

1 Module Details	
Module Name	Automated Surface Mount Assembly
Nominal duration	It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 - 40hours
Module code	NUE130
Discipline code	0703230
2 Module purpose	This module will provide students with the generic knowledge and skills underpinning the automated assembly of printed wiring boards using surface mount technology.
3 Prerequisites	NE 184.1 Electronic hand Soldering Technology
4 Relationship to competency standards	This module provides some of the knowledge and skills underpinning competency in the following standards: National Electrotechnology Industry Standards, Units NES201, NES202, NES401, NES111
5 Content	<ol style="list-style-type: none"> 1. Documentation <ul style="list-style-type: none"> • Product documentation <ul style="list-style-type: none"> Drawings Bill of Materials • Process documentation <ul style="list-style-type: none"> Production sequence flow chart Process control requirements and procedures • Materials audit • OH&S 2 Solder Paste <ul style="list-style-type: none"> • Composition <ul style="list-style-type: none"> Cleaning agents Rheology agents Viscosity agents Tackifiers Flux Solder ball • Storage <ul style="list-style-type: none"> Shelf life • Manufacturers designators • Preparation <ul style="list-style-type: none"> Bringing to ambient temperature Stirring • Testing <ul style="list-style-type: none"> Slump test Oxidation/cohesion test Tacky test Viscosity test 3. Manual solder paste deposition equipment <ul style="list-style-type: none"> • Alignment <ul style="list-style-type: none"> PCB alignment x, y axis

- Screen alignment
 - Snap-off
 - Paste application
 - Squeegee type
 - Squeegee angle
 - Application speed
 - Inspection
 - Definition of print
 - Evenness of paste surface
 - Paste distribution
 - Paste smearing and solder balls
 - Paste alignment with PCB
 - Stencil cleaning
4. Automatic solder paste deposition equipment
- Preparation
 - Manual setup
 - Programming automatic printing equipment
 - Stencil fit
 - Support arrangement according to PCB size
 - Conveyor belt adjustment for correct PCB
 - Stencil alignment to PCB
 - Operation
 - First run
 - Inspection
 - Definition of print
 - Evenness of paste surface
 - Paste distribution
 - Paste smearing and solder balls
 - Paste alignment with PCB
 - Stencil cleaning
5. Automatic component placement systems:
- Equipment
 - Types of automatic pick and place machines
 - Chip shooter
 - Odd shape component placement
 - Typical specifications
 - Typical functions
 - Vision systems
6. Preparation
- Mechanical adjustments
 - Rails
 - Supporting pins
 - Location pins
 - Conveyor belt adjustment
 - Component handling
 - tube feed
 - tape feed
 - Component loading feeder
 - Programming
 - Vision system setup
 - Operation
 - PCB population sequence
 - First run
 - PCB inspection
7. Reflow Ovens and Solder Reflow

	<ul style="list-style-type: none"> • Principles <ul style="list-style-type: none"> Temperature profiling Temperature preheating Temperature zones - setting and adjustment Throughput variation • Reflow ovens <ul style="list-style-type: none"> Types of reflow ovens Advantages Disadvantages Conveyor belt adjustment • Operation <ul style="list-style-type: none"> Software program Preparation PCB loading First run board inspection Adjustments Production run Quality check <p>8. Cleaning</p> <ul style="list-style-type: none"> • Chemical • Aqueous • Advantages • Disadvantages • Rosin based flux removal • Water soluble flux removal • Non-washable components • Cleanliness testing <p>9. Inspection</p> <ul style="list-style-type: none"> • Visual <ul style="list-style-type: none"> Cleanliness Damage Orientation Correct component and value Compliance with placement and soldering standards • Electronic <ul style="list-style-type: none"> Basic electrical tests: “Go/NoGo” testing Functional testing
<p>6 Assessment strategy</p> <p>Assessment methods</p> <p>Conditions of assessment</p>	<p>Assessment should be progressive reflecting a holistic approach to ensure the module purpose is met. In general, to assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments and written tests consisting of a number of item types, such as multiple choice, short answer and problem solving. The assessment should focus on the practical skills emphasised in the module.</p> <p>Learning and assessment may take place in either a classroom/laboratory or an industrial workshop environment</p>
<p>7 Learning Outcome</p>	

Details

Learning Outcome 1

Prepare necessary production documentation, components and materials.

Assessment criteria

- 1.1 Identify and obtain the correct documentation used in a production run.
- 1.2 Identify and correctly interpret typical PWB drawings
- 1.3 Interpret the requirements of a typical bill of materials
- 1.4 Audit components and materials supplied under the requirements of a bill of materials
- 1.5 Analyse a typical production flow chart and describe the illustrated production sequence
- 1.6 Describe typical process control requirements and procedures including OH&S requirements.
- 1.7 Describe typical ESD and EOS requirements used in the workplace.

Learning Outcome 2

Describe the composition of solder paste and the methods of solder paste testing.

Assessment criteria

- 2.1 Describe the composition of solder paste.
- 2.2 Describe the correct environmental storage requirements for solder paste including shelf life and manufacturers designators.
- 2.3 Demonstrate the correct method(s) used to prepare solder paste for a production run.
- 2.4 Describe the common methods used to test solder paste.
- 2.4 Perform a slump resistance test on solder paste and classify the solder paste as either acceptable or unacceptable.
- 2.5 Perform an oxidation/cohesion test on solder paste and classify the solder paste as either acceptable or unacceptable.

