

## MEM24012B Apply metallurgy principles

<b>Unit descriptor</b>	This unit covers applying basic metallurgy principles related to non-destructive testing techniques (NDT).
<b>Prerequisites</b>	None
<b>Competency field</b>	Non-destructive testing
<b>Application of the competency</b>	<p>This unit applies to knowledge of metallurgy 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.</p> <p>Such variables as the type of discontinuity, manufacturing process and limitations will assist in determining the sequence of testing and the ultimate selection of one non-destructive test method in preference to another. Any testing that may be carried out must be completed with particular attention to personal and OH&amp;S regulations.</p> <p>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.</p>
<b>Related units</b>	None
<b>Band</b>	A
<b>Unit weight</b>	4
<b>Notes</b>	This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).

<b>Elements</b>	<b>Performance criteria</b>
Elements are the essential outcomes of the unit of competency.	Together, performance criteria specify the requirements for competent performance. Text in <i>italics</i> is explained in the range statement following.
1 Interpret and apply the principles of solidification and crystal structures in metals	1.1 Principles of solidification and crystal structures in metals are interpreted and applied in relation to NDT techniques.
2 Interpret equilibrium diagrams for metals	2.1 Equilibrium diagrams are correctly interpreted.
3 Interpret and apply the principles of fusion welding of steel	3.1 <i>Principles and methods for fusion welding of steel</i> are applied to NDT testing. 3.2 <i>Defects in weldments</i> are identified and classified.

4 Interpret and apply the principles of the formation of castings	4.1 Principles and methods used to produce metal castings are applied to NDT testing. 4.2 <i>Defects in metal castings</i> are identified and classified.
5 Interpret and apply the principles of steel forging	5.1 <i>Principles and methods used to produce steel forgings</i> are applied to NDT testing. 5.2 Defects in steel castings are identified and classified.
6 Interpret and apply the principles of mechanical testing	6.1 <i>Principles of mechanical testing</i> are applied to NDT testing.

### Range statement

The range statement provides information about the context in which the unit of competency is carried out. The variables and scope cater for different work requirements, work practices and knowledge between States, Territories and the Commonwealth, and between organisations and workplaces. The range statement relates to the unit as a whole and provides a focus for assessment. Text in italics in the performance criteria is explained here.

The following variables may be present and may include, but are not limited to, the examples listed under the scope. All work is undertaken to relevant legislative requirements, where applicable.

Variable	Scope
<i>Principles and methods for fusion welding of steel</i>	MMAW SAW GMAW GTAW FCAW
<i>Defects in weldments</i>	Cracks, lack of fusion, cavities, imperfect shape, solid inclusions, miscellaneous
<i>Defects in metal castings</i>	Shrinkage cavities, hot tears, cold cracks, gas holes
<i>Principles and methods used to produce steel forgings</i>	Deformations, strengthening mechanisms, annealing
<i>Principles of mechanical testing</i>	Impact, tensile, hardness testing

### Evidence guide

The evidence guide specifies the evidence required to demonstrate achievement in the unit of competency as a whole. It must be read in conjunction with the unit descriptor, performance criteria, range statement and the assessment guidelines for the Metal and Engineering Training Package.

#### Overview of assessment requirements

A person who demonstrates competency in this unit must be able to apply metallurgy principles. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Context of assessment

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.

<b>Interdependent assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic metallurgy principles as related to non-destructive testing techniques, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	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.
<b>Consistency of performance</b>	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.
<b>Required skills</b>	Look for evidence that confirms skills in: <ul style="list-style-type: none"><li>• research</li><li>• understanding and applying metallurgy principles</li></ul>
<b>Required knowledge</b>	Look for evidence that confirms knowledge of: principles of solidification and crystal structures in metal: classification of materials structure of atoms process of solidification crystal structures defects formed during solidification modification of crystal structure heat treatment processes defects formed during heat treatment

- meaning of equilibrium diagrams representative of a range of metals including aluminium and steel:
  - alloy systems
  - solid and liquid solubility
  - basic equilibrium diagrams
  - equilibrium diagrams for common alloys
  
- principles of fusion welding in relation to NDT testing
- defects in fusion welding:
  - processing defects
  - grinding cracks
  - pickling cracks
  - heat treatment cracks
  - service defects
  - fatigue cracks
  - corrosion and stress corrosion cracks
  
- principles of the formation of castings
- defects in castings
- principles of steel forging
- defects in steel forging
- principles of mechanical testing:
  - mechanical testing
  - tensile testing
  - impact testing
  - hardness testing
  - fatigue testing
  - other tests