



Australian Government

Department of Education, Employment and Workplace Relations

UETTDRTS04B Design testing and commissioning procedures for substation and field devices

Release: 1

UETTDRTS04B Design testing and commissioning procedures for substation and field devices

Modification History

Not Applicable

Unit Descriptor

Unit Descriptor

1)

1.1) Descriptor

This Competency Standard Unit covers the testing and commissioning procedures for new substation and field devices in accordance with design. This will involve analysis of settings, and a thorough understanding of the circuit design, which will involve covering such areas as metering, communication circuits and SCADA. It also includes the procedures needed to enable proof of correct operation of all circuits to design specifications. It also encompasses the need for supplying accurate communication in the format that is acceptable to the Operating or Testing Authority.

Application of the Unit

Application of the Unit 4)

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 6 or higher.

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:.

	UETTDRTS06B	Commission metering schemes
or	UETTDRTS08B	Test, repair and calibrate protection relays and meters
or	UETTDRTS12B	Conduct evaluation of primary plant
or	UETTDRTS15B	Maintain network protection and control systems (complex)

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.
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Elements and Performance Criteria Pre-Content

6) Elements: 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 for the design of testing and commissioning procedures for substation and field devices	1.1 OHS practices/procedures and environmental and sustainable energy procedures, which may influence the undertaking of design of testing and commissioning procedures for substation and field devices, are reviewed and determined. 1.2 Purpose for designing of testing and commissioning procedures for substation and field devices 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 design of testing and commissioning procedures for substation and field devices are obtained or established with the appropriate personnel. 1.4 Testing procedures are discussed with the

ELEMENT	PERFORMANCE CRITERIA
	appropriate personnel in order to ascertain the project brief.
	1.5 Testing parameters are established from organisational established procedures on policies 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 design of testing and commissioning procedures for substation and field devices	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 Design testing and commissioning procedures for substation and field devices decisions are made on the basis of safety and effective outcomes according to requirements and/or established procedures

ELEMENT

PERFORMANCE CRITERIA

- 2.4 Mathematical and/or engineering models of design testing and commissioning procedures for substation and field devices 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 Testing and commissioning procedures for substation and field devices are developed according to requirements and established procedures
- 2.8 Work teams/groups are arranged/coordinated/evaluated to ensure planned goals are met according to established procedures
- 2.9 Solutions to non-routine problems are identified and actioned, using acquired essential knowledge and associated skills, according to requirements
- 2.10 Quality of work is monitored against personal performance agreement and/or established organisational and professional standards
Strategic plans are developed incorporating organisation initiatives as per established procedures.
- 2.11 Strategic plans are developed incorporating organisation initiatives as per established procedures.

ELEMENT		PERFORMANCE CRITERIA	
3	Complete the design of testing and commissioning procedures for substation and field devices	3.1	Final review of testing and commissioning procedures for substation and field devices are undertaken to ensure they comply with all requirements and include all specifications and documentations needed to complete the project.
		3.2	Appropriate personnel are notified of completion and reports and/or completion documents are finalised/commissioned.
		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 testing and commissioning procedures for substation and field devices documents are issues 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 testing and commissioning procedures for substation and field devices.

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 practices
- E2.18.8.2 Occupational Health and Safety , - enterprise responsibilities
- T2.3.1 Powerline safety practices

REQUIRED SKILLS AND KNOWLEDGE

- T2.3.3 Statutory and safety considerations
- T2.3.4 Electrical equipment - protection and control schemes
- T2.3.5 Discrete protection schemes - isolation and tagging procedures
- T2.3.6 Protection devices - maintenance and commissioning principles
- T2.3.7 Protection devices - manufacturers requirements
- T2.10.1 Visual inspection procedures - substations
- T2.10.2 Surge relay operation and maintenance - substations
- T2.10.9 Analyse and interpret results and measurements - substations
- T2.10.11 Substation safety practices
- T2.10.15 High voltage insulation system principles - substations
- T2.10.16 Power transformer and reactor principles - substations
- T2.10.17 Static reactive plant principles - substations
- T2.10.18 On load tap changer principles - substations
- T2.10.26 Voltage regulation scheme principles - substations
- T2.10.27 Use of test equipment on discrete protection scheme - substations
- T2.11.8 Voltage control devices on interconnected transmission systems
- T2.11.11 Control of transient over voltages
- T2.11.15 Visual inspection procedures
- T2.11.16 Commissioning procedures

REQUIRED SKILLS AND KNOWLEDGE

- T2.11.18 Discrete protection systems
- T2.11.19 Interdependent protection systems
- T2.11.24 Metering devices and principles
- T2.11.26 Test equipment A - fundamental
- T2.11.27 Test equipment B - protection
- T2.11.28 Test equipment C - metering
- T2.11.30 Test equipment E - field
- T2.11.41 Fault finding and diagnostic techniques

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.

EVIDENCE GUIDE

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 - 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
A	Develop testing and	Bus protection Feeder/line protection

EVIDENCE GUIDE

	commission procedures for at least three (3) of the following substation equipment:	Transformer protection Earth fault protection Backup protection Metering schemes Communicate and SCADA schemes
B	Develop testing and commission procedures for any two of the following field devices:	Regulator ACR/gas switch Line capacitors
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 testing and commissioning procedures for substation and field devices.
- Operational access to relevant plant, protection equipment, scheme drawings and specialised testing 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.

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 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

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 undertaking the design of testing and commissioning procedures for substation and field devices.

Tests may include: DC/AC measurements, error, continuity, noise level, return loss, spectrum analysis, radio on receiver sensibility, surveys - mobile phones/pager, end to end, line levels both in and out, transmitter power, transmitter frequency, transmitter deviation, receiver frequency and sensitivity, level and quality of demodulated output - audio/bit error rate, antenna sweep measurements, power and environmental conditions including emergency power plant.

Diagnostic, testing and restoration may involve: Appropriate documentation relating to the protection device; Voltage, current and resistance measuring instruments; Microprocessor based diagnostic test equipment; Laptop computer and diagnostic software; Loop control test instruments.

Complex testing refers to dielectric dissipation factors tests, partial discharge, applied and induced HV tests, CT and VT accuracy tests (calibration), watts loss, ratio confirmation tests, tests on interconnected equipment, sf6 tests.

Testing and recording equipment could include: Digital bearer test equipment; Voice frequency analysers; RF mounting equipment; RF spectrum equipment; Multimeters; Communication testers; Transmission measuring sets; Directional couplers; Laptop computers.

Test and recording equipment may include: Infrascan equipment; Phasing equipment; Recording meters; Trend monitoring equipment; Condition monitoring equipment; Diagnostic testing devices using computer hardware and software; Taplon sticks; Insulation and continuity test instruments; Voltage, resistance and current testers; Ductors; Ratio meters; Earth systems testing devices; Capacitor bridge meters; Doble Test sets devices; High voltage alternating current test sets; Scope meters; Clip on ammeters; Test plans for automatic relay testing SCADA systems used for developing and evaluating voltage regulation systems, circuit breaker reclosing systems, VAR's monitoring and similar computer controlled diagnostic testing and recording.

Test and recording equipment may include: AC/DC test sets; IR testers; earth resistance meters; cable fault location equipment; circuit breaker timers; recording equipment; devices utilising computer hardware and software; oil dielectric strength equipment; trend monitoring equipment; infrared thermographic equipment; schering bridge; partial discharge test equipment; double insulation test set; primary injection test sets; CT and VT calibration equipment and sf6 leakage testers.

Computerised test equipment work may include, for example: Secondary injection test sets, primary test sets, insulation test sets, timing test sets, Circuit breaker test sets,

RANGE STATEMENT

magnetic test sets.

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

Unit Sector(s)

Not Applicable

2.2) Literacy and numeracy skills

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)

Testing Units