



Australian Government

UETTDRSB29 Maintain capacitor bank equipment for voltage regulation

Release: 1

UETTDRSB29 Maintain capacitor bank equipment for voltage regulation

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 capacitor bank equipment for voltage regulation in the electricity supply industry (ESI).

It includes maintaining and repairing substation voltage regulating equipment and is restricted to high voltage (HV) capacitor banks and associated switching reactors and the inspection, recording of information, testing and measurement of the associated control circuits. It also includes the range of acceptance tests and discharge requirements for complete units within a substation in accordance with industry standards and workplace procedures, fault diagnosis and return to service tests and interpretation of test results 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

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

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

UEENEEK142A Apply environmentally and sustainable procedures in the energy sector

Competency Field

Substation

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Plan to maintain voltage regulating equipment (capacitor banks)

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
- 2 Carry out the maintenance of voltage regulating equipment (capacitor banks)**
- 1.9** Worksite is prepared to minimise risk, damage to property, commerce and individuals in accordance with workplace procedures
- 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 immediate authorised personnel for directions in accordance with workplace procedures
- 2.6** Capacitor bank is isolated, discharged and maintained in accordance with workplace procedures
- 2.7** Defective capacitor elements are identified, located and replaced in accordance with manufacturer instructions and workplace procedures
- 2.8** Capacitor network is balanced and pre-service tests and measurements completed in accordance with workplace procedures
- 2.9** Voltage regulating equipment (capacitor banks) are safely maintained to ensure completion in agreed timeframes, to quality standards and with minimum waste in accordance with workplace procedures
- 2.10** Unplanned events are responded to in accordance with workplace procedures
- 3 Complete the maintenance of voltage regulating**
- 3.1** Completed work is checked against work schedule, construction plans and drawings for compliance and

equipment (capacitor banks)

anomalies are reported in accordance with workplace procedures

- 3.2** Safe working documentation is surrendered and the capacitor bank is made ready for service
- 3.3** Worksite is rehabilitated, cleaned up and confirmed safe in accordance with workplace procedures
- 3.4** Tools, equipment, surplus resources and materials are 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 UETTDRSB29A Maintain capacitor bank equipment for voltage regulation.

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 UETTDRSB29 Maintain capacitor bank equipment for voltage regulation

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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 at least one (1) of the following systems:
 - double star neutral current unbalance type
 - voltage unbalance type, single star
- maintaining at least two (2) of the following components:
 - internal discharge resistor cans
 - external resistor type
 - switching reactors
 - neutral unbalance current transformer
- performing at least three (3) of the following types of tests:
 - insulation resistance tests
 - capacitance tests
 - unbalance current/voltage tests
 - primary injection tests
 - high voltage (HV) direct current d.c. withstand tests
- 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
 - 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 deal 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, 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 alternating current (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 - the rescue procedures for 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
- principles of power transformer construction and operations, including:
 - applications of static reactive plant in HV networks, including voltage control, volt-ampere reactive VAR control and transient response capacity
 - types of static reactive plant, including HV capacitors, HV reactors, static VAR compensators and combinations of these
 - operating characteristics and operational constraints, including point on wave switching issues
 - ratings, cooling systems and control systems and ancillary equipment used
 - configurations and system layout, including single star, double star and bridge type
 - typical protection systems used, including neutral unbalance current and neutral unbalance voltage
 - techniques used when balancing elements within static reactive plant
 - safety precautions when testing and maintaining HV static reactive plant - safe working practices and procedures; identification of hazards; assessment and control of WHS/OHS risks; types, selection, maintenance and use of PPE.

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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