Australian Government

UEENEEK128A Solve problems in stand-alone renewable energy systems

Release: 2

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

UEENEEK128A Solve problems in stand-alone renewable energy systems

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers providing known solutions to predictable problems in stand-alone renewable energy systems operated at extra-low voltage. It encompasses working safely, problem solving procedures, including the use of basic voltage, current and resistance measuring devices, providing known solutions to predictable circuit problems.

Application of the Unit

Application of the Unit **2)**

This unit is intended for competency development in entry-level employment-based programs incorporated in approved contracts of training.

Licensing/Regulatory Information

License to practice **3)**

The skills and knowledge described in this unit do not require a license 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/Territories subject to regulations related to electrical work.

Note.

Competency requirements to be granted a license to carry

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License to practice **3)**

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.

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 and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.

2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting, risk safety measures etc

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.

UEENEEK123A	Carry out basic repairs to renewable energy apparatus

Literacy and numeracy skills **4.2)**

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 ‘Literacy and

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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

6) Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to work on stand-alone renewable energy systems	1.1 OHS procedures for a given work area are obtained and understood
	1.2 OHS risk control work preparation measures and procedures are followed
	1.3 The nature of the apparatus problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken
	1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others
	1.5 Sources of materials that may be required for the work are identified and accessed in accordance

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ELEMENT	PERFORMANCE CRITERIA	
		with established procedures
	1.6	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety
2 Solve problem in stand-alone renewable energy systems	2.1	OHS risk control work measures and procedures are followed
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures
	2.3	Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures
	2.4	Established routines are used to solve stand-alone renewable energy systems problems using measured and calculated values of apparatus operating parameters
	2.5	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices
3 Complete work and document problem solving 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	Justification for solutions used to solve stand-alone renewable energy systems problems is documented
	3.4	Work completion is documented and appropriate person(s) notified in accordance with established routine procedures

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Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Evidence must show that knowledge has been acquired of safe working practices and solving basic problems in stand-alone renewable energy systems.

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

KS01-EK128A Stand alone renewable energy system components

Evidence shall show an understanding of stand-alone RE system components to an extent indicated by the following aspects:

T1 ELV wiring and circuit protection for renewable power systems encompassing:

- extra low voltage (ELV) and low voltage (LV) circuits in a stand-alone or grid connected renewable power system and the regulatory restrictions regarding work at each level.
- earthing requirements for renewable power systems over a range of applications and environments
- required sizes for ELV cabling in a renewable power system, considering allowable voltage drops and cable current carrying capacity, in accordance with AS/NZS 3000 and AS 4509.
- Selection of suitable d.c. circuit protection and isolation for all relevant points in a stand-alone renewable power system, in accordance with AS/NZS 3000 and AS 4509

T2 Electrical diagrams for a renewable power system encompassing:

- functional block diagrams for typical stand-alone renewable power system configurations.
- circuit schematic of typical renewable power systems supplying d.c. and/or a.c. loads, including all major components, protection devices, earthing, isolation, switching and metering
- unit wiring diagram for a typical renewable stand-alone power system d.c. control board
- architectural and site diagrams to show the locations of equipment, fittings and cabling

T3 Batteries encompassing:

- major features of each of the major types of commercially

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REQUIRED SKILLS AND KNOWLEDGE

available batteries for stand-alone power system applications including basic chemistry, physical structure, advantages and disadvantages

- factors affecting the life of a battery
- processes of sulphation and stratification in lead acid batteries, their causes, effects and methods of prevention or reduction.
- effect of depth of discharge and of temperature on the capacity and life of lead-acid batteries.
- major specifications for a lead-acid battery in a stand-alone power system application.
- main features of charging regimes suitable for the major types of stand-alone power system batteries, using real examples.
- life of a standalone power system battery in years, based on manufacturer's cycle life data and given capacity, configuration and operating conditions
- precautions required when handling, installing or maintaining lead-acid batteries.
- procedures required for safe disposal of the major commercially available types of batteries in accordance with AS 4509.

