Australian Government

Department of Education, Employment and Workplace Relations

UETTDRSB21A Diagnose and rectify faults in substation environment

Release: 1

UETTDRSB21A Diagnose and rectify faults in substation environment

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This Competency Standard Unit covers the identification and analysis of fault conditions including the isolation, repair and restoration of substation control circuits.

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 requires 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) **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
UEENEEE102A	Fabricate, assemble and dismantle utilities industry components
UEENEEE104A	Solve problems in d.c. Circuits
UEENEEE105A	Fix and secure electrotechnology equipment
UEENEEE107A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEE137A	Document and apply measures to control OHS risks associated with electrotechnology work
UEENEEG006A	Solve problems in single and three phase low voltage machines
UEENEEG033A	Solve problems in single and three phase electrical apparatus and circuits
UEENEEG063A	Arrange circuits, control and protection for general electrical installations

Prerequisite Unit(s) **4)**

UEENEEG101A	Solve problems in electromagnetic devices and related circuits
UEENEEG102A	Solve problems in electromagnetic devices and related circuits
UEENEEG106A	Terminate cables, cords and accessories for low voltage circuits
UEENEEG108A	Trouble-shoot and repair faults in low voltage electrical apparatus and circuits
UEENEEG109A	Develop and connect electrical control circuits
UEENEEK142A	Apply environmentally and sustainable energy procedures in the energy sector
Pathway 1 - Electrician	
UEENEEG103A	Install low voltage wiring and accessories
UEENEEG104A	Install appliances, switchgear and associated accessories for low voltage electrical installations
UEENEEG105A	Verify compliance and functionality of low voltage general electrical installations
UEENEEG107A	Select wiring systems and cables for low voltage general electrical installations
Pathway 2 – Electrical Fitter	
UEENEEG199A	Conduct compliance and functional verification of electrical apparatus and existing circuits

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 4 Writing 4 Numeracy 4

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 Prepare/plan for fault finding and rectification in power system substation environment	1.1 Work schedules including drawings, plans, requirements procedures and material lists are acquired, analysed and the extent of work determined.
	1.2 Relevant requirements and established procedures for the work are communicated to all personnel and identified for all work sites.

ELEMENT	PERFORMANCE CRITERIA	
	1.3	Hazards are identified, OHS risks assessed and control measures are prioritised, implemented and monitored including emergency exits kept clear, to ensure safe systems of work are followed and according to established procedures.
	1.4	Work is prioritised and sequenced for the most efficient and effective outcome following consultation with others for completion within acceptable timeframes, to agreed quality standards and in accordance with established policies and procedures.
	1.5	Risk control measures are identified, prioritised, implemented and evaluated against the work schedule.
	1.6	Resources including personnel, equipment, tools and personal protective equipment required for the job are identified, acquired and confirmed in safe/technical working order.
	1.7	Liaison issues with other personnel and/or authorities are resolved and activities coordinated to facilitate the work.
	1.8	Personnel participating in the work including plant operators and contractors are fully briefed, their respective responsibilities explained and coordinated and appropriate authorisation checked in accordance with established procedures.
	1.9	Work site is prepared according to the work schedule and to minimise OHS risk and damage to property and personnel in accordance with established procedures.
2 Carry out fault finding within the substation environment	2.1	OHS and sustainable energy principles and practices to reduce the incidence of accidents and minimise waste are implemented and monitored in accordance with requirements and/or established procedures.
	2.2	CPR, Rescue from live electrical apparatus and other related safety procedures are in place according to requirements and established

