

OPERATING INSTRUCTIONS



For every person who will be engaged in operation and maintenance supervision, it is recommended to read through this manual before any operation, so as to permit optimum operation of this machine. Keep this manual carefully so that you can use it again later.

WeldyFi Portable Auto Welding Carriage

CO₂ / MIG / MAG / FCAW Gas-Shielded Automatic Welding Carriage

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This manual applies to the Cruxweld WeldyFi portable automatic welding carriage.
Read it completely before installing, operating or servicing the machine.

1. Safety instruction

Operation, inspection and maintenance that disregard the basic safety rules cause many accidents. Carefully read, understand and observe the safety measures and precautions described in this manual and marked on the machine before operating, inspecting and maintaining it. The safety messages are classified as shown on the machine safety labels.

- ★ Read this instruction manual before operating the machine.
- ★ When you connect the power supply, choose the installation position, store high-pressure gas, store products or dispose of waste, do so in accordance with the applicable laws and rules.
- ★ This manual contains precautions that protect you and other people from injury.
- ★ Operating the machine incorrectly may cause injury or damage. The severity is divided into the three classes below; the corresponding signs and words are marked on the machine as a warning.

Sign	Meaning	Illustration
	Danger	It may lead to death or serious injury.
	Caution	It may lead to death or serious injury.
	Notice	It may lead to injury. In general, these are dangerous operations.
	Precaution signs	Shown to the operator and maintenance personnel where the machine or external equipment may be damaged.

● Serious injuries are loss of sight, electric shock, burns, fractures, poisoning and so on, which may leave permanent effects or need long-term specialist treatment. Burns or electric shock that do not need hospital treatment, and losses of property, are treated as ordinary damage.

2. Safety precautions before operation



PRECAUTION

Please observe the following precautions to avoid serious accidents.

- ◆ The machine is designed with safety factors in mind. Even so, it must be operated according to these precautions to avoid serious accidents.
- ◆ Keep other people away from the operating space and the work area.
- ◆ The welding equipment creates a magnetic field which may affect some sensing devices and clocks. For the same reason, a person with a cardiac pacemaker must not go near the machine while it is operating.
- ◆ For safety, installation, maintenance, inspection and repair must be carried out by trained personnel.
- ◆ Before operating the machine, you must understand this manual well.
- ◆ The machine must not be used for any work other than the electric arc welding described in this manual.
- ◆ Do not modify the machine.
- ◆ Before operation, check that the surroundings are safe, to avoid accidents.
- ◆ When you carry the machine, hold it by the handle and carry it smoothly.
- ◆ To touch the machine during or after welding you must wear protective gloves. Do not touch the welded surface before it has cooled.



PRECAUTION — ELECTRIC SHOCK

Please observe the following precautions to avoid electric shock.

- ◆ Do not touch live parts; this can cause serious electric shock or burns. When the power is on, the circuit and the internal parts are live. The capacitors remain charged even after the power is switched off. When the welding power source output is energised, the electrode, the metal base and the parts connected to them are live.
- ◆ Connect the distribution box, the metal base and all related connections according to the rules. This must be done by a qualified electrician.
- ◆ Before installation, maintenance and inspection, cut off the power at the incoming terminal. The capacitors are not discharged immediately, so confirm that there is no residual voltage before starting work.
- ◆ Carry out maintenance and inspection periodically; repair broken parts before operating the machine.
- ◆ Do not use broken cable or cable of insufficient rating.
- ◆ Cable connections must be firm and insulated.
- ◆ Fix the welding return cable firmly to the metal base.
- ◆ Do not operate the machine with the frame or cover removed.
- ◆ Cover the power connector before use.
- ◆ Do not use broken or damp protective gloves and do not wear damp clothing.
- ◆ Do not operate the machine outdoors after rain, and do not operate it standing on a damp floor.
- ◆ Use a safety line when working at height.
- ◆ Cut off all power when the machine is not in use.

- ◆ A fuse must be fitted at the incoming terminal of the power supply.
- ◆ Check the input voltage before use. The input voltage must be within $\pm 10\%$ of the rated voltage. Do not use the machine outside this range.
- ◆ The metal plug of the rubber-sheathed cable has screw threads; tighten them and make sure that no external force pulls on the plug during welding.
- ◆ Earth the rubber-sheathed cable.
- ◆ Stop operating, cut off the power and call a qualified engineer if any of the following occurs:
 - ▼ The cable is broken.
 - ▼ The machine is damaged by leakage.
 - ▼ Faults occur although the machine is being operated correctly.
 - ▼ The machine develops a fault.
 - ▼ The machine cannot operate normally.



PRECAUTION — ARC RAYS, SPATTER AND NOISE

Use shields to protect yourself and other people from arc rays, spatter, slag and noise.

- ◆ The arc contains harmful ultraviolet and infrared rays, which may inflame or burn your eyes.
- ◆ Spatter and slag can damage your eyes.
- ◆ Noise can damage your hearing.
- ◆ During welding, wear an effective eye protector and protective gloves.
- ◆ Set up screens to protect other people's eyes.
- ◆ During operation, wear a complete set of protective equipment: leather gloves, leg covers, leather apron, helmet and safety shoes.
- ◆ Wear hearing protection when the noise level is too high.



