



Australian Government

UEEEL0077 Evaluate and report on the performance of LV machines

Release: 1

UEEEL0077 Evaluate and report on the performance of LV machines

Modification History

Release 1. This is the first release of this unit of competency in the Electrotechnology Training Package.

Application

This unit covers determining correct operation of single and three phase machines, evaluating and reporting on their performance.

It includes safe working practices, machine connections circuit arrangements, issues related to machine operation, characteristics and protection and solutions to machine problems derived from calculated and measured parameters.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

UEEEL0020 Solve problems in low voltage a.c. circuits

UEEEL0021 Solve problems in magnetic and electromagnetic devices

Competency Field

Electrical

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to evaluate and report on the performance of LV

PERFORMANCE CRITERIA

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

1.1

Work, health and safety (WHS) / occupational health and safety (OHS) risk control measures are identified and applied

machines

	1.2	Machines to be evaluated, and scope of works to be undertaken are identified and confirmed
	1.3	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety
2 Evaluate single and three phase low voltage machines	2.1	Correct machine is identified for a specified range of applications
	2.2	Machine performance is evaluated from measured and calculated values as they apply to single and three-phase low voltage machines and results are recorded
	2.3	Problems are diagnosed, recorded, and solutions are identified
3 Complete work and document problem solving activities.	3.1	Results of evaluation and recommendations are reported
	3.2	Justification for identified solutions is reported
	3.3	Work completion is documented, and an appropriate person 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 Electrotechnology Training Package Companion Volume Implementation Guide.

Unit Mapping Information

This is a new unit.

Links

Companion Volume Implementation Guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEEEL0077 Evaluate and report on the performance of LV machines

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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:

- evaluating the operating parameters of existing machines
- recommending alterations to an existing machine for compliance with specified operating parameters
- justifying selection of machines/circuits to comply with a specified function and operating parameters
- determining the cause of problems in an existing machine
- determining solutions for problems in an existing machine
- determining conditions causing an existing machine to be unsafe
- recommending solutions for identified machine problems
- determining correct machine for a specified range of applications
- determining parameters for the equivalent circuit using data from short circuit and open circuit tests
- determining percentage resistance, reactance and impedance of a transformer
- determining voltage regulation using percentage resistance, percentage reactance and load power factor
- determining parameters for maximum regulation and zero regulation.

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:

- single and three phase transformers including:
 - transformer construction including:
 - types of lamination style and core construction used in single-phase, three phase, double wound, auto transformers and instrument transformers
 - identification of different winding styles/types used in transformers
 - methods used to insulate low and high voltage transformers
 - construction of transformer tanks for distribution transformers

- transformer auxiliary equipment
- function of transformer auxiliary equipment
- types of information stated on transformer nameplates
- application of transformers
- performing basic insulation resistance, continuity and winding identification tests
- transformer operation including:
 - principles of mutual induction of a transformer
 - factors that determine the induced voltage in a transformer winding
 - determining the value of a transformer's secondary voltage and current given one winding's electrical details and the turns ratio
 - identification of voltage and current components of a phasor diagram for a transformer no-load and load
 - principles of power transferred from the primary to the secondary when a load is connected using a phasor diagram neglecting impedance drops
 - selecting transformers for specific application/s
 - safety features specified in AS/NZS3000 with respect to transformers and isolating transformers
 - transformer resistance, reactance and impedance, including total equivalent values, referred to the primary and the secondary
 - equivalent circuit of a transformer
 - harmonics in transformers, including their generation, measurement, problems they cause and overcoming their impact
 - the purpose of tertiary windings
- transformer losses, efficiency and cooling including:
 - power losses which occur in a transformer
 - tests which allow the power losses of a transformer to be determined
 - determination of transformer losses and efficiency using test results
 - efficiency for loads other than full load
 - relationship between transformer cooling and rating
 - methods used for natural and forced cooling of transformers
 - properties of transformer oil
 - tests conducted on transformer oil
- transformer voltage regulation and percent impedance including:
 - voltage regulation as applicable to a transformer
 - reasons for voltage variation in the output of a transformer
 - determine the voltage regulation of a transformer from voltage and percentage impedance values
 - percentage impedance as applied to transformers
 - determine the percent impedance by using test results
 - determine percent impedance of a transformer by calculation
 - approximate voltage drop and exact voltage drop equations

