

# EDM----

Portable electric spark machine

User Manual

## **Abstract**

As an EDM tool, the portable EDM machine can easily remove taps, drill bits, reamer, screws, plug gauges and so on broken in the workpiece. Its lightweight structure and convenient operation can be applied to a variety of complex processing environments.

This manual briefly introduces the application skills of portable electric spark machine in daily production from the principle and operation mode of discharge.

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## Series electric spark machine parameter table

Model	HBS-60
Current shift adjustable	√
Automatic return, alarm	√
External effluent unit	√
Adjustable displacement	√
Input voltage	AC110V+10%
Output power	500W
Secondary output voltage	70V
Minimum machinable aperture of cylindrical electrode	1.0mm
Maximum machinable aperture of cylindrical electrode	8mm
Flat electrode Machining of Transducer Joint	8-20mm
fluid	running water
maximum travel of spindle	100mm
processing speed	≈0.8mm/min
Body size (mm)	420*180*320
Head size (mm)	380*45*45
packing measurement (mm)	540*420*350
Net weight of power box	7.9kg
Box gross weight	15kg
range of work	Lossless, quick removal of taps (M2~M30)\ bits, reamer, screws, plug gauges, etc. Tools / tools broken in workpiece  Small holes without strict precision requirements can be machined on any metal material, such as quenched steel, hard alloy steel, etc. (wire-cut through-wire holes) or marking

## 1. Principle of Electric discharge Machining of Electric igniter

During EDM, the tool electrode and the workpiece are connected to the two poles of the pulse power supply, and infiltrate into the working fluid. An automatic gap

control system is used to control the electrode feed to the workpiece. When the gap between the two electrodes reaches a certain distance, the pulse voltage applied on the electrode breaks through the working fluid and generates an EDM. At the moment of discharge, the arc produces a sharp high temperature with the change of pressure, which causes the metal material to melt immediately, vaporize, and explode spatter into the working liquid, which condenses into solid particles and is carried away by the working liquid. At this time the metal surface is electroetched a pit, the discharge stops, the working fluid resumes the insulation state. Tight Then the next pulse voltage continues to discharge, repeating the above process. Although there are few metals corroded by each pulse discharge, there are thousands of pulse discharges per second, which can rapidly etch metals and achieve a certain productivity. Under the condition that the discharge gap between the tool electrode and the workpiece is kept constant, the tool electrode is continuously fed to the workpiece while the electrode is corroded, and the shape corresponding to the tool electrode is finally changed.

## **2. Selection of electrode material and working fluid (medium)**

Tool electrodes are often used as discharge processing materials, such as copper, graphite, copper-tungsten alloy, which have good conductivity, high melting point and easy machining resistance to electrical corrosion. In daily electric pick-up taps and other broken materials, preferential use of economical brass materials, can achieve good results.

Working fluid as discharge medium, in the process of processing plays a role of cooling, chip removal and so on. Therefore commonly used viscosity is lower, lightning is higher, the performance is stable medium, such as kerosene, pure water and so on. In daily processing, kerosene can be used as working fluid to prevent oxidation of aluminum parts, and clean tap water can be used for iron, steel and other workpieces to achieve good results.

## **3. Under what circumstances can EDM be used**

EDM can replace the traditional machining methods for high hardness and difficult machining materials, such as non-precision drilling, wire cutting through silk holes, marking and so on. Small shape, complex position or difficult to remove taps, drills, etc., can be removed by electric spark. And suitable for cast iron, carbon steel, quenched steel, tool steel, aluminum, alloy and other arbitrary conductive materials.

## **4. The difference of portable igniter 500W, 800W**

500W and 800W are different in their maximum power, and the output voltage of internal power supply is different, so the maximum processing speed is different. The machining capacity of the two electrodes is the same when the electrode is less than  $\text{Ø}3\text{mm}$ . When the diameter of the electrode is greater than  $\text{Ø}3\text{mm}$ , the processing efficiency of 800W power is better than 500W (800W is not recommended for electrode below  $\text{Ø}1$ , electrode consumption is too high). Therefore, according to the usual processing conditions to choose to buy the appropriate power of the spark machine.