PRECAUTION — WELDING FUME

Use protection to shield yourself and others from the fume generated during welding.

- ◆ Fume is generated during welding and can damage your health.
- ◆ Working in a small space may lead to suffocation because of lack of oxygen.
- ◆ Use a respirator and fume extraction equipment according to the rules, to prevent poisoning and suffocation.
- ◆ When the space is small, provide good ventilation or wear a respirator, and ask an experienced person to monitor the welding process.
- ◆ When welding steel plate with a zinc coating, toxic gas is produced; remove the zinc or wear a respirator.

**PRECAUTION — GAS CYLINDERS**

- ◆ Observe the following precautions to prevent the gas cylinder from tipping over or bursting.
- ◆ A gas cylinder that tips over may cause a serious accident.
- ◆ The cylinder contains high-pressure gas. If it is not handled correctly it may burst and cause injury.
- ◆ Dispose of gas cylinders according to the rules.
- ◆ Do not expose the cylinder to high temperature.
- ◆ Place the cylinder on its special stand so that it cannot tip over.
- ◆ Do not strike an arc on the cylinder. Do not rest the torch on the cylinder or let the electrode touch it.
- ◆ Keep your head away from the outlet when opening the cylinder valve.
- ◆ Fit the protective cap when the cylinder is not in use.
- ◆ Use a gas regulator made by, or recommended by, the same manufacturer, and read its instructions before use.
- ◆ Do not use a leaking or damaged cylinder, and use cylinders only for their intended purpose.
- ◆ Do not smear oil or grease on the cylinder.
- ◆ Contact the supplier when the cylinder valve is difficult to open.

**PRECAUTION — ROTATING PARTS**

Please observe the following precautions to prevent injury from rotating parts.

- ◆ Keep your hands, hair and clothing away from the cooling fan of the power source and from the feed rollers of the wire feeder, otherwise they may be caught.
- ◆ Do not put your head near the end of the torch while the welding wire is being fed, otherwise the wire may injure your eyes.
- ◆ A wire reel that is released may cause injury.
- ◆ Do not remove the frame or cover in order to use the machine.
- ◆ Let a professional remove the frame for maintenance, inspection or repair. Set a guard rail around the machine to keep other people away.
- ◆ When moving or storing a wire reel, secure the welding wire to the reel.
- ◆ When the wire is loaded into the feeder, secure it so that it cannot come loose.



PRECAUTION — FIRE AND EXPLOSION

Please observe the following precautions to prevent fire, bursting or explosion.

- ◆ Spatter and the hot metal base may cause a fire.
- ◆ If the return conductor is not properly connected, overheating resistance may cause a fire.
- ◆ Striking an arc on an oil container may cause an explosion.
- ◆ Welding on a sealed container may cause it to burst.
- ◆ Do not weld where spatter can reach combustible material, and do not weld near flammable gas.
- ◆ Do not place the overheated metal base near combustible material after welding.
- ◆ Welding on a floor or wall may cause a fire in the room. Remove combustible material from the room before welding.
- ◆ Secure the cable connector and connect the welding return cable to the metal base.
- ◆ Do not weld a cylinder full of gas or a sealed container.
- ◆ Fire extinguishers must be available in the welding area.
- ◆ Do not carry a cigarette lighter, matches or other combustible items during welding.

3. Outline of the machine

3.1 Summary

The Cruxweld **WeldyFi** CO₂ welding carriage is used in many fields, such as shipbuilding, bridges, railways, steel structures and the petroleum industry. It is suitable for welding many structures, such as stiffened web plates, ribbed plates, cross positions and box beams. It is a trackless carriage: the magnetic base holds it on the workpiece, so no rail has to be laid. It offers the following advantages:

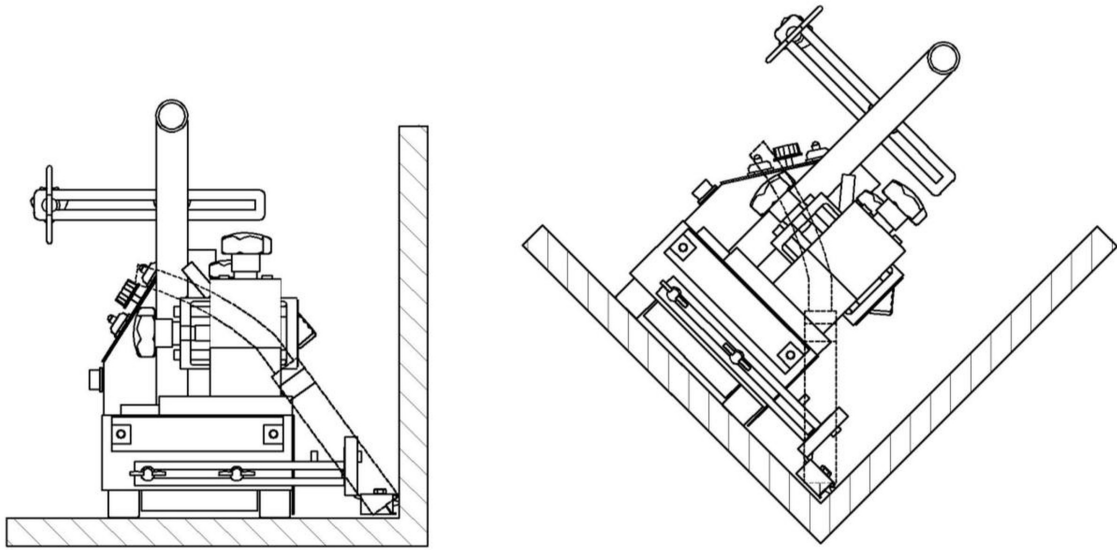
- It reduces work intensity and improves working conditions.
- It increases working efficiency; it is about 1.5 times that of manual welding.
- It avoids defective weld seams caused by the operator. The defect rate of manual operation is about 20%, whereas there is practically no defect rate with the automatic welding carriage. Taking overall efficiency into account, it raises efficiency by more than 200% compared with manual operation.
- It is highly automated, which ensures consistent welding quality.

