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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

**BIML Technical Agents**

**Director**
Jean-François Magaña (jfm@oiml.org)

**Assistant Directors**
Attila Szilvássy (asz@oiml.org)
Ian Dunmill (id@oiml.org)

**Editor**
Chris Pulham (cp@oiml.org)

**Engineers**
Régine Gaucher (rg@oiml.org)
Edouard Weber (ew@oiml.org)
Jean-Christophe Esmiol (jce@oiml.org)

**Administrator**
Philippe Leclercq (phl@oiml.org)

**Office Manager**
Patricia Saint-Germain (psg@oiml.org)

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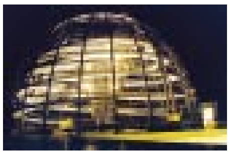

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# Editorial

ALAN JOHNSTON

## A period of transition

I would like to thank all of you for your support in electing me as the next CIML President, and it is with great pride that I accept this new challenge. As well, I would like to take this opportunity to recognize the leadership provided by Manfred Kochsiek over the past year.

One of the many benefits of being the President-elect is the transition period between the election in Berlin and the June 2005 CIML Meeting in Lyon when I will assume the duties of President. While I am already involved in the implementation of the *Decisions and Resolutions* of the 12$^{th}$ OIML Conference, this transition period will allow me the time to gain valuable insight and experience as I take on this new role.

As I stated in my acceptance speech in Berlin, I hope to focus my attention on the *Long-term Policy* and *Action Plan*, the continued implementation of the MAA, and the acceleration of technical work. In addition, discussions are underway with Jean-François Magaña to streamline the agendas when the Conference and CIML Meeting are held concurrently. This, of course, is not a major issue but one that warrants attention nonetheless.

And let's not forget the 50$^{th}$ Anniversary of the OIML that will be held in conjunction with the CIML Meeting in Lyon in 2005, during which we will also be hoping to elect a new CIML First Vice-president. It is important that we take the time next year to celebrate the past, present, and future achievements of the OIML. I hope you will be able to join in the festivities.

It only remains for me to wish all our Members and Readers a very happy, prosperous New Year on behalf of myself and all the Staff at the BIML. ■

## Une période de transition

Je voudrais vous remercier tous de l'appui que vous m'avez démontré en m'élisant Président du CIML, et c'est avec fierté que j'accepte de relever ce nouveau défi. J'aimerais aussi profiter de l'occasion pour souligner le leadership dont a fait preuve Manfred Kochsiek au cours de la dernière année.

L'un des nombreux avantages d'être Président désigné est la période de transition dont je tirerai profit entre l'élection à Berlin et la Réunion du CIML à Lyon, en juin 2005, moment auquel j'entrerai en fonction. Bien que je participe déjà à la mise en œuvre des *Décisions et Résolutions* de la 12$^{ème}$ Conférence de l'OIML, cette période de transition me permettra d'obtenir un bon aperçu de mon nouveau rôle et d'acquérir une expérience valable.

Comme je l'ai mentionné dans mon discours d'acceptation à Berlin, je désire concentrer mes efforts sur la *Politique à long terme* et le *Plan d'action*, la mise en œuvre continue de l'Arrangement d'Acceptation Mutuelle (MAA) et l'accélération des travaux techniques. En outre, des discussions sont actuellement en cours avec Jean-François Magaña en vue de simplifier les ordres du jour lorsque la Conférence et la Réunion du CIML ont lieu simultanément. Bien sûr, ce dernier point n'est pas un enjeu capital, mais il mérite toutefois qu'on s'y attarde.

Il ne faudrait surtout pas oublier le 50$^{ème}$ Anniversaire de l'OIML qui se tiendra conjointement avec la Réunion du CIML à Lyon en 2005, et pendant laquelle nous espérons aussi pouvoir élire un Premier Vice-président du CIML. Il est important que nous prenions le temps, l'an prochain, de célébrer les réalisations passées, présentes et futures de l'OIML. J'espère que vous pourrez participer aux festivités.

Il ne me reste plus qu'à souhaiter à tous nos Membres et Lecteurs une bonne et heureuse Nouvelle Année de la part de moi-même et tout le Staff du BIML. ■

SURVEILLANCE

# Metrological surveillance in public utilities measurements

PAUL DÂRVARIU
Romanian Bureau of Legal Metrology (BRML)

## Foreword

The *International Vocabulary of Terms in Legal Metrology* defines metrological surveillance as a *"control exercised in respect of the manufacture, import, installation, use, maintenance and repair of measuring instruments, performed in order to check that they are used correctly as regards the observance of metrology laws and regulations"* [1]. On first reading this definition appears contradictory: how can one obtain information on the correct use of a measuring instrument by exercising controls over its manufacturer or importer? In fact though, the definition becomes clear when metrological surveillance is perceived as an overall activity performed after measuring instruments have been placed on the market, including both *market surveillance* and *surveillance of instruments in service*. There is a distinction between the two components: since the aim of market surveillance is to be sure that manufacturers and importers have only placed instruments on the market which meet legal requirements, in service surveillance is essentially targeted at the user, who is responsible for the suitability of the instrument to the process, its installation and maintenance, data acquisition, processing and use in transactions involving the public [2] [3].

However, sometimes feedback to the manufacturer or importer is necessary, for instance when the measuring instrument is not suitable for its intended use (taking normal operating conditions into account). Despite the distinction between the two kinds of activities, there is a smooth passage from market surveillance to surveillance in service. Although the Measuring Instruments Directive 2004/22/EC (MID) [4] deals only with market surveillance, it does also contain some prescriptions that can be extended to in service surveillance. For instance, in all the four Annexes specific to instruments destined for public utilities measurements (MI-001, MI-002, MI-003 and MI-004), there is a requirement that obliges the distributor or the installer of a meter to determine the range of operating conditions (flow rate, temperature, pressure, current, etc.), *"so that the meter is appropriate for the accurate measurement of consumption that is foreseen or foreseeable"*.

Market surveillance is performed in order to check that instruments intended for regulated use have been placed on the market and put into service on the basis of appropriate conformity assessment procedures and appropriate markings. For instruments not intended for regulated use, only the correctness of markings is checked. It is not the intention of this paper to go into market surveillance in depth, though in service surveillance of some instruments used in the field of public utilities will be detailed here. In this particular field, in service surveillance consists essentially in checking that:

- The instrument was properly chosen according to:
  - Current practice and the manufacturer's instructions;
  - Required accuracy and the estimated errors in practical working conditions;
  - Actual ranges of fluid parameters (flow rate, temperature, pressure, etc.);
  - Ambient conditions (temperature, pressure, humidity, etc.);
  - The particular physical and chemical properties of the fluid (composition, viscosity, corrosiveness, etc.);
- The instrument was properly installed, maintained and used according to current practice and in line with the manufacturer's instructions;
- There are no features likely to facilitate fraudulent use or unintentional misuse;
- The measurement values are properly collected, processed and handled in commercial transactions;
- The customer can check the relation between the measurement results and the price to pay;
- The instrument was subjected to legal metrological controls and is properly marked.

Free movement of measuring instruments in the global market will dramatically reduce the activities of legal metrology services in the stages before placing on the market and putting into use [4]. Generally speaking in those countries that import measuring instruments, the workload relating to type evaluations and initial verifications will substantially decrease. On the other hand the increase in utilities costs and new developments in measuring technologies (most of which are software-based) will lead to the temptation for the user to manipulate the instruments - or at least the measurement results. These factors create new responsibilities for legal metrology services, but since surveillance can only be partly performed within the scope of subsequent verifications, they must concentrate on other activities. The future of legal metrology will be characterized by a shift from a metrology system based on preventive measures to a rather repressive system, but supported by more advanced technical competence and by efficient cooperation with manufacturers, importers and installers [2] [5] [6] [7].

This paper presents some possible implications of a legal metrology service within the scope of surveillance of measuring instruments used for certain public utilities such as water, gas and heat. The following examples attempt to demonstrate that although there is not necessarily any fraudulent intention in a commercial transaction and the manufacturer's instructions are fully met, simply neglecting basic metrological principles can sometimes cause major conflicts between parties.

## 1 A balance that never closes

***Facts:*** After 1990, many Romanian housing associations decided to install small water meters inside apartments, in order to separate individual consumptions and to reduce the wastage of water. Since the regulations in force at that time allowed housing associations to choose the cost allocation methods themselves, some of them decided that each tenant should only pay on the basis of his or her own water meter readings. In certain cases when some tenants were unsuccessful in installing individual water meters, it was decided that they should pay the difference between the volume of water measured by the custody transfer meter installed on the branch water pipe, and the sum of volumes measured by all the individual meters. Unfortunately, despite generally positive effects on water savings, this kind of decision led to many conflicts because of the significantly (and sometimes unreasonably) higher water costs allocated to apartments without individual meters.

***Actions and findings:*** In the particular case of a block of flats with 98 apartments, the surveillance action found that the branch water pipe had been equipped with a DN 50, class C water meter and a number of 285 DN 15 class B single jet water meters were installed inside 95 apartments. Since the starting flow rate of small water meters is about 8 L/h, small water leakages (most of them caused by old toilet reservoirs) were not measured in the apartments. On the other hand however, the custody transfer water meter (with a starting flow rate of 50 L/h) could measure a significant part of the cumulative leakage. Figure 1 shows that even if all the apartments had been equipped with individual meters, the difference between volumes measured by the custody transfer meter and the sum of volumes measured by individual meters could be about (16...56)%. Split up between the three apartments only, that difference becomes statistically significant: at least 6 times higher than a normal consumption!

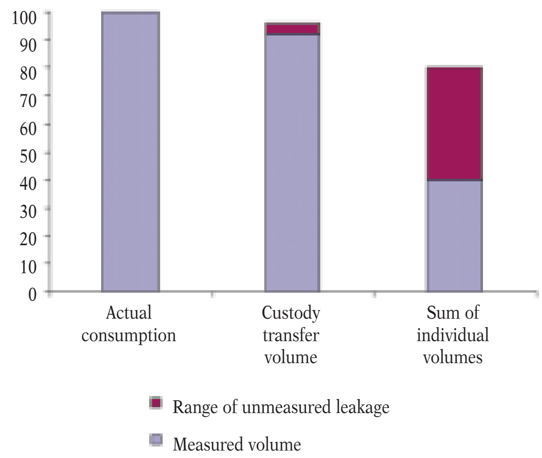


**Fig. 1 Water balance in a block of apartments**

***Conclusions:*** In this case, the individual water meters cannot be used as custody transfer meters, but their measurement results can be used as inputs into a cost allocation system. From a metrological point of view, that approach has significant consequences: although these instruments are normal water meters, they should not be subjected to mandatory legal control, because of their particular use. Consequently, the meters could be checked as and when required on site using portable equipment. On the other hand, some national regulations have been proposed in order to recommend fair methods for water costs allocation.

## 2 "Uncle Frost" and legal metrology

***Facts:*** Many instruments from a large batch of a particular type of imported gas meters failed, only a few months after their putting into use. The failures ranged from measuring errors outside the permissible range to outright blocking of the mechanism.

***Actions and findings:*** 65 gas meters were sampled from the total batch of 37.500 installed meters. The sampled meters were uninstalled from the pipes and taken to the laboratory, where they were verified. The verification results (shown in Figure 2) were obviously unsuitable. Checking the instruments and the pattern approval certificate, the inspectors found that these gas meters were not designed to work in a such a very large ambient temperature range as that commonly found on the external walls of houses (usually – 20 °C ... + 60 °C). Therefore, strong winter frosts combined with some of the liquid components in the gas (water, hydrocarbons) irretrievably damaged most of the meters.

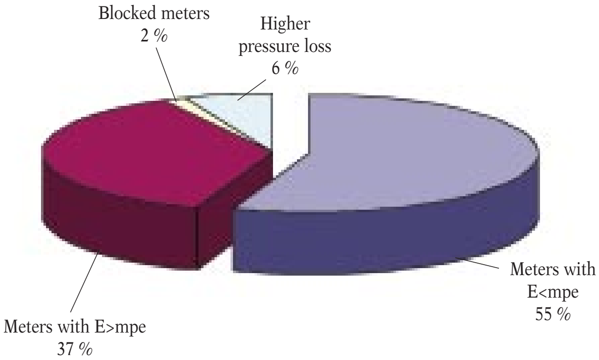


**Fig. 2 Verification results of a sample from a batch of gas meters**

***Conclusions:*** From the point of view of ambient temperature and gas composition, the type of gas meter was not suitable. Since for security reasons the precise installation location cannot usually be changed, the only proposed measure was to ban the use of the whole batch of instruments.

