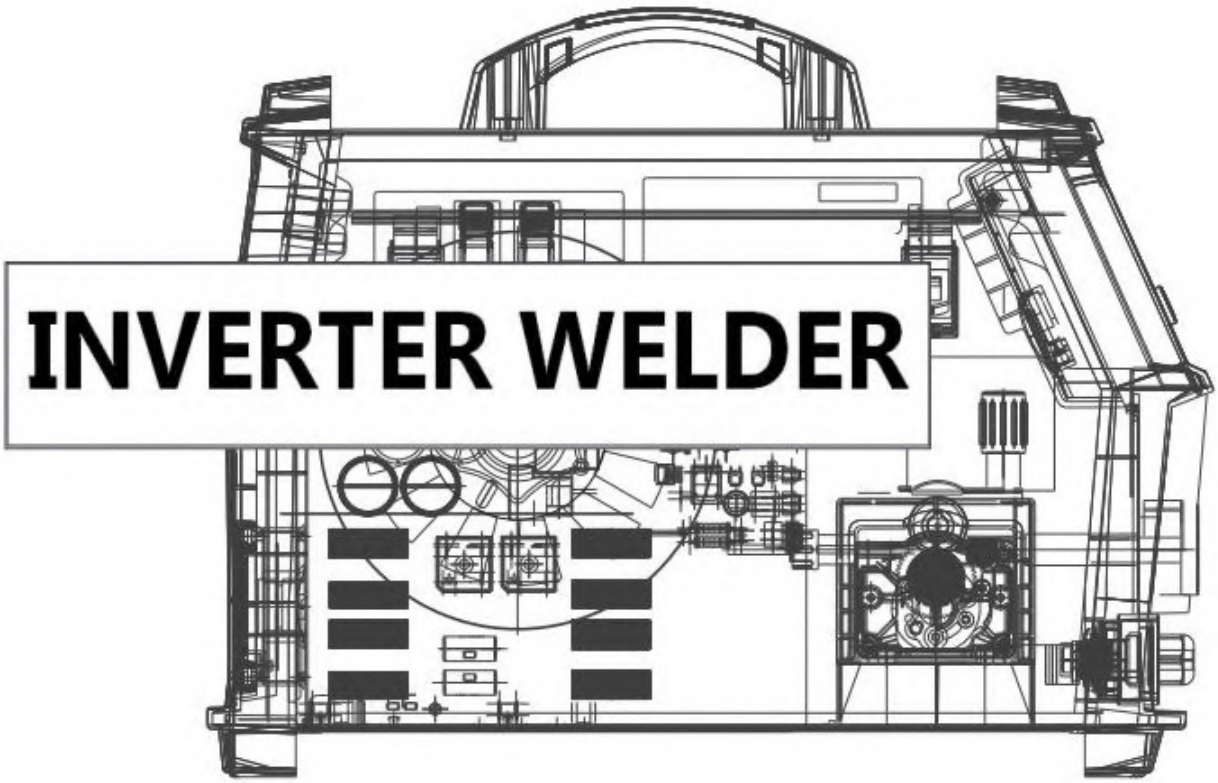
ARCCAPTAIN®

Inverter Welding Machine
MIG200



User Manual

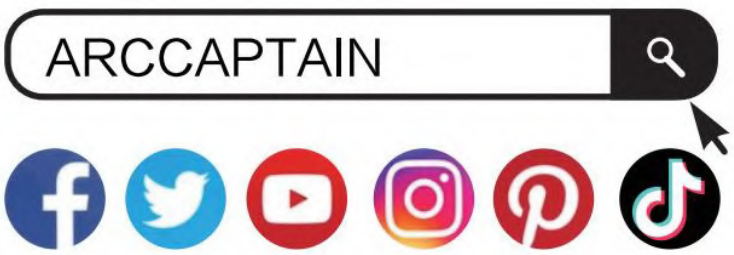
www.arccaptain.com

ARCCAPTAIN®

Dear Valued Customer,

Thank you very much for being our valued customer. ARCCAPTAIN welder was built by high quality components, every single unit machine was passed multiple industry leading laboratory tests to provide a great welding experience and performance.

For your safety, please read and understand this manual carefully before using this product. Your satisfaction is our priority! For any question or concerns, please do not hesitate to contact ARCCAPTAIN for SUPPORT :
service@arccaptain.com



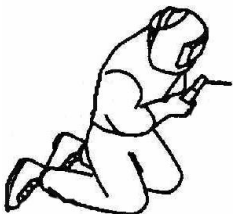
www.arccaptain.com

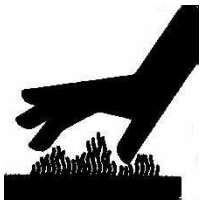
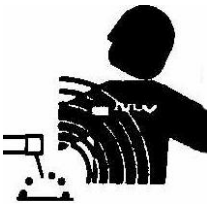
CONTENTS

1. SAFETY PRECAUTIONS 1
   1.1 Working Environment 3
   1.2 Safety Tips 3
   1.3 Symbol Explanation 4
2. PRODUCT OVERVIEW 4
3. FUNCTION OVERVIEW 4
4. PERFORMANCE CHARACTERISTICS 5
5. SYSTEM CHARACTERISTICS 6
6. ORDERING INFORMATION AND PACKING 7
7. TECHNICAL PARAMETERS 7
8. ELECTRICAL SCHEMATIC DIAGRAM 8
9. OPERATION CONTROL AND DESCRIPTION 8
   9.1 Multi-function digital operation panel 10
   9.2 Detailed function description 12
   9.3 Setting of system parameters 15
10. INSTALLATION, DEBUGGING AND OPERATION 17
   10.1 Installation and operation for MMA welding 17
   10.2 Operation 17
   10.3 Welding parameters table (for reference only) 18
   10.4 Installation and operation for MIG welding 18
   10.5 Installation and operation for Gasless self-shielded arc welding 19
   10.6 Installation and operation for TIG welding 20
   10.7 Installation and operation for 2lb(1kg) /11lb(5kg) Roller 22
11. BASIC KNOWLEDGE OF WELDING 23
   11.1 MMA 23
   11.2 Welding Process of MMA 23
   11.3 Tools for MMA 23
   11.4 Basic Operation of MMA 24
   11.5 GMAW 26
   11.6 Welding operation in different position 31
12. MAINTENANCE 32
13. FAILURE AND TROUBLESHOOTING 32
14. TRANSPORTATION AND STORAGE 34
15. WIRING DIAGRAM OF COMPLETE MACHINE 35
16. EXPLOSIVE VIEW OF COMPLETE MACHINE 36

1. SAFETY PRECAUTIONS

Welding may result in injury to you and others, so please implement protection during welding. See more details in Safety Protection Guidebook for Operator which meets the requirements to manufacturers on accident prevention.

	**Operate this equipment by trained professional only!** ·Use welding labor protection supplies with approval of safety supervisory authority. ·Operators must be the special workers with valid work permits of "Metal Welding (Gas Cutting) Operation". ·Do not maintain and repair welder with power.
	**Electric shock-may result in severe injury or death!** ·Install grounding device according to application standard. ·Do not touch live parts with naked skin, wet gloves or wet clothes. ·Be sure you are insulated from ground and workpiece. ·Confirm the safety of your working position.
	**Smoke-can harm your health!** ·Keep your head away from the smoke to avoid inhalation of waste gas in welding. ·Keep the working environment well ventilated with exhaust or ventilation equipment when welding.
	**Arc radiation-may hurt your eyes and burn your skin!** ·Use proper welding mask and wear protective clothing to protect your eyes and body. ·Use proper mask or curtain to protect onlooker from being injured.
	**Improper use and operation may result in fire or explosion** ·Welding spark may result in fire, so please make ensure there are no inflammables near the welding position, and pay attention to fire safety. ·Ensure there is fire extinguisher nearby, and make sure someone has been trained to operate the fire extinguisher. ·Do not weld closed container. ·**Do not use this machine for pipe thawing.**

	**Hot workpiece can cause severe scald.** ·Do not touch hot workpiece with bare hands. ·Cool the welding torch for a while after continuously working.
	**Excessive noise does great harm to people's hearing.** ·Wear ear covers or other hearing protectors when welding. ·Give warning to onlooker that noise may be potentially hazardous to hearing.
	**Magnetic field can make cardiac pacemaker a bit wonky.** ·People with cardiac pacemaker should stay away from the welding spot before consulting their doctor.
	**Moving parts may injure your body.** ·Please keep away from moving parts (like fan). ·Each door, panel, cover, baffle plate, and protective device the like should be closed and located correctly.
	**Seek professional support when trouble strikes.** ·When trouble strikes in installation and operation, please inspect according to related contents in this manual. ·If you still cannot understand fully, or you still cannot solve the problem, please contact the dealer or the service center of our to obtain professional support.

Replacing the components can be dangerous.

- Only professionals can replace the machine components.
- Make sure there is nothing left such as wire leads, screws, gaskets and metal bars in the machine when replacing the components.
- Make sure the internal connection of machine is correct after replacing the PCBs, and then the machine can be operated. Otherwise, machine may be damaged.

Precautions for scrapping

Pay attention to the following when discarding the welding machine:

- Burning the electrolytic capacitors in the main circuit or on the PCBs may cause an explosion.
- Burning plastic parts like front panel will result in toxic gases.
- Dispose the machine as industrial waste.

1.1 Working Environment

1) The installation should be performed in place which can withstand the weight of the welding machine.

2) Installation should not be performed in place where water splash may happen such as water pipe.

3) Welding should be carried out in dry environment with humidity of 90% or less.

4) The temperature of the working environment should be between -10℃ and 40℃.

5) Welding should not be performed in sunlight or rain. Keep it dry at all times.

6) Welding should not be performed in dusty area or environment with corrosive chemical gas.

7) Gas shielded arc welding should be operated in environment without strong airflow.

8) Welding should not be performed on a platform with slope of more than 10°.

1.2 Safety Tips

Over-current and over-heating protection circuit are installed in this machine. When the output current and inner temperature exceeds the set standard, the machine will stop automatically. However, **excessive use** will cause damage to the welder. Therefore, please note:

1) **Make sure good ventilation.**

This welder can create powerful welding current that has strict cooling requirements that cannot be met with natural ventilation. Therefore the internal fan is very important in enabling the machine to work steadily with effective cooling. The operator should make sure that the louvers be uncovered and unblocked. The minimum distance between the machine and nearby objects should be 30cm. Good ventilation is of critical importance to the normal performance and lifespan of the machine.

2) **Overload is forbidden.**

Welder should be operated according to allowable duty cycle (refer to the duty cycle table). Make sure that the welding current should not exceed the max load current. Overload could obviously shorten the machine's service life, or even damage the machine.

3) **Over-voltage is forbidden.**

Regarding the power voltage, please refer to “Technical Parameters” table. This machine is of automatic voltage compensation, which ensures welding current is within allowable range. In case that the power voltage exceeds the allowable value, it would damage the machine. Operators should be fully aware of such situation and take according precautions.

4) **The power cord of a welder has a yellow/green ground cable.**

Before operation, well connect the ground cable to GND to discharge static electricity or prevent accidents caused by static electricity.A sudden halt may occur with digital display showing “E60” on the front panel if the machine is in over-load triggering temperature switch. Under this circumstance, it is unnecessary to unplug the power plug so that the fan keeps working to cool down the machine. Welding can be continued after the inner temperature falls into the standard range and “E60” is off.

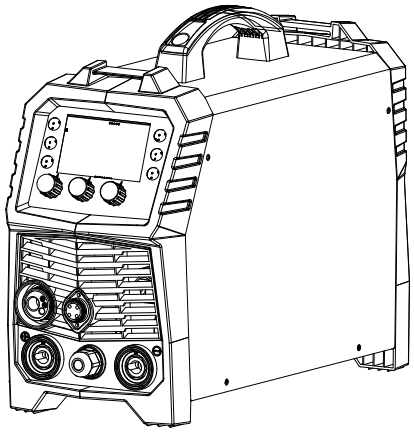
1.3 Symbol Explanation

WARNING 	**Matters to be noticed in operation**		
	**Objects to be specially described and pointed out**		**It is prohibited to dispose the electrical waste together with other common wastes. Please protect the environment.**

2. PRODUCT OVERVIEW

Unique electric structure and air passage design in this series of machines can speed up the heat rejection of the power device as well as improving the duty cycles of the machines. The unique heat rejection efficiency of the air passage can effectively prevent the power devices and control circuits from being damaged by the dust absorbed by the fan, and the reliability of the machine is greatly improved thereby.