3.2 Characteristics

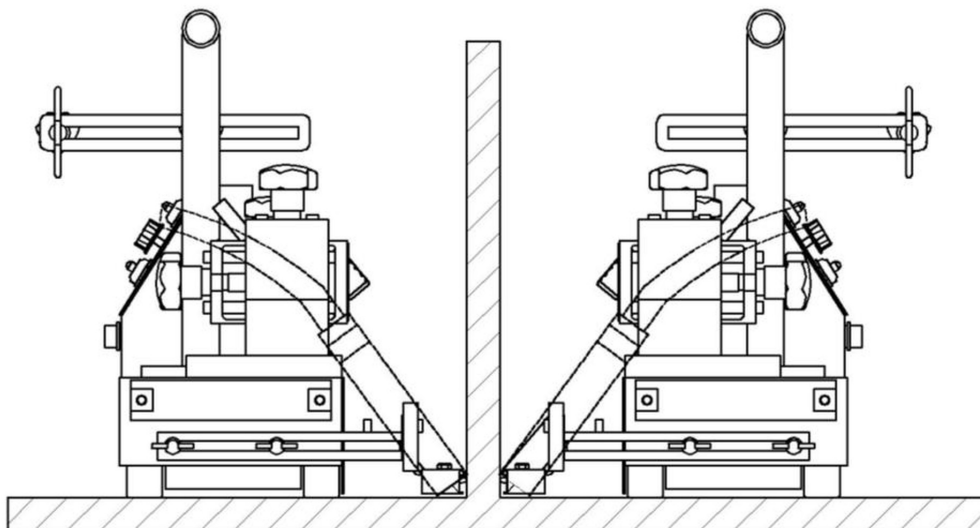
1. The welding position of the WeldyFi carriage is in the middle of its body.
2. It is used for general welding, especially for long fillet welds.
Caution: when welding with arc extinction is required, make sure the self-protection loop switch of the welding machine is on (that is, in the arc-extinction position) and that the switch of the welding carriage is in the arc-extinction state; if the self-protection loop switch is off, the welding carriage cannot work. When welding without arc extinction is required, make sure the self-protection loop switch of the welding machine is off and the switch of the welding carriage is in the state without arc extinction; if the self-protection loop switch is on, the welding carriage stops operating but the arc does not extinguish.
3. The carriage can weld while travelling forward and backward.
4. It is easy to move and install the carriage under different conditions because of its small volume and light weight.
5. The carriage's movement has high stability because of the synchronous four-wheel drive with solid rubber tyres.
6. Welding starts when the carriage is set to automatic control.
7. The number of staff is reduced; one operator can run several carriages welding at the same time.
8. Workers who have not been trained can also weld. Because of the machine's compact size, light weight and easy automatic operation, an untrained worker can achieve better results with it than a skilled worker using a normal welding machine.
9. Equipped with a fixture for the welding torch, it welds more stably and improves welding quality.
10. Aluminium extruded sections are assembled in a mosaic pattern into the base plates, and the axles are fitted with additional silicone rubber sealing gaskets, so the internal dust protection of the carriage is very good.
11. Because of the copper gear transmission of the carriage, the system is efficiently protected against magnetisation.
12. The magnetic base holds the carriage on the workpiece with a holding force of about 35 kg, and the lifting handle is integrated in the base.

3.3 Suitable working positions

The WeldyFi carriage is suitable for fillet welds, V-groove welds, overhead and out-of-position welds. Typical working positions are shown below.

