Ultrasonic sealing machine QDFM-125

Instructions

1. Summary

A hose is jointed through a solvent or in an electrothermal manner in the early days, but these methods are low in efficiency, the hose is poor in appearance, and the jointed surface of the hose is easy to age, thus the reject ratio of products is increased, and the health of a human body may be affected. Due to application of an ultrasonic technology, these problems of hose jointing are solved.

The working theory of an ultrasonic sealing machine is as follows: a machine converts high-frequency electric energy into mechanical energy through a transducer; the mechanical energy is conducted to a hose workpiece through a tool head to enable the jointed surface of the hose workpiece to generate severe friction at an ultrasonic frequency of 20,000 times/second and certain amplitude and be smelted, so that a gluing process is implemented instantaneously, and the process is known as ultrasonic hose welding.

The ultrasonic sealing welding machine in which an electronic protection circuit is arranged is controlled through an electronic program and is high in automation degree and easy to operate.

2. Main technical parameters

2-1. the working power supply: AC 220V+/-10V/50HZ

2-2. the apparent power of the transducer: 1,500W/2,000+/-10%

2-3. the ultrasonic frequency: 20KHZ-15KHZ

2-4. the delay time: 0.1-9.9 seconds

2-5. the welding time: 0.1-9.9 seconds

2-6 the edge cutting time: 0.1-9.9 seconds

2-7. the effective travel of a welding head: 80MM

2-8. the working air pressure: 0.15-0.8MPAa

2-9. the size of a workbench: 300*325 (mm)

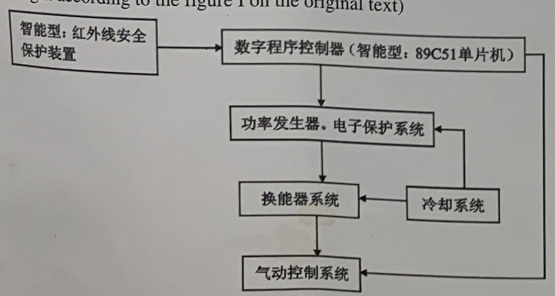
2-10. the appearance size: length*width*height (mm)=1,100*650*530MM

2-11. the net weight: 75KG

3. Structure

An ultrasonic hose welding machine comprises an ultrasonic power generator, a program controller, an electronic protection system, a cooling system, a transducer system, a pneumatic control system, a stander and the like. The systematic structure is as follows:

Intelligent: an infrared safety protection device, the digital program controller (intelligent: a singlechip 89C51), the power generator, the electronic protection system, the transducer system, the cooling system and the pneumatic control system (which are listed from top to bottom and from left to right according to the figure I on the original text)



(FIG. I)

4. Installation and debugging

4-1. Installation requirements of the machine

4-1-1. the machine shall be arranged on a firm working tabletop; a clearance of 1,500mm shall be reserved behind the generator, and it shall make sure that gas can be smoothly discharged from the rear part of the generator.

4-1-2. an air inlet of an air filter shall be tightly connected with an air source. The air source shall be provided with an air filter to ensure that the air source is clean and dry, so that the service life of an acoustic element can be prolonged.

4-1-3. the machine adopts a 220V alternating current power supply and has a higher requirement on the power supply as unstable voltage of the power supply can directly affect a welding effect. A voltage stabilizer shall be installed at a position with unstable voltage. It is required that the fluctuation of the output voltage of the voltage stabilizer is less than 2%, and the output power of the voltage stabilizer shall be double of the nominal power of the machine.

4-1-4. the machine must be well connected with a ground wire before use, and the grounding resistance shall be smaller than 4 ohms. Do not use the machine in case of poor grounding.

4-1-5. the machine must be confirmed as follows before use: cooling air shall be discharged from the rear side of a contactor after the power supply is switched on, otherwise the machine is easy to damage.

4-2. Installation of the transducer system and a welding clamp

4-2-1. the transducer has been already installed on the machine during delivery. In case of mounting and dismounting, a randomly installed internal hexagonal wrench shall be used for releasing a fastening screw of a machine welding die support and then mounting or dismounting the transducer.

4-2-2. Assembling of the transducer

The transducer system consists of the transducer, an amplitude-change pole and a welding die which are connected through two connection screws.

The transducer system has already been assembled and debugged during delivery. In case of replacement of the welding die or any part, the randomly installed wrench can be used, and then a new welding die is reassembled. A specific assembling method is as follows:

Assembling the amplitude-change pole and the welding die: locking one sharp end of each screw on the welding die, and when the end face, which is connected with the welding die, of the amplitude-change pole is parallel to a lower die, locking the amplitude-change pole on the welding die.

