



Australian Government

Department of Education, Employment and Workplace Relations

MSL905002A Create or modify calibration procedures

Revision Number: 1

MSL905002A Create or modify calibration procedures

Modification History

Not applicable.

Unit Descriptor

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| <p>Unit descriptor</p> | <p>This unit of competency covers the ability to create or modify calibration procedures in response to the introduction of alternative/new equipment, changing test circumstances, activities involved in research and development trials or to meet client needs. The unit covers research of current calibration procedures and technology, development or modification of a procedure, its subsequent trialling and confirmation that it is fit for purpose. This unit of competency does not cover the ability to create or edit software controlled calibration procedures as this is covered in another unit of competency.</p> |
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Application of the Unit

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| <p>Application of the unit</p> | <p>This unit of competency is applicable to calibration technicians/specialists who carry out test and/or calibrations in first, second and third party laboratories, and laboratories where testing and/or calibration forms part of inspection or product certification. It covers the work of only those personnel who 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

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| Prerequisite units | | |
| | <i>MSL905001A</i> | <i>Perform non-standard calibrations</i> |
| | <i>MSL904001A</i> | <i>Perform standard calibrations</i> |

Employability Skills Information

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

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| 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 |
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| 1. Assess the suitability of available calibration procedures | 1.1. Confirm that the authorised calibration procedure is not appropriate for intended use or requires modification 1.2. Research suitable alternative established calibration 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 or modify a calibration procedure, as necessary 1.5. Confirm that available resources meet all the requirements of the alternative or new procedure 1.6. Gain authorisation for any deviation from requirements previously agreed with client |
| 2. Develop procedure | 2.1. Identify and document all relevant calibration data to be collected, including parameters and ranges to be tested 2.2. Describe all new instructions or modifications to methods to ensure repeatability of test 2.3. Document all hazards and safety measures to be observed 2.4. Specify data to be recorded and produce a results template, if required 2.5. List the requirements for calibration approval and rejection 2.6. Confirm that all calibration requirements can be fulfilled by using the procedure |
| 3. Prepare equipment for testing | 3.1. Use the appropriate personal protective equipment, safety equipment and procedures 3.2. Assemble and set up reference standards and associated equipment prior to testing 3.3. Verify performance of reference standards and measuring equipment prior to use and adjust or calibrate as necessary 3.4. Identify and minimise potential sources of measurement error |
| 4. Trial modified/new calibration procedure | 4.1. Perform individual steps and confirm they are adequately documented to ensure repeatability of measurement 4.2. Critically analyse readings to confirm they are the result of a valid measurement and record data as |

| ELEMENT | PERFORMANCE CRITERIA |
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| | <p>required</p> <p>4.3. Adjust device under test to bring readings within tolerance and record results</p> <p>4.4. Analyse the resulting test data to detect trends or inconsistencies that may significantly affect the accuracy or validity of test results</p> |
| <p>5. Confirm the modification or new procedure is fit for purpose</p> | <p>5.1. Compare results achieved with those from other calibration procedures</p> <p>5.2. Systematically analyse all measurement and environmental factors that may influence the result and take corrective action, if necessary</p> <p>5.3. Arrange for internal peer checking of calibration procedure, data and results and incorporate feedback</p> <p>5.4. Quantify the uncertainties of results obtained by analysing equipment specifications and test methodology</p> <p>5.5. Compare results with those obtained by other laboratories, if applicable</p> <p>5.6. Confirm that the modified/new procedure is fit for purpose and relevant to the client's needs and document as necessary</p> |
| <p>6. Document and review modified/new calibration procedure</p> | <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:

- researching current, alternative calibration methods and equipment
- applying specialised technical knowledge to critically analyse and resolve complex problems associated with measurement non-conformances where solutions are not obvious or readily available
- developing or adapting methods to suit technical and/or client requirements
- conducting reliable calibration/testing trials to ensure a high degree of reproducibility
- explaining complex calibration procedures to clients and clarifying requirements and deviations
- liaising with peers and technical staff from other laboratories to clarify and validate test methods
- estimating measurement uncertainty and applying statistical techniques for analysing test and/or calibration data
- writing calibration procedures using an unambiguous, logical sequence of instructions that meet statutory and regulatory requirements
- 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 calibration procedures
- structure and terminology used in standard calibration methods, procedures, requests and instructions
- current calibration methods, procedures and technology applications used in laboratory
- implications of modifying standard calibration procedures
- equipment specifications and limitations and the implications of equipment substitution
- 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

