COMPETENCY STANDARD

FOR

INDUSTRIAL ELECTRONICS

(LIGHT ENGINEERING SECTOR)

Skills for Industry Competitiveness and Innovation Program (SICIP)
Finance Division, Ministry of Finance

COPYRIGHT

The Competency Standards for Industrial Electronics serve as a foundational document for the development of curricula, teaching materials, and assessment tools specifically tailored for the Light Engineering sector. This document ensures that training activities align with industry requirements, enabling individuals who successfully meet the established standards through assessment to become qualified professionals in relevant roles within the sector.

Developed under the Skills for Industry Competitiveness and Innovation Program (SICIP), this document addresses the skills requirements critical for Industrial Electronics. It is owned by the Finance Division of the Ministry of Finance of the People's Republic of Bangladesh.

This document is available at:
Skills for Industry Competitiveness and Innovation Program (SICIP)
Finance Division, Ministry of Finance,
Probashi Kallyan Bhaban (Level-15 & 16)
71-72 Old Elephant Road, Eskaton Garden
Dhaka-1000
Phone: +8802 55138753-55, Fax: +88 02 55138752
Website: https://sicip.gov.bd/

INTRODUCTION

The Skills for Industry Competitiveness and Innovation Program (SICIP) has the overall objective of developing a skilled workforce adept at handling new technologies, especially for emerging industries in Bangladesh. It will expand skills training and strengthen the development of the training ecosystem to address the skills requirements of the SICIP-selected industry sectors. The program aims to (i) increase the technology-oriented skilled workforce across emerging and priority sectors, (ii) promote inclusive skilling and upskilling opportunities for women and socially disadvantaged groups, (iii) incentivize industry-university partnerships to nurture innovation capacity and improve industry competitiveness, and (iv) foster skills for climate-resilient manufacturing processes and green technologies. The program is expected to benefit about 220,000 new and existing workers over a 6-year implementation period from 2024-2029.

The SICIP Program has, therefore, taken the initiative to enhance the employability and productivity of trainees by implementing market-responsive and job-focused training programs through public and private training providers. This will require the development of competency standards for each of the occupations/trades which will provide a structured framework in the learning process to guide training providers, ensure consistent training quality, and create an alignment between the skills provided by the training institutes and the needs of the industry.

This competency standard is therefore developed to improve skills following the job roles and skill sets of the occupation and ensure that the required skills are aligned with industry requirements.

The Competency Standard also suggests integration of YouTube or similar digital platforms or downloaded clips into classroom practice to ensure simulated creation of the contents so that learners are exposed to visual demonstrations before classroom instruction or practical session, which aligns with modern learning preference and supports flipped classroom models.

The document details the format, sequencing, wording, and layout of the Competency Standard for an occupation which comprises Units of Competence and its corresponding Elements.

OVERVIEW:

A **Competency Standard** is a written specification of the knowledge, skills, and attitudes required for the performance of a job or occupation or trade corresponding to the standard of performance required in the workplace.

Competency standard:

- provides a consistent and reliable set of components for training, recognizing, and assessing people's skills, and may also have optional support materials.
- enables industry-recognized qualifications to be awarded through direct assessment of workplace competencies
- encourages the development and delivery of flexible training that suits individual and industry requirements
- encourages learning and assessment in a work-related environment which leads to verifiable workplace outcomes.

Competency Standard has been developed by a working group comprised of occupation-specific experts from the industry/institution and relevant consultants of SICIP.

Competency Standards describe the skills, knowledge, and attitude needed to perform effectively in the workplace. Competency Standards acknowledge that people can achieve vocational and technical competency in many ways by emphasizing what the learner can do, not how or where they learned to do it.

With Competency Standards, assessment and training may be conducted at the workplace, at training organization, during regular work, or through work experience, work placement, work simulation or any combination of these.

A Unit of Competency describes a distinct work activity that would normally be undertaken by one person in accordance with industry standards.

Units of Competency are documented in a standard format that comprises:

- Reference to Industry Sector, Occupational Title and Occupational Description
- Unit code
- Unit title
- Unit descriptor
- Elements and performance criteria
- Variables and range statement
- Evidence guides

Together all the parts of a Unit of Competency:

- Describe a work activity
- Guide the assessor in determining whether the candidate is competent.

Identification and validation of units of competency and elements for each occupation were made by experts from various Light Engineering companies in industry consultative workshops.

The ensuing sections of this document comprise a description of the respective occupation with all the key components of a Unit of Competence:

- An overview of all Units of Competence for the occupation and their corresponding duration required for completion of training.
- The Competency Standards that include the Unit of Competency, Unit Descriptor, Elements and Performance Criteria, Range of Variables, Curricular Content Guide, and Assessment Evidence Guide.

Units & Elements at a Glance:

Generic Competencies (18 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SICIP-LE-IEL-01-G	Apply Occupational Health and Safety (OHS) Practices in Workplace	1. Identify OHS policies and procedures 2. Practice personal health and safety procedures 3. Report hazards and risks 4. Respond to emergencies	09
SICIP-LE-IEL-02-G	Operate in a Self-Directed Team	1. Identify team goals and work processes 2. Communicate and cooperate with team members. 3. Work as a team member. 4. Solve problems as a team member	09
		Total Hour	**18 Hrs.**

Sector Specific Competencies (18 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SICIP-LE-IEL-01-S	Apply Green Practices	1. Interpret green concepts 2. Minimize resource use in the workplace 3. Implement waste management practices	18
		Total Hour	**18 Hrs.**

Occupation Specific Competencies (324 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (hours)
SICIP-LE-IEL-01-O	Apply Basic Concepts of Electrical and Electronics	1. Identify Conductors, Semiconductors, and Insulators 2. Apply Basic Electrical Circuits 3. Connect and Terminate Electrical Wiring and Circuits 4. Understand Electronics Concepts 5. Identify Industrial Electronic Components 6. Test and Check Electronic Components	54
SICIP-LE-IEL-02-O	Use Equipment and Measuring Devices in the Workplace	1. Identify Equipment and Measuring Devices 2. Use Equipment and Measuring Devices for Measurement 3. Perform Soldering of Components 4. Perform De-soldering of Components	36
SICIP-LE-IEL-03-O	Assemble Electronic Components on PCB	1. Prepare Tools and Materials for Assembly 2. Prepare PCB and Electronic Modules 3. Mount Electronic Components 4. Solder Components on PCB 5. Test and Inspect Assembled Products	54
SICIP-LE-IEL-04-O	Service Appliances and Products.	1. Identify the appliances and products. 2. Diagnose Faults in Appliances and Products 3. Disassemble Appliances and Products for Inspection 4. Repair or Replace Faulty Components 5. Test Appliances and Products for Functionality	90

		6. Reassemble and Package Appliances and Products	
SICIP-LE-IEL-05-O	Apply PLC Basics in Industrial Control	1. Identify PLC Hardware and Software Components 2. Connect PLC Input and Output Devices 3. Create basics PLC programming 4. Identify Basic PLC Faults 5. Test PLC-Controlled Systems	45
SICIP-LE-IEL-06-O	Service industrial products and systems	1. Prepare for work. 2. Install products and systems. 3. Diagnose faults and defects. 4. Repair products and systems. 5. Test products and systems.	45
		Total Hour	**324 Hrs.**

COMPETENCY STANDARD: INDUSTRIAL ELECTRONICS

The Generic Competencies

Unit of Competency: **APPLY OCCUPATIONAL HEALTH AND SAFETY (OHS) PRACTICES IN THE WORKPLACE**	**Nominal Duration:** 09 hrs.	**Unit Code:** SICIP-LE-IEL-01-G
Unit Descriptor: This unit covers knowledge, skills and attitudes required to apply occupational health and safety (OHS) practices in the workplace. It specifically includes the tasks of identifying OHS policies and procedures, practicing personal health and safety procedures, reporting hazards and risks, and responding to emergencies.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify OHS policies and procedures	1.1 **OHS policies** and safe operating procedures are read and understood. 1.2 Safety signs and symbols are identified and followed. 1.3 Emergency response, evacuation procedures and other contingency measures are determined.
2. Practice personal health and safety procedures	2.1 OHS policies and procedures are followed and practiced. 2.2 **Personal Protective Equipment (PPE)** is selected and used. 2.3 Personal health, hygiene and safety procedures are practiced.
3. Report hazards and risks	3.1 **Hazards and risks** are identified, assessed and controlled. 3.2 Incidents arising from hazards and risks are reported to authority. 3.3 Corrective actions are implemented to correct unsafe conditions in the workplace.
4. Respond to emergencies	4.1 Alarms and warning devices are responded. 4.2 **Emergency response plans and procedures** are implemented. 4.3 **First aid procedure** is applied during emergency situations.

Range of Variables

Variable	Range May include but not limited to:

1. OHS policies	1.1 International/ Local OHS requirements 1.2 Fire Safety Rules and Regulations 1.3 Industry Guidelines
2. Personal Protective Equipment (PPE)	2.1 Apron 2.2 Gloves 2.3 Safety shoes 2.4 Helmet 2.5 Face mask 2.6 Goggles and safety glasses 2.7 Ear plugs 2.8 Sun block 2.9 Chemical/Gas masks
3. Hazards and risks	3.1 Chemical hazards 3.2 Biological hazards 3.3 Physical Hazards 3.3.1 Machine hazards 3.3.2 Materials hazards 3.3.3 Tools and Equipment hazards
4. Emergency response plans and procedures	4.1 Firefighting procedures 4.2 Earthquake response procedures 4.3 Evacuation procedures 4.4 Medical and first-aid
5. First aid procedure	5.1 Washing of open wound 5.2 Washing chemically infected area 5.3 Applying bandage 5.4 Applying CPR (Cardiopulmonary Resuscitation) 5.5 Taking appropriate medicine

Curricular Content Guide:

1. Underpinning Knowledge	1.1 OHS workplace policies and procedures 1.2 Work safety procedures 1.3 Emergency procedures 1.3.1 Firefighting 1.3.2 Earthquake response 1.3.3 Explosion response 1.3.4 Accident response 1.4 Types of hazards (biological, chemical and physical) and their effects. 1.5 PPE types and uses 1.6 Personal hygiene practices 1.7 OHS awareness 1.8 Malfunctions and resolutions
2. Underpinning Skills	2.1 Identifying OHS policies and procedures 2.2 Applying personal work safety practices in the workplace 2.3 Identifying, assessing and controlling hazards and risks 2.4 Reporting incidents arising from hazards and risks 2.5 Responding to emergency procedures

	2.6 Maintaining physical well-being in the workplace 2.7 Using firefighting accessories and fire extinguishers 2.8 Implementing emergency response plans and procedures 2.9 Applying basic first aid procedures
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, sub-ordinates and seniors in the workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 PPEs 4.3 Firefighting equipment 4.4 Emergency response manual 4.5 First aid kits 4.6 Learning manual

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 described emergency procedures 1.2 followed OHS policies and procedures 1.3 selected and used personal protective equipment (PPE) 1.4 practiced personal health and safety procedures 1.5 identified, assessed and controlled hazards and risks 1.6 reported incidents arising from hazards and risks to the authority 1.7 implemented plans and procedures to respond emergency 1.8 applied basic first aid procedure
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral question 2.4 Portfolio (optional)
3. Context of Assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training 3.2 Assessment should be done by a certified assessor or occupation-specific industry expert.

Unit of Competency: **OPERATE IN A SELF-DIRECTED TEAM**	**Nominal Duration:** 09 hrs.	**Unit Code:** SICIP-LE-IEL-02-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to operate in a self-directed team. It specifically includes the tasks of identifying team goals and work processes, communicating and cooperating with team members, working and solving problems as a team member.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify team goals and work processes	1.1 Team goals and collaborative decision-making processes are identified. 1.2 Roles and responsibilities of team members are identified. 1.3 Relationships within team and with other workers are identified.
2. Communicate and cooperate with team members	2.1 Effective interpersonal skills are used to interact with team members and to contribute to activities and objectives. 2.2 Formal and informal **forms of communication** are used effectively to support team achievement. 2.3 Diversity in character is respected and valued in team functioning. 2.4 Views and opinions of other team members are understood, valued and practiced. 2.5 Workplace terminology is used correctly to assist communication.
3. Work as a team member	3.1 Duties, responsibilities, authorities, objectives and task requirements are identified and clarified with team. 3.2 Tasks are performed in accordance with organizational and team requirements, and workplace procedures & practices. 3.3 Team member's support to other members is appreciated and valued. 3.4 Agreed reporting lines are followed using standard operating procedure.
4. Solve problems as a team member	4.1 Current and potential problems faced by team are identified. 4.2 A solution to the problem is identified. 4.3 Problems are solved effectively and the outcome of the implemented solution is evaluated.

Range of Variables

Variable	Range May Include but not limited to:
1. Forms of communication	1.1 Agenda 1.2 Simple reports such as progress and incident reports 1.3 Job sheets 1.4 Operational manuals 1.5 Brochures and promotional material 1.6 Visual and graphic materials 1.7 Standards 1.8 OHS information 1.9 Signs

Curricular Content Guide:

1. Underpinning Knowledge	1.1 Team goals and collaborative decision-making processes 1.2 Roles and responsibilities of team members 1.3 Relationships within team and with other workers 1.4 Effective interpersonal skills to interact with team members 1.5 Effective formal and informal forms of communication 1.6 Value of diversity in team functioning 1.7 Correct use of workplace terminology 1.8 Team's duties, responsibilities, authorities, objectives and task requirements 1.9 Methods of identifying current and potential problems faced by a team 1.10 Effective problem-solving methods and evaluation of outcomes
2. Underpinning Skills	2.1 Identifying team goals and collaborative decision-making processes 2.2 Identifying roles and responsibilities of team members 2.3 Identifying relationships within team and with other workers 2.4 Using effective interpersonal skills to interact with team members and to contribute to activities and objectives 2.5 Using formal and informal forms of communication 2.6 Understanding and valuing views and opinions of other team members 2.7 Performing tasks in accordance with organizational and team requirements, and workplace procedures and practice 2.8 Appreciating and valuing team member's support to other members of the team

	2.9 Identifying current and potential problems faced by the team 2.10 Identifying solutions to the problem 2.11 Solving problems effectively and evaluating the outcome of the implemented solution
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, sub-ordinates and seniors in the workplace
4. Resource Implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Work book 4.3 Learning & operational manuals 4.4 Workplace tools/equipment

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 described team's duties, responsibilities, authorities, objectives and task requirements 1.2 identified team goals and work processes 1.3 communicated and cooperated with team members 1.4 used effective interpersonal skills to interact with team members 1.5 worked as a team member 1.6 solved problems as a team member
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of Assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training 3.2 Assessment should be done by a certified assessor or occupation-specific industry expert

The Sector Specific Competencies

Unit of Competency: **APPLY GREEN PRACTICES**	**Nominal Duration:** 18 hrs.	**Unit Code:** SICIP-LE-IEL-01-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to apply green practices. It specifically includes the tasks of interpreting green concepts, minimizing resource use in the workplace, and implementing waste management practices.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Interpret green concepts	1.1 **Principles of green practices** are explained. 1.2 **Sources of environmental impacts** during light engineering activities are identified. 1.3 Work activities contributing to environmental degradation, improper disposal of materials and excessive energy use are explained. 1.4 **Ways of mitigating environmental impacts** in light engineering sector are explained.
2. Minimize resource use in the workplace	2.1 Water, energy and raw material consumption are documented. 2.2 **Recyclable and non-recyclable items** are identified. 2.3 Procedures to reduce resource consumption are implemented. 2.4 Sustainable alternatives to fossil-based energy resources are explored and applied.
3. Implement waste management practices	3.1 **Different types of wastes** are identified. 3.2 Hazardous waste is disposed of according to environmental regulations. 3.3 Green habits to reduce wastes in personal and professional life are practiced.

Range of Variables

Variable	Range May include but not limited to:
1. Principles of green practices	1.1 Reducing energy consumption 1.2 6R for waste management 1.2.1 Refuse 1.2.2 Reduce 1.2.3 Reuse 1.2.4 Recycle 1.2.5 Recover 1.2.6 Repair

	1.3 Use of sustainable materials with low environmental impact 1.4 Recycling materials 1.5 Sustainable transportation
2. Sources of environmental impacts	2.1 Air pollution 2.1.1 Dust generation 2.1.2 Emission from machinery and vehicles 2.2 Water pollution 2.2.1 Debris and sediments 2.2.2 Chemical's leakage 2.3 Noise pollution 2.4 Waste generation 2.4.1 Waste 2.4.2 Non-recyclable and hazardous materials 2.5 Resource Depletion 2.5.1 Excessive use of raw materials 2.5.2 Non-renewable material uses like use of fossil fuel, steel cement etc.
3. Ways of mitigating environmental impacts	3.1 Utilizing energy-efficient equipment 3.2 Adopting renewable energy sources 3.3 Implementing site protection measures 3.4 Using reusable materials 3.5 Choosing sustainable materials 3.6 Using noise-reducing equipment and scheduling work appropriately 3.7 Optimizing logistics and delivery
4. Recyclable and non-recyclable items	4.1 Recyclable items 4.1.1 Metal 4.1.2 Wood 4.1.3 Brick 4.1.4 Concrete 4.2 Non-recyclable items 4.2.1 Paints and coatings 4.2.2 Contaminated materials like lead paint, asbestos 4.2.3 Treated wood
5. Different types of wastes	5.1 Wood waste 5.2 Metal waste 5.3 Plastic waste 5.4 Electrical system waste 5.5 Gypsum board waste 5.6 Packaging waste 5.7 Organic waste 5.8 Chemical West 5.9 Fuel/oil west

Curricular Content Guide

1. Underpinning Knowledge	1.1 Principles of green practices in light engineering sector 1.2 Ways of mitigating environmental impacts in light engineering sector 1.3 Key terms and symbols related to environmental sustainability in light engineering drawings 1.4 Sources of environmental impacts in light engineering 1.5 Methods to minimize resource consumption (water, energy, raw materials) 1.6 Waste management practices 1.7 Sustainable alternatives to fossil-based energy resources 1.8 Personal and workplace habits for reducing environmental impact
2. Underpinning Skills	2.1 Identifying sources of environmental impacts during light engineering activities 2.2 Identifying recyclable and non-recyclable items 2.3 Exploring and applying sustainable alternatives to fossil-based energy resources 2.4 Applying methods to minimize resource use in the workplace 2.5 Implementing waste management practices 2.6 Applying procedures for safely disposing of hazardous materials 2.7 Identifying different types of wastes 2.8 Documenting water, energy and material consumption in the workplace 2.9 Performing green practices in personal and professional activities
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, sub-ordinates and seniors in the workplace
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Different types of light engineering hand tools and power tools 4.3 Sustainable, re-cyclable, reusable materials 4.4 Work books 4.5 Operation and maintenance manuals 4.6 Waster segregation bins

	4.7 Learning manual 4.8 Energy-efficient equipment

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 explained the principles of green practices in light engineering 1.2 identified sources of environmental impacts 1.3 implemented procedures to minimize resource use (water, energy, raw materials) 1.4 explained ways of mitigating environmental impacts in light engineering sector 1.5 disposed of hazardous waste in compliance with safety and environmental standards 1.6 practiced green habits to reduce waste in both personal and professional life 1.7 applied methods to minimize resource use in the workplace
2. Methods of Assessment	Competency should be assessed by: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of Assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training. 3.2 Assessment should be done by a nationally certified assessor or occupation-specific industry expert.

The Occupation Specific Competencies

Unit of Competency: APPLY BASIC CONCEPTS OF ELECTRICAL AND ELECTRONICS	Nominal Duration: 54 hrs.	Unit Code: SICIP-LE-IEL-01-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to apply basic concepts of electrical and electronics. It specifically includes the tasks of identifying conductors, semiconductors and insulators, applying basic electrical circuits, connecting and terminating electrical wiring and circuits, understanding electronics concepts, identifying industrial electronics components & testing and checking electronic components.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify Conductors, Semiconductors, and Insulators	1.1 Characteristics of conductors, semiconductors, and insulators are interpreted. 1.2 **Electrical conductors** are identified based on their properties and applications. 1.3 **Semiconductors** are identified and distinguished from conductors and insulators. 1.4 **Insulators** are identified and their roles in electrical circuits are explained.
2. Apply Basic Electrical Circuits	2.1 **Electrical circuits** are identified for basic parameters. 2.2 Relationship between voltage, current, and resistance is demonstrated using Ohm's Law. 2.3 A series circuit is constructed and analyzed. 2.4 A parallel circuit is constructed and analyzed. 2.5 A mixed circuit is constructed with corresponding behaviors for current and voltage drop observed. 2.6 Electrical power is calculated using the relevant formulas. 2.7 Functionality of the circuit is checked by observing the measured parameters.
3. Connect and Terminate Electrical Wiring and Circuits	3.1 **Different types of cables and wires** are identified according to their specifications. 3.2 Electrical wiring is connected following the circuit diagrams and safety standards. 3.3 Terminations are made securely and accurately on cables and wires. 3.4 Connections are tested for proper functionality. 3.5 Electrical circuits are terminated using appropriate tools and techniques.
4. Understand Electronics	4.1 **Basic electronics concepts** are explained.

Concepts	4.2 Circuit theory and principles are interpreted. 4.3 Behavior of components in different circuits is understood. 4.4 Role of semiconductors in electronic devices is explained.
5. Identify Industrial Electronic Components	5.1 **Industrial electronic components** are identified based on their function and characteristics. 5.2 Specifications of components are interpreted. 5.3 Components are classified according to their type. 5.4 Role of each component in industrial applications is explained.
6. Test and Check Electronic Components	6.1 Electronic components are tested using appropriate measuring instruments. 6.2 Functionality of components is checked according to the manufacturer's specifications. 6.3 Test results are recorded for analysis and verification. 6.4 Faulty components are identified and marked for replacement or repair.

Range of Variables

Variable	**Range** (Includes but not limited to:)
1. Electrical conductors	1.1 Silver 1.2 Copper 1.3 Aluminum 1.4 Tungsten 1.5 Brass 1.6 Nichrome
2. Semiconductors	2.1 Germanium 2.2 Silicon 2.3 Carbon 2.4 Charcoal 2.5 Wet soil
3. Insulators	3.1 Cotton 3.2 Dry wood 3.3 Stone 3.4 Porcelain 3.5 Glass 3.6 Rubber 3.7 Ebonite 3.8 Plastic
4. Electrical circuits	4.1 Series 4.2 Parallel 4.3 Mixed (with corresponding behaviors for current and voltage drop)

5. Different types of cables and wires	**Cable types** 5.1 Power Cables 5.2 Control Cables 5.3 Communication Cables 5.4 Flexible Cables 5.5 Armored Cables 5.6 Underground Cables 5.7 Fire-Resistant Cables **Wire types** 5.8 Single-Core Wires 5.9 Multi-Core Wires 5.10 Twisted-Pair Wires 5.11 Coaxial Wires
6. Basic electronics concepts	6.1 **Voltage (V):** The potential difference that drives current through a circuit. 6.2 **Current (I):** The flow of electrical charge through a conductor. 6.3 **Resistance (R):** The opposition to the flow of current in a circuit. 6.4 **Ohm's Law:** V = I × R (Voltage = Current × Resistance). 6.5 **Power (P):** The rate at which electrical energy is used or produced. P = V × I. 6.6 **AC/DC:** Alternating Current (AC) changes direction periodically; Direct Current (DC) flows in one direction. 6.7 **Capacitance:** The ability to store electrical energy in an electric field. 6.8 **Inductance:** The ability of a conductor to resist changes in current. 6.9 **Diodes:** Allow current to flow in one direction only. 6.10 **Transistors:** Used to amplify or switch electronic signals.
7. Industrial electronic components	7.1 Resistors 7.2 Capacitors 7.3 Inductors 7.4 Diodes 7.5 Transistors 7.5.1 Bipolar Junction Transistor (BJT) 7.5.2 Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) 7.5.3 Silicon Controlled Rectifier (SCR) 7.5.4 Diode for Alternating Current (DIAC) 7.5.5 Triode for Alternating Current (TRIAC) 7.5.6 Insulated Gate Bipolar Transistor (IGBT)

	7.5.7 Unijunction Transistor (UJT) 7.6 Operational Amplifier (OP-AMP) 7.7 Relays 7.8 Transformers 7.9 Oscillators 7.10 Rectifiers 7.11 Integrated Circuits (ICs) 7.12 Microcontrollers 7.13 Sensors 7.14 Switches 7.15 Batteries 7.16 Connectors 7.17 Fuses 7.18 Heat Sinks 7.19 PCBs (Printed Circuit Boards) 7.20 Variable Resistors (Potentiometers) 7.21 Diodes (Zener Diodes, Light-Emitting Diodes) 7.22 Inductive Coils (Chokes) 7.23 Thyristors 7.24 Thick Film Resistors

Curricular Content Guide

1. Underpinning knowledge	1.1 Concept of conductors, semiconductors, and insulators and their basic properties. 1.2 Identify electrical materials based on conductivity and application. 1.3 Understand basic electrical circuits and their main components. 1.4 Understand voltage, current, resistance, and power using Ohm's Law. 1.5 Identify series, parallel, and mixed circuits and their behavior. 1.6 Identify cables, wires, and wiring methods according to specifications. 1.7 Understand safe connection and termination procedures for wiring and circuits. 1.8 Understand basic electronics concepts and component behavior.
2. Underpinning skills	2.1 Applying standard operating procedures to prepare workplace, tools, and equipment. 2.2 Following service manuals, manufacturer instructions, and safety requirements. 2.3 Selecting appropriate tools, equipment, and materials based on job needs. 2.4 Performing installation of industrial products and systems correctly and safely.

	2.5 Demonstrating troubleshooting techniques to diagnose faults and defects. 2.6 Using testing instruments to check circuits, controls, and system performance. 2.7 Performing repair, replacement, mounting, and soldering of defective parts.
3. Underpinning attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, sub-ordinates and seniors in the workplace
4. Resource implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Learning manual 4.3 Simulation/testing equipment 4.4 Drawings and sketches

Assessment Evidence Guide

1. Critical aspects of competency	Assessment must evidence that the candidate: 1.1 identified conductors, semiconductors, and insulators 1.2 applied basic electrical circuits 1.3 connected and terminated electrical wiring and circuits 1.4 understood electronics concepts 1.5 identified industrial electronic components 1.6 tested and checked electronic components performed electrical circuit connections
2. Methods of assessment	Methods of assessment may include but is not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training. 3.2 Assessment should be done by a nationally certified assessor or occupation-specific industry expert.

Unit of Competency: **USE EQUIPMENT AND MEASURING DEVICES IN THE WORKPLACE**	**Nominal Duration:** 36 hrs.	**Unit Code:** SICIP-LE-IEL-02-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to Use Equipment and Measuring Devices in the Workplace. It specifically includes the tasks of identifying equipment and measuring devices, using equipment and measuring devices for measurement, performing soldering of components and performing de-soldering of components.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify Equipment and Measuring Devices	1.1 **Equipment** and **measuring devices** are identified based on their function. 1.2 Proper use of each equipment and device is explained. 1.3 Tools required for measuring specific parameters are selected. 1.4 Condition of equipment and measuring device is checked for usability.
2. Use Equipment and Measuring Devices for Measurement	2.1 Equipment and measuring devices are selected based on the measurement requirements. 2.2 Devices are calibrated and verified for accuracy before use. 2.3 Measurement process is performed according to standard procedures. 2.4 Measurement results are recorded and analyzed for consistency.
3. Perform Soldering of Components	3.1 **Soldering tools and materials** are prepared for use. 3.2 **Soldering techniques** are demonstrated on the specified components. 3.3 Soldering process is performed according to safety standards. 3.4 Solder joints are inspected for quality and proper connection. 3.5 Excess solder is removed, and the work area is cleaned after soldering.
4. Perform De-Solder Components of Components	4.1 Components to be de-soldered are identified. 4.2 Soldering tools and materials are prepared for de-soldering. 4.3 Heat is applied to the solder joints to loosen them. 4.4 Components are carefully removed from the circuit board. 4.5 Excess solder is cleaned from the connections.

	4.6 Circuit board is inspected for damage or defects.

Range of Variables

Variable	**Range** (Includes but not limited to:)
1. Equipment	1.1 Power Supply Units (PSUs) 1.2 Oscilloscope 1.3 Micro scope 1.4 Signal/ Function Generators 1.5 Power Meters 1.6 Inductance/Capacitance Meters 1.7 Logic Analyzers
2. Measuring devices	2.1 Multimeters (Digital/Analog) 2.2 Ammeter 2.3 Voltmeter 2.4 Ohmmeter 2.5 Techo meter 2.6 Clamp Meters 2.7 Insulation Resistance Tester (Megger) 2.8 Temperature Probes/Thermometers 2.9 Frequency Counters 2.10 Phase Sequence Indicators
3. Soldering tools and materials	**Soldering Tools:** 3.1 Soldering Iron 3.2 Soldering Iron Stand 3.3 SMD re-work station 3.4 Soldering Iron Tip 3.5 Tweezers 3.6 Wire Cutters 3.7 Desoldering Pump (Solder Wick) **Soldering Materials:** 3.8 Solder (Lead-based or Lead-free) 3.9 Soldering Flux 3.10 Soldering Wire 3.11 Soldering Paste 3.12 Lead paste 3.13 Soldering Iron Tip Cleaner
4. Soldering techniques	4.1 Preparation: Clean components and PCB. Heat the soldering iron. 4.2 Tinning: Melt a small amount of solder on the iron tip. 4.3 Soldering: Heat the joint, then apply solder to the joint (not the iron). 4.4 Cooling: Let the joint cool naturally.

	4.5 Desoldering (if needed): Use a pump or wick to remove excess solder. 4.6 Cleanup: Clean the area with alcohol to remove flux residue.

Curricular Content Guide

1. Underpinning knowledge	1.1 Concept of measuring equipment and devices and their functions. 1.2 Identify appropriate tools for measuring specific electrical parameters. 1.3 Understand correct use and handling of measuring equipment. 1.4 Understand equipment condition checking for safety and accuracy. 1.5 Concept of measurement procedures and standard practices. 1.6 Understand calibration and accuracy of measuring devices. 1.7 Concept of soldering tools, materials, and techniques. 1.8 Understand safe soldering and de-soldering procedures.
2. Underpinning skills	2.1 Selecting appropriate measuring tools for specific electrical parameters. 2.2 Checking the condition and usability of equipment before use. 2.3 Using measuring devices correctly according to standard procedures. 2.4 Applying calibration and verification procedures to ensure measurement accuracy. 2.5 Recording and analyzing measurement results for consistency and reliability. 2.6 Preparing soldering and de-soldering tools and materials safely. 2.7 Performing soldering and de-soldering techniques according to safety standards.
3. Underpinning attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, sub-ordinates and seniors in the workplace
4. Resource implications	The following resources must be provided:

	4.1 Workplace (simulated or actual) 4.2 Learning manual 4.3 Simulation/testing equipment 4.4 Drawings and sketches

Assessment Evidence Guide

1. Critical aspects of competency	Assessment must evidence that the candidate: 1.1 identified equipment and measuring devices 1.2 used equipment and measuring devices for measurement 1.3 performed soldering of components 1.4 performed de-soldering of components
2. Methods of assessment	Methods of assessment may include but is not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of assessment	3.3 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training. 3.4 Assessment should be done by a nationally certified assessor or occupation-specific industry expert.

Unit of Competency: **ASSEMBLE ELECTRONIC COMPONENTS ON PCB**	**Nominal Duration:** 54 hrs.	**Unit Code:** SICIP-LE-IEL-03-O

Unit Descriptor:

This unit covers the knowledge, skills and attitudes required to assemble electronic components on PCB. It specifically includes the tasks of preparing tools and materials for assembly, preparing PCB and electronic modules, mounting electronic components, soldering components on PCB and testing and inspecting assembled products.

Elements and Performance Criteria:

(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Prepare tools and materials for assembly.	1.1 **Assembly tools** are gathered as per job requirements. 1.2 Tools are inspected for proper condition and safety. 1.3 Required electronic components and materials are selected. 1.4 Components are checked against the assembly list. 1.5 Work area is arranged and prepared for assembly. 1.6 Tools and materials are placed for easy and safe access.
2. Prepare PCB and electronic modules.	2.1 **PCB and electronic module** requirements are identified from the design brief. 2.2 Components and **symbols** are selected. 2.3 PCB layout is generated and checked for basic design rules. 2.4 PCB and module orientation and polarity are verified. 2.5 Designed PCB files are prepared for assembly or fabrication.
3. Mount electronic components.	3.1 Components are identified and sorted according to the PCB layout. 3.2 Correct component orientation and polarity are checked. 3.3 Components are placed at designated positions on the PCB. 3.4 Components are secured using appropriate mounting methods. 3.5 Mounted components are checked for alignment and stability. 3.6 Assembly is prepared for soldering or final fixing.
4. Solder components on PCB.	4.1 Soldering tools and materials are prepared and checked. 4.2 Correct soldering temperature is set. 4.3 Component leads and PCB pads are heated properly. 4.4 Solder joints are formed cleanly and securely. 4.5 Excess solder and flux residues are removed. 4.6 Soldered joints are inspected for defects.

5. Test and inspect assembled products.	5.1 Assembled products are visually inspected for defects. 5.2 Electrical connections and continuity are tested. 5.3 Functional tests are performed according to specifications. 5.4 Test results are compared with expected outcomes. 5.5 Faults or defects are identified and recorded. 5.6 Final inspection status is confirmed before approval.

Range of Variables

Variable	Range May include but not limited to:
1. Assembly tools	1.1 Soldering Iron 1.2 Soldering Station 1.3 Soldering Tip Cleaner 1.4 Tweezers 1.5 Pliers 1.6 Wire Cutters 1.7 Multimeter (for testing) 1.8 PCB Holder/Clamp 1.9 Desoldering Pump 1.10 Soldering Flux 1.11 Soldering Wire 1.12 Vacuum Pick-up Tool 1.13 Precision Screwdriver Set 1.14 ESD Wrist Strap (Electrostatic Discharge Protection) 1.15 PCB Cleaning Brush 1.16 Hot Air Rework Station 1.17 Magnifying Glass or Magnifying Lamp 1.18 PCB Stencils (for SMT assembly) 1.19 Lead Bender Tool
2. PCB and electronic module	**Printed Circuit Board (PCB)** 2.1 Single-sided PCB 2.2 Double-sided PCB 2.3 Multilayer PCB 2.4 Copper clad board 2.5 Breadboard 2.6 Prototype board (Perfboard) **Electronic module** 2.7 Power supply module 2.7.1 Rectifier module 2.7.2 Filter circuit 2.8 Relay module 2.9 Sensor module 2.10 Controller module 2.11 Display module
3. Symbols	3.1 Resistor symbol

	3.2 Capacitor symbol 3.3 Inductor symbol 3.4 Diode symbol 3.5 LED symbol 3.6 Transistor symbol 3.6.1 Bipolar Junction Transistor (BJT) 3.6.2 Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) 3.6.3 Silicon Controlled Rectifier (SCR) 3.6.4 Diode for Alternating Current (DIAC) 3.6.5 Triode for Alternating Current (TRIAC) 3.6.6 Insulated Gate Bipolar Transistor (IGBT) 3.6.7 Unijunction Transistor (UJT) 3.7 Integrated circuit (IC) symbol 3.8 Operational Amplifier (OP-AMP) symbol 3.9 Thyristors symbol 3.10 Switch symbol 3.11 Relay symbol 3.12 Power symbol 3.13 Ground symbol 3.14 Fuse symbol 3.15 Micro controller symbol 3.16 Communication symbol 3.17 Motor and actuators symbol

Curricular Content Guide

1. Underpinning knowledge	1.1 Concept of tools and materials preparation for electronic assembly work. 1.2 Identify and check assembly tools for safety, condition, and job suitability. 1.3 Understand electronic components and materials using assembly lists and design briefs. 1.4 Concept of PCB and electronic module preparation, layout, symbols, and polarity. 1.5 Understand component identification, orientation, and mounting methods on PCB. 1.6 Concept of soldering tools, temperature control, and solder joint quality. 1.7 Understand correct soldering procedures and defect prevention.
2. Underpinning skills	2.1 Selecting appropriate tools, materials, and electronic components as per job requirements. 2.2 Inspecting tools, components, and work area to ensure safety and readiness. 2.3 Arranging the work area and positioning tools and materials for safe assembly.

	2.4 Identifying and interpreting PCB layouts, symbols, orientation, and polarity. 2.5 Preparing PCB designs and files for assembly or fabrication. 2.6 Mounting electronic components accurately according to PCB layout. 2.7 Performing soldering operations with correct temperature and technique. 2.8 Inspecting and cleaning solder joints to ensure quality and reliability.
3. Underpinning attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in workplace 3.8 Good relationships with peers, sub-ordinates and seniors in workplace
4. Resource implications	Following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Computer/laptop/notebook 4.3 Learning manual 4.4 Drawings, Job specifications and work instructions

Assessment Evidence Guide

1. Critical aspects of competency	Assessment must evidence that the candidate: 1.1 prepared tools and materials for assembly 1.2 prepared PCB and electronic modules 1.3 mounted electronic components 1.4 soldered components on PCB 1.5 tested and inspected assembled products
2. Methods of assessment	Methods of assessment may include but is not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training. 3.2 Assessment should be done by a nationally certified assessor or occupation-specific industry expert.

Unit of Competency: **SERVICE APPLIANCES AND PRODUCTS**	**Nominal Duration:** 90 hrs.	**Unit Code:** SICIP-LE-IEL-04-O
Unit Descriptor: This unit of competency covers the knowledge, skills and attitudes required to service appliances and products. It specifically includes the tasks of identifying the appliances and products, diagnosing faults in appliances and products, disassembling appliances and products for inspection, repairing or replacing faulty components, testing appliances and products for functionality and reassembled and packaged appliances and products.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify the appliances and products.	1.1 **Appliances and products** are identified based on their type and function. 1.2 **Key parts of each appliance and product** are identified. 1.3 Specifications and features of each appliance and product are understood. 1.4 Compatibility of parts within each appliance is interpret.
2. Diagnose Faults in Appliances and Products.	2.1 **Faults in appliances and products** are identified through visual inspection and operational testing. 2.2 Faulty components are located by systematically checking each part of the appliance. 2.3 **Diagnostic tools** to measure electrical parameters and identify discrepancies. 2.4 **Fault-finding techniques** are identified to reduce the breakdown time. 2.5 Continuity of circuits and the resistance of key components are tested to locate faults. 2.6 Troubleshooting guides and manufacturer manuals are referenced to verify the correct diagnostic procedures.
3. Disassemble Appliances and Products for Inspection	3.1 Appliance or product is powered off and disconnected from all power sources before disassembly. 3.2 External components are removed carefully to access internal parts. 3.3 Internal components are inspected for wear or damage. 3.4 Disassembled parts are cataloged and labeled for easy identification during reassembly. 3.5 Disassembled appliance is checked for potential faults.

4. Repair or Replace Faulty Components.	4.1 Replacement parts are selected based on the appliance's specifications and compatibility. 4.2 Soldering or other **repair techniques** are applied to faulty components when necessary. 4.3 New components are installed according to manufacturer guidelines. 4.4 Connections are checked and secured to ensure proper functionality.
5. Test Appliances and Products for Functionality	5.1 Appliance or product is powered on and checked for proper operation. 5.2 **Functionality tests** are performed to ensure that all components are working as intended. 5.3 Measurements of voltage, current, and resistance are taken to verify electrical performance. 5.4 Appliance is tested under normal load conditions to ensure reliability and performance. 5.5 Appliance or product is tested for safety features, such as circuit breakers or thermal protection.

Range of Variables

Variable	**Range** May include but not limited to:
1. Appliances and Product	1.1 LED Television 1.2 Microwave Oven 1.3 Electric Rice Cooker 1.4 Electric Kettle 1.5 Blender 1.6 Juicer 1.7 Grinder 1.8 Vacuum Cleaner 1.9 IPS
2. Key parts of each appliance and product	**LED Television** 2.1 Display Panel 2.2 LED Backlight 2.3 Power Supply Unit (PSU) 2.4 Mainboard 2.5 T-Con Board 2.6 Inverter Board 2.7 Speakers 2.8 Motherboard 2.9 Remote Control Sensor 2.10 Processor (CPU) 2.11 Connectors & Ports 2.12 Frame **Microwave Oven** 2.13 Magnetron

	2.14 High voltage capacitor 2.15 High voltage transformer 2.16 High voltage diode 2.17 Turntable 2.18 Control Panel 2.19 Waveguide 2.20 Door with safety switch **Electric Rice Cooker** 2.21 Heating plate 2.22 Thermostat 2.23 Rice cooking bowl 2.24 High resistance coil 2.25 Magnetic switch 2.26 Lid 2.27 Control panel 2.28 Steam vent **Electric Kettle** 2.29 Heating Element 2.30 Body (usually stainless steel or plastic) 2.31 Power Switch 2.32 Lid 2.33 Handle 2.34 Base with Cord **Blender** 2.35 Motor 2.36 Blade Assembly 2.37 Jar (Glass or Plastic) 2.38 Control Panel 2.39 Lid **Juicer** 2.40 Motor 2.41 Juice Collector 2.42 Pulp Container 2.43 Feed Tube 2.44 Blade Assembly 2.45 Lid **Grinder** 2.46 Motor 2.47 Grinding Bowl 2.48 Blades 2.49 Control Switch 2.50 Lid **Vacuum Cleaner** 2.51 Motor 2.52 Fan 2.53 Dust Bag or Bin 2.54 Suction Hose 2.55 Filter

	2.56 Nozzle/Brush 2.57 Power Cord **IPS** 2.58 Battery 2.59 AC Input (Power Circuit) 2.60 Rectifier Circuit 2.61 Filter Capacitor 2.62 Converter Circuit 2.63 Inverter Circuit 2.64 Transformer 2.65 Pulse Width Modulation (PWM) Controller 2.66 Output Capacitor 2.67 Protection Circuit 2.68 Cooling System 2.69 DC Output 2.70 Control (switching) Circuit
3. Faults in appliances and products	3.1 Power circuit failure 3.2 Short circuit and open circuit 3.3 Battery Failure in case of IPS 3.4 Worn-out Parts 3.5 Connectivity Issues 3.6 Motherboard in case of LED TV 3.7 Circuit Board Damage 3.8 Software Malfunction in case of LED TV 3.9 Motor failure 3.10 Overheating 3.11 Transformer failure
4. Diagnostic tools	4.1 Multimeter 4.2 Oscilloscope 4.3 Thermometer 4.4 Clamp Meter 4.5 Power Meter 4.6 Signal Generator 4.7 Infrared Camera 4.8 Voltage Tester 4.9 Circuit Tester 4.10 Logic Analyzer 4.11 Frequency Counter 4.12 Diagnostic Software 4.13 Wire Tracer 4.14 Spectrum Analyzer 4.15 Test Light
5. Fault-finding techniques	5.1 Visual Inspection 5.2 Process of Elimination 5.3 Component Isolation 5.4 Circuit Testing 5.5 Signal Tracing

	5.6 Listening for Abnormal Sounds 5.7 Checking Power Supply 5.8 Measuring Voltage and Current 5.9 Heat Sensing 5.10 Smell sensing 5.11 Using Diagnostic Tools 5.12 Checking for Loose Connections 5.13 Software Troubleshooting 5.14 Resetting/Power Cycling 5.15 Cross-Referencing with Manuals
6. Repair techniques	6.1 Component Replacement 6.2 Soldering and Desoldering 6.3 Cleaning Contacts and Connectors 6.4 Troubleshooting Circuits 6.5 Tightening Loose Connections 6.6 Recalibrating and resetting devices 6.7 Reseating Components 6.8 Reflow Soldering 6.9 Patch or Software Update
7. Functionality tests	7.1 Power-On Test 7.2 Signal Test 7.3 Load Test 7.4 Performance Benchmarking 7.5 Connectivity Test 7.6 Display Test 7.7 Sound Test 7.8 Battery Life Test 7.9 Input/Output Test 7.10 Safety Test

Curricular Content Guide

1. Underpinning knowledge	1.1 Concept of appliances and products based on type, function, and application. 1.2 Identify key parts and specifications of appliances and their compatibility. 1.3 Understand common faults and symptoms in electrical and electronic appliances. 1.4 Concept of fault diagnosis using visual inspection and operational testing. 1.5 Identify diagnostic tools and fault-finding techniques to locate problems efficiently. 1.6 Understand safe disassembly procedures and inspection of internal components. 1.7 Concept of repair and replacement methods including soldering and component fitting. 1.8 Understand reassembly and connection checking for

	proper operation.
2. Underpinning skills	2.1 Identifying appliances and products based on type, function, and application. 2.2 Interpreting specifications, features, and part compatibility of appliances. 2.3 Performing visual inspection and operational testing to detect faults. 2.4 Using diagnostic tools to measure voltage, current, resistance, and continuity. 2.5 Applying fault-finding and troubleshooting techniques to locate faulty components. 2.6 Following safe isolation and disassembly procedures for appliances and products. 2.7 Inspecting and cataloging internal components for wear, damage, or defects.
3 Underpinning attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, sub-ordinates and seniors in the workplace
4 Resource implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Computer/laptop/notebook 4.3 Appliances 4.4 Products

Assessment Evidence Guide

1. Critical aspects of competency	Assessment must evidence that the candidate: 1.1 identified the appliances and products. 1.2 diagnosed faults in appliances and products 1.3 disassembled appliances and products for inspection 1.4 repaired or replaced faulty components 1.5 tested appliances and products for functionality 1.6 reassembled and packaged appliances and products
2. Methods of assessment	Methods of assessment may include but is not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or

	simulated work place after completion of the training. 3.2 Assessment should be done by a nationally certified assessor or occupation-specific industry expert.

Unit of Competency: **APPLY PLC BASICS IN INDUSTRIAL CONTROL**	**Nominal Duration:** 45 hrs.	**Unit Code:** SICIP-LE-IEL-05-O

Unit Descriptor:

This unit of competency covers the knowledge, skills and attitudes required to apply PLC basics in industrial control. It specifically includes the tasks of identifying PLC hardware and software components, connecting PLC input and output devices, creating basics PLC programming, identifying basic PLC faults and testing PLC controlled systems.

Elements and Performance Criteria:

(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify PLC hardware components.	1.1 **Components of a PLC system** are identified. 1.2 Function and role of each hardware component in the PLC system are explained. 1.3 Specifications and capabilities of the PLC hardware components are reviewed. 1.4 Communication ports and connections between PLC components are identified. 1.5 Types of input and output modules used in PLC systems are recognized.
2. Connect PLC input and output devices.	2.1 **Input devices** are connected to the PLC input module. 2.2 **Output devices** are connected to the PLC output module. 2.3 Wiring connections for input and output devices are properly made according to system specifications. 2.4 PLC input and output devices are connected to the correct channels as specified by the PLC configuration. 2.5 Functionality of connected devices is verified after installation.
3. Create basics PLC programming	3.1 **PLC programming software** is selected based on system requirements. 3.2 Program structure is created using basic programming language. 3.3 Input and output devices are configured in the PLC programming environment. 3.4 Program is tested for correctness by running simulations or on actual hardware. 3.5 Completed program is saved and documented for future reference.

4. Identify basic PLC faults.	4.1 **Common PLC faults** and faulty inputs are identified. 4.2 PLC error codes and diagnostic indicators are interpreted to locate the fault. 4.3 Condition of the PLC hardware is checked for possible faults. 4.4 Faulty PLC components are identified through systematic troubleshooting procedures. 4.5 Potential causes of PLC malfunctions are analyzed and narrowed down.
5. Test PLC-controlled systems.	5.1 PLC-controlled system is tested by simulating input signals and observing output responses. 5.2 Functionality of the PLC system is verified to ensure proper control of connected devices. 5.3 Tests are conducted on the system's logic and operation to ensure it meets design specifications. 5.4 PLC program is tested to ensure it correctly processes input signals and controls output devices.

Range of Variables

Variable	Range May include but not limited to:
1. Components of a PLC system	1.1 CPU 1.2 Input/output modules 1.3 Power supply
2. Input devices	2.1 Sensors 2.2 Switches 2.3 Encoders
3. Output devices	3.1 Motors 3.2 Actuators 3.3 Lights
4. PLC programming software	4.1 TIA portal/ Logo Soft/ Studio 5000/ ISPSoft
5. Common PLC faults	5.1 Power issues 5.2 Wiring problems 5.3 Faulty inputs 5.4 Faulty outputs

Curricular Content Guide

1. Underpinning knowledge	1.1 Concept of PLC systems and their role in industrial control. 1.2 Identify PLC hardware components and understand their functions. 1.3 Understand PLC specifications, I/O modules, and communication ports. 1.4 Concept of PLC input and output wiring and correct channel assignment.

	1.5 Understand basic PLC programming concepts and program structure. 1.6 Identify PLC programming software and basic configuration of I/O devices. 1.7 Concept of testing PLC programs using simulation or actual hardware. 1.8 Understand common PLC faults and diagnostic indicators.
2. Underpinning skills	2.1 Interpreting functions, roles, and specifications of PLC hardware. 2.2 Connecting input and output devices to PLC modules according to configuration. 2.3 Performing correct wiring and channel assignment for PLC I/O devices. 2.4 Selecting and using PLC programming software based on system requirements. 2.5 Creating and configuring basic PLC programs and I/O parameters. 2.6 Testing and simulating PLC programs on software or actual hardware. 2.7 Diagnosing common PLC faults using error codes and troubleshooting methods.
3. Underpinning attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, subordinates and seniors in the workplace
4. Resource implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Computer/laptop/notebook 4.3 Learning manual 4.4 PLC software 4.5 Software components

Assessment Evidence Guide

1. Critical aspects of competency	Assessment must evidence that the candidate: 1.1 identified PLC hardware and software components 1.2 connected PLC input and output devices 1.3 created basics PLC programming 1.4 identified basic PLC faults

	1.5 tested PLC-controlled systems
2. Methods of assessment	Methods of assessment may include but is not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training. 3.2 Assessment should be done by a nationally certified assessor or occupation-specific industry expert.

Unit of Competency: **SERVICE INDUSTRIAL PRODUCTS AND SYSTEMS**	**Nominal Duration:** 45 hrs.	**Unit Code:** SICIP-LE-IEL-06-O
Unit Descriptor: This unit of competency covers the knowledge, skills and attitudes required to service industrial products and systems. It specifically includes the tasks of preparing for work, installing products and systems, diagnosing faults and defects and repairing products and systems and testing products and systems.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Prepare for work.	1.1 **Industrial products and systems** are checked and defects are identified, verified and recorded against customer description. 1.2 **Service manuals and information** required for installation are identified. 1.3 Repair and maintenance history are confirmed with consumer as per standard operating procedure. 1.4 Workplace is prepared for repair as per job requirement. 1.5 **Tools and equipment** are identified and selected as per job requirement.
2. Install products and systems.	2.1 Materials are identified and obtained as per job requirement. 2.2 Products and systems are installed in accordance with manufacturer's instructions. 2.3 Products and systems are tested and inspected as per standard operating procedure. 2.4 Unplanned events or conditions are responded to in accordance with standard operating procedure. 2.5 Report on installation and testing of equipment is prepared as per organizational policy. 2.6 Workplace is cleaned and cleared of all debris.
3. Diagnose faults and defects.	3.1 **Troubleshooting techniques** are identified. 3.2 Pre-testing procedure is carried out as per manufacturer's instructions. 3.3 Circuits are checked and isolated using as per standard operating procedure. 3.4 System defects or fault symptoms are identified using appropriate troubleshooting technique. 3.5 Control settings and adjustments are checked to ensure

	compliance with service-manual specifications. 3.6 Results of diagnosis and testing are recorded accurately. 3.7 Customer is informed of status and serviceability of product or system.
4. Repair products and systems.	4.1 Electro-static discharge (ESD) protection procedure is followed in accordance with industry standards. 4.2 Defective parts are repaired or replaced as per manufacturer's instructions. 4.3 Repaired or replaced parts are mounted and soldered as per job requirement. 4.4 Control settings and adjustments are checked to ensure compliance with service-manual specifications. 4.5 Repaired product or system is reassembled. 4.6 Product or system is cleaned as per standard operating procedure. 4.7 Workplace is cleaned and cleared of all debris.
5. Test products and systems.	5.1 Product or system is tested and inspected in accordance with quality standards and standard operating procedure. 5.2 Job completion is recorded and reported as per standard operating procedure.

Range of Variables

Variable	**Range** May include but not limited to:
1. Industrial products and systems	1.1 Motor controllers and drives 1.2 Sensors and input devices
2. Service manuals and information	2.1. **Manuals:** 2.1.1. Service manual/schematic diagram/parts list 2.1.2. Operating instructions/Owner's manual 2.2. **Information:** 2.2.1. Job report sheets 2.2.2. Job order 2.2.3. Bill of materials 2.2.4. Customer index 2.2.5. Service flowchart 2.2.6. Stock and inventory record 2.2.7. Requisition slips (for acquisition of parts) 2.2.8. Supplier index
3. Tools and equipment	3.1. **Tools**: 3.1.1. Screwdrivers 3.1.2. Wrenches 3.1.3. Allen keys 3.1.4. Soldering iron 3.1.5. De-soldering tools 3.1.6. Multi-testers (analog/digital)

	3.1.7. Utility knife/stripper 3.1.8. Pliers 3.1.9. Ball been hammer 3.1.10. Test jig 3.1.11. Cleaning brush 3.1.12. High-grade magnifying glass (with lamp) 3.2. **Equipment:** 3.2.1. Variable power supply 3.2.2. Step-down transformer 3.2.3. Hot air soldering station 3.2.4. Table top reflow oven 3.2.5. Function/signal generator 3.2.6. ESD-free work bench with mirror 3.2.7. Oscilloscope (digital) 3.2.8. Multi-testers 3.2.9. Flashlight/headlamp 3.2.10. High voltage probe 3.2.11. Assorted wires 3.2.12. Assorted electronic sensors
4. Troubleshooting techniques	4.1 Sensory methods 4.2 Component substitution 4.3 Signal injection and tracing 4.4 Voltage and current measurement 4.5 Continuity/resistance testing 4.6 Waveform analysis 4.7 Display analysis (for video displays) 4.8 Circuit analysis

Curricular Content Guide

1. Underpinning knowledge	1.1 Concept of industrial products and systems and common defects or service issues. 1.2 Understand service manuals, SOPs, and customer information for installation and repair work. 1.3 Identify workplace preparation, tools, equipment, and materials based on job requirements. 1.4 Concept of installation procedures following manufacturer instructions and safety standards. 1.5 Understand testing and inspection methods during and after installation. 1.6 Concept of troubleshooting techniques for diagnosing faults and defects. 1.7 Understand circuit isolation, control settings, and diagnostic recording procedures.
2. Underpinning skills	2.1 Applying standard operating procedures to prepare the workplace and job requirements. 2.2 Identifying and verifying defects using customer descriptions and service information.

	2.3 Selecting appropriate tools, equipment, and materials for installation and repair work. 2.4 Following manufacturer instructions and service manuals during installation. 2.5 Performing testing and inspection of products and systems according to SOPs. 2.6 Demonstrating troubleshooting techniques to diagnose faults and defects. 2.7 Using safe isolation, ESD protection, and repair techniques during maintenance work. 2.8 Repairing, replacing, mounting, and soldering components as per job requirements.
3. Underpinning attitudes	3.1 Commitment to occupational health and safety 3.2 Promptness in carrying out activities 3.3 Sincerity and honesty to duties 3.4 Environmental concerns 3.5 Eagerness to learn 3.6 Tidiness and timeliness 3.7 Respect for rights of peers and seniors in the workplace 3.8 Good relationships with peers, subordinates and seniors in the workplace
4. Resource implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Computer/laptop/notebook 4.3 Learning manual

Assessment Evidence Guide

1. Critical aspects of competency	Assessment must evidence that the candidate: 1.1 prepared for work. 1.2 installed products and systems. 1.3 diagnosed faults and defects. 1.4 repaired products and systems. 1.5 tested products and systems.
2. Methods of assessment	Methods of assessment may include but is not limited to: 2.1 Written test 2.2 Practical demonstration 2.3 Oral questioning 2.4 Portfolio (optional)
3. Context of assessment	3.1 Competency assessment must be done in an assessment/training center or in an actual or simulated work place after completion of the training. 3.2 Assessment should be done by a nationally certified assessor or occupation-specific industry expert.

END OF COMPETENCY STANDARD

Workshop/Lab Facility Standard

Course Name:	Industrial Electronics
Number of Trainees:	25

Course-wise Training Space:

- Class room cum Workshop lab: 700-800 sft.

Major Training Equipment and Training Facilities:

S.N.	Major Training Equipment and facilities	Required facilities
1.	Computer/Laptops	02
2.	Printer	01
3.	Multimedia Projector	01
4.	PLC CPU	01
5.	HMI	01
6.	Drive (VFD)	01
7.	Motor	01
8.	SMD re-work station	10
9.	Analog Output Module (AQ)	01
10.	Ethernet/Profinet Cables	02
11.	Multimeter	10
12.	Power Supply Unit	10
13.	Soldering Iron	25
14.	Desoldering Pump	25
15.	Oscilloscope	10
16.	Wire Strippers	25
17.	Crimping Tool	25
18.	Screwdrivers and Pliers	25
19.	PCB (Printed Circuit Board)	25
20.	Electronic Components	25
21.	Tweezers	25

22.	Hot Gun	10
23.	Component Tester	25
24.	Signal Generator	10
25.	Insulation Resistance Tester	25

The following conditions must be fulfilled –

- The institute shall not use the same facilities for any other projects/organizations offering a similar course.
- The institute must provide sufficient evidence to prove ownership of the proposed training equipment.

The list denotes the minimum training equipment and facility required to effectively conduct training for a specific course. Additionally, the institute must ensure that all other necessary training tools, equipment, and furniture are available to meet the requirement of competency standards (CS) provided by SICIP.

For the operation of training course on Industrial Electronics, the institute must ensure the availability of at least 80% of the major training equipment and training facilities (according to the CS) to be eligible for SICIP training delivery. If the score is below 80%, the remaining equipment and facilities need to be installed before the commencement of the training.

The institute will also provide all other hand tools and power tools as per CS for 25 trainees. Also, they will arrange adequate seating arrangement and classroom setup for the 25 trainees.