The whole machine is in form of coherent streamline, the front and rear panels are naturally integrated via large-radian transition manner. The front and the rear panel of the machine and the handle are matte, with good hand feeling.



3. FUNCTION OVERVIEW

Versatility

- Synergic MIG: Automatic matching of the voltage & wire feeding speed by adjusting wire diameter,material and gas.
- 6 in 1 Multi-functions: Gas MIG/Gasless MIG/MMA /TIG/Spot welding/Spool Gun are available.
- 2T/4T: Realize wide application, easy welding and continuous long-term welding.
- Inductance Adjustment: Improve welding performance.
- Wire Feed Speed Adjustment: Meet your welding requirement.
- VRD: Reduce the risk of electric shock to ensure operator’s safety.
- Dual Voltage: 110V/220V.
- Accurate Preset Parameter: 10 groups parameter can be set and storage for each welding mode.
- Hot Start: Make the arc ignition in MMA welding easier and more reliable.
- Arc Force: Obviously improve the performance of the machine contribute to long-distance welding.
- Anti-stick: Improve welding performance to prevent stickiness.

- Adaptive Crater: No need manual adjustment.
- Burn Back Adjustment: Set burn-back time and voltage at MIG.
- Pre Flow and Post Flow: Set pre-flow/post flow time at MIG/TIG mode.

4. PERFORMANCE CHARACTERISTICS

Advanced IGBT Inverter Technology

- Inverting frequency of 43 KHz greatly reduces the volume and weight of the welder.
- Great reduction in copper and iron loss obviously enhances the welding efficiency and energy saving effect.
- Switching frequency is beyond audiorange, which almost eliminates noise pollution.

Leading Control Mode

- Advanced digital control meets requirement of welding process and greatly improves the welding performance.
- It is applicable to welding wire with diameter of 0.6-1.0 and different grades, and electrode of acid or basic.
- Easy arc ignition, less spatter, stable current, nice shape, etc.
- Cooling fan on demand prolongs its service life by stopping working during no load.

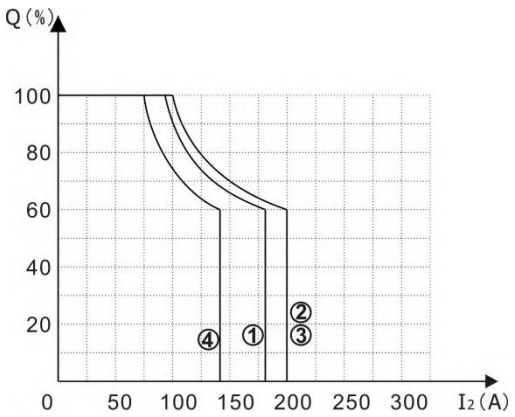
Nice Shape and Structure Design

- Front and rear panels in shape of streamline make the whole shape nicer.
- Large LED digital display: Read data Easily .
- Panel made of strong engineering plastics ensures high efficiency of the machine in severe conditions such as high impact, drop down and so on.
- With complete and closed air passage, welding machine can pass metal dust test with dust of 25 kg in 1 hour during normal operation.
- With complete and reliable structure, welding machine can pass HF vibration test from three directions in the condition of 6G acceleration and 2 mm displacement.

5. SYSTEM CHARACTERISTICS

1) **Duty cycle**

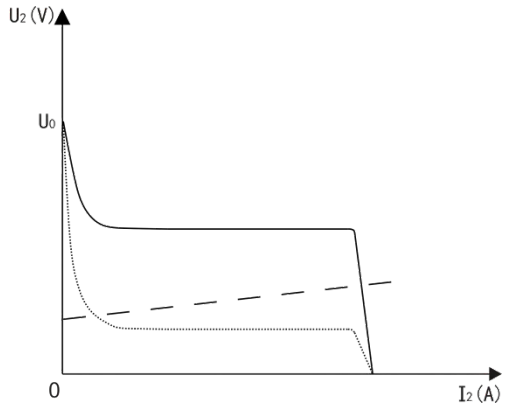
Rated duty cycle is the percentage of the ratio of operating time at rated Max output current to a 10-minute period.



220V	①：MMA load curve ②：TIG load curve ③：MIG load curve
110V	④：MMA /TIG/MIG load curve

Graph of duty cycle

2) **Output characteristics**



_____	External characteristic curve of max output
.....	External characteristic curve of mini output
– – – ·	Rated load relationship

Graph of output characteristic

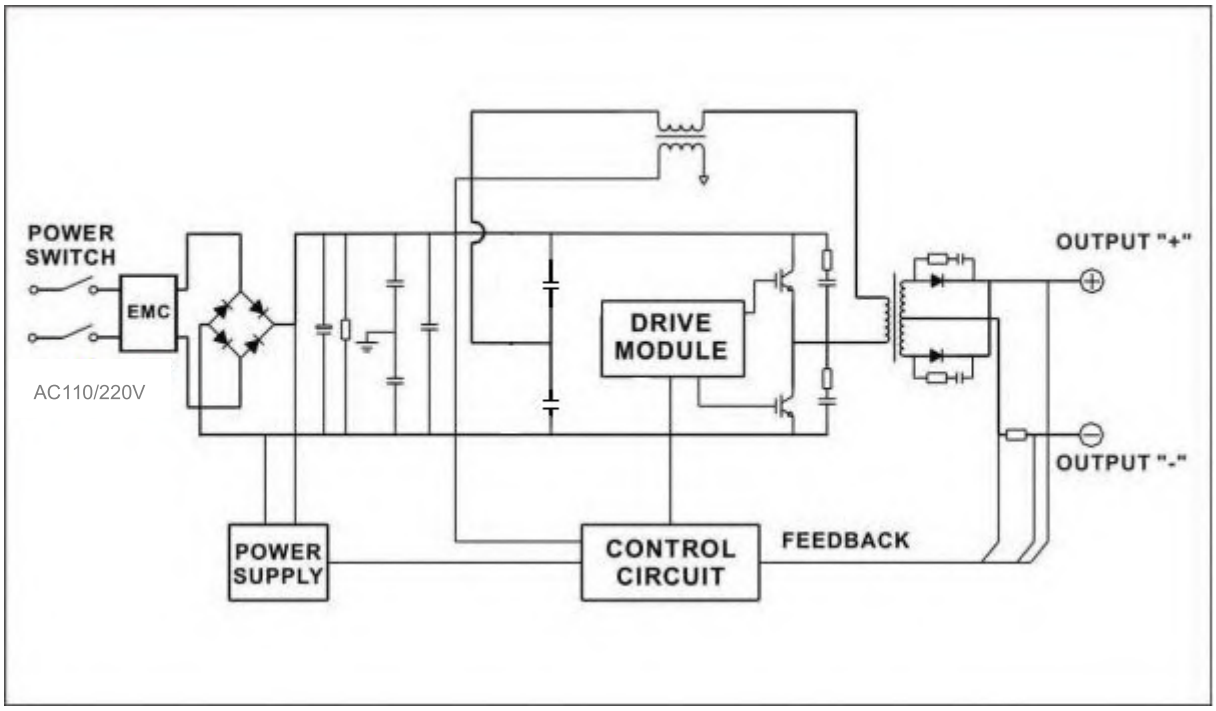
6. ORDERING INFORMATION AND PACKING

Model	Function Configuration	Package List
MIG200	Welding Mode: Gas MIG/Gasless MIG/MMA /TIG/Spot welding/Spool Gun. MIG Functions: Spot Welding, 2T/4T, Inductance Adjustment and Spool Gun Interface. MIG Synergic Functions: Diameter Selection, Material Selection,Inductance Adjustment and Spool Gun Interface. MMA functions: Built-in Hot Start, Arc-force, Anti-stick and VRD. TIG Functions: Lift arc, Anti-stick and VRD.	1* ARCCAPTAIN MIG Welder 1* MIG Welding Torch 1* Welding Ground Clamp 1* Welding Electronic Holder 1* Welding Gas Hose 1* Brush&Hammer 1* Nozzle 5* Rollers 1* Diffuser 2* Contact Tips 1* User Manual

7. TECHNICAL PARAMETERS

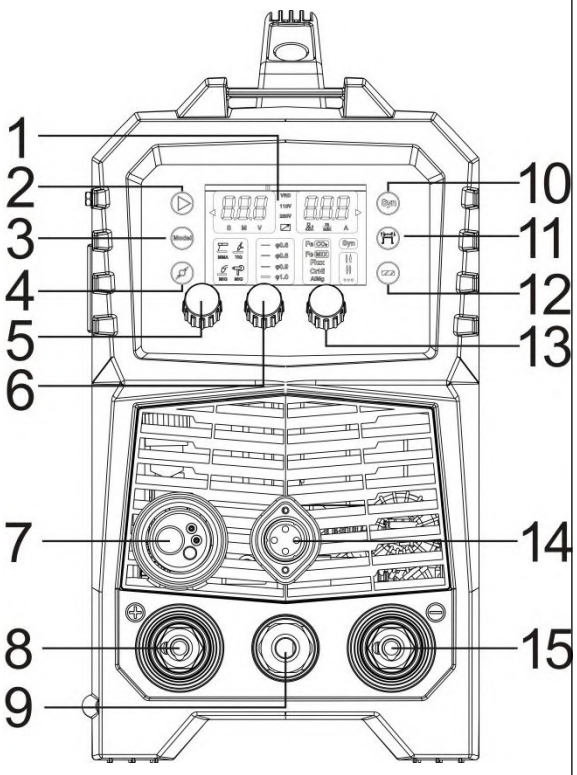
Technical Parameter	Units	Model	
		MIG200	
Rated input voltage	V	AC110V±15% 50/60HZ	AC220V±15% 50/60HZ
Rated input power	KVA	4.9	6.9
Rated input current	A	44.2	30.9
Welding current range (MMA)	A	20～135	20～180
Welding current range (TIG)	A	20～135	20～200
Welding voltage range (MIG)	A	30～160	30～200
	V	11～22	11～26
Wire feed speed range	m/min	2.0～10	2.0～15
Rated duty cycle	%	60	60
Open circuit voltage	V	U_0: 64 U_r:15	
Overall efficiency	%	85	
Enclosure class	IP	21S	
Power factor	COSφ	0.72	
Insulation class		H	
Standard		UL60974-1	
Dimension	mm/in	530x215x410mm / 20.9″x8.5″x16.1″	
Weight	kg/lb	12.8kg /28.2 lb	
Applicable electrode/wire	mm/in	1.6-3.2 (1/16"-1/8") 0.6/0.8/0.9 (0.024"/0.030"/0.035")	1.6-4.0 (1/16"-5/32") 0.6/0.8/0.9/1.0 (0.024"/0.030"/0.035"/0.039")

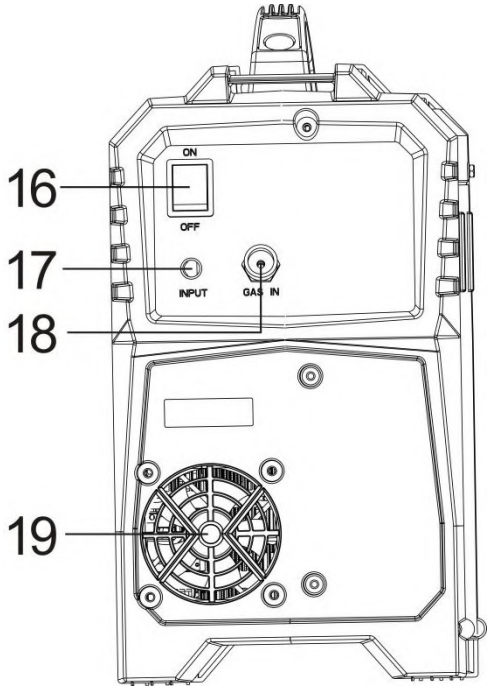
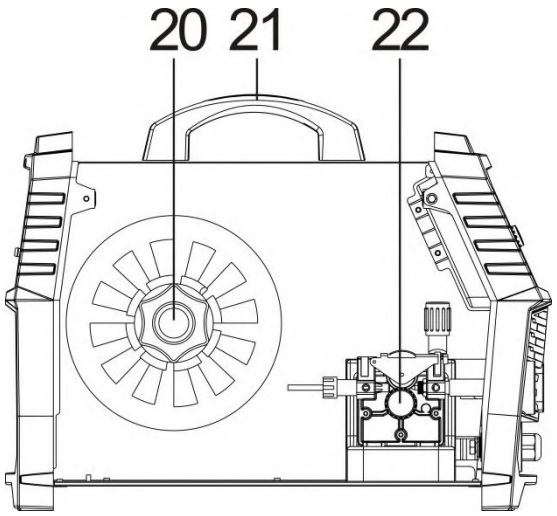
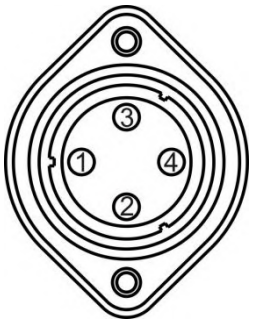
8. ELECTRICAL SCHEMATIC DIAGRAM



