



Australian Government

UETDRIS009 Install and maintain ESI network infrastructure electrical equipment

Release: 1

UETDRIS009 Install and maintain ESI network infrastructure electrical 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 Release 2.0.

Application

This unit covers the installation and maintenance of electrical equipment, such as fuse switches, drop-out switches, sectionalisers, links, surge arrestors, gas-filled and/or oil-filled switches, which are relevant to the transmission, distribution and rail networks.

It includes the termination/connection of the equipment in accordance with enterprise requirements, the repair and/or replacement of like-for-like electrical equipment and associated hardware, and sampling of insulating oils. It also encompasses the identification of faults, the relevant pre-commissioning tests involving the equipment/system and the interpretation of these tests against agreed specifications.

It excludes the energisation of the equipment maintained in a highly complex, interdependent and interconnected electricity supply network system, where the effects of unintended consequences on the system are high risk and appropriate personnel effect energisation.

The application of the skills and knowledge described in this unit requires a licence/registration to practice in the workplace subject to regulations for undertaking of electrical work.

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

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

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

UEENEEG106A Terminate cables, cords and accessories for low voltage circuits

UEENEEG107A Select wiring systems and cables for low voltage general electrical installations

UEENEEG108A Troubleshoot 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

UETDREL005 Work safely in the vicinity of live electrical apparatus

UETDRIS005 Implement & monitor power system environmental & sustainable energy management policies & procedures

UETDRIS006 Implement and monitor the power system organisational WHS/OHS policies, procedures and programs

Competency Field

Industry Specific Cross Discipline

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare for the installation and maintenance of network infrastructure electrical equipment

PERFORMANCE CRITERIA

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

1.1 Work schedules, including drawings, plans, requirements, established procedures and material lists, are received, analysed and confirmed, as necessary, by site inspection

- 1.2** Relevant requirements and established procedures for the work are communicated to all personnel and identified for all worksites
- 1.3** Work health and safety (WHS)/occupational health and safety (OHS) policies and procedures related to requirements and established procedures for the installation and/or maintenance of network infrastructure electrical equipment are obtained and confirmed for the purposes of the work to be performed
- 1.4** Work is prioritised and sequenced following consultation with others for completion within acceptable timeframes and in accordance with established procedures
- 1.5** Hazards are identified, WHS/OHS risks assessed and control measures prioritised, implemented and monitored, including emergency exits kept clear according to established procedures
- 1.6** Relevant work permits are obtained to access and perform work according to requirements and/or established procedures
- 1.7** Resources, including personnel, equipment, tools and personal protective equipment (PPE) required for the job are obtained and confirmed in working order
- 1.8** Relevant personnel at worksite are confirmed current in first aid, pole top rescue and other related work procedures according to requirements
- 1.9** Liaison and communication issues with others/authorised personnel, authorities, clients and landowners are resolved to carry out work, where necessary
- 1.10** Site is prepared according to the work schedule and to minimise risk and damage to property, commerce and individuals in accordance with established procedures
- 1.11** Personnel participating in the work, including plant operators and contractors, are fully briefed and respective responsibilities confirmed, where applicable, in accordance with established procedures
- 1.12** Road signs, barriers and warning devices are positioned in accordance with requirements

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| 2 Carry out installation and maintenance of network infrastructure electrical equipment | <p>2.1 WHS/OHS and sustainable energy principles and practices to reduce the incidents of accidents and minimise waste are monitored and followed in accordance with requirements and/or established procedures</p> <p>2.2 Lifting, climbing, working in confined spaces and aloft, and use of power tools/equipment, techniques and practices are safely followed, and currency according to requirements confirmed</p> <p>2.3 Essential knowledge and associated skills are applied in the safe installation of network infrastructure electrical equipment to ensure completion in an agreed timeframe and to quality standards with a minimum of waste according to requirements</p> <p>2.4 Electrical equipment and associated hardware are positioned, secured and terminated/connected in accordance with requirements and established procedures</p> <p>2.5 Maintenance, including repair and/or replacement of network infrastructure electrical equipment, is carried out in accordance with the work schedule and requirements/established procedures</p> <p>2.6 Hazard warnings and safety signs are recognised and hazards and assessed WHS/OHS risks are reported to immediate authorised personnel for directions according to established procedures</p> <p>2.7 Unplanned events in the installation of electrical equipment (network infrastructure) are undertaken within the scope of established procedures</p> <p>2.8 Known solutions to a variety of problems are applied using acquired essential knowledge and associated skills</p> <p>2.9 Ongoing checks of quality of the work are undertaken in accordance with instructions and established procedures</p> |
| 3 Complete the installation and maintenance of network infrastructure electrical equipment | <p>3.1 Work undertaken is checked/tested against works schedule for conformance with requirements and anomalies reported in accordance with established procedures</p> <p>3.2 Accidents and/or injuries are reported in accordance with requirements/established procedures, where applicable</p> |

- 3.3 Worksite is rehabilitated, cleaned up and made safe in accordance with established procedures
- 3.4 Tools, equipment and any surplus resources and materials are, where appropriate, cleaned, checked and returned to storage in accordance with established procedures
- 3.5 Relevant work permit(s) are signed off and electrical equipment (network infrastructure) are returned to service in accordance with requirements
- 3.6 Work completion records, reports, as installed/modified drawing and/or documentation and information are finalised and processed and appropriate 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 UET Transmission, Distribution and Rail Sector Training Package Companion Volume Implementation Guide.

