



USER MANUAL
INVERTER Based Welding Machines

GRAND ARC 161 GRAND ARC 202PFC

IMPORTANT: Read this OPERATOR MANUAL together with PRESCRIPTION AND COMPLIANCE MANUAL before to use this equipment. In case of loss one of two parts contact immediately your dealer.

Allow the operator to consult this manual.

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INSTALLATION WARNING

This machine is certified according to 60974-10:2014 Arc Welding Equipment Part 10: Electromagnetic compatibility (EMC) requirement and the EUT belongs to Group 2 Class A.

WARNING: This Class A equipment is intended for industrial use and it is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances.

WARNING: This equipment does not comply with IEC 61000-3-12. If it is connected to a public low-voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

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:

- a) other supply cables, control cables, signalling and telephone cables, above, below and adjacent to the arc welding equipment;
- b) radio and television transmitters and receivers;
- c) computer and other control equipment;
- d) safety critical equipment, for example guarding of industrial equipment;
- e) the health of the people around, for example the use of pacemakers and hearing aids;
- f) equipment used for calibration or measurement;
- g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- h) the time of day that welding or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of reducing emissions-Public supply system

Arc welding equipment should be connected to the public supply system according to this manual 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 throughout 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.

Maintenance of the arc welding equipment

The arc welding equipment should be routinely maintained according to this manual 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 this manual. In particular, the spark gaps of arc striking and stabilising devices should be adjusted and maintained according to our recommendations.

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.

Equipotential bonding

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

Earthing of the workpiece

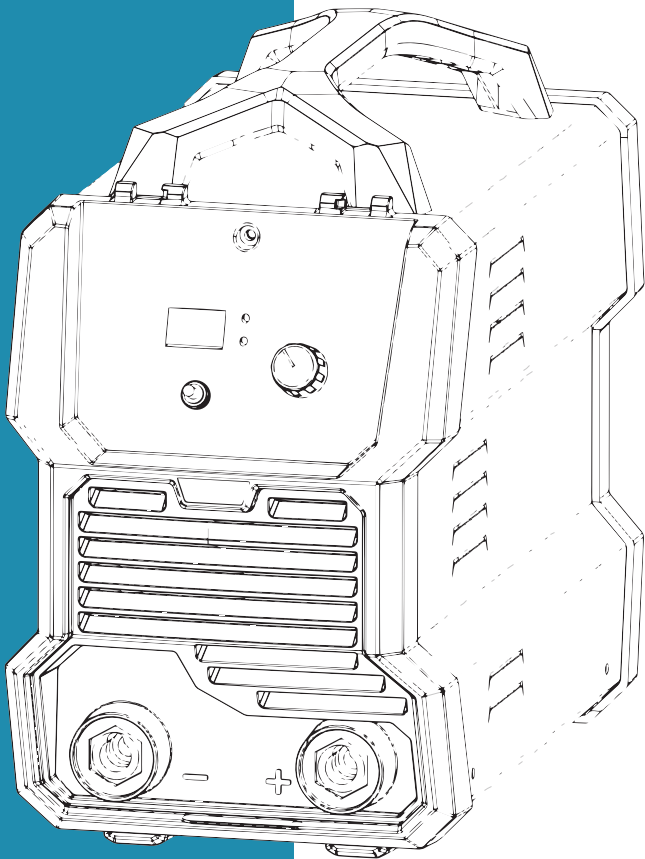
Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example, ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the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

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 area may be considered for special applications.

2.1 Features

- PFC Tecnology: Power Factor more than 99%. Multiple advantages such as energy saving and wider input voltage.
(only for GRAND ARC 202 PFC)
- MMA Mode: capable of welding in SMAW (Shield Metal Arc Welding).
- Tig Mode: capable of welding with Lift TIG mode.
- Extra functions:
 - "Hot Start"(built in): help the welder in the arc ignition;
 - "Anti-sticking": stop the output current when the electrode is glued to the working piece.
 - "Arc Force" (built in): increase the output current when the arc is to short helping the welder.



- Protections: equipped with temperature, voltage
and current sensors for high protection.
- Digital display: digital current display meter for accurate presetting and feedback of welding parameters and out put.
- Extremely low weight and versatility.
- Generator friendly: Designed to work with diesel generators and to avoid failures due to its voltage spikes.

