



**SIM
METROLOGY
SCHOOL**



MWG11 Legal Metrology

SPEAKER

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Fundamental Concepts of Legal Metrology



Fundamental Definition of Legal Metrology

Categories of Metrology

1. Scientific metrology
2. Industrial metrology
3. Legal metrology

Legal Metrology

Legal metrology is concerned with measurements which have **influence in** the transparency of **economic transactions**.

All the measuring instruments which results are involved in those areas, in general, need legal technical requirements to assure fair trade.

But, not only economic transactions, **any measurement affecting public health and environmental welfare, as well as the prepackage products** is also a legal metrology concern.

The main objective of legal metrology is to assure the citizens the correct measurement results when it can be subject to public scrutiny.



Formal Definition of Legal Metrology

Legal Metrology Definition of VIML (1.01):

Legal metrology is the practice and process of applying statutory and regulatory structure and enforcement to metrology (VIM).

Virtually all countries provide protection for both the buyer and the seller by including metrology in their legislation

Legal metrology tasks include:

- setting up legal requirements
- control / conformity assessment of regulated products and regulated activities
- supervision of regulated products and of regulated activities
- providing the necessary infrastructure for the traceability of regulated measurements and measuring instruments to SI or national standards.



What is the OIML?

The OIML is an intergovernmental organization established in 1955 to resolve internationally the technical and administrative problems raised by the use of measuring instruments.

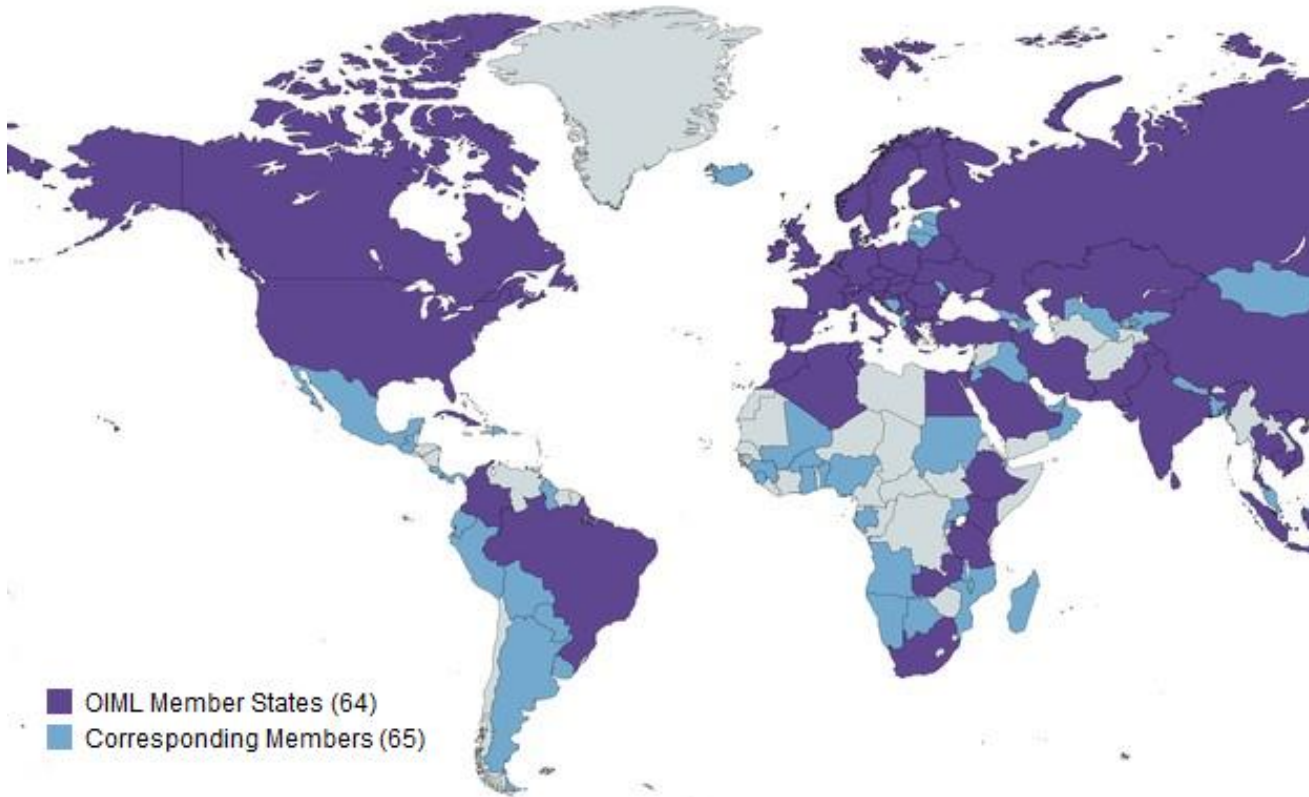
Its main objectives are:

- To organize mutual information and cooperation among its members.
- To promote the global harmonization of the legal metrology procedures and regulations that underpin and facilitate international trade.
- To foster mutual confidence.



The harmonization of legal metrology regulations is promoted by OIML through the development of international recommendations, which are the model regulations for the

OIML members states



There are two categories of OIML Members:

Member States which have ratified the OIML Convention.

Corresponding Member states which are countries that cannot, or do not yet wish to become Member States, but are interested in the work of the OIML and want to participate in it.



Regulation of Legal Metrology



Legal aspects of Legal Metrology

Metrology Law (VIML 1.02):

Every country have a Metrology Act and secondary legislation usually defining the following (more in OIML D1):

- The legal units of measurement
- Hierarchy of measurement standards
- Requirements of measuring instruments (accuracy, technical properties, etc.)
- A system of legal control
- Metrological control on prepackage products
- Authority responsible for legal metrology
- Collection of fees;
- Offences and penalties.

Legal Metrology Regulations (VIML 1.03)

Technical regulation in the field of legal metrology.

These regulations shall, when applicable, be compatible with the International Recommendations of the OIML and make use of their requirements.



Legal aspects of Legal Metrology

National Responsible Body

Organization or agency at the national level, responsible for developing and/or enforcing laws or regulations regarding **legal metrological control**.

Ex.

- China: SAMR
- Colombia: SIC
- Brazil: Inmetro

Metrological Authority

Legal entity designated by law or by the government to be responsible for specific legal metrology activities.



ent & Measuring

Police Powers

What has to be regulated?

Measuring instruments

- Sphygmomanometers
- Clinical Thermometers
- Utility meters (electricity, water, heat and gas)
- Measuring systems for liquids other than water (fuel pumps)
- Weighing instruments (automatic and non-automatic, etc.)
- Material measures (length and volume)
- Vehicle exhaust gas analyzers
- Taximeters
- Speed meters
- Breath analyzers
- Grain moisture meters






What has to be regulated?

Prepackaged products (See more in OIML R87)

A prepackaged product is an item and its packing material, in which the quantity of the product has a predetermined value made up before being offered for sale.

The actual quantity of product cannot be altered without open the packing material

Requirements for the sale of prepackaged goods are part of national legislation in many countries and they usually provide the following:

- Labelling requirements;
 - Standardization of pack sizes;
 - Metrological control; and
 - Prevention of misleading packaging.
- 



Legal Metrology Activities



Legal Metrology Activities

Legal metrological control (See OIML D3)

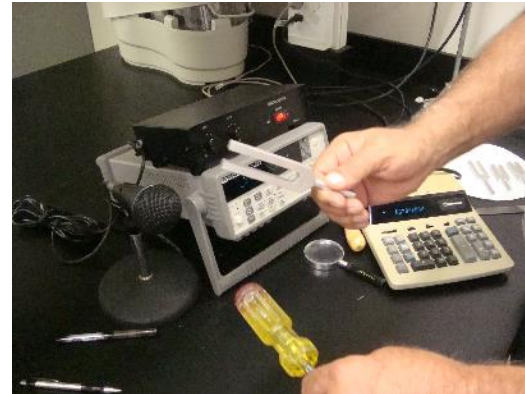
All the operations for the purpose of examining and demonstrating, e.g. to testify in a court of law, the condition of a measuring instrument and to determine its metrological properties, amongst others by reference to the relevant statutory requirements.

- Type Evaluation (Approval) (See OIML D19)
- Initial Verification
- Subsequent Verifications
 - Periodical Verifications
 - After repair
 - By user request (Voluntary)
- Metrological Supervision

Metrological Supervision (See OIML D9)

Activity of legal metrological control to check the observance of metrology laws and regulations

- Market Surveillance
- Conformity to (the approved) type



Standard tuning fork

This standard tuning fork is used to periodically verify radar based speed meters

Type (Pattern) Evaluation (VIML 2.04)

Conformity assessment procedure to demonstrate that specified requirements are fulfilled on one or more specimens of an identified type (pattern) of measuring instruments.

The **type approval** (VIML 2.05) is a decision of legal relevance, based on the review of a type evaluation report certifying that the measuring instrument complies with the relevant requirements.

As a result, it is issued a **type approval certificate**, as well as a permission to exhibit a **type approval mark**.



Issuing Authority NMI Certin B.V., OIML Issuing Authority NL1
15 January 2018

**Type approval Mark
from Inmetro fixed on
an electricity meter**

Type Evaluation Requirements

The type evaluation requirements are generally specified in a metrological technical regulation (MTR) and basically there are the following requirements categories:

- **Performance requirements**
 - Accuracy tests (Maximum Permissible Errors)
- **Performance under influence quantities**
 - Electromagnetic Compatibility (EMC) tests
 - Mechanical tests
 - Climatic tests
- **Software Evaluation (See OIML D31)**
 - Software identification and integrity.
 - Protection of legally relevant parameters
 - Correctness of algorithms



EMC test lab at NIM China testing a NAWI

Initial Verification (VIML 2.12)

Initial verification is a verification of a measuring instrument which has not been verified previously.

- Usually, it is performed in the factory before to put the instrument into the market.
- Ideally in 100% of the instrument production should be verified and stamped. However, sampling verification is also allowed.
- Generally, the accuracy requirements for initial verification are more stringent than those for subsequent verification
- Initial verification is normally the responsibility of the legal metrology service or other authorized organization.

**Subject to Periodical Verification,
as soon as put in use**

Pre-market activity



Initial Verification stamp used in Brazil

Subsequent Verifications (VIML 2.12)

Subsequent verifications are any verification of a measuring instrument after an **initial verification**. They can be:

- Periodical verification.
- After repair Verification.
- By user request.

The national regulations of several countries specify that measuring instruments must be **verified periodically** at regular intervals (1 year, 2 years or longer) **to ensure that the individual instruments are still within their prescribed limits of error** among other metrological properties

What happen if the instrument do not comply the MPE in the field?

Incorrect Instrument

It is illegal using it without repair
The retire of this stamp without authorization of the metrological body constitutes an infraction foreseen by the law.



Periodical Verification stamp used in Brazil



Interdiction /proscription stamp used in Brazil

Subsequent Verifications (VIML 2.12)

After Repair Verification

Frequently, the law also establish that any measuring instrument has to be verified and stamped after being repaired.

- Usually, after repair verification are carried out by [accredited instrument repair workshops](#) such as fuel pumps, chronographs and NAWI's.
- Repair workshops are periodically audited by metrological authorities to ensure they meet specific requirements of the quality management system.

Post-market activity



After repair Verification stamp used in Brazil



Metrological Supervision (See more in OIML D9)

Metrological supervision is the control exercised after the instrument has been put in service, in order to check whether the metrology law and regulations are properly complied with.

- It includes the checking of correctness of quantities indicated on and contained in [prepackage products](#).
- Inspections are carried out without notice and are very often initiated as a result of complaints from the public.

Main forms/tools to do the metrological supervision:

- [In-service Surveillance on measuring instruments](#).
- [Market Surveillance on instruments and prepackage products](#).
- [Conformity to \(approved\) type – CTT \(See more in OIML D34\)](#): conformity assessment procedure focused on the assessment of measuring instruments to give assurance that manufactured (or production) instruments meet the approved type.



Prepackaged products (See more in OIML R87)

Requirements for prepackaged products

A **prepackaged product** is a product which is not measured in the presence of the consumer and which is being commercialized.

Prepackage products are sold in units of:

- Mass
- Volume
- Length
- Counts

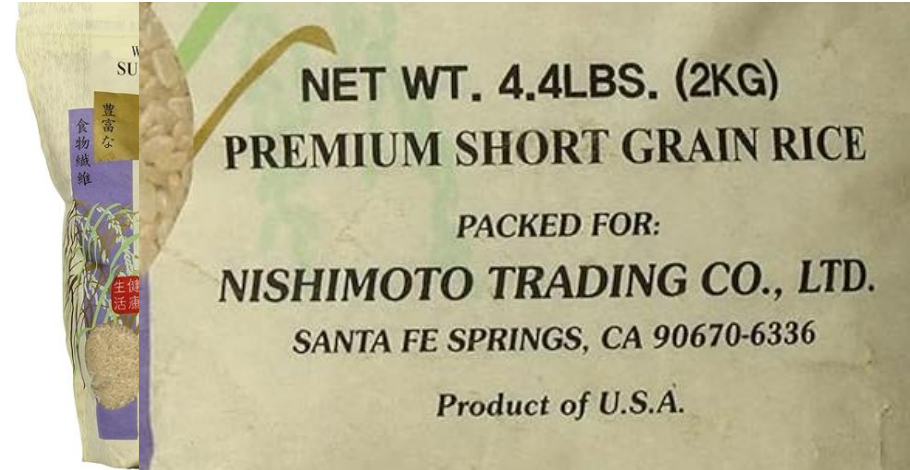
To sale prepackaged products countries usually provide the following:

- Labelling requirements;
- Standardization of pack sizes;
- Metrological control; and
- Prevention of misleading packaging.



Labeling Requirements for Prepackaged products

- Every package intended for retail sale has to bear the following main information:
 - Product identification (common or generic name);
 - The name of manufacturer, packer, distributor, importer or retailer;
 - The **net quantity** of the product.
- The information has to be legibly and displayed on the part of the package which is likely to be shown to the customer.
- Usually, there is a minimum size of letters for the net quantity (for example, in Brazil it must be greater than 2 mm).
- The way of declaring the net quantity, including the symbols for units and the number of decimal places to be used, is usually also regulated.



Standardization of Pack Sizes for Prepackaged products

- To facilitate price comparison and to prevent unfair competition, many countries have specified standard pack sizes for certain products.
- If the package have the label, Why standardize the package size?
- Some countries not opting for standard package sizes, have made it mandatory to declare the unit price for goods in order to facilitate price comparison.

Exercise:

What coffee is the best deal?



250 g
\$4.50



500 g
\$9.80



250 g
\$4.70

Metrological control of Prepackaged products

In order to ensure the accuracy of the net content the law may specify the checking at any level of distribution (in the factory, at the market, etc.).

The metrological control is carried out by sample inspections of the production lots.

As a general rule: $\bar{Q} \geq Q^{nom}$

Of course, some variations are allowed:

This reasonable limit ensure that an inspection lot do not have more than 2.5 % of non-compliant packages

Inspection lot size	Sample size	Sample correction factor	Number of prepackages in a sample allowed to exceed the tolerable deficiencies
100 to 500	50	0.379	3
501 to 3 200	80	0.295	5
More than 3 200	125	0.234	7



Can the countries perform all the stages of Legal Metrological control?

Legal metrological control


- Type Evaluation (Approval)
- Initial Verification
- Subsequent Verifications
 - Periodical Verifications
 - After repair
 - By user request (Voluntary)
- Metrological Supervision
 - In-service surveillance
 - Market surveillance
 - Conformity to type

No, a Law on Metrology is always a national affair!

Legal metrological control need to be designed for the particular needs of each country:


- Economical priorities
- The geographic size of the country
- Economical development
- Scientific and technological infrastructure

At type evaluation level, one or more instruments are subjected to examination and a wide range of tests that require **specialized and expensive test facilities**.





Mutual confidence and the OIML Certification System (OIML-CS)



Mutual confidence and the OIML Certification System (OIML-CS)



What is the OIML-CS

Principle: Once tested accepted anywhere!

- The OIML-CS is a system for issuing, registering and using OIML type approval certificates of measuring instruments, which are approved based on the requirements of the OIML Recommendations.
- The aim is to facilitate the work of national and regional authorities responsible for the type evaluation and approval of measuring instruments subject to legal metrological control.
- It is a voluntary system and OIML Member States are free to adopt or not the system (Brazil is not participating)

The new OIML-CS

- Implemented in 2018 substituting the existent MAA and Basic Certification Systems.
- Promote global harmonization for measuring instruments facilitating global trade.
- Avoid unnecessary re-testing establish rules and procedures for fostering mutual confidence
- Address the demands of Stakeholders
- OIML B 18:2022 establishes these rules whereby signatories voluntarily accept and utilize OIML type evaluation and test reports, when associated with an OIML-CS certificate issued by an OIML Issuing Authority, for type approval or recognition in their national or regional metrological controls.



Benefits of OIML-CS

(OIML Seminar – Colombia 2017)



For manufacturers

- Compliance with harmonized requirements of the relevant OIML-recommendations
- Avoid of repeat type approval tests in different countries
- Reduced effort to obtain national approvals (saving time and money)
- Shorter time-to-market period
- Easier access to international market

Utilizers Countries

- Easy issuing of national approvals by authorities from countries in which no test facilities are available and where national type evaluations and approvals are required.
- Reliance on the work of issuing authorities, which have demonstrated competence.
- Reliance on internationally agreed harmonized requirements.
- Only measuring instruments enter the national market, where the quality has been proven.



Benefits of OIML-CS

(OIML Seminar – Colombia 2017)



For Issuing Authorities

- Acceptance of the certificates on an international level (in all utilizers and associated countries)
- Being more attractive for manufacturers from the whole world
- The choice of demonstrating competence by peer assessment or by accreditation
- Working on the basis of internationally agreed requirements
- Higher degree of utilization laboratory capacity as possible

For costumers

- Higher reliance on measuring instruments
- Measurements can be compared on international level (interesting especially for companies working in several countries)
- Maybe lower prices for measuring instruments, as the manufacturers save much money (no duplicate testing & easier approval procedures!)
- Measuring instruments are prepared for national metrological control



Example of Regulation Development



Development of Metrological control of EVSE in Brazil

Regulatory Impact Analysis!

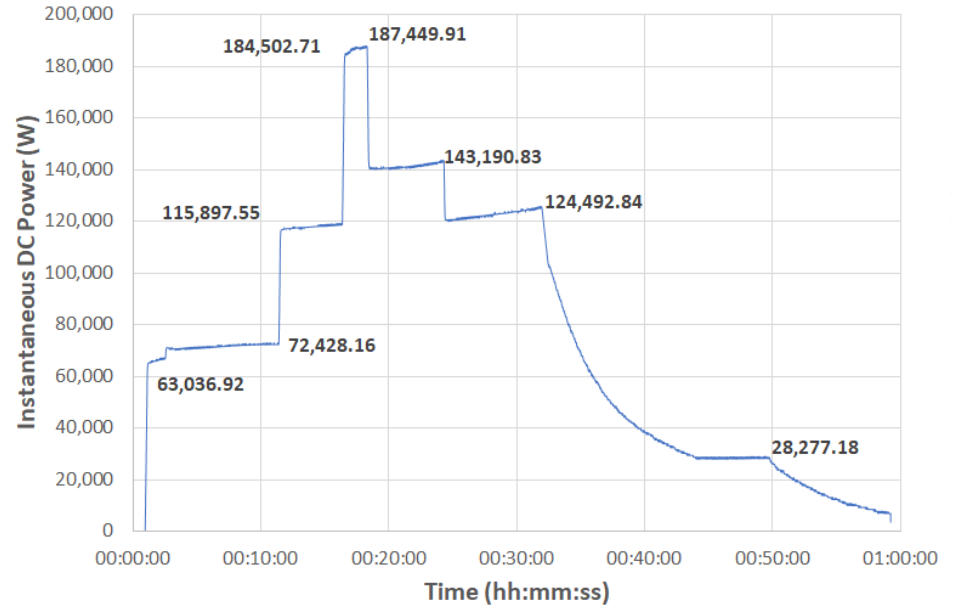
Participation on OIML TC Groups

- TC12 – Electricity metering
- PG – EVSE to convert OIML G-22 in a new OIML Recommendation

Main Concerns:

- Are primary standards prepared to bring traceability to DC metering?
- Are DC energy working standards available and traced to the SI?
- How to perform initial verifications?
- How to perform in-service verifications?
- What is the cost of implementing each metrological control stage?

Typical Load profile of an EVSE during the charging process





Development of Metrological control of EVSE in Brazil

Imetro Plans and Expectations

- Define metrological control requirements and [procedures](#) aligned with the OIML new recommendation.
- Discuss the type approval requirements with international experts and influence the procedures of the new document.
- Define requirements and [procedures](#) for metrological control according to the needs of the Brazilian stakeholders and society
- Release a Regulation for AC EVSE in 2025.
- To release a second Regulation on DC EVSE (ASAP 2026?)






Conclusions and Final Comments





Conclusions and Final comments

- Legal Metrology is where the real action happens!
 - There is a close synergy between legal metrology and scientific metrology
 - It is a universe totally different from the scientific metrology and industrial metrology.
 - Legal Metrology have with their own challenges to overcome which demands specific research activities.
 - The legal aspect brings additional attention.
- 

Thanks!

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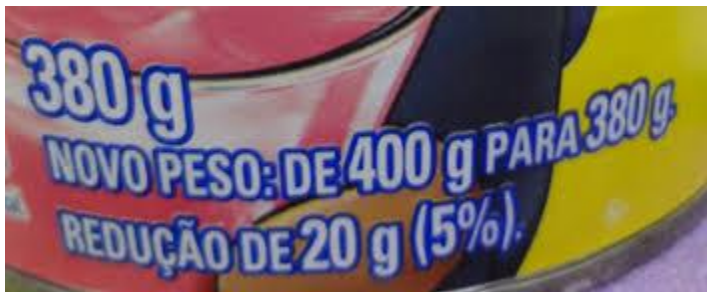
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Prepackaged products (See more in OIML R87)



Weighing inflation observed in Brazil,
regulated by Portaria nº 392/2021 from the
Justice Ministry