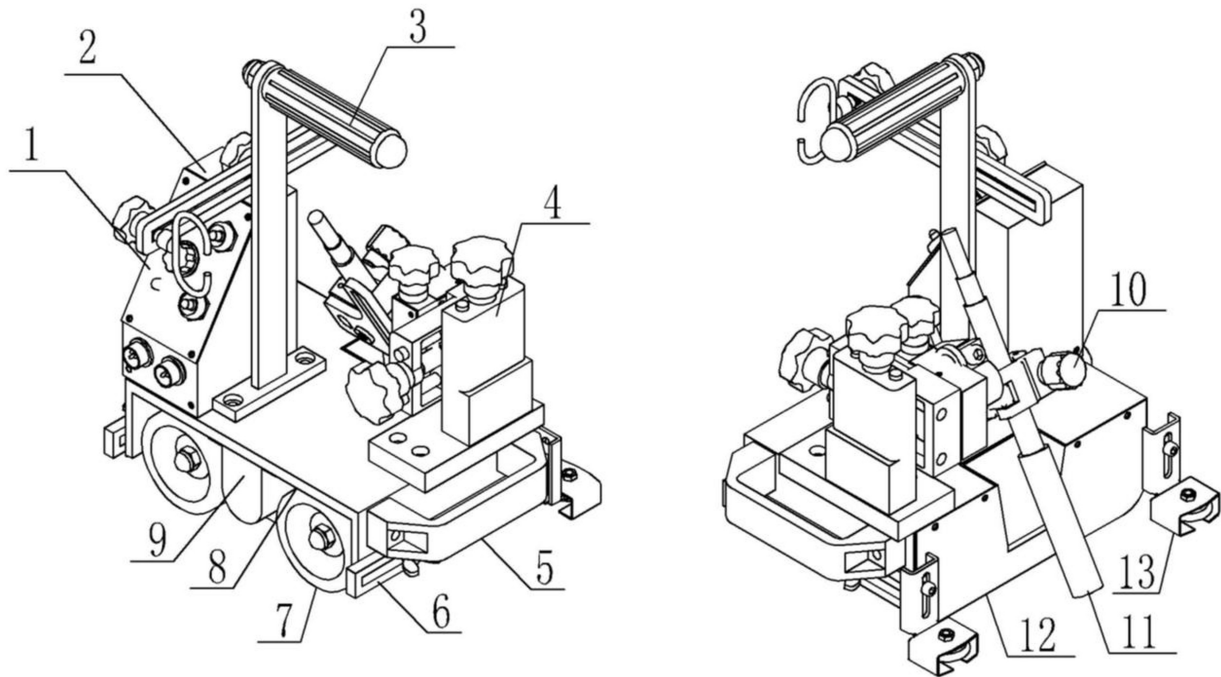


Horizontal fillet welding and inclined (45°) fillet welding



Fillet welding on both sides of a vertical web plate

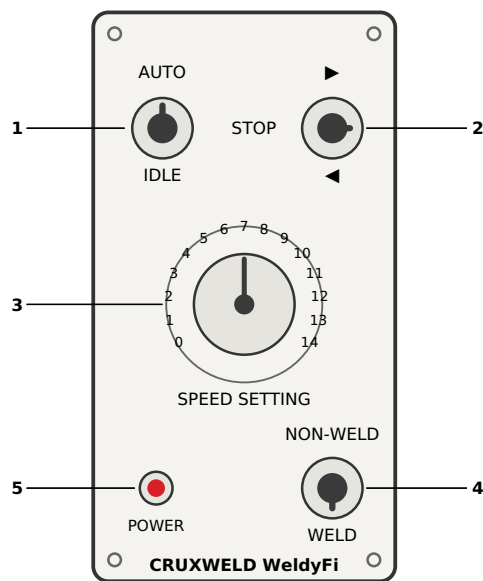
3.4 Constituent parts



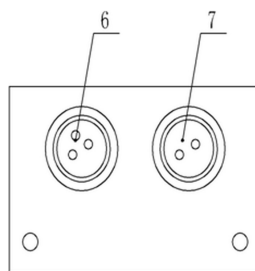
The WeldyFi is made up of the carriage body, the guide wheel, the torch handle, the X-Y slide, the torch holder and the control box. The carriage body is the frame of the machine and carries all other parts.

- | | |
|---|---|
| 1. Control panel | 8. Base (magnetic) |
| 2. Control box: it controls all actions of the carriage. Refer to "The control panel explained". | 9. Motor casing |
| 3. Hand grip: hold this grip when carrying the machine. | 10. Welding torch gripper: used to hold the torch. The torch can be taken out of it for repair or adjustment. |
| 4. X-Y moving slide: used to adjust the position of the torch. During welding the torch can be tuned up and down. | 11. Welding torch |
| 5. Plastic handle | 12. Insulation baffle plate |
| 6. Guide pulley bar | 13. Guide wheel assembly: it rolls along the base metal surface and aligns the torch with the welding part. |
| 7. Travelling wheel | |

3.5 The control panel explained



WeldyFi control panel



Connection sockets on the control box

1. Selector switch for the operating state: **IDLE**, **AUTO** and **STOP**.
2. Selector switch for the direction of travel: forward and backward.
3. Speed regulating knob for the travel of the carriage (scale 0 – 14).
4. Selector switch for the welding state: **WELD** and **NON-WELD**.
5. Power indicator LED.
6. Three-core socket: connection for the power supply from the supply unit.
7. Two-core socket: connection for the control switch of the welding torch.

