



Australian Government

UETTDRSB24 Maintain high voltage power system circuit breakers

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 involves the skills and knowledge required to maintain high voltage (HV) power system circuit breakers in the electricity supply industry (ESI).

It includes diagnosing faults, repairing and replacing HV power system circuit breakers components in accordance with workplace procedures. It also includes performing diagnostic checks, pre-commissioning tests and function checks involving circuit breakers and associated control circuits and interpreting these tests against agreed specifications.

The application of the skills and knowledge described in this unit may require a licence/registration to practice in the workplace.

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

Pre-requisite Unit

All competencies in the Common Unit Group must have been completed, plus all competencies in one (1) of the identified Pathway Unit Group(s).

Common Unit Group

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 low voltage electrical apparatus and circuits

UEENEEG063A Arrange circuits, control and protection for general electrical installations

UEENEEG101A Solve problems in electromagnetic devices and related circuits

UEENEEG102A Solve problems in low voltage a.c. 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 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

Competency Field

Substation

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Plan to maintain HV power system circuit breakers

PERFORMANCE CRITERIA

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

- 1.1** Work schedules, construction plans, drawings, workplace procedures and material lists are obtained and analysed
- 1.2** Job requirements and workplace procedures are identified and communicated with relevant personnel
- 1.3** Hazards are identified, work health and safety (WHS)/occupational health and safety (OHS) risks

assessed and control measures prioritised, implemented and monitored in accordance with workplace procedures

- 1.4** Work is prioritised and sequenced for completion within acceptable timeframes following consultation with relevant personnel and in accordance with workplace procedures
- 1.5** Risk control measures are identified, prioritised, implemented and evaluated against the work schedule
- 1.6** Equipment, tools and personal protective equipment (PPE) required for work are identified, obtained and confirmed in working order
- 1.7** Liaison and communication issues with authorised personnel, authorities, clients and land owners are resolved to facilitate work, as required
- 1.8** Personnel participating in work are fully briefed and responsibilities confirmed in accordance with workplace procedures
- 1.9** Worksite is prepared in accordance with the work schedule and to minimise risk and damage to property and personnel in accordance with established procedures

2 Carry out maintenance on HV power system circuit breakers

- 2.1** WHS/OHS, sustainable energy and environmental principles and practices are monitored and actioned to reduce incidents of accidents in accordance with workplace procedures
- 2.2** Cardiopulmonary resuscitation (CPR), rescue from live electrical apparatus and other related safety procedures are in place in accordance with job requirements and/or workplace procedures
- 2.3** Safe working documentation is acquired and requirements completed in accordance with established procedures
- 2.4** Requirements for lifting, climbing, working at heights, confined spaces and use of power tools/equipment are followed in accordance with workplace procedures
- 2.5** Hazard warnings and safety signs are recognised and hazards and assessed WHS/OHS risks are reported to immediate authorised personnel for directions in accordance with established procedures

- 2.6 Essential knowledge and associated skills are applied for the safe maintenance of HV power system circuit breakers and maintained to ensure completion in agreed timeframes, to quality standards and with minimum waste in accordance with workplace procedures
- 2.7 Maintenance of HV power system circuit breakers is performed in accordance with work schedules, job requirements and workplace procedures
- 2.8 Maintenance of HV power system circuit breakers is completed in agreed timeframes, to quality standards and with minimum waste in accordance with workplace procedures
- 2.9 Unplanned events or conditions are responded to in accordance with established procedures
- 3 **Complete the maintenance of HV power system circuit breakers**
 - 3.1 Completed work is checked against work schedule, construction plans and drawings for compliance and anomalies are reported in accordance with workplace procedures
 - 3.2 Safe working documentation is surrendered and HV power system circuit breakers are made ready for service in accordance with workplace procedures
 - 3.3 Worksite is cleaned and confirmed safe in accordance with workplace procedures
 - 3.4 Tools, equipment, surplus resources and materials are, where appropriate, cleaned, checked and returned to storage in accordance with workplace procedures
 - 3.5 Work records, reports and/or documentation are completed in accordance with workplace procedures and relevant personnel notified

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 UETTDRSB24A Maintain high voltage power system circuit breakers.

