



Australian Government

MEM24012 Apply metallurgical principles

Release: 1

MEM24012 Apply metallurgical principles

Modification History

Release 1. Supersedes and is equivalent to MEM24012C Apply metallurgy principles.

Application

This unit of competency defines the skills and knowledge required to apply basic metallurgical principles to the selection of appropriate non-destructive testing (NDT) techniques and interpretation of the results of NDT tests for metallurgical processes.

It applies to knowledge of metallurgical principles, and the relationship between the various non-destructive testing methods and their capabilities and limitations when applied to the detection of specific discontinuities in metals and alloys.

The unit applies to employees who select and order NDT tests and who interpret results provided by tests for metal manufacturing, casting, shaping, and joining processes. It does not involve conduct of NDT tests.

Where materials and chemicals which are subject to codes and regulations are stored and used - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - safe work habits must be considered.

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

Band: B

Unit Weight: 4

Pre-requisite Unit

MEM13015 Work safely and effectively in manufacturing and engineering

MEM16006 Organise and communicate information

Competency Field

Non-destructive testing

Unit Sector

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>

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. Determine job requirements	1.1 Follow standard operating procedures (SOPs) 1.2 Comply with work health and safety (WHS) requirements at all times 1.3 Identify job requirements from specifications
2. Interpret and apply the principles of solidification and crystal structures and equilibrium diagrams in metals and alloys	2.1 Interpret principles of solidification and crystal structures in metals and alloys and apply in relation to NDT techniques 2.2 Source and interpret equilibrium diagrams for metals and alloys
3. Interpret and apply the principles for fusion welding of metals and alloys	3.1 Apply principles and methods for fusion welding of metals and alloys to NDT test selection 3.2 Identify defects in weldments and classify from NDT test results
4. Interpret and apply the principles of the formation of castings	4.1 Apply principles and methods used to produce metal castings to NDT test selection 4.2 Identify defects in metal and alloy castings and classify from NDT test results
5. Interpret and apply the principles of steel forging	5.1 Apply principles and methods used to produce steel forgings to NDT test selection 5.2 Identify defects in steel forgings and classify from NDT test results
6. Interpret and apply the principles of mechanical testing	6.1 Apply principles of mechanical testing to NDT test selection 6.2 Identify defects in metal product and classify from NDT test results

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.

Principles and methods for fusion welding of metals and alloys include:	• manual metal arc welding (MMAW) • submerged arc welding (SAW) • gas metal arc welding (GMAW) • gas tungsten arc welding (GTAW) • flux core arc welding (FCAW).
Defects in weldments include:	• cracks • lack of fusion • cavities • imperfect shape • solid inclusions • miscellaneous.
Defects in metal and alloy castings include:	• shrinkage cavities • hot tears • cold cracks • gas holes.
Principles and methods used to produce steel forgings include:	• deformations • strengthening mechanisms • annealing.
Principles of mechanical testing include:	• impact • tensile • hardness testing.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM24012C Apply metallurgy principles.

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 MEM24012 Apply metallurgical principles

Modification History

Release 1. Supersedes and is equivalent to MEM24012C Apply metallurgy principles.

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:

- following work instructions, standard operating procedures (SOPs) and safe work practices
- researching and applying metallurgical principles associated with selecting non-destructive testing (NDT) appropriate to metal or alloy and manufacturing process
- interpreting and applying principles and methods for fusion welding of metals and alloys in weldments on at least two occasions
- identifying defects in weldments
- identifying defects in metal and alloy castings
- interpreting and applying principles and methods used to produce steel forging on at least two occasions
- interpreting and applying principles of mechanical testing on at least two occasions
- identifying and classifying all defects from NDT test results on at least two occasions.

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:

- safe work practices and procedures
- principles of solidification and crystal structures in metal 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
- meaning of equilibrium diagrams representative of metals including aluminium, iron, steel and common nonferrous alloys including:
 - alloy systems
 - solid and liquid solubility
 - basic equilibrium diagrams for common alloys

- principles of fusion welding in relation to NDT testing
- defects in fusion welding including:
 - processing and service defects
 - grinding
 - pickling
 - heat treatment
 - fatigue
 - corrosion and stress corrosion cracks
- principles of the formation of castings
- defects in castings
- principles of steel forging
- defects in steel forging
- principles and methods for fusion welding of metals and alloys including:
 - manual metal arc welding (MMAW)
 - submerged arc welding (SAW)
 - gas metal arc welding (GMAW)
 - gas tungsten arc welding (GTAW)
 - flux core arc welding (FCAW)
- defects in weldments including:
 - cracks
 - lack of fusion
 - cavities
 - imperfect shape
 - solid inclusions
- defects in metal and alloy casting including:
 - shrinkage cavities
 - hot tears
 - cold cracks
 - gas holes
- principles and methods used to produce steel forgings including:
 - deformations
 - strengthening mechanisms
 - annealing
- principles of mechanical testing including:
 - impact
 - tensile
 - hardness testing.

Assessment Conditions

- Assessors must:

- have vocational competency in applying metallurgical principles 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.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>