LEAD FREE REFLOW OVEN

Operation Manual

(Model：S-RO200)

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Directory

Chapter 1 Equipment knowledge

1.Heating principle

1.1 Form of heater

The main part of structure of the heater is the high-nickel complex hot line in a metal tube filled with calcium silicate material. It can quickly transfer inner heat to heat storage full metal plate and regional air out of the tube. Each plate has inner 6mm and outer 8mm hot air circulation holes in each 25mm pitch. It can blow down laminar flow of high temperature hot air from hole.

1.2 Heating method

Hot air from the plate holes come to PCB surface, a variety of components and solder paste (SMT adhesive).

Heat transfer to the PCB solder to ensure that temperature distribution in the machine and uniformity of the heating temperature on the work piece.

1.3.Heating characteristics

Hot air from the plate can be passed to the PCB, solder and components, so that:

· Be able to directly heat the solder under shaded shaped components
· Be able to directly transfer heat to pad and solder
· To prevent overheating of parts
· Make different solder components temperature equilibration
· Make different positions of the solder components the temperature equilibrium
· Can weld on different materials PCB, such as: soft flexible panels

1.4 Heating structure

Zone No.:Upper 2
Numbers of upper heater elements:2 sets
Starting power;6KW
Working power:3kw

1.4.1 temperature control detection point

Each zone is equipped with a standard thermocouple detection point, which is a static temperature detection point,for testing represent temperature in that space. (The point is accurately tested before leaving the factory, don't shift it without confirmation by factory).

1.4.2Temperature Controller

Industrial control computer for temperature detection of each temperature zone, PID control and
high-power SSR driver.

2. Temperature curve

2.1 Description:

Reflow machine is to heat the surface of the PCB with the paste components PADS bit, to make solder melt and slurry heated under reflux, to obtain the predetermined temperature to the solder paste , and without causing any damage to the PCB and components (for example, fuel combustion or dark burning, etc.). IPC standards welding temperature diagram:

Suggested Temperature Profile （一般温控曲线）
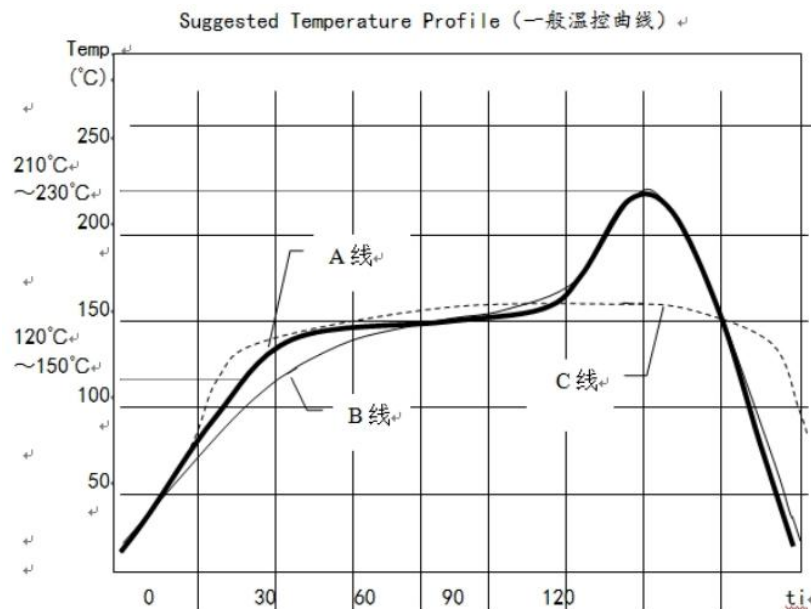
Line A: Used for solder paste soldering.

General in 60 seconds, PCB pad heats up from room temperature to 120-150 ℃, the rate at 3 ℃ / s or less; from 60 -180 seconds to 90-150 seconds stabilize at about 150 ℃, less than solder paste melting point 183℃, so that the welding work piece reaches temperature equilibrium before the paste slurry liquefaction; It stays 30 seconds from 183 ℃ to 210-230 ℃ so that solder paste can be reflowed adequately.

Line B: used for fine pitch IC and tiny components (such as 1005) and other welding techniques ,control temperature risen sharply in the preheating zone , postpone the flux in the solder paste to soften slightly, control the tiny solder paste tin powder to form a solder ball together .