## 3 "Wet" breathing

***Facts:*** A large number of big heat meters installed in thermal substations failed very soon after their putting into use. In fact, their electronic circuits became damaged, although the instruments were apparently installed and used according to the manufacturer's instructions.

***Actions and findings:*** Since drops of water were found inside the waterproof cases of the electronic circuits, three meters were subjected to complete climatic tests. Although all three instruments successfully passed the tests, poor waterproofing was still assumed to be the problem. Checking the working conditions, the inspectors found that the thermal substation operators usually pumped only cold water into the heating circuits. In that case, the very warm and wet air from the thermal substations was absorbed into the cold bodies of the meters, where condensation occurred on the electronic circuits. A simulation test (cold body inside a warm, wet room) subsequently confirmed that assumption.

***Conclusions:*** Although the manufacturer's instructions were followed and the specific tests were passed, both the user and the manufacturer must observe all the specific on site conditions that could affect the instrument. In the case under consideration, the manufacturer had to withdraw all the meters and improve their waterproof qualities.

## 4 A strange "perpetuum mobile"

***Facts:*** The housing associations of 6 blocks of apartments fed from a thermal substation claimed that every month the sum of the heat metered at the building inlets was about equal to or even higher than the heat measured at the level of the thermal substation. They asked for an explanation for this strange "perpetuum mobile" that resulted in unfair over-billing of their heat consumption.

***Actions and findings:*** The surveillance over five years of almost 6000 heat meters led to some interesting conclusions concerning the operating conditions inside the blocks' basements. The first conclusion is that the poor conditions at the place of installation usually reduce the measurement accuracy and sometimes jeopardize the integrity of the meters. For example, the filling of the installations through the return pipe, the poor quality of the hot water as well as the negligence in repairing broken pipes, caused a build-up of solids in the flow meters, eventually blocking them. Generally speaking, the older buildings were not ready to "receive" heat-metering systems. Moreover, the working conditions in the basements (high levels of humidity and temperature, floods, rodents, insects, etc.) were not appropriate for the correct operation of such accurate instruments. All these negative factors increased the measurement uncertainties, making both the maintenance and metrological surveillance too laborious and expensive.

The surveillance action finally established that although in both primary and secondary heating circuits there were similar metering solutions, the accuracy in the secondary circuit was substantially worse.

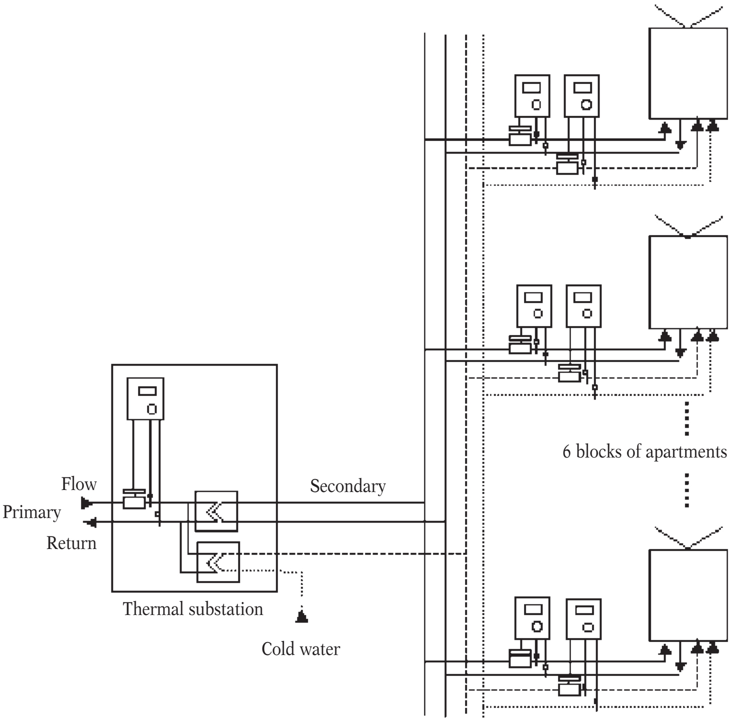


Fig. 3 Solution to meter heat and warm water at blocks of apartments

A heat meter consists of a flow sensor (in principle, a hot water meter with a pulse generator), a pair of temperature sensors to measure the difference between temperatures at the inlet and the outlet of the energy-conveying liquid and a calculator, which solves the equation:

$$Q = V \times \rho \times c \times \Delta\Theta$$

where $Q$ is the consumed heat, $V$ is the volume of the energy-conveying liquid passed through flow sensor, $\Delta\Theta$ is the temperature difference, $c$ is the specific thermal capacity and $\rho$ is the density of the energy-conveying liquid.

In order to evaluate the measurement uncertainties in the above-mentioned heat distribution case, a study was performed, monitoring for relatively long times all the heat meters installed at the thermal substation and all 6 blocks of apartments. Additionally to the scheme in Figure 3, two heat meters were installed on both the heat and hot water outputs of the thermal substation. Also, the 15 calculators were inter-connected in an M-Bus net assisted by a PC. The system was permanently monitored for 35 days during January - February 1998. 75 000 values were measured and recorded hourly for 6 different parameters (energy, volume, flow rate, flow temperature, return temperature and temperature difference). Although the study identified the sources of measurement uncertainties in that particular case, most of the conclusions could be extrapolated to the whole heat distribution system in Bucharest or even in the whole country.

*a) Errors in the temperature difference measurement*

In Romania, in the secondary heating circuits, the energy is delivered at relatively low temperatures. Figure 4 shows that about one third of the heat is supplied during one year at low flow temperatures (lower than 50 °C). Consequently, inside old buildings the temperature difference will have very low values (less than 6 K); this leads to serious problems in heat metering accuracy.

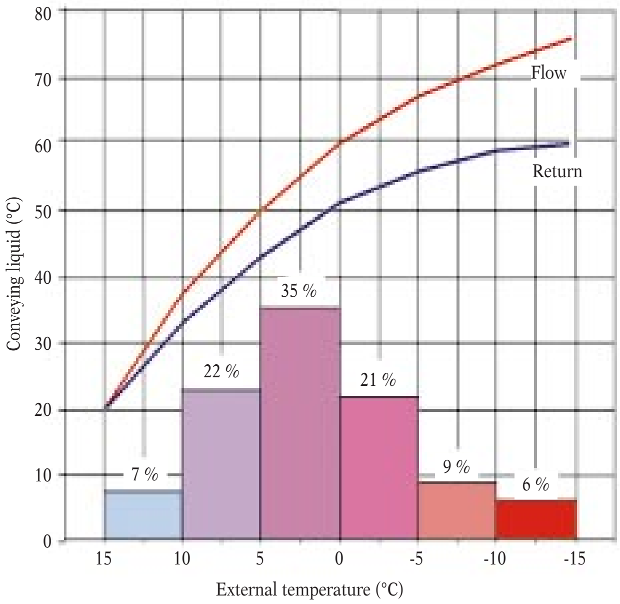


Fig. 4 Typical heat distribution chart

Our study confirmed the theoretical diagram, showing that during 35 consecutive days the temperature difference in the secondary circuit remained within the interval (4.2...5.8) K, for temperature differences in the primary circuit of (40...60) K. The curves in Figure 5 show the simultaneous variation of the primary/secondary temperature differences within a given interval (34 hours, on January 26 and 27, 1998, external temperatures between – 10 ºC and – 3 ºC) for one of the blocks of apartments under consideration. A simple analysis of the two curves leads to the conclusion that the same error in measuring the differential temperature gives heat measurement errors in the secondary circuit 10 times higher than in the primary circuit. This contributes to the lower accuracy of the integrating calculator and the pair of temperature sensors, at low values of temperature difference.

Practice has demonstrated that many errors in temperature difference occur at the installation place in the secondary circuit. Both the different installation features of each temperature sensor and different operating conditions give rise to potential sources of errors. They consist in the difference in:

- Immersion depths;
- Extension cable lengths;
- Diameters of flow and return pipes;
- Installation fittings;
- Thermal insulation of external parts;
- Type of flow (turbulent or laminar);
- Mineral deposits;
- Ambient temperatures in the two installation places.

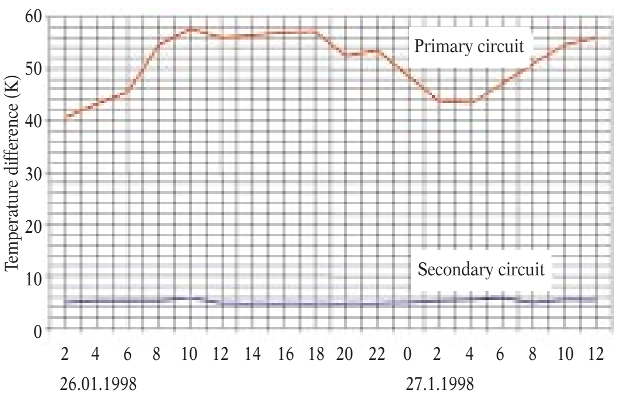


**Fig. 5 Comparison between temperature differences in both primary and secondary circuits**

*b) Errors in flow rate measurement*

Apparently, the measurement of the heat-conveying liquid flow rate in the secondary heating circuits should not give rise to special problems because, for reasons related to the state of hydraulic equilibrium at the consumers' premises, the heat-conveying liquid is supplied at a constant or scarcely variable flowrate. It becomes very clear that choosing special flow sensors with a large measurement range is not an appropriate solution here, but using common warm water meters (Woltman type or multi-jet) would be more appropriate. The real problem with these flow sensors is caused by poor operating conditions (length of service of pipes, poor quality of the energy-conveying liquid, deposits in the pipes, negligent repairs, etc.), which gradually become sources of additional errors. Frequently, abrasive suspensions in the water cause wear of the meter bearings. The phenomenon is called "under-measurement" and was perceived in Germany as a progressive modification of the measurement error up to – 1 % per year [8]. There have been no long-term studies performed in Romania, but considering the much poorer operating conditions and the 2-year regulated interval between two successive metrological verifications, one can estimate the average level of the systematic error given by "under-measurement" at – 1 %. Deposits of solids in meters can cause blockages during certain time periods, depending on the quality of the meter surveillance. In the case of common surveillance, considering the sometimes difficult access to locked or flooded basements, the value of (– 2 ± 1)% is a reasonable statistical average. These two additional sources are less effective in the primary circuits where the heat-conveying liquid is of high quality, the circuits are carefully monitored and breakdowns are more carefully dealt with.

*c) Calculator errors*

Operating conditions in the blocks' basements (humidity, heat, floods, rodents, insects, etc.) are not normal operating conditions for accurate electronic instruments. These conditions cause additional errors to the calculators, especially those used for secondary circuits.

*d) Combined uncertainty in heat measurement*

Table 1 (see next page) shows the measurement uncertainties of similar heat meters installed in primary and secondary heating circuits. The results in the last row were obtained simply by using the equation of MPEs applicable to complete heat meters, according to the MID (requirement 3 in Annex MI-004) [4]. It clearly follows that the same heat meter has a much poorer accuracy when it is installed in the secondary circuit.

***Conclusions:*** Using similar heat meters in both primary and secondary heating circuits, a much larger uncertainty range in heat measurement in blocks of apartments is estimated. Since the most important uncertainty source is the temperature difference measurement, the simplest solution seems to be the improvement of installation and operating conditions for temperature sensors. Unfortunately, this action sometimes becomes impossible because of the age of certain buildings and many influence factors, which are usually unpredictable.

## 5 Returning to the heat balance

***Facts:*** During the above-mentioned surveillance action, a bad energy balance in the warm water distribution was found, although no substantial warm water losses were

Table 1 Combined uncertainty in heat measurement

| Sources of uncertainty | Where the measurement is performed | |
|---|---|---|
| | Primary ($\Delta\Theta_{med}$ = 50 K) | Secondary ($\Delta\Theta_{med}$ = 5 K) |
| Intrinsic error of the pair of temperature sensors | ± 0.68 % | ± 2.3 % |
| Additional error of temperature sensors given by operating conditions (± 0.5 K) | ± 1 % | ± 10 % |
| Intrinsic error of the flow sensor | ± 3 % | ± 3 % |
| "Under-measurement" error | – 1 % | – 1 % |
| Flow disturbances | - | ± 1 % |
| Temporary blocking of the flow sensor | - | (– 2 ± 1) % |
| Intrinsic error of the calculator | ± 0.56 % | ± 1.1 % |
| Additional calculator error given by operating conditions | - | ± 1.5 % |
| Temporary blocking of the calculator | - | (– 1.5 ± 0.75) % |
| **Combined uncertainty** | **(– 1 ± 5.2) %** | **(– 4.5 ± 20.7) %** |

detected. A low accuracy of measurement was incriminated.

