



Australian Government

MEM48032 Select composite materials for engineering and manufacturing applications

Release: 1

MEM48032 Select composite materials for engineering and manufacturing applications

Modification History

Release 1. New unit.

Application

This unit of competency defines the technical skills and knowledge required to recognise and select composite materials for engineering and manufacturing applications, including use of test results to evaluate the suitability of composite materials for an application.

The unit applies to composite material selection tasks. The unit applies to the requirement for undertaking a formal evaluation process that considers the technical requirements of both the composite product and the manufacturing process.

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

Pre-requisite Unit

Nil.

Competency Field

Materials

Elements and Performance Criteria

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1. Identify common composite materials by their principal properties	1.1 Identify the principal properties of composite resins, reinforcing and core materials 1.2 Identify the effects of different types of bonding in composite materials 1.3 Identify the effects of mechanical and thermal processes on the principal properties of composite materials 1.4 Identify common failures of composite materials and relationship to manufacturing errors, wear and usage 1.5 Identify the effects of different types of reinforcing and core materials in composite materials

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
2. Determine requirements for composite materials selection	2.1 Review design specifications, drawings, job sheets or work instructions for composite material function, performance, commercial and environmental parameters 2.2 Review reference information for relevant data on composite parameters 2.3 Prepare list of constraints and objectives for composite material selection 2.4 Identify any requirement for expert technical or professional assistance
3. Select composite materials for specific manufacturing and engineering related applications	3.1 Determine the least constrained composite materials for the requirement 3.2 Select potential composite material based on the requirement and consideration of principal properties and further processing 3.3 Arrange appropriate tests to confirm suitability of selected composite materials 3.4 Review test results and use the information in the selection process 3.5 Confirm selection according to standard operating procedures 3.6 Produce composite materials selection report including traceability records for material selection process, recommendations, and supporting data

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance and are explicit in the performance criteria of this unit of competency.

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 filters, 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. Al_2O_3, SiC fibres - adhesives.
Resins include one or more of the following:	- resin types including: - phenolic - polyester - alkyd - polycarbonate - polyurethane - polyamide - silicone - epoxy - polyethylene - polystyrene - polypropylene - vinyl ester.
Appropriate tests include those:	- undertaken by employees within the organisation - required to be undertaken by external organisations.
Required properties to be tested include:	- tensile strength - compression - shear characteristics - torsion - hardness - impact resistance - fatigue resistance - creep resistance - visual appearance and colour

	• corrosion resistance. • UV stability • flammability.
Appropriate persons include:	• internal technicians • external organisations.

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 MEM48032 Select composite materials for engineering and manufacturing applications

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Performance Evidence

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

- follow work instructions, standard operating procedures (SOPs) and safe work practices
- identify and interpret specifications, drawings, job sheets and other applicable reference documents in selecting composite materials for engineering applications
- research common composites and natural materials for engineering applications by their required properties for a specific application on at least two occasions
- select tests appropriate for the selected material
- arrange tests appropriate to the non-metallic material and analyse the results on at least two occasions
- verify selection of materials.

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:

- safe work practices and procedures and use of personal protective equipment (PPE)
- bonding processes within and between composites including:
- adhesion and substrate/resin interactions and control mechanisms
- types of polymers and plastics used in composites including:
 - linear polymers: e.g., polyethylene, PVC, polystyrene
 - elastomers including natural rubber (polyisoprene), (acrylonitrile butadiene)
 - thermosetting polymers: e.g. phenol formaldehyde, epoxides
 - inorganic glasses: e.g., oxide glasses, silica, borosilicate
 - gels
- common features and difference between monomers and polymers
- thermoplastics and thermosets
- crystallinity and non-crystallinity features in polymers
- additives including fillers, reinforcements, plasticizers, UV stabilisers, antioxidants, lubricants, colourings and flame retardants
- safe working practices to take into account when selecting composite materials with silica and quartz-based fillers
- common resins used in composite materials and their applications, including:

- phenolic
- polyester
- alkyd
- polycarbonate
- polyurethane
- polyamide
- silicone
- epoxy
- polyethylene
- polystyrene
- polypropylene resins
- vinyl ester
- failure modes of common composites and relationship to manufacturing errors, wear and incorrect usage or maintenance
- principles involved in selecting composite materials
- common engineering related properties of composites
- composite properties commonly requiring testing and testing methods.
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Assessment Conditions

- Assessors must:
 - have vocational competency in selecting composite materials for engineering and manufacturing applications 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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