Line C : Used for general SMD adhesive curing.

Stay at 150 ℃ for about 3-5 minutes to maintain temperature curing time.

In order to obtain maximum yield in highly automated SMT production environment, before starting machine must set heating temperature according to the paste heating chart. And, strict supervision in working time. Waste PCB is recommended to help to set up the digital temperature monitors of machine in use, in order to get the paste heating chart.

3. Set temperature curve

To obtain a given temperature curve, it requires a process of seeking temperature profile, that refers to the temperature setting and speed of mesh. Changed Products, such as the board type, thickness, component type, the array density, the pad bit areas and types of solder paste, shape of printed tin, thickness, etc., will affect the temperature curves.The zone classification heated hot air reflow equipment heat products by gradually completing preheating, drying, melting and heating through progressively heating and solder paste. The first stage is a fast heating zone, in which, PCB gets rapid warm-up; The second stage is a long slow heating eating zone, finish drying Solder of PCBs in this stage;

The third heating stage is for solder paste molten, after functional change in the second stage, solder paste is rapidly

heated and melted here, then get reflow; solder paste cooled rapidly through the cooling zone, the above process forms a complete temperature curve.

Now most of the machines (combined with hot air or full hot air) adopt hot air heated to reflux, that within the security of sensitive components, to avoid direct intense heating

on components, top heating is relatively stable, through the hot air convection and heat conduction on PADS and tin slurry so that the surface components are welded stably. By this way, temperature curve is ease, the temperature difference between zones is relatively reduced, and the second functional areas set temperature is relatively increased.

Another change in control is the mesh speed. This will set the time that PCB board stays in oven. To match the soldering process of PCBs. Multi-layer PCB boards requires a little longer time in the machine,as it is thicker,relatively need a longer time to achieve a unified balanced heating.

Heaters on top and bottom are controlled independently, so that the board can be heated on top or bottom surfaces. Thus, if the element is sensitive to heat, you can choose to heat its backside.That means the bottom warming. About half of the total energy are used in the bottom preheat zone , this peak HF energy can pre-warm the PCB board evenly , thus reducing the surface impact to damage components, and reduce heat absorption of components. Small amount of energy is applied to the top to minimize warpage. If an insensitive component is to be heated, the preheat temperature can be set higher.

Long-wave Energy from top and bottom dryness area may heat the tin point slowly (and dryness). For hot air reflow in full hot fan, the top and bottom surfaces are mutual control and relatively stable balance. The top surface temperature is relatively higher. In the recirculation zone, full hot fan's force micro hot air reflow
will be used to melt and reflow solder paste.

Temperature curve is established by:
First, classify the PCB boards to determine the heat absorption, component types ,density and degree of difficulty with the PCB production capacity in order to determine the top, bottom and reflux strategy determining a point, a set of components and machines with a thermocouple is conducive to promoting the
process of temperature curves. But this is not essential, the starting point as follows:

<p align="center">Origin Point</p>

ZONE: 1 ……Upper preheating zone ZONE: 2 ……First upper dry zone

ZONE: 5 ……Lower preheating zone ZONE: 6 ……First lower dry zone

ZONE: 3 ……Second upper dry zone ZONE: 4 ……Upper reflow zone

ZONE: 7 ……Second lower dry zone ZONE: 8 ……Lower reflow zone

General machine completes cooling function with natural cooling curve.

Note: These are general starting point (in the basis of four eight reflow temperature, the other by
analogy, the 1st preheat zone includes zone 1and 6.The 2nd,3rd ,and 4th drying zone includes zone 2,zone7,zone 3,zone 8,zone 4,and zone 9. The 5th reflowing zone refers to zone 5 and zone 10), once the subject of a PCB board temperature curves for the End, similar to the PCB board is well on the PCB can be affected by temperature map (in increasing tape speeds) as a starting point.

4. Temperature zone Description:

4.1 Preheating zone:

Preheating zone, also known as rapid heating zone, is used to preheat the PCB and solder paste to improve the boiling temperature of the flux. In the bottom of the heating strategy, the temperature zone is the key. Energy into the preheating zone, generally there is sufficient time to conduct or radiate to the PCB, so that the board can quickly reach thermal stable equilibrium point, to ensure sufficient time for the drying   zone.   As effect

of components' thermal contingency, heating rate should be within 3 ℃ / sec, otherwise it may   damage relatively heat-sensitive components.

