



MANUAL BOOK

ARC400SI

INVERTER DC MMA

WELDING MACHINE



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This operating manual can be fit for ARC (include ARC315 SI /400 SI/500 SI /630 SI) series welding machines. The technical data are measured with power supply 3 phase 400V, the data will be changed when you use different voltage such as 380V and 415V.

ARC series Block diagram of principle (ARC series welding machines do not have HF Arc-starting device)

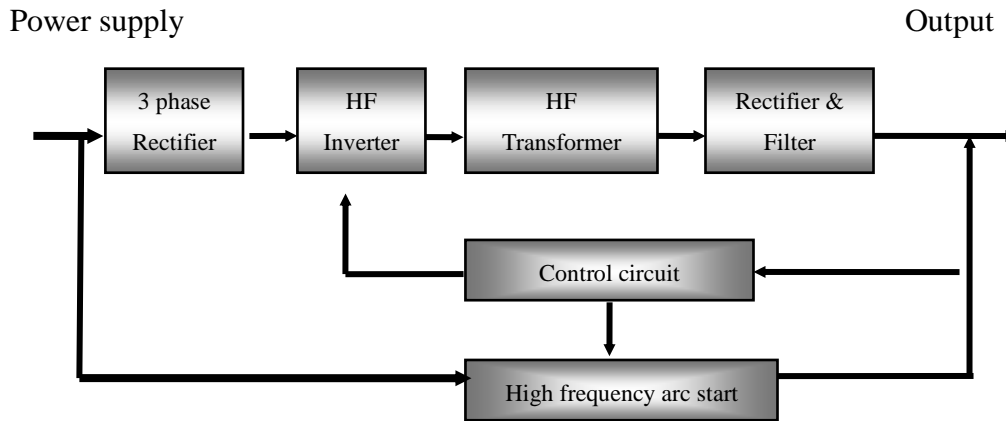


Figure 1: Block diagram of principle

This series welding machines apply IGBT soft switch inverter technology. 3- phase input volt are rectified by rectifier, inverted into HF AC, reduced by HF transformer, rectified and filtered by HF rectifier, then output DC power suitable for welding. After this process, the welder's dynamical responsive speed has been greatly increased, so the welder size and weight are reduced noticeably result in energy saving. Power source enjoy sound anti-fluctuating ability and high-quality performance during external context changes (As to fluctuation in input power supply and extended welding cables). Easy to arc start, stable arc length, pretty weld formation and capability of continuous regulation the current of welding, arc-starting, arc force current and time of down-slope as well as remote control availability add significant values to customers. They can also perform down-slope, pre-gas flow and post-gas flow function due to reasonable logic circuit design.

Inverter DC arc welding machines output characteristic curve is as follows:

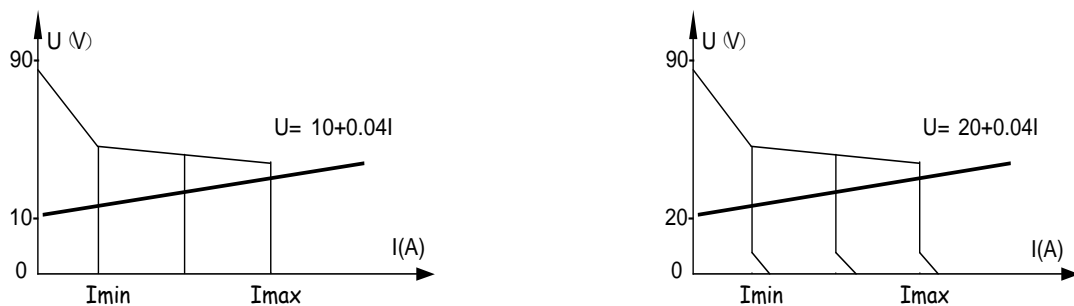


Figure 2: TIG mode Volt-Ampere curve

MMA mode Volt-Ampere curve

1. Main technical parameters

► **ARC- SI series**

Description	Parameters			
	315	400	500	630
Primary power voltage/frequency	3 phase 400V±10%/50Hz			
Rated output capacity	10.3KW	14.4KW	20KW	27.7KW
Rated input current	20A	26A	35A	52A
Rated duty cycle	60%			
Range of output current	20 ~ 315A	20 ~ 400A	20 ~ 500A	50 ~ 630A
Output voltage of open load	80±8V			
Full-load efficiency	89%			
Power factor	0.95			
Welding electrode diameter	2 ~ 5mm	2 ~ 6mm	2 ~ 6mm	2 ~ 6mm
Weight	34Kg	43Kg	50Kg	58Kg
Dimension	576×297×557 mm		636×322×582 mm	686×322×584 mm
Insulation grade	Main transformer		H	
	Power source transformer/output reactance		B	

Table1: Parameter Specification of ARC series welding machine

► Features & Applications for ARC series welding machines

ARC series welding machine include 315, 400, 500, 630 etc., which are novelty high-efficient and energy-saving DC Arc welders, suitable for welding mild steel, alloy steel by perfect welding performance.

Features and Benefits:

- Soft switch technology, high efficiency.
- High duty cycle. Small size, light weight.
- Designed for demanding industrial environments.
- It is suitable for long distance welding. (up to 50m).
- Easy to arc-starting and molten pool control.
- Digital display for accurate parameter preset.
- ARC-II Type machine can perform downhill welding function for cellulose electrode, ideal for pipeline, construction and maintenance welding.
- ARC-B Type machine has wider welding current range(5-400A), 40% duty cycle, not suitable for long cables welding. It is more compact, only 23kg, suitable for general purposes.

Applications:

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

This series welding machine is strict in line with National standard IEC 60974-1 and IEC60974-10.

Pre-installation

Installation Environment

This series is designed for use in adverse environments. Examples of environments with increased adverse conditions are:

- In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts;
- In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator;
- In wet or damp hot locations where humidity or perspiration considerably reduces the skin resistance of the human body and the insulation properties of accessories.
- Environments with adverse conditions do not include places where electrically conductive parts, in the near vicinity of the operator, which can cause increased hazard, have been insulated.
- The gradient of ground must be no more than 10°
- Ensure no wind at the welding position, or use screen to block the wind.
- When using water-cooled torch, must be care of not being frozen.

1.2. Installation Location

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

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

1.3 Power Source Connections

Warning

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

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

DO NOT TOUCH live electrical parts.

- SHUT DOWN welding power source, disconnect input power employing lockout/tagging procedures.
- Lockout/tagging procedures consist of padlocking line disconnect switch in open position.
- Removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1.4. Power Supply Requirements

- Input volt must be standard sine wave, effective value 400V, and frequency 50Hz.
- Unbalance degree of 3- phase volt must be no more than 5%.
- Power supply:

Product model		315	400	500	630
Power supply		3 phase 400V±10%/50Hz			
Min. power capacity		21KVA	28KVA	38KVA	51KVA
Input protection	Fuse	40A	50A	63A	63A
	breaker	63A	63A	100A	100A
Min. Cable size	Input side	4mm ²	4mm ²	6mm ²	6mm ²
	Output side	35mm ²	50mm ²	50mm ²	70mm ²
	Earth lead	4mm ²	4mm ²	6mm ²	6mm ²

