



Australian Government

PMC557093A Design a refractory/ceramic component

Revision Number: 1

PMC557093A Design a refractory/ceramic component

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers confirming the application and conditions of use of the proposed component and then designing the most appropriate component for that use. It is intended for refractory experts who will most likely also have some management responsibility.
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Application of the Unit

Application of the unit	<p>This unit of competency requires the application of knowledge about types of refractories, refractory properties and uses to the design of an appropriate refractory/ceramic component for a specified end use. This may be manufactured in a jobbing shop environment, or it may be a routine product manufactured by batch or continuous means. This unit does NOT cover the selection of the refractory material which is covered by <i>PMC557090A Select refractory materials for an application</i>. The units are obviously related and it may be appropriate to consider both concurrently.</p> <p>This unit applies to individuals who will be designing a refractory component. They may be working in liaison with other refractory specialists or they may be the sole refractory specialist for this job/in their organisation. They will typically be liaising with a range of other technical experts as well as management and maybe accounts. The components could be a refractory sleeve for a valve in an engine, a refractory tip for a flame lance or other application requiring a refractory component of a product.</p> <p>This unit may apply to individuals working for an organisation which supplies refractory components, is a refractory consulting organisation or a client organisation which buys and uses the refractory component.</p>
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		

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. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Confirm required end use	1.1.Liaise with relevant stakeholders 1.2.Confirm the end use conditions for the refractory 1.3.Define interface requirements with the product 1.4.Identify discrepancies or conflicts in requirements 1.5.Negotiate a consistent set of requirements for the refractory component
2. Undertake preliminary design	2.1.Undertake required mechanical design calculations 2.2.Undertake the required heat transfer calculations 2.3.Undertake relevant thermal expansion calculations 2.4.Determine implications for refractory material selection 2.5.Liaise with refractory material selector 2.6.Prepare preliminary designs of component
3. Compare possible design solutions	3.1.Compare the preliminary designs with the set of requirements 3.2.Rank possible design solutions 3.3.Identify health, safety and environment (HSE) risks of top ranked possible refractory designs 3.4.Estimate the cost of top ranked possible refractory designs
4. Design refractory component	4.1.Liaise with relevant stakeholders 4.2.Determine customer issues of relevance to the refractory designs 4.3.Determine manufacturing issues of relevance to the refractory designs 4.4.Review short list ranking 4.5.Recommend optimum refractory component design for the end use
5. Develop design and technical specification for recommended refractory component	5.1.Determine suitable format for design and specification 5.2.Prepare design and specification 5.3.Review specification with refractory material selector, production and customer 5.4.Modify design and specification if required 5.5.Publish design and specification in required format to required people/organisations

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills include:

- solving problems
- communicating at all levels
- using organisation knowledge system
- analysing
- interpreting data
- negotiating
- technical reporting
- technical drawing - possibly computer aided drafting (CAD)

Required knowledge

Required knowledge includes:

- properties of all common refractory materials
- typical limitations and applications of all common refractory materials when used as components
- manufacturing methods for refractory components and their advantages, disadvantages, typical uses and limitations
- heat transfer calculations (resistances in series and parallel)
- mechanical calculations (stress/strain, modulus, stiffness, shear, strength of refractory materials and physical properties of refractory materials)
- thermal expansion (calculation of and allowance for)
- methods of fixing refractory components to products
- basic metal product manufacturing methods and possible uses for refractory components and their impact on component design
- methods of reuse, recycling and disposal of refractory components at the end of their life and the differences for different types of refractory components
- critical refractory component specifications

Evidence Guide

EVIDENCE GUIDE	
<p>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.</p>	
<p>Overview of assessment</p>	<p>Assessment of this unit should include demonstrated competence in a workplace based project or a simulated workplace project.</p> <p>Access should be available to all normally accessed tables, data etc which would be available to and used by a competent refractory specialist performing this assignment.</p>
<p>Critical aspects for assessment and evidence required to demonstrate competency in this unit</p>	<p>Competence must be demonstrated in the ability to design an appropriate refractory system and write the required specification.</p>
<p>Context of and specific resources for assessment</p>	<p>Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>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.</p>
<p>Method of assessment</p>	<ul style="list-style-type: none"> • Assessment must satisfy the endorsed assessment guidelines of the Manufactured Mineral Products Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods which include direct observation of tasks should also include questioning on underpinning knowledge to ensure its correct interpretation and application. • Assessment may be applied under project related conditions (real or simulated) and require evidence of

EVIDENCE GUIDE	
	<p>process.</p> <ul style="list-style-type: none">• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.• Assessment may be in conjunction with assessment of other units of competency where required.
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. 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>	
Stakeholders	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> • customer representatives • technical experts • regulators • refractory designer • refractory installer
End use conditions	<p>End use conditions may include:</p> <ul style="list-style-type: none"> • surface temperature of refractory • required temperature gradient through refractory/outside surface temperature • chemical condition (e.g. pH) • mechanical condition (e.g. impingement) • temperature or other cycling
Types of refractory components	<p>Typical types of refractory components include:</p> <ul style="list-style-type: none"> • shafts • bearing plates/rings • nozzles and tips • valves and valve seats • crucibles and crucible linings • shelving
Ranking of possible designs	<p>Ranking should be based on:</p> <ul style="list-style-type: none"> • how well they meet the technical requirements of the end use
HSE risks	<p>HSE risks should include focus on the comparative health, safety and environmental risks of the refractory systems under consideration.</p> <p>Risks would include risks during:</p> <ul style="list-style-type: none"> • manufacture • component installation • use • repair

RANGE STATEMENT	
	<ul style="list-style-type: none"> removal and disposal at end of life
Cost of refractory component	<p>Cost of refractory components should be total costs and should include:</p> <ul style="list-style-type: none"> material costs manufacturing cost installation costs repair costs life cycle costs
Optimum refractory component design	<p>The optimum refractory component design would be:</p> <ul style="list-style-type: none"> that system which best delivers the technical requirement at the lowest cost and the least HSE risk

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	