

Inverter DC Manual Metal Arc Welding Machine



MODELS

MMA-400 & MMA-400L PRO

MMA-630 & MMA-630L PRO

Operation Manual



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



Description: This machine is designed and built to weld ferrous and non-ferrous metals.

Disclaimer: The information, illustrations and instructions described in this manual are based on the latest product information available at the time of publication. The manufacturer and distributors reserve the right to modify the contents of this manual at any time. Modifications may result following product modifications and the manufacturer and distributors are not obliged to notify any organization or individual of such modifications. Welding work must be executed only by professionally trained and qualified individuals. Therefore, the manufacturer and distributors will only accept responsibility for product quality. No liability, joint or several, shall be accepted for incidents including but not limited to loss of profit resulting from omissions or misdirection that may be printed in this operation manual. This manual will contain as far as possible preventive and safe operation measures related to the equipment but cannot exclude the occurrence of accidents. Therefore, the manufacturer and distributors shall not be liable for any direct or indirect, joint or several liability for any incidental or consequential damages which may occur. For detailed health and safety information, the relevant professional agencies and manufacturers of consumables such as welding materials and flux should be contacted.

Warranty Exclusions:

- ✓ Consumable items such as welding electrode, welding cable sets, fuses, quick connectors, etc.
- ✓ Machine damages caused by incorrect voltage input or power surges.
- ✓ Machine or parts malfunction owing to incorrect connections or user operation.
- ✓ Illegal disassembly or re-fitment of the machine without permission of the manufacturer, resulting in damage or malfunction.
- ✓ Accidental damage during shipment, transportation and storage.
- ✓ Damage owing to incorrect handling, natural disaster and other force majeure occurrences.

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Safety precautions

The equipment is designed for use by qualified personnel who have completed professional training and have obtained a qualification certificate as a welder. The operator shall have sufficient professional knowledge of welding, cutting and circuitry. The machine should be operated only after having read and fully understood all the safety precautions and warnings contained in this manual and those generally applicable to welding operations. The risk of personal injury and damage to equipment is reduced by safety precautions being followed when using tools and equipment. This machine is easy to operate and the selection of its functions is straight forward. Improper use and maintenance will reduce the safe operation of the machine and the following safety precautions must be followed:

1. The operator must be suitably qualified and certificated before operating the equipment.
2. A qualified professional should be employed to ensure that the machine and all cables are properly connected, grounded and installed.
3. Personal protective equipment approved by the local safety authority must be used. All relevant safety procedures must be adhered to.
4. Before operation, insulation layers on wires and cables as well as connection sequences should be inspected and corrected if required.
5. Repairs and maintenance should be carried out by qualified technicians only after the machine has been disconnected from the electricity supply.
6. Operating the machine in a humid environment may result in a short circuit or may cause an electric shock to the operator.
7. Modifications to the machine or equipment are not allowed.
8. The disposal of scrap machine parts and equipment must comply with local regulations.

Warnings

Welding and cutting operations are specialised operations which present a certain degree of risk. Professional training, correct operating procedures and protective measures reduce the accident risk and damage to equipment.

Personal Safety Protection



Welding and cutting operations generate noise, bright light and high-temperature sparks which will cause harm to human hearing, eyes and skin unless personal protective measures are implemented and proper operational instructions are adhered to.

1	Wear flame retardant personal protective equipment (PPE) such as gloves, overalls, welding helmets with correct shading filter, shoes and aprons to protect against thermal radiation, sparks and hot metal particles.
2	Hot sparks and metal fragments can cause skin damage. Avoid clothes with front pockets and button-up sleeves and collars.
3	Use appropriate flame-retardant shields or curtains to protect bystanders from arc radiation and high temperature sparks. Bystanders also need to wear a protective helmet fitted with a shading filter to protect face and eyes or a pair of spectacles fitted with shading filters.
4	Avoid burns and scalds by not touching a welded work piece with bare hands.

Fire and Explosion Dangers



Welding and cutting operations generate high-temperature flames and arc which can cause fires and explosions. The same applies to welding slag and sparks.

1	Operators and bystanders must be protected from arc, sparks and metal fragments.
2	The welding/cutting area should be free from flammable and explosive materials. Should these materials be required in the welding/cutting process, flame retardant covers should be applied.
3	Care should be taken to avoid fire hazards from cracked floors and walls.

4	Welding and cutting on sealed gas tanks will cause explosions. These operations are prohibited.
5	Welding and cutting areas must be provided with adequate fire extinguishing equipment. Regular testing for efficiency of this equipment is compulsory as is training of staff in the use of the equipment.
6	Once the welding/cutting operation is completed, check for any high temperature spark or metal which might cause a fire and immediately dispose of it. If necessary, employ the assistance of a firefighter.