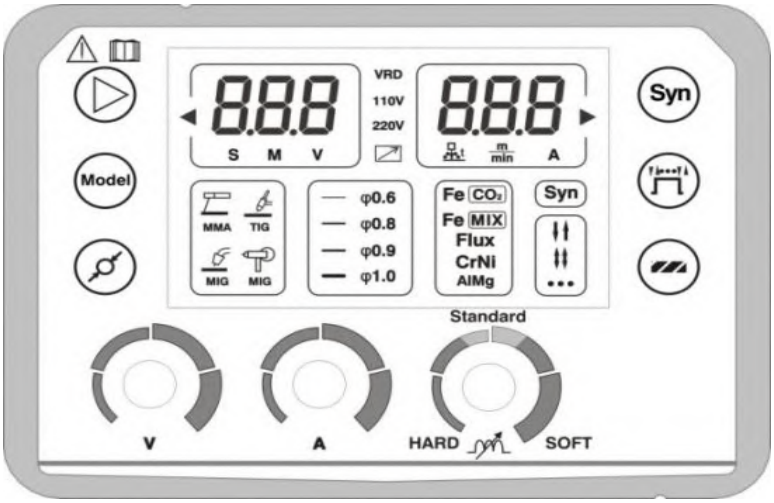
9. OPERATION CONTROL AND DESCRIPTION

1. Digital screen display area
2. Parameter setting and display area for spot welding time, parameter group storage, voltage and so on
3. Welding process selection area
4. MIG diameter selection area
5. Voltage and spot welding time adjustment knob
6. Current and wire feed speed adjustment knob
7. Euro connector for torch
8. "+" output terminal
9. Polarity changeover plug
10. Synergic selection button
11. MIG operation mode selection area
12. MIG material selection area
13. Inductance adjustment knob
14. Socket for Spool gun
15. "-" output terminal



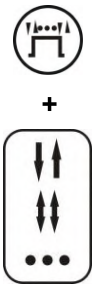
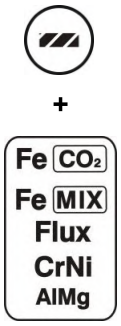
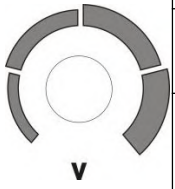
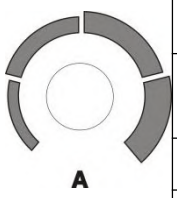
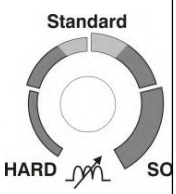
16. Power switch **17. Input power cable** **18. Gas inlet** **19. Cooling Fan**	
20. Spool holder **21. Handle** **22. Wire feeding unit**	
14. Socket for Spool gun **Hole 1: Spool gun** power source ”+” **Hole 2: Spool gun** power source ”-” **Hole 3~4:** Null	

9.1 Large Digital LED Operation Panel



Detailed description for operation panel functions：

1	**VRD, input voltage**	**VRD** **110V** **220V**	**VRD**	VRD LED
			110V	110V LED
			220V	220V LED
2	**Parameter setting and display area for spot welding time, parameter group storage, voltage and so on**	+		Parameter switch button
			S	Spot welding time LED
			M	Parameter group storage LED
			V	Voltage parameter LED
				Parameter LED display
3	**Parameter setting and display area for wire feed speed and current**			Bum-back time LED
			m/min	Wire feed speed LED
			A	Current parameter LED
				Parameter LED display
4	**Synergic selection button**	Syn + Syn	Syn	Switch button for “synergic” and “separated”
			Syn	MIG “synergic”LED The LED is on when the machine is in “synergic”
5	**Welding process selection area**	Model +	Model	Welding process selection button
			MMA	DC MMA LED
			TIG	Simple TIG LED
			MIG	MIG LED
			MIG	MIG spool gun LED

6	**MIG operation mode selection area**			MIG operation mode selection button
				2T LED
				4T LED
			•••	Spot welding LED
7	**MIG diameter selection area**			MIG diameter selection button
			— **φ0.6**	Φ0.6 wire diameter LED
			— **φ0.8**	Φ0.8 wire diameter LED
			— **φ0.9**	Φ0.9 wire diameter LED
			— **φ1.0**	Φ1.0 wire diameter LED
8	**MIG material selection area**			Material selection button
			Fe CO₂	Steel(carbon steel) + CO_2 100% +ER50S-6/ER70S-6
			Fe MIX	Steel(carbon steel) + Ar80% CO_2 20% +ER50S-6/ER70S-6
			Flux	FCAW+gasless+E71T-GS
			CrNi	CrNi(stainless steel) + Ar98% CO_2 2% + ER308
			AlMg	AlMg(Aluminum-magnesium alloy) + Ar100% + ER5356
9	**Voltage and spot welding time adjustment knob**			Subtle adjustment on welding voltage in MIG “synergic”mode
				Welding voltage adjustment in MIG “separated”mode
				In MIG “spot welding”mode, press switch button  and select “S” for spot welding time adjustment.
10	**Current and wire feed speed adjustment knob**			Welding current adjustment in MIG “synergic” mode
				Wire feed speed adjustment in MIG “separated” mode
				Welding current adjustment in MMA mode
				Welding current adjustment in TIG mode
11	**Inductance adjustment knob**			Adjust soft or hard arc characteristics in MIG all mode

9.2 Detailed function description



Attention! Please select welding functions according to welding requirements. During welding, choose proper welding process and parameters according to the technology requirements of workpiece. With improper welding process and parameters, there will be unstable arc, excessive spatter and wire and electrode sticking during welding.

9.2.1 Parameter group

“ **M** ”, function of parameter group storage and usage, is in support of ten parameter group storage“0~9” with one group covering all adjustable parameters on the machine panel, including welding mode and the related conditions and settings. Prior to any other parameters, the parameter group will automatically save the adjusted parameters(save after keeping the same parameters for 20S).The parameter group keeps the last used parameters when the machine is turned on again.No designated button for storage and no manual operation for parameter storage and usage.It is easy to use parameter group. Press the parameter switch button , turn on the parameter group “ **M** ” LED, and switch parameter groups by encoder “ **V** ” . Select the parameter group and work with the related parameters, and the group will automatically save the adjusted parameters.

9.2.2 MIG welding mode

1) **“Synergic” and “separated”**

There are two MIG/MAG welding mode, “synergic” and “separated”, for welding specification adjustment:

Synergic: Current and voltage settings vary with different welding wire, wire diameter and gas; and also at the same welding current, wire feed speed and synergic voltage may differ; the welder will auto-match preset current and welding voltage, and users can adjust the inductance to the standard position according to the process requirements.

In synergic mode, the welder panel will display preset current on the right LED and preset voltage on the left LED. The synergic parameter database will auto-match the voltage based on the preset current, with adjustment range of synergic voltage ±3.0V.

Separated: No relation between wire feed speed and voltage adjustment, and users need to set values separately.

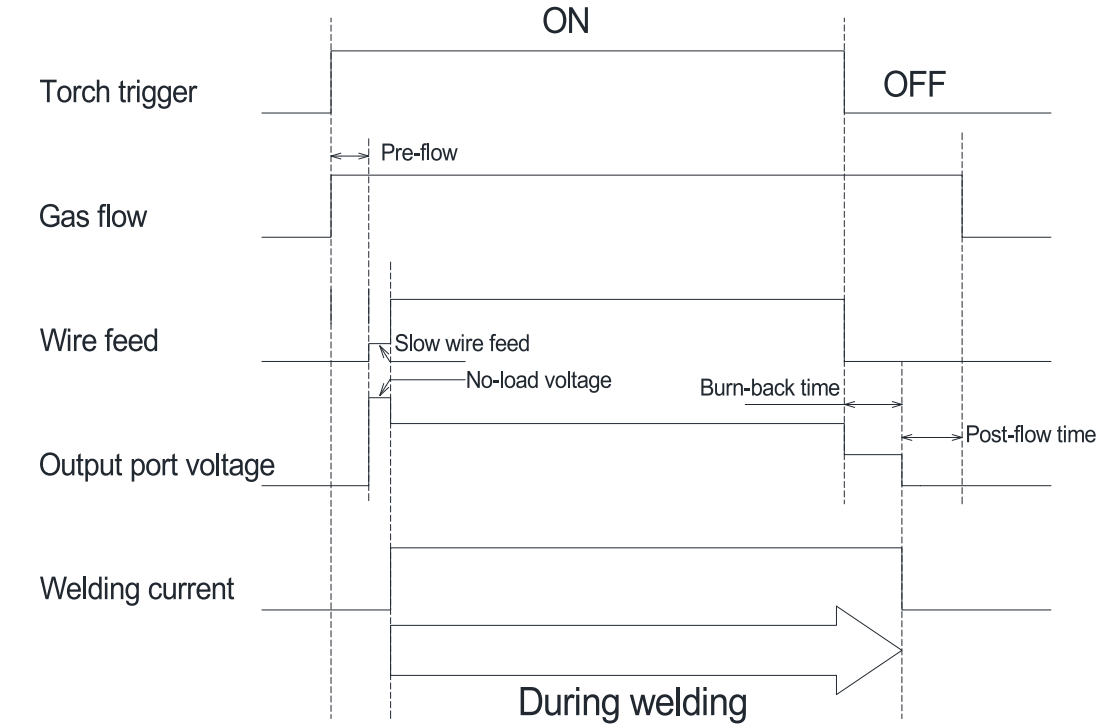
2) **Matching table of relation between welding wire, diameter, shielding gas, material and wire feeding roll：**

In synergic mode, different welding wire, diameter, shielding gas, material and wire feeding roll have corresponding matching relationship as below table. Please select correct settings to achieve optimal welding performance.

