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JANUARY 2016

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60th Anniversary of the OIML
CIML meets in Arcachon for its 50th meeting

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THE OIML BULLETIN IS THE QUARTERLY JOURNAL OF THE ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

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OIML SECRETARIAT

BUREAU INTERNATIONAL DE MÉTROLOGIE LÉGALE (BIML)

11 RUE TURGOT – 75009 PARIS – FRANCE
TEL: 33 (0)1 4878 1282
FAX: 33 (0)1 4282 1727
INTERNET: www.oiml.org or www.oiml.int
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Editorial

PETER MASON
CIML PRESIDENT

Happy New Year!

One key challenge we face after a very successful and productive CIML meeting – and I think our 50th meeting in Arcachon last October was one of the most productive in all my years as UK CIML Member – is that there is now a great deal of work to follow up on.

So as we look forward to 2016, the one thing I am sure about is that it will be a very busy year. The two Project Groups which were set up – one to introduce the new approach to our Certification System and the other to look again at our Technical Directives to ensure we carry out our technical work as efficiently and effectively as possible – have ambitious goals, and these projects will require significant contributions from many colleagues.

Perhaps even more importantly, the resolution we passed concerning a comprehensive package of activities related to countries and economies with emerging metrology systems will require actions on many fronts if it is to have the impact we are hoping for, and which we expect.

However, I am optimistic that we will again rise to these challenges. After all, this is the time of year at which we traditionally contemplate the future; what all these initiatives have in common is that they are intended to keep our Organization *relevant* for that future. If we can harness the enthusiasm and goodwill we saw in Arcachon, I am very confident that 2016 will be another successful year.

Season's greetings and a very Happy New Year to all our Members and Readers. ■

Bonne Année !

L'un des principaux défis que nous devons relever après la réussite de la très fructueuse et productive réunion du CIML – et je pense que notre 50ème réunion à Arcachon en octobre dernier a été l'une des plus productives de toutes mes années en tant que Membre du CIML pour le Royaume-Uni – est de faire face, à présent, à la grande quantité de travail qui nous attend.

Aux portes de 2016, s'il y a une chose dont je suis sûr, c'est qu'il s'agira d'une année très chargée. Les deux Groupes de Projets qui ont été constitués – l'un pour introduire la nouvelle approche de notre Système de Certification et l'autre pour réexaminer nos Directives Techniques pour s'assurer que nous effectuons nos travaux techniques aussi efficacement que possible – ont des objectifs ambitieux, et ces projets exigeront des contributions importantes venant de nombreux collègues.

Le plus important peut-être est que la résolution que nous avons adoptée concernant un ensemble complet d'activités relatives à des pays et économies disposant de systèmes de métrologie émergeants nécessitera des actions sur plusieurs fronts si par cette résolution nous voulons assurer l'impact que nous espérons et que nous attendons.

Toutefois, je suis confiant que nous nous montrerons de nouveau à la hauteur de ces défis. Après tout, c'est l'époque de l'année au cours de laquelle nous envisageons traditionnellement l'avenir ; toutes ces initiatives ont en commun d'être destinées à faire en sorte que notre Organisation demeure *pertinente* pour accomplir ces projets d'avenir. Si nous pouvons tirer parti de l'enthousiasme et de la bonne volonté que nous avons vus à Arcachon, je suis très confiant que 2016 sera une autre année couronnée de succès.

Je souhaite de joyeuses fêtes de fin d'année et de Nouvel An à tous nos Membres et Lecteurs. ■

HEAT METERS

Portable test equipment for residential utility meters

Part 1: Portable test equipment using thermo-electric modules (TEM) for residential heat meters

YOUNG-MUN KWEON AND SUNG-WOOK KIM,
Metrology Industry Division
Korea Testing Certification (KTC),
Republic of Korea

1 Introduction

The aim of this series of short articles is to provide readers who are responsible for testing the quality of utility meters in service with information that will broaden their testing knowledge of utility meters used for billing purposes.

The OIML provides general, type approval testing and verification requirements for heat meters in OIML R 75 *Heat meters*.

When an abnormality occurs in a heat energy measuring instrument that is being operated on site, while the usability status can be determined by checking its performance, there are many restrictions to directly checking the operating conditions on site. Therefore, most performance tests are carried out in a laboratory.

In particular, for heat meters, not only flow sensor performance but also calculator performance needs to be checked, and for this reason a temperature generation apparatus is required. However, due to the physical size of such apparatus, it is impractical to carry out on-site inspection of heat meters.

In general, when abnormalities occur in a residential heat meter, the status of the abnormality can be checked using the procedure shown in Figure 1.

To summarize, when a user identifies an abnormality in the performance of a heat meter and requests a performance evaluation to the managing agency, the latter will have the heat meter separated from the piping by a repairman, and the meter is then sent to the inspection agency.

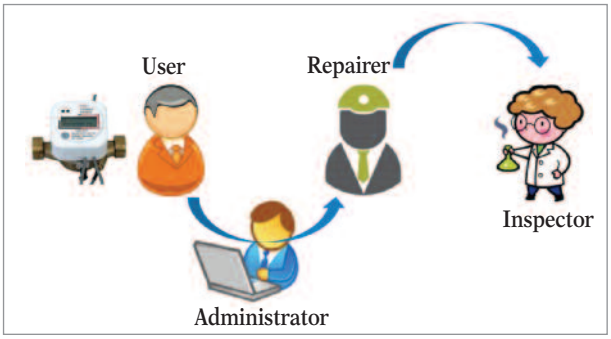


Figure 1 Procedure to resolve bill complaints

The heat meter then undergoes a process of measurement performance evaluation conducted at the inspection agency over a given period, following which the results are reported to the user.

In such cases and depending on the administrative procedures, significant time and cost may be incurred.

To reduce these inconveniences, an inspection device capable of carrying out on-site inspection of heat meters has been developed to address the problems that used to occur in the past, as well as to reduce distrust in heat meter related commercial transactions.

2 Application technique

The components of the portable test equipment for heat meters include:

- a flow sensor which measures the integrated flow rate values of the thermal fluid in piping as shown in Figure 2;
- a temperature generation apparatus capable of measuring temperatures before and after the heat meter;
- a calculator to measure the heat quantity values by receiving and processing signals generated at the flow sensor; and
- a test bench.

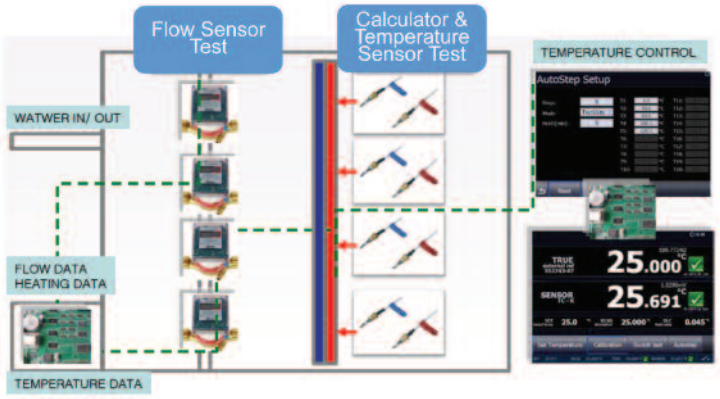


Figure 2 Components of the portable test equipment for a heat meter

The specifications for the portable inspection equipment for heat meters are given in Table 1.

Table 1 Portable test equipment specifications

Basic specifications	
Flow rate interval	[0.5, 2.8] m^3/h
Temperature interval	[5, 90] °C
Nominal diameter of heat meters	(15, 20, 25) mm
Number of meters	4
Model size W × H × D (cm)	85 × 55 × 70

As a reference for the measurement of the flow sensor, an electromagnetic flow meter is used within the flow rate measurement interval of [0.5, 2.8] m^3/h.

For the temperature generation apparatus, a thermoelectric module method is utilized with consideration given to the size and weight of the portable test equipment, where the interval of temperature generation is [5, 90] °C. As the thermoelectric module utilizes what is known as the Peltier effect, it has a smaller size and weight than the existing constant-temperature water bath, which has the advantage of easy temperature control, so it may be applied to the portable test equipment.

Further, a test bench is configured to allow the simultaneous testing of up to 4 units at the nominal diameter of 15~25 mm, which is commonly used in households.

Unlike heat meter test equipment installed in a laboratory, which has no constraints related to its weight, the portable test equipment is obviously intended to be moved around. Thus, the most critical points in terms of the design are light weight and convenient mobility.

Figure 3 shows the actual appearance of the portable inspection equipment for heat meters, which is optimized through the application of a drawer-type setup to place the flow sensor, the calculator, the temperature generation apparatus, and the test bench in the same case. In this way, it is designed as an integrated piece of equipment, to optimize its mobility using a vehicle.

In terms of the light weight of the equipment, the temperature generation apparatus is configured using a new measurement method. In the conventional temperature generation apparatus, the weight is significant as a constant-temperature water bath is employed (and there is also a safety problem due to the hot water). However, for the portable equipment on the other hand, the supply and return temperatures are controllable without direct heating of the water by utilizing a dry type temperature supply apparatus and applying thermoelectric module technology as shown in Figure 4.

The advantages of thermoelectric modules are:

- miniaturization and light weight;
- simultaneous cooling and heating possible through polarity conversion;
- precise constant-temperature control possible;
- wide interval of temperature control [–75, +300] °C possible; and
- eco-friendly equipment.

Figure 3 Portable test equipment for a heat meter

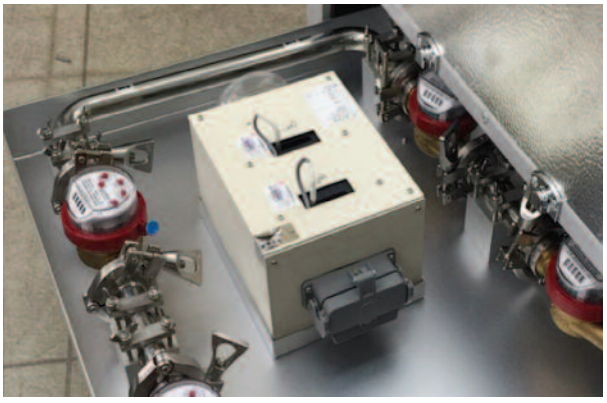


Figure 4 Temperature generation apparatus

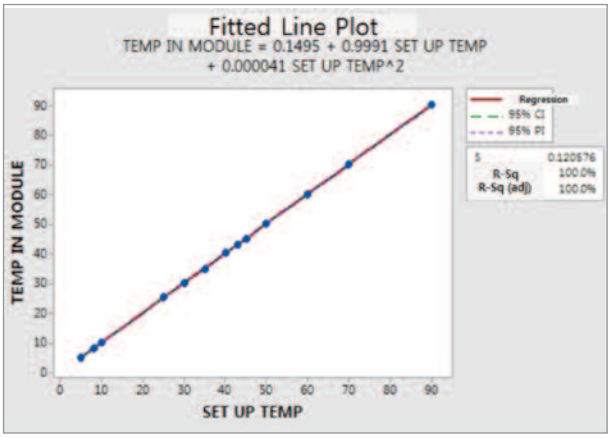
By verifying through the analysis that the temperatures set by the control part can be produced and maintained within 0.5 °C as shown in Figure 5, it has been confirmed that on-site inspection is possible.

As the CI (confidence interval) and the PI (prediction interval) are 95 % according to the fitted line plot, the tester inputs the setting values for the operating temperature within 5 °C~90 °C, with the probability of realizing the temperature confirmed to be higher than 95 %.

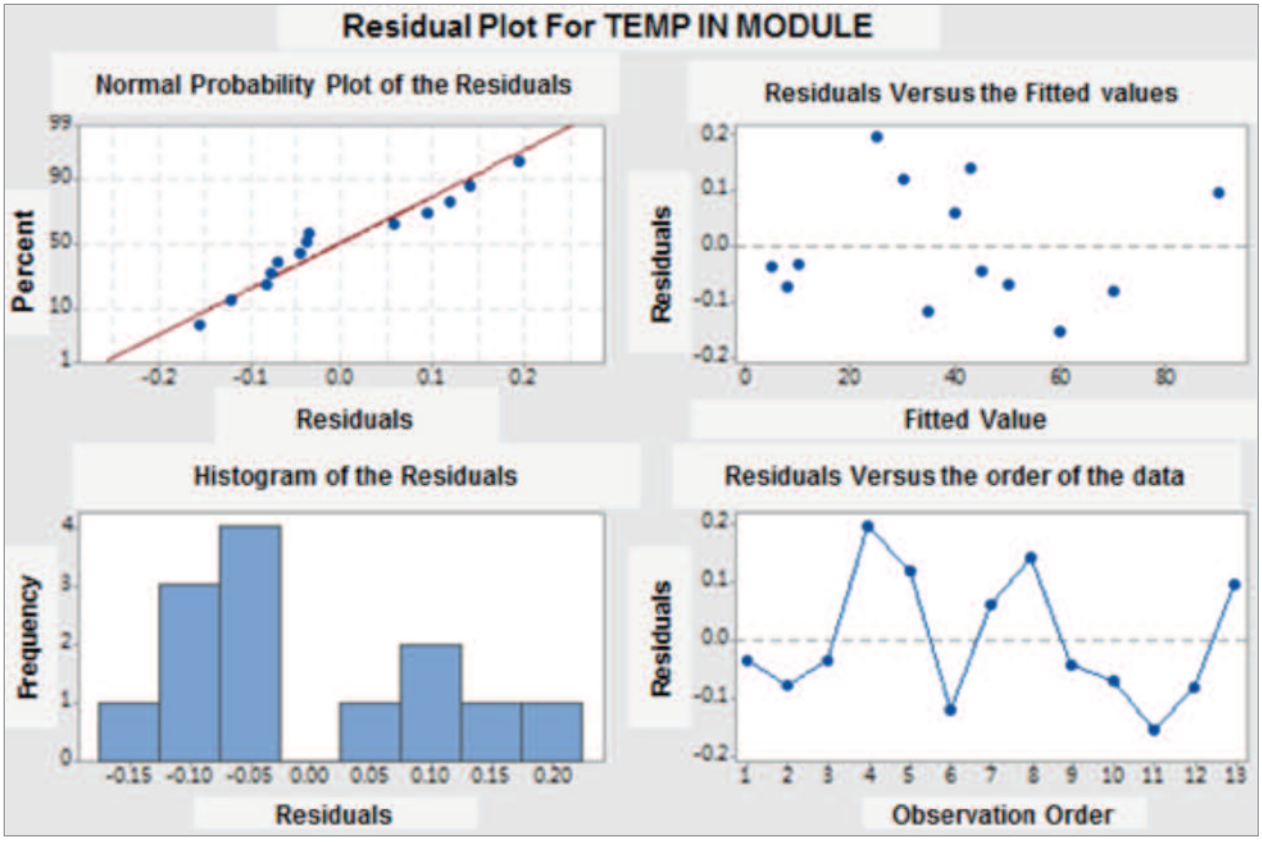
Also, through outlier analysis of any residual plots, normal distribution can be confirmed in the normal probability plot of the residuals, while equal variance in the residuals versus the fitted values is confirmed and a tendency is exhibited in the residuals versus the order of the data.