ELEMENT	PERFORMANCE CRITERIA
	procedures.
	2.3 Safe working documentation is acquired and requirements completed in accordance with established procedures.
	2.4 Lifting, climbing and working aloft, use of power tools/equipment techniques and practices are safely exercised in accordance with established procedures.
	2.5 Hazard warnings and safety signs are recognised and hazards and assessed OHS risks are reported to the immediate authorised persons for directions/preventative action taken according to established procedures.
	2.6 Essential knowledge and associated skills are applied for the safe diagnose and rectification of faults in power system substation to ensure completion in an agreed timeframe and, to quality standards with a minimum of waste according to requirements.
	2.7 Faults are located, identified and affected circuits isolated in accordance with the work schedule and requirements and/or established procedures.
	2.8 Faults in power system substation control circuits are rectified in an agreed timeframe and to established quality standards with a minimum of waste.
	2.9 Faults are diagnosed, analysed and recommendations made to prevent a reoccurrence.
	2.10 Solutions to non-routine problems are identified and actioned using acquired essential knowledge and associated skills according to requirements.
	2.11 Circuit functions are restored in accordance with work schedule requirements and/or established procedures.
	2.12 Ongoing checks of quality of the work are undertaken in accordance with requirements and established procedures to ensure a quality

ELEMENT	PERFORMANCE CRITERIA	
		outcome is achieved for the client/customer and to a community/industry standard.
3 Complete fault finding within the substation environment	3.1	Work undertaken is checked against work schedule for conformance with requirements, anomalies reported and solutions identified in accordance with established procedures.
	3.2	Safe working documentation is surrendered and equipment made ready for service.
	3.3	Work site is rehabilitated, cleaned up and confirmed safe in accordance with established procedures.
	3.4	Tools, equipment and any surplus resources and materials are cleaned, checked and returned to storage in accordance with established procedures.
	3.5	Required works completion records, reports and/or documentation and information are completed, processed and appropriate personnel notified 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 diagnosing and rectifying faults in secondary systems substation environment.

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

KS01-TSB21A Substation faults finding

Evidence shall show an understanding of substation faults finding to an extent indicated by the following aspects:

T1 Safe working on energised low voltage equipment encompassing:

- Standards, codes, Commonwealth, State/Territory/local government legislation, supply authority regulations and or enterprise requirements
- Safety precautions specific to working on or near energised low voltage conductors - safe working practices and procedures, identification of hazards, assessment and control of OHS risks, types, selection, maintenance and use of personal protective equipment
- Work on or near energised LV conductors - types and function of specialised tools, safe working practices when using specialised tools, methods of using specialised tools, safe procedures for work on panels and in cubicles on or near energised LV conductors, release and rescue procedures for work on or near exposed energised LV conductors.

T2 Enterprise specific — policy and procedure instructions encompassing:

- Responsibilities and duty of care of employer and employee relationship
- Methods of obtaining the up-to-date information on enterprise policy and procedures
- Rules and regulations
- Induction into workplace - location of work area and storage area, timetable, uniform, personal well-being, housekeeping rules, emergency procedures, evacuation procedures
- Techniques when deal with others - working in teams, customer relation, complaint and issues procedures.
- Overview of enterprise professional development - fire fighting procedures, fatigue management, training and competency development - understanding and promotion

T3 Enterprises specific — OHS instructions encompassing:

- Standards, codes, legislation, supply authority regulations and specific enterprise regulations pertaining to the OHS policies and procedures
- Methods of obtaining the up-to-date information on enterprise OHS policy and procedures

REQUIRED SKILLS AND KNOWLEDGE

- Specific enterprise personal protection equipment - type and application, where and when to be used, method of replacement, responsibility of maintenance including cleaning inspection and testing, emergency response, rescue, evacuation and First Aid procedures
- Personal well-being – hygiene, fatigue/stress management, drugs/alcohol
- OHS training - induction training, specific hazard training, specific task or equipment training, emergency and evacuation training, training as part of broader programs such as equipment operation
- OHS records including audits, inspection reports, workplace health and environmental monitoring records, training and instruction records, manufacturers and suppliers information such as MSDSs, registers, maintenance reports, workers compensation and rehabilitation records and First Aid/medical records

T4 Enterprises specific — technical drawing and documents encompassing:

- Types and application of enterprise specific drawings and documents - electrical and electronic drawings, mechanical drawings, project charts, schedules, graphs, technical manuals and catalogues
- Instruction/worksheets sheets - types and application of enterprise specific symbols and diagrams
- Title box - description of parts and version control.