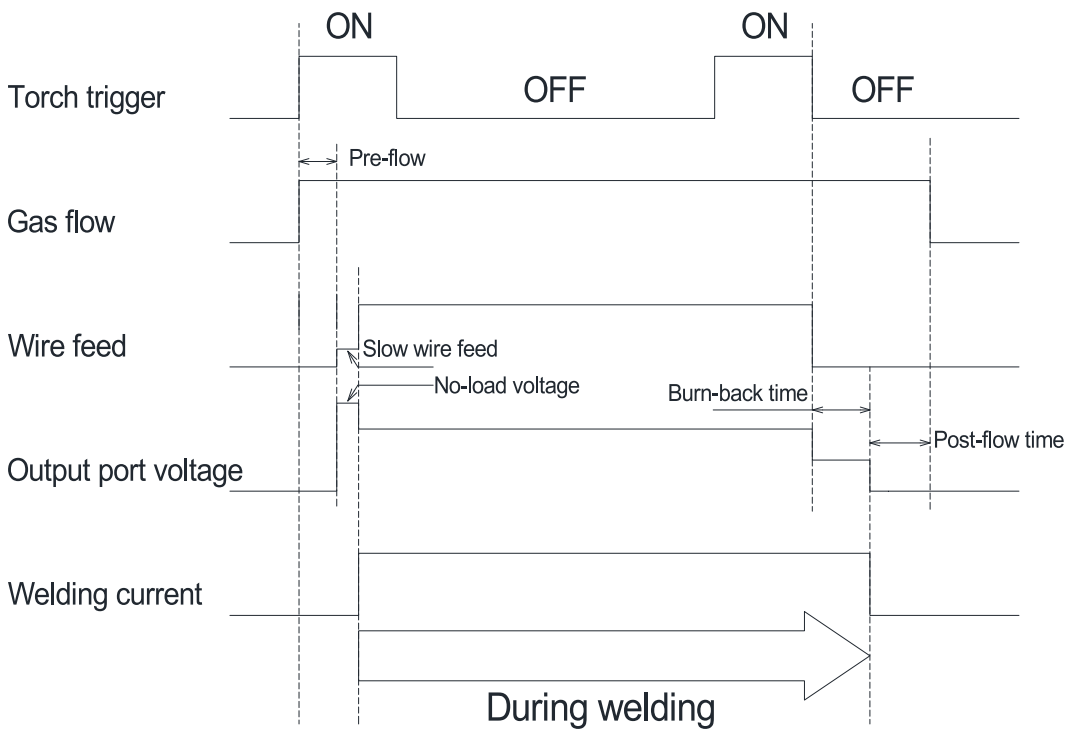
	Fe CO_2	Fe MIX	Flux	CrNi	AlMg
MATERIAL	STEEL	STEEL	FLUX CORED	STAINLESS	ALUMINIUM
WIRE TYPE	ER70S-6	ER70S-6	E71T-GS	ER308	ER5356
DRIVE ROLLER	V GROOVE	V GROOVE	KNURLED	V GROOVE	U GROOVE
POLARITY	DCEP	DCEP	DCEN	DCEP	DCEP
GAS TYPE	100%CO_2	20%CO_2+80%Ar	NO GAS	2%CO_2+98%Ar	100%Ar

9.2.3 Operation mode

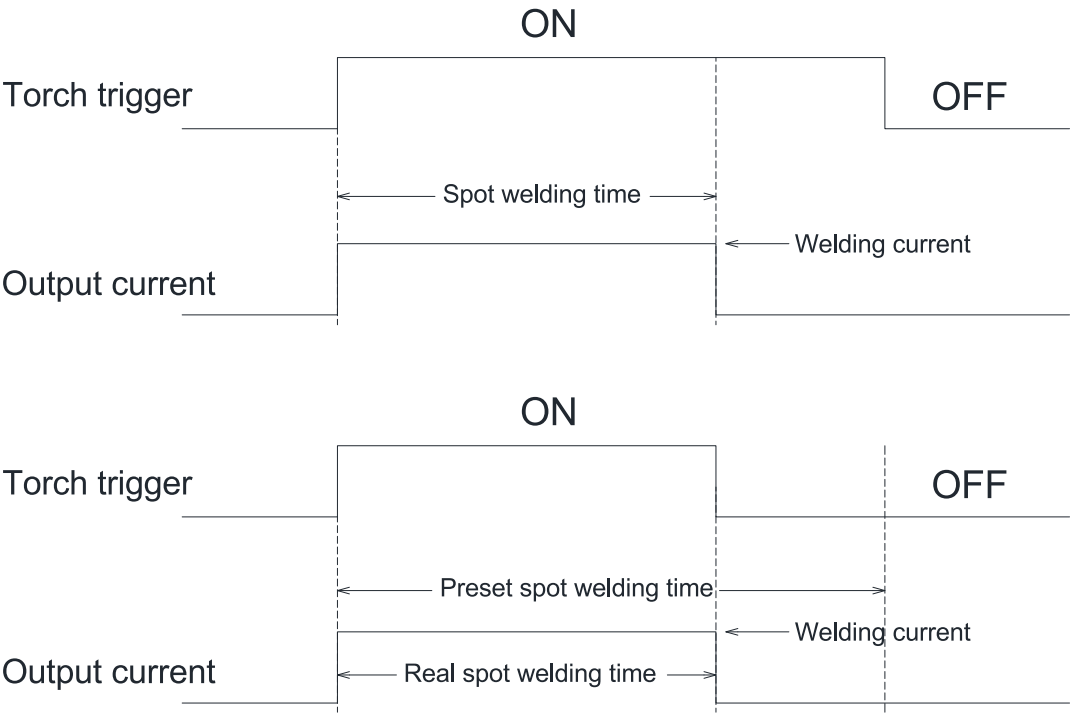
MIG operation mode diagram

Mode	Diagram
2T	

4T



Spot welding



9.2.4 Inching

In MIG mode, not during welding, press torch trigger for at least 3S, the welder will go in fast inching status, closing output port voltage and gas valve. Release torch trigger,the welder will stop inching. Current display shows actual welding current, while voltage display shows actual welding voltage during welding. Below is display in standby:

Welding process	Voltage display	Current display
MMA	Open circuit voltage or VRD voltage（V）	Preset current value（A）
TIG	Open circuit voltage or VRD voltage（V）	Preset current value（A）
MIG	Preset voltage value（V）	Preset wire feed speed（m/min）

※During MIG welding, actual welding current is displayed when current knob is not rotated, preset wire feed speed is displayed when current knob is rotated.

9.3 Setting of system parameters

A default set of common welding parameters for this machine can be revised by revising system parameters in case of need. Below is method:

1) Press **operation selection** button without releasing, turn on the power switch of the welder. As soon as display shows **"P1"**, release **operation selection** button to enter revision interface of system parameters.

2) Select system parameters of **MIG, TIG** or **MMA** by pressing **Welding Mode** Model button.

3) Select the parameter to be revised by rotating **Welding Voltage** knob. Revise the parameter value by rotating **Welding Current** knob. After revision, press **synergic** Syn button to save.

4) After revising parameters, press **operation selection** button again to exit the setting of system parameters to be in normal standby.

Below is system parameter:

MIG mode

No.	Function parameter	Default	Setting range	Unit	Description
P1	Background parameters initialization	0	0/1	-	Restore factory default (Select “1” to restore factory default)
P2	Welding time calculation	0.0	0.0～999	day	Calculate welding time
P3	Burn-back time at MIG	200	0～400	ms	Burn-back time at MIG
P4	Burn-back voltage at MIG	12.0	10.0～18.0	V	Given output voltage of removing metal ball after releasing torch trigger at MIG
P5	Pre-flow time at MIG	5	0～300	ms	Pre-flow time at MIG
P6	Post-flow time at MIG	0.2	0.0～2.0	S	Post-flow time at MIG

MMA mode

No.	Function parameters	Default	Setting range	Unit	Description
P1	Background parameters initialization	0	0/1	-	Restore factory default (Select “1” to restore factory default)
P2	Welding time calculation	0.0	0.0～999	day	Calculate welding time
P3	VRD switch at MMA	0	0/1	-	VRD switch at MMA （“0”: VRD is off, “1”：VRD is on）
P4	Arc-force current at MMA	50	20～80	A	Given current value when output voltage is below 14V at MMA
P5	Arc ignition current at MMA	60	20～100	A	Given current value of arc ignition at MMA
P6	Arc ignition time at MMA	400	300～999	ms	Duration for given current value of arc ignition at MMA

TIG mode

No.	Function parameters	Default	Setting range	Unit	Description
P1	Background parameters initialization	0	0/1	-	Restore factory default (Select “1” to restore factory default)
P2	Welding time calculation	0.0	0.0～999	day	Calculate welding time
P3	Lift TIG current	50	35～65	A	Current value when tungsten and workpiece are shorted at Lift TIG
P4	Post-flow time at TIG*	2.0	1.0-10.0	S	Post-flow time at TIG

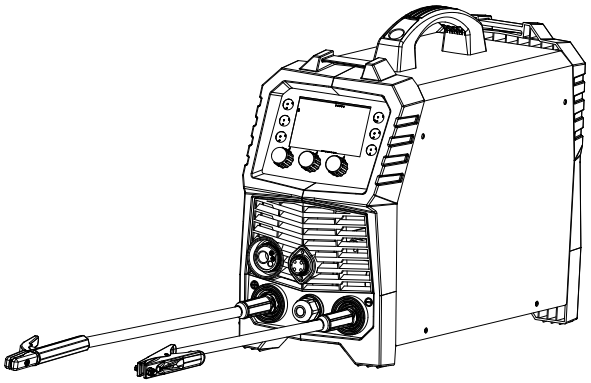
10. INSTALLATION, DEBUGGING AND OPERATION

Note: Please install the machine according to the following steps.

Turn off the power switch of distribution box before any electric connection.

The enclosure class of this machine is IP21S, so do not use it in rain.

10.1 Installation and operation for MMA welding



Sketch map of MMA Welding

1) A primary power supply cable is available for a welding machine. Well connect the primary cable to the according voltage level based on input voltage of the machine.

2) The primary cable should be tightly connected to the according power line terminal or socket to avoid oxidization.

3) Check whether the voltage value varies in acceptable range with a multi-meter.

4) Insert the cable plug with electrode holder into the “+” socket on the front panel of the welding machine, and tighten it clockwise.

5) Insert the cable plug with earth clamp into the “—” socket on the front panel of the welding machine, and tighten it clockwise.

6) Ground connection is needed for safety purpose.

10.2 Operation

1) After being installed according to the above method, and the power switch being switched on, the machine is started with the power LED on and the fan working.

2) Pay attention to the polarity when connecting. There are two ways of wiring on DC welder: DCNP and DCEP. DCNP: welding holder connected to “-“and work piece to “+”; DCEP: workpiece to “-“and welding holder to “+”. Please choose the proper connection method according to different workpiece and processing methods. Unstable arc, spatter, and electrode sticking could happen if improper polarity is selected. Please change the polarity by exchanging the quick connector in case of above abnormal situation.

3) When switching the welding mode to MMA, welding can be carried out with output current in rated range.

4) Select cable with larger cross-section to reduce the voltage drop if the workpiece is far away from the welder with long secondary cables (welding cable and earth cable).

Preset the welding current according to the type and size of the electrode, clamp the electrode and then welding can be carried out by short circuit arc ignition. For welding parameters, please refer to **10.3 table**.

10.3 Welding parameters table (for reference only)

Electrode Diameter (mm)	Recommended Welding Current (A)	Recommended Welding Voltage (V)
1.0	20~60	20.8~22.4
1.6	44~84	21.76~23.36
2.0	60~100	22.4~24.0
2.5	80~120	23.2~24.8
3.2	108~148	23.32~24.92
4.0	140~180	24.6~27.2
5.0	180~220	27.2~28.8
6.0	220~260	28.8~30.4

Note: This table is suitable for mild steel welding. For other materials, consult related materials and welding process for reference.

10.4 Installation and operation for MIG welding

Installation

1) Insert the torch into EURO Connector for Torch in MIG on the front panel and tighten it.

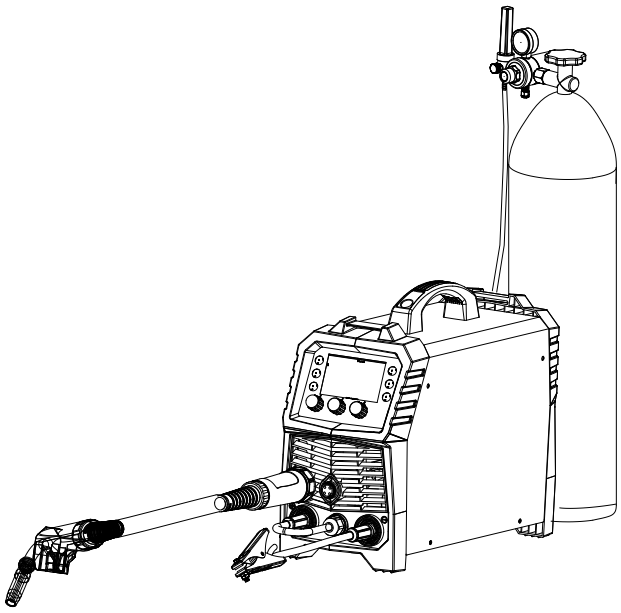
2) Connect the cylinder equipped with the gas regulator to the gas inlet on the rear panel of the machine with a gas hose.

3) Insert the cable plug with work clamp into the “-” output terminal on the front panel of the welding machine, and tighten it clockwise.

4) Insert the quick plug on the front panel into the “+” output terminal and tighten it clockwise.

5) Install the wire spool on the spindle adapter. Make sure that the groove size of wire feed roll matches the contact tip size of the welding torch and the wire diameter being used. Release the pressure arm of the wire feeder to thread the wire through the liner, into the roll groove and then into the liner of central connector. Adjust the pressure arm to ensure no sliding of the wire. Too high pressure will lead to wire distortion, which will affect wire feeding. Press the Inching button to thread the wire out of the contact tip on the torch.

