

## **UEERE0034Y Diagnose and rectify faults in renewable energy (RE) control systems**

### **Modification History**

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

This unit replaces and is not equivalent to UEERE0034 Diagnose and rectify faults in renewable energy control systems. Modifications include:

- Licencing statement updated
- Prerequisites changed
- Significant amendments made to Elements and Performance Criteria
- Performance amended to reflect changed elements and performance criteria.

### **Application**

This unit involves the skills and knowledge required to diagnose and rectify faults in renewable energy (RE) control systems.

It includes preparing to diagnose and rectify faults, diagnosing and rectifying faults in RE control systems, and completing and reporting fault-finding and repair activities.

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.

### **Pre-requisite Unit**

UEERE9999Y Conduct site survey for grid-connected renewable energy systems

UEEEL0039 Design, install and verify compliance and functionality of general electrical installations

## Competency Field

Renewable Energy

## Unit Sector

Electrotechnology

## Elements and Performance Criteria

### ELEMENTS

Elements describe the essential outcomes.

#### **1 Prepare to diagnose and rectify faults**

### PERFORMANCE CRITERIA

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

**1.1** Work health and safety (WHS)/occupational health and safety (OHS) processes and procedures for relevant work area are identified and applied in accordance with workplace procedures

**1.2** The nature of the fault/issue is identified from stakeholders and relevant data and documentation

**1.3** Requirements for working with other stakeholders are confirmed and applied

**1.4** Required materials, tools, apparatus and testing devices are identified, accessed and checked for correct operation and safety

**1.5** Need to test or measure live electrical work is determined in accordance with WHS/OHS requirements and workplace procedures

#### **2 Diagnose and rectify faults in RE control systems**

**2.1** Circuits/apparatus are isolated in accordance with WHS/OHS requirements and workplace procedures

**2.2** Nature of reported fault/issue is verified

**2.3** System testing is conducted and documented

**2.4** Fault/s are diagnosed, faulty equipment is identified, and the replacement products required are documented

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|--|------------|--|
|  | <b>2.5</b> | System is made safe, faulty apparatus is dismantled, recorded and stored in accordance with manufacturer guides and stakeholder instructions |
|  | <b>2.6</b> | Repaired or replaced apparatus is assembled in accordance with manufacturer guidelines, industry standards and regulation                    |
| <b>3 Complete and report fault-finding and repair activities</b> | <b>3.1</b> | Repaired apparatus is tested and commissioned in accordance with manufacturer guidelines, industry standards and regulation                  |
|  | <b>3.2</b> | Work area is cleaned and made safe   |
|  | <b>3.3</b> | Repair is documented and stakeholders notified   |

## 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.

RE system fault finding and repairing must include at least four of the following:

- open circuit
- short circuit
- incorrect connections
- insulation failure
- unsafe condition
- apparatus/component failure
- related mechanical failure.

## Unit Mapping Information

This unit replaces and is not equivalent to UEERE0034 Diagnose and rectify faults in renewable energy control systems.

## Links

UEE - Electrotechnology Training Package Companion Volume Implementation Guide at:  
[sector webpage link here]

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# Assessment Requirements for UEERE0034Y Diagnose and rectify faults in renewable energy (RE) control 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
- finding and repairing faults/issues in renewable energy (RE) control systems including:
  - verifying the reported faults/issues
  - diagnosing fault/issue based on measured and expected values
  - determining and implementing solution
  - documenting issue and justification for the solution used.

## 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:

- renewable energy (RE) system electronics, including:
  - fault-finding techniques encompassing:
    - factors to consider in clarifying the nature of a fault:
      - initial fault report
      - confirmation of symptoms of the fault
      - comparison of symptoms with normal operation
      - effect to cause reasoning — assumptions of possible causes
    - methods for testing assumptions:

- visual inspection
- sectional testing
- split-half tests
- component isolation
- dealing with intermittent faults
- semiconductor components encompassing:
  - symbols for common semiconductor components, including rectifier diodes, light-emitting diodes (LEDs), zener diodes, bipolar transistors, darlington pairs, MOSFETs, IGBTs, SCRs and triacs
  - basic function of these devices above
  - major rating parameters of devices above
  - applications for each device
  - I-V curve characteristics of diodes and the current gain characteristic of bipolar transistors
- linear regulated direct current (d.c.) power supplies encompassing:
  - label circuit diagrams for half wave and full wave, single phase and three phase rectifiers
  - voltage and current waveforms for these rectifier circuits with and without capacitor filtering
  - peak output voltages from single phase and three phase rectifier circuits
  - block diagram showing the structure of a regulated d.c. power supply
  - main features of linear integrated circuit and voltage regulator integrated circuits
  - each of the major components and their physical location in a regulated power supply
- switching power control circuits encompassing:
  - power dissipation of a transistor when operated as a switch
  - how pulse width modulation (PWM) can provide a variable output voltage from a switch mode regulator
  - advantages and disadvantages of switch mode power circuits compared with linear power circuits
  - block diagram of a basic photovoltaic (PV) switching voltage regulator for battery charging
  - applications of switch mode circuits found in RE systems
  - how power control in alternating current (a.c.) circuits is achieved using SCRs and triacs
  - methods used to reduce radio frequency interference (RFI) in d.c. and a.c. circuits utilising high-speed switching
- digital electronic circuits encompassing:
  - characteristic features that distinguish analogue and digital devices and circuits
  - how numbers or text information can be represented using binary numbers and how these are represented in digital circuits

- operation of voltage comparators, analogue to digital (A-D) converters, and digital to analogue (D-A) converters, and examples of each one's use in a RE application
- basic function of microcontrollers, volatile and non-volatile memory devices
- operation of a solar hot water (SHW) system pump differential controller as an example of the use of logic in digital circuits
- power conversion equipment encompassing:
  - basic function of inverters and d.c converters and their use in RE systems
  - the operation of an inverter bridge and half-bridge
  - output voltage waveforms for square wave, modified square wave and synthesised sine wave inverters showing typical voltages and timing
  - the function of PWM techniques in modified square wave and synthesised sine wave inverters
  - block diagrams showing the structure of common forms of d.c converters and inverters used in RE applications
- maintenance encompassing:
  - safety procedures for work on electronic systems, circuits and apparatus
  - hazards that may be encountered when performing tests on inverters, battery chargers or other equipment containing low voltage (LV) circuits
  - functionality of electronic equipment through appropriate client questioning and application of systematic tests and observation
  - various types of common faults and their causes in RE electronic equipment
  - typical test equipment used to repair electronic and electrical equipment
  - safe and correct use of tools and test equipment to locate electronic equipment faults under the direction of an electronics technician
  - replacement of circuit boards, observing appropriate handling precautions for static sensitive devices
  - replacement of socketed integrated circuits such as EPROMs or microprocessors using appropriate tools and methods
- relevant manufacturer specifications
- relevant safe work method statements (SWMS)/job safety assessments or risk mitigation processes
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace policies and procedures
- RE control systems.

## 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 suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in suitable 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
- resources that reflect current industry practices in relation to diagnosing faults in RE control systems
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

## Links

UEE - Electrotechnology Training Package Companion Volume Implementation Guide at:  
[sector webpage link here]