SMT Engineer Level Training Program

Overview

This unit is about operator (level-1) training of Surface Mount Technology PCB assembly process, which covers the loading of bare PCB to un-loading of assembled product and its operating work details as per SMT standards.

Unit Title (Task)	Operate SMT machine
Description	This OS unit is about the process of full surface mount technology required for electronics product assembly. The job responsibilities require to carry out a number of process in product manufacturing and mentioning the equipment used in the assembly process. The individual must comply with related occupational health & safety guidelines while carrying out the work.

Scope	**This unit/task covers the following:**
	• Working safely
	• Understanding Surface Mount Technology
	• Setting machines for assembling operation
	   1. Vacuum Loader
	   2. Magazine Loader
	   3. Un-Loader
	   4. Screen Printer
	   5. Pick & Place mounter
	   6. Reflow Oven
	   7. AOI/SPI
	• Monitoring the PCBA quality
	• Managing the full line assembly process
	• Maintaining the SMT line machines
	• Documentation

Element	**Performance Criteria**
Working safely	**The user / individual on the job should be able to:** PC1. work safely at all times, complying with health and safety, environmental and other relevant regulations and guidelines related to PCB assembly. PC2. use appropriate personal protective equipment while carrying out work PPE: protective head covers, ESD gloves, finger coat, ESD slipper, ESD wrist bands, aprons, eye protection glasses, first aid kit, warning signs, tapes, etc. PC3. assess possible risks associated with the work and implement necessary safety control measures to prevent injury to self and others PC4. identify and work in electrostatic protected areas while working with ESD sensitive parts
	PC5. confirm that appropriate ground paths are established to reduce electrostatic charge generation and accumulation as per relevant occupational health and safety guidelines. PC6. comply with electrical safety practices while handling power tools and equipment. PC7. verify that static control materials are used while handling assembly parts.

	The user / individual on the job should be able to understand:
Understanding Surface Mount Technology	PC1. SMT technique of affixing the SMT components on the surface of PCB.
	PC2. all electronics products require more functions with compact size, hence Surface mount technology has been introduced.
	PC3. SMT is a method for constructing electronic circuits in which the components are mounted directly onto the surface of PCB.
	PC4. growth history of SMT from 3216 size components to 0402 size components.
	PC5. important advantages and few disadvantages of this technology.
Understanding Basics	The user / individual on the job should be able to:
	PC6. read and calculate the value of Surface mount devices by the part no. SMD: Resistor, Capacitor, Inductor.
	PC7. understand working of other Surface mount devices. SMD: R-L-C, IC, BGA, Transistor, connector
	PC8. recognize and differentiate the SMT defects. Defects: missing, short, tilt, excess, shift, wrong polarity, etc.
	PC9. identify the different products used in SMT process. Product Parts: PCB, Solder Paste, UV Bond, stencil mask, squeegee blade, etc.
	PC10. Carried-out the incoming Quality check procedure of SMT components, Checking the condition of material, attaching part details tag on it and store at their defined places.
	PC11. understand the 5S and ESD Measures.
Types of Line Configuration	The user / individual on the job should be able to understand:
	PC12. different SMT line Configuration
	PC13. technique of Bond + Auto Insertion line configuration Line Configuration: Loader => Dispenser=>Mounter=>Reflow=>AOI=>Un-loader=>VI
	PC14. technique of SMT + AI + Bond line configuration Line Configuration: Loader => Paste Printer=>Dispenser=>SPI=>Mounter=>Reflow=>AOI=>Un-loader=>VI
	PC15. technique of SMT + SMT line configuration Line Configuration: Loader => Paste Printer=>SPI=>Mounter=>Reflow=>AOI=>Un-loader=>VI

Setting machine for assembling operation	**The user / individual on the job should be able to:**
1. Vacuum Loader	PC16. check the packing condition and expiry date of PCB. before loading, clean the dust on PCB by air and load the PCB on conveyor.
	PC17. Follow the m/c setting procedure and verify the process of PCB supply to screen printer.
2. Magazine Loader	PC18. place the magazine on the top surface of the machine input.
	PC19. press POWER ON button to START the machine & click LOCK button to change the PITCH, make sure the pitch should not be zero.
	PC20. select the Auto mode and verify the process of PCB supply to Screen Printer from magazine loader.
3. Un-loader	PC21. check the status of previous stage (Reflow/AOI). Place the magazine on top surface of the m/c.
	PC22. press POWER ON button to START the machine & click LOCK button to change the PITCH, make sure the pitch should not be zero.
	PC23. select Auto mode and verify the process of assembled PCB supply to magazine rack.