Sketch map of installation



Sketch map of MIG Welding

Operation

1) After being installed according to the above method, and the power switch being switched on, the machine is started with digital display on and the fan working. Open the cylinder valve, and adjust the flow regulator to get the proper gas flow.

2) Press 2T/4T button to select desired mode.

2T: Press torch trigger to activate wire feeding. After arc ignition, start welding based on set wire feed speed and voltage. Release torch trigger to stop wire feeding and welding. Gas is turned off after 0.5S.

4T: Press torch trigger to activate wire feeding. After arc ignition, start welding based on set wire feed speed. When releasing torch trigger, welding continues. Press torch trigger again, welding still continues. After releasing torch trigger, wire feeding and welding stops. Gas is turned off after 0.5S.

3) Operators can adjust burn-back time and post-flow time based on actual demands, **see 9.3** for specific setting.

10.5 Installation and operation for Gasless self-shielded arc welding

Installation

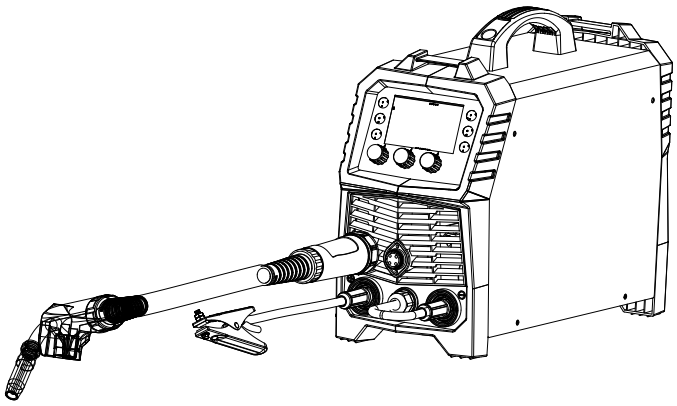
1) Insert the welding torch into the Euro connector for torch in MIG on the front panel of the machine, and tighten it.

2) Insert the cable plug with work clamp into the “+” output terminal on the front panel of the welding machine, and tighten it clockwise.

3) Insert the quick plug on the front panel into the “-” output terminal, and tighten it clockwise.

4) Install the wire spool on the spindle adapter and tighten the cover of spindle. Make sure that the groove size of wire feed roll matches the contact tip size of the welding torch and the wire diameter being used. Release the pressure arm of the wire feeder to thread the wire through the liner, into the roll groove and then into the liner of central connector. Adjust the pressure arm to ensure no sliding of the wire. Too high pressure will lead to wire distortion, which will affect wire feeding. Press the Inching button to thread the wire out of the contact tip on the torch. **(Gasless self-shielded arc welding applies flux-cored self-shielded welding wire, which requires knurling rolls)**

Sketch map of installation



Sketch map of Gasless Self-shielded Arc Welding

Operation

The operation is the same as MIG operation except that there is no gas option.

10.6 Installation and operation for TIG welding

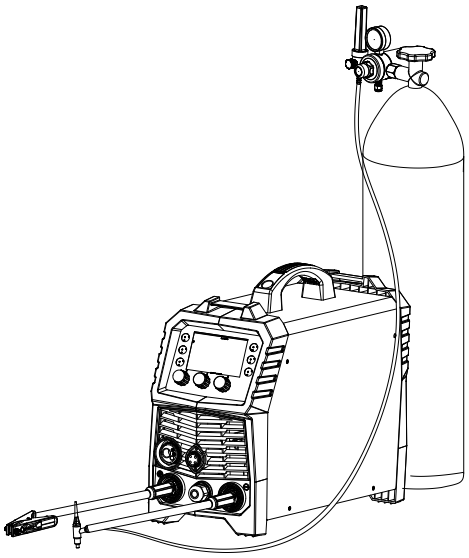
Installation

1) As it is shown in the figure, TIG torch is connected to **negative** pole on the front panel, while workpiece is connected to **positive** pole. Please note that quick connector should be tightened.

2) Connect Argon cylinder and gas inlet hose of TIG torch. Open the gas valve after achieving suitable gas flow. Attention: Make sure connection is well to prevent gas leakage.

(Note: At TIG, gas is not controlled by built-in gas valve; therefore, gas should be connected to gas inlet hose of TIG torch outside the machine)

Sketch map of installation



Operation

1) After being installed according to the above method, and the power switch on the rear panel being switched on, the machine is started with digital display on and the fan working.

2) Select “TIG” as the welding mode.

3) According to workpiece thickness, select welding current by adjusting “current adjusting knob” and ammeter displays this set value. Press torch trigger to start welding.

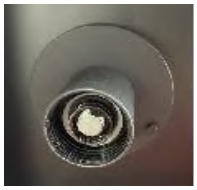
Arc starting method: As this machine adopts touch start TIG, operator can start normal welding by slightly raising the torch when there is current after the tungsten is touching the workpiece.

10.7 Installation and Operation for 2lb(1kg) /11lb(5kg) Roller

Installation of 11lb(5kg) Roller

	1) Unscrew the top cover.
	2) Install 11lb(5kg) wire on the roller.
	3) Tighten the top cover.

Installation of 2lb(1kg) Roller

 	1) Unscrew the top cover and unscrew the inner knob with pliers。
  	2) Take off the outer large roller and the 1kg roller show out. And take out inside spare parts for next steps.
	3) Install 2lb(1kg) wire on the roller.
	4) Put spare parts removed in step 2 back on the roller. Tighten the knob removed in step 1)

11. BASIC KNOWLEDGE OF WELDING

11.1 MMA

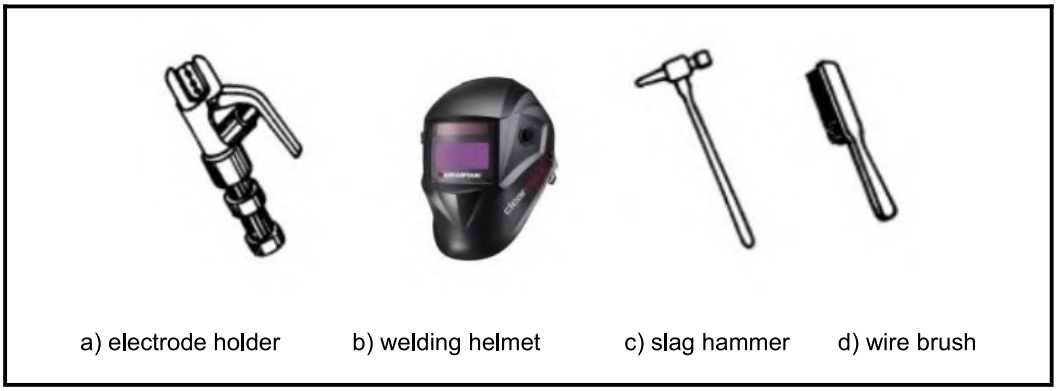
Manual metal arc welding, MMA for short, is an arc welding mode by manually operating electrode. Equipment for MMA is simple, convenient and flexible to be operated with high adaptability. MMA is applied to various metal materials with thickness more than 2mm and various structures, in particular to workpiece with complex structure and shape, short weld joint or bending shape, as well as weld joints in various spatial locations.

11.2 Welding Process of MMA

Connect the two output terminals of the welder to the workpiece and electrode holder respectively, and then clamp the electrode by the electrode holder. When welding, arc is ignited between the electrode and the workpiece, and the end of the electrode and part of the workpiece are fused to form a weld crater under the high-temperature arc. The weld crater is quickly cooled and condensed to form weld joint which can firmly integrally connect two separate pieces of workpiece. The coating of the electrode is fused to produce slag to cover the weld crater. The cooled slag can form slag crust to protect the weld joint. The slag crust is removed at last, and the joint welding is finished.

11.3 Tools for MMA

Common tools for MMA include electrode holder, welding mask, slag hammer, wire brush (see below), welding cable and labor protection equipment.



a) electrode holder b) welding helmet c) slag hammer d) wire brush

Tools for MMA

1) **Electrode holder**: a tool for clamping electrode and conducting current, mainly including 300A type and 500A type.

2) **Welding mask**: a shielding tool for protecting eyes and face from injuring due to arc and spatter, including handholding type and helmet type. Colored chemical glass is installed on the viewing window of the mask to filter ultraviolet ray and infrared ray. Arc burning condition and weld crater condition can be observed from the viewing window during welding. Thus, welding can be carried out by operators conveniently.

3) **Slag hammer (peen hammer)**: for the use of removing slag crust on the surface of weld joint.

4) **Wire brush**: for the use of removing dirt and rust at the joints of the workpiece before welding, as well as cleaning the surface of weld and the spatter after welding.

5) **Welding cable**: generally cables formed from many fine copper wires. Both YHH type arc welding rubber sleeve cable and THHR type arc welding rubber sleeve extra-flexible cable can be used. Electrode holder and welding machine are connected via a cable, and this cable is named as welding cable (live wire). Welding machine and workpiece are connected via another cable (earth wire). The electrode holder is covered with insulating material performing insulation and heat insulating.

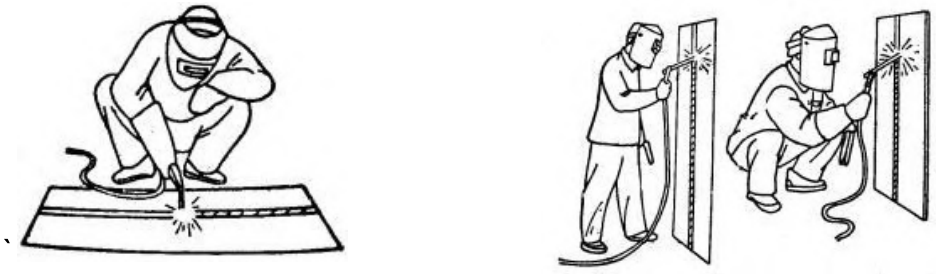
11.4 Basic Operation of MMA

a. Welding joint cleaning

Rust and greasy dirt at the joint should be removed completely before welding in order to implement arc igniting and arc stabilizing conveniently as well as ensure the quality of weld joint. Wire brush can be used for condition with low requirement on dust removal; grinding wheel can be used for condition with high requirement on dust removal.

b. Posture in operating

Take flat welding of butt joint and T-shaped joint from left to right as an example (See below). The operator should stand at the right side of the working direction of weld joint with mask in the left hand and electrode holder in the right hand. The left elbow of the operator should be put on his left knee to prevent his upper body from following downwards, and his arm should be separated from the costal part so as to stretch out freely.

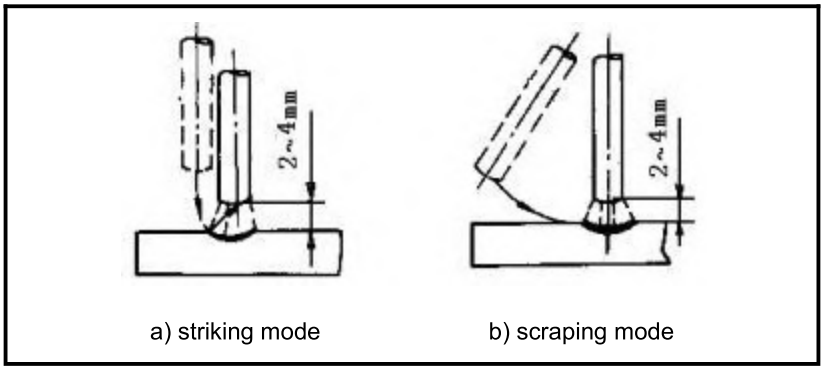


a) flat welding b) vertical welding

Posture in welding

c. Arc igniting

Arc igniting is the process for producing stable arc between electrode and workpiece in order to heat them to implement welding. Common arc ignition mode includes scraping mode and striking mode (See below). During welding, touch the surface of the workpiece with the end of the electrode by scraping or light striking to form short circuit, and then quickly lift the electrode 2~4mm away to ignite arc. If arc ignition fails, it is probably because there is coating at the end of the electrode, which affects the electric conduction. In this case, the operator can strongly knock the electrode to remove the insulation material until the metal surface of the core wire can be seen.



Arc ignition mode

d. Tack weld

For fixing the relative positions of the two pieces of weldment and welding conveniently, 30~40mm short weld joints are welded every certain distance in order to fix the relative positions of the workpiece during welding assembly. This process is named as tack weld.