4.2 Dry zone:

Above mentioned temperature zone is a slow long-temperature zone, PCB stays in this temperature   zone for a longer time, after a quick warm-up, when the PCB through these areas, the temperature   fluctuations of PCB is small, in this almost constant temperature environment. Various ingredients occur   quickly and efficiently physical and chemical reactions of themselves, to do PADS copper, tin and solder   paste on PCB For preparation of the next step of melting and reflux, and the solder paste will be dried   slowly.

4.3. Reflow zone:

Represents the reflow soldering area, full hot air heating system provides the PCB enough energy to   melt and reflow the solder paste. In general, temperature on the upper zone is higher than lower reflow   oven in order to reflow the top of PCBs.

5.Temperature settings

5.1. Set the zone temperature and belt speed to be starting value (usually starting value is given by   machine manufacturer).

5.2. For annealing furnace, needs 20-30 minutes to warm up.

5.3. The temperature reaches equilibrium; make the sample PCB cross the heating zone, in which the   solder paste is set to reach reflux point. Such as: If reflow process does not occur, follow step 4.If reflow too   much, and maintain and correct the temperature settings, put the sample PCB through the system again   until reaching the reflux critical point, turn to step 4, as per when and only when there is no or just inverse   flow.

5.4. If reflux does not occur, reduce the belt speed 5% to 10%, for example: belt speed is 500mm/min   without reflowing, make adjustment to 460 mm / min or so. Generally speaking, reducing the belt speed of   10% will increase product reflux temperature about 30F. Or, without changing the belt speed, appropriately   increase the setting temperature, the temperature increasing rate should take the standard reference curve as the center, adjust the temperature as per the difference between actual temperature and standard curve,   generally adjust the temperature at 5 ℃ for each gradient, please note that the temperature adjustment   should not exceed the capacity of PCBs and the components.

5.5. Then make the PCB board reflowed with new belt speed or new setting temperature, if no reflux   occurs, back to step 4, otherwise make step 6, fine-tuning the temperature curve.

5.6. Temperature curves can be adjusted appropriately by the complexity of the PCB. You can use   mesh speed two scale (1-5% belt speed) to tune. Reducing mesh speed will improve the product   temperature. Conversely, increasing mesh speed will reduce product temperature.

5.7. Tips: If the PCB board with components is not fully reflowed through oven, adjust the system and   make another reflow into the reflow soldering, normally it will have no bad effects to the PCB and   components.

5.8. Generally set the temperature from low to high, if the temperature is too much larger than the reflux   temperature, please increase the belt speed or decrease setting temperature. Opposite to Step 4.

Chapter 2 Installation

1. Installation place

1.1, Please run machine under clean environment.

2.2, Avoid high temperature and humidity environmental conditions to keep and run machines.

1.3, Please do not install the machine near sources of electromagnetic interference.

1.4, When installation, do not place reflow furnace inlet and outlet facing fan or a window with wind in.

2. Safety Precautions

2.1, When machine in use, do not put anything other than workpiece into it.

2.2, Please pay attention to high temperature to avoid scalding when operation.

2.3, Boot machine under normal temperature during overhaul.

3.Operating environment

Ambient temperature: operating temperature should be between 5-40 ℃.

Relative Humidity: This series machine working environment relative humidity should range from 20-95%.

Transportation and storage: This series machine can be transported and storage in the range of -25-55

℃. Within 24 hours, it can stand high temperature less than 65 ℃, during transport, please try to avoid

excessive humidity, temperature, vibration, pressure and mechanical shocks.

4. Power supply

Please use the   220V,

Reliable grounding, the wiring must be carried out by a qualified electrician.

5. Height of reflow oven adjustment

Adjust the height and horizontal transmission by the bottom feet of the machine. The adjustment method: use industrial or alcohol level meter to measure, and then adjust the feet back and forth from left to right repeatedly until it is fully attained.

6. Notice to users

6.1, Operate the reflow oven in a clean environment to ensure the welding quality.

6.2, Do not use or storage the oven in the open air, high temperature and humidity conditions.

6.3 do not install the machine nearby the electric and magnetic interference sources.