***Actions and findings:*** The accuracy of warm water metering was also monitored. Figure 3 shows the method used for metering warm water in Bucharest. The meter consists in a typical heat meter that measures both the volume of consumed water and the heat consumed to produce that volume of warm water. Although the volume metering is quite simple, the heat metering requires some special precautions. Since the warm water is supplied through an open circuit, the temperature of the cold water pipe, present in every basement, is taken to simulate the return temperature at the entry of the heat meter. The method is, apparently, quite accurate: in fact the warm water meter installed in the thermal substation uses the same cold water as in blocks of apartments. However, in practice, there are many uncertainty sources that deserve careful analysis, as detailed below.

*a) Errors in the temperature difference measurement*

Contrary to the heat metering in a secondary heating circuit, the temperature difference has higher values (20…30) K, that puts to advantage the measurement of the heat used to prepare domestic warm water. The only source of significant additional errors is the difference between the cold water temperatures measured in the thermal substation and in the block's basement, respectively. In the present case study, the mean daily variation was + 0.35 °C, which is much lower than the cooling of warm water between the thermal substation and the consumer (about 6.5 °C, giving energy losses of up to 20 %). Therefore, the uncertainties in the heat measurement caused by the errors in the temperature difference are not very significant.

*b) Errors in the warm water volume measurement*

"Under-measurement" and temporary blocking of mechanical water meters exist in this case, too. Additionally, a new uncertainty source appears: the insensitiveness of flow sensors to water leakages. Statistics demonstrate that this additional error is (– 9 ± 6)%.

*c) Calculator errors*

Similar values to those revealed in a heating circuit can be estimated.

*d) Combined uncertainty in the measurement of heat used to produce warm water*

Table 2 (see next page) shows significant uncertainties of measurements performed with a heat meter installed on a domestic warm water inlet.

***Conclusions:*** Most energy losses in the monitored warm water distribution were given by the cooling of warm water between the thermal substation and the blocks of apartments. As for the measurement accuracy, the most

Table 2 Combined uncertainty in warm water metering

| Sources of uncertainty | Values |
|---|---|
| Intrinsic error of the pair of temperature sensors | ± 0.95 % |
| Additional error because of the change in cold water temperature (+ 0.35 K) | (– 0.7 ± 0.7)% |
| Intrinsic error of the flow sensor | ± 3 % |
| "Under-measurement" error | – 1 % |
| Flow disturbances | ± 1 % |
| Temporary blocking of the flow sensor | (– 2.5 ± 1.5)% |
| Insensitiveness to water leakages | (– 9 ± 6)% |
| Intrinsic error of the calculator | ± 0.6 % |
| Additional calculator error given by operating conditions | ± 1.5 % |
| Temporary blocking of the calculator | (– 1.5 ± 0.75)% |
| **Combined uncertainty** | **(– 14.7 ± 16)%** |

important source of uncertainty is the insensitiveness of flow sensors to water leakages. Only using better flow sensors and having a larger flow rate range could substantially improve the measurement accuracy. ■

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*The Author welcomes comments to his article and can be contacted as below:*

Paul Darvariu
Romanian Bureau of Legal Metrology (BRML)
Technical Department
Sos. Vitan Barzesti nr. 11 Sector 4
042122 Bucuresti, Romania
E-mail: drn@brml.ro
darvariu@hotmail.com

WEIGHING IN MOTION

# Vehicle for dynamic calibration of a multiple sensor weigh-in-motion system

BOUDEWIJN HOOGVELT, TNO Automotive
NOL VAN ASSELDONK, Kalibra International
RONALD HENNY, Road and Hydraulic Eng. Institute
HANS VAN LOO, Road and Hydraulic Eng. Institute
GERBEN VISSER, Kalibra International

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## 1 Background

### 1.1 Introduction

International and domestic goods transportation by road is an important part of the Dutch economy; 173,000 trucks transport 600 million tonnes annually [CBS, 2000]. Truck traffic in particular is burdening the infrastructure. The number of trucks and the truck axle loads are the major determinant for the degree of maintenance required, as there is a progressive (4th order) relationship between an axle load and the damage that this axle load causes to the road surface. A disproportionately large percentage of the damage to the infrastructure is caused by trucks with axle loads higher than the legal maximums. The direct costs for additional asphalt maintenance are roughly estimated at around Euro 17 million per annum for Dutch highways alone. This excludes the costs resulting from additional hindrance to traffic (including traffic jams) caused by road works. Moreover, the policy of the Ministry of Transport, Public Works and Water Management is also aimed at stimulating fair competition between companies. Finally, overloading of one or more axles of a truck or the whole vehicle is also likely to have a negative effect on traffic safety.

To reduce the negative effects of overloading, the Directorate General Goods Transportation of the Dutch Ministry of Transport, Public Works and Water Management has started the project 'Overloading'. As part of this project the Road and Hydraulic Engineering Division (DWW) of the Ministry of Transport is working on two projects involving Weigh-in-Motion - WIM-NL and WIM-Hand. The WIM-NL project concerns the installation of six WIM+ Video-systems in The Netherlands [Saan, 2002]. The systems are used by enforcement agencies as a tool for pre-selection and pro-active controls. As static weighing remains necessary, these methods of enforcement are extremely labor-intensive. Therefore, in parallel, the WIM-Hand project was started. WIM-Hand stands for Weigh-In-Motion for automatic enforcement or, in Dutch, 'Handhaving'. This project investigates whether existing technology can be used for building an axle load measuring system that can be employed for automatic enforcement of overloading by heavy goods vehicles. Automatic enforcement means that a citation will be directly based on the measurement of the WIM-system.

### 1.2 WIM-Hand project

As a part of the WIM-Hand project a multi-sensor WIM test site has been built at the A12/A50 highway near Arnhem in the East of The Netherlands. The choice of the multi-sensor approach and the design of the sensor array was based on [Gillespie, 1996], [Dolcemascolo, 1998], [Cebon, 1999], [WAVE, 2001] and others. The test site consists of sixteen rows of sensors, each row consisting of four Kistler Lineas Piezo Quartz sensors [Kunz, 1999]. The length of each of the Kistler sensors is 1.0 m, the spacing between each row of sensors is 1.5 m (see Figure 1). A full description of the design and installation of the test site can be found in [van Loo, 2001]. The system measures the wheel loads of all passing vehicles and stores the measured data from each sensor per vehicle in a database. Along with the measured data a number of video images of the vehicle are also stored.

The measurement part of a WIM-system consists of the combination of the WIM-sensors and the surrounding pavement. As a result, a WIM-system can only be calibrated when the sensors are installed in the road pavement. The basic idea of a multiple sensor WIM-system is that by taking sufficient samples of the

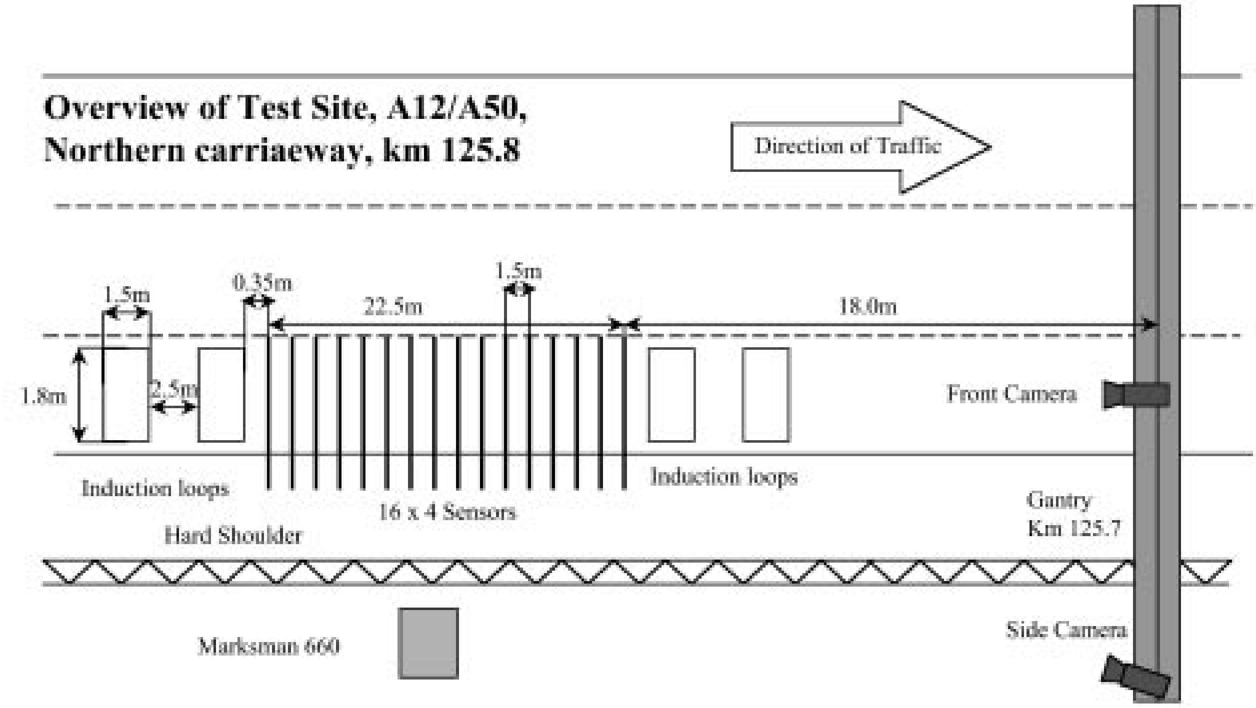



Figure 1 The WIM-Hand test system

dynamic axle loads of the passing trucks the static axle loads can be calculated. The accuracy of most calculation algorithms is sensitive to the measurement error in the sampled axle load, except the neural network technique [Gonzalez, 2003]. That is why it is important that each sensor measures the exact value of the dynamic axle load at the moment the axle passes over that sensor. This can be achieved if each individual sensor is dynamically calibrated. Dynamic calibration means that the sensor will be calibrated to the dynamic force measured by the measurement axle of the instrumented vehicle the moment it passes the sensor. As part of the WIM-Hand project an instrumented vehicle has been built to perform the dynamic calibration of the sensors of the WIM-Hand test site.

## 2 Design of the vehicle

During the last decades several instrumented vehicles have been built and used for calibration and testing of WIM-systems. For example the vehicles from the Transport Road Research Laboratory in the UK [Cebon, 1999], the National Research Council of Canada [WAVE, 2001] and the Technical Research Centre of Finland [Hutala, 1998]. However these vehicles are either based on outdated computer technology or not available for long periods of time in The Netherlands. That is why the possibilities were investigated to build a WIM-calibration vehicle in The Netherlands.

The dynamic calibration of a WIM-system can be done in several ways: at low speed with standard trucks or at high speed with an instrumented vehicle. In the case of low speed calibration it is assumed that the dynamic part of the axle loads is negligible. Then the WIM-system can be calibrated to the axle loads that are measured when the vehicle is stationary. However, when the operational range of the WIM-system is tested at considerably higher speeds with such a standard truck, then the system is in effect not calibrated for this operational range. Since the speeds at the test site vary by around 80 km/h, high speed calibration is preferred.

### 2.1 Vehicle specifications

The key functional specifications for the instrumented vehicle for the WIM-Hand system include:

- The vehicle has to measure and store the dynamic forces that are exercised by the measurement axle on the WIM-system;

- The vehicle has to synchronize its measurements (in time) with the individual measurements of the WIM-system;
- The sample frequency of the measurement systems should be more than 8 kHz to be able to synchronize with the WIM-Hand system;
- The vehicle has to have a 'quiet' dynamic behavior in order to minimize the dynamic component of load of the measurement axle;
- The vehicle has to be able to measure at speeds from 10 to 100 km/h;
- The vehicle has to be able to measure with axle loads from 5 to 15 tonnes;
- The inaccuracy of the measurements of the vehicle should be 5 % or less over the entire measurement range;
- The calibration of the vehicle has to be traceable to international standards and approved by the national metrology institute. The calibration procedure will be an integral part of the certification for future WIM-systems for automatic enforcement.

