



Australian Government

UEERE0022 Solve basic problems in photovoltaic energy apparatus and systems

Release: 1

UEERE0022 Solve basic problems in photovoltaic energy apparatus and systems

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Application

This unit involves the skills and knowledge required to solve problems with solar radiation, photovoltaic (PV) modules and the impact that tilt, location and orientation has on the output of a PV system.

It includes providing known solutions to predictable problems in photovoltaic energy modules and system operated at extra-low voltage (ELV) and low voltage (LV).

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 volt (V) alternating current (a.c.) or 120 V direct current (d.c.). However, other conditions may apply in some states/territories subject to regulations related to electrical work.

No other licensing, legislative or certification requirements apply to this unit at the time of publication.

Note: Those holding an Unrestricted Electrician's Licence or equivalent issued in an Australian state or territory meet the prerequisite requirements of this unit.

Pre-requisite Unit

UEECD0016 Document and apply measures to control WHS risks associated with electrotechnology work

and

UEECD0043 Solve problems in direct current circuits

or

UEECD0044 Solve problems in multiple path circuits

UEECD0046 Solve problems in single path circuits

and

UEECD0025 Lay wiring/cabling and terminate accessories for extra-low voltage (ELV) circuits

or

UEEEL0023 Terminate cables, cords and accessories for low voltage circuits

Competency Field

Renewable Energy

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to work on PV energy apparatus and systems

2 Solve problems in PV energy apparatus and systems

PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

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| 1.1 | Work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures for a given work area are obtained and applied |
| 1.2 | Hazards are identified, risks are assessed, and control measures and workplace procedures are implemented |
| 1.3 | Nature of apparatus/modules problem/s are identified from relevant documentation or work supervisor to determine the scope of work to be undertaken |
| 1.4 | Advice is sought from work supervisor to ensure the work is coordinated effectively with others |
| 1.5 | Materials required for the work are identified and accessed in accordance with workplace procedures |
| 1.6 | Tools, equipment and testing devices needed for the work are obtained and checked for correct operation and safety in accordance with workplace procedures |
| 2.1 | WHS/OHS risk control measures and workplace procedures are followed |
| 2.2 | Need to inspect, test or measure live work is determined and conducted, as required in accordance with job requirements and workplace safety procedures |
| 2.3 | Circuits are checked and isolated in accordance with WHS/OHS requirements and workplace procedures |

	2.4	Problem-solving techniques are used to solve PV energy modules problems using measured and calculated values of apparatus/modules operating parameters
	2.5	Problems are resolved without damage to apparatus/modules, circuits, the surrounding environment or services using sustainable energy practices
3 Complete work and document problem-solving activities	3.1	WHS/OHS risk control measures and workplace procedures for work completion are followed
	3.2	Worksite is cleaned and made safe in accordance with workplace procedures
	3.3	Justification for solutions used to resolve PV energy modules problems is documented in accordance with workplace procedures
	3.4	Work completion is documented and appropriate person/s notified in accordance with workplace procedures

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

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| <p>Solving problems related to installation, fault finding, maintenance or development work functions must include at least three of the following types of PV energy problems and on at least two occasions:</p> | <ul style="list-style-type: none"> • determining the operating parameters of an existing apparatus/modules • identifying and locating electrical faults • determining solar radiation faults and problems • identifying and locating mechanical fault |
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Unit Mapping Information

This unit replaces and is equivalent to UEENEEK125A Solve basic problems in photovoltaic

energy apparatus and systems.

Links

Companion Volume implementation guides are found in VETNet - -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEERE0022 Solve basic problems in photovoltaic energy apparatus and systems

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two occasions and include:

- applying relevant work health and safety (WHS)/occupational health and safety (OHS) procedures, including:
 - using risk control measures
 - checking tools, materials, equipment and testing devices for correct operation and safety
 - testing or measuring on live work and operating systems safely
 - ensuring circuits are isolated
- providing viable solutions to apparatus/modules problems, including:
 - using problem-solving techniques to solve photovoltaic (PV) energy apparatus/modules problems from measured and calculated values
 - determining the operating parameters of an existing PV energy apparatus/modules
 - dealing effectively with unplanned events in accordance with workplace procedures
 - documenting justification for the solution used
- using known solutions to predictable problems to solve apparatus/modules problems
- measuring solar irradiance with a solarimeter
- using field measurements and a sun path diagram, the times and dates when a PV array will be shaded by obstacles at a particular site
- calculation of:
 - the daily average irradiation on a horizontal plane given extra-terrestrial irradiation, location constants and sunshine hour data
 - the monthly mean daily irradiation falling on a PV array for each month of the year, adjusted for the effects of shading, using irradiance and irradiation data tables and a sun path diagram and/or appropriate software
 - the power at maximum power point (MPP), and the power under typical battery charging conditions of a PV module, given irradiance and ambient air temperature
 - the daily energy output of a PV array in accordance with relevant industry standards, and by using “rule of thumb” de-rating factors
 - selection of an appropriate tilt angle for fixed and seasonally adjustable PV arrays at a given latitude.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- relevant manufacturer specifications
- relevant WHS/OHS legislated requirements
- relevant workplace documentation, policies, procedures and standards
- risk mitigation processes
- daily irradiation, including:
 - definition of the terms: declination angle, reflectance, sunshine hours, extra-terrestrial irradiation, latitude, direct and diffuse radiation, azimuth and altitude angles, radiance, solar window, tilt angle, solstice and equinox
 - units and symbols for irradiation and irradiance
 - interpretation of solar radiation data tables and contour maps
 - how radiation varies throughout the year on the surface of a fixed collector
 - factors affecting the optimal tilt and orientation of PV arrays
- PV modules, including:
 - definition of the terms: cell, module, array, mono-crystalline, poly-crystalline, amorphous, band gap energy and semi-conductor
 - diagram of a basic crystalline silicon PV cell, showing its physical structure, with at least five major features labelled
 - major steps in the production of PV modules based on bulk silicon cells in comparison with the production of thin film PV modules
 - basic physical principles of PV cell operation for the main types of commercially available PV modules
 - efficiency, spectral response, cost and typical applications of the main types of commercially available PV modules
 - new PV technologies currently being developed towards commercialisation, and their major features
 - mechanical and electrical features necessary for the long life of a PV module under a wide range of operating conditions
- module characteristics including:
 - definition of the terms: I-V curve, fill factor, operating point, MPP, cell temperature co-efficient, nominal operating cell temperature (NOCT), current, voltage and power output co-efficient
 - equivalent circuit for a PV cell, labelling each of the elements and the polarity of the terminals
 - family of current - voltage (I-V) curves for a PV module, labelling major points and showing the effects of variation in irradiance and variation in cell temperature
 - major ratings of a PV module from manufacturer's information or nameplate data
 - determination of the operating point of a PV module with a resistive load, a constant voltage source or any other load with known I-V characteristics, using the load line

method

- configuration of a typical PV array, including the function, placement and ratings of blocking and bypass diodes
- the effect of partial shading of a PV module or array, the impact of bypass diodes and the significance of their configuration on output current in typical operating conditions
- the scope and content of Australian or international standards relevant to the performance of PV modules
- the electrical characteristics of a PV module according to relevant Australian or international standards, using an outdoor test method.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, equipment and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

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