T4 Balance of system components and common loads encompassing:

- features of commercially available inverters suitable for use in stand-alone power systems.
- major operating parameters of an inverter, including d.c. voltage operating window; efficiency, output voltage waveform and output voltage regulation over a range of loads up to 5 minute ratings.
- problems that may be caused by non-sine supply voltage waveforms on typical loads, and the solutions used to overcome these
- significance of low power factor loads for inverter systems and the principle of power factor correction.
- operation of the major types of regulators for use in stand-alone renewable power systems, using commercially available equipment as examples.
- current vs. voltage characteristics, efficiency and charging voltage waveform for a transformer/rectifier type and a switchmode type battery charger suitable for use in stand-alone renewable power systems.

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REQUIRED SKILLS AND KNOWLEDGE

- operation of and applications for MPPTs for photovoltaic arrays.
- basic operation, advantages and disadvantages of mechanical tracking devices for PV arrays.
- control parameters or data using digital displays on inverters, regulators or controllers

T5 Basic lighting design encompassing:

- properties and features of the major lamp types including their suitability for use in stand-alone PV power systems.
- effect on room lighting levels, of luminaire design and positioning, décor, room construction and windows.
- Selection and sizing of suitable lamps and fittings and their placement in a household taking into account usage, lighting levels required by relevant standards and energy efficiency considerations.

T6 Generating sets encompassing:

- major components in the construction of a generating set
- main components of gas, petrol or diesel internal combustion engines
- basic principle of operation of internal combustion engines, including different fuel types and ignition methods.
- operating characteristics, advantages and disadvantages of gensets using different fuel types, aspiration methods, operating speed and number of cylinders.
- major methods of mechanical coupling and power transmission between an engine and alternator
- function and ratings of mechanical and electronic speed governing systems.
- basic structure and operation of an alternator.
- advantages and disadvantages of different types of excitation system and voltage regulation used for genset alternators.
- components and basic operation of a brushless excitation system in an alternator, and the principle of self-excitation

T7 Generator set sizing calculations encompassing:

- major electrical and mechanical ratings which control the performance of a genset
- calculations relating to real and apparent power, power factor, mechanical power, voltage regulation and speed droop for single phase gensets
- derating factor for a genset given manufacturer's derating

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REQUIRED SKILLS AND KNOWLEDGE

data and a given set of operating conditions.

- Selection of a suitable genset given maximum demand and surge loadings and derating factor.
- Calculation of the fuel consumption of a genset given manufacturer's data and operating conditions

Evidence Guide

EVIDENCE GUIDE

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

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment **9.1)**

Longitudinal 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-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. In some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

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 issues inherent in working with electricity, electrical equipment, gas or any other hazardous substance/material present a challenge for those determining

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competence. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday 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 practised. 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 must be met.

Evidence for competence in this unit must be considered holistically. Each element and associated performance criteria must be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence must also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this must 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 statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - 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.
  - Demonstrate an appropriate level of skills enabling employment
  - Conduct work observing the relevant Anti Discrimination

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legislation, regulations, polices and workplace procedures

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Solve basic problems in stand-alone renewable energy systems as described in 8) and including:

A Understanding the nature of the problem

B Using established routines to solve apparatus problems

C Providing viable solutions to apparatus problems.

D Documenting justification for the solutions used

E Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a 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 unit.

These should be part of the formal learning/assessment environment.

Note:

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

The resources used for assessment should reflect current industry practices in relation to solving basic problems in stand-alone renewable energy systems.

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Method of assessment **9.4)**

This 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 unit applies. This requires assessment in a structured environment which is intended primarily 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)**

There are no concurrent assessment recommendations for this unit.

The critical aspects of occupational health and safety covered in unit UEENEEE101A and other discipline specific occupational health and safety units shall be incorporated in relation to this unit.

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Range Statement

RANGE STATEMENT

10) This relates to the unit 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 unit must be demonstrated in relation to stand-alone renewable energy systems as they apply to problems related to installation, fault finding, maintenance or development work functions in any of the following:

- In relation to at least three of the following types of stand-alone renewable energy system problems and on at least two occasions:
  - Open-circuit
  - Short-circuit
  - Incorrect connections
  - Insulation failure
  - Unsafe condition
  - Apparatus/component failure
  - Related mechanical failure

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement 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

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