As a result, it can be confirmed that the thermo-electric modules method is adequate for the temperature generation apparatus.

Another development is carried out to allow the user to reach and maintain the set temperatures in a stable manner through a PID (proportional integral derivation) algorithm.



a) Regression line of setup temperature and temperature in the module



b) Residual graph of regression line

Figure 5 Analysis of temperature data

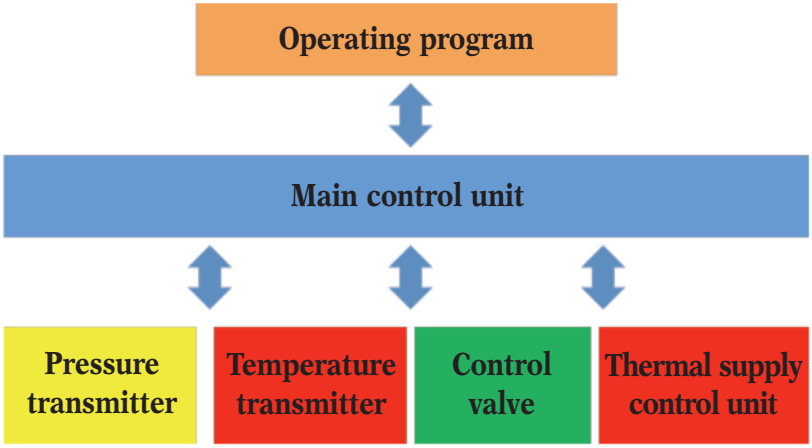


Figure 6 Control part block diagram

Figure 7 Operating program

The control part (see Figure 6), which manages data collection and analysis while controlling various measuring instruments, consists of a hardware configuration and a software operating program.

The hardware part again consists of the main control unit, the part that controls the thermoelectric modules technology, and the part that converts the measuring instrument signals.

The software part is composed of a program to enable the integration of such components for control.

Since the equipment and program are configured for easy access and use, anyone can operate them with ease.

In particular, the main control unit is designed and built to have an interface capable of receiving data through direct communication with the equipment, to prepare for the possible scenario of measuring instrument manufacturers providing protocols for each brand in the future. It is also capable of performing diversified functions with the 32-bit main chipset.

In addition, the operating program is configured as shown in Figure 7 to be readily recognized when the user operates the equipment or deciphers the data through an interactive HMI (human machine interface), to be able to control all the operating conditions of the equipment and check for flow rate, temperature, pressure, etc. produced upon inspection via the screen.

3 Discussion and concluding remarks

By utilizing this portable test equipment for heat meters, it is expected that the following problems experienced in laboratories can be solved:

First, on-site civil complaints occurring between the administrator and the user are expected to be alleviated.

This means that when arguments regarding heat meter bills occur, the inspection equipment is utilized; if inspection can be carried out through an on-site visit, then time and financial savings can be achieved and consumer complaints can be promptly resolved as a result.

Secondly, when the managing agency utilizes the present equipment, independent performance inspection may be conducted for the heat meter when the effective calibration period arrives, enabling accurate predictions to be made regarding the replacement of the measuring instrument.

For a heat meter for which the effective calibration period has expired, the economic burden the user incurs related to replacement can be reduced by avoiding unnecessary disposal of the equipment. ■

To contact the authors

Young-Mun Kweon and Sung-Wook Kim
Measuring Instrument Evaluation Center
Metrology Industry Division
Korea Testing Certification (KTC)
55 Gungnae-ro, Bundang-gu, Seonganam-si,
Gyeonggi-do,
Republic of Korea
thippo@ktc.re.kr, swkim@ktc.re.kr

Acknowledgment

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HISTORY OF SCALES

Part 17: Automatic checkweighers (ACWs) – Automatic catchweighing instruments in accordance with OIML R 51

Design, function and application

Wolfgang Euler, Hennef/Sieg (Region Cologne/Bonn)

Bernd Zinke, Wipotec Wiege- und Positioniersysteme GmbH, Kaiserslautern, Germany

Figure 1 Automatic checkweigher type HC-A made by OCS Checkweighers GmbH

Introduction

Automatic checkweighers (ACWs) occupy a prominent position in economic life, as they are used for quality assurance in the production of prepackaged goods. Around 85 % of all ACWs are used for in-plant production tasks without having to be verified. They help increase productivity and streamline material usage by keeping the required overfilling of the prepackaged goods to a minimum.

Only around 15 % of ACWs are used as verified measuring instruments to check the nominal fill quantity of prepackaged goods.

Frequently, ACWs are furnished with useful additional functions. For example, they can provide a continuous analysis of production tendencies for one or several production lines and adjust filling devices. They can apply labels to packaging and inspect these labels (detect them, analyze them and check their contents). They can control upstream filling machines to execute functions such as initiating empty cycles for regular zero-point monitoring and they can synchronize themselves automatically with downstream packaging machines (e.g. cartoning machines). Machines that look out for foreign objects (metal detectors) can be linked to or incorporated into ACWs.

1 Basic application and operating sequence of ACWs

An ACW is used to feed the item to be measured (such as packages or parts) to the load measuring device without the interaction of an operator, and to determine the deviation of the mass (package/part) from the target weight. For most applications, a downstream sorting device controlled by the ACW then rejects parts which exceed the set minus and/or plus limits or sorts the parts into classes.

An ACW compares a preset setpoint with the weight of the package as measured by the weight sensor and classifies the package.

The comparison takes place by way of subtraction. If the difference is zero, the weight of the package corresponds exactly to the preset setpoint. If the weight of the package deviates from the setpoint, the indicator points to one side ("too light") or the other ("too heavy").

> *Definition T.1.3.1 "Checkweigher" in OIML R 51-1:2006:*
>
> Catchweigher that sub-divides prepackages of different mass into two or more sub-groups according to the value of the difference between their mass and the nominal set point.

The primary metrological function of an ACW is to classify prepackaged goods of equal weight into at least two weight classes. A physical sorting device to sort the product flow is not mandatory. Similarly, the weight sensor used does not require an approal of its own, as the ACW is inspected and approved as a single unit.

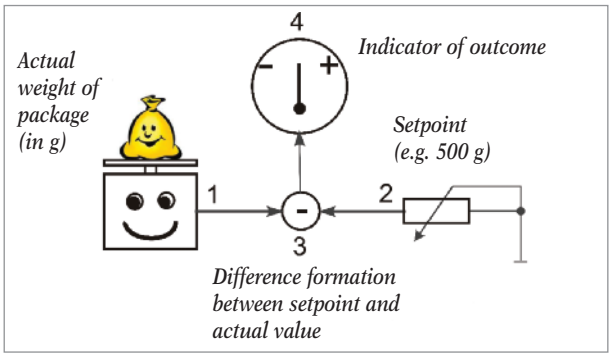
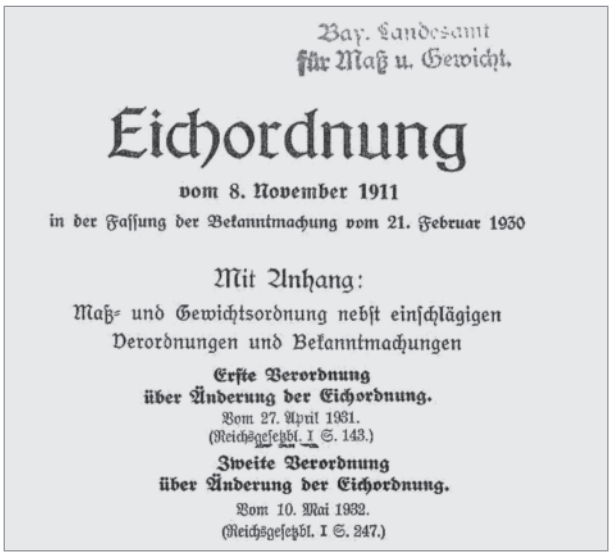


Figure 2 Operating principle of an ACW.
1 - Weight sensor
2 - Setpoint
3 - Difference formation
4 - Indication of result (plus/minus)



Bay. Landesamt
für Maß u. Gewicht.

Eichordnung

vom 8. November 1911

in der Fassung der Bekanntmachung vom 21. Februar 1930

Mit Anhang:

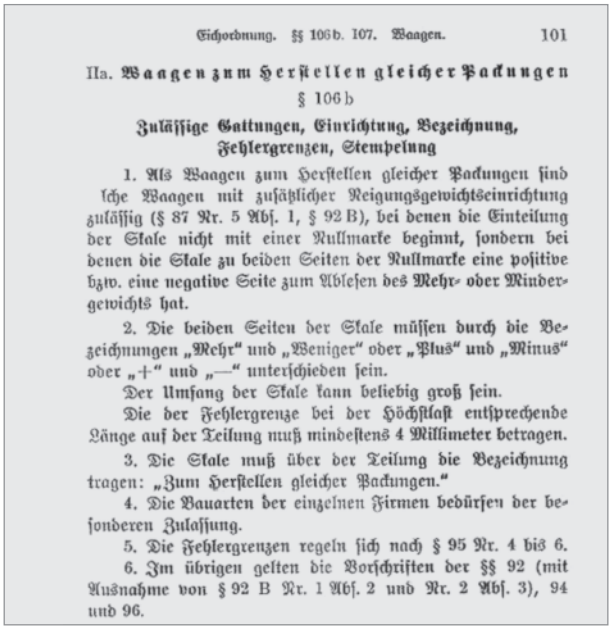
Maß- und Gewichtsordnung nebst einschlägigen Verordnungen und Bekanntmachungen

Erste Verordnung über Änderung der Eichordnung.

Vom 27. April 1931.
(Reichsgesetzbl. I S. 143.)

Zweite Verordnung über Änderung der Eichordnung.

Vom 10. Mai 1932.
(Reichsgesetzbl. I S. 247.)



Eichordnung. §§ 106b. 107. Waagen. 101

IIa. **Waagen zum Herstellen gleicher Packungen**

§ 106b

Zulässige Gattungen, Einrichtung, Bezeichnung, Fehlergrenzen, Stempelung

1. Als Waagen zum Herstellen gleicher Packungen sind iche Waagen mit zusätzlicher Neigungsgewichtseinrichtung zulässig (§ 87 Nr. 5 Abs. 1, § 92 B), bei denen die Einteilung der Skale nicht mit einer Nullmarke beginnt, sondern bei denen die Skale zu beiden Seiten der Nullmarke eine positive bzw. eine negative Seite zum Ablesen des Mehr- oder Mindergewichts hat.

2. Die beiden Seiten der Skale müssen durch die Bezeichnungen „Mehr" und „Weniger" oder „Plus" und „Minus" oder „+" und „—" unterschieden sein.

Der Umfang der Skale kann beliebig groß sein.

Die der Fehlergrenze bei der Höchstlast entsprechende Länge auf der Teilung muß mindestens 4 Millimeter betragen.

3. Die Skale muß über der Teilung die Bezeichnung tragen: „Zum Herstellen gleicher Packungen."

4. Die Bauarten der einzelnen Firmen bedürfen der besonderen Zulassung.

5. Die Fehlergrenzen regeln sich nach § 95 Nr. 4 bis 6.

6. Im übrigen gelten die Vorschriften der §§ 92 (mit Ausnahme von § 92 B Nr. 1 Abs. 2 und Nr. 2 Abs. 3), 94 und 96.

Figures 3 and 4 Title page and excerpt from the German Verification Ordinance of 1911

Figures 5 and 6 ACW type KW100 made by OPTIMA Maschinenfabrik (1976)

No digital indication for individual weights is needed to fulfill the primary metrological function. Although a digital indicator is helpful when performing a static test on ACWs, as is often done as the first step, such an indication is not explicitly stipulated in OIML R 51 for normal, automatic operation. Taking readings of individual weights via a digital indicator has proven to be a difficult task, particularly during high-speed production processes.

Early on, the German Verification Ordinance of 1911 contained the following definition for "Scales for the Production of Identical Packages": "Both sides of the scales must be marked with the labels 'More' and 'Less', 'Plus' and 'Minus', or '+' and '-'."

Therefore, as recently as 45 years ago, ACWs still had only a classification indicator in addition to the setting potentiometer, but did not have an indicator for individual weights.

2 Modern high-performance ACWs

Currently, modern high-performance ACWs process 750 to 800 packages per minute and per stream. Thus, multi-stream systems can check many thousands of packages in one minute. The goal of weighing 1 000 packages per minute and per stream on an ACW that has been verified also for this quantity is, in principle, possible for leading scale manufacturers. However, demand for such high-speed ACWs is low due to their high purchase cost.

The average ACW is used to process between 100 and 300 packages per minute.

Most ACWs, particularly high-performance ACWs, use weighing sensors which work in accordance with the principle of electromagnetic force restoration (EMFR). This principle is based on the notion that an electromagnet compensates for the weight which is to be determined. During this process, the position of a two-armed supporting lever is continuously recorded, and readjusted in such a way that a quasi-pathless measurement is carried out. Under this condition, the set current in the coil of the electromagnet is proportional to the weight which is to be determined.

To guarantee a high level of reproducibility, most force-compensated weighing sensors used in modern-day ACWs have a monolithically constructed lever mechanism, also called a monoblock.

Normally, the final weight measurement is completely determined in units of mass within the weighing sensor, which contains a complex digital data-processing unit for this purpose. The plateau in the measurement signal pattern that is available for the determination of the measurement value lasts only a few milliseconds, depending on the conveying speed of the ACW.

If needed, an Active Vibration Compensation (AVC) system can be incorporated into the weighing sensor; this system consistently suppresses ground-vibration disturbances in the measurement signal without reducing the measurement speed.