3.6 Main technical parameters

Item		Value
1. Dimensions (L × W × H)		220 × 280 × 230 mm
2. Weight		8.5 kg
3. Power source		AC 110 – 230 V, 50/60 Hz
4. Power consumption		22 W
5. Drive motor		DC 110 V, 30 W, 4200 rpm
6. Magnetic holding force		35 kg
7. Travel speed		5 – 1100 mm/min
8. Traction system		Four-wheel drive, solid rubber tyres
9. Ground clearance		5.5 mm
10. Torch holder diameter		16 – 25 mm (universal, quick attach)
11. Maximum wheel temperature		70 °C
12. Range of adjusting the welding torch	Up and down	50 mm
	Left and right	50 mm
	Up / down angle	45° ± 10°
	Running (lead) angle	±10°
	Working angle range	360°
13. Welding methods		MIG, MAG (CO ₂), FCAW

Note: the carriage holds itself on the workpiece magnetically, so the workpiece must be a magnetic metal such as carbon steel or low-alloy steel.

4. Installation and operation

4.1 Preparation before operation

4.1.1 Tools and equipment required

- A suitable welding power source and wire feeder;
- The WeldyFi carriage with its travelling mechanism and its power supply unit;
- A CO₂ automatic welding torch;
- The CO₂ gas cylinder used for welding;
- Other auxiliary tools for the welding operation.

4.1.2 Connecting the system

- Connect the three-pin plug of the carriage power supply unit to the AC mains supply (110 – 230 V).
- Connect the three-core metal plug of the supply unit output to the three-core socket on the control box.
- Connect the two-core socket of the carriage to the switch wire of the welding torch.
- Set the welding state, including voltage and current, and install the welding torch. Adjust the angle of the welding torch and of the steerable wheel. While moving to the left, the left steerable wheel must be adjusted shorter than the right one; while moving to the right, the right steerable wheel must be adjusted shorter than the left one.
- Clear any litter and spatter from the carriage's travel path.

4.2 Welding operation

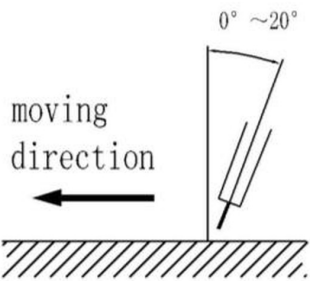
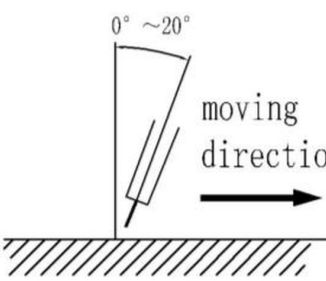
The carriage is assumed to be connected and switched on. For welding, set the travel speed of the carriage, adjust the welding current, voltage and torch angle, and then set the “weld / non-weld” switch to the **WELD** position.

- If the “auto / stop / idle” switch is set to **AUTO**, the carriage starts to move and weld.
- If it is set to **IDLE**, the carriage moves but does not weld.
- If it is set to **STOP**, all actions stop.

4.3 Welding procedure

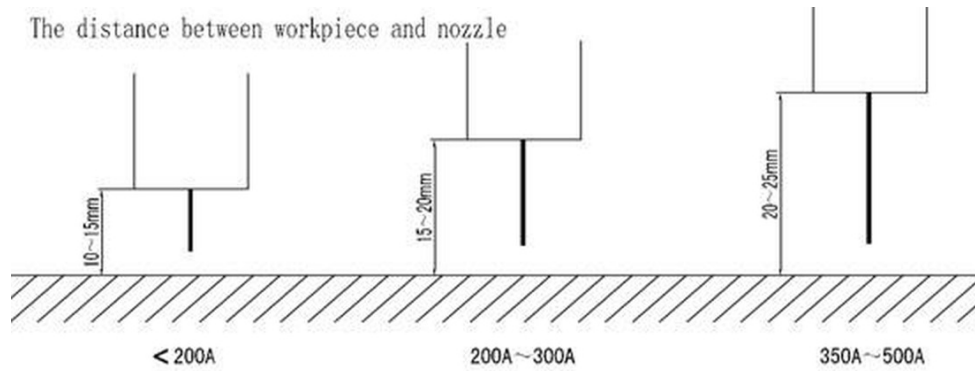
1. Choose the diameter of the welding wire.
2. Choose the type of welding wire: solid wire or flux-cored wire.
3. Switch on the power distribution board.
4. Switch on the welding power source (the self-protection circuit must be OFF).
5. Open the valve of the CO₂ cylinder and adjust the pressure to 2 – 3 kg/cm²; adjust the flow using the “check” step of the gas switch.
6. Feed the wire to the tip of the torch by hand and fit the contact tip that matches the wire diameter.
7. Confirm the extension (stick-out) of the wire.

8. Place the carriage at the start of the weld and adjust the left and right extension of the guide bar. The extension of the front guide bar should be slightly shorter than that of the rear guide bar, measured along the welding direction.
9. Put the torch in the torch clamping fixture and adjust the working and moving angles.

