



Australian Government

UETTDRSB27 Maintain high current d.c. equipment and switchgear

Release: 1

UETTDRSB27 Maintain high current d.c. equipment and switchgear

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 current direct current (d.c.) equipment and switchgear in the electricity supply industry (ESI).

It includes maintaining d.c. switchgear and other equipment, such as rectifier transformers, rectifiers, invertors, isolators and links, harmonic filters, negative reactors and energy dissipation resistors (EDR)s. It also includes diagnosing of faults and replacement and repair in accordance to workplace procedures and industry standards, isolating systems and/or circuits for safe work in accordance with work plans, visual inspections and necessary checks to ensure safe energisation, and updating of maintenance data and relevant quality assurance documentation.

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 high current d.c. switchgear and equipment

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, including emergency exits kept clear, to ensure safe systems of work are followed and in accordance with workplace procedures
 - 1.4 Work is prioritised and sequenced for the most efficient and effective outcome following consultation with others and for completion within acceptable timeframes, to agreed quality standards 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 to minimise risk, damage to property, commerce and individuals in accordance with workplace procedures
- 2 **Carry out the maintenance of high current d.c. switchgear and equipment**
 - 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 workplace 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 the immediate authorised persons for directions in accordance with workplace procedures
 - 2.6 Maintenance and repair of high current d.c. switchgear and equipment are maintained and repaired in accordance with works schedules, job requirements and workplace procedures
 - 2.7 High current d.c. switchgear and equipment are safely maintained to ensure completion in agreed timeframes, to quality standards and minimum waste in accordance with workplace procedures
 - 2.8 Unplanned events or conditions are responded to in accordance with workplace procedures
- 3 **Complete the maintenance of high current d.c. switchgear and equipment**
 - 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 equipment made ready for service
 - 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 UETTDRSB27A Maintain high current DC equipment and switchgear.

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 UETTDRSB27 Maintain high current d.c. equipment and switchgear

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
- maintaining high current direct current (d.c) switchgear and equipment using all of the following:
 - multimeters
 - low resistance high current
 - megger tester
 - ammeter
 - voltmeter
 - 1500 V drop out tester
 - wiring diagrams
 - schematic drawings
 - operating and substation arrangement diagrams
 - building layouts
 - cable block and schedule diagrams
- maintaining at least six (6) of the following types of equipment:
 - direct current circuit breakers
 - rectifier transformers
 - rectifiers
 - isolators and links
 - harmonic filters
 - negative reactors
 - energy dissipation resistors
- maintaining at least ten (10) of the following associated equipment:
 - d.c. feeders
 - surge arresters

- isolating links
- busbars
- cables
- cable supports
- pits and enclosures
- protection/alarm systems
- control wiring
- metering
- supervisory interface
- cabinets
- REC
- using all of the following:
 - cable terminations
 - busbar termination/joint
 - alignment of electrical contacts of withdrawable equipment
- dealing with unplanned events on at least one 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
- 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 policy 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 drawing, 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, d.c. traction supply sectioning diagrams, high voltage (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 the enterprise-specific procedures
 - calculation of results and data measurements using the computer
 - techniques in the preparation of preliminary works creation and closure
- substation d.c circuit breaker principles, including:
 - standards, codes, Commonwealth/state/territory legislation, supply authority regulations and/or enterprise requirements associated with the d.c. circuit breakers
 - types of d.c. circuit breakers - self and withdrawable types
 - characteristics of d.c. circuit breakers - purpose of d.c. circuit breakers and application of d.c. circuit breakers
 - principles of operation of different types of d.c. circuit breakers - arc expulsion versus arc containment, latched versus magnetically held, advantages and disadvantages of different types, fixed or withdrawable and protection/diagnostic technology
 - principles of operation of high-speed d.c. circuit breakers – characteristics and calibration
 - how d.c. circuit breakers are designated - feeder, rectifier, EDR, bus-section and negative breakers, auto-reclose or non-auto-reclose type
 - type and function of d.c. circuit breaker peripheral components - delta I relays, busbar,

control wiring, trunk and associated plug/receptacle

- identification, characteristics, application and care of d.c. circuit breakers components - holding coils, closing coils, contactors, resistors, arc chutes, blow-out coils, arcing contacts, main contacts, braids, moving arm, pole face, arcing horns, electronic cards, dashpots, fingers, diode strings, fuses, insulators, latching mechanisms, motors, wiring and relays
- characteristics, application and care of hand and specialised tools used on d.c. circuit breakers - combination/multigrips/long nose pliers, side cutters, screwdrivers, wire strippers, crimpers, knife, hacksaw, hammers, mallets, levels, tape measures, spanners, T-wrench, pistol drills, battery drills, heat gun, de-soldering tools and soldering iron/torches, Allen keys, socket spanners, gauges, feeler gauges and specialist tools supplied by the manufacturer
- characteristics, application and care of test and measurement instruments used on d.c. circuit breakers - multimeters, tong testers, ammeters, voltmeters, ohmmeters, test lamps, HV and LV insulation resistance/continuity testers, earth resistance tester, ductor and drop-out test sets
- maintenance of substation d.c. circuit breakers and associated equipment, including:
 - standards, codes, Commonwealth/state/territory legislation, supply authority regulations and/or enterprise requirements associated with the maintenance of d.c. circuit breakers
 - requirements for the use and interpretation of manuals, system diagrams/plans and drawings - 1500V sectioning diagrams, substation HV operating diagrams, substation arrangement diagrams and layout drawings, technical/manufacture specifications and maintenance instructions/schedules
 - relationship and function of d.c. circuit breaker equipment/component interface - d.c. circuit breaker frame, connection fingers, associated busbar, physical arrangements and clearances
 - safety precautions when undertaking maintenance procedures on d.c. circuit breakers - safe working practices; WHS/OHS hazards and precautions; identification of hazards; assessing and controlling risks; types, selection, maintenance and uses of PPE; permit to work systems and isolation procedures; types and function of specialised equipment; safe working practices when using specialised equipment; and emergency response and rescue, including first aid
 - techniques in maintenance of d.c. circuit breakers - closing and opening operations, range settings, adjustments and calibration, spring settings, main contact arrangement and auxiliary contact arrangement, arc chute inspection and procedures, basic fault finding and repair/adjustment techniques, control cards, their uses, application and fault finding, and earthing requirements and techniques
 - techniques in testing and commissioning of d.c. circuit breakers - supply authority regulations and/or enterprise requirements, standards and procedures
- installation of substation d.c. circuit breakers and associated equipment including:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements pertaining to the installation of substation d.c. circuit breakers
 - safety precautions when installing substation d.c. circuit breakers - safe operation procedures; WHS/OHS hazards and precautions; identification of hazards; assessing and controlling risks; types, selection, maintenance and uses of PPE; permit to work systems

and isolation procedures; safe working practices when using specialised equipment; and emergency response and rescue, including first aid

- use and interpretation of technical manuals and diagrams - manufacturer/enterprise manuals, block, wiring and schematic diagrams, 1500 V sectioning diagrams, substation HV operating diagrams, substation arrangement diagrams and layout drawings, technical/manufacturer specifications and maintenance instructions/schedules
- techniques in the safe installation of d.c. circuit breakers.

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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