2.2 Technical Data

Models Parameters	GRAND ARC 161	GRAND ARC 202 PFC	
Power Supply Voltage(V)	1~220/230/240±10%	1~220	1~220
Frequency(HZ)	50/60	50/60	
Rated input current (I _{lmax}) (A)	37 MMA/27 TIG	30 MMA/18,5 TIG	29MMA/19,5 TIG
Rated input power (KW)	5,5 MMA/ 4,0 TIG	3,4 MMA/2 TIG	29MMA/19,5 TIG
Duty cycle (40°C 10 min)	40% 160A	40%110A	40%200A
	60% 135A	60%90A	60%165A
	100% 105A	100%70A	100%130A
Welding Current Range (A)	10-160	10-110	10-200
No Load Voltage (V)	62V	67V	67V
Efficiency (%)	≥85%	MMA 83,1% TIG 80,2%	MMA 84,4% TIG 80,2%
Power Factor	0.99	0.99	
Insulation class	F	F	
Protection class	IP23S	IP23S	
Cooling	AF	AF	
Net Weight (Kg)	7	7	
Dimensions(mm)	380x185x305	380x185x305	
Electrode Diameter	φ 1.6~φ 4.0	φ 1.6~φ 4.0	
Electrode Type	6013,7018 etc.	6013,7018 etc.	
Idle state of consumption (w)		36W	37,8W

3 Brief Introduction

Grand Arc series of welding machines adopt the latest Pulse Width Modulation (PWM) technology and the Insulated Gate Bipolar Transistor (IGBT) power modules. It uses switching frequencies in the 20KHz-50KHz ranges so as to replace the traditional line-frequency transformer type welding machines. So, machines are characterized with portability, small size, lightweight, low energy consumption and noise, etc.

Grand Arc series of welding machines has excellent performance: constant current output makes welding arc more stable; fast dynamic response speed reduces the impact from the arc length fluctuation to the current; accurate stepless current adjustment and pre-setting function. There are also some automatic protection functions for under voltage, over current, over heat, etc. inside the welder, when the problems listed before occurred, the alarm light on the front panel is on and at the same time the output current will be cut off. It can self-protect, prolong the usefull life, greatly improved the reliability and practicality of the welding machine. Grand Arc series of welding machines can also realize TIG operation.

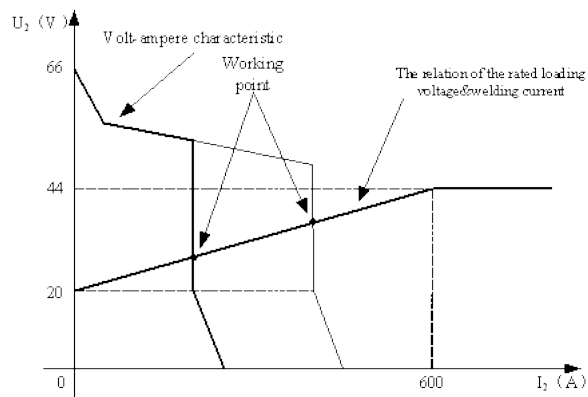
Grand Arc series of welding machines is widely used in Petroleum, chemical, mechanical, shipbuilding, architecture, boiler, pressure container, military industry and Maintenance work, etc. These machines have high duty cycle even in the 40°, which can keep the continuous operation.

2.4 Volt-Ampere Characteristic

Grand Arc series of welding machines has excellent volt-ampere characteristic. Referring to the following graph.

In MMA welding, the relation between the rated loading voltage U_2 and welding current I_2 is as follows:

When $I_2 \leq 600A$, $U_2 = 20 + 0.04 I_2 (V)$; When $I_2 > 600A$, $U_2 = 44 (V)$.