## 3 Building of the vehicle

### 3.1 Project organization

The project was divided into two parts - the building of the vehicle and the execution of the measurements. The vehicle had to be ready within one year. After the vehicle was finished, the measurements were divided over 60 calibration-days spread over five years. Kalibra has been overall responsible for both parts of the project. The subcontractor for the development of the measurement system was TNO Automotive in Delft, the Netherlands. The subcontractor for the building of the custom-built trailer was Nooteboom Trailers BV in Wychen, the Netherlands. Furthermore, there were a number of other subcontractors for specific parts of the project, e.g. the axles and the tyres.

In order to minimize costs for both Kalibra and DWW and to allocate the costs fairly, the contract negotiations were conducted in an open atmosphere. Both parties were fully open about which costs were expected to be carried by Kalibra and which would be fair to be accepted by the DWW. Despite the risks involved in building a prototype the contract between DWW and Kalibra was a fixed price contract.

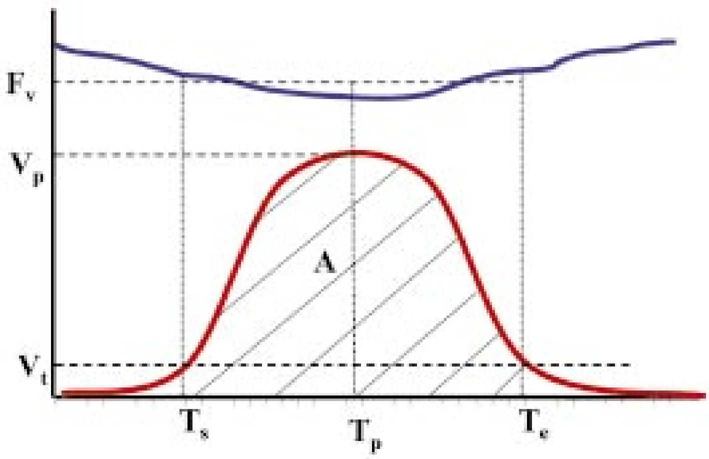



Figure 2 Example of signals measured by WIM-sensor (red) and vehicle (blue). Note: both lines in Figure 2 are examples to explain the measurement principle and not actual measurement signals.

## 4 Use of the vehicle

### 4.1 Measurement principle

To be able to compare the measured signal from the WIM-system with the data measured by the vehicle, both systems must be synchronized. This is done using the exact time of the GPS-signal as a time reference for both systems. At first a DCF-77 receiver was considered. However, the time signal was not accurate enough (± 25 ms) to be used for synchronization. With the GPS-receiver the maximum difference in the time synchronization is less than 10 µs. At the maximum speed of 100 km/h with a length of the tyre/road contact surface of 30 cm, the contact time of the wheel on the sensor (width of 5 cm) is 12.6 ms. The sample frequency of the vehicle is 8 kHz and of the WIM-test system 8192 Hz (0.12 ms). This amounts to approximately 100 samples per axle load measurement.

The output from a WIM-sensor is similar to the signal (red line) shown in Figure 4. The axle load is determined by calculating the area (A) under the signal between the start time ($T_s$) and the end time ($T_e$). The start time is the moment the signal is higher than a certain trigger value ($V_t$) and the end time is when the signal drops under that value again. The axle load measured by the WIM-sensor ($F_s$) is calculated by way of the following formula:

$$F_s = (V / L_s) \times A \times C \qquad (1)$$

Where:

V is the velocity of the vehicle;
$L_s$ is the sensor width; and
C is the calibration factor.


Figure 3 The instrumented vehicle in action

In the currently used post-processing standard, the start time ($T_s$) is considered to be the measurement time of the axle load measured by the WIM-sensor [Helg, 2000].

The output from the measurement axle is similar to that of the blue line in Figure 2. The axle load is calculated by taking the weighed ($W_i$) average of the measured samples from start to end time:

$$F_V = \sum_{i=T_s}^{T_e} W_i \cdot F_i / (T_e - T_s) \qquad (2)$$

The weighing factor $W_i$ may be used to adjust for the variation of the load exerted on the WIM-sensor when the wheel rolls over the sensor. Depending on the magnitude of this variation the weighing factor can be 1 (no variation) or for example 'Bell-shaped' similar to the signal measured by the WIM-sensor.

## 4.2 Standard operational procedure

The load on the trailer is 44 tonnes, consisting of 44 mass pieces of 1000 kg each and a fork-lift truck for the on and off loading of the mass pieces. This way every axle load between 3 tonnes and 15 tonnes may be realized on the measurement axle. All mass pieces are certified and traceable to international standards. The lifting of the measurement axle is also used to compensate eventual off-set of the force sensors. This 'zero-setting' of the axle is done at the beginning of each measurement day. The lifting of one or more axles causes a change in the 'driving height' of the trailer. This change is detected and displayed, so the driver can adjust it electronically. The vehicle has a set of special permits to be allowed to drive with 70 tonnes at 100 km/h with axle loads of up to 15 tonnes. Nevertheless, the

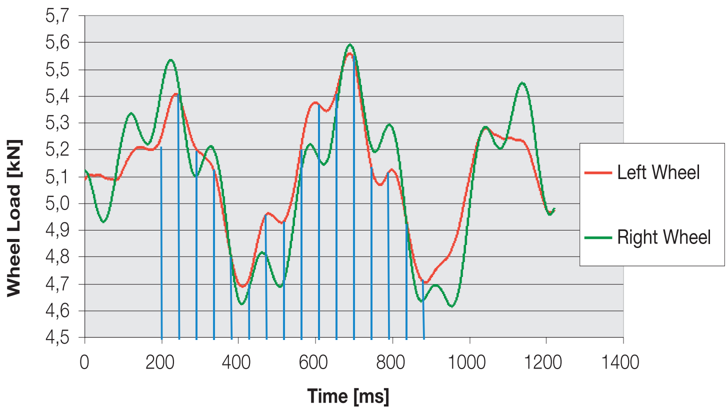



Figure 4 Measurement results

vehicle is detected as being overweight by the WIM-NL systems, the systems used by the enforcement agencies (see Figure 5).

The type approval test of the WIM-Hand test site will consist of a large number of different runs by the instrumented vehicle. The runs differ in the following aspects:

- Different axle loads on the measurement axle, i.e. 5, 10 and 15 tonnes;
- Different speeds, i.e. 40, 60, 80 and 100 km/h;
- Different axles configurations, i.e. is axles 2 and 4 lifted, or axles 4 and 5 lifted;
- Different ways of driving over the WIM-system, i.e. accelerating, braking, and zigzagging;
- Under varying weather conditions, i.e. different temperatures, rainy spells, over dry or wet surfaces, etc.

Which tests are deemed necessary for the type approval test is determined in cooperation with the NMi. The time interval between two calibrations will be determined based on the results of the type approval test. An example of the measurement results from the instrumented vehicle is shown in Figure 4. The difference in the amplitude of the axle-hop frequency between the right and left wheel was caused by a difference in the pressure in the tyres. The blue lines only indicate the relative position of the sensors within in the WIM-Hand test-site. The absolute position of the sensors of the test site can not be given since the test site is not operational yet.

Figure 5 DAF 95XF530 (6x4) tractor and five axle semi-trailer. Left to right: ir P.H.A. Hoogweg, Managing Director, Oad and Hydrolic Engineering Division of the Dutch Ministry of Transport; Mr. G. Faber, Immediate Past President of the CIML and ir. M.J.J. Vernooij, Managing Director of Kalibra International B.V.

## 5 The vehicle itself

### 5.1 The measurement system

The calibrating vehicle is a tractor semi-trailer combination with a maximum total vehicle weight of 78 tonnes. The tractor is a DAF 95XF530 (6x4) and the five-axle semi-trailer is manufactured by Nooteboom. The first axle of the semi-trailer is fixed and the others are steered hydraulically. All axles except the third axle are liftable. The first axle is the 'instrumented' axle for measuring the dynamic wheel loads. The total vehicle weight is derived from the unloaded vehicle mass and from 44 stainless steel blocs of 1000 kg each. In combination with the liftable axles any static load on the first axle from 30 to 150 kN can be arranged within an accuracy of 50 daN. Lifting of the first axle is used to zero the load sensors. The dynamic axle load is measured by strain gauges. The SAF axle is hollow with an outside diameter of 127 mm and an inside diameter of 77 mm. The part of the axle between of the ground plate of the braking system and the fixation points for the hydraulic suspension system at each end of the axle is used to measure the wheel loads. This part is small,

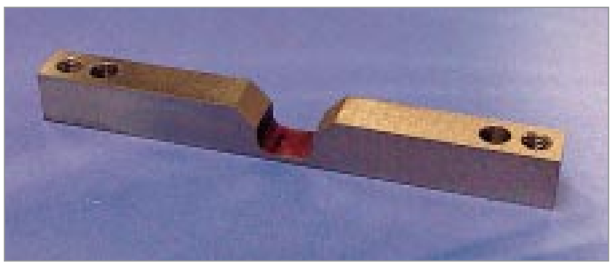


Figure 6 Mechanical stress/strain amplifier

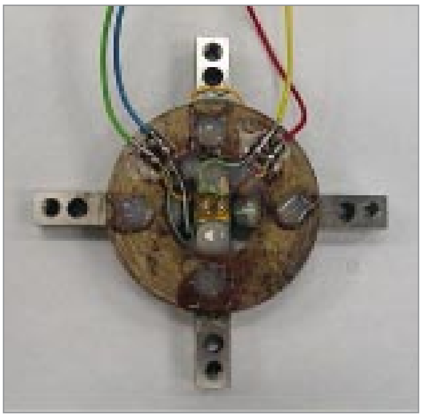


Figure 7 Set of mechanical strain amplifiers in a full bridge set-up

Figure 8 Mounting points for the set on the axle

but wide enough to mount the sensor. The bending stress at the upper and lower part of the axle can not be used to quantify the vertical wheel load, because the bending moment is not only related to the wheel load itself, but also to the lateral position of the wheel load. Because of e.g. uneven roads it may vary by up to 25 %. Also lateral wheel forces will contribute to the bending moment. The shear stress in the neutral line of the axle is not related to the lateral position of the wheel load and lateral wheel forces and is therefore an accurate representation of the vertical wheel load on each side of the axle. But the problem is that this strain signal is very weak.

TNO developed a mechanic strain amplifier. It is a 'bar' with a thin section in the middle. The stiffness of this part is an order smaller than the rest to concentrate all the stress in the middle part (see Figure 6). In this section the strain gauges are fixed. Two of these elements are configured to form a full strain gauge bridge in a 90° cross (see Figure 7). The cross is placed as one element on the axle between the hub and the connection point to the suspension system (see Figure 9).

The center of the cross is placed exactly on the neutral line of the axle. Special fixation elements are used to make it possible to (de)mount the set when needed (see Figures 8 and 9). The sensor set is covered with a stainless steel box for protection against water, dirt, etc.

## 5.2 Correction for inertia

The requested level of accuracy of the measuring system is so high that it was decided to correct the measured data from the strain gauge for the influence of the inertia of the wheels, the hub and the braking system by accelerometers mounted on the axle (see Figure 10).

$L + m \cdot z_c - V = 0$

Where:

L = wheel load

m = wheel mass, including bearing and hub

$z_c$ = vertical acceleration

V = measured shear force in the strain gauge bridge

Figure 9 Location of the set on the axle

# 6 Data acquisition system

## 6.1 Data processing

The data-acquisition system is based on the National Instruments PXI-1010 hardware and LABVIEW software. The signals of the two strain-gauge full bridge sets and the two accelerometers are recorded using the same sample frequency as used by the MSWIM system itself (8196 Hz). The time signal is derived from the GPS time generator.

Before the actual calibration experiments the first axle is lifted from the ground and data is recorded, defining the zero. The measured data from the strain-gauge sensors during the calibration run is corrected in real-time for zero and for wheel inertia using the data from the accelerometers. The calibration measurement is controlled by a laptop computer in the cabin via a wireless link. After each run the calculated dynamic wheel load data is transferred to the MSWIM system, and the MSWIM data of each WIM sensor (time and load) is compared with the time history of the wheel load from the vehicle.

*Time stamping*

The wheel load data from the calibration vehicle and the MSWIM system are compared. A trigger point is needed for an accurate comparison of the data generated by two stand alone systems. Another option is to synchronize the time base of both data series.

