Electronics Assembly for Operators

Instructor Guide

MANDATORY MODULES

Module 1: Introduction to the Electronics Industry
1. The Role of IPC Standards
2. Classes of Electronic Products
3. IPC Certifications and Certificates

Module 2: Introduction to Printed Circuit Board Assembly
1. What is PCB/PCA?
2. Common PCA Components
3. Attachment Methods

Module 3: Overview of the Electronics Assembly & Soldering Processes
1. Surface Mount Technology (SMT)
2. Through-Hole Technology (TH)
3. Assembly Post-Processes

Module 4: Safety
1. Signs for Safety
2. Company Safety Procedures
3. Hazards and Precautions

Module 5: ESD & Product Handling
1. ESD and Personal Grounding
2. Product Handling
3. Foreign Object Debris
4. Company Procedures

Module 6: Component Identification
1. TH & SMT Components
2. Active & Passive Components
3. Polarity and Orientation
4. Cables, Wire Harnesses, and Terminals
5. Hardware

Module 7: Drawings, Specifications, and Measurements
1. Drawings and Documentation
2. Symbols and Measurement Tools

Module 8: Basic PCB/PCA Defects
1. Introduction
2. PCB Defects
3. PCA Defects

Module 9: IPC Standards
1. IPC Standards and the Electronics Industry
2. Common IPC Standards for Assembly Operators
3. Certification vs. Certificate

OPTIONAL MODULES

Module 10: Introduction to Hand Soldering
1. Common Hand Soldering Tools and Materials
2. Best Practices and Methods for Hand Soldering
3. Hand Soldering Defects

Module 11: Surface Mount Technology
1. Introduction & PCB Prep
2. SMT Assembly
3. Other SMT Processes
4. SMT Inspection & Defects

Module 12: Through-Hole Technology
1. Introduction & Manual TH Assembly Process
2. Automatic TH Assembly Process
3. TH Component Defects

Module 13: Wire and Cable Preparation
1. Introduction to Wires and Cables
2. Wire Preparation
3. Wire and Cable Inspection

Module 14: Wire and Terminal Technology
1. Introduction to Terminations
2. Soldered Terminations
3. Crimped Terminations

Module 15: Cable and Harness Technology
1. Connectorization
2. Splicing
3. Wire Harness Assembly

Module 16: Hardware
1. Introduction and Assembly Tools
2. Materials and Consumables
3. Correct Hardware Installation

Module 17: Conformal Coating
1. What is Conformal Coating?
2. Equipment, Tools, and Materials
3. Conformal Control Process
4. Inspection & Defects

Module 18: Press Fit
1. Press Fit Tools, Equipment, and Materials
2. Press Fit Process
3. Press Fit Inspection

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2. Through-Hole Technology (TH)
3. Assembly Post-Processes

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Module 7: Drawings, Specifications, and Measurements

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2. Symbols and Measurement Tools

Module 8: Basic PCB/PCA Defects

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Module 9: IPC Standards

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3. Certification vs. Certificate

Final Exam for Mandatory Modules 1-9

Students must complete the Final Exam for Modules 1 through 9 with a passing score of 80% in order to access and download their Qualified IPC Assembly Operator Certificate. Students may attempt the exam up to three (3) times. Please note that a third and final attempt is permitted after 24 hours of the second attempt.

OPTIONAL MODULES

Module 10: Introduction to Hand Soldering

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Module 15: Cable and Harness Technology

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3. Wire Harness Assembly

Module 16: Hardware

Sections

1. Introduction and Assembly Tools
2. Materials
3. Correct Hardware Installation

Module 17: Conformal Coating

Sections

1. What is Conformal Coating?
2. Equipment, Tools, and Materials
3. Conformal Coating Process
4. Inspection & Defects

Module 18: Press-Fit

Sections

1. Press-Fit Tools, Equipment, and Materials
2. Press-Fit Process
3. Press-Fit Inspection

Module 1: Introduction to the Electronics Industry

Objectives

- Recognize the role of IPC standards
- Distinguish Class 1, 2, and 3 electronics products
- Identify IPC standards training levels
- Recognize topics covered by common IPC standards