4. Solder Paste Printer	PC24. check the stencil is as per model & version with PCB. PC25. Follow FIFO and expiry date of solder paste, write solder paste opening time on solder paste container. read data sheet specification provided by manufacturer. PC26. set the backup pin position with backup pin position jig. PC27. Teach the stencil position by auto teaching manual. PC28. verify the squeegee speed, pressure and separation speed as per setup chart. PC29. check first 5 boards printing condition, position, height, amount of paste and solder spread. PC30. check auto cleaning setting as per setup chart, every 2 hours check the paste amount and refill it. PC31. check the PCB for defects. Defects: Missing solder, No solder, Bridge/Solder short, Shift, Spread, Mis-print. PC32. clean the stencil manually if line is stop for more than 20 min. Remove all solder past on stencil by spatula and clean it by wiper paper and IPA. After cleaning check 1 PCB and then start production. PC33. verify that mis-print PCB are cleaned immediately with wiper paper and IPA. Use clean PCB within 30 min. PC34. study screen printer setup chart parameters. Parameters: Program Name, Squeegee speed, Pressure, Snap off, cleaning frequency, Board Size, Print gap, 2D inspection mode. PC35. set the machine for production. Follow model changeover procedure while changeover. PC36 . check daily, weekly and monthly maintenance as per maintenance check-sheet.
5. Pick and Place mounter	PC37. different types of pick and place machine and their working. Types: Gantry type, rotary type, modular type PC38. understand the types of fiducial mark and defects due to wrong selection of fiducial mark. PC39. understand the mounting procedure of rotary and gantry machine. PC40. check the next production plan and prepare the material as per Bill of Material (BOM). PC41. select the mounter program and verify it as per loading sheet. PC42. check the stencil condition, model, no. of stokes. PC43. verify screen printer, reflow, AOI/SPI programs are ready. PC44. load the material in feeders as per loading sheet. PC45. fill the production report, material change report. PC46. understand the procedures of part change, drop component use and model changeover. PC47 . check daily, weekly and monthly maintenance as per maintenance check-sheet.
6. Reflow Oven	PC48. understand different types of reflow oven and their working Type: IR (Infra Red) and Blower PC49. verify the program, model and temperature setting as per setup chart. PC50. Set the conveyor width with bare PCB PC51. verify all the thermo couples are connected properly to the components on dummy PCB PC52. take the profile after every shift change or at the time of model change. PC53. the temperature setting is different for glue, Pb and Pb free solder paste PC54. use Ramp-Soak-Spike method to set temperature. PC55. check the PCBA after soldering for defect. Defects: Solder short, cold solder, Tombstone, solder balls and PCB warpage.

