Australian Government

Department of Education, Employment and Workplace Relations

MSL904001A Perform standard calibrations

Revision Number: 1

MSL904001A Perform standard calibrations

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to calibrate test and measurement equipment in accordance with standard calibration procedures and documented test methods. These procedures/methods specify all associated reference standards, materials, equipment and methods to be used and the required parameters or quantities and ranges to be tested, including the criteria for rejection or approval.

Application of the Unit

Application of the unit	This unit of competency is applicable to laboratory and calibration technicians who carry out tests and/or calibrations using standard calibration methods in first, second and third party laboratories, and laboratories where testing and/or calibration forms part of inspection or product certification. Personnel are not permitted to deviate from explicit instructions in any manner, modify the procedure, nor substitute alternative equipment. They work under limited supervision and results of their work are interpreted and checked by the laboratory supervisor, quality inspector or designated signatory. 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'.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.

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.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare items for calibration	1.1. Select the authorised calibration procedure in accordance with enterprise procedures 1.2. Identify hazards and use appropriate personal protective equipment, safety equipment and procedures 1.3. Confirm all measuring equipment meets the laboratory's specification requirements and complies fully with the calibration procedure 1.4. Assemble and set up specified reference standards and associated equipment prior to testing 1.5. Verify performance of reference standards and measuring equipment prior to use and adjust or calibrate as necessary 1.6. Identify and minimise potential sources of measurement error
2. Perform calibration	2.1. Perform individual tests without variance according to the documented procedure to ensure repeatability of measurement 2.2. Confirm readings are the result of a valid measurement and record data as required (as-found or before adjustment) 2.3. Adjust device under test to bring readings within specification and record data (as-left or after adjustment) if required 2.4. Analyse resulting test data to detect trends or inconsistencies that would significantly affect the accuracy or validity of test results 2.5. Seek appropriate advice when interpretation of results is outside authorised scope of approval
3. Document results	3.1. Document compliance/non-compliance with requirements of test and/or specifications 3.2. Estimate and document uncertainty of measurement in accordance with enterprise procedures, if required 3.3. Record the results of each test/calibration accurately, unambiguously and objectively 3.4. Ensure confidentiality of enterprise information
4. Finalise calibration	4.1. Prepare and issue a final report on the job/item detailing testing carried out, traceability, statement of compliance and relevant information as required 4.2. Report any non-compliance and verify next course of

ELEMENT	PERFORMANCE CRITERIA
	action with supervisor 4.3. Attach calibration labels, equipment stickers, quality control tags and tamper resistant seals as required in enterprise procedures 4.4. Store test equipment/measurement standards and results in accordance with enterprise procedures

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills include:

- selecting and applying appropriate test methods and calibration procedures
- maintaining close attention to procedures, accuracy and precision of measurement to ensure the integrity of test/calibration results
- using calibration and correction charts
- calculating to give results in appropriate accuracy, precision and units
- preparing test/calibration documentation that is accurate and complies with requirements
- operating equipment correctly and safely
- recognising problems or departures in systems and documentation and initiating actions to prevent or minimise them
- recognising and report opportunities for improvements to procedures

Required knowledge

Required knowledge includes:

- purpose of metrology and calibration, including common terminology, concepts, principles, procedures, and applications
- National Association of Testing Authority's (NATA) and National Measurements Institute's (NMI) role in the measurement and testing system in Australia
- traceability, including legal requirements for traceability
- requirements for the competence of testing and calibration laboratories (e.g. AS ISO/IEC 17025) as they affect job role and responsibilities
- hierarchy and appropriate selection of reference materials and instruments
- non-conformance/non-compliance procedures and protocols associated with equipment, reference material and calibration procedures
- troubleshooting procedures for equipment and test methods
- methods for statistical analysis (means, ranges and standard deviations) and estimation of uncertainty of measurement (may include the use of software)
- reporting procedures and legislative requirements
- handling, transport, storage and operation of reference and working standards
- laboratory environmental control 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

REQUIRED SKILLS AND KNOWLEDGE

Specific calibration fields

Additional knowledge requirements may apply for different calibration fields. For example, testing and calibrations conducted in the following:

- 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 measurements

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: • maintain very close attention to procedures, accuracy and precision of measurement to ensure integrity of test/calibration results (especially during lengthy tests) • critically examine each calibration step to ensure repeatability and validity of data • apply all relevant procedures and regulatory requirements to ensure the quality and integrity of the services or data provided • prepare test/calibration documentation that is accurate and complies with requirements • operate equipment correctly and safely • recognise problems or departures in systems and documentation and initiate actions to prevent or minimise them • recognise and report 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. This unit of competency may be assessed with: • *MSL924001 Process and interpret data* • *relevant MSL974000 series unit of competency* • *relevant MSL975000 series unit of competency*. Resources may include: • specialised calibration/test equipment, reference standards and laboratory facilities • access to a library of calibration methods, procedures and equipment specifications • enterprise quality manual and procedures.
Method of assessment	The following assessment methods are suggested: • review of calibration results, uncertainty calculations and workplace documentation completed by the

