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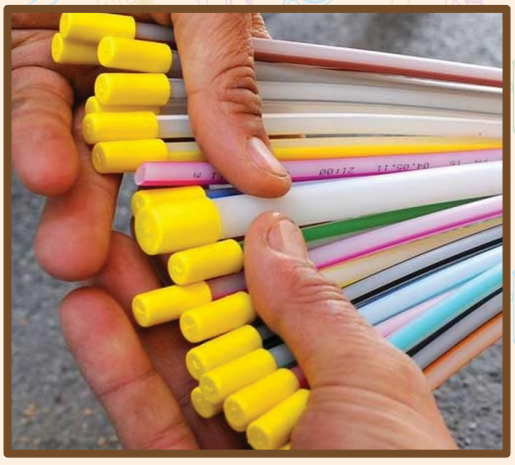
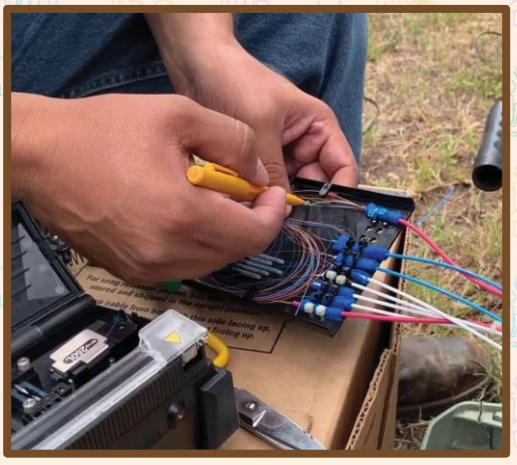
Telecom Sector Skill Council

Facilitator Guide


Sector
Telecom

Sub-Sector
Passive Infrastructure

Occupation
Operations and Maintenance - Passive Infrastructure

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Hand Soldering Technician - Telecom Board

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"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India

Acknowledgements

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The preparation of this guide would not have been possible without the Telecom Industry's support. Industry feedback has been extremely beneficial since inception to conclusion and it is with their guidance that we have tried to bridge the existing skill gaps in the industry. This facilitator guide is dedicated to the aspiring youth, who desire to achieve special skills which will be a lifelong asset for their future endeavours.

About this Guide

The facilitator guide (FG) for Hand Soldering Technician - Telecom Board is primarily designed to facilitate skill development and training of people, who want to become professional Hand Soldering Technician - Telecom Board in the industry. The Facilitator Guide is aligned to the Qualification Pack (QP) and the National Occupational Standards (NOS) as drafted by the Telecom Sector Skill Council of India (TSSCI) and ratified by National Skill Development Corporation (NSDC).

It includes the following National Occupational Standards (NOSs):

1. TEL/N2500: High-Density Hand Soldering of Components on Telecom Boards
2. TEL/N2501: Rework on Defects and Undertake Selective Soldering
3. TEL/N2502: Cleaning and Inspection of Telecom Boards
4. TEL/N9107: Follow sustainability practices in telecom production and assembly line processes
5. DGT/VSQ/N0101: Employability Skills (30 Hours)

Post this training, the participants will be able to perform tasks as professional Hand Soldering Technician - Telecom Board. We hope that this Facilitator Guide provides a sound learning support to our young friends to build a lucrative career in the telecom industry.

Symbols Used

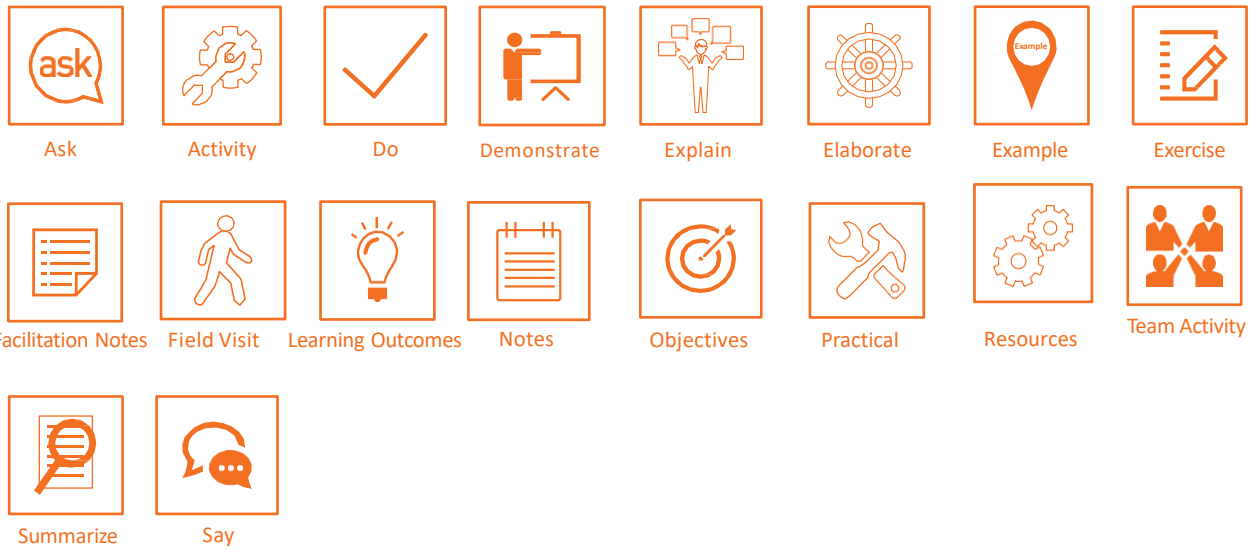


Table of Contents

It is recommended that all trainings include the appropriate Employability skills Module. Content for the same is available here: **https://www.skillindiadigital.gov.in/content/list**

1. Introduction to the Sector and the Job Role of a Hand Soldering Technician - Telecom Board

Unit 1.1 - Introduction to Telecom Sector and Role of a Hand Soldering Technician - Telecom Board

TEL/N2500

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the importance of Telecom Sector.
2. Discuss the role and responsibilities of a Hand Soldering Technician - Telecom Board.

UNIT 1.1: Introduction to Telecom Sector and Role of a Hand Soldering Technician - Telecom Board

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the significance of the telecom sector in the installation and maintenance of optical fiber networks.
2. Elucidate the key skills and technical expertise required for a Hand Soldering Technician - Telecom Board.
3. Describe the challenges faced in splicing, testing, and troubleshooting optical fiber cables in telecom networks.
4. Determine the impact of precision and quality control in optical fiber installation and maintenance for reliable telecom services.
5. Discuss the roles and responsibilities of a Hand Soldering Technician - Telecom Board in ensuring efficient and high-quality network performance.

Resources to be Used

Participant handbook, optical fiber samples, splicing machine, testing tools (OTDR, power meter, light source), soldering kit, magnifying lamp, ESD wrist strap, projector, whiteboard.

Note

This unit gives an overview of how optical fiber networks power modern telecom services and why the role of a Hand Soldering Technician is crucial for ensuring quality, reliability, and seamless connectivity.

Say

Good morning everyone!

Today's telecom world runs on high-speed, reliable optical fiber networks. Behind these networks are trained professionals who install, maintain, and troubleshoot fiber systems and telecom PCBs. One such important role is that of a Hand Soldering Technician – Telecom Board, who ensures that electronic components and circuit boards used in telecom equipment perform flawlessly.

Ask

Ask the participants:

- What telecom services do you use daily—mobile data, broadband, fiber internet?
- Have you ever experienced slow internet or network downtime?

Write their answers on the whiteboard or flipchart.

Use their responses to transition into the lesson.

Elaborate

In this session, we will discuss the following point:

- Introduction to Telecom Industry
- Various Sub-Sectors of the Telecom Industry
- Impact on Economic Development
- Fundamentals of Electronics in Telecom Boards
- Functions of Electronic Circuits in Telecom Equipment
- Hand Soldering Technician: Roles, Skills, and Challenges

Say

Now let us move into a short classroom demonstration and discussion to connect theory with practical applications.

Activity

- **Duration**: 30 minutes
- **Resources**: Optical fiber sample, cleaving tool, soldering board, magnifier.
- **Steps**:
  1. Show trainees a fiber strand and explain why it requires careful handling.
  2. Demonstrate a clean fiber cleave and show what a bad cleave looks like.
  3. Display a correctly soldered joint and an improper one, explaining performance impact.
  4. Ask trainees to identify which sample shows better workmanship and why.