	PC56. set the temperature of reflow oven as per output defects to control the quality of product. PC57. understand why profile taking is necessary PC58. practice the setting of profile as per standard profile provided by solder paste manufacturer. PC59. set the temperature by combing ramp and spike temperature profile. PC60. set the machine for production. Follow model changeover procedure while changeover. PC61. understand the difference of Air reflow oven and N2 reflow oven temperature setting. PC62. check daily, weekly and monthly maintenance as per maintenance check-sheet.
Automated Optical Inspector/ Solder Paste Inspector machine	PC63. understand that AOI is used to inspected soldered PCB while SPI is used to check solder printing condition. PC64. make defective library of each defect PC65. Import the Gerber data or scan the sample PCB PC66. teach fiducial of PCB, mark 1 and mark 2 PC67. make inspection part library Solder short, missing, shift, etc. PC68. adjust the tolerance for the error point in program, inspect 20 PCB PC69. verify there should not be falls call or imitation defects. PC70. inform supervisor for debugging of program for falls call. PC71. fill the report as per result and give on-time feed back to supervisor for any defects. PC72. check daily, weekly and monthly maintenance as per maintenance check-sheet.
Monitoring the PCBA quality	**The user / individual on the job should be able to:** PC73. check quality data is controlled in PPM not in percentage. PC74. one point means each component qty (R, L, C, IC, TR, CN, etc.) So in SMT all data need to be controlled by each point not by PCB qty. PC75. Avoid quality defects and achieve the highest quality standards PC76. inform to supervisor in case of any quality accidents (defectives)
Managing the full line assembly process	**The user / individual on the job should be able to:** PC77. Monitor & manages the full line assembly process from loading bare PCB in loader to screen printer printing, Solder Paste Inspection, Mounting of SMD on PCB, Soldering in reflow oven, Soldering inspection in AOI and un-loading of populated PCB in magazine rack. PC78. verify defects in process and take immediate corrective action on any accidents during process.
Maintaining the SMT line machines	**The user / individual on the job should be able to:** PC79. verify that there should not be any shut down of machine due to improper maintenance PC80. Perform regular cleaning & lubrication process and methodology as prescribed by manufacturer of the machine
Documentation	**The user / individual on the job should be able to:** PC81. maintain properly all the reports like Production, Part change, Stencil, Cleaning, Inspection etc. PC82. Ensure that correct & accurate production qty is entered in the report.

Knowledge and Understanding (K)	
A. Organizational Context **(Knowledge of the company / organization and its processes)**	**The individual on the job needs to know and understand:** KA1. Company's policies on: incentives, delivery standards, and personnel management KA2. Work flow involved in assembly process of the company KA3. importance of the individual's role in the workflow KA4. reporting structure, inter-dependent functions, lines and procedures in the work area KA5. importance of working in clean and safe environment practices and procedures KA6. relevant people and their responsibilities within the work area
B. Technical Knowledge	**The individual on the job needs to have:** KB1. basic knowledge of electronics KB2. ability to read part code of SMT material. KB3. ability to calculate RLC value and to read their polarity KB4. knowledge of Material handling & requirements KB5. ability to identifying the component locations & type on PCB KB6. ability to identify the defects KB7. ability to take corrective action KB8. knowledge of various parts used in PCB assembly process KB9. basic knowledge of SMT machines KB10. ability to perform visual inspection of the soldered PCB KB11. ability to control material in/out flow KB12. knowledge of 5S & ESD measures KB13. ability to monitor entire PCB assembly process KB14. knowledge and awareness of all safety rules, policies and procedures, Quality standards to be followed in the process

Skills (S)	
A. Core Skills/Generic Skills	**Reading and Writing Skills**
	The user/individual on the job needs to know and understand how:
	SA1. to read job and specification sheet and technical writing
	SA2. to use computers
	SA3. to document the completed work in report
	SA4. to learn SMT standard language
	SA5. to read work instructions, procedures for different product models
	Communication Skills
	The user/individual on the job needs to know and understand how:
	SA6. to effectively communicate, speak clearly and persuasively in positive or negative situations
	SA7. to listen intently to others and provide clear responses
	Teamwork and some multitasking
	The user/individual on the job needs to know and understand how:
	SA8. To share work load as required
	SA9. To deliver frame to next work process on time
B. Management Skills	The user/individual on the job needs to know and understand how:
	SB1. to load Program in machine
	SB2. to do set the machine for production
	SB3. to do Model changeover
	SB4. to do maintenance of machine
C. Professional Skills	**Reflective thinking**
	The user/individual on the job needs to know and understand how:
	SC1. to improve work processes
	SC2. to reduce errors
	Using tools and machines
	The user/individual on the job needs to know and understand how:
	SC3. to operate SMT machines for achieving the required outcome
	SC4. to operate tools for machine maintenance
	SC5. to use LCR meter for measuring component value
	Critical thinking
	The user/individual on the job needs to know and understand how:
	SC6. To spot process disruptions and delays
	SC7. To detect abnormalities in machine performance and prevent major machine malfunctioning
	SC8. To be prompt to respond to machine errors to improve product quality and enhancement of machine performance