



**Australian Government**

# **MEM23063 Select and organise mechanical engineering material tests**

**Release: 1**

# MEM23063 Select and organise mechanical engineering material tests

## Modification History

Release 1. Supersedes and is equivalent to MEM23063A Select and test mechanical engineering materials

## Application

This unit of competency defines the skills and knowledge required to interpret design information for material and material test requirements, select appropriate tests and use results in the selection of appropriate materials for mechanical and manufacturing engineering-related applications. It applies to mechanical and manufacturing engineering applications in mass production, batch production, jobbing shop and prototyping. Activities are generally performed as a member of a design and development team.

Within this unit, mechanical engineering is defined as the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of mechanical products, processes, systems or services for converting energy into power and motion, materials into product and components into machines and systems. Manufacturing engineering is defined as the conceptual development, design, manufacture, construction, implementation, installation, optimisation, commissioning and maintenance of resources and processes employed for the manufacture of product and components, machines and systems.

The unit applies to mechanical engineering or related activities and is suitable for people giving technical support to production activities and those pursuing technical qualifications and careers at paraprofessional or technician level.

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

## Pre-requisite Unit

MEM23004 Apply technical mathematics

MEM23109 Apply engineering mechanics principles

## Competency Field

Engineering science

## Elements and Performance Criteria

| Elements | Performance Criteria |
|----------|----------------------|
|----------|----------------------|

| <i>Elements describe the essential outcomes.</i>                                               | <i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Distinguish classes of engineering materials, based on properties and materials tests       | <p>1.1 Follow standard operating procedures (SOPs) and comply with work health and safety (WHS) requirements at all times</p> <p>1.2 Relate material properties to common mechanical and manufacturing engineering methods and processes</p> <p>1.3 Identify common characteristics, faults or flaws in materials, components and product</p> <p>1.4 Identify engineering-related test methods for materials and components or product properties</p> <p>1.5 Identify common industrial test standards and codes, calibration requirements, regulations and authorities relevant to selection of materials and products for mechanical and manufacturing engineering applications</p> |
| 2. Utilise sources of information on engineering materials, materials tests and test equipment | <p>2.1 Review design information for material specifications and required material tests</p> <p>2.2 Identify and use appropriate sources of information on materials, material tests and test calibration</p> <p>2.3 Identify and use appropriate sources of information on methods of testing of properties of materials</p> <p>2.4 Investigate and report on relevant standards and codes</p> <p>2.5 Identify and use appropriate sources of information on safety data sheets (SDS)</p> <p>2.6 Establish availability of technical and professional assistance</p>                                                                                                                 |
| 3. Determine the properties of engineering materials                                           | <p>3.1 Specify required materials tests and determine the quality, safety and suitability for applications</p> <p>3.2 Ensure traceability of measurement standard</p> <p>3.3 Obtain test sheets and/or certificates for appropriate materials for applications in accordance with organisational procedures and/or codes and regulations</p> <p>3.4 Obtain appropriate SDS for applications in accordance with organisational procedures and/or codes and regulations</p>                                                                                                                                                                                                             |
| 4. Determine suitable materials                                                                | <p>4.1 Select materials for use in mechanical or manufacturing engineering applications based on relevant test information</p> <p>4.2 Incorporate materials and components into mechanical and manufacturing processes in accordance with design functional requirements</p>                                                                                                                                                                                                                                                                                                                                                                                                          |

| Elements                                         | Performance Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Elements describe the essential outcomes.</i> | <i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 5. Report and record outcomes                    | <p>5.1 Report and record materials selections against design functional requirements in accordance with organisational procedures, codes and regulations</p> <p>5.2 Undertake any required environmental impact and sustainability assessment</p> <p>5.3 Report and record materials tests and test sheets or certificates in accordance with organisational procedures, codes and regulations, including appropriate calibration and traceability</p> <p>5.4 Report and record appropriate SDS for applications in accordance with organisational procedures, codes and regulations</p> |