Examples of influence quantities which act upon the force measurement of the measuring sensor (weighing cell) are:

- local gravitational acceleration
- external vibrations, e.g. underground vibrations caused by adjacent machines
- mechanical and electrical transient effects
- air interference
- conveying speed/throughput quantity

3 ACW design

ACWs generally have the following components (see Figure 7):

1 - Base frame
2 - Weighing sensor (weighing module)
3 - Weighing conveyor belt
4 - Infeed and outfeed conveyor belt
5 - Operator terminal with display
6 - Switch cabinet for electronic control system

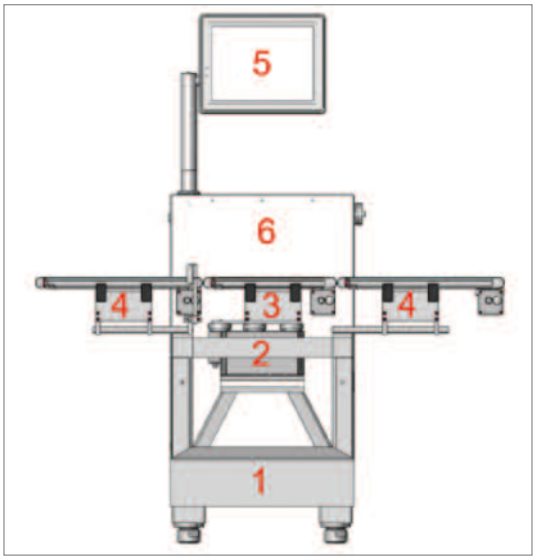


Figure 7 Design of an ACW

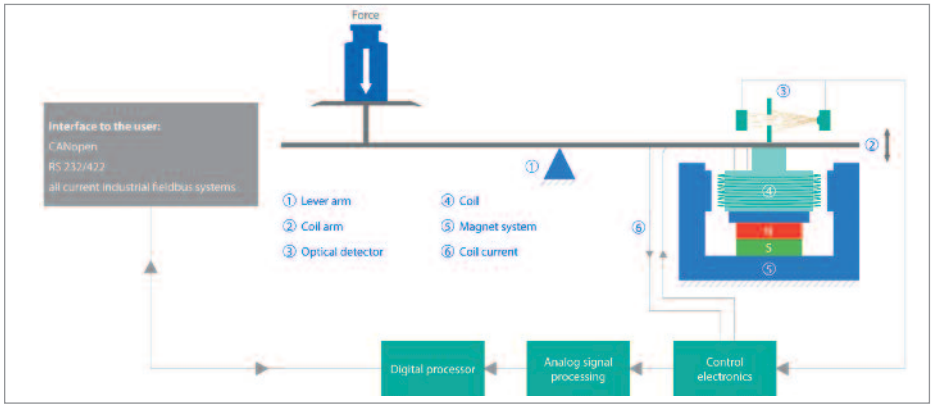


Figure 8 Operating principle of a weighing sensor with force compensation

4 Other essential functions of ACWs

Apart from their primary metrological function, modern-day ACWs have a variety of additional functions, since prepackaged goods can only be put on the market if they meet the respective national regulations concerning prepackaged goods.

In addition to the functions mentioned above, the following basic functions should be noted as being essential:

- TARA substraction: allows a net weight classification to be derived from the gross weight measured;
- physical sorting device: separates the product stream into several channels according to the classification determined;
- zero-setting: resets the zero point of the measuring system (weighing sensor);
- marking of the metrological data of the ACW (today possible using software programs);
- protection against tampering with the relevant access points by verification marks.

A conveyor system is not mandatory for an ACW. However, most ACWs have their own conveyor system, which is designed and optimized by the ACW manufacturer in consideration of a number of factors, including the maximum load to be conveyed, the maximum speed (throughput) to be achieved, the tolerable vibration disturbance (unbalance) and the cost-effectiveness for the given purpose.

In most countries, a conveyor system is considered "non-essential". This means that an ACW manufacturer merely has to demonstrate one conveyor system during the type approval; other, similar conveyor systems in the same series are then approved as well. Normally, the ACW model with the smallest verification scale interval, the highest number of intervals of the indicator, and the highest conveying speed is tested. ■

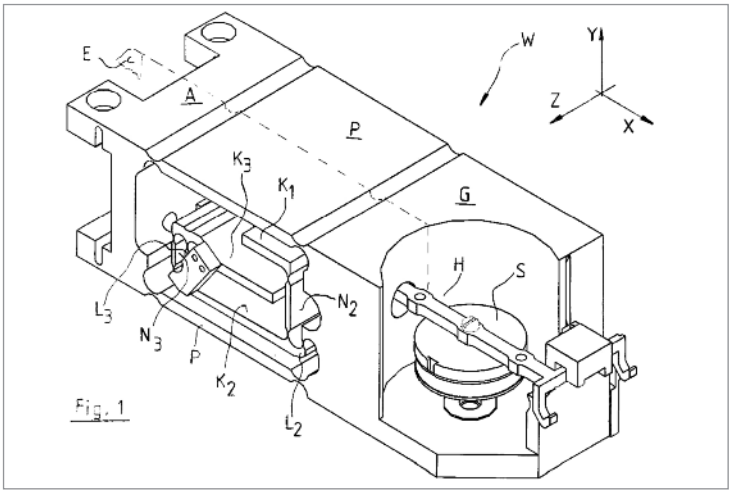


Figure 9 Example of a monoblock with a multiple-transmission lever system

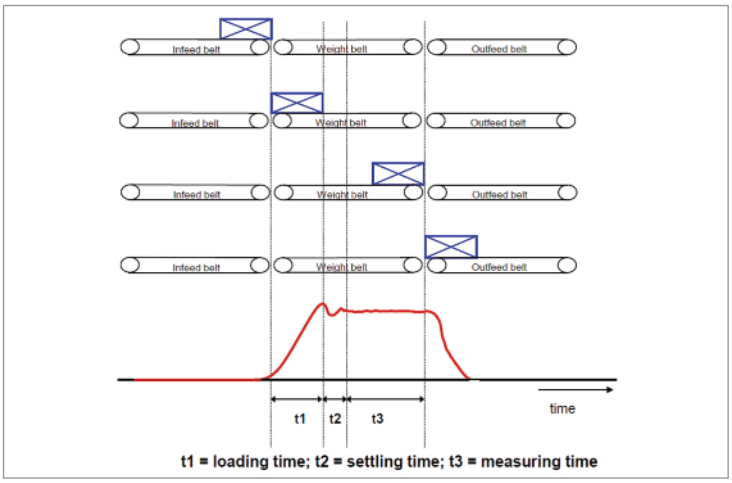


Figure 10 Progression of the measurement signal during movement of a package across the conveyor belts

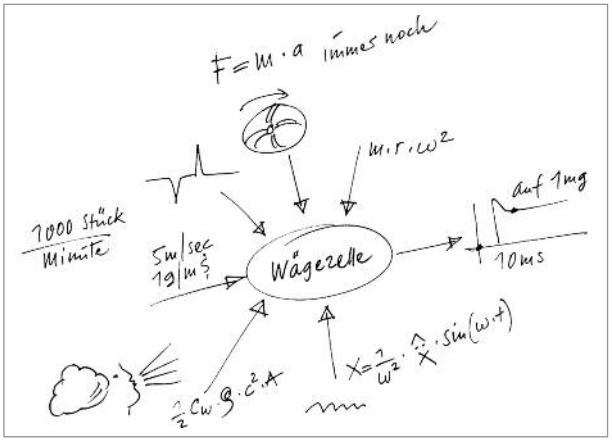


Figure 11 Influences on the weighing sensor (load cell)

Note from the Authors

This article on ACWs will be continued. With a view to the much-discussed transatlantic trade agreement TTIP, currently being negotiated between the US and the EU, important common features as well as differences in regulations which apply to ACWs (Handbook 44 and OIML R 51-1) will be highlighted.

EXPLORING BOUNDARIES

Re-thinking Legal Metrology

PETER MASON
CIML President

This article is taken from a speech given on 24 September 2015 to the IV International Scientific and Practical Conference organized by the Russian Academy of Metrology in St. Petersburg.

It is widely accepted that the resources available to virtually all legal metrology authorities across the world are under significant pressure. One of the features of this pressure is that many of us are required to explain to policy-makers elsewhere in our governments the economic value of the work carried out under the heading of "Legal Metrology". Very often, however, it is first necessary to consider how we should understand this subject of legal metrology in such discussions.

It is widely accepted that metrology can be conveniently separated into one of three branches – scientific metrology, industrial metrology and legal metrology.

But are we clear where those boundaries lie, and indeed does it matter?

I think it does matter for two reasons. First, so many of our institutional structures are built around these distinctions. Second, metrology is hard enough for non-metrologists to get to grips with. In the English-speaking world our first task is to explain it isn't about the weather! Or at least, not usually. When we start trying to explain the differences between the various branches, we lose the interest of all but the most curious. And this is important because the fact is that all of us – scientific, industrial and legal metrologists – are dependent on Governments to finance vital parts of the infrastructure on which we rely.

As all branches of metrology are at heart scientific ones, the obvious starting point is to look for a definition.

Surprisingly, the 1955 Treaty does not contain a definition. So in my case the first place to look was OIML Document OIML D 1 *Considerations for a law on Metrology*, which states that:

> "**Legal metrology** is the practice and the process of applying **regulatory structure and enforcement** to metrology."

This is actually the definition in the "VIML", the International Vocabulary of Legal Metrology. However, the VIML itself adds, not altogether helpfully, three notes. I'll be returning to two of those notes later, but for now I would draw attention to Note 2:

Legal metrology includes:

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

The VIML definition requires us to look in turn at the definition of "metrology", which is given as follows:

> "**Metrology** is the **science of measurement** and its application
>
> **Metrology** includes **all** theoretical and practical aspects of measurement…"

The OIML's own website explains legal metrology rather more briefly:

> *"Legal metrology is the application of legal requirements to measurements and measuring instruments"*

Both these definitions seem pretty clear – but I personally have a bit of a problem with both approaches. This is illustrated by that bullet in Note 2 of the VIML definition which talks about *providing the necessary infrastructure for the traceability of regulated measurements and measuring instruments to SI or national standards*.

More generally, it is clear that the key words here are *regulatory structure* and *enforcement*, but both these definitions are expressed in terms of applying regulation, legal requirements, etc. to metrology, while most legal metrologists, I believe, actually think in terms of applying metrology – the science of measurement – to regulation.

This difference of view is actually well illustrated in OIML D 1 *Considerations for a law on Metrology* (note not "legal metrology") which identifies three key activities by a government:

1. **establishing a law;**
2. **enforcing the law; and**
3. **providing traceability for measurements.**

It is easy to see why we should start by establishing a clear legal framework for measurement. Historians of Metrology usually emphasise the crucial role of Kings, Emperors, Pharaohs, etc. in establishing the first measuring systems.

They established a physical standard, that was then used to create an artifact, and then working standards. These had to be calibrated and adjusted in ways set down by the ruler.

Traditionally those standards were established by law, or at the very least some action of a local leader.

But if we look at Egypt, for instance, the Pharaoh was establishing a cubit not just for what we would see as classic legal purposes such as trade. Perhaps the most important application in this case was what we would regard these days as industrial metrology – building pyramids. And there was possibly even some scientific metrology– astronomy, producing calendars, etc.

There will be those who ask why, in the 21st Century, this should be necessary, when normally no one likes to pass more laws if they can avoid it. Indeed, scientific metrology and industrial metrology do not now depend to the same extent on the legal basis for any given standard. The answer given in D 1 is that:

> "there is a **societal need** to **protect** both the buyer and the seller in a commercial exchange or service…"

An interesting point to note here is that this definition is two sided, not only consumer based.

The observation I would make is that a society's needs will reflect the levels of sophistication and knowledge in that society. The extent to which, for instance, buyers and sellers are naturally in a position of equality which does not require the intervention of the state – except perhaps to provide courts where they can resolve differences.

But at the same time, a more complex society may require more complex rules – and it may take time to establish equality of understanding in these areas.

Moreover, as D 1 also points out:

> "…since there is an increasingly **global aspect** to many measurements, a country's Law on Metrology should take this global aspect into account, as far as possible."

There is thus another reason for seeing this as a proper matter for state authorities, even in the 21st Century. In a globalised world Governments want to be sure that their economies can be competitive.

But you will note that we are now talking about things which are some way from what most of us think of as legal metrology.

The second activity mentioned in D 1 – enforcement of the law – need not detain us long here, as a law means nothing if it is not enforced. This is clearly the field of regulation.

The third activity mentioned in D 1 – **providing traceability** for measurements – is the area I find most problematic.

Some will simply state that *Legal metrology complements **scientific** and **industrial** metrology and supports the practical application of measurements within the community.*

However, this is an area in which there is more scope for a variety of approaches. Often for scientific or industrial purposes it is sufficient that as part of a national quality infrastructure there is traceability, through laboratories which are subject to processes such as accreditation to prove that they are traceable back to the SI units, with the necessary levels of accuracy for the purposes for which they are being used.

The situation in the case of legal metrology, however, is different. The UK, like many other jurisdictions I am sure, specifies that for enforcement in the traditional field of weights and measures there will only be one route of traceability considered by the courts – one which operates through local enforcement agencies, back to my own organisation's secondary standards and then back to the UK's NMI, the National Physical Laboratory, which holds the UK national standards.

This is not the only possible approach. In other areas, such as food safety, both companies and enforcement authorities may conduct their own tests which follow different traceability routes. But in that case there is then a need for a third laboratory to conduct testing in the event of any significant differences in results. We recently conducted a consultation within the UK on whether we should move to such a system for our legal standards of weights and measures and it is interesting to note that the majority view was that we should not.

If a definitional approach is problematic, what others are available? The first possibility is to adopt an *institutional* approach to the question by looking the institutions involved in the various aspects of legal metrology. Is it possible to take an approach based on the various institutions involved? To a certain extent that is the situation at the international level where there are two separate bodies – the OIML and the BIPM – concerned with metrology. In practice, however, I do not think examining institutions will provide us with an answer. The reasons for this can be seen when we look at the various Institutions identified in OIML D1:

- Ministry responsible for national metrology policy
- National Metrology Institute
- National Legal Metrology Institute
- Central Metrology Authority
- Local Metrology Authorities
- Metrology Advisory Board/Council
- Private sector testing/inspection/conformity assessment companies

The basic problem is that the relationships – and in some cases even the very existence of some of those bodies – vary hugely from one country to another. I have yet to find two countries that have identical systems. Those systems change from time to time and there is not even a consistent pattern to the direction of those changes.

A third possible approach is to look at what metrologists themselves think of the work they do. We are familiar, after all, with the concept of the *legal metrology community*, which often – but not invariably – sees itself distinct from other metrologists. This does not take us all the way, however. In particular, metrologists in the top national metrology institutes, regardless of which community they might identify themselves with, may be asked to work on projects which the rest of us might think of as scientific metrology, industrial metrology or legal metrology.

Which leaves us with the final approach I would like to put forward. I think of it as a functional approach. It involves thinking about measurement in a functional way as follows:

- measurement used in science, which typically means new scientific discoveries, new measurement techniques or new applications which result in innovation;
- measurement used in industrial production and business-to-business trade;
- measurement used in regulation, be it related to trade, safety, health or environmental protection.

One consequence of such an approach is that it requires us to stop using the phrase "legal metrology" to mean all areas of law relating to measurement. But that then makes it *easier* to start thinking about the *different* ways in which Governments can make sure that the measurement needs which they are interested in are met. These include:

- the funds they may provide for scientific research into new measurement methods, in particular those providing new levels of accuracy;
- the investment they make into ensuring the standards infrastructure for traceability is available; and
- the specifications they apply when acting as *customers*,

all of which are matters of public policy on which all metrologists, not just legal metrologists, will want to have a voice.

The real advantage of this approach, however, is that it allows us to take a quite different look at the scope of what we mean by legal metrology.

I suggest there are three "scope" questions to be considered.

The first concerns the areas of regulation included in our concept of "legal metrology". Notes 1 and 3 of the VIML definition are relevant here, though not very helpful!

