



Australian Government

Department of Education, Employment and Workplace Relations

MEM23061A Select and test mechanical engineering materials

Release: 1

MEM23061A Select and test mechanical engineering materials

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers selecting appropriate materials and material and component tests for mechanical and manufacturing engineering applications.
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Application of the Unit

Application of the unit	<p>Applications of this unit include selecting engineering materials and material tests, sourcing materials data; ensuring appropriate performance and physical standards for mechanical and manufacturing applications; documenting materials tests, ensured calibration standards; interpreting and documenting materials data sheets as appropriate for mass production, batch production, jobbing shop, and prototyping applications.</p> <p>Activities may be performed as a member of a design and development team.</p> <p>This unit only has application in qualifications that are not points based.</p> <p>Band: 0</p> <p>Unit Weight: 0</p>
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Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.
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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. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<p>1. Identify classes of materials, based on properties and materials tests relevant to mechanical and manufacturing engineering</p>	<p>1.1. Identify classes of materials, based on properties, required for particular mechanical and manufacturing engineering applications.</p> <p>1.2. Relate material properties to common production and construction methods and processes.</p> <p>1.3. Identify common characteristics, faults or flaws in materials and components or product in particular engineering applications.</p> <p>1.4. Identify test methods for materials and components or product in particular engineering applications.</p> <p>1.5. Identify specific industrial test standards/codes, calibration requirements, regulations and authorities related to selection of materials and products for</p> <p>1.6. particular engineering applications.</p> <p>1.7. Investigate the role of Australia's national measurement system.</p>
<p>2. Identify and use sources of information on engineering materials, materials tests and test equipment including manufacturers' catalogues and websites</p>	<p>2.1. Identify and use appropriate sources of information on materials.</p> <p>2.2. Identify and use appropriate sources of information on methods of testing of properties of materials to ensure suitability for a particular application.</p> <p>2.3. Identify and use appropriate sources of information on materials, materials tests, test calibration, test certificates, regulations, standards, standards councils/societies/authorities/regulatory bodies. Investigate and report on the use of standards and codes.</p> <p>2.4. Identify and use appropriate sources of information on Materials Safety Data Sheets (MSDS).</p>
<p>3. Specify and implement methods used to test or obtain the properties of engineering materials</p>	<p>3.1. Required materials tests are specified and implementation of tests is managed to ensure quality, safety or suitability for a range of applications. Ensure traceability of measurement standard.</p> <p>3.2. Obtain Test Sheets / certificates for appropriate materials for applications in accordance with organisational procedures and/or codes and</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>regulations.</p> <p>3.3. Obtain appropriate Materials Safety Data Sheets (MSDS) for applications in accordance with organisational procedures and/or codes and regulations.</p>
<p>4. Select and implement materials for mechanical/manufacturing</p>	<p>4.1. Materials are selected for use in given mechanical/manufacturing engineering applications based on relevant test information</p> <p>4.2. Materials and components are incorporated into mechanical and manufacturing processes in accordance with design functional requirements</p>
<p>5. Report on and record materials design data and methods and results of materials tests</p>	<p>5.1. Report and record materials selections against design functional requirements in accordance with organisational procedures, codes and regulations. Include environmental impact and sustainability assessment.</p> <p>5.2. Report and record materials tests and test sheets/certificates in accordance with organisational procedures, codes and regulations. Ensure appropriate calibration and traceability.</p> <p>5.3. Report and record appropriate Materials Safety Data Sheets (MSDS) for applications in accordance with organisational procedures, codes and regulations.</p>

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Look for evidence that confirms skills in:

- selecting class of materials for an application based on comparison of properties for a significant range of materials classes
- selecting class of materials for an application suitable to production and construction methods and processes
- identifying, overcoming or compensating for common characteristics, faults or flaws in materials or product
- identifying test methods for materials and components, specific industrial test

REQUIRED SKILLS AND KNOWLEDGE

- standards and regulations for particular engineering applications
- identifying test methods for faults or flaws in materials and components or product
- selecting materials following an extensive search of appropriate sources of information including manufacturer's catalogues and websites
- selecting appropriate tests from a range of possible tests, following an extensive search of appropriate sources of information including manufacturer's catalogues and websites
- satisfying applicable standards and regulations for materials and components
- sourcing materials test certificates and using the material properties information from them
- sourcing and implementing Materials Safety Data Sheets
- implementing tests correctly for materials and component faults and properties of materials
- selecting testing methods appropriate to applications
- obtaining appropriate test sheets / certificates for applications
- obtaining appropriate Materials Safety Data Sheets (MSDS) for application
- completing reports, records and design documentation
- addressing environmental impact and sustainability issues
- reporting, recording and filing test reports and documentation
- implementing materials tests and test sheets/certificates, test calibration and traceability