Unit Mapping Information

This unit replaces and is equivalent to UETTDRIIS46 Install and maintain ESI network infrastructure electrical equipment.

Links

Companion Volume Implementation Guides are found in VETNet - <https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=229bace1-b7bc-4653-9300-dffb13ecfad7>

Assessment Requirements for UETDRIS009 Install and maintain ESI network infrastructure electrical equipment

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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
- installing and maintaining any three (3) of the following:
 - fuse switches
 - drop-out fuses
 - sectionalisers
 - disconnectors
 - links
 - fuses
 - surge arrestors
- installing and maintaining any one (1) of the following:
 - reclosers
 - motorised switches
 - gas-filled switches
 - ring main units
 - line fault indicators
 - oil-filled switches
 - air-break switches
- installing and maintaining any one (1) of the following:
 - transformers
 - reactors
 - regulators
 - capacitors
 - relays
 - line fault indicators
 - with regards to the above incorporate any three (3) of the following:

- voltage detectors
 - phasing equipment
 - clip-on ammeters
 - insulation resistance testers
 - recording meters
 - earth resistance tester
- 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:

- mathematical techniques encompassing:
 - calculations involving fractions, decimals, ratios and proportions
 - calculations involving area, volume, mass and density
 - calculations involving transposition and substitution of formulae
 - calculations involving simple trigonometric problems
- engineering mechanics encompassing:
 - identification of basic concepts, principles and applications - application of velocity, acceleration, force, density, torque and pressure
 - applications of the International System of Units (SI) units
 - the relationship between work, power and energy
 - behaviour of object under force - using a block and tackle under load, concept of mechanical advantage, determination of resultant forces, and determining the sag in a catenary conductor and the force applied at each end
 - fundamentals of the basic laws of fluid mechanics
- materials properties encompassing:
 - identification and classification of engineering materials material properties
 - types and applications - properties of tensile strength; effects of temperature on the expansion of metals; ductility, malleability, work hardening and annealing and the conditions that lead to corrosion; and the properties of timbers
- basic rigging techniques encompassing:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements associated with rigging, including the operation of cranes, hoists and winches, and relevant certification and licensing (as required)
 - requirements for the use of enterprise construction manuals, system diagrams/plans and drawings
 - safe use of rigging equipment, tools and associated equipment - types, techniques and application
 - site inspection procedures - identifying hazards, assessing and controlling risks, and appropriate sequence of loading and unloading

- determining the mass and dimensions of load
- selection and inspection procedures - rigging equipment, materials and tools (natural and synthetic fibre ropes and chains, fittings, winch and capstan), ratings of wire ropes and slings, removing, repairing and replacing of damage parts
- techniques for assembling and erecting power winches and capstans
- checking the integrity of support structure - visual inspection of load connections
- techniques in moving, lifting, shifting, managing and placing loads - use of appropriate communication and signalling methods, codes of practice/compliance, enterprise and Commonwealth/state/territory legislative requirements, weather conditions, erection of safety nets and lines, methods of fixing and anchoring loads, and load stability
- procedures in providing store support encompassing:
 - classification and identification of equipment, components and tools
 - procedures for purchasing/ordering items, removing/dispatching items, stocktaking, security and bookkeeping/record keeping
 - material handling - warehouse/depot storage techniques, handling equipment, pallet lift trucks, forklifts and cable drum handling equipment
 - safety procedures - storage and care of safety equipment, handling hazardous materials, storage of hazardous substances and dangerous goods, and depot safety procedures
 - manufacturer and supplier information, including material safety data sheets (MSDS)
- generation systems encompassing:
 - methods of generating electricity - types of power stations and reasons for their location, and layout of thermal and hydroelectric power stations
 - relationship between power control and load requirements - operating speeds for thermal and hydroelectric generating sets, typical generator voltage levels and output ratings
 - the purpose and features of typical types of co-generation systems
- transmission, distribution and rail systems encompassing:
 - relationship between the transmission, distribution and rail/tram system within an overall power system - different organisations responsible for generation, transmission, distribution and rail/tram and, how they correlate and their functions
 - characteristics of a transmission, a distribution and a rail system - principal components; typical voltage levels and methods of transmission and distribution, including grid type transmission systems, radial, parallel and ring main feeders
 - relationship between an overhead and underground supply systems within an overall power system - advantages/disadvantages, applications and the basic steps for planning and installing an overhead and underground distribution system
 - single line drawings and layouts - drawings and layouts of transmission and distribution systems, including, radial, parallel and ring main feeders and the high voltage (HV) equipment associated with substations
- substations, power transformers and reactors encompassing:
 - relationship between the substations within an overall power system - purpose, location in relation to load centres, layout of HV equipment within the substation and auxiliary equipment
 - characteristics of a power transformer - basic construction of distribution transformers,