Table 6: Power supply connection

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

2. Installation

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

3.1 MMA mode

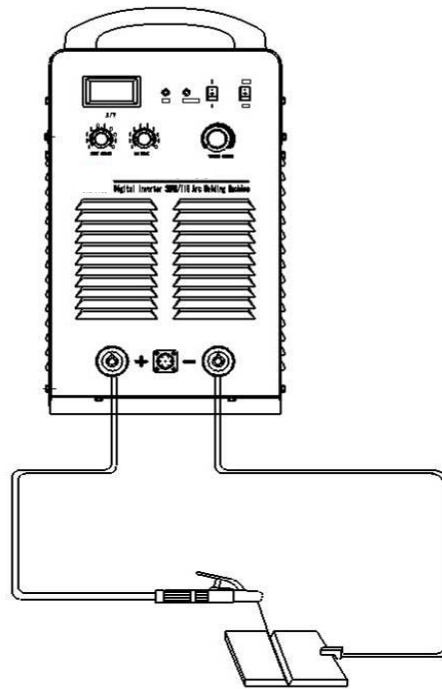


Figure 4: Outside connection diagram of ARC series

- (1) Ensure firmly connection to welding cable.
- (2) Connect to remote controller if needed.
- (3) Adjust every knobs and switches on the front panel to proper position in line with selected mode.
- (4) Turn on the circuit breaker on the power source.
- (5) Connect input 3 phase power cable to switch box.

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

► **Part one: ARC Series Operating Instruction**

1. Functional introduction

1.1 Front panel illustration and parts code reference

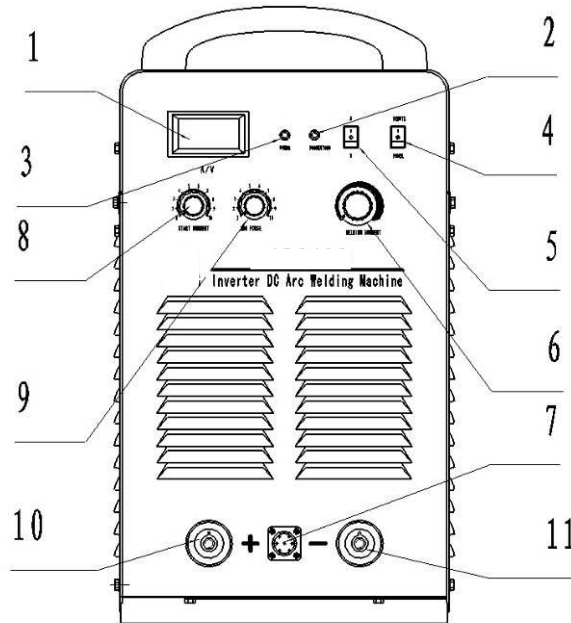


Figure 5: Front Panel

(1) Amp/volt LCD

- When display mode switch indicates to “Amp”:
 - LCD displays preset open-load current value;
 - LCD displays real welding current during working.
- When display mode switch indicates to “Volt”, LCD displays real welding voltage during welding.

(2) Protection on LED

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

(3) Power on LED

Lamp indicating whether power source is effectively connected to power supply.

(4) “Remote control/ Panel control” switch

When it is on “Panel control”, you can adjust welding current, arc force current or down-slope time through the knobs and switches on the panel; when it is on “Remote control”, you can adjust the above parameters through remote control box in an extended distance from the welding areas.

- (5) “Amp/Volt” meter mode switch
- (6) “Welding current” regulation knob
Used to adjust welding current on panel control mode.
- (7) Remote control socket
It is used to connect to the wire remote control box with remote control cable to adjust welding current, arc force current or down-slope time when it is on the “Remote control” mode, used to weld in extended distance.
To weld in normal distance on TIG, it is used to connect TIG torch's control cable directly.
- (8) “Arc-starting current “regulation knob
Used to adjust arc starting current under MMA.
- (9) “Arc force current/ down-slope time” regulation knob
Used to adjust arc force current under MMA or crater fill time under TIG
- (10) Welding cable (+) quick plug socket
It is used to connect with electrode holder on MMA mode, connect to workpiece on TIG mode.
- (11) Welding cable (-) quick plug socket
It is connected to workpiece on MMA mode and connected to TIG torch welding cable on TIG mode.