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	candidate • feedback from supervisors and/or customers regarding quality of calibration services provided by the candidate • observation of the candidate performing standard calibrations • oral or written questioning to check underpinning knowledge of standard calibration procedures. 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. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. Access must be provided to appropriate learning and/or assessment support when required. 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.
This competency in practice	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. **Background** Calibration work may be simple or highly complex depending upon the type of equipment being calibrated and the accuracy or uncertainties required. Manual calibrations may involve interconnecting equipment and setting the stimulus devices to the settings listed in the procedure. At each setting, the technician must verify that the response or output of the unit under test (UUT) is within the tolerances specified in the procedure. In addition, many procedures require that 'as-found' (before adjustment) and 'as-left' (after adjustment) results are recorded for maintaining the UUT documentation history. Often calibration technicians must assess and document the total uncertainties for a given measurement by analysing equipment specifications and methodology

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	during calibration. They have to interpret specifications and technical information and demonstrate initiative when adjusting and repairing instruments. The calibration technician's workload can be routine and repetitive. A perpetual backlog of work and the constant need to reduce turn-around-time to meet client demands, coupled with enterprise productivity goals, can induce stress and mental fatigue if not carefully managed. However, it is essential that all personnel are able to perform tests and associated work tasks without undue pressure that might influence technical judgement if 'integrity of measurement' is to be retained. Errors arising from items incorrectly calibrated will, at best, have to be recalled which wastes time, resources and destabilises enterprise credibility. At worst, if undetected, they may have severe safety implications to personnel or equipment, depending on the nature of the item. **Calibration (1)** A customer delivers a test pressure gauge and requires certification that the gauge conforms to manufacturer's specifications. Personnel in the item reception area log the job and the laboratory supervisor assigns it to a calibration technician. He/she reads the work order and retrieves the approved calibration procedure. The procedure requires the customer's gauge to be tested to 1000 kPa using a hydraulic test station. The technician assembles the required apparatus and personal protective equipment. The gauge is visually inspected for defects and contamination. The temperature of the environment is checked and the hydraulic test station confirmed as fully operational. The required pressures are applied to the gauge and the indicated readings are transcribed onto the test report. The technician notes that some readings are outside the allowable tolerance and adjustments will have to be made. He/she takes another set of readings after making the necessary adjustments and records them on the report. The technician applies the required labels to the gauge, updates the database, produces a test report and places the item on the quality assurance bench for inspection by the supervisor. The supervisor visually inspects the item and checks the readings on the report. The job has taken two hours to complete. **Calibration (2)** A client has asked the laboratory to calibrate a spectrum

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	analyser to manufacturer's specification. The supervisor assigns the job to a calibration technician who reads the job sheet and locates the appropriate calibration procedure. Although this spectrum analyser will be calibrated partly with the aid of automated technology, the technician estimates that the calibration will still take about nine hours to complete. The technician reads the procedure and assembles the equipment and allows for the required warm-up time for instrument stabilisation. Possible sources of error are minimised by cleaning connectors and tensioning them with the torque spanner. The technician performs the manual phase of the test and manually records 12 pages of results. The equipment is reconnected for the automated part of the procedure the test recommenced. The technician produces a further six pages of results. These are assessed for errors and non-conformances and all calculations are carefully checked. A final report is produced which accompanies the spectrum analyser to the quality assurance bench for checking by the supervisor. All cables and equipment used for the calibration are returned to the store.

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

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	published by international, national or regional standards, reputable technical organisations, scientific texts or journals and equipment manufacturers • incident and accident/injury reports • schematics, work flows, laboratory layouts and production and laboratory schedules
Standard calibrations	Standard calibrations may include testing and/or calibrating the following equipment and reference materials using standard methods and procedures: • 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	Hazards may include: • electric shock • disturbance or interruption of services

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	• manual handling of heavy equipment boxes • sources of electromagnetic radiation (lasers and RF generators/transmitters) • fluids under pressure • heat sources, such as ovens
Safety procedures	Safety procedures may include: • 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
Reference materials	Reference materials may include: • colour standards • graded granular materials • hardness blocks
Communication	Communication may be with: • 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 for example, NATA • manufacturers of equipment and suppliers of spare parts and materials
Working environment	The working environment will have a controlled environment but may include: • purpose-built designed facility • mobile facility in the field
Occupational health and safety (OHS) and environmental management requirements	OHS and environmental management requirements: • all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these

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	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	Calibration

Competency field

Competency field	

Co-requisite units

Co-requisite units		