



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **MSL905003A Create or modify automated calibration procedures**

**Revision Number: 1**

## MSL905003A Create or modify automated calibration procedures

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the ability to create, edit, test and document computer controlled calibration procedures for test and measurement instruments. This may be in response to the introduction of alternative or new equipment, changing test circumstances, activities involved in research and development trials or to meet client needs. The unit covers performance of automated, including computer-aided, calibrations as well as the programming and control of automated calibration systems.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency is applicable to calibration technicians/specialists who carry out tests and/or calibrations in first, second and third party laboratories, and laboratories where testing and/or calibration forms part of inspection or product certification. They require a substantial, in-depth technical knowledge across a broad spectrum of advanced calibration practices and technologies, including a thorough understanding of equipment specifications and proprietary software writing skills. They are authorised by their laboratory to create or modify calibration procedures. They work with limited guidance and results of their work are checked by the laboratory manager, quality inspector or designated signatory.</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 can be 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		
	MSL905002A	Create or modify calibration procedures
	MSL905001A	Perform non-standard calibrations
	MSL904001A	Perform standard calibrations

## Employability Skills Information

<b>Employability skills</b>	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. Assess the suitability of available automated procedures	1.1. Determine the technical and quality deficiencies of the current automated calibration procedure 1.2. Research alternative established procedures, if available 1.3. Establish whether an available procedure can be customised or if a new procedure is needed 1.4. Obtain internal approval to develop an automation plan and strategy 1.5. Identify the resources required for automation and verify they meet necessary quality, laboratory and technical requirements 1.6. Confirm that the automated procedure will meet the needs of the client, if applicable
2. Create or edit automated procedure	2.1. Identify and document all relevant calibration data to be collected, including parameters and ranges to be tested 2.2. Check that instructions are adequately documented to ensure repeatability of test 2.3. Document hazards and safety measures to be observed 2.4. List the requirements for calibration approval and rejection 2.5. Specify data to be recorded and produce a results template, if required 2.6. Edit or compile the procedure using appropriate software 2.7. Confirm that all calibration requirements can be fulfilled by using the procedure 2.8. Test run the program, check errors and debug as necessary
3. Configure instruments/equipment	3.1. Use the appropriate personal protective equipment, safety equipment and procedures 3.2. Configure workstation, reference standards, instruments and equipment 3.3. Verify performance of reference standards, instruments and equipment prior to use and adjust or calibrate as necessary 3.4. Identify and minimise potential sources of measurement error
4. Refine the automated	4.1. Run automated procedure to confirm functionality of

ELEMENT	PERFORMANCE CRITERIA
procedure	<p>all steps</p> <p>4.2. Recognise non-conforming results or data and amend the program or troubleshoot procedure/equipment as necessary</p> <p>4.3. Verify all data are the result of valid measurements and all calculations are correct</p> <p>4.4. Confirm the integrity of procedure at each step to ensure repeatability of measurement</p>
5. Verify automated procedure is fit for purpose	<p>5.1. Generate a calibration report and compare results achieved with other methods</p> <p>5.2. Systematically analyse all measurement and environmental factors that may influence results and take corrective action</p> <p>5.3. Quantify the uncertainties of results by analysing equipment specifications and test methodology</p> <p>5.4. Arrange for internal peer checking of procedure, data and results and incorporate feedback</p> <p>5.5. Review feedback from other laboratories to assess acceptance of procedure, if applicable</p> <p>5.6. Confirm the procedure is fit for purpose and relevant to the client's needs and document as required</p>
6. Document and review automated procedure	<p>6.1. Ensure that the procedure is written in accordance with enterprise procedures or statutory and regulatory requirements</p> <p>6.2. Ensure that the procedure has been reviewed in accordance with enterprise procedures</p> <p>6.3. Report and present the procedure to appropriate personnel for validation before use</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:

- assessing the suitability of software controlled calibration procedures
- researching current, alternative calibration methods and equipment
- developing or modifying calibration procedures to automate as many processes as possible
- writing efficient calibration procedures using an unambiguous, logical sequence of instructions that meet statutory and regulatory requirements
- writing/editing efficient software programs for a range of calibration applications and assessing their integrity under test
- applying specialised technical knowledge to critically analyse and resolve complex problems associated with measurement non-conformances where solutions are not obvious or readily available
- explaining automated calibration procedures to clients and clarifying their requirements
- conducting reliable calibration/testing trials to ensure a high degree of reproducibility
- liaising with peers and technical staff from other laboratories to clarify and validate automated procedures
- estimating measurement uncertainty and applying statistical techniques for analysing test and/or calibration data
- critically examining each calibration step to ensure repeatability and validity of data
- preparing all test documentation accurately, concisely and in accordance with requirements
- recognising opportunities for improvements to procedures

#### Required knowledge

Required knowledge includes:

- requirements for the competence of testing and calibration laboratories (e.g. AS ISO/IEC 17025) as they affect job role and responsibilities
- limits of authority and procedures for creating or modifying automated calibration procedures
- structure and terminology used in standard calibration methods, procedures, requests and instructions
- current automated calibration methods, procedures and technology applications used in laboratory