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 UETTDRSB24 Maintain high voltage power system circuit breakers

Modification History

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

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
- working on at least two (2) of the following types of high voltage (HV) power system circuit breakers:
 - bulk oil circuit breakers
 - small oil volume circuit breaker
 - air blast circuit breaker
 - vacuum circuit breaker
 - gas-insulated HV switchgear (GIS) circuit breakers
 - gas circuit breakers
- working on at least two (2) of the following types of operating mechanisms:
 - spring operated mechanism
 - solenoid operated mechanism
 - hydraulic operated mechanism
 - pneumatic operated mechanism
- performing at least three (3) of the following tests:
 - insulation resistance tests
 - contact resistance tests
 - minimum close and open tests (reduced voltage tests)
 - sequence timing tests
 - contact travel/timing test
 - vibration test
 - gas pressure tests
- performing measuring or sampling tests using at least two (2) of the following:
 - gas measuring devices
 - pressure measuring devices

- sulfur hexafluoride (SF6) gas sampling
- oil sampling
- SF6 moisture content (dew point)
- 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:

- safe working on energised low voltage (LV) equipment, including:
 - standards, codes, Commonwealth/state/territory/local government legislation, supply authority regulations and/or enterprise requirements
 - safety precautions specific to working on or near energised LV conductors - safe working practices and procedures; identification of hazards; assessment and control of WHS/OHS risks; types, selection, maintenance and use of personal protective equipment (PPE)
 - 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, and release and rescue procedures for work on or near exposed energised LV conductors
- LV switching principles, including:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements applicable to switching of LV to a given schedule
 - requirements for the use of manuals, system diagrams/plans and drawings - types, characteristics and capabilities of electrical apparatus; use, characteristics and capabilities of specialised tools and testing equipment; and LV network interconnectors source of possible back-feed
 - LV switching techniques - identifying hazards, assessing and controlling risks associated with LV switching operations, electrical access permit(s), operational procedures and earthing procedures
 - PPE for LV switching
- enterprise-specific policies and procedure instructions, including:
 - responsibilities and duty of care of employer and employee relationship
 - methods of obtaining the up-to-date information on enterprise policies and procedures
 - rules and regulations
 - induction into workplace - location of work area and storage area, timetable, uniform, personal wellbeing, housekeeping rules, emergency procedures and evacuation procedures
 - techniques when dealing with others - working in teams, customer relation, and complaint and issues procedures
 - overview of enterprise professional development - fire-fighting procedures, fatigue management, and training and competency development - understanding and promotion
- enterprise-specific WHS/OHS instructions, including:
 - standards, codes, legislation, supply authority regulations and specific enterprise

- regulations pertaining to WHS/OHS policies and procedures
- methods of obtaining the up-to-date information on enterprise WHS/OHS policies and procedures
 - specific enterprise PPE - type and application; where and when to be used; method of replacement; responsibility of maintenance, including cleaning, inspection and testing; and emergency response, rescue, evacuation and first aid procedures
 - personal wellbeing – hygiene, fatigue/stress management and drugs/alcohol
 - WHS/OHS training - induction training, specific hazard training, specific task or equipment training, emergency and evacuation training, and training as part of broader programs, such as equipment operation
 - WHS/OHS records - audits; inspection reports; workplace health and environmental monitoring records; training and instruction records; manufacturer and supplier information, such as material safety data sheets (MSDS); registers, maintenance reports; workers compensation and rehabilitation records; and first aid/medical records
 - enterprise-specific technical drawing and documents, including:
 - types and application of enterprise-specific drawings and documents - electrical and electronic drawings, mechanical drawings, project charts, schedules, graphs, technical manuals and catalogues
 - instructions/worksheets - types and application of enterprise-specific symbols and diagrams
 - title box - description of parts and version control
 - enterprise-specific switching diagrams and drawings, including:
 - 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, and instructions/worksheets
 - interpretation of different system switching diagrams - LV system switching diagrams, direct current (d.c.) traction supply sectioning diagrams, HV transmission and distribution system symbols and feeder plans, and processes of updating switching diagrams
 - enterprise-specific specialised tools, including:
 - legislation, standards, codes, supply authority regulations and specific enterprise regulations pertaining to the use and care of specialised tools (voltage detectors, polarity testers and phase rotation)
 - characteristics, capabilities and application of specialised tools for a particular job
 - safety policies, procedures and precautions with regards to using, transporting and storing 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 WHS/OHS hazards, and assessing and controlling risks associated with their use
 - techniques for the safe use of specialised power tools

