



Australian Government

Department of Education, Employment and Workplace Relations

MSL974010A Perform mechanical tests

Revision Number: 1

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Modification History

Not applicable.

Unit Descriptor

<p>Unit descriptor</p>	<p>This unit of competency covers the ability to interpret mechanical test requirements, prepare samples, conduct pre-use and calibration checks on equipment and perform routine mechanical tests. These tests will involve several measurement steps. The unit includes data processing and interpretation of results and tracking of obvious test malfunctions where the procedure is standardised. However, personnel are not required to analyse data, optimise tests/procedures for specific samples or troubleshoot equipment problems where the solution is not apparent.</p>
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Application of the Unit

<p>Application of the unit</p>	<p>This unit of competency is applicable to laboratory or technical assistants and instrument operators working in the manufacturing, food and construction materials testing industry sectors.</p> <p>Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These are found at the end of this unit of competency under the section 'This competency in practice'.</p>
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Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.
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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.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Interpret and schedule test requirements	1.1. Review test request to identify samples to be tested, test method and equipment/instruments involved 1.2. Identify hazards and enterprise control measures associated with the sample, preparation/test methods and/or equipment 1.3. Plan work sequences to optimise throughput of multiple samples, if appropriate
2. Receive samples and prepare test pieces	2.1. Log samples using standard operating procedures (SOPs) 2.2. Record sample description, compare with specification and note and report discrepancies 2.3. Prepare test pieces, and standards if appropriate, in accordance with mechanical testing requirements 2.4. Ensure traceability of samples from receipt to reporting of results
3. Check equipment before use	3.1. Set up equipment/instruments in accordance with test method requirements 3.2. Perform pre-use and safety checks in accordance with relevant enterprise and operating procedures 3.3. Identify faulty or unsafe components and equipment and report to appropriate personnel 3.4. Check equipment calibration using specified procedures, if applicable 3.5. Quarantine out-of-calibration equipment/instruments
4. Test samples to determine mechanical properties	4.1. Operate equipment/instruments in accordance with test method requirements 4.2. Perform tests/procedures on all test pieces and standards, if appropriate in accordance with specified methods 4.3. Shut down equipment/instruments in accordance with operating procedures
5. Process and interpret data	5.1. Record test data noting atypical observations 5.2. Ensure calculated values are consistent with expectations 5.3. Record and report results in accordance with enterprise procedures 5.4. Estimate and document uncertainty of measurement in accordance with enterprise procedures, if required 5.5. Interpret trends in data and/or results and report out

ELEMENT	PERFORMANCE CRITERIA
	<p>of specification or atypical results promptly to appropriate personnel</p> <p>5.6. Determine if obvious procedure or equipment problems have led to atypical data or results</p>
<p>6. Maintain a safe work environment</p>	<p>6.1. Use established work practices and personal protective equipment to ensure personal safety and that of other laboratory personnel</p> <p>6.2. Minimise the generation of wastes and environmental impacts</p> <p>6.3. Ensure the safe collection of laboratory and hazardous waste for subsequent disposal</p> <p>6.4. Care for and store equipment, used test pieces and back-up samples as required</p>
<p>7. Maintain laboratory records</p>	<p>7.1. Enter approved data into laboratory information management system (LIMS)</p> <p>7.2. Maintain confidentiality and security of enterprise information and laboratory data</p> <p>7.3. Maintain equipment and calibration logs in accordance with enterprise procedures</p>

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- using instruments for qualitative and/or quantitative analysis
- interpreting test methods and procedures
- sample preparation procedures
- performing calibration checks
- metrology techniques underpinning test/procedure including estimating uncertainty
- using instruments for qualitative and/or quantitative analysis
- maintaining and evaluating reagents
- troubleshooting basic equipment/method
- preparing calibration graphs and calculating results using appropriate units and precision
- applying theoretical knowledge to interpret gross features of data and make relevant conclusions such as identifying atypical results as out of normal range or an artefact
- tracing and sourcing obvious causes of an artefact
- recording and communicating results in accordance with enterprise procedures
- maintaining security, integrity, traceability of samples, sub-samples, test data, results and documentation

