Australian Government

Assessment Requirements for UETTDRSB33 Install high voltage plant and equipment

Release: 1

Assessment Requirements for UETTDRSB33 Install high voltage plant and equipment

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
- installing at least two (2) of the following pieces of equipment:
  - power transformer
  - high voltage (HV) reactor (series or parallel)
  - auxiliary transformer
  - current transformer
  - voltage transformer
  - capacitor bank
  - circuit breaker
  - high current direct current (d.c.) switchgear and/or equipment
- installing at least two (2) of the following pieces of associated equipment:
  - disconnector
  - fault throwing switch
  - earth switch
  - earth grid connections
  - surge arrestor
  - neutral earthing transformer
  - resistor bank
  - busbar
- performing at least three (3) of the following tests:
  - insulation resistance tests
  - dielectric dissipation factor tests
  - low voltage (LV) excitation checks
  - continuity checks

  - ratio checks
  - winding resistance tests
  - gas pressure checks
  - timing checks
  - contact resistance checks
- 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 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 drawings 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, 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 regarding 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 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 and 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, gas insulated switchgear (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
- principles of power transformer construction and operations, including:
  - transformer types - shell, core, auto, double wound, three phase, single phase and combinations of these types, step up and step-down transformers, transmission and generation types
  - reactor types - shunt and series, applications and design considerations
  - iron circuit characteristics - steel types, losses and techniques used to eliminate excess eddy currents and other circulating currents
  - winding configurations and construction techniques - helical, spiral, disc and interleaved disc types
  - insulation methods and techniques - fully insulated windings and graded insulation techniques, oil filled and gas filled power transformers
  - transformer and reactor ratings, losses and efficiency - equivalent circuits and vector relationships, and impedance percent
  - nameplate details - basic insulation level (BIL), tapping winding detail, physical layout, cooling ratings and physical details
  - transformer and reactor cooling types and their effects on design and rating
  - transformer and reactor auxiliaries - temperature indicators, over pressure devices and control systems
  - winding configurations - star-star, star-delta, star-zigzag, nomenclature and common

methods of diagrammatic representation of winding configuration
    - operating constraints as single units and in parallel
    - tapping windings - placement issues, tapping range, on-load tap changer (OLTC) versus off load tap changer techniques, types in use (high speed resistor, reactor and vacuum types, Jansen mechanisms, dead tank and live tank types), and control system characteristics
    - HV bushing selection – type, insulation system used, rating, BIL, selection criteria and testing considerations
- 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.

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