



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **MEA273A Select and test avionic engineering materials**

**Revision Number: 2**

## **MEA273A Select and test avionic engineering materials**

### **Modification History**

Minor formatting and editorial changes made.

### **Unit Descriptor**

This unit of competency covers selecting appropriate materials and materials and components tests for avionic engineering applications.

### **Application of the Unit**

Applications of this unit include selecting engineering materials and materials tests; sourcing materials data; ensuring appropriate performance and physical standards for avionic applications; documenting materials tests; ensuring calibration standards; and interpreting and documenting materials data sheets, as appropriate for mass production, batch production, jobbing shop and prototyping applications.

Activities may be performed as a member of a design and development or engineering support team.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

<p>Elements describe the essential outcomes of a unit of competency.</p>	<p>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.</p>
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## Elements and Performance Criteria

1. Identify classes of materials, based on properties and materials tests relevant to avionic engineering
  - 1.1. *Classes of materials, based on properties*, required for particular *avionic engineering* applications are identified
  - 1.2. Material properties are related to common production and construction methods and processes
  - 1.3. Common characteristics, faults or flaws in materials and components or product in particular engineering applications are identified
  - 1.4. Test methods for materials and components or product in particular engineering applications are identified
  - 1.5. Specific industrial test standards/codes, calibration requirements, regulations and authorities related to selection of materials and products for particular engineering applications are identified
  - 1.6. The role of *Australia's national measurement system* is investigated
2. Identify and use sources of information on engineering materials, materials tests and test equipment, including manufacturers' catalogues and websites
  - 2.1. Appropriate *sources of information* on materials are identified and used
  - 2.2. Appropriate sources of information on methods of testing of properties of materials are identified and used to ensure suitability for a particular application
  - 2.3. Appropriate sources of information on materials, materials tests, test calibration, test certificates, regulations, standards, *standards councils/societies/authorities/regulatory bodies* are identified and used
  - 2.4. The use of *standards and codes* are investigated and reported on
  - 2.5. Appropriate sources of information on MSDS are identified and used
3. Specify and implement materials for particular avionic engineering applications
  - 3.1. Methods used to test or obtain the properties of engineering materials are specified and implemented
4. Specify and implement methods used to test or obtain the properties of engineering materials
  - 4.1. *Tests of materials* are specified and implemented to ensure quality, safety or suitability for a range of applications
  - 4.2. *Traceability* of measurement standard is ensured
  - 4.3. Test sheets/certificates for appropriate materials are obtained for applications in accordance with organisational procedures and/or codes and regulations
  - 4.4. Appropriate MSDS are obtained for applications in

- accordance with organisational procedures and/or codes and regulations
5. Report on and record materials design data and methods and results of materials tests
    - 5.1. Materials selections are reported and recorded against design functional requirements in accordance with organisational procedures, codes and regulations including environmental impact and sustainability assessment
    - 5.2. Materials tests and test sheets/certificates are reported and recorded in accordance with organisational procedures, codes and regulations
    - 5.3. Appropriate calibration and traceability are ensured
    - 5.4. Appropriate MSDS are reported and recorded for applications in accordance with organisational procedures, codes and regulations

## Required Skills and Knowledge

### 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
- obtaining appropriate test sheets/certificates for applications
- obtaining appropriate 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
- identifying test methods for materials and components, specific industrial test 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 MSDS
- implementing tests correctly for materials and component faults and properties of materials
- selecting testing methods appropriate to applications

### 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 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
- the need for obtaining and filing test sheets/certificates
- significance of MSDS 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

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.

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to select and test avionic engineering materials.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<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> <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.</p>
<b>Context of and specific resources for assessment</b>	<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>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>
<b>Method of assessment</b>	<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 aeronautical engineering materials or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	





## 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 include:

- non-ferrous metals and alloys (copper, aluminium, zinc, lead, tin and their alloys), ferrous metals (carbon steels, alloy steels, cast irons), non-metallic composite materials, bearing materials, lubricants, non-metals (timber, ceramics, polymers and fabrics, adhesives, electrical insulation materials), thermal conductors and insulators, electrical conductors, semiconductors and insulators

Properties of materials include:

- strength, elasticity, plasticity, malleability, toughness, brittleness, fatigue endurance, mouldability, weldability, machinability, formability, resistance to creep and stress relaxation, resistance to degradation (e.g. use of plastic fillers to enhance UV resistance), adhesion (electrical, magnetic, thermal, chemical and optical), material structure and effect on properties

Other factors include:

- corrosion and corrosion protection methods
- the effect of manufacturing and construction processes on material properties
- the effect of property enhancement on design (e.g. adhesives plus sintering replacing some forging and machining of gears on shafts)

Cost includes:

- manufacture of material and source of material, typical applications and possibilities

**Avionic engineering**

Avionic engineering refers to:

- the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications

<b>Australia's national measurement system</b>	Australia's national measurement system includes: <ul style="list-style-type: none"> <li>• National Standards Commission (legal metrology)</li> <li>• Commonwealth Scientific and Research Organisation (physical standards)</li> <li>• National Association of Testing Authorities, Aust. (Laboratory accreditation)</li> <li>• Standards Australia International Ltd (AS standards specifications)</li> </ul>
<b>Sources of information</b>	Sources of information includes: <ul style="list-style-type: none"> <li>• reference texts, manufacturer's catalogues and industrial magazines</li> <li>• websites, use of phone, email and fax information gathering</li> </ul>
<b>Standards councils/societies/authorities/regulatory bodies</b>	Standards councils/societies/authorities include: <ul style="list-style-type: none"> <li>• Australian Standards</li> <li>• ASTM</li> <li>• MIL Spec.</li> <li>• ASME</li> <li>• ISO</li> </ul> Regulatory bodies include: <ul style="list-style-type: none"> <li>• CASA</li> <li>• ADF</li> <li>• United States FAA</li> <li>• European Joint Aviation Authority</li> </ul>
<b>Standards and codes</b>	Standards and codes include: <ul style="list-style-type: none"> <li>• NDT and mechanical test standards</li> <li>• chemical test standards</li> <li>• electrical test standards</li> <li>• compliance test standards for components</li> </ul>
<b>Tests of materials</b>	Tests of materials include: <ul style="list-style-type: none"> <li>• destructive, including tensile, compression, impact, hardness, fatigue, corrosion, stress relaxation and creep, and peel resistance (adhesives)</li> <li>• non-destructive, including hardness, ultrasonics, X-ray, dye penetrant, eddy current, surface friction, conductivity, heat expansion, photoelastic, heat capacity refractive index, and magnetic hysteresis loop</li> </ul>
<b>Traceability</b>	Traceability ensures: <ul style="list-style-type: none"> <li>• test calibrations can be traced back to the relevant base</li> </ul>

	unit in the relevant measurement system
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**Unit Sector(s)**

Engineering science

**Competency field****Co-requisite units**

Not applicable