3.1 Layout for the front and rear panel

Installation & Operation

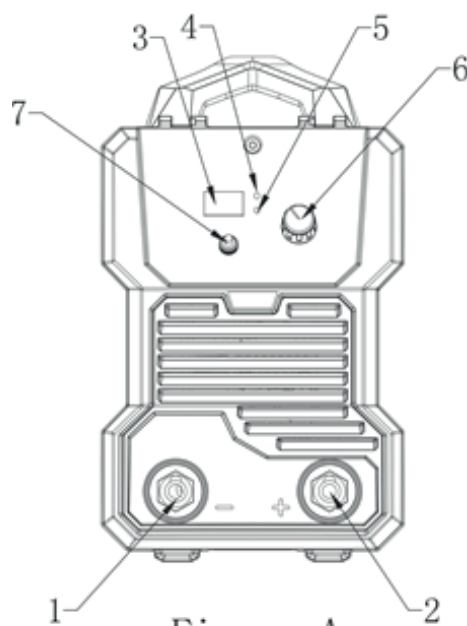


Figure A

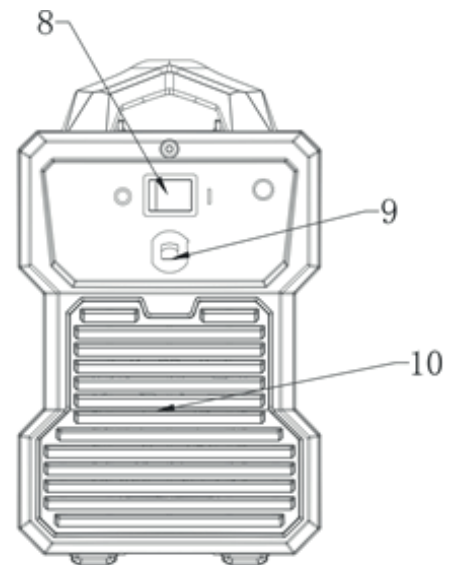
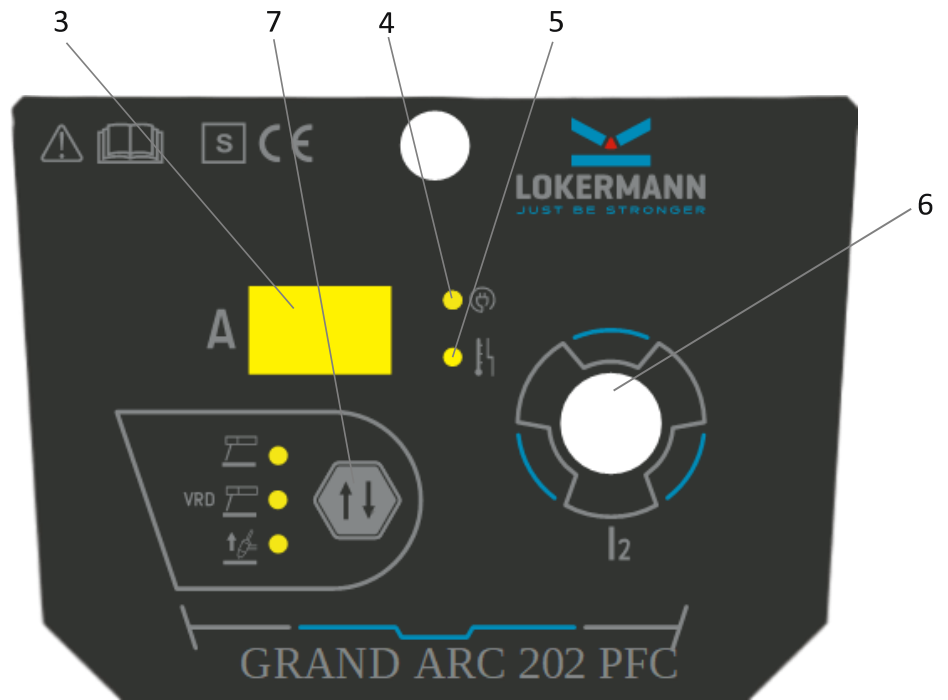
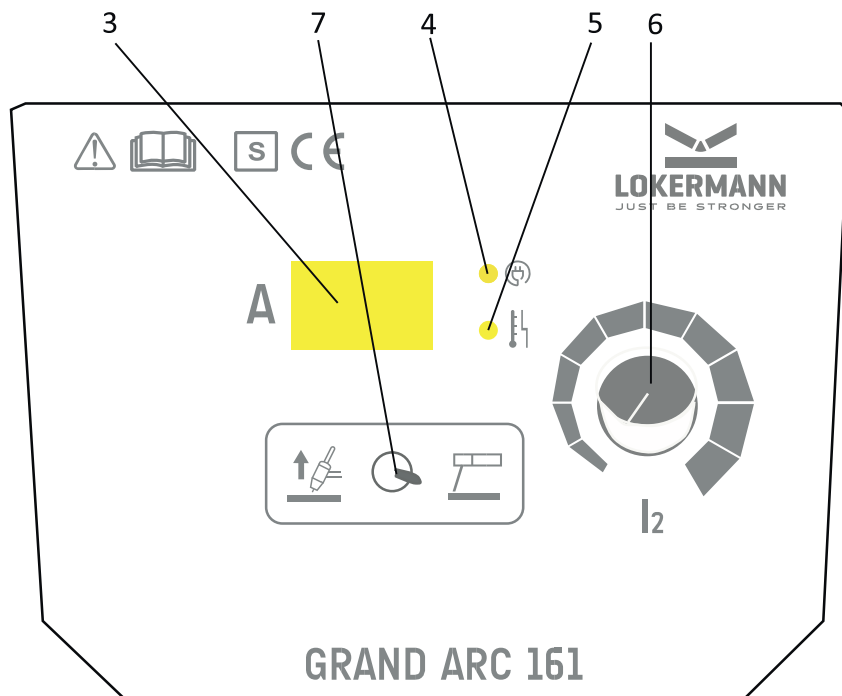


Figure B

GRAND ARC 160 PFC
GRAND ARC 200 PFC



GRAND ARC 160 CEL
GRAND ARC 161



Front Panel

- (1) Output terminal “-”
- (2) Output terminal “+”
- (3) Current digital display
- (4) Power light: Power indicator, power on light on
- (5) Alarm light: Alarm indicator, lights that occurred over voltage, over current, or overheating inside the machine, is protected
- (6) Welding current adjustment knob: Turn this knob to adjust the output current size
- (7) Conversion switch: choose LIFT TIG; choose MMA

Back panel

- Power switch: control power through and break.
- Power Access client: access to cable.
- Fan: help plant cooling.

