



Australian Government

Assessment Requirements for UETDRDS001 Design customer power system substations

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 six (6) designs in total drawn from at least two (2) of the following project types:
 - single transformer substations
 - multi-transformer substations
 - upgrade/alteration to existing assets
 - auto-changeover systems
- 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:

- substations and power transformers encompassing:
 - relationship between the substations within an overall power system - purpose, location in relation to load centres, layout of high voltage (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
 - maintenance of a power transformer - basic connections, restrictions to parallel operation, problems and remedies associated with harmonics, testing and fault-finding procedures
 - characteristics of reactors - description and purpose
- installation of metering and control equipment encompassing:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements pertaining to the installation and maintenance of energy meters and associated equipment

- types of meters - kilowatt-hour meters, single and polyphase, demand meters, recording meters and electronic recording metering system summators
- installation and removal methods - direct connection and plug in method, and enterprise specific
- types of associated equipment and accessories - meter boards, service fuse, links, contactors, time switch and audio frequency injection relay
- testing procedures - safety and polarity testing
- HV distribution transformer principles encompassing:
 - operation of HV distribution transformers - principle governing factors for transformer ratings, protection and alarms, operating limitations and the relationship between transformer and HV fuse rating, purpose and principle operation of HV distribution transformer tap changers, HV distribution transformer and transformer - cable combination switching practices, paralleling requirements, isolation and earthing procedures for access, common distribution transformer and associated electrical apparatus faults
 - HV underground switching equipment - arc strangles, switch operation, load break elbows, switching cubicles, canister fuses, bayonet fuses, F and G switching cubicles, voltage indicators and phasing testers
- feeder automation system encompassing:
 - function of feeder automation system and the main components
 - operation procedure for a remote field device from a local control station
 - functions of supervisory control and data acquisition (SCADA) (or any other relevant data acquisition and control) systems and its main components
 - SCADA system security interlocks and access restrictions
 - SCADA system operation when switching apparatus or retrieving data via a remote access device, such as remote access terminal (RAT), dial up voice annunciated system and local control station
 - function of the main components of a local/remote control system
 - operation of a field devices using SCADA systems via a RAT, dial up annunciated system and local control station
- layout principles for a distribution substation minor upgrade encompassing:
 - Commonwealth, state/territory and local government legislation, standards, codes, supply authority regulations and/or enterprise requirements applicable to a distribution substation minor upgrade
 - requirements for the use of distribution substation minor upgrade construction manuals, system diagrams/plans and drawings and for plans such as work method statements for the control of WHS/OHS risks
 - methods in determining material, equipment and tool lists - components types and quantity required, spacing of components and equipment, and costings of items and components
 - purchasing and contractual arrangements, including requirements to eliminate WHS/OHS hazards, minimise risks and provide residual WHS/OHS risk information
 - determination of conductor size, type and route length

- resources needed for the laying of conductors, cables and equipment
- determining the appropriate installation sequence
- minimum clearances between conductors and equipment
- estimation of the duration of underground distribution extension project
- fundamentals of distribution transformers encompassing:
 - standards, codes, legislation, supply authority regulations and/or enterprise requirements pertaining to the safe operation and testing of distribution transformers and auxiliary equipment
 - drawing layouts, conventions and symbols - vector group of transformers and three phase transformers
 - construction of a distribution transformer
 - characteristics when operated under load and no-load conditions
 - percentage impedance determinations by test and calculation
 - function and operation of tap changing switches, including solid state tap changing equipment
 - function and operation of transformer auxiliary equipment
 - problems caused by harmonics in transformers
 - methods and equipment used to overcome harmonics in transformers
- testing procedures of distribution transformers encompassing:
 - safety precautions specific to the testing of distribution transformers
 - procedures for safely connecting distribution transformers for testing
 - testing of distribution transformers to determine losses
 - calculation of transformer efficiency
 - methods and types of equipment used to cool transformers - properties of transformer oil and tests performed on transformer oil
 - techniques in performing selected tests on transformer oil
 - techniques in performing testing procedures on armer
 - techniques in testing distribution transformers
 - distribution transformer parallel connections - conditions and restrictions for parallel operations and calculations of loading on transformers operating in parallel
 - connection of transformer in parallel to supply a common load.

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 to design customer substations
- 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>