



COMPETENCY STANDARD

Solar Electrical System Installation and Maintenance

Level: 3

(Light Engineering Sector)

Competency Standard Code: CS-LE-SESIM-L3-EN-V1



**National Skills Development Authority
Chief Advisor's Office
Government of the People's Republic of Bangladesh**

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This Competency Standard for Solar Electrical System Installation and Maintenance is a document for the development of curricula, teaching and learning materials, and assessment tools. It also serves as the document for providing training consistent with the requirements of industry in order to meet the qualification of individuals who graduated through the established standard via competency-based assessment for a relevant job.

This document has been validated by NSDA in association with Light Engineering Sector, industry representatives, academia, related specialist, trainer and related employee.

Public and private institutions may use the information contained in this standard for activities benefitting Bangladesh.

Introduction

The NSDA aims to enhance an individual's employability by certifying completeness with skills. NSDA works to expand the skilling capacity of identified public and private training providers qualitatively and quantitatively. It also aims to establish and operationalize a responsive skills ecosystem and delivery mechanism through a combination of well-defined set of mechanisms and necessary technical supports.

Key priority economic growth sectors identified by the government have been targeted by NSDA to improve current job skills along with existing workforce to ensure required skills to industry standards. Training providers are encouraged and supported to work with industry to address identified skills and knowledge to enable industry growth and increased employment through the provision of market responsive inclusive skills training program. " **Solar Electrical System Installation and Maintenance** " is selected as one of the priority occupations of Construction Sector. This standard is developed to adopt a demand driven approach to training with effective inputs from Industry Skills Councils (ISC's), employer associations and employers.

To support this effort, technical assistance has been provided by GIZ through its Skills Development for Sustainable Energy Solutions (Skills4SE) project, which focuses on strengthening the training ecosystem for grid connected renewable energy and energy efficiency. Skills4SE works closely with NSDA, training institutions, and industry stakeholders to enhance CS & CAD, develop curricula, and provide capacity-building support for trainers and assessors in line with industry demands. Additionally, GIZ is going to support the piloting of training programs to ensure effective implementation and industry alignment.

Generally, a competency standard informs curriculum, learning materials, assessment and certification of trainees enrolled in Skills Training. Trainees who successfully pass the assessment will receive a qualification in the Bangladesh National Qualification Framework (BNQF) and will be listed on the NSDA's online portal.

This competency standard is developed to improve skills and knowledge in accordance with the job roles, duties and tasks of the occupation and ensure that the required skills and knowledge are aligned to industry requirements. A series of stakeholder consultations, workshops were held to develop this document.

The document also details the format, sequencing, wording and layout of the Competency Standard for an occupation which is comprised of 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 an occupation, trade or job corresponding to the industry standard of performance required in the workplace.

The purpose of a competency standards is to:

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

Competency standards are developed by a working group comprised of representative from NSDA, Key Institutions, ISC, and industry experts to identify the competencies required of an occupation in Light Engineering Sector.

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

With competency standards, training and assessment may be conducted at the workplace or at training institute or any combination of these.

Competency standards consist of a number of units of competency. 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 of:

- unit title
- nominal duration
- unit code
- unit descriptor
- elements and performance criteria
- variables and range statement
- curricular content guide
- assessment evidence guides

Together, all the parts of a unit of competency:

- describe a work activity
- guide the assessor to determine whether the candidate is competent or not yet competent

The ensuing sections of this document comprise of a description of the relevant occupation, trade or job with all the key components of a unit of competency, including:

- a chart with an overview of all Units of Competency for the relevant occupation, trade or job including the Unit Codes and the Unit of Competency titles and corresponding Elements
- the Competency Standard that includes the Unit of Competency, Unit Descriptor, Elements and Performance Criteria, Range of Variables, Curricular Content Guide and Assessment Evidence Guide.

