Australian Government

Department of Education, Employment and Workplace Relations

UEENEEE160A Provide engineering solutions for uses of materials and thermodynamic effects

Release: 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

UEENEEE160A Provide engineering solutions for uses of materials and thermodynamic effects

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor **1) Scope:**

1.1) Descriptor

This unit covers the engineering solution for the appropriate selection and use of materials and thermodynamic effects relative to an electrotechnology problem. It encompasses working safely, problem solving procedures, including using measuring instruments, applying appropriate theorems and providing solutions derived from measurements and calculations and justification for such solutions.

Application of the Unit

Application of the Unit **2)**

This unit is intended to apply to any recognised development program that leads to the acquisition of a formal award at AQF level 6. It may also be suitable for employment-based programs under an approved contract of training.

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, codes of work practice and standard work procedures related to the characteristics and behaviour of material in an engineering

License to practice **3)**

environment.

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.

UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace

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 provide solutions for the uses of materials and thermodynamics.	1.1	OHS procedures for a given work area are obtained and understood
		1.2	OHS risk control work preparation measures and procedures are followed.
		1.3	The nature of the problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.
		1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.
		1.5	Sources of equipment and products that may be required for the work are established in accordance with established procedures.
		1.6	Tools, equipment and testing devices necessary for the work are obtained and checked for correct operation and safety.
2	Provide solutions for the uses of materials and thermodynamics.	2.1	OHS risk control work measures and procedures are followed.
		2.2	The need to test or measure active systems is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures
		2.3	Systems are checked as being isolated where necessary in strict accordance OHS requirements and procedures
		2.4	Established methods are used to solve system problems from measure and calculated values,

ELEMENT	PERFORMANCE CRITERIA	
		as they apply to materials and thermodynamics.
	2.5	Unexpected situations are dealt with safely and with the approval of an authorised person.
	2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices with the minimum waste and rework.
3 Complete work and document solutions to discovered problem.	3.1	OHS work completion risk control measures and procedures are followed.
	3.2	Work site is cleaned and made safe in accordance with established procedures.
	3.3	Justification for solutions used to solve system problems is documented.
	3.4	Work completion is documented and appropriate person(s) notified in accordance with established procedures.

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 providing solutions for uses of materials and thermodynamic effects.
All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EE160A Material science and thermodynamics

Evidence shall show an understanding of materials and there characteristics and thermodynamics to an extent indicated by the following aspects:

T1 Classification of materials on the basis of state
T2 Difference between elements, compounds and mixtures
T3 Atomic structure and bonding of materials
T4 Properties of ferrous and non-ferrous materials
T5 Properties of ceramic and composite materials
T6 Chemical, physical and mechanical properties of materials
T7 Corrosion and corrosion protection of metallic structures and systems
T8 Causes of degradation of polymer materials
T9 Non-destructive testing and types of test equipment
T10 Corrosion testing
T11 Evaluation and suitability of materials for specific applications
T12 Principles, advantages and limitations of casting, forging, extrusion and powder metallurgical processes
T13 Methods of joining materials, including limitations
T14 Methods used for surface finishing of materials, including limitations
T15 Relationship between energy usage and standard of living
T16 Energy conversion and conversion efficiencies
T17 Energy sources and there advantage in engineering processes
T18 Energy conservation
T19 State of matter in terms of molecular theory
T20 Relationship between mass, volume, density, force, pressure and temperature in thermodynamic concepts
T21 Compression ratio and pressure ration calculations in a basic piston and cylinder mechanism
T22 Concepts, theorems and calculations related to potential energy, kinetic energy, work and powered, heat and internal energy of object.
T23 Relationship between work and pressure/volume
T24 Concept and calculations related to energy transfer in a closed loop system
T25 Concept of and calculations about property changes and work, heat and internal energy transfer in gases in typical engineering processes
T26 Principle, operation and performance of common types of heat engines
T27 Heat engine performance parameters and typical performance tests

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 the 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-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 everyday 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 must 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, polices and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Provide solutions for uses of materials and thermodynamic effects as described in 8) and including:

A Determining the characteristics and application of materials and the effects of thermodynamics.

B Using established problem solving methods.

C Taking relevant measurements accurately.

D Interpreting measured values appropriately.

E Providing effective solutions to system problems from measurements and calculations.

F Giving written justification of solutions provided.

G Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a 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 in this unit.

These should be used in the formal learning/assessment environment.
Note:
Where simulation is considered a suitable strategy for assessment, conditions for assessment 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 providing solutions for uses of materials and thermodynamic effects.

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 that the specified essential knowledge and associated skills are assessed 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 analysing materials and thermodynamic effects relative to two different engineering applications.
Note.
Typical engineering applications are those encountered in meeting performance requirements and compliance standards, revising a machine operating parameters and dealing with machine malfunctions.
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)**

Electrotechnology