Locking the sharp ends of the screws on the amplitude-change pole after the welding die is assembled according to the first step.

The twisting force for installation of the transducer system shall be proper; generally a worker only needs to hold the tail end of an adjustable spanner and try to twist the transducer system. Attentions: do not attempt to length the force arm at the tail end of the wrench as a thread is very easy to damage and the system is further damaged.

4-2-3. A workpiece clamp is arranged on a machine seat workbench and can be parallel to the welding die through adjustment of screws on four corners of the machine seat workbench; a plastic workpiece to be welded is arranged on the workpiece clamp; the pressure of a gas-pressure meter of the machine is zeroed; a transducer seat is pulled to right with strength; the positions of the welding die, the workpiece and the clamp are calibrated, and then the clamp is locked.

4-2-4. A power supply switch is turned on; when the gas pressure is adjusted to 0.2MPA, shunt-off sudden stop is implemented; when a power supply starting button is pressed down to enable the welding die to move, the positions of the welding die, the workpiece and the clamp are checked again.

4-3. Debugging

4-3-1. Working frequency checking

The ultrasonic hose sealing machine has an extremely high requirement on accurate tuning of its working frequency; if the ultrasonic hose sealing machine continues to work after the frequency is deviated, side effects that the welding quality is low and even the generator and the transducer system are damaged are caused. The working frequency of the machine shall be checked or readjusted under the following conditions:

4-3-1-1. before the work of the machine every day

4-3-1-2. no work of the machine for a long time

4-3-1-3. replacement of the transducer system or one of the parts in the system (such as the transducer or the amplitude-change pole or the welding die)

4-3-1-4. larger no-load current in a working process of the machine

4-3-1-5. after maintenance

4-3-2. the debugging method is as follows:

A filter capacitor residual voltage method:

4-3-2-1. turning on the power supply switch, returning off the power supply switch after 1 second (at that time, a filter capacitor is stored with electric energy), then pressing down a test switch, implementing working (through the filter capacitor and residual electricity), and observing the swing amplitude of a current meter.

4-3-2-1-1. when the transient amplitude of the current meter is more than 1A, the machine cannot work until the transient amplitude of the current meter is reduced to be smaller than 1A.

4-3-2-2. A discontinuous starting method

When the transient amplitude of the current meter is not more than 1A through the method in the 4-3-2-2, debugging can be implemented through a discontinuous method:

Starting the current, discontinuously pressing down an ultrasonic test button (pressing for 0.3 second and releasing for 3 seconds), and observing the current meter, wherein at that time, an indicating value of the voltage meter is changed; when the value on the current meter is more than 1.5A, quickly releasing the test switch, and clockwise or anticlockwise knobbing an inductance tuner to make the next test current be smaller than the last test current; when the value on the current meter is smaller than 1.5A, pressing down the test switch, and observing the current meter and adjusting a fine adjustment inductor to make the current be minimum.

4-3-3. Determination of pressure, delay time and welding time

The pressure is generally related to factors such as an area of a welded piece, a material and a distance between a fusion surface and the tool head and affects the transient output power of the machine. Therefore, the pressure shall be adjusted according to a specific situation. 0.2MPA gas pressure can be used for over-adjustment when a small-size or high-hardness material is welded; for those welded pieces with high requirements on materials or sealing properties, the pressure can be adjusted from 0.4MPA.

The pressure can be also observed from the current meter; if the pressure is high, an indicating value is large, so that the indicating value can be generally ranged from 1A to 4A. When the

pressure is overhigh, the indicating value is 5A or even larger; meanwhile, an overload lamp is lightened to indicate that the protection circuit is overridden, thus the pressure can be properly reduced. Attentions: the actual pressure of the tool head on the workpiece is related to and in inverse proportion to the sum of the delay time and the welding time. According to the figure II, the welding time can be selected through an experiment.

The welding time is in inverse proportion to the pressure; the pressure is high, and the welding time is short; the pressure is low, and the welding time can be properly prolonged.

These factors directly affect the appearance of the welded piece. If the pressure may easily damage some welded pieces with high requirements on the appearances and form indentations, the pressure shall be reduced, and the welding time shall be prolonged; however, if the pressure is too low, and the welding time is too long, the surfaces of the welded pieces are slightly melted and rotted, and the appearances are affected, thus the pressure shall be properly increased, and the welding time shall be shortened.