1.2 The rear panel and parts number reference

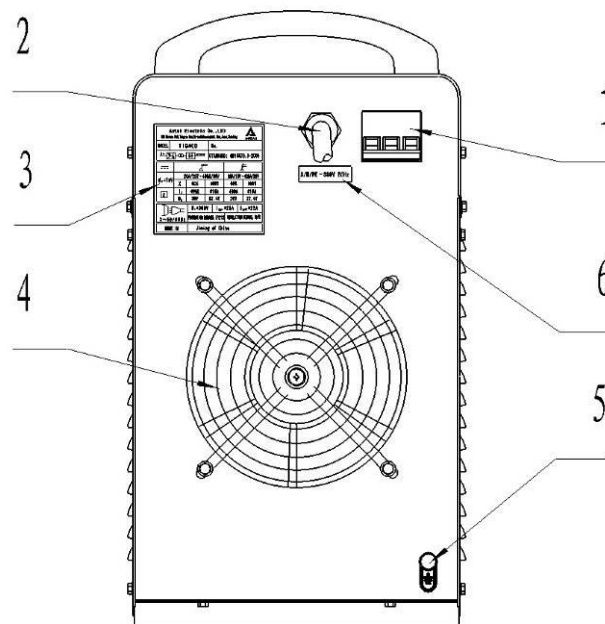


Figure 6: Rear Panel

(1) Circuit Breaker

The function of air switch is to protect welding machine by automatic trip to turn-off power supply while in machine overload or failure. Normally, the switch flipped to upward means power-on. Use switch on the switch box to start or stop welding machine. Don't use this air switch as power switch.

(2) Input power cable

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

(3) Specification plate

(4) Cooling fan

Cool down the heat components in the welding machine.

(5) Earthing bolt

To ensure operators not to be harmed and welding machine to work normally, make sure the earthing bolt grounded firmly by ground cable, or make sure the ground wire (mixed-colored) of the input power cable grounded firmly.

(6) Input warning mark

1.3 Remote control box

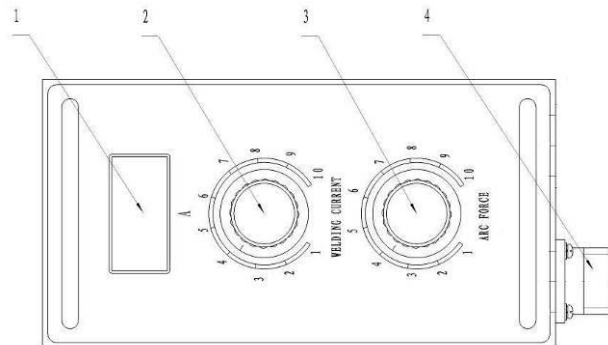


Figure 7: Remote Control Box

(1) “Amp” meter

It displays preset value while in open load, and displays practical value of welding current while in actual working.

(2) “Welding current” regulation knob

(3) “Arc force current/ down-slope” regulation knob

(4) Control socket (Connect to remote control cable)

2. Operating instruction

2.1 Turn on the air switch on the switch box, the “Normal” indication lamp will light on and cooling fan rotates. Before welding normally, set up parameters by adjusting knobs and switches on the control box and front panel according to the selected mode. Customer should refer to parameters defined in table 7 owing below:

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

Table 7: MMA welding parameters

Attention: On MMA, when welding current is low and cable length of electrode holder is short (no more than 40m), arc force current should be adjusted in the range of 1-7 . As to large welding current and long cable of electrode holder, where volt potential difference is very high between the two ends of cable, arc force current should be adjusted in the range of 7- 10.

