



Australian Government

**Assessment Requirements for
UETDRDS006 Develop high voltage and
low voltage distribution protection systems**

Release: 1

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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.

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
- completing at least two (2) designs from two (2) of the following project types:
 - distribution overhead designs
 - distribution underground designs
 - distribution substation designs
- 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:

- WHS/OHS enterprise responsibilities encompassing:
 - provisions of relevant WHS/OHS legislation
 - principles and practice of effective WHS/OHS management
 - management arrangements relating to regulatory compliance
 - enterprise hazards and risks, control measures and relevant expertise required
 - characteristics and composition of workforce and their impact on WHS/OHS management
 - relevance of enterprise management systems to WHS/OHS management
 - analysis of working environment and design of appropriate WHS/OHS systems
 - analysis of relevant data and evaluation of WHS/OHS system effectiveness
 - assess resources to establish and maintain WHS/OHS management systems
- principles of safe design encompassing:
 - Commonwealth/state/territory legislation, standards, codes, supply authority regulations and/or enterprise requirements associated with safe design principles

- particular reference to state and territory regulations regarding working near energised conductors, electrical access, heights, confined space, testing procedures and licensing rules
- application of safe design principles:
 - safe design duty related information, safe design process related information and safe design evaluations
- installation of switchgear and associated equipment encompassing:
 - types and function of various switchgear:
 - isolators, air-break switches, gas-filled switches, vacuum type, links, fuses, oil disconnectors, fuse switches and circuit breakers
 - operating characteristics
 - advantages and disadvantages of different types of switchgear
 - installation procedures
 - earthing requirements and techniques
 - types of equipment:
 - transformers, reactors, regulators, capacitors, relays, surge arrestors, fault indicators and mobile generators
 - installation procedures for switchgear and equipment:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements
 - assembly and erecting procedures
 - earthing requirements and techniques and pole mounted locations
 - maintenance procedures for switchgear and equipment:
 - diagnosing and rectifying faults according to electricity supply industry (ESI) standards and procedures
 - testing and commissioning:
 - ESI standards and procedures
- electrical equipment associated with distribution field device protection and control schemes encompassing:
 - types and applications of electrical equipment:
 - characteristics and capabilities
 - schemes, automatic circuit reclosers (ACRs), gas switches, secondary injection tests, primary injection tests, TMR radios, supervisory control and data acquisition (SCADA), remote control, overcurrent, earth fault, sensitive earth fault, inverse time curves, definite time curves, tripping, reclose, direct current (DC) supplies, alternating current (AC) supplies and alarms
- calculation of fault levels encompassing:
 - calculation of fault levels in symmetrical and asymmetrical fault conditions:
 - types of faults
 - interconnected and radial systems
 - symmetrical components
 - representation of voltages and currents

- sequence impedances of system plant
- calculation/determination of sequence impedance networks
- determination of operative sequence impedances
- fault or arc impedances
- first approximation techniques
- interrupting device capabilities:
 - determination of fault current breaking capability and let through energy capability of fuses and circuit breakers
 - DC offset and transient condition effects
- detailed operation and setting of discrete protection systems encompassing:
 - earth fault protection:
 - master earth leakage schemes
 - sensitive earth fault relays and schemes
 - residual earth fault scheme
 - core balance earth fault scheme
 - frame/structure earth leakage scheme
 - time graded discrimination
 - backup protection
 - overcurrent protection:
 - feeder overcurrent protection
 - instantaneous overcurrent schemes
 - inverse timed overcurrent schemes
 - types and location of components of an overcurrent scheme
 - CT summation
 - time graded discrimination
 - backup protection
 - alarms and controls:
 - auxiliary relays
 - voltage regulating relays
 - line drop compensation
 - gas relay types
 - gas relay scheme operation and setting
 - over temperature schemes
- polyphase systems and its application towards the calculation of circuit conditions encompassing:
 - structure of a three phase system:
 - components, sequence of phases and balanced and unbalanced load conditions
 - calculations of phase and line voltages for a specified phase sequence
 - calculation of voltage, current, power, power factor in a three phase system:
 - balanced three phase systems

- unbalanced delta connected loads
- unbalanced four-wire star connected loads
- unbalanced three-wire star connected loads
- unbalanced four-wire star connected systems
- calculation of the neutral displacement voltage in unbalanced three-wire star connected systems
- selection and connection of meters to confirm calculations
- control of harmonics:
 - harmonic analysis of non-sinusoidal waves of voltage and current
 - production of harmonics in three phase power systems
 - effects of harmonics on three power systems and loads
 - types of harmonics commonly encountered on three phase power systems
 - identification by observation of harmonic components present in a waveform
- calculation of effective value of non-sinusoidal waves
- calculation of current/voltage in a complex load given a voltage/current with a Fourier analysis of up to 3 terms
- pre-unit system in calculations:
 - reasons for use
 - groups of parameters commonly represented
 - common applications of the per-unit system to represent device specifications
 - applications of per-unit quantities in simple electrical calculations
- method of symmetrical components:
 - reasons for the use
 - types of components used to represent a three phase system
 - reasons for difference in the impedance of a component to the various symmetrical components and commonly occurring relationships between different sequence impedances for common component groups
- protection schemes encompassing:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements applicable to protection schemes
 - types of protection schemes:
 - reasons for use
 - application of protection zones around system elements and degree of protection
 - types of feeder protection equipment:
 - overcurrent protection inverse time-current operating characteristics
 - operation of overcurrent protection equipment used on distribution systems
 - operation of ACRs and their time-current characteristics
 - types and characteristics of overcurrent relays
 - coordination methods of a distribution feeder protection scheme
 - earth fault protection used on a distribution feeder

- operation of a single wire earth return (SWER) system.

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, facilities, equipment and personal protective equipment (PPE) currently used in industry for high voltage (HV) and low voltage (LV) distribution protection systems
- applicable documentation, including workplace procedures, relevant industry standards, equipment specifications, regulations, codes of practice and operation manuals.

Links

Companion Volume Implementation Guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=229bace1-b7bc-4653-9300-dffb13ecfad7>