Electricity Hazards



Electric shock can cause serious injury or even death to the individual when contact is made with live wires. Humid conditions can add to the risk and great care should be taken when welding or cutting machines are used in these conditions.

1	Reliable grounding of machine and work piece as well as a secure ground clamp, is important.
2	Insulation layers of electric wires and cables must be checked regularly for wear and replaced if necessary.
3	All equipment used and clothing worn during the welding/cutting operation should be free from moist and kept dry.
4	Do not make direct body contact with any live electrical parts.
5	Wearing rubber-insulated shoes and standing on an insulated platform greatly reduce the risk of accidental shock.
6	Refrain from replacing the ground cable on the machine with wires not suitable for the task.
7	The machine operates on high voltage and capacitors remain charged even after power is switched off. Removing covers for maintenance procedures must only be executed by qualified professionals.

Effects of Electromagnetic Fields



Electric current flowing through a conductor produces magnetic fields (EMF). The discussion on the topic of the effects of EMF on the human body is ongoing worldwide and up to the present no evidence has been forthcoming proving negative effects on health. However, it would be wise to limit exposure to EMF as far as

possible and the following procedures are suggested:

1	Welders and cutters with cardiac pacemaker implants should obtain medical advice on the effects of EMF on the implant.
2	Welders should minimise the possibility of electromagnetic field damage through the following methods.
2.1	Route the electrode and ground cables together and, where possible, secure them with tape.
2.2	Do not wrap wires and cables around arms or coil power cables around body parts. If possible, keep cables away from the body.
2.3	Keep the distance between the ground clamp to the workpiece and the electrode as short as possible.
2.4	Keep a safe distance between the operator and the welding/cutting machine.

Protection from Fumes and Gases



Welding and cutting produces a lot of fumes and gas, which is harmful to human health.

1	The working area should be well ventilated and welding/cutting activities should not be executed in confined spaces. Eye, nose or throat discomfort can be the result of inadequate ventilation.
2	Welding and cutting in or near locations where chlorinated hydrocarbon vapours are produced such as degreasing, cleaning and spraying operations, should not be undertaken since phosgene, a highly toxic gas as well as other irritants can be reaction products.
3	The industry offers a variety of respiratory masks and must be used in conditions where clean breathing air is required.

Gas Cylinder Safety



Gas leaks can occur on cylinders connected to welding/cutting operations if the system is not properly managed and maintained. A ruptured cylinder or relief valve can cause serious injury or can even be fatal.

1	Gas cylinders should be kept away from extreme temperatures and fire sources. Scratching on cylinder walls with hard objects should be avoided.
2	A flowmeter should be installed on the gas cylinder in use in accordance with the manufacturer's operating instructions. Quick-coupling connectors must not be used and gas hose fitting should be tested for leaks.
3	Gas cylinders must always be kept upright and chained or belted to a cylinder trolley, base, wall, post or shelf. Never fix a gas cylinder to a worktable or machine: It can become party to an electrical circuit and explode.
4	Ensure that the cylinder valve is closed when not in use. If there is no hose connected to the flowmeter then cover the outlet with a dust cap.

Protection Against Moving and Rotating Parts



Moving parts, such as fans, rotors and belts, can be hazardous.

1	Ensure that all protective covers, doors and panels on the machine are closed or securely intact before starting an operation.
2	Ensure that maintenance on machines are only carried out by qualified technicians.
3	Ensure that hands, hair, clothing and tools are safely out of range from moving and rotating parts.

Packaging and Transportation

1. Pay attention to and comply with packaging, storage and transportation instructions which are clearly identified on the containers.
2. Always handle all containers with care.
3. Equipment must be stored in waterproof, moisture proof and well-ventilated facilities within the temperature range -25°C - 55°C.

Parameters

Model	MMA-400	MMA-400L PRO
Parameters	Value	
Rated input voltage:	3PH-AC380V±15% 50/60Hz	3PH-AC380V/525V 50/60Hz
Rated Capacity:	18.2KVA	21.5KVA
Rated input current:	33.7A	56A
Rated duty cycle:	60%	80%
Output current range:	15A-400A	15A-400A
Open circuit voltage:	68V	68V
Insulation grade:	F	
IP grade:	IP21S	
Package dimensions(mm):	647*367*542	
N.W.(kg):	18/20	19/21

