Australian Government

Department of Education, Employment and Workplace Relations

UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems

Release: 1

UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers diagnosing and rectifying faults in electrical energy transmission systems. The unit encompasses safe working practices, interpreting diagrams and technical data, applying knowledge of energy supply and transmission systems to logical fault finding processes, implementing fault rectification, safety and functional testing and reporting work activities and outcomes.

Application of the Unit

Application of the Unit **2)**

This unit is intended as an additional competency to relevant competencies previously acquired. It is suitable for employment-based programs under an approved contract of training at the aligned AQF 5 level or higher.

Licensing/Regulatory Information

License to practice **3)**

The skills and knowledge described in this unit require a license to practice in the workplace where plant and equipment operate at voltage above 50 V a.c. or 120 V d.c. However 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 regulations directly related to occupational

License to practice **3)**

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 and risk safety measures.

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 be have been completed plus all the competencies in one (1) of the identified Pathway Unit Group(s):
Common Unit Group

Unit Code	Unit Title
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE102A	Fabricate, assemble and dismantle utilities industry components
UEENEEE104A	Solve problems in d.c. Circuits
UEENEEE105A	Fix and secure electrotechnology equipment
UEENEEE107A	Use drawings, diagrams, schedules,

Prerequisite Unit(s) **4)**

	standards, codes and specifications
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in low voltage a.c. Circuits
UEENEEG006A	Solve problems in single and three phase low voltage machines
UEENEEG106A	Terminate cables, cords and accessories for low voltage circuits
UETTDRIS67A	Solve problems in energy supply network equipment
UETTDRIS68A	Solve problems in energy supply network protection equipment and systems
UETTDRIS69A	Diagnose and rectify faults in energy supply 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 Numeracy’

Reading 5 Writing 5 Numeracy 5

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 diagnose and rectify faults.	1.1	OHS procedures for a given work area are identified, obtained and understood.
	1.2	Established OHS risk control measures and procedures in preparation for the work are followed.
	1.3	Safety hazards that have not previously been identified are documented and risk control measures devised and implemented in consultation with appropriate personnel.
	1.4	The extent of faults is determined from reports and other documentation and from discussion with appropriate personnel.
	1.5	Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.
	1.6	Tools, equipment and testing devices needed to diagnose faults are obtained in accordance with established procedures and checked for correct operation and safety.
2 Diagnose and rectify faults.	2.1	OHS risk control measures and procedures for carrying out the work 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.

ELEMENT	PERFORMANCE CRITERIA	
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.
	2.4	Logical diagnostic methods are applied to diagnose electrical energy transmission system faults employing measurements and estimations of system operating parameters referenced to system operational requirements.
	2.5	Suspected fault scenarios are tested as being the source of system problems.
	2.6	Source of the fault is identified and appropriately competent persons are engaged to rectify the fault where it is outside the scope of the control system.
	2.7	Faults in the system components are rectified to raise electrical energy transmission system to its operation standard.
	2.8	System is tested to verify that it operates as intended and to specified requirements.
	2.9	Decisions for dealing with unexpected situations are made from discussions with appropriate persons and job specifications and requirements.
	2.10	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
	2.11	Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the surrounding environment or services and using sustainable energy practices.
3 Complete and report fault diagnosis and rectification activities.	3.1	OHS work completion risk control measures and procedures are followed.
	3.2	Work site is made safe in accordance with established safety procedures.
	3.3	Rectification of faults is documented in

ELEMENT	PERFORMANCE CRITERIA
	accordance with established procedures.
	3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.
Evidence shall show that knowledge has been acquired of safe working practices and diagnosing and rectifying faults in electrical energy supply transmission systems.
All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.
KS01-TIS71A Electrical power system transmission faults
Evidence shall show an understanding of electrical power system transmission faults to an extent indicated by the following aspects:
T1 Overview of the transmission system including lines, buses, transformers and cables. Line/bus layouts including single and double switching, breaker and a half systems and HV crossing methods.
T2 The principles involved in high voltage a.c. transmission including tower types and configurations, choice of towers or poles (economic and environmental), insulator types and configuration, types of conductors, their configuration and standard nomenclature. Typical line spacing and ground clearances. Line ratings based on ambient temperature. Conductor terminating and clamping equipment including vibration damping principles and equipment.
T3 The principles involved in d.c. transmission including the economics, harmonic generation, VAR requirements and protection difficulties. Types of connections and transformer requirements. Advantages and disadvantages of d.c. transmission. Typical overseas systems. Likely (future) use in this country.
T4 The principles of operation, voltage and current range, breaking capacity and field of use of the following types of circuit breakers.

- bulk oil
- small oil volume
- air break
- air blast
- air puffer
- vacuum and
- SF6 (double pressure and puffer types).

T5 The types of isolators in use. Examples include duo-roll, blade and scissor type.
T6 Circuit breaker auxiliary systems including:

- high pressure air systems and air storage and handling processes
- d.c. systems including battery types, charging and protection systems and earth fault detection systems
- SF6 conditioning, storage and handling system

T7 The characteristics of lines and cables including the calculation of R, X and B for different arrangements of conductor. Typical values for actual lines. Transposition. Models based on line length. Voltage and line regulation. The transmission of power

REQUIRED SKILLS AND KNOWLEDGE

(P) and VARs (Q).

T8 Control of voltage. Conditions leading to voltage collapse and system disintegration. Effects on the system of high/low volts. Voltage control devices including:

- voltage regulators applied to generators and synchronous phase modifiers
- electromagnetic voltage regulators
- series and parallel capacitors
- OLTC transformers and static Var compensations (SVCs)

T9 Range of devices covered by SVCs including:

- saturated reactor compensations (SRs)
- thyristor controlled reactor compensators (TCRs)
- combined TCR/TSCs and
- production of wave-form distorting harmonics and control devices

T10 Importance of the location in the system of voltage control devices

T11 Use of graphical methods to calculate the size of VAr regulating plant

T12 Types of communication systems including telephone, power line carrier, dedicated cable, micro-wave links and fibre optics. Quantities and signals to be communicated. Advantages and disadvantages of the various systems. Equipment requirements

T13 Transient over-voltages in power systems. Switching and lightning overvoltages and their effect on different plant items. Transient over-voltage control and reduction using surge diverters, shield wires and CB are control. Insulation systems, insulation co-ordination, insulation grading in plant items, bushings and capacitor bushings

T14 Factors leading to the generation of corona. Consequences of corona. Reduction of corona including conductor bundling, grading rings and conductor surface treatment

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit. It 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's 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 every day 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 shall be met.
Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UET12'. Evidence shall 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 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 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 legislation, regulations, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Diagnose and rectify faults in electrical energy supply transmission systems as described in 8) and including:

    A Applying logical diagnostic methods.

    B Using fault scenarios to test the source of system faults.

    C Identifying faults and competency needed to rectify them.

D Rectifying faults in system.

E Verifying that the system operates correctly.

F Documenting fault rectification.

G Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

Note:
Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

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 diagnosing and rectifying faults in electrical energy supply transmission systems.

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 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)**

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 unit(s) shall be reassessed in relation to this unit.

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 shall be demonstrated in relation to diagnosing and rectifying at least four faults in a servo/stepper drive control system.
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)**

Electrical