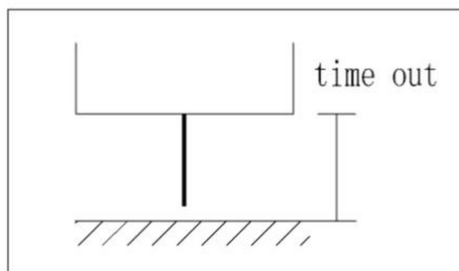
angle	Forhand welding	Backhand welding
The moving angle and direction of the torch		
The section configuration of welding		

Forehand and backhand welding — moving angle and resulting bead section

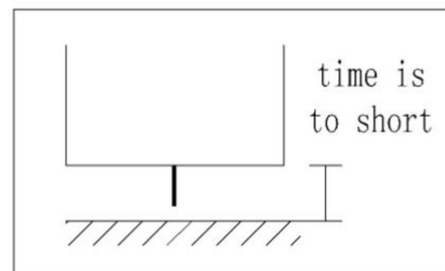
10. Adjust the X-Y slide to set the torch position and the distance between the workpiece and the nozzle. An excessive distance between the workpiece and the nozzle causes defects such as blow holes and pits; adjust it according to the following drawings.



Distance between the workpiece and the nozzle for different welding currents



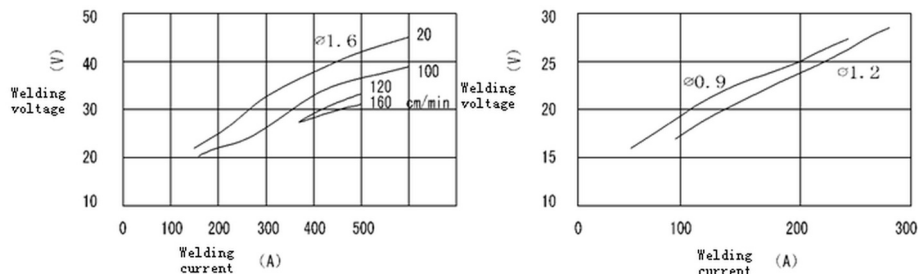
effect:Create blow hole,
difficult to start arc,
the arc is not stable,
insufficient penetration.



effect: The nozzle can be easily blinded, can't see the sealing wire clearly, and variable depth the penetration.

Effect of an excessive (left) and an insufficient (right) nozzle distance

11. Make the initial setting of the process parameters (current and voltage).

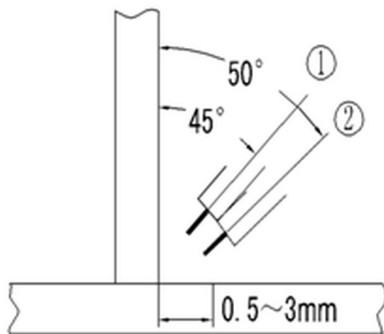


Welding current and its corresponding voltage

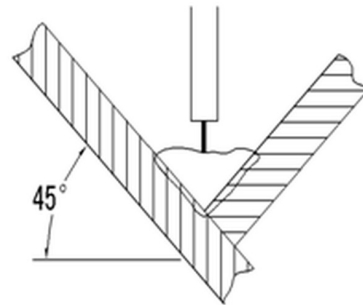
12. Confirm the CO₂ flow rate and the protection of the weld pool.
13. Start the welding process, observe the arc, and adjust the welding speed and the other welding parameters until they are suitable.
14. Press the stop button after finishing the welding process, or place an obstacle at the end of the workpiece in order to trigger the inductive stop switch of the carriage.

5. Welding parameters

Welding parameter		Φ1.2 mm	Φ1.4 mm	Φ1.6 mm
Current (A)	Down-hand welding	120 - 300	150 - 380	180 - 430
	Flush fillet welding	120 - 280	150 - 320	180 - 380
	Horizontal welding	120 - 280	150 - 300	180 - 330
Voltage (U)	1. $U = 14 + 0.05 I$ 2. below 300 A: $U = 0.04 I + 16 \pm 1.5$ 3. above 300 A: $U = 0.04 I + 20 \pm 2.0$			
Distance between nozzle and workpiece (H)	1. below 200 A: $H = 10 - 15$ mm 2. 200 - 350 A: $H = 15 - 20$ mm 3. 350 - 500 A: $H = 20 - 25$ mm			
Wire extension length (L)	About 10 times the welding wire diameter, that is $L = 10 d$			



(1) Flush fillet weld



(2) Fillet welding in the flat position

1) Flush fillet weld

Thickness (mm)	Length of fillet weld (mm k)	Wire diameter (mm d)	Current (A)	Voltage (V)	Speed (cm/min)	Distance between workpiece and tip (mm)	Position	Gas flow rate (L/min)
6	6.0	1.2	220 – 250	25 – 27	35 – 45	13 – 18	①	15 – 20
	4.0 – 6.0	1.2	270 – 300	28 – 31	60 – 70	13 – 18	①	15 – 20
8	5.0 – 7.0	1.2	270 – 300	28 – 31	55 – 60	13 – 18	①	20 – 25
	7.0 – 8.0	1.2	260 – 300	26 – 32	25 – 35	15 – 20	②	20 – 25
	6.5 – 7.0	1.2	300 – 330	30 – 34	30 – 35	15 – 20	②	20 – 25
12	7.0 – 8.0	1.2	260 – 300	26 – 32	25 – 35	15 – 20	②	20 – 25

