Australian Government

Department of Education, Employment and Workplace Relations

MEM24012C Apply metallurgy principles

Release: 2

INDUSTRY SKILLS COUNCILS

Creating Australia's Future

MEM24012C Apply metallurgy principles

Modification History

Single band identifier removed to clarify dual status

Unit Descriptor

Unit descriptor	This unit covers applying basic metallurgy principles related to selecting appropriate non-destructive testing techniques (NDT) and interpreting the results of NDT tests for metallurgical processes.

Application of the Unit

Application of the unit	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 and alloys. The unit applies to employees other than NDT technicians such as metallurgists, welding supervisors etc. who select and order NDT tests and who interpret results provided by tests for metal manufacturing, casting, shaping, and joining processes. The unit does not apply to the conduct of NDT tests. 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&S regulations. 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. **Band:** 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). **Unit Weight**: **4**

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.

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.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Interpret and apply the principles of solidification and crystal structures in metals and alloys	1.1. Principles of solidification and crystal structures in metals and alloys are interpreted and applied in relation to NDT techniques.
2. Interpret equilibrium diagrams for metals and alloys	2.1. Equilibrium diagram for metal or alloy is correctly sourced 2.2. Equilibrium diagrams are correctly interpreted.
3. Interpret and apply the principles of fusion welding of metals and alloys	3.1. Principles and methods for fusion welding of metals and alloys are applied to NDT test selection. 3.2. Defects in weldments are identified and classified from NDT test results.
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 test selection. 4.2. Defects in metal and alloy castings are identified and classified from NDT test results.
5. Interpret and apply the principles of steel forging	5.1. Principles and methods used to produce steel forgings are applied to NDT test selection. 5.2. Defects in steel forgings are identified and classified from NDT test results.
6. Interpret and apply the principles of mechanical testing	6.1. Principles of mechanical testing are applied to NDT test selection. 6.2. Defects in metal product are identified and classified from NDT test results

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: • research • understanding and applying metallurgy principles • selecting NDT test appropriate to metal or alloy and manufacturing process

REQUIRED SKILLS AND KNOWLEDGE

Required knowledge

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, iron, steel and common non-ferrous alloys:
  - 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

Evidence Guide

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.	
Overview of assessment	A person who demonstrates competency in this unit must be able to apply metallurgy principles to NDT test selection and interpretation. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	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.
Context of and specific resources for 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. 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.
Method of assessment	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,

EVIDENCE GUIDE	
	standards, manuals and reference materials.
Guidance information for 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.	
Principles and methods for fusion welding of metals and alloys	• MMAW • SAW • GMAW • GTAW • FCAW
Defects in weldments	Cracks, lack of fusion, cavities, imperfect shape, solid inclusions, miscellaneous
Defects in metal and alloy castings	Shrinkage cavities, hot tears, cold cracks, gas holes
Principles and methods used to produce steel forgings	Deformations, strengthening mechanisms, annealing
Principles of mechanical testing	Impact, tensile, hardness testing

Unit Sector(s)

Unit sector	

Co-requisite units

Co-requisite units		

Competency field

Competency field	Non-destructive testing