6.4, Shut off the power to prevent electric shock or cause a short circuit when check and repair machine.

6.5, after movement of repair, each part is required to be checked, particularly the position of mesh, make sure it won't be jammed or fall off.

6.6, The machine should remain stable, without tilting or instability. By adjusting the bottom foot cups, keeping transport chain at the horizontal level, to prevent PCB board from displacement during transmission.

6.7, when operation please note that high temperature to avoid scalding.

6.8 do not put too bulky, too much heat absorption to avoid damage to the transport mesh and influence temperature of oven.

Chapter 3 Operation Instruction

1. Preparation before operation

1.1, check the power supply voltage 3-phase 5-wire 380V +1 N + G.

1.2, check the main circuit wires in electrical box loose or not, make sure reliable connection.

1.3, check whether the device is grounded reliably.

1.4, Check if there is a foreign object in the electric box.

1.5, check if the belt stucked by foreign objects.

1.6, check the transmission bearing lubrication.

1.7, check whether the temperature terminals are loose or got burned.

1.8, check the control card connected or not.

1.9, check whether the drive chain is with temperature lubricant.

1.10, check whether the external exhaust pipe smooth.

1.11, check whether the air transport motor abnormal.

1.12, check the inverter extension cable is loose or not.

2. Operation sequence

2.1, close the main switch

2.2, Press the UPS switch

2.3, Start button switch

2.4, start the computer into the following operating interface
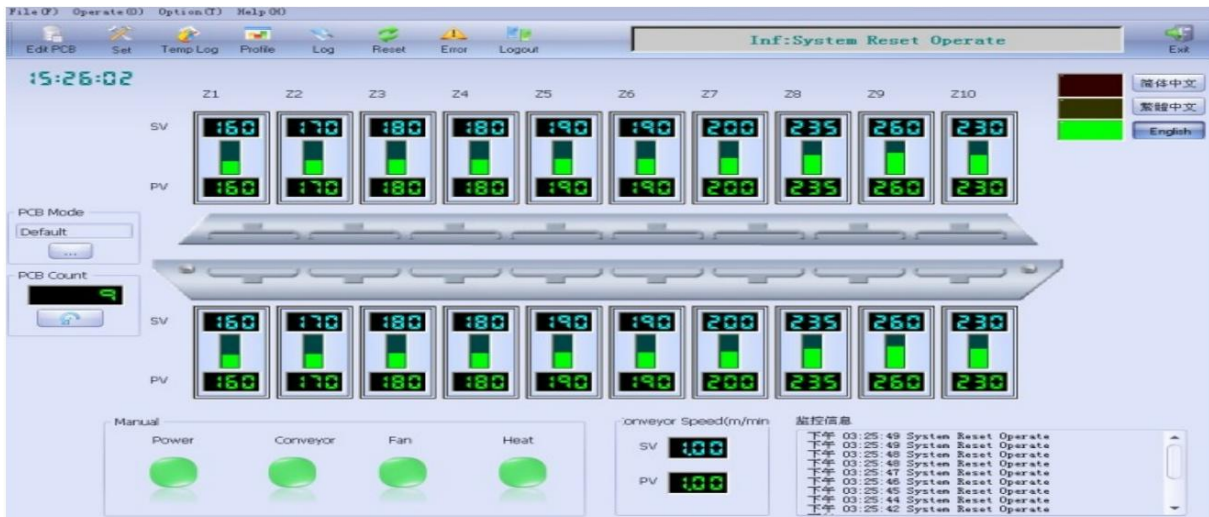
2.5, Start Heating: In the main operating screen, click "Start", "drive", "air transport", "warming" ,Then machine will start heating as per the setting temperature. when there is no communication with Hot air,drive,oven cannot work at the moment.

2.6, Temperature setting:

2.6.1 Click SV value on the main screen, enter the temperature value, click to confirm;

2.6.2 Click "temperature settings" on the main screen shown as below, enter the appropriate value ,then click OK.

2.7, Function parameter setting:

2.7.1 Click "Operation" on main screen,will pop up the following interface: If you want to set the variable

frequency speed and other related functions, click the appropriate button.