Model	MMA-630	MMA-630L PRO
Parameters	Value	
Rated input voltage:	3PH-AC380V±15% 50/60Hz	3PH-AC380V/525V 50/60Hz
Rated Capacity:	25.4KVA	35KVA
Rated input current:	47A	85A
Rated duty cycle:	80%	
Output current range:	20A-630A	20A-630A
Open circuit voltage:	77V	77V
Insulation grade:	F	
IP grade:	IP21S	
Package dimensions(mm):	647*367*542	
N.W.(kg):	24/27	27/30

Product Description

The welding machine in the DC MMA welders series, inverts the 50/60Hz power supply to a high-frequency, high-voltage power supply of up to 21KHz. The inversion process is facilitated by a powerful IGBT device followed by step-down rectification and pulse-width modulation (PWM) technology producing a high-power DC output suitable for welding. The advanced inverter technology allows for the construction of a smaller volume and light-weight, stable and reliable transformer with a 35% improved efficiency.

Added to the advantages of the inverted power supply, the machine has good dynamic characteristics and performance, offers a stable arc and good quality welding as well as ease of control.

Welding machines in the inverter DC MMA series are widely used in, amongst others, the petrochemical industry, electric power construction, shipbuilding, machinery manufacturing, building construction, indoor and outdoor decoration, hardware and kitchen equipment production.

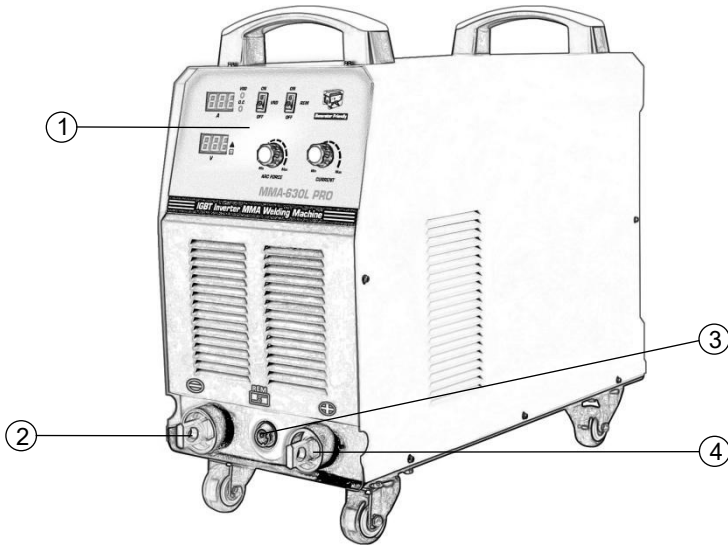
The inverter welding machines in this series are manufactured in accordance with IEC60974-1 <Arc Welding Equipment - Part 1: Welding Power Sources>.

1. Product Functions and Features:

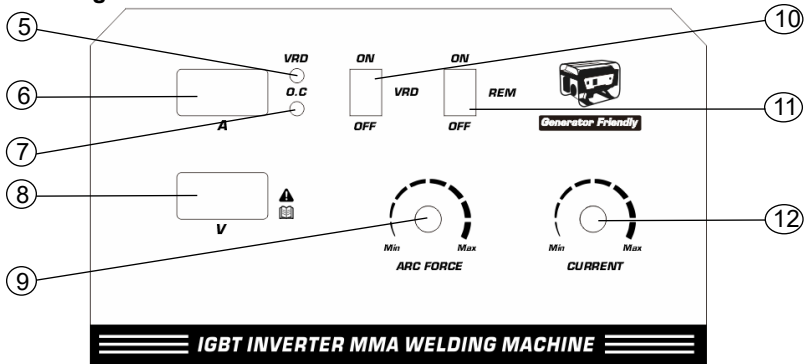
- 1.1. The advanced control technology ensures that a variety of welding applications are met with excellent performance.
- 1.2. Easy arc starting, a stable arc, less spatter, a high metal-deposition rate, less deformation and high seam quality.
- 1.3. Adjustable ignition current and hot-start ignition ensure that MMA welding is simpler with a higher degree of reliability.
- 1.4. The VRD anti-shock protection facility adds an important personal safety feature and complies with international norms and standards.
- 1.5. The overheat protection system ensures a high degree of machine reliability.
- 1.6. The machine conforms to IP21S protection level standards in harsh environmental conditions.

