



## **Occupational Standards of Competence**

# **Photovoltaic Panel Installation - Roofer/Fitter**

## **Level 2**

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**Qualification Overview**

**NVQB**

**in**

**Photovoltaic Panel Installation - Roofer/Fitter**

**Level 2**

# **NVQB in Photovoltaic Panel Installation - Roofer/Fitter Level 2**

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## **Qualification Overview**

The **Photovoltaic Panel Installation - Roofer/Fitter Level 2** is a competence-based qualification that covers installing photovoltaic (PV) panels and systems into roofs, onto roofs or in non-roof structures. It is suitable for those who install photovoltaic panels as PV Installers or Solar Panel Installers. It covers communicating and working with others; working at heights; PV systems; and locating, preparing, testing, handling, fixing and completing the installation of photovoltaic panels. The importance and requirements of health and safety are emphasized throughout the qualification.

The standards of competence cover significant aspects of the work required with PV panel installation; although it stops short of the actual commissioning of the installation, so there is no requirement for a qualification in electrical installation to achieve the qualification. The grouping of optional units should allow all employed in the industry equal opportunity to complete the qualification.

## **Who is this qualification for?**

Although this qualification is at Level 2, there may be individual units at other levels that should be taken by those who are fully trained to deal with the installation process; however candidates should require minimum supervision in undertaking these tasks.

Candidates for this qualification will primarily be working on customers' premises carrying out the installation of PV panels.

The groups of optional units are intended to permit all those involved in the installation of PV panels and systems to complete the qualification. When choosing from the optional units, it is important to ensure the units selected are appropriate and achievable within the candidates' job role.

## **Restrictions**

This qualification is approved for learners aged 16 and older. Further age limits on candidates undertaking this NVQ will depend on the legal requirements of the process or the environment. Learners, however, should be able to function at Level 1 or above and be comfortable working outdoors and at heights. Otherwise, there are no formal entry requirements for candidates undertaking this qualification. Centres must ensure that candidates have the potential and opportunity to gain evidence for the qualification in the workplace.

**NATIONAL VOCATIONAL QUALIFICATION STRUCTURE**  
**PHOTOVOLTAIC PANEL INSTALLATION - ROOFER/FITTER**  
**LEVEL 2**

Candidates are required to successfully complete **eighteen (18)** units to gain the qualification - **sixteen (16) mandatory** units and **any two (2) optional** units that do not have content that overlaps to any great degree of significance. **Optional units** should be selected as follows: **one (1) from Group A; one (1) from Group B.**

<b>Mandatory Units (All must be completed)</b>	<b><u>CODE</u></b>
<b>1. Undertake interactive workplace communication</b>	<b>U49002</b>
1.1 Communicate information	
1.2 Share information to achieve appropriate work outcomes	
1.3 Develop and maintain good working relationships with colleagues	
<b>2. Use access equipment to work at heights</b>	<b>U49102</b>
2.1 Prepare to work at heights	
2.2 Conduct all necessary checks before using the access equipment	
2.3 Work safely	
2.4 Clean up	
2.5 Record information regarding working at heights	
<b>3. Maintain health and safety in the photovoltaic panel installation environment</b>	<b>U49202</b>
3.1 Follow safe work practices	
3.2 Adopt systems of work	
3.3 Identify and report workplace hazards and risks	
3.4 Follow accident and emergency procedures	

## **NVQB in Photovoltaic Panel Installation - Roofer/Fitter Level 2 cont'd.**

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### **Mandatory Units (ALL must be completed)**

- |           |   |               |
|-----------|---|---------------|
| <b>4.</b> | <b>Confirm photovoltaic panel installation requirements</b>                               | <b>U49302</b> |
| 4.1       | Identify and confirm the specifications required to complete the installation             |               |
| 4.2       | Establish the type, location, characteristics and features of the installation            |               |
| <b>5.</b> | <b>Work with photovoltaic systems</b>   | <b>U49402</b> |
| 5.1       | Obtain tasks specifications and make plans  |               |
| 5.2       | Identify components and suitable locations  |               |
| 5.3       | Check system  |               |
| <b>6.</b> | <b>Locate, test, handle and position photovoltaic panels prior to installation</b>        | <b>U49502</b> |
| 6.1       | Locate and select materials and components.   |               |
| 6.2       | Handle and transport materials and components   |               |
| 6.3       | Carry out testing procedures on photovoltaic panels                                       |               |
| 6.4       | Position materials and components   |               |
| <b>7.</b> | <b>Prepare the structure for photovoltaic panel installation on an existing structure</b> | <b>U49602</b> |
| 7.1       | Prepare area and structure for panel installation   |               |
| 7.2       | Identify and remove dangerous components or materials                                     |               |
| 7.3       | Remove existing roof components and materials   |               |
| 7.4       | Select and prepare installation equipment   |               |
| 7.5       | Select materials to be used   |               |
| 7.6       | Check that the installation area meets specifications                                     |               |
| <b>8.</b> | <b>Fix photovoltaic panels onto a roof structure</b>                                      | <b>U49702</b> |
| 8.1       | Expose roof area  |               |
| 8.2       | Locate and mark out area for fixing panels  |               |
| 8.3       | Select and fix brackets to roof structure   |               |

## **NVQB in Photovoltaic Panel Installation - Roofer/Fitter Level 2 cont'd.**

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### **Mandatory Units (ALL must be completed)**

- 8.4 Replace roof covering after fixing brackets
- 8.5 Fix panels to mounting system
- 8.6 Connect panels
  
- 9. Perform post-photovoltaic installation activities U49802**
  - 9.1 Check the installation
  - 9.2 Handle and remove waste
  - 9.3 Clean up
  - 9.4 Provide customer service
  
- 10. Plan to undertake a routine task U49902**
  - 10.1 Identify task requirements
  - 10.2 Plan steps required to complete task
  - 10.3 Review plan
  
- 11. Use graduated measuring devices U50002**
  - 11.1 Use a range of graduated devices to measure/determine dimensions or variables
  - 11.2 Maintain graduated devices
  
- 12. Use hand tools U50102**
  - 12.1 Use hand tools
  
- 13. Perform related computations (basic) U50202**
  - 13.1 Apply four rules of calculation
  - 13.2 Perform calculations involving fractions and decimals
  
- 14. Mark off/out (general engineering) U50302**
  - 14.1 Determine job requirements
  - 14.2 Transfer dimensions
  - 14.3 Make templates



## **NVQB in Photovoltaic Panel Installation - Roofer/Fitter Level 2 cont'd.**

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### **Mandatory Units (ALL must be completed)**

- 15. Draw and interpret sketches and simple drawings** **U50402**
- 15.1 Prepare free-hand sketch
  - 15.2 Interpret details from free-hand sketch
  - 15.3 Select correct technical drawing
  - 15.4 Identify drawing requirements
  - 15.5 Prepare or make changes to engineering drawing
- 16. Perform manual handling and lifting** **U50502**
- 16.1 Lift materials
  - 16.2 Move/shift materials

### **Optional Units (Group A)**

- 17. Prepare structure for photovoltaic panel installation - new structure** **U50602**
- 17.1 Prepare work areas
  - 17.2 Select and prepare installation equipment
  - 17.3 Ensure materials are available for use
  - 17.4 Prepare area and secure installation to structure
- 18. Fix photovoltaic panels into a roof structure** **U50702**
- 18.1 Locate and mark out area where panels are to be fixed
  - 18.2 Expose roof area to attach panels within roof structure
  - 18.3 Remove existing roof covering for fixing panel in roof mounting kit
  - 18.4 Fit and fix panel to roof structure
  - 18.5 Fix panel in roof mounting system
  - 18.6 Connect panels

## **NVQB in Photovoltaic Panel Installation - Roofer/Fitter Level 2 cont'd.**

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### **19. Fix photovoltaic panels onto a non-roof structure U50802**

- 19.1 Mark out location to install photovoltaic panels
- 19.2 Check suitability and conditions of location
- 19.3 Select and fix bracket mounting system to non-roof structures
- 19.4 Fix panels to mounting system
- 19.5 Connect panels together

### **Optional Units (Group B)**

### **20. Complete related installation U50902**

- 20.1 Inspect the installation prior to commissioning
- 20.2 Share information about the installation with customers
- 20.3 Develop the relationship between your customers and your organization

### **21. Use electrical/electronic measuring devices U51002**

- 21.1 Use electro-measuring devices
- 21.2 Maintain electro-measuring devices

### **22. Prepare for electrical conduit/wiring installation U51102**

- 22.1 Plan for installation process
- 22.2 Prepare materials selected for installation process
- 22.3 Prepare work area for installation process
- 22.4 Use tools and equipment appropriate for installation process
- 22.5 Prepare background of services/environment for electrical conduit/wiring installation
- 22.6 Handle materials
- 22.7 Store material
- 22.8 Clean up

## **NVQB in Photovoltaic Panel Installation - Roofer/Fitter Level 2 cont'd.**

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**23. Cut, bend and install electrical conduits** **U51202**

- 23.1 Plan and prepare for installation
- 23.2 Install conduit
- 23.3 Inspect and notify about completion of work

**24. Install, terminate and connect electrical wiring** **U51302**

- 24.1 Prepare for electrical wiring installation, termination and connection
- 24.2 Install electrical wiring
- 24.3 Connect electrical wiring

## U49002

## Undertake interactive workplace communication

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively communicate with others in the related working environment to achieve required objectives.

It focuses on responding promptly to requests, the sharing of information and developing good working relationships with colleagues.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |   |  |
|---|--|
| 1. Communicate information                                    | 1.1 Questions are asked to elicit additional <b>information</b> .<br>1.2 Appropriate sources of <b>information</b> are identified.<br>1.3 <b>Information</b> is selected and sequenced appropriately.<br>1.4 <b>Information</b> is <b>communicated</b> about tasks, processes, events or skills.<br>1.5 Verbal or written communication is used as required. |
| 2. Share information to achieve appropriate work outcomes     | 2.1 <b>Information</b> is shared with colleagues.<br>2.2 Feedback is sought and <b>information</b> provided to others.<br>2.3 Goals and aims are <b>communicated</b> to appropriate persons.<br>2.4 Outcomes are <b>communicated</b> to appropriate persons.   |
| 3. Develop and maintain working relationships with colleagues | 3.1 Constructive contributions are made to the production process.<br>3.2 Requests from colleagues and customers are responded to promptly.  |

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Information:**

- (i) Drawings
- (ii) Work schedules
- (iii) Job instructions
- (iv) Client instructions
- (v) Organizational policies

**B. Communicated:**

- (i) Face-to-face methods (including verbal and non-verbal communication)
- (ii) Using the telephone
- (iii) Using written (including electronic) methods
- (iv) Signage

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to communicate in the workplace.
2. How to convey information in simple English.
3. How to read and interpret instructions.
4. What is the basic level in writing English (writing short, routine text).
5. What information to share with colleagues in your job role and why this is important.
6. Why it is important to respond promptly to requests.
7. Why good working relationships with colleagues are important.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate 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, products 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 according to company and manufacturer's guidelines.

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 organizational 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 company guidelines.
  - 3.5 Work activities are safely conducted at heights.
- 4. Clean up
  - 4.1 Waste material is removed and disposed of safely according to industry and company procedures.
  - 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/goggles
- (vi) Ear plugs/earmuffs
- (vii) Dust masks/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 at least two (2) occasions**. This evidence must come from a real working environment.

### Method of Assessment

#### (2) Method 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:

- Written/oral questioning
- Observation
- Written evidence (case study, projects, assignments)
- Witness testimony

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 using 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 an individual 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.

## U49202

## Maintain health and safety in the photovoltaic panel installation environment

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively perform work activities and conform to occupational health and safety requirements.

It focuses on knowledge of Acts, regulations and guidelines in the photovoltaic panel installation environment and how these apply in practice.

Candidates will be required to identify hazards and report safety risks to their supervisor while adopting safe working practices and systems. They will also need to know what to do in the event of accidents and emergencies.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

## 1. Follow safe work practices

- 1.1 **Occupational health and safety requirements** associated with the working environment are adhered to.
- 1.2 Safety equipment and devices are checked in accordance with legislative requirements and/or company and manufacturer's procedures or instructions.
- 1.3 **Personal protective equipment** is selected and used in accordance with legislation and company procedures.
- 1.4 **Personal protective equipment**, tools and equipment are fit for the work undertaken.
- 1.5 **Personal protective equipment** not being used is stored appropriately.
- 1.6 Safe **manual handling** procedures are used.

2. Adopt systems of work
  - 2.1 Work tasks are prioritized and carried out in accordance with **occupational health and safety requirements** and company procedures.
  - 2.2 Equipment required to carry out the work is selected and safely used.
  - 2.3 Components and materials required for the installation are selected and correctly used according to company and industry guidelines.
3. Identify and report workplace hazards and risks
  - 3.1 **Hazards and risks** in the workplace are identified.
  - 3.2 Identified **hazards and risks** are reported to the appropriate person according to company guidelines.
  - 3.3 Identified risks are minimized.
4. Follow accident and emergency procedures
  - 4.1 Appropriate persons are notified when there is an accident or emergency.
  - 4.2 **Emergency procedures** are followed according to company guidelines.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Occupational Health and Safety requirements:**

- (i) Operation of mechanical/manual equipment
- (ii) Protective clothing and equipment
- (iii) Worksite environment and safety
- (iv) Handling of materials
- (v) Emergency procedures
- (vi) Physical/mental/emotional condition of workers

**B. Personal protective equipment:**

- (i) Coveralls
- (ii) Safety boots
- (iii) Hard hat/cap
- (iv) Gloves
- (v) Safety glasses/goggles
- (vi) Ear plugs/ear muffs
- (vii) Dust masks/respirator
- (viii) Harnesses

**C. Manual handling techniques:**

- (i) Lifting and lowering of heavy loads
- (ii) Pushing and pulling objects/loads
- (iii) Carrying or moving objects/loads
- (iv) Holding or restraining

**D. Hazards or risks:**

- (i) Limited space
- (ii) Weather conditions
- (iii) Wet surfaces
- (iv) Electrical

**E. Emergency procedures:**

- (i) Fire
- (ii) Medical
- (iii) Evacuation

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the basic principles of the Safety and Health at Work Act 2005-12 (SHAW Act).
2. What are the Occupational Health and Safety regulations and guidelines pertaining to the photovoltaic installation environment and how these apply in practice.
3. What are the different types of personal protective equipment and how these should be used and stored.
4. What are the possible hazards and risks in the photovoltaic installation working environment.
5. How to follow safety instructions.
6. How to adopt safe working practices.
7. How to select and safely use material, equipment and tools to standards.
8. What are the different manual handling techniques.
9. How to follow procedures to respond to accidents and emergencies.
10. Who to contact in the event of an accident or emergency.



## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U49302: Confirm photovoltaic panel installation requirements

### Unit Descriptor:

This unit describes the knowledge, skills and attitudes required for identifying and confirming the specifications required to complete photovoltaic panel installation.

It focuses on establishing the type, location, characteristics and features of the installation and on assessing the structure intended for the installation.

ELEMENT	PERFORMANCE CRITERIA
1. Identify and confirm specifications required to complete installation	<p><i>To be competent you must achieve the following:</i></p> 1.1 Sources of information to confirm the specifications are identified. 1.2 Components that need to be checked when confirming the requirements are identified. 1.3 Aspects of the installation other than components to be checked are listed. 1.4 Work is carried out to the latest specifications and in accordance with company policies. 1.5 Confirmation is sought to ensure that specifications are accurate and up to date.
2. Establish type, location, characteristics and features of installation	2.1 <b>Type</b> and location of the installation work are established. 2.2 Checklist is prepared of the characteristics, features and other conditions. 2.3 Ground level and floor surface are checked for stability. 2.4 <b>Structure</b> intended for the installation is assessed for suitability.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Type of installation:**

- (i) Pole mount
- (ii) Ground mount
- (iii) Pitched-roof mount
- (iv) Flat-roof mount
- (v) Façade (thin film)

**B. Structure:**

- (i) Existing structure
- (ii) New building
- (iii) Onto a roof structure
- (iv) Into a roof structure
- (v) Onto a non-roof structure

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to identify and confirm the specifications required to complete the installation.
2. How to establish the type, location, characteristics and features of the installation.
3. How to check for stability of ground level and floor surface.
4. How to assess the structure for suitability.

## 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 at least two (2) occasions**. 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
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- Personal statement
- Written evidence (projects or assignments)
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- Role play/simulation

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 using 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, products 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.

## U49402

## Work with photovoltaic systems

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required for working with photovoltaic systems and identifying major components and their purposes in photovoltaic systems.

It also focuses on the necessary conditions for operating an effective photovoltaic system and the legislation and safety precautions that must be taken.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |   |  |
|---|--|
| 1. Obtain task specifications and make plans  | 1.1 Relevant specifications for task outcomes are obtained.                                |
|   | 1.2 Steps required to complete tasks are identified.                                       |
|   | 1.3 Tasks are specified that must be carried out and completed by a qualified electrician. |
| 2. Identify components and suitable locations | 2.1 <b>Major components</b> of the photovoltaic system are identified.                     |
|   | 2.2 Components are labeled with the correct information according to specifications.       |
|   | 2.3 Photovoltaic technology used in panels is recognized.                                  |
|   | 2.4 Conditions are approved for an effective photovoltaic system.                          |
|   | 2.5 A suitable location for each component is identified.                                  |

3. Check the system
  - 3.1 System is checked and relevant information recorded in accordance with legislation and manufacturer's and company procedures.
  - 3.2 Safety precautions relating to photovoltaic systems are identified and followed.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Major components:**

- (i) Panels
- (ii) Inverter
- (iii) Charger controller
- (iv) Mounting system



**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How the photovoltaic system works.
2. What types of photovoltaic technology is used in panels.
3. What are the different materials used to construct photovoltaic panels.
4. What is the difference between grid-connected and off-grid systems.
5. What are the common words and terms used in the photovoltaic environment.
6. How to identify non-compliance equipment.
7. Why equipment may be non-compliant.
8. What are the necessary conditions for operating an effective photovoltaic system.
9. What safety precautions to take with photovoltaic systems.
10. What are the specific installation requirements that are to be met.
11. What work relating to photovoltaic installation must be carried out by a qualified electrician.
12. What planning permission is required for photovoltaic installations.
13. What problems may arise with photovoltaic installation and their possible causes.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U49502                      Locate, test, handle and position photovoltaic panels prior to installation

### Unit Descriptor:

This unit describes the knowledge, skills and attitudes required for locating, testing, handling and positioning of photovoltaic panels prior to installation.

It is about selecting the correct type and quantity of components and understanding the testing procedures that need to be carried out on the photovoltaic panels.

Additionally, it considers the impact of incorrect handling and transportation of materials and components, as well as the importance of positioning materials and components correctly.

ELEMENT	PERFORMANCE CRITERIA
	<i>To be competent you must achieve the following:</i>
1. Locate and select materials and components.	1.1 Materials and components are located and identified. 1.2 Materials and components are checked and their markings matched. 1.3 Correct types and quantity of materials and components for the job are selected.
2. Handle and transport materials and components	2.1 Materials and components are handled safely and correct handling methods and <b>equipment</b> used. 2.2 Materials and components are transported safely.
3. Carry out testing procedures on photovoltaic panels	3.1 Relevant tests are carried out in accordance with manufacturer's recommendations and company policy. 3.2 Information is recorded to comply with manufacturer's recommendations.

- 4. Position materials and components
  - 4.1 Materials and components are positioned securely to avoid damage to them and surrounding objects.
  - 4.2 Materials are positioned to allow for ease of access for other work.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Equipment:**

- (i) Hand trucks
- (ii) Platform trucks
- (iii) Pallet jacks
- (iv) Pallet racks
- (v) Strapping

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to locate and select the correct type and quantity of materials and components to meet the specifications.
2. How to handle, position and transport materials and components correctly.
3. What are the consequences of handling and transporting materials and components incorrectly.
4. What weather conditions impede handling and transportation of materials.
5. What testing procedures must be carried out on the photovoltaic panels.
6. What are the different ways to carry out the tests in adverse conditions.
7. Who is permitted to carry out tests.
8. What are the different faults that may be found when testing and transporting materials and equipment and how these should be dealt with.
9. What recording and reporting procedures are required following the tests and why.

**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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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 an individual 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, products 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.





## U49602 Prepare the structure for photovoltaic panel installation on an existing structure

### Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to prepare an existing structure for photovoltaic panel installation. It relates to the removal of existing roof components, the types of dangerous components or materials that might be discovered and what actions should be taken if these are found.

It includes knowledge of the specific type of preparation required for an existing structure and the methods of securing installation materials to different types of structures. It also focuses on ensuring that the installation area meets specifications.

### ELEMENT

### PERFORMANCE CRITERIA

*To be competent you must achieve the following:*

- |  |   |
|--|---|
| 1. Prepare area and structure for panel installation     | 1.1 Work areas are clearly marked out and isolated from the rest of the site.<br><br>1.2 Areas exposed to debris are protected.<br><br>1.3 Ground and floor surfaces are prepared ready to receive installation equipment and materials and access equipment.<br><br>1.4 Structure for panel installation is prepared in accordance with customer requirements, company guidelines, manufacturer's recommendations and current legislation. |
| 2. Identify and remove dangerous components or materials | 2.1 <b>Dangerous components or materials</b> that may be revealed are identified.<br><br>2.2 Occupational health and safety procedures relevant to hazardous components and materials are followed.<br><br>2.3 <b>Appropriate action</b> is taken to remove dangerous components and materials.   |

- |  |   |
|--|---|
| 3. Remove existing roof components and materials         | 3.1 Existing roof material is removed with minimum damage.  |
|  | 3.2 Checks are made to ensure that access to the internal roof structure is not impeded by materials.   |
| 4. Select and prepare installation equipment             | 4.1 Required installation equipment is identified and selected.   |
|  | 4.2 Equipment is set up correctly and safely according to manufacturer's recommendations and guidelines.  |
|  | 4.3 Checks are made to ensure that equipment is in good working order.  |
| 5. Select materials to be used                           | 5.1 Specifications for materials to be used are identified and confirmed.   |
|  | 5.2 Checks are made to ensure that the required type, quantity and quality of materials are available for use.                                  |
| 6. Check that the installation area meets specifications | 6.1 All necessary checks are carried out to ensure the installation area meets job specifications, legislative and manufacturer's requirements. |

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Dangerous components or materials:**

- (i) Asbestos cement
- (ii) Infested materials
- (iii) Fibreglass

**B. Appropriate actions:**

- (i) Report to appropriate persons
- (ii) Remove/treat infested wood
- (iii) Remove/repair damaged components

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. Which parts of the Building Regulations relate to the removal of existing roof components and how these apply in practice.
2. What types of dangerous components or materials might be discovered and what actions should be taken if these are found.
3. What preparation should be made for the various types of installations.
4. What are the advantages and disadvantages of different installation methods.
5. What are the different methods for securing installation materials to different types of structures.
6. What are the types of problems or challenges that may occur when preparing an existing structure for installation and how these can be overcome.

**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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

**U49702****Fix photovoltaic panels onto a roof structure**

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to fix photovoltaic panels onto a roof structure. It covers locating and marking out the area to which panels are to be fixed and how to expose the roof area to attach fixtures to the structure.

The unit also describes selecting and fixing brackets correctly, reinstating the roof covering after fixing brackets, fixing panels to mounting system correctly and safely, connecting panels and the different issues to be considered when fixing panels onto some types of roofs.

During both preparation and construction, candidates may have to deal with unexpected events such as accidental damage to a roof structure or difficulty in conforming to specifications. Corrective action is expected to be taken under such circumstances.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |   |   |
|---|---|
| 1. Expose roof area                           | <ul style="list-style-type: none"> <li>1.1 Roof covering is removed to expose area for attaching fixing brackets.</li> <li>1.2 Roof covering removed is stored safely and securely with no damage to surrounding area.</li> <li>1.3 Roof structure is checked for soundness before panel mounting kit is attached.</li> <li>1.4 Structure and brackets are examined to ensure suitability for the installation prior to fixing.</li> <li>1.5 Roof is kept water tight throughout the installation process.</li> </ul> |
| 2. Locate and mark out area for fixing panels | <ul style="list-style-type: none"> <li>2.1 Location for fixing the panels onto the roof structure is identified.</li> </ul>   |

- 2.2 **Occupational health and safety requirements** are adhered to and are consistent with the relevant legislation and codes of practice.
- 2.3 Working methods allow for waste to be disposed of safely and correctly according to industry and company procedures.
- 2.4 Documents are referenced to identify location to fix panels in compliance with **specifications**.
- 2.5 Area for fixing photovoltaic panels is identified and marked out.
- 3. Select and fix brackets to roof structure
  - 3.1 Brackets are checked for associated problems and related solutions.
  - 3.2 Brackets are fixed to roof structure in accordance with manufacturer's instructions and site conditions.
- 4. Replace roof covering after fixing brackets
  - 4.1 Roof covering is replaced safely and securely.
  - 4.2 Checks are made to ensure that no damage is caused when replacing roof.
  - 4.3 Brackets are checked to ensure that they do not interfere with the integrity of the roof covering.
- 5. Fix panels to mounting system
  - 5.1 Pre-checks are carried out on panels and findings recorded appropriately.
  - 5.2 Panels are moved safely and correctly to area in which they are to be installed according to specifications and industry and company procedures.
  - 5.3 Correct fixing kit is selected for panels.
  - 5.4 Panels are placed onto mounting bar/brackets and fitted correctly according to specification and manufacturer's recommendations.

- 5.5 Panels are attached to bracket-mounting bar safely and securely.
- 6. Connect panels
  - 6.1 Correct method for connecting panels is identified.
  - 6.2 Panels are connected correctly and safely using the correct joining process.
  - 6.3 Panels are left in a safe condition.



**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Occupational health and safety requirements:**

- (i) Operation of mechanical equipment
- (ii) Operation of manual equipment
- (iii) Protective clothing and equipment
- (iv) Worksite environment and safety
- (v) Working at heights policy
- (vi) Handling of exposed electrical wires
- (vii) Handling of materials
- (viii) Emergency procedures

**B. Specifications:**

- (i) Agreed location
- (ii) Budget for materials and resources
- (iii) Working methods
- (iv) Waste management
- (v) Customers' requirements

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to safely remove roof covering for attaching a panel mounting kit.
2. How to interpret specifications and the importance of following them.
3. What are your basic responsibilities in relation to safety and health in the photovoltaic environment.
4. How to locate and mark out the area where panels are to be fixed.
5. What are the different types of roof coverings and how to remove them safely.
6. What are the types of problems which may occur and the appropriate corrective actions to take.
7. What improvements may be needed to roof structures before the panel mounting kit is attached.
8. How to ensure the roof is kept water tight during the installation process when a roof structure has been removed.
9. What is a panel mounting kit and how it functions when on the roof.
10. What are the different types of mounting kits and how these are fitted to different roof types.
11. How to connect panels in a roof mounting kit correctly and safely.
12. What problems can occur when connecting panels together and what are the possible solutions.
13. How and why to leave panels in a safe condition.
14. What are the different issues to consider when fixing panels into flat roofs.
15. Why the installation may differ on different types of roofs.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U49802 Perform post-photovoltaic installation activities

### Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to execute post-photovoltaic installation activities. It covers aspects relating to ensuring that the installation is left in a safe condition, removing materials and debris from the site, dealing with customer queries, resolving problems and recording information.

### ELEMENT

### PERFORMANCE CRITERIA

*To be competent you must achieve the following:*

- |                            |  |
|----------------------------|--|
| 1. Check the installation  | 1.1 Technical requirements of installation are checked to ensure installation is left in a safe condition.<br><br>1.2 Occupational health and safety requirements associated with task application and workplace environment are followed.   |
| 2. Handle and remove waste | 2.1 Waste materials are handled correctly and safely disposed of according to occupational health and safety requirements.<br><br>2.2 <b>Hazardous materials</b> are identified for separate handling.<br><br>2.3 <b>Hazardous materials</b> are removed using correct procedures. |
| 3. Clean up                | 3.1 Tools and equipment are cleaned, maintained and stored.<br><br>3.2 Unused materials are safely stacked/stockpiled/stored.<br><br>3.3 Site is cleared of debris and unwanted material.  |

- 4. Provide customer service
  - 4.1 Relevant contact information is shared with others to maintain organizational standards for service delivery.
  - 4.2 Service provided is checked against customers' needs and expectations.
  - 4.3 Customers' questions or concerns are responded to appropriately.
  - 4.4 Information on the installation activity is accurately recorded in accordance with legislation, manufacturer's and company procedures.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Hazardous materials:**

- (i) Broken glass
- (ii) Unwanted materials and debris
- (iii) Harmful substances

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to leave the installation in a safe condition.
2. Why it is important to remove all materials and debris from the site.
3. How to identify and overcome problems in relation to the post-installation activity.
4. What type of information needs to be recorded regarding the installation.
5. What are types of hazardous chemicals and substances which may be present.
6. What are the safe and correct methods of disposing of waste materials.
7. What are safe and suitable methods for storing tools, equipment and machinery.
8. How to deal with customers' questions concerning the work.
9. How to record the required information.

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**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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role playing/simulation

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 using 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, products 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.



## U49902

## Plan to undertake a routine task

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively plan to undertake a routine task and applies to all individuals working in the photovoltaic industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |   |  |
|---|--|
| 1. Identify task requirements           | 1.1 <b>Instructions</b> for procedures are obtained, understood and clarified when necessary.<br>1.2 Relevant specifications for task outcomes are obtained, understood and confirmed when necessary.<br>1.3 Task outcomes are identified.<br>1.4 Task requirements such as completion time and quality measures are identified.   |
| 2. Plan steps required to complete task | 2.1 Individual steps or activities required to undertake the task are understood and clarified when necessary, based on instructions and specifications provided.<br>2.2 Sequence of activities required to be completed is identified in the plan.<br>2.3 Planned steps and their outcome are checked to ensure conformity with instructions and relevant specifications. |
| 3. Review plan                          | 3.1 Outcomes are identified and compared with (planned) objectives, task instructions, specifications and task requirements.<br>3.2 Plan is revised to better meet objectives and task requirements as necessary.  |

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Instructions:**

- (i) Standard operating procedures
- (ii) Clear specifications and requirements
- (iii) Quality control and time allowances

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What is the basic level of ability in speaking.
2. What is the basic level in reading.
3. What is the basic level in writing English.
4. What is basic numeracy.
5. What are task requirements.
6. What are the workplace operating procedures.
7. What is the use of work schedules, charts, work bulletins and memos.
8. How to work safely to instructions.
9. How to convey information in simple English to invoke correct actions.
10. How to apply quality procedures.
11. How to read and interpret simple drawings and specifications.
12. How to plan a routine task.
13. How to undertake a routine task.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using a combination of both on. 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, products 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.

**U50002****Use graduated measuring devices**

Unit Descriptor:

This unit describes the knowledge, skills and attitude required to effectively measure with graduated devices, and applies to all individuals working in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |  |  |
|--|--|
| 1. Use a range of graduated devices to measure/determine dimensions or variables | <p>1.1 Appropriate <b>measuring device</b> or equipment is selected to achieve required outcome.</p> <p>1.2 Correct and appropriate measuring technique is used.</p> <p>1.3 <b>Measurements</b> are accurately taken to the finest graduation of the instrument as appropriate to the field or area.</p> |
| 2. Maintain graduated devices  | <p>2.1 Routine care and storage of devices are carried out to manufacturer's specifications or standard operating procedures.</p> <p>2.2 Routine adjustments to devices are made and checked, e.g. zeroing.</p>  |

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Measuring devices:**

- (i) Verniers
- (ii) Feeler gauges
- (iii) Pressure gauges
- (iv) Squares
- (v) Levels
- (vi) Micrometers
- (vii) Dial indicators
- (viii) Thermometers
- (ix) Measuring tapes
- (x) Protractors

**B. Measurements:**

- (i) Length/width/depth
- (ii) Roundness
- (iii) Squareness
- (iv) Flatness angle
- (v) Angles
- (vi) Clearances
- (vii) Measurements that can be read off analog, digital or other graduated devices
- (viii) Plumbness

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are comparison devices.
2. What are comparison measurements.
3. What are comparative measurements.
4. What are electrical/electronic devices.
5. What are basic measuring devices.
6. What you are reading.
7. How to write English.
8. What is basic numeracy.
9. How to follow safely to instructions.
10. How to use power tools and hand tools.
11. How to use measuring devices
12. How to adjust measurements.
13. How to handle materials.
14. How to select materials.
15. How to apply quality assurance.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.



**U50102****Use hand tools**

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to competently select and use appropriate hand tools of the photovoltaic installation trade and applies to all individuals in the industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

## 1. Use hand tools

- 1.1 **Hand tools** are selected according to the **task requirements**.
- 1.2 Hand tools are used to produce desired outcomes to job specifications, e.g. finish, tension, size or shape.
- 1.3 Safety requirements are adhered to before, during and after use.
- 1.4 Unsafe or faulty tools are identified and marked for repair according to designated procedures before, during and after use.
- 1.5 Routine maintenance of tools, including hand sharpening is carried out according to standard operational procedures, principles and techniques.
- 1.6 Hand tools are stored safely in appropriate locations according to standard operating procedures and manufacturer's recommendations.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Hand tools:**

- (i) Hack saws
- (ii) Hammers
- (iii) Punches
- (iv) Screwdrivers
- (v) Sockets
- (vi) Wrenches
- (vii) Scrapers
- (viii) Chisels
- (ix) Gouges
- (x) Planes
- (xi) Files of all cross-sectional shapes and types

**B. Task requirements:**

- (i) Adjusting
- (ii) Dismantling
- (iii) Assembling
- (iv) Finishing
- (v) Cutting
- (vi) Scraping
- (vii) Cleaning
- (viii) Lubricating
- (ix) Tightening
- (x) Simple tool repairs
- (xi) Hand sharpening
- (xii) Adjustments

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the workplace and equipment safety requirements and OH&S guidelines.
2. What are the workshop procedures.
3. What are the technical applications.
4. How to use hand tools and equipment.
5. How to use materials.
6. How handle materials whilst operating tools.
7. How to work safely to instructions.
8. How to apply appropriate hand-eye coordination in the use of tools
9. How to select appropriate tools for material usage.
10. How to communicate effectively.
11. How to use tools correctly.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U50202

## Perform related computations (basic)

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to perform basic computations and effectively carry out measurements of work to required tolerance, and applies to all individuals working in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |  |   |
|--|---|
| 1. Apply four rules of calculation                       | 1.1 Simple <b>calculations</b> are performed using four basic rules - addition, subtraction, division and multiplication.                   |
|  | 1.2 Concepts are understood and simple calculations are performed using <b>basic numeracy skills</b> for the required <b>computations</b> . |
| 2. Perform calculations involving fractions and decimals | 2.1 Simple calculations are performed involving fractions and mixed numbers using the four basic rules.                                     |
|  | 2.2 Simple calculations are performed involving fractions, decimals and mixed numbers using the four basic rules.                           |

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Calculations** may be performed using:

- (i) Electronic calculating devices
- (ii) Manual calculation devices

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to read drawings and specifications.
2. How to estimate and use precise calculations.
3. How to use numbers and arithmetic operations.
4. How to use percentages (for some applications).
5. How to use ratios and proportions (for some applications).
6. How to use mathematical statements and formulae.
7. How to read and interpret drawings.
8. How to operate electronic calculating devices.
9. How to communicate effectively.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.



## U50302

## Mark off/out (general engineering)

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively transfer dimensions from engineering drawings, prints or plans and applies to individuals working in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

1. Determine job requirements

1.1 Drawings, job instructions and specifications are interpreted and understanding demonstrated.

1.2 Appropriate methods and sequencing are selected and are consistent with proposed fabricating process.

2. Transfer dimensions

2.1 **Marking off/out** is carried out to specifications using appropriate tools and **equipment**.

2.2 Data points are correctly established.

2.3 Dimensions transferred are correct and appropriate.

3. Make templates

3.1 Appropriate template materials are selected.

3.2 Templates are produced to specifications and appropriate to desired use.

3.3 **Storage procedures** are followed correctly.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Marking off/out:**

- (i) Engineering components
- (ii) Jigs and fixtures
- (iii) Castings
- (iv) Templates
- (v) Dies and tooling

**B. Equipment:**

- (i) Marking out tables
- (ii) Surface tables
- (iii) Rotary tables
- (iv) Dividing heads
- (v) Vee blocks
- (vi) Cylinder squares
- (vii) Sine bars and the like
- (viii) Vernier height gauges
- (ix) Protractors
- (x) Straight edge
- (xi) Set squares
- (xii) Marking out tools

**C. Storage procedures include:**

- (i) Labelling
- (ii) Identification

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to read and interpret drawings and specifications.
2. How to use basic numeracy.
3. How to use marking out tools and equipment.
4. How to use marking off/out techniques.
5. How to handle template materials.
6. What are the different template materials relevant to the engineering process.
7. How to use basic operations in simple geometry measurements and calculations.
8. How to transfer measurements.
9. How to mark off/out accurately.
10. How to measure and calculate manually.
11. How to record measurement.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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 candidates must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, products 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.

## U50402

## Draw and interpret sketches and simple drawings

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively draw and interpret sketches and simple drawings and applies to all individuals working in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |  |   |
|--|---|
| 1. Prepare free-hand sketch                | 1.1 Sketch is correctly and appropriately drawn.                      |
|  | 1.2 Objects or parts of sketch are depicted.                          |
|  | 1.3 Correct dimensions are obtained and clearly shown.                |
|  | 1.4 Instructions are shown clearly.                                   |
|  | 1.5 Base-line or datum point is indicated.                            |
| 2. Interpret details from free-hand sketch | 2.1 Components, assemblies or objects are recognized.                 |
|  | 2.2 Dimensions identified are appropriate to field of employment.     |
|  | 2.3 Instructions are identified and followed.                         |
|  | 2.4 Material requirements are identified.                             |
|  | 2.5 Symbols are recognized in sketch.                                 |
| 3. Select correct technical drawing        | 3.1 <b>Drawing</b> is checked and validated against job requirements. |
|  | 3.2 <b>Drawing</b> version is checked and validated.                  |

- 4. Identify drawing requirements
  - 4.1 Requirements and purpose of the **drawing** are determined from customer, work specifications and/or associated documents.
  - 4.2 Data required to produce the **drawing** are identified and collected.
  - 4.3 **Drawing** requirements are confirmed with relevant personnel and timeframes for completion established.
- 5. Prepare or make changes to engineering drawings
  - 5.1 Drafting equipment is appropriately selected.
  - 5.2 Drafting principles are applied to produce a **drawing** that is consistent with standard operating procedures within the company.
  - 5.3 Work is undertaken to prescribed procedures.
  - 5.4 Completed drawing is approved in accordance with standard operating procedures.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Drawing:**

- (i) Perspective
- (ii) Exploded views
- (iii) Hidden view
- (iv) Engineering (r their equivalents from the full range of engineering disciplines)
- (v) Standard engineering symbols or their equivalents

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the types and use of drawing instruments and supplies.
2. How to identify alphabet of lines, line type variation, order of usage and application on drawings.
3. What are the types of scales and proportions and how they are used for measurement.
4. How symbols, dimensions, drawing terminology and their applications are used.
5. How to estimate measurements.
6. How to read and interpret simple drawings.
7. How to measure accurately.
8. How to communicate effectively.



## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U50502

## Perform manual handling and lifting

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively manually handle materials and applies to individuals working in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

## 1. Lift materials

1.1 Material weight is determined using the most appropriate technique.

1.2 Lifting techniques are undertaken according to standard operating procedures, required movement, movement techniques, storage conditions, height and position.

## 2. Move/shift materials

2.1 **Appropriate equipment** is selected when required.

2.2 Material is placed safely and securely on moving equipment.

2.3 Material is relocated ensuring safety of personnel and security of material.

2.4 Material is unloaded from moving equipment and placed in a safe and secure manner.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Appropriate equipment:**

- (i) Hand trolleys
- (ii) Wheelbarrows
- (iii) Motorized/hand pallet trucks (not sit on)
- (iv) Hand carts
- (v) Dedicated production or process lifting equipment
- (vi) Baskets
- (vii) Spreader bars
- (viii) Cradles or the like attached to lifting equipment
- (ix) Rope

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the workplace and equipment safety requirements including occupational health and safety guidelines and regulations.
2. How to read and interpret basic documents.
3. How to use basic numeracy.
4. How to use manual handling techniques/methods.
5. How to operate handling tools and equipment.
6. What techniques are used for weight determination.
7. How to work safely to instructions.
8. How to communicate effectively.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U50602

## Prepare structure for photovoltaic panel installation – new structure

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to prepare to install photovoltaic panels on a newly built structure. It includes preparing the work areas correctly and using different types of installation equipment safely.

It focuses on the methods of securing a photovoltaic installation to a newly built structure and ensuring that the required materials are available for use.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

## 1. Prepare work areas

1.1 Work areas are clearly marked out and isolated from the rest of the site.

1.2 Areas exposed to debris are protected.

1.3 Ground and floor surfaces are prepared ready to receive installation/access equipment and materials.

1.4 Structure for panel installation is prepared in accordance with customer requirements, company guidelines, manufacturer's recommendations and current legislation.

## 2. Select and prepare installation equipment

2.1 Required **installation equipment** is identified and selected.

2.2 Equipment is correctly set up.

2.3 Checks are made to ensure that equipment is in good working order.

- 3. Ensure materials are available for use
  - 3.1 Specifications for materials to be used are identified and confirmed.
  - 3.2 Checks are made to ensure the required type, quantity and quality of materials are available for use.
  
- 4. Prepare area and secure installation to structure
  - 4.1 Necessary checks are carried out to ensure installation area meets job specifications, legislative and manufacturer's requirements.
  - 4.2 Fixing methods are applied in accordance with current codes of practice and relevant legislation.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Installation equipment:**

- (i) Battery-powered equipment
- (ii) Job-specific machinery
- (iii) Power and hand tools
- (iv) Extension leads
- (v) Scaffolding and roof edge protection
- (vi) Fall arrest systems
- (vii) Ladders



**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the different types of installation equipment and their uses.
2. How to operate installation equipment.
3. How to prepare structures for photovoltaic panel installation.
4. What are the company's guidelines and manufacturer's recommendations for panel installation.
5. What are the different methods for securing a photovoltaic installation to different types of structure.
6. What are the types of problems that can occur with preparation and how these can be overcome.

**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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

**U50702****Fix photovoltaic panels into a roof structure**

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to fix photovoltaic panels into a roof structure. It covers locating and marking out the area where panels are to be fixed and exposing the roof area to attach panels within the roof structure.

It also focuses on fixing panels in a roof mounting kit to a roof structure, connecting panels in a roof mounting kit and understanding the different issues that may occur when fixing panels into a roof structure.

During both preparation and construction, candidates may have to deal with unexpected events, such as accidental damage or difficulty in conforming to specifications. Candidates must be able to take the corrective action under such circumstances.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |  |   |
|--|---|
| 1. Locate and mark out area where panels are to be fixed   | 1.1 Location for fixing the panels into the roof structure is identified and confirmed.       |
|  | 1.2 Area in which panel is to be fixed is marked out.   |
| 2. Expose roof area to attach panels within roof structure | 2.1 Roof covering is removed safely for attaching panel mounting kit.                         |
|  | 2.2 Problems that can occur when removing roof covering are identified and solutions offered. |
|  | 2.3 Roof structure is checked for soundness before panel mounting kit is attached.            |
|  | 2.4 Roof is kept watertight during the installation process.                                  |

3. Remove existing roof covering for fixing panel in roof mounting kit
  - 3.1 Type of roof covering to be used is identified.
  - 3.2 Roof covering is removed and stored safely and correctly, with no damage to surrounding area.
  - 3.3 Exposed roof area is checked to ensure structure is in a suitable condition to receive panel mounting kit.
  - 3.4 Condition of the roof membrane is checked for soundness and/or for damage.
  
4. Fit and fix panel to roof structure
  - 4.1 Area is set out to receive panel mounting kit.
  - 4.2 Correct components and consumables are selected to use for the mounting kit.
  - 4.3 Panel mounting kit is fixed to roof structure in accordance with manufacturer's instructions and site conditions.
  - 4.4 Panel mounting kit is fixed in correct order.
  - 4.5 Panel in roof mounting kit is fixed to roof structure to provide a weatherproof installation.
  - 4.6 Roof panel mounting kit is fitted squarely and securely on completion.
  - 4.7 Roof mounting kit is adequate for roof covering on completion of installation.
  - 4.8 Installation is checked to ensure it is weatherproof according to manufacturer's instructions.

- 5. Fix panel in roof mounting system
  - 5.1 Pre-checks are carried out on panels and findings recorded appropriately.
  - 5.2 Panels are moved correctly to area where they are to be installed.
  - 5.3 Correct mounting fixing kit for panels is selected.
  - 5.4 Panels are placed onto mounting fixing kit and fitted correctly.
  - 5.5 Checks are made to ensure that panels are attached to roof mounting system safely and securely.
  
- 6. Connect panels together
  - 6.1 Information is identified on how to connect panels correctly.
  - 6.2 Correct joining process is used to connect panels safely and securely.
  - 6.3 Panels are left in a safe condition after connection.

**RANGE STATEMENT**

*All range statements must be assessed:*

**No range**

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the requirements of the specification and how to finish the structure or surface so that it meets specifications.
2. What are your basic responsibilities in relation to safety and health and the photovoltaic environment.
3. How to locate and mark out area where panels are to be fixed.
4. How to safely remove roof covering to expose area for attaching panel mounting kit.
5. What are the types of roof coverings and how to remove them safely.
6. What types of problems may occur and the appropriate corrective actions required.
7. Why improvements may need to be made to the roof structure before the panel mounting kit is attached.
8. What to consider when removing a roof structure to ensure the roof is kept watertight.
9. What is the purpose of the panel mounting kit.
10. Why different mounting kits are used for different roofs.
11. What are the methods for fitting a panel mounting kit and why they are used.
12. How to fix and connect panels in a roof mounting kit correctly and safely.
13. What problems may occur when connecting panels and how to solve them.
14. How to leave panels in a safe condition and why this is important.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.



## U50802

## Fix photovoltaic panels onto a non-roof structure

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to fix photovoltaic panels onto a non-roof structure. It involves dealing with types of structures other than roofs that may be suitable for mounting photovoltaic panels.

It focuses on preparing to fix photovoltaic panels to a mounting system and connecting the panels to a non-roof structure.

Candidates may have to deal with unexpected events such as accidental damage or difficulties in conforming to specifications. They must also be able to take the necessary corrective actions under such circumstances.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |  |  |
|--|--|
| 1. Mark out location to install photovoltaic panels              | 1.1 Drawings and associated documents used to identify location comply with <b>specifications</b> .            |
|  | 1.2 Area to receive panels is identified and marked out.   |
| 2. Check suitability and conditions of location                  | 2.1 Location chosen is checked to ensure that it is suitable and in appropriate condition to mount the panels. |
|  | 2.2 Confirmation is obtained that the structures and surfaces are consistent with <b>specifications</b> .      |
|  | 2.3 Mounting system is checked and is suitable for the chosen location.  |
| 3. Select and fix bracket mounting system to non-roof structures | 3.1 Confirmation is obtained that the mounting system selected is the correct type to be used.                 |
|  | 3.2 Mounting system used is fixed in accordance with manufacturer's instructions.                              |

4. Fix panels to mounting system
  - 4.1 Pre-checks are carried out on the panels and findings recorded appropriately.
  - 4.2 Panels are moved safely to the area they are to be installed.
  - 4.3 Correct fixing kit for panels is selected according to specifications.
  - 4.4 Panels are placed onto the mounting system and secured in the correct manner according to manufacturer's guidelines.
  - 4.5 Panels are checked and attached to bracket mounting bar safely and securely.
  
5. Connect panels
  - 5.1 Correct process for connecting panels is identified.
  - 5.2 Panels are correctly and safely connected according to specifications and manufacturer's and company requirements.
  - 5.3 Panels are left in safe condition.

**RANGE STATEMENT:**

*All range statements must be assessed:*

**A. Specifications:**

- (i) Agreed location
- (ii) Budget for materials and resources
- (iii) Working methods
- (iv) Customers' requirements

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the types of structures other than roofs that may be suitable for mounting photovoltaic panels.
2. When to select non-roof surfaces for mounting panels.
3. What are the benefits of fixing panels to a location other than a roof structure
4. What problems can occur with installation on non-roof structures.
5. How to select safely and fix a bracket mounting system to non-roof structure.
6. How to ensure the mounting system used is correct and fixed in accordance with manufacturer's instructions.
7. What problems may occur when fixing mounting systems to non-roof structures and how these can be overcome.
8. What are the different fixing kits that are available and where they are used.
9. How to fix panels to mounting system correctly and safely.
10. How to safely connect panels.
11. What are the different connections that can be used.
12. What problems can occur when connecting panels and how to solve them.
13. How to leave the panels in a safe condition and why this is important.
14. What checks need to be carried out once panels are installed.
- .

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U50902

## Complete installation

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to ensure that installation is completed safely and handed over to customers. It includes finishing off the work to specified requirements and carrying out a final inspection, confirming the installation meets the agreed job specifications, and sharing relevant information with customers.

Throughout the unit, the focus is on good customer service, building effective working relationships with customers and professionalism and dealing with problems that can arise during the handover process.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |  |  |
|--|--|
| 1. Inspect installation prior to commissioning                     | 1.1 Work is finished to specified requirements.<br>1.2 Installation is left in a safe condition prior to commissioning.<br>1.3 Required checks are made to ensure the system is safe and ready for handover.<br>1.4 Discussion is held with team members to confirm the installation meets specifications. |
| 2. Share information about the installation                        | 2.1 Information about the installation that needs to be shared with customer is presented appropriately and in <b>different formats</b> .<br>2.2 Customers' understanding of the information provided is checked and confirmed.  |
| 3. Develop the relationship between customers and the organization | 3.1 Customers' expectations are discussed and explanations offered in keeping with the products or services provided by the organization   |

- 3.2 Customers' questions and requests are responded to appropriately.
- 3.3 Customers are treated courteously at all times.
- 3.4 Others are informed of feedback received from customers.
- 3.5 Notes are made during the handover process and appropriate records kept.
- 3.6 Communication is appropriately maintained with customers to ensure they are kept informed and reassured

## RANGE STATEMENT

*All range statements must be assessed:*

### **A. Different formats:**

- (i) Manual/electronic catalogues and or electronic databases
- (ii) Technical/manufacturer's handbooks/manuals
- (iii) Electronic media with information pertinent to skill area
- (iv) Face-to-face conversations
- (v) Demonstrations
- (vi) Written notes
- (vii) Drawings/sketches
- (viii) Telephone (voice or text)
- (ix) Email
- (x) Internet
- (xi) Work schedules/work bulletins
- (xii) Signage



**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the customers' rights.
2. What information is to be shared with your customers.
3. What are the industry, organizational and professional codes of practice and ethical standards that affect the way the products or services can be delivered to your customers.
4. What are contractual agreements between customers and the organization.
5. What are the organizational guidelines that limit what you can do within your job role.
6. What are the limits of your own authority and when you need to seek agreement with or permission from others.
7. How to deal with a request that is outside of the agreed job specifications and why it is important to deal with this correctly.
8. How to communicate in a clear, polite, confident manner and why this is important.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

**U51002****Use electrical/electronic measuring devices**

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to take electrical/electronic measurements using appropriate measuring devices in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

1. Use electro-measuring devices
  - 1.1 **Appropriate devices** or equipment and settings are selected to achieve required outcomes.
  - 1.2 Appropriate connections are made to achieve required outcomes according to standard operating procedures.
  - 1.3 Readings are obtained and interpreted and converted into **units of measurement** made where necessary.
2. Maintain electro measuring devices
  - 2.1 Routine care and storage of devices is undertaken according to manufacturer's specifications or standard operating procedures.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Appropriate devices:**

- (i) Analogue/digital multimeters
- (ii) Tong testers
- (iii) Oscilloscopes
- (iv) Potentiometers
- (v) Digital devices

**B. Units of measurement:**

- (i) Voltage
- (ii) Current
- (iii) Frequency
- (iv) Resistance
- (v) Power
- (vi) Temperature

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. How to use comparison measurements.
2. How to use comparison devices.
3. How to use measuring devices.
4. How to use electrical/electronic measurements.
5. How to read drawings and specifications.
6. What you are reading.
7. How to appropriately communicate required information.
8. How to use basic numeracy.
9. How to work safely to instructions.
10. How to operate power tools and hand tools.
11. What equipment to select.
12. How to apply quality assurance.
13. How to read and interpret drawings and specifications.
14. How to measure and calculate manually.
15. How to operate electronic measurement calculating devices.
16. How to record measurements.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U51102

## Prepare for electrical conduit/wiring installation

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively prepare for the installation of electrical conduits/wiring and applies to individuals working in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

## 1. Plan for installation process

- 1.1 Quality assurance requirements of engineering/maintenance operations are recognized and adhered to.
- 1.2 Preparation and planning requirements are identified from drawings/work location and/or supervisor's instructions.
- 1.3 Occupational health and safety requirements are identified and adhered to in accordance with application tasks and workplace environment.
- 1.4 Safety hazards are identified and correct procedures adopted to minimize risk to self and others according to company requirements.
- 1.5 Materials are selected according to supervisor's instructions.
- 1.6 Appropriate personal protective equipment is selected, correctly fitted and used according to manufacturer's and company requirements..
- 1.7 Tools and equipment selected are consistent with job requirements.
- 1.8 Tools and equipment are checked for serviceability and any faults **reported** to supervisor.

- |   |   |
|---|---|
| 2. Prepare selected materials for installation process                                    | 2.1 Activities for material preparation are identified from specifications or supervisor's instructions.                                      |
|   | 2.2 Material preparation is carried out to satisfy requirements of installation process.  |
| 3. Prepare work area for installation process   | 3.1 Activities to be carried out in work area are identified from <b>installation techniques</b> , method of installation and access to area. |
|   | 3.2 Work area is prepared for installation process according to supervisor's instructions.  |
| 4. Utilize tool and equipment for installation process                                    | 4.1 Regular tools/measuring devices suitable for application processes are identified according to job requirements.                          |
|   | 4.2 Correct tools/measuring devices are used safely and effectively to carry out <b>technical processes</b> where applicable.                 |
| 5. Prepare background of surfaces/environment for electrical conduits/wiring installation | 5.1 Surfaces/environment to be prepared are/is identified.  |
|   | 5.2 Surfaces are chased/chopped/prepared where appropriate.   |
|   | 5.3 Excavations are carried out, where appropriate.   |
| 6. Handle materials   | 6.1 Materials are obtained as per instructions.   |
|   | 6.2 Correct manual handling techniques are used to move and place materials.  |
|   | 6.3 Materials are safely moved to work area.  |
|   | 6.4 Techniques are used to accurately cut/bend/fabricate/secure components to specified length according to given instructions.               |
| 7. Store material   | 7.1 Components are distributed and stacked to suit job location and execution.  |



8. Clean up

- 8.1 Materials are stacked or stored for reuse or disposed of in the correct manner.
- 8.2 Work area is cleared of all debris.
- 8.3 **Tools and equipment** are cleaned, maintained and stored.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Reported:**

- (i) Verbal
- (ii) Written

**B. Technical processes:**

- (i) Marking out
- (ii) Measuring
- (iii) Cutting
- (iv) Shaping
- (v) Drilling
- (vi) Installing
- (vii) Threading
- (viii) Tapping
- (ix) Finishing
- (x) Dismantling
- (xi) Assembling
- (xii) Reaming

**C. Installation techniques:**

- (i) Surface mount
- (ii) Flush mount
- (iii) PVC conduits up to 32mm
- (iv) PVC trunking
- (v) Metal not exceeding 25mm
- (vi) Masonry
- (vii) Steel
- (viii) Clamps
- (ix) Saddles
- (x) Walls, floors, roofs/ceilings
- (xi) Access ways
- (xii) Wood
- (xiii) Underground

**D. Tools/equipment may include:**

- (i) Electric hand drill
- (ii) Drill bits
- (iii) Cold chisel and files

- (iv) Ball pein hammer
- (v) Reamers
- (vi) Benders
- (vii) Hole saws
- (viii) Knockout saw
- (ix) Hack-saw
- (x) Screwdrivers
- (xi) Spirit level
- (xii) Pipe dies
- (xiii) Pipes – PVC, metal
- (xiv) Pipe vices
- (xv) Ladders
- (xvi) Combination squares

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are workplace and equipment safety requirements.
2. What are drawings and specifications.
3. What are measuring devices.
4. How to use hand tools and equipment.
5. What are the materials relative to installation process.
6. How to select and handle materials.
7. How to use measuring devices.
8. How to measure relative to installation process.
9. What are installation techniques consistent with solid plastering.
10. How to communicate effectively in the workplace.
11. How to work safely to instructions.
12. How to prepare for conduit/wiring installation.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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 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, products 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.

## U51202

## Cut, bend and install electrical conduits

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to effectively cut, bend and install electrical conduits associated with electrical installation instrumentation, refrigeration, and air conditioning systems or other related systems in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

## 1. Plan and prepare for installation

- 1.1 Installation is planned and prepared to ensure occupational safety and health policies and procedures are followed.
- 1.2 Work is sequenced appropriately in accordance with requirements.
- 1.3 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.
- 1.4 Conduits are obtained in accordance with established procedures and comply with requirements.
- 1.5 Location in which conduits are to be installed is determined from job requirements.
- 1.6 Materials necessary to complete the work are obtained in accordance with established procedures and checked against job requirements.
- 1.7 **Tools and equipment** needed to carry out the installation work are obtained in accordance with established procedures.
- 1.8 Preparatory work is checked to ensure no unnecessary damage has occurred to tools, equipment or location.

2. Install conduits
  - 2.1 Occupational safety and health policies and procedures for installing conduits are followed.
  - 2.2 Conduits are installed in accordance with requirements, without damage or distortion to the surrounding environment or services.
  - 2.3 Conduits are terminated and connected in accordance with requirements.
  - 2.4 Unplanned events or conditions are responded to in accordance with established procedures.
  - 2.5 Approval is obtained in accordance with established procedures from appropriate personnel before any contingencies are implemented.
  - 2.6 On-going checks on the quality of the work are undertaken in accordance with established procedures.
3. Inspect and notify about completion of work
  - 3.1 Final inspections are undertaken to ensure installed conduits conform to requirements.
  - 3.2 Work completion is communicated in accordance with established procedures.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Tools/equipment:**

- (i) Electric hand drill
- (ii) Drill bits
- (iii) Cold chisel and files
- (iv) Ball peen hammer
- (v) Reamers
- (vi) Benders
- (vii) Hole saws
- (viii) Hack-saw
- (ix) Screwdrivers
- (x) Spirit level
- (xi) Pipe dies



**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the safety and work procedures.
2. What are the regulations and other relevant codes.
3. What are the standards of quality.
4. What are the installation tools and equipment.
5. What materials are used in installation.
6. What types of materials are used for conduits.
7. What are fabrication techniques.
8. What are installation techniques.
9. How to use assembly/disassembly techniques.
10. How to handle ladders.
11. How to identify potential workplace hazards and implement preventative measures.
12. How to work with electrically operated tools and equipment.
13. How to read and interpret simple freehand sketches.
14. How to measure accurately.
15. How to communicate effectively.
16. How to bend 90 degrees and offsets in conduits.
17. How to cut, thread and ream conduits.
18. How to install PVC and metal conduits.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

## U51302

## Install, terminate and connect electrical wiring

## Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to install, terminate and connect electrical wiring and applies to individuals working in the photovoltaic installation industry.

**ELEMENT****PERFORMANCE CRITERIA**

*To be competent you must achieve the following:*

- |   |   |
|---|---|
| 1. Prepare for electrical wiring installation, termination and connection | 1.1 Work is undertaken safely and to workplace procedures and occupational safety and health requirements.                            |
|   | 1.2 Materials are checked for correct specifications.   |
|   | 1.3 Preparation of work is undertaken or inspected for correct location and specifications, e.g. cable trays, brackets, trenches etc. |
| 2. Install electrical wiring  | 2.1 <b>Installations</b> are made to specifications, manufacturer's requirements and safety and industry regulations.                 |
|   | 2.2 Conduits and wiring are fixed to specifications.  |
|   | 2.3 Cables, wires, conductors and installations are marked/tagged and labeled to specifications.                                      |
|   | 2.4 Completed installations are tested for compliance.  |
|   | 2.5 Reports and documentation are completed correctly to specifications.  |

3. Connect electrical wiring
  - 3.1 **Terminations/connections** are made to specifications, manufacturer's requirements and to safety and industry standards.
  - 3.2 Brackets, clamps, holders, etc. are adjusted and fixed to specifications.
  - 3.3 Cables, wires, conductors and connections, etc. are marked/tagged and labeled to specifications.
  - 3.4 Completed wiring and connections are **tested for compliance** with specifications.
  - 3.5 Reports and documentation are completed correctly according to company procedures.

**RANGE STATEMENT**

*All range statements must be assessed:*

**A. Installation:**

- (i) Surface mount
- (ii) Flush mount
- (iii) PVC conduits up to 32mm
- (iv) Metal not exceeding 25mm
- (v) Mechanical connectors
- (vi) Clamping
- (vii) Pin connection

**B. Terminations/connections:**

- (i) Plug sockets
- (ii) Clamping of cables and wires, sealing entry points where required
- (iii) Soldered joints
- (iv) Crimping

**C. Testing for compliance:**

- (i) Continuity and resistance checks
- (ii) Insulation test
- (iii) Polarity test
- (iv) Specifications obtained from electrical/electronic circuit drawings and data sheets

**UNDERPINNING KNOWLEDGE AND SKILLS**

*You need to know and understand:*

1. What are the safety and work procedures.
2. What are the industry standards to use.
3. What are standards of quality.
4. What are installation tools and equipment.
5. What are the materials used in installation.
6. What connection methods to use when wiring.
7. What bonding methods to use.
8. What are the types of joints.
9. What are the termination and connection methods to use.
10. What are the installation methods to use.
11. How to work safely to instructions.
12. How to select and use appropriate tools and equipment.
13. How to use soldering tools and equipment.
14. How to handle materials.
15. How to select material and supplies.
16. How to join electrical wiring.
17. How to terminate electrical wiring.
18. How to apply quality assurance.

## 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 at least two (2) occasions**. 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
- Witness testimony
- Personal statement
- Written evidence (projects or assignments)
- Case study and scenario analysis
- Role play/simulation

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 using 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, products 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.

**Assessment Methods**

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

**Assessors**

The Assessor's 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 (NVQs).

**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 it 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 predetermined 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 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 (Level 1) through to senior management (Level 5).



**Level**

**2**

**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 the 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 contributions 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 the consistent quality of assessment and competence. They need to be competent to assess to national standards in the area under assessment.

**Level**

**2**

**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**

Within each approved centre offering NVQs, there is a centre contact who 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 the requirements for the successful achievement of an element. They are descriptions of what the Assessor 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 that the Assessor has all of the evidence about a candidate's performance. It also allows the Assessor to clarify situations.

## Level

# 2

## Glossary of Terms

### Range Statements

The range puts the element of competence into context. A range statement describes the range of situations to which an element and its performance criteria should be applied.

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 assessors are able to collect evidence and make a judgement 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 his/her work, or where the candidate needs to develop competence, before being judged competent, 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 a 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, the Assessor will be able to elicit evidence which will help him/her 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 candidate to possess in order to successfully achieve an element and prove total competence.

### Units

A unit of competence describes one or more than one activity which forms a significant part of a candidate's work. Units are accredited separately but, in combination, can make up a vocational qualification. There are three categories of units:

**Mandatory Units:** These are core to a qualification and must 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 the Assessor to collect evidence to support any decision made 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 or observation.

A project often involves the identification of a solution to a specific problem identified by the Assessor 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).