Optional Instructor Materials

- Copy of IPC Standard(s) relevant to your facility (e.g., 610, 620, J-STD-001)

Pre-Quiz

Sections

1. The Role of IPC Standards

- General overview of electronics industry
- Areas covered by IPC standards
- Benefits of using IPC standards

- **Practice: IPC Standards?**

2. Classes of Electronic Products

- Definitions and examples of Class 1, 2, 3 products

Practice: Distinguish Product Classes
Practice: Characteristics of Class 3 Products

3. IPC Certifications and Certificates

- Certification vs. Certificate
- 6 major IPC standards
- Description of 6 IPC Certification levels: CIS, CIT, MIT, CSE, CID/CID+, and CEPM

Practice: IPC Standards
Practice: Standards Certification Levels

Post-Quiz

Module 2: Introduction to Printed Circuit Board Assembly

Objectives

- Define the common features of a Printed Circuit Board (PCB)
- Identify the common components of a Printed Circuit Assembly (PCA)
- Describe the different attachment methods used in printed circuit assemblies

Optional Instructor Materials

- Examples of common PCB and PCA materials (as available):
  - Blank SMT, TH, and PTH PCBs
  - Rigid and flexible PCBs
  - Components like capacitors, resistors, diodes, transistors, terminals, cables, and hardware
  - Soldering iron
  - Adhesive like epoxy or resin
  - Mechanical fasteners like screws, bolts, and press-fit pins

Pre-Quiz

Sections

1. What is a PCB/PCA?

- General overview of PCB types and parts

Practice: TH and SMT – Which is Which?

Practice: Types of PCBs

2. Common PCA Components

- Definition of capacitor, resistor, diode, transistor, terminal, cable, and hardware

Practice: Common PCA Components

3. Attachment Methods

- Description of soldering, adhesive, and mechanical attachment methods

Practice: PCA – Fitting It All Together

Post-Quiz

Module 3: Overview of Assembly & Soldering Processes

Objectives

- Describe the assembly process of Surface Mount Technology (SMT)
- Describe the assembly process of Through Hole (TH) Technology
- Distinguish processes used in Surface Mount Technology (SMT) and Through Hole (TH) Technology
- Identify the different post-processes within the electronics assembly process

Optional Instructor Materials

- Examples of common PCB and PCA materials (as available):
  - Blank SMT, TH, and PTH PCBs
  - Solder paste (tin-lead and lead-free)
  - Solder wire (tin-lead and lead-free)
  - Soldering iron
  - PCB/PCA cleaner like IPA
  - Lead preforming tools like Christmas tree, blocks, pliers, and cutters
  - Box build materials like wire harnesses, power supplies, and connectors
  - PCAs with conformal coating
  - Adhesives like epoxy and resin
- Be prepared to show students examples of assembly process machines in your facility, such as:
  - Solder paste printer
  - Pick-and-place machine
  - Automatic insertion machine
  - Reflow oven
  - Wave soldering machine
  - Selective soldering machine
  - Semi-automatic/automatic lead preforming machines
  - PCB/PCA cleaning machines
  - In-circuit and functional testing machines
  - Automatic Optical Inspection (AOI) machine
  - Automatic X-ray Inspection (AXI) machine

Pre-Quiz

Sections

1. Surface Mount Technology (SMT)

- General overview of the SMT assembly process including:
  - PCB prep
  - Solder paste application
  - Component placement
  - Reflow oven soldering

Practice: SMT Assembly Process

2. Practice: Compare SMT and TH ProcessThrough-Hole Technology (TH)

- General overview of the TH assembly process including:
  - PCB prep
  - Automatic component insertion
  - Lead preforming (manual and semi-automatic)
  - Manual component insertion
  - Wave, selective, and hand soldering

- **PRACTICE: TH ASSEMBLY PROCESS**
- **PRACTICE: COMPARE SMT AND TH PROCESS**

3. Assembly Post-Processes

- General overview of common post-processes that can occur during electronics assembly including:
  - Cleaning
  - Testing
  - Inspection
  - Conformal coating
  - Adhesive
  - Box Build

