Technical and Vocational Education and Training (TVET) Council

Occupational Standards of Competence

Photovoltaic Installation - Electrical Technician

Level 3

Hastings House West, Balmoral Gap, Christ Church

Telephone: (246) 435-3096 Fax: (246) 429 2060 E-mail: office@tvetcouncil.com.bb.

Published by:
The Technical and Vocational Education and Training (TVET) Council
Hastings House West
Balmoral Gap
Christ church
BARBADOS, W.I.
Tel: (246) 435-3096 Fax: (246) 429-2060
Email: office@tvetcouncil.com.bb Website: www.tvetcouncil.com.bb

ACKNOWLEDGEMENTS

The Technical and Vocational Education and Training Council thanks the following for their contribution to the development of this document:

Members of the Photovoltaic Installation - Electrical Technician Working Group

Mr. David Green	-	Williams Solar Ltd
Mr. Akeil Haynes	-	Solaris Energy Ltd
Mr. Trevor Headley	-	Barbados Community College
Mr. Colin Kirkwood	-	Sault College, Ontario Canada
Ms. Alison Holder	-	Technical Consultant, TVET Council

Qualification Overview

NVQB

Photovoltaic Installation Electrical Technician

Level 3

NVQB Photovoltaic Installation - Electrical Installation - Level 3

Qualification Overview

About this Qualification

The NVQB Photovoltaic Installation – Electrical Technician is a competence-based qualification aimed at senior electrical professionals working in the renewable energy sector with experience in the installation of photovoltaic electrical systems and who are responsible for the electrical aspect of photovoltaic (PV) installation. **To complete this qualification, candidates should have a post-secondary electrical installation qualification, equivalent to the CVQ Level 2 in Electrical Installation from a recognized institution.**

Who is the qualification for?

The qualification is specifically designed for person who will assume overall responsibility for ensuring that the photovoltaic electrical system installation is completed in accordance with industry standards, best practices and conforms to regulatory requirements for the systems.

Jobs within the occupational area

Relevant occupations include:

- Photovoltaic Installation Project Managers
- Senior Photovoltaic Electrical Installers
- Senior Electrical Technicians

This list is not exhaustive and only serves to illustrate the breadth of the qualification.

Where could it be used?

These competencies are for persons who are likely to be in roles where for example their duties include:

- Planning and designing of photovoltaic electrical systems
- Managing installation teams

A04303 - APPROVED NATIONAL VOCATIONAL QUALIFICATION STRUCTURE

PHOTVOLTAIC INSTALLATION – ELECTRICAL TECHNICIAN - LEVEL 3

To achieve the full qualification, candidates must complete all six (6) mandatory units. Candidates can also take additional units, although these are not required to complete the qualification. The prerequisite to this qualification is the Caribbean Vocational Qualification Electrical Installation Level 2.

MANDATORY UNITS (ALL MUST BE COMPLETED)		CODE
1.	**Assess electrical design of the photovoltaic system**	**U75003**
1.1	Read and interpret photovoltaic system technical drawings and equipment data sheets	
1.2	Perform basic electrical design calculations for photovoltaic systems	
1.3	Determine photovoltaic system compatibility with site electrical conditions	
1.4	Adapt photovoltaic system electrical design to site electrical conditions	
1.5	Report on electrical design	
2.	**Install photovoltaic system electrical components**	**U75103**
1.1	Plan and prepare for installation of photovoltaic electrical components	
1.2	Install and connect all photovoltaic electrical components and devices	
1.3	Test PV system	
1.4	Commission photovoltaic system	
1.5	Prepare required documentation	
3.	**Maintain and troubleshoot photovoltaic systems**	**U75203**
1.1	Perform photovoltaic system inspection	
1.2	Assess photovoltaic system function	
1.3	Resolve photovoltaic system functional failures related to electrical components	
4.	**Allocate and monitor the performance and quality of work of team members**	**U75303**
1.1	Assign work to team members	
1.2	Monitor performance of work	
1.3	Monitor quality of work	

5. Communicate with customers and with others **U47403**

1.1 Communicate information to customers and others
1.2 Respond to customers and others

6. Use access equipment at heights **U49102**

1.1 Prepare to work at heights
1.2 Conduct checks before using access equipment
1.3 Work safely
1.4 Clean up
1.5 Record information regarding working at heights

U75003 Assess the electrical design of the photovoltaic system

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to interpret a photovoltaic system design, modify the design to meet site conditions and report on the final configuration.

ELEMENT	PERFORMANCE CRITERIA

To be competent you must achieve the following:

1. Read and interpret photovoltaic system technical drawings and equipment data sheets	1.1 Review project objectives, resources and requirements outlined in the preliminary assessment.
	1.2 Identify accurately site-specific installation issues outlined in the survey of site conditions, in accordance with technical specifications.
	1.3 Assess accurately utility requirements for interconnection and metering in accordance with technical specifications.
	1.4 Examine other **design documents** and note contents.
	1.5 Identify considerations for locating and installing photovoltaic arrays according to specifications.
2. Perform basic electrical design calculations for photovoltaic systems	2.1 Accurately calculate photovoltaic array size according to system specifications.
	2.2 Calculate string wiring and containment type and size.
	2.3 Calculate and evaluate energy storage and system energy output.
3. Determine photovoltaic system compatibility with site electrical conditions	3.1 Evaluate existing electrical equipment for compatibility.
	3.2 Examine electrical distributor, conduit paths and grounding methods for appropriateness.

		3.3 Carefully examine combiner boxes, number and type of inverters, charge controllers and overcurrent protection devices for suitability in compliance with the authority having jurisdiction (AHJ) regulations.
		3.4 Verify adequate access to telecommunications ports on site to facilitate wireless component functionality.
4.	Adapt photovoltaic system electrical design to site electrical conditions	4.1 Identify potential conflicts in design and document resulting changes.
		4.2 Accurately maintain construction documentation according to organizational requirements.
		4.3 Promptly submit modified proposals.
		4.4 Acquire approvals to change design before application.
5.	Report on electrical design	5.1 Prepare brief in accordance with client and regulatory requirements.
		5.2 **Plans** are accurately prepared for the range of photovoltaic electrical systems.
		5.3 Prepare **specifications** for the photovoltaic electrical system in accordance with industry standards.
		5.4 Prepare the **testing** and commissioning schedule in accordance with regulatory and manufacturers' requirements.
		5.5 Produce operation and maintenance manual including information on how to correctly and safely maintain the system.

RANGE STATEMENT

All range statements must be assessed:

1. **Design documents**:

    - Architectural plans
    - Engineering designs
    - Builder specifications
    - Owner's requirements
    - Authority having jurisdiction (AHJ) regulations
    - Grid code requirements
    - Manufacturer's specifications

2. **Plans**:

    - Axonometric
    - Cross sections
    - Details
    - Elevations
    - Isometrics
    - Schematics
    - Sections

3. **Specifications**:

    - Containment support
    - System voltage and power
    - Operational and short circuit current
    - System frequency
    - Safety
    - Testing
    - Cable
    - Mechanical and electrical system protection
    - Workmanship

4. **Testing**:

    - Array direct current (DC) and voltage
    - System alternating current (AC), voltage and frequency
    - Torque settings for roof racking
    - Insulation resistance
    - Grounding resistance
    - Anti-islanding

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What the symbols and coding represent on technical drawings and equipment data sheets.
2. How site conditions will impact the installation, metering and interconnection.
3. How to adapt drawings to site specific conditions.
4. What are the requirements, regulations and relevant standards related to photovoltaic and electrical installations.
5. What calculations are used in photovoltaic and electrical installations and how they are used.
6. What are the minimum requirements for compatibility with varying sizes of photovoltaic systems.
7. How to determine the appropriate number of components, such as combiner boxes, inverters etc., to use in proportion to the photovoltaic system size.
8. What are potential compatibility conflicts and the required modifications to apply to adapt the system design.
9. How to document the system design and modifications.
10. How to create a client proposal, plans and specifications, testing and commissioning schedules.
11. How to create and customize an operations and/or maintenance manual for the specific system.
12. How to interpret the manufacturers' specifications.
13. What are the specifications for specialized component testing and the tools required to perform testing.
14. What are the industry standards for workmanship specifications.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates must prove that they can carry out **all** the elements, meeting **all** of the performance criteria, range and underpinning knowledge **on more than one occasion.** This evidence must come from a real working environment.

(2) Methods of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U75103 Install photovoltaic system electrical components

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to install photovoltaic system electrical components; inclusive of testing and commissioning the system and preparing the required system efficiency documentation

ELEMENT	PERFORMANCE CRITERIA
	To be competent you must achieve the following:
1. Plan and prepare for installation of photovoltaic electrical components	1.1 Plan project tasks, timelines and procedures in accordance with industry standards.
	1.2 Identify and obtain required tools, equipment and materials in a timely manner.
	1.3 Verify **site conditions** with reference to design documents.
	1.4 Confirm logistics as agreed with **stakeholders**.
	1.5 Identify and assess electrical hazards and implement appropriate controls in accordance with **relevant standards**.
2. Install and connect all photovoltaic electrical components and devices	2.1 Install photovoltaic array in accordance with **relevant standards**.
	2.2 Install photovoltaic direct current circuit **components** in accordance with industry standards.
	2.3 Install bonding, grounding, over current, surge and lightning protection in accordance with **relevant standards**.
	2.4 Correctly install provision for utility metering and interconnection equipment in accordance with **relevant standards**.

		2.5 Accurately connect photovoltaic system to distribution systems in accordance with **relevant standards**.
		2.6 Install batteries and charge controllers safely and in accordance with **relevant standards**.
		2.7 Install system instrumentation in accordance with **relevant standards**.
		2.8 Correctly connect panel array and electrical **components** to minimize cable length and voltage drop in accordance with **relevant standards**.
3.	Test photovoltaic system	3.1 Verify mechanical connection integrity, system grounding, electrical connections torque and polarity in accordance with **relevant standards**.
		3.2 Conduct physical inspections of the system and document findings in accordance with industry standards.
		3.3 Verify that containment fill and wiring supports conform to industry standards**.**
		3.4 Validate overall workmanship against system requirement and **relevant standards**.
		3.5 Measure, record and verify direct current (DC) and alternating current (AC) voltages and currents and inverter operations in accordance with regulatory standards.
		3.6 Consistently compare measured values with expected values.
		3.7 Coordinate and confirm inspections by relevant authorities in a timely manner.
4.	Commission photovoltaic system	4.1 Turn on photovoltaic system and initiate startup procedures according to manufacturer's instructions and industry standards.

		4.2 Correctly programme variable set points according to technical specifications.
		4.3 Measure and consistently compare electrical parameters to expected values.
		4.4 Clearly record anomalous conditions and quickly rectify where possible.
		4.4 Accurately document design changes according to organizational procedures.
		4.5 Verify the accuracy of as-built documentation and labelling.
5.	Prepare required documentation	5.1 Accurately complete required documentation for testing and commissioning activities according to organizational procedures.
		5.2 Accurately review, agree and sign off installation documentation in accordance with organizational procedures.
		5.3 File documentation and photographs securely for easy retrieval.

RANGE STATEMENT

All range statements must be assessed:

1. **Site conditions**:

    - Electrical distribution
    - Ground and soil conditions
    - Roof conditions
    - Building and structural conditions
    - Environmental conditions
    - Site access
    - Site security

2. **Stakeholders**:

    - Customer
    - Authority Having Jurisdiction (AHJ)
    - Installation and engineering team
    - Procurement personnel
    - Utility company
    - Relevant governmental authorities
    - Fire service

3. **Relevant standards**:

    - Recognized industry legislation, policies and procedures
    - Electrical regulations and standards
    - Manufacturer's guidelines
    - Environmental requirements

4. **Components**:

    - Distribution panel
    - Inverters
    - Direct current cabling
    - Combiner
    - Photovoltaic panels
    - Transformers
    - Batteries
    - Modules
    - Alternating current and direct current disconnects
    - Charge controllers
    - Over current, transient voltage surge suppressors (TVSS) and lightening protection system

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the industry standards for project tasks, timelines and procedures.
2. What resources are required for the installation and the requisition process to obtain them.
3. How to conduct pre-installation requirements.
4. How to communicate the logistical details to stakeholders to obtain their confirmation.
5. What are the layouts and requirements for installing photovoltaic module arrays.
6. How to sequence the work flow correctly to minimize the risk of injury through electrocution and other hazards.
7. What are the requirements for connecting photovoltaic modules with multiple arrays.
8. How to confirm that the string voltages and currents are suitable for the inverter rating and overall system.
9. What are photovoltaic system protection techniques, components and settings.
10. What are the requirements to test and commission solar photovoltaic systems.
11. What is the required documentation for compliance with industry and workplace standards.
12. What are the workplace filing protocols for installation documentation.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates must prove that they can carry out **all** the elements, meeting **all** of the performance criteria, range and underpinning knowledge **on more than one occasion.** This evidence must come from a real working environment.

(2) Methods of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U75203 Maintain and troubleshoot photovoltaic systems

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to maintain and troubleshoot photovoltaic systems, in addition to resolving the faults discovered from the troubleshooting process.

ELEMENT	PERFORMANCE CRITERIA
	To be competent you must achieve the following:
1. Perform photovoltaic system inspection	1.1 Identify and assess hazards and strictly implement appropriate controls.
	1.2 Inspect **components** and grounding systems and accurately verify against technical specifications.
	1.3 Inspect module mounting system and module glazing integrity.
	1.4 Inspect weatherproofing systems in accordance with **relevant standards** and precisely identify damage due to corrosion and improper installation.
	1.5 Check inverter status, cell coloration and wiring supports and report and any damages.
	1.6 Precisely identify array shading and soiling in addition to electrical connection damage due to overheating according to technical specifications and industry standards.
	1.7 Accurately document findings on inspections in accordance with organizational procedures.
2. Assess photovoltaic system function	2.1 Accurately measure systems electrical parameters and document according to **relevant standards** and organizational requirements.

		2.2 Calculate electrical parameters and accurately compare to measured parameters.
		2.3 Accurately note anomalous conditions and rectify in accordance with specifications and **relevant standards**.
		2.4 Test system electrical operations.
		2.5 Accurately verify source circuits' connections are accurately verified against technical specifications and **relevant standards**.
		2.6 Equipment and terminal temperatures are correctly measured, where necessary.
		2.7 Battery auxiliary systems are thoroughly verified.
		2.8 Customers are interviewed and concerns immediately documented according to organizational requirements.
		2.9 Corrective actions are identified and recommended in detail.
		2.10 Faults which pose an immediate threat to life, limb and property are immediately actioned.
3.	Resolve photovoltaic system functional failures related to electrical components	3.1 Relevant precautionary actions are consistently taken to minimize risk of injury to self or others during fault rectification.
		3.2 Equipment variable set points are correctly checked against technical specifications
		3.3 Frayed wires, blown fuses and other faulty electrical components are correctly replaced or repaired according to regulations and organizational requirements.

3.4 Corrective actions are accurately documented in line with organizational procedures.

3.5 System operations and electrical parameters are thoroughly retested.

3.7 Post resolution test results are accurately documented according to organizational and **relevant standards**.

RANGE STATEMENT

All range statements must be assessed:

A. Standards:

i) Recognized industry legislation, policies and procedures
ii) Electrical regulations and standards
iii) Manufacturer's guidelines
iv) Environmental requirements

B. Components:

i) Distribution panel
ii) Inverters
iii) Direct current cabling
iv) Combiner
v) Photovoltaic panels
vi) Transformers
vii) Batteries
viii) Modules
ix) Alternating current and direct current disconnects
x) Charge controllers
xi) Over current, transient voltage surge suppressors (TVSS) and lightning protection system

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What documentation must be used to conduct routine inspections and fault assessments.
2. What are the requirements for inspections and systems tests.
3. What are the procedures and expected test results for functional tests and performance tests.
4. How to dismantle the electrical component assemblies.
5. What are the procedures for replacing and repairing faulty electrical components.
6. What documents are to be completed and produced during and after corrective actions are taken, according to workplace and industry standards.
7. What precautions are necessary to avoid risk of injury to self and others.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates must prove that they can carry out **all** the elements, meeting **all** of the performance criteria, range and underpinning knowledge **on more than one occasion.** This evidence must come from a real working environment.

(2) Methods of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **must not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U75303 Allocate work and monitor the performance and quality of work from team members

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to assign work to team members. It involves monitoring performance in terms of time, cost, risk and quality. Candidates will also be required to report on the current status and the impact on completion of work assignments in accordance with workplace and industry standards.

ELEMENT	PERFORMANCE CRITERIA
	To be competent you must achieve the following:
1. Assign work to team members	1.1 Review overall work, break down into smaller work requirements and succinctly identify priorities.
	1.2 Conduct risk assessments to identify and assess safety hazards and thoroughly review appropriate controls with team members.
	1.3 Accurately match work lists to team members' skills, knowledge, experience and opportunities to develop skills provided in line with organizational requirements.
	1.4 Comprehensively brief team members on their work assignments, resources available for work and expected performance level(s).
	1.5 Fully confirm that work assignments and requirements for successful completion are understood by team members.
2. Monitor performance of work	2.1 Verify that resources required to complete work are available.
	2.2 Obtain and collate status reports are in a timely manner.
	2.3 Assess status reports and validate by inspection of work completed to date.

	2.4 Identify variances in time and cost in collaboration with team members and rectify promptly.
	2.5 Clearly communicate variances and corrective actions to customers.
	2.6 Consistently recognize effective performance in relation to time and cost and provide support where improvements are required.
	2.7 Consistently update work performance documentation to reflect any changes in accordance with organizational requirements.
3. Monitor quality of work	3.1 Confirm that materials and other resources meet workplace or industry standards.
	3.2 Apply quality control methods in accordance with industry standards, at agreed points to verify quality is being met.
	3.3 Promptly identify, document and correct sources of variances with input from team members and management, where necessary.
	3.4 Accurately document corrective actions in line with organizational requirements.
	3.5 Clearly update work quality documentation.

RANGE STATEMENT

All range statements must be assessed:

1. Inspected:

- Accuracy measurements
- Precision measurements
- Quality checklist

A. Inspected:

i) Accuracy measurements
ii) Precision measurements
iii) Quality checklist

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. How to select and successfully apply different methods for communicating with others across an area of responsibility.

2. Why it is important to confirm and clarify the work required in your own area of responsibility with your manager and how to do this effectively.

3. How to identify and take due account of health and safety issues in the planning, allocation and monitoring of work.

4. How to produce a plan of work for your own area of responsibility, including how to identify any priorities or critical activities and the available resources.

5. Why it is important to seek views from persons working in your own area and how to take account of their views in producing the plan of work.

6. Why it is important to brief individuals and teams on allocated work and the standard or level of expected performance and how to do so effectively.

7. What are ways of encouraging individuals and teams to ask questions seek clarification and make recommendations in relation to the work which they have been allocated.

8. What are the additional support and resources which individuals and teams might require to help them complete their work and how to assist in their provision.

9. How to log information on the ongoing performance of individuals and teams and use this information for formal performance appraisal purposes.

10. Why it is important to review and update plans of work for your own area to account for changes in work.

11. How to reallocate work and resources and clearly communicate the changes to those affected.

12. What are the requirements of relevant legislation on employees' rights and health and safety.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates must prove that they can carry out **all** the elements, meeting **all** of the performance criteria, range and underpinning knowledge **on more than one occasion.** This evidence must come from a real working environment.

(2) Methods of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U47403 Communicate with customers and others

Unit Descriptor:

This unit describes the knowledge skills and attitudes required to politely and effectively communicate with other persons encountered while working.

Clear communication is important to pass on all necessary information and make sure health and safety information and workplace procedures are understood.

ELEMENT	PERFORMANCE CRITERIA
	To be competent you must achieve the following:
1. Communicate information to customers and others	1.1 Organizational standards for appearance and positive behaviour are adhered to.
	1.2 Relevant and current information for effective working is obtained.
	1.3 Colleagues and other personnel are communicated with using appropriate communication strategies
	1.4 Information is clearly communicated in a systematic and structured manner
2. Respond to customers and others	2.1 **Customers**' questions and comments are responded to promptly and in a positive manner.
	2.2 All **communication** is acknowledged and responded to clearly, courteously and promptly.
	2.3 Persons are questioned to confirm that the information received is correctly understood.
	2.4 Information is recorded in an appropriate manner in accordance with the organizational procedures.
	2.5 Accurate and current information is presented in a clear and concise manner to the relevant persons.
	2.6 Corrective action is taken when there are difficulties in relaying information.

2.7 **Faults** with c**ommunication equipment** are reported immediately to appropriate persons.

2.8 Customers' needs and attitudes are acknowledged and responded to.

RANGE STATEMENT

All range statements must be assessed:

A. Customers:

i) Internal (colleagues, supervisors etc.)
ii) External (other organizations , business places, public)

B. Communication:

i) Telephone calls
ii) Emails/internet
iii) Faxes
iv) Letter
v) Social Media
vi) Face to face/verbal

C. Faults:

i) Electronic
ii) Mechanical
iii) Physical

D. Communication Equipment

i) Telephones (fixed line/mobile)
ii) Computer equipment
iii) Smart phones and tablets
iv) Faxes

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the reasons for communicating with others.
2. What are the organizational procedures for personal appearance and behaviour.
3. How does your behaviour and attitude reflect on your workplace and organization.
4. What is the importance of creating a positive impression.
5. How to obtain your work instructions and verify that that the work instructions are up-to-date.
6. What is reason for checking that the information is understood correctly.
7. What are the different forms of communication available and how they are used.
8. How to use appropriate strategies to communicate with colleagues and other personnel.
9. Why is it important to communicate clearly and provide necessary information.
10. How to communicate information clearly and systematically.
11. Why it is important to respond positively to questions and queries from customers.
12. How to respond to customers' questions and queries courteously, promptly and in a positive Manner.
13. What are the organizational procedures for acknowledging and responding to incoming information.
14. How to use effective questioning techniques to ensure information is understood.
15. What are the organizational and workplace procedures for recording information.
16. What is the correct process for transferring information.
17. How to ensure that the correct or authorized person receives the information.
18. How to identify problems in the relaying of information.
19. What are the corrective measures or actions taken to rectify problems in relaying information and how these should be applied.
20. What is the procedure for reporting faults with communication equipment.
21. How to identify customer needs and attitudes.
22. How to respond correctly to customer needs and attitudes.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates must prove that they can carry out **all** the elements, meeting **all** of the performance criteria, range and underpinning knowledge **on more than one occasion.** This evidence must come from a real working environment.

(2) Methods of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U49102 Use access equipment to work at heights

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively and safely work on elevated surfaces.

It focuses on using access equipment to work on elevated surfaces as well as the associated health and safety risks.

ELEMENT		PERFORMANCE CRITERIA	
		To be competent you must achieve the following:	
1	Prepare to work at heights	1.1	Occupational Health and Safety requirements associated with working on **elevated work surfaces** are recognized and adhered to.
		1.2	**Personal protective equipment** is selected, correctly fitted and used appropriately.
		1.3	Workplace operation plans are identified and followed in accordance with job requirements, surrounding activities and environment.
		1.4	**Safety hazards** are identified and correct procedures followed to minimize risks to self and others.
		1.5	Risks of working at heights are assessed with supervisor.
2	Conduct checks before using access equipment	2.1	All necessary checks are made to access equipment before use.
		2.2	Checks are made to ensure that ground and floor surfaces are suitable and safe.
3	Work safely	3.1	Barricades and signage to isolate working area are safely erected.
		3.2	Different types of surfaces are identified in relation to risks.
		3.3	Tools, equipment, materials and components in, on or around the access equipment are safely and effectively placed.

		3.4	Equipment used to gain access to and from the working height is used in accordance with manufacturer and organizational guidelines.
		3.5	Work activities are safely conducted at heights.
4	Clean up	4.1	Waste material is removed and disposed of safely.
		4.2	Unused materials are stored/stacked appropriately.
		4.3	Tools and equipment are removed and stored safely.
5	Record information regarding working at heights	5.1	Records are kept of **relevant information** pertaining to working at heights.
		5.2	Completed records are handled and stored in accordance with company policies.

RANGE STATEMENT

All range statements must be assessed:

A. Elevated work surfaces:

i) Scissor-type lifts
ii) Extending arm
iii) Roofs (various types)
iv) Mounting structures (independent)
v) Scaffolding
vi) Support structures

B. Personal protective equipment:

i) Coveralls
ii) Safety boots
iii) Hard hat/cap
iv) Gloves
v) Safety glasses or googles
vi) Ear plug or earmuffs
vii) Dust masks or respirator
viii) Harnesses

C. Safety hazards:

i) Limited space
ii) Other activities taking place within vicinity
iii) Weather conditions
iv) Wet surfaces
v) Vegetation
vi) Utilities

D. Relevant information:

i) Service information
ii) Condition of equipment
iii) Environmental condition

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What is meant by 'working at heights'.
2. What are the workplace and equipment safety requirements relative to working at heights.
3. How to assess the risks of working at heights and why this is important.
4. What are the different types of access equipment and working platforms for working at heights and the limitations of the use of this equipment.
5. How to inspect the prepared access equipment or working platforms before use.
6. What to do when the supplied access equipment is not suitable for the work required.
7. Why it is important to regularly inspect access equipment and working platforms.
8. What types of work surfaces are suitable and safe.
9. What types of information should be recorded when working at heights.
10. How to document information in accordance with company policies.
11. How to handle and store completed records.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates must prove that they can carry out all the elements, meeting **all** of the performance criteria, range and underpinning knowledge **on more than one occasion.** This evidence must come from a real working environment.

(2) Methods of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **must not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

Level 3 Glossary of Terms

Assessment methods

The methods which can be used to determine competence in performance and underpinning knowledge.

Assessors

The Assessor guides and assesses the candidate. His/her role is to determine whether evidence presented by a candidate for assessment within the programme, meets the required standard of competence in the relevant unit or element. The Assessor needs to be competent to assess to national standards in the area under assessment.

Approved Centre

Organization/Centre approved by the TVET Council to offer full National Vocational Qualifications.

Case Studies

In situations where it is difficult for workplace assessment to take place, case studies can offer the candidate an opportunity to demonstrate potential competence.

A case study is a description of an actual or imaginary situation presented in some detail. The way the case study is presented will vary depending upon the qualification, but the most usual methods are written, taped or filmed.

The main advantage of a case study is the amount of evidence of underpinning knowledge they can generate and the specific nature of the evidence produced.

Competence

In the context of vocational qualifications, competence means: the ability to carry out prescribed activities to nationally pre-determined standards in an occupation. The definition embraces cognitive, practical and behavioural skills, underpinning knowledge and understanding and the ability to react appropriately in contingency situations.

Element

An element is a description of an activity which a person should be able to do. It is a description of an action, behaviour or outcome which a person should be able to demonstrate.

Explanation of NVQ Levels

NVQs cover five (5) levels of competence, from entry level staff at Level 1 through to senior management at Level 5.

Level 3 Glossary of Terms

Level 1 - Entry Level
Recognizes competence in a range of varied work activities performed in a variety of contexts. Most work activities are simple and routine. Collaboration with others through work groups or teams may often be a requirement. Substantial supervision is required especially during the early months evolving into more autonomy with time.

Level 2 - Skilled Occupations:
Recognizes competence in a broad range of diverse work activities performed in a variety of contexts. Some of these may be complex and non-routine and involve some responsibility and autonomy. Collaboration with others through work groups or teams and guidance of others may be required.

Level 3 - Technician and Supervisory Occupations:

Recognizes competence in a broad range of complex, technical or professional work activities performed in a wide variety of contexts, with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and the allocation of resources are often a requirement. The individual is capable of self-directed application, exhibits problem solving, planning, designing and supervisory capabilities.

Level 4 - Technical Specialist and Middle Management Occupations:

Recognizes competence involving the application of a range of fundamental principles and complex techniques across a wide and unpredictable variety of contexts. Requires very substantial personal autonomy and often significant responsibility for the work of others, the allocation of resources, as well as personal accountability for analysis, diagnosis, design, planning, execution and evaluation.

Level 5 - Chartered, Professional and Senior Management Occupations:

Recognizes the ability to exercise personal professional responsibility for the design, development or improvement of a product, process, system or service. Recognizes technical and management competencies at the highest level and includes those who have occupied positions of the highest responsibility and made outstanding contribution to the promotion and practice of their occupation.

External Verifier

The External Verifier is trained and appointed by the TVET Council and is competent to approve and ensure an approved Centre's quality of provision.

Internal Verifier

The Internal Verifier acts in a supporting role for Assessors to ensure consistent quality of assessment and competence. They need to be competent to assess to national standards in the area under assessment.

Level 3 Glossary of Terms

NVQ

National Vocational Qualifications (NVQs) are work-based qualifications that assess an individual's competence in a work situation and certify that the individual can perform the work role to the standards expected in employment.

NVQs are based on national occupational standards of competence drawn up by standards-setting bodies known as Industry Lead Bodies. The standards describe the level and breadth of performance that is expected of persons working in the industry or sector which the NVQ covers.

NVQ Coordinator

The NVQ Coordinator is the centre contact within each approved Centre offering NVQs. He/she has overall responsibility for the operation and administration of the NVQ system.

Observation

Observation of the candidate carrying out his/her job in the workplace is the assessment method recommended in the vast majority of units and elements. Observation of staff carrying out their duties is something that most supervisors and managers do every day.

Performance Criteria

Performance criteria indicate what is required for the successful achievement of an element. They are descriptions of what you would expect to see in competent performance.

Product of Work

This could be items produced during the normal course of work, which can be used for evidence purposes such as reports, menus, promotional literature, training plans, etc.

Questioning

Questioning is one of the most appropriate ways to collect evidence to assess a candidate's underpinning knowledge and understanding.

Questioning can also be used to assess a candidate in those areas of work listed in the range which cannot be assessed by observation. Guidance on when this assessment method can be used is given in the assessment guidance of each individual element.

As an assessment method, questioning ensures you have all of the evidence about a candidate's performance. It also allows you to clarify situations.

Level 3 Glossary of Terms

Rage statements

The range puts the element of competence into context. A range statement is a description of the range of situations to which an element and its performance criteria is intended to apply.

Range statements are prescriptive therefore each category must be assessed.

Role-plays

Role-plays are simulations where the candidate is asked to act out a situation in the way he/she considers "real" people would behave. By using role-play situations to assess a candidate you are able to collect evidence and make a judgment about how the candidate is most likely to perform. This may be necessary if the range specified includes a situation in which the candidate is unlikely to find himself/herself in the normal course of their work, or where the candidate needs to develop competence, before being judged competently, for example, in a disciplinary situation,

Simulations

Where possible, assessment should always be carried out by observing **natural performance** in the workplace. **Simulated performance,** however, can be used where specified to collect evidence about an aspect of the candidate's work which occurs infrequently or is potentially hazardous; for example, dealing with fires.

By designing the simulated situation, briefing the candidate and observing his/her performance, you will be able to elicit evidence which will help you judge how a candidate is **most likely** to perform in real life.

Supplementary evidence

Supplementary evidence can be used to confirm and support performance evidence. Types of supplementary evidence include witness testimonies, reports, journals or diaries, records of activities, personal statements, simulation (see note in glossary).

Underpinning knowledge

Underpinning knowledge indicates what knowledge is essential for a person to possess in order to successfully achieve an element and prove total competence.

Units

A unit of competence describes one or more activities which form a significant part of an individual's work. Units are accredited separately but in combination can make up a vocational qualification. There are three categories of units:

Level 3 Glossary of Terms

Mandatory units - are core to a qualification and must to be completed.

Optional units - candidates must choose the required number of individual units, specified in the qualification structure, to achieve the qualification.

Work-based projects

Work-based projects are a useful way for you to collect evidence to support any decision you make about a candidate's performance. They are particularly appropriate in determining the level of a candidate's underpinning knowledge and understanding where it may be insufficient to rely only on questioning observation.

A project often involves the identification of a solution to a specific problem identified by you and/or the candidate (such as looking at ways to redress a recent drop in sales), or may be a structured programme of work built around a central situation or idea (such as the introduction of a new job rostering process).