- Note 1 The scope of legal metrology may be different from country to country.
- Note 3 There are also regulations outside the area of legal metrology pertaining to the accuracy and correctness of measurement methods.

The OIML has, certainly since the Birkeland Report, taken quite a broad view which goes beyond areas of law concerning measurements used for trade. Measurement can also play an important part in regulations relating to:

- safety (speed or weight restrictions, tyre pressures, etc.);
- health (clinical thermometers, sphygmomanometers, etc.);
- environmental controls (instruments measuring pollution, etc.).

At its broadest we might be interested in all areas of law where measurement is applied to regulation, i.e. where application of a sanction depends on a measurement reading. But this is something which individual countries will always answer in different ways. Ultimately it depends on the remit each country gives to its legal metrology authorities.

The second scope question is a structural one. What is the relationship between legal metrology policy – should there be a rule and if so what should it be? – and legal metrology delivery – who carries out approvals, verifications, inspections, prosecutions, etc.? And how do we ensure the right level of technical expertise is available in all parts of the legal metrology system?

Most of the most important questions concerning legal metrology are ones that I would regard as policy questions. Should we be trying to regulate transactions, using concepts such as "short measure" offences, or should we regulate measuring instruments and how they are used? Should we rely on general rules, for example that quantity declarations should be provided and that they should be accurate, or do we need to be specific in our rules, which may make it easier for traders to know when they are complying but can be quite restrictive when it comes to introducing innovation. How far can we combine these approaches by setting a general rule expressed in terms of its outcomes but where meeting a widely accepted standard (such as an OIML Recommendation!) is a guaranteed way of showing compliance.

Similarly, there are important policy questions regarding the "tool-box" that is available, for instance when regulating instruments – what is the best mix of

prior authorisation such as type approval, conformity to type controls, market surveillance in the distribution chain, verification when an instrument is put into use and the inspection regime to be used when it is in service?

And no less important are the policy questions of what sanctions should be used when a rule is broken and who should carry out the inspections and apply the sanctions – public officials organised in a national service, local officials, approved contractors or conformity assessment bodies, volunteers, etc.?

But at the technical level we are inevitably concerned with what are essentially delivery questions – what is and is not acceptable, which of the available sanctions should be applied? And it is here that the technical expertise of the legal metrology community is so important.

The third scope question concerns what we might call the "hard law/soft law debate". In many parts of the world, Governments are being urged to change the way they regulate. Sometimes it is called Deregulation, sometimes Better Regulation, sometimes Alternatives to Regulation. And already we can see there is not always a clear distinction between improvements in measurement standards or practices attributable to actions by legal metrology authorities and those which are purely voluntary. For instance, improvements might be introduced in order to avoid formal legal metrology requirements; voluntary agreements might be negotiated with legal metrology authorities; or some sectors may choose to adopt OIML standards even when there is no legal obligation to do so. My answer to this is that the purpose of legal metrology is to ensure adequate measurements where they influence the transparency and quality of economic transactions, or where the impact of measurement accuracy is so important for the quality of life (e.g. health and safety), that Governments are *prepared* to regulate in that area. If for whatever reason the standards of measurement practice are good enough, there is no need to regulate. And even if there is thought to be a problem, it may be dealt with by voluntary means promoted by Governments of the kind mentioned above. So we have another circular definition, but one which I think is helpful – legal metrology can cover anything that legal metrology authorities take an interest in!

Viewing legal metrology in these terms makes it much easier to see how legal metrology can contribute to a wide range of objectives which Governments set out to achieve:

- reducing technical barriers to trade;
- improving health;
- reducing deaths and injuries;
- collecting government revenue;
- and not least, fair treatment for consumers.

This in itself may be sufficient for presenting a qualitative appreciation of the value of legal metrology. However, for anyone involved in measurement, it is not satisfactory simply to identify *qualitative* benefits such as these. We naturally want to measure the benefits. But that is a huge topic and one which should be left for another article. ■

ELECTRICITY METERS

Electricity metering regulation in Australia

DR. VALERIE VILLIERE
General Manager, Legal Metrology
Dept. of Industry, Innovation, Science, Research and Tertiary Education
National Measurement Institute (NMI)
Australia, Institution

Introduction

This article discusses electricity metering regulation in Australia. It provides some background to electricity metering, regulations in Australia, OIML Recommendations, challenges for Australia, and future work.

Background

Since the 1990s in Australia, various functions in the electricity market – generation, transmission, distribution and retail – have increasingly transitioned from state-owned, vertically-integrated functions, to separate private sector functions. This shift to the private sector and increased separation of functions relating to metering is changing the landscape for the regulation of electricity meters.

There has also been an increase in the types of and applications for electricity meters. In addition to standard 'utility' electricity meters, which are progressively being replaced with smart meters, there are numerous other types and applications. Smaller (e.g. DIN-rail mounted) or multi-circuit current sensor (branch circuit) meters are used for sub-metering applications. For instance in shopping centres and other multi-tenanted buildings and sites, small or multi-circuit metering is widely used to save space, and to provide desired functionality.

Other metering applications include solar inverter metering, electric vehicle charging stations and individual device metering. Solar inverter metering has increased in recent years in Australia for a number of reasons. Firstly, various government programs have been initiated to encourage residents to install photovoltaic cells (solar panels). In addition, some third-party businesses are offering solar power purchase agreements under which residents purchase power generated by a solar panel installed by the business.

In relation to electric vehicles, various businesses are marketing charging equipment for home, business or public locations. These potentially involve billing customers based on energy consumption.

NMI (Australia) is also aware of various current and future applications for device-level metering. These include individually-metered street lighting. In many cases, street-lighting is billed on estimates based on lamp energy usage data and load profiles. A shift to individual metering would enable direct measurement of consumption. Another example is appliance metering (e.g. refrigerators) which could enable improved home energy management, or enable innovative third-party business models to offer appliance level billing.

All of these factors present a number of challenges for the effective selection of standards and appropriate metrological controls for electricity metering. One factor is the environment in which the meter is installed. What impact does that have on the appropriate approval standard? Another factor is the role of the meter indicator. An individual device indicator (local or remote to the meter) may not be appropriate for some sub-metering applications, or individually-metered street lamps.

National regulation

In the late 1990s, a national framework for the metrological control of utility meters (electricity, water and gas meters) was established in Australia. This framework provides for the type approval and verification of meters used for trade. Regulation of the in-service testing of meters remains the jurisdiction of the states and territories (sub-national level).

In the early 2000s, NMI (Australia) developed a national type approval standard for electricity meters (NMI M 6), developed with input from industry and consumers. NMI provided the service of type approval against this standard, but this only became mandatory under the national framework on 1 January 2013, making type approval and verification mandatory for newly installed meters.

For type approval, NMI (Australia) appoints third-party laboratories called "Approving Authorities" to conduct the approval testing. NMI assesses applications and test reports and determines whether to issue an approval. For verification, NMI appoints third-party laboratories, called Utility Meter Verifiers (UMVs), to verify meters. These UMVs are appointed to test and mark instruments as verified.

OIML Recommendations

In parallel with developing national regulations for electricity meters, NMI (Australia) participated in OIML TC 12 *Instruments for measuring electrical quantities* in the development of OIML R 46 *Active electrical energy meters*. The aim was to develop an internationally harmonised OIML Recommendation for active electrical energy meters, sometimes referred to as kilowatt-hour meters.

In the late 2000s, NMI (Australia) took over the secretariat for OIML TC 12. OIML R 46 was finalised, approved and published as an OIML Recommendation in 2012.

During the development of OIML R 46 there were discussions within TC 12 on the existing metering standards. Primarily, these standards were the IEC standards (predominantly in Europe), and the ANSI C 12 standards (predominately in North America). For Europe, the focus was also on alignment between OIML R 46 and the European Measuring Instruments Directive (MID).

NMI (Australia) has not yet adopted OIML R 46, but has commenced consultation with Australian stakeholders. NMI understands that the implementation under the MID in Europe represents two pathways for manufacturers. One pathway is assessment against OIML R 46, the other is assessment against IEC standards. Manufacturers may choose either pathway for approval.

Challenges for regulation in Australia

Many manufacturers seeking approval for the Australian market have already obtained approval in the European market. For some manufacturers there is an expectation that because their meter is approved for the European market, it should also be accepted in Australia. However, Australia participated in the development of OIML R 46 on the understanding that it would be the appropriate international standard. The Australian government is also focussed on regulation reform and there is an emphasis on reducing the regulatory burden placed on industry.

Australia faces the following challenges:

- Given that approval has already been obtained in Europe for many electricity meters in Australia, what is the appropriate scope of OIML R 46 for their approval in Australia?
- Given the different types and applications for electricity meters, what is the appropriate scope of OIML R 46 in Australia?
- What is the role of the indicator on the meter? What about alternatives such as summated or compiled measurement data made available through internet portals or other network connected devices? What is the appropriate regulation to provide confidence in such measurement data?

Future work

As secretariat of OIML TC 12, NMI (Australia) surveyed member nations in 2012 on future projects, however none have yet been proposed. This is partly due to competing priorities at NMI, and partly due to the challenges outlined above. Australia will continue to hold the secretariat for OIML TC 12, and intends to review proposals for new projects in the near future. ■

ARCACHON 2015

50th CIML Meeting
60th OIML Anniversary

BIML

The International Committee of Legal Metrology held its 50th meeting in Arcachon, France, from 20 to 22 October 2015.

In this article we publish the welcome speech by Mme Notter, Director of Regional Business, Competition, Consumer Affairs, Work and Employment Management and the general report by Mr. Peter Mason, CIML President.

We also feature photos of the 2015 OIML Award Winners and other general photos and a brief account of the CEEMS Seminar.

Unfortunately, due to space limitations we are only able to publish Mme Notter's speech in English, however the French original will be published in the meeting minutes. ■

Delegates enjoyed a cocktail cruise round Arcachon Bay aboard the *Côte d'Argent* Catamaran

Welcome speech by Mme Notter

Director of Regional Business, Competition, Consumer Affairs, Work and Employment Management

The President of the International Committee of Legal Metrology,

Vice-Presidents,

Members of the Committee,

Director of the International Bureau of Legal Metrology,

and all the delegates,

In the name of the Minister for the Economy, Industry and Digital Affairs, and in the name of the Aquitaine region, I am pleased to welcome you to Arcachon for the Fiftieth Meeting of the International Committee of Legal Metrology.

The OIML, your organization, which was founded in October 1955 in Paris, is celebrating its sixtieth anniversary and I wanted to pay tribute to its vital role. Over the years, it has allowed technical Recommendations, harmonized at a global level, to be set up. States refer to them to establish their regulations which must be compatible as part of the globalization of exchanges. To contribute to the fluidity of global markets, a certification system was also developed and its evolution after some years of experience will be the subject of your discussions this week.

Metrology features among the oldest commercial regulations in the world. When we buy and when we sell, we must be sure that the weight of we are buying and selling is the correct weight. For those of us who put regulations in place, whose goal is to verify the fairness of commercial transactions, among other things, metrology is a tool, an absolutely essential brick.

Your organization also supports States setting up their legal metrology system and a seminar was held on this subject for countries and economies with emerging metrology systems. This seminar took place yesterday and was met with great interest.

Since the creation of the OIML, France has played an active role in the development of its work. The unification of measurements in France dates back to the 18th century and its source lies in the wake of the French Revolution of 1789. Based on a law from 1795, the system was established with the first inspections and the creation of a body of inspectors. The law currently in force, which makes up the basis of the metrology system, dates back to 1837. It was modified recently, in 2014, to introduce administrative fines under a more general reform of the law relating to consumption and commerce, aiming for a greater effectiveness of inspections, through adapted sanctions.

The most important thing about French regulations, which cover 37 categories of measuring instruments and various transactional and legal uses, is that they are based on decrees and orders which largely make reference to the technical requirements developed by the OIML.

Since the end of the 1990s, the French State has redefined its role and the activity of its services for regulating and monitoring a system which calls on third party bodies to carry out certification and verification duties.

So in France we have more than 700 private bodies, authorized by Prefects or designated by the Minister to carry out checks on measuring instruments. Most of them are accredited by COFRAC (the French Committee of Accreditation).

The Bureau of Metrology of the Directorate General of Businesses, represented here by Corinne Lagauterie, CIML Member for France, is responsible for the development of regulations and carries out technical coordination of regional metrology service activities.

The National Laboratory of Metrology and Tests, LNE, represented by Thomas Lommatzsch, manager of the Certification of Measuring Instruments division, is the organization which issues national and European type examination certificates, and also OIML certificates. The LNE also plays a role at the highest level of scientific metrology concerning the definition and maintenance of standards with the financial support of the ministry in charge of industry.

In the Regions, and so also in Aquitaine, the legal metrology services are part of the C group (competition, consumption, metrology) of the regional directorate for businesses, competition, consumption, work and employment.

In Aquitaine, the directorate's metrology service, led by Éric Lefèvre, who is here today, is made up of seven inspectors. They dedicate at least 25 % of their work to monitoring those who possess measuring instruments to ensure that they are correctly using instruments which are appropriate and up to date with their mandatory verifications. Furthermore, an important part of their activity involves monitoring the authorized bodies to which the verifications have been delegated. Notably, this monitoring takes the form of unexpected on-site visits (170 in 2015, to date). It aims to ensure that the bodies respect their obligations and work under conditions of fair competition. This is the essential element of monitoring.

Lastly, the metrology service ensures the monitoring of the market for new instruments but also for repaired instruments, to ensure that only instruments which are compliant are put into service on the market and that they continue to be compliant during their use.

To finish, I would like to give you a brief introduction to the Aquitaine region.

Aquitaine is the third region in France in terms of its surface area which extends over more than 4 100 km^2. In terms of its population and its economic activity, it has more than 3.3 million inhabitants and is placed sixth in terms of GDP. Its capital, Bordeaux, is the sixth city in France and is an important logistical hub with air, rail, maritime and road links.

Our region, as you already know, is very famous for its vineyards and its tourist attractions, with the Atlantic coast and mountain activities. It also boasts many businesses linked to these activities, and beyond all this, we could give further examples of the aerospace and petrochemical industries.

I hope that during your stay you will have the opportunity to appreciate some of these different aspects.

I have no doubt that the debates during your meeting will be fruitful, will take into account society's needs in the framework of the globalization of exchanges and will remain attentive to the consumer protection and the fairness of exchanges and competition between professionals.

Mr. President, I thank you for having given me the opportunity to make this address and I wish you an excellent Fiftieth CIML Meeting. ■

General report by Mr. Peter Mason
CIML President

We have a lot to celebrate this year as we commemorate the sixty years since the establishment of our Organisation and this, the fiftieth meeting of our Committee. We have a number of important issues to discuss during this meeting, and all of them illustrate, I believe, the continued vigour which CIML Members, staff from their administrations and the Director and his colleagues in the BIML bring to the world of legal metrology. It is also appropriate that we are meeting once again in France to celebrate these anniversaries, since it is here that, in many respects, it all began.

