



Australian Government

Department of Education, Employment and Workplace Relations

UETTDRDS28B Design underground transmission systems

Release: 1

UETTDARDS28B Design underground transmission systems

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This Competency Standard Unit covers the technical design of underground transmission networks to relevant standards, including cable sizing and locations, soil resistivity and heat dissipation, backfill and trenching details, minor civil aspects and dynamic and cyclic ratings. It also includes the necessary established procedures to ensure the line design conforms to specific organisational technical standards, operational and system planning requirements and incorporates the principles of safe design.

Application of the Unit

Application of the Unit

4)

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

1.2) License to practice

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 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) 2)

2.1) Competencies

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

UETTD RDS15B Organise and Implement Line
and Easement Surveys

For the full prerequisite chain details for this unit please refer to Table 3 in Volume 1, Part 2

Employability Skills Information

Employability Skills 3)

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 unit of competency	Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT

PERFORMANCE CRITERIA

1 Plan and coordinate for the design of underground transmission systems	1.1	OHS practices/procedures and environmental and sustainable energy procedures, which may influence the design of underground transmission systems, are reviewed and determined.
	1.2	Purpose of the design is established and expected outcomes of the work are confirmed with the appropriate personnel.
	1.3	Established policies, procedures and specifications for the design are obtained or established with the appropriate personnel.
	1.4	Equipment/tools and personal protective equipment are selected and coordinated based on specified requirements and established procedures
	1.5	Work is prioritised and sequenced for the most efficient and effective outcome following

ELEMENT	PERFORMANCE CRITERIA
	consultation with others for completion within acceptable timeframes, to a quality standard and in accordance with established procedures
	1.6 Risk control measures are identified, prioritised and evaluated against the work schedule
	1.7 Relevant work permits are secured to coordinate the performance of work according to requirements and/or established procedures
	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 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 underground transmission systems	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 incidents 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

ELEMENT	PERFORMANCE CRITERIA
2.4	Mathematical models of the design 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 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 underground transmission systems	3.1 Final inspections 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

7) 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 distribution substations.

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

The extent of the essential knowledge and associated skills (EKAS) required is given in Volume 2 - Part 2.2 EKAS. It forms an integral part of this unit.

E2.18.1	Occupational Health and Safety principles
E2.18.2	Electrical safe working practice
T2.2.1	Generation power systems
T2.2.2	Transmission, Distribution and Rail power systems
T2.2.10	Transmission structures and hardware
T2.2.11	Routine maintenance on transmission structures
T2.2.21	Installation and maintenance on transmission lines and associated equipment
T2.3.8	Safe design principles
T2.4.3	High voltage switching principles
T2.4.7	Feeder automation system
T2.8.1	Enterprise specific - policies and procedure instructions
T2.8.2	Enterprise specific - OHS instructions
T2.9.6	Underground mains layout principles
T2.11.1	Power system layouts

REQUIRED SKILLS AND KNOWLEDGE

T2.11.4	AC Transmission system components
T2.11.5	AC Transmission line electrical parameters
T2.11.6	AC Transmission lines equivalent circuit calculations
T2.11.8	Voltage control devices on interconnected transmission systems
T2.11.12	Corona and discharge losses
T2.11.40	Harmonics
T2.11.65	HV system load calculation principles
T2.11.66	EHV system load calculation principles

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

EVIDENCE GUIDE

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 - UET09". 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 be demonstrated	Item List

EVIDENCE GUIDE

A	Completion of six (6) compliant technical designs of an underground transmission network with at least one relating to each of the following project types:	Alteration to existing assets Underground supplies between substations possibly including overhead to underground connections.
B	Designs should also included 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 underground transmission systems.

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.

EVIDENCE GUIDE

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

8) 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/may be demonstrated in relation to the design of underground transmission systems and may include the following items or equipment:

Manufacture's data sheets, documents, drawings

Manufacturers recommendations; Reliability performance profiles; Knowledge of local history and experience; Consultation with other Authorities; Environmental influences; Present practices.

Equipment includes; Sectionalisers, air break switches, capacitor banks, transformer taps, metering and protection equipment, data communication systems

Primary and secondary voltage and current injection equipment; time delay measuring equipment; Current transformers; Voltage transformers; Power transformers; Tapchangers; Circuit breakers; Capacitor banks; Ring main units; Audio frequency load control; Circuit breaker auxiliary systems; Substation and metal structure earthing systems; SCADA interfaces and transducer inputs; local opto-isolated alarms; PLC programs; Auto Reclosers (ACRs); protection relays; metering; control circuits; Statistical metering systems; Frame leakage relays; Distance relays; Pilot wire relays; Transformer differential relays; Busbar differential relays; Impedance bus zone relays; Overcurrent and earth fault relays; Transformer neutral check relays; Circuit breaker fail relays; Multi-trip relays; Auto recloser relays; Voltage transformer failure relays; Surge protection relays; Buchholz relays; Winding temperature relays; Sensitive earth fault relays; Phase failure relays; Frequency relays; Load shedding relays; General protection LV devices; Oil temperature protection devices; Oil surge protection devices; Power supplies. differential relays; power systems; multi-faceted schemes; interactive overload schemes, distance protection (incorporating relay selection, switched/non-switched schemes; mutual coupling and teed feeder systems); protection signalling (incorporating series, direct, permissive, distance acceleration, block interruption); telecommunication circuits and equipment.

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

RANGE STATEMENT

- 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
- 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

Custom Content Section

2.2) Literacy and numeracy skills

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
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Competency Field

Competency Field	5)
	Design