

SV-550 BGA Rework Operation Instruction Manual

一、Operating Instructions Overview

This article mainly describes the operation procedure for repairing leaded and lead-free single-board surface array devices on the BGA rework equipment (SV-550) and the precautions that need to be taken during the repair process.

二、Operating Instructions

1 Definition

BGA: A type of integrated circuit package where input/output terminals (including solder balls, solder pillars, pads, etc.) are arranged in a grid pattern on the bottom surface of the component. Includes, but is not limited to, PBGA, UBGA, WBGA, TBGA, CBGA, and CCGA.

Lead-free BGA: A BGA with lead-free solder balls.

Lead-free BGA information sources: For BGA chips with codes, confirmation is made via PDM; for new devices where data-sheets are not yet available, device information is provided by the customer (the person repairing the board).

Hybrid process: Refers to a process that uses both leaded solder paste and lead-free BGA for assembly.

2 Purpose

Instruct on-site operators on how to select and call programs when using rework equipment to rework single-board array devices with lead, hybrid, and lead-free processes, and to standardize the operation methods and processes of operators to ensure the quality of reworked single boards.

3 Scope of application

This tool is applicable to the selection, recall, and rework of programs for array devices such as PBGA, QFP, PLCC, SOIC, CSP, and BGA sockets on leaded, hybrid, and lead-free process boards.

4 Job Responsibilities and Special Skill Requirements

Post	Responsibility	Special Skill Requirements
Maintenance Operator	Operate and maintain the equipment correctly, and complete all relevant record forms. Handle emergency malfunctions.	Possesses proficient maintenance operation skills
Maintenance Engineer	Equipment troubleshooting, equipment parameter setting and management, providing technical support for front-line operation and maintenance, program modulation and planning management, and process technology support.	Working principle and process of equipment under repair, and temperature curve for debugging and repair.

5 Contents

5.1 Repair tools, accessories and equipment

5.1.1 Repair tools: BGA rework station, soldering iron, scraper, small stencil, vacuum pen, scissors, tweezers,

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drawing brush (for applying solder paste).

5. 1. 2 Consumables: Alpha Metals paste flux (no-clean type LR721H2 HV); Cleaning agent YC336 (for leaded solder), SC-10 (for lead-free solder); Desoldering tape; Leaded solder paste (Sn63Pb37, NC-92J); Lead-free solder paste (Sn96.5Ag3.0Cu0.5); Shredded white cloth

5. 1. 3 SV-550 repair station

The RD-500 rework station has three heating systems. The top and bottom heating elements use hot air to precisely heat the target chip and circuit board. The third is a zone heater that gradually heats the entire printed circuit board from the bottom. The SV-550 requires different sized hot air nozzles for reworking different components.



Figure 1

5. 1. 4 Various auxiliary professional tools:



Figure 2

Solder paste, drawing brush, desoldering wick

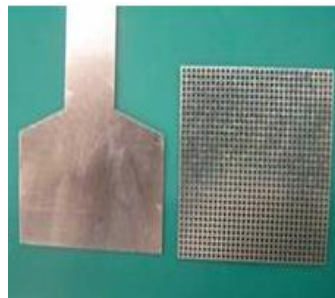
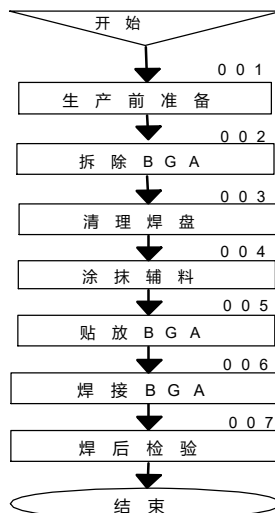


Figure 3

Printing stencil, scraper

5. 2 Operating Procedures



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001 Pre-production preparation

一 Preparation and Requirements for Single-Layer Baking:

1) Different baking requirements will be given for each single-layer veneer depending on the exposure time.

Layer Exposure Time: The processing month on the bar-code of the finished single-layer veneer shall prevail. The single-layer veneer in the current month is assumed to be 1 month, and so on.

2) Baking Time

- i. SMT boards sent for repair are typically less than 24 hours old and do not require baking. BGA boards are to be repaired within 10 hours of receipt.
- ii. For special boards or boards sent for repair with specific requirements, such as component analysis, please provide baking requirements to the process engineers.
- iii. For other boards not listed in the above two points, baking should be performed according to the following guidelines.

