

MANUAL

Mold Welder VN-31



Technical Considerations

Applicable Materials:	Ferrous metal
Applicable Projects:	wear and tear of moulds, dies and tools Excessive cutting. Casting defects. Insufficient arch/TIG welding. Erosion marks
Electric current:	Single-phase 220V±20% 50Hz
Power:	5W – 900W
Instantaneous power:	Max >30KW
Mode:	5 modes, from mode 0 – mode 4
Machine size:	360×150×200mm ³
Machine Weight	8Kg

General Description

Steel & Casting Repair Welder helps to reduce cost and improve production quality in many areas, such as plastic moulds, casting, and any industries that have trouble with surface defects in ferrous metal.

welder uses a micro-resistance welding process. The heat is generated by the passage of electrical current through the joint of the workpiece and the welding sheet. The heat is intelligently controlled to be large enough to fuse the material locally and form a nugget at the interface, and small enough not to anneal or quench the workpiece. This welding technique is better than conventional repair methods in many aspects:

Firm: complete metallurgy combination, the welded area can sustain milling, lathing, filing or grinding.

Precise: minimum welding amount: 0.03mm (using welding material $\delta 0.035$). Less material wastage.

Wide Application: all kinds of moulds, dies, castings, hardware made of ferrous metal.

Intelligent Power Distribution: microchips automatically allocate best power for different settings.

Minimum Thermal Effect: the workpiece remains in normal temperature during welding.

VN-31 has some user-friendly designs that ensure easy operation:

Multi-mode: four modes for different precision requirements.

Wide Voltage: stabilize output within a $\pm 20\%$ vibration.

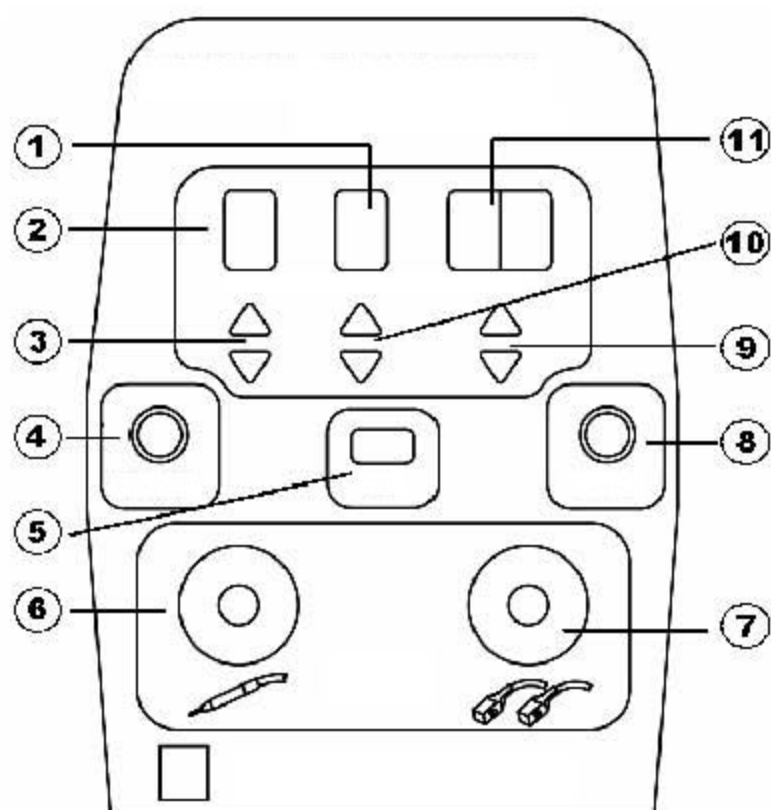
Protection Function: prevent workpieces against operation accidents.

Magnetic Connectors: Convenient connection to any ferrous metal workpieces.