**REQUIRED SKILLS AND KNOWLEDGE**

- computer operation/automation using graphical user interfaces
- equipment specifications and limitations and the implications of equipment substitution
- equipment and testing method troubleshooting procedures
- the hierarchy and appropriate selection of reference materials
- handling, transport, storage and operation of reference and working standards
- laboratory environmental control requirements
- calculation procedures to give results in appropriate accuracy, precision and units
- methods for statistical analysis (means, ranges and standard deviations) and estimation of uncertainty of measurement (may include the use of software)
- enterprise procedures and legislative requirements for documenting calibration procedures
- enterprise and/or legal traceability requirements
- relevant health, safety and environmental requirements
- layout of the enterprise, divisions and laboratory
- organisational structure of the enterprise
- lines of communication
- role of laboratory services for the enterprise and customers

**Specific industry**

Additional knowledge requirements may apply for different industry sectors. For example, testing conducted in the following fields:

- acoustic and vibration measurement
- chemical testing
- construction materials testing
- electrical testing
- heat and temperature measurement
- mechanical testing
- metrology
- non-destructive testing
- optics and radiometry
- pressure testing



## 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

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

Assessors should ensure that candidates can:

- assess the suitability of software controlled calibration procedures
- research current, alternative calibration methods and equipment for a given request
- develop or modify calibration procedures to automate as many processes as possible
- write efficient calibration procedures using an unambiguous, logical sequence of instructions that meet statutory and regulatory requirements
- write/edit efficient software programs for a range of calibration applications and assess their integrity under test
- apply specialised technical knowledge to critically analyse and resolve complex problems associated with measurement non-conformances where solutions are not obvious or readily available
- explain automated calibration procedures to clients and clarify their requirements
- conduct reliable calibration/testing trials to ensure a high degree of reproducibility
- liaise with peers and technical staff from other laboratories to clarify and validate automated procedures
- estimate measurement uncertainty and apply statistical techniques for analysing test and/or calibration data
- critically examine each calibration step to ensure repeatability and validity of data
- prepare all test documentation accurately, concisely and in accordance with requirements
- recognise opportunities for improvements to procedures.

#### Context of and specific resources for assessment

This unit of competency is to be assessed in the workplace or simulated workplace environment.

<b>EVIDENCE GUIDE</b>	
	<p>This unit of competency may be assessed with:</p> <ul style="list-style-type: none"> <li>• <i>MSL925001A Analyse data and report results</i></li> <li>• <i>MSL925002A Analyse measurements and estimate uncertainties.</i></li> </ul> <p>Resources may include:</p> <ul style="list-style-type: none"> <li>• specialised calibration/test equipment, reference standards and materials and laboratory facilities</li> <li>• access to a library of calibration methods, procedures and equipment specifications</li> <li>• laboratory calibration software and programs and manufacturer's proprietary software</li> <li>• enterprise quality manual and procedures.</li> </ul>
<b>Method of assessment</b>	<p>The following assessment methods are suggested:</p> <ul style="list-style-type: none"> <li>• review of documented automated procedures modified or developed by the candidate and associated validation data</li> <li>• feedback from supervisors and/or customers regarding quality of automated procedures developed or modified by the candidate</li> <li>• observation of the candidate trialing automated procedures as part of their development</li> <li>• oral or written questioning to check underpinning knowledge of automated procedures, calibration software and programming techniques used in the laboratory.</li> </ul> <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>
<b>This competency in practice</b>	Industry representatives have provided the case studies

**EVIDENCE GUIDE**

below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting.

**Background**

Automated calibration relies heavily on computers to assist technicians do their jobs. While calibration software is used to conduct the actual calibrations, it is usually not necessary to know how to program in a computer programming language to conduct the actual tests. Most systems do not require high-order programming expertise for generating calibration procedures. Often, procedures are self-documenting and resemble familiar manual procedures. Most off-the-shelf applications incorporate error checking, online help screens, tolerance calculation, and test uncertainty ratio checking. Many systems display illustrations that show connection points or operator locations of adjustments in devices being tested. Sample procedures are often provided to guide new users through the steps of writing an automated procedure for an instrument.

**Calibration**

The laboratory supervisor presents a signal generator to a senior calibration technician/specialist and explains that a client will send another 20 units for calibration if the laboratory can calibrate each item within a day. The laboratory currently has an automation station configured to test similar instruments in five hours and therefore the client's request should present no problem. On closer inspection, the specialist realises that the instrument is fitted with a higher-specification option rendering the laboratory's automated procedure deficient in a number of respects. The specialist searches the internal database for something more applicable but concludes that either a new procedure needs to be sourced externally or the current one needs to be modified.

Checks on the internet confirm that no suitable procedure has been developed yet so they obtain approval from the supervisor to edit the current one. The specialist determines which tests have to be modified and where new instructions have to be compiled. They analyse all the equipment specifications, including calculating the measurement uncertainties and what data is to be collated. Particular attention is paid to highlighting the safety measures that must be observed.