Exposure time	≤2 months	Above 2 months
Baking time	10 hours	20 hours
Baking temperature	105±5°C	105±5°C

3) Before baking the board, the receiving personnel may request the maintenance delivery person or project manager to remove temperature-sensitive components for baking, such as optical fibers, batteries, and plastic handles; otherwise, any heat damage to the components will be the responsibility of the delivery person. (The installation of removed components is the responsibility of the original delivery person; BGA maintenance is not responsible for this work.)

4) All single boards must undergo BGA rework within 10 hours of removal from the oven after baking.

5) PCB and materials that cannot be reworked within 10 hours must be stored in a dry box.

二 Precautions for Single-Board Rework Inspection and Preparation:

1) Check if there are any components exceeding 20mm in height (that interfere with the hot air nozzle) within 10mm of the board and the chip to be reworked (on both the rework side and the back of the board). These components must be removed before rework.

2) If there are optical fibers or batteries in the accessory area on the front or back of the board to be reworked, they must be removed before rework.

3) If there are heat sinks, through-hole crystal oscillators, electrolytic capacitors, plastic light guides, non-high-temperature bar-codes, BGA, BGA sockets, and through-hole molded devices such as molded connectors on the back of the returned circuit board at a distance of 10mm or more from the chip being repaired, their surfaces must be sealed with 5-6 layers of high-temperature adhesive tape before repair. If they are within 10mm, the

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corresponding devices (except for BGA) must be removed before repair.

- 4) Other BGA and other chips, and molded devices that may be affected by heat during the repair process, require appropriate heat insulation treatment.

If any of the above four situations involve the disassembly or assembly of related components, the person sending the board for repair should disassemble it themselves before sending it to the BGA rework section for repair. Otherwise, the person sending the board will be responsible for handling any heat damage to the components.

三 Determination of rework materials

- 1) When the components to be repaired are CCGA, CBGA, surface mount BGA, or solder balls made of solder material other than 63/37, solder paste must be printed for repair. The type of solder paste should be selected according to the specifications in the machine's operating instructions.
- 2) When using 63/37 solder material, soldering can be performed using either flux or printed solder paste. When using solder paste, a stencil corresponding to the component pads must be used for soldering. The type of solder paste should be selected according to the specifications in the machine's operating instructions. All flux used is ALPHA flux paste LR721H2, 100g/bottle.
- 3) For lead-free component rework, BGA smaller than 15*15mm can be soldered using flux, while larger BGA must be soldered using solder paste. The type of solder paste should be selected according to the specifications in the machine's operating manual. All flux used is ALPHA flux LR721H2, 100g/bottle.

四 Repair equipment and other requirements

- 1) Before rework, if the equipment has not heated for more than 30 minutes, it must be preheated. The preheating procedure can be any rework procedure.
- 2) Single board positioning and support

Positioning of support rods: Support rods should be distributed as symmetrically as possible (to ensure even heating of the PCB) and should not touch the components at the bottom. The optimal position for the support rods is in the center of the PCB, keeping the PCB flat and preventing them from supporting the components. The clips and positioning pins should be securely fastened. For smaller PCB, the support blocks can be rotated 90 degrees for fixation. (Figure 4)



Figure 4



Figure 5

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3) Selection and replacement of heating nozzles

i. Select a nozzle whose actual size is 2-5mm larger than the BGA. Be careful not to damage the surrounding components with the nozzle. After use, return the nozzle to its corresponding position on the fixture.

ii. Nozzle replacement: Simply rotate the nozzle body 30 degrees to replace the nozzle on the heating element. Be careful not to forcefully pull out the upper nozzle when replacing it to avoid damaging the vacuum suction rod and the connected silicone nozzle and gasket. (Figure 5)

002 BGA Removal

Place the rework board on the rework station. Select the appropriate rework program from the BGA removal program catalog for each device to heat the BGA. After the program finishes running, remove the component from the rework station.

1) If a program with the same name as the board exists in the program library, prioritize using that program.

Generally, the appropriate rework program can be selected based on the size and dimensions of the BGA. (See section 5.3 – BGA Removal/Soldering Program Selection Correspondence Table for rework programs.)

2) After the rework program finishes running, the equipment will automatically pick up the component to be removed. If the component surface is rough or uneven, tweezers may be used. When using tweezers, gently move the component with the tweezers first to ensure it is completely melted before immediately picking it up.

3) After removing the component, before cleaning the pads, check the removed component pads for any missing pads, damage, or other defects. If any abnormalities are found, report them to an engineer for handling.

4) If the disassembled BGA needs to be reused, it needs to be balled. For specific operation details, please refer to the 《BGA Balling Operation Manual》.