Required knowledge

Look for evidence that confirms knowledge of:

- properties of materials classes
- the effect of material properties on production and construction methods and processes
- the effect of characteristics, faults or flaws in materials on product and processes
- test methods for materials and components, specific industrial test standards, regulations and authorities related to particular engineering applications
- test methods for faults or flaws in materials and components or product
- methods of accessing and using alternative information sources
- test procedures and typical applications for tests
- sources and uses of information on materials, materials tests, test certificates, regulations, standards, regulatory bodies and industrial authorities
- methods of accessing Materials Safety Data Sheets (MSDS)
- identification of materials for an application based on comparison of properties of materials
- identification of test for an application based on an understanding of its ability to measure specific material or product properties
- significance of test sheets / certificates to applications

REQUIRED SKILLS AND KNOWLEDGE

- the need for obtaining and filing test sheets / certificates
- significance of MSDSs and relevance of procedures
- materials selections in relation to design functional requirements
- environmental impact and sustainability assessment
- significance of test reports and documentation to applications
- significance of reporting and recording procedures
- significance of materials tests and test sheets/certificates, test calibration and traceability
- significance of MSDS to applications
- significance of reporting and recording procedures

Evidence Guide

EVIDENCE GUIDE	
<p>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.</p>	
Overview of assessment	<p>A person who demonstrates competency in this unit must be able to select and test mechanical engineering materials.</p>
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
Context of and specific resources for assessment	<p>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, that is the candidate is not in productive work, then an appropriate simulation 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. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and testing mechanical engineering materials or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
Method of assessment	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
Guidance information for	

EVIDENCE GUIDE**assessment****Range Statement****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.

Classes of materials, based on properties

- **Classes of materials:**
 - non-ferrous metals and alloys - copper, aluminium, zinc, lead, tin and their alloys
 - ferrous metals - carbon steels, alloy steels, cast irons; bearing materials; lubricants
 - non-metals - timber, concrete, ceramics, polymers and fabrics, adhesives, electrical insulation materials; thermal conductors and insulators; electrical conductors, semiconductors and insulators
- **Properties of materials:**
 - strength, elasticity, plasticity, malleability, toughness, brittleness, fatigue endurance, mouldability, weldability, machinability, formability, resistance to creep and stress relaxation, resistance to degradation (eg. use of plastic fillers to enhance UV resistance), adhesion; electrical, magnetic, thermal, chemical and optical; material structure and effect on properties
- **Other factors:**
 - corrosion and corrosion protection methods.
 - the effect of manufacturing and construction processes on material properties.
 - the effect of property enhancement on design (eg. adhesives plus sintering

RANGE STATEMENT	
	<p>replacing some forging and machining of gears on shafts)</p> <ul style="list-style-type: none"> • Cost: <ul style="list-style-type: none"> • manufacture of material and source of material; typical applications and possibilities
Mechanical engineering	The engineering discipline concerned with 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 for domestic, industrial, public or private services, entertainment and military applications.
Manufacturing engineering	Manufacturing engineering includes 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 for domestic, commercial, industrial, entertainment, civil, medical or military applications
Australia's national measurement system	National Measurement Institute (legal metrology); Commonwealth Scientific and Research Organisation (physical standards); National Association of Testing Authorities, Aust. (Laboratory accreditation); Standards Australia International Ltd (AS standards specifications)
Sources of information	Includes reference texts, manufacturer's catalogues and industrial magazines, websites, use of phone, email and fax information gathering.
Standards councils/ societies/ authorities/regulatory bodies	AS: Australian; ASTM : American Society of Testing materials; MIL Spec.:US Military Specification; ASME: American Society of Manufacturing Engineers; ISO : International Standards Organisation

RANGE STATEMENT	
Standards and codes	NDT and mechanical test standards; chemical test standards; electrical test standards; compliance test standards for components
Tests of materials	<ul style="list-style-type: none"> • Destructive including tensile, compression, impact, hardness, fatigue, corrosion, stress relaxation and creep, fatigue , peel resistance (adhesives). • Non Destructive including Hardness, Ultrasonics, X-ray, Die Penetrant, Eddy current, Surface Friction, conductivity, heat expansion, photoelastic. Heat capacity refractive index, magnetic hysteresis loop.
Traceability	Test calibrations can be traced back to the relevant base unit in the relevant Measurement System

Unit Sector(s)

Unit sector	
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Co-requisite units

Co-requisite units	

Competency field

Competency field	Engineering science
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