- operation under load/no load conditions, types and basic operation of tap changing switches, including solid state types, efficiency and cooling
- auxiliary equipment used on transformers - function and basic operation of equipment
- maintenance of a power transformer - basic connections, restrictions to parallel operation, problems and remedies associated with harmonics, testing and fault-finding procedures
- description, purpose and characteristics of a reactors
- installation of overhead distribution conductors encompassing:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements applicable to installing conductors and associated equipment
 - requirements for the use of overhead line construction manuals, system diagrams/plans and drawings - material lists, conductor size, type and route length
 - constructions types and structures for distribution and sub transmission lines
 - types, sizes and characteristics of overhead conductors
 - resources for the stringing and maintenance of conductors - types of low voltage (LV) and HV overhead electrical conductor connections; causes and effects of poor electrical connections; reasons for and methods used to maintain standard phase sequencing; removing, repairing and replacing damaged conductors; and minimum clearances between overhead conductors and LV and HV structures
 - techniques for conductor installation - types and application of tools, equipment and hardware, methods of stringing, tensioning and termination of LV and HV conductors
- safe working practices and procedures for the installation of overhead distribution conductors encompassing:
 - limits of approach for personnel, vehicles, mobile plant and elevated work platforms (EWP)
 - requirements of persons prior to making bare-hand contact with dead LV mains and apparatus
 - requirements of relevant electrical access permits necessary to allow work to be performed on LV and HV apparatus
 - safe working practices - requirements to enable safe working on conductive poles, procedure to attach an on-site earthing device to de-energised LV and HV overhead circuit
- installation of poles and/or structures and hardware encompassing:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements applicable to installing poles and associated hardware
 - requirements for the use of enterprise construction manuals, system diagrams/plans and drawings
 - characteristics and applications of different types of poles and associated hardware
 - techniques for installing poles and associated hardware - types of installation equipment/tools, excavation methods, types of footings/foundations, types of attachments, earthing systems, clearances between conductors, safe methods of erecting and stabling poles and-or structures and cross-arms
 - techniques for maintenance of poles and associated hardware - stabilisation techniques for unstable poles, methods of strengthen poles, maintenance and replacement of HV

insulators and cross-arms

- installation of LV electrical services encompassing:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements
 - requirements for the use of enterprise construction manuals, system diagrams/plans and drawings types of LV overhead services, methods of construction and installation, minimum clearances for overhead services to assets and structures, and types of installation equipment/tools
 - characteristics and applications of different types of cables - cable cross-sectional area of conductors, current rating and fuse type
 - techniques for maintenance of service installations - diagnosis and repair of faults
 - jointing and terminating methods - polymeric heat shrink materials, polymeric tape materials, energised and de-energised cables, connections to fuse boxes and pole top boxes
 - testing and commissioning procedures – inspection, polarity, voltage and phase sequence tests
 - construction types and structures for distribution and sub transmission lines
 - types, sizes and characteristics of overhead conductors
 - resources for the stringing and maintenance of conductors, - types of LV and HV overhead electrical conductor connections; causes and effects of poor electrical connections; reasons for and methods used to maintain standard phase sequencing; removing, repairing and replacing damaged conductors; and minimum clearances between overhead conductors and LV and HV structures
 - techniques for conductor installation - types and application of tools, equipment and hardware, methods of stringing, tensioning and termination of LV and HV conductors
- powerline safety practices encompassing:
 - protective apparatus and apparel for linework - responsibilities for the selection, use, maintenance and storage of protective apparatus and apparel; and the types of protective apparatus and apparel used for the line worker
 - requirements for the use of ladders - carrying, erecting, collapsing and lowering different types of extension ladder against a standing pole; maintenance checks on different types of ladders; renewal of extension ropes and the safety issues relating to clearances from overhead conductors
 - requirements for climbing and working aloft - methods used to identify a pole is safe to climb; methods used to inspect a line worker's body belt; application of knots and hitches appropriate to the requirements of a line worker; height safety principles, including personal fall protection, prevention and related requirements; and the practical procedures for climbing an overhead structure and fitting a pole chair
 - traffic management - purpose of traffic management and a line worker's responsibilities in accordance with relevant statutory requirements and electricity supply industry (ESI) requirements, demonstration of the procedure used to provide an effective traffic management scheme, and the use of a two-way radio
 - control of small fires - identification, selection and operation of the appropriate extinguishing mediums for various types of fires; general fire prevention methods; and the precautions for personal protection when fighting small fires

- rescue victims from heights and confined spaces - planning and identifying procedures, establishing responses and developing techniques; involving external emergency services; and emergency procedures for the rescue of an electric shock victim, including cardiopulmonary resuscitation (CPR)
- requirements for aerial linework - planning, establishing and implementing relevant aviation authority clearances; determining system requirements; aircrew familiarisation with network operations and equipment; and requirements for effective communications operations for aerial work.

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

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