- **PRACTICE: ASSEMBLY POST-PROCESSES**

POST-QUIZ

Module 4: Safety

Objectives

- Identify standard safety signs and symbols relevant to assembly operators
- Describe standard safety procedures for protecting assembly operators, equipment, and products
- Identify potential risks and hazards of standard materials used by assembly operators
- Describe safety concerns of using standard assembly equipment

Optional Instructor Materials

- Copy of your facility's Emergency Action Plan
- Examples of common safety equipment such as:
  - PPE like gloves, glasses, face masks, respirators, and aprons
  - ESD wrist straps, foot grounders, and smocks
  - Fire extinguishers
  - Safety Data Sheet (SDS)
- Be prepared to show students examples of safety signs in your facility, such as:
  - HazMat labels
  - ESD Protected Area
  - Lock-out/tag-out
  - Eye Protection Required
- Be prepared to show students examples of emergency stations in your facility, such as:
  - Emergency eye wash/shower
  - First aid
- Examples of common materials that may be potentially hazardous, such as:
  - Flux
  - Solder wire (tin-lead)
  - Isopropyl Alcohol (IPA)
  - Conformal coating chemicals

Pre-Quiz

Sections

1. Signs for Safety

- General overview of safety signage types and purposes
- Definition of HazMat and Lock-out/Tag-out labels
- Role of ESD and ESD Protected Area

Practice: Know Your Hazards

2. Company Safety Procedures

- Definition and examples of Personal Protective Equipment (PPE)
- General overview of basic manufacturing safety procedures like Emergency Action Plans, fire safety, first aid, and Safety Data Sheets (SDS)

Practice: PPE Purposes

Practice: In Case of Emergency

3. Hazards and Precautions

- Description of hazards related to flux, tin-lead soldering, IPA, and conformal coating

Practice: Fun with Flux

- **Practice: Safety In Processes**
- **Practice: Know Your Solder**
- **Practice: Safety During Box Build**

Post-Quiz

Module 5: ESD & Product Handling

Objectives

- Identify the cause and concerns of electrostatic discharge (ESD) in electronics assembly
- Describe the function of personal grounding and static control devices
- Demonstrate proper handling procedures for PCBs and PCAs
- Describe cause and prevention of foreign object debris (FOD)

Optional Instructor Materials

- Copy of ESD and product handling procedures specific to your facility
- Examples of personal grounding equipment like ESD wrist straps, foot grounders, and smocks
- Examples of PCAs or components damaged by errors such as:
  - ESD
  - Improper handling
  - Heat and moisture exposure
  - FOD
- Examples of ESD-safe packaging, storage, and transport equipment

Pre-Quiz

Sections

1. ESD & Personal Grounding

- Definition and damage of ESD within electronics assembly

Practice: ESD In Action
Practice: Static Control Items for Operators
Practice: ESD-Control Devices

2. Product Handling

- Overview of damage caused by improper product handling and exposure
- Description of ESD-safe packaging, storage, and transport equipment

Practice: Packaging, Storage, and Transport
Practice: Handling PCAs

3. Foreign Object Debris (FOD)

- Definition and risks associate with FOD
- Examples of procedures to mitigate damage from FOD

Practice: Examples of FOD
Practice: Clean Workstations

4. Company Procedures

- Overview of facility specific ESD and product handling procedures

Post-Quiz

Module 6: Component Identification

Objectives

- Identify types of components used in electronic assemblies
- Distinguish between component polarity and orientation
- Differentiate between wires, cables, and harnesses
- Identify the types of terminals used in electronic assemblies
- Identify types of hardware used in electronic assemblies

Optional Instructor Materials

- Examples of common electronic assembly components, such as:
  - TH and SMT capacitors, resistors, diodes, transistors, terminals, wires, cables, and hardware
  - Axial-, radial-, and multi-leaded components
  - Wires, cables, insulation, and wire harnesses

Pre-Quiz

Sections

1. TH & SMT Components

- General overview of both surface mount (SMT) and through-hole (TH) electronic components
- Definition of axial-, radial-, and multi-leaded components