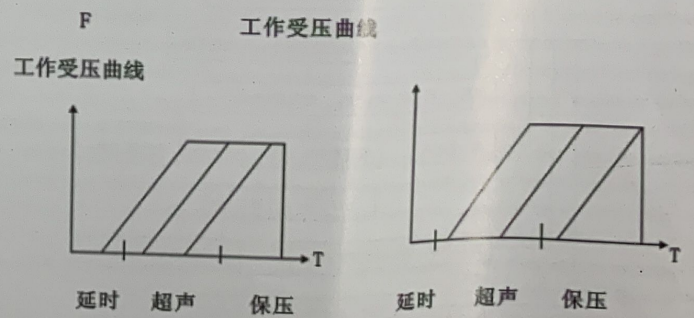
After welding is finished, pressure maintaining is executed; the pressure of the welding head on the welded piece is retained to a certain extent (attention to adjustment of operation on a cylinder), so that plastic can be molded. The welding surface of a small-size welded piece can be cooled within short time, so that the pneumatic delay can be short; however, the pneumatic delay time of a large-size welded piece or a welded piece with a higher requirement on the sealing property shall be longer.

(3) the delay time (the delay time of the electronic program controller must not be zero, otherwise, the electronic program controller cannot work normally) is a time period from starting to work of the overall machine to starting to emit ultrasonic waves. If a preset value is large, the ultrasonic triggering time is late. Fragile, fissile and large-size welded pieces shall be triggered early, and welded pieces with complicated appearances shall be triggered late. The relation between the delay time and the pressure is as follows:

Working pressure curve

Delay time, ultrasonic and pressure maintaining

(FIG. I)



（图 二）

(4) a limiting screw

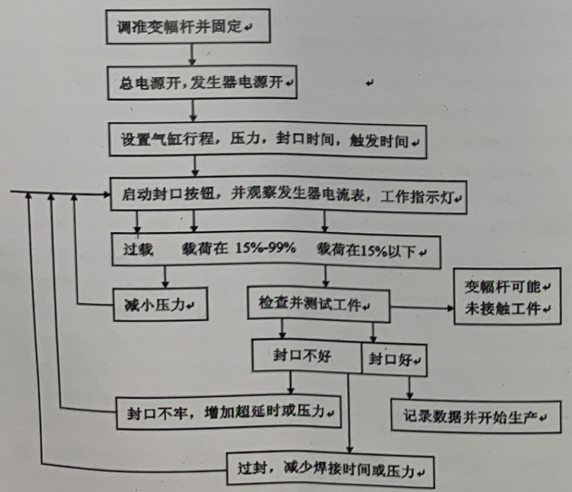
The working theory of the limiting screw is that: in a process of welding the machine, under the action of the ultrasonic waves, the hose is melted; as the machine applies certain pressure to the hose welded piece, the welding quality may be affected due to over-welding of the welded piece or overload of the machine in case of no limitation.

The limiting screw is adjusted as follows: under a condition that the machine is well mounted, the power supply and the air source are switched on; the power supply switch is turned on, and a handpiece starting button is pressed down, so that the welding head can compact the welded piece; a clearance between a nut (a long movable nut on the cylinder) on the limiting screw and the welding die support shall be 0.5MM by adjusting the nut.

4-3-4 Selection and adjustment of thewelding technical parameters

The basic operating programs of the ultrasonic sealing machine are as follows:

Gauging and fixing the amplitude-change pole; switching on the main power supply and the generator power supply; setting the travel of the cylinder, the pressure, the sealing time and the triggering time; pressing down the sealing button and observing the current meter and the working indicating lamp of the generator; checking whether the generator is overloaded; if the load is 15-99 percent, indicating that the generator is overloaded, then reducing the pressure and returning to the step of pressing down the sealing button and observing the current meter and the working indicating lamp of the generator; if the load is smaller than 15 percent, checking and testing the workpiece or indicating that the amplitude-change pole may not be in contact with the workpiece; if a seal is poor, prolonging super delay time or the pressure, and returning to the step of pressing down the sealing button and observing the current meter and the working indicating lamp of the generator; if the seal is good, recording data and starting to implement production; if the seal is excessive, shortening the welding time or reducing the pressure, and also returning to the step of pressing down the sealing button and observing the current meter and the working indicating lamp of the generator for cyclic operation. (FIG. III)



(FIG.III)

For general workpieces, the following initial parameters are recommended, and the parameterscanbe adjusted according to trial-sealing effects:

the welding pressure: 0.4MPA

the pneumatic time: 1.3 seconds

the ultrasonic delay time: 0.6 second

the edge cutting time: 0.2 second

4-3-5. Operation

The machine can work after being adjusted. The machine can work once a working button on an operating panel is pressed down. During running, in case of any accident, a red emergency stop switch in the operating panel shall be pressed down to make the machine recover to an original state immediately; after the accident is solved, the emergency stop switch shall be knobbed right to be popped out, and the machine can continue to work.