2.7.2 There's "locking system" in the interface, the key is for machine adjustment ,maintenance, and testing from manufacturer, can not freely enter, otherwise it will have serious consequences.
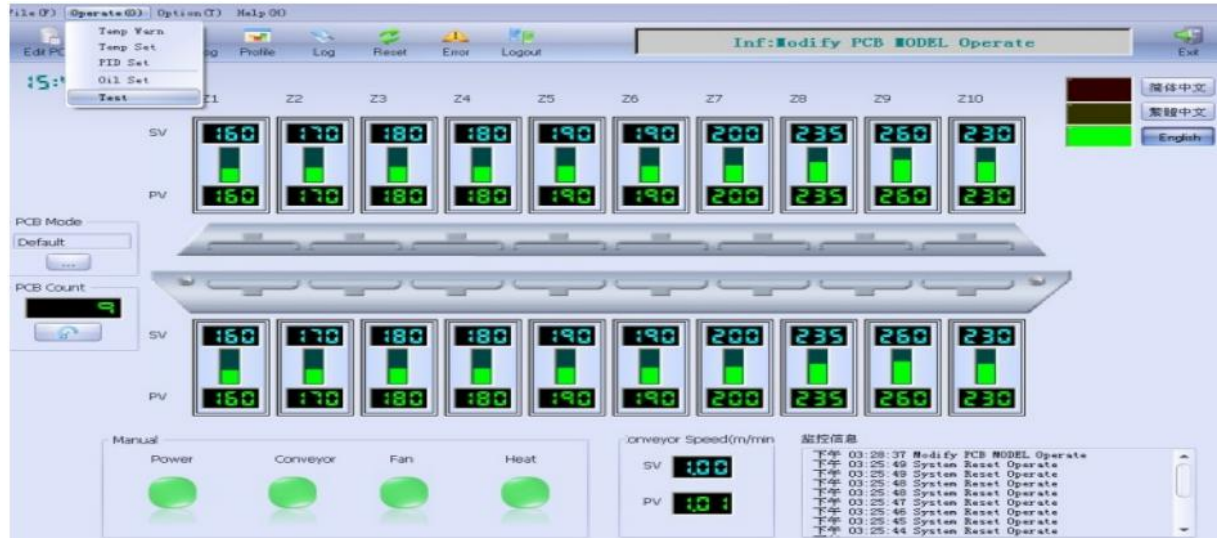

2.8.Settings for Transmission speed and motor rotary speed:

2.8.1, In the main screen,click "Operation", look for "System Settings" pop up, as following interface

2.8.2, Modify the motor rotary speed and frequency inverter rate.

2.8.3, Please do not arbitrarily modify the parameters.


2.9 Temperature curve test

2.9.1, prepare temperature curve test plate : Temperature plug inserted;

2.9.2, Put the test plate into the oven ,make it walk into the chamber with chain and mesh;
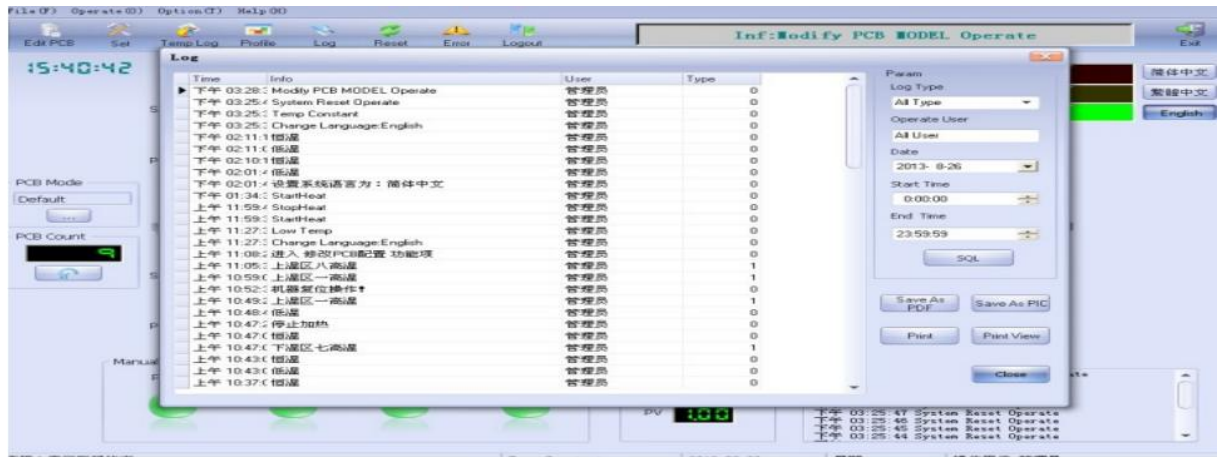
2.9.3,Click "Test" to enter the temperature curve test status;

2.9.4, print, save, saved as pictures, etc. according to the corresponding instructions.