Super-Portable: the main machine weighs only 8Kg, and occupies only $360 \times 150 \times 200 \text{mm}^3$

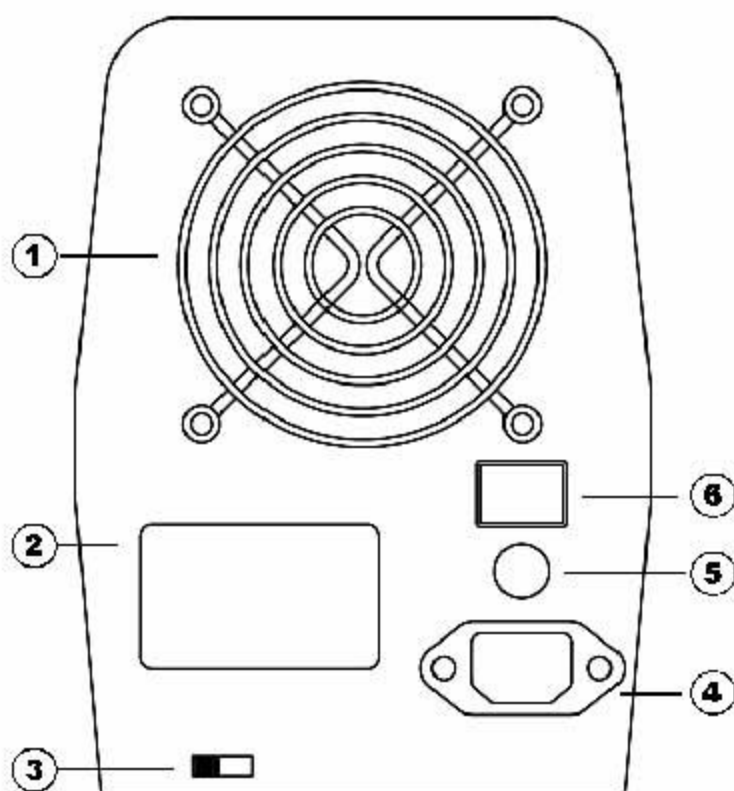


Panel Illustration



Front (Illustration 1)

- ①electrode diameter indicator
- ②mode indicator
- ③mode select
- ④precise outlet
- ⑤power button (pause/work)
- ⑥positive pole (for the welding electrode)
- ⑦negative pole (for the magnetic connectors)
- ⑧foot switch socket
- ⑨welding sheet thickness select
- ⑩electrode diameter select
- ⑪welding sheet thickness indicator



Back(Illustration 2)

- ①cooling fan
- ②data plate
- ③protection switch (on/off)
- ④main power inlet (220V 50Hz)
- ⑤fuse (8A)
- ⑥main power switch (on/ off)

Operation procedures

Preparations

Front:

1. Fasten the magnetic connector to the negative pole⑦.
2. Plug in the pedal switch⑧.
3. Fasten the thicker electrode (for normal welding) to the positive pole⑥
4. Plug in the thinner electrode (for precise welding) ⑤ if delicate area is to be repaired.

Back:

