



Australian Government

Department of Education, Employment and Workplace Relations

UETTDRDS55A Design power system transmission and sub-transmission substation earthing

Release: 1

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Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This Competency Standard Unit covers the design of transmission and sub-transmission zone substation earthing. This may include earth resistivity tests coordination, design of the earth grid, electrodes, grid connections, equipment connections and remote earthing connections to conduct maximum earth fault currents without exceeding the maximum allowable earth potential rise. The design does include earthing engineering aspects and must conform to safety regulations and environmental standards and incorporate the principles of safe design. However, it excludes the certification of earthing design.

Application of the Unit

Application of the Unit 2)

This competency standard 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)

The skills and knowledge described in this unit may require a licence/registration to practice in the work place subject to regulations for undertaking of electrical work. Practice in workplace and during training is also subject to

License to practice

3)

regulations directly related to Occupational Health and Safety, electricity/telecommunications/gas/water industry safety and compliance, industrial relations, environmental protection, anti discrimination and training. Commonwealth, State/Territory or Local Government legislation and regulations may exist that limits the age of operating certain equipment.

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
UEENEEE104A	Solve problems in d.c. Circuits
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in electromagnetic devices and related circuits
UETTD RDS39A	Prepare and manage detailed construction plans for electrical power system infrastructure
UETTD RDS44A	Design power system substations

Prerequisite Unit(s)	4)	modifications
	UETTDREL11A	Apply sustainable energy and environmental procedures
	UETTDREL16A	Working safely near live electrical apparatus
	UETTD RIS62A	Implement and monitor the power system organisational OHS policies, procedures and programs
	UETTD RIS63A	Implement and monitor the power system environmental and sustainable energy management policies and procedures

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 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 Plan for and coordinate the design of transmission, sub-transmission and zone substation earthing	<p>1.1 OHS practices/procedures and environmental and sustainable energy procedures, which may influence the design of substations, are reviewed and determined.</p> <p>1.2 Purpose of the design is established and expected outcomes of the work are confirmed with the appropriate personnel.</p> <p>1.3 Established policies, procedures and specifications for the design are obtained or established with the appropriate personnel.</p> <p>1.4 Equipment/tools and personal protective equipment are selected and coordinated based on specified requirements and established procedures</p> <p>1.5 Work is prioritised and sequenced for the most efficient and effective outcome following consultation with others for completion within acceptable timeframes, to a quality standard and in accordance with established procedures</p> <p>1.6 Risk control measures are identified, prioritised and evaluated against the work schedule</p> <p>1.7 Relevant work permits are secured to coordinate the performance of work according to requirements and/or established procedures</p> <p>1.8 Resources including personnel, equipment, tools and personal protective equipment required for the job are identified, scheduled and coordinated and confirmed in a safe and technical working</p>

ELEMENT

PERFORMANCE CRITERIA

order

- 1.9 Liaison and communication issues with other/authorised personnel, authorities, clients and land-owners are resolved and activities coordinated to carry out work
- 1.10 Site is prepared according to the work schedule and to minimise risk and damage to property, commerce, and individuals in accordance with established procedures
- 1.11 Personnel participating in the work, including plant operators and contractors, are fully briefed and respective responsibilities coordinated and authorised where applicable in accordance with established procedures
- 2 Carry out and coordinate the design of transmission, sub-transmission and zone substation earthing
 - 2.1 Circuit/systems modelling is used to evaluate alternative proposals as per established procedures.
 - 2.2 OHS and sustainable energy principles, functionality and practices to avoid incidence and accidents and minimise waste are incorporated into the project in accordance with requirements and/or established procedures
 - 2.3 System design decisions are made on the basis of safety and effective outcomes according to requirements and/or established procedures
 - 2.4 Mathematical models of the earth grid are used to analyse the effectiveness of the finished project as per requirements and established procedures
 - 2.5 Technical advice is given regarding potential hazards, safety risks and control measures so that monitoring and preventative action can be undertaken and/or appropriate authorities consulted, where necessary, in accordance with requirements and established procedures
 - 2.6 Essential knowledge and associated skills are applied to analyse specific data and compare it with compliance specifications to ensure completion of the project within an agreed

ELEMENT

PERFORMANCE CRITERIA

		timeframe according to requirements.
	2.7	Solutions to non-routine problems are identified and actioned using acquired essential knowledge and associated skills according to requirements
	2.8	Quality of work is monitored against personal performance agreement and/or established organisational and professional standards.
3	Complete and coordinate the design of transmission, sub-transmission and zone substation earthing	
	3.1	Final checks of the design are undertaken to ensure they comply with all requirements and include all specifications and documentations needed to complete the design brief.
	3.2	Appropriate personnel are notified of completion and reports and/or completion documents are finalised.
	3.3	Reports and/or completion documents are submitted to relevant personnel/organisations for approval and, where applicable, statutory or regulatory approval
	3.4	Approved copies of design documents are issued and records are updated in accordance with established procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) Essential Knowledge and Associated Skills (EKAS): This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of designing transmission, sub-transmission and zone substation earthing.