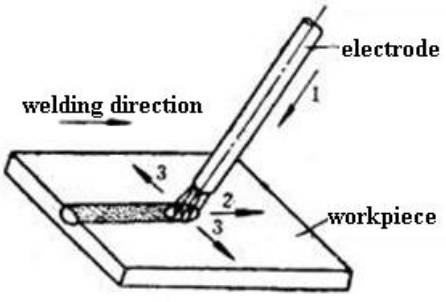
e. Electrode manipulation

The electrode manipulation actually is a resultant movement in which the electrode simultaneously moves in three basic directions: the electrode gradually moves along the welding direction; the electrode gradually moves toward the weld crater; and the electrode transversely swings. (See below figure) Electrode should be correctly manipulated in three movement directions after arc is ignited. In butt welding and flat welding, the most important is to control the following three aspects: welding angle, arc length and welding speed.

1) Welding angle: the electrode should be inclined in 70～80° forwards as shown in the figure.

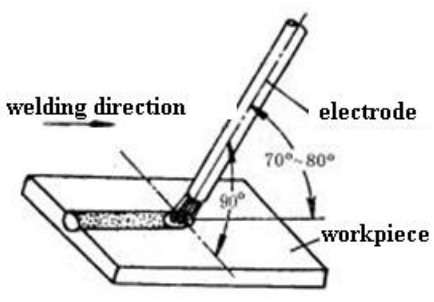
2) Arc length: the proper arc length is equal to the diameter of electrode in general.

3) Welding speed: proper welding speed should make the crater width of the weld bead about twice the diameter of the electrode, and the surface of the weld bead should be flat with fine ripples. If the welding speed is too high, and the weld bead is narrow and high, the ripples are rough, and the fusion is not well implemented. If the welding speed is too low, the crater width is excessive, and the workpiece is easy to be burned through. Besides, current should be proper, electrode should be aligned, arc should be low, and welding speed should not be too high and should be kept uniform during the whole welding process.



1-downwards feed
2-move toward welding direction
3-transversely swing

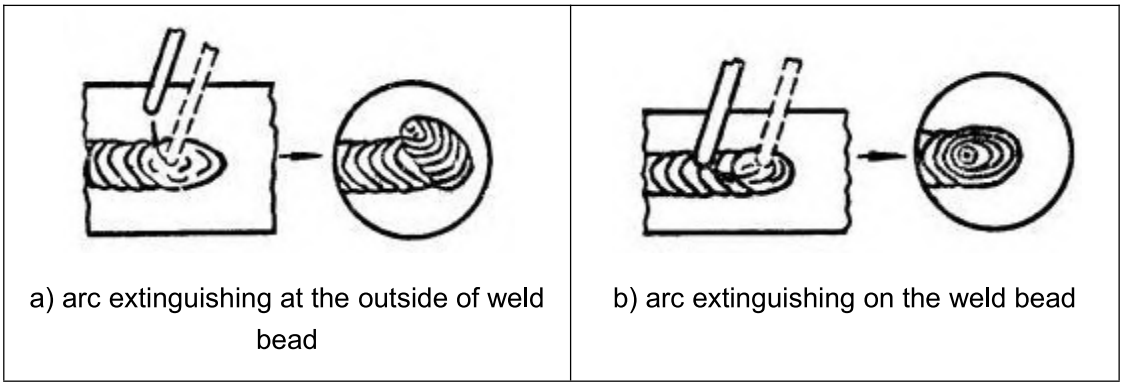
Three basic movement directions of electrode



Angles of electrode in flat welding

f. Arc extinguishing

Arc extinguishing is unavoidable during welding. Poor arc extinguishing may bring shallow weld crater and poor density and strength of weld metal by which cracks, air holes, slag inclusion and the like are easy to be produced. Gradually pull the end of the electrode to the groove and raise the arc when extinguishing arc, in order to narrow the weld crater and reduce the metal and heat. Thus, defects such as cracks and air holes can be avoided. Pile up the weld metal of the crater to make the weld crater sufficiently transferred. Then, remove the excessive part after welding. The operation modes of arc extinguishing are shown in the figure below.



a) arc extinguishing at the outside of weld bead

b) arc extinguishing on the weld bead

Arc extinguishing mode

g. Weldment cleaning

Clean welding slag and spatter with wire brush and the like after welding.

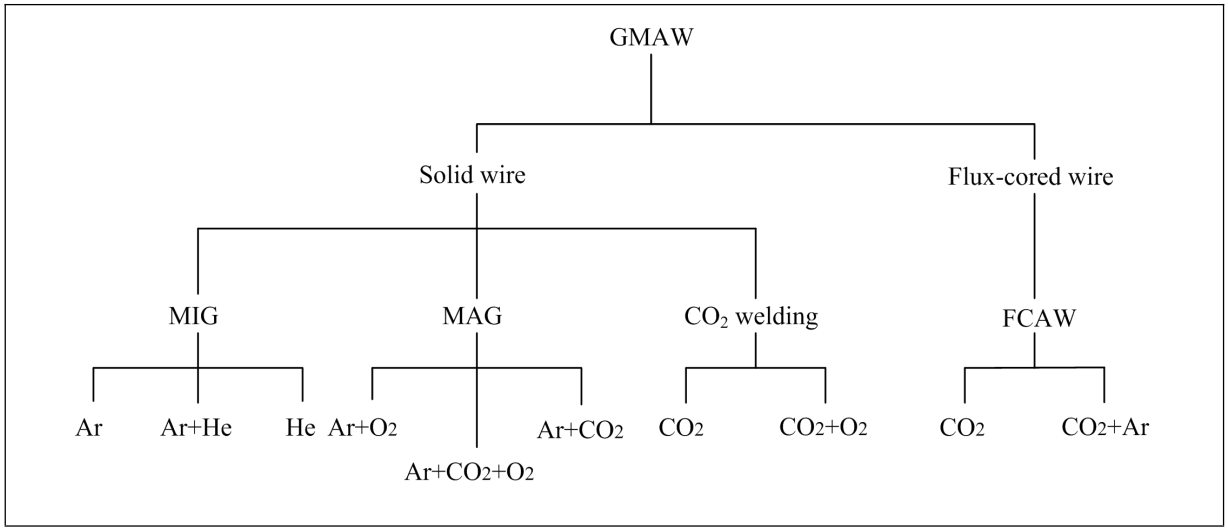
11.5 GMAW

Gas shielded arc welding is a kind of arc welding mode which adopts gas as arc media and for protecting arc and welding zone. Gas shielded welding is a kind of open arc welding, and it does not adopt flux-cored wire generally. It can be applied widely with high productivity. Gas shielded arc welding can be divided into non-consumable electrode (tungsten) inert gas arc welding (TIG) and gas metal arc welding (GMAW).

Metal inert gas arc welding, MIG for short, is a kind of welding mode which adopts the continuous fed welding wire as the melting electrode and inert gas as the shield gas. It is one of the most commonly used welding modes in the automotive sheet metal welding repair job, and it is mainly applied in the welding of metal which is relatively active, such as stainless steel, heat-resistant alloy, copper alloy and aluminum-magnesium alloy, etc.

11.5.1 Classification and application of GMAW

According to the type of shield gas, the form of welding wire and the mode of operation, GMAW can be divided into several categories as below:



1) GMAW can be applied to the welding of most metals and alloys, and it is ideal for welding carbon steel, low alloy steel, stainless steel, aluminum, aluminum alloy, copper, copper alloy and magnesium alloys.

2) For metal with high melting point such as high strength steel and high strength aluminum alloy, some corresponding treatment should be done before welding

3) GMAW is not suitable for welding metal with low melting point.

4) The minimum welding thickness is 1mm.

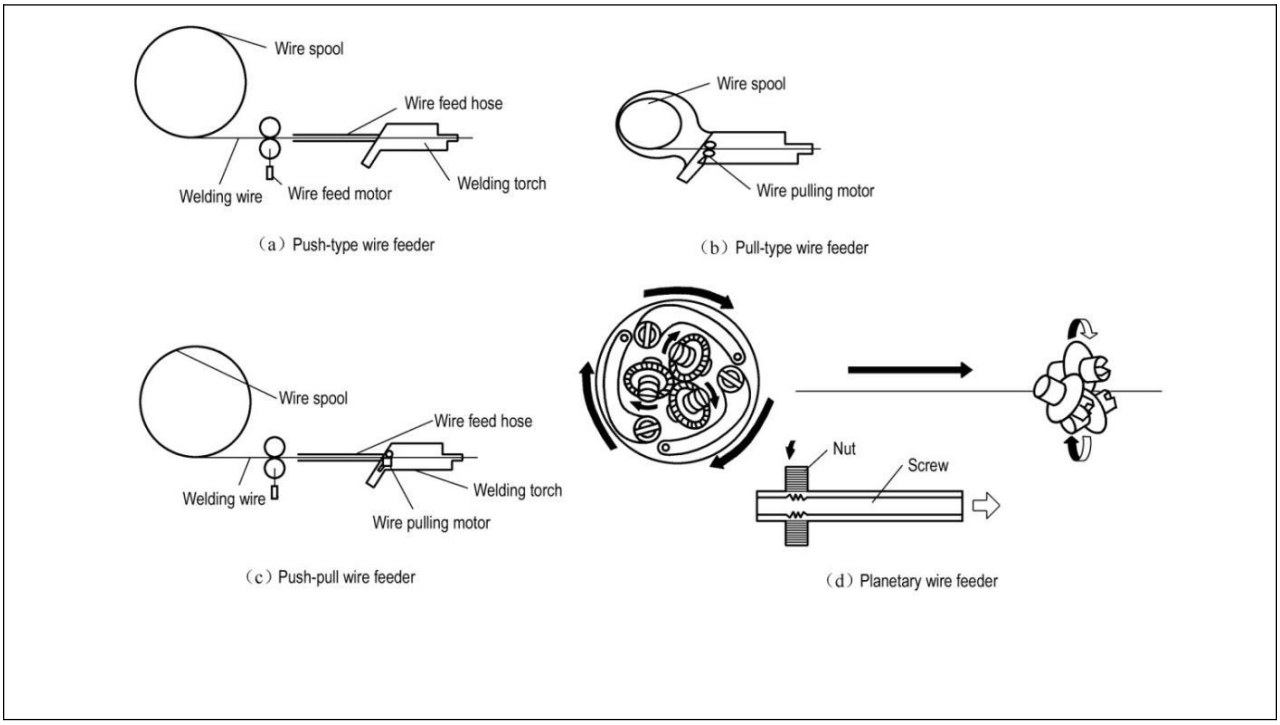
5) It has a high adaptability to various welding positions.

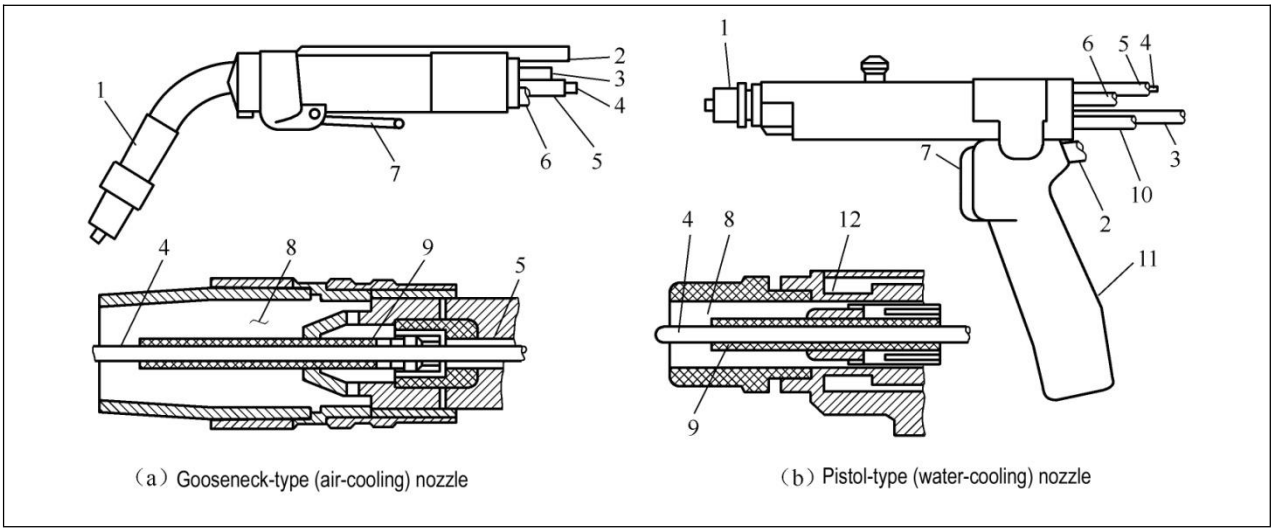
11.5.2 Welding equipment for GMAW

1) **Welding source**: GMAW adopts DC welding source generally, and the power of welding source depends on the desired current range in different applications.

