



Australian Government

UEPMNT447A Diagnose and repair faults in wind turbine generator electrical systems

Release: 1

UEPMNT447A Diagnose and repair faults in wind turbine generator electrical systems

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit deals with the skills and knowledge required to diagnose and repair faults in large scale wind turbine generator (WTG) electrical systems.

Application of the Unit

Application of the Unit 2)

This 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)

During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships.

In the workplace: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c.

Other conditions may apply under State and Territory legislative and regulatory requirements.

Pre-Requisites

Prerequisite Unit(s) 4)

Competencies 4.1)

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

Where pre-requisite pathways have been identified. All competencies in the Common Unit Group must have been completed.

Common Unit Group

Unit Code	Unit Title
UEPMNT371A	Maintain large scale wind turbine generators
UEPMNT442A	Maintain wind turbine generator electrical systems
UEPMNT445A	Diagnose and repair faults in large scale wind turbine generators
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102A	Fabricate, dismantle, assemble of electrotechnology components
UEENEEE104A	Solve problems in d.c circuits
UEENEEE105A	Fix and secure electrotechnology equipment
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEG006A	Solve problems in single and three phase low voltage machines
UEENEEG033A	Solve problems in single and three phase low voltage electrical apparatus and circuits

Prerequisite Unit(s) 4)

UEENEEG063A	Arrange circuits, control and protection for general electrical installations
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in low voltage a.c. circuits
UEENEEG106A	Terminate cables, cords and accessories for low voltage circuits
UEENEEG108A	Trouble-shoot and repair faults in low voltage electrical apparatus and circuits

Literacy and numeracy skills 4.2)

Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following levels. A description of what each level entails is provided in Section 2.3.1 Language, Literacy and Numeracy.

Reading	4	Writing	4	Numeracy	4
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Employability Skills Information**Employability Skills 5)**

This unit contains Employability Skills.

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 Gather data	1.1 Data logging information and error codes are accessed 1.2 Sensory data on fault or problem (auditory, visual, smell, touch), is gathered 1.3 Relevant hard copy or online documentation is accessed to support fault finding process 1.4 Built-in fault indicators and error codes are, where appropriate, examined and correctly interpreted 1.5 Reference to circuit diagrams, specifications, schematics and/or consultation with technical adviser is used to determine circuit/system function and characteristics
2 Interpret data to establish hypothesis in regards to WTG electrical system fault	2.1 Knowledge of WTG electrical systems and performance parameters is applied to interpretation of fault data 2.2 Faults are verified or localised using correct and appropriate techniques, procedures, tools and test equipment. 2.3 Priorities are set for testing / replacement of specific components, wiring, and connections in the WTG
3 Repair WTG electrical system fault	3.1 Risk analysis of the job is undertaken and communicated among the work team. 3.2 Safety precautions such as circuit isolations, physical barriers, and other protective devices or

ELEMENT

PERFORMANCE CRITERIA

- | | | |
|--------------------------------------|-----|---|
| | | systems are, where appropriate, used to ensure safety |
| | 3.3 | Tests are conducted to ensure fault has been correctly repaired or isolated |
| | 3.4 | Faulty components that have been removed from service are examined and where possible the cause of problem is identified |
| | 3.5 | Loose connections or wiring are repaired |
| | 3.6 | Parts likely to be cause of fault are removed and replaced with tested and operational parts |
| | 3.7 | System is tested to ensure correct operation |
| | 3.8 | Fault finding processes and work to repair complex fault(s) are, if required, effectively escalated with technical adviser. |
| 4 Record WTG electrical system fault | 4.1 | Faulty components and parts are correctly tagged, identified and stored or shipped as per enterprise requirements |
| | 4.2 | Faults are recorded to standard operating procedures. |
| | 4.3 | Cause of complex fault and process of repair is discussed with the team and other personnel using an appropriate forum. |

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

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

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Evidence shall show that knowledge has been acquired of diagnosing and repairing wind turbine generator electrical systems to the extent indicated by the following aspects:

- T1. Slip ring
 - installation/replacement
 - repair
- T2. Isolation diode
 - fault diagnosis
 - replacement
- T3. Diagnose and repair uninterruptible power supply (UPS) systems
- T4. Diagnose and repair DC back-up supply systems
 - Battery banks
- T5. Techniques for replacing damaged wiring (where permitted)
- T6. Reset principles for protection devices
- T7. Live trouble-shooting
- T8. Diagnose and repair power factor correction equipment
 - Capacitors
 - 'Flexi-slip' system
 - Solid-state phase feedback conversion systems
 - Resistors
- T9. Wave pattern analysis
- T10. Current measurements
- T11. Interfacing to the power grid
 - Grid failure response
 - Principles of grid synchronisation
- T12. Safety chain

