



Australian Government

PMBTECH603B Design structural/mechanical polymer components

Revision Number: 1

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Modification History

Not applicable.

Unit Descriptor

Unit descriptor

This competency covers the mechanical/structural design of components which are to be made from polymeric materials. It applies the traditional engineering structures to viscoelastic materials.

This competency is typically performed by senior technicians/technologists who are designing, or part of a team, designing polymeric structures or polymeric mechanical components.

Application of the Unit

Application of this unit

This competency applies to technologists designing new mechanical or structural components. The key factors in the design of the component are adequate strength and rigidity and making allowances for, and taking maximum advantage of, the inherent properties of polymeric materials.

It includes working with:

- structural components, such as support columns and beams in plastic playground equipment
- rigid beams and frames, such as in boat hulls and decks
- mechanical components, (such as gears, cams, etc) subject to forces/transmitting mechanical power
- a certified structural engineer (when appropriate) to provide specialised polymer knowledge.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisites

This unit of competency has the prerequisite of *PMBTECH505B Choose polymer materials for an application*.

This unit of competency requires a detailed understanding of mechanics such as might be gained from some engineering studies. Where this knowledge is to be gained as part of this unit of competency, it will require a significantly greater effort and time than would otherwise be required.

Employability Skills Information

Employability Skills

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	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 ELEMENT	PERFORMANCE CRITERIA Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
1. Determine mechanical/ structural design requirements.	1.1 Determine stress/strain requirements of end use. 1.2 Determine flexural/rigidity requirements of end use. 1.3 Determine required physical properties (such as size, shape, density) of end use. 1.4 Determine environmental requirements (physical, chemical, radiation) of end product. 1.5 Identify how component fits with entire end product. 1.6 Develop mechanical design brief and verify with appropriate people.
2. Select material(s) and additives, including reinforcing, appropriate for the design brief.	2.1 Select material/combination of materials with appropriate physical properties. 2.2 Select material/combination of materials with appropriate chemical properties. 2.3 Select material/combination of materials with appropriate radiation resistance properties. 2.4 Arrange for compounding and testing of possible material(s) as appropriate. 2.5 Determine relevant properties of selected material/shortlisted materials.
3. Undertake mechanical design of component.	3.1 Calculate size and shape/profile of component to meet design brief. 3.2 Liaise with product developer to also deliver required aesthetic aspects. 3.3 Liaise with product developer/production to ensure efficiency in manufacture. 3.4 Suggest modifications to material(s)/compound as required.
4. Design jointing/joining/ other product interfaces.	4.1 Liaise with designers of other components. 4.2 Agree on interface requirements/joints/joining as appropriate. 4.3 Design suitable interfaces. 4.4 Check interface design to ensure it meets the end use requirements without sacrificing integrity.

ELEMENT	PERFORMANCE CRITERIA
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
5. Finalise design.	5.1 Check internal consistency of design. 5.2 Check overall design meets end use requirements. 5.3 Write component specification. 5.4 Liaise with product developer/production to write production specification/procedures. 5.5 Supervise manufacture and testing of prototypes/manufacturing trials as appropriate. 5.6 Finalise specifications and manufacturing processes, complete all reports. 5.7 Ensure project records are complete and all required reports have been completed and submitted. 5.8 Archive records according to company procedure.

Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit. Knowledge and understanding of the materials, equipment and process sufficient to design a component which is mechanically/structurally fit for its end purpose and which can be efficiently manufactured.

Knowledge of organization policies and procedures and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and in a manner relevant to the job.

Competence includes the ability for the practical completion of the job to apply and explain:

- stress/strain data of polymeric materials to the design situation
- material creep/viscoelasticity
- impact and notch strength
- tensile, compressive, shear and torsional strength
- tear strength
- adequate safety factors
- overall design features which take advantage of the polymeric material(s) being used.

Competence also includes the ability to make compounding recommendations to modify properties such as:

- stress/strain data of polymeric materials
- material creep/viscoelasticity, rheometric properties
- material strength
- environmental resistance (e.g. temperature, chemicals, UV and other radiation)
- make changes to physical size and shape to change:
- stiffness/rigidity, deflection
- strength.

Language, literacy and numeracy requirements

This unit requires high levels of numeracy and literacy with the ability to write and interpret technical specifications and reports. Advanced numeracy allowing the calculation and interpretation of statistics, design formulae and process conditions is also required.

Evidence Guide

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.

Overview of assessment

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

The critical aspect for this unit of competency is the ability to apply a thorough understanding of polymer materials, their additives and the rheological, heat and other effects of processing to the design of a new mechanical or structural component. The ability to modify both compound design and mechanical design to optimise the results should be evident. The designed product must not only be fit for its purpose but also capable of efficient manufacture for an appropriate price.

Assessment method and context

Assessment will occur using industrial situations and equipment using industrial polymers and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- using appropriate, industrial equipment, situations and polymers
- in a situation allowing for the generation of evidence of the ability to recognise, anticipate and respond to problems
 - by using a suitable simulation and/or a range of case studies/scenarios
 - through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

Specific resources for assessment

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method.

Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required.

Where applicable, physical resources should include equipment modified for people with disabilities.

Range Statement

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice and/or Australian/international standards, the latest version must be used.

Context

This competency unit is for the design of a new product or a component of a new product which has a significant structural or mechanical requirement. It assumes an understanding of the operation of all relevant equipment and processes but does not necessarily require them to be used personally.

This competency applies to all work environments and sectors within the plastics, rubber and cabling industry. The competency assumes a working knowledge of all main processes and polymer materials so that an informed choice can be made between them.

Procedures

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

Unit Sector(s)

Not applicable.