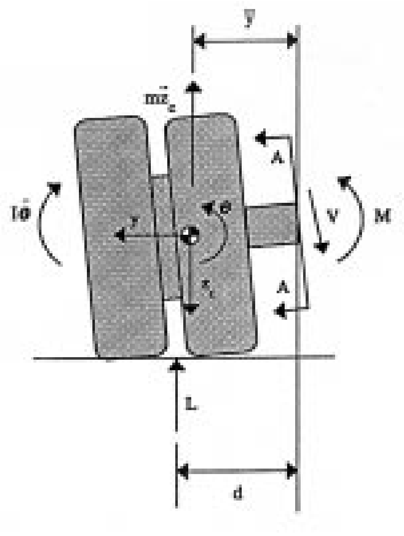



Figure 10 Left axle side

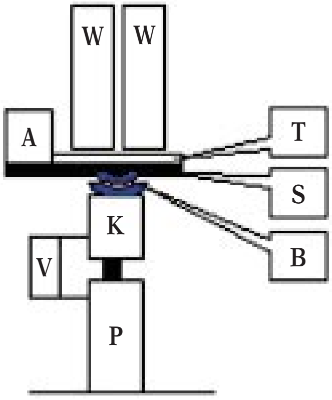
Figure 11 Hydraulic cylinders underneath the first axle

Figure 12 Leveled semi-trailer in the Lab for calibrating the measurement system

In both data acquisition systems the data is sampled with 8196 Hz. The contact time between the individual WIM-sensor and the passing tyre is a function of the length of the wheel-print (approx 20 cm) and the vehicle speed. With a vehicle speed of 105 km/h (≈ 30 m/s) this equals to a time frame of 7 ms during which about 56 wheel load samples will be recorded.

We considered using the PTB DCF77 (Braunschweig) atom clock pulse for synchronization, being very accurate for long time periods with $10^{-13}$ per week. But the time stamp in each measuring system may vary from 5 to 25 ms because of the fact that the time signal is transported using a radio signal of 77.5 kHz. This variation of 20 ms makes this PTB DCF77 time signal inaccurate and unacceptable.

A more accurate time signal is generated by the GPS world clock (GPS-UTC). The accuracy of this signal is 250 ns - about 15 times better than required - when the




W = Wheel
T = Teflon
S = Steel plate
K = Load cell
V = Displacement sensor
P = Hydraulic cylinder
A = Accelerometer on steel plate
B = Ball-joint interface

Figure 13 Hydraulic actuator, load cell and steel plate underneath the wheel set

same Time and Frequency Generator Datum ET6000 is used based on contact with six satellites [20]. It was decided that both WIM and vehicle data acquisition systems will use the same Datum ET6000 system.

## 7 Calibration

### 7.1 Static calibration of the wheel load measuring system

The vehicle is placed in a leveled position with the wheels of the first axle (measuring axle) on two hydraulic cylinders (see Figures 11 and 12). A calibrated load cell between the wheels and the hydraulic cylinder is used to measure the actual wheel loads. Both wheels (left & right) of the first axle are located on a steel plateau. A ball-joint connection between the plateau and the load cell is used to exclude other loads then the wheel load 'in-line' with the load cell (see Figure 13).

The static wheel load from 15 to 75 kN is introduced by the steel blocs and/or by lifting the axles '2', '4' and '5'. For these wheel loads the measured load from the calibrated load cell is used to obtain the gain factor and offset for the data acquisition system in the semi-trailer. The gain was very constant over the wheel loads from 15 to 75 kN (see Figure 14 and Table 1).

Several static experiments were carried out to check the stability of the system, with good results.

Table 1 Static calibration factors of the strain gauges

| Location | Gain [$10^{-12}$ V/N] |
|---|---|
| Left | 9710.39 |
| Right | 9047.65 |

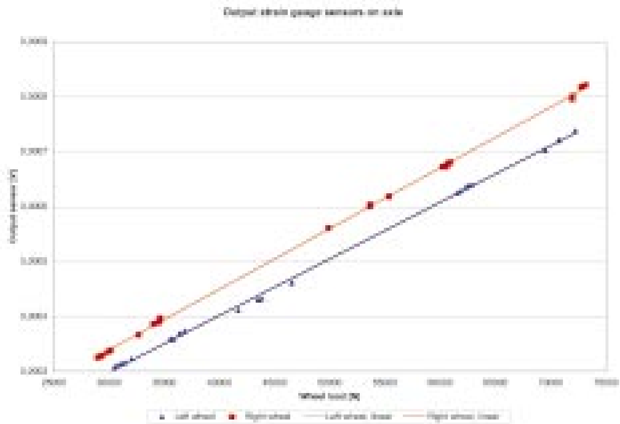


Figure 14 Gainfactor from strain gauge signal [V] to wheel load [N]

### 7.2 Dynamic calibration of the wheel load measuring system

The dynamic calibration of the wheel load measuring system was carried out on the same test bench as that used for the static calibration. With three nominal static wheel loads of 38, 50 and 60 kN a vertical sinusoidal sweep excitation is introduced by the hydraulic cylinders with an amplitude of 1.5 mm, and a frequency of 1.0 up to 13.5 Hz in 240 seconds. The left and right wheels were excited both in phase and anti phase. Of course the complete system, including the contribution from the accelerometers on the axle to correct for the inertia of the wheels, is taken into account during this dynamic calibration.

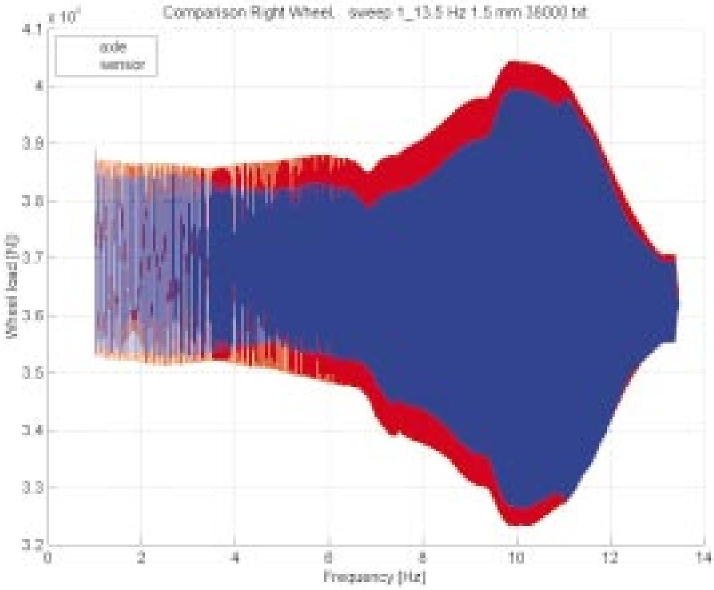



**Figure 15** Right wheel, sinusoidal sinus sweep at 38 kN left and right wheel in phase

Accelerometers were mounted on the steel plateau to correct the measured load from the load cells for the inertia of the steel plate.

An example of the corrected data of the load measuring system underneath the wheels and the corrected data from the axle sensors is shown in Figure 15. The data is analyzed for uncertainty factors through the bandwidth of 1.0 to 13.5 Hz.

### *Accuracy of the system according to EA-4/02*

The total accuracy of the measuring system was derived from the contribution of each and every element used in the calibration, according to EA-4/02.

The deviation in the measured load and the 'real' load is:

$$\Delta F = F_i - F_d + \delta F_{d,dev} + \delta F_{d,unc} + \delta F_{d,repro} + \delta F_{d,drift} + \delta F_{d,temp}$$

Where:

- $\Delta F$ deviation in reading value at the measuring system (indicator)
- $F_i$ load, measured with the measuring system (indicator)
- $F_d$ load, measured with the calibrated load cell
- $\delta F_{d,dev}$ deviation of the load cell mentioned in the certificate
- $\delta F_{d,unc}$ deviation in the uncertainty of the load cell according to the certificate
- $\delta F_{d,repro}$ deviation from the reproducibility
- $\delta F_{d,drift}$ deviation from the drift of the system
- $\delta F_{d,temp}$ deviation from the temperature drift of the system

The standard uncertainty 'u' of the deviation in $\Delta F$ is derived from the uncertainty in each element. Table 2 shows the uncertainty contribution of the elements.

According to the certificates the deviation of the left load cell '$\delta F_{d,dev,(left)}$' differs from the deviation of right load cell '$\delta F_{d,dev,(right)}$'.

Deviation from the reproducibility '$\delta F_{d,repro}$' was derived from the dynamic measurements on the test bench.

Deviation from the drift of the system '$\delta F_{d,drift}$' was derived from a 24-hour static load to the system.

**Table 2** Uncertainty contribution of the elements at 38 kN

| Parameter | Standard uncertainty [N] | Sensitivity | Uncertainty participation [N] |
|---|---|---|---|
| $F_i$ | $3 / \sqrt{12}$ | 1 | 0.87 |
| $F_d$ | $3 / \sqrt{12}$ | 1 | 0.87 |
| $\delta F_{d,dev,(right)}$ | $0.8 \cdot 10^{-2} \cdot F / \sqrt{12}$ | 1 | $0.23 \cdot 10^{-2} \cdot F$ |
| $\delta F_{d,dev,(left)}$ | $0.9 \cdot 10^{-2} \cdot F / \sqrt{12}$ | 1 | $0.26 \cdot 10^{-2} \cdot F$ |
| $\delta F_{d,unc}$ | $0.25 \cdot 10^{-2} \cdot F / 2$ | 1 | $0.125 \cdot 10^{-2} \cdot F$ |
| $\delta F_{d,repro}$ | $R \cdot 10^{-2} \cdot F / 2$ | 1 | $0.5 \cdot R \cdot 10^{-2} \cdot F$ |
| $\delta F_{d,drift}$ | $(62.5 - (-62.5)) / \sqrt{12}$ | 1 | 36.1 |
| $\delta F_{d,temp}$ | NIHIL | 1 | 0 |

The total uncertainty 'U' is: $U = 2\,u$

$$U_{38,left} = 2\sqrt{[(3/\sqrt{12})^2 + (3/\sqrt{12})^2 + (0.9 \cdot 10^{-2}F/\sqrt{12})^2 + (0.25 \cdot 10^{-2}F/2)^2 + (R \cdot 10^{-2}F/2)^2 + ((125\sqrt{12})^2]}$$

From the dynamic test:

$R_{left,38} = 2.05$, and $R_{right,38} = 2.16$

$U_{38,left} = 2.20$ %
$U_{38,right} = 2.34$ %

The maximum standard deviation from the sinus sweep test at the lowest and highest value for the wheel loads (25 and 75 kN) were not measured but estimated from the maximum uncertainty at each of the measured wheel loads on each side (see Figure 16).

The calculation of the uncertainty was executed for all the frequency sweeps (phase and counter phase) and wheel loads of 38, 50 and 60 kN, at the left and right wheel (see Table 3) and for the wheel loads 25 and 75 kN (see Table 4).

The uncertainty at all wheel loads between 25 kN and 75 kN is smaller then the requested 5 %. ■

Table 3 Total maximum uncertainty at the three measured wheel loads 38, 50 and 60 kN, phase and counter phase, left and right

| Total uncertainty | Total maximum uncertainty [%] |
|---|---|
| 38 kN, left wheel | 2.20 |
| 38 kN, right wheel | 2.34 |
| 50 kN, left wheel | 2.24 |
| 50 kN, right wheel | 2.49 |
| 60 kN, left wheel | 2.15 |
| 60 kN, right wheel | 2.02 |

Table 4 Total maximum estimated uncertainty at 25 and 75 kN, left and right

| Total uncertainty | Total maximum uncertainty [%] |
|---|---|
| 25 kN, left wheel | 4.49 |
| 25 kN, right wheel | 4.14 |
| 75 kN, left wheel | 1.58 |
| 75 kN, right wheel | 1.68 |

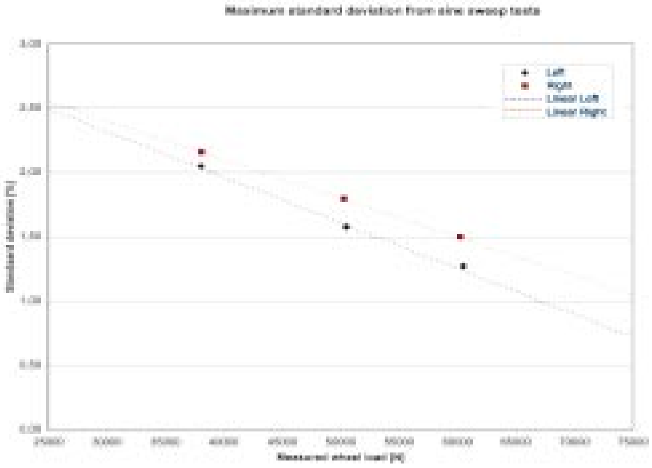


Figure 16 Standard deviation from the sinus sweep test, estimated at wheel loads 25 and 75 kN.

