



Australian Government

MEM24020 Apply materials technology principles to non-destructive tests

Release: 1

MEM24020 Apply materials technology principles to non-destructive tests

Modification History

Release 1: New unit.

Application

This unit of competency defines the skills and knowledge required to determine an appropriate strategy for a non-destructive test and interpret the test results, based on the composition, properties and behaviour of manufactured products.

Personnel are required to determine the most appropriate non-destructive test strategy and technique(s) for a particular application based on their capabilities and limitations for detecting specific discontinuities in metals, alloys and/or composites/plastics.

This unit of competency applies to non-destructive testing (NDT) level 2 and 3 technicians and other technicians and metallurgists who interpret NDT test results for processes used in manufacturing, maintenance, mining, oil/gas, and other industry sectors.

Where reading and interpretation of technical drawings is required, unit MEM09229 Read and interpret technical drawings should also be selected.

Where the selection and use of engineering measurement is required, unit MEM12023 Perform engineering measurements should also be selected.

Where the selection and use of hand tools are required, unit MEM18001 Use hand tools should also be selected.

Where the selection and use of power tools are required, unit MEM18002 Use power tools/hand held operations should also be selected.

No licensing or legislative requirements apply to this unit at the time of publication. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712 Non-destructive testing — Qualification and certification of personnel.

Band: B

Unit Weight: 8

Pre-requisite Unit

MEM30007 Select common engineering materials

Competency Field

Non-destructive testing

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. Apply general principles of non-destructive testing to materials and products	1.1 Check that specified non-destructive testing method, access and set-up requirements will leave material and product usable after NDT 1.2 Review general principles of calibration and uncertainty of measurement for implications for NDT request 1.3 Identify safety and environmental considerations of test methods 1.4 Comply with work health and safety requirements (WHS)
2. Review the properties of products and materials specified for non-destructive testing	2.1 Identify provided materials and products for consistency with specifications 2.2 Review material physical and mechanical properties and identify properties relevant to specified NDT 2.3 Review the implications of the manufacturing processes and use and operating conditions of provided products for NDT strategy
3. Determine test strategy and techniques for a product	3.1 Apply knowledge of material and product properties to predict the most likely failure modes, discontinuities and defects present and their significance 3.2 Identify an appropriate test strategy from standards, codes and standard operating procedures 3.3 Select appropriate test techniques to provide reliable data to confirm product integrity or detect degradation 3.4 Report findings including the methodology used and the advantages and limitations of the recommended test strategy and techniques.

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.

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|---|---|
| Materials include one or more of the following: | <ul style="list-style-type: none">• ferrous metals, nonferrous metals and alloys• polymers• ceramics• composites• glasses• natural materials. |
| Defects in weldments include one or more of the following: | <ul style="list-style-type: none">• cracks• lack of fusion• cavities• imperfect shape• solid inclusions. |
| Casting methods include one or more of the following: | <ul style="list-style-type: none">• die casting• sand casting• investment casting. |
| Defects in metal and alloy castings include one or more of the following: | <ul style="list-style-type: none">• shrinkage cavities• hot tears• cold cracks• gas holes• segregation• cold shuts. |
| Forging/wrought methods include one or more of the following: | <ul style="list-style-type: none">• upset forging, die forging, smith forging• rolling• extrusion• annealing. |
| Defects in forgings/wrought materials include one or more of the following: | <ul style="list-style-type: none">• bursts• laps• seams• inclusions• stringers• laminations• burning• flakes• cracking. |

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.

Fabrication methods for composites/plastics include one or more of the following:

- open moulding
- resin infusion processes
- high volume and automated methods.

Defects in composites/plastics include one or more of the following:

- laminations
- disbonds
- foreign objects
- uncured composites
- moulding discontinuities.

Principles of mechanical testing include one or more of the following:

- impact
- tensile
- hardness testing.

In-service discontinuities/defects include one or more of the following:

- corrosion modes and types
- erosion modes and types
- cracking.

Standards and codes include:

- the latest version of all relevant Australian and international standards and codes applicable to non-destructive testing of the material/product
- codes of practice from Australian and overseas engineering and technical associations and societies.

WHS, regulatory requirements and workplace procedures include:

- WHS Acts and regulations
- industry codes of practice
- risk assessments
- safe work practices
- workplace documents such as workplace procedures or SOPs
- equipment manuals
- quality procedures
- calibration and maintenance schedules; material safety data sheets (MSDS) safety procedures; and work schedules
- workplace recording and reporting procedures
- waste minimisation, containment, processing and safe disposal procedures.

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 MEM24020 Apply materials technology principles to non-destructive tests

Modification History

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Performance Evidence

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

- select and document an NDT strategy and techniques for a specified NDT method for at least three manufactured products to confirm integrity or detect degradation with details of methodology used and advantages and limitations of possible options and with supporting arguments for preferred NDT strategy
- assess the materials present in at least three manufactured products and relate the structure and composition of each product to its physical and mechanical properties
- report on the effects of manufacturing processes, product use, and operating conditions on the structure, integrity and physical/mechanical properties of at least two manufactured products.

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:

- requirements of all applicable industry standards, national/Australian standards, Safe Work Australia guidelines, and state/territory regulatory codes of practice/standards relevant to NDT used in job role
- principles of solidification and crystal structures in metals including:
 - classification of materials
 - structure of atoms
 - process of solidification and defects formed during solidification
 - crystal structures and modification of crystal structure
 - heat treatment processes and defects formed during heat treatment
- information contained in equilibrium diagrams representative of a range of metals including aluminium, iron, steel and common nonferrous alloys:
 - alloy systems
 - solid and liquid solubility
 - basic equilibrium diagrams for common alloys
- principles of fusion welding relevant to NDT
- defects in fusion welding
- processing and service defects

- grinding, pickling, heat treatment, fatigue, corrosion and stress corrosion cracks
- principles of casting and common defects in castings
- principles of forging and common defects in forging
- principles of fabrication of composites/plastics and common defects in composites/plastics
- principles of mechanical, tensile, impact, hardness and fatigue testing
- standard recording and reporting formats and procedures for reporting test results, job records, routine reports
- hazards, health, safety and environment requirements relevant to job role.
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying materials technology principles to NDT 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.
- There must be 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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