Practice: Axial- vs. Radial-Leaded Components

Practice: Multi-Leaded Components

Practice: SMT Components

2. Active & Passive Components

- Definition and examples of active and passive electronic components

Practice: Active Components

Practice: Passive vs. Active Components

3. Polarity and Orientation

- Definition and examples of electronic component polarity and orientation

Practice: Component Polarity

Practice: Component Orientation

4. Cables, Wire Harnesses, and Terminals

- General overview of wires and cables
- Description of wire gauge, wire insulation, and wire harness
- Description of terminal types

Practice: Wires and Cables

Practice: Wire Gauges

Practice: Terminals

5. **Hardware**

- Overview of hardware types and purposes
- Examples of threaded and non-threaded fasteners

PRACTICE: THREADED VS. NON-THREADED

PRACTICE: HARDWARE IDENTIFICATION

POST-QUIZ

Module 7: Drawings, Specifications, and Measurements

Objectives

- Explain how the Bill of Materials (BOM) is used in the assembly process
- Explain how assembly drawings are used in the assembly process
- Identify common measurement tools and symbols used in the assembly process

Optional Instructor Materials

- Copy of common documents used in electronics assembly (as available):
  - Bill of Materials (BOM)
  - Procurement Order (Customer Contract)
  - Assembly Drawing
  - Schematic
  - Gerber board file
- Examples of common measurement tools like rulers, micrometers, calipers, go-and-no-go gauges, pull testers, and Coordinate-Measuring Machines (CMM)

Pre-Quiz

Sections

1. Drawings and Documentation

- Definition of typical drawings and documents used in electronics assembly
- Description of different parts of a Bill of Materials (BOM)

Practice: Bill of Materials

Practice: Documentation

2. Symbols and Measurement Tools

- General overview of basic measurement systems and symbols
- Description of common measurement tools used in electronics assembly

Practice: Measurement Symbols

Practice: Measurement Tools

Post-Quiz

Module 8: Basic PCB & PCA Defects

Objectives

- Define quality in electronics manufacturing
- Recall different quality conditions specified in IPC-A-610 and IPC-A-600
- Identify PCB and PCA defects according to IPC standards
- Use quality condition criteria to determine component acceptability

Optional Instructor Materials

- Copy of IPC-A-600 and IPC-A-610 standards
- Examples of target and acceptable PCAs
- Examples of PCBs with laminate, plating, and/or solder mask defect conditions
- Examples of PCAs with common soldering and component defect conditions

Pre-Quiz

Sections

1. Introduction

- General overview of electronics inspection process
- Definition of quality conditions within electronics assembly

Practice: Defining Quality

Practice: Quality Conditions

2. PCB Defects

- Description and examples of laminate, plating, and solder mask defects

Practice: PCB Defects

3. PCA Defects

- Examples of soldering defects
- Examples of component damage defects
- Examples of component placement defects

Practice: Solder Defects

Practice: Component Defects

Practice: Component Placement Defects

Post-Quiz

Module 9: IPC Standards

Objectives

- Define IPC standards in reference to the electronic manufacturing industry
- Identify the most common IPC standards relevant to assembly operators
- Compare IPC certification with IPC Certificate programs

Optional Instructor Materials

- Copy of common IPC Standards, such as:
  - IPC-A-600
  - IPC-A-610
  - J-STD-001
  - IPC-7711/7721
  - IPC-WHMA-A-620

Pre-Quiz

Sections

1. IPC Standards and the Electronics Industry

- Overview of scope and purpose of IPC Standards Tree

Practice: The IPC Standards Tree

2. Common IPC Standards for Assembly Operators

- Description of topics covered by IPC-A-600, IPC-A-610, J-STD-001, IPC-7711/7721, IPC-WHMA-A-620
- Overview of revision process for IPC Standards

Practice: Common Standards

3. Certification vs. Certificate

- General overview of difference between IPC Certifications and Certificates
- Description of IPC Certification exams
- Description of IPC Certificate courses

Practice: Certification Exam Development

Practice: IPC Certificate Programs

Post-Quiz

Module 10: Introduction to Hand Soldering

Objectives

- Explain the function of common hand soldering tools, equipment, and materials
- Identify best practices and methods for hand soldering
- Identify common hand soldering defects and soldering anomalies

