Metrology Society Of Australasia

MSA Technical Guide-

How to build and manage a Calibration or Testing Laboratory in your organisation.

Introduction

This technical guide has been written to assist organisations to build a functioning measurement facility in the field of calibration or testing and seek accreditation from the relevant bodies. The guide covers a range of relevant considerations and topics to assist in the planning, implementation, and ongoing improvement of your measurement facility.

This guide advises organisations to seek information that is available from Accreditation Bodies, National Measurement Institutes, Standards Laboratories and Equipment Manufactures. The goal is to provide an overview of all the elements of a measurement facility that should be taken into consideration and provide some detailed information on each element with links to further sources of information.

This guide will assist organisations that will perform the following types of Calibration or Testing activities:

- Acoustics
- Chemical metrology
- Communications, EMR and EMC
- Dimension metrology
- Electrical low frequency metrology
- Flow
- Force
- Ionising radiation
- Magnetism
- Mass & weighing equipment.
- Optics
- Pressure
- Speed
- Time and frequency
- Temperature metrology
- Torque
- Ultrasonics

- Vibration
- Volume and Density

Pathology, Environmental, testing of foods and beverages and Biology Laboratories are outside the scope of this guide.

This Technical Guide has been provided by the Metrology Society of Australasia (MSA). www.metrology.asn.au

Measurement and Metrology

Metrology is the science of measurement. All aspects including designing, performing, or analysing the output of calibrations and tests is a form of metrology.

What is a Calibration or Testing Laboratory?

An organisation may identify a need to perform some type of measurement or testing on an item, device, or product to attest that is fit for purpose, consistent, reliable, or compliant with a documented standard.
Reporting the results of these measurements with metrological traceability improves the level of confidence for the end users or customers. These measurement facilities are called Calibration or Testing Laboratories.

Why is Metrology important?

Good metrology provides consistency of product and process between organisations. Accurate and consistent measurement means we can trust that instruments are reporting correctly. An example of the importance of good metrology is the trust in measurements of components for precision engineered products from different suppliers- Think modern aircraft, consumer electronics or medical imaging equipment.

Why Accreditation is important to industry.

Industry trust in a Calibration or Testing Laboratories published results is based on the recognition of the laboratories capabilities. This is best achieved through accreditation by a laboratory accreditation body.

The accreditation bodies in Australia and New Zealand are:

- National Association of Testing Authorities, Australia (NATA)
- International Accreditation New Zealand (IANZ)

ILAC is International Laboratory Accreditation Cooperation (ilac.org). If you are using overseas Laboratories as calibration providers. Check to see they are accredited by a body that is a signatory to the ILAC MRA.

Accreditation bodies assess your Laboratories compliance to **ISO/IEC 17025 General Requirements for the Competence of testing and calibration Laboratories**.

This ISO standard can be purchased directly from the International Organization for Standardization ISO - Store or from any standards publication supplier.

International Metrology

The International Committee of Weights and Measures (CIPM) was formed to provide the basis for a single, coherent system of measurements throughout the world, traceable to the International System of Units (SI). It is an intergovernmental organization where the country members act together on matters related to measurement science and measurement standards.

Standard Units (SI)

The International System of Units (SI, abbreviated from the French Système international (d'unités)) is the modern form of the metric system. It is the only system of measurement with an official status in nearly every country in the world. It comprises a coherent system of units of measurement starting with seven base units. The SI units are:

- Length measured in **Meters** (m)
- Time (t) measured in **Seconds** (s)
- Amount of a substance (n) measured in **Mole** (mol)
- Luminous Intensity (I_v) measured in **Candela** (cd)
- Electrical Current (I) measured in **Ampere** (A)
- Thermodynamic temperature (T) measured in **Kelvin** (K)
- Mass (m) measured in **Kilograms** (kg)

Traceability to standards

National Metrological Institutes maintain each country's primary measurement standards to realise the legal units of measurement and provide traceability to the SI for all measurements. Traceability in measurement involves ensuring an unbroken chain of calibrations to primary measurement standards. Traceability helps ensure that measurements are comparable to each other and gives industry, researchers, regulators, and consumers' confidence in the accuracy of measurement results.
The national measurement institute and laboratories for Australia and New Zealand are:

- NMI Australia National Measurement Institute
- MSL New Zealand Measurement Standards Laboratory

Building capability in your facility

Research and development of the measurement capability.

Your organisation may have technical experts that can perform the Research and Development to build the measurement capability and seek accreditation from the relevant accreditation body.
If your organisation does not have these experts, technical consultancy can be utilised. The MSA is an association of professional metrologists throughout Australia and New Zealand and from a wide range of Calibration and Testing backgrounds and capabilities. This is a great place to ask for assistance Metrology Society of Australasia

People, skills, and training.

ISO/IEC 17025 details the requirement for personnel, training, and competency. It is good idea to consider professional training courses for the more technical aspects of Calibration and Testing such as Measurement methods and Estimating Uncertainties of Measurement. Training courses and Technical publications are available from:

- NMI Australia National Measurement Institute
- MSL New Zealand Measurement Standards Laboratory

International National Metrological Institutes also have a great range of technical publications on the various types of calibration methods and reporting of results. One example is the European Association of National Metrological Institutes (EURAMET) Calibration Guidelines - EURAMET

Management System, Environment and Equipment

Detailed requirements for the Calibration or Testing Laboratory documented management system, Environmental controls, handling and management of Test Equipment, and record keeping are provided in ISO/IEC 17025.

Particular attention should be made to the purchasing of reference instruments to perform calibration measurements. It is a good idea to purchase the most accurate reference instruments your facility can afford. A good rule of thumb is accuracies greater than four times the device under test where possible.

It is very important to have an appropriate calibration of the reference instruments that will cover all the functions and ranges that will be used in your calibration/testing facility, and with uncertainties of measurement suitable to the devices under test. A good way to source an appropriate calibration supplier is to use the IANZ or NATA directory

IANZ directory Directory (ianz.govt.nz)
NATA directory Find accredited facilities (nata.com.au)

Continuous Improvement processes

Internal auditing, quality monitoring, corrective actions, opportunities for improvement, seeking customer feedback, performing proficiency testing and inter-laboratory comparisons are all part of continuous improvement and ensuring the validity of your facilities published results. The requirements for these processes are detailed in ISO/IEC 17025. General Requirements for the Competence of testing and calibration Laboratories.

Conclusion

This Technical Guide provides a high-level overview of many of the considerations and tasks required to build and manage a rigorous calibration or testing facility. More detailed information can be found using any of the links provided to further explore these resources. You can also post questions at the MSA Web Site discussion forums page- Metrology Society of Australasia.