5. Precautions to use

5-1. the working environment of the machine shall be dry, and an operator shall wear plastic or rubber shoes;

5-2. the transducer system shall not be dismounted and replaced when the machine is switched on;

5-3. do not put two hands below the tool head to prevent the hands from being injured through ultrasonic waves in case of ultrasonic wave generation during working or test of the machine;

5-4. the welding die shall not be in direct contact with the base or the metal clamp of the machine in working or test;

5-5. high-quality ventilating equipment shall be arranged in the operating acoustic field when plastic workpieces with odors are processed;

5-6. during operation, operation shall be immediately stopped in case of abnormal noise or that the transducer system is heated to 50 DEG C or even higher, and the operator shall test the working frequency of the machine and check whether the machine is normal;

5-7. do not switch on the machine immediately after a broken fuse of the machine is replaced, and the machine cannot be switched on until a trained technician checksrelevant parts of the machine to confirm that other faults do not exist in order to avoid extension of the fault;

5-9. the work of the cooling system of the transducer shall be specially checked when the machine is started, and if the cooling system does not work when the machine is started or works, the work shall be stopped immediately in order to prevent the transducer system from being damaged.

6. The amplitude-change pole and the welding die must be strictly selected in order to enable an emitter and the transducer system to be optimally matched and improve the part processing quality and the production efficiency when the welding surface of the hose is enlarged or widened through the ultrasonic sealing machine, so that the acoustically matched and proper amplitude of the transducer system can be obtained. The amplitude-change pole which is arranged on the machine before delivery can meet most amplitude-change demands. The factory also provides various amplitude-change poles for users to select in order to adapt to different processing occasions.

The welding die is used for applying the ultrasonic energy on a part to be welded; under the assistance of the clamp, the ultrasonic processing can be implemented; the welding die and the clamp are designed according to the welded plastic part; the shapes, the sizes and the materials of the welding die and the clamp are different, but they must be acoustical matched with those of the transducer, so that no certain form can be followed. The design of the welding die must be managed by a qualified professional. The factory will design and manufacture various required

welding dies and clamps as well as amplitude-change poles with special amplitude-change ratios for users.

The welding surface of the hose workpiece shall be far away from the welding die instead of being directly close to the welding die.

Such a welding state is known as transmission welding; most hoses to be sealed comprise toothpaste, cosmetics and the like. The welding performance, the technology difficulty, the processing performance, the intensity and the like of part of the hoses during transmission welding are listed in the following table.

7. Judgment and maintenance flow chart of common faults

As shown in a figure IV and a figure V:

Starting the machine, checking whether the alternating current contactor is closed, if the alternating current contactor is closed, pressing down the test switch to check whether the current is less than 1A, if the alternating current contactor is not closed, unplugging the power supply, checking the fuse, if the fuse is damaged, replacing the fuse, if the fuse is not damaged, replugging the power supply and judging whether the contact is good, if the contact is poor, repairing a power supply socket, if the contact is good, unplugging the power supply and checking a coil of the alternating current contactor and the power supply switch, and if the new replaced fuse is broken again, checking a power triode group; (FIG. IV)

If the current is larger than 1A, reducing the power, adjusting the switch to the first gear, uncovering a case to adjust the fine adjustment inductor to make the current indicating value minimum, reading the current value again, if the current value is also larger than 1A, dismounting the tool head and connecting the screw, adjusting the fine adjustment inductor to make the current indicating value minimum, reading the current valueagain, if the current value is less than 0.3 A, indicating that the tool head is internally damaged and shall be replaced or the transducer is in a perfect condition, and if the current value is larger than 0.5A, indicating that the tool head is internally damaged and shall be replaced or the transducer is in the perfect condition. If the current is larger than 1A, reducing the power, adjusting the switch to the first gear, uncovering a case to adjust the fine adjustment inductor to make the current indicating value minimum, reading the current value again, if the current value is lessthan 1A, gradually increasing the power, adjusting the switch to the second gear or the third gear, reading the current value again, if the current value is less than 0.8A, indicating that the machine is normal, and if the current value is still larger than 1A, repeating the above processes of dismounting the tool head and connecting the screw, adjusting the fine adjustment inductor to make the current indicating value minimum, reading the current value again, if the current value is less than 0.3 A, indicating that the tool head is internally damaged and shall be replaced or the transducer is in a perfect condition, and if the current value is larger than 0.5A, indicating that the tool head is internally damaged and shall be replaced or the transducer is in the perfect condition. (FIG. V)

8. The amplitude-change pole is mainly used for changing the amplitude output by the transducer. Different welding dies meet different technical requirements. The following situations are references to selection of the amplitude-change pole.