Required knowledge

Required knowledge includes:

- mechanical principles and concepts underpinning the test/procedure
- purpose of tests
- metrology techniques underpinning test/procedure
- principles and concepts related to equipment/instrument operation and testing
- function of key components of the equipment/instrument
- effects on test of modifying equipment/instrument variables
- sample preparation procedures
- basic equipment/method troubleshooting procedures
- calibration procedures
- calculation steps to give results in appropriate units and precision
- enterprise and/or legal traceability requirements
- relevant health, safety and environment requirements

Evidence Guide

EVIDENCE GUIDE	
<p>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.</p>	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors should ensure that candidates can:</p> <ul style="list-style-type: none"> • interpret test methods/procedures accurately • prepare and test samples in accordance with specified methods • perform calibration checks (if required) • safely operate test equipment/instruments to enterprise standards and/or manufacturer's specifications • apply basic knowledge of physical properties of materials to interpret gross features of data and make relevant conclusions • identify atypical results, such as out of normal range or an artefact • trace and source obvious causes of an artefact • communicate problems to a supervisor or outside service technician • record and communicate results in accordance with enterprise procedures • maintain security, integrity and traceability of samples, sub-samples, test data/results and documentation.
Context of and specific resources for assessment	<p>This unit of competency is to be assessed in the workplace or simulated workplace environment.</p> <p>This unit of competency may be assessed with:</p> <ul style="list-style-type: none"> • <i>MSL924001A Process and interpret data.</i> <p>Resources may include:</p> <ul style="list-style-type: none"> • standard laboratory equipped with appropriate test equipment/instruments, standards and materials • enterprise procedures and standard methods.
Method of assessment	<p>The following assessment methods are suggested:</p> <ul style="list-style-type: none"> • review of test data/results obtained by the candidate over a period of time to check accuracy, consistency and timeliness of results

EVIDENCE GUIDE	
	<ul style="list-style-type: none"> • review of test records and workplace documentation completed by the candidate • observation of candidate conducting a range of mechanical tests and sample preparation procedures • feedback from peers and supervisors • oral or written questioning of mechanical principles and concepts, test methods and enterprise procedures. <p>In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required.</p> <p>The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work like environment.</p>
This competency in practice	<p>Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting.</p> <p>Construction materials</p> <p>A technical assistant is responsible for compressive strength testing of concrete cylinders. Typically, there are 20 to 30 to be tested each day. On arrival in the morning the assistant records the maximum and minimum temperatures of the curing tanks, locates the particular cylinders to be tested and removes them from the tanks. She/he dries each cylinder, weighs it and measures its diameter and length using a comparator gauge. The ends are checked for excessive roughness and non-parallelism. She/he then starts the compression test machine and checks that the load pacer is set to the correct loading rate. She/he places a rubber cap on the finished end of each cylinder in turn and places it centrally on the platen of the load frame. The assistant closes the protective screen, applies load at the specified rate until failure occurs, and records the maximum load. After the</p>

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cylinder has failed, the assistant removes it from the platen and checks for invalid failure modes. When this occurs (e.g. a shear failure) she/he puts the cylinder aside for further investigation. Any debris is removed from the platen and the next cylinder is tested. When all cylinders have been tested, the assistant cleans away any material left on the compression machine and switches it off. She/he enters all the data into the laboratory information management system (LIMS) which calculates the unit mass and ultimate compressive strength of each cylinder. Finally, the assistant reviews the data for unusual or unexpected results that may indicate an error.

Manufacturing

A technician is asked to test a new polymeric material that is to be used to manufacture children's toys. The technician makes several representative test pieces and measures the elastic properties of the polymer as well as the durability of the polymer to flex many times without cracking. Because the polymer is to be used in a toy, the technician also dispatches samples of the polymer for chemical testing by a consulting laboratory to determine whether any toxic monomer could leach out if a child sucked the toy.