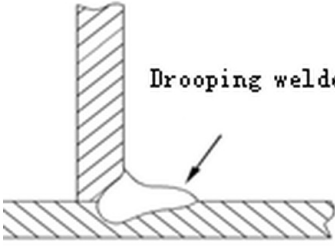
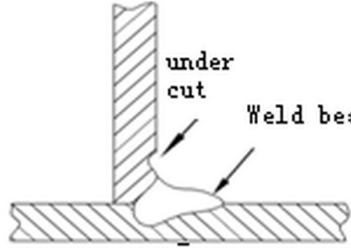
Refer to the following swing parameter list:

Plate thickness (mm)	Swing model	Swing speed	Swing angle	Length of stay on right or left (s)
6	Saw-tooth wave form	4 – 5	1 – 2	0.1 – 0.2
8	Saw-tooth wave form	5 – 6	1 – 2	0.2 – 0.4
12	Saw-tooth wave form	7 – 8	1 – 2	0.3 – 0.6

2) Fillet welding in the flat position

Thickness (mm)	Length of fillet weld (mm k)	Wire diameter (mm d)	Current (A)	Voltage (V)	Speed (cm/min)	Distance between workpiece and tip (mm)	Position
6	4 – 4.5	1.2	300 – 330	30 – 35	60 – 70	15 – 20	20
	6 – 7	1.2	300 – 350	30 – 36	40 – 45	15 – 20	20
	6 – 7	1.6	380 – 400	37 – 38	45 – 50	15 – 20	20
8	6	1.2	300 – 350	30 – 36	40 – 45	15 – 20	20
	8 – 9	1.6	430 – 480	38 – 42	40 – 45	15 – 20	20
12	10	1.6	430 – 480	38 – 42	30 – 40	15 – 20	20
	12 – 13	1.6	450 – 480	39 – 42	25 – 30	20 – 25	20

Weld defects and their causes

Welding mode	Defect	Causes
Flush fillet weld	 Drooping welded seam	1. The current is too high 2. Low arc (striking) voltage 3. The welding speed is too slow 4. The position of the torch is not good
	 under cut Weld beading	1. Overheating of the base metal 2. The welding speed is too high 3. The arc (striking) voltage is too high 4. The position of the torch is not good 5. The arc length is too long and the arc voltage is too high

6. Maintenance and checking of the carriage

Periodic maintenance and checking are necessary if the carriage is to be used for a long time.

- 1. Is there too much dust on the carriage?**
 - The switches on the control box and the torch position adjustment must be kept clean and free of dust.
- 2. Have dirty deposits accumulated?**
 - Clean deposits from the contact tip, the torch head, the guide wheel, the rubber tyres and the sliding block, so that the carriage works safely.
- 3. Are the screws of the torch fixing mount and the guide wheel loose?**
 - Loose screws make the carriage travel abnormally and the bead non-uniform. Make sure the screws are tight.
- 4. Does the X-Y sliding block adjust easily?**
 - Add lubricating oil to the sliding block.
- 5. Are the joints, connecting cables, flexible pipe or welding torch damaged?**
 - Check them periodically for looseness or damage.
- 6. Is abnormal noise or heat generated?**
 - Check the guide wheel, the motor and the welding torch periodically for abnormalities.
- 7. Is the fuse burned out?**
 - Check the fuse if the power light does not come on after the cables have been connected.

7. Malfunctions and remedies

The following table lists the faults of the carriage and the corresponding countermeasures.

1) The lamp of the control box does not light

Cause	Correction
The control connector makes poor contact	Change the control cable
The fuse of the control box is burned out	Change the fuse
The mains power supply is not switched on	Check the power supply

2) The switch is inactive when welding is started

Cause	Correction
The welding wire does not make good contact	Clear the welding slag
The drive motor is burned out	Change or repair the drive motor
The weld / non-weld switch is damaged	Check the wiring or change the switch

3) The welding point of the torch cannot be aligned with the target position

Cause	Correction
The fixing mount of the welding torch is not tightened	Tighten the fixing mount

4) The sliding block does not adjust smoothly

Cause	Correction
There are deposits around the sliding block	Clear the deposits or add lubricating oil

5) The carriage stops welding during automatic welding

Cause	Correction
There are obstacles on the path of the carriage	Take the obstacles away
There are deposits on the guide wheel	Clear the deposits