Optional Instructor Materials

- Examples of hand soldering tools and equipment, such as:
  - Soldering station
  - Soldering iron/tips
  - Cutters/pliers/tweezers
  - Solder vacuum (solder sucker)
  - Hot air gun
  - Microscope/magnifier
- Examples of hand soldering materials, such as:
  - Solder paste (tin-lead and lead-free)
  - Solder wire (tin-lead and lead-free)
  - Flux (pen/bottle)
  - Cleaner like IPA
  - Solder braid
- Examples of common hand soldering defects like burned PCBs, damaged components, and solder joints

Pre-Quiz

Sections

1. Common Hand Soldering Tools and Materials

- Overview of hand soldering instruments like soldering stations and handheld tools
- Properties of solder materials like solder alloys, flux, solder wick, and cleaners

Practice: Solder Iron Tips

Practice: Hand Soldering Tools

Practice: Hand Soldering Tools and Materials

2. Best Practices and Methods for Hand Soldering

- Description of basic hand soldering processes

Practice: Tinning

3. Hand Soldering Defects

- Examples of common PCB and component defects related to hand soldering

Practice: Classifying Soldering Defects

Post-Quiz

Module 11: Surface Mount Technology

Objectives

- Identify tools and materials used in surface mount technology (SMT) assembly process
- Describe steps in surface mount technology (SMT) assembly process
- Define the reflow soldering process for SMT assemblies
- Identify the cause and types of SMT defects within the soldering process

Optional Instructor Materials

- Examples of SMT assembly tools, equipment, and materials, such as:
  - Solder paste (tin-lead and lead-free)
  - Magnifiers
- Be prepared to show students examples of SMT assembly process machines in your facility, such as:
  - Bare board bake oven
  - Solder paste printer
  - Pick-and-place machine
  - Reflow oven
  - Pin-in-paste
- Examples of common SMT defects like overhang, adhesive issues, tombstoning, billboarding, and incorrect orientation

Pre-Quiz

Sections

1. Introduction & PCB Prep

- General overview of the inspection and preparation process for SMT PCBs

2. SMT Assembly

- Overview of SMT assembly process
- Description of solder paste printing, component placement using pick-and-place machines, and soldering with a reflow oven

Practice: Solder Paste Printer

3. Other SMT Processes

- Description of when hand soldering and pin-in-paste can be used within the SMT assembly process

Practice: Pin-in-Paste

4. SMT Inspection & Defects

- Examples of common SMT defects of overhang, adhesive issues, tombstoning, billboarding, and incorrect orientation

Practice: SMT Defects

Post-Quiz

Module 12: Through-Hole Technology

Objectives

- Describe the process and properties of through-hole (TH) technology
- Identify common through-hole insertion methods, tools, and machines
- Identify common through-hole assembly defects

Optional Instructor Materials

- Examples of TH assembly tools, equipment, and materials, such as:
  - Lead forming tools like blocks and Christmas trees
  - Soldering station
  - Clinching and cutting tools
- Be prepared to show students examples of SMT assembly process machines in your facility, such as:
  - Semi-automatic lead-forming machine
  - Automatic insertion machine
  - Wave soldering machine
  - Selective soldering machine
- Examples of common TH defects related to component placement and soldering

Pre-Quiz

Sections

1. Introduction & Manual TH Assembly Process

- Overview of manual TH assembly process
- Description of different lead forming processes, component installation, and hand soldering

Practice: Component Polarity and Orientation

Practice: Cutting and Clinching Leads

Practice: Why Form Leads?