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

Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used

Standards, codes, procedures and/or enterprise requirements

Standards, codes, procedures and/or enterprise requirements may include:

- Australian and international standards, such as:
 - AS 1012 Methods of testing concrete
 - AS 1289 Methods for testing soils for engineering purposes
 - AS ISO 1000-1998 The international system of units (SI) and its application
 - AS ISO 17025-2005 General requirements for the competence of testing and calibration laboratories
 - AS/NZS 2243 Set:2006 Safety in laboratories set
 - AS/NZS ISO 9000 Set:2008 Quality management systems set
 - ISO 5269 Pulps - Preparation of laboratory sheets for physical testing
 - ISO 9142:2003 Adhesives - Guide to the selection of standard laboratory ageing conditions for testing bonded joints
- Australian code of good manufacturing practice for medicinal products (GMP)
- calibration and maintenance schedules
- data quality procedures
- enterprise recording and reporting procedures
- equipment startup, operation and shutdown procedures
- material safety data sheets (MSDS)
- material, production and product specifications
- national measurement regulations and

RANGE STATEMENT	
	<p>guidelines</p> <ul style="list-style-type: none"> • principles of good laboratory practice (GLP) • production and laboratory schedules • quality manuals, equipment and procedures manuals • SOPs
Mechanical principles and concepts underpinning the test/procedure	<p>Mechanical principles and concepts underpinning the test/procedure may include:</p> <ul style="list-style-type: none"> • matter, interatomic and intermolecular forces and states of matter • mass, weight, forces, pressure and energy • cohesive/adhesive forces, friction and slip resistance • elasticity, hardness, ductility, malleability, strength of materials, elastic limit, elastic moduli and ultimate stress • electrical concepts, including electric field, voltage, current, resistance and AC/DC • elasticity, hardness, strength of materials, plasticity, permeability and dispersion
Preparation of samples and test pieces	<p>Preparation of samples and test pieces may include processes such as:</p> <ul style="list-style-type: none"> • cutting • trimming • machining • etching
Mechanical tests and procedures	<p>Mechanical tests and procedures may include:</p> <ul style="list-style-type: none"> • adhesive strength • elastic properties and strength of materials • slip resistance and friction • viscosity and torque • creep and endurance • abrasion, hardness, impact, indent and penetration resistance • pressure and/or vacuum testing using manometers and load cells
Tests	<p>Tests may include methods for:</p> <ul style="list-style-type: none"> • control of starting materials, in-process materials and finished products

RANGE STATEMENT	
	<ul style="list-style-type: none"> • investigation of sources of construction materials • basic troubleshooting of enterprise processes
Hazards	<p>Hazards may include:</p> <ul style="list-style-type: none"> • microbiological organisms and agents associated with soil • chemicals, such as acids and solvents • sharps and hand tools • flammable liquids and gases • cryogenics, such as dry ice and liquid nitrogen • fluids under pressure, such as steam and industrial gases • sources of ignition • disturbance or interruption of services • crushing, entanglement and cuts associated with moving machinery or falling objects
Hazard control measures	<p>Hazard control measures may include:</p> <ul style="list-style-type: none"> • ensuring access to service shut-off points • recognising and observing hazard warnings and safety signs • labelling of samples and hazardous materials • handling and storage for hazardous materials and equipment in accordance with labelling, MSDS and manufacturer's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning equipment and work areas regularly using enterprise procedures • using personal protective clothing and equipment, such as hard hats, hearing protection, gloves, safety glasses, coveralls and safety boots • following established manual handling procedures • reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/waste water, gases, smoke, vapour, fumes, odour and particulates to appropriate personnel
Records	<p>Records may include:</p>

RANGE STATEMENT	
	<ul style="list-style-type: none"> • test and calibration results • equipment use, maintenance and servicing history • faulty or unsafe equipment
Occupational health and safety (OHS) and environmental management requirements	<p>OHS and environmental management requirements:</p> <ul style="list-style-type: none"> • all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any time • all operations assume the potentially hazardous nature of samples and require standard precautions to be applied • where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health

Unit Sector(s)

Unit sector	Testing
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Competency field

Competency field	
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Co-requisite units

Co-requisite units		

