



Australian Government

PMC556031 Design structural/mechanical components

Release: 1

PMC556031 Design structural/mechanical components

Modification History

Release 1. Supersedes and is equivalent to PMC556031C Design structural/mechanical components.

Application

This unit of competency covers the skills and knowledge required to design a new product/component which has a significant structural or mechanical requirement and which is to be made from manufactured mineral products. It applies to large and small components, such as:

- 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.

This unit of competency applies to advanced technologists, technical experts or those in similar roles who are required to apply significant depth and breadth of theoretical materials, product and process knowledge in order to determine the design requirements, select the materials to be used, design the components, supervise product testing/trials and finalise specifications for the new component.

Where the design is being undertaken by a design team the technologist will perform a lead technical role. The technologist is not required to demonstrate ‘hands on’ operation of equipment as part of this competency.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

PMC555031 Choose materials for an application

Competency Field

Technical

Unit Sector

Not applicable

Elements and Performance Criteria

Elements describe the essential outcomes.

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

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

Foundation Skills

This section describes those required skills (language, literacy and numeracy) that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Regulatory framework The latest version of all legislation, regulations, industry codes of practice and Australian/international standards, or the version specified by the local regulatory authority, must be used.

Applicable legislation, regulations, standards and codes of practice include:

- health, safety and environmental (HSE) legislation, regulations and codes of practice relevant to the workplace, materials and processes being used and products being made
- Australian/international standards relevant to the materials being used and products being made
- any relevant licence and certification requirements.

All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between performance criteria and such requirements the legislative requirements take precedence.

Procedures All operations must be performed in accordance with relevant procedures.

Procedures may be written, verbal, visual, computer-based or in some other form. They include one or any combination of:

- test procedures
- technical specifications
- technical drawings
- emergency procedures
- work instructions
- standard operating procedures (SOPs)
- safe work method statements (SWMS)
- formulas/recipes
- batch sheets
- temporary instructions

- any similar instructions provided for the smooth running of the plant.

Unit Mapping Information

Release 1. Supersedes and is equivalent to PMC556031C Design structural/mechanical components.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=45a7f1d5-61a5-447a-9688-7abbd7e1a5c7>

Assessment Requirements for PMC556031 Design structural/mechanical components

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and demonstrate the ability to:

- read and interpret test results, technical information, mechanical information/specifications, equipment specifications and instruments/control panels
- determine mechanical and structural specifications, physical properties of component, and regulatory requirements
- develop mechanical design brief
- select and trial materials and determine final materials specifications
- develop component design and confirm it meets structural, mechanical, physical specifications and interface requirements
- supervise trialling and interpret results
- finalise and document design specifications and manufacturing processes
- communicate technical information verbally and in writing
- communicate with internal and external stakeholders about technical issues and bring agreement as to requirements from the different parties
- calculate and interpret cost estimates, test results, trialling data, product formulae and process conditions.

Knowledge Evidence

Must provide evidence that demonstrates knowledge relevant to their job sufficient to fulfil their job role, including knowledge of:

- impact of different materials, their additives and the rheological, heat and other effects of processing on design of a new mechanical or structural component
- factors affecting structural and mechanical properties of new component
- significance to the design of factors, including:
 - stress/strain data of materials
 - material flow properties
 - impact and notch strength
 - tensile, compressive, shear and torsional strength
- options for compounding changes to modify properties, including:
 - stress/strain data of materials
 - flow, rheometric properties

- material strength
- environmental resistance (e.g. temperature, chemicals, ultra-violet (UV) and other radiation)
- options for changes to component shape and size to modify properties, including:
 - stiffness/rigidity, deflection
 - strength
- component trialling and testing procedures
- principles of operation of all relevant equipment and processes
- differentiating features of main processes, materials and materials of construction of structural/mechanical components
- organisation procedures relevant to the work environment/job role
- hierarchy of control
- hazards that may arise in the job/work environment and:
 - their possible causes
 - potential consequences
- appropriate risk controls.

Assessment Conditions

- The unit should be assessed holistically and the judgement of competence shall be based on a holistic assessment of the evidence.
- The collection of performance evidence is best done from a report and/or folio of evidence drawn from:
 - a single project which provides sufficient evidence of the requirements of all the elements and performance criteria
 - multiple smaller projects which together provide sufficient evidence of the requirements of all the elements and performance criteria.
- A third-party report, or similar, may be needed to testify to the work done by the individual, particularly when the project has been done as part of a project team.
- Assessment should use a real project in an operational workplace. Where this is not possible or where personal safety or environmental damage are limiting factors assessment must occur using a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions. This must cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Assessment in a simulated environment should use evidence collected from demonstration of skills and one or more of:
 - walk-throughs
 - pilot plant operation
 - industry-based case studies/scenarios
 - ‘what ifs’.
- Knowledge evidence may be collected concurrently with performance evidence or through an independent process, such as workbooks, written assessments or interviews.

- 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.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required, including relevant workplace procedures, product and manufacturing specifications associated with this unit.
- The regulatory framework will be reflected in workplace policies and procedures and is not required to be independently assessed.
- Foundation skills are integral to competent performance of the unit and should not be assessed separately.
- Assessors must satisfy the assessor competency requirements that are in place at the time of the assessment as set by the VET regulator.
- In addition the assessor or anyone acting in subject matter expert role in assessment shall demonstrate both technical competency and currency. If the assessor cannot demonstrate technical competency and currency they shall assess with a subject matter expert who does meet these requirements.
- Technical competence can be demonstrated through one or more of:
 - relevant VET or other qualification/Statement of Attainment
 - appropriate workplace experience undertaking the type of work being assessed under routine and non-routine conditions
 - appropriate workplace experience supervising/evaluating the type of work being assessed under routine and non-routine conditions
- Currency can be demonstrated through one or more of:
 - being currently employed undertaking the type of work being assessed
 - being employed by the organisation undertaking the type of work being assessed and having maintained currency in accordance with that organisation's policies and procedures
 - having consulted/had contact with an organisation undertaking the type of work being assessed within the last twelve months, the consultation/contact being related to assessment
 - conducting on the job training/assessments of the type of work being assessed
 - being an active member of a relevant professional body and participating in activities relevant to the assessment of this type of work.

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