**Competency Standards for National Skill Certificate, Level-3 in
Solar Electrical System Installation and Maintenance in Light Engineering Sector**

Level Descriptors of NSQF (BNQF 1-6)

Level & Job classification	Knowledge Domain	Skills Domain	Responsibility Domain
6-Mid-Level Manager/ Sub Assistant Engineer	Comprehensive actual and theoretical knowledge within a specific work or study area with an awareness of the validity and limits of that knowledge, able to analyse, compare, relate and evaluate.	Specialised and wider range of cognitive and practical skills required to provide leadership in the development of creative solutions to defined problems. Communicate professional issues and solutions to the team and to external partners/users.	Work under broad guidance and self-motivation to execute strategic and operational plan/s. Lead lower-level management. Diagnose and resolve problems within and among work groups.
5-Supervisor	Broad knowledge of the underlying, concepts, principles, and processes in a specific work or study area, able to scrutinize and break information into parts by identifying motives or causes.	Broad range of cognitive and practical skills required to generate solutions to specific problems in one or more work or study areas. Communicate practice-related problems and possible solutions to external partners.	Work under guidance of management and self-direction to resolve specific issues. Lead and take responsibility for the work and actions of group/team members. Bridge between management.
4-Highly Skilled Worker	Broader knowledge of the underlying, concepts, principles, and processes in a specific work or study area, able to solve problems to new situations by comparing and applying acquired knowledge.	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying the full range of methods, tools, materials and information. Communicate using technical terminology and IT technology with partners and users as per workplace requirements.	Work under minimal supervision in specific contexts in response to workplace requirements. Resolve technical issues in response to workplace requirements and lead/guide a team/ group.
3-Skilled Worker	Moderately broad knowledge in a specific work or study area, able to perceive ideas and abstract from drawing and design according to workplace requirements.	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools. Communicate with his team and limited external partners upholding the values, nature and culture of the workplace	Work or study under supervision with considerable autonomy. Participate in teams and responsible for group coordination.
2-Semi Skilled Worker	Basic understanding of underpinning knowledge in a specific work or study area, able to interpret and apply common occupational terms and instructions.	Skills required to carry out simple tasks, communicate with his team in the workplace presenting and discussing results of his work with required clarity.	Work or study under supervision in a structured context with limited scope of manipulation
1 –Basic Skilled Worker	Elementary understanding of ability to interpret the underpinning knowledge in a specific study area, able to interpret common occupational terms and instructions.	Specific Basic skills required to carry out simple tasks. Interpret occupational terms and present the results of own work within guided work environment/ under supervision.	Work under direct supervision in a structured context with limited range of responsibilities.

List of Abbreviations

CS	Competency Standard
ISC	Industry Skills Council
NSDA	National Skills Development Authority
BNQF	Bangladesh National Qualifications Framework
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SCVC	Standards and Curriculum Validation Committee
STP	Skills Training Provider
SOP	Standard Operating Procedure
UoC	Unit of Competency
ISO	International Organization for Standardization
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures

Approved by
40th Authority Meeting of NSDA
Held on 26 February 2025

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**Competency Standards for National Skill Certificate, Level- 3, in
Solar Electrical System Installation and Maintenance in Light Engineering Sector**

Course Structure

SL No	Unit code and Title	UOC Level	Nominal (hours)
Generic Units of Competencies			
Sector Specific Units of Competencies			
Occupation Specific Units of Competencies			
1.	OU-LE-SESIM-01-L3-V1	Prepare Site Assessment Report for Large Scale (On-Grid) System and Energy Storage System	3 20
2.	OU-LE-SESIM-02-L3-V1	Interpret Design, Drawing and Specifications for Large Scale (On-Grid) System and Energy Storage System	3 40
3.	OU-LE-SESIM-04-L3-V1	Use Hand and Power Tools in Large Scale (On-Grid) System and Energy Storage System	3 50
4.	OU-LE-SESIM-05-L3-V1	Install Large Scale (On-Grid) System and Energy Storage System	3 90
5.	OU-LE-SESIM-06-L3-V1	Maintain and Troubleshoot Large Scale (On-Grid) System and Energy Storage System	3 50
Sub Total			270
Total Duration			270

Units & Elements at Glance

Generic Competencies

Sector specific competencies

Occupation specific competencies

Code	Unit of competency	Elements of competency	Duration (hours)
OU-LE-SESIM-01-L3-V1	Prepare Site Assessment Report for Large Scale (On-Grid) System and Energy Storage System	<ol style="list-style-type: none"> 1. Conduct site inspection and collect data 2. Identify potential challenges and constraints 3. Prepare and document the site assessment report 	20
OU-LE-SESIM-02-L3-V1	Interpret Design, Drawing and Specifications for Large Scale (On-Grid) System and Energy Storage System	<ol style="list-style-type: none"> 1. Identify signs, symbols, and specifications in the layout drawing 2. Interpret layout drawings 3. Apply freehand sketching 	40
OU-LE-SESIM-03-L3-V1	Use Hand and Power Tools in Large Scale (On-Grid) System and Energy Storage System	<ol style="list-style-type: none"> 1. Select hand and power tools 2. Practice to use hand and power tools 3. Maintain hand and power tools 	50
OU-LE-SESIM -04-L3-V1	Install Large Scale (On-Grid) System and Energy Storage System	<ol style="list-style-type: none"> 1. Prepare site and system components 2. Assemble and connect components 3. Conduct pre-commissioning testing 	90
OU-LE-SESIM -05-L3-V1	Maintain and Troubleshoot Large Scale (On-Grid) System and Energy Storage System	<ol style="list-style-type: none"> 1. Perform routine maintenance 2. Identify and troubleshoot faults 3. Replace faulty components and ensure system restoration 	

Generic Units of Competencies

Sector Specific Units of Competencies

Occupation Specific Units of Competencies

Unit Code and Title	OU-LE-SESIM-01-L3-V1: Prepare Site Assessment Report for Large Scale (On-Grid) System and Energy Storage System		
Unit Descriptor	This unit of competency requires the knowledge, skills and attitude to prepare site assessment report for large scale (on-grid) system and energy storage system. It specially includes the tasks -conduct site inspection and collect data, identify potential challenges and constraints and prepare and document the site assessment report		
Nominal Hours	20 Hours		
Elements of Competency	Performance Criteria <u>Bold & underlined</u> terms are elaborated in the Range of Variables		
1. Conduct site inspection and collect data	1.1 Site inspection is conducted following occupational safety and health standards. 1.2 Relevant <u>site data</u> is collected as required. 1.3 Customer energy needs and preferences are documented. 1.4 Site and Environmental conditions are verified and recorded.		
2. Identify potential challenges and constraints	2.1 Potential shading issues and site-specific obstructions are identified; 2.1 Potential shading issues and site-specific obstructions are identified; 2.2 Structural integrity of installation surfaces is evaluated. 2.3 Placement for components are identified; 2.4 Weather conditions and potential hazards are evaluated.		
3. Prepare and document the site assessment report	3.1. Site data is consolidated; 3.1. Site data is consolidated; 3.2. Challenges, risks, and mitigation strategies are documented. 3.3. Site assessment report including recommendations is prepared.		
Range of Variables			
Variable	Range (may include but not limited to):		
1. Site data	1.1 Shading, 1.2 Roof orientation and inclination 1.3 Available space 1.4 Existing details of Substation ,generators and evacuation points.		

Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidences that the candidate: 1.1 Conducted site inspection and collect data 1.2 Identified potential challenges and constraints 1.3 Prepared and documented the site assessment report
2. Underpinning knowledge	2.1 Procedure of preparing site assessment report 2.2 Challenges and constraints of site assessment 2.3 Documentation procedure of site assessment
3. Underpinning skills	3.1 Inspecting site for assessment 3.2 Collecting Data for assessment 3.3 Preparing assessment report
4. Required attitudes	4.1. Commitment to occupational safety and health. 4.2. Promptness in carrying out activities. 4.3. Sincere and honest to duties. 4.4. Eagerness to learn. 4.5. Tidiness and timeliness. 4.6. Environmental concerns. 4.7. Respect for rights of peers and seniors at workplace. 4.8. Communication with peers and seniors at workplace.
5. Resources implication	The following resources must be provided: 5.1 Workplace (actual or simulated) 5.1 Workplace (actual or simulated) 5.2 Tools, equipment and physical facilities appropriate to perform activities. 5.3 Relevant drawings, manuals, codes, standards and reference materials.
6. Methods of assessment	Methods of assessment may include but not limited to: 6.1 written test 6.2 demonstration 6.3 oral questioning
7. Context for assessment	7.1 Competency assessment must be done in NSDA accredited assessment center 7.2 Assessment should be done by a NSDA certified/nominated assessor

Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code and Title	OU-LE-SESIM-02-L3-V1: Interpret Design, Drawing and Specifications for Large Scale (On-Grid) System and Energy Storage System
Unit Descriptor	<p>This unit covers the knowledge, skills and attitudes required to interpret design, drawing and specifications for large scale (on-grid) system and energy storage system</p> <p>It specifically includes – Identify signs, symbols and specifications in the layout drawings, interpret layout drawings and apply freehand sketching.</p>
Nominal Hours	40 Hours
Elements of Competency	<p>Performance Criteria</p> <p><u>Bold and Underlined</u> terms are elaborated in the Range of Variables.</p>
1. Identify signs, symbols and specifications in the layout drawing	<p>1.1 <u>Layout drawing</u> of the selected work plan is collected;</p> <p>1.2 Signs, symbols and specifications are identified.</p> <p>1.3 Signs, symbols and specifications are checked against job requirement.</p>
2. Interpret layout and SLD	<p>2.1 Layout drawing is interpreted.</p> <p>2.2 Placement of <u>components</u> is identified in layout drawings</p> <p>2.3 Wiring diagrams and schematics are read and understood.</p> <p>2.4 Electrical pathways and interconnections are verified from drawings.</p> <p>2.5 Walkway and plumbing line for cleaning system is identified.</p> <p>2.6 Tools and equipment are identified,</p> <p>2.7 Specifications are matched with available resources and job requirements.</p>
3. Apply freehand sketching.	<p>3.1 Freehand sketching is applied where applicable in accordance with the job requirements.</p> <p>3.2 The drawing is adjusted to the specifications.</p>
Range of Variables	
Variables	Range (may include but not limited to):
1. Layout drawings	<p>1.1 Electrical single line diagram (SLD)</p> <p>1.2 Solar mounting structure drawing</p> <p>1.3 Wiring diagram</p> <p>1.4 Layout of walkway and cleaning system</p>
2. Components	<p>2.1 Solar Module</p> <p>2.2 Module Mounting Structure (MMS)</p> <p>2.3 Inverter (On-Grid)</p> <p>2.4 Cable and connectors (DC and AC)</p>

	2.5 Remote Monitoring System 2.6 Data Logger 2.7 Hybrid Controller/ Fuel save controller 2.8 Combiner Box (AC and DC) 2.9 System protection devices 2.9.1 Surge Protector 2.9.2 Lighting Protection system 2.9.3 Earthing 2.9.4 DC switch 2.9.5 DC breaker /Fuse 2.10 Walkway 2.11 Cable Tray 2.12 Energy meter 2.13 Weather station 2.13.1 Irradiance Sensor/Pyranometer 2.13.2 Temperature sensor 2.13.3 Wind direction and speed sensor 2.14 Cleaning Tools 2.15 Battery 2.16 Energy Storage System (ESS) /Battery Storage System (BSS) 2.16.1 Energy management system (EMS) 2.16.2 Power conditioning system (PCS) 2.16.3 Battery management system (BMS) 2.16.4 Battery
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidence that the candidate: 1.1 Identified signs, symbols and specification in the drawing; 1.2 listed components, assemblies and materials in the drawing; 1.3 matched specifications with available resources and job requirements.
2. Underpinning knowledge	2.1 Interpretation of drawing. 2.2 Standard symbols in drawing. 2.3 Symbols and abbreviations used in electrical 2.4 Mechanical drawing. 2.5 Production of perpendicular and horizontal straight lines. 2.6 Linear measurement. 2.7 Dimension. 2.8 Unit conversion.

	2.9 Performance standard as per workplace standards.
3. Underpinning skills	3.1 Comprehending blueprint reading. 3.2 Identifying of symbols and abbreviations. 3.3 Selecting of fixing materials. 3.4 Using of fixing tools, spirit level and T-square. 3.5 Listing the usages of tools, accessories, equipment, components, assemblies and material
4. Underpinning attitudes	4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect for rights of peers and seniors in workplace
5. Resource implications	The following resources must be provided: 5.1. workplace (simulate or actual); 5.2. measuring tools, equipment and physical facilities appropriate to perform activities; 5.3. materials, consumables to perform activities; and 5.4. electrical drawings with SES layout.
6. Methods of assessment	6.1 Demonstration 6.2 Oral questioning 6.3 Written test
7. Context of assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor
Accreditation Requirements Training Providers must be accredited by NSDA, the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.	

Unit Code and Title	OU-LE-SESIM-03-L3-V1: Use Hand and Power Tools in Large Scale (On-Grid) System and Energy Storage System
Unit Descriptor	<p>This unit covers the knowledge, skills and attitudes required to use hand and power tools in large scale (on-grid) system and energy storage system</p> <p>It specifically includes - select hand and power tools, practice to use hand and power tools and maintain hand and power tools</p>
Nominal Hours	30 Hours
Elements of Competency	<p>Performance Criteria</p> <p><u>Bold and Underlined</u> terms are elaborated in the Range of Variables.</p>
1. Select hand and power tools	<p>1.1 <u>Hand and power tools</u> for specific <u>tasks</u> are identified.</p> <p>1.2 Tools are inspected for safety and functionality before use.</p>
2. Practice to use hand and power tools	<p>2.1 Proper techniques for using tools are demonstrated.</p> <p>2.2 Tools are used following safety guidelines and manufacturer instructions.</p>
3. Maintain hand and power tools	<p>3.1 Tools are cleaned and stored after use.</p> <p>3.2 Damaged tools are identified and repaired or replaced.</p> <p>3.3 Preventive maintenance of tools is performed periodically.</p>
Range of Variables	
Variables	Range (may include but not limited to):
1. Hand tools	<p>1.1 Screw drivers</p> <p>1.2 Diagonal cutting pliers</p> <p>1.3 Cable cutter</p> <p>1.4 Long nose pliers</p> <p>1.5 Combination pliers</p> <p>1.6 Adjustable wrenches</p> <p>1.7 Socket wrench set</p> <p>1.8 Torque wrench</p> <p>1.9 Hand punch</p> <p>1.10 Neon tester</p> <p>1.11 Battery tester</p> <p>1.12 Allen key</p> <p>1.13 Ferrule printer/ punch</p> <p>1.14 Crimping tool</p> <p>1.15 Spanner set</p> <p>1.16 Touch light</p>

	1.17 Electrician knife
2. Power tools	2.1 Hydraulic punch 2.2 Cordless drill machine 2.3 Electric hammer drill 2.4 Heat gun 2.5 Impact wrench
3. Task	3.1 Adjusting 3.2 Assembling 3.3 Straightening / flattening 3.4 Finishing items or components 3.5 Clamping 3.6 Marking and tagging
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidence that the candidate: 1.1 Selected hand and power tools 1.2 Practiced to use hand and power tools 1.3 Maintained hand and power tools
2. Underpinning knowledge	2.1 Uses of hand tools and power tools 2.2 Distinguish between hand tools and power tools 2.3 Proper utilization technique of hand and power tools. 2.4 Specification, types and use of hand and power tools. 2.5 Principles and techniques of maintenance and care of tools and equipment
3. Underpinning skills	3.1 Selecting hand tools and power tools. 3.2 Following safe practices for handling of tools and materials. 3.3 Performing maintenances of hand and power tools. 3.4 Maintaining and storing the tools.
4. Underpinning attitudes	4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect for rights of peers and seniors in workplace
5. Resource implications	5.1. Pens 5.2. Telephone 5.3. Computer 5.4. Writing materials 5.5. Online communication

6. Methods of assessment	6.1 Workplace observation 6.2 Demonstration 6.3 Oral questioning 6.4 Written test 6.5 Portfolio
7. Context of assessment	7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor
Accreditation Requirements Training Providers must be accredited by NSDA, the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.	

Unit Code and Title	OU-LE-SESIM-04-L2-V1: Install Large Scale (On-Grid) System and Energy Storage System
Unit Descriptor	<p>This unit of competency requires the knowledge, skills and attitude required to install large scale (on-grid) system and energy storage system</p> <p>It specifically includes the tasks of identifying SES components, locating and prepare place, setting the solar panel and installing components</p>
Nominal Hours	90 Hours
Elements of Competency	<p>Performance Criteria <u>Bold & underlined</u> terms are elaborated in the Range of Variables</p>
1. Prepare site and system components	<p>1.1 Necessary <u>safety</u> use are implemented at the site.</p> <p>1.2 Components are inspected and organized for assembling.</p> <p>1.3 Temporary Power Source is ensured with safety .</p>
2. Assemble and connect components	<p>2.1 <u>Components</u> are assembled as per design and manufacturer specifications.</p> <p>2.2 Electrical connections are made following wiring diagrams.</p> <p>2.3 Labeling of components and connections is ensured.</p>
3. Conduct pre-commissioning testing	<p>3.1 System is inspected for compliance with design and safety standards.</p> <p>3.2 <u>Pre-commissioning tests</u> are conducted.</p> <p>3.3 System is prepared for final commissioning.</p>
Range of Variables	
Variable	Range (may include but not limited to):
1. Safety measures	<p>1.1 Safety railing</p> <p>1.2 Lifeline</p> <p>1.3 PPE</p>
2. Components	<p>2.1 PV Module</p> <p>2.2 Module Mounting Structure(MMS)</p> <p>2.3 Inverter (On-Grid)</p> <p>2.4 Cable and connectors (DC and AC)</p> <p>2.5 Remote Monitoring System</p> <p>2.6 Data Logger</p> <p>2.7 Hybrid Controller/ Fuel save controller</p> <p>2.8 Combiner Box (AC and DC)</p> <p>2.9 System protection devices (SPD,Fuse, CB, MCCB)</p> <p>2.10 Walkway</p>

	2.11 Cable Tray 2.12 Energy meter 2.13 LPS and Surge Protection devices 2.14 Weather station 2.15 Cleaning Tools 2.16 Generator (Disel/ Gas) 2.17 Battery 2.18 Energy management system 2.19 Power conditioning system 2.20 Battery management system
3. Pre-commissioning tests	3.1 Continuity and polarity tests 3.2 Earth resistance test 3.3 Insulation test
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspect of competency	Assessment required evidences that the candidate: 1.1 Prepare site and system components 1.2 Assemble and connect components 1.3 Conduct pre-commissioning testing
2. Underpinning knowledge	2.1 List components 2.2 Use of components 2.3 Total connection procedure
3. Underpinning skills	3.1. Selecting components 3.2. Setting solar panel 3.3. Installing equipment and accessories.
4. Required attitudes	4.1 Commitment to occupational safety and health. 4.2 Promptness in carrying out activities. 4.3 Sincere and honest to duties. 4.4 Eagerness to learn. 4.5 Tidiness and timeliness. 4.6 Environmental concerns. 4.7 Respect for rights of peers and seniors at workplace. 4.8 Communicate with peers and seniors at workplace.
5. Resource implication	The following resources must be available: 5.1. workplace (actual or simulated) 5.2. Tools, equipment, materials and physical facilities appropriate to perform activities. 5.3. Relevant drawings, manuals, standards and reference materials. 5.4. Required PPEs.

6. Methods of assessment	<p>Methods of assessment may include but not limited to:</p> <p>6.1 Written test</p> <p>6.2 Demonstration</p> <p>6.3 Oral questioning</p>
7. Context of assessment	<p>7.1 Competency assessment must be done in NSDA accredited assessment centre</p> <p>7.2 Assessment should be done by a NSDA certified/nominated assessor</p>
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA</p>	

Unit Code and Title	OU-LE-SESIM-05-L3-V1: Maintain and Troubleshoot Large Scale (On-Grid) System and Energy Storage System
Unit Descriptor	This unit of competency covers the knowledge, skills and attitude required to maintain and troubleshoot large scale (on-grid) system and energy storage system. It specially includes the tasks of performing routine maintenance and identifying and troubleshoot faults.
Nominal Hours	50 Hours
Elements of Competency	Performance Criteria <u>Bold & underlined</u> terms are elaborated in the Range of Variables
1. Perform routine maintenance	1.1 <u>PPE</u> is used and OSH is observed 1.2 Routine maintenance schedule is followed. 1.3 Cleaning of system components, such as panels, is performed. 1.4 Quality of water for cleaning system is checked. 1.5 Periodic inspections of <u>wiring and connections</u> are carried out.
2. Identify and troubleshoot faults	2.1 Faulty components or connections are identified through inspection and testing. 2.2 Appropriate troubleshooting techniques are applied. 2.3 Root cause of faults is documented.
3. Replace faulty components and ensure system restoration	3.1 Faulty components are replaced with compatible and functional ones under supervision 3.2 System is tested after repair to ensure functionality. 3.3 Maintenance and repair records are updated as per standard
Range of Variables	
Variable	Range (may include but not limited to):
1. Personal Protective Equipment	1.1 Apron 1.2 Hand gloves 1.3 Face mask 1.4 Safety shoes 1.5 Goggles 1.6 Safety helmet
2. wiring and connections	2.1 Terminal connection of switches, sockets, light fixtures 2.2 Terminal connection of PV Module 2.3 Terminal connection of Battery Management System 2.4 Terminal connection of Power conditioning system

	2.5 Terminal connection of inverter 2.6 Terminal connection of battery 2.7 Switchgear and protection equipment incoming and outgoing points 2.8 Connection of solar operated motor
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspect of competency	Assessment requires evidence that the candidate: 1.1 Performed routine maintenance 1.2 Identified and troubleshoot faults 1.3 Replaced faulty components and ensure system restoration
2. Underpinning knowledge	2.1 Function of each individual component 2.2 Checking procedure of connection terminal. 2.3 Physical and operational faults of major components. 2.4 Testing process of Panel and string 2.5 Repairing or replacing technic of component or parts components. 2.6 Usages of testing instrument. 2.7 Electrical connections checking process. 2.8 Checking process of motor connection. 2.9 Motor pump and its parts.
3. Underpinning skills	3.1 Checking physical faults in the major components. 3.2 Checking operational faults in the major components 3.3 Testing panel and string. 3.4 Identifying fault code. 3.5 Checking battery for appropriate voltage. 3.6 Repairing and replacing of component 3.7 Cleaning of tools, equipment and workplace.
4. Required attitudes	4.1 Commitment to occupational safety and health. 4.2 Promptness in carrying out activities. 4.3 Sincere and honest to duties. 4.4 Eagerness to learn. 4.5 Tidiness and timeliness. 4.6 Environmental concerns. 4.7 Respect for rights of peers and seniors at workplace. 4.8 Communicate with peers and seniors at workplace.

5. Resource implication	<p>The following resources must be available:</p> <ul style="list-style-type: none"> 5.1 workplace (actual or simulated) 5.2 tools, equipment, materials and physical facilities appropriate to perform activities 5.3 relevant drawings, manuals and reference materials 5.4 required PPE.
6. Methods of assessment	<p>Methods of assessment may include but not limited to:</p> <ul style="list-style-type: none"> 6.1 written Test 6.2 demonstration 6.3 oral Questioning
7. Context of assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment centre 7.2 Assessment should be done by a NSDA certified/nominated assessor
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA</p>	

Development of Competency Standard

The Competency Standards for National Skills Certificate in Solar Electrical System Installation and Maintenance, Level-1 is developed by NSDA with assistance GIZ on 14-16 and 22-23 January 2025.

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