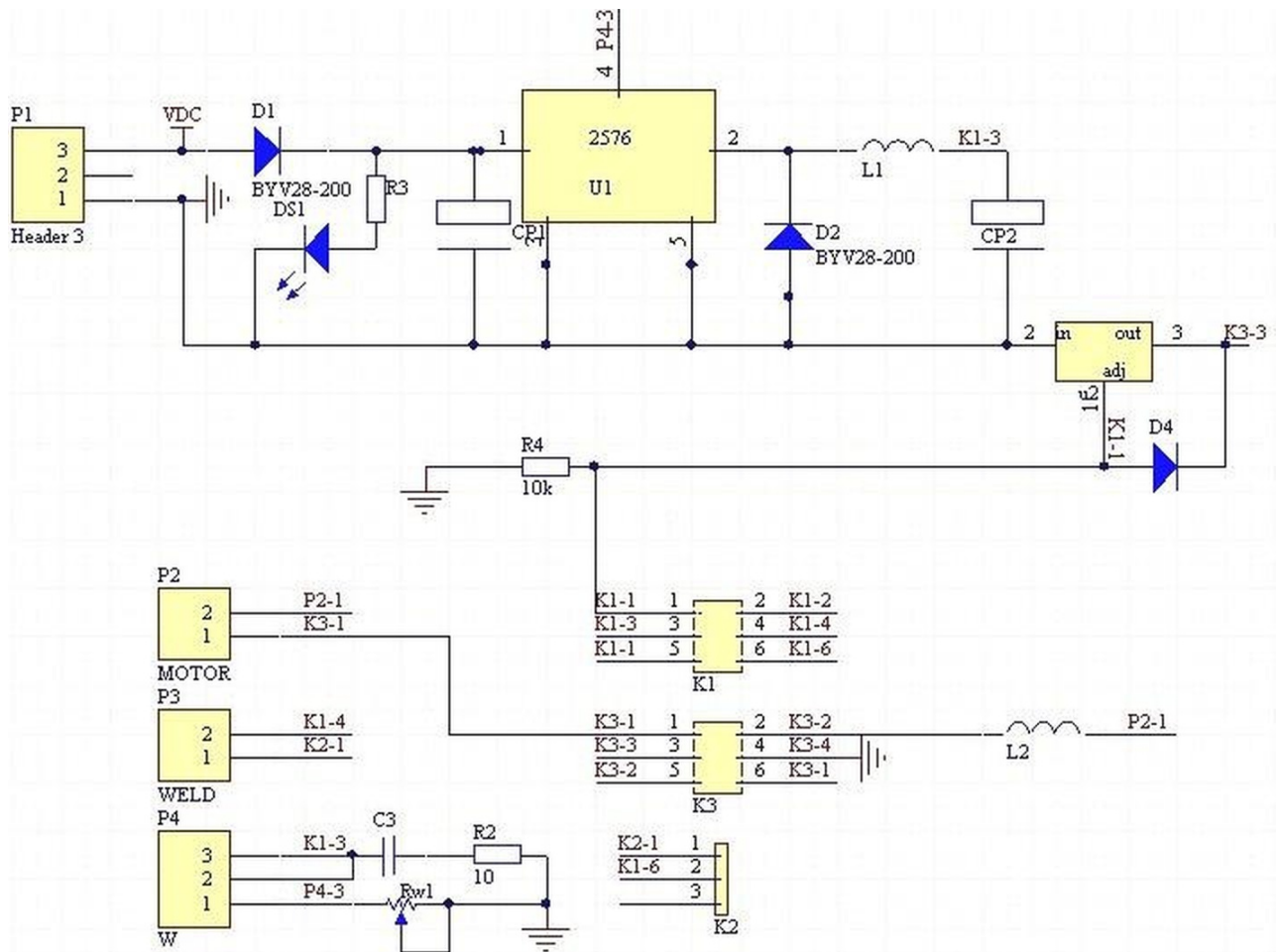
6) The welding arc is not extinguished when the welding stop switch is pressed

Cause	Correction
The welding-off switch does not work	Check the switch and change it
The self-protection circuit switch is in the "on" position	Set the self-protection circuit switch to the "off" position

7) The carriage does not travel along the weld line

Cause	Correction
The position of the guide wheel is not fixed well	Adjust the position of the guide wheel again and fix it

8. Wiring diagram



Control circuit of the WeldyFi welding carriage

9. Contents of package

Item	Quantity
1. Carriage body	1 set
2. Regulated power supply unit	1 set
3. Standard power cord, 20 m	1 set
4. Two-pin control cable for the torch, 5 m	1 set
5. Fuse, 3 A	3 pcs
6. Spanner set (M3, M4, M5, M6)	1 each
7. Certificate of quality	1 pc

10. Warranty

If the machine is operated in accordance with this operating manual and a fault occurs because of product quality, we undertake to repair the machine free of charge for six months from the date of invoice. According to the rules, the warranty does not cover the following cases:

1. Damage caused by incorrect transport or improper storage.
2. Damage caused by operating the machine other than as described in this manual, or beyond the specified voltage range.
3. Machines without a maintenance card and purchase invoice.
4. Machines where the maintenance card does not match the machine.
5. Damage caused by natural disasters or other events beyond control.
6. Damage caused by the machine being dismantled by an unqualified person.
7. Damage caused by using fittings and accessories that were not supplied by our company.

Note: the technical specifications of the machine and the contents of this operating manual are subject to change without notice.



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