2.10.Process parameters:press "Open" in the main interface, you can also use the previous operating parameters.
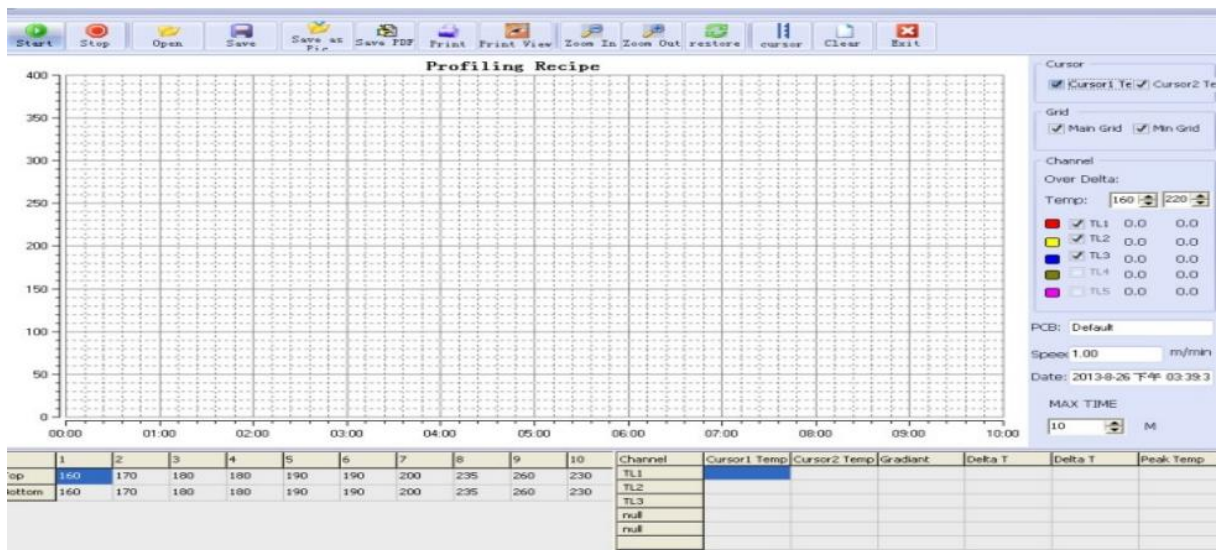
2.11.View history: In the main interface,press "record.

2.12.Port debug: temperature zone heating and alarm light switches can be turned on/off individually ,easy maintenance.

Chapter 4 Lead-free Process Descriptions

1. Lead-free solder

Alloy composition	Dissolution temperature	Tensile Strength	Elongation
SN-3.5AG-0.7CU	217-220	39	31
SN-3.1AG-1.3CU	217	50	32
SN-0.3AG-0.7CU	216-227	25	40
SN-3.0AG-0.5CU	217-221	37	33
SN-0.7CU	227	28	34
SN-3.5AG	221	43	45
SN-37PB	183	49	44

2.Paste

Use ordinary solder paste 63 | 37 or lead-free solder paste ,set the temperature of each zone and transportation speed according to the temperature curve given by paste manufacturer.

Chapter 5 Maintenance and fault analysis

1. Precautions

1.1 Machine body must be grounded
1.2 Operated by specific worker.
1.3 Lubricant the drive chain with high temperature grease every 7 days.
1.4 Red light,Stop working .
1.5 Do not put flammable, explosive hazardous materials near the reflow oven.
1.6 Do not put your hands, body into reflow when it's working.

1.7 Do not change the parameters of frequency or temperature table arbitrarily.

1.8 Do not insert foreign objects in the mesh transmission

1.9 Lubricate the bearings with high temperature grease once a month.

1.10 Follow instructions.

2. Routine maintenance

2.1.Keep electronic wirings clean.