1. Connect the machine to AC 220V. Make sure the electrical source has a good earthing.

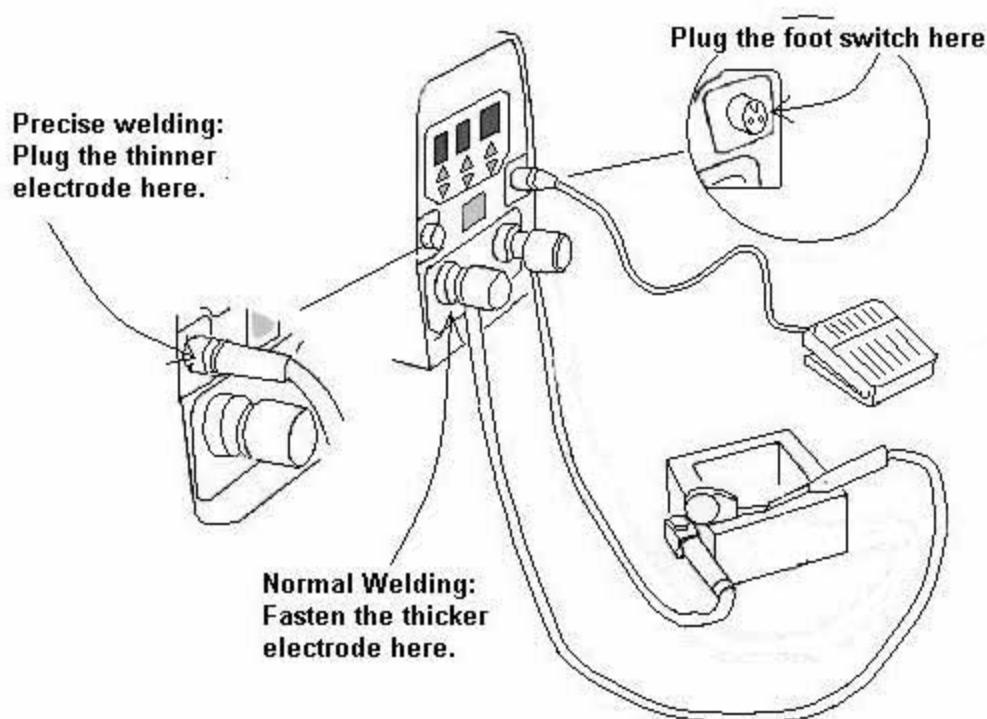


Illustration 3

Operating

1. Choose "ON" of the main power switch at the back. The machine is now in preparation state. The indicators on the front panel will display two small red dots.

2. Wait for 30 seconds, and then press the power button on the front panel. The machine is now ready to work. The indicators will display four numbers "1208".

If you press the power button before a full 30 seconds, the indicators will flash "1208" then the "Mode" indicator will display "7". In this case, please wait for a longer period of time.

Make sure you wait for 30 seconds after you turning on the main power switch, and then press the power button.

3. Select the electrode diameter and the welding sheet thickness.

The electrode diameter ranges from 1mm to 5mm. The number 1 stands for Φ 1mm, 2 for 2mm; 3, 4, and 5

can be deduced accordingly

The welding sheet thickness ranges from 3mm to 22mm. The number 3 stands for thickness of 30 μ m; The rest can be deduced accordingly.

4. Select the welding mode.

VN-31 has five welding modes, mode 0, mode 1, mode 2, mode 3, and mode 4. They are designed to fit different surface roughness.

Mode 0: for working area that has large roughness. Using this mode, the welding material deforms the greatest and combines with the workpiece most closely.

Mode 4: for working area that is quite smooth. Using this mode, the welding material deforms slightly and precision retains. The welding sheet thickness will be automatically restrained to 120 μ m, and you can only select 'welding sheet thickness' from 1-12.

Mode 1, 2, 3 are three transitional choices for roughness between Mode 0 and Mode 4. In most of the cases, Mode 1 and Mode 2 are most frequently used.

5. Connect the workpiece using magnetic connectors.

To ensure good connection, please put magnetic connectors on clean and smooth area near the working area. If the workpiece is consisted of several separated parts, put the magnetic connector on the same part of the working area.

6. Clean the welding sheet, the working area and the electrode. Remove any oil, rust or dust.

7. Press the welding sheet firmly on top of the defect by the electrode, and then step on the foot switch. The electrode is now welding. Roll the electrode slowly to produce continuous welded lines and these overlapping lines form a repaired area. Please see Illustration Four next page.

If one layer of welding sheet is not thick enough, weld more layers on top of previous ones. Make sure each layer is welded firmly.

