



Australian Government

PMC556031C Design structural/mechanical components

Revision Number: 1

PMC556031C Design structural/mechanical components

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the mechanical/structural design of components which are to be made from manufactured mineral products. It applies the traditional engineering structures to brittle materials. It is based on <i>PMBTECH603A Design structural/mechanical polymer components</i> .
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Application of the Unit

Application of the unit	<p>This unit of competency applies to senior technicians/technologists who are designing, or part of a team designing, structures or structural or mechanical components.</p> <p>This unit of competency relates to 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.</p> <p>This unit does NOT provide a qualification as a certified structural engineer such as might be required by government regulation for some structures. However, persons with this qualification should be able to work closely with such people, if required, providing specialised material and process knowledge.</p> <p>This competency applies to all work environments and sectors within the industry. The competency assumes a working knowledge of all main processes and materials so that an informed choice can be made between them.</p> <p>The key factors in the design of the component are adequate strength and toughness and making allowances for, and taking maximum advantage of, the inherent properties of manufactured mineral product materials.</p>
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
	<i>PMC555031B</i>	<i>Choose materials for an application</i>

Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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 and 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 materials 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/transmission properties 2.4.Arrange for compounding and testing of possible materials 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 materials/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.
5. Finalise design	5.1.Check internal consistency of design 5.2.Check overall design meets end use requirements 5.3.Ensure issues identified in the hazard analysis for both end use safety requirements and manufacturing

ELEMENT	PERFORMANCE CRITERIA
	<p>requirements are addressed in the final design</p> <p>5.4. Write component specification</p> <p>5.5. Liaise with product developer/production to write production specification/procedures</p> <p>5.6. Supervise manufacture and testing of prototypes/manufacturing trials as appropriate</p> <p>5.7. Finalise specifications and manufacturing processes, and complete all reports</p> <p>5.8. Ensure project records are complete and all required reports have been completed and submitted</p> <p>5.9. Archive records according to company procedures</p>

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- designing a component which is mechanically/structurally fit for its end purpose and which can be efficiently manufactured
- implementing enterprise policies and procedures and relevant regulatory requirements, including the OHS legislative obligations of designers within appropriate time constraints, and in a manner relevant to the job
- high levels of numeracy and literacy to write and interpret technical specifications and reports
- advanced numeracy allowing the calculation and interpretation of statistics, design formulae and process conditions

Required knowledge

Required knowledge includes:

- stress/strain data of materials to the design situation
- material flow properties
- impact and notch strength
- tensile, compressive, shear and torsional strength
- adequate safety factors
- overall design features which take advantage of the materials being used
- make compounding recommendations to modify properties such as:
 - stress/strain data of materials
 - flow, rheometric properties
 - material strength
 - environmental resistance (e.g. temperature, chemicals, ultra-violet (UV) and other radiation)
- make changes to physical size and shape to change:
 - stiffness/rigidity and deflection
 - strength

Evidence Guide

EVIDENCE GUIDE	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	The unit will be assessed in as holistic a manner as is practical and may be integrated with the assessment of other relevant units of competency.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> • a thorough understanding of materials, their additives and the rheological, heat and other effects of processing to the design of a new mechanical or structural component are applied • both compound design and mechanical design are able to be modified to optimise the results • the designed product is fit for its purpose and also capable of safe and efficient manufacture for an appropriate price/cost.
Context of and specific resources for assessment	<p>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.</p> <p>Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p> <p>Simulation or case studies/scenarios may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual plant and will include 'walk-throughs' of the relevant competency components. A bank of scenarios/case studies/what ifs and questions will be required to probe the reasoning behind observable actions.</p>
Method of assessment	This unit of competency assumes the knowledge component included in the following unit of competency:

EVIDENCE GUIDE	
	<ul style="list-style-type: none">• <i>PMC555031B Choose materials for an application</i> <p>Competence in this unit may be assessed:</p> <ul style="list-style-type: none">• by observation of an actual design project where the assessee takes a lead technical role• by use of a suitable design project where arrangements are made to also assess the implementation aspects. <p>Evidence must be available that the specified knowledge has been acquired and is able to be applied or the units may be co-assessed:</p>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. 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) may also be included.</p>	
Procedures	All operations are performed in accordance with standard procedures and work instructions
Standard procedures	<p>Standard procedures refer to:</p> <ul style="list-style-type: none"> all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards
Situations	<p>The situations covered by this unit include, but are not limited to:</p> <ul style="list-style-type: none"> critical load bearing structural components requiring significant design such as columns and beams critical mechanical components transmitting power/forces such as shafts, gears and bearings component joints/joins components with a critical rigidity/flexural specification individual components integrated structural components large and small components

Unit Sector(s)

Unit sector	Operational/technical
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Competency field

Competency field	
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Co-requisite units

Co-requisite units		