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*Author contact details*


**Boudewijn Hoogvelt** TNO Automotive, Delft, The Netherlands
Phone: +31 (15) 269 6411; Email: hoogvelt@wt.tno.nl

**Nol van Asseldonk** Kalibra International B.V., Delft, The Netherlands
Phone: +31 (413) 293 592; Email: nasseldonk@kalibra.nl

**Ronald Henny** Road and Hydraulic Engineering Institute of the Dutch Ministry of Transport, Public Work and Water Management (DWW), Delft, The Netherlands
Phone: +31 (15) 251 8381; Email: r.j.henny@dww.rws.minvenw.nl

**Hans van Loo** Road and Hydraulic Engineering Institute of the Dutch Ministry of Transport, Public Work and Water Management (DWW), Delft, The Netherlands
Phone: +31 (15) 251 8381; Email: F.J.vLoo@dww.rws.minvenw.nl

**Gerben Visser** Kalibra International B.V., Delft, The Netherlands
Phone: +31 (15) 2780111; Email: gvisser@kalibra.nl

CONFORMITY ASSESSMENT

# Conformity assessment and metrology: Where to go in the future?

PAVEL KLENOVSKÝ
CIML Member, Czech Republic


## Abstract

A couple of years ago ISO CASCO launched a major project of transforming all the existing ISO Guides on conformity assessment into a comprehensive series of ISO 17000 standards, which are now at various stages of development. As the concept of traceability underpinning all measurements has been a basic mission of metrology, a number of these standards have a direct bearing on metrology. The series is logically based on a definition standard, ISO 17000, giving, among others, guidance as to which activities fall under conformity assessment. The fact that calibration does not might have important consequences which must yet be assessed.

A controversial discussion on some issues has been in progress concerning ISO 17011 on accreditation bodies which touches both on national metrology institutes (NMIs) with an accreditation function and on calibration laboratories at large. ISO 17040 on peer review could be used with an advantage to support mutual recognition arrangements among a limited number of bodies of a specialized expertise (e.g. CIPM MRA among NMIs under the Metre Convention). ISO 17025 has been the most important standard for the metrology community and it is now undergoing a major overhaul taking on board the uncovered requirements from ISO 9001:2000. These changes might have a great impact on quality systems in laboratories. ISO 9001:2000 can be easily cross-referenced with ISO 17025 but accreditors, in pursuance of their business interests, would prevent it from happening. The author is a member of the corresponding ISO CASCO WG 25 responsible for this revision. We are now confronted with a proliferation of ISO 9000:2000-based standards (clones), some of them requiring accreditation as nearly the only way to demonstrate technical competence (e.g. ISO TS 16949). This paper will discuss alternative ways to achieve that.

In general, the paper will give up-to-date information on the developments outlined above and discuss the consequences and further steps from the viewpoint of metrology.


## 1 Introduction

Progress in metrology has always been largely driven by research and development of new solutions and technologies in relation to methods and instrumentation. In maintenance of measurement infrastructure, traceability of measurement results and related calibration of measuring instruments used play a crucial even if sometimes underestimated role: they provide a long-term information on metrological characteristics of instruments, enable their fitness for the given purpose to be assessed and to maintain various processes under control. Recently, due to globalization, internationally accepted uniformity in measurement and equipment calibration to globally accepted norms is gaining importance. By a rather broad definition of conformity assessment in ISO Guide 2:1996, calibration (and testing as well) was included among conformity assessment activities (CAA) and it is therefore essential for the metrology community to keep an eye on the development in this area. A couple of years ago, ISO CASCO launched a major project to cover all the CAAs by full-fledged ISO International Standards and thus to overcome the existing fragmentation in terms of various guides of an inferior status. The paper aims at providing up-to-date information on the status of work within this project from the viewpoint of metrology.

## 2 Conformity assessment and management systems

Initially, it is important to highlight the relation between conformity assessment and management systems (sometimes wrongly reduced to quality management systems only). The whole conformity assessment hierarchy is schematically given in Figure 1. The basic principle here is that technical competence of various certification bodies which is most important for their correct performance should be assessed by (mostly national) accreditation bodies (NABs) - the process called accreditation. These certification bodies in turn

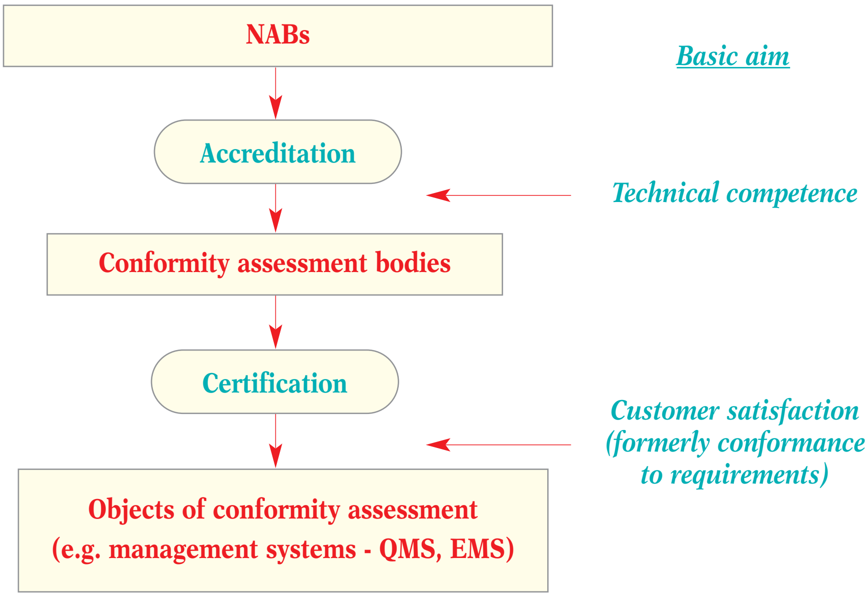


Figure 1 Current structure of conformity assessment and its relation to management systems

should then assess various objects of conformity assessment, such as management systems (quality management systems - QMS, environmental management systems - EMS, occupational health and safety - OH&S), personnel, products etc. - the process called certification (in the USA called registration, at least in relation to QMS). Formerly, the way of making this assessment could be described as an analysis of conformance to specified requirements; nowadays, after the major revision of the ISO 9000 series of standards, the focus here should be better described as customer satisfaction. Both the above processes are basically aimed at demonstration as to whether specified requirements are fulfilled (should be finalized by a statement to this effect), i.e. they fall among CAAs. A CAA should therefore contain the following three phases:

- Selection (preparatory phase);
- Determination (development of complete information on the object);
- Review and attestation (evaluation of the information and **making a decision**).

There is no question that accreditation and various certification bodies fall among conformity assessment bodies (CABs). i.e. bodies performing CAAs - all of these three phases are present. All the CABs with the exception of accreditation bodies should therefore be accredited - this is unfortunately not always the case, especially in the case of some globalized certification bodies for QMS acting through their national subsidiaries. The situation is more complicated in relation to calibration and testing (includes also various chemical analyses). These activities were included among CAAs by way of ISO Guide 2:1996, a guide on definitions of conformity assessment related terms, where the following definition was given in par. 12.2: "Conformity assessment is **any activity concerned** with determining directly or indirectly that relevant requirements are fulfilled" (see also Annex 1). Whereas calibration and testing are typical determination activities they do not include, by definition, any decision-making (see below). The direct result of this unnecessarily broad definition is inclusion of calibration and testing laboratories among CABs subject to accreditation.

As far as the coverage of CAAs by standards is concerned, it is still done by a number of fragmented documents not possessing the status of an international standard (mainly ISO Guides) or by regional standards not harmonized worldwide. A couple of years ago, this was identified by ISO CASCO as a major deficiency and a large project was launched to transfer all the requirements to full-fledged ISO/IEC standards. Currently, the following main standards are at various stages of development under ISO CASCO:

- ISO/IEC 17000: Conformity assessment – Fundamentals and vocabulary
- ISO/IEC 17011: Conformity assessment – General requirements for bodies providing assessment and accreditation of conformity assessment bodies

- ISO/IEC 17020: Conformity assessment – General requirements for bodies performing certification of products
- ISO/IEC 17021: Conformity assessment – General requirements for bodies providing assessment and certification for management systems
- ISO/IEC 17024: Conformity assessment – General requirements for bodies operating certification of persons
- ISO/IEC 17025:1999 General requirements for the competence of testing and calibration laboratories
- ISO/IEC 17040: Conformity assessment – General requirements for peer assessment of conformity assessment bodies

As decision-making should be present in CAAs it is important to formulate some rules for impartiality of CABs - the first attempt was made in 2003 through draft ISO PAS 17001. In the process of development of these standards it is crucial, on the part of ISO CASCO, to ensure, to a maximum extent, an impartial approach as potential vested interests (already present) of various parties involved could negatively influence the outcome. All the standards should also be properly inter-related and cross-referenced consistently using the terminology given by ISO/IEC 17000.

From the view point of metrology, the most important ones are 17000, 17011, 17025 and 17040.

## 2.1 ISO/IEC 17000

This basic definition standard has eventually reached a final, FDIS, stage whereas a part of the controversy has been centered around the pivotal term "conformity assessment". It has been argued from the beginning that a broad, flexible definition like "any activity concerned" in line with that given above is not consistent with any reasonable rules of procedure and with the generally accepted understanding of this term as outlined in Annex A (informative) "Principles of conformity assessment", i.e. the three phases given above. As a result, calibration and testing should cease to formally be CAAs and the term "calibration" would not be mentioned among CAAs in the note attached to this term. The outcome has a comparatively large bearing on calibration (and testing) because it will set down the relationship of these activities to accreditation for a number of years to come, especially whether their management system will be subject to accreditation following their inclusion among CAAs or to certification stressing their role as service-oriented activities with customer satisfaction as a main priority. Namely, no decisions are taken and no assessments are by definition made when carrying out these activities in the majority of cases and no standard against which to assess conformity is often available (especially in calibration), not to mention the ambiguity generated by uncertainties always attached to the results of both the processes (see the definition of calibration in VIM - Annex 1). Therefore the concept of impartiality has no real sense at least in relation to calibration - no conflicting interests can be attached to items under calibration in a vast majority of cases (in contrast to verification of legally controlled measuring instruments which is CAA).

The representative of ILAC on the corresponding ISO CASCO working group WG 5 has kept to argue otherwise and the wording has gone back and forth several times as it is demonstrated in sequential order in Annex 1. In final stages the definition in the "non-flexible" version remains unchallenged and in the FDIS version calibration is not included in the note under this term (NOTE 1). But it does not prevent WG 18 of ISO CASCO from making an attempt to extend conformity assessment by calibration in ISO/IEC FDIS 17011 - eventually, it was concluded at the joint meeting of both WG in July 2004 that ISO FDIS 17000 remains as it is and ISO FDIS 17011 will be editorially changed to be in line with the definition of CAA in ISO 17000 (calibration is only an associated activity). In this relation it has to be pointed out that at the 22nd General Conference of Weights and Measures in 2003 the official Government delegations agreed to note in Resolution N that calibration is not a conformity assessment activity - this clearly demonstrates the position of the metrology community on this issue. The target date for publication of this standard is February 2005.

There is another point to be made in this context. On the one hand, accreditors argue that due to the reason of impartiality accreditation bodies have to be set up as national monopolies and on the other hand accreditation of laboratories forms ca. 80 % of their capacity and represents a huge number of bodies (in Europe well over 10 000). At the same time calibration and testing are normal business activities, to a great deal outside any regulatory framework (as to calibration, 100 % outside). Firstly, under the circumstances, it is difficult to imagine a totally impartial attitude of accreditors towards any issues connected with (quality) management systems in laboratories. The opposition to a straightforward definition of conformity assessment without any technical reason, as described above, might serve as evidence of such an approach. Secondly, a sheer number of bodies, largely small and medium enterprises, find their access to the market being quite sensitive to quality-related issues through this highly monopolized arrangement - obviously something next to a new barrier to trade.