003 Cleaning Solder Pads

1) Place the circuit board on the workbench and use a soldering iron and desoldering wick to remove excess solder from the pads, smoothing them out.

When cleaning, place the desoldering wick on the pads, lift it upwards with one hand, and place the soldering iron on the wick with the other. Gently press the soldering iron to melt the residual solder on the BGA pads and transfer it to the wick. Then move the wick to another location to remove the remaining solder. Do not drag the wick forcefully on the pads to avoid damaging them.

2) For leaded component pads, the soldering iron temperature

should be <measured value> 340 +/- 40°C; for lead-free

component pads, the soldering iron temperature should be <measured value> 370 +/- 30°C; for CBGA and

CCGA pads, the soldering iron temperature should be set <measured value> 400 +/- 30°C. After cleaning, use a cleaning agent to remove solder residue and foreign matter from the components and PCB pads. After cleaning,

use a 20X-50X magnifying glass to inspect the components and PCB pads, circuits, etc. for scratches,

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detachment, damage, or other defects; if any are found, report them to the engineer for handling.

004 Applying Flux

Based on point 3 of section 001, determine whether to use solder paste printing or flux application for rework. The methods for printing solder paste and applying flux are described below.

一 Applying Flux:

- 1) Use a brush to apply a small amount of flux (Figure 6) back and forth lightly to the pads (Figure 7).
- 2) Check the flux application on the pads. The flux should be evenly distributed. There should be no flux buildup on the board.
- 3) Check the pads after flux application. There should be no fiber, hair, or other residue. If any is found, clean the pads and apply flux again.



Figure 6



Figure 7

二 Solder Paste Printing

- 1) Select the appropriate solder stencil, position the stencil, and attach it to the PCB with tape (to secure the stencil and prevent solder paste overflow); ensure the stencil opening and the pads are completely aligned. (Figure 8)
- 2) Use a squeegee to apply an appropriate amount of solder paste to the stencil. When applying the paste, try to allow it to roll between the stencil and the squeegee. (Figure 9)
- 3) Slowly lift the stencil upwards using your hand or a tool, minimizing hand tremors during the process.
- 4) Visually inspect the solder paste quality and surrounding area for solder splatter. Check for defects such as missing solder, solder bridging, insufficient solder, solder spikes, or misalignment on the pads. (Figure 10) If any defects are found, clean the pads with board cleaner and reprint after the cleaner has evaporated.
- 5) Clean the stencil and squeegee, and return them to their original positions for future use.

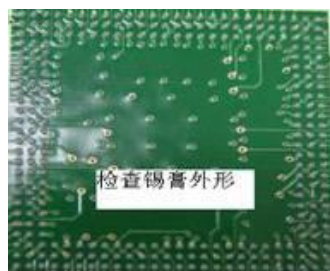
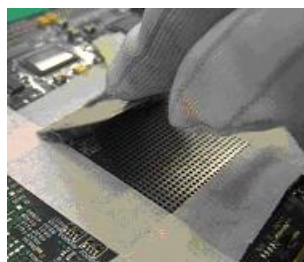
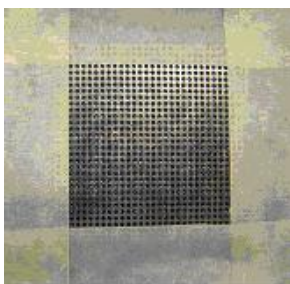


Figure 8: Steel mesh alignment and fixing Figure 9: Applying solder paste Figure 10: Inspecting the quality of solder printing

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Notes: 1. For densely packed BGA components where a small stencil cannot be placed on the PCB, this method can also be used for solder paste application to the components. Place the ball-mounted stencil on the BGA balls, and apply the solder paste using the same method as applying it to the PCB. Handle with care to avoid damaging the BGA.

2. Refer to the "Repair Material Usage Specifications" for the use of printed solder paste, flux, and environmentally friendly cleaning solutions, and record them in the corresponding defective board barcode.

005 BGA Placement

1) Place the board with the applied flux evenly on the worktable, ensuring the bottom of the board is evenly supported (specifically, follow the board positioning and support requirements in 001 Pre-Production Preparation). Start the image alignment system, place the component on the nozzle in the machine's nozzle, ensuring the component and pad images align. Run the machine to complete the placement. (See the 《RD-500 Operating Procedures》 for detailed steps.)

Before placing the BGA, verify that the BGA's coding and orientation match the board being repaired; check for any abnormalities in the BGA's solder balls, such as inconsistent size, missing balls, or irregular shapes.

