



Australian Government

Department of Education, Employment and Workplace Relations

UETTDRTS34A Install and maintain power system communication equipment

Release: 1

UETTDRTS34A Install and maintain power system communication equipment

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This Competency Standard Unit covers the installation and maintenance of Network Communication Systems and includes the isolation and functional checks of discrete and interdependent communication schemes associated with power systems. It also encompasses power line carrier equipment, protection signalling equipment, radio systems and telephone systems, VF systems, multiplexing systems and fibre optic systems, but does not include wiring.

Application of the Unit

Application of the Unit 2)

This competency standards unit is intended to apply to any recognised development program that leads to the acquisition of a formal award at AQF level 5 or higher.

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 regulations directly related to Occupational Health and Safety, electricity/telecommunications/gas/water industry

License to practice**3)**

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
UEENEED104A	Use engineering applications software on personal computers
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
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEE124A	Compile and produce an energy sector detailed report
UEENEEE125A	Provide engineering solutions for problems in complex multiple path circuits problems

Prerequisite Unit(s)**4)**

UEENEEE126A	Provide solutions to basic engineering computational problems
UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in electromagnetic devices and related circuits
UEENEEG149A	Provide engineering solutions to problems in complex polyphase power circuits
UETTDREL11A	Apply sustainable energy and environmental procedures
UETTDREL16A	Working safely near live electrical apparatus
UETTDRI62A	Implement and monitor the power system organisational OHS policies, procedures and programs
UETTDRI63A	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

Employability Skills**5)**

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 the installation and maintenance of power system communication equipment

1.1 OHS practices/procedures and environmental and sustainable energy procedures, which may influence the installation and maintenance of power system communication equipment systems, are reviewed and determined.

1.2 Purpose of the installation and maintenance of power system communication equipment is established after data is analysed and expected outcomes of the work are confirmed with the appropriate personnel.

1.3 Organisational established procedures on policies and specifications for the installation and maintenance of power system communication equipment are obtained or established with the appropriate personnel.

1.4 Testing procedures are discussed with/directed to the appropriate personnel in order to ascertain the project brief.

1.5 Testing parameters are established from organisational established procedures on policies

ELEMENT	PERFORMANCE CRITERIA
	and specifications
	1.6 Equipment/tools and personal protective equipment are selected based on specified Performance Criteria and established procedures.
	1.7 Work roles and tasks are allocated according to requirements and individuals' competencies.
	1.8 Work is prioritised and sequenced for the most efficient/effective outcome, completed within an acceptable timeframe to a quality standard and in accordance with established procedures.
	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 Risk control measures are identified, prioritised and evaluated against the work schedule.
	1.11 Relevant work permits are secured to coordinate the performance of work according to requirements and/or established procedures.
2 Carry out the installation and maintenance of power system communication equipment	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 reduce the incidents of accidents and minimise waste are incorporated into the project in accordance with requirements and/or established procedures.
	2.3 Installation and maintenance of power system communication equipment decisions are made on the basis of safety and effective outcomes according to requirements and/or established procedures.
	2.4 Mathematical/engineering models of the installation and maintenance of power system communication equipment are used to analyse the effectiveness of the finished project as per requirements and established procedures.

ELEMENT**PERFORMANCE CRITERIA**

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| | <p>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.</p> <p>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.</p> <p>2.7 Testing of the installed and/or maintained power system communication equipment is undertaken according to requirements and established procedures.</p> <p>2.8 Work teams/groups are arranged/coordinated/evaluated to ensure planned goals are met according to established procedures.</p> <p>2.9 Solutions to non-routine problems are identified and actioned, using acquired essential knowledge and associated skills, according to requirements.</p> <p>2.10 Quality of work is monitored against personal performance agreement and/or established organisational and professional standards.</p> <p>2.11 Strategic plans are developed incorporating organisation initiatives as per established procedures.</p> |
| <p>3 Complete the installation and maintenance of power system communication equipment</p> | <p>3.1 Final inspections of the installed and/or maintained power system communication equipment are undertaken to ensure they comply with all requirements and include all specifications and documentations needed to complete the project.</p> <p>3.2 Appropriate personnel are notified of completion and reports and/or completion documents are finalised/commissioned.</p> <p>3.3 Reports and/or completion documents are</p> |

ELEMENT**PERFORMANCE CRITERIA**

submitted to relevant personnel/organisations for approval and, where applicable, statutory or regulatory approval.

- 3.4 Approved copies of the installation and maintenance of power system communication equipment documents are issues 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 installing and maintaining power system communication equipment.

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

KS01-TTS34A Power systems communication equipment

Evidence shall show an understanding of power systems communication equipment to an extent indicated by the following aspects:

T1 Generation systems encompassing:

- Methods of generating electricity - types of power stations and reasons for their location, layout of thermal and hydroelectric power stations
- Relationship between power control and load requirements - operating speeds for thermal and hydroelectric generating sets, typical generator voltage levels and output ratings
- The purpose and features of typical types of co-generation systems.

T2 Transmission, distribution and rail systems encompassing:

- Relationship between the transmission, distribution and rail/tram system within an overall power system - different organisations responsible for generation, transmission, distribution and rail/tram and, how they correlate and their functions
- Characteristics of a transmission, a distribution and a rail system - principal components, typical voltage levels and methods of transmission and distribution including grid type transmission systems, radial, parallel and ring main feeders
- Relationship between an overhead and underground supply systems within an overall power system - advantages/disadvantages, applications and the basic steps for planning and installing an overhead and underground distribution system
- Single line drawings and layouts - drawings and layouts of transmission and distribution systems including, radial, parallel and ring main feeders and the HV equipment associated with substations

T3 Substations, power transformers and reactors encompassing:

- Relationship between the substations within an overall power system - purpose, location in relation to load centres, layout of HV equipment within the substation and auxiliary equipment
- Characteristics of a power transformer - basic construction of distribution transformers, operation under load/no load conditions, types and basic operation of tap changing switches including solid state types, efficiency and cooling
- Auxiliary equipment used on transformers - function and basic operation of equipment
- Maintenance of a power transformer - basic connections, restrictions to parallel

REQUIRED SKILLS AND KNOWLEDGE

operation, problems and remedies associated with harmonics, testing and fault finding procedures

- Description, purpose and characteristics of a reactors

T4 Co-ordinating access authority procedures encompassing:

- Specific enterprise processes, policies and procedures to be followed
- Processes of consultation, negotiation and co-ordination - clear and concise instructions and information, methods for the encouragement of feedback and contributions of information and ideas, responsibilities of members of the team.
- Techniques in analysing, planning, co-ordination and organising work for a safe outcome and according to statutory requirements and regulations
- Techniques in the effective utilisation of available resources
- Techniques in the development of an access authority/permit and/or access authority/permit issuing procedures
- Techniques in facilitating and co-ordinating the delivery and issuing of access authorities
- Techniques in gathering, collating and confirming data on different worksites - electrical network diagrams for the specific work site, earth access authorities, safe working area, work to be carried out in confined space or in hazardous environment, specific outsourcing procedures, specific hazard identification, risk classification and management procedures, regulatory requirements such as Occupational Health and Safety and electrical safety
- Techniques in the receiving and co-ordinating the cancellation of access authorities in readiness for restoration
- Methods of conducting audits on correct access authority procedures
- Process of issuing of other access authorities for work permits - working in confined space, if required, co-ordination of access authorities, engaging and briefing contractors on electrical and other work
- Issue and receipt of operating agreements.

T5 Principles of Statutory and safety considerations encompassing:

- Commonwealth/State/Territory legislation, standards, codes, supply authority regulations and or enterprise requirements associated with working on High Voltage
- Particular reference to State and Territory regulations regarding - working near energised conductors, electrical access, heights, confined space, testing procedures, licensing rules.

T6 HV system switching principles including switching authorisation procedures to an extent indicated by the following aspects:

- Legislation, Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to system switching
- Requirements for the use of manuals, system diagrams/plans and drawings
- Types and characteristics of HV systems and equipment to be switched
- Procedures for obtaining correct HV switching authorisation - identification of

REQUIRED SKILLS AND KNOWLEDGE

OHS hazards, assessing and controlling risks, Safety procedures and precautions, safe approach distances

- responsibilities and protocols, identifying switching resources, procedures for obtaining electrical access permits authorities, Requirements for team switching, procedures for coordination of operations.
- Techniques in HV system switching - pre-switching checks, switching operational procedures, isolation procedures and proving dead de-energised, earthing procedures, switching operational procedures, emergency fault procedures, energisation procedures

T7 LV system switching principles including switching authorisation procedures encompassing:

- Legislation, Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to system switching
- Requirements for the use of manuals, system diagrams/plans and drawings
- Types and characteristics of LV systems and equipment to be switched
- Procedures for obtaining correct LV switching authorization - identification of OHS hazards, assessing and controlling risks, safety procedures and precautions, safe approach distances, responsibilities and protocols, identifying switching resources, procedures for obtaining electrical access permits authorities, requirements for team switching, procedures for coordination of operations.
- Techniques in LV system switching - isolation procedures and proving dead, earthing procedures, pre-switching checks, switching operational procedures, emergency fault procedures, energisation procedures.

T8 Enterprise Specific Equipment Installation Procedures encompassing:

- Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to equipment installation
- Requirements for the use of manuals, substation diagrams/plans and drawings
- Types, characteristics and capabilities of HV substation equipment to be installed
- Identification of components within the equipment to be Installed and associated control housings
- Use, characteristics and capabilities of specialised tools and equipment
- Enterprise Specific Policies and Procedures for equipment to be installed
- Control equipment and auxiliary relays, flags and alarms
- Techniques in evaluating serviceability of equipment to be Installed
- Safety precautions when testing and measuring equipment to be Installed - safe working practices and procedures, identification of hazards, assessment and control of OHS risks, types, selection, maintenance and use of personal protective equipment, responsibilities and protocols, safe working clearances
- Remote and local operating principles and conventions

T9 Detailed operation of communication devices and principles encompassing:

- Types of communication systems

REQUIRED SKILLS AND KNOWLEDGE

- Interface to power system equipment
- Hardware configurations
- Testing of communication links

T10 Procedure for the systematic fault isolation through the application of diagnostic techniques encompassing:

- Principles of analytical questioning
- Techniques in drawing valid conclusions from first observations
- Concepts of broad first-line testing
- Consideration of/responsibility for, avoidance of further damage
- Interpretation of specific test results: cause/effect
- Techniques for isolation to appropriate level - half-split, module/function isolation (kernel technique), substitution, diagnostic software, requirements for the use of manuals, system diagrams/plans, drawings, handbooks, specifications and fault pathways.
- Software/firmware functions awareness
- Factors affecting field versus workshop repair costs
- Scheduling minor/major repair activities, downtime
- Implications of temporary repairs
- Use of system knowledge and history
- Data interpretation, expected versus actual
- Feedback to design/production/installation processes
- Subsystems and system structures
- System signals/status indicators
- Known failure modes and trends
- Action threshold warnings versus catastrophic failure
- Component ratings/upgrades
- Disassembly/reassembly techniques and care
- Relative costs of repair and replacement - remaining life, ongoing maintenance, additional benefits of replacement equipment, e.g. improved productivity, quality

T11 Protection schemes encompassing:

- Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to protection schemes
- Types of protection schemes - reasons for use, application of protection zones around system elements, degree of protection
- Types of feeder protection equipment - over current protection inverse time-current operating characteristics
- Operation of over current protection equipment used on distribution systems
- Operation of ACRs and their time-current characteristics
- Types and characteristics of over-current relays
- Coordination methods of a distribution feeder protection scheme

REQUIRED SKILLS AND KNOWLEDGE

- Earth fault protection used on a distribution feeder
- Operation of a single wire earth return (S.W.E.R) system

T12 EHV generator control systems encompassing:

- Legislation, Standards, codes, legislation, supply authority regulations and or enterprise requirements pertaining to the operation of a portable generator
- Safety precautions specific to the synchronisation of generator sets - safe working policies, practices and procedures, synchronising procedures
- Techniques in the installation of generator sets control systems - the synchronising of generator control systems onto and off the network without interruption to supply, estimation of EHV load, assessing the appropriateness of the generator
- Operating a generator in parallel to a single EHV job - overhead systems, indoor systems, customer installations, kiosk substations
- EHV generator set and control system to EHV Distribution assets.

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 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 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
A	Carry out maintenance testing on Substation communications equipment, to include isolation and functional checks on at least three (3) of the following systems:	Supervisory cables Power line carrier systems Protection signalling equipment Telephone systems VF systems Fibre optics
B	Carry out commissioning tests on Substation communications equipment, to include isolation and functional checks on at least three (3) of the following systems:	Supervisory cables Power line carrier systems Protection signalling equipment Telephone systems VF systems Fibre optics
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.
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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 installation and maintenance of power system communication equipment.

In addition to the resources listed above, in Context of and specific resources for assessment, evidence should show demonstrated competency working in 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 Transmission, Distribution and Rail Traction Industry. 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 concurrent assessment recommendations for this unit.

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 installation and maintenance of power system communication equipment and may include the following:

Power Line Carrier Equipment, Protection Signalling Equipment, Radio Systems and Telephone Systems, VF Systems, Multiplexing systems and Fibre Optic Systems, but does not include wiring.

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
- Inspect
- Legislation
- MSDS
- Notification
- OHS practices
- OHS issues

RANGE STATEMENT

- Permits and/or permits to work
- Personnel
- Quality assurance systems
- Requirements
- Testing procedures
- Work clearance systems

Unit Sector(s)

Not applicable.

Competency Field

Competency Field **11)**

Testing Units