First, however, it is my great pleasure to welcome a number of new CIML Members. Over the course of the year, we have welcomed eight new Members:

- for Bulgaria: Mr. Paun Ilchev,
- for Hungary: Mr. Kristof Torok,
- for Iran: Mr. Khosro Madanipour,
- for the Netherlands: Ms. Anneke van Spronssen,
- for the Russian Federation: Dr. Sergey Golubev,
- for South Africa: Mr. (Nnditsheni) Thomas Madzivhe,
- for Switzerland: Mr. Gregor Dudle,
- for Zambia: Ms. Himba Cheelo.

The Director will be providing detailed information on the current financial position of the Organisation, but in summary, our financial position remains healthy and will hopefully form a strong platform for our future plans.

There have not been any personnel changes in the Bureau in the past year, but there have been some health issues for a number of staff. I am pleased to say that none of these were related to their official duties, but it has meant that for significant periods staff have been covering for one or more of their colleagues, which places a strain on the resources of such a small team. I would like to pay tribute to the way in which all concerned have continued to deliver in difficult circumstances. It reflects well on the team morale within the Bureau that they have worked so well to keep the impact of absences to a minimum, and I am also grateful for the support of fellow CIML Members and for the support that they have shown during this period.

With the effective completion of the repair and renovation of the Rue Turgot building, attention has naturally turned to the updating of the Organisation's IT and communication systems. With the introduction of the "Project Group Workspace" functionality earlier this year, we now have a set of sophisticated tools which are able to support new and much more efficient ways of working.

As with the introduction of any new technology, we face a number of challenges in making the most of the new website's potential for improving the way we conduct our work, most specifically our technical work.

The first and most obvious challenge is the challenge that each one of us faces, as individuals, in understanding what the new systems can do and what we need to do in order for those systems to work properly. A start was made on this last year with the sessions in Auckland, which allowed those attending to understand how the new site ought to be used and this has now been followed up by the first of our proposed series of training sessions aimed specifically at those who act as secretariats and conveners. I am grateful to our colleagues in Germany for acting as guinea pigs for that first training session. I am encouraged by the use which many colleagues are making of features such as updating contact details and registering of electronic votes but it is clear that there is a lot of scope to make better use of the Project Group Workspaces.

A second and more fundamental challenge, however, is to keep our rules and procedures in step with the new systems and new technology. There is both a long term and a short term aspect to this. The long term aspect requires us, in my view, to look again at the B 6 *Directives for OIML technical work*. A proposal will be made at our meeting, later this week, to begin a project to carry out a limited revision of B 6. I am sure that will generate a lot of debate, as this subject always does.

The short term aspect concerns how we operate the existing provisions of B 6 in the light of the potential which already exists in a world where we can now do electronically what previously would have had to be done at a formal face-to-face meeting. We are developing some experience of this as more conveners become familiar with the ways of working that the "Project Group Workspace" offers. However, it remains very important, as I mentioned last year, that conveners and secretariats are prepared to work closely with Bureau staff so that experiences can be shared and ideas exchanged on how we can make the best and most imaginative use of the resources available.

In all of this it is essential to keep in mind the fundamental objective of the changes we are making. This is to make sure our Recommendations and our Documents remain relevant in a rapidly changing world. Those publications are the foundation of everything else we do – from providing certificate schemes to giving support to members of the worldwide legal metrology community. Keeping them up to date requires both that our technical work is carried out more quickly than in the past and that we are more inclusive about who is involved in that work. As I also said last year, the best

way to achieve this is for CIML Members themselves to take a close personal interest in the work being carried out in the important project groups.

A second major area of work has been the development of thinking on the OIML's certificate schemes. This has its origins in the Seminar which was held alongside the 48th CIML Meeting two years ago. Although the issue was originally considered to be how to make the MAA more successful, as work has progressed it has been increasingly clear that it would be better to rethink our approach to both the Basic and MAA schemes. As a consequence of the overlap between the conclusions coming out of the various task groups set up in 2013, the Presidential Council agreed earlier this year that a comprehensive package of recommendations covering the whole operation of both schemes should be submitted to the CIML, including some major structural changes. I am sure that these will also be a subject of lively debate at our meeting. I would like to take this opportunity to thank once again and to express my appreciation of the contribution made by CIML First Vice-President, Dr. Roman Schwartz in leading this work.

Another area where I feel there has been a lot of good progress is on matters relating to what I think most of us now refer to as "countries and economies with emerging metrology systems" (CEEMS). Following the first formal meeting of the Advisory Group chaired by the CIML Member for China in Auckland, and building on the survey which the Group carried out to identify what the priorities of the Group should be, a very successful workshop was held in May in Chengdu. This was followed by the Seminar which was held on 19 October and will again be a subject of discussions later in the week. I believe it offers us a unique opportunity to put together a comprehensive package of measures which set a clear way forward on meeting the needs of members with emerging metrology systems and which addresses concrete proposals for things which both OIML itself and others can do in this area.

In my report last year I mentioned that OIML has taken up the opportunity to participate in an OECD study on the role of international organisations in regulatory cooperation. As this work has progressed it has confirmed my view that we have a valuable role in sharing with colleagues in other organisations our experience of introducing reform and modernisation into our processes and procedures. I hope that by next year this study will have produced a published report which will recognise the wider relevance of what we have learned by going through this process, and which will also at the same time raise the profile of legal metrology with other important international organisations.

Of the international organisations with whom we already have bilateral relationships, by far the most important is the BIPM. It is very pleasing to see how well we are working together in areas of mutual interest, the most important of which, in my view, is the support both organisations offer to countries and economies with emerging metrology systems. During a conference in St. Petersburg last month, I was able to discuss in some depth with the President of the International Committee of Weights and Measures (CIPM) how our two organisations might work even more closely together in promoting the role which a modern metrology infrastructure, designed to support scientific metrology, industrial metrology and legal metrology, can play in economic development. And indeed, only yesterday, I think that approach of working together was further confirmed, and I believe we are now moving to a situation where in these matters the default assumption is that the two organisations will work together. There will be occasions where we do our own things in these areas, but those will be the exception rather than the rule.

I was also delighted to be able to participate in a conference organised at the end of June by the BIPM on the role of measurement in addressing issues relating to climate change. My own view is that it is still too early to be thinking of a legal metrology response to the challenges of climate change, but it is encouraging that we are now moving to a position where the focus is no longer exclusively on the role of measurement in identifying the problems but we can start considering the role of measurement in formulating solutions.

More generally, given the links which legal metrology has with standardisation, accreditation and conformity assessment – another theme which came out very clearly in yesterday's seminar – it is encouraging to see the interest the BIPM, ISO and ILAC are showing in how these different elements of what is now widely regarded as an economy's "quality infrastructure" all work together.

In addition to the CEEMS workshop in Chengdu, the conference in St Petersburg, and the OECD and BIPM meetings in France I have already mentioned, the only other meeting I have attended as CIML President over the last year, or since the last CIML meeting, was the APLMF meeting in Wellington. I also took advantage, however, of visits to Azerbaijan and Egypt in my capacity as a UK representative to draw attention to the role that OIML could play in their work on improving their metrology systems. Before the end of the year I also plan to attend the annual SIM meeting in Punta Cana in November and the UNECE Working Party 6 meeting in Geneva in December. Such meetings in my view play a vital role in maintaining our links with other international organisations which can help us achieve the OIML mission and help ensure our activities remain relevant to the needs of our Members.

Looking forward it seems clear to me that the three main challenges for our Organization over the next few

years are ones we can expect to debate in some detail at our meeting this week:

First, we have to speed up and make more efficient the process of producing and revising our Recommendations and other publications. Indeed, a number of the proposals that came out of the seminar yesterday would involve the drafting of new Documents, and that will be something which is done through our framework of technical work. So it is those processes which will again be tested to demonstrate how quickly we can produce the things which our Members are asking for. We have introduced new web-based technology to make this easier, but we need to make sure that our rules and procedures are updated to reflect the new ways of working and we have to encourage everyone involved in technical work to use the new systems.

Second, in my view we need to make substantial changes to both our certificate schemes, if they are to be more widely used and cover more types of instrument, and that will probably involve changes in the way that OIML supervises this work.

Finally, we need a clear way forward on meeting the needs of our Members – including our Corresponding Members – with emerging metrology systems. However, I am now hopeful, and even more hopeful after yesterday, that we can produce a comprehensive package of proposals for things both OIML and others can do.

During the past year we have seen the departure from the CIML of three valued colleagues who have served on the Presidential Council: Stuart Carstens, the CIML Member for South Africa and a former Vice-President, Cees van Mullem, the CIML Member for the Netherlands, and Philippe Richard, the CIML Member for Switzerland. Stuart has however been able to join us to help facilitate and lead the work in yesterday's seminar, so we have the pleasure of his company for one more year and we will take full advantage of that. I also received, late last night, a message from Cees van Mullem wishing us well for the 50th meeting, and expressing his feelings about not being with us. Indeed, I would like to express my thanks to all three of these departing colleagues for the support and wise advice they have offered both myself and my predecessors. I am pleased to say that Magdalena Chuwa, the CIML Member for Tanzania, and Anneke van Spronssen, the new CIML Member for the Netherlands, have both accepted my invitation to join the Presidential Council. Both are already well known for their contributions to our debates and I look forward to being able to draw on their talents even more in the future.

There are many others, however, beyond those on the Presidential Council and other members of the CIML, who make important contributions to our work. In addition to the staff in the Bureau, whom I have already mentioned, we should also acknowledge the many hundreds of experts who participate in our technical work, in particular those who act as secretaries and conveners. And we should also not forget the colleagues in their administrations whose support makes that participation possible. As we celebrate our 60th Anniversary, this is a good time to reflect on the fact that none of what this Organisation has achieved over those years would have been possible without a huge range of contributions from colleagues all over the world and we have every reason to be grateful for their efforts. ■

OIML Awards 2015

In 2015, OIML Medals were awarded to **Mr. Ngo Quy Viet (Vietnam)** and to **Mr. Cartaxo Reis (Portugal)** for their outstanding contributions to international legal metrology. They are pictured below (left and right respectively) receiving their Awards from CIML President Mr. Peter Mason during the Thursday evening OIML Reception at the Château Smith Haut-Laffite.

Also during the Reception, Mr. Mason announced that the Seventh *OIML Awards for Excellent Contributions in Legal Metrology in Developing Countries* went to **Mr. Nam Hyuk Lim**, Director of Korea Testing Certification (represented by **Dr. Choi Mi-Ae** - see photo below, left) and to the Metrology Department of the Saint Lucia Bureau of Standards. The right hand photo shows **Mr. Anselm Gittens**, Head of the Metrology Department, being given the Award during the SIM Seminar in the Dominican Republic.

ARCACHON 2015

Seminar on CEEMS 19 October 2015

PETER MASON, CIML President

The seminar was attended by almost one hundred delegates from OIML Member States and Corresponding Members. Both developed economies and those with emerging metrology systems were represented.

Speakers from within the OIML and also representatives from international organizations (ACP EU TBT Programme, BIPM and UNIDO) gave presentations.

It followed some of the outline devised for the workshop in Chengdu reported in the July 2015 OIML Bulletin, which had identified three broad areas for CEEMS work:

- capacity building, that is the efforts made to assist CEEMS countries in developing their legal metrology personnel, mainly through training initiatives;
- what the OIML could do specifically to help countries in the CEEMS community improve the effectiveness and the efficiency of their market regulation; and
- new ideas in legal metrology, including the challenge of how to capture those ideas and to share best practice.

Capacity building

It was noted that most of the actions that the OIML could carry out in this area would involve working with others, as it was not feasible for the OIML to organize training courses and assistance programs on its own. On the other hand, it was clear that a number of organizations that were active in this area (not least those making a presentation at the seminar – UNIDO, the EU through its ACP program, and the BIPM), as well as various bilateral programs were keen to work with the OIML. The main challenge facing the OIML in this area was to make sure that legal metrology featured in those programs, and at least in the case of the organizations present it appeared that we were "pushing at an open door".

Seminar Agenda

Welcome and introduction
- Peter Mason, CIML President
- Report on the outcome of the Chengdu seminar – Ian Dunmill, BIML

Session 1:
Capacity building
Chair: Anna Cypionka

Presentations by:
- Anna Cypionka, PTB, Germany
- Juan Pablo Davila, UNIDO
- Irina Kireeva, ACP EU TBT Programme
- Andy Henson, BIPM

Session 2:
Helping CEEMS improve regulation in their markets
Chair: Manfred Kochsiek

Presentations by:
- Manfred Kochsiek, Germany
- Magdalena Chuwa, Tanzania
- Stephen O'Brien, New Zealand

Session 3:
New ideas - doing legal metrology differently
Chair: Stuart Carstens, South Africa

Presentations by:
- Stuart Carstens, South Africa
- Himba Cheelo, Zambia
- Ian Dunmill, BIML

Session 4:
Panel discussion
Chair: Peter Mason, CIML President
- All speakers

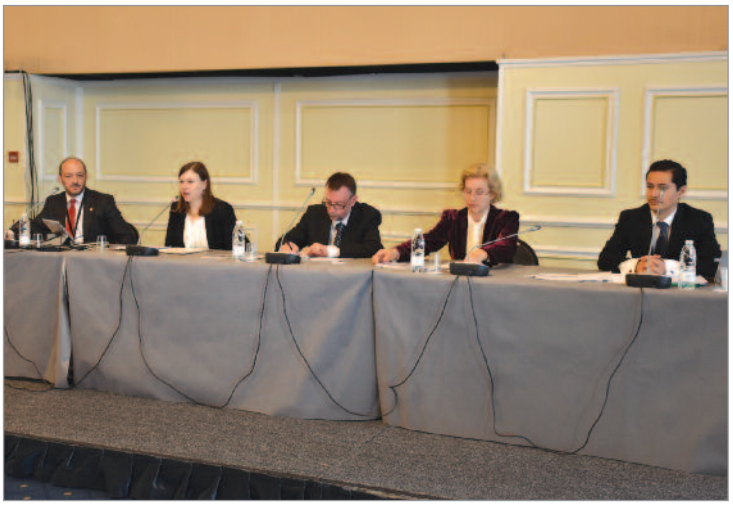
It was also clear that much of the activity on capacity-building took place as part of a wider quality infrastructure agenda – helping this community of countries improve all aspects of their quality infrastructure, of which legal metrology was a part. It was important therefore that the OIML should make sure that what metrology could do was expressed in appropriate terms. The clearest example of this was the need to align what the OIML was doing with matters such as the UN sustainable development goals. Specific proposals in support of capacity building put forward at the Seminar were:

- to create a database of experts – in the modern world of greater interconnectivity, using internet tools was now easier to do, to provide up to date information and actually give the experts themselves self-service rights, so that they could update their own details. This had been suggested by a number of contributors;
- to develop the OIML website, which should be seen as a potential source of up to date information in the capacity building area;
- to develop the BIML's direct engagement in capacity building activities. What the BIML did together with representatives from individual Member States was already valued. A good example of this was the AFRIMETS metrology school which had been held in Tunisia the previous year. Even if there were no dramatic upturn in activity, it would be useful if the CIML could confirm and endorse that they expected the Bureau to engage, at that level, in this sort of activities;
- to improve the skills and experience of staff in CEEMS countries by providing them with secondment opportunities. This was something which could be pursued both by individual Member States and within the Bureau itself.

