



Australian Government

MEM23131A Evaluate rapid prototyping applications

Release: 1

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Modification History

Release 1 (MEM05v9).

Unit Descriptor

This unit of competency covers the evaluation of rapid prototyping applications using additive processes, spray deposition and casting processes, 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 prototyping for engineering-related 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	Establish scope of rapid prototyping application	1.1	Identify technology, including software, used in rapid prototyping application
		1.2	Identify purpose and product of rapid prototyping application
		1.3	Confirm stakeholders to be consulted as part of evaluation
		1.4	Confirm that appropriate support, including technical and professional assistance, is available
		1.5	Determine 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 prototyping application	2.1	Determine principles and techniques required to evaluate and optimise the rapid prototyping applications
		2.2	Select appropriate analysis and development software and software validation techniques
3	Evaluate rapid prototyping application	3.1	Assess WHS and regulatory compliance requirements and risk management practices of rapid prototyping processes
		3.2	Assess effectiveness of software for product design, process analysis and optimisation
		3.3	Determine suitability of facilities, services, plant and

- tooling for rapid prototyping processes
 - 3.4 Assess materials against specifications in design and suitability for rapid prototyping processes
 - 3.5 Review prototypes for compliance with specifications and process efficiency,
 - 3.6 Review rapid prototyping cost-effectiveness, including break-even and comparative costing relative to alternatives
 - 3.7 Review labour and skills requirement of rapid prototyping application
 - 3.8 Investigate sustainability implications of rapid prototyping application
 - 3.9 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 drawings, calculations, 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 rapid prototyping applications
- investigating sustainability implications of rapid prototyping applications
- reviewing features and functions of rapid prototyping applications
- identifying rapid prototyping principles and techniques, analysis techniques and software
- identifying relevant WHS, regulatory and risk management compliance requirements for rapid prototyping applications
- assessing software, facilities, services, plant and tooling, and materials
- analysing labour and skills distribution requirements, degree of automation and competitiveness, costs and break-even
- evaluating rapid prototyping against alternative methods and technologies
- reporting and documenting results of scoping, principles and techniques identification and evaluation of products and processes, product and process analysis, and CAD files

Required knowledge

Required knowledge includes:

- range, features and applications of rapid prototyping processes, including:
 - digitisers and reverse engineering processes
 - selective laser sintering (SLS)
 - fused deposition modelling (FDM)
 - stereolithography (SLA)
 - laminated object manufacturing (LOM)
 - electron beam melting (EBM)
 - 3-D printing (3-DP)
 - solid freeform fabrication
 - sprayed metal deposition
 - direct metal deposition (DMD)
 - casting (patternless and rapid pattern processes)
 - vacuum forming
 - rapid machining (subtractive) options
 - rapid cutting options, such as computer driven gas and laser cutting
 - robot and auto welding

- common applications for rapid prototyping, including:
 - concept modelling
 - multiple design iterations at low cost
 - form, fit and function testing prior to committing to tooling
 - market design verification prior to mass production
 - masters for vacuum forming and investment casting
 - one piece thermoplastic jigs and fixtures
 - one-off full strength plastic, cast, direct deposited metal or sprayed metal components
- sources of technical and professional assistance
- sustainability implications of rapid prototyping applications and processes
- rapid prototyping principles, techniques and software
- WHS, regulatory and risk management requirements relevant to rapid prototyping applications
- facilities, services, plant and tooling required for rapid prototyping applications
- materials used in 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
- component design processes and CAD techniques relevant to rapid prototyping processes and applications, including:
 - size limitations
 - combining components
 - digitising
 - reverse engineering
- labour and skills requirements relevant to rapid prototyping
- systems thinking, continuous improvement, and constraint and contingency management techniques
- 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 prototyping 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: • evaluate suitability of a rapid prototyping application against alternative processes • review features and functions of rapid prototyping processes • select appropriate rapid prototyping principles and techniques, analysis techniques and software • determine 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 prototyping applications	Rapid prototyping applications are typically applications with either one-off or small to medium quantities. Rapid prototypes are typically developed for: • concept modelling • multiple design iterations at low cost • form, fit and function testing prior to committing to tooling • market design verification prior to mass production • masters for vacuum forming and investment casting • one piece thermoplastic jigs and fixtures • one-off full strength plastic, cast, direct deposited metal or sprayed metal components
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
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
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular rapid prototyping application
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.