2) **Wire feed system**: Generally, the wire feed system consists of wire feeder (including motor, reducer, aligning wheels and wire feed wheel), wire feed hose, wire spool and other components.

3) **Welding torch**: The welding torch for GMAW can be classified into semi-automatic torch and automatic torch, and the former can be classified into air-cooled torch and water-cooled torch according to different cooling methods.





11.5.3 Basic Operation of GMAW

a. Preweld cleaning, equipment check and labor protection **Preweld cleaning**: 1. Chemical cleaning: Chemical cleaning methods vary with the materials. 2. Mechanical cleaning: Mechanical cleaning includes sanding, scraping and sand blasting, and it is used to clean oxidation film on the metal surface.

Equipment check: Firstly, check if there are obvious damage marks on the exterior of the welding machine, and if there is any lack or damage of any components of the welding machine. Get known of the maintenance history and lifespan of the welding machine, the welding environment and welding process. Then, Check if the category, connection, grounding and capacity of the welding machine, and the welding process used are correct. After making sure there is no problem with the welding machine, check other equipment.

Labor protection: Operators should take proper labor protection such as masks, protective gloves, protective footwear, and canvas overalls before welding, and should wear protective goggles or welding helmet during operation. Wear rubber overshoes when welding in wet places or in rainy day. Meanwhile, pay attention to avoiding the damage from dust, electric shock, scalding, fire and radiation.

b. Welding parameter selecting

The parameters for MIG mainly include welding current, welding voltage, welding speed, stick-out, angle of welding wire, wire diameter, welding position, polarity, type and flow of the shield gas and so on.

Current and welding voltage

Generally, operators choose proper wire diameter according to the thickness of the workpiece, and then decide the welding current, mode of metal transfer and arc voltage.

1) **Welding speed**

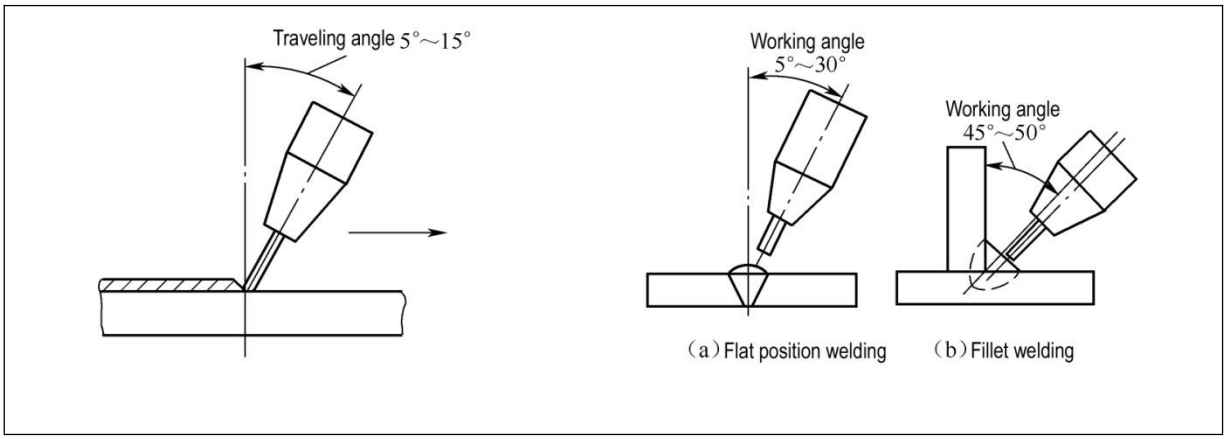
The welding speed of single-pass welding refers to the relative moving speed of the torch moving along the center line of the weld joint. Other things being equal, the penetration will increase when reducing the welding speed, and the depth and width of the molten pool will reduce when increasing the welding speed.

2) **Stick-out**

The longer the stick-out is, the greater the resistance heat will be, and accordingly the higher the melting sped of the wire will be. If the stick-out is too long, the filling metal will be too much. If the stick-out is too short, the contact tip will be burned easily. Therefore, the proper stick-out should be about 10 times as long as the wire diameter.

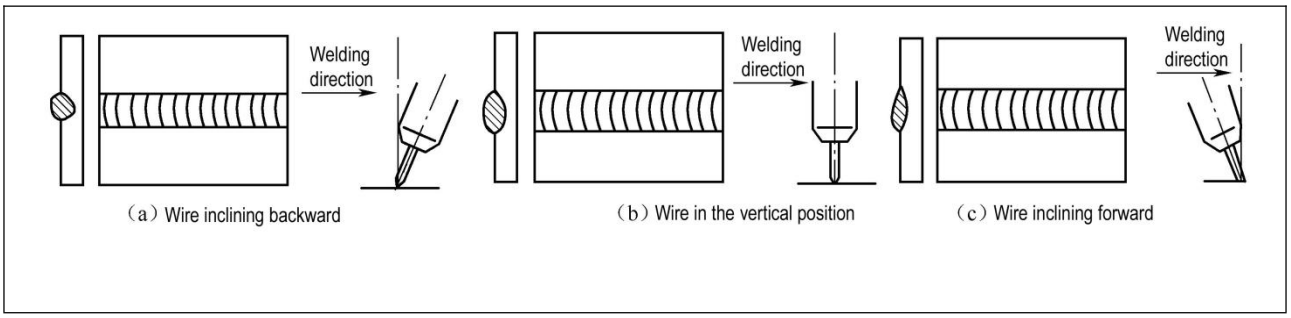
3) **Position of welding wire**

The angle and position of the axis of welding wire relative to the center line of weld bead will affect the shape of weld bead and the penetration. In the plane of the axis of welding wire and the center line of weld bead, the angle formed by the axis of welding wire and the vertical line of the center line of weld bead is called traveling angle.



The effect on the weld bead shaping caused by the position of welding wire is shown in the above figure. When welding wire changes to backward position from vertical position, other things equal, the

penetration will increase, the weld bead will narrow, the weld reinforcement will increase, and arc will be stable with little spatter. Usually, maximum penetration can be obtained by backward welding with a traveling angle of 25°. In order to control the molten pool better, the traveling angle is 5°~15° generally. When welding fillet welds in the horizontal position, the working angle is 45° generally.



1) **Welding position**

GMAW is applicable to flat position welding, vertical position welding, overhead position welding, upward welding in the inclined position and downward welding in the inclined position.

2) **Gas flow**

There are two situations for shield gas flowing out of the nozzle: the thicker laminar flow and the thinner laminar flow close to the turbulent flow. Generally, the diameter of the nozzle should be 12mm, and the gas flow should be 8~15L/min.

c. Arc igniting

Gas shielded arc welding generally adopts contact-short arc ignition. Adjust the stick-out to the proper length before arc ignition. When igniting arc, pay attention that the welding wire should not be too close to the workpiece, and keep the end of welding wire 2~3mm away from the workpiece. If thick spherical head appears at the end of welding wire, cut it off.

d. Welding

For the welding process (including positioning, weld bead initiating, electrode manipulation method, weld bead connection and weld bead ending) of MIG welding, please refer to the relevant contents.

e. Arc extinguishing

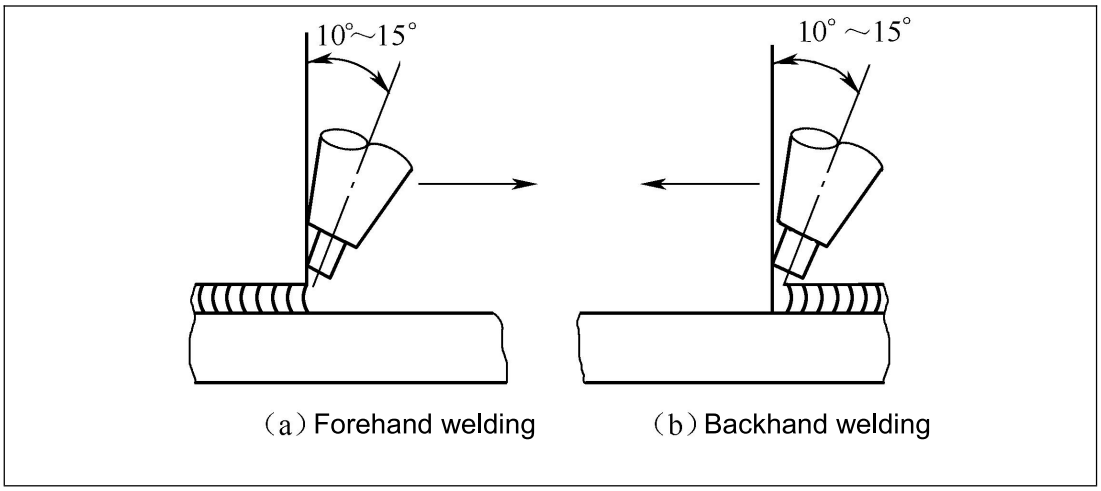
Do not extinguish arc immediately when ending welding. Otherwise, crater will be left and defects such as cracks and air holes are easy to be produced. Keep the torch staying a little while at the crater when extinguishing arc, and raise the torch slowly after the crater is filled, so that the molten pool can be well protected before it is solidified.

f. Weld bead connection

Generally, backward welding is adopted for weld bead connection, and its operation is the same as that of MMA welding.

g. Forehand welding and backhand welding

GMAW adopts forehand welding generally.



h. Electrode manipulation

There are two modes of electrode manipulation, namely straight moving mode and transverse swing mode. The weld bead obtained through straight moving mode is narrow, and this mode is mainly used in sheet metal welding and backing welding. Transverse swing mode means that electrode makes cross-swing transversely based on the center line of the weld bead during welding, mainly in the form of zigzag, crescent shape, regular triangle, and oblique circle shape, and the electrode manipulation method is similar to that of MMA welding.

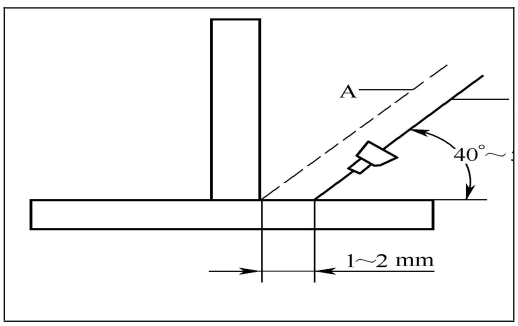
11.6 Welding operation in different position

11.6.1 Flat position welding

Flat position welding usually adopts forehand welding with a traveling angle of 10°~15°. For sheet metal welding and backing welding, straight moving electrode manipulation mode is applied; for groove filling layer welding, transverse swing electrode manipulation mode can be used.

11.6.2 Welding of T-shaped joints and lap joints

Defects such as undercut, incomplete penetration and weld bead sagging are easy to produce when welding T-shaped joints, so operators should control the angle of torch according to the plate thickness and the fillet weld size during welding operation. For horizontal fillet welding of T-shaped joints formed by plates of different thickness, incline the arc toward to the thicker plate, in order that the two plates can be heated equally.



11.6.3 Vertical position welding

There are two modes for the vertical position welding of GMAW, namely upward welding in the vertical position and downward welding in the vertical position. Due to the gravitation effect, the melting metal may drop down easily in upward welding in the vertical position. Disadvantages such as deep penetration and narrow weld bead result from the arc effect, so this welding mode is seldom used.

11.6.4 Horizontal position welding

The parameters in horizontal position welding are mainly the same as that in vertical position welding, except that the welding current can be a little higher.

12. MAINTENANCE



The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

1) Check periodically whether inner circuit connection is in good condition, connector is fastened (esp. plugs or components). Tighten the loose connection. If there is rust or oxidization, remove it with sandpaper and then reconnect tightly.

2) Don't let hands, hair or other tools contact live parts when machine is powered on, e.g., fan, so that to avoid any injury or machine damage.

