



Australian Government

UEEEL0042 Develop engineering solutions for d.c. machine and control problems

Release: 1

UEEEL0042 Develop engineering solutions for d.c. machine and control problems

Modification History

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

Application

This unit involves the skills and knowledge required to develop engineering solutions for direct current (d.c.) machine and control problems.

It includes working safely; determining problem; obtaining direct current d.c. machine operation, construction and application; gathering and analysing data; applying problem-solving techniques; and developing and documenting solutions.

The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V d.c..

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, may be required.

Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation

Pre-requisite Unit

UEECD0007 Apply work health and safety regulations, codes and practices in the workplace

UEECD0036 Provide engineering solutions for problems in complex multiple path circuit

UEECD0039 Provide solutions to basic engineering computational problems

and

UEECD0041 Solve electrotechnical engineering problems

or

UEECD0043 Solve problems in direct current circuits

UEEEL0019 Solve problems in direct current (d.c.) machines

UEEEL0021 Solve problems in electromagnetic devices

or

UEECD0044 Solve problems in multiple path circuits

UEECD0046 Solve problems in single path circuits

UEEEL0019 Solve problems in direct current (d.c.) machines

UEEEL0021 Solve problems in electromagnetic devices

or

UEEEC0074 Troubleshoot resonance circuits in an electronic apparatus

and

UEECD0043 Solve problems in direct current circuits

or

UEECD0044 Solve problems in multiple path circuits

UEECD0046 Solve problems in single path circuits

or

UEEEC0065 Solve problems in basic electronic circuits

Competency Field

Electrical

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to develop engineering solution for d.c. machine problems

PERFORMANCE CRITERIA

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

- 1.1** WHS/OHS processes and workplace procedures for a given work area are identified, obtained and applied
- 1.2** WHS/OHS risk control measures and workplace procedures in preparation for the work are followed
- 1.3** Scope of d.c. machine problem is determined from performance specifications and/or documentation and in consultation with relevant person/s

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| | 1.4 | Activities are planned to meet scheduled timelines in consultation with others involved in the work |
| | 1.5 | Strategies are formed to ensure solution development and implementation is carried out efficiently |
| 2 | Develop engineering solution for d.c. machine problems | |
| | 2.1 | WHS/OHS risk control measures and workplace procedures for carrying out the work are followed |
| | 2.2 | Relevant d.c. machine construction operation characteristics and applications are applied to developing solutions to d.c. machine problems |
| | 2.3 | Parameters, specifications and performance requirements to each machine problem are obtained in accordance with workplace procedures |
| | 2.4 | Approaches to resolving d.c. machine problems are analysed to provide most effective solutions |
| | 2.5 | Unplanned events are dealt with safely in accordance with relevant industry standards and workplace procedures |
| | 2.6 | Quality of work is monitored in accordance with relevant industry standards and workplace procedures |
| 3 | Implement engineering solution and complete documentation | |
| | 3.1 | Solutions to machine problems are tested to determine their effectiveness and modified as required |
| | 3.2 | Adopted solutions are documented and instructions for implementation with risk control measure developed |
| | 3.3 | Relevant person/s required to implement solutions to d.c. machine problems is coordinated in accordance with relevant industry standards and workplace procedures |
| | 3.4 | Justification for solutions used to solve d.c. machine problems is documented in work/project records in accordance with relevant industry standards |

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 UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Developing engineering solutions must include the following:

- at least two different d.c. machines using different control systems

Unit Mapping Information

This unit replaces and is equivalent to UEENEEG144A Develop engineering solutions for d.c. machine and control problems.

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 UEEEL0042 Develop engineering solutions for d.c. machine and control problems

Modification History

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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, 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

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