## **5. How to distinguish high quality machine head**

High quality head can be identified by its appearance, structure, axial verticality, sloshing, axial clearance, flexibility, etc. The drive mode of the spindle is usually screw nut structure. In the guide part of the spindle, the high quality machine head will set up the guide mechanism, such as slide rail, slider, straight bearing, etc., and the general head will simply slide in the housing, and there is no corresponding guiding mechanism. Therefore, after the spindle protrudes a distance, the high-quality machine head has slide rail, linear bearing and other structures can ensure the straight line feed of the spindle, the sloshing amount is very small, even not, its axial verticality can reach  $\text{Ø}0.05$ ; But the general machine head can not guarantee the main axis straight line feed to its sloshing momentum is very large. The sloshing of the head will cause the electrode side to contact the workpiece, on the one hand, it will damage the workpiece and enlarge the aperture. On the other hand, increase the current loss to reduce the machining efficiency.

The high quality machine head will set the corresponding mechanism to exclude the positive and reverse clearance between the motor shaft and the screw nut to ensure the stable and fast feed and retreat of the main shaft in the process of use. In general, there is no corresponding structure, and the longer the service time is, the greater the axial jump momentum is.

There is no force between the electrode and the workpiece during normal discharge, and the head of the machine will not shake. However, when the electrode and the workpiece are in contact, the spindle does not turn around in time, and its axial expansion force can reach more than ten kilograms, which will cause the head of the machine to deviate from the position. Damage to workpieces, etc. The high quality machine head has smooth and smooth pointers, flexible spindle rotation and low noise. It has a stroke switch at the limit position to prevent the spindle from getting stuck after turning to the limit position. In general, there is no protective device in the head

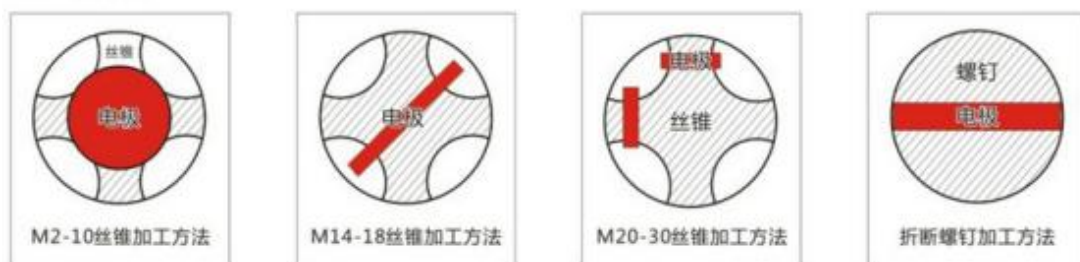
of the machine. When the main shaft rotates in an unreasonable way, the pointer will not bend to death, and then the head of the machine will be damaged and the workpiece will be damaged.

## 6. How to break taps, drills, screws, etc.

The common point of the tools such as tap and bit is that the center part is solid, so the middle solid part can be broken, then the tap and bit can be removed.

As shown below:

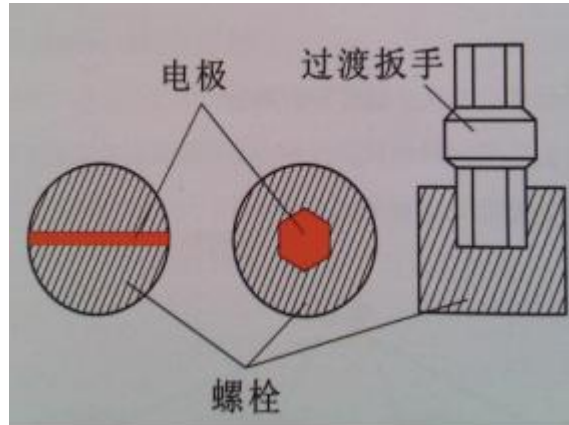
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Taps with normal threads less than M12 can be removed by breaking the center. If the central part of the tap is too large when the thread is too large, it can be divided into two parts with a flake electrode or the four corners of the tap can be broken up and removed. You can break the center of the bit and take it out when you encounter a broken bit. In practical application, the electrode does not have to be machined down all the time, and when it reaches a certain depth, it can turn the head of the machine, knock down the debris with a chisel in time, remove the debris with tweezers or magnets and continue to process it downwards, so that the discharge area can be reduced. It is beneficial to speed up.