Learning Outcome 3

Perform manual solder paste deposition on a PWB.

Assessment criteria

- 3.1 Explain the terms and definitions associated with manual solder paste deposition.
- 3.2 Prepare and adjust manual paste deposition equipment prior to operation.
- 3.3. Demonstrate the correct method used to deposit solder

	<p>paste using manual equipment.</p> <p>3.4 Inspect a PWB after manual solder paste deposition and classify the PWB as either acceptable or unacceptable.</p> <p>3.5. Perform the required equipment cleaning procedures.</p>
Learning Outcome 4	Perform automatic solder paste deposition on a PWB.
Assessment criteria	<p>4.1 Explain the terms and definitions associated with automatic solder paste deposition.</p> <p>4.2 Prepare and adjust automatic paste deposition equipment prior to operation.</p> <p>4.3 Correctly deposit solder paste using automatic equipment.</p> <p>4.4 Inspect a PWB after automatic solder paste deposition and classify the PWB as either acceptable or unacceptable.</p> <p>4.5 Perform the required equipment cleaning procedures.</p>
Learning Outcome 5	Describe the operation of automatic pick and place machines.
Assessment criteria	<p>5.1 Describe the principles of operation of typical SMT pick and place machines.</p> <p>5.2. List the typical operating specifications of a SMT pick and place machine.</p> <p>5.3 Describe the operating functions of a typical pick and place machine.</p> <p>5.4 Describe the operation of a typical vision alignment system.</p>
Learning Outcome 6	Operate SMT pick and place machines
Assessment criteria	<p>6.1 Prepare a SMT pick and place machine for operation.</p> <p>6.2 Demonstrate the correct method used to setup a vision alignment system.</p> <p>6.3. Demonstrate the correct operation of a SMT pick and place machine</p> <p>6.3 Briefly describe adjustments that rectify common faults occurring in automated pick and place machines.</p> <p>6.4 Inspect the placement accuracy of a SMT pick and place machine and classify the machine operation as either acceptable or unacceptable.</p>

Learning Outcome 7

Operate reflow ovens.

Assessment criteria

- 7.1 Describe the principles of preheating and temperature profiling.
- 7.2 Describe the general operating characteristics of different reflow oven types.
- 7.3. Perform the correct procedure required to prepare a reflow oven for production
- 7.4 Demonstrate the correct method used to program a reflow oven for a production run.
- 7.5 Demonstrate the correct method used to conduct a test PWB run.
- 7.6 Inspect and classify individual PWBs to the requirements of ANSI/J-STD-001 as either acceptable or unacceptable.
- 7.7 Perform in process inspection as specified in the quality assurance plan.

Learning Outcome 8

Post assembly cleaning of PWB's

Assessment criteria

- 8.1 List the advantages and disadvantages of cleaning PWB's after manufacture.
- 8.2 State the typical types of damage caused by ultrasonic cleaning.
- 8.3 Demonstrate the correct method(s) used to clean a PWB using aqueous and non aqueous methods.
- 8.3 Briefly describe the tests used to evaluate the cleanliness of a PWB.

Learning Outcome 9

Inspect the PWB visually and electronically for serviceability against an appropriate standard

Assessment criteria

- 9.1 Describe the correct procedure used to visually inspect a PWB.
- 9.2 List the common faults detected during visual inspection.
- 9.3 Inspect and classify individual PWA's to client requirements.
- 9.4 Describe the correct disposition process for non-conforming PWA's.
- 9.5 Describe the correct method used to rectify process faults.

8 Delivery of the module

Delivery strategy

9.6 Perform functional testing of PWA's after a production run and classify the boards as acceptable or unacceptable

9.7 Classify inspected PWA's as accepted or rejected

Delivery strategies must be suitable for learning both Theoretical and practical aspects described in the module Purpose. It is considered that the most effective way to Achieve this is by the integration of theory and practice where Students learn by experimentation and through research and Laboratory reports. It is recommended that learning and Assessment be facilitated in a holistic manner, which may Require a learning outcome sequence other than that indicated in the module. This module is designed to be taught on industrial premises.

It is important that occupational health and safety issues, static discharge avoidance and workplace cleanliness are reinforced throughout the delivery of this module.

Resource requirements

Resources should be sufficient for students to carry out practical exercises on an individual basis. This will require:

- Automatic and manual solder paste machines
- Automatic pick and place machines
- Reflow ovens
- Cleaning stations and chemicals
- Inspection stations

Useful references include

US National Standards: ANSI/J-STD-001: Requirements for Soldered Electrical and Electronic Assemblies.

IEC 61340-5-1: ELECTROSTATICICS – Part 5 Specification for the protection of electronic devices from electrostatic phenomena Section 1: General Requirements.

IEC 61340-5-2: ELECTROSTATICICS – Part 5 Specification for the protection of electronic devices from electrostatic phenomena – Section 2: User Guide.

IPC-A-600; Acceptability of Printed Circuit Boards.

IPC-A-610: Acceptability of Electronic Assemblies.

IPC-HDBK-001. Handbook and Guide to requirements for Soldered Electrical and Electronic Assemblies.

Occupational health and

A safe and healthy environment will be provided for students and teachers as well as safety procedures followed with

safety requirements | regard to teaching/learning activities.