



COMPETENCY STANDARD
FOR
Electrical Installation and Maintenance
(Light Engineering ISC)

Level: 03

Competency Standard Code: I07S001L3V1

National Skills Development Authority
Prime Minister's Office, Bangladesh

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Introduction

The National Skills Development Authority (NSDA) aims to enhance an individual's employability by certifying competitiveness 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 skill 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 programmes. "**Electrical Installation and Maintenance**" is selected as one of the priority occupations of **Light Engineering** 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.

Generally a competency standard informs curriculum, learning materials, assessment and certification of students enrolled in TVET. Students who successfully pass the assessment will receive a qualification in the National Technical and Vocational Qualification Framework (NTVQF) 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.

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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 emphasising 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 guide

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

Bangladesh NTVQF with Job Classifications

NTVQF LEVELS	EDUCATION SECTORS			Job Classification
	Pre-Vocation Education	Vocational Education	Technical Education	
NTVQF 6			Diploma in engineering or equivalent	Middle Level Manager / Sub Assistant Engr. etc.
NTVQF 5		National Skill Certificate 5 (NSC 5)		Highly Skilled Worker / Supervisor
NTVQF 4		National Skill Certificate 4 (NSC 4)		Skilled Worker
NTVQF 3		National Skill Certificate 3 (NSC 3)		Semi-Skilled Worker
NTVQF 2		National Skill Certificate 2 (NSC 2)		Basic Skilled Worker
NTVQF 1		National Skill Certificate 1 (NSC 1)		Basic Worker
Pre-Voc 2	National Pre-Vocation Certificate 2 (NPVC 2)			Pre-Vocation Trainee
Pre-Voc 1	National Pre-Vocation Certificate 1 (NPVC 1)			Pre-Vocation Trainee

NTVQF Level Descriptors

NTVQF Level	Knowledge	Skill	Responsibility	Job Class.
6	<ul style="list-style-type: none"> Comprehensive actual and theoretical knowledge within a specific study area with an awareness of the limits of that knowledge 	<ul style="list-style-type: none"> Specialised and restricted range of cognitive and practical skills required to provide leadership in the development of creative solutions to defined problems 	<ul style="list-style-type: none"> Mange a team or teams in workplace activities where there is unpredictable change Identify and design learning programs to develop performance of team members 	Supervisor / Middle Level Manager / Sub Assistant Engr. etc.
5	<ul style="list-style-type: none"> Very broad knowledge of the underlying, concepts, principles, and processes in a specific study area 	<ul style="list-style-type: none"> Very broad range of cognitive and practical skills required to generate solutions to specific problems in one or more study areas. 	<ul style="list-style-type: none"> Take overall responsibility for completion of tasks in work or study Apply past experiences in solving similar problems 	Highly Skilled Worker / Supervisor
4	<ul style="list-style-type: none"> Broad knowledge of the underlying, concepts, principles, and processes in a specific study area 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Take responsibility, within reason, for completion of tasks in work or study Apply past experiences in solving similar problems 	Skilled Worker
3	<ul style="list-style-type: none"> Moderately broad knowledge in a specific study area. 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Work or study under supervision with some autonomy 	Semi-Skilled Worker
2	<ul style="list-style-type: none"> Basic underpinning knowledge in a specific study area. 	<ul style="list-style-type: none"> Basic skills required to carry out simple tasks 	<ul style="list-style-type: none"> Work or study under indirect supervision in a structured context 	Basic Skilled Worker
1	<ul style="list-style-type: none"> Elementary understanding of the underpinning knowledge in a specific study area. 	<ul style="list-style-type: none"> Limited range of skills required to carry out simple tasks 	<ul style="list-style-type: none"> Work or study under direct supervision in a structured context 	Basic Worker
Pre-Voc 2	<ul style="list-style-type: none"> Limited general knowledge 	<ul style="list-style-type: none"> Very limited range of skills and use of tools required to carry out simple tasks 	<ul style="list-style-type: none"> Work or study under direct supervision in a well-defined, structured context. 	Pre-Vocation Trainee
Pre-Voc 1	<ul style="list-style-type: none"> Extremely limited general knowledge 	<ul style="list-style-type: none"> Minimal range of skills required to carry out simple tasks 	<ul style="list-style-type: none"> Simple work or study exercises, under direct supervision in a clear, well defined structured context 	Pre-Vocation Trainee

Team

List of Abbreviations

General

NSDA - National Skills Development Authority

CS – Competency Standard

ILO – International Labor Organization

ISC – Industry Skills Council

NPVC – National Pre-Vocation Certificate

NTVQF – National Technical and Vocational Qualifications Framework

SCVC – Standards and Curriculum Validation Committee

TVET – Technical Vocational Education and Training

UoC – Unit of Competency

Occupation Specific Abbreviations

MSDS – Material Safety Data Sheet

OSH – Occupational Safety and Health


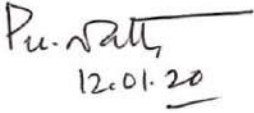
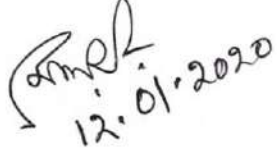
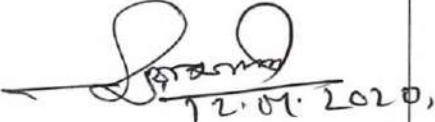
PPE – Personal Protective Equipment

SOP – Standard Operating Procedures

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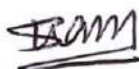
Approval of Competency Standard

Members of the Approval Committee:

Member	Signature
Md. Faruque Hossain Executive Chairman (Secretary) National Skills Development Authority (NSDA)	
Pijush Kanti Nath Additional Secretary Member (Admin & Finance) National Skills Development Authority (NSDA)	 12.01.20
Mohammad Rezaul Karim Additional Secretary Member (Skills Standard & Certification) National Skills Development Authority (NSDA)	 12.01.2020
Md. Abdur Razzaque Joint Secretary Member (Planning & Research) National Skills Development Authority (NSDA)	 12.01.2020,



Md. Faruque Hossain
Executive Chairman (Secretary)
National Skills Development Authority (NSDA)
Date: 12.01.2020



**National Competency Standards for National Skill Certificate – III in
Electrical Installation and Maintenance in Light Engineering Sector**

Course Structure

SL	Unit Code and Title		UoC Level	Nominal Duration (Hours)
The Generic Competencies				55
1	GCU01L1V1	Use Basic Mathematical Concepts	1	25
2	GCU02L1V1	Apply OSH Practices in the Workplace	1	15
3	GCU05L3V1	Carryout Workplace Interaction in English	3	15
The Sector Specific Competencies				30
1	SSU01I07L1V1	Interpret Drawings and Specifications in Electrical Installation	1	15
2	SSU02I07L1V1	Use Hand and Power Tools for Electrical Works	1	15
The Occupation Specific Competencies				275
1	OSU01I07L1V1	Perform Channel Wiring	1	40
2	OSU02I07L1V1	Install Earthing and Atmospheric Lightning Protection System	1	20
3	OSU03I07L2V1	Perform Conduit Wiring	2	35
4	OSU04I07L2V1	Perform Service Connection	2	20
5	OSU05I07L3V1	Perform Motor Connection	3	30
6	OSU06I07L3V1	Install and Maintain of Electric Motor with Control System	3	50
7	OSU07I07L3V1	Perform Motor Rewinding and Servicing	3	55
8	OSU08I07L3V1	Install and Troubleshoot Solar Electrical System	3	25
Total Nominal Learning Hours				360

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Units & Elements at Glance

The Generic Competencies

Code	Unit of Competency	Elements of Competency	Duration (Hours)
GCU01L1V1	1. Use Basic Mathematical Concepts	1.1. Identify calculation requirements in the workplace 1.2. Select appropriate mathematical methods for the calculation 1.3. Use basic mathematical concepts to calculate workplace calculation.	25
GCU02L1V1	2. Apply OSH Practices in the Workplace	2.1. Identify, control and report OSH hazards 2.2. Conduct work safely 2.3. Follow emergency response procedures 2.4. Maintain and improve health and safety in the work place	15
GCU05L3V1	3. Carryout Workplace Interaction in English	3.1. Interpret workplace communication and etiquette 3.2. Read and understand workplace documents 3.3. Participate in workplace meetings and discussions 3.4. Practice professional ethics at workplace	15

The Sector Specific Competencies

SSU01I07L1V1	1. Interpret Drawings and Specifications in Electrical Installation	1.1 Identify information from manuals 1.2 Identify drawings and specifications 1.3 Interpret drawings and specifications 1.4 Store manuals	15
SSU02I07L1V1	2. Use Hand and Power Tools for Electrical Works	2.1 Inspect hand tools and power tools for usability 2.2 Use hand tools 2.3 Operate power tools 2.4 Clean and maintain hand tools and power tools after use	15

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The Occupation Specific Competencies

OSU01I07L1V1	1. Perform Channel Wiring.	<ul style="list-style-type: none"> 1.1 Interpret drawings and specifications. 1.2 Collect tools, equipment and materials 1.3 Draw the layout to set channels and cables 1.4 Install boards and set all other accessories of wiring 1.5 Perform circuit operation as per diagram and layout 1.6 Clean the work place 	35
OSU02I07L1V1	2. Install Earthing and Atmospheric Lightning Protection System	<ul style="list-style-type: none"> 2.1 Identify the type of earthing to be used 2.2 Identify the type of lightning protection system to be used 2.3 Select and collect tools, equipment and materials 2.4 Excavate the hole for earthing element installation 2.5 Install earthing components 2.6 Finish earth pit chamber for pipe earthing method 2.7 Install lightning protection system 2.8 Clean and maintain the work area 	20
OSU03I07L2V1	3. Perform Conduit Wiring	<ul style="list-style-type: none"> 3.1 Collect tools, equipment and materials 3.2 Install conduits and set cables 3.3 Install boards and other accessories of wiring 3.4 Test the wiring 3.5 Measure the earth resistance 3.6 Clean the work place 	35
OSU04I07L2V1	4. Perform Service Connection	<ul style="list-style-type: none"> 4.1 Interpreted drawings and specifications 4.2 Collect tools, equipment and materials 4.3 Measure the distance of service line 4.4 Install cables for service connection 4.5 Install energy meter 4.6 Connect energy meter and main switch 4.7 Clean the work place 	20
OSU05I07L3V1	5. Perform Motor Connection	<ul style="list-style-type: none"> 5.1 Identify and select controlling and protective devices for motor connection 5.2 Collect tools, equipment and materials 5.3 Install, controlling and protective devices 5.4 Perform motor connection 5.5 Check and test circuit 5.6 Clean the work place 	30

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OSU06I07L3V1	6. Install and Maintain Electric Motor with Control System.	6.1 Identify and select controlling devices for motors. 6.2 Connect starter with the motors 6.3 Monitor and test conditions of motor 6.4 Service motors 6.5 Maintain tools, equipment, materials and workplace	40
OSU07I07L3V1	7. Perform Motor Rewinding and Servicing	7.1 Check the machine physically and dismantle it to detect the actual fault 7.2 Select tools and prepare material for winding / rewinding 7.3 Carry out winding / rewinding of stator, rotor and armature 7.4 Make connections, carry out pre-assembly tests and assemble the machine 7.5 Carry out final test 7.6 Record the test result	55
OSU08I07L3V1	8. Install and Troubleshoot Solar Electrical System.	8.1 Estimate electrical load of customer 8.2 Identify tools, equipment, and materials 8.3 Set solar panel 8.4 Install solar home system and accessories 8.5 Diagnose faults in solar home system unit and wiring 8.6 Repair faults in solar home system unit and wiring 8.7 Clean and store the tools and materials	40

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The Generic Competencies

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Unit code and Title	GCU01L1V1: Use Basic Mathematical Concepts
Nominal Hours	25 Hours
Unit Descriptor	This unit covers the knowledge, skill and attitudes required to use basic mathematical concepts. It specifically includes – identify calculation requirements in the workplace; select appropriate mathematical methods for the calculation; and use basic mathematical concepts to calculate workplace calculation.
Elements of Competency	Performance Criteria Bold & Underlined terms are elaborated in the Range of Variables Training Components
1. Identify calculation requirements in the workplace	1.1 Calculation requirements are identified from <u>workplace information</u>
2. Select appropriate mathematical methods for the calculation	2.1 Appropriate <u>Mathematical methods</u> are selected to carry out the calculation 2.2 <u>System and units of measurement</u> to be followed are determined
3. Use basic mathematical concepts to calculate workplace calculation	3.1 Calculations are completed using appropriate methods such as addition, subtraction, multiplication and division. 3.2 Systems and units of measurement for the task are applied to workplace calculation.
Range of Variables	
Variable	Range (may include but not limited to):
1. Equipment and tools	1.1 Calculator 1.2 Computer with office software

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2. Mathematical methods	<ul style="list-style-type: none"> 2.1 Addition 2.2 Subtraction 2.3 Division 2.4 Multiplication 2.5 Ratio on any types of real values (such as whole numbers, fractional numbers, percentages, numbers with exponents)
3. System and units of measurement	<ul style="list-style-type: none"> 3.1 Measurement 3.2 Volume 3.3 Weight 3.4 Mass 3.5 Density 3.6 Percentage 3.7 Length / Breadth / Thickness 3.8 Capacity 3.9 Time 3.10 Temperature 3.11 Budget, Pay/ Wages, Leave entitlements 3.12 Material usage 3.13 Speed 3.14 Costing
4. Workplace information	<ul style="list-style-type: none"> 4.1 Project documents 4.2 Graphs 4.3 Charts 4.4 Tables 4.5 Spread sheets 4.6 Item price quotations 4.7 Equipment manuals
5. Budget	<ul style="list-style-type: none"> 5.1 Budget of consumables 5.2 Calculation for software components 5.3 Hardware equipment 5.4 Maintenance budget of a set-up 5.5 Cost estimation
<p>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</p>	

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1. Critical Aspects of Competency	<p>Assessment required evidence that the candidate:</p> <p>1.1 Applied mathematical methods such as addition, subtraction, division and multiplication to workplace calculations</p>
2. Underpinning Knowledge	<p>Trainee will acquire knowledge of:</p> <p>2.1 Calculation requirements in the workplace 2.2 Select appropriate mathematical methods 2.3 Equipment and tools 2.4 Mathematical language, symbols and terminology 2.5 Application of units 2.6 Workplace information 2.7 Using arithmetic processes to find solutions to simple mathematical problems</p>
3. Underpinning Skills	<p>3.1 Identifying calculation requirements from workplace information 3.2 Selecting appropriate mathematical methods 3.3 Using appropriate technology 3.4 Using mathematical language, symbols and terminology 3.5 Using units of measurement (such as kg, meter) and application may include measurement, volume, weight, density, percentage etc. 3.6 Including workplace information (project documents, graphs, charts, tables, spread sheets, item price quotations, equipment manuals) 3.7 Using arithmetic processes to find solutions to simple mathematical problems 3.8 Applying OSH practices in the workplace</p>
4. Underpinning Attitude	<p>4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers, sub-ordinates and seniors in workplace</p>

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5. Resource Implications	<p>The following resources must be provided:</p> <p>5.1 Tools, equipment and physical facilities appropriate to perform activities</p> <p>5.2 Materials, consumables to perform activities</p>
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 Competencies may be assessed in the work place or a simulated work place</p> <p>7.2 Assessment should be done by NSDA certified assessor</p>

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 any NTVQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

ASOM

Unit Code and Title	GCU02L1V1 Apply OSH Practices in the Workplace
Nominal Hours	15 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to apply OSH practices in the workplace. It specifically includes – identify, control and report OSH hazards; conduct work safely; follow emergency response procedures; and maintain and improve health and safety in the workplace.
Elements of Competency	Performance Criteria <u>Bold & Underlined</u> terms are elaborated in the Range of Variables Training Components
1. Identify, control and report OSH hazards	<p>1.1 Immediate work area is routinely checked for OSH hazards prior to commencing and during work</p> <p>1.2 <u>Hazards</u> and unacceptable performance are identified and corrective action is taken within the level of responsibility</p> <p>1.3 OSH hazards and incidents are reported to appropriate personnel according to workplace procedures</p> <p>1.4 Safety Signs and symbols are identified and followed</p>
2. Conduct work safely	<p>2.1 OSH practices are applied in the workplace</p> <p>2.2 Appropriate <u>Personal Protective Equipment (PPE)</u> is selected and worn</p>
3. Follow emergency response procedures	<p>3.1 Emergency situations are identified and reported according to workplace reporting requirements</p> <p>3.2 Emergency procedures are followed as appropriate to the nature of the emergency and according to workplace procedures</p> <p>3.3 <u>Workplace procedures</u> for dealing with accidents, fires and emergencies are followed whenever necessary within scope of responsibilities</p>

4. Maintain and improve health and safety in the workplace	<p>4.1 Risks are identified and appropriate control measures are implemented in the work area</p> <p>4.2 Recommendations arising from risk assessments are implemented within level of responsibility</p> <p>4.3 Opportunities for improving OSH performance are identified and raised with relevant personnel</p> <p>4.4 Safety records according to <u>company policies</u> are maintained</p>
Range of Variables	
Variable	Range (may include but not limited to):
1. Company policies	1.1 Job-related Standard Operating Procedures (SOPs) and OSH-specific procedures. Examples of OSH procedures include consultation and participation, emergency response, response to specific hazards, incident investigation, risk assessment, reporting arrangements and issue resolution procedures
2. Workplace procedures	<p>2.1 OSH system and related documentation including policies and procedures</p> <p>2.2 Standard Operating Procedures (SOPs)</p> <p>2.3 Information on hazards and the work process, hazard alerts, safety signs and symbols</p> <p>2.4 Labels</p> <p>2.5 Material Safety Data Sheets (MSDSs) and manufacturers' advice</p>
3. Hazards	<p>3.1 OSH incidents include near misses, injuries, illnesses and property damage, noise, handling hazardous substances, other hazards</p> <p>3.2 Working with and near moving equipment / load shifting equipment</p> <p>3.3 Broken or damaged equipment or materials</p>
4. Personal Protective Equipment (PPE)	<p>4.1 Goggles</p> <p>4.2 Ear muffs</p> <p>4.3 Ear plugs</p> <p>4.4 Gloves</p> <p>4.5 Clothing</p> <p>4.6 Apron</p> <p>4.7 Helmet</p> <p>4.8 Boots</p>

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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, controlled and reported OSH hazards 1.2 Followed work safety 1.3 Followed emergency response procedures. 1.4 Maintained and improved health and safety in the workplace
2. Underpinning knowledge	Trainee with acquire knowledge of: 2.1 Personal protective equipment - Hand gloves, safety shoes, safety goggles, masks, apron, 2.2 Identification of tools and equipment 2.3 Hazardous events 2.4 Tools, equipment, machinery and relevant accessories 2.5 Communication 2.6 Job roles, responsibilities and compliance 2.7 Workplace laws
3. Underpinning skill	3.1 Using appropriate PPE 3.2 Identifying tools and equipment 3.3 Taking safety precautions and responding to different hazardous situations 3.4 Operating and using tools, equipment, machinery and accessories properly as per SOP (Company Standards) 3.5 Communicating with peers and supervisors 3.6 Applying OSH practices in the workplace
4. Required attitude	4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace

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5. Resource implication	<p>The following resources must be provided:</p> <p>5.1 Tools, equipment and physical facilities appropriate to perform activities</p> <p>5.2 Materials, consumables to perform activities</p>
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 a training center or in an actual or simulated work place after Completion of the training module</p> <p>7.2 Assessment should be done by NSDA certified assessor</p>

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 any NTVQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

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Unit Code and Title	GCU05L3V1: Carryout Workplace Interaction in English
Nominal Hours	15 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to carry out workplace interaction. It specifically includes – interpret workplace communication and etiquette; read and understand workplace documents; participate in workplace meetings and discussions; and practice professional ethics at workplace.
Elements of Competency	Performance Criteria <u>Bold & Underlined</u> terms are elaborated in the Range of Variables Training Components
1. Interpret workplace communication and etiquette	<p>1.1 Workplace code of conducts are interpreted as per organizational guidelines</p> <p>1.2 Appropriate lines of communication are maintained with supervisors and colleagues</p> <p>1.3 Workplace interactions are conducted in a <u>courteous manner</u> to gather and convey information</p> <p>1.4 Questions about routine <u>workplace procedures and matters</u> are asked and responded as required</p>
2. Read and Understand Workplace Documents	<p>2.1 Workplace documents are interpreted as per standard.</p> <p>2.2 Assistance is taken to aid comprehension when required from peers / supervisors</p> <p>2.3 Visual information / symbols / signage's are understood and followed</p> <p>2.4 Specific and relevant information are accessed from <u>appropriate sources</u></p> <p>2.5 Appropriate medium is used to transfer information and ideas</p>

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3. Participate in workplace meetings and discussions	3.1 Team meetings are attended on time and followed meeting procedures and etiquette 3.2 Own opinions are expressed and listened to those of others without interruption 3.3 Inputs are provided consistent with the meeting purpose and interpreted and implemented meeting outcomes
4. Practice professional ethics at workplace	4.1 Responsibilities as a team member are demonstrated and kept promises and commitments made to others 4.2 Tasks are performed in accordance with workplace procedures 4.3 Confidentiality is respected and maintained 4.4 Situations and actions considered inappropriate or which present a conflict of interest are avoided

Range of Variables

Variable	Range (may include but not limited to):
1. Courteous Manner	1.1 Effective questioning 1.2 Active listening 1.3 Speaking skills
2. Workplace Procedures and Matters	2.1 Notes 2.2 Agenda 2.3 Simple reports such as progress and incident reports 2.4 Job sheets 2.5 Operational manuals 2.6 Brochures and promotional material 2.7 Visual and graphic materials 2.8 Standards 2.9 OSH information 2.10 Signs
3. Appropriate Sources	3.1 HR Department 3.2 Managers 3.3 Supervisors

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

TEAM

1. Critical Aspects of Competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Followed workplace code of conducts is as per organizational guidelines 1.2 Interpreted workplace documents as per standard 1.3 Interpreted workplace instructions and symbols 1.4 Interpreted and implemented meeting outcomes
2. Underpinning Knowledge	<p>Trainee will acquire knowledge of:</p> <ul style="list-style-type: none"> 2.1 Workplace communication and etiquette 2.2 Workplace documents, signs and symbols 2.3 meeting procedure and etiquette
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Demonstrating performance of workplace communication and etiquette 3.2 Following workplace instructions and symbol 3.3 Following workplace code of conducts is as per organizational guidelines 3.4 Interpreting workplace documents as per standard 3.5 Interpreting and implementing meeting outcomes
4. Underpinning Attitudes	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource Implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 Work place Procedure 5.2 Materials relevant to the proposed activity 5.3 All tools, equipment, material and documentation required. 5.4 Relevant specifications or work instructions
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

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7. Context of Assessment	7.1 Competency assessment must be done in a training centre or in an actual or simulated work place after Completion of the training module 7.2 Assessment should be done by NSDA certified assessor
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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 any NTVQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

JAMM

The Sector Specific Competencies

ISMM

Unit Code and Title	SSU01I07L1V1: Interpret Drawings and Specifications in Electrical Installation
Nominal Hours	15 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to interpret drawings and specifications in electrical installation. It specifically includes – identify information from manuals; identify drawings and specifications; and interpret drawings and specifications.
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables Training Components
1. Identify information from manuals	1.1 Appropriate <u>manuals</u> are identified and accessed. 1.2 Version and date of manual are checked to ensure up-to-date specifications of tools, equipment, materials and procedures.
2. Identify drawings and specifications	2.1 Relevant <u>drawings</u> and <u>specifications</u> are identified. 2.2 <u>Terms and abbreviations</u> are identified. 2.3 <u>Signs and symbols</u> are identified.
3. Interpret drawings and specifications	3.1 Drawings and specifications are interpreted. 3.2 Schedules, dimensions and specifications contained in the drawings are interpreted.
4. Store manuals	4.1 Manuals and documents are collected and packed. 4.2 Manuals and Documents are stored appropriately to prevent damage, ready access and updating of information where required.
Range of Variables	
Variables	Range (may include but not limited to):

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1. Manuals	<ul style="list-style-type: none"> 1.1 Manufacturer's specification manual 1.2 Repair manual 1.3 Maintenance procedure manual 1.4 Periodic maintenance manual 1.5 Quality manual 1.6 Manual of instruction
2. Drawings	<ul style="list-style-type: none"> 2.1 Technical drawings 2.2 Sketch
3. Specifications	<ul style="list-style-type: none"> 3.1 Product specifications 3.2 Performance specifications 3.3 Method specifications
4. Terms and abbreviations	4.1 Refers to all terms and abbreviations associated with the electrical works
5. Signs and symbols	5.1 Include all signs and symbols associated with the electrical works
<p>Evidence Guide</p> <p>The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency</p>	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Identified drawings and specifications of electrical works 1.2 Interpreted drawings and specifications in electrical installation
2. Underpinning knowledge	<p>Trainee will acquire knowledge of:</p> <ul style="list-style-type: none"> 2.1 Types of electrical installation manuals 2.2 Identification of signs and symbols 2.3 Identification of units of measurement 2.4 Identification of units of conversion 2.5 Drawings and specifications 2.6 Terms and abbreviations used
3. Underpinning skill	<ul style="list-style-type: none"> 3.1 Identifying appropriate manuals 3.2 Identifying drawings and specifications 3.3 Interpreting drawings and specifications

RAM

4. Required attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource implication	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace (actual or simulated) 5.2 Necessary of all manuals 5.3 Accessibility of storage area
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 a training center or in an actual or simulated workplace after completion of the training module 7.2 Assessment should be done by NSDA certified assessor

Accreditation Requirements

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JAM

Unit Code and Title	SSU02I07L1V1: Use Hand and Power Tools for Electrical Works
Nominal Hours	15 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to use hand and power tools for electrical works. It specifically includes – inspect hand tools and power tools for usability; use hand tools; operate power tools; and maintain hand tools and power tools after use.
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables
1. Inspect hand tools and power tools for usability	1.1 Hand tools are identified 1.2 Application of tools to job requirement is interpreted 1.3 Usability of tools are checked and verified 1.4 <u>Hand tools</u> and <u>power tools</u> are prepared 1.5 Sources of power supply for power tools are identified
2. Use hand tools	2.1 Appropriate hand tool for the job is used 2.2 Proper and safe use and operation of hand tools are applied 2.3 <u>Safety precautions</u> is observed when using hand tools 2.4 Unsafe or faulty tools are identified and marked for repair
3. Operate power tools	3.1 Power supply outlet and electrical cord are inspected and confirmed safe for use in accordance with established workplace safety requirements 3.2 Proper sequence of operation is applied in using power tools 3.3 Power tools are used safely in accordance to manufacturer's operating specification

AMM

<p>4. Clean and maintain hand tools and power tools after use</p>	<p>4.1 Dust and foreign matters are removed from power tools in accordance to workplace standard</p> <p>4.2 Condition of tools is checked after use</p> <p>4.3 Appropriate lubricant is applied after use and prior to storage</p> <p>4.4 Measuring tools are checked and calibrated</p> <p>4.5 Defective tools, instruments, power tools and accessories are inspected and corrected or replaced</p>
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Range of variables

Variables	Range (may include but not limited to):
<p>1. Hand tools</p>	<p>1.1 Ball peen hammer</p> <p>1.2 Cross peen hammer</p> <p>1.3 Straight peen hammer</p> <p>1.4 Mallet / soft hammer</p> <p>1.5 Bench vise</p> <p>1.6 Soft jaw</p> <p>1.7 Rough file</p> <p>1.8 Medium file</p> <p>1.9 Smooth file</p> <p>1.10 Punches</p> <p>1.11 Chisels</p> <p>1.12 Wrenches</p> <p>1.13 Pliers</p> <p>1.14 Scriber</p> <p>1.15 Scraper</p> <p>1.16 Screw drivers</p> <p>1.17 Dividers</p> <p>1.18 Trammels</p> <p>1.19 Surface plate</p> <p>1.20 Marking table</p> <p>1.21 Height gauge</p> <p>1.22 Layout tools</p> <p>1.23 Tap sets</p> <p>1.24 Die sets</p> <p>1.25 Tap handle</p> <p>1.26 Die handle</p> <p>1.27 Hacksaw</p> <p>1.28 Paint brushes</p>

Form

	<ul style="list-style-type: none"> 1.29 Drill bits 1.30 Tap extruder 1.31 Screw Extruder 1.32 Hacksaw frame 1.33 Hacksaw blade 1.34 Rivet Gun 1.35 Sledge Hammers 1.36 Sockets 1.37 Spanners 1.38 Vice grip 1.39 Wire Cutters 1.40 Wood Planners 1.41 Hand drill machine 1.42 Hand grinding machine 1.43 Pedestal drill 1.44 Powered screw driver 1.45 Hand shear 1.46 Clamps 1.47 Jacks 1.48 Soldering iron 1.49 Allen wrenches 1.50 Draft punches
2. Power tools	<ul style="list-style-type: none"> 2.1 Power drills 2.2 Power rivet gun 2.3 Hand grinders 2.4 Pneumatic wrenches 2.5 Press machine 2.6 Jack hammer 2.7 Planers 2.8 Pedestal drills
3. Safety precautions	<ul style="list-style-type: none"> 3.1 Use of appropriate PPEs 3.2 Proper hand, feet and eye coordination 3.3 Safe condition of electrical outlets, cords and lamps 3.4 Working environment 3.5 Safe operating condition of hand tools and power tools 3.6 Awareness to OHS requirements
4. Measuring Tools	<ul style="list-style-type: none"> 4.1 Measuring tape 4.2 Steel rule 4.3 Meter rule 4.4 Outside & inside caliper

JMM

	<ul style="list-style-type: none"> 4.5 Protractors' 4.6 Tri-square 4.7 Sprit level 4.8 Vernier caliper 4.9 Micrometer 4.10 Simple protractor 4.11 Vernier protractor 4.12 Limit gauges 4.13 Snap gauges
<p>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</p>	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Used hand tools as per workplace requirement 1.2 Maintained safety precaution for using hand & power tools 1.3 Maintained operation procedure of power tools
2. Underpinning knowledge	<p>Trainee will acquire knowledge of:</p> <ul style="list-style-type: none"> 2.1 Types of hand tools and their proper uses 2.2 Types of power tools, their uses and safe handling method 2.3 Procedures in the use of hand tools and power tools 2.4 Policies and procedures for occupational health and safety 2.5 Use of PPE 2.6 Reporting and documentation 2.7 Preventive maintenance methods and techniques 2.8 Storage procedures
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Using hand tools 3.2 Maintaining tools 3.3 Maintaining safety precaution for using hand & power tools 3.4 Maintaining operation procedure of power tools 3.5 Applying proper sequence of operation

TEAM

4. Underpinning Attitudes	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace.
5. Resource Implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace (simulated or actual) 5.2 Different types of hand tools and power tools 5.3 Work books 5.4 Hand tools and power tools operating and maintenance manuals
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 a training center or in an actual or simulated work place after completion of the training module 7.2 Assessment should be done by NSDA certified assessor

Accreditation Requirements

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JAM

The Occupation Specific Competencies

SWM

Unit Code and Title	OSU01I07L1V1: Perform Channel Wiring
Nominal Hours	35 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to perform channel wiring. It specifically includes – interpret drawings and specifications; draw the layout, set channels and cables; install boards and set all other accessories of wiring; and perform circuit operation as per diagram and layout.
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables
1. Interpret drawings and specifications	1.1 Drawings are collected and interpreted. 1.2 Sign and symbols are identified. 1.3 Terms and abbreviations are identified. 1.4 Specifications are interpreted.
2. Collect tools, equipment and materials	2.1 <u>Hand tools, power tools, equipment and materials</u> are collected. 2.2 Tools, equipment and materials are <u>checked</u> for usability.
3. Draw the layout, set channels and cables	3.1 <u>PPE</u> is collected and used. 3.2 Wiring layout is drawn according to supplied drawing. 3.3 Rowel plug points are located, drilled and inserted as per procedure. 3.4 Bottom part of the channels are installed and screwed. 3.5 Cables with ECC are laid on the bottom part of the channel
4. Install boards and set all other accessories of wiring	4.1 <u>Boards</u> are collected and fitted as per wiring diagram. 4.2 Switches, sockets, fan regulator and ballast are fitted on the board with screw 4.3 Switches, sockets and fan regulator are connected to the circuits 4.4 Ceiling rose and different types of holders are fitted on the board 4.5 Those fixtures are connected to the circuit 4.6 <u>MCB</u> , and <u>MCCB</u> are connected and fitted on the board.

DOMM

5. Perform circuit operation as per diagram and layout	5.1 Bottom parts of the channels are placed and set according to drawing on the board 5.2 Cables are drawn through the bottom part of the channels 5.3 Circuit materials required for the specified circuit are placed on the board 5.4 Other accessories are connected and fitted 5.5 The bottom parts of the channels are covered with upper part of the channel
6. Clean the workplace	6.1 Tools and equipment are prepared for cleaning 6.2 Tools and equipment are stored as per standard 6.3 Waste materials are disposed as per workplace standard
Range of Variables	
Variables	Range (may include but not limited to):
1. Hand Tools	1.1 Adjustable wrench 1.2 Chisels: (a) Wooden, (b) Cold 1.3 Drill bits 1.4 Electrician knife 1.5 Files: (a) Flat (b) Round (c) Half round 1.6 Hacksaw 1.7 Hammers: (a) Ball peen, (b) Claw 1.8 Hand drill 1.9 Ladder 1.10 Mallet 1.11 Measuring tape 1.12 Neon tester 1.13 Pliers: (a) Combination pliers, (b) Cutting pliers, (c) Diagonal cutting pliers, (d) Long nose pliers, 1.14 Punches 1.15 Screwdrivers: (a) Star, (b) Flat, (c) Connecting 1.16 Set squares 1.17 Spirit leveller 1.18 Tri square 1.19 Wire cutters 1.20 Wire Gauge (S.W.G / A.W.G) 1.21 Wire stripper
2. Power Tools	2.1 Electric drill machine 2.2 Grinders 2.3 Soldering iron

ISMM

3. Equipment	3.1 Earth tester 3.2 Insulation resistance tester 3.3 Micro-meter 3.4 Multi meter / AVO meter
4. Materials	4.1 Ballast 4.2 Bulb / light 4.3 Cable (PVC, VIR) 4.4 Cable lugs 4.5 Cable tie 4.6 Channel (1/2", 3/4", 1", 1.25", 1.5" PVC) 4.7 Electric soldering lead 4.8 Fan 4.9 Fuse 4.10 Holder 4.11 Insulating clip 4.12 Insulating tape 4.13 Junction box 4.14 Plug 4.15 Rawlplug 4.16 Regulator 4.17 Screw 4.18 Socket 4.19 Switch 4.20 Switch board 4.21 Thread ball 4.22 Tube light
5. PPE	5.1 Apron 5.2 Dust mask 5.3 Goggles 5.4 Hand Gloves 5.5 Helmet 5.6 Safety belt 5.7 Safety shoes
6. Boards	6.1 Ebonite boards 6.2 Plastic board 6.3 Wooden boards

RAM

7. Fuses & MCB	<ul style="list-style-type: none"> 7.1 Cartridge fuse 7.2 Double pole MCB 7.3 Earth leakage circuit breaker (ELCB)/ RCD 7.4 MCCB 7.5 Rewire cable fuse 7.6 Single pole MCB
<p>Evidence Guide</p> <p>The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency</p>	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Drawn wiring layout 1.2 Performed circuit connection 1.3 Installed fittings and fixtures
2. Underpinning knowledge	<p>Trainee will acquire knowledge of:</p> <ul style="list-style-type: none"> 2.1 Drawings and specifications. 2.2 Signs and symbol identification 2.3 Terms and abbreviations identification 2.4 Drawings interpretation. 2.5 Different type of fittings and fixtures 2.6 Quality of fittings and fixtures use for installing 2.7 Different types of tools equipment and machinery used for installing fittings and fixtures 2.8 Fittings and fixture installation
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Using PPE 3.2 Selecting appropriate tools and equipment. 3.3 Selecting appropriate materials. 3.4 Checking specifications 3.5 Locating points 3.6 Installing channel 3.7 Laying cables 3.8 Selecting appropriate materials as per schedule 3.9 Fitting all switches, sockets, and fixtures 3.10 Installing fittings and fixtures

BRAM

4. Underpinning attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource Implication	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace (actual or simulated) 5.2 Tools and equipment appropriate to joint 5.3 Accessibility to the work place 5.4 Quality materials availability
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 a training center or in an actual or simulated workplace after completion of the training module 7.2 Assessment should be done by NSDA certified assessor

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RAM

Unit Code and Title	OSU02I07L1V1: Install Earthing and Atmospheric Lightning Protection System
Nominal Hours	20 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to install earthing and atmospheric lightning protection system. It specifically includes – identify the type of earthing to be used; identify the type of lightning protection system to be used; excavate the hole for earthing element installation; install earthing components; finish earth pit chamber for pipe earthing method.
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables
1. Identify the type of earthing to be used	1.1 <u>Types</u> and method of earthing is identified in accordance to electrical plan / design 1.2 Types and sizes of earthing materials are identified in accordance to electrical plan / design
2. Identify the type of lightning protection system to be used	2.1 <u>Types of lightning protection system</u> is identified in accordance to electrical plan / design 2.2 Types and sizes of <u>lightning protection system materials</u> are identified in accordance to electrical plan / design
3. Select and collect tools, equipment and materials	3.1 <u>Tools and equipment</u> are selected and collected 3.2 Tools and equipment are checked for usability 3.3 Earthing materials are collected and checked for conformance in accordance to specification 3.4 Lightning protection materials are collected and checked for conformance in accordance to specification

SAAM

4. Excavate the hole for earthing element installation	<p>4.1 PPE is collected and used in accordance to OHS requirements</p> <p>4.2 Hole is dug following with safety requirements</p> <p>4.3 Hole is shaped and sized in accordance to electrical plan / design specification</p>
5. Install earthing components	<p>5.1 Earthing element is fitted in the bottom of the excavated hole following standard earthing procedure</p> <p>5.2 Earth lead is connected to the earth element tightly and brought up the meter board through the conduit.</p> <p>5.3 Powdered charcoal and salt are laid around the earthing element in accordance to workplace procedure</p> <p>5.4 A proper sized and length of GI pipe is fitted from top of the earth element to the bottom of the earth pit chamber</p> <p>5.5 Rest of the excavated hole is filled with earth</p>
6. Finish earth pit chamber for pipe earthing method	<p>6.1 Earth pit chamber is constructed with brick chips, cements sand and water mixture in accordance with standard/specification.</p> <p>6.2 Pit chamber cover is made with G.I sheet in accordance with electrical plan/design</p> <p>6.3 Pit cover is fitted/installed on the pit chamber</p> <p>6.4 Check earth resistance in accordance with electrical plan / specification</p>
7. Install lightning protection system	<p>7.1 Lightning rod is installed at specified location</p> <p>7.2 Earth down conductor is connected as per diagram</p> <p>7.3 Performance of lightning protection system(LPS) is tested as per standard</p>
8. Clean and maintain the work area	<p>8.1 Electrical tools / instruments are cleaned and checked for operability</p> <p>8.2 Work area is cleaned and waste materials are disposed in accordance with workplace requirements</p>
Range of Variables	
Variables	Range (may include but not limited to):

JAM

1. Earthing materials	1.1 Continuity conductor / cable 1.2 Earthing lead 1.3 Earth electrode / plate 1.4 Connector 1.5 G.I. pipe / conduit 1.6 Bolts and nuts 1.7 Powdered charcoal 1.8 Salt
2. Types of earthing	2.1 Pipe earthing 2.2 Rod earthing 2.3 Plate earthing 2.4 Waterman earthing 2.5 Strip or wire earthing
3. Tools and equipment	3.1 Tools 3.1.1 Measuring tape (30m) 3.1.2 Tri- square 3.1.3 Pocket tape (3m) 3.1.4 Claw hammer / crow bar 3.1.5 Wire stripper 3.1.6 Adjustable wrench 3.1.7 Bolt cutters 3.1.8 C-clamp 3.1.9 Chisels: (wooden, cold) 3.1.10 Drill bits 3.1.11 Files: (flat, round, half round) 3.1.12 Hand hacksaw 3.1.13 Hammers: (ball peen, claw) 3.1.14 Pliers: (combination pliers, cutting pliers, diagonal cutting pliers, long nose pliers) 3.1.15 Punches 3.1.16 Screwdrivers: (star, negative, positive) 3.1.17 Electrician knife 3.2 Equipment 3.2.1 Electric drill machine 3.2.2 Soldering iron 3.2.3 Megger tester 3.2.4 Multi meter/AVO meter 3.2.5 Earth Tester

BAM

4. PPE	<ul style="list-style-type: none"> 4.1 Safety shoes 4.2 Safety gloves 4.3 Safety helmet 4.4 Apron
5. Types of lightning protection system	<ul style="list-style-type: none"> 5.1 Conventional LPS 5.2 Non-conventional LPS
6. Lightning protection system materials	<ul style="list-style-type: none"> 6.1 Lightning rod (spike arrester) 6.2 Earth down conductor (arrester) 6.3 Check terminal 6.4 Earth lead
<p>Evidence Guide</p> <p>The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.</p>	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Followed OHS regulations for the required job 1.2 Tested earth resistance as per standard procedure 1.3 Tested the performance of LPS as per standard procedure
2. Underpinning knowledge	<p>Trainee will acquire knowledge of:</p> <ul style="list-style-type: none"> 2.1 Types of earthing 2.2 Materials required for earthing 2.3 Procedure of earthing 2.4 Testing procedure of earthing 2.5 Types of LPS 2.6 Materials required for LPS 2.7 Installation procedure of LPS 2.8 Performance testing procedure of LPS
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Collecting earthing and LPS materials and checked for conformance in accordance to specification 3.2 Excavating a hole for the earthing element 3.3 Fitting earthing element in the bottom of the excavated hole following standard earthing procedure 3.4 Connecting earth lead to the earth element tightly and brought up the meter board through the conduit 3.5 Installing lightning rod at specified location 3.6 Connecting earth down conductor as per diagram

SWMM

	<p>3.7 Testing the performance of lightning protection system(LPS) as per standard</p> <p>3.8 Checking earth loop resistance using appropriate test instrument</p>
4. Underpinning Attitudes	<p>4.1 Commitment to occupational health and safety</p> <p>4.2 Promptness in carrying out activities</p> <p>4.3 Sincere and honest to duties</p> <p>4.4 Environmental concerns</p> <p>4.5 Eagerness to learn</p> <p>4.6 Tidiness and timeliness</p> <p>4.7 Respect for rights of peers and seniors in workplace</p> <p>4.8 Communication with peers and seniors in workplace</p>
5. Resource Implications	<p>The following resources must be provided:</p> <p>5.1 Workplace (simulated or actual)</p> <p>5.2 Tools and equipment required for the job</p> <p>5.3 Materials required</p> <p>5.4 Work books</p> <p>5.5 Diagram and instruction manual</p>
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 a training center or in an actual or simulated work place after completion of the training module</p> <p>7.2 Assessment should be done by NSDA certified assessor</p>

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RAM

Unit Code and Title	OSU03I07L2V1: Perform Conduit Wiring
Nominal Hours	35 Hours
Unit Descriptor	This unit covers the knowledge, Skills and attitudes required to perform conduit wiring. It specifically includes – install conduits and set cables; install boards and other accessories of wiring; test the wiring; and measure the earth resistance.
Elements of Competency	Performance Criteria Bold and Underlined terms are elaborated in the Range of Variables.
1. Collect tools, equipment and materials	1.1. <u>Hand tools, power tools, equipment</u> and <u>materials</u> are checked for usability 1.2. <u>PPEs</u> are collected and used 1.3. Drawings are collected and interpreted
2. Install conduits and set cables	2.1. Layout is drawn on the wall as per drawing 2.2. Wall is cut and grooved 2.3. Collected conduits are cut and set 2.4. Conduits are installed on the wall and clamped 2.5. Fish wires are measured and cut 2.6. Fish wire is inserted 2.7. Collected cables are cut 2.8. Cables are tied with fish wire and insert into the conduit.
3. Install boards and other accessories of wiring	3.1. <u>Boards</u> are collected and fitted. 3.2. Switches, sockets, fan regulator and ballast are fitted on the board with screw. 3.3. Switches, sockets and fan regulator are connected to the circuits. 3.4. Ceiling rose and different types of holders are fitted on the board. 3.5. Those fixtures are connected to the circuit. 3.6. <u>MCB</u> , and <u>MCCB</u> are connected and fitted on the board.

RAM

4. Test the wiring	<p>4.1 Polarity of wiring is checked by megger as per procedure</p> <p>4.2 Polarity is justified and checked each of the switches, fuses and circuit breakers</p> <p>4.3 The main switches and circuit breakers are disconnected</p> <p>4.4 All loads are connected and checked the continuity each of the switches and circuit breakers</p> <p>4.5 By observing the zero positions of the megger continuity is tested and insulation resistance is measured</p>
5. Measure the earth resistance	<p>5.1 The earth terminals are connected as per the appropriate measurements and positions.</p> <p>5.2 By observing the positions of the pointer of the megger earth resistance is measured.</p>
6. Clean the workplace	<p>6.1 Cleaning tools and equipment are selected & collected.</p> <p>6.2 Cleaning tools and equipment are prepared for cleaning waste materials are disposed.</p> <p>6.3 Cleaning is completed.</p>
Range of Variables	
Variables	Range (may include but not limited to):
1. Hand Tools	<p>1.1 Adjustable wrench</p> <p>1.2 Wire stripper</p> <p>1.3 C-clamp</p> <p>1.4 Chisels: (a) Wooden, (b) Cold</p> <p>1.5 Drill bits</p> <p>1.6 Files: (a) Flat, (b) Round, (c) Half round</p> <p>1.7 Hacksaw</p> <p>1.8 Hammers: (a) Ball peen, (b) Claw</p> <p>1.9 Hand drill</p> <p>1.10 Measuring Tapes</p> <p>1.11 Paint Brushes/Rollers</p> <p>1.12 Pliers: (a) Combination Pliers, (b) cutting Pliers, (c) Diagonal cutting Pliers, (d) Long Nose Pliers,</p> <p>1.13 Punches</p> <p>1.14 Screwdrivers: (a) Star, (b) Flat, (c) Connecting</p> <p>1.15 Tri square</p> <p>1.16 Neon tester</p> <p>1.17 Wire cutters</p> <p>1.18 S.W.G.</p>

RAM

	<ul style="list-style-type: none"> 1.19 Set squares 1.20 Electrician knife 1.21 Ladder 1.22 Fish wire
2. Power Tools	<ul style="list-style-type: none"> 2.1 Electric hand drill machine 2.2 Hand grinders 2.3 Soldering iron
3. Equipment	<ul style="list-style-type: none"> 3.1 Insulation resistance tester 3.2 Calculator 3.3 Multi meter/AVO meter 3.4 Earth tester
4. Materials	<p>Refers to all construction(electrical) materials included but not limited to the following:</p> <ul style="list-style-type: none"> 4.1 Conduit 4.2 Socket 4.3 GI Wire 4.4 Elbow 4.5 Bend 4.6 Circular box 4.7 Rawlplug 4.8 Saddle 4.9 Screw 4.10 Cable lugs 4.11 Cable tie 4.12 Thread ball 4.13 Flexible conduit 4.14 Electric soldering lead 4.15 Insulating tape 4.16 Cable (PVC, VIR)
5. PPE	<ul style="list-style-type: none"> 5.1 Hand gloves 5.2 Helmet 5.3 Goggles 5.4 Safety shoes
6. Boards	<ul style="list-style-type: none"> 6.1 Plastic board 6.2 Ebonite boards

JAMM

7. Fuses & MCB	7.1 Single pole MCB 7.2 Double pole MCB 7.3 Triple Pole MCCB 7.4 Triple pole with neutral MCB 7.5 Earth leakage circuit breaker (ELCB)
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: <ol style="list-style-type: none"> 1.1 Drawn layouts for wiring 1.2 Installed conduit and cables. 1.3 Checked and tested polarity and continuity. 1.4 Measured and tested earth and insulation resistance.
2. Underpinning Knowledge	Trainee will acquire knowledge of: <ol style="list-style-type: none"> 2.1 Types of tools and equipment. 2.2 Material collection and preparation. 2.3 Layout drawing. 2.4 Measurement. 2.5 Different types of fittings and fixtures 2.6 Types of switches, sockets, and ceiling rose, fittings and fixtures. 2.7 Specification checking. 2.8 Fittings and fixture installation. 2.9 Types of tests, and insulation and earth resistance testing.
3. Underpinning Skills	<ol style="list-style-type: none"> 3.1 Cutting conduits, fishing wires and cables 3.2 Using tools & machinery related to the installing fittings and fixtures 3.3 Selecting appropriate machinery related to the Installing fittings and fixtures 3.4 Selecting appropriate materials as per schedule 3.5 Checking specifications 3.6 Connecting terminals 3.7 Checking and testing polarity and continuity 3.8 Measuring and testing insulation and earth resistance

RAM

4. Underpinning Attitudes	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource Implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace (simulated or actual) 5.2 Access to the work place 5.3 Tools and equipment appropriate to joint and connection process 5.4 Availability of materials
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 a training center or in an actual or simulated work place after completion of the training module 7.2 Assessment should be done by NSDA certified 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 any NTVQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

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Unit Code and Title	OSU04I07L2V1: Perform Service Connection
Nominal Hours	20 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to perform service connection. It specifically includes – interpreted drawings and specifications; measure the distance of service line; install cables for service connection; install energy meter; and connect energy meter and main switch
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables
1. Interpret drawings and specifications	1.1 <u>Drawing</u> are collected and interpreted. 1.2 <u>Sign and symbols</u> are identified. 1.3 Terms and abbreviations are identified. 1.4 <u>Specifications</u> are interpreted.
2. Collect tools, equipment and materials	2.1 Usability of <u>tools and equipment</u> are checked and verified 2.2 <u>Materials</u> are collected
3. Measure the distance of service line	3.1 <u>PPEs</u> are collected and used. 3.2 Distance between distribution pole and meter are checked and measured. 3.3 Distance between main switch and meter are checked and measured.
4. Install cables for service connection	4.1 Size of cables are selected as per load 4.2 Quality cables are selected and collected for service connection 4.3 Collected cables are cut and set. 4.4 Cables are held on and clamped properly with distribution pole. 4.5 Cables are joined and connected with the pole and energy meter.

JAMM

5. Install energy meter	5.1 Energy meter is collected and set on the board 5.2 Energy meter is connected with service line.
6. Connect energy meter and main switch	6.1 Cables are measured and sized 6.2 Cables are laid into the conduit 6.3 Connection between energy meter and main switches is performed.
7. Clean the workplace	7.1 Tools and equipment are cleaned as per standard 7.2 Cleaning tools and equipment are prepared for cleaning 7.3 Waste materials are disposed 7.4 Tools and equipment are stored as per standard
Range of Variables	
Variable	Range (may include but not limited to):
1. Drawings	1.1 Sketch 1.2 Electrical drawings
2. Specification's	2.1 Product specification's 2.2 Performance specification's 2.3 Method specifications 2.4 Specification manuals
3. Sign and symbols	3.1 Include all signs and symbol associated with Electrical and maintenance work 3.2 Drawing symbol 3.3 Connection symbols 3.4 Load symbols 3.5 Socket symbols 3.6 Main switch symbols 3.7 Supply symbols 3.8 Danger symbols 3.9 Switch board symbols 3.10 Conduit board 3.11 Circuit Breaker symbol 3.12 Protective device symbol

TEAM

4. Tools and equipment	<ul style="list-style-type: none"> 4.1 Hand tools <ul style="list-style-type: none"> 4.1.1 Adjustable wrench 4.1.2 Wire stripper 4.1.3 Mallet 4.1.4 Chisels: (Wooden, Cold) 4.1.5 Hacksaw 4.1.6 Hammers (Ball pin, Claw) 4.1.7 Measuring tape 4.1.8 Pliers: <ul style="list-style-type: none"> 4.1.8.1. Combination pliers 4.1.8.2. side cutting pliers 4.1.8.3. Diagonal cutting pliers 4.1.8.4. Long nose pliers 4.1.9 Screwdrivers: Star, Flat, Philips 4.1.10 Tri square 4.1.11 Neon tester 4.1.12 Wire cutters 4.1.13 Set squares 4.1.14 Electrician knife 4.1.15 Ladder 4.1.16 Power tools 4.1.17 Electric hand drill 4.1.18 Grinder 4.1.19 Soldering Iron 4.2.1 Multi Meter / AVO Meter 4.2.2 Earth Tester
5. PPE	<ul style="list-style-type: none"> 5.1 Skull Guard / helmet 5.2 Goggles 5.3 Safety shoes 5.4 Safety gloves 5.5 Uniform
6. Materials	<ul style="list-style-type: none"> 6.1 GI wire 6.2 Connector 6.3 Distribution board 6.4 Energy Meter 6.5 Main switch 6.6 Cables 6.7 Guy insulator 6.8 Clamps 6.9 Tie 6.10 Hook 6.11 Cable lug

RAM

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 Installed service cable, energy meter and main switch as per drawing 1.2 Connected energy meter and main switch as per drawing
2. Underpinning Knowledge	Trainee will acquire knowledge of: 2.1 Types of tools and equipment 2.2 Materials collection and preparation 2.3 Layout drawing 2.4 Measurement 2.5 Service cables and energy meter setting 2.6 Service cables and energy meter connection
3. Underpinning Skills	3.1 Collecting materials 3.2 Preparing materials 3.3 Measuring distance 3.4 Setting service cables 3.5 Connecting service cables, energy meter and main switch
4. Underpinning Attitudes	4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource Implications	The following resources must be provided: 5.1 Workplace (actual or simulated) 5.2 Access to workplace 5.3 Tools and equipment to appropriate to join and connection process 5.4 Availability of materials

RAM

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 a training center or in an actual or simulated work place after completion of the training module</p> <p>7.2 Assessment should be done by NSDA certified assessor</p>

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 any NTVQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

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Unit Code and Title	OSU05I07L3V1: Perform Motor Connection
Nominal Hours	30 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to perform motor connection. It specially includes - identify and select controlling and protective devices for motor connection; install controlling and protective devices; perform motor connection; and check and test circuit
Elements of Competency	Performance Criteria Bold and Underlined terms are elaborated in the Range of Variables
1. Identify and select controlling and protective devices for motor connection	1.1 <u>Manuals</u> and <u>documents</u> of controlling and protective devices are collected. 1.2 <u>Drawings</u> and <u>symbols</u> of controlling and protective devices are sorted. 1.3 Types of <u>controlling</u> and <u>protective devices</u> are listed
2. Collect tools, equipment and materials	2.1 <u>Tools, equipment</u> and <u>materials</u> are identified and collected. 2.2 Tools, Equipment and Materials are checked for usability, 2.3 <u>PPE</u> is collected and used.
3. Install controlling and protective devices	3.1 <u>Controlling</u> and <u>protective</u> devices are selected and collected according to the need of the operations 3.2 Controlling and protective devices are installed according to the layout plan 3.3 Controlling and protective devices are set and connected to the motor

ISOM

4. Perform motor connection	4.1 Direct on-line starter is collected and its diagram interpreted. 4.2 Direct on-line starter is connected with the motor 4.3 Star-delta starter is collected and its diagram interpreted. 4.4 Star-delta starter is connected with the motor 4.5 Auto- transformer starter is collected and its diagram interpreted. 4.6 Auto-transformer starter is connected with motor
5. Check and test circuit	5.1 All the connections of each starter are checked and justified 5.2 Connection between motor and starter is checked and tested
6. Clean the workplace	6.1 Cleaning Tools and equipment are selected & collected 6.2 Cleaning Tools and equipment are prepared for cleaning 6.3 Waste materials are disposed 6.4 Cleaning is completed
Range of Variables	
Variables	Range (may include but not limited to):
1. Manuals	1.1 Manufacturer's specification manual 1.2 Repair manual 1.3 Maintenance procedure manual 1.4 Periodic maintenance manual 1.5 Quality manual 1.6 Manual of instruction
2. Drawings	2.1 Technical drawing 2.2 Sketch 2.3 Electrical drawings 2.4 Connection diagram
3. Symbols	3.1 Drawing symbols 3.2 Connection symbol 3.3 Load symbol 3.4 Socket symbol 3.5 Main switch symbol 3.6 Supply symbol 3.7 Danger symbol 3.8 Switch board symbol

JRAM

	<p>3.9 Conduit symbol</p> <p>3.10 Starter symbols</p> <p>3.11 Protective device symbol</p> <p>3.12 Motor symbol</p>
4. Controlling Devices	<p>4.1 Switches</p> <p>4.2 Main switches</p> <p>4.3 Direct on-line starter</p> <p>4.4 Change over switches</p> <p>4.5 Forward reverse starter</p> <p>4.6 Star-delta starter</p>
5. Protective devices	<p>5.1 MCB</p> <p>5.2 MCCB</p> <p>5.3 Relays</p> <p>5.4 ELCB</p>
6. Tools	<p>6.1 Hand Tools:</p> <p>6.1.1 Adjustable wrench</p> <p>6.1.2 Wire stripper</p> <p>6.1.3 Mallet</p> <p>6.1.4 Hammers: (a) Ball pin, (b) Claw</p> <p>6.1.5 Measuring tapes</p> <p>6.2 : (a) Combination Pliers, (b) Side cutting pliers, (c) Diagonal cutting pliers, (d) Long nose pliers</p> <p>6.3 Screwdrivers: (a) Star (b) Flat (c) Connecting</p> <p>6.4 Wire gauge/ micrometer</p> <p>6.5 Neon tester</p> <p>6.6 Wire cutters</p> <p>6.7 Power tools:</p> <p>6.8.1 Electric drill machine</p> <p>6.8.2 Nail guns</p> <p>6.8.3 Electric grinder</p> <p>6.8 Soldering iron</p>

JAMM

7. Equipment	<ul style="list-style-type: none"> 7.1 Multi Meter/AVO Meter 7.2 Insulation resistance 7.3 Tachometer 7.4 Clamp meter
8. Materials	<ul style="list-style-type: none"> 8.1 GI wire 8.2 Connector 8.3 Distribution board 8.4 Motor 8.5 Main switch 8.6 Starter 8.7 Cables 8.8 Cable lug 8.9 Conduit 8.10 Flexible conduit 8.11 Saddle 8.12 Rawlplug 8.13 Wooden screw 8.14 Insulating tape
9. PPE	<ul style="list-style-type: none"> 9.1 Hand gloves 9.2 Apron 9.3 Goggles 9.4 Mask 9.5 Safety shoe
<p>Evidence Guide</p> <p>The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.</p>	
1. Critical Aspects of Competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Installed protective and controlling devices 1.2 Connected motor
2. Underpinning Knowledge	<p>Trainee will acquire knowledge of:</p> <ul style="list-style-type: none"> 2.1 Diagram of motor connection 2.2 Diagram of protective and controlling devices 2.3 Classification of protective and controlling devices 2.4 Drawings, and manuals 2.5 Technique of motor connection

JMM

3. Underpinning Skills	3.1 Collecting manuals and diagrams required for motor connection 3.2 Collecting and using PPE 3.3 Collecting and using tools and equipment as per job requirements 3.4 Collecting and using materials as per job requirements 3.5 Installing service cables, main switch, Starter and motor 3.6 Performing motor connection
4. Underpinning Attitudes	4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource Implications	The following resources must be provided: 5.1 Workplace (simulated or actual) 5.2 Materials, tools and equipment needed for the activity 5.3 Instruction manual
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 of Assessment	7.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module 7.2 Assessment should be done by NSDA certified assessor

Accreditation Requirements

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SIOMM

Unit Code and Title	OSU06I07L3V1: Install and Maintain Electric Motor with Control System
Nominal Hours	40 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to install and maintain electrical motor with control system. It specifically includes – identify and select controlling devices for motors; connect starter with the motors; monitor and test conditions of motor; service motors; and maintain tools, equipment, materials and workplace.
Elements of Competency	Performance Criteria Bold and Underlined terms are elaborated in the Range of Variables
1. Identify and select controlling devices for motors	1.1 <u>Manuals</u> and documents of motors with controlling devices are collected. 1.2 Drawings and symbols of controlling devices are sorted. 1.3 <u>Tools, Equipment</u> and <u>materials</u> are collected for required job. 1.4 Necessary controlling devices for motor are selected and collected.
2. Connect starter with the motors	2.1 <u>PPE</u> is collected and used 2.2 <u>Starter</u> is collected and its diagram is interpreted 2.3 Wire up control and power circuits as per job requirement 2.4 Starter is connected with the motors 2.5 Test and commission the motors as per job requirement
3. Monitor and test conditions of motor	3.1 Mechanical <u>defects</u> are checked visually in accordance with standard practices 3.2 Electrical defects of motors are checked such as loose or burned electrical connections 3.3 Motors are tested by using specified instruments 3.4 Motors are tested under running conditions for detecting <u>faults</u>

JKM

4. Service motors	<p>4.1 Work order for maintenance is obtained from concern personnel according to established procedure</p> <p>4.2 Motor mains is disconnected before inspection and testing in accordance with standard procedure</p> <p>4.3 Motor is dismantled for replacing bearings and greasing, repairing windings, varnishing, heating or any other tests if required as per standard procedures following safety precautions</p> <p>4.4 Service parts of the motor are cleaned by using specified cleaning agent and tools in accordance with manufacturer's specification</p> <p>4.5 Check winding insulation of motors with magger / insulation resistance tester if necessary in accordance with standards</p> <p>4.6 Motors are assembled according to the manufacturer's specification</p> <p>4.7 No load and load test are conducted and noted down results in accordance with specification</p>
5. Maintain tools, equipment, materials and workplace	<p>5.1 Tools, equipment, and materials are cleaned as per manufacturer instructions</p> <p>5.2 Tools, equipment, and materials are restored as per workplace procedures</p> <p>5.3 Defective tools and equipment are identified, separated / removed, and reported to the designated person</p> <p>5.4 Workplace is cleaned as per company procedure</p> <p>5.5 Waste materials are disposed in the designated place</p>
Range of Variables:	
Variables	Range (may include but not limited to):
1. Tools and equipment	<p>1.1 Electrician tool set</p> <p>1.2 Tachometer</p> <p>1.3 Insulation resistance tester</p> <p>1.4 Phase sequence meter</p> <p>1.5 Multi meter</p> <p>1.6 Test Lamp</p> <p>1.7 Mechanical Tool Set</p> <p>1.8 Pulley Puller / Pusher</p> <p>1.9 Bearing Puller / Pusher</p> <p>1.10 Workbench</p>

BAM

	<ul style="list-style-type: none"> 1.11 Cleaning agents and cotton 1.12 Temperature Gun
2. Materials	<ul style="list-style-type: none"> 2.1 Starters 2.2 Motors 2.3 Lugs / Glands / Connectors 2.4 Cables 2.5 Wires 2.6 Switches 2.7 Lubricant
3. Starters	<ul style="list-style-type: none"> 3.1 Direct online (DOL) starters 3.2 Star – delta Starters 3.3 Forward – revers starters
4. PPE	<ul style="list-style-type: none"> 4.1 Apron 4.2 Safety gloves 4.3 Safety helmets 4.4 Safety belts 4.5 Safety shoes 4.6 Air muff 4.7 Safety goggles
5. Manuals	<ul style="list-style-type: none"> 5.1 Manufacturer's specification manual 5.2 Repair manual 5.3 Maintenance procedure manual 5.4 Periodic maintenance manual 5.5 Quality manual 5.6 Manual of instruction
6. Mechanical defects	<ul style="list-style-type: none"> 6.1 Bearing jam 6.2 Vibration 6.3 Humming sound 6.4 Misalignment
7. Faults	<ul style="list-style-type: none"> 7.1 Tripping of protective devices 7.2 Difficulty in starting 7.3 Low RPM 7.4 Low/ high supply voltage 7.5 Unusual noises 7.6 Excessive heat 7.7 Phase failure
<p>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</p>	

DOM

<p>1. Critical Aspects of Competency</p>	<p>The assessment required evidence that the candidate:</p> <p>1.1 Followed occupational health and safety regulations at workplace</p> <p>1.2 Tested performance of motor in accordance with manufacturer's specification</p>
<p>2. Underpinning knowledge</p>	<p>Trainee will acquire knowledge of:</p> <p>2.1 Read, and interpret motors data, name plate information, specification circuits and diagrams</p> <p>2.2 Fundamental of electrical rotating machines</p> <p>2.3 Type of electric motors and their construction</p> <p>2.4 Working principles of motors</p> <p>2.5 Types of measuring and test instruments used</p> <p>2.6 Types of electric control and protective switchgears and accessories used electric motors</p> <p>2.7 Record keeping and reporting</p> <p>2.8 Occupational health and safety regulations</p> <p>2.9 Preventive maintenance works on motors</p> <p>2.10 Fire precautions</p>
<p>3. Underpinning skills</p>	<p>3.1 Referring, applying, interpreting motors and generator name plate information, diagram</p> <p>3.2 Using of tools, equipment and test instruments safely</p> <p>3.3 Handling of heavy loads without endangering anybody safely</p> <p>3.4 Connecting motors through protective and controlling devices</p> <p>3.5 Testing and commissioning motors as per job requirements</p> <p>3.6 Keeping record and reporting</p>
<p>4. Underpinning Attitude</p>	<p>4.1 Commitment to occupational health and safety</p> <p>4.2 Promptness in carrying out activities</p> <p>4.3 Sincere and honest to duties</p> <p>4.4 Environmental concerns</p> <p>4.5 Eagerness to learn</p> <p>4.6 Tidiness and timeliness</p> <p>4.7 Respect for rights of peers and seniors in workplace</p> <p>4.8 Communication with peers and seniors in workplace</p>

DOMM

5. Resource Implications	<p>The following resources must be provided:</p> <p>5.1 Workplace (actual or simulated)</p> <p>5.2 Access to relevant work place or appropriately simulated environment where assessment can take place</p> <p>5.3 Materials and equipment relevant to the proposed activity or task Work place</p> <p>5.4 Tools and equipment appropriate to joint and connection process.</p> <p>5.5 Drawings and specifications relevant to the task</p>
6. Methods of Assessment	<p>Methods of assessment may include but not limited to:</p> <p>6.1 Written test</p> <p>6.2 Oral questioning</p> <p>6.3 Demonstration</p>
7. Context of Assessment	<p>7.1 Competency must be assessed individually in the actual work place or in a simulated workplace by direct observation after completion of the module</p> <p>7.2 Assessment should be done by NSDA certified assessor</p>

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 any NTVQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

TEAM

Unit Code and Title	OSU07I07L3V1: Perform Motor Rewinding and Servicing
Nominal Hours	55 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to perform motor rewinding and servicing. It specially includes – check the machine physically and dismantle it to detect the actual fault; select tools and prepare material for winding / rewinding; carryout winding / rewinding of stator, rotor and armature; make connections, carryout pre-assembly tests and assemble the machine; carryout final test; and record the test result.
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables
1. Check the machine physically and dismantle it to detect the actual fault	1.1 The <u>machine</u> is physically checked and dismantled to detect the actual fault. 1.2 The machine is dismantled as per standard procedure and manufacturer instructions. 1.3 Burnt winding is checked by smelling. 1.4 Winding data is collected and winding diagram is prepared. 1.5 Winding is checked with specified <u>measuring instrument</u> to detect the fault. 1.6 <u>Associated accessories</u> faults are checked as per manufacturer data and noted down. 1.7 Bearing, carbon brushes, rockers, slip rings are checked visually and tested. 1.8 Fault is detected and noted down for proper repair.

TEAM

<p>2. Select tools and prepare material for winding / rewinding</p>	<p>2.1 Technical information and winding data is collected and winding diagram is prepared as per winding data 2.2 Specified tools, materials and equipment are selected for winding work. 2.3 Winding wire of required gauge, insulation and binding material are prepared 2.4 Formers are prepared according to winding data. 2.5 Coil is formed on former as per collect winding data.</p>
<p>3. Carryout winding / rewinding of stator rotor and armature</p>	<p>3.1 Stator/rotor and armature are cleaned by using specified tools. 3.2 Insulation material is inserted into slots 3.3 Formed coil is inserted into slots as per standard 3.4 Rotor is cleaned and checked 3.5 Servicing and repaired works is carried out as necessary 3.6 Formed coil is insulated, binned and inserted into slot</p>
<p>4. Make connections, carry out pre-assembly tests and assemble the machine</p>	<p>4.1 Winding resistance and insulation level is checked by specified test instrument. 4.2 Coil ends are terminated and insulated 4.3 Winding continuity is checked 4.4 Dry running is carried out, performance is checked and remedial action has taken if necessary. 4.5 Insulating varnish is applied to winding and baked it up to recommended temperature in baking oven. 4.6 Assembly of stator, rotor and other parts are assembled.</p>
<p>5. Carry out final test</p>	<p>5.1 Rotor free movement is checked. 5.2 No load / load / locked rotor tests are performed. 5.3 Rotor static and dynamic balancing is carried out.</p>
<p>6. Record the test result</p>	<p>6.1 Test result are documented in the relevant recorded sheet 6.2 Test reports are prepared. 6.3 Machine performance is demonstrated 6.4 Tools, equipment and materials are cleaned and stored as per workplace standard.</p>
<p>Range of Variables</p>	
<p>Variable</p>	<p>Range (may include but not limited to):</p>

RAM

1. Equipment	<ul style="list-style-type: none"> 1.1 Electric oven 1.2 Manual rewinding machine 1.3 Power driven rewinding machine 1.4 Winding head cutter 1.5 Winding puller 1.6 Electric hand drill machine with bits 1.7 AC & DC power supply unit 1.8 Single phase AC motor 1.9 DC motor 1.10 Three phase AC motor, universal motor.
2. Machine	<ul style="list-style-type: none"> 2.1 Single-phase AC motor 2.2 DC motor 2.3 Three phase AC motor
3. Measuring Instrument	<ul style="list-style-type: none"> 3.1 Ammeters 3.2 Voltmeters 3.3 Ohmmeter 3.4 Wattmeter 3.5 Meggar 3.6 Clamp meter 3.7 Tachometer
4. Tools	<p>Toolbox containing a set of tools. (The following tools may include to make a set but not limited to):</p> <ul style="list-style-type: none"> 4.1 Flat / Philips headed screw drivers 4.2 Bradawl 4.3 Electrician knife 4.4 Diagonal cutting pliers 4.5 Combination pliers 4.6 Round nose pliers 4.7 Stripping pliers 4.8 Adjustable wrenches 4.9 Hacksaw 4.10 Hammer 4.11 Files 4.12 Measuring tape 4.13 Steel ruler 4.14 Soldering iron 4.15 Neon line tester 4.16 Spirit leveler 4.17 Continuity tester.

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	<ul style="list-style-type: none"> 4.18 Socket wrenches sets 4.19 Bearing puller 4.20 Crimping pliers 4.21 Saw 4.22 Divider 4.23 Micrometer 4.24 Bolt cutter 4.25 Pipe cutter
5. Materials	<ul style="list-style-type: none"> 5.1 Super enamel wires 5.2 Insulating plastic film 5.3 PVC tape 5.4 Laminates 5.5 Insulating paper 5.6 Ceramic fiber Flexible cables 5.7 Slot insulation paper 5.8 Binding thread 5.9 Varnish 5.10 Thinner 5.11 Grease 5.12 Bearings 5.13 Solder 5.14 Resin 5.15 Winding string
6. PPE	<ul style="list-style-type: none"> 6.1 Uniform 6.2 Goggles 6.3 Hand gloves 6.4 Hard hat 6.5 Protective shoes
<p>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.</p>	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Identified winding faults 1.2 Formed coil for rewinding as per job requirements 1.3 Inserted coil in the slot and completed connections 1.4 Tested motor before establishing electrical connection

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2. Underpinning Knowledge	<p>Trainee will acquire knowledge of:</p> <ul style="list-style-type: none"> 2.1 Estimation of winding. 2.2 Types of winding. 2.3 Process of preparation of insulation paper, coils and wedges. 2.4 Setting the insulation paper, coils and wedges. 2.5 Internal position of the coil groups. 2.6 Process of connection of coils (winding) in groups. 2.7 Separation of groups of coils. 2.8 Process of connection of the winding terminals to the terminal post. 2.9 Process of preparation and application of varnish. 2.10 Measurement of insulation resistance
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Using the proper tools 3.2 Disassembling the motor 3.3 Tracing out the internal connection of the winding 3.4 Preparation of the insulation paper coils and wedges 3.5 Setting the insulation paper, coils and wedges in the slots 3.6 Testing the connection of the coils with meter 3.7 Assembling the motor for test run 3.8 Preparation of the motor for varnishing 3.9 Assembling the motor for use
4. Underpinning Attitudes	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource Implications	<p>The following resources must be provided;</p> <ul style="list-style-type: none"> 5.1 Workplace (actual or simulated) 5.2 Materials relevant to the proposed activity 5.3 Measuring instrument 5.4 Relevant drawings, manuals, codes, standards and reference material

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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 a training center or in an actual or simulated work place after completion of the training module.</p> <p>7.2 Assessment should be done by NSDA certified assessor</p>

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 any NTVQF qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

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Unit Code and Title	OSU08I07L3V1: Install and Troubleshoot Solar Electrical System
Nominal Hours	40 Hours
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to install and troubleshoot solar electrical system. It specially includes – estimate electrical load of customer; set solar panel; install solar home system and accessories; diagnose faults in solar home system unit and wiring; and repair faults in solar home system unit and wiring.
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables
1. Estimate electrical load of customer	1.1 Customer required <u>electrical load</u> are estimated 1.2 Layout drawing of selected work plan is prepared 1.3 Capacity of panel, battery, inverter, charge controller and <u>other accessories</u> are selected as per guidance 1.4 Following the layout plan required quantity and size of cable, wire, and, other installation materials are estimated 1.5 Information on cost of <u>equipment, accessories and materials</u> collected from suppliers / manufacturers 1.6 Cost of equipment accessories and materials are estimated 1.7 Installation charges are estimated
2. Identify tools, equipment, and materials	2.1 <u>Tools</u> are selected and collected 2.2 <u>Installation materials</u> , and, <u>solar electrical system components and accessories</u> are collected 2.3 Battery is collected and tested

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3. Set solar panel	<p>3.1 Personal Protective Equipment (PPE) is used while working</p> <p>3.2 Special rope, safety belts, and ladder are used for working on the roof</p> <p>3.3 Frames are constructed as per panel size</p> <p>3.4 Appropriate place with maximum sunlight exposure for panel setting is located</p> <p>3.5 Setting of panels within frame is demonstrated between 23 to 30 degrees</p>
4. Install solar home system and accessories	<p>4.1 Solar home system and accessories are installed as per layout plan</p> <p>4.2 Channel or conduit wiring is performed as per layout diagram</p> <p>4.3 Switches and sockets on board are fixed</p> <p>4.4 Connections with all related components are performed</p> <p>4.5 Testing of solar electrical system for operation is performed</p>
5. Diagnose faults in solar home system unit and wiring	<p>5.1 Physical faults in the inverter, charger, charge controller, panel, battery, and wiring system are checked visually</p> <p>5.2 Operational faults in the inverter and charge controller are checked by testing instrument</p> <p>5.3 Panel is tested for appropriate functioning</p> <p>5.4 Battery is checked by meter for appropriate voltage</p> <p>5.5 Electrolyte of battery is checked by hydrometer</p> <p>5.6 Electrical connections are checked throughout the wiring</p> <p>5.7 Charge controller and inverter are tested</p>
6. Repair faults in solar home system unit and wiring.	<p>6.1 Burn components are replaced</p> <p>6.2 Inactive and faulty components are replaced</p> <p>6.3 Battery water is added if required</p> <p>6.4 Loose Connections are repaired throughout the wiring</p>
7. Clean and store the tools and materials	<p>7.1 Tools and equipment are cleaned</p> <p>7.2 Tools, measuring instruments, and access materials are stored as per work place standards</p>
Range of Variables	
Variable	Range (may include but not limited to):

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1. Electrical Load	<ul style="list-style-type: none"> 1.1 Light fixtures 1.2 Ceiling fans 1.3 Television 1.4 Refrigerator 1.5 Water pump 1.6 Computer
2. Other accessories	<ul style="list-style-type: none"> 2.1 Light fixtures 2.2 Switch board 2.3 Switch 2.4 Sockets 2.5 MCB 2.6 Cables and wires
3. Equipment, accessories, and material's	<ul style="list-style-type: none"> 3.1 Solar panel 3.2 Charge controller 3.3 Battery 3.4 Inverter 3.5 Switch and sockets 3.6 Cables / wires 3.7 Conduit 3.8 Fixing materials
4. Tools	<ul style="list-style-type: none"> 4.1 Screw drivers 4.2 Diagonal cutting pliers 4.3 Long nose pliers 4.4 Combination pliers 4.5 Adjustable wrenches 4.6 Socket wrench set 4.7 Hammer 4.8 Electric hand drill with bits 4.9 Sprit level 4.10 Measuring tape 4.11 Neon tester 4.12 Battery tester.
5. Installation materials	<ul style="list-style-type: none"> 5.1 Cables 5.2 Channels 5.3 Screws 5.4 Rawl plugs 5.5 Clips 5.6 Nails

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	<ul style="list-style-type: none"> 5.7 Plastic board 5.8 Conduits 5.9 Plastic connectors 5.10 Cable ties
6. Solar home system components	<ul style="list-style-type: none"> 6.1 Panel 6.2 Inverter 6.3 Charge controller 6.4 Battery
7. Solar home system accessories	<ul style="list-style-type: none"> 7.1 Light fixtures 7.2 Switches 7.3 Sockets 7.4 Junction boxes
8. Physical faults	<ul style="list-style-type: none"> 8.1 Burn components by high temperature 8.2 Damaged by insect 8.3 Disconnection due to vibration 8.4 Loose connection
9. Operational faults	<ul style="list-style-type: none"> 9.1 Components are inactive by aging 9.2 Components are inactive by transient effects 9.3 Components are inactive due to manufacturing defects 9.4 Components are inactive due to overload
10. Testing instruments	<ul style="list-style-type: none"> 10.1 Volt meter (Analogue / Digital) 10.2 Ammeter (Analogue / Digital) 10.3 Multi meter (Analogue / Digital) 10.4 Hydro meter
11. Electrical connections	<ul style="list-style-type: none"> 11.1 Terminal connections of switches, sockets, and light fixtures. 11.2 Terminal connection of panel 11.3 Terminal connection of charge controller 11.4 Terminal connection of inverter. 11.5 Terminal connection of battery.
<p>Evidence Guide</p> <p>The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency</p>	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Prepared layout drawing for selected work. 1.2 Constructed frame as per panel size.

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	<p>1.3 Installed solar electrical system and accessories as per layout plan.</p> <p>1.4 Performed solar home system testing for operation.</p> <p>1.5 Tested charge controller and inverter.</p> <p>1.6 Replaced burn component.</p>
2. Underpinning knowledge	<p>Trainee will acquire knowledge of:</p> <p>2.1 Draw layout & compute load</p> <p>2.2 Selection of panel, battery, inverter, charge controller and other accessories.</p> <p>2.3 Personal Protective Equipment (PPE)</p> <p>2.4 Technique connect solar home system</p> <p>2.5 Technique of testing solar home system operation</p> <p>2.6 Diagnose faults in solar home system unit and wiring.</p>
3. Underpinning Skills	<p>3.1 Interpreting required electrical load.</p> <p>3.2 Preparing layout drawing for selected work.</p> <p>3.3 Constructing frame as per panel size.</p> <p>3.4 Installing solar home system and accessories as per layout plan.</p> <p>3.5 Performing solar home system testing for operation.</p> <p>3.6 Testing charge controller and inverter.</p> <p>3.7 Replacing burn component.</p> <p>3.8 Repairing loose connection through wiring.</p>
4. Underpinning Attitudes	<p>4.1 Commitment to occupational health and safety</p> <p>4.2 Promptness in carrying out activities</p> <p>4.3 Sincere and honest to duties</p> <p>4.4 Environmental concerns</p> <p>4.5 Eagerness to learn</p> <p>4.6 Tidiness and timeliness</p> <p>4.7 Respect for rights of peers and seniors in workplace</p> <p>4.8 Communication with peers and seniors in workplace</p>
5. Resource Implications	<p>The following resources must be provided:</p> <p>5.1 Workplace (Actual or simulated)</p> <p>5.2 Necessary electrical equipment, tools and instruments.</p> <p>5.3 Laptop/Computer, Projector, Speakers</p>
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>

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7. Context of Assessment	7.1 Competency assessment must be done in a training center or in an actual or simulated work place after completion of the training module 7.2 Assessment should be done by NSDA certified assessor
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Validation of Competency Standard by Standard and Curriculum Validation Committee (SCVC)

The Competency Standards for National Skills Certificate in **Electrical Installation and Maintenance, NTVQF L-III** Qualification is validated by SCVC on 06 November 2019 and approved by NSDA.

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