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

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Evidence shall show an understanding of designing power system transmission and sub-transmission earthing to an extent indicated by the following aspects:

T1 Distribution earthing system encompassing:

- Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to the distribution earthing system
- Reason and types of distribution earthing systems
- Terminologies used in the earth systems including, touch and step potential
- Conditions associated when an active HV conductor fails to earth
- Selection of earthing electrodes and grids
- Determination of the earthing resistance of copper clad rods using earthing monograms

T2 Principles of transmission, sub-transmission and zone substation earthing designs encompassing:

- Commonwealth, State/Territory and local government legislation, Standards, codes, supply authority regulations and or enterprise requirements applicable to the substation design management principles
- Requirements for the use of the substation system construction manuals, system diagrams/plans and drawings and for plans such as work method statements for the control of OHS risks
- Types of activities to be carried out - earth resistivity tests coordination, design of the earth grid, confirmation of control of transfer of EPR
- Types of earthing design parameters - coordination and analysis of earth resistivity tests, design and drafting of earth grid including electrodes, grid connections, equipment connections and remote earthing connections to conduct maximum earth fault currents without exceeding the maximum allowable earth potential rise (EPR), confirmation of acceptable step and touch potentials including attenuation or hazard control measures, water, telephone service and LV neutral supplies isolation to isolate local EPR

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit of competency and must be read in conjunction with the Performance Criteria and the range statement of the unit of competency and the Training Package Assessment Guidelines. The Evidence Guide forms an integral part of this Competency Standard Unit and shall be used in conjunction with all component 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 accord with Industry and, Regulatory policy in this regard.

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. Hence, sources of evidence need to be 'rich' in nature so as 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 practiced. 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 is based, shall be considered holistically. Each element and associated Performance Criteria shall be demonstrated on at least two occasions in accordance with the “Assessment Guidelines – UET12UET12”. Evidence shall also comprise:

- A representative body of Performance Criteria 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; and
 - Apply sustainable energy principles and practices as specified in the Performance Criteria and range; and
 - Demonstrate an understanding of the essential knowledge and associated skills 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:

Range of tools/equipment/materials/procedures/workplaces/other variables		
Group No	The minimum number of items on which skill is to	Item List

	be demonstrated	
A	Completion of two (2) compliant technical designs including each of the following:	Coordination and analysis of earth resistivity tests. Design and drafting of earth grid including electrodes, grid connections, equipment connections and remote earthing connections to conduct maximum earth fault currents without exceeding the maximum allowable earth potential rise (EPR). Confirmation of acceptable step and touch potentials including attenuation or hazard control measures. Confirmation of control of transfer of EPR.
B	Designs should also include all the following:	Activities that address the correction of errors in the process. Application of a design control checklist which lists all of the required design activities to be carried out in this process.
C	At least one occasion	Dealing with an unplanned event by drawing on essential knowledge and associated skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

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 design of transmission, sub-transmission and zone substation earthing.

In addition to the resources listed above, in Context of and specific resources for assessment, evidence should show demonstrated competency working realistic environment and a variety of conditions.

Method of assessment 9.4)

This Competency Standard 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 Competency Standard Unit applies. This requires that the specified essential knowledge and associated skills are assessed 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 associated skills described in this unit.

Concurrent assessment and relationship with other units 9.5)

There are no recommended concurrent assessments with this unit, however in some cases efficiencies may be gained in terms of learning and assessment effort being concurrently managed.

Range Statement

RANGE STATEMENT

10) This relates to the unit of competency 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 Competency Standard Unit shall be demonstrated in relation to the design of transmission, sub-transmission and zone substation earthing and may include the following:

Concerns associated with the earthing design should take into account: Grid designed for max fault current, maximum allowable earth potential rise, step potentials, touch potentials, fence separately earthed or bonded to station grid, fence isolation from all items bonded to station grid, e.g. building, grading ring outside fence, two connections to every switchyard device, disconnecter earth mats bonded directly to handle, disconnectors earthed correctly, control building(s) earthed in two places, switchgear building (s) earthed in two places, two connections to switchgear earth bar (s), two connections to control panel earth bar (s), sufficient portable earth connection points, gates earthed via flexible connections, equipotential conductor between all gate posts, grading ring extends to extremity of gate radius, fence earthed adequately, earthing of sheath at substation end of power cables and earthing of sheath at remote end of power cables

The following constants and variables included in the element/Performance Criteria in this unit are fully described in the Definitions Section 1 of this volume and form an integral part of the Range Statement of this unit:

- Appropriate and relevant persons (see Personnel)
- Appropriate authorities
- Appropriate work platform.
- Assessing risk
- Assessment
- Authorisation
- Confined space
- Diagnostic, testing and restoration.
- Documenting detail work events, record keeping and or storage of information.
- Drawings and specifications
- Emergency
- Environmental and sustainable energy procedures
- Environmental legislation.
- Environmental management documentation.
- Established procedures.
- Fall prevention
- Hazards
- Identifying hazards

RANGE STATEMENT

- Inspect
- Legislation
- MSDS
- Notification.
- OHS practices
- OHS issues
- Permits and / or permits to work
- Personnel.
- Quality assurance systems.
- Requirements.
- Safe design principles
- Testing procedures
- Work clearance systems

Unit Sector(s)

Not applicable.

Competency Field

Competency Field **11)**
Design.