



Australian Government

MEM23133A Evaluate rapid tooling applications

Release: 1

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Modification History

Release 1 (MEM05v9).

Unit Descriptor

This unit of competency covers evaluation of rapid tooling applications for their suitability for purpose. It includes additive processes, spray deposition and casting processes, and rapid machining, cutting and welding. It requires consideration of product manufacturability, materials, resources and skills, plant and tooling requirements systems and processes, strength, form, fit, function, lead time and sustainability.

Application of the Unit

This unit applies to rapid tooling applications. It is suitable for people working as manufacturing or maintenance technicians, designers and draftspersons, and those pursuing engineering or related technical qualifications and careers.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MEM23004A Apply technical mathematics

Employability Skills Information

This unit contains employability skills.

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.

Elements and Performance Criteria

1	Determine scope of rapid tooling application	1.1	Identify technologies, including software, used or proposed in rapid tooling application
		1.2	Confirm stakeholders to be consulted on evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Identify market context for rapid manufacturing product
		1.5	Identify relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Identify principles and techniques required for evaluation of rapid tooling application	2.1	Determine principles and techniques required to evaluate and optimise rapid tooling process and application
		2.2	Select appropriate analysis and development software and software validation techniques
3	Evaluate rapid tooling application	3.1	Evaluate WHS and regulatory compliance requirements and risk management practices of rapid tooling processes
		3.2	Assess tooling and rapid tooling processes for sustainability
		3.3	Assess effectiveness of software used for tool design, rapid tooling process control and process optimisation
		3.4	Review suitability of facilities, services and plant for

- rapid tooling processes
 - 3.5 Evaluate suitability of materials used in rapid tooling process
 - 3.6 Evaluate tooling and process effectiveness, costs, break-even, and comparative costing relative to alternatives
 - 3.7 Review labour and skill requirements of rapid tooling process
 - 3.8 Apply systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management
- 4 Report results
- 4.1 Record results of evaluation
 - 4.2 Provide documentation, such as tool, product and process analysis, and computer-aided design (CAD) files

Required Skills and Knowledge

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

Required skills

Required skills include:

- determining technologies, parameters and context of tooling applications
- investigating sustainability implications of tooling and rapid tooling processes
- reviewing features and functions of rapid tooling processes, including assessing:
 - compliance of tooling with tool design
 - suitability of materials and equipment used in a rapid tooling process
 - efficiency of selected rapid tooling processes against other tool manufacturing processes, including cost-benefit analysis of alternative methods of rapid tooling, where applicable
 - skill and training requirements of the applicable rapid tooling processes
- identifying and evaluating rapid tooling control systems and software
- selecting and using appropriate analysis techniques and software for evaluation of rapid tooling processes
- identifying relevant WHS, regulatory and risk management compliance requirements for rapid tooling applications
- assessing software, facilities, services, plant and materials for suitability to rapid tooling applications
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of rapid tooling processes
- reporting and documenting results of scoping, principles and techniques identification and evaluation of systems, layouts, programs and flow charts

Required knowledge

Required knowledge includes:

- features and functions of additive rapid tooling processes, including:
 - 3-D printing (3-DP)
 - stereolithography (SLA)
 - selective laser sintering (SLS)
 - electron beam melting (EBM)
 - fused deposition modelling (FDM) and direct metal deposition (DMD)
 - casting (patternless and rapid pattern processes)
 - vacuum forming
 - rapid prototyping machines

- metal spray deposition
- materials for additive 'printing' processes
- materials for sprayed metal deposition
- materials for rapid casting
- other materials, including:
 - thermoplastics for vacuum forming
 - materials for rapid machining and fabrication
- tool features and functions, such as:
 - functional requirements
 - punches and dies
 - cavity shapes
 - clearances and drafts
 - heat treatment options
 - surface finishing
 - tool component assembly, location and security
- CAD design and modelling techniques to suit rapid tooling materials, machines and processes
- sustainability implications of rapid tooling and rapid processes
- typical advantages and disadvantages of rapid tooling compared to alternative or traditional system costings
- sources of support, including technical and professional assistance
- rapid tooling software principles and applications
- WHS, regulatory and risk management requirements
- typical facilities, services, plant required for rapid tooling
- systems thinking, continuous improvement, constraint and contingency management, and comparative supply chain performance
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements

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	A person who demonstrates competency in this unit must be able to evaluate rapid tooling applications for safety, economy and fitness for purpose.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • review features and functions of rapid tooling processes and the fitness for purpose of tooling produced • evaluate rapid tooling processes for efficiency and cost-benefit against alternative tool manufacturing techniques • select appropriate analysis principles, techniques and software • identify and assess compliance against relevant WHS and regulatory requirements, risk management and organisational procedures • report and document results.
Context of and specific resources for assessment	• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. • The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • 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.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering 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 must be by direct observation of tasks

	and include questioning on underpinning knowledge to ensure correct interpretation and application. • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference that competency is not only able 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

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.

Rapid tooling applications	Rapid tooling applications are typically used in: • small to medium volumes of product using sintered tools • large volumes of product using sprayed metal tools • situations where one-off tooling requirements are common and speed of tooling manufacture is important
Context of rapid tooling processes	The context of rapid tooling processes includes consideration of: • global competitive markets • product and process sustainability • lean systems • product manufacturability • facilities, services, plant and tooling requirements • supply chains • material, transfer operations • process control • labour requirements and skills distribution • information flow • systems thinking, continuous improvement, and constraint and contingency management

	• WHS, regulatory requirements and risk management
WHS, regulatory requirements and enterprise procedures	WHS, regulatory requirements and enterprise procedures may include: • WHS Acts and regulations • relevant standards • codes of practice from Australian and overseas engineering and technical associations and societies • risk assessments • registration requirements • safe work practices • state and territory regulatory requirements applying to electrical work
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular rapid tooling application
Appropriate technical and professional assistance	Appropriate technical and professional assistance may include: • technical support and advice relating to elements which have intrinsic dangers, such as: • high pressure • energised fluid vessels • high temperatures and heat energy capacity • wiring with high current control voltages above extra low voltage • professional support for technologies, such as: • specialist electric motor drives and controllers • specialist materials, plastics, metal alloys and nano materials • special processes, foundry, alloy welding, heat treatment, sealing and fastening
Sustainability	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: • meeting all regulatory requirements • conforming to all industry covenants, protocols and best practice guides • minimising ecological and environmental footprint of process, plant and product • maximising economic benefit of process plant and product to the organisation and the community • minimising the negative WHS impact on employees, community and customer
Systems thinking	Systems thinking refers to the conduct of engineering work in a

	manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
Continuous improvement implementation	Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance. Improvement processes may include techniques, such as: • balanced scorecard • current and future state mapping • measuring performance against benchmarks • process improvement, problem solving and decision making • data management, generation, recording, analysing, storing and use of software • training for improvement systems participation • technical training
Constraints and contingencies	Constraints and contingencies may be: • financial • organisational, procedural or cultural • physical constraints, such as limits to resources, limits to site access or logistical limitations

Unit Sector(s)

Competency field

Unit sector Engineering science

Custom Content Section

Not applicable.