



Australian Government

**Assessment Requirements for UEEEL0041
Develop engineering solution for
synchronous machine and control problems**

Release: 1

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Modification History

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

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least one occasion and include:

- understanding the extent of the machine problem
- forming effective strategies for solution development and implementation
- obtaining machine parameters, specifications and performance requirements appropriate to each problem
- testing and applying solutions to machine problems
- documenting instruction for implementation of solutions that incorporate risk control measure to be followed
- documenting justification of solutions implemented in accordance with professional standards
- dealing with unplanned events
- analysing approaches to solutions
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures
- applying synchronous machine construction operation characteristics and applications to developing solutions
- determining the scope of synchronous machine problem
- monitoring quality of work
- planning activities to meet timelines.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- synchronous machine diagnostics and engineering solutions for synchronous machine problems, including:
 - alternating current (a.c.) generators – construction, types and cooling encompassing:
 - construction of stator and rotor windings

- rotor construction (cylindrical and salient pole)
- advantages of rotating field construction
- excitation methods
- cooling methods
- prime movers
- a.c. generators – operating principles and characteristics encompassing:
 - a.c. generator equivalent circuits (synchronous reactance and resistance components)
 - tests – open circuit, short circuit and stator impedance
 - voltage regulation, island generator's terminal voltage load power factor
 - determination of excitation voltage and load angle
- synchronising a.c. generators encompassing:
 - conditions for synchronising (infinite bus)
 - methods for synchronising (lamp methods and synchroscope)
 - alternator load sharing, parallel operation
- a.c. generators power, torque and efficiency encompassing:
 - power input, input torque and speed
 - power losses
 - output power, load power factor, rotor angle and pu power
 - efficiency
 - performance chart interpretation
- automatic voltage regulation (AVR) encompassing:
 - need for AVRs
 - features of AVRs
 - effects of rotor inductance
 - connections of AVRs
 - operation of AVRs
- a.c. generator operational stability encompassing:
 - power output, variance (VAR) effects, rotor angle and excitation
 - control of VAR (on-load tap-changers (OLTC) transformers)
 - voltage dependant nature of stability
 - critical clearance angle of a.c. generator
 - stability limits
- a.c. generator protection encompassing:
 - restricted, unrestricted primary, back up and duplicated protection
 - overcurrent, short circuit, differential, reverse power, load unbalance, rotor overload, loss-of-field, rotor earth fault, station earth-fault and under-frequency protection
 - external fault protection
- induction generator encompassing:
 - types operating principles and characteristics
 - excitation methods

- losses and efficiency
- synchronising and paralleling
- three phase synchronous motors encompassing:
 - construction – rotor, stator and windings
 - excitation methods
 - operating principles (equivalent circuits and synchronous impedance)
 - hunting and stability limits
 - power factor correction
 - paralleling and synchronisation techniques
 - starting methods
 - braking methods
- problem-solving techniques
- relevant machine parameters, specifications and performance requirements
- relevant manufacturer specifications and operating instructions/manuals
- relevant job safety assessments or risk mitigation processes
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace quality, instructions, policies and procedures.

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 suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated suitable 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 simulations
- relevant and appropriate materials, tools, facilities and equipment currently used in industry
- resources that reflect current industry practices in relation to developing engineering solution for synchronous machine problems
- applicable documentation, including workplace procedures, 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=b8a8f136-5421-4ce1-92e0-2b50341431b6>