In addition, there were a number of actions that the individual Member States within the OIML could undertake. The bilateral programs organized by the PTB were one such example and the subsequent proposal for pilot training centers put forward by the Advisory Group was another.

Improving "traditional" regulation

Discussion concentrated on the contribution the OIML could make to improving the way traditional regulation operated, i.e. the making and enforcement of rules through recognized mechanisms such as type approvals, verification systems, inspection, etc. There was a strong



Session 1 chaired by Anna Cypionka

Session 2 chaired by Manfred Kochsiek

Session 3 chaired by Stuart Carstens

desire in many countries to improve the way that national regulations were enforced, but one of the major difficulties they faced, in common with most other Member States, was a lack of resources to revise their regulations and adopt the controls that countries with more developed and mature metrology systems enjoyed.

One recurring theme was the need to make more effort to ensure that OIML Recommendations really were relevant to the CEEMS membership. Another, which had featured more prominently than previously, was the need to explicitly address the requirements of the CEEMS community in the OIML certificate systems. There was concern that the OIML had failed to sufficiently promote what a really well functioning certificate system could contribute to individual countries looking for a better and less expensive way of achieving greater assurance of the quality of the products in their market place. A number of speakers emphasized that the solution in both cases was to ensure there was greater involvement of the CEEMS community in technical work. The only way of ensuring that the Recommendations were relevant and that the certificate system was meeting the needs of the CEEMS community, was for representatives of that community to be involved in that technical work.

If this was to be done, then the best way was to make full use of modern technology. Everybody found it difficult to travel to as many meetings as they had in the past (in particular technical meetings) but the members of the CEEMS community found it even more difficult to participate in meetings of that kind. Modern technology was therefore a solution to this need.

A number of new OIML publications were suggested at the seminar. At least two of them (a document on the use of "Conformity to Type" techniques and a Guide on the use of certificate schemes for pre-packages) were already in preparation. In addition, however, there was particular interest in the OIML doing something more on market surveillance, in advising on good techniques for carrying this out, alongside the more traditional ways of performing legal metrology tasks.

Nevertheless, any new publications would require additional technical work, and therefore resources and funding. As with all technical work, it was necessary to address such questions as who was to be the owner of any of these projects – could these projects be allocated to any existing TCs and SCs or to a new one? And who was going to do the work? On ownership, was a different ownership model required for projects of particular interest to the CEEMS community – perhaps under the leadership of the Advisory Group? And was there a case for a new way of working in conducting the work? There was a well-established model where most OIML technical work was done by Member State conveners, sometimes working together with the Bureau. But if more was to be done in this area, should other models be looked at, some possibly still involving collaboration between the Bureau and an individual Member State, others possibly using external experts?

Beyond work in "traditional" regulation which could take place within the OIML, it was also suggested that countries might look at how market surveillance could be carried out not just nationally but in a coordinated way across borders. Examples were quoted both from the European Union and from parts of Africa. There was a consistent message that a lot of countries did not have the resources to carry out good market surveillance projects on their own, but, coordinated with similar nearby countries it would both be more affordable and yield a better result.

New ideas on legal metrology

Like the Chengdu workshop, the Arcachon seminar produced a wealth of new ideas. The question for the OIML was whether we should attempt to list, prioritize and schedule new ideas, or whether we should concentrate on providing the mechanisms for sharing and evaluating new ideas? On the latter it was pointed out that there were a number of avenues available:

- traditional OIML publications, such as Documents and Guides already discussed;
- the OIML Bulletin, for which it was often difficult to obtain enough articles to fill its quarterly editions;
- the OIML website, where much work was already being done to turn this basic but powerful tool into a useful support for technical work, and in future it could act as the first port of call when considering new approaches to OIML work;
- seminars such as the ones in Chengdu and Arcachon which had proved how they could generate and spread new ideas;
- research, where the OIML had already recognized that it is not sufficient to simply share existing information, and there was potential for a role in actually generating some of that information.

General themes

In addition, there were some common themes which could be identified as running through all of the areas discussed at the seminar:

- one could be summarized as "the OIML has access to a small pot of money but a large pool of goodwill". This was useful in steering the approach to what the OIML could contribute in this area;

- second, it was emphasized on several occasions that in order to make an impact it was essential to reach beyond the legal metrology community, to touch the policy makers, whose decisions ultimately affected how legal metrology was practiced in each and every Member State in both the developed and the less developed world. This advocacy role should be seen as a core function of the BIPM as well as the OIML;
- the third theme was the important role that research could play in capacity building, in improving regulation and in generating new ideas.

In the light of the report on the two Seminars and a set of proposals from the Advisory Group, the CIML adopted a comprehensive resolution on CEEMS matters which can be found in the "Structure – CIML" section of the OIML website. ■

An article analyzing what this resolution means and plans for acting upon it will appear in the next edition of the Bulletin.

The seminar was attended by almost one hundred delegates from OIML Member States and Corresponding Members

REGIONAL ACTIVITIES

OIML Workshop on the participation of SIM countries in the work of the OIML

19 November 2015

Punta Cana, Dominican Republic

BIML

Introduction

With the exception of the United States and Canada, the member countries of the Interamerican Metrology System (SIM) do not actively participate in the work of the OIML.

Taking this fact into account, a workshop was organized in conjunction with the 2015 annual SIM week (SIM General Assembly meeting and related activities), with the objective of obtaining feedback from these countries on the causes of and potential solutions to this lack of participation.

The aim was to enter into direct contact with the countries from Central and South America and the Caribbean, some of which have well-established metrology systems while others are still developing their systems.

Workshop program

1 Introduction to the work of the OIML by the CIML President, Mr. Peter Mason

- the work of the OIML
- capacity-building initiatives
- helping Member States regulate their markets more effectively and efficiently, by developing OIML Recommendations and our Certificate System
- sharing best practice and new ideas

2 Discussion session *What do legal metrology authorities in Central and South America and the Caribbean see as their challenges* (Presentation by participants of their views on the causes for the low level of participation in OIML activities)

- are you satisfied with the capabilities of your legal metrology personnel? If not, how are you addressing this issue?
- are you happy with the effectiveness and cost of your current arrangements for regulating the marketplace?
- do you have adequate access to new ideas on how to improve your legal metrology systems?

3 Discussion session *What can the OIML do to fill in any gaps identified in the previous session and what is stopping the OIML from making more impact*

- is it an issue of language?
- is a new or different model required for the region?
- what other constraints are there?

Conclusions of the workshop

a) The OIML should take into account the needs of the smaller countries to produce guides for the periodic verification of instruments. It has to be decided whether this should be independent of the Recommendations (i.e. as a Guide) or as an integral part (i.e. as a Part 4 to the Recommendation).

b) The OIML should provide more information to potential members on the benefits of becoming part of the OIML, and the required procedures to become a member.

c) The OIML should provide more information on how to participate in the Project Groups.

d) Regular training and awareness activities should be planned at a "sub-regional" level in Central America and in the Caribbean in coordination with the SIM Legal Metrology Working Group.

e) The OIML/BIML should be invited to SIM workshops and seminars on legal metrology and those organized at a sub-regional level.

f) Seminars should focus on creating awareness among policy-makers and not only among metrologists.

g) Ways to make more documents in Spanish (and other languages such as Dutch and Portuguese) widely available should be studied. One proposal is to have a pool of resources in SIM to translate Recommendations into Spanish for publication on the OIML website.

More detailed information will be published on the OIML website. ■

OIML Systems

Basic and MAA Certificates registered 2015.09–2015.11

Information: www.oiml.org section "OIML Systems"

The OIML Basic Certificate System

The *OIML Basic Certificate System for Measuring Instruments* was introduced in 1991 to facilitate administrative procedures and lower the costs associated with the international trade of measuring instruments subject to legal requirements. The System, which was initially called "OIML Certificate System", is now called the "OIML Basic Certificate System". The aim is for "OIML Basic Certificates of Conformity" to be clearly distinguished from "OIML MAA Certificates".

The System provides the possibility for manufacturers to obtain an OIML Basic Certificate and an OIML Basic Evaluation Report (called "Test Report" in the appropriate OIML Recommendations) indicating that a given instrument type complies with the requirements of the relevant OIML International Recommendation.

An OIML Recommendation can automatically be included within the System as soon as all the parts - including the Evaluation Report Format - have been published. Consequently, OIML Issuing Authorities may issue OIML Certificates for the relevant category from the date on which the Evaluation Report Format was published; this date is now given in the column entitled "Uploaded" on the Publications Page.

Other information on the System, particularly concerning the rules and conditions for the application, issue, and use of OIML Certificates, may be found in OIML Publication B 3 *OIML Basic Certificate System for OIML Type Evaluation of Measuring Instruments* (Edition 2011) which may be downloaded from the Publications page of the OIML web site. ■

The OIML MAA

In addition to the Basic System, the OIML has developed a *Mutual Acceptance Arrangement* (MAA) which is related to OIML Type Evaluations. This Arrangement - and its framework - are defined in OIML B 10 (Edition 2011) *Framework for a Mutual Acceptance Arrangement on OIML Type Evaluations*.

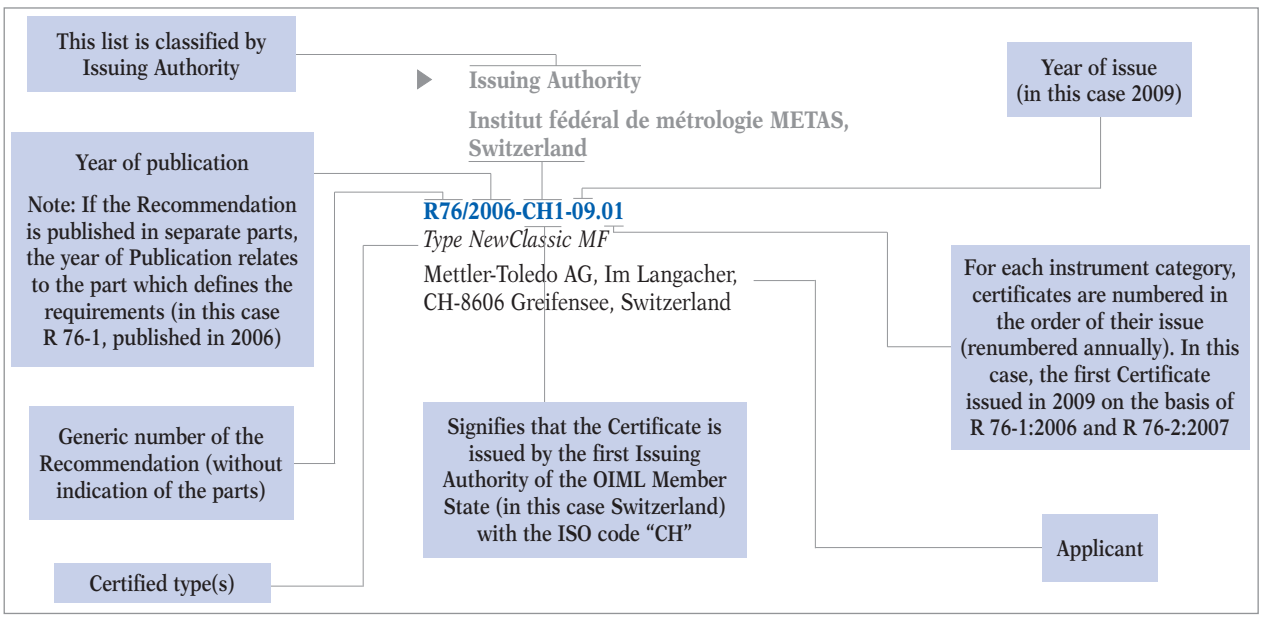
The OIML MAA is an additional tool to the OIML Basic Certificate System in particular to increase the existing mutual confidence through the System. It is still a voluntary system but with the following specific aspects:

- increase in confidence by setting up an evaluation of the Testing Laboratories involved in type testing,
- assistance to Member States who do not have their own test facilities,
- possibility to take into account (in a Declaration of Mutual Confidence, or DoMC) additional national requirements (to those of the relevant OIML Recommendation).

The aim of the MAA is for the participants to accept and utilize MAA Evaluation Reports validated by an OIML MAA Certificate of Conformity. To this end, participants in the MAA are either Issuing Participants or Utilizing Participants.

For manufacturers, it avoids duplication of tests for type approval in different countries.

Participants (Issuing and Utilizing) declare their participation by signing a Declaration of Mutual Confidence (Signed DoMCs). ■



INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Taximeters
Taximètres

R 21 (2007)

▶ **Issuing Authority / *Autorité de délivrance***

Laboratoire National de Métrologie et d'Essais, Certification Instruments de Mesure, France

R021/2007-FR2-2015.01 Rev. 1
Taximeter A.T.A. Type: Revolution
Automatismes et Techniques Avancées SA, 30 impasse du Nid, ZA du Verdalai, FR-13790 Peynier, France

R021/2007-FR2-2015.01 Rev. 2
Taximeter A.T.A. Type: Revolution
Automatismes et Techniques Avancées SA, 30 impasse du Nid, ZA du Verdalai, FR-13790 Peynier, France

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Water meters intended for the metering of cold potable water and hot water
Compteurs d'eau pour le mesurage de l'eau potable froide et de l'eau chaude

R 49 (2006)

▶ **Issuing Authority / *Autorité de délivrance***

Laboratoire National de Métrologie et d'Essais, Certification Instruments de Mesure, France

R049/2006-FR2-2014.03 Rev. 1
Water meter ITRON – Type: NEVOS/ICI
Itron France, 9 rue Ampère, FR-71031 Macon, France

▶ **Issuing Authority / *Autorité de délivrance***

Physikalisch-Technische Bundesanstalt (PTB), Germany

R049/2006-DE1-2015.03
Water meter - Electromagnetic flow meter for cold and hot water - Type: iPERL
Sensus GmbH Ludwisgshafen, Industriestrasse 16, DE-67063 Ludwigshafen, Germany

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Water meters for cold potable water and hot water
Compteurs d'eau potable froide et d'eau chaude

R 49 (2013)

▶ **Issuing Authority / *Autorité de délivrance***

Laboratoire National de Métrologie et d'Essais, Certification Instruments de Mesure, France

R049/2013-FR2-2015.01
Water meter ITRON - Type: WOLTEX (WE)
Itron France, 11 Boulevard Pasteur, FR-67500 Haguenau, France

▶ **Issuing Authority / *Autorité de délivrance***

NMi Certin B.V., The Netherlands

R049/2013-NL1-2015.01
Ultrasonic water meter - Type: E-Series
Badger Meter Europa GmbH, Nurtinger Strasse 76, DE-72639 Neuffen, Germany

▶ **Issuing Authority / *Autorité de délivrance***

Physikalisch-Technische Bundesanstalt (PTB), Germany

R049/2013-DE1-2015.04
Water meter - Type: QALSONIC FLOW 3 - Ultrasonic flow meter
Schor & Parfenov Nurnberg GmbH, Hauptstrasse 27, DE-90547 Stein, Germany

R049/2013-DE1-2015.05
Water meter - Type: AFLOWT BUF-Lite - Ultrasonic flow meter
Schor & Parfenov Nurnberg GmbH, Hauptstrasse 27, DE-90547 Stein, Germany

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Automatic catchweighing instruments
Instruments de pesage trieurs-étiqueteurs à fonctionnement automatique

R 51 (2006)

▶ Issuing Authority / *Autorité de délivrance*

NMi Certin B.V.,
The Netherlands

R051/2006-NL1-2013.03 Rev. 0
Automatic catchweighing instrument - Type: SSV series checkweigher (KWS5xxxBxxx)
Anritsu Industrial Solutions Co., Ltd., 5-1-1 Onna, JP-243-0032 Atsugi, Kanagawa-Prefecture, Japan

R051/2006-NL1-2015.01
Automatic catchweighing instrument - Type: AW-5600, AW-5600CPR, AW-5600CPR-IW, AW-5600CPR-IWC
Teraoka Seiko Co., Ltd., 13-12 Kugahara, 5-Chome, Ohta-ku, JP-146-8580 Tokyo, Japan

R051/2006-NL1-2015.02
Automatic catchweighing instrument - Type: Ventocheck
FLSmidth Ventomatic SpA, Via G. Marconi, I-24030 Valbrembo (BG), Italy

▶ Issuing Authority / *Autorité de délivrance*

NMRO Certification Services (NMRO),
United Kingdom

R051/2006-GB1-2009.03 Rev. 3
9000 Series Checkweigher / Weight or Weight-Price labeller
Marel Ltd, Wyncolls Road, Severalls Industrial Park, Colchester CO4 9HW, United Kingdom

R051/2006-GB1-2013.01 Rev. 2
L- Series 2180
Trimble Loadrite Auckland Ltd, 45 Patiki Road, Avondale, Auckland, New Zealand

▶ Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB),
Germany

R051/2006-DE1-2015.02
Automatic catchweigher, integrated into a hydraulic system of front-end loaders and other vehicles - Type: WK60
Pfreundt GmbH & Co. KG, Robert-Bosch-Str. 5, DE-46354 Südlohn, Germany

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Metrological regulation for load cells (applicable to analog and/or digital load cells)
Réglementation métrologique des cellules de pesée (applicable aux cellules de pesée à affichage analogique et/ou numérique)

R 60 (2000)

▶ Issuing Authority / *Autorité de délivrance*

NMi Certin B.V.,
The Netherlands

R060/2000-NL1-2015.07 Rev. 1 (MAA)
Single point load cell, with strain gauges - Type: 651HSxx, 651KSxx, 651TS, 651JS
Anyload Transducer Co. Ltd., 6994 Greenwood Street, Unit 102, V5A 1X8 Burnaby, BC, Canada

R060/2000-NL1-2015.11 (MAA)
Compression load cell, with strain gauges, equipped with electronics - Type: DSC2
Vishay Transducers Celtron/Technologies Inc., Binguan Nan Dao Youyi Road, Hexi District, CN-300061 Tianjin, P.R. China

R060/2000-NL1-2015.17 (MAA)
Compression load cell, with strain gauges - Type: CZL425
Dongguan South China Sea Electronic Company Ltd., Dashen Industrial Estate, Mayong Town, Dongguan City, CN-523136 Guangdong, P.R. China

R060/2000-NL1-2015.17 Rev. 1 (MAA)
Compression load cell, with strain gauges - Type: CZL425
Dongguan South China Sea Electronic Company Ltd., Dashen Industrial Estate, Mayong Town, Dongguan City, CN-523136 Guangdong, P.R. China

R060/2000-NL1-2015.18 (MAA)
A tension or compression load cell, with strain gauges - Type: 620-X000 kg
Vishay Precision or Tedea-Huntleigh, 8a Hazoran Street, New Industrial, IL-42506 Natanya, Israel

R060/2000-NL1-2015.21 (MAA)
Compression load cell, with strain gauges - Type: TS
Kobas Elektronik Tarti Sistemleri, Fevzi Cakmak Mah., Ayyildiz Cad. No 16/F, Karatay, Konya, Turkey

R060/2000-NL1-2015.22 (MAA)
Single point load cell, with strain gauges - Type: PS

Shanghai Teraoka Electronic Co., Ltd., Tinglin Industry Developmental Zone, Jin Shan District, CN-201505 Shanghai, P.R. China

R060/2000-NL1-2015.24 (MAA)
Bending beam load cell, with strain gauges - Type: DEBB-220 or DEBB-300.

Shekel Electronics Scales, Kibbutz Beit Keshet, IL-15247 M.P. Lower Galilee, Israel

▶ Issuing Authority / *Autorité de délivrance*
NMRO Certification Services (NMRO), United Kingdom

R060/2000-GB1-2015.03 (MAA)
FP-XXXKG (with XXX the capacity of the load cell in kg)

Cardinal Scale Manufacturing Co., 203 East Daugherty Street, P.O. Box 151, 64870 Webb City, Missouri, United States

▶ Issuing Authority / *Autorité de délivrance*
Physikalisch-Technische Bundesanstalt (PTB), Germany

R060/2000-DE1-2015.01 (MAA)
Load Cell - Type: Z6R

Hottinger Baldwin Messtechnik GmbH, Im Tiefen See 45, DE-64293 Darmstadt, Germany

CATÉGORIE D'INSTRUMENT

Automatic gravimetric filling instruments
Doseuses pondérales à fonctionnement automatique

R 61 (2004)

▶ Issuing Authority / *Autorité de délivrance*
NMi Certin B.V., The Netherlands

R061/2004-NL1-2013.01 Rev. 1
Automatic gravimetric filling instrument - Type: ADW-O- . . . . (Omega series)

Yamato Scale Co., Ltd., 5-22 Saenba-cho, JP-673-8688 Akashi, Hyogo, Japan

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Nonautomatic weighing instruments
Instruments de pesage à fonctionnement non automatique

R 76-1 (1992), R 76-2 (1993)

▶ Issuing Authority / *Autorité de délivrance*
NMi Certin B.V., The Netherlands

R076/1992-NL1-2010.16 Rev. 1 (MAA)
Non-automatic weighing instrument - Type: FZ-I series

A&D Instruments Ltd., 24 Blacklands Way, Abingdon Business Park, Abingdon OX14 1DY, United Kingdom

▶ Issuing Authority / *Autorité de délivrance*
NMRO Certification Services (NMRO), United Kingdom

R076/1992-GB1-2015.02 Rev. 1
Type: CL7200 Series

CAS Corporation, #262, Geurugogae-ro, Gwangjeok-myeon, Yangju-si, Gyenonggi-do, Korea (R.)

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Non-automatic weighing instruments
Instruments de pesage à fonctionnement non automatique

R 76-1 (2006), R 76-2 (2007)

▶ Issuing Authority / *Autorité de délivrance*
Dansk Elektronik, Lys & Akustik (DELTA), Denmark

R076/2006-DK3-2015.06
Non-automatic weighing instrument - Type: LEXUS: Houston 7T / Houston 22T / Texas 10M / Texas 10M Pole / Texas 20 M / Texas 20M Pole

BCI Ingenieria SAS, Carrera 88Z No. 64D-90, Bodega 23, Bogota D.C., Colombia

Issuing Authority / *Autorité de délivrance*

**NMi Certin B.V.,
The Netherlands**

R076/2006-NL1-2015.26 (MAA)
Non-automatic weighing instrument - Type: Resuscitaire Radiant Warmer (RW82, RW82-VHA), Resuscitaire Birthing Room Warmer (WBR82).

Drager Medical Systems Inc., 3135 Quarry Road, Telford, PA 18969 Pittsburgh, United States

R076/2006-NL1-2015.32 (MAA)
Indicator - Type: EHI-E1

Nanjing Easthigh Measurement Co., Ltd., No. 77 Tangton Road, Hushu Town, Jiangning, Nanjing, P.R. China

R076/2006-NL1-2015.34 (MAA)
Non-automatic weighing instrument - Type: FS, FZ series

Shinko Denshi Co., Ltd, 3-9-11 Yushima, Bunkyo-ku, JP-113-0034 Tokyo, Japan

R076/2006-NL1-2015.38 (MAA)
Weighing module - Type: AD2000; RM-5800LL B

Shanghai Teraoka Electronic Co., Ltd., Tinglin Industry Developmental Zone, Jin Shan District, CN-201505 Shanghai, P.R. China

R076/2006-NL1-2015.41
Non-automatic weighing instrument - Type: SWS-5600

Teraoka Seiko Co., Ltd., 13-12 Kugahara, 5-Chome, Ohta-ku, JP-146-8580 Tokyo, Japan

R076/2006-NL1-2015.49 (MAA)
Indicator - Type: IND245/IND246

Mettler-Toledo (Changzhou) Measurement Technology Ltd., N° 111, West TaiHu Road, ChangZhou XinBei District, CN-213125 Jiangsu, P.R. China

R076/2006-NL1-2015.50 (MAA)
Non-automatic weighing instrument - Type: PCSK

Grupo Epelsa S.L., c/Punto Net, 3, Polígono Industrial Tecnoalcalá, ES-28805 Alcalá de Henares (Madrid), Spain

R076/2006-NL1-2015.51 (MAA)
Indicator - Type: K5M/K5EM, K3M/K3EM, K5+M/K5E+M, K3+M/K3+EM

Moorange Electronics Mfg (Shanghai) Co., Ltd., No. 336m Haiqiao Road, Huinan Town, Pudong District, CN-201301 Shanghai, P.R. China

R076/2006-NL1-2015.52 (MAA)
Non-automatic weighing instrument - Type: DSX-1000

Shanghai Teraoka Electronic Co., Ltd., Tinglin Industry Developmental Zone, Jin Shan District, CN-201505 Shanghai, P.R. China

Issuing Authority / *Autorité de délivrance*

**NMRO Certification Services (NMRO),
United Kingdom**

R076/2006-GB1-2012.04 Rev. 3 (MAA)
Type: ZM401, ZM303,AM305,ZQ375 Series

Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP, United Kingdom

R076/2006-GB1-2014.04 Rev. 1
Type: Spirit Select

Stryker Medical London, 1020 Adelaide Street South, N6E 1R6 London, Ontario, Canada

R076/2006-GB1-2015.04 (MAA)
Type: ZP900 Series

Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP, United Kingdom

R076/2006-GB1-2015.07 (MAA)
Type: ZM401, ZM405 Series

Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP, United Kingdom

Issuing Authority / *Autorité de délivrance*

**Physikalisch-Technische Bundesanstalt (PTB),
Germany**

R076/2006-DE1-2015.02 (MAA)
Non-automatic electromechanical weighing instrument with or without level works - Type: TA-X

Sartorius Industrial Scales GmbH & Co. KG, Leinetal 2, DE-37120 Bovenden, Germany

R076/2006-DE1-2015.03
Non-automatic electro-mechanical weighing instrument without lever system - Type:SARTOCOWAT

Sartorius Industrial Scales GmbH & Co. KG, Leinetal 2, DE-37120 Bovenden, Germany

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Automatic level gauges for fixed storage tanks
Jaugeurs automatiques pour les réservoirs de stockage fixes

R 85 (2008)

▶ Issuing Authority / *Autorité de délivrance*

NMi Certin B.V.,
The Netherlands

R085/2008-NL1-2015.01
Automatic level gauge for measuring the level of liquid in storage tanks - Type: FMR540

Endress + Hauser GmbH + Co., KG, Haupstrasse 1, DE-79689 Maulburg, Germany

R085/2008-NL1-2015.01
Automatic level gauge for measuring the level of liquid in storage tanks - Type: FMR540

Endress + Hauser GmbH + Co., KG, Haupstrasse 1, DE-79689 Maulburg, Germany

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Multi-dimensional measuring instruments
Instruments de mesure multidimensionnels

R 129 (2000)

▶ Issuing Authority / *Autorité de délivrance*

NMRO Certification Services (NMRO),
United Kingdom

R129/2000-GB1-2013.01 Rev. 2
Multidimensional measuring instrument designated QubeVu® for measuring square or rectangular boxes only

Postea Inc, 2750 Prosperity Ave, Suite 450, VA-22031 Fairfax, Virginia, United States

The OIML is pleased to welcome the new

CIML Member

for Tunisia: **Mr. Lotfi Khedir**

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Gas meters
Compteurs de gaz

R 137 (2012)

▶ Issuing Authority / *Autorité de délivrance*

NMi Certin B.V.,
The Netherlands

R137/2012-NL1-2015.07
Rotary displacement gas meter - Type: TYL

Tancy Instrument Group Co. Ltd., No. 3468 Tongfu Rd., Lingxi Town, Wenzhou City, Cangnan County, CN-235800 Zhejiang Province, P.R. China

R137/2012-NL1-2015.08
Turbine gas meter - Type: TBQM

Tancy Instrument Group Co. Ltd., No. 3468 Tongfu Rd., Lingxi Town, Wenzhou City, Cangnan County, CN-235800 Zhejiang Province, P.R. China

R137/2012-NL1-2015.09
Ultrasonic gas meter - Type: 3414 / 3415 / 3416 / 3417 Senior Sonic

Emerson Process Management, 11100 Brittmoore Park Drive, 77041 Houston, Texas, United States

R137/2012-NL1-2015.10
Diaphragm gas meter - Type: G4, G2.5 and G1.6

Hangxhou Beta Gas Meter Co., Ltd., No. 181 Wuchang Avenue, Yuhang District, Hangzhou, P.R. China

Calendar of OIML meetings

OIML TC 17/SC 7
Software Validation Working Group (R 126)
23–24 February 2016 – Berlin, Germany

MAA CPRs meeting
22–23 March 2016 – Denmark (hosted by Delta)

OIML TC 8/SC 3/p 4
Revision of R 117
30 May–1 June 2016 – The Netherlands

OIML TC 8/SC 1
Revisions of R 71, R 80 and R 85
June 2016 (exact dates to be advised)
Göteborg, Sweden

TC/SC NEWS

Meeting of OIML TC 8/SC 1 *Static volume and mass measurement*

2–4 December 2015 Schopfheim, Germany

GUDRUN WENDT, PTB (GERMANY)
TC 8/SC 1 SECRETARIAT
TC 8/SC 1/p 6 Convener

RALPH RICHTER, NIST (USA)
TC 8/SC 1/p 9 and p 10 Convener

LUIS MUSSIO, BIML
TC 8/SC 1 Contact Person

A meeting of OIML TC 8/SC 1 *Static volume and mass measurement* was hosted by Endress+Hauser on 2–4 December 2015 in Schopfheim, Germany. Eighteen delegates from China, Czech Republic, Germany, Netherlands, Slovenia, Sweden and the USA participated in the meeting, and proxies were received from Australia, Austria, France and South Africa. Also attending were a delegate from CECOD and Mr. Luis Mussio from the BIML.

The conveners and the participants wish to thank Endress+Hauser for their outstanding hospitality and for providing a factory tour of their facility in Maulburg, Germany.

Revision of R 80
Road and rail tankers with level gauging

Based on the output of the last TC 8/SC 1 meeting in December 2014, Dr. Gudrun Wendt, the convener of the p 6 Project Group, prepared new drafts of Parts 2 and 3 and these were reviewed and discussed during the meeting. The draft of Part 3 was drawn up in cooperation with the contact person from the Netherlands, Mr. George Teunisse.

The next stage in the development of this publication is to post and distribute the 2 CD packages of R 80 Parts 2 and 3 for PG vote and comment.

Revision of R 71
Fixed storage tanks and

Revision of R 85
Automatic level gauges for measuring the level of liquids in stationary storage tanks

Mr. Ralph Richter (NIST, USA) reviewed and discussed the project proposals for the revision of R 71 (now project p 9) and the revision of R 85 (now project p 10) that were approved by the CIML in Arcachon in October 2015. Mr. Richter also reviewed advanced drafts of both R 71 and R 85 with meeting participants in preparation for distributing and posting the 1 CD packages of both of these Recommendations.

The proposed program for the development of these publications is:

2016-01:
- p 9: 1 CD of OIML R 71 distributed for comment
- p 10: 1 CD of OIML R 85-1 and R 85-2 distributed for comment

2016-01:
- p 6: 2 CD of R 80-2 and R 80-3 distributed for vote and comment

2016-03:
- Compilation and distribution of the comments received on R 71 and R 85

2016-04:
- R 80 next step is either a 3 CD or CIML preliminary ballot depending on the voting results and the comments received

2016-06:
- Meeting in Göteborg, Sweden, to resolve all the comments received on R 71 and R 85 and to prepare the 2 CD packages

Participants attending the meeting of OIML TC 8/SC 1 *Static volume and mass measurement*

CIM2015
17th INTERNATIONAL CONGRESS OF METROLOGY

CIM 2015 in Paris ... A success!

The International Metrology Congress (CIM) has shown the decisive contribution metrology makes in industrial processes. It has also allowed practical solutions for today and tomorrow's technologies to be discovered.

This event was an unlikely gathering of several worlds which coexist without necessarily speaking to or understanding each other: people from industry, sales managers, experts and researchers.

This was like "mixing oil and vinegar" with a small dose of French improvisation – and yet it works!

The CIM has once again confirmed its appeal and leading position in the field of measurement:

- 813 participants and exhibitors took part in the Congress,
- 42 different countries were represented, and 30 % of participants came from abroad, mainly from Europe but also from North and South America, Africa, the Middle East and Asia,
- 60 companies were exhibitors in the Metrology Village at the heart of the event,
- the technical level was excellent or satisfactory for 92 % of participants,
- the possibilities for application are excellent or satisfactory for 72 % of participants.

Almost 180 lectures were presented on regular or new topics:

- great success for Uncertainties, Mechanical Challenges and 3D Trends sessions,
- "Metrology 4.0" session with the interventions of American, English and German national laboratories took place in a full room,
- many emerging topics on Water quality and Energy,
- finally, always a lot of interest in the round tables, especially Outsourcing of Metrology and Risk Management.

The CIM was concluded by the prestigious intervention of Prof. Claude Cohen Tannoudji, 1997 Nobel Prize in Physics, highlighting today's necessary fundamental research which will generate new technologies in 10 or 20 years.

The Congress also confirmed that it appeals to all audiences in the field of measurement:

- 57 % of participants were industrial users of measurements in all types of sectors: analysis and metrology laboratories, equipment manufacturers, etc.,
- 30 % were representatives of major national and international organizations: the national laboratories of the large European countries, ministries, accreditation bodies, international organizations, etc.,
- 10 % were academics or researchers,
- 3 % come from other backgrounds: hospitals, training organizations, consultants, the press, etc.

The Collège Français de Métrologie, the event organiser, wishes to extend its warm thanks to everyone who attended and all the partners of the Congress:

- the Organizing Committee: A+ Métrologie, Acac, Afnor Normalisation, BEA Métrologie, BIPM, Cetiat, EA, Euramet, Hexagon Metrology, Implex, LNE, Metas, NIST, NPL, Peugeot Citroën Automobiles, Trescal,
- the sponsors: A+ Métrologie, Cetiat, Hexagon Metrology, Implex, Metrologic Group and Wika,
- the institutional supporters: the Ministry in charge of Industry and the Ministry of Culture.

For further technical information related to CIM 2015

The final texts of the lectures are available online here: http://cfmetrologie.edpsciences.org/fr/

Outsourcing the metrology function is a recurrent topic. But until now discussions were about outsourcing the calibration of measuring instruments.

A new question arises on outsourcing the metrology function. Should we or should we not keep the skills within the company? What are the limits and risks of complete outsourcing?

The round table brought together small companies, conscious of the importance of metrology without being able to pay for it; providers who already offer advice – but will they remain close to the interests of their customers? And of course major companies who question regarding the new technologies and the skills they request.

At the end of this round table there was no straight answer, but there were exchanges that will continue to advance this debate.

Press information:

+ 33 (0)4.67.06.20.36
info@cfmetrologie.com
www.metrologie2015.com

Bilan du CIM 2015 ... Paris réussi !

Le Congrès International de Métrologie (CIM) montre l'apport décisionnel de la métrologie dans les processus industriels. Il permet également de découvrir des solutions pratiques pour aujourd'hui et les technologies de demain.

Cette manifestation est un rassemblement improbable de plusieurs mondes qui se côtoient sans forcément se parler ou se comprendre : des industriels, des commerciaux, des experts, et des chercheurs.

C'est le « mariage de la carpe et du lapin » avec une petite dose de « French improvisation » ... et pourtant ça fonctionne ...

Le CIM confirme, une nouvelle fois, son attrait et sa place dominante dans le milieu de la mesure :

- 813 participants et exposants ont assisté au congrès,
- 42 pays différents étaient présents, et 30 % des participants sont issus de l'étranger,
- 60 sociétés exposaient sur le Village Métrologie situé au sein du Salon Enova,
- le niveau technique est jugé excellent ou satisfaisant par 92 % des participants,
- les possibilités d'application ressortent comme excellentes ou satisfaisantes dans 72 % des cas.

Près de 180 conférences ont été présentées autour de thèmes classiques ou très nouveaux :

- grand succès comme toujours pour les sessions Incertitudes, Défis mécaniques, Tendances 3D,
- la conférence « Métrologie 4.0 » avec des interventions des laboratoires nationaux américain, anglais et allemand a eu lieu dans une salle comble,
- et de nombreux sujets émergents sur la Qualité de l'eau et l'Energie,
- enfin toujours beaucoup d'intérêt pour les tables rondes notamment sur l'Externalisation de la fonction Métrologie et la Maîtrise de risques.

Le CIM a été conclu par l'intervention prestigieuse de Monsieur Claude Cohen Tannoudji, Prix Nobel de Physique 1997, qui pointe l'indispensable recherche fondamentale d'aujourd'hui, qui va générer les nouvelles technologies dans 10 ou 20 ans.

Le Congrès rassemble tous les publics et acteurs du secteur de la mesure :

- 57 % sont des industriels : utilisateurs de moyens de mesure dans tout type de secteur, laboratoires d'analyses, laboratoires de métrologie ou fabricants de matériels, ...
- 30 % sont issus des grands organismes nationaux et internationaux : laboratoire national des grands pays européens, ministères, organismes d'accréditation, organisations internationales, ...
- 10 % des universitaires ou des chercheurs,
- 3 % des participants sont d'origines diverses : hôpitaux, organisme de formation, consultant, presse, ..

Le Collège Français de Métrologie, porteur de l'événement, souhaite remercier chaleureusement tous ceux qui étaient présents et l'ensemble des partenaires du Congrès :

- les membres du Comité d'Organisation : A+ Métrologie, Acac, Afnor Normalisation, BEA Métrologie, BIPM, Cetiat, EA, Euramet, Hexagon Metrology, Implex, LNE, Metas, NIST, NPL, Peugeot Citroën Automobiles, Trescal
- les sponsors et partenaires : A+ Métrologie, Cetiat, Hexagon Metrology, Implex, Metrologic Group, Wika
- les soutiens institutionnels : Ministère de l'Economie, de l'Industrie et du Numérique et DGE, Ministère de la Culture.

Pour compléter les informations techniques du CIM 2015

Les textes des conférences du Congrès sont en ligne ici : http://cfmetrologie.edpsciences.org/fr/

L'externalisation de la métrologie est un sujet récurrent. Cependant il était question jusqu'à présent d'externaliser la prestation d'étalonnage des instruments de mesure.

Une nouvelle question se pose sur l'externalisation de la fonction métrologie. Doit-on garder ou non la compétence au sein de l'entreprise ? Quelles sont les limites et les risques d'une externalisation complète ?

Cette table ronde a réuni des PMEs, soucieuses de l'importance de la métrologie sans pouvoir y mettre les moyens ; des prestataires qui offrent d'ores et déjà un conseil aux entreprises mais pourront-ils prendre toute la prestation en restant proche des intérêts de leur client ? Et bien sûr les grands groupes qui s'interrogent vis-à-vis des nouvelles technologies dont ils n'ont pas encore les compétences.

A la sortie de cette table ronde, pas de réponse franche mais des échanges qui continueront de faire avancer ce débat plus que d'actualité. En savoir plus : http://www.metrologie2015.com/presse-cim-2015.html

Plus d'infos : 04.67.06.20.36 - info@cfmetrologie.com - www.metrologie2015.com

OIML CERTIFICATE SYSTEM

List of OIML Issuing Authorities

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There are no changes since the last issue of the Bulletin.

		R 16	R 21	R 31	R 35	R 46	R 49	R 50	R 51	R 58	R 60	R 61	R 75	R 76	R 81	R 85	R 88	R 93	R 97	R 98	R 99	R 102	R 104	R 105	R 106	R 107	R 110	R 112	R 113	R 114	R 115	R 117/118	R 122	R 126	R 128	R 129	R 133	R 134	R 136	R 137
AT1	Bundesamt für Eich- und Vermessungswesen (BEV)							■	■	■		■		■		■	■		■	■		■	■		■	■	■				■	■	■								
AU1	National Measurement Institute (NMI)						■	■	■		■			■		■									■	■	■					■		■			■				
BE1	SPF Economie, PME, Classes Moyennes et Energie													■					■	■												■								
BG1	State Agency for Metrology and Technical Surveillance (SAMTS)													■						■																				
BR1	Instituto Nacional de Metrologia, Normalização e Qualidade Industrial (INMETRO)													■																										
CH1	Institut fédéral de métrologie METAS	■		■			■	■	■		■	■		■					■	■				■	■	■						■					■			
CN1	General Administration of Quality Supervision, Inspection and Quarantine of P. R. China (AQSIQ)			■		■		■	■		■	■		■					■	■						■						■					■			
CZ1	Czech Metrology Institute (CMI)						■							■	■	■								■								■					■			
DE1	Physikalisch-Technische Bundesanstalt (PTB)			■	■		■	■	■	■	■	■		■		■	■		■	■	■	■	■	■	■	■	■			■	■	■		■	■	■	■		■	
DK1	The Danish Accreditation and Metrology Fund (DANAK)							■	■		■	■		■						■				■	■	■						■					■		■		
DK2	FORCE Certification A/S						■																																	
DK3	Dansk Elektronik, Lys & Akustik (DELTA)							■	■		■	■		■											■	■											■		■		
ES1	Centro Español de Metrología (CEM)						■		■		■	■		■					■	■															■					
FI1	Inspecta Oy							■	■		■	■		■		■									■	■						■								
FR1	Ministère de l'Economie, de l'Industrie et de l'Emploi (MEIE)	*All activities and responsibilities were transferred to FR2 in 2003*																																						
FR2	Laboratoire National de Métrologie et d'Essais (LNE)		■	■			■	■	■	■	■	■		■	■	■	■		■	■	■	■		■	■	■	■			■	■	■		■		■		■		■
GB1	NMRO Certification Services (NMRO)		■		■		■	■	■		■	■	■	■		■				■				■	■	■						■				■		■		
GB2	National Physical Laboratory (NPL)																		■																					
HU1	Hungarian Trade Licensing Office (MKEH)													■																										
IT1	Ministero dello sviluppo economico - Direzione generale mercato, concorrenza, consumatori, vigilanza e normativa tecnica						■																																
JP1	National Metrology Institute of Japan / National Institute of Advanced Industrial Science and Technology (NMIJ / AIST)						■				■			■																	■	■							
KR1	Metrology and Measurement Division (KATS)													■																										
NL1	NMi Certin B.V.		■	■		■	■	■	■		■	■		■	■	■			■		■			■	■	■						■		■	■	■		■		■
NL2	KIWA Nederland B.V.						■																																	
NO1	Norwegian Metrology Service (Justervesenet)							■	■			■		■										■	■	■						■					■			
NZ1	Measurement and Product Safety Service (MAPSS Wellington)													■																										
PL1	Central Office of Measures (GUM)													■						■		■																		
RO1	Bureau Roumain de Métrologie Légale (B.R.M.L.)																		■	■							■			■	■									
RU1	Russian Research Institute for Metrological Service (VNIIMS)			■			■	■	■	■	■	■		■		■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
SE1	Swedish National Testing and Research Institute AB (S.P.)							■	■		■	■		■		■				■					■	■						■								
SI1	Metrology Institute of the Republic of Slovenia (MIRS)													■																										
SK1	Slovak Legal Metrology						■							■																			■							
US1	NCWM, Inc.										■			■																										
VN1	Directorate for Standards and Quality (STAMEQ)													■																										

Call for papers

OIML Members
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Manufacturers' Associations
Consumers' & Users' Groups, etc.

- Technical articles on legal metrology related subjects
- Features on metrology in your country
- Accounts of Seminars, Meetings, Conferences
- Announcements of forthcoming events, etc.

The **OIML Bulletin** is a forum for the publication of technical papers and diverse articles addressing metrological advances in trade, health, the environment and safety - fields in which the credibility of measurement remains a challenging priority. The Editors of the Bulletin encourage the submission of articles covering topics such as national, regional and international activities in legal metrology and related fields, evaluation procedures, accreditation and certification, and measuring techniques and instrumentation. Authors are requested to submit:

- a titled, typed manuscript in Word or WordPerfect either on disk or (preferably) by e-mail;
- the paper originals of any relevant photos, illustrations, diagrams, etc.;
- a photograph of the author(s) suitable for publication together with full contact details: name, position, institution, address, telephone, fax and e-mail.

Note: Electronic images should be minimum 150 dpi, preferably 300 dpi.

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BIML, 11 Rue Turgot, F-75009 Paris, France
(chris.pulham@oiml.org)