



Australian Government

MEM48026 Analyse metallurgical failures of components and recommend preventative measures

Release: 1

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Modification History

Release 1. Supersedes and is equivalent to MSATCM515A Analyse metallurgical failures of components and recommend preventative measures.

Application

This unit of competency defines the skills and knowledge required to identify and analyse metallurgical failures in engineering components where the failure is suspected of being related to the production or composition of the component and recommend preventative measures.

It applies to technician level activities in manufacturing or engineering environments.

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

Pre-requisite Unit

MEM48004 Interpret basic binary phase diagrams

MEM48006 Prepare and examine metallographic samples

Competency Field

Metallurgy

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>
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 work information
2. Prepare failed component for failure analysis	2.1 Identify, clean and prepare inspection areas for testing using appropriate procedures and materials 2.2 Carry out preparation processes in accordance with the relevant procedures and statutory and work requirements

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	2.3 Assess inspection areas visually and identify any defects
3. Perform failure analysis	3.1 Select the most appropriate test for the material or application 3.2 Select and prepare test equipment in accordance with standards and/or procedures 3.3 Perform failure analysis on engineering components 3.4 Check test equipment for defects and maintain and store in accordance with procedures and manufacturer instructions
4. Interpret and report the results and recommend preventative action	4.1 Assess indications and classify defects that are detected in accordance with national and international codes and standards 4.2 Confirm defects in accordance with enterprise procedures and industry practices 4.3 Report test results in accordance with enterprise procedures, accepted industry practices and customer service requirements 4.4 Make recommendations to prevent future failures

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.	
Preparation processes include:	• surface cleaning • surface drying • preservation of fracture surfaces.
Most appropriate tests include one or more of the following:	• non-destructive testing • mechanical testing • microscopic and microscopic preparation of metallographic

	sections • scanning electron microscopy (SEM) evaluation for fracture mode • energy dispersive spectroscopy (EDS) for chemical inconsistencies • chemical analysis • application of fracture mechanics • simulated service testing • analysing the evidence.
Report includes:	• accurate identification of cause of failure • recommendation of preventative measures.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MSATCM515A Analyse metallurgical failures of components and recommend preventative measures.

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 MEM48026 Analyse metallurgical failures of components and recommend preventative measures

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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
- identifying and interpreting specifications, charts, lists, drawings and other applicable reference documents in analysing metallurgical failures of components and recommending preventative measures
- identifying inspection areas
- conducting visual inspections and identifying discontinuities and defects
- selecting and using appropriate testing techniques, procedures and equipment on at least two occasions
- performing appropriate measurements associated with the selected test on at least two occasions
- undertaking root cause analysis on at least two occasions
- reporting test results and making recommendations to prevent future failures.

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 and use of personal protective equipment (PPE)
- cleaning and preparation processes for different test surfaces
- procedural, statutory and work health and safety (WHS) requirements in relation to the preparation process
- established assessment procedures and techniques
- testing techniques, procedures, tools and equipment
- maintenance and storage procedures for test equipment
- common faults, damage and defects
- meaning and application of national and international codes and standards
- methods and procedures for reporting test results
- implications of test results for the particular material and/or application

- types of discontinuities and their effect on the material including:
 - plastic deformation including:
 - elastic and plastic strain, dislocations, pile-up and interaction
 - work hardening
 - changes in strength, ductility, yield point, hardness, conductivity and corrosion resistance
 - annealing including:
 - dislocation movement and realignment during heating
 - recovery, nucleation of strain free areas, recrystallisation and grain growth
 - accompanying changes in mechanical and physical properties
 - hot and cold working including:
 - changes in deformation mechanism with rising heat input
 - the effects of strain rate and temperature on work hardening
 - recrystallisation and dynamic recovery
 - resulting microstructure and properties
 - ductile and brittle fracture including:
 - crack theory and mechanism of fracture
 - factors affecting fracture modes
 - fatigue including:
 - mechanism of fatigue crack nucleation
 - mechanism of fatigue crack growth
 - engineering considerations of fatigue and metallurgical factors affecting fatigue
 - creep including:
 - creep mechanisms
 - metallurgical factors affecting creep.
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Assessment Conditions

- Assessors must:
 - have vocational competency in analysing metallurgical failures of components and recommending preventative measures 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.
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