## 2.2 ISO PAS 17001

In April 2003 CASCO/WG 23 released this special type of a normative document (PAS - Publicly Available Specification), often an infant stage of an international standard, on impartiality and related bodies, i.e. bodies linked in a specified way to a body whose impartiality is under consideration. According to the draft, e.g. different Government agencies are related bodies and in Clause 5.2.3 it was required that in the absence of complete legal and ownership separation of consultancy and conformity assessment functions, the body shall not provide conformity assessment services to customers to which itself or a related body has provided consultancy related to the object of conformity assessment within the past 2 years. This limitation on parallel provision of consultancy and a CAA, apart from not being able to be reasonably implemented in practice, can e.g. prevent national metrology institutes from doing what they have been set up to do, i.e. to provide consultancy to industry for the purposes of technology transfer if calibration is considered a CAA. Due to strong opposition the draft had to be amended but this example clearly demonstrates the importance of the whole matter: the inclusion of calibration among CAAs has the unacceptable consequence that bodies with a calibration function could potentially be subject, by way of various ISO CASCO normative documents, to a number of requirements that are totally inappropriate for them - and the process can easily pass by totally unnoticed by the metrology community. The target date for publication of this normative document was May 2004.

## 2.3 ISO/IEC 17025

This important standard for laboratories was actually the first in the whole 17000 series, released in 1999 and overcoming the then existing fragmentation of related standards worldwide. Apart from harmonization, an additional benefit was its alignment with the corresponding quality management standards at that time (ISO 9000:1994 series). Indeed, there is a problem in the fact that the current structure of quality-related standards does not correspond to typical scopes of bodies with a calibration function in real life which are as follows:

- National metrology bodies: maintenance and development of national standards + corresponding calibrations;
- Manufacturers of measuring instruments or of any other products (manufacture + calibrations);
- Repairs + calibrations of measuring instruments.

The calibration part of their scope can be covered by accreditation against ISO/IEC 17025 but the rest of the activities should be covered by the ISO 9000 series of standards. This *de facto* implies operation of two quality systems in one body, independently audited and independently paid if the body needs to cover all the activities by a quality system. To overcome this problem the standard is structured as follows:

- Management requirements (in fact quality management requirements from ISO 9001/9002:1994 + a requirement of impartiality);
- Technical requirements (typical metrological requirements).

In that way, the requirements of the ISO 9000:1994 series of standards form a sub-set of all the requirements of ISO 17025 and a full alignment can justifiably be claimed.

However, just after the standard was implemented by labs the necessity arose to align it with the major revision of the ISO 9000 series of standards released in 2000 with a transition period by the end of 2003. That is why the responsible CASCO/WG 25 launched, at the end of 2001, a project of aligning ISO 17025 with ISO 9001:2000, ideally to finalize it by the end of the ISO 9000 transition period. It has to be pointed out here that the project could wait for a regular revision of ISO 17025 planned, according to the ISO rules, for 2004 (5 years after the publication of the current version) - the project was mainly accelerated by accreditors being afraid that the market of labs, so to speak, would be tapped by certifiers of QMS if the alignment was not achieved in time.

First of all, it has to be pointed out here that both standards can be easily cross-referenced: ISO 9001 can stipulate that when the process of calibration or testing is present the requirements of ISO 17025 shall be fulfilled, ISO 17025 having been stripped to contain only the technical requirements. This is perfectly in line with the fact mentioned above that both activities are not real CAAs - only that accreditors will not make it happen at any cost.

Just at the beginning the WG adopted the following principles for the alignment:

- ISO/IEC 17025 is not a sector specific application standard of ISO 9001;
- ISO/IEC 17025 should be a stand-alone standard;
- ISO/IEC 17025 should not adopt the ISO 9001:2000 wording as it is;
- The reference to ISO 9001 should not be lost in ISO/IEC 17025;
- The changes in ISO/IEC 17025 should be as minimal as possible;

- No changes should be made to the technical requirements of ISO/IEC 17025.

These principles are fully in line with the interests of accreditors themselves - representatives of accreditation bodies have more or less dominated the attendance of the WG. They claimed that it was the opinion of laboratories as well - maybe rightly so but it was taken for granted by labs that the full alignment would be achieved (see e.g. the standpoint of EUROLAB). Moreover, the terms of reference set up in this way are by themselves internally controversial: it is difficult to imagine how a full alignment with the major revision of ISO 9000 could be achieved by only minimal changes.

Furthermore, a discussion took place regarding the use of the term "quality management system" from ISO 9000 in ISO 17025. The convenor (Mr. van de Leemput of RvA, the accreditation body of The Netherlands) explained that the management system in labs is not only about quality requirements but also some administrative and technical requirements are involved, i.e. that it is not exactly what is meant by ISO 9001:2000 so that the term cannot be used in ISO 17025. This standpoint can be challenged: these additional requirements can be viewed as an extension or more detailed specification of general generic requirements contained in ISO 9001:2000 in application to a special situation of labs.

The main point of discussions in WG 25 was the extensive expression of views on the crucial statement in the "Introduction" which, after a lengthy discussion between ISO TC 176 (responsible for ISO 9000) and the WG 25 convenor and ISO CASCO Secretariat, before the final meeting on the DAM (Draft Amendment) of this standard read:

> *Conformity of the quality management system within which the laboratory operates to the requirements of ISO 9001 does not of itself demonstrate the competence of the laboratory to produce technically valid data and results. Nor does demonstrated conformity to this international standard imply conformity of the quality management system within which the laboratory operates to all the requirements of ISO 9001.* ***For this reason, this international standard may be used in conjunction with, but not to substitute certification of the quality management system within which the laboratory operates.***

WG 25 members tried to persuade the TC 176 (Mr. Chris Cox was present) that the second and third sentences be removed. Eventually, the third sentence was removed while TC 176 firmly stood on the inclusion of the second one: namely, it is in line with the current ISO/IEC rules for technical work as the alignment is not completely full (e.g. the process approach has not been addressed) - it is the unhappy result of the "minimal changes" approach (see above).

As a result, the statement of alignment with ISO 9001:2000 (clause 1.6) had to be changed as well, from a full alignment (with the 1994 version) in the current standard to mere "meeting the principles" of ISO 9001:2000. But again, confusion has been generated by doing that: the process approach happens to be one of the eight main principles of the ISO 9000:2000 series of standards so that even this weaker statement about principles can be challenged (and confusion is generated here) as the process approach happens to be one of the eight main principles of the major revision. This is arguably the worst possible outcome to arrive at: nearly all the important requirements from ISO 9001:2000 which are not easily implemented by labs were taken on board but still the standard will explicitly state that this is not a full harmonization with ISO 9001. For stand-alone labs the whole project is completely unwanted (they will probably have to be reaccredited afterwards) and larger organizations will probably not be spared multiple assessments, exactly as apprehended by some associations of labs (EUROLAB). It is basically the result of the approach enforced by accreditors to keep both standards as far as possible from each other - in such a way the alignment fell victim to the self interests of accreditors. The only problem is that labs may suffer from such attitudes.

The schedule of next steps was as follows: the final WG draft had gone right away to the DAM stage which was in November 2003 presented for comments and voting to national standards bodies (NSB) with a deadline of April 2004. In June the WG met to settle the comments received - due to a largely positive voting the project went to the FDAM stage in summer 2004 without major changes even if some confusions still persist (e.g. the claim of meeting "the principles" of ISO 9001:2000, QMS, etc.). In an attempt to win positive votes ISO DIS 17025 was presented as an interim solution before a full alignment. But at the same time WG 25 decided to propose it to the ISO General Secretary as a regular revision of the standard due in 2004 (see above) - the proposal has been finally approved. The result is that a full harmonization with ISO 9001:2000 can be expected sometimes in 2011-2012 (the regular revision should start in 2009), i.e. a standard based on the 1994 version of ISO 9000 and presented as an interim solution will still be around nearly 10 years after the 1994 version expires.

In summary, the WG was instructed (or decided) to achieve the following goals:

- To align ISO 17025 with ISO 9001:2000;
- To make only minimal changes in ISO 17025.

The proposed changes to be implemented by labs are not at all minimal and a full alignment is not achieved even if an attempt is made to cover it up. As both these objectives have obviously not been met (as explained above) it would be in the best interest of laboratories if such a proposal receives a negative voting and a full alignment is made during the regular revision of the standard. The target day for publication of this amendment is August 2005 but it could be expected sooner (during the first half of 2005) - a transitional period for its implementation is foreseen by ILAC.

## 2.4 ISO/IEC 17011

This standard, being in the final FDIS stage, should lay down the requirements for accreditation bodies themselves. In the initial stages of development a proposal was made by accreditors to put a requirement in the standard that accreditation bodies shall be national monopolies. This motion was rejected but it is an important concept to discuss - it may actually underpin the attitudes and positions made by accreditors in public. The reasons for this concept are either securing a necessary impartiality in carrying out this type of conformity assessment (an argument going rather to an extreme - there are other situations, e.g. in legal metrology, where decisions have to be made under conflicting interests) or that it is simply a requirement of regulatory bodies (with which e.g. calibration has nothing in common). Whatever the official reasons are, accreditation bodies are now set up as national monopolies in all the ILAC member countries with the exception of the USA. Apart from apparent disadvantages for their customers a monopoly position at least gives accreditation bodies an ideal position for impartial decision-making which should subsequently imply a major improvements in real technical competence of laboratories. This effect can be assessed by an evaluation of results in interlaboratory comparisons (ILCs) in the calibration area or proficiency testing (PT) in the testing area achieved in the long-term. If this experience is anything to go by then the situation in physical metrology (calibration labs) is quite good, as it always has been, and the situation in metrology in chemistry (a number of testing labs) is still rather unsatisfactory, as it always has been (mainly due to persistent problems with traceability, calculation of uncertainties etc.) - no major improvement can be identified. This can be demonstrated e.g. on the results of the so-called IMEP (International Measurement Evaluation Program) comparisons having been organized by one of the EU research institutes IRMM in the area of analytical chemistry where a number of labs from all across Europe regularly take part. The interpretation of this and other results simply is that ca. 50 % of labs in this particular comparison failed and out of those who failed ca. 50 % were accredited labs - such and similar but less dismal results have been achieved repeatedly in the long-term. It is under the circumstances when accreditation is around for more than 10 years and no demand for any urgent corrective actions here seems to be imminent. The conclusion from here is that while accreditation is an acceptable way to formally take care of the technical competence of a huge number of bodies (on behalf of regulatory bodies) its technical added value is arguably rather doubtful, at least at present. The target day for publication of this standard is March 2005.

## 2.5 ISO/IEC 17040

Lets us start with the definitions of related terms taken from ISO CD 17040:

> ***peer group*** *(3.3) – group pf conformity assessment bodies with rules of membership of the group (further referred to as PG).*
>
> *NOTE A peer group could form an agreement group as defined in ISO/IEC Guide 68.*
>
> ***peer assessment*** *(3.4) – evaluation of a body, against specified requirements, by representatives of other bodies in, or candidates for, a peer group (further referred to as PA).*
>
> *NOTE "Candidates" are included to cater for the situation where a new group is being formed, at which time there would be no bodies in the group.*

The ISO CD 17040 uses, strictly speaking, the term "peer assessment", not "peer review" which is frequently used in this context.

The core of the problem in the scope of application of peer assessment (peer review) to quality system practice consists in achieving a reasonable compromise between impartiality and expertise. Third party assessment bodies in a broader sense (accreditation + certification bodies or simply quality audit providers) have a potential to be highly impartial in technical matters (but, on the other hand, they seem to be excessively dependent on revenues collected from their customers) but often have a tendency to lose expertise in underlying technical fundamentals of the activity under auditing. That is arguably the reason why they are relying more and more on external experts who are often attached to similar and competing businesses. On the other hand, among peers, as the name indicates (= "equals"), the mutual confidence in their expertise is naturally very high but the PG performance and competence might be challenged on the grounds of impartiality driven by excessive competition among them (e.g. trying to deny access to newcomers, etc.). It may place a limit on the rate of their use in practice, especially in the environment generated by quality audit providers against any use of PAs as it is sharply against their vested interests. On the other hand, the external experts used by quality audit providers are often nothing less than people from competing businesses (very often mentioned to be the case in relation to laboratories) so that, essentially, peers.

Nowadays, the main application of PAs is for NABs themselves and in the field of CAAs in those cases which are characterized by a very narrow and unique expertise. In the field of metrology the following are good examples of such a situation:

- Pattern evaluations and approvals of legally controlled measuring instruments as performed by national legal metrology authorities (the corresponding mutual acceptance arrangement - OIML MAA);
- Equivalence of and calibration to national standards as performed by NMIs (the corresponding mutual recognition arrangement - CIPM MRA).