- parallel operation of transformers and transformer auxiliary equipment including:
 - determine polarity markings for an unidentified single phase double wound transformer
 - need for parallel operation of transformers
 - conditions/restrictions required before two transformers can be connected in parallel
 - vector grouping
 - connecting transformers in parallel to supply a single load
 - loading on transformers operating in parallel
 - the consequences/effect of an incorrect connection
- auto-transformers and instrument transformers including:
 - identification of auto-transformers, voltage transformers and current transformers from their winding diagrams
 - determining voltage and current in the windings of an auto-transformer by calculation
 - advantages and disadvantages of an auto-transformer
 - AS/NZS3000 requirements with respect to transformers
 - construction and ratings of voltage transformers
 - construction and ratings of current transformers
 - precautionary measures taken to connect and disconnect instrument transformers
 - connection diagrams for instrument transformers
 - applications for auto-transformers and instrument transformers
- alternating current rotating machines including:
 - operating principles of three phase induction motors including:
 - characteristics of the magnetic field produced by a single-phase, two-phase and three-phase windings
 - speed of rotation of a rotating magnetic field
 - relationship between the rotor speed, slip and rotor frequency
 - basic principle of operation of an induction motor
 - reversing the direction of rotation of a three-phase induction motor
 - three phase induction motor construction including:
 - basic component parts of a three-phase induction motor
 - types of rotors used in three-phase induction motors
 - connecting a three-phase induction motor in both star and delta
 - testing insulation resistance of a three-phase induction motor prior to connection to the supply
 - testing winding resistance (ohmic value and continuity) of a three-phase induction motor prior to connection to the supply
 - three phase induction motor characteristics including:
 - relationship between torque, speed, and power and interpretation of speed/torque curves of induction motors
 - squirrel cage motors operating characteristics conditions necessary for an induction motor to produce maximum torque

- operating characteristics of an induction motor from name plate information and by measurement
- induction motor efficiency and minimum energy performance standards (MEPS)
- full load efficiency and power factor of induction motors
- comparison of the advantages of squirrel cage and wound rotor induction motors
- single-phase motors – split phase including:
 - common types of single-phase motors
 - principles of operation of split phase induction motors
 - construction and basic characteristics of split phase induction motors
 - applications of split phase induction motors
 - operation of split phase induction motors
- single phase motors – capacitor including:
 - identification of single-phase induction motors including capacitor start, capacitor start/capacitor run and permanent split capacitor (PSC)
 - principles of operation
 - operating characteristics and typical applications
 - connection and running
 - reversing the direction of rotation
- single phase motors –shaded pole including:
 - principles of operation
 - operating characteristics and typical applications
 - connection and running
 - reversing the direction of rotation
- single phase motors – universal including:
 - principles of operation
 - identification and functions of each of the basic parts
 - operating characteristics and typical uses
 - connecting, running and reversing
- motor protection including:
 - reasons why motor protection is required
 - requirements of the AS/NZS3000 Wiring rules with regards to motor protection
 - types of motor overload protection
 - operating principles of microtherm devices, thermal and magnetic motor protection devices
 - electrical features of motor protection HRC fuses
 - effects of under voltage and over voltage on motors and motor circuits
 - effects of repetitive starting and/or reversing on motors and motor circuits
 - special requirements for motor protection, in high humidity or moist environments, high temperature areas and corrosive atmospheres
 - operating principles of phase failure protection

- selecting suitable protection devices for a given motor and starter combination
- three phase synchronous machines- operation principles and construction including:
 - power transfer diagram of an a.c. synchronous machine
 - need for the generation of a sinusoidal waveform
 - principles of operation of a synchronous alternator
 - principles of operation of a synchronous motor
 - principles of operation of an asynchronous generator (induction generator)
 - identification of main parts of a synchronous alternator/motor
 - methods used to provide the excitation of a synchronous alternator/motor
 - block diagram of an alternator voltage regulator
 - advantages gained by the parallel operation of alternators
 - starting methods of synchronous motors
 - vee curves
 - the behaviour of synchronous motors at various excitation levels and their associated phasor diagrams
 - limits of stability for synchronous motors
- alternators and generators including:
 - effects on the generated voltage of variations in excitation
 - effects on generated voltage of variations in load
 - identification of characteristic curves of an alternator
 - types of prime movers used with single and three phase portable/standby alternators
 - manual operation of single and three phase portable/standby alternators
 - ratings of single and three phase portable/standby alternators
 - applications of single and three phase portable/standby alternators
 - construction details of single and three phase portable/standby alternators
 - common faults found in portable/standby alternators
 - limits of stability for synchronous alternators.

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 workplace operational situations that replicate 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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