**EVIDENCE GUIDE**

On completion of the software program, the specialist conducts a dummy run to confirm that the program is bug free. A colleague vets the procedure and verifies that each step is technically justified. The supervisor emails a copy of the procedure interstate for external validation by means of inter-laboratory comparison. Following successful feedback, the laboratory obtains agreement from the client to use the procedure, calibrates the instrument in 5.5 hours and returns it with a certificate of conformance. The automated procedure is entered into the laboratory's database as an authorised procedure and distributed to affiliated laboratories.

## 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 ISO 17025-2005 General requirements for the competence of testing and calibration laboratories
  - AS/NZS ISO 9001:2008 Quality management systems - Requirements
  - AS/NZS ISO 10005:2006 Quality management systems - Guidelines for quality plans
  - AS/NZS ISO 10012:2004 Quality assurance requirements for measurement equipment
  - ISO 5725 Accuracy (trueness and precision) of measurement methods and results
  - ISO/IEC Guide 98-3:2008 Uncertainty of measurement - Part 3 Guide to the expression of uncertainty in measurement (GUM)
- Eurachem/CITAC Guide CG4 Quantifying uncertainty in analytical measurement
- laboratory calibration software and programs, manufacturer's proprietary software
- material safety data sheets (MSDS)
- enterprise recording and reporting procedures and standard operating procedures (SOPs)
- quality manuals, equipment and operating/technical manuals
- test methods and calibration procedures

<b>RANGE STATEMENT</b>	
	<p>(validated and authorised)</p> <ul style="list-style-type: none"> <li>test methods and calibration procedures published by international, national or regional standards, reputable technical organisations, scientific texts or journals and equipment manufacturers</li> <li>incident and accident/injury reports</li> <li>schematics, workflows, laboratory layouts and production and laboratory schedules</li> </ul>
<b>Editing or creating automated procedures</b>	<p>Editing or creating automated procedures may involve using, testing and or calibrating the following:</p> <ul style="list-style-type: none"> <li>common test equipment, such as anemometers, balances, barometers, callipers, environmental chambers, hygrometers, manometers, masses, micrometers, pressure equipment, spectrophotometers, tape measures, rules, temperature (digital) indicating systems, thermometers, thermocouples, timing devices, vibration analysis equipment and weighing instruments</li> <li>electrical reference standards, such as air-lines, analogue meters, attenuators, bridges-manual balance, capacitors, DC voltage references, digital instruments (calibrators, DMMs, electronic transfer standards), inductors, instrument and ratio transformers, instrument transformer test sets, potentiometers, resistors, radio frequency (RF) power meters, RF thermistor mounts and thermal converters, shunts, time interval and frequency standards, transfer standards AC-DC, voltage dividers, volt ratio boxes and watt-hour references</li> <li>working standards, instruments and testing equipment, such as electromagnetic compatibility (EMC) test equipment, field strength meters, flammability test equipment, gauges/test fingers/test pins, hipot testers, impact hammers, impulse testers, instrument calibrators, network analysers, signal generators and spectrum and harmonic analysers</li> </ul>
<b>Hazards</b>	Hazards may include:

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• electric shock</li> <li>• disturbance or interruption of services</li> <li>• manual handling of heavy equipment boxes</li> <li>• sources of electromagnetic radiation (lasers, RF generators/transmitters)</li> <li>• fluids under pressure</li> <li>• heat sources, such as ovens</li> </ul>
<b>Safety procedures</b>	<p>Safety procedures may include:</p> <ul style="list-style-type: none"> <li>• use of personal protective equipment, such as hearing protection, gloves, safety glasses and coveralls</li> <li>• ensuring access to service shut-off points</li> <li>• handling and storing hazardous materials and equipment in accordance with labels, MSDS, manufacturer's instructions, enterprise procedures and regulations</li> <li>• regular cleaning of equipment and work areas</li> </ul>
<b>Communication</b>	<p>Communication may be with:</p> <ul style="list-style-type: none"> <li>• supervisors and managers (laboratory, quality and customer service)</li> <li>• peers and other laboratory or relevant technical personnel</li> <li>• clients and end users of equipment</li> <li>• external auditors, or accreditation agency such as National Association of Testing Authorities (NATA)</li> <li>• equipment manufacturers and suppliers of spare parts</li> </ul>
<b>Working environment</b>	<p>The working environment will have a controlled environment but could be a:</p> <ul style="list-style-type: none"> <li>• purpose-built designed facility</li> <li>• mobile facility in the field</li> </ul>
<b>Occupational health and safety (OHS) and environmental management requirements</b>	<p>OHS and environmental management requirements:</p> <ul style="list-style-type: none"> <li>• 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</li> </ul>

**RANGE STATEMENT**

	<ul style="list-style-type: none"><li>• all operations assume the potentially hazardous nature of samples and require standard precautions to be applied</li><li>• 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</li></ul>
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**Unit Sector(s)**

<b>Unit sector</b>	Calibration
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**Competency field**

<b>Competency field</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		