2) When placing the component, carefully observe and adjust to ensure the component image and pad image are completely aligned, or verify that the component's silkscreen frame is flush with the component.

i. When using solder paste for rework, the BGA must be placed on the PCB using equipment; manual placement is prohibited.

ii. When using flux for rework, components can be placed manually. For standard single-board components, alignment is based on the silkscreen frame; for single-board components without silkscreen, alignment is based on the etched frame diagonally opposite the pads; single-board components without any outer frame markings must be aligned and mounted using a machine.

3) After component placement, it is necessary to check whether the height of the reworked components is consistent, and whether there are any abnormalities such as uneven height or component tilt.

006 BGA Soldering

First, set up the support and position the PCB according to the single-board positioning and support requirements in section 001 (Pre-production Preparation). After the position is determined, call the corresponding program from the BGA soldering program directory of each device to heat the BGA. After the program runs, the component soldering process is complete. Remove the PCB after the single board has cooled.

Note: During operation, closely monitor the single board soldering condition. If there are any abnormalities such as burning or severe deformation, stop the machine immediately, preserve the site, and report to the engineer for handling. The same PCB board can be reworked a maximum of 3 times, and the same BGA can be reworked a

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maximum of 2 times.

007 Post-Soldering Inspection

After soldering, the board needs to be inspected. The following items should be emphasized:

- 1) Visually inspect the solder joints around the BGA for defects such as cold solder joints, bridging, and solder balls on the back. After confirming there are no soldering quality issues using X-ray (and if necessary, using a 3D microscope to check the soldering condition), the next board can be reworked or handed over to the next process.
- 2) Inspect the area around the soldered components for solder splatter and other defects. Check the back of the board for chips or other components damaged by ejector pins.
- 3) Clean excess flux residue around the BGA with board cleaning fluid.

5.3 GA Rework Disassembly and Soldering Procedure Selection Table

BGA Removal Procedure Compatibility Table - Lead-Containing

BGA size Thickness	15×15+/-5mm	25×25+/-4mm	33×33+/-3 mm	42×42+/-5 mm
1.6MM+/-10%	R-1.6mm-15×15	R-1.6mm-25×25	R-1.6mm-33×33	R-1.6mm-42×42
2MM+/-10%	R-2mm-15×15	R-2mm-25×25	R-2mm-33×33	R-2mm-42×42
2.5MM+/-10%	R-2.5mm-15×15	R-2.5mm-25×25	R-2.5mm-33×33	R-2.5mm-42×42
3MM+/-8%	R-3mm-15×15	R-3mm-25×25	R-3mm-33×33	R-3mm-42×42

BGA Soldering Procedure Selection Table - Lead-containing

BGA size Thickness	15×15+/-5mm	25×25+/-4mm	33×33+/-3 mm	42×42+/-5 mm
1.6MM+/-10%	P-1.6mm-15×15	P-1.6mm-25×25	P-1.6mm-33×33	P-1.6mm-42×42
2MM+/-10%	P-2mm-15×15	P-2mm-25×25	P-2mm-33×33	P-2mm-42×42
2.5MM+/-10%	P-2.5mm-15×15	P-2.5mm-25×25	P-2.5mm-33×33	P-2.5mm-42×42
3MM+/-8%	P-3mm-15×15	P-3mm-25×25	P-3mm-33×33	P-3mm-42×42

BGA Removal Procedure Selection Table - Lead-Free

BGA size Thickness	15×15+/-5mm	25×25+/-4mm	33×33+/-3 mm	42×42+/-5 mm
1.6MM+/-10%	R-1.6mm-15×15-PBF	R-1.6mm-25×25-PBF	R-1.6mm-33×33-PBF	R-1.6mm-42×42-PBF
2MM+/-10%	R-2mm-15×15-PBF	R-2mm-25×25-PBF	R-2mm-33×33-PBF	R-2mm-42×42-PBF
2.5MM+/-10%	R-2.5mm-15×15-PBF	R-2.5mm-25×25-PBF	R-2.5mm-33×33-PBF	R-2.5mm-42×42-PBF
3MM+/-8%	R-3mm-15×15-PBF	R-3mm-25×25-PBF	R-3mm-33×33-PBF	R-3mm-42×42-PBF

BGA Soldering Procedure Selection Table - Lead-Free

BGA size Thickness	15×15+/-5mm	25×25+/-4mm	33×33+/-3 mm	42×42+/-5 mm
1.6MM+/-10%	P-1.6mm-15×15-PBF	P-1.6mm-25×25-PBF	P-1.6mm-33×33-PBF	P-1.6mm-42×42-PBF

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2MM+/-10%	P-2mm-15×15-PBF	P-2mm-25×25-PBF	P-2mm-33×33-PBF	P-2mm-42×42-PBF
2.5MM+/-10%	P-2.5mm-15×15-PBF	P-2.5mm-25×25-PBF	P-2.5mm-33×33-PBF	P-2.5mm-42×42-PBF
3MM+/-8%	P-3mm-15×15-PBF	P-3mm-25×25-PBF	P-3mm-33×33-PBF	P-3mm-42×42-PBF

Note: The RD-500 program bar cannot display decimal points. Use "_" to represent the decimal point for PCB board thickness, such as 1_6mm for 1.6mm.