REQUIRED SKILLS AND KNOWLEDGE

- methods for statistical analysis (means, ranges and standard deviations) and estimation of uncertainty of measurement (may include the use of software)
- equipment and testing method troubleshooting procedures
- 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 | |
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| <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"> • research current, alternative calibration methods and equipment for a given request • apply specialised technical knowledge to critically analyse and resolve complex problems associated with measurement non-conformances where solutions are not obvious or readily available • develop or adapt methods to suit technical and/or client requirements • conduct reliable calibration/testing trials to ensure a high degree of reproducibility • explain complex calibration procedures to clients and clarify requirements and deviations • liaise with peers and technical staff from other laboratories to clarify and validate test methods • estimate measurement uncertainty and apply statistical techniques for analysing test and/or calibration data • write calibration procedures using an unambiguous, logical sequence of instructions that meet statutory and regulatory requirements • prepare all test documentation accurately, concisely and in accordance with requirements • recognise opportunities for improvements to procedures. |
| 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>MSL925001A Analyse data and report results</i> • <i>MSL925002A Analyse measurements and estimate uncertainties.</i> <p>Resources may include:</p> <ul style="list-style-type: none"> • specialised calibration/test equipment, reference standards and materials and laboratory facilities |

| EVIDENCE GUIDE | |
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| | <ul style="list-style-type: none"> • access to a library of calibration methods, procedures and equipment specifications • enterprise quality manual and procedures. |
| Method of assessment | <p>The following assessment methods are suggested:</p> <ul style="list-style-type: none"> • review of documented calibration procedures modified or developed by the candidate and associated validation data • feedback from supervisors and/or customers regarding quality of calibration procedures developed or modified by the candidate • observation of the candidate creating/modifying calibration procedures • oral or written questioning to check underpinning knowledge of complex calibration 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>Background</p> <p>Calibration specialists have the skills and knowledge to operate, maintain and calibrate a very wide variety of test equipment and measuring instruments with limited guidance. They must remain abreast of technical and equipment advances, interpret complex technical information accurately and liaise with clients to clarify their needs. They must demonstrate high levels of initiative and concentration when performing technically</p> |

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demanding measurements, providing solutions for non-conforming work and when adjusting and repairing complex instruments. Calibration specialists are often asked to modify existing calibration procedures and develop new ones. International and Australian standards specify strict criteria for how this is to be done. Above all, clients must agree that the procedures meet their requirements and the procedures must be validated before use. A considerable understanding of test methods is required and personnel must be able to analyse complex technical specifications and estimate uncertainties.

Calibration

The calibration laboratories within the Australian Defence Force have recently been advised that all metric dimensional metrology (for example, micrometers, verniers and dial test indicators) must be calibrated to current Australian Standards. The supervisor of the physical laboratory conveys the new instruction to his staff. One of the technicians is about to begin calibrating a batch of micrometers but because the client's (Defence) calibration requirements have changed, they halt proceedings until a new procedure is drafted. The technician rings the other Defence laboratories and establishes that no procedure for that particular model of micrometer exists and therefore seeks permission from the supervisor to develop one. The laboratory supervisor has no reservations because the technician is a calibration specialist who has worked in the industry for a long time.

The technician first obtains a copy of AS 2102 *Micrometer calipers for external measurement*, copies of the technical specifications relating to the reference standards (gauge blocks and optical flats/parallels) and those for the micrometers themselves. The technician lists all the parameters to be tested and drafts a new results template. They calculate tolerances and uncertainties, amend the template accordingly and neatly lay out raw data, calculations and formulae used for peer review. As the technician goes through each measurement they record the various steps in accordance with enterprise procedures so that the test can be reproduced. The required safety procedures, the environmental conditions and the need for equipment stabilisation are also carefully documented.

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On completion of the test, the technician compares the data with the micrometer's previous calibration history and double checks the new methodology against a similar American NAVAIR calibration procedure. They are satisfied that the procedure is fit for purpose, that it meets the client's needs and is technically justified and that the data is valid. The technician then presents the draft procedure for another technician to complete.

The test is reproduced successfully and the documentation is given to the administration staff for word processing. Upon completion, the draft test procedure is emailed to the other six Defence laboratories for comment. Following the correction of minor clerical errors, the procedure is submitted to the military's primary standard laboratory (MSL) for final approval and authorisation.

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 procedures 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
- 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 (validated and authorised)
- test methods and calibration procedures

| RANGE STATEMENT | |
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| | <p>published by international, national or regional standards, reputable technical organisations, scientific texts or journals and equipment manufacturers</p> <ul style="list-style-type: none"> • incident and accident/injury reports • schematics, workflows, laboratory layouts and production and laboratory schedules |
| Modifying or developing new test methods | <p>Modifying or developing new test methods may involve using, testing and/or calibrating the following:</p> <ul style="list-style-type: none"> • common test equipment, such as anemometers, balances, barometers, calipers, 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 • 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 • 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 |
| Hazards may include: | <p>Hazards may include:</p> <ul style="list-style-type: none"> • electric shock • disturbance or interruption of services |

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

RANGE STATEMENT

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| | precautions to be applied <ul style="list-style-type: none"> 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 |
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Unit Sector(s)

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| Unit sector | Calibration |
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Competency field

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| Competency field | |
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Co-requisite units

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| Co-requisite units | | |
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