T5 Enterprise specific switching diagrams and drawing encompassing:

- Types and application of enterprise specific switching drawings and documents - wiring and schematic diagrams and switching symbols, mechanical drawings dealing with switching operations, project charts, switching schedules, graphs, technical manuals and catalogues, instruction/work sheets.
- Interpretation of different system switching diagrams - LV system switching diagrams, DC traction supply sectioning diagrams, HV transmission and distribution system symbols and feeder plans,
- Processes of updating switching diagrams

T6 Enterprises specific specialised tools encompassing:

- Legislation, Standards, codes, legislation, supply authority regulations and specific enterprise regulations pertaining to the use and care of specialised tools (voltage detectors; polarity testers, phase rotation)
- Characteristics, capabilities and application of specialised tools for a particular job
- Safety policies, procedures and precautions with regards to using, transporting and storage of specialised tools
- Selection methods for obtaining the correct specialised tool for the particular job including during procurement, purchasing and or hiring arrangements
- Techniques in pre-use inspection on the serviceability of specialised tools
- Techniques in the selection, use, maintenance, and care and storage of specialised tools
- Identifying OHS hazards, assessing and controlling risks associated with their use
- Techniques for the safe use of specialised power tools.

REQUIRED SKILLS AND KNOWLEDGE

T7 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

T8 Enterprise Specific Data Management Processes encompassing:

- Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to Data Management
- Requirements for the use of manuals, substation diagrams/plans and drawings
- Types of enterprise specific computer software
- Techniques in storing and retrieving data and reports from the computer
- Techniques in using the Data Management systems in following necessary commands and protocols in accordance with the Enterprise Specific Procedures
- Calculation of results and data measurements using the computer
- Techniques in the preparation of preliminary works creation and closure.

T9 Fault conditions and symptoms related to the plant and/or equipment type encompassing:

- Standards, codes, Commonwealth, State/Territory/local government legislation, supply authority regulations and or enterprise requirements pertaining to typical fault conditions and systems
- Interpretation of faults in operating mechanisms which may include drive trains and mechanical power drives, stored energy systems including hydraulic systems, pneumatic systems and mechanical storage systems, accumulators
- Interpretation of faults in electrical control systems which may include electro-mechanical relay systems, micro-processor based systems, PLC systems, integrated control systems or combinations of electrical/mechanical systems
- Types of electrical systems including AC, DC and combinations of both
- Types of fault conditions - failure to operate, failure in service and include the appropriate procedures for work on in service plant/equipment
- Types of symptoms - alarms, relay flags, mechanical defects, insulation

REQUIRED SKILLS AND KNOWLEDGE

deterioration, leaks, over-pressure, under pressure, out of tolerance measurements and checks.

T10 Substation equipment components and materials related to the plant and/or equipment type encompassing:

- Types of components - complete unit of plant and/or equipment, replacement components or appropriate substitutes, their dimensions, suitability and serviceability; also the components associated with the local control systems of the equipment including indication of levels, quantities, volumes, pressures and temperatures and the operating principles of these devices and components
- Types of materials - insulation, construction, fabrication or lubrication of the plant/equipment
- Techniques in enterprise procedures and regulatory/legislative requirements for the handling/use and storage of equipment components and materials which may present an OHS hazard to persons in the workplace

T11 Substation safety practices encompassing:

- Standards, codes, Commonwealth, State/Territory/local government legislation, supply authority regulations and or enterprise requirements pertaining to substation safety practices
- Techniques in the use of protective apparatus and apparel for substations work, including responsibilities with regard to the use and maintenance of protective apparatus and apparel and the types of protective apparatus and apparel used for work in substations
- Requirements for the use of ladders and appropriate ladder types for work in substations - safe work methods when carrying, erecting, collapsing and lowering different types of extension ladder against substation structures, plant and equipment, maintenance checks on different types of ladders, renewal of extension ropes and the safety issues relating to clearances from energised conductors
- Requirements for climbing and working at heights in substations - attached climbing principles, selection, use and operation of elevated work platforms and any OHS requirements associated with the use of EWPs
- Control of small fires - identification, selection and operation of the appropriate extinguishing mediums for various types of fires and the precautions for personal protection when fighting small fires
- Control of oil spills - identification, use and maintenance of spill oil control equipment and materials, oil containment facilities and systems
- Rescue and release procedures - the rescue personnel from energised conductors, emergency descent from an EWP and may include rescue from confined spaces.
- Enterprise requirements - safe access and Authorisation to Work procedures, use of mobile extendable equipment on or near energised HV conductors, emergency response procedures.
- Hazards associated with work in substations including earthing systems, transfer potentials, step and touch effects, electrostatic and electromagnetic induction, dangers of near approach to energised conductors