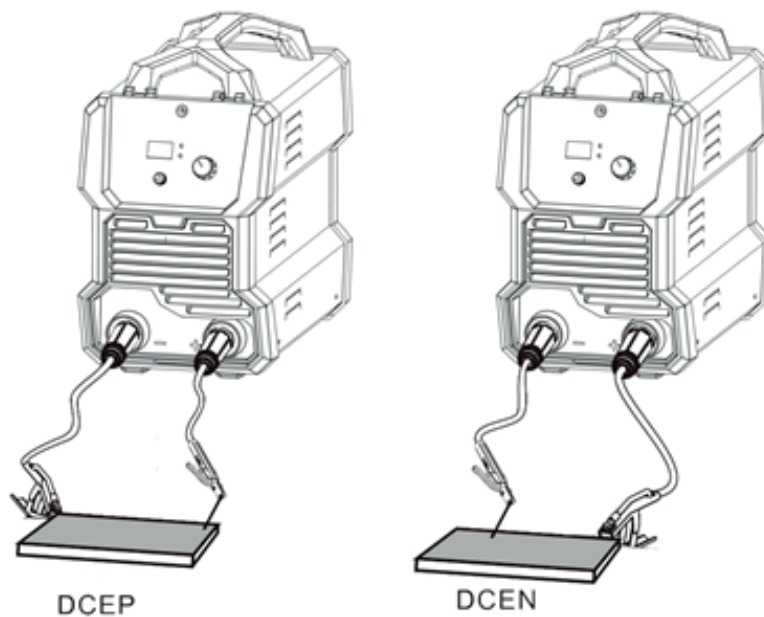
3.2 Installation & Operation for MMA Welding

3.2.1 Set up installation for MMA Welding

Connection of output cables two sockets are available on this welding machine. For MMA welding the electrode holder is shown be connected to the positive socket, while the earth lead (work piece) is connected to the negative socket, this is known as DCEP. However various electrodes require a different polarity for optimum results and careful attention should be paid to the polarity, refer to the electrode manufacturers information for the correct polarity.

DCEP (reverse polarity): Electrode connected to "+" output socket.

DCEN (strait polarity): Electrode connected to "-" output socket.



- (1) Connect the earth lead to "-", tighten clockwise;
- (2) Connect the electrode lead to "+", tighten clockwise;
- (3) Each machine is equipped with a power supply cable based on the input voltage of power source. Don't pick the wrong voltage;
- (4) With the corresponding input power supply terminal or socket good contact and prevent oxidation;
- (5) With a multi meter measure the input voltage is within the fluctuation range;
- (6) Make sure that power ground is well grounded.

3.2.2 Operation for MMA Welding

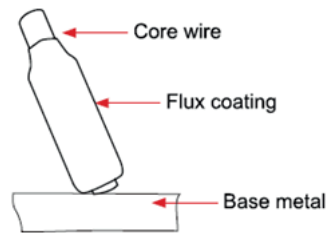
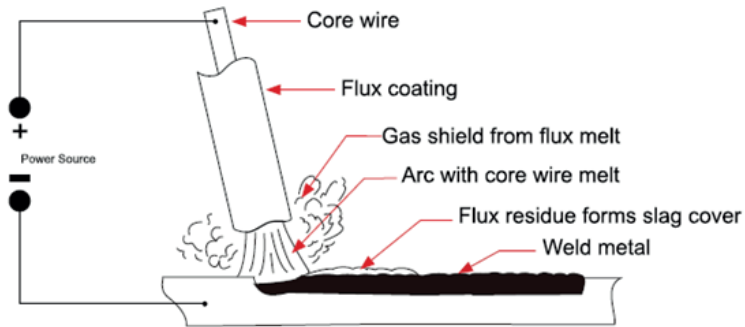
- (1) According to the above method to install is correct, turn the power switch, so that the power switch is "ON" position, then the power indicator light switch on, the fan comes on, the device work properly.
- (2) Select the MMA function with the LIFT TIG/MMA selector switch.
- (3) Set the welding current relevant to the electrode type and size being used as recommended by the electrode manufacturer with the knob.
- (4) Only with GRAND ARC 202 PFC, pressing the knob (6) can adjust hot start (0 to 10, letter "H" appears on the display) and arc force (0 to 10, letter "F" appears on the display).
Increasing the hot start increases the initial current ,facilitating arc initiation. Increasing arc force causes the welder to deliver a current greater than the set current when it senses that the electrode is getting too close to the workpiece during welding. It is used to help the operator avoid sticking the electrode to the workpiece.
EVERY TIME YOU TURN THE MACHINE OFF, AT RESTART HOT START AND ARC FORCE WILL GO TO LEVEL 3 (default settings).
In GRAND ARC 161, hot start and arc force are preset by the machine based on the current setting and cannot be adjusted by the operator.
- (5) Place the electrode into the electrode holder and clamp tight.
- (6) Strike the electrode against the work piece to create the arc and hold the electrode steady to maintain the arc.
- (7) Commence welding. If necessary, readjust the Weld Current control to obtain the welding condition required.
- (8) After completion of welding the Power Source should be left turned ON for 2 to 3 minutes. This allows the fan to run and cool the internal components.
- (9) Switch the ON/OFF (located on the rear panel) to the OFF position.