5.4 Rework Precautions for Lead-Free Single-Board (Process Attribute Y2) and Mixed-Assembly

Single-Board (Process Attribute Y3):



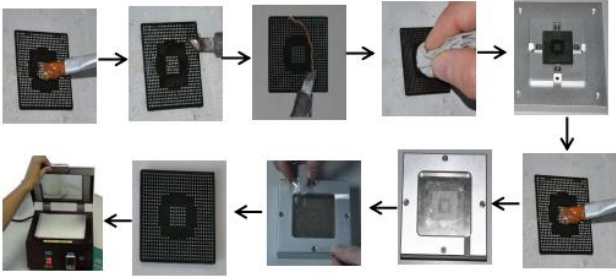
- 1) For lead-free components, if the component size is larger than 15*15mm, solder paste must be printed for rework; flux application is prohibited.
- 2) For lead-free single-board (Process Attribute Y2), tools, consumables, desoldering wicks, soldering irons, and cloths used for BGA rework must not be mixed with leaded BGA rework tools, and the tools must be marked "For Lead-Free Use Only".
- 3) Rework Precautions for Mixed-Assembly Single-Board (Process Attribute Y3):
 - i. For reworked lead-free BGA surface array components (without damage), re-place leaded solder balls and then use the corresponding leaded BGA rework soldering procedure.
 - ii. For reworked BGA surface array components requiring new material requisition, if the BGA component is lead-free, a lead-free BGA rework soldering procedure must be used.

5.5 Other Precautions:

- 1) During normal component assembly and disassembly, no operations are permitted on the circuit board. Do not collide with the positioning fixtures, adjust the ejector pin positions, etc.
- 2) When operating the circuit board, take precautions against static electricity.

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Appendix: Rework Flowchart

一、Operating Procedures	二、Operating steps	三、Related images
1 Power on	1. After turning on the power switch of the hot air repair station, first check whether cold air is blowing out from the upper and lower hot air nozzles. If no air is blowing out, do not start the heating, otherwise the heater may be burned out.	<div data-bbox="1066 353 1359 398" style="border: 1px solid red; padding: 2px; text-align: center; color: red; font-weight: bold;">BGA disassembly steps</div> 
2 BGA removal	1. Place the PCBA on the rework station positioning bracket, clamp the PCB board using the clamping method, and install it on the lower hot air head. The lower nozzle can be adjusted up and down using the lower nozzle adjustment knob. 2. Select the appropriate recirculation nozzle, set the appropriate temperature profile, and then press and hold the descent button to lower the hot air head to the heating position. 3. Click "Disassemble" in the software. After heating is complete, wait for the cooling time to finish before gently removing the PCB board from the positioning bracket.	<div data-bbox="1072 586 1449 631" style="border: 1px solid red; padding: 2px; text-align: center; color: red; font-weight: bold;">Welding/Demolding Software Steps</div> 
3 Software operation steps	1. Access the main control panel 2. Select your desired mode (soldering mode/removal mode/manual mode/cooling mode) 3. Set the BGA temperature and profile analysis 4. Begin soldering/removal	<div data-bbox="1072 788 1369 833" style="border: 1px solid red; padding: 2px; text-align: center; color: red; font-weight: bold;">BGA ball-planting steps</div> 
<div data-bbox="135 929 316 963" style="border: 1px solid black; padding: 2px;">三、Precautions</div>		
<ol style="list-style-type: none"> 1. When the machine is in automatic operation, do not put your hands, head, or any foreign objects into the heating area to avoid burns. 2. Do not place any debris on the surface of the heating area to prevent it from falling into the machine and causing damage. 3. If the machine malfunctions, immediately press the emergency stop switch and notify the relevant technical personnel for assistance. 4. To inspect any internal parts of the machine, the emergency stop switch must be pressed before opening the safety cover and entering the machine. It is strictly forbidden for more than one person to operate the same machine simultaneously. 5. Operators must wear anti-static wrist straps or gloves, and the machine body and work area must be cleaned daily. 		