1.2 The rear panel and parts number reference

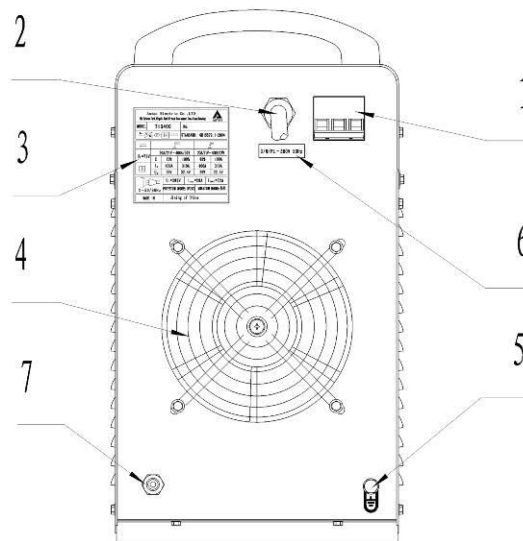


Figure 6: Rear Panel

(1) Circuit Breaker

The function of air switch is to protect welding machine by automatic trip to turn-off power supply while in machine overload or failure. Normally, the switch flipped to upward means power-on. Use switch on the switch box to start or stop welding machine. Don't use this air switch as power switch.

(2) Input power cable

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

(3) Specification plate

(4) Cooling fan

Cool down the heat components in the welding machine.

(5) Earthing bolt

To ensure operators not to be harmed and welding machine to work normally, make sure the earthing bolt grounded firmly by ground cable, or make sure the ground wire (mixed-colored) of the input power cable grounded firmly.

(6) Input warning mark

(7) Gas inlet

Connect to Argon gas regulator with gas hose.

1.3 Remote control box

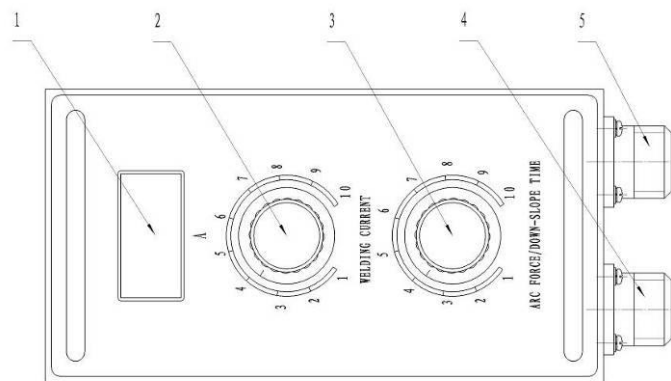


Figure 7: Remote Control Box

(5) “Amp” meter

It displays preset value while in open load, and displays practical value of welding current while in actual working.

(6) “Welding current” regulation knob

(7) “Arc force current/ down-slope” regulation knob

(8) Socket 1

Connect to remote control cable

(5) Socket 2

Connect to welding torch control cable which has a plug. There are 2 control wires welded to lug 1 and lug 2 respectively on the plug

2. Operating instruction

2.1 Turn on the air switch on the switch box, the “Normal” indication lamp will light on and cooling fan rotates. Before welding normally, set up parameters by adjusting knobs and switches on the control box and front panel according to the selected mode. Customer should refer to parameters defined in table 8 showing below:

Work piece thickness (mm)	Welding current (A)	Tungsten electrode diameter (mm)	Max Argon gas flow rate (L/min)
1 ~ 3	40 ~ 50	1 ~ 2	4
	50 ~ 80		6
3 ~ 6	80 ~ 120	2 ~ 4	7
	120 ~ 160		8
	160 ~ 200		9
	200 ~ 300		10
6 ~ 9	300 ~ 400	4 ~ 6	12

Table 8: TIG welding parameters

Attention: On MMA, when welding current is low and cable length of electrode holder is short (no more than 40m), arc force current should be adjusted in the range of 1-7 . As to large welding current and long cable of electrode holder, where volt potential difference is very high between the two ends of cable, arc force current should be adjusted in the range of 7- 10.

2.2 Working styles on TIG mode of STG series

Can be divided into 2 working styles: scratch arc-start and high frequency arc-start.

