



Australian Government

UEENEEG161A Design and develop modifications to LV electrical machines

Release: 2

UEENEEG161A Design and develop modifications to LV electrical machines

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit covers the performance and efficiency aspects of electrical machine design as applied to the modification of existing machines. It encompasses designing to given parameters including those related to safety and efficiency, adhering to compliance standards and compliance assessments and documentation.

Application of the Unit

Application of the Unit 2)

This unit is intended for competency development entry-level employment based programs incorporated in approved contracts of training. It applies to any formal recognition for this standard at the aligned AQF 6 level.

Licensing/Regulatory Information

License to practice 3)

The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

Pre-Requisites

Prerequisite Unit(s) 4)

Competencies 4.1)

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEG1 60A	Evaluate performance of LV electrical machines
UEENEEG1 57A	Conduct electrical tests on LV electrical machines
UEENEEE1 01A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE1 02A	Fabricate, assemble and dismantle utilities industry components
UEENEEE1 04A	Solve problems in d.c. circuits
UEENEEE1 05A	Fix and secure electrotechnology equipment
UEENEEE1 07A	Use drawings, diagrams, schedules, standards, codes and specifications
UEENEEG0 06A	Solve problems in single and three phase low voltage machines
UEENEEG1 01A	Solve problems in electromagnetic devices and related circuits
UEENEEG1 02A	Solve problems in low voltage a.c. circuits
UEENEEG1 06A	Terminate cables, cords and accessories for low voltage circuits
AND	
UEENEEG1 50A	Wind electrical coils
UEENEEG1	Place and connect electrical coils

Prerequisite Unit(s)	4)
	51A
UEENEEG1 53A	Rewind three phase low voltage induction machines
	OR
UEENEEG0 33A	Solve problems in single and three phase electrical apparatus and circuits
UEENEEG0 63A	Arrange circuits, control and protection for general electrical installations
UEENEEG1 08A	Trouble-shoot and repair faults in low voltage electrical apparatus and circuits
	AND
UEENEEG1 43A	Develop engineering solution for synchronous machine and control problems
UEENEEG1 49A	Provide engineering solutions to problems in complex polyphase power circuits
UEENEEE1 25A	Provide engineering solutions for problems in complex multiple path circuit
UEENEEE1 26A	Provide solutions to basic engineering computational problems
	AND
UEENEEE1 29A	Solve electrotechnical engineering problems
	OR
UEENEEE1 01A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEE1 04A	Solve problems in d.c. circuits
UEENEEG1 01A	Solve problems in electromagnetic devices and related circuits
	OR

Prerequisite Unit(s)**4)**

UEENEEH1
14A Troubleshoot resonance circuits in an electronic apparatus

UEENEEE1
01A Apply Occupational Health and Safety regulations, codes and practices in the workplace

AND

UEENEEE1
04A Solve problems in d.c. circuits

OR

UEENEEH1
69A Solve problems in basic electronic circuits

OR

UEENEEG1
44A Develop engineering solutions for d.c. machine and control problems

UEENEEE1
25A Provide engineering solutions for problems in complex multiple path circuit

UEENEEE1
26A Provide solutions to basic engineering computational problems

AND

UEENEEE1
29A Solve electrotechnical engineering problems

OR

UEENEEE1
01A Apply Occupational Health and Safety regulations, codes and practices in the workplace

UEENEEE1
04A Solve problems in d.c. circuits

UEENEEG1
01A Solve problems in electromagnetic devices and related circuits

OR

UEENEEH1 Troubleshoot resonance circuits in an

Prerequisite Unit(s)	4)
	14A electronic apparatus
	UEENEEE1 01A Apply Occupational Health and Safety regulations, codes and practices in the workplace
	AND
	UEENEEE1 04A Solve problems in d.c. circuits
	OR
	UEENEEH1 69A Solve problems in basic electronic circuits
	OR
	UEENEEG1 45A Develop engineering solutions for induction machine and control problems
	UEENEEG1 49A Provide engineering solutions to problems in complex polyphase power circuits
	UEENEEE1 25A Provide engineering solutions for problems in complex multiple path circuit
	UEENEEE1 26A Provide solutions to basic engineering computational problems
	AND
	UEENEEE1 29A Solve electrotechnical engineering problems
	OR
	UEENEEE1 01A Apply Occupational Health and Safety regulations, codes and practices in the workplace
	UEENEEE1 04A Solve problems in d.c. circuits
	UEENEEG1 01A Solve problems in electromagnetic devices and related circuits
	OR

Prerequisite Unit(s)**4)**

UEENEEH1 14A Troubleshoot resonance circuits in an electronic apparatus

UEENEEE1 01A Apply Occupational Health and Safety regulations, codes and practices in the workplace

AND

UEENEEE1 04A Solve problems in d.c. circuits

OR

UEENEEH1 69A Solve problems in basic electronic circuits

Literacy and numeracy skills**4.2)**

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading 5 Writing 5 Numeracy 5