Screws below level 8.8. When bolts break in the workpiece, you can punch a small hole in the center of the end face, unscrew the screw after tapping a reverse thread, or spin it out with a broken screw extractor. If the diameter of the bolt is too large or the strength grade is  $\geq$  level 8.8. in general, if it is difficult to process, you can use a flake electrode to punch a groove of 2-3mm on the end face, then screw it out with a screwdriver, or hit a groove with a hexagonal electrode. Then wrench it out with a six-way wrench; If the position is too deep, the normal screw is broken. The extractor is unable to reach the hole and can be wrenched deep into the deep groove with the help of a hexagonal transition wrench.

As shown below:



## 7. Selection of electrode structure and size and Application of Special electrode

The discharge area of the electrode is usually about 0.3 times larger than its own diameter, for example, the diameter of the electrode is  $\text{Ø}3$ , and the diameter of the electrode is about  $\text{Ø}3.3$ . The discharge area should be considered when selecting the electrode size, and the thread should be avoided according to the actual machining conditions.

The electrode sizes commonly used for folding can be found in the following table:

**Brass electrode size table**

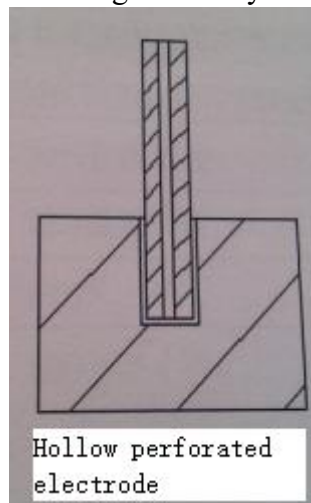
Broken matter	specifications	Recommended electrode	remarks
screw tap	M3	$\text{Ø}1.5$	Electrodes should be as short as possible to reduce jitter
screw tap	M4	$\text{Ø}2.0$	
screw tap	M6	$\text{Ø}3.0$	
screw tap	M8	$\text{Ø}4.0$	
screw tap	M10	$\text{Ø}5.0$	
screw tap	M12	$\text{Ø}6.0$	Flake electrode
screw tap	M14	$7 \times 2$	
screw tap	M16	$8 \times 2$	Separable machining of taps above M20
screw tap	M20-30	$10 \times 2$ Flake electrode	

Hollow electrodes are available if holes are to be drilled on the workpiece ( $\text{Ø}1\text{-}\text{Ø}3$ ) As shown in the figure:

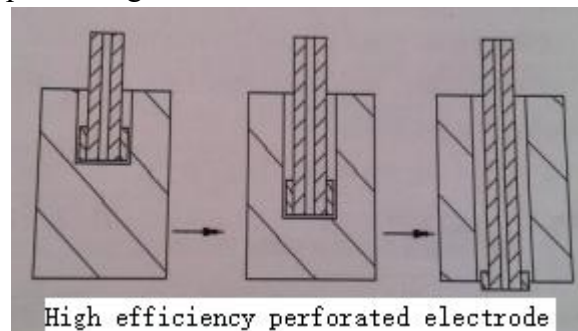
When the hollow electrode is used, the working fluid can be entered from the interior,



and the iron chips can be washed away directly, which avoids the external water flow difficult to enter, and speeds up the drilling efficiency.



In the case of deep grooves, high efficiency perforated electrodes are used at the time of deep hole processing. As shown below:



The motor is hollow and has a large head diameter. The internal water intake can well remove iron debris to avoid debris clogging, and the head diameter larger than the pole body increases the gap between the electrode and the workpiece, reduces the side discharge loss, and also increases the discharge rate at the same time.

In addition, different cross-sectional electrodes can be used to process holes of different shapes.

## 8. How to regulate current

The current of the portable electric spark machine is electrodeless adjustable current. The duration of impulse discharge (pulse width), current 2 and current 10, the more the open current, the greater the current. You can refer to the following table for the use of shock sizes and current switches:

Shock diameter (mm)	Current regulating switch	
<Ø1	2-4 (low)	
Ø1~Ø3	4-6 (Middle)	
>Ø3	10 (high)	

Workflow: first turn on the pump switch, then turn on the work switch, The work

light is on (the red light is the rising green light is down) when the clockwise twist of the current knob to the downward position the green light starts to drop when the copper worker and the workpiece contact, the automatic discharge begins. When adjusting the current knob, after rotating the current to the descending position, the spindle begins to fall, and after the electrode reaches a certain distance from the workpiece, it starts to discharge. Fretting the current knob to achieve an appropriate discharge gap between the electrode and the workpiece (where a crisp and continuous click is heard and the ammeter is in a steady state). Stable flow, spark machine work at high frequency. Then the gap automatic control system will automatically detect the distance, control the spindle feed up and down to maintain a suitable discharge gap, so as to ensure the continuous and stable discharge effect. When the processing is finished, spin to the rising position, let the spindle turn.