- enterprise-specific equipment installation procedures, including:
 - 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 WHS/OHS risks; types, selection, maintenance and use of PPE; responsibilities and protocols; and safe working clearances
 - remote and local operating principles and conventions
- enterprise-specific data management processes, including:
 - 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 enterprise-specific procedures
 - calculation of results and data measurements using the computer
 - techniques in the preparation of preliminary works creation and closure
- fault conditions and symptoms related to the plant and/or equipment type, including:
 - 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, such as drive trains and mechanical power drives, stored energy systems, including hydraulic systems, pneumatic systems and mechanical storage systems; and accumulators
 - interpretation of faults in electrical control systems, such as electromechanical relay systems, micro-processor-based systems, programmable logic controller (PLC) systems, integrated control systems or combinations of electrical/mechanical systems
 - types of electrical systems, including a.c., d.c. and combinations of both
 - types of fault conditions - failure to operate and failure in service, including the appropriate procedures for work on or in service plant/equipment
 - types of symptoms - alarms, relay flags, mechanical defects, insulation deterioration, leaks, over pressure, under pressure, out of tolerance measurements and checks
- substation equipment components and materials related to the plant and/or equipment type,

including:

- 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 WHS/OHS hazards to persons in the workplace
- substation safety practices, including:
 - 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 (EWP), and any WHS/OHS requirements associated with the use of EWP
 - 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; and oil containment facilities and systems
 - rescue and release procedures - rescue procedures of personnel from energised conductors, emergency descent from an EWP and/or confined spaces
 - enterprise requirements - safe access and authorisation to work procedures, use of mobile extendable equipment on or near energised HV conductors, and emergency response procedures
 - hazards associated with work in substations, including earthing systems, transfer potentials, step and touch effects, electrostatic and electromagnetic induction, and dangers of near approach to energised conductors
- design principles of substation LV a.c. and d.c. supply systems, including:
 - 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, d.c. distribution panels and control systems, a.c. distribution panels and control systems, and auto change-over requirements
- control equipment and auxiliary relays, flags and alarms
- common panel layouts
- design principles of hydraulic and pneumatic operating mechanism principles, including:
 - standards, codes, Commonwealth/state/territory/local government legislation, standards, supply authority regulations and-or enterprise requirements
 - control system operating diagrams, including nomenclature, symbols and operating sequences, and units of measurement
 - fundamentals of pressure intensification, forces and energy accumulators
 - applications for substation HV equipment - circuit breaker operating mechanisms, interrupter mechanisms, pumps and compressors, GIS operating mechanisms and transformer cooling systems
 - safety precautions for work on hydraulic and/or pneumatic systems - safe working practices and procedures; identification of hazards, assessment and control of WHS/OHS risks; types, selection, maintenance and use of PPE
- LV substation switching principles, including:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements applicable to LV 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 procedures for operational forms, access authorities and permits
 - use, care and operation of equipment associated with LV substation switching
 - LV switchgear – types, categories, application and 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
 - LV switching techniques
 - restrictions pertaining to enterprise -specific procedures
- circuit breaker operating principles, including:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements applicable to circuit breakers
 - requirements for the use of manuals, circuit breaker diagrams/plans and drawings

- operation of protection systems and substation equipment associated with circuit breakers
- use, characteristics and capabilities of specialised tools and equipment
- capabilities of operating mechanisms
- capabilities of interrupter chambers
- enterprise-specific policies and procedures for the operation of circuit breakers
- techniques in evaluating serviceability of circuit breaker operation
- control equipment and auxiliary relays, flags and alarms
- safety precautions when constructing circuit breakers - safe working practices and procedures; identification of hazards; assessment and control of WHS/OHS risks; types, selection, maintenance and use of PPE; responsibilities and protocols; and access for operating.

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, equipment and PPE currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

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