



Australian Government

MEM48034 Apply efficient materials management techniques to composite manufacturing operations

Release: 1

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Modification History

Release 1. New unit.

Application

This unit applies to technicians, supervisors and managers in fibre composite manufacturing who are required to ensure efficient use of materials in a composite manufacturing facility.

The unit scope includes the implications of design specifications and geometry for material use, material usage in low and high volume composite manufacturing, modelling of material costs through analytical techniques and prototyping, monitoring of material usage during forming and assembly, and minimising of waste material.

The unit applies to all types of composite processes and materials including monolithic and sandwich composites.

Where the manufacturing process or design requires detailed chemical knowledge, unit MEM48033 Apply chemistry principles to materials used in manufacturing and engineering processes should be selected.

Where technical skill and knowledge in materials selection across both composite and non-composite materials is required, unit MEM48030 Apply materials selection analysis techniques and its prerequisites MEM30007 Select common engineering materials and MEM30012 Apply mathematical techniques in a manufacturing, engineering or related environment should be selected.

The unit does not apply to tradespersons and operators required to manage efficient composite materials use for their own work.

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

Pre-requisite Unit

MEM48032 Select composite materials for engineering and manufacturing applications

Competency Field

Materials

Elements and Performance Criteria

Elements	Performance Criteria
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Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1. Review composite product design and estimate feedstock (raw material) quantity required	1.1 Review composite product design geometry, material specification, and quality standard 1.2 Determine product suitability for manual or automatic production techniques 1.3 Identify most efficient raw materials for the production of the composite product 1.4 Estimate amount of feedstock required to cover production requirement and waste provision
2. Model material costs	2.1 Select appropriate material cost modelling method 2.2 Cost estimated feedstock requirement 2.3 Estimate production and scrap losses during each stage of production 2.4 Cost total waste and waste for each production stage 2.5 Rank production stages from highest to lowest cost in terms of waste volume and cost
3. Test material cost model	3.1 Test model through prototyping for new products or processes 3.2 Research current state of material use and waste reporting through records analysis, walk through of workstations and consultations with employees 3.3 Determine if additional variables and waste stream data collection points are required to be included in material cost model 3.4 Finalise material cost model based on testing and research
4. Use material cost model to establish efficiency improvement goals	4.1 Use finalised material cost model to establish baseline data for material efficiency plan 4.2 Establish specific, measurable and achievable goals for material efficiency improvements for each production stage 4.3 Develop a record keeping system and standard operating procedures (SOP) system to track feedstock requisition and goal achievement for material costs, material usage, waste and scrap
5. Implement materials efficiency improvements	5.1 Develop implementation strategy for each production stage material efficiency goal 5.2 Select criteria to review strategies and prioritise for implementation 5.3 Establish responsibilities, milestones and timelines for stages selected for implementation 5.4 Commence implementation of materials efficiency strategies for

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	selected production stages including monitoring and reporting 5.5 Review results and establish continuous improvement processes for each material efficiency strategies

Foundation Skills

This section describes those language, literacy, numeracy and employment skills 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.

Common engineering composite materials include:

- polymers and plastics including:
 - linear polymers
 - thermoplastic polymers
 - thermoset polymers
 - natural and synthetic elastomers
 - crystalline polymers
 - additives including fillers, reinforcements, plasticizers, UV stabilisers, antioxidants, lubricants, colourings and flame retardants
- resins
- fibres including:
 - natural fibres and whiskers
 - metallic and non-metallic
 - carbon fibres
 - glass fibres e.g. Al₂O₃, SiC fibres
- adhesives.
- resin types including:
 - phenolic

Resins include one or more of the following:

- polyester
- alkyd
- polycarbonate
- polyurethane
- polyamide
- silicone
- epoxy
- polyethylene
- polystyrene
- polypropylene
- vinyl ester.

Implementation strategies for material efficiency goals include one or more of the following:

- changes to process requiring little or no capital cost or additional training
- product and/or process redesign to minimise/eliminate waste generation
- error reduction through new/better maintained equipment
- error reduction through additional training of employees
- changes to feedstock material
- changing from scrapping waste material to recycling/re-use
- changes in purchasing quantities, materials handling, and transport.

Unit Mapping Information

No equivalent unit

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM48034 Apply efficient materials management techniques to composite manufacturing operations

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Performance Evidence

There must be evidence the candidate has demonstrated the ability to:

- review at least two composite designs and determine if manual or automated layup would be most efficient for each design in terms of material usage
- model material costs on at least two occasions for at least one of the following manufacturing methods:
 - volume production of a composite product using automated processes
 - manufacturing of a fibre composite product requiring at least two acute part angles
 - manufacturing of a large composite product or component using manual lay up
- supervise production of at least two composite components or products and for each product:
 - determine the proportion of waste to total material used
 - determine the proportion of material cost against total production costs
 - classify material waste as either:
 - waste that is unavoidable, but which should be minimised
 - waste which should not occur
- recommend strategies to minimise waste.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

There must be evidence the candidate has knowledge of:

- composite material characteristics and their links to usage and potential for waste
- methods for modelling material costs in composite production including:
 - qualitative modelling
 - quantitative modelling using:
 - statistical data from similar design manufacturing
 - analytical data from cost examination of prototyping and sub-process steps
- the relationship between composite material costs and:
 - geometry of composite designs including part angles and other cutting and assembly requirements

- product or component size
- resin systems, including dry fibre, pre-preg, bulk moulding compounds (BMC), sheet moulding compounds (SMC), glass-mat thermoplastics (GMT), long fibre-reinforced thermoplastics (LFT), and resin injection
- curing and finishing
- sources of assembly generated material waste including:
 - cutting waste
 - pressure flashes
 - left over raw material
- manufacturing errors that lead to increased material waste including:
 - draping errors
 - assembly errors
 - fabrication errors
 - curing errors
- typical steps to reduce or eliminate material waste including:
 - design modification
 - process modification
 - preventative maintenance
 - waste powder and/or fibre recovery
 - sale or re-use of waste material
- methods available to recycle composite waste including:
 - waste preparation using mechanical grinding or shredding
 - fibre recovery using fluidised bed, pyrolysis or solvolysis.

Assessment Conditions

- Assessors must:
 - have vocational competency in applying efficient materials management techniques to composite manufacturing operations at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015 or its replacement* and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring State as the case requires.
- Where possible, assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- There must be suitable access to an operating plant or equipment that allows for appropriate and realistic simulation and documentation including relevant workplace procedures, industry codes and standards.

- 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.
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