down and wait for 2 to 3 minutes. 3. Inverter circuit is fault. Remove power plug for main transformer on MOS plate (close to fan VH-07 inserter) and restart. (1) Indicator lamp for fault is still on. Shut down and remove high frequency arcing power plug (close to fan VH-03 inserter) and restart. a. Indicator lamp for fault is on due to some field effect transistors on MOS plate are damaged. Check and replace the same type field effect transistor. b. Indicator lamp for fault is off due to step up transformer of high frequency arcing circuit is damaged and need to be replaced. (2) Indicator lamp for fault is off. a. Medium transformer is damaged. Measure the primary inductance and Q value of transformer by electric bridge. If L=0.9-1.6mH, Q>35 as well as inductance and Q value is very small, replace it. b. Some transformer secondary rectifying tubes are penetrated. Check and replace by same type. 4. Feedback circuit is opened.
7. Output current is unstable or not controlled by potentiometer during welding.	1. IK potentiometer is damaged and need to be replaced. 2. Check poor contact for each connection especially for connector etc.
8. Alkaline welding rod is difficult to operate due to serious splashing for manual welding.	1. Polarity connection is wrong and it is need to change the polarity of grounding cable and welding torch cable.

VIII. Circuit Diagram



Functional block diagram for the Models smaller than WS – 200M



Functional block diagram for models greater than WS – 250M