2.2.1 Shift between two working styles:

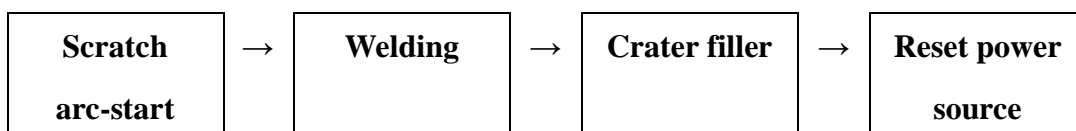
Shift scratch arc-start to high frequency arc-start

(1) Switch to “TIG” mode, then pull TIG torch trigger, and then loose it, open load voltage of power source will disappear to indicate working style is shifted to HF arc-start.

(2) Shift HF arc-start to scratch arc-start

Switch to “MMA” mode from “TIG”, then back to “TIG” to complete shift.

2.2.2 Scratch arc-start operation procedure:



Attention: This working style needs continuous gas flow without interruption in whole welding process, suited for the occasions by using TIG torch with no trigger.

2.2.3 High frequency arc-start

Procedure flow sheet shows below:

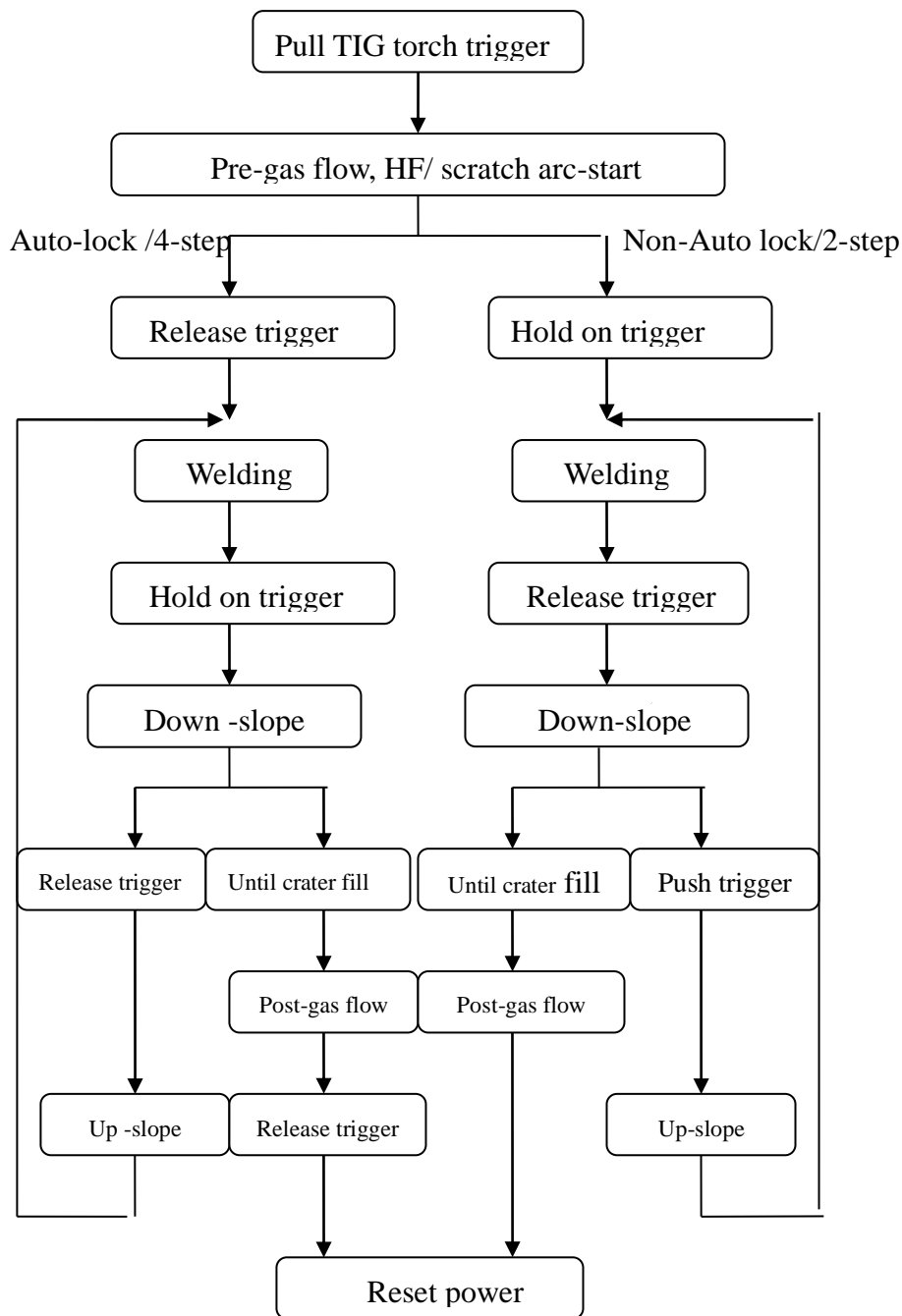


Figure 8: HF arc-start procedure flow sheet

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

1. Cautions:

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

2. General maintenance

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

3. Procedure for regular checking prior to maintenance

- Check if all front panel switches are on the proper positions.
- Check if the input volt has the phase missing, and range are between 360~440V.
- Check if the input cable is connected correctly and firmly with the power source.
- Check if the ground lead is connected correctly and firmly.
- Check if the welding cables are connected correctly and firmly.
- Check if gas regulator is in good situation and gas flows out normally.

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

No	TROUBLE	CAUSES	WHAT TO DO
1	After power on, it doesn't work.	<ol style="list-style-type: none"> 1) Phase missing in power source 2) Fuse (2A) in welder is broken. 3) Cable is broken 	<ol style="list-style-type: none"> 1) Check power source 2) Check if the Fan, Transformer for ZKB/QDB and Main Control Board are good or not. 3) Check connection
2	Circuit Breaker on Rear Panel trips while the machine is working normally.	<ol style="list-style-type: none"> 1) The following components may be damaged: IGBT Module, 3-phase Rectify Module, Output Diode Module, or other components 2) Drive Board is damaged. 3) Short circuit of the cable. 	<ol style="list-style-type: none"> 1) Check and replace. 2) When IGBT Module is damaged, please check 12Ω, 5.1Ω resistance or SR160 on Drive Board is damaged or not. 3) Check and repair.