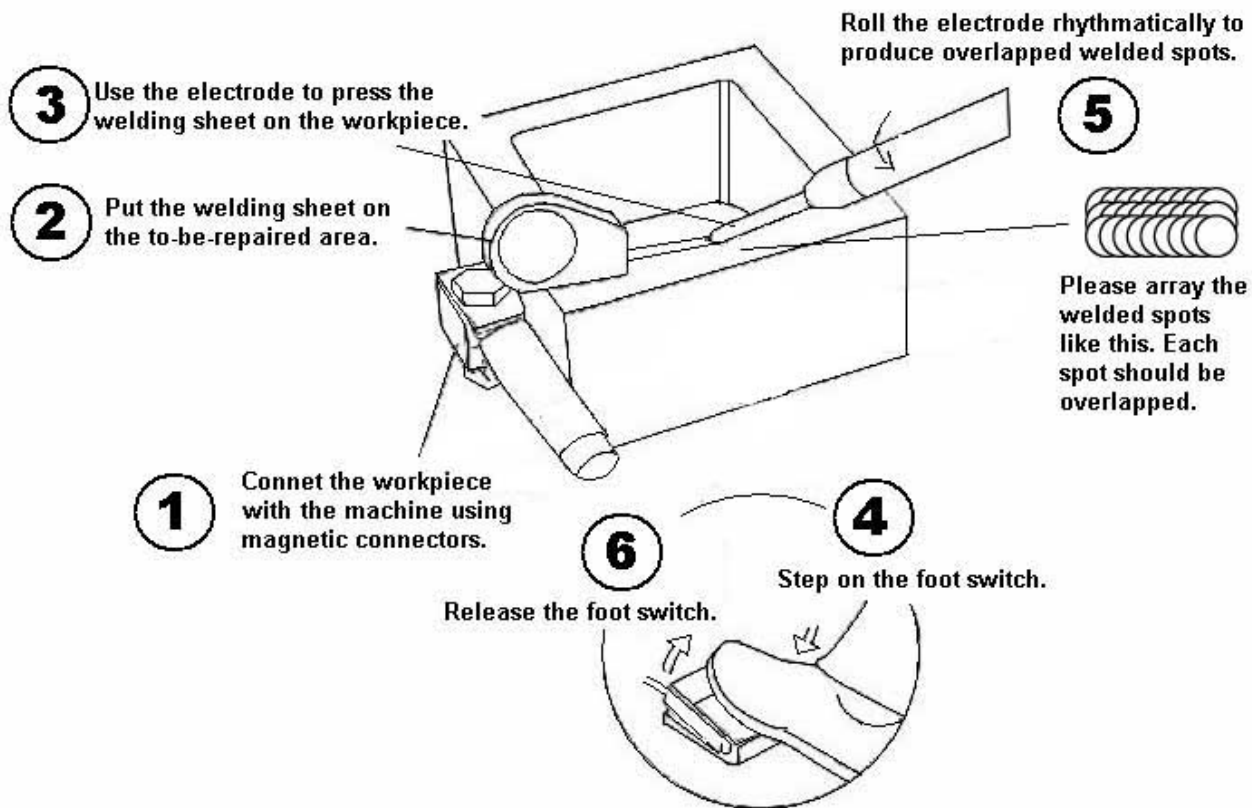
You are suggested to wear a pair of protection glasses to prevent you from accidentally splashing metal. We have prepared one piece for you. It is in the tool box.

8. Protection Function:

If you choose "ON" of the protection switch, you turn on the protection function. With protection on, you step on the foot switch before pressing electrode or accidentally drop the electrode during welding; the machine will stop output and give a beeping alarm. It can protect the workpiece from being burnt. Once you release the foot switch, the alarm will be off. Note: With protection on, you cannot use Mode 0. Please turn off the protection if you must use Mode 0.

If you choose "OFF" of the protection switch, you turn off the protection function. In this condition, you can use Mode 0, and the machine will neither stop output nor beep when abnormal operations occur.

Illustration 4



9. Use precise electrode when you feel normal electrode is too clumsy for delicate work. Plug the precise electrode in the precise outlet, the machine will automatically adjust to precise welding mode. Using precise welding, the maximum single welding thickness is $120\text{ }\mu\text{m}$, maximum electrode diameter is 4mm, pulse frequency decreases by three fourths of normal welding.

Make sure the precise electrode is fully plugged in, otherwise, the machine still work at normal welding state, which will damage the precise outlet parts.