2.2 Check the fan shaft sleeve loose or not.

2.3 Check the fan drive flexible or not.

2.4 Check if there is abnormal sound on the fan and drive motor.

2.5 Check if there are foreign objects blocking the air inlet and outlet.

2.6 Check the transmission belt loose or not.

2.7 Check whether there is abnormal sound in electrical power box.

2.8 Check whether the transmission part is loose and abnormal sound.

To ensure machine parts may work properly,please check if the operating voltage is within safety limits or stable before starting machine.Then check if the parameters are same with the ones before shutdown.Don't shutdown machine when the conveyor belt at high temperatures to stop it aging fast.Better   stop machine when its body temperature cools down.

Generally machine works every day, as per the indoor environment requirements,clean the main case   every day , as well as the residue in outlet to keep machine clean and work smoothly.

2.9 Conveyor belt:

A, lubricate the drive chain with high temperature oil (molybdenum disulfide) every two months.

B, while using follower roller (outside the device) to maintain belt tension, you need to keep the tension

rails clean and dust free. Or, while two roll parallelism adjustment, you need to adjust top wire near to the

follower roll.

2.10 Motor:

Under long-term high-speed operation, motor should be lubricated with high temperature shaft oil no less than twice a week to keep it runs smoothly.

2.11 Fan:

Clean the fun timely to avoid short circuit or fun burned.

2.12 Grounding：

If machine is with 3-phase 4-wire system, must keep machine connected to ground with a wire. Checked the ground wire is switched on or not before starting. (3-phase 5-wire system is better)