NOTE

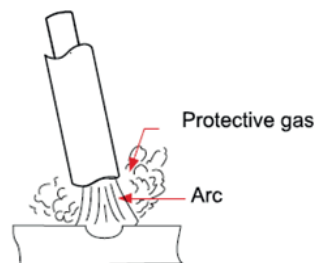
- Note the polarity of wiring, the general DC welding wire in two ways. Selected according to the technical requirements of welding the appropriate connection, if you choose incorrectly will result in arc instability and spatter arge adhesion and other phenomena, such cases can be quickly reversed to joints.
- If the work piece distance from the welding machine, the second line(electrode holder and ground) is longer, so choose the appropriate conductor cross-sectional area should be larger to reduce cable voltage drop.

3.2.3 MMA Welding

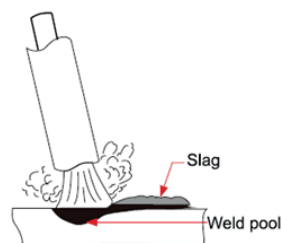
One of the most common types of arc welding is manual metal arc welding (MMA) or stick welding. An electric current is used to strike an arc between the base material and a consumable electrode rod or 'stick'. The electrode rod is made of a material that is compatible with the base material being welded and is covered with a flux that gives off gaseous vapours that serve as a shielding gas and providing a layer of slag, both of which protect the weld area from atmospheric contamination. The electrode core itself acts as filler material the residue from the flux that forms slag covering over the weld metal must be chipped away after welding.



- The arc is initiated by momentarily touching the electrode to the base metal.
- The heat of the arc melts the surface of the base metal to form a molten pool at the end of the electrode.
- The melted electrode metal is transferred across the arc into the molten pool and becomes the deposited weld metal.
- The deposit is covered and protected by a slag which comes from the electrode coating.
- The arc and the immediate area are enveloped by atmosphere of protective gas.



Manual metal arc (stick) electrodes have a solid metal wire core and a flux coating. These electrodes are identified by the wire diameter and by a series of letters and numbers. The letters and numbers identify the metal alloy and the intended use of the electrode. The Metal Wire Core works as conductor of the current that maintains the arc. The core wire melts and is deposited into the welding pool.



The covering on a shielded metal arc welding electrode is called Flux. The flux on the electrode performs many different functions. These include:

- producing a protective gas around the weld area
- providing fluxing elements and deoxidizer
- creating a protective slag coating over the weld as it cools
- establishing arc characteristics
- adding alloying elements.

Covered electrodes serve many purposes in addition to filler metal to the molten pool. These additional functions are provided mainly by the covering on the electrode.

Electrode Selection

As a general rule, the selection of an electrode is straight forward, in that it is only a matter of selecting an electrode of similar composition to the parent metal. However, for some metals there is a choice of several electrodes, each of which has particular properties to suit specific classes of work. It is recommended to consult your welding supplier for the correct selection of electrode.

Material and Joint Preparation

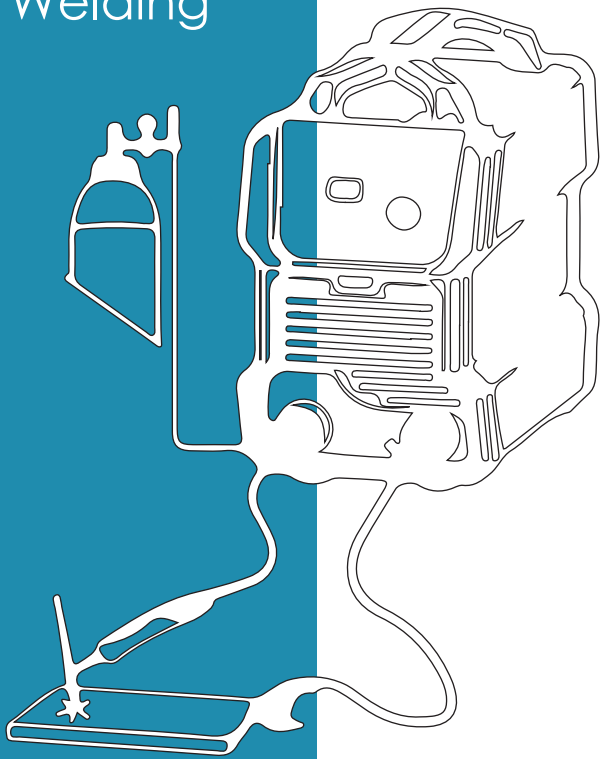
The material to be welded should be clean and free of any moisture, paint, oil, grease, mill scale, rust or any other material that will hinder the arc and contaminate the weld material. Joint preparation will depend on the method used include sawing, punching, shearing, machining, flame cutting and others. In all cases edges should be clean and free of any contaminants. The type of joint will be determined by the chosen application.