When finishing precise welding, remember to take off the precise electrode from the outlet, otherwise, the machine still work at precise welding state, which decreases output power significantly.

Repair Techniques

a) Choose suitable welding material

Our company provides several common steels for repair work - alloy steel (H08Mn2SiA), stainless steel (1Cr18Ni9Ti) and spring steel (70# high carbon steel), T10 and low carbon steel.

alloy steel (H08Mn2SiA):	Good combination with most mould steel. Hardness after welding: ≈ 30 HRC. Easy for afterward trimming work. Similar color. Small repair marks
stainless steel (1Cr18Ni9Ti)	Erosion proof. Good combination with most steels. Good ductility, hardness after welding: ≈ 20 HRC Unsuitable for workpieces that need chemical treatment.
spring steel (70# high carbon steel) T10	High hardness. hardness after welding: > 50 HRC Suitable for quenched or to be quenched workpieces. Welded area is more brittle than the rest four kinds.
Low carbon steel	Low hardness after welding, ≈ 15 HRC Especially good for casting repair.

You can DIY your own favorite welding material using materials that have similar properties as the workpieces.

b) Choose suitable welding sheet thickness

Suitable welding sheet thickness varies according to varied workpiece smoothness and repair amount.

If you are repairing high smoothness moulds, the thickness should be below $120 \mu\text{m}$. If the workpiece steel is easy to quench but should not be quenched, the thickness should be below $80 \mu\text{m}$.

c) Essential preparation

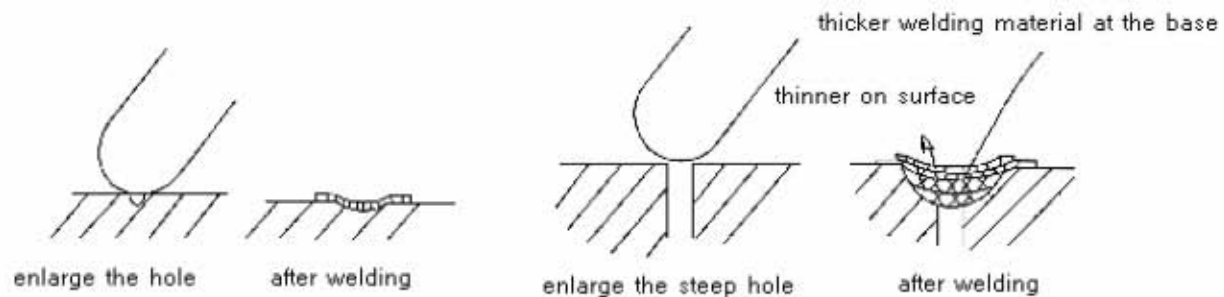
1. Clean work: clean the working area, magnetic connectors, the electrode or the welding sheet before welding.

Clean Oil: use ethanol or acetone.

Oxides: use abrasive paper or whetstone.

2. Expand small deep holes: Small deep holes (such as pin holes) and steep holes need to be expanded first. Select thickness of 06-09, and use ball end electrode (usually $\Phi 3-\Phi 5$). The electrode diameter depends on the diameter of the hole.
Press the electrode on the hole (without welding sheet), step on the foot switch, and then melt the top corners of the hole until it becomes a spherical depression.
3. Grind the working area:
If the working area has dense small holes, please grind the surface by 0.1mm.
4. Remove nitrides: Nitrides often worsen welding quality; therefore they need to be removed before work.
You can remove the nitride cover by grinding or welding the nitride cover once before repairing, to release part of the nitrogen.

Illustration 5



d) Choose suitable welding electrode

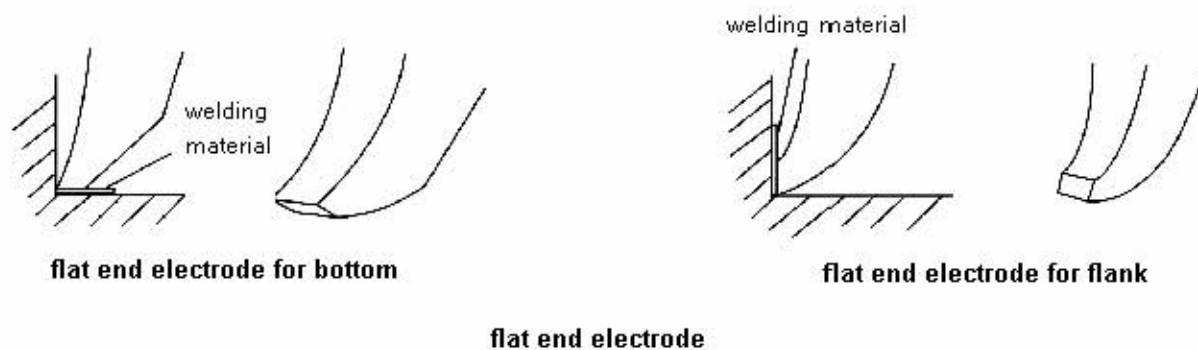
The machine has two types of electrode shape, ball end and flat end.

Ball end electrode can roll continuously during welding, and the touching area is stable. Ball end electrode is used frequently, because it guarantees stable welding quality.

Flat end electrode is especially designed for bottom corner repair. The touching area of flat end electrode should be 1-2mm². Area that is smaller than 1mm² may cause electrical arc and burn the workpiece. Area that is larger 2mm² may cause fake welding because of insufficient power.

Both electrodes need daily maintenance to keep the touching area smooth. A smooth electrode helps greatly with welding quality. Please avoid very sharp electrode.

Illustration 6



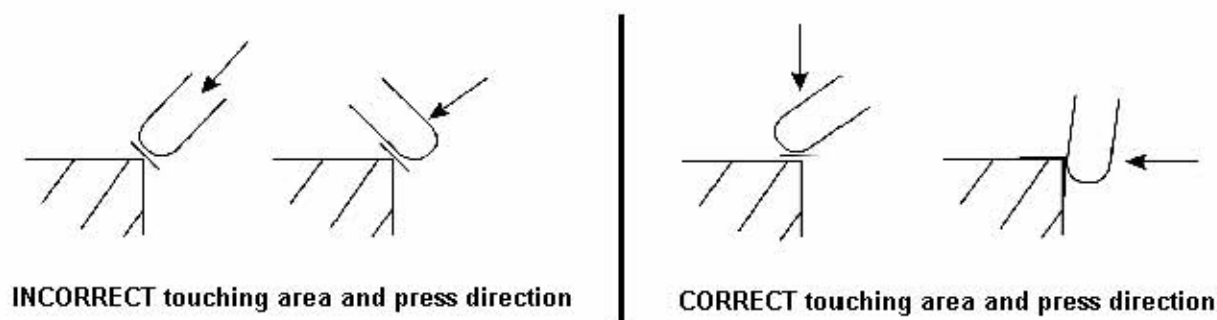
e) Deal with welding quality problems

1. Can NOT repair edges:

Green-hand operators may find edge repair very difficult, because they have to weld several layers of 0.1mm sheet just to repair a 0.1mm defect. This problem may occur when output power mismatches touching area. Edges have a relatively smaller touching area, therefore normal welding power is too big for edge repair. Excessive power melts and throws up welding material.

To avoid such problem, please decrease output power and change touching areas and press directions. See illustration Six next page.

Illustration 7



2. lots of tiny holes after polishing the workpiece:

This problem may happen because:

Mismatching output power and touching area;

Air, oxides, or brass is melt in the welded area.

To avoid this problem, you are advised to use thinner welding sheet, and select suitable output power.

Before re-welding such areas, please grind the surface by 0.1mm.

3. tiny cracks or holes circling the repaired area after polishing workpiece:

This problem may have two possible causes:

If the working area is a flat depression before repair, this circling defect is caused by insufficient welding power. Please increase welding power or decrease touching area.

If the working area is a steep depression/hole before repair, this circling defect is caused by impurities, such as oxides, nitrides, etc. Please grind the nitride or oxide cover before re-weld.

4. the welded spot is slightly lower than the datum surface after polishing the workpiece:

This problem mainly happens when welding material is softer than workpiece material, especially when the workpiece is quenched or has a nitride cover. Please use harder material as welding sheet, to match the hardness of the workpiece.

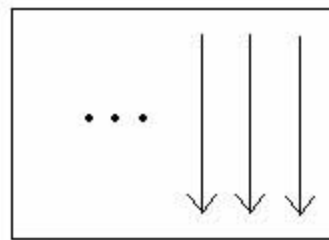
5. the welded spot is slightly higher than the datum surface after polishing the workpiece

This problem mainly happens because the welding power quenches the workpiece, especially obvious when the material is easy to quench. Please use thinner welding sheet (0.05mm) for the bottom layer. Thinner sheet requires smaller welding power and reduces the quench degree.

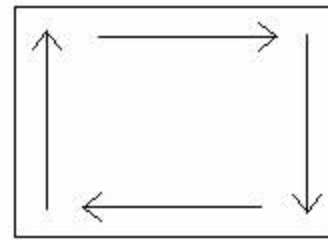
6. bubble-like peeling off after thermal treatment:

This may happen when you melt air into the metal during welding. The melt air inflates during thermal treatment and peels off the surface. You can avoid this problem by orderly welding sequence.

Illustration 8



correct



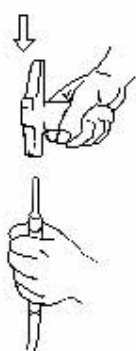
incorrect

Dos	Dons
Weld line by line from one border of the sheet to another	Weld the four borders first and then weld the middle area.
Try to weld every spot firmly the first time	Miss many spots during the first welding. Weld again and again to patch.

Maintenance of the Electrodes

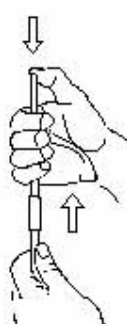
The electrode can be disassembled following the picture below.

Illustration 9



1. Pull out the welding tip.
2. Stick a steel rod (4.5mm thick, 200mm long) into the main shell.
3. Hammer the stick softly until the main shell separates from the core.

Disassemble the Normal Welding Electrode



1. Pull out the welding tip.
2. Stick a steel rod (4mm thick, 120mm long) into the main shell.
3. Press the stick down and pull the shell upward.

Disassemble the Precise Welding Electrode

The Normal Welding Electrode can be disassembled into six parts – one copper welding tip, one plastic support ring, one tip cap, one cable cap, one shell, and one core, as illustrated in the next page.

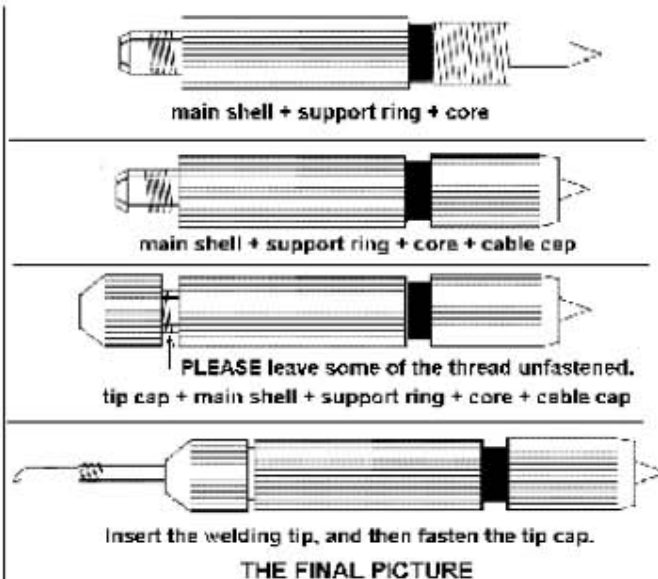
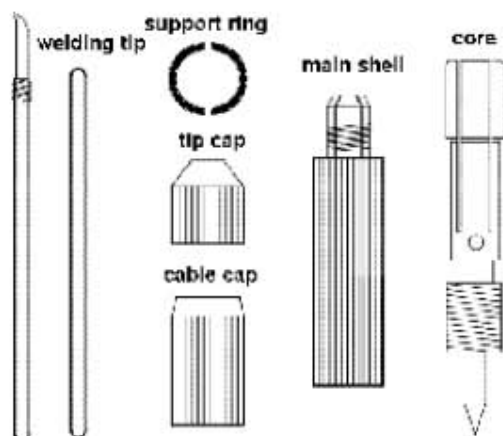
The copper welding tip is the part that directly presses on the welding sheet. It will gradually wear during work.