3.Common fault

3.1 Red light:

3.1.1 Check whether the main controlling circuit has phase;

3.1.2 Check whether the control thermocouple is open;

3.1.3 Check whether the main circuit SSR control segment is damaged

3.2 Fail to boot:

3.2.1 Check power supply ;

3.2.2 Check whether the control power off;

3.2.3 Check the emergency stop switch is reset.

3.3 Conveyor belt stops working.

3.3.1 Check whether the transmission driver has power;

3.3.2 Check whether the inverter connection problems;

3.3.3 Check whether the conveyor motor is running;

3.3.4 Check whether the conveyor chain is disconnected;

3.3.5 Check whether the conveyor belt is stucked by foreign objects.

3.4 No heating

3.4.1 Check wether the air transport, transmission switch is turned on;

3.4.2 Whether heating switch is turned on;

3.4.3 Control SSR unipolar switch closed or not;
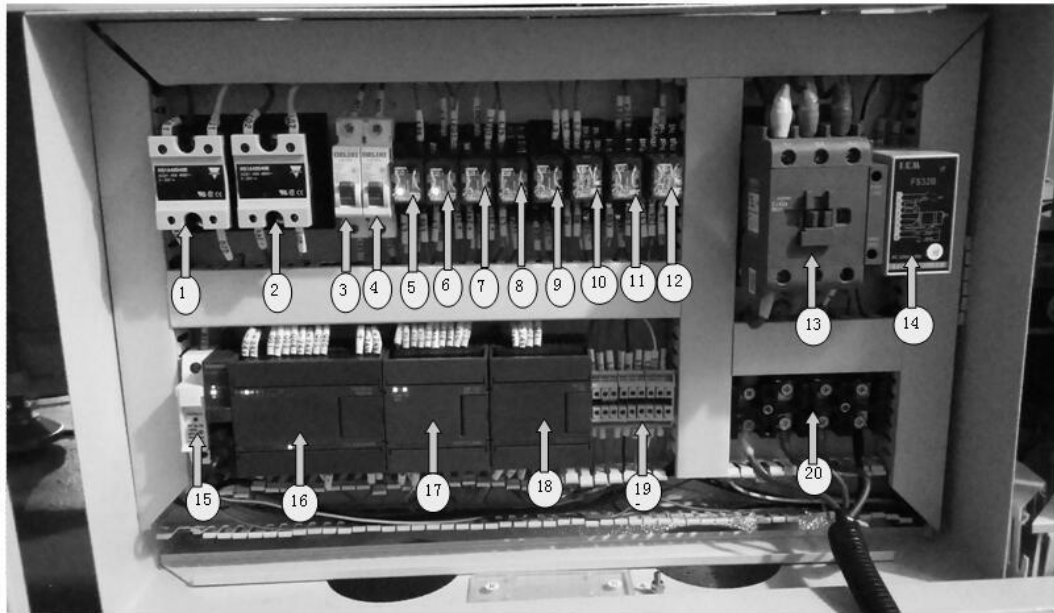
3.4.4 SSR damage

Chapter 6 Circuit Diagram and Graph

1.Two zones reflow oven Circuit diagram
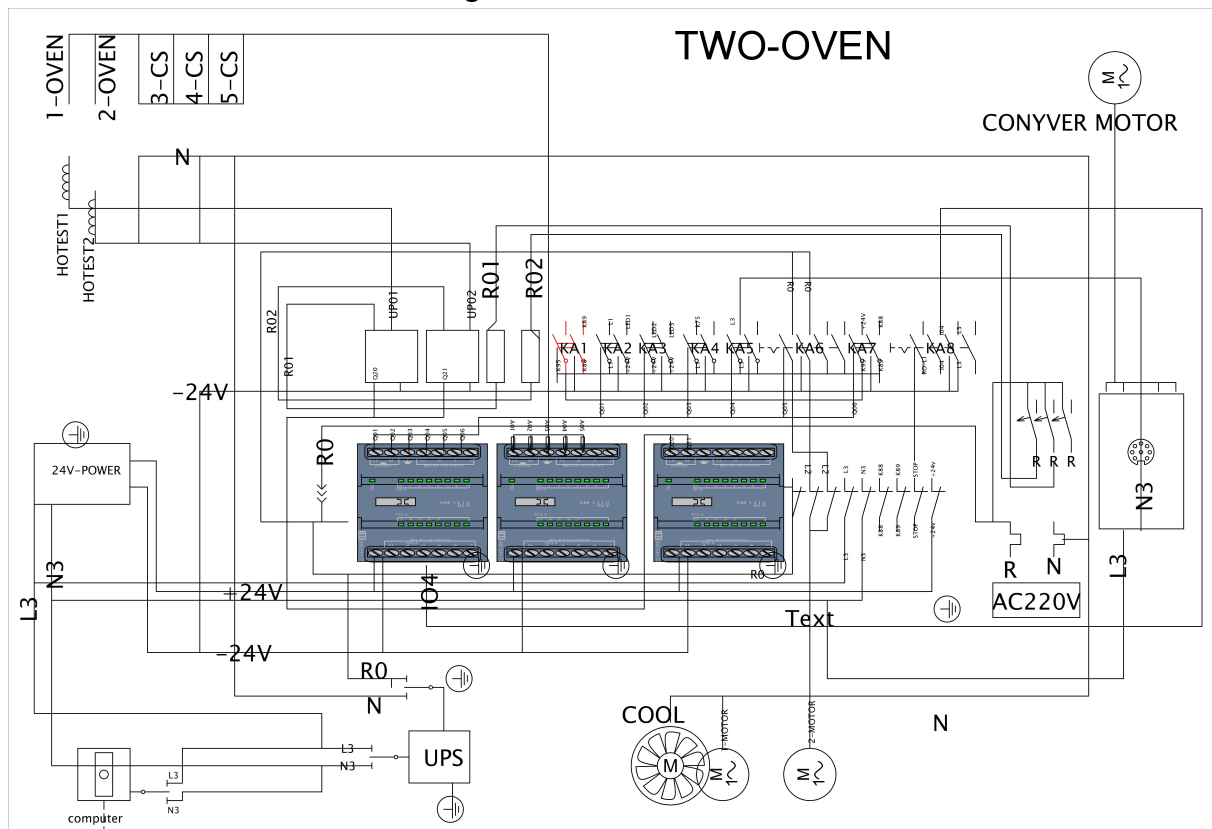
2.Two zones reflow oven simple graph

Two zones reflow oven simple graph

1.First zone heating switch	2.Second zone heating switch	3.First zone heating master switch	4.Second zone heating master switch	5.Start
6.Red light	7.Green light	8.Heating	9.Transport	10.Wind operating
11.Shut down	12.Emergency stop	13.Heating contactor	14.Transport speed governor	15.Fuse holder
16.CPU master control system	17.Temperature control module	18. IO module	19.Connecting terminal	20.220V input terminal