The following chart addresses some of the common problems of MMA welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	No arc	Incomplete welding circuit	Check earth lead is connected. Check all cable connections.
		No power supply	Check that the machine is switched on and has a power supply
		Wrong mode selected	Check the MMA selector switch is selected
2	Porosity – small cavities or holes resulting from gas pockets in weld metal	Arc length too long	Shorten the arc length
		Work piece dirty, contaminated or moisture	Remove moisture and materials like paint, grease, oil, and dirt, including mill scale from base metal
		Damp electrodes	Use only dry electrodes
3	Excessive Spatter	Amperage too high	Decrease the amperage or choose a larger electrode
		Arc length too long	Shorten the arc length
4	Weld sits on top, lack of fusion	Insufficient heat input	Increase the amperage or choose a larger electrode
		Work piece dirty, contaminated or moisture	Remove moisture and materials like paint, grease, oil, and dirt, including mill scale from base metal
		Poor welding technique	Use the correct welding technique or seek assistance for the correct technique
5	Lack of penetration	Insufficient heat input	Increase the amperage or choose a larger electrode
		Poor welding technique	Use the correct welding technique or seek assistance for the correct technique
		Poor joint preparation	Check the joint design and fit up, make sure the material is not too thick. Seek assistance for the correct joint design and fit up
6	Excessive penetration - burn through	Excessive heat input	Reduce the amperage or use a smaller electrode
		Incorrect travel speed	Try increasing the weld travel speed
7	Uneven weld appearance	Unsteady hand, wavering hand	Use two hands where possible to steady up, practise your technique
8	Distortion – movement of base metal during welding	Excessive heat input	Reduce the amperage or use a smaller electrode
		Poor welding technique	Use the correct welding technique or seek assistance for the correct technique
		Poor joint preparation and or joint design	Check the joint design and fit up, make sure the material is not too thick. Seek assistance for the
9	Electrode welds with different or unusual arc characteristic	Incorrect polarity	Change the polarity, check the electrode manufacturer for correct polarity

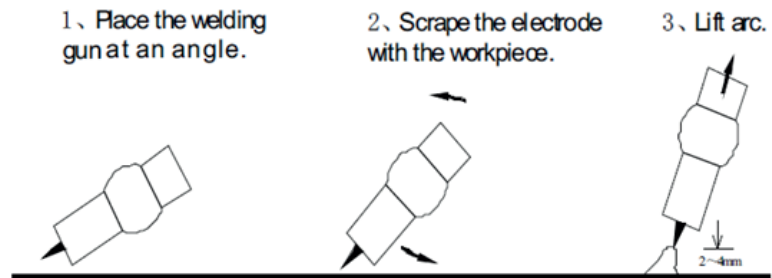
3.3 Installation & Operation for TIG Welding

3.3.1 Set up installation for TIG Welding



- (1) Switch the ON/OFF Switch to OFF.
- (2) Connect the earth lead to "+", tighten clockwise;
- (3) Connect the TIG torch cable to "-", tighten clockwise;
- (4) Install the regulator and tighten with a wrench;
- (5) Connect the gas hose to the outlet of the Argon regulator, and tighten with a wrench;
- (6) Be sure the gas valve on the torch is closed, and slowly open the Argon Cylinder Valve to the fully open position;
- (7) Connect the ground clamp to your work piece;
- (8) Plug the power cable into the appropriate outlet

Scraping arc



3.4 Operation environment

- ▲ Height above sea level ≤ 1000 M
- ▲ Operation temperature range $-10 \sim +40^{\circ}\text{C}$
- ▲ Air relative humidity is below 90 % (20°C)
- ▲ Preferable site the machine some angles above the floor level, the maximum angle does not exceed 15° .
- ▲ Protect the machine against heavy rain and against direct sunshine.
- ▲ The content of dust, acid, corrosive gas in the surrounding air or substance cannot exceed normal standard.
- ▲ Take care that there is sufficient ventilation during welding. There must be at least 30cm free distance between the machine and wall.

4 Maintenance & Troubleshooting

4.1 Maintenance

In order to guarantee safe and proper operation of welding machines, they must be maintained regularly. Let customers understand the maintenance procedure of welding machines. Enable customers to carry on simple examination and inspections. Do your best to reduce the fault rate and repair times of welding machines to lengthen service life of arc welding machine. Maintenance items in detail are in the following table.

- Warning: For safety while maintaining the machine, please shut off the main input power and wait for 5 minutes, until capacitors voltage already drop to safe voltage!