REQUIRED SKILLS AND KNOWLEDGE

- Troubleshooting
 - Isolating issues
- T13. Terminating lugs and connectors specific to the industry
- T14. In-rush protection circuitry, function and repair
- Crowbar protection circuitry

Evidence Guide

EVIDENCE GUIDE

9) The Evidence Guide forms an integral part of this 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)

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. It is recognised that, 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 nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. 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, Section 3.1 of this Training Package.

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

9.2)

Evidence for competence in this unit shall be considered holistically. Each element and associated Performance Criteria shall be demonstrated:

- On at least two (2) occasions, In accordance with the "Assessment Guidelines" for the UEP12 Training Package.

Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframe 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 required skills and knowledge as described in this unit to such an extent that the learner's performance outcome is reported in accordance with the preferred approach; namely a percentile graded result, where required by the regulated environment; and
 - Demonstrate an appropriate level of employability skills; 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:

- | | |
|------------------------|--|
| A All of the following | <ul style="list-style-type: none"> • Replace a battery cell in a DC battery bank • Repair an uninterruptible power supply (UPS) by replacing user-serviceable component/s |
| B All of the following | <ul style="list-style-type: none"> • Diagnose and replace an isolation diode • Repair a faulty 'crowbar' protection circuit • Replace a defective power factor correction capacitor |
| C All of the following | <ul style="list-style-type: none"> • Replace a defective LV circuit breaker • Perform a 'cold' start up sequence on the WTG |
| D All of the following | <ul style="list-style-type: none"> • Measure output current using current tongs • Measure HV, LV and ELV voltages through use of the appropriate test measurement tool • Perform wave analysis using an appropriate test measurement tool |
| E All of the following | <ul style="list-style-type: none"> • Confirm correct operation of grid isolation circuitry |
| F All of the following | <ul style="list-style-type: none"> • Repair damaged or faulty slip rings • Replace slip rings |
| G All of the following | <ul style="list-style-type: none"> • Replace a power transformer desiccant breather |
| H All of the following | <ul style="list-style-type: none"> • Deal with an unplanned event by drawing on essential knowledge and skills to provide appropriate solutions. |

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 used in 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:

Diagnose and repair faults in wind turbine generator electrical systems

Method of assessment

9.4)

This unit shall be assessed by methods given in the Assessment Guidelines, Section 1.3 of this Training Package.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this competency standard unit applies. This requires assessment 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:

UEPMNT448 Diagnose and repair faults in wind turbine generator control systems

UEPMNT449 Diagnose and repair mechanical systems faults in wind turbine generators

Range Statement

RANGE STATEMENT

10) This relates to the competency standard 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.

Climbing equipment, including personnel lifts, climb assist, elevators, kadders

Lifting apparatus includes winches and cranes

Diagnose and rectification of faults in wind turbine generator electrical systems may include:

Power transformers and ring mains units (RMU)s as used for WTGs

Hydraulic equipment, including turbine braking equipment.

Diagnosis and repair may include: visual inspections, replacement of electrical components, replacement of electrical protection equipment, isolation diodes, uninterruptible power supplies (UPS, safety chain, DC systems, power factor correction equipment, loose wiring, checking the tension of bolts, replacing sensors, replacing slip rings, testing of equipment for correct operation

Tools may include spanners, screwdrivers, side cutters, pliers, wire strippers, RCD protection devices

Consumables include electrical tape, lugs and connectors

Test equipment may include multimeters, current tongs, micro-ohm meters, laptop computers, PC tablet, smart phones and other data acquisition tools and equipment.

Large Scale Wind Generators (WTGs) include systems having a rating of greater than 10 kW

Work completion details may include plant and maintenance records, job cards, check sheets, on device labelling updates and reporting and/or documenting equipment defects.

Work site environment may be affected by nearby plant or processes and climatic conditions e.g. wind speed, chemical, heat, dust, noise, height and oil.

Location of wind turbine generators may be in urban, suburban, regional or rural locales and environments.

Documentation may be either paper-based or electronic format.

Isolations can refer to electrical/mechanical or other associated processes.

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 the Glossaries, Section 2.1 of this Training Package.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field	11)
	Maintenance