(1) Occasions in which the amplitude is required to be increased:

1. the welding energy is insufficient, the welding effect is poor, and the speed is low;
2. the clamp vibrates, and indentations of a press are formed on the lower surface of the part;
3. a power indicating meter is difficult to adjust upwards during welding;
4. the bottom of a pin instead of the top of the pin is smelted during riveting;

(2) Occasions in which the amplitude is required to be reduced:

1. overload always emerges;
2. the machine easily fails to work when the air pressure is increased;
3. the frequency is very difficult to tune during tuning;
4. the plastic piece or the metal embedded piece is damaged;
5. the center region of the welding die is overheated.

(2) The amplitude can be increased and reduced by adjusting a power adjustment knob on an ultra-large generator panel. On the premise of guaranteeing the welding quality, low-gear power shall be used as much as possible in order to prolong the service life of the transducer.

9. Operating instructions of a panel keyboard of an intelligent ultrasonic welding machine

9-1. the keyboard consists of pneumatic time delay, ultrasonic time delay, edge cutting, ultrasonic emission and whole machine working.

9-2. the pneumatic time delay, the ultrasonic time delay and the edge cutting time delay are segmental type 0-9 cyclic setting memory switches and can be used for a long time only if the user sets them once; new data can be set through once working by only inputting corresponding data in case o change.

9-3. the whole machine working can be finished by pressing down the pneumatic power supply switch.

9-4. the ultrasonic waves can be tested by pressing down the ultrasonic emission.

10. Operating steps

Turning off the emergency stop switch if the work is not started, switching on the power supply, pressing down the test switch, checking whether the no-load current is overlarge, indicating that the no-load current is normal if the no-load current is less than 1A, inserting a steam pipe, switching on the pneumatic power supply, checking whether the cylinder and the edge cutting are in perfect conditions, if the cylinder and the edge cutting are in the perfect conditions, switching off the pneumatic power supply, putting a sealed object, extracting the emergency stop switch, and pressing down the starting button.

If the work is finished, checking whether the edge of the seal meets a requirement, if the edge of the seal is abnormal, switching off the emergency stop switch, adjusting the relevant time or the air pressure, extracting the emergency stop switch until the edge of the seal is normal, and pressing down the starting switch to make the machine work. (attention: no empty sealing)

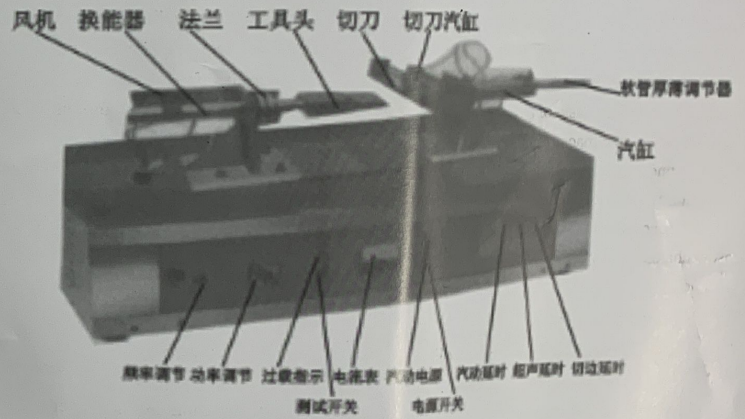
11. Characteristics

The ultrasonic sealing machine QDFM-125 adopts a Taiwan movement line and is high in working stability and high in efficiency, and movable components are of famous brands. Due to ingenious design of the company, the ultrasonic sealing machine runs ahead of superior ultrasonic series products developed by the same trade in China.

12. Applications

The ultrasonic sealing machine can be applied to sealing of various types of hoses such as toothpaste, cosmetics, medicines, food and industrial articles.

13. The diagrammatic drawing of the machine



A fan, the transducer, a flange, the tool head, a cutter, a cutter cylinder, a hose thickness adjuster, the cylinder, frequency adjustment, power adjustment, overload indication, test switch, the current meter, the pneumatic power supply, the power supply switch, the pneumatic time delay, the ultrasonic time delay and the edge cutting time delay are shown in the drawing from top to bottom and left to right.