



Australian Government

Department of Education, Employment and Workplace Relations

MSATCM515A Analyse metallurgical failures of components and recommend preventative measures

Release: 1

MSATCM515A Analyse metallurgical failures of components and recommend preventative measures

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor	This unit applies to identifying and analysing metallurgical failures in engineering components and recommending preventative measures
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Application of the Unit

Application of the unit	This unit applies to the identification and analysis of failures in metallic engineering components where the failure is suspected of being related to the production or composition of the component. The unit applies to technician level activities in a manufacturing or engineering environments.
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Pre-requisite Units	MSATCM406A	<i>Interpret basic binary phase diagrams</i>
	MSATCM401A	<i>Prepare and examine metallographic samples</i>

Employability Skills Information

Employability Skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Not applicable.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare failed component for failure analysis	1.1. Inspection areas are identified, cleaned and prepared for testing using appropriate procedures and materials. 1.2. Preparation processes are carried out in accordance with the relevant procedures, statutory and OH&S requirements. 1.3. Inspection areas are visually assessed and any defects identified.
2. Perform failure analysis	2.1. The most appropriate test for the material/application is selected. 2.2. Test equipment is selected and prepared in accordance with standards and/or procedures. 2.3. Test equipment is checked for defects, maintained and stored in accordance with procedures, OH&S requirements and manufacturer instructions.
3. Interpret and report the results and recommend preventative measures	3.1. Indications are assessed and defects are detected and classified in accordance with national and international codes and standards. 3.2. Defects are confirmed in accordance with enterprise procedures and industry practices. 3.3. Test results are reported in accordance with enterprise procedures, accepted industry practices and customer service requirements. 3.4. Recommendations are made to prevent future failures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

Required skills:

- interpret and follow procedures
- identify inspection areas
- conduct visual inspections
- identify discontinuities and defects
- select and use appropriate testing techniques, procedures and equipment
- assess risk
- perform measurements needed to meet the requirements of this unit
- undertake root cause analysis
- locate, read and interpret information on written job instructions, specifications, drawings, charts, lists and other reference documentation
- plan, sequence operations

Required knowledge:

Competency includes sufficient knowledge of:

- cleaning and preparation processes for a range of test surfaces
- procedure, statutory and OH&S requirements in relation to the preparation process
- established assessment procedures and techniques
- testing techniques and procedures for a range of situations
- tools, equipment, techniques
- hazards and safety requirements associated with testing
- maintenance and storage procedures for test equipment
- common faults and damage
- range of defects
- meaning and application of national and international codes and standards
- methods/procedures for reporting test results
- implications of test results for the particular material/application
- any applicable industry standards, national/australian standards, nohsc guides, state/territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

Types of discontinuities and their consequences/effect on the material including:

Plastic Deformation

- elastic and plastic strain, dislocations, pile-up and interaction.
- work hardening.

REQUIRED SKILLS AND KNOWLEDGE

- changes in strength, ductility, yield point, hardness, conductivity, corrosion resistance.

Annealing

- dislocation movement and realignment during heating
- recovery. nucleation of strain free areas. recrystallisation. grain growth.
- accompanying changes in mechanical and physical properties listed above.

Hot&Cold Working

- 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

- crack theory, mechanism of fracture
- factors affecting fracture modes, Brittle fracture, Ductile fracture

Fatigue

- mechanism of fatigue crack nucleation
- mechanism of fatigue crack growth
- engineering considerations of fatigue, metallurgical factors affecting fatigue

Creep

- creep mechanisms
- metallurgical factors affecting creep

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, the 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 analyse metallurgical failures of engineering components. Critical aspects for assessment and evidence are required to demonstrate competency in this unit.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the ability to:

- Correctly diagnose the mode of failure of selected cases
- recommend appropriate preventative measures

Relationship to other units

This unit may be assessed concurrently with other relevant units.

Assessment method and context

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the elements, performance criteria, skills and knowledge. A holistic approach should be taken to the assessment. Assessors should gather sufficient, fair, valid, reliable, authentic and current evidence from a range of sources. Sources of evidence may include direct observation, reports from supervisors, peers and colleagues, project work, samples, organisation records and questioning. Assessment should not require language, literacy or numeracy skills beyond those required for the unit.

The assessee will have access to all techniques, procedures, information, resources and aids which would normally be available in the workplace. The method of assessment should be discussed and agreed with the assessee prior to the commencement of assessment.

Resource implications

This section should be read in conjunction with the range of variables for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

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.	
Codes of practice/standards	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used.
Preparation processes	Surface cleaning ,drying, preservation of fracture surfaces
Obvious flaws	Observed changes in material homogeneity
Most appropriate tests	• collection of background data and selection of samples • preliminary examination of the failed part • non-destructive testing • mechanical testing • section, preservation and cleaning of fracture surfaces • microscopic and microscopic preparation of metallographic sections • SEM evaluation for fracture mode • EDS for chemical inconsistencies • determination of fracture type and failure origin • chemical analysis • application of fracture mechanics • simulated service testing • analysing the evidence • formulating conclusions and writing the report
Reported	Accurate identification of cause of failure and recommendation of preventative measures

Unit Sector(s)

Unit Sector	Metallurgy
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Competency field

Competency Field	
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Co-requisite units

Co-requisite Units		