



International metrology: The work of the BIPM and the OIML

*Metrology
can be found
everywhere*

Metrology is the science of measurement and its application. Metrology includes all theoretical and practical aspects of measurement, whatever the measurement uncertainty and field of application.

(International Vocabulary of Metrology - Basic and General Concepts and Associated Terms. VIM, 3rd Edition, 2007).

Measurement science is something of vital importance to us all. The intricate and mostly invisible network of services, suppliers and communications upon which we all depend, relies on metrology for its efficient and reliable operation.

Many physical and chemical measurements have an immediate impact on the quality of the world in which we live.

Examples of where metrology is encountered in everyday life:

- The wealth of nations depends upon the ability to manufacture and trade precisely made and tested products and components.
- Trade between countries often involves huge amounts of money, therefore a small error in measurement of, for example, flow rates and quantities of oil and gas can represent a significant amount of money.
- Economic globalization often requires that individual parts of complex engineered structures are manufactured in different countries. Metrology ensures that these parts fit together when the final system is assembled. For this reason, large multinational companies often have their own metrology departments.
- The tremendous advances in micro-electronics in the last forty years would not have been possible without metrology in the continual improvement of micro-chip production. The development of fast computers allows engineers to design new micro-circuits, which in turn allows better computers, and so on.
- Satellite navigation systems and international time correlation make accurate location possible. These systems allow networking between computer systems around the world and permit aircraft to land safely in poor visibility.
- Human health depends on our ability to make accurate diagnoses requiring measurements, for example determining the level of cholesterol in blood.
- Breath analyzers are used to measure alcohol levels in the body.
- Consumers need to trust the volume delivered by a petrol pump.

Scientific and applied metrology:

The BIPM and the international chain of measurements

The International Bureau of Weights and Measures (in French, Bureau International des Poids et Mesures or BIPM) was created by the Metre Convention of 1875 and is located just outside Paris, France. The BIPM is an intergovernmental organization financed by those States who are signatories of the Metre Convention, and operates under the supervision of the Comité International des Poids et Mesures (CIPM).

The BIPM has a mandate to provide the basis for a single, coherent system of measurements throughout the world which is traceable to the International System of Units (SI). This task takes many forms, from direct dissemination of units (as in the case of mass and time) to international comparisons to validate the consistency of national standards (as in electricity, ionizing radiation and chemistry).

The BIPM undertakes scientific work at the highest level on a selected set of physical and chemical quantities. The major task of the BIPM is the worldwide coordination of metrology, mainly through national metrology institutes (NMIs) which continue to disseminate the chain of traceability to the SI into national accredited laboratories and finally to industry.

Scientific metrology, as undertaken at the BIPM and the NMIs, establishes and validates the comparability and accuracy of measurements. This is achieved through traceable measurement results, obtained by connecting measurement standards of known metrological behaviour through unbroken chains of measurements, preferably traceable to the SI. The SI quantities are now almost all related to quantum phenomena, such as the spectroscopic properties of atoms or, for example, the quantum Hall effect and von Klitzing constants, for which we can assume invariability with time. Relation to unchanging quantum standards also removes the need for a physical artifact as a reference which can be broken or whose values can drift with time.



The BIPM is based near Paris

The BIPM's mission is worldwide uniformity of measurements

Metrology is more than 'simply' doing measurements

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Legal metrology:

The OIML and worldwide confidence in regulated measurements

The OIML provides guidelines for national and regional legal metrology requirements

The OIML, International Organization of Legal Metrology (in French, Organisation Internationale de Métrologie Légale), is an intergovernmental treaty organization which develops model regulations/legislation for its membership. This membership includes Member States (which participate actively in technical activities) and Corresponding Members (which join the OIML as observers).

The Organization was established in 1955 to promote the global harmonization of legal metrology requirements and procedures. From the outset, the OIML's main objective has been to develop a worldwide technical structure that provides:

- mutual information and confidence in each Member's legal metrology structures,
- documents that provide harmonized requirements,
- guidance for the development and implementation of legal metrology regulations, and
- global systems for international certification and acceptance in legal metrology.

This work allows the OIML to contribute to the implementation of the World Trade Organization's (WTO) Technical Barriers to Trade (TBT) Agreement. The OIML is an observer on the WTO TBT Committee, and also participates actively in the work of a large number of international and regional standardization and legal metrology organizations.



The OIML is based in Paris

Legal metrology comprises all activities for which legal requirements are prescribed on measurement, units of measurement, measuring instruments and methods of measurement, these activities being performed by or on behalf of governmental authorities, in order to ensure an appropriate level of credibility of measurement results in the national regulatory environment.

(Definition taken from OIML D 1 Elements for a Law on Metrology, 2004).



Conclusions: The World Metrology System

The BIPM and the OIML play an integral role in what could be termed the 'World Metrology System'. The amount of money spent on metrology is a very small portion of total national expenditure, but its impact is tremendous, demonstrating the vital importance of metrology to us all and the world in which we live.

Without metrology our world would be very different. Metrology is of fundamental importance in industry and trade - not only from the point of view of the consumer but also for those involved in manufacturing. Both groups must have confidence in the accuracy and reliability of the measurements upon which they depend.

Every small investment in metrology results in a large return to the investor, whether the investor be a private company, a national government or an international organization. This makes investing in metrology a sound strategy for future prosperity.

*Metrology has
an impact on
everybody,
every day*

*Metrology
generates a high
return on the
investment of
public money*

*Further details about the work of the BIPM and the OIML can be found
on their respective web sites, and also on the Joint Web Portal:*

www.metrologyinfo.org



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