



Australian Government

Assessment Requirements for UEEEL0042

Develop engineering solutions for d.c. 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 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
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures
- determining the scope of direct current (d.c.) machine problems
- planning activities to meet timelines
- analysing approaches to solutions
- monitoring quality of work.

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:

- d.c. machine diagnostics and engineering solutions for d.c. machine problems, including:
 - basic d.c. machine construction and operation encompassing:
 - general principles of operation
 - applications of d.c. machines
 - construction of d.c. machines
 - d.c. machine configurations; series, shunt, compound long shunt and compound short

- shunt
- armature and field currents
- insulation
- ratings
- cooling paths
- bearings
- general maintenance of d.c. machines
- construction and use of lap and wave windings encompassing:
 - coils and elements
 - generated voltage equation for generator
 - generated voltage equation for motors
 - application of lap and wave windings
- commutation process encompassing:
 - use of interpoles
 - loading of machines
 - brush shifting
 - brush selection
 - classes of brush grades:
 - natural graphite, hard carbon, electrographite, metal-graphite and metal-carbon, “treated” grades
 - carbon brush contact characteristics:
 - specific resistance, thermal conductivity, density and porosity, elastic properties and contact properties
 - carbon brush factors:
 - pressure, current, polarity and speed
 - brush construction:
 - dimensions, tolerances, preferred sizes, surfaces, edges, bevels, flexible shunts, connection of flexible shunt to brush and insulation of flexible connections
 - brush holders:
 - types, brush angles, trailing holders, reaction holders, top bevel angles, reversible rotation, cantilever holders, effective arc of contact, construction of brush holders and pressure mechanism
 - mounting of brush holders and brushes:
 - clearances, brush angle, brush arm spacing, alignment, staggering, brush bedding and brush pressure
 - brush operation:
 - temperature rise, number and size of brushes, current distribution between brushes, slotting brushes, polarity effects, arc of contact, materials for commutators and mica
 - selection of brush grades:
 - machine data, current density, commutator peripheral speed, brush arc, pitch of

segments, number of segments covered by brush and cooling surface

- armature reaction in d.c. machines encompassing:
 - effect of armature reaction on d.c. machine characteristics
 - use of compensating winding
- d.c. generators encompassing:
 - relative advantages and disadvantages of the various d.c. generator configurations and their performance under various load conditions
 - voltage regulation as a percentage or per unit value
 - operation in parallel
- d.c. motors encompassing:
 - relative advantages and disadvantages of the various d.c. motor configurations and their performance under various load conditions
 - shape of motor speed/torque curves
 - reversal of rotation
- starting and protection of d.c. motors encompassing:
 - types of d.c. motor starters in use
 - d.c. motor protection
- speed regulation and speed control of d.c. motors encompassing:
 - methods in use
 - effect on motor design and operation caused by the use of SCR
 - speed control equipment
- braking of d.c. motors encompassing:
 - plugging
 - dynamic
 - regenerative
 - mechanical
- losses, heating and efficiency encompassing:
 - copper losses
 - iron losses
 - mechanical losses
 - efficiency
- acceleration of d.c. motors and loads encompassing:
 - characteristics of typical loads
 - matching a suitable motor to a given load
 - heating of windings
 - derating of motors
- special d.c. motors construction, operation and applications encompassing:
 - permanent-magnet motors
 - brushless motors (e.c. motors)
 - coreless and moving coil motors

- linear motors
- printed circuit motor
- stepping motors
- voice-coil motors
- maintenance of d.c. machines encompassing:
 - routine maintenance
 - breakdown repairs
- types of faults encompassing:
 - brushes/brush gear problems:
 - sparking, excessive heating, excessive wear of brushes, commutator or slip rings, bad surface conditions, excessive maintenance, flexible burning, flexible corrosion, separation or grooving, blackening, copper picking, copper dragging and brush noise
- adjustment of machines encompassing:
 - correct brush position
 - machining and finishing of commutators
- problem-solving techniques
- machine parameters, specifications and performance requirements
- relevant manufacturer specifications and operating instructions
- 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 solutions for d.c. 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>