2. Automatic TH Assembly Process

- Description of automatic lead forming, insertion, clinching, and cutting process
- Overview of the wave soldering process

Practice: Wave Soldering Phases

Practice: Wave Soldering Machine

Practice: TH Soldering Methods

3. TH Component Defects

- Examples of common TH defects related to component placement and soldering

Practice: TH Defects – Part 1

Practice: TH Defects – Part 2

Post-Quiz

Module 13: Wire and Cable Preparation

Objectives

- Identify characteristics of wire and cables used in electronics assembly
- Identify steps in wire preparation
- Identify inspection criteria for cutting, stripping, and tinning wire

Optional Instructor Materials

- Examples of wire and cable types like solid wires, stranded wires, coaxial, twinaxial, and triaxial cable
- Examples of wire terminals like ring, hook, fork, bullet, and quick disconnect
- Common wire preparation tools like cutters, strippers, and tinning pots

Pre-Quiz

Sections

1. Introduction to Wires and Cables

- Overview of types and properties of wires and cables
- Process of measuring wires and cables

Practice: Distinguish Parts of a Wire (2 parts)

Practice: Identify Features of a Cable

Practice: Distinguish Types of Cable (2 parts)

Practice: Wires, Cables, and Terminations (3 parts)

2. Wire Preparation

- Overview of tools needed for manual, semi-automatic, and automatic wire preparation
- Description of the different methods of wire preparation

Practice: Manual Wire Preparation (2 parts)

Practice: Wire Tinning (2 Parts)

3. Wire and Cable Inspection

- Examples of defects related to wire insulation, conductors, and tinning

Practice: Insulation Defects

Practice: Conductor Defects

Practice: Tinning Defects

Practice: Identifying Wire Defects

Post-Quiz

Module 14: Wire and Terminal Technology

Objectives

- Identify types of wire terminations
- Differentiate between methods of connecting wires to terminals
- Differentiate between acceptable and defect soldered and crimped terminations

Optional Instructor Materials

- Examples of common terminals like turret, cup, pierced, bifurcated, and hook
- Hand soldering station
- Tools for tinning and cleaning soldered connections
- Common tools for manual, semi-automatic, and automatic wire crimping

Pre-Quiz

Sections

1. Introduction to Terminations

- Description of types of soldered and crimped wire terminals

Practice: Termination Identification

2. Soldered Terminations

- Overview of process for routing, placement, soldering, cleaning and inspection of wire terminals
- Examples of defects related to soldered terminations

Practice: Soldered Terminations

Practice: Soldered Termination Defects

3. Crimped Terminations

- Overview of manual, semi-automatic, and automatic crimping of wire terminals
- Comparison of open barrel and closed barrel crimps
- Examples of defects related to crimped terminations

Practice: Crimping

Practice: Inspecting Crimped Terminations (4 parts)

Post-Quiz

Module 15: Cable and Harness Technology

Objectives

- Identify types of connectors used in wire harness technology
- Distinguish methods of connectorization
- Distinguish methods for making and evaluating wire splices
- Describe the wire harness assembly process

Optional Instructor Materials

- Examples of circular and rectangular connectors
- Examples of target and defective soldered, crimped, and ultrasonic welded splices
- Components related to wire harness assemblies, including ties, terminations, and identification labels
- Copy of Bill of Materials (BOM) related to wire harness assembly

Pre-Quiz

Sections

1. Connectorization

- Overview of connectorization components and process
- Comparison of crimped and soldered connectors

Practice: Connector Structure

Practice: Connector Types

Practice: Connectorization (2 parts)

2. Splicing

- Description of types and defects of soldered splice types (mesh, wrap, hook, and lap)
- Description of types and defects of crimped splice types
- Overview of ultrasonic welding process

Practice: Identify Soldered Splicing Defects (2 parts)

Practice: Identify Crimped Splicing Defects

Practice: Ultrasonic Welding Characteristics

3. Wire Harness Assembly

- General overview of wire harness assembly materials
- Description of wire harness assembly process

Practice: Wire Harness Assembly Process

Practice: Packing List

Post-Quiz

Module 16: Hardware

Objectives

- Identify tools used in electronics assembly
- Recognize hardware and other materials used in electronics assembly
- Differentiate between acceptable and defect conditions of installed hardware and materials

Optional Instructor Materials

- Copy of Bill of Materials (BOM)
- Common hardware installation tools like drivers, wrenches, pliers, tweezers, cutter, fixtures, and presses
- Common hardware materials like bolts, screws, and washers
- Other hardware materials like clips, pem nuts, studs, standoffs, spades, tie wraps, test pins, roll pins, rivets, card stiffeners, stamped sheet metal, face plates, and handles
- Examples of heat dissipative materials like heat sinks, mounting spacers, and fans
- Examples of hardware assembly consumables like sleeving, adhesive, and sealant

Pre-Quiz

Sections

1. Introduction and Assembly Tools

- General overview of common tools used for assembling PCAs

Practice: Tool Identification

2. Materials

- Overview of common and less typical assembly hardware
- Description of how sleeving, adhesive, and sealant is used in the assembly process

Practice: Assembly Materials

3. Correct Hardware Installation

- Description of proper installation of parts and hardware within an assembly
- Definition of Minimum Electrical Clearance (MEC)
- Examples of target, acceptable, and defect conditions like heatsink mounting, insulation and thermal compound application, and threaded fastener installation.

Practice: Hardware Installation: Acceptable or Defect?

Post-Quiz

Module 17: Conformal Coating

Objectives

- Identify equipment, tools, and materials used in conformal coating
- Explain steps in conformal coating process
- Classify causes and characteristics of conformal coating defects

Optional Instructor Materials

- Copy of IPC-A-610: Acceptability of Electronics Assembly
- Examples of PCAs with and without conformal coating applied
- Common conformal coating tools like brushes, syringes, sprayers, UV lamps, and fixtures
- Common masking materials like tape, liquid latex, and masking boots
- Personal Protective Equipment (PPE) like gloves, safety glasses, aprons, and respirators
- Examples of conformal coating materials (as available) like acrylic resin, epoxy resin, and silicone resin
- Tools for inspecting conformal coating like micrometers, Eddy current probes, and flat process coupons
- Be prepared to show students examples of conformal coating stations within your facility (as available), such as:
  - Spray booth/room
  - Automatic dipping machine
  - Curing ovens and racks
  - Vapor deposition machine

Pre-Quiz

Sections

1. What is Conformal Coating?

- General overview of need and purpose of conformal coating

Practice: Conformal Coating Protections

2. Equipment, Tools, and Materials

- Overview of instruments used for manual application of conformal coating
- Review of different types of conformal coating materials and their respective uses and benefits
- Description of how tools like masking tape, UV lamps, curing ovens, and fixtures are used within the conformal coating process

Practice: Conformal Coating Tools and Equipment

Practice: Safety Apparel

Practice: Conformal Coating Types

3. Conformal Coating Process

- Description of major steps for the conformal coating processes including cleaning, masking, application (manual or automatic), curing, masking removal, and removal of conformal coating (if necessary)

Practice: Conformal Coating Methods

Practice: Conformal Coating Process

4. **Inspection & Defects**

- Definition of acceptable qualities for conformal coating
- Examples of conformal coating defects like discoloration, bubbles, cracking, orange peels, and FOD

PRACTICE: CONFORMAL COATING THICKNESS

PRACTICE: –CONFORMAL COATING DEFECTS

PRACTICE: CONFORMAL COATING INSPECTION

POST-QUIZ

Module 18: Press-Fit

Objectives

- Identify tools, equipment, and materials used in press-fit insertion
- Describe steps in press-fit insertion process
- Identify common press-fit insertion defects

Optional Instructor Materials

- Examples of press-fit pins both separate from and within a PCA
- Examples of press-fit defects like bent and twisted pins, incorrect pin height, lifted and fractured annular PTH rings, and PCB crazing
- Manual press-fit insertion apparatus
- Automatic press-fit insertion machine

Pre-Quiz

Sections

1. Press-Fit Tools, Equipment, and Materials

- Overview of the purpose and types of press-fit pins like compliant and solid pins
- Description of manual and automatic press-fit insertion processes

- **Practice: Press-Fit Technology**

2. Press-Fit Process

- Description of major steps for the conformal coating processes including securing assembly to fixture, placing components, and applying pressure

Practice: Manual Press-Fit Process

3. Press-Fit Inspection

- Overview of tools for visual and x-ray inspection of press-fit insertion
- Examples of press-fit defects like bent or twisted pins, incorrect pin height, crazing, and lifted or fractured annular PTH ring

Practice: Press-Fit Pin Defects

Practice: Press-Fit Board Defects

Post-Quiz