Employability Skills Information**Employability Skills****5)**

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

- 6) Elements describe the essential outcomes of a competency standard unit. Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Prepare to design and develop modifications to electrical machines.	1.1 OHS procedures for a given work area are identified, obtained and understood.
	1.2 The extents of modifications required are determined from performance test results and customer's requirements.
	1.3 Original specification documents for the machine are sought and received in order to check currency of compliance requirements. (see note 1)
	1.4 Activities are planned to meet scheduled timelines in consultation with others involved in or relying on outcomes of the work.
2 Design modifications to electrical machines.	2.1 OHS risk control measures and procedures for carrying out the work are followed.
	2.2 In depth knowledge of electrical machine and sustainable energy policies in improving machine efficiency is applied to modification design.
	2.3 Modifications are designed to comply with the requirements of Standards and regulations.
	2.4 Acceptance/approval for modification design is sought from appropriate person(s) in accordance with established procedures.
	2.5 Specifications and instructions for the modification work are documented and processed in accordance with requirements.

ELEMENT	PERFORMANCE CRITERIA
3 Arrange modification work.	2.6 Solutions to unplanned or unforeseen events are provided consistent with safety and work outcomes.
	3.1 OHS risk control measures and procedures for carrying out the work are followed.
	3.2 Arrangements are made for the modification work to be done in accordance with established procedures.
	3.3 A copy of modification specifications and instructions is provided to personnel responsible for carrying out the work.
	3.4 Strategies are implemented that verify that modification conforms to specifications.
4 Complete work and report	3.5 Solutions to unplanned or unforeseen events are provided consistent with safety and work outcomes.
	4.1 OHS work completion risk control measures and procedures are followed.
	4.2 Arrangements are made for formal certification of modifications where required by regulation or customer.
	4.3 Machine marking is revised to comply with performance parameters resulting from modifications.
	4.4 Modification and machine performance standard are documented and report issued to appropriate person(s) in accordance with established procedures.

Note 1:

Examples of documentation are those specifying safety requirements, technical standard, as marketed technical performance and product quality endorsement standards.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and designing and developing modifications to electrical machines.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

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Electrical machine design

Evidence shall show an understanding of the design and development of modifications to electrical machines to an extent indicated by the following aspects:

T1 Motor windings principles and construction encompassing

- direct-current machine types
- construction of direct current machine
- types of armature windings
- parallel circuits in armature windings
- magnitude of generated e.m.f.

T2 Direct current armature windings encompassing:

- terms used in armature winding
- effects of chording
- lap and wave windings
- progressive and retrogressive windings

T3 Simplex lap windings encompassing:

- simplex lap armature winding
- commutator pitch
- number and position of brushes
- characteristics of simplex lap windings
- equalising connections for armature windings
- applications for lap windings

T4 Simplex wave windings encompassing:

- simplex wave armature winding
- commutator pitch
- number and position of brushes
- dummy coils
- characteristics of simplex wave windings
- applications of wave windings
- comparison of lap and wave windings
- armature winding calculations

REQUIRED SKILLS AND KNOWLEDGE

T5 Commutation and interpoles encompassing:

- principles of commutation
- conditions for sparkless commutation
- methods used to reduce sparking
- resistance commutation
- e.m.f. commutation
- interpoles or commutating poles
- advantages of interpoles

T6 Alternator windings encompassing:

- elementary single-phase stator winding
- elementary three-phase stator winding
- half-coil and whole-coil windings
- concentrated and distributed windings
- chain, lap and wave windings
- pole-pitch and coil-span
- half-coil winding for a three-phase alternator
- whole-coil stator winding for a three-phase alternator

T7 Breadth factor and sinusoidal output encompassing:

- breadth factor
- e.m.f. equation for an alternator
- methods of obtaining sinusoidal wave form
- star and delta connection of alternator windings

T8 Rating, cooling and regulation encompassing:

- rating of alternators
- cooling of alternators
- the voltage regulator

T9 Testing techniques encompassing:

- continuity
- insulation testing
- use of 'growler'
- magnetic field testing

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment 9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

**Critical aspects
of evidence
required to
demonstrate
competency in
this unit** 9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
 - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the performance criteria and range statement
 - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
 - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
 - Demonstrate an appropriate level of skills enabling employment
 - Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Design and develop modifications to electrical machines as described as described in 8) and including:
 - A Determining the extent of work correctly.
 - B Designing modification to meet requirements.
 - C Documenting modification specifications clearly.
 - D Arranging for formal certification of modifications.
 - E Completing final report.

F Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

Context of and specific resources for assessment 9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

OHS policy and work procedures and instructions.

Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to designing and developing modifications to electrical machines.

Method of assessment 9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:

Competent performance with inherent safe working practices is expected in the industry to which this unit applies. This requires assessment in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

**Concurrent
assessment and
relationship with
other units****9.5)**

There are no concurrent assessment recommendations for this unit.

Range Statement**RANGE STATEMENT**

10) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to designing and developing modifications to at least two different types of electrical machines.

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not applicable.

Competency Field**Competency Field** **11)**

Electrical