## 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

### 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.

|                                                                                    |                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Classes of materials include:                                                      | <ul style="list-style-type: none"> <li>• nonferrous metals and alloys</li> <li>• ferrous metals</li> <li>• non-metals including timber, concrete, ceramics, polymers and fabrics, adhesives and lubricants</li> <li>• thermal and electrical conductors and insulators.</li> </ul> |
| Properties and characteristics of materials includes one or more of the following: | <ul style="list-style-type: none"> <li>• strength</li> <li>• elasticity</li> <li>• plasticity</li> <li>• malleability</li> <li>• hardness</li> <li>• toughness</li> </ul>                                                                                                          |

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|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                | <ul style="list-style-type: none"> <li>• brittleness</li> <li>• fatigue endurance</li> <li>• mouldability</li> <li>• weldability</li> <li>• machinability</li> <li>• formability</li> <li>• resistance to creep and stress relaxation</li> <li>• resistance to degradation</li> <li>• susceptibility to corrosion</li> <li>• conductivity and resistance – both thermal and electrical</li> <li>• the effect of manufacturing and construction processes on material properties.</li> </ul>                                                                                                                                                                                                             |
| Tests of materials includes one or more of the following destructive or non-destructive tests: | <ul style="list-style-type: none"> <li>• destructive: <ul style="list-style-type: none"> <li>• tensile</li> <li>• compression</li> <li>• impact</li> <li>• hardness</li> <li>• fatigue</li> <li>• corrosion</li> <li>• stress relaxation and creep</li> <li>• fatigue and peel resistance (adhesives)</li> </ul> </li> <li>• non-destructive: <ul style="list-style-type: none"> <li>• hardness</li> <li>• ultrasonics</li> <li>• X-ray</li> <li>• die penetrant</li> <li>• eddy current</li> <li>• surface friction</li> <li>• conductivity</li> <li>• heat expansion</li> <li>• photoelasticity</li> <li>• heat capacity refractive index</li> <li>• magnetic hysteresis loop.</li> </ul> </li> </ul> |

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## Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23063A Select and test mechanical engineering materials.

## 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 MEM23063 Select and organise mechanical engineering material tests

## Modification History

Release 1. Supersedes and is equivalent to MEM23063A Select and test mechanical engineering materials

## Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include:

- reviewing design information for materials and materials test requirements
- selecting classes of materials for applications, for further research, testing and evaluation, based on comparison of properties relevant to design
- identifying standards, codes and regulatory requirements relevant to materials testing and application
- identifying test methods for properties of, and faults and flaws in, materials and components on at least two occasions
- specifying and organising appropriate tests and test methods and interpreting test results for material selection on at least two occasions
- selecting materials consistent with test results, design and regulatory requirements
- applying environmental and sustainability requirements to materials selection
- ensuring traceability in material selection process
- documenting all results and tests in accordance with procedures.

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

## Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- properties of materials classes
- effect of material properties, faults or flaws on mechanical and manufacturing engineering methods and processes
- test methods and procedures for materials and components, including specific industrial test standards, regulations and authorities related to mechanical engineering applications
- test methods for faults or flaws in materials and components or product
- sources and uses of information on materials and materials tests, including test certificates, regulations, standards, regulatory bodies and industrial authorities
- methods of accessing safety data sheets (SDS)
- significance of test sheets and certificates to applications
- significance of SDS and relevance of procedures

- materials selections in relation to design functional requirements
- environmental impact and sustainability assessment
- significance of test procedures, reports and documentation to applications, including the need for obtaining and filing test sheets and certificates
- significance of test calibration and traceability
- safe work practices and procedures and use and application of personal protective equipment (PPE)
- hazards and control measures associated with selecting and testing mechanical engineering materials including housekeeping.
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## Assessment Conditions

- Assessors must:
  - have vocational competency in selecting and organising tests of mechanical engineering materials 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/territory 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.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- 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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