The plastic support ring is used to help the rotation of the electrode.

The tip cap is used to fix the welding tip.

The cable cap the used to fix the cable that connects the positive pole.

Illustration 10
Normal Welding Electrode



It is very important that the welding tip, the main shell and the core are having good contact. If there is much oxide between the main shell and the core, or the main shell and the welding tip, the actual welding power will weaken significantly, hence welding quality will decrease.

Therefore, please clean these contact areas regularly. Normally, you can use abrasive paper to remove the oxide cover.

Common System Failures and Solutions

Failure Condition	Cause	Solutions
The indicators have no display after switching on the main power	The power cable is in bad connection. The fuse broke.	Check and connect the power cable properly. Replace the broken fuse.
Low or no welding power	The magnet connectors are dirty The magnetized area is dirty The electrode is dirty The electrode is not firmly fastened to the positive pole	Clean the connectors, the magnetized surface, the electrode inside and the welding tip surface. Fasten the electrode.
The machine sounds an alarm when stepping on the foot switch	The protection function is on. The mode is 0.	Turn off the protection function. Don't choose mode 0.
	The to-be-repaired area is dirty. The electrode is dirty.	Remove rust, dust and oil from the to-be-welded area, from the electrode inside, and from the welding tip surface.
	Wrong operation procedures. The operator steps on the foot switch before the electrode is pressed on the workpiece.	Practice more. Make sure the welding tip is pressed on the workpiece before stepping on the foot switch, and release the foot switch before the electrode leaves the working surface.
	The workpiece is not tightly magnetized by the magnet connectors.	Magnetize the connector to areas that is clean and smooth. Remove rust, dust, scrap iron, and oil before magnetizing.
The machine stop working after several dozen minutes, with the "Mode" indicator displaying "1" and others off.	The machine automatically shut off to avoid overheat damage, which is usually caused by bad ventilation.	Check the cooling fan Make sure the machine has enough space for ventilation.
Unable to select neither thickness larger than 12, nor diameter larger than 4. The frequency of welding impulse decreases significantly.	The machine is in precise welding mode.	Pull out the precise welding electrode, and the machine will be back in normal welding mode.

NOTICE: the electrical source has a good earthing no larger than 4 Ω.

WARNING: We do NOT recommend dismantling the main machine. If you have to, cut off the main power before opening the shell of the machine. Be extra careful when examining the inner circuits.

Package List

Main machine	1 pcs
Normal welding electrode (with cable)	2 pcs
Precise welding electrode (with cable)	1 pcs
Magnet connectors (with cable)	2 pcs
protection glasses	1 pair
foot switch	1 pcs
Power cable	1 pcs
Fuse (8A)	4 pcs
Scissor	1 pcs
Welding tip	5 pcs
H08 welding sheet (0.05;0.07;0.10;0.15;0.2)	1 coil each specification
Stainless welding sheet (0.05;0.07;0.10;0.15;0.2)	1 coil each specification
Spring welding sheet (0.05;0.07;0.10;0.15;0.2)	1 coil each specification
Manual	1 pcs
Guarantee card	1 pcs
Conformity Certificate	1 pcs

Please contact us if any fittings are needed. We sell these fittings as well.

We provide free repair of the main machine for one year since the purchase date, and charge repair cost for fittings and main machine that is older than one year since the purchase date.