



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **UETTDRIS73A Develop engineering solutions for energy supply power transformer problems**

**Release: 1**

## **UETTDRIS73A Develop engineering solutions for energy supply power transformer problems**

### **Modification History**

Not applicable.

### **Unit Descriptor**

#### **Unit Descriptor**

#### **1) Scope:**

##### **1.1) Descriptor**

This unit covers developing engineering solutions to resolve problems with energy supply system protection. It encompasses working safely, apply extensive knowledge of energy supply power transformer operation and their application, gathering and analysing data, applying problem solving techniques, developing and documenting solutions and alternatives.

Note.

Typical transformer problems are those encountered in meeting performance requirements and compliance standards, revising a transformer operating parameters and dealing with transformer malfunctions

### **Application of the Unit**

#### **Application of the Unit 2)**

This unit applies to any recognised development program that leads to the acquisition of a formal award at AQF level 6 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 for work involving direct access to plant and equipment connected to installation wiring at voltage above 50 V a.c. or 120 V d.c.

## License to practice

3)

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 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

**Prerequisite Unit(s)**

**4)**

UEENEEE105A	Fix and secure electrotechnology equipment
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEE125A	Provide engineering solutions for problems in complex multiple path circuits problems
UEENEEE126A	Provide solutions to basic engineering computational problems
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
UEENEEG149A	Provide engineering solutions to problems in complex polyphase power circuits
UETTDNIS67A	Solve problems in energy supply network equipment
UETTDNIS68A	Solve problems in energy supply network protection equipment and systems
UETTDNIS69A	Diagnose and rectify faults in energy supply apparatus
Distribution Pathway Unit Group	
UETTDNIS70A	Diagnose and rectify faults in electrical energy distribution systems
Transmission Pathway Unit Group	
UETTDNIS71A	Diagnose and rectify faults in electrical energy supply transmission

**Prerequisite Unit(s) 4)**

systems

Distributed Generation Pathway Unit Group

UETTD72A Diagnose and rectify faults in distributed generation systems

**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 develop engineering solution for energy supply power transformer problems.	1.1 OHS processes and 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 The extent of the transformer problem is determined from performance specifications and situation reports and in consultations with relevant persons.
	1.4 Activities are planned to meet scheduled timelines in consultation with others involved in the work.
	1.5 Effective strategies are formed to ensure solution development and implementation is carried out efficiently.
2 Develop engineering solutions for energy supply power transformer problems.	2.1 OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Knowledge of supply power transformer arrangements, operation, device characteristics and applications are applied to developing solutions to supply power transformer problems.
	2.3 Parameters, specifications and performance requirements in relation to each transformer problem are obtained in accordance with established procedures.
	2.4 Approaches to resolving supply power transformer problems are analysed to provide most effective solutions.
	2.5 Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.
	2.6 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
3 Test, document and implement engineering solution for energy supply power transformer problems.	3.1 Solutions to transformer problems are tested to determine their effectiveness and modified where necessary.
	3.2 Adopted solutions are documented including instruction for their implementation that incorporates risk control measure to be followed.
	3.3 Appropriately competent and qualified person(s) required to implement solutions to supply power transformer problems are coordinated in accordance with regulatory requirements and enterprise policy. (Note)
	3.4 Justification for solutions used to solve supply power transformer problems is documented for inclusion in work/project development records in accordance with professional standards.

Note: A license to practice in the workplace is required for work involving direct access to plant and equipment connected to installation wiring at voltages above 50 V a.c. or 120 V d.c.

## **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 developing engineering solutions for energy supply power transformer problems. All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-TIS73A Power transformers diagnostics

Evidence shall show an understanding of power transformers to an extent indicated by the following aspects:

T1 Transformer construction and operating principles encompassing:

- various types of lamination style and core construction used in single phase, three phase, double wound and auto transformers.
- different winding styles/types used in transformers.
- how input current is limited on no load and how power is transferred from primary to secondary when a load is connected.
- using the transformation ratio to determine an unknown quantity of V, I, VA.
- significance of nameplate data items.
- operation of a transformer under load/no load conditions.
- the reason any particular type of transformer is used in a specific application.
- safety features specified in regulatory standards with respect to transformers.
- safety features specified in regulatory standards with respect to isolating transformers.
- basic insulation resistance, continuity and winding identification tests.

T2 Transformer parameters encompassing:

- the percentage impedance of a transformer by test.
- percentage impedance of a transformer by calculation.
- the equivalent circuit of a transformer.
- calculation of voltage regulation.
- losses that occur in a transformer.
- tests to determine losses.
- efficiency and state typical values.
- the all day efficiency of a transformer.

T3 Cooling methods encompassing:

- methods of natural and forced cooling.



## REQUIRED SKILLS AND KNOWLEDGE

- properties of transformer oil.
- tests performed on transformer oil.
- auxiliary equipment
- the purpose and operation of the types of auxiliary equipment used on transformers - bushings, explosion vents, surge diverters, tap changers, conservator, breathers and desiccants, gas relays, temperature indicators.

### T4 Instrument transformers encompassing:

- construction of current transformers.
- uses and ratings of current transformers.
- construction of voltage transformers.
- uses and ratings of voltage transformers.
- safety techniques when using instrument transformers.

### T5 Transformer connections encompassing:

- vector group of a transformer from a connection diagram.
- connections of a three-phase transformer to create a particular vector group.
- reasons for using the different vector groups.
- purpose of tertiary windings.
- consequences/effect of an incorrect connection.

### T6 Parallel operation encompassing:

- polarity markings for the windings of a transformer.
- conditions/restrictions for parallel operation of transformers.
- calculation of loading on transformers operating in parallel.
- connection of transformers in parallel to supply a common load.
- the consequences/effect of an incorrect connection.

### T7 Harmonics in transformers encompassing:

- how harmonics are generated in transformers.
- problems caused by harmonics in transformers.
- measurement of the harmonics in a transformer.
- methods/equipment used to overcome harmonics in transformers.

### T8 High voltage isolation encompassing:

- the term high voltage.
- procedures for isolating high voltage apparatus.
- regulations with respect to access permits.
- clearances to be observed with respect to high voltages up to 33 kV.
- the term 'step' and 'touch' potential.

## 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, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Develop engineering solutions for energy supply power transformer problems as described in 8) and including:
    - A Understanding the extent of the transformer problems.
    - B Forming effective strategies for solution development and implementation.
    - C Obtaining transformer parameters, specifications

and performance requirements appropriate to each problem.

- D Testing and solutions to transformer problems.
- E Documenting instruction for implementation of solutions that incorporate risk control measure to be followed.
- F Documenting justification of solutions implemented in accordance with professional standards.
- 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 developing engineering solutions for energy supply power transformer problems.

**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)**

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

UETTDRIS70 A Diagnose and rectify faults in electrical energy supply distribution system

OR

UETTDRIS72 A Diagnose and rectify faults in distributed generation systems

OR

UETTDRIS71 A Diagnose and rectify faults in electrical energy supply transmission system

AND

UEENEEG149 A Solve problems in complex polyphase power circuits

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 developing engineering solution for at least four supply power transformer problems.

Note.

Typical transformer problems are those encountered in meeting performance requirements and compliance standards, revising a transformer operating parameters and dealing with transformer malfunctions.

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

<b>Competency Field</b>	<b>11)</b>
	Electrical