## **9. How to clamp electrode to prevent Electrical injury of workpiece**

In EDM, negative electrode (green wire) connecting tool electrode and positive electrode (red wire) connecting tool electrode are usually selected, which can reduce the consumption of tool electrode and reduce the surface roughness.

During wiring, there is a small gap between the clamp or the junction column and the workpiece, which results in the damage of the workpiece by discharge. To avoid this phenomenon, wire connections can be done by screwing a screw in a nearby thread hole or tapping a pin on a smooth hole in the processing unit, and then holding the screw, pin, or selecting an unimportant place to hold the screw, pin, or pin with a clamp. Avoid gap discharge damage workpiece. In order to reduce the current loss in transmission, the clamping distance of positive and negative poles should be kept close to each other. It is an important factor to ensure the machining quality that the machine head and the workpiece are fixed and the motor is aligned with the main axis of the machining center.

## **10. How to process horizontally and upward**

Transverse machining and upward machining are the same as vertical machining, but the media which will be affected by the force cannot fully enter the hole clearance, weaken the discharge velocity, and the reflux working fluid may flow into the head of the machine head to damage the head of the machine along the main axis. Therefore, the head of the machine should be protected before processing. Plastic sheet or other waterproof cloth can be used to wrap the head along the main shaft in and out of the machine to prevent the flow of water into the head of the machine.

In order to solve the problem that the medium cannot fully enter into the hole clearance, hollow electrode can be used to feed water from inside, and use electric spark machine with its own high pressure pump on the fuselage or deep hole outfall set to increase the flow force of the medium and make the medium fully enter the hole.

## **11.Do a good job of pre-processing processing**

In the past, we have concluded that the factors affecting EDM efficiency are electrode cross-section, current, machining material, discharge rate, oxide layer and so on.

In the actual processing application, the preparation and treatment work should be done well before processing, rust, oxide layer and so on will be treated cleanly; If deep grooves, countersunk holes or deep hole processing, hollow electrodes can be selected, high-pressure pump to increase the speed of discharge.

The electrode diameter is too small, the impurity is difficult to be discharged from the hole, the electrode diameter is too large, it will weaken the discharge effect, both of them reduce the processing efficiency. Therefore, the best machining condition can be achieved by choosing the appropriate size electrode for different machining conditions.

## **12.Do a good job in the maintenance of the spark machine**

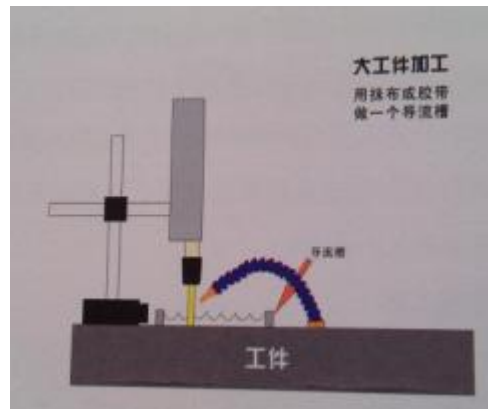
Spark machine belongs to electrical processing equipment, the fuselage has precision electronic components, do water-proof, moisture-proof work, avoid falling to ensure the normal use of the equipment.

After the machine is used, it should be cleaned up and stored in time to avoid dust and debris entering into the chute to affect the use.