A case study in itself is the situation around the recognition of pattern evaluation certificates worldwide initiated some time ago in the OIML. The OIML has undertaken, to that effect, to draw up a corresponding mutual recognition agreement called the MAA (Mutual Acceptance Arrangement) under which test reports issued by those national responsible bodies that are notified as OIML Issuing Authorities, as a basis to issue certificates, will be recognized by other countries and subsequently used to issue their own certificates (this slightly complex arrangement is necessary as in some countries like the USA and Brazil, direct recognition of certificates is forbidden by law). Unlike the CIPM MRA, the MAA has not been implemented up to now[1] - one of the crucial points is the assessment of the technical competence of those labs. As is basically the case in the CIPM MRA, two options have been proposed: peer assessment (originally self-declaration) and accreditation. To form a PG or an agreement group was not considered at the beginning under pressure from authorities which testing labs were accredited (the reason: why prepare a dedicated procedure when a systematic accreditation tool is available and can, at the same time, arrange for mutual recognition through the ILAC MLA). Since the beginning, the CIML has been embroiled in seemingly never ending discussions concerning what the meaning of peer-assessment or self-declaration is, the quality system issue as a whole, who will guarantee quality of experts, what are the costs of accreditation, etc., as it is already known from the implementation of the CIPM MRA. Let us assume for the moment that the MAA has been drawn up as membership rules of the corresponding peer group based on peer assessment only. Then we should consider the following:

- The necessary technical standard is available to be used by everybody interested (ISO/IEC 17025);
- The quality system experts and especially unquestionable technical experts are available as well within the PG;
- The system could be made extremely cheap compared with accreditation (reciprocity principle, subsequent assessments reduced in scope and time, taking into account the results of intercomparisons, etc.);
- The PG can in principle solve the problem of international recognition within itself;
- The system will be simple, even-handed, transparent, streamlined, inexpensive and based on an international standard (ISO 17040).

After the system is established accredited bodies could enter membership on relaxed terms and could then stop seeking re-accreditations in future. Even the argument often given by accredited bodies that they are not allowed by NABs to recognize external test reports is simply not valid - ISO/IEC 17025 in paragraph 4.5 permits subcontracting of tests and calibrations on terms being in line with the PG rules of membership. Of course, some additional work on necessary documents should have been undertaken in this respect but with an infrastructure provided by the corresponding supporting bodies (BIPM, BIML) it is manageable. But surely the uncertainty and confusion in the final stages of the approval or during the implementation of these arrangements in relation to quality systems should have been avoided. Therefore, there is a clear potential for a wider application of peer assessment in the quality-related issues in metrology on the basis of this standard, maybe in a more simplified form. The target date for publication of this standard is August 2005.

As to the use of the concepts of peer assessments and self-declaration/self-assessment in today's practice the following, to my knowledge, can be summarized:

- Peer assessment in the technical, not formal, sense is now extensively used in practice of NABs in relation to the technical part of ISO/IEC 17025 when accrediting labs, even if there may be an impartiality concern (the experts are often from competing labs).
- The same is basically applicable to the practice of certification bodies for QMS and this trend will be strengthened by increased focus on real processes

[1] Editor's note: This article was written when the Framework Document on the OIML MAA (OIML B 10-1) had just been published.

performed by certified bodies (without the proper knowledge about them it will be difficult to audit them).

- Big companies consider self-declaration of their QMS as a viable alternative for the future (see the conclusions of the ILAC seminar in Germany in 2002) as a response to the ever growing "certification industry" which annoys them (see the parallel to the global approach in Europe: it was forced through by big companies like Philips being annoyed by multiple re-testing in all the countries). Such pressure exerted by big companies has eventually led to something called one-stop testing - similarly, what we now need in the calibration/testing area is (at least) one-stop certification (all the existing processes certified at once by one body).
- Self-declaration of manufacturers of products (with some conditions attached like damage liability + market surveillance) lies in the core of the EU global approach to conformity assessment in the regulated safety area. Following this concept, we can imagine that the technical competence of a calibration/testing laboratory could be demonstrated by a certified QMS + successful participation in PT or ILC schemes.
- Quality prize awards schemes like EFQM and Baldrige are based on self-assessment by way of accumulating an extensive amount of information against given criteria (together with various objective surveys, studies and analyses) followed by an evaluation by a panel of experts (and this pool of experts consists of peers - equals - in a technical sense, to a large extent).

As shown above, peers in the technical sense lie at the core of QMS auditing performed by certifiers and self-declaration/self-assessment schemes are as well relatively extensively used with a potential of wider application in practice.

## 3 Summary

In general, bodies subject to certification/accreditation are now more and more concerned by the following issues:

- A real added value of any third party assessment in the present mature situation;
- An excessive dependence of certifiers/accreditors on the financial side of the business sidelining the technical content;
- A hostile environment for small and medium enterprises (SMEs) created by certifiers/accreditors.

The experience from ISO CASCO working groups indicates that behind the scene a fierce struggle between accreditors and certifiers for a so to speak "laboratory market" is going on. To face this challenge ILAC, IAF and ISO CASCO even issued in 2003 a joint communiqué on their position towards the applicability of accreditation and certification to laboratories. An alternative position to the same problem from the viewpoint of a laboratory can be formulated on the basis of the facts and arguments given above.

It has been demonstrated above that crucial activities in metrology are now subject, by way of ISO CASCO, to standardization which is influenced by various vested interests. Especially accreditors are quite active regarding standards of highest priority to them: ISO/IEC 17011, ISO/IEC 17025 - they dominate the attendance of the corresponding working groups, the draft standards are simply written by them. ISO CASCO is unfortunately not able to guarantee a reasonable degree of impartiality here. It is therefore in the best interest of the metrology community to closely pursue the work in ISO CASCO and try to formulate and press ahead with its own agenda on these issues. The present situation when accreditors are in the habit of speaking on behalf of the metrology (laboratory) community should be challenged. Otherwise it can easily happen that one day labs will wake up to a hostile environment in which they will not be able to carry out their usual work or pursue their missions.

As it is demonstrated above calibration (and testing, strictly speaking, as well) is not a true CAA. Therefore, accreditation is a legitimate approach to demonstrating the technical competence of labs but it is not the only applicable approach here. The other approaches can be summarized as follows:

- Client audits;
- Extensive participation in ILCs or PT schemes;
- Self-declaration supported by evidence from PT and ILC programs with openly accessible results (further supported by e.g. client audits and by making openly available a part of the QMS documentation, e.g. on the internet);
- Peer assessment on the basis of ISO 17040 (e.g. within national associations of calibration and/or testing labs, especially suitable for mutual recognition arrangements among NMIs - CIPM MRA, OIML MAA);
- Certification against ISO/IEC 17025 or cross-referenced ISO 9001:2000 and ISO/IEC 17025 or ISO 9001:2000 + ISO 10012.

At present accreditation is dominant here even if there are legitimate grudges against some aspects of its practical implementation. Future developments will depend on the overall price versus performance (added value) ratio for laboratories. ■

## Annex 1: Definitions of terms - Conformity assessment and calibration

**Conformity assessment (ISO/IEC Guide 2:1996, par. 12.2):**

"Conformity assessment is any activity concerned with determining directly or indirectly that relevant requirements are fulfilled."

**Conformity assessment ( original ISO CD 17 000):**

"Conformity assessment is the generic term used nowadays to mean any activity **concerned in any way** with checking or giving assurance that relevant requirements have been met."
*After comments objecting to such a form of a definition being unnecessarily broad (see the words in bold) - it can therefore cover e.g. manufacture and repair of measuring instruments, special SW, etc. - it was argued that calibration (and "pure" testing labs making no decisions) labs should not be a part of CABs. The Preliminary Draft of this standard then followed:*

**Conformity assessment (Preliminary draft ISO/IEC CD 17000, par. 3.1.1):**

"Conformity assessment is development of information, comparison with specified requirements, decision on fulfillment of requirements by the object of conformity assessment (3.1.4) and communication of the decision."
*During the WG 5 meetings the representative of accreditation bodies which are always present (Mr. Squirrel, ILAC) strongly argued that if calibration is not a CA activity then the definition in the VIM should be changed (!). Due to the fact that other WG 5 members are not experts in metrology the position of Mr. Squirrel has prevailed resulting in a new definition, basically going back to the original one:*

**Conformity assessment (ISO/IEC CD 17000, October 2001, par. 3.1.1):**

"Activity or activities **related to demonstrating** whether or not an object of conformity assessment (3.1.2) fulfils or continues to fulfill specified requirements."

**3.1.2 Object of conformity assessment**

"Product (including service), process, system, person or organization."
*This definition has apparently not been accepted in voting by ISO CASCO members on a national level so that the wording has basically reverted to that of the Preliminary draft:*

**Conformity assessment (ISO/IEC CD 17000, May 2002, par. 3.1.1, DIS, February 2003, FDIS, December 2003, par. 2.1.1):**

"Activity that **provides demonstration** that specified requirements relating to a product, process, system, person or body are fulfilled."
*The last definition of CA is absolutely correct and clearly contradicts that of the term "calibration" in the VIM:*

**Calibration (VIM under 6.11):**

"Calibration is a set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument, or values represented by a material measure or a reference material, and the corresponding values realized by standards."
*It is clear from this definition that during calibration:*
*No requirements, especially in terms of limits or tolerances, are in most cases available (also no written standards are available);*
*No decisions are made in the process or in the calibration certificate;*
*No assessment whatsoever is made during the process.*
Then, calibration was mentioned in NOTE 1 only - maybe that everything put in notes might anyhow be virtually disregarded as in the case of the ISO 9000 series of standards. In the DIS version calibration was not included in this note, on pressure from accreditors it was included in the FDIS version as a related activity.
*As a matter of course, verification of measuring instruments in legal metrology as defined in the VIML:*

**Verification of legally controlled measuring instruments (VIML under 2.13):**

"Verification of a measuring instrument is a procedure which includes the examination and marking and/or issuing of a verification certificate, that ascertains and confirms that the measuring instrument complies with the statutory requirements."
*is a conformity assessment activity.*
*Pure testing labs confined to issuing a test report only and not involved in any decisions should not be a CA activity as well - see the definitions:*

**Testing, test, testing laboratory (ISO Guide 2) in par. 13:**

"Testing is an action of carrying out one or more tests."
"Test - technical operation that consists of the determination of one or more characteristics of a given product, process or service according to a specified procedure."
"Testing lab - laboratory that performs tests."

GAS METERING

# Dreams about legal gas metering

Jos G.M. van der Grinten

NMi Certin B.V., The Netherlands

## Abstract

The future of gas metering is determined by past, present and future developments in the areas of metrology, the economy and metering technology. For each of these areas, this paper will show current developments and also those that are likely to occur, or which users would like to see in the future. This overview will cover metrological, economical and technological aspects.

Terminology related to measurement results can be divided into two categories representing *available information* and *missing information*, respectively. In the first catogory the reference value and deviation are found and the latter category includes everthing that leads to measurement uncertainty. Economically, the supply of natural gas will be metered on an energy basis. New miniaturized, fast responding and cheap gas composition measurements will contribute to this market demand.

Not only the development of new metering principles and the improvement of existing principles are important, but also the measurement of flow profile, swirl, pulsations, acoustic noise, vibration and the thermodynamic properties of natural gases play a key role.

In the future, research on flow meters, energy measurement, natural gas properties, disturbance testing and new metrological phenomena will remain interesting and challenging.

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## Introduction

Legal gas metering is the activity whereby gas meters are used to measure the amount of gaseous fuel or industrial gases for custody transfer purposes, i.e. financial transactions for gas supplies and fiscal purposes: taxes, levies and duties. Many counties have legal requirements for gas meters that are based on current OIML Recommendations R 6 [1], R 31 [2] and R 32 [3]. In most European countries these Recommendations were implemented in the context of weights and measures legislation. In countries such as e.g. Japan and Australia, OIML Recommendations are implemented via standards that are compulsory for custody transfer measurements. Countries that signed the OIML treaty have the moral obligation to implement OIML Recommendations in their national legislation, the objective being to establish coherent metrology legislation, which renders trade between countries easier.

The current OIML Recommendations are technology oriented: diaphragm meters R 31 [2], rotary piston and turbine gas meters R 32 [3], supported by general provisions R 6 [1]. For other technologies (e.g. ultrasonic and coriolis) no Recommendations currently exist. Today, under Dutch legislation only diaphragm, rotary piston and turbine meters are allowed for custody transfer. Other meter types are possible but only via a dispensation procedure, which takes approximