



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **UEENEEK134A Install ELV stand-alone photovoltaic power systems**

**Release: 1**

## UEENEEK134A Install ELV stand-alone photovoltaic power systems

### Modification History

Not applicable.

### Unit Descriptor

#### Unit Descriptor

#### 1) Scope:

##### 1.1) Descriptor

This competency standard unit covers the installation, adjustment and set up of ELV stand-alone photovoltaic power systems. It encompasses working safely and to installation standards, matching components with that specified for a given location, placing and securing system components accurately, making required circuit connections and completing the necessary installation documentation.

### Application of the Unit

#### Application of the Unit 2)

This competency standard unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training

### Licensing/Regulatory Information

#### License to practice 3)

The skills and knowledge described in this unit do not require a licence to practice in the workplace provided equipment is not connected to installation wiring at voltages above 50 V a.c. or 120 V d.c. However other conditions may apply in some States and Territories subject to regulations related to electrical work.

Note.

**License to practice****3)**

Competency requirements to be granted a license to carry out installations, fault finding, repair or maintenance on low voltage electrical installations is incorporated in unit UEENEEG105A and all prerequisite units it specifies

Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships and the like.

Note:

1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control, lifting equipment and the like. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus, site rehabilitation and the like.

2. Compliance may be required in various jurisdictions relating to currency in first aid, confined space, lifting, risk safety measure and the like.

**Pre-Requisites****Prerequisite Unit(s)****4)****Competencies****4.1)**

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEK1 25A Solve basic problems in photovoltaic energy apparatus and systems

**Literacy and numeracy skills****4.2)**

Participants are best equipped to achieve this unit if they have reading, writing and maths skills indicated by the following scales. Description of each scale is given in

Volume 2, Part 3 “Literacy and Numeracy”

Reading 3      Writing 3      Numeracy 3

## Employability Skills Information

### Employability Skills      5)

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

## Elements and Performance Criteria Pre-Content

<p>6) Elements describe the essential outcomes of a competency standard unit</p>	<p>Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.</p>
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## Elements and Performance Criteria

### ELEMENT

### PERFORMANCE CRITERIA

<p>1 Prepare to install ELV stand-alone photovoltaic power apparatus and systems.</p>	<p>1.1 OHS procedures for a given work area are obtained and understood.</p> <p>1.2 Health and safety risks are identified and established risk control measures and procedures in preparation for the work are followed.</p> <p>1.3 Safety hazards that have not previously been identified are noted and established risk control measures are implemented.</p> <p>1.4 Installation of the system is prepared in consultation with others affected by the work and sequenced appropriately.</p> <p>1.5 The nature and location of the work is</p>
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<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
	determined from documentation or appropriate person to establish the scope of work to be undertaken.
	1.6 Sitting limitations and customer system requirements are identified by consultation with the customer.
	1.7 Energy demand is assessed and recommendations made to the customer for energy efficiency improvements if necessary.
	1.8 Suitable system components are specified and selected.
	1.9 Location of system components is planned within the constraints of the building structure and regulations.
	1.10 Advice is sought from appropriate persons to ensure the work is co-ordinated effectively with others.
	1.11 Materials and components needed for the installation work are obtained in accordance with established procedures, pre-assembled where necessary, and checked against job requirements.
	1.12 Materials and components are prepared for transport to the site and transport is arranged.
	1.13 Tools, equipment and testing devices needed for the installation work are obtained in accordance with established procedures and checked for correct operation and safety.
	1.14 Preparatory work is checked to ensure no unnecessary damage has occurred and complies with requirements.
2 Install ELV stand-alone photovoltaic power apparatus and systems.	<p>2.1 OHS risk control measures and procedures for carrying out the work are followed.</p> <p>2.2 Equipment is transported safely to the site.</p> <p>2.3 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established</p>

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
	safety procedures.
	2.4 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.
	2.5 System components are installed to comply with technical standards and job specifications and requirements with sufficient access to affect terminations, adjustment and maintenance.
	2.6 Wiring is terminated at components and associated equipment in accordance with manufacture's specifications and functional and regulatory requirements.
	2.7 Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.
	2.8 Unexpected situations are dealt with safely and with the approval of an authorised person.
	2.9 On-going checks of the quality of installed apparatus are undertaken in accordance with established procedures.
	2.10 System installation is carried out efficiently without unnecessary waste of materials or damage to apparatus, circuits, the surrounding environment or services and using sustainable energy principles.
3 Complete installation and report installation activities.	3.1 OHS work completion risk control measures and procedures are followed.
	3.2 Work site is cleaned and made safe in accordance with established procedures.
	3.3 Final checks are made to that the installed apparatus conforms to requirements.
	3.4 System operation is tested and installation verified to be compliant with standards and work specifications.

**ELEMENT****PERFORMANCE CRITERIA**

- 3.5 'As-installed' apparatus and associated equipment is documented and an appropriate person or persons notified in accordance with established procedures.
- 3.6 Customer is informed of the system operation, routine maintenance and limitations.
- 3.7 Appropriate documentation as required by standards or job specifications is provided to the customer.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and installing and setting up ELV stand-alone photovoltaic power apparatus and systems.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

#### **KS01-EK134 Stand-alone ELV photovoltaic systems**

##### **A**

Evidence shall show an understanding of the installation requirements for stand-alone ELV photovoltaic systems to the extent indicated by the following aspects:

- T1 PV array installation requirements encompassing:
- OH&S requirements and methods for working on roofs.
  - common methods of roof construction (rafters and tile battens) and methods to ensure integrity of waterproofing.
  - common types of roof mounted and free-standing PV array frame construction and methods of tilt angle adjustment.
  - fixing methods for different roof types.
  - array mounting methods for north orientation roof sections and non-north facing roof sections.
  - aesthetic considerations in choosing an appropriate array location and type of mounting.

## REQUIRED SKILLS AND KNOWLEDGE

- the mounting and fixing methods for at least one type of domestic available building integrated PV product.
- T2 Electrical PV array installation requirements encompassing:
- methods used in wiring and connecting PV arrays as per the Australian Standards AS 4509 and AS5033
  - considerations involved in wiring of series connected PV modules in order to minimise power losses due to shading.
  - PV array wiring diagram including the placement of blocking and bypass diodes.
  - considerations involved in choosing the location of associated system equipment including regulators, d.c. control board,
  - cable route from PV array/s to regulators so as to minimise the route length to battery so as to minimise the route length.
- T3 System installation and maintenance encompassing:
- installation work on a PV power system in accordance with relevant standards and OH&S guidelines.
  - correct isolation and shutdown procedures prior to carrying out maintenance tasks.
  - routine maintenance tasks on PV arrays.
  - required vegetation control to remove or reduce shading or soiling on a PV array

## Evidence Guide

### EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit of competency and must be read in conjunction with the performance criteria and the range statement of the unit of competency and the Training Package Assessment Guidelines.

The Evidence Guide forms an integral part of this Competency Standard Unit and shall be used in conjunction with all components parts of this unit and, performed in accordance with the Assessment Guidelines of this Training Package.

### Overview of Assessment 9.1)

Longitude competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best



utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accord with Industry and, Regulatory policy in this regard.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Hence, sources of evidence need to be 'rich' in nature so as to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practiced. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

**Critical aspects  
of evidence  
required to  
demonstrate  
competency in  
this unit** 9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

The evidence on which competency in this unit is based shall be considered holistically for each element on at least two occasions comprising:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range; and
  - Apply sustainable energy principles and practices as specified in the performance criteria and range; and
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. and
  - Demonstrate an appropriate level of skills enabling employment; and
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures; and
- Demonstrated performance across a representative range of contexts from the prescribed items below:
  - Install and set up stand-alone (ELV) photovoltaic power systems as listed in Range statement' and including:
    - A Assessing customer energy requirements, efficiency improvements and site limitations.
    - B Reading and interpreting drawings related to and apparatus locations and circuit connections.
    - C Placing and securing system components accurately.

- D Maintaining fire integrity
- E Connecting system components to comply with requirements.
- F Testing system operation and verifying compliance with standards and job specifications.
- G Completing necessary documentation including handing over system operational documents to the customer and informing customer of system operation, routine maintenance and limitations.
- H Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items

**Context of and specific resources for assessment** 9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this competency standard unit.

Resources required to assess this unit are listed above in Context of assessment', which should also be used in the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment it must ensure that the conditions for assessment are authentic and as far as possible reproduce and replicate the workplace and is consistent with the approved industry simulation policy.

In addition to the resources listed above in Context of and specific resources for assessment, evidence should show demonstrated competency in installing and setting up ELV stand-alone photovoltaic power systems.

**Method of assessment****9.4)**

This competency standard unit shall be assessed by methods given in Volume 1, Part 3 “Assessment Guidelines”.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this competency standard unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

**Concurrent assessment and relationship with other units****9.5)**

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with units:

UEENEEK12 Solve basic problems in photovoltaic energy  
5A apparatus and systems

**Range Statement****RANGE STATEMENT**

**10)** This relates to the unit of competency as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This competency standard unit shall be demonstrated by completing the installation of two different types of ELV stand-alone photovoltaic system on at least two occasions.

Generic terms are used throughout this Vocational Standard shall be regarded as part of the Range of Variables in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

## **Unit Sector(s)**

Not applicable.

## **Competency Field**

**Competency Field**            **11)**

Renewable and Sustainable Energy