



Australian Government

UETTDRSB34 Carry out surveys using thermovision techniques

Release: 1

UETTDRSB34 Carry out surveys using thermovision techniques

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 carry out surveys using thermovision techniques in the electricity supply industry (ESI).

It includes thermographic inspections of transmission/distribution systems and/or substation equipment. It also includes surveying, inspecting, recording information and reporting of defective/non-compliant conditions in accordance with workplace procedures.

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 requirement 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 carry out thermographic surveys

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 is 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 thermographic surveys**
 - 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, as appropriate, 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 Circuit load conditions are assessed, relevant personnel and/or organisations consulted and appropriate circuit

- adjustments made prior to survey in accordance with workplace procedures
- 2.7** Substation equipment and/or transmission/distribution systems are surveyed, joints, connections and components surveyed and assessed in accordance with workplace procedures
 - 2.8** Non-conformance defects are assessed for level of safety/system impact and communicated to appropriate personnel for further action in accordance with workplace procedures
 - 2.9** Circuits are restored to pre-survey conditions and appropriate personnel/organisations informed in accordance with workplace procedures
 - 2.10** Thermographic surveys are performed to ensure completion in agreed timeframes, to quality standards and minimum waste in accordance with workplace procedures
 - 2.11** Unplanned events or conditions are responded to in accordance with workplace procedures
- 3 Record the outcomes of thermographic surveys**
- 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 if appropriate
 - 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 UETTDRSB34A Carry out surveys using thermovision techniques.

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 UETTDRSB34 Carry out surveys using thermovision techniques

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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
- performing surveys using thermovision techniques in one (1) of the following substations:
 - transmission substation
 - distribution substation
 - traction substation
 - zone substation
- performing surveys using thermovision techniques on at least one (1) of the following:
 - substation apparatus and equipment
 - transmission/distribution system conlow resistance high currents and components
- performing surveys using thermovision techniques on at least three (3) of the following associated equipment:
 - disconnectors
 - transmission/distribution system conlow resistance high currents
 - mid-span joints
 - bolted palms and connections
 - terminations
 - jumpers
 - pot heads
- 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:

- 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 personal protection equipment (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 - low voltage (LV) system switching diagrams, direct current (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 storage of 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
- 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 HV insulation systems, including:
 - insulation design principles - common materials used, electrical characteristics, thermal characteristics, uses and applications to substation HV plant and equipment, grading, construction and cooling
 - common contaminants and their effects - internal contaminants and external contaminants
 - testing and measurement of insulation quality - test types and common measuring instruments and techniques, resistance and resistivity, losses, measurement errors, temperature corrections, and safe work practices related to testing and measurement
 - safety precautions when testing and measuring HV insulation systems - safe working practices and procedures; identification of hazards; assessment and control of WHS/OHS risks; types, selection, maintenance and use 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.

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