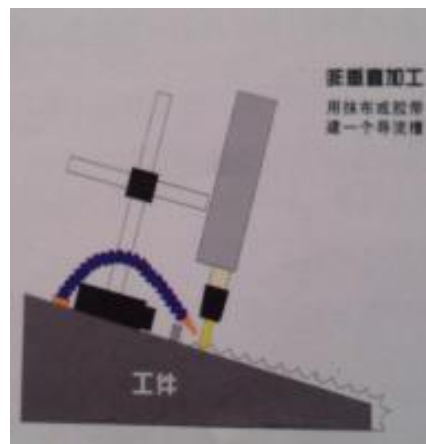
## **13.Schematic Diagram of various processing methods of Spark Machine**

Easy-to-use spark machine uses magnetic base and cross bracket to support the head of the machine, can be placed in any position, omni-directional adjustment of

machining direction, suitable for all kinds of large and small workpieces. The following is a process diagram:



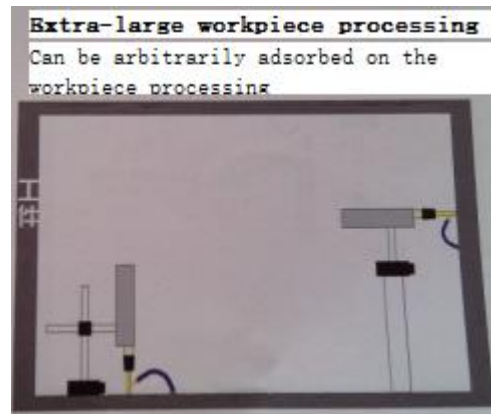
Vertical machining of large workpieces, directly adsorbing the support to the workpiece, building a diversion groove under the head of the machine, so that the cooling fluid flows to the outside.



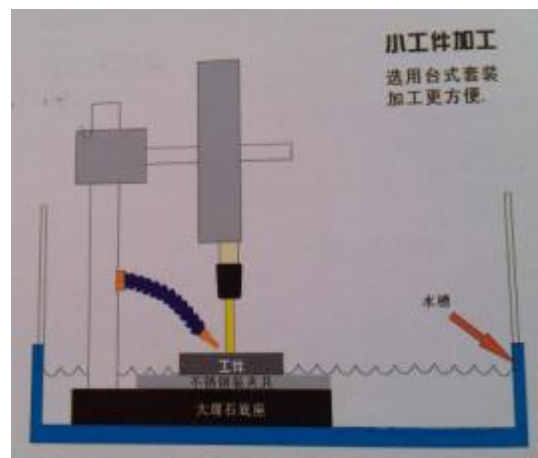
In non-vertical machining, the head of the machine is directly attached to the inclined surface of the workpiece, and a diversion groove is built under the head to make the cooling flow to the outside.



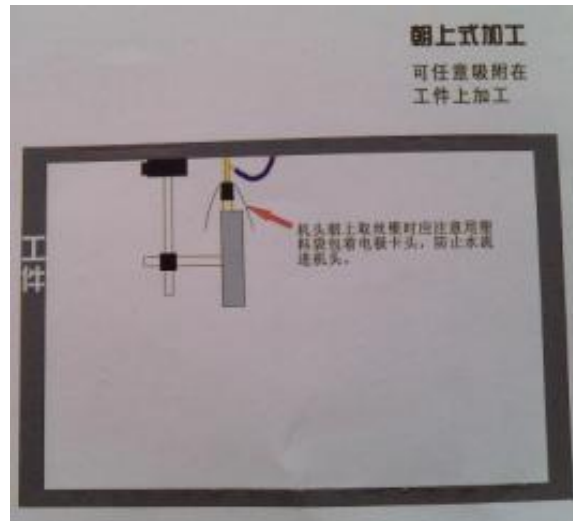
Ultra-large workpiece processing can be directly adsorbed on the workpiece surface, the position of the machine head can be arbitrarily adjusted.



Large workpiece inner wall processing, the machine head can be attached to the side of the workpiece. Pay special attention to horizontal processing to do a good job of waterproofing of the head of the machine.



The desk set is used to install the head of the machine on the work table, which can process the small workpieces. When working, the worktable is put into the sink to avoid the loss of coolant.



Large-scale workpiece upward processing, can be attached or fixed on the top of the workpiece, special attention should be paid to the head of the machine water-proof work.

## **Post-editorial language**

Our easy-to-use electric spark machine can easily remove broken taps, screws and other broken objects in the workpiece, but also can be used as a production tool for quenched steel piercing, wire-cutting piercing, metal marking and so on. Compared with other electric spark machines sold on the market, it has the characteristics of small volume, light weight, simple operation and easy to carry. It can be used in many processing environments.

This manual for our company technical personnel in the actual production of the use of summed-up skills. The scope of application may be limited and the techniques and methods are not comprehensive, but we will continue to sum up more usage methods in future production. At the same time welcome the majority of users to share their practical production skills, we will work together to improve.