



Australian Government

UETTDRDS52 Design power system transmission, sub-transmission and zone substation buildings

Release: 1

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Modification History

Release 1. This is the first release of this unit of competency in the UET Transmission, Distribution and Rail Sector Training Package.

Application

This unit covers the design of transmission, sub-transmission and zone substation buildings. It includes basic augmentations or new installations on green field sites. The design must conform to safety and building regulations and environmental standards and incorporate the principles of safe design.

The application of the skills and knowledge described in this unit may require a licence/registration to practice in the workplace subject to regulations for undertaking of electrical work.

Other conditions may apply under state and territory legislative and regulatory licencing requirements which must be confirmed prior to commencing this unit.

Pre-requisite Unit

Common Unit Group

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 low voltage a.c. circuits

UETTDRDS39 Prepare and manage detailed construction plans for electrical power system infrastructure

UETTDRDS44 Design power system substations modifications

UETTDRREL11 Apply sustainable energy and environmental procedures

UETTDRREL16 Working safely near live electrical apparatus

UETTDRIS62 Implement and monitor the power system organisational WHS/OHS policies, procedures and programs

UETTDRIS63 Implement & monitor power system environmental & sustainable energy management policies & procedures

Competency Field

Design

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Plan for and coordinate the design of transmission, sub-transmission and zone substation buildings

PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

- 1.1** Work health and safety (WHS)/occupational health and safety (OHS) practices/procedures and environmental and sustainable energy procedures, which may influence the design of substations buildings, are reviewed and determined
- 1.2** Purpose of the design is established and expected outcomes of the work are confirmed with appropriate personnel
- 1.3** Established policies, procedures and specifications for the design are obtained or established with appropriate personnel
- 1.4** Equipment/tools and personal protective equipment (PPE) 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 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 PPE, required for the job are identified, scheduled and

- coordinated and confirmed safe and in technical working order
- 1.9** Liaison and communication issues with others/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 buildings**
- 2.1** Circuit/systems modelling is used to evaluate alternative proposals in accordance with established procedures
 - 2.2** WHS/OHS and sustainable energy principles, functionality and practices to reduce the incidence of 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 system are used to analyse the effectiveness of the finished project in accordance with 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 transmission, sub-transmission and zone substation buildings	3.1	Final checks of the design are undertaken to ensure it complies with all requirements and includes 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

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the Companion Volume Implementation Guide.

Unit Mapping Information

This unit replaces and is equivalent to UETTD RDS52A Design power system transmission, sub-transmission and zone substation buildings.

Links

UET Training Package Companion Volume Implementation Guide is found in VETNet - <https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=229bace1-b7bc-4653-9300-dffb13ecfad7>

Assessment Requirements for UETTDRDS52 Design power system transmission, sub-transmission and zone substation buildings

Modification History

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:

- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including the use of risk control measures
- applying sustainable energy principles and practices
- completing two (2) compliant technical designs, including each of the following:
 - establishment of equipment dimensions, weights and dynamic loadings
 - suitability of building room/compartments and door opening dimensions for the equipment to be housed
 - compliance with security, fire rating and safety, pressure relief, Building Code of Australia (BCA) and BA requirements
 - compliance with electrical requirements, i.e. frame leakage and earthed metal isolation
 - appropriateness of floor reference levels
 - provision of cable supports, penetrations and pulling ring requirements
 - building light and power design and drafting
- completing designs, including 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
- dealing with unplanned events on at least one (1) occasion.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- electrical power circuit analysis encompassing:
 - superposition theorem
 - Kirchhoff's laws

- mesh analysis
- Thevenin's and Norton's theorems
- maximum power transfer theorem
- complex impedance
- frequency domain
- transients
- identification of basic concepts, principles and applications - application of velocity, acceleration, force, density, torque, and pressure encompassing:
 - applications of the International System of Units (SI) units
 - the relationship between work, power and energy
 - behaviour of object under force - using a block and tackle under load, concept of mechanical advantage, determination of resultant forces, and determining the sag in a catenary conductor and the force applied at each end
 - fundamentals of the basic laws of fluid mechanics
- principles to light design layout encompassing:
 - Commonwealth/state/territory and local government legislation, standards, codes, supply authority regulations and/or enterprise requirements applicable to light design principles
 - requirements for the use of street lighting system construction manuals, system diagrams/plans and drawings and for plans such as work method statements for the control of WHS/OHS risks
 - types of tariffs and charges
 - types of street lighting components - column types, foundations, brackets, luminaries and mounting heights
 - types of electrical street lighting circuits - types of supply, lighting circuit and control circuit
 - fundamentals of lighting production - electromagnetic spectrum, visible and non-visible radiation, spectral energy distribution, infra-red, ultra-violet (UV), radiation-safety, incandescence and phosphorescence, reflection and refraction
 - fundamentals of lighting concepts - terms and units, and purpose of reflectors and diffusers
 - factors affecting external lighting design
 - calculation of light output
 - determining illuminance - point to point method and lumen method
 - determining rated life of luminaries
 - fundamentals of street lighting design
 - considerations for special lighting situations - security lighting, hazardous street locations and emergency lighting
- layout principles for underground mains distribution extension encompassing:
 - Commonwealth/state/territory and local government legislation, standards, codes, supply authority regulations and/or enterprise requirements applicable to underground mains distribution extension
 - requirements for the use of underground mains construction manuals, system

- diagrams/plans and drawings and for plans such as work method statements for the control of WHS/OHS risks
- methods in determining material, equipment and tool lists - components types and quantity required, spacing of components and equipment, and costings of items and components
- purchasing and contractual arrangements, including requirements to eliminate WHS/OHS hazards, minimise risks and provide residual WHS/OHS risk information
- determination of conductor size, type and route length
- resources needed for the laying of conductors
- determining the appropriate excavation for the location
- determining the size and depth of excavation
- determining the trench and pit layout procedures
- minimum clearances between conductors
- estimation of the duration of underground distribution extension project
- principles of transmission, sub-transmission and zone substation building 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 WHS/OHS risks
 - types of building designs - fixed and/or portable control, switchgear, frequency injection and miscellaneous building designs
 - types of building floor construction - concrete poured in situ, pre-cast, elevated ultra-floor beams with poured in situ slab, and pre-manufactured steel framed floor
 - types of building walls construction - steel framed, masonry, pre-cast tilt-up, steel framed and lined
 - types of roof construction - steel framed and sheet steel clad
 - parameters to be considered - establishment of equipment dimensions, weights and dynamic loadings; suitability of building room/compartments and door opening dimensions for the equipment to be housed; compliance with security, fire rating and safety; pressure relief; BCA and BA requirements; and compliance with electrical requirements, i.e. frame leakage, earthed metal isolation, appropriateness of floor reference levels, provision of cable supports, penetrations and pulling ring requirements, building light and power design and drafting.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the

time of assessment.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated conditions involving realistic and authentic activities that replicate operational workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, facilities, equipment and personal protective equipment (PPE) currently used in industry to undertake design of transmission, sub-transmission and zone substation buildings
- applicable documentation, including workplace procedures, relevant industry standards, equipment specifications, regulations, codes of practice and operation manuals.

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