3) Clean periodically the dust with dry compressed air whose pressure should be at a proper level in order to avoid the small parts inside the machine being damaged. If welding environment with heavy smoke and pollution, the machine should be cleaned every day.

4) Avoid water or vapor entering machine inside; in case it happens, please dry the machine internal structure. Then use a mega-meter to test machine's insulation (including wire to wire connection and wire to machine enclosure connection.). Welding can be continued only after the confirmation of normal

5) Check periodically whether the insulation cover of all cables is in good condition. If there is any dilapidation, rewrap it or replace it.

6) Put the machine into the original packing in dry location if it is not to be used for a long time.

13. FAILURE AND TROUBLESHOOTING



The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

1) **Common Failure Analysis and Troubleshooting:**

Common failure and troubleshooting

Failure	Cause	Solution
Turn on the machine, there is no current	● Power is not well connected ● Welder fails	● Reconnect power ● Ask professional personnel for help
Fan does not work during welding	●Fan power cord is not well connected ● Auxiliary power supply fails	● Reconnect fan power cord ● Ask professional personnel for help
Display “E10”	● Over-current protection for welder	● Restart the welder, if problem cannot be solved, contact maintenance personnel
Display “E14”	●Short-circuit current protection	● Restart the welder, if problem cannot be solved, contact maintenance personnel
Display “E15”	● Power limitation protection	● Restart the welder, if problem cannot be solved, contact maintenance personnel
Display “E20”	●Over-current protection for wire feeder	● Restart the welder, if problem cannot be solved, contact maintenance personnel
Display “E60”	● Overheat protection	● It gets to normal after cooling the welder

GMAW (MIG/MAG) failure and troubleshooting

Failure	Cause	Solution
There are no response and error code after pressing torch trigger	● Torch is not well connected to wire feeder ● Torch trigger fails	● Reconnect torch and wire feeder ● Repair or replace the torch
There are gas output and wire feeding after pressing torch trigger but no current output and error code	● Ground wire is not well connected to workpiece ● Wire feeding unit or torch fails	● Reconnect ground wire and workpiece ● Repair the wire feeding unit or torch
There are gas supply and current output but no wire feeding after pressing torch trigger	●Wire feeding unit is stuck ●Wire feeder fails ●Control board in the welder fails	● Unblock the wire feeding unit ● Repair the wire feeder ● Ask professional personnel for help

Welding current is instable	●Unsuitable moment adjustment for wire feeder ● Wire feed rolls do not match welding wire ● Contact tip is worn severely ● Wire liner of torch is worn severely ●Welding wire is of poor quality	● Readjust moment of wire feeder ● Select suitable wire feed rolls and welding wire ● Replace the contact tip of torch ● Replace the wire liner ● Replace wire with one of better quality

2) **Spare Parts List for Maintenance**

No.	Material Code	Name of Material
1	10050332	IGBT SGT40N60NPFDPN
2	10043957	Rectifier tube SFR25U20PN
3	10037137	Electrolytic capacitor CD-1500uF-200V
4	10069363	Relay QX90ASDC24VCFR
5	10006278	MOSFET 2SK3878
6	10066303	Integrated circuit UC3525AN
7	10033188	Integrated circuit UC3844B
8	10075418	Diode SFR20S20T
9	10075332	Integrated circuit OP2177
10	10075308	MOSFET SVT06130NDTR
11	10075093	DC fan RS8025S24SH-A

14. TRANSPORTATION AND STORAGE

Transportation

Equipment should be handled with care in transportation to avoid severe impact. Equipment should be protected from damp and rain in transportation.

Storage

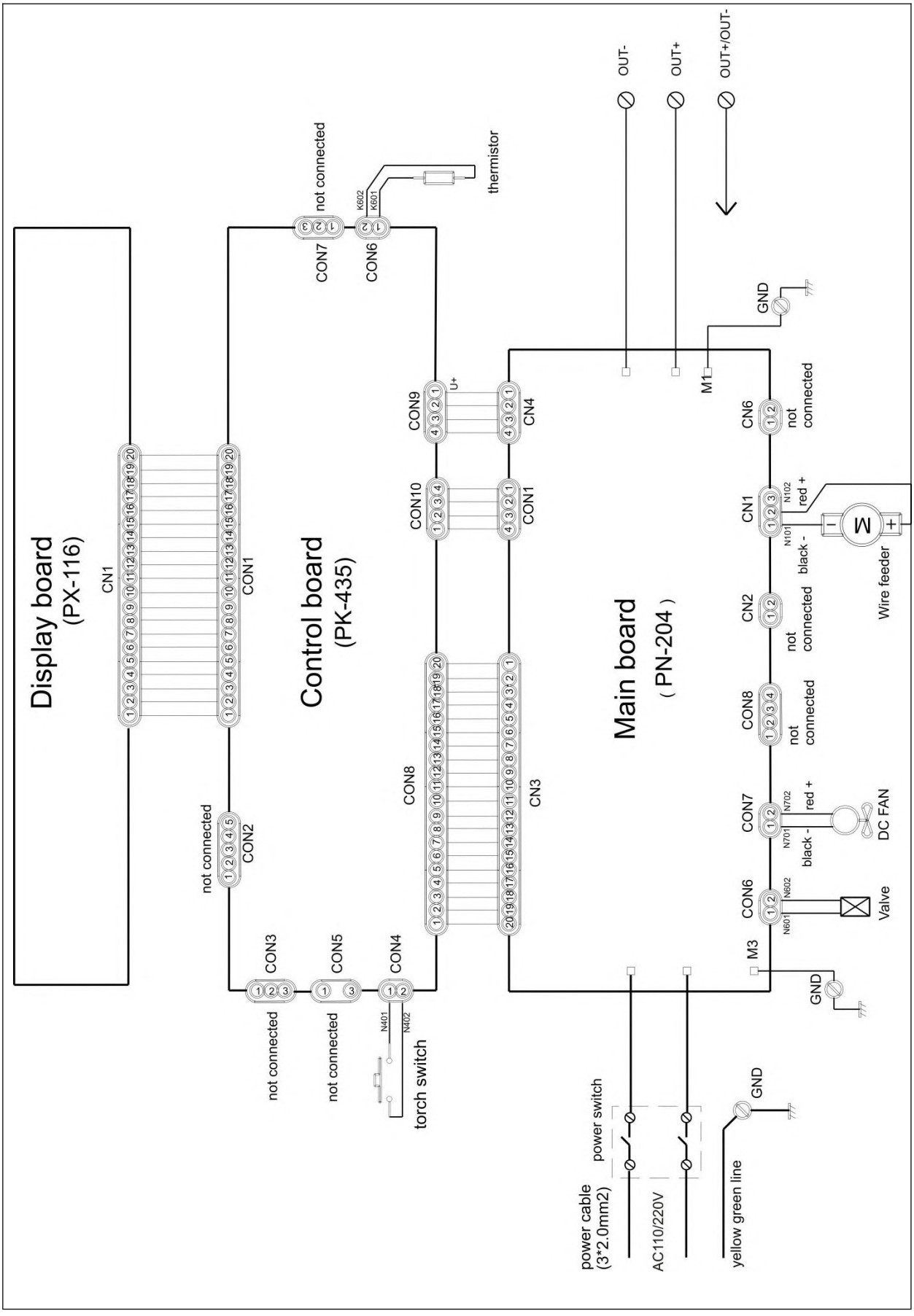
Temperature for storage: -25℃~+50℃

Humidity for storage: relative humidity≤90%

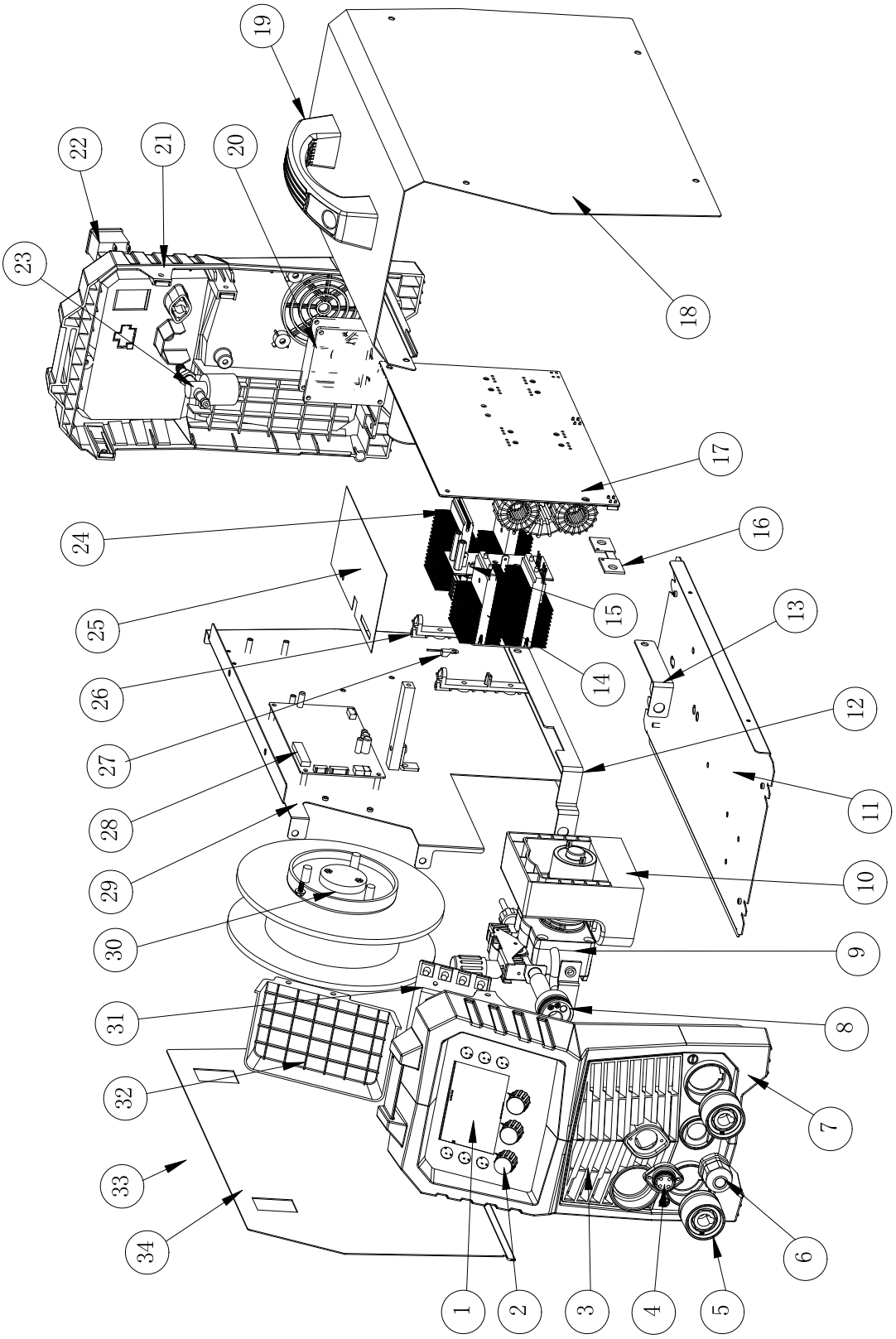
Storage life: 12 months

Place for storage: ventilated indoor place without corrosive gas

15. WIRING DIAGRAM OF COMPLETE MACHINE



16. EXPLOSIVE VIEW OF COMPLETE MACHINE



Components list from explosive view

No.	Name	Quantity
1	Bracket for panel	1
2	Knob	3
3	Plastic louver	1
4	Plastic cover	1
5	Quick connector	2
6	Welding cable	1
7	Plastic front panel	1
8	Central connector	1
9	Wire feeder base	1
10	Wire feeding unit	1
11	Chassis	1
12	“+” connection fitting	1
13	“-“ connection fitting	1
14	Heat sink for rectifie	2
15	Bridge rectifier board	1
16	Shunt	1
17	Main board PCB	1
18	Machine cover	1
19	Handle	1
20	DC fan	1
21	Plastic rear panel	1
22	Power switch	1
23	Solenoid valve	1
24	Heat sink for inverter	2
25	Wind shield	1
26	column	2
27	Thermistor	1
28	Control board PCB	1
29	Medium septum	1
30	Spool holder	1
31	Display panel PCB	1
32	Plastic baffle	1
33	Door catch	2
34	Left machine cover	1
35	column	2