Date	Maintenance items
Daily examination	<p>Observe that the knobs and switches in the front and at the back of arc welding machine are flexible and put correctly in place. If any knob has not been put correctly in place, please correct. If you can't correct or fix the knob, please replace immediately;</p> <p>If any switch is not flexible or it can't be put correctly in place, please replace immediately. Please get in touch with maintenance service department if there are no accessories.</p> <p>After turn-on power, watch/listen if the arc-welding machine has shaking, whistle calling or peculiar smell. If there is one of the above problems, find out the reason and clear it. If you can't find out the reason, please contact your local service repair station or distributor/agent .</p> <p>Observe that the display value of LED is intact. If the display number is not intact, please replace the damaged LED. If it still doesn't work, please maintain or replace the display PCB.</p> <p>Observe that the min/max values on LED agree with the set value. If there is any difference and it has affected the normal welding results, please adjust it.</p> <p>Check whether the fan is damaged and whether it is normal to rotate or control. If the fan is damaged, please change immediately. If the fan does not rotate after the machine is overheated, observe if there is something blocking the blade. If it is blocked, please clear the problem. If the fan does not rotate after getting rid of the above problems, you can poke the blade by the rotation direction of fan. If the fan rotates normally, the start capacity should be replaced. If not, change the fan.</p> <p>Observe whether the fast connector is loose or overheated. If the arc-welding machine has the above problems, it should be fastened or changed.</p> <p>Observe whether the current output cable is damaged. If it is damaged, it should be insulated or changed.</p>
Monthly examination	<p>Using the dry compressed air to clear the inside of arc welding machine. Especially for clearing up the dusts on radiator, main voltage transformer, inductors, IGBT modules, fast recover diodes, PCB's, etc.</p> <p>Check the screws and bolts in the machine. If any is loose, please screw it tight. If it is shaved, please replace. If it is rusty, please erase rust on all bolts to ensure it works well.</p>
Quarter-yearly examination	<p>Check whether the actual current accords with the displaying value. If they did not accord, they should be regulated. The actual welding current value can be measured by and adjusted by plier-type ampere meter.</p>
Yearly examination	<p>Measure the insulating impedance among the main circuit, PCB and case, if it below $1M\Omega$, insulation is thought to be damaged and need to change, and need to change or strengthen insulation.</p>

4.2 Troubleshooting

- Before the welding machines are dispatched from the factory, they have already been tested and calibrated accurately. It is forbidden for anyone who is not authorized by our company to do any change to the equipment!
- Maintenance course must be operated carefully. If any wire becomes flexible or is misplaced, it may be potential danger to user!
- Only professional maintenance staff that is authorized by our company could overhaul the machine!
- Be sure to shut off the Main Input Power before doing any repair work on the welding machine!
- If there is any problem and there is no authorized professional maintenance personal on site, please contact local agent or the distributor

If there are some simple troubles with the welding machine, you can consult the following Chart:

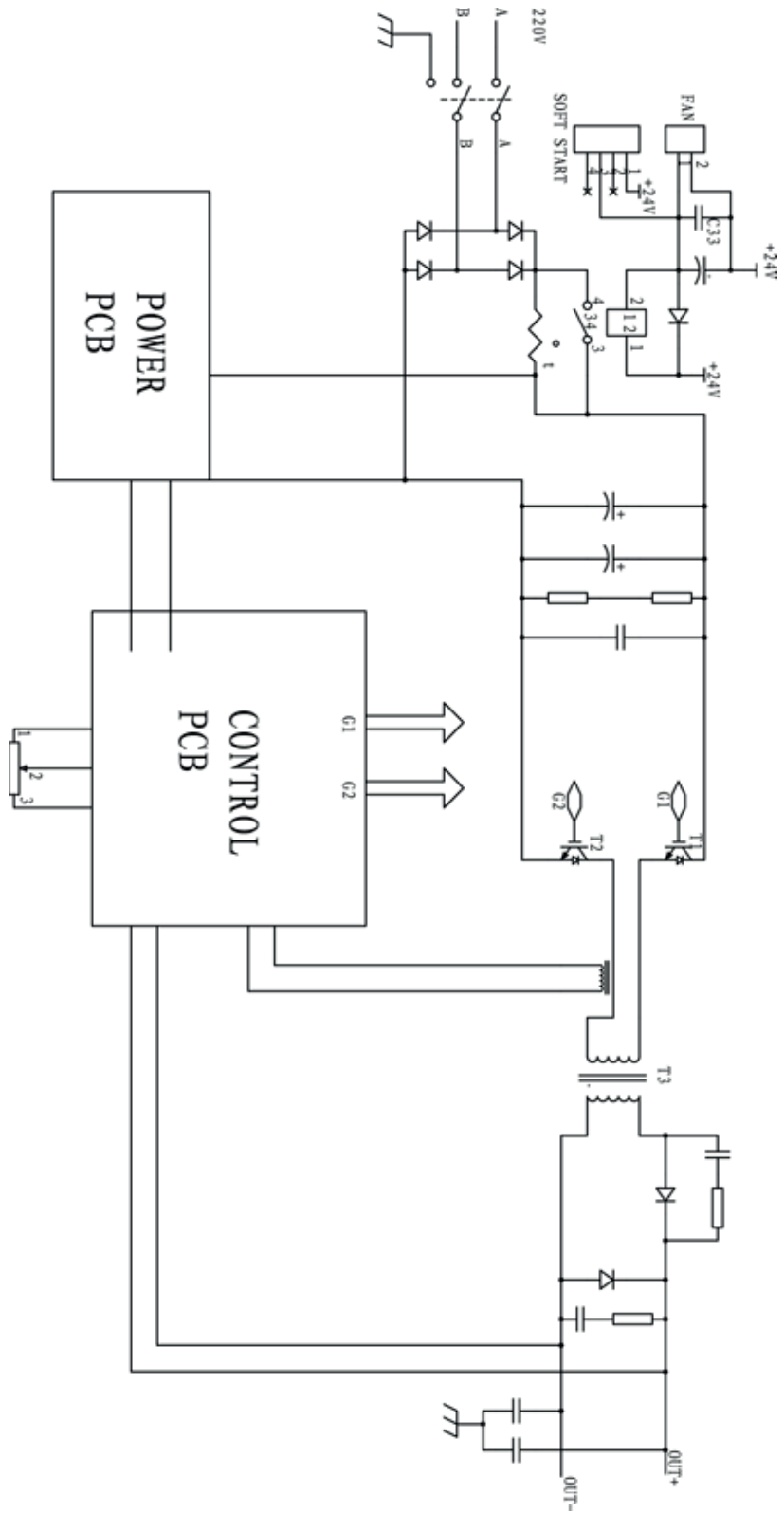
S/N	Troubles	Reasons	Solutions	
1	Turn on the power source, and fan works, but the power light is not on.	The power light damaged or connection is not good	Test and repair the inside circuit of power light Pr3	
		Power PCB failures	Repair or change power PCB Pr2	
2	Turn on the power source, and the power light is on, but fan doesn't work	There is something in the fan	Clear out	
		The fan motor damaged	Change fan motor	
3	Turn on the power source, and the power light is not on, and fan doesn't work	No input voltage	Check whether there is input voltage	
		Overvoltage (Input voltage is too much or not)	Check input voltage	
4	No no-load voltage output	There is trouble inside the machine	Check the main circuit, Pr1 and Pr2	
5	No current output in the welding	Welding cable is not connected with the two output of the welder.	Connect the welding cable to the welder's output	
		Welding cable is broken	Wrap, repair or change the welding cable	
		Earth cable is not connected or loosen	Check the earth clamp	
6	Not easy to start a the welding, or eas cause sticking	The plug loosen or connect not well	Check and tighten the plug	
		Oil or dust covered the workpiece	Check and clear out	
		Wrong mode selected	Check the MMA selector switch is selected	
7	The arc is not stab the welding proces	The arc force is too small	Increase the arc force	
8	The welding current not be adjusted	Welding current potentiometer in the front panel connection not so good or damaged	Repair or change the potentiometer	
9	The penetration of molten pool is not enough (MMA)	The welding current adjusted low	Increase the welding current	
		The arc force adjusted too small	Increase the arc force	
10	Arc blow	Airflow disturbance	Use the shelter from airflow	
		The electrode eccentricity	Adjust the electrode angle	
			Change the electrode	
		Magnetic effect	Incline the electrode to the opposite way of the magnetic blow	
Change the position of earth clamp or add earth cable in the two side of workpiece				
11	The alarm light is on	Over heat protection	Over welding current	Induce the welding current output
			Working time too long	Induce the duty cycle (interval work)
		Over current protection	Unusual current in the main circuit	Test and repair the main circuit and drive PCB (Pr1)

4.3 List of error code

Error Type	Error code	Description	Lamp status
Thermal relay	E01	Over-heating(1st thermal relay)	Yellow lamp(thermal protection) always on
	E02	Over-heating(2nd thermal relay)	Yellow lamp(thermal protection) always on
	E09	Over-heating(Program in default)	Yellow lamp(thermal protection) always on
Welding machine	E10	Phase loss	Yellow lamp(thermal protection) always on
	E13	Under voltage	Yellow lamp(thermal protection) always on
	E14	Over voltage	Yellow lamp(thermal protection) always on
	E15	Over current	Yellow lamp(thermal protection) always on
Switch	E20	Button fault on operating panel when switch on the machine	Yellow lamp(thermal protection) always on
	E21	Other faults on operating panel when switch on the machine	Yellow lamp(thermal protection) always on
	E41	Communication error	

4.4 Electrical schematic drawing

GRAND ARC 161





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