2. Appearance Diagram:

Machine Layout



Panel Diagram:

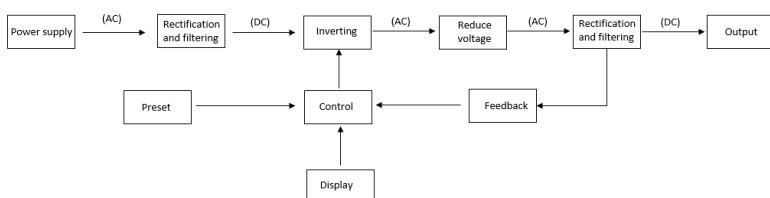


1	Control panel
2	Welding cable coupling device, negative pole: Connects to electrode holder cable set in DC electrode negative mode. Connects to earth clamp cable set in DC current electrode positive mode.
3	Remote control box aviation socket: Connects to remote control box and control line aviation plug.
4	Welding cable coupling device, positive pole: Connects to electrode

	holder cable set in DC electrode negative mode. Connects to earth clamp cable set in DC current electrode positive mode.
5	VRD function indicator light: When VRD is turned off in MMA mode, the indicator light is off. When VRD is turned on, the indicator light is lit.
6	Current display: Output current is displayed in real time. While data is set, the set values are displayed.
7	Error indicator light: When no abnormalities are present during operation, the light will be off. The light will be lit if abnormalities occur during operation.
8	Voltage display: Output voltage, arc length and program channels are displayed.
9	Arc force current adjustment: The function of the arc force is to eliminate the phenomenon of electrode 'sticking' and is adjusted by rotating the knob.
10	VRD function: An ON/OFF switch which can regulate whether the VRD function is active or not. When turned ON, the open-circuit voltage of the machine is restricted to below 24V which reduces the shock risk in humid conditions, at high altitudes and welding in confined areas and metal containers.
11	Remote control function: An ON/OFF switch regulating the remote control function. The welding current can be adjusted remotely or turned off if not required.
12	Welding current adjustment: The output current is adjusted by rotating the knob.

Working Principle

1. Diagram Explaining Working Principle



- 1.1. A bridge rectifier converts AC to DC;
- 1.2. After secondary rectification and reactor filtering, output welding current is delivered that meets the welding requirements;
- 1.3. Controlled by PWM the IGBT inverts the DC to 20KHz AC which is transmitted via a high-frequency transformer;
- 1.4. The in-time protection circuit provides signals to the PWM warning for overheat and over-current situations;
- 1.5. A closed-loop control system ensures a good anti-grid fluctuation ability and an excellent cutting performance.

Installation and Wiring

1. Location Requirements

- 1.1. The machine should not be installed in an area where it is exposed to direct sunlight or rain but where the humidity is as low as possible and the ambient temperature is within the range of -10°C - 40°C.
- 1.2. The machine should be installed on a flat, preferable level surface but, in any case not on a surface with an inclination of more than 10°.
- 1.3. The machine should not be operated in a work station exposed to wind. Should a windy environment be unavoidable, suitable screening should be installed.
- 1.4. In order to allow for efficient ventilation, a clear space of at least 20cm should be allowed in front of and behind the machine as well as at least 10cm at each side.

2. Power Input Requirements

The power supply waveform should be the standard sin wave, the rated voltage 380V±10% 50/60Hz. Three phase voltage unbalance should be ≤ 5%.

Model	MMA-400	MMA-400L PRO
Parameters	Value	
Rated input current:	33.7A	56A
Input cable:	≥4mm ²	≥6mm ²
Output cable:	50mm ²	50mm ²
Ground cable:	≥4mm ²	≥6mm ²

Model	MMA-630	MMA-630L PRO
Parameters	Value	
Rated input current:	47A	85A
Input cable:	≥6mm ²	≥10mm ²
Output cable:	70mm ²	70mm ²
Ground cable:	≥6mm ²	≥10mm ²

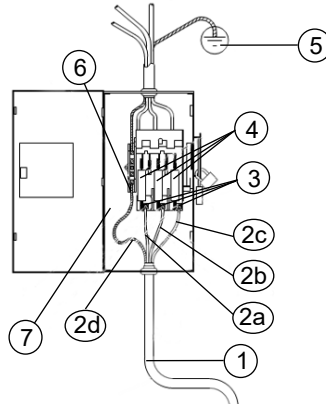
3. Main Power Supply Connection

		
	Pay attention to prevent electric shock	Wear goggles

Take note of the following when the machine is connected to the main power supply:

- 3.1. The connection must be carried out by a qualified electrician or technician.
- 3.2. The connection must be in compliance with national and local regulations.
- 3.3. Before the connection is carried out, the main power supply to the control box must be switched off.
- 3.4. An earth cable set must be securely connected from the machine to the work-piece. The machine must be earthed.
- 3.5. Ensure that the required power supply of the machine (as printed on its nameplate) corresponds to the main power supply.
- 3.6. The connection screws on the terminal block must be tight ensuring a solid connection between the machine cable wires and the main power supply.
- 3.7. The correct wiring procedure is explained in the following diagram:

Wiring of three phase 50/60Hz welding machine



No.	Item	No.	Item
1	Power cord	3	Terminal block
2a	Live wire L1	4	Overcurrent protection device
2b	Live wire L2	5	GND
2c	Live wire L3	6	Earth wire terminal block
2d	Earth wire	7	Electric control box

Brief Procedure for the welding operation

1. Welding Process

- 1.1. Wear the necessary welding protection equipment such as helmet, mask, earplugs, protective clothing, gloves, insulating safety shoes.
- 1.2. Confirm the electrical grid connected to the welding machine is consistent with the correct power supply of the machine.
- 1.3. Confirm that the insulation layers on all the wires and cables of the welding machine are intact and that the cable set is secure and correctly connected to the machine.
- 1.4. Confirm the machine is freely vented and that the vents on the machine are not obstructed and no objects are lying on the machine body.
- 1.5. Connect and tighten the earth cable to the negative pole. Clamp the other end of the cable to the workpiece.

- 1.6. Connect and tighten the electrode cable to the positive pole. Use the electrode holder to clamp the electrode.
- 1.7. Turn the machine on - the power indicator lights up and the fan becomes operational.
- 1.8. Set the parameters for the welding job. The welding current is set in accordance with welding rod specifications. (See table below).
- 1.9. Commence welding using short-circuit arc ignition.
- 1.10. Complete the operation following the normal procedure. During the operation the parameters can be adjusted to suit the situational demands.
- 1.11. After completion of the operation, turn off the power using the switch on the rear panel of the machine.

2. Table Guideline for MMA Electrode Specification and Welding Current

Electrode diameter (mm)	Welding current range (A)	Welding Voltage range (V)
Φ1.6	44~84	21.8~23.4
Φ2.0	60~100	22.4~24.0
Φ2.5	80~120	23.2~24.8
Φ3.2	108~148	23.3~24.9
Φ4.0	140~180	24.6~27.2
Φ5.0	180~220	27.2~28.8
Φ6.0	220~260	28.8~30.4

Maintenance

Safe operation of the machine is dependent on regular maintenance and the replacement of worn and defective parts where necessary.

1. Daily Precautionary Checks

- 1.1. For any abnormal vibrations, sounds or odours.
- 1.2. For any sign of overheating on cable connections.


- 1.3. Whether the power switch is operational and the fan operates smoothly when the machine is switched on.
- 1.4. Whether cables are correctly connected, insulated and in sound order.
- 1.5. Torch consumables are subject to wear and tear and should be replaced when worn..

2. Three to Six Monthly Check List

2.1. Dust Removal

Remove the side cover plate and clean off all parts with dry compressed air. Since the effective cooling of the machine is dependent on a designed air flow pattern, it is important to return the side cover plate after the cleaning operation. Not paying attention to this detail, will result in over-heating of and consequent damage to the transformer and semi-conductor parts.

Common Machine Malfunctions and Solutions

 **Warning: Machine maintenance and repair must be carried out by qualified technicians. The operating voltage in the machine can be up to 600V and it is important that power be cut at the machine and at the control box before covers are removed and repairs carried out. A cooling-down period of at least 5 minutes is required before commencement of any inspection and repairs. This will allow the capacitor to fully discharge.**

1. Inspection Before Overhaul

- 1.1. Check if the line voltage on the three-phase power supply is within the range of 340V - 420V and, that all phases on a three-phase system are intact.
- 1.2. Check if the power cable as well as the earth wire is firmly connected.
- 1.3. Check whether the wiring connections are correct and firmly connected.

2. Common Machine Problems and Troubleshooting

No.	Problem	Root cause	What to do
1	Machine is switched on, no indicator light, fan not operational, no welding output.	Power phase down.	Check power supply phases and rectify.
		Power switch malfunction or damaged.	Repair or replace switch.
		Control board damaged.	Replace the control board.
2	Machine turned on, power switch on the rear panel shuts off immediately.	Power switch broken.	Replace power switch.
		IGBT damaged.	Replace IGBT and drive circuit board.
		Bridge rectifier damaged.	Replace the bridge rectifier.
		Control board damaged.	Replace control board.
3	Warning light on during welding operation, but no welding output.	Extended overload operation.	Wait 2 - 3 minutes. Welding machine to be used within the duty cycle.
		Power switch damaged.	Replace power switch.
		Faulty inverter circuit.	Replace inverter circuit board.
4	Welding circuit not adjustable.	Failed current potentiometer.	Replace potentiometer.
		Machine control board damaged.	Replace control board.