



Australian Government

UEERE0016 Install, configure and commission LV grid-connected photovoltaic power systems

Release: 1

UEERE0016 Install, configure and commission LV grid-connected photovoltaic power 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 install and commission a low voltage (LV) photovoltaic (PV) power system to the grid power system.

It includes working safely and to industry installation standards, matching PV components specified for a given location, placing and securing system components accurately, making required circuit connections and completing the necessary installation documentation.

The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c.).

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, is required.

Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

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

UEERE0022 Solve basic problems in photovoltaic energy apparatus and systems

UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories

Competency Field

Renewable Energy

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

PERFORMANCE CRITERIA

Elements describe the essential outcomes.

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

1 Plan to install PV power system

- 1.1** Nature and location of the PV work is determined from documentation, diagrams or relevant person/s to determine the scope of work to be undertaken
- 1.2** WHS/OHS requirements and workplace procedures for a given work area are obtained and applied
- 1.3** Hazards are identified, risks assessed, control measures and workplace procedures implemented
- 1.4** Installation and/or alteration of the PV system is planned in consultation with persons effected by the work and sequenced appropriately
- 1.5** PV array mounting methods and roof orientation is determined in accordance with relevant industry standards
- 1.6** Location of PV system components is planned within the constraints of the building structure, significant and regulations
- 1.7** Material for the PV installation work is obtained in accordance with workplace procedures and checked against relevant diagrams and job requirements prior to installation
- 1.8** Need to test or measure live electrical work is determined in accordance with workplace safety procedures
- 1.9** Tools, equipment and measuring devices required for the PV installation work are obtained in accordance with workplace procedures and checked for correct operation and safety

2 Install LV PV power system

- 2.1** Electrical WHS/OHS risk control measures and workplace procedures associated with extra-low voltage (ELV) and LV PV power system are followed
- 2.2** Circuits/machines/plant are checked as isolated in accordance with WHS/OHS requirements and

workplace procedures

- 2.3 PV system components are installed to comply with industry technical standards, job specifications and system requirements and with sufficient access to affect terminations, adjustment and maintenance
 - 2.4 Wiring is terminated at components and associated equipment in accordance with manufacturer specifications and functional and regulatory requirements
 - 2.5 Unplanned situations are dealt with safely in accordance with workplace procedures in a manner that minimises risk to personnel and equipment and with the approval of an authorised person
 - 2.6 PV system installation is carried out efficiently without waste of materials or damage to apparatus, circuits, the surrounding environment or services using sustainable energy principles
 - 2.7 Checks of installed apparatus quality and components are undertaken in accordance with workplace procedures
- 3 Complete and report PV installation activities**
- 3.1 Worksite is cleaned and made safe in accordance with workplace procedures
 - 3.2 Final inspections and tests are made to the installed apparatus to ensure installation conforms to job requirements, industry technical standards and manufacturer specifications

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.

Install, configuring and commissioning LV grid-connected PV power systems must

- installing PV power systems in at least two different types of premises, construction or

include:

environment

Unit Mapping Information

This unit replaces and is equivalent to UEENEEK148A Install, configure and commission LV grid-connected photovoltaic power 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 UEERE0016 Install, configure and commission LV grid-connected photovoltaic power systems

Modification History

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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) requirements, including:
 - checking tools, materials, equipment and testing devices for correct operation and safety
 - ensuring circuits are isolated
 - terminating wiring correctly and safety
 - testing or measuring low voltage (LV) photovoltaic (PV) power and operating systems safely
 - using risk control measures
- dealing with unplanned events/situations in accordance with workplace procedures in a manner that minimises risk to personnel and equipment
- installing and setting up grid-connected PV system, including:
 - applying appropriate array mounting methods for roof sections
 - connecting grid inverter and measuring inverter parameters for various loads
 - placing and securing system components, including PV array
 - reading and interpreting drawings/diagrams related to apparatus locations and circuit connections
- tilting and adjusting angle of roof mounted and free-standing PV array frame construction
- connecting and commissioning at least one PV product in accordance with industry standards and regulations.

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:

- PV array installation requirements, including:
 - WHS/OHS 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
- the mounting and fixing methods for at least one type of commercially available building integrated PV product
- electrical PV array installation requirements, including:
 - methods used in wiring and connecting PV arrays in accordance with relevant industry standards
 - considerations involved in wiring of series connected PV modules 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, direct current (d.c.) control board, inverters and inverters for grid-connected systems
 - cable route from PV array/s to inverters to minimise the route length
- system installation and maintenance including:
 - installation work on a PV power system in accordance with relevant industry standards and WHS/OHS 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
- inverters, including:
 - types of inverters used in grid-connected systems
 - industry standard symbol for a LV inverter
 - the basic function of an inverter
 - simple block diagram of a typical inverter used in grid-connected system
- inverter operation, including:
 - the basic principle of operation of a single phase inverter (using switch analogue)
 - the operation of a field effect transistor (FET) inverter, an inverter bridge and half-bridge configuration
 - connection of a grid inverter and measurement of the inverter parameters for various loads
- inverter characteristics, including:
 - the characteristics which distinguish inverters suitable for grid-connected PV array application from standard inverters
 - using waveform diagrams, the function of pulse width modulator (PWM) techniques in square wave, modified square wave and synthesised sine wave inverters

- output voltage waveforms for square wave, modified square wave and synthesised sine wave inverters showing typical voltages and periodic times
- the six (6) essential inverter specifications
- PV grid-connected system operation, including:
 - block diagram of a PV grid-connected system
 - operation of grid interactive PV systems, including synchronisation, safety feature, power flow control, passive and active anti-islanding, and metered energy for systems
 - schematic diagrams of common grid-connected inverter circuit configurations, including metering arrangements, isolation and connection with respect to residual current devices (RCDs) in accordance with relevant industry standards
- installation of grid-connected inverters, including:
 - major installation requirements for all system components which will ensure correct operation, long life, safety and ease of maintenance consistent with relevant industry standards and WHS/OHS guidelines
 - selection of a suitable location for the PV array, inverter and other components, at a given installation site in accordance with relevant industry standards
 - typical installation configurations for grid connection of energy systems via inverters
 - the function and operation of a grid protection device as specified by relevant industry standards
 - array wiring plan for series connected modules to minimise power loss due to shading at a particular site
 - installation requirements for a grid-connected system
 - labelling and signage requirements for switchboards supplied with power from grid connected inverters, as set out in the relevant industry standards
 - the additional requirements for UPS systems as specified in the relevant industry standards
 - installation of a PV grid-connected system
- system commissioning and maintenance, including:
 - the isolation procedures required for grid-connected inverters
 - relevant commissioning procedures, including start-up and shutdown procedures for grid-connected inverter systems in accordance with relevant industry standards
 - testing a grid-connected inverter system for correct operation
 - location and rectification of an electrical fault within a PV array/inverter and wiring
 - maintenance schedule for a grid-connected PV power system
 - performing commissioning work on a PV power system in accordance with relevant industry standards.

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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