3	Welding current is unstable.	<ol style="list-style-type: none"> 1) Phase missing 2) The following components may be damaged: Potentiometers, switches on front panel and remote control cable, potentiometer on remote controller. 3) Main Control Board is damaged 	<ol style="list-style-type: none"> 1) Check power source. 2) Check and replace. 3) Check and replace.
4	Welding current is not adjustable.	<ol style="list-style-type: none"> 1) Welding Current Rotary Encoder is damaged. 2) Remote control cable is broken. 3) Main Control Board is damaged 4) The switch on the front panel is damaged 	Check and replace.
5	TIG welding is abnormal.	<ol style="list-style-type: none"> 1) TIG torch switch is damaged. 2) Remote control cable is broken. 	Check and replace.

		3) The tungsten electrode in welder is in the wrong position. 4) Main Control Board is damaged	
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Table 9: Trouble Shooting Table

Appendix A

1. General

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

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

2. Assessment of area

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

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

3. Methods of reducing emissions

- 1) Public supply system
Arc welding equipment should be connected to the public supply system according to

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

2) Maintenance of the arc welding equipment

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

3) Welding cables

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

4) Equipotent bonding

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

5) Earthling of the work piece

Where the work piece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example ships hull or building steelwork, a connection bonding the work piece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthling of the work piece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the work piece to earth should be made by a direct connection to the work piece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

6) Screening and shielding

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

Feedback Form

Name of Company			
Address			
Contact person		Title	
Telephone No		Fax No.	
Email Address			
Company's filed of business			
Comments :			

Thank you for taking the time to share your feedback. Your comments and suggestions will help us to serve you better.