Do

- Help trainees inspect fiber ends and solder joints under magnification.
- Encourage them to practice identifying quality issues.
- Guide them in noting down observations in their workbook.

Notes for Facilitation

- Use simple examples to explain signal loss and quality issues.
- Reinforce the relationship between technician skills and network reliability.
- Encourage questions before moving to the next unit.

Exercise

Answers to exercises for PHB

A. Multiple Choice Questions (MCQs):

1. b) Facilitates high-speed data and voice connectivity
2. b) Precision fiber cleaving and splicing
3. b) Aligning fiber cores precisely to minimize signal loss
4. b) Internet speed and connectivity
5. b) Installing, splicing, and testing fiber optic cables

B, Short Answer Questions:

1. Significance of the telecom sector: It enables fast, reliable communication, supports digital services, enhances business operations, and drives economic growth by improving connectivity and technology adoption.
2. Three key technical skills for an Hand Soldering Technician – Telecom Board:
   - Fiber preparation, cleaving, and splicing
   - Soldering and assembling telecom components
   - Testing and troubleshooting fiber links or PCB sections
3. Challenge in fiber optic splicing: Precise core alignment is difficult; misalignment increases signal loss. This can be addressed using high-accuracy fusion splicers and clean, well-prepared fiber end faces.
4. Impact of fiber optic technology on connectivity: Fiber provides extremely high bandwidth, low latency, and faster data transfer, resulting in improved internet speed and stable long-distance communication.
5. Main roles and responsibilities of an Hand Soldering Technician – Telecom Board:
   - Preparing, splicing, soldering, and terminating fiber/board components
   - Testing and inspecting cable joints and PCB connections
   - Ensuring quality standards during installation and network deployment

C. Fill in the Blanks:

1. preparing and splicing
2. communication and data
3. Alignment
4. total internal reflection
5. core

Notes

2. High-Density Hand Soldering of Components on Telecom Boards

Unit 2.1 – Preparing Telecom Boards for Soldering

Unit 2.2 – Performing High-Density Hand Soldering on Telecom Boards

TEL/N2500

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the key steps involved in inspecting the route plan for optical fiber cable installation.
2. Elucidate the process of coordinating cable laying and pulling to ensure compliance with industry standards.
3. Discuss the importance of adhering to health and safety guidelines in optical fiber installation projects.
4. Explain the significance of reporting and recording installation activities for project tracking and fault management.

UNIT 2.1: Preparing Telecom Boards for Soldering

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the importance of interpreting CAD specifications to identify soldering points, pad layouts, and component placements.
2. Describe the setup process for soldering jigs, fixtures, and workstations to ensure stability during soldering.
3. Discuss the selection criteria for soldering tools, including soldering bits, flux types, and solder wire diameters based on application requirements.
4. Elucidate the impact of contamination on soldering quality and the need for proper cleaning of PCB surfaces, soldering tips, and component leads.
5. Explain the significance of temperature control in soldering stations and methods to prevent overheating or cold solder joints.
6. Enlist the safety, health, and environmental (SHE) guidelines related to handling soldering materials, including proper ventilation and personal protective equipment (PPE).
7. Describe the role of electrostatic discharge (ESD) protection in preventing damage to sensitive telecom components.
8. Discuss documentation and record-keeping requirements related to soldering preparation, including tracking materials used and maintaining quality checklists
9. Demonstrate how to interpret CAD drawings to locate soldering points, pad connections, and component placements.
10. Show how to set up and align soldering jigs and fixtures to ensure component stability and precision during soldering.
11. Demonstrate the process of selecting appropriate soldering materials, including flux, solder wire, and soldering tips for different applications.
12. Show how to clean soldering bits, PCB surfaces, and component leads to prevent contamination and ensure strong solder joints.
13. Demonstrate the proper calibration and temperature setting of a soldering station to match the requirements of different telecom components.
14. Show how to implement ESD protection measures, including the use of anti-static mats, wrist straps, and grounding techniques.
15. Demonstrate safe handling and storage of soldering materials following SHE guidelines.
16. Show how to document and maintain records of soldering material usage, cleaning procedures, and equipment calibration.

Resources to be Used

Participant handbook, PCB samples, CAD layout printouts, soldering station, various soldering bits, flux samples, solder wire spools, ESD mat and wrist strap, magnifying glass, fume absorber, cleaning sponge, IPA solution, projector, whiteboard.

Note

This unit focuses on preparing for high-quality soldering by understanding PCB specifications, workstation setup, tool selection, contamination control, and safety practices.

Say

Good Morning everyone!
Before we start soldering telecom boards, we must understand that good soldering begins long before the iron touches the PCB. Preparation, cleanliness, workstation setup, and correct interpretation of CAD drawings are all essential to ensure accuracy and reliability.

Ask

Ask the participants the following questions:

- Has anyone seen a PCB design on CAD before?
- How do you identify where each component goes on a PCB?
- What do you think happens when a soldering workstation is not grounded or clean?
- Why is temperature control so important during soldering?

Write down their answers on the whiteboard or flipchart. Use their responses as your starting point for the lesson.

Elaborate

In this session, we will discuss the following point:

- Interpreting Technical Specifications and Setup
- Selection of Soldering Materials and Tools
- Contamination Control and Cleaning Procedures
- Safety, ESD Protection, and Documentation

Say

Now that we understand the importance of proper preparation, let's do a quick activity to reinforce these concepts.

Activity

- **Duration**: 25 minutes
- **Resources**: PCB, CAD printouts, soldering station, ESD mat, cleaning tools.
- **Steps**:
  1. Show a CAD layout and ask trainees to identify component positions.
  2. Demonstrate correct workstation setup and tool arrangement.
  3. Let trainees practice identifying soldering pads and alignment marks.
  4. Ask them to inspect a PCB for contamination and suggest cleaning steps.

Do

- Encourage each trainee to handle CAD printouts and match them with PCB samples.
- Observe and guide them in setting up their workstation properly.
- Provide feedback on how they are organizing tools and maintaining cleanliness.

Notes for Facilitation

- Reinforce the importance of cleanliness and ESD safety during every practical session.
- Ask trainees to note three key learnings at the end of the session.
- Encourage peer discussion for clarity and confidence.

UNIT 2.2: Performing High-Density Hand Soldering on Telecom Boards

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the importance of precise component alignment in high-density telecom boards to ensure functional connections.
2. Describe different soldering techniques, including drag soldering, point-to-point soldering, and controlled heat application, to achieve uniform joints.
3. Discuss the correct use of flux in soldering, its types, and its role in preventing oxidation and improving solder flow.
4. Elucidate the significance of maintaining optimal soldering temperature to avoid overheating and cold joints.
5. Enlist common soldering defects, such as cold joints, solder bridges, and excess solder, along with their causes.
6. Describe corrective actions to fix defects, including reflow techniques, solder wick usage, and desoldering pumps.
7. Discuss industry standards for soldering quality (IPC-A-610) and their role in ensuring telecom board reliability.
8. Explain the role of magnification tools in inspecting solder joints for defects and compliance with industry standards.
9. Describe preventive maintenance practices for soldering stations, including tip cleaning, calibration, and replacement schedules.
10. Discuss safety precautions while soldering, including ventilation requirements, PPE usage, and handling of lead-based and lead-free solder
11. Demonstrate the process of aligning and placing components accurately on high-density telecom boards before soldering.
12. Show how to apply the correct amount of solder and flux to achieve optimal solder joints without bridging.
13. Demonstrate controlled heat application techniques to prevent overheating and thermal stress on components.
14. Show how to use high-density soldering methods, such as drag soldering and point-to-point soldering, to maintain uniformity.
15. Demonstrate the identification of common soldering defects using visual inspection and magnification tools.
16. Show how to correct soldering defects such as cold joints, solder bridges, and excessive solder using desoldering tools.
17. Demonstrate the inspection of solder joints using IPC-A-610 standards and checking for compliance.
18. Show how to perform preventive maintenance on soldering stations, including tip cleaning and equipment calibration.
19. Demonstrate safe handling and disposal of soldering materials following industry safety guidelines.

Resources to be Used

Telecom PCB samples, soldering station, flux samples, solder wick, desoldering pump, magnifying lamp or microscope, IPC-A-610 guidelines, cleaning sponge, IPA solution, projector, whiteboard.

Note

This unit focuses on improving soldering quality in telecom boards by understanding advanced soldering methods, inspection standards, common defects, and safety best practices.

Say

Good Morning everyone!
Today, we are diving deeper into advanced soldering skills that are essential when working on high-density telecom boards. These boards are compact, sensitive, and require precision, clean workmanship, and reliable joint formation.

Ask

Ask the participants the following questions:

- Have you seen a telecom PCB with many tightly packed components?
- Why do you think alignment becomes critical in such boards?

Write down their answers on the whiteboard or flipchart.

Use their responses as your starting point for the lesson.

Elaborate

In this session, we will discuss the following point:

- Component Placement and Soldering Techniques
- Flux Application and Temperature Control
- Defect Identification, Correction, and Quality Standards
- Safety and Preventive Maintenance
- Rework and De-soldering Advanced Techniques
- Troubleshooting and Circuit Verification

Say

Now let's move on to a quick hands-on activity to understand these techniques better.

Activity

- **Duration**: 30 minutes
- **Resources**: Demo tool kit, fiber tools (stripper, cleaver, cutter), PCB Bpards.
- **Steps**:
  1. Show trainees a telecom PCB with intentional defects (bridges, cold joints).
  2. Ask them to identify the type of defect using magnification tools.
  3. Demonstrate corrective actions using solder wick and reflow techniques.
  4. Let trainees practice repairing the defects.

Do

- Ensure every trainee gets a chance to inspect and correct a solder joint.
- Guide them on correct heat application and proper flux usage.
- Provide supportive feedback and correct posture/tools handling.

Notes for Facilitation

- Reinforce IPC standards throughout the session.
- Encourage trainees to maintain log sheets of defects and corrections.
- Repeat safety reminders whenever hot tools are in use.

Exercise

Answers to exercises for PHB

A. Short Answer Questions:

1. Accurate CAD interpretation ensures correct identification of pads, solder points, and component positions, preventing misalignment and soldering errors on telecom PCBs.
2. Proper temperature control prevents overheating and cold joints; incorrect temperature can cause pad lifting, poor wetting, or weak solder connections.
3. ESD protection prevents static discharge from damaging sensitive telecom ICs and components during handling and soldering preparation.
4. Contamination blocks proper solder wetting; cleaning PCB surfaces and tips removes oxides, dust, and oils to ensure strong, reliable joints.
5. Defects like bridging, cold joints, voids, and insufficient solder can cause signal issues, overheating, or failure in high-density telecom boards.

B. Multiple Choice Questions (MCQs):

1. b) Anti-static wrist strap
2. b) Using too large a soldering tip
3. c) IPC-A-610
4. b) Prevent oxidation and improve solder flow
5. b) High-density SMD components

C. Fill in the Blanks:

1. temperature control
2. ESD
3. Solder wick
4. Contamination
5. IPC-A-610

Notes

3. Rework on Defects and Undertake Selective Soldering

Unit 3.1 – Verification of Telecom Boards and Identification of Defects

Unit 3.2 – Selective Soldering and Rework of Defective Components

TEL/N2501

Key Learning Outcomes 

After the completion of this module, the participant will be able to:

1. Explain how advanced tools are used to test the effectiveness of a fiber splice.
2. Describe the process of recording test results for traceability and performance analysis in fiber splicing.

UNIT 3.1: Verification of Telecom Boards and Identification of Defects

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the role of CAD layouts and Bill of Materials (BOM) in verifying telecom board assemblies.
2. Describe methods to compare component placement, orientation, and values against given specifications.
3. Discuss common soldering defects, including solder bridges, blowholes, spikes, dry solder joints, and gold finger contamination.
4. Elucidate the industry standards and best practices for telecom board soldering and rework.
5. Enlist various defect identification techniques such as visual inspection, X-ray inspection, and Automated Optical Inspection (AOI).
6. Explain quality control procedures used in PCB assembly to ensure functional and defect-free boards.
7. Describe functional testing methods and tools used to assess the performance of assembled boards.
8. Discuss documentation and reporting procedures for recording defect findings and preparing quality reports.
9. Explain Occupational Health and Safety (OHS) regulations related to telecom board inspection and defect rectification.
10. Demonstrate how to retrieve and interpret CAD layouts and Bill of Materials (BOM) for telecom board verification.
11. Show how to inspect telecom boards for proper component placement, alignment, and orientation.
12. Demonstrate the use of magnification tools to identify soldering defects such as solder bridges, blowholes, and dry solder joints.
13. Show how to perform functional testing of assembled telecom boards using appropriate testing tools.
14. Demonstrate defect identification using different inspection techniques, including visual checks, X-ray, and AOI.
15. Show how to document defect findings and prepare quality reports based on inspection results.
16. Demonstrate compliance with OHS guidelines while handling telecom boards and performing inspections.

Resources to be Used

Participant handbook, PCB samples, CAD/BOM printouts, soldering station, magnifying lamp, multimeter, AOI video samples, projector, whiteboard, markers, ESD wrist strap, PPE equipment.

Note

In this unit, we focus on how technicians examine telecom boards, detect soldering defects, and ensure that every board meets industry quality standards before deployment.

Say

Good Morning everyone!
In today's session, we are going to explore one of the most crucial aspects of telecom hardware work—inspection and quality control. Even a tiny solder defect or incorrect component orientation can lead to major network failures. That's why telecom boards demand extremely high precision and careful verification.

Ask

Ask the participants the following questions:

- What do you think happens if a component is placed in the wrong orientation?
- Has anyone seen a soldering defect like bridging or dry soldering?

Write down their answers on the whiteboard.

Elaborate

In this session, we will discuss the following point:

- Verification Using Technical Documentation
- Methods to Compare Component Placement and Values
- Soldering Defects and Rework Standards
- Industry Standards and Best Practices for Rework
- Defect Identification and Quality Control Procedures
- Quality Control (QC) and Functional Testing
- Documentation and Safety (OHS)
- Advanced Rework and PCB Repair Techniques

Say

Let us now move into a small activity to help you better identify defects on telecom boards.

Activity

- **Duration**: 30 minutes
- **Resources**: CB samples (good and defective), magnifiers.
- **Steps**:
  1. Divide participants into pairs.
  2. Give each pair two PCBs—one good and one with defects.
  3. Ask them to identify as many defects as possible.
  4. Conduct a quick discussion on findings.

Do

- Assist trainees as they inspect the PCBs.
- Encourage them to compare against CAD and BOM sheets.
- Jot important observations on the whiteboard.

Notes for Facilitation

- Reinforce adherence to ESD and OHS safety throughout the activity.
- Use real examples of defects to enhance understanding.
- Encourage questions and peer learning.

UNIT 3.2: Selective Soldering and Rework of Defective Components

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the steps involved in marking and categorizing defective components for rework or replacement.
2. Describe criteria for determining whether components can be reused or require replacement.
3. Elucidate proper desoldering techniques for removing faulty joints without damaging the PCB.
4. Discuss selective soldering techniques, including temperature control, solder flow management, and flux application.
5. Enlist different soldering and desoldering tools, such as rework stations, soldering irons, and vacuum desoldering pumps.
6. Explain the importance of maintaining proper soldering station settings to ensure uniform solder joints.
7. Describe verification methods for reworked components using magnification tools and testing procedures.
8. Discuss ESD control measures and best practices for preventing damage to sensitive electronic components.
9. Explain industry protocols for handling lead-free and lead-based soldering materials and their compatibility with components.
10. Describe work process documentation and the escalation matrix for defect reporting.
11. Demonstrate how to identify, mark, and categorize defective components for rework or replacement.
12. Show how to safely remove defective components using proper desoldering techniques.
13. Demonstrate selective soldering techniques while maintaining precise temperature control and solder flow.
14. Show how to inspect reworked components under a microscope for quality assurance.
15. Demonstrate safe handling of soldering stations, desoldering tools, and rework stations.
16. Show how to maintain proper documentation of rework, including defect reports and corrective actions taken.
17. Demonstrate compliance with ESD safety precautions while handling telecom boards and components.

Resources to be Used

Participant Handbook, soldering workstation, lead-free and lead-based solder wire samples, PCB boards, flux, multimeter, magnification lamp/microscope, ESD mat and wrist strap, rework station, vacuum desoldering pump, temperature-controlled soldering iron, projector, whiteboard.

Note

Trainees often perform repair and rework tasks in telecom device servicing. This unit teaches them safe, accurate, and industry-standard techniques to handle components, perform soldering/desoldering, evaluate defects, and maintain documentation.

Say

Good Morning everyone!
Today's unit focuses on one of the most hands-on and skill-based areas of telecom device repair—soldering, desoldering, and component rework. These activities require precision, safety, and strong understanding of component handling. By the end of this session, you'll be equipped to identify defects, remove faulty components, re-solder correctly, and verify your work professionally.

Elaborate

In this session, we will discuss the following point:

- Defect Categorization and Component Management
- De-soldering and Selective Soldering Techniques
- Rework Tools and Process Control
- Maintaining Proper Soldering Station Settings
- Safety, Standards, and Documentation

Say

Now we will move into a practical activity where you will identify defective components on a sample PCB and practice safe and accurate desoldering and rework procedures.

Activity

- **Duration**: 60 minutes
- **Resources**: PCB boards, soldering iron, rework station, magnifier, multimeter.
- **Steps**:
  1. Provide trainees with a PCB containing marked defective joints.
  2. Ask trainees to identify additional defects through visual inspection.
  3. Demonstrate proper desoldering using wick and vacuum pump.
  4. Guide them to re-solder a fresh component using correct temperature.
  5. Trainees verify the joint under magnification.
  6. They record:
     - Defect identified
     - Rework performed
     - Verification result

Do

- Supervise trainees to ensure they follow ESD safety.
- Observe temperature settings and technique.
- Provide corrections where needed.
- Ensure every trainee performs at least one desoldering and one re-soldering task.

Notes for Facilitation

- Emphasize cleanliness, flux quantity, and tip condition.
- Highlight why improper rework causes long-term device failure.
- Reinforce documentation practices after each rework cycle.

Exercise

Answers to exercises for PHB

A. Short Answer Questions:

1. CAD layouts provide exact pad locations, routing, and component orientation, while the BOM lists correct part numbers, values, and quantities—together ensuring accurate verification of component placement and assembly integrity.
2. Common defects include solder bridges, cold joints, insufficient solder, voids, and tombstoning. These defects weaken electrical connections, cause shorts or intermittent failures, and reduce overall board reliability.
3. Industry standards and best practices ensure consistent workmanship, prevent damage to telecom components, and maintain reliability. Following standards like IPC helps ensure safe temperatures, proper reflow profiles, and correct rework techniques.
4. Visual inspection checks for obvious defects, AOI uses automated cameras for fast and precise surface defect detection, and X-ray inspection identifies hidden issues such as voids, internal shorts, or BGA alignment problems.
5. Safe handling requires ESD protection, proper PPE, controlled work areas, and adherence to OHS regulations to prevent electrical hazards, chemical exposure, burns, and accidental component damage during inspection and repair.

B. Multiple Choice Questions (MCQs):

1. c) Bill of Materials (BOM)
2. b) Excess solder connects two adjacent pins
3. b) Visual defect detection using programmed image comparison
4. b) Vacuum desoldering pump
5. b) Solder accidentally touches contact edges meant to remain clean

C. Fill in the Blanks:

1. X-ray
2. Temperature
3. Gases
4. Inspection
5. quality

Notes

4. Cleaning and Inspection of Telecom Boards

Unit 4.1 – Cleaning of PCBs

Unit 4.2 – Inspection of PCBs

TEL/N2502

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Identify the different types and sources of contamination in PCBs.
2. Describe various methods of PCB cleaning and their applications.
3. Explain the causes and impact of white residue on PCB performance and reliability.
4. Demonstrate correct procedures for storing and handling PCBs after cleaning.
5. List and explain key points of importance in visual inspection of PCBs.
6. Identify the attributes, capabilities, and limitations of Automated Optical Inspection (AOI).
7. List the applications and advantages of Automated X-ray Inspection (AXI).
8. Apply in-circuit testing (ICT) methods to verify assembly integrity.
9. Compare different types of visual inspection systems and their suitability for specific applications.

UNIT 4.1: Cleaning of PCBs

Unit Objectives

After the completion of this module, the participant will be able to:

1. Identify different types and sources of contamination in PCBs.
2. List the common methods used for PCB cleaning.
3. Explain the impact of white residue on PCB quality and reliability.
4. Demonstrate correct methods for storage and handling of PCBs after cleaning.

Resources to be Used

Participant handbook, sample PCBs (contaminated and cleaned), magnifying glass or microscope, lint-free wipes, cleaning solvents (IPA), PCB cleaning station (if available), ESD mats, gloves, projector, whiteboard.

Note

This unit focuses on the importance of maintaining PCB cleanliness to ensure long-term reliability, prevent failures, and support high-quality repair and manufacturing practices.

Say

Good Morning everyone!
Today we are going to learn something very important for technicians — PCB contamination and proper cleaning methods. A tiny residue on a PCB can cause corrosion, overheating, intermittent faults, or complete board failure. Understanding this will help you maintain high repair standards and deliver reliable service.

Ask

Ask the participants the following questions:

- Have you ever seen dust, fingerprints, or white residue on a circuit board?
- What problems do you think contamination can create?
- Which tools or materials do you currently use for cleaning PCBs?

Write their responses on the whiteboard.

Elaborate

In this session, we will discuss the following point:

- PCB Cleaning and Flux Residue
- Waste IPC Standards of Soldering
- Types of Contamination in PCBs
- Types of Cleaning Solvents
- Board Cleaning Methods
- White Residues on PCBs
- Storage and Handling of PCBs after Cleaning

Say

Now let's move to a hands-on activity where you will inspect, clean, and correctly store PCBs following proper procedures.

Activity

- **Duration**: 40 minutes
- **Resources**: Sample contaminated PCBs, IPA, brushes, wipes, ESD mat, gloves.
- **Steps**:
  1. Divide the trainees into pairs.
  2. Provide each pair with a contaminated PCB.
  3. Ask them to inspect the contaminants and list what they observe.
  4. Demonstrate proper IPA-based PCB cleaning.
  5. Allow trainees to clean their assigned PCB.
  6. Show them how to dry, inspect, and store the PCB.
  7. Each pair documents the contamination type and cleaning method used.

Do

- Demonstrate correct use of IPA, brushes, and lint-free wipes.
- Guide trainees to avoid damage to components or tracks.
- Check that PCBs are dried and stored in ESD-safe packaging.
- Ensure all trainees practice contamination identification and post-cleaning handling.

Notes for Facilitation

- Reinforce ESD precautions throughout the session.
- Highlight real-world failures caused by improper cleaning.
- Encourage trainees to speak about mistakes they made previously and how to avoid them now.
- Ask trainees to update their workbooks with cleaning procedures.

UNIT 4.2: Inspection of PCBs

Unit Objectives

After the completion of this module, the participant will be able to:

1. Explain the importance and key requirements of visual inspection in PCB assembly.
2. Identify the features and capabilities of Automated Optical Inspection (AOI) systems.
3. Describe the applications and benefits of Automated X-ray Inspection (AXI) methods.
4. Perform in-circuit testing to verify electrical functionality.
5. Compare the working principles, advantages, and limitations of different visual inspection machines.

Resources to be Used

Participant handbook, sample PCBs (good and defective), magnifying lamps, microscopes, AOI/AXI demo videos, multimeter, ICT jig (if available), laptop, projector, whiteboard, markers.

Note

This unit helps trainees understand how visual inspection and automated test systems ensure quality, detect defects early, and avoid costly failures in electronic manufacturing and repair workflows.

Say

Good Morning everyone!

In this session, we are going to explore how PCBs are inspected, tested, and verified before they are delivered to customers or integrated into devices. Visual inspection—whether manual or automated—plays a critical role in finding soldering issues, missing components, polarity mistakes, and hidden structural defects.

Ask

Ask the participants the following questions:

- Have you ever used a magnifying lamp or microscope to inspect a PCB?
- What kind of defects have you commonly noticed on circuit boards?

Write their responses on the whiteboard.

Elaborate

In this session, we will discuss the following point:

- Visual Inspection
- Automated Optical Inspection (AOI)
- Automated X-ray Inspection (AXI)
- In-Circuit Testing (ICT)
- Comparison between Visual Inspection Machines

Say

Now let's move to a small activity where you will inspect PCBs manually and compare your findings with an AOI sample result.

Activity

- **Duration**: 60 minutes
- **Resources**: Magnifying lamp, microscope, sample PCBs, multimeter.
- **Steps**:
  1. Divide the class into small groups.
  2. Provide each group with a PCB containing known defects.
  3. Ask them to identify as many defects as possible using visual tools.
  4. Show an AOI/AXI sample report and compare results.
  5. Demonstrate basic ICT using a multimeter or test jig.
  6. Ask trainees to note whether the board passes or fails the tests.

Do

- Guide trainees on how to classify defects (critical/major/minor).
- Encourage them to discuss what defects they detected or missed.
- Reinforce the habit of documenting each defect correctly.
- Ensure safe handling of PCBs and ESD precautions.

Notes for Facilitation

- Encourage peer learning—ask trainees to cross-check each other's inspection observations.
- Use real-world examples of failures caused by poor inspection.
- Ask them to complete questions and exercises from the participant manual.

Exercise

Answers to exercises for PHB
Ax Multiple Choice Questions (MCQs):

1. b) Prevent electromigration and improve reliability
2. c) IPC J-STD-001
3. b) Flux chemistry and improper cleaning processes
4. b) Ultrasonic cleaning
5. b) Inspecting hidden solder joints like BGAs and CSPs
6. b) A structural electrical test for verifying assembly integrity

7. Fill in the Blanks:

a) Ionic contamination includes salts and flux activators, while non-ionic contamination includes oils, greases, and solder balls.
b) The IPC standard IPC J-STD-001 covers requirements for soldered electrical and electronic assemblies.
c) White residues on PCBs are complex mixtures of flux residues, metallic salts, and other materials.
d) In ultrasonic cleaning, contaminants are removed through a process called cavitation.
e) AOI inspection uses high-resolution cameras and image-processing algorithms to detect surface defects on PCBs.
f) The two common ICT methods are Bed-of-Nails tester and Flying Probe tester.

8. Short Answer Questions (Shortened)

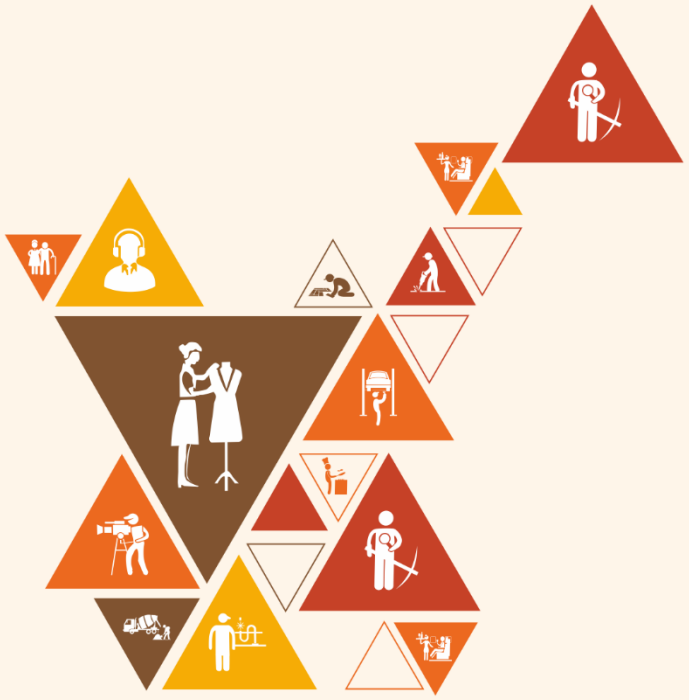
a) Electromigration occurs when ionic contaminants move under electrical stress and create conductive paths. Cleaning removes these contaminants and prevents failures.
b) Three benefits of IPC standards: Improve soldering quality, Reduce defects, and rework Ensure consistent and reliable manufacturing
c) Aqueous: Water-based, eco-friendly, needs rinsing. Semi-aqueous: Solvent-based, removes tougher residues, then rinsed with water.
d) White residues are flux salts or reaction byproducts left after poor cleaning. They can cause corrosion, leakage, and reliability issues.
e) AOI: + Fast surface inspection; – cannot check hidden joints. AXI: + Inspects hidden joints; – expensive. ICT: + Accurate electrical testing; – fixtures can be costly.
f) Bed-of-Nails: Fast and good for mass production; expensive fixtures. Flying Probe: Flexible and low-cost for small batches; slower.

Notes

5. Sustainability Practices in Telecom Production and Assembly Line Processes

Unit 5.1 - Environmental Compliance and Sustainable Practices

Unit 5.2 - Waste Management, Disposal, and Environmental Audit Compliance



TEL/N9107

Key Learning Outcomes

After the completion of this module, the participant will be able to:

1. Explain the organization's sustainability policies and goals.
2. Demonstrate the use of energy-efficient equipment, tools, and automated systems to reduce carbon footprint and optimize material, water, and electricity consumption.
3. Elucidate the key aspects of EPR guidelines, ISO 14001, and e-waste disposal laws.
4. Demonstrate how to inspect, categorize, and store telecom components such as PCBs, cables, batteries, and plastic casings for appropriate processing, ensuring compliance with EPR guidelines.
5. Discuss the methods for identifying recyclable and hazardous components in telecom production.
6. Show how to maintain an inventory of recyclable and hazardous materials while tracking waste management and reporting improper disposal practices.
7. Describe green manufacturing practices, including energy-efficient tools, lead-free soldering, and automation.
8. Show how to follow low-emission soldering and lead-free assembly processes while ensuring compliance with ISO 14001 (Environmental Management System).
9. Explain the proper handling, storage, and disposal methods for e-waste.
10. Demonstrate how to properly dispose of hazardous waste (e.g., lithium batteries, chemical residues) and deposit non-hazardous recyclable materials (e.g., plastics, aluminum, copper) in designated collection areas.
11. Determine techniques for reducing material wastage without impacting production quality.
12. Demonstrate the process of maintaining and calibrating energy-efficient machinery to ensure optimal performance and minimize environmental impact.
13. Discuss the safe and responsible handling of hazardous and non-hazardous materials in telecom manufacturing.
14. Demonstrate how to coordinate with authorized e-waste recyclers to ensure proper processing and disposal of materials.
15. Describe environmental impact assessment techniques for telecom production.
16. Demonstrate how to follow national and international environmental laws, participate in sustainability audits, check for adherence to guidelines, and implement corrective actions based on assessments.
17. Explain the documentation requirements for sustainability audits and compliance tracking.
18. Demonstrate how to maintain documentation for waste disposal, conduct periodic waste audits, and identify opportunities for further waste reduction.

Unit 5.1: Sustainability Practices in Telecom Infrastructure Management

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Explain the organization's sustainability policies and goals.
2. Demonstrate the use of energy-efficient equipment, tools, and automated systems to reduce carbon footprint and optimize material, water, and electricity consumption.
3. Elucidate the key aspects of EPR guidelines, ISO 14001, and e-waste disposal laws.
4. Demonstrate how to inspect, categorize, and store telecom components such as PCBs, cables, batteries, and plastic casings for appropriate processing, ensuring compliance with EPR guidelines.
5. Discuss the methods for identifying recyclable and hazardous components in telecom production.
6. Show how to maintain an inventory of recyclable and hazardous materials while tracking waste management and reporting improper disposal practices.
7. Describe green manufacturing practices, including energy-efficient tools, lead-free soldering, and automation.
8. Show how to follow low-emission soldering and lead-free assembly processes while ensuring compliance with ISO 14001 (Environmental Management System).
9. Explain the proper handling, storage, and disposal methods for e-waste.
10. Demonstrate how to properly dispose of hazardous waste (e.g., lithium batteries, chemical residues) and deposit non-hazardous recyclable materials (e.g., plastics, aluminum, copper) in designated collection areas.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, E-waste bins (color-coded), Sample PCBs, cables, batteries, plastic casings, ISO 14001 overview slides, EPR guideline handouts, Inventory register/format, PPE

Say

- Environmental compliance is critical for sustainable telecom manufacturing and legal adherence.
- This unit focuses on responsible use of resources, waste segregation, and regulatory compliance.
- You will learn how EPR, ISO 14001, and e-waste laws guide daily shop-floor practices.
- Proper identification and disposal of waste protects the environment and organizational credibility.

Ask

- Why is environmental compliance important in electronics and telecom production?
- What risks arise from improper disposal of batteries or PCBs?
- How does ISO 14001 support sustainable manufacturing?
- What is the role of workers in meeting EPR requirements?

Do

- Observe samples of telecom components and classify them as recyclable or hazardous.
- Review a simple waste inventory format and reporting mechanism.
- Identify energy-efficient tools and practices used in the workshop.
- Discuss examples of improper disposal and corrective actions.

Elaborate

Use the following key questions for discussion:

1. What are the main goals of organizational sustainability policies?
2. How do EPR guidelines impact handling of telecom components?
3. What practices help reduce energy, water, and material consumption?
4. How does ISO 14001 ensure environmental compliance at the site?
5. Why is proper segregation and documentation of waste important?

Link environmental practices to legal compliance and cost optimization.

Demonstrate

- Demonstrate segregation of PCBs, cables, batteries, and plastic casings.
- Show proper storage and labeling of hazardous and recyclable waste.
- Demonstrate how to record recyclable and hazardous material movement in inventory logs.
- Demonstrate lead-free soldering and low-emission assembly practices.
- Show correct disposal of hazardous and non-hazardous waste in designated bins.

Activity

1. **Activity Name:** Waste Segregation and Environmental Compliance Drill
2. **Objective:** Build hands-on understanding of sustainable practices and compliance.
3. **Type:** Group Activity
4. **Resources:** Sample components, waste bins, inventory sheets
5. **Duration:** 30 minutes
6. **Instructions:**
   - Groups classify provided components into recyclable and hazardous categories.
   - Learners store them in appropriate bins and update inventory records.
   - Groups identify one non-compliance scenario and propose corrective action.
7. **Outcome:** Learners confidently apply environmental compliance and waste management practices.

Notes for Facilitation

- Keep explanations practical and linked to shop-floor activities.
- Emphasize compliance as a shared responsibility.
- Reinforce correct labeling, documentation, and segregation habits.
- Encourage adherence to ISO 14001 principles in daily work.
- Promote sustainability as both an environmental and operational priority.

Unit 5.2: Sustainability Practices in Telecom Infrastructure Management

Unit Objectives

After the completion of this unit, the participant will be able to:

1. Determine techniques for reducing material wastage without impacting production quality.
2. Demonstrate the process of maintaining and calibrating energy-efficient machinery to ensure optimal performance and minimize environmental impact.
3. Discuss the safe and responsible handling of hazardous and non-hazardous materials in telecom manufacturing.
4. Demonstrate how to coordinate with authorized e-waste recyclers to ensure proper processing and disposal of materials.
5. Describe environmental impact assessment techniques for telecom production.
6. Demonstrate how to follow national and international environmental laws, participate in sustainability audits, check for adherence to guidelines, and implement corrective actions based on assessments.
7. Explain the documentation requirements for sustainability audits and compliance tracking.
8. Demonstrate how to maintain documentation for waste disposal, conduct periodic waste audits, and identify opportunities for further waste reduction.

Resources to be Used

Participant Handbook, Projector, Whiteboard & markers, Sample waste audit checklist, Energy-efficient equipment (demo/visual), Waste segregation bins, Sample documentation formats, PPE, Calibration sticker samples

Say

- Waste management is critical to sustainable telecom manufacturing and regulatory compliance.
- Reducing material wastage directly improves cost efficiency and environmental performance.
- Proper calibration and maintenance of machinery minimizes energy loss and emissions.
- Environmental audits help identify risks, gaps, and opportunities for continuous improvement.

Ask

- How can material wastage be reduced without affecting product quality?
- Why is calibration of machines important from an environmental point of view?
- What risks are involved in poor handling of hazardous waste?
- How do environmental audits help an organization stay compliant?

Do

- Review examples of hazardous and non-hazardous waste used in telecom production.
- Observe a sample calibration label and audit checklist.
- Identify possible waste reduction opportunities in a given production scenario.
- Discuss roles of authorized recyclers in e-waste disposal.

Elaborate

Discuss using the following key questions:

1. What techniques help reduce material wastage while maintaining quality?
2. How does preventive maintenance of machinery contribute to sustainability?
3. What are the regulatory requirements for handling hazardous waste?
4. How are environmental impact assessments conducted in telecom manufacturing?
5. Why is proper documentation essential during sustainability audits?

Connect audit outcomes to corrective actions and continuous improvement.

Demonstrate

- Demonstrate safe segregation and storage of hazardous and non-hazardous waste.
- Show how calibration status of energy-efficient machinery is checked and recorded.
- Demonstrate coordination steps with authorized e-waste recyclers (process flow).
- Show how to fill waste disposal records and audit checklists.
- Demonstrate identifying non-compliance findings and suggesting corrective actions.

Activity

1. **Activity Name:** Waste Audit and Compliance Exercise
2. **Objective:** Develop practical understanding of waste audits and environmental compliance.
3. **Type:** Group Activity
4. **Resources:** Waste audit checklist, sample records, waste bins
5. **Duration:** 30 minutes
6. **Instructions:**
   - Learners review a mock telecom production scenario.
   - Identify types of waste generated and proper disposal methods.
   - Complete a basic waste audit checklist.
   - Suggest two corrective or improvement actions to reduce waste.
7. **Outcome:** Learners gain confidence in waste management, audit participation, and compliance practices.

Notes for Facilitation

- Use real-life examples from telecom or electronics production environments.
- Emphasize compliance as part of daily operational responsibility.
- Reinforce correct documentation and record-keeping habits.
- Encourage learners to think in terms of continuous improvement.
- Highlight coordination with authorized agencies as mandatory, not optional.

Exercise

Answers to exercises for PHB

A. Multiple Choice Questions – Answers only

1. b) Accurate measurement
2. b) Lockout/Tagout
3. c) Hazardous materials
4. b) Authorized e-waste recycler
5. b) ISO 14001

B. Short Answer Questions

1. Accurate measurement before cutting, use of cutting jigs/templates, reuse of leftover cables where permitted.
2. Calibration ensures machines operate efficiently, reduce energy loss, maintain product quality, and prevent wastage.
3. Use PPE while handling, proper labeling and storage, and follow approved disposal procedures.

C. True or False – Answers

1. True
2. False
3. True
4. False

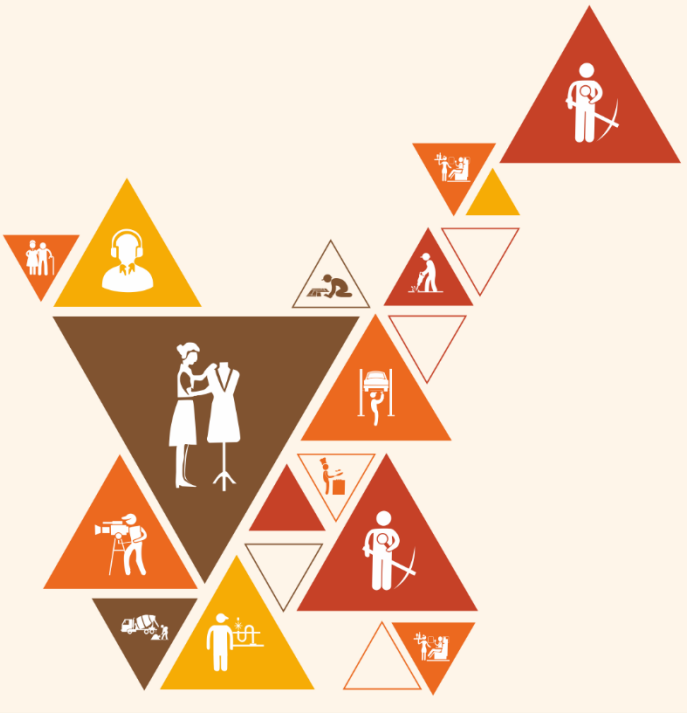
D. Fill in the Blanks

1. Fixtures
2. Lockout/Tagout
3. Environmental Impact
4. quantity

Notes

6. Employability Skills (30 Hours)

It is recommended that all training include the appropriate. Employability Skills Module. Content for the same can be accessed https://www.skillindiadigital.gov.in/content/list



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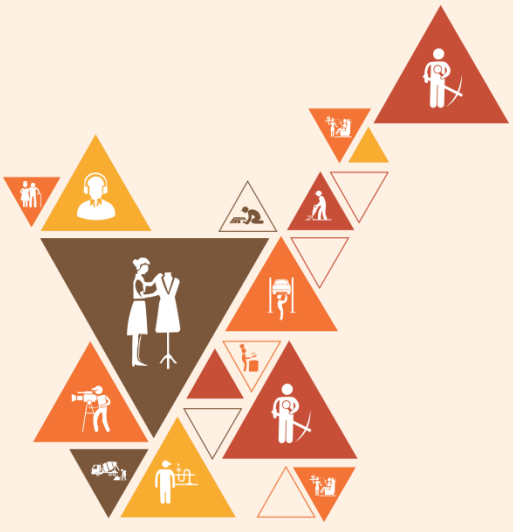
7. Annexure

Annexure I: Training Delivery Plan

Annexure II: Assessment Criteria

Annexure III: List of QR Codes used in PHB



Annexure I

Training Delivery Plan

Training Delivery Plan			
Program Name:	Hand Soldering Technician - Telecom Board		
Qualification Pack Name & Ref. ID	TEL/Q2500 & NSQF Level: 3.0		
Version No.	4.0	**Version Update Date**	08-05-2025
Pre-requisites to Training (if any)	N.A.		
Training Outcomes	**After the completion of this program, the participants will be able to:** • Explain the process of high-density hand soldering of components on telecom boards while ensuring quality, safety, and efficiency. • Describe the methods for reworking defects and performing selective soldering on telecom boards in compliance with industry standards. • Discuss the procedures for cleaning and inspecting telecom boards to ensure reliability and adherence to quality norms. • Explain sustainability practices in telecom production and assembly, including waste segregation, recycling, and compliance with environmental regulations. • Discuss the Employability and Entrepreneurship Skills.		

Sl. No.	Module Name	Session Name	Session Objectives	NOS Reference	Method ology	Training Tools / Aids	Duration (in Hours)
1	**Introduction to the Sector and the job role of Hand Soldering Technician - Telecom Boards Thery: 05:00**	Introduction to the Sector and the job role of Hand Soldering Technician - Telecom Boards	•Explain the significance of the telecom sector in modern communication and economic development. •Elucidate the key skills and technical expertise required for a Hand Soldering Technician - Telecom Boards. •Describe the challenges faced in the soldering and de-soldering components, reworking defects, and cleaning and inspecting telecom boards. •Describe the different kinds of diodes – switch and rectifier, transistors – amplifier and switch and logic gates •Describe the functions of electronic circuits (transmitters, receivers, switches, power supplies, amplifiers, multiplexers, couplers, registers, memory and all RF circuits) in different telecom equipment. • Discuss the roles and responsibilities of a Hand Soldering Technician - Telecom Boards.	Bridge Module	Facilitat or - led discussi on	Laptop, book, pen, discussi on duster, Projecto r/ slides	T: 05:00. P: 00:00

2	TEL/N2500: High-Density Hand Soldering of Components on Telecom Boards (Theory-55:00 Hours Practical-50:00 Hours)	Introduction to PCB Soldering & Standards	Understand CAD-based soldering requirements and IPC/industry standards	PC1, KU1, KU3	Interactive Lecture + Demo	Sample CAD drawings, IPC-A-610 visuals	T: 04:00. P: 04:00
		Reading CAD for Component Placement	Identify soldering requirements and placement from CAD layouts	PC1, KU1, KU4	Hands-on Practice + Guided Exercise	CAD workstation, PCB layouts	T: 04:00. P: 04:00
		Setting Up Soldering Jigs/Fixtures	Understand and apply jig setup procedures	PC2, KU5	Demonstration + Hands-on	Soldering jig/fixtures, clamps	T: 04:00. P: 04:00
		Component Identification & Collection	Identify components, compatibility, and orientation	PC3, KU7	Demonstration + Sorting Activity	Resistors, capacitors, ICs, datasheets	T: 04:00. P: 04:00
		Temperature Control & Soldering Station Setup	Understand temperature requirements, calibration, and accuracy verification	PC4, KU6	Demo + Hands-on	Soldering station, temp sensors	T: 04:00. P: 04:00
		Selecting Solder Bit, Wire & Flux	Identify correct materials for various components and boards	PC5, KU4, KU10	Demonstration	Solder bits, wires, flux types	T: 04:00. P: 04:00
		Cleaning Procedures for Boards & Components	Apply correct cleaning methods to remove oxidation/contamination	PC6, PC7, KU4, KU5	Practical Demo + Hands-on	Isopropyl alcohol, lint-free wipes, brushes	T: 04:00. P: 04:00
		Flux Application Techniques	Apply correct flux types and quantities to enhance solder quality	PC8, KU4	Demonstration + Practice	Flux pens, gels, pastes	T: 04:00. P: 04:00

		Component Positioning & Alignment	Precisely place components as per CAD and SOPs	PC9, KU7	Demo + Hands-on	Tweezers, magnifiers, PCBs	T: 04:00. P: 04:00
		Soldering Techniques & Thermal Control	Apply correct soldering technique, temperature, and nozzle vector speed	PC10, PC11, KU6	Demonstration + Hands-on	Soldering iron, reflow samples	T: 04:00. P: 04:00
		Avoiding Solder Defects	Identify and prevent bridges, cold joints, dry soldering	PC12, KU2, KU8	Demo + Defect Analysis	Sample defect boards	T: 04:00. P: 03:00
		Soldering Station Maintenance	Perform start-up, shutdown, and preventive maintenance	PC13, KU5	Hands-on Practice	Soldering station manuals	T: 04:00. P: 03:00
		Inspection & Rework Techniques	Inspect joints using magnification and rectify defects	PC14, PC15, KU8	Hands-on + Demo	Magnifier, rework tools	T: 04:00. P: 02:00
		Documentation & SHE Guidelines	Record soldering work and follow Safety, Health & Environmental norms	KU9, KU10	Lecture + Case Study	Templates, PPE, MSDS sheets	T: 03:00. P: 02:00
3	TEL/N2501: Rework on Defects and Undertake Selective Soldering (Theory-30:00 Hours Practical-70:00 Hours)	Introduction to Rework & Selective Soldering	Understand telecom board rework requirements, standards & defects	KU1, KU3	Interactive Lecture	PPT, sample boards, standards	T: 02:00. P: 06:00
		Accessing CAD Layouts & BOM	Retrieve and interpret CAD layout and BOM accurately	PC1, KU2	Demo + Hands-on	CAD software, BOM sheets	T: 02:00. P: 06:00
		Verifying Component Placement & Orientation	Compare on-board components with CAD specifications	PC2, PC3	Hands-on Exercise	PCBs, CAD view, datasheets	T: 02:00. P: 06:00
		Identifying Soldering Defects	Identify defects (burrs, bridges, pinholes, dry joints, visible damage)	PC4, KU3	Defect analysis workshop	Defect samples, magnifiers	T: 02:00. P: 06:00
		Functional Testing of PCBs	Conduct and interpret functional tests using appropriate tools	PC5, KU8	Demonstration + Practice	Multimeter, power supply, test jigs	T: 02:00. P: 06:00

		Marking and Categorizing Defects	Mark defective components and decide reuse/replace criteria	PC6, PC7	Demo + Case Studies	Marking tools, PCB samples	T: 02:00. P: 06:00
		Desoldering Techniques	Perform safe & precise desoldering of faulty joints	PC8, KU4	Hands-on Practice	Desoldering gun, wick, hot air rework station	T: 02:00. P: 06:00
		Selective Soldering Techniques	Apply selective soldering methods with proper temperature control	PC9, KU9	Demo + Practice	Selective soldering nozzles, solder fountain	T: 02:00. P: 06:00
		Avoiding Soldering Defects During Rework	Ensure compliance with solder flow, avoid overheating & cold joints	PC10, KU1, KU9	Hands-on	Solder alloys, flux, microscopes	T: 02:00. P: 06:00
		Component Reassembly & ESD Safety	Safely resolder & reassemble components while following ESD protocols	PC11, KU6	Lecture + Practice	ESD mats, wrist straps, ESD tools	T: 02:00. P: 06:00
		Microscopic Inspection & Verification	Inspect reworked joints for alignment, orientation, connectivity	PC12, KU8	Practical + Demo	Microscope, AOI samples	T: 02:00. P: 06:00
		Documentation & Escalation Protocols	Maintain rework logs, follow escalation matrix for unresolved issues	PC13, KU5	Lecture + Form-fill activity	Templates, log sheets	T: 04:00. P: 02:00
		OHS, Environmental & Material Handling Guidelines	Follow OHS, environmental rules & handling lead/lead-free solder	KU7, KU10	Safety Session + Demonstration	PPE, MSDS sheets, solder samples	T: 04:00. P: 02:00

5	TEL/N2502: Cleaning and Inspection of PCBs (Theory- 20:00 Hours Practical- 40:00 Hours)	Introduction to PCB Cleaning & Inspection	Understand the importance of PCB cleaning, inspection, and quality compliance	KU1, KU2, KU5	Interactive Lecture + Case Study	Sample PCBs, PPT, SOP manuals	T: 02:30. P: 05:00
		Cleaning Chemicals & Solvent Handling	Identify and use cleaning agents safely for PCB cleaning	PC1, KU6	Demonstration + Hands-on	Cleaning solvents, PPE, MSDS sheets	T: 02:30. P: 05:00
		Cleaning Equipment Operation	Operate vapor de-greasers and ultrasonic cleaners effectively	PC2, KU7, KU8	Demo + Practical	Vapor de-greaser, Ultrasonic cleaner, Sample PCBs	T: 02:30. P: 05:00
		PCB Drying & Packaging	Apply proper drying methods and ESD-safe storage techniques	PC3–PC4, KU11	Hands-on Practice	Drying stations, ESD bags, Storage racks	T: 02:30. P: 05:00
		Component Placement & Solder Inspection	Inspect PCBs for correct component placement, solder quality, and conformance to BOM	PC5–PC7, KU9, KU10	Hands-on + Demo	Magnifiers, AOI/inspection tools, Sample boards	T: 02:30. P: 05:00
		Defect Identification & Corrective Actions	Identify soldering or assembly defects (cold joints, bridging) and take corrective action	PC8–PC9, KU9, KU10	Practical + Group Activity	Defective PCB samples, Rework tools	T: 02:30. P: 05:00
		Documentation & Escalation Procedures	Record inspection findings and escalate non-conformities as per reporting protocols	PC10, KU3, KU4	Lecture + Exercise	Inspection forms, Logbooks, Escalation templates	T: 02:30. P: 05:00
		Equipment Maintenance & Shop Floor Audits	Conduct routine maintenance and audits for cleaning and inspection equipment	PC11–PC12, KU8	Demonstration + Practical	SMT cleaning equipment, Audit checklists	T: 02:30. P: 05:00

6	TEL/N9107: Follow sustainability practices in telecom production and assembly line processes (Theory-10:00 Hours Practical-20:00 Hours)	Identification and Segregation of Components	Understand how to identify, categorize, and store recyclable, refurbishable, and hazardous components	PC1–PC5, KU1–KU3	Lecture + Hands-on Activity	Sample PCBs, batteries, cables, labels, inventory sheets	T: 02:30 P: 0500
		Green Manufacturing and Sustainable Assembly Practices	Apply energy-efficient tools, low-emission soldering, lead-free assembly, and optimize resources in production	PC6–PC10, KU4–KU6	Demonstration + Group Discussion	Energy-efficient equipment, lead-free soldering stations, automation tools	T: 02:30 P: 0500
		Waste Disposal and Recycling	Follow proper disposal protocols, maintain records, and coordinate with e-waste recyclers	PC11–PC15, KU5–KU7, KU9	Demo + Practical Activity	Hazardous waste containers, recycling bins, documentation templates	T: 02:30 P: 0500
		Environmental Compliance and Sustainability Audits	Comply with environmental laws, participate in audits, and implement corrective actions	PC16–PC19, KU2, KU8–KU9	Lecture + Case Study	Audit checklists, ISO 14001 templates, regulatory manuals	T: 02:30 P: 0500

Total Duration	**Theory Duration 120:00** **Practical Duration 180:00**
Employability Skills (DGT/VSQ/N0102) **(https://www.skillindiadigital.gov.in/content/list)**	**30:00**
OJT	**120:00**
Total Duration	**Theory + Practical + ES + OJT 450:00**

Annexure II
Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for	
Job Role	Hand Soldering Technician - Telecom Board
Qualification Pack	TEL/Q2500
Sector Skill Council	Telecom Sector Skill Council

S. No.	Guidelines for Assessment
1	The assessment for the theory part will be based on knowledge bank of questions approved by the SSC.
2	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/ option NOS/ Set of NOS.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criterion.
5	To pass the Qualifications File, every trainee should score a minimum of 50% of aggregate marks.
6	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification File.

National Occupational Standards	NOS Code & Version	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
High-Density Hand Soldering of Components on Telecom Boards	TEL/N2500, v5.0	30	50	-	20	100	25
Rework on Defects and Undertake Selective Soldering	TEL/N2501, v4.0	30	50	-	20	100	25
Cleaning and Inspection of PCBs	TEL/N2502, v5.0	30	50	-	20	100	20
Follow Sustainability Practices in Telecom Production and Assembly Line Processes	TEL/N9107, v1.0	30	50	-	20	100	20
Employability Skills (30 Hours)	DGT/VSQ/N0101, v1.0	20	30	-	-	50	10
Total		**140**	**230**	**-**	**80**	**450**	**100**

Annexure I

QR Codes –Video Links

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
1. Introduction to the sector and the job role of a Hand Soldering Technician - Telecom Board (TEL/N2500)	Unit 1.1 - Introduction to Telecom Sector and Role of an Hand Soldering Technician - Telecom Board	Intro- duc-tion to the Telecom Sec-tor in India	https://youtu.be/Cag-bc-bivtM	Introduction to the Telecom Sector in India
		Fundamentals of Electronics in Telecom Boards	https://www.youtube.com/watch?v=4sBgu_tUpiI	Basic electronics Guide to components
2. High-Density Hand Soldering of Components on Telecom Boards (TEL/N2500)	Unit 2.1 – Preparing Telecom Boards for Soldering	Selection of Soldering Materials and Tools	https://www.youtube.com/watch?v=KElnqQ85ZdQ	Soldering and Soldering Process
		Safety, ESD Protection, and Documentation	https://www.youtube.com/watch?v=xay2p514iS8	Electrostatic Discharge
	Unit 2.2 - Performing High-Density Hand Soldering on Telecom Boards	Component Placement and Soldering Techniques	https://www.youtube.com/watch?v=aWj7N0BF26M	Types of soldering,

Module No.	Unit No.	Topic Name	Link for QR Code (s)	QR code (s)
3. Reflow Soldering on Telecom Boards (TEL/N2505)	Unit 3.1 - Verification of Telecom Boards and Identification of Defects	Soldering Defects and Rework Standards	https://www.youtube.com/watch?v=e-HsIoQKwEU	Soldering defects and their remedies
	Unit 3.2 - Selective Soldering and Rework of Defective Components	De-soldering and Selective Soldering Techniques	https://www.youtube.com/watch?v=bG7yW9FigJA	Desoldering
4. Cleaning and Inspection of Telecom Boards (TEL/N2502)	UNIT 4.1 Cleaning of PCBs	PCB Cleaning and Flux Residue	https://www.youtube.com/watch?v=Ji5aF0RkIlM	Cleaning of PCBs

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GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
RE IMAGINE FUTURE

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