REQUIRED SKILLS AND KNOWLEDGE

T12 Design principles of Substation LV AC and DC supply systems encompassing:

- Standards, codes, Commonwealth, State/Territory/local government legislation, supply authority regulations and or enterprise requirements
- Wiring conventions, systems and labelling conventions
- Substation equipment identification and layout, wiring and schematic diagrams and other appropriate diagrammatic representations
- LV design specifications, supply requirements, electrical load assessments
- Substation LV system distribution requirements - substation batteries, isolation requirements, paralleling requirements, battery chargers, DC distribution panels and control systems, AC distribution panels and control systems, auto change-over requirements,
- Control equipment and auxiliary relays, flags and alarms,
- Common panel layouts.

T13 Low voltage substation switching principles encompassing:

- Standards, codes, legislation, supply authority regulations and or enterprise requirements applicable to low voltage substation switching
- Requirements for the use of manuals, system diagrams/plans and drawings - types, characteristics and capabilities of LV electrical equipment to be switched, use, characteristics and capabilities of specialised tools and testing equipment
- Role and responsibilities of the LV switching operator
- Operational forms, access authorities and permits associated with LV switching - types of operational forms, access authorities and permits, purpose and procedure for operational forms, access authorities and permits
- Use, care and operation of equipment associated with LV substation switching
- LV switchgear – types, categories, application, operating capabilities
- Operation of LV substation switching or indicating devices
- Operation of protection systems and substation equipment
- Restrictions pertaining to LV switching equipment
- Earthing LV electrical apparatus practices and procedures for access
- Low voltage switching techniques
- Restrictions pertaining to Enterprise Specific procedures.

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the competency standard unit and must be read in conjunction with the Performance Criteria and the Range Statement of the competency standard unit 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**	**Item List**

	demonstrated	
A	At least two of the following:	HV circuit breaker control system fault Transformer control system fault DC supply systems fault DC switchgear and equipment fault
B	At least three of the following:	Multimeters Tong testers Insulation resistance/continuity tester low resistance high current tester Overload injection tester Specialist test equipment
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 diagnosis and rectification of faults in power system substation environments.

In addition to the resources listed above, in Context of and specific resources for assessment, evidence should show demonstrated competency of:

Working at realistic heights above ground, i.e. above 3 metres, in limited spaces, with different structural/construction types and method and in a variety of environments.

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 competency standard unit 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 low voltage AC/DC control and supervisory systems associated with substation plant and equipment. Control systems may include those associated with HV transformers, tap changers, switchgear and associated control panels, alarms, alternators, mimic panels, cooling systems, automatic voltage regulators, batteries and battery chargers.

Test and measurement instruments may include multimeters, tong testers, insulation resistance/continuity tester, low resistance high current tester, overload injection tester and specialist test equipment

Fault finding and diagnostic techniques may include linear approach, half split rule, sensory detection, loop test, insulation/resistance and continuity tests. Fault indicators may include indication lamps, LEDs, alarms and flag relays.

Initial fault location may be performed with the affected circuits energised.

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
- 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
- Identifying hazards
- Inspect
- Legislation
- MSDS

RANGE STATEMENT

- Notification
- OHS practices
- OHS issues
- Permits and/or permits to work
- Quality assurance systems
- Testing procedures
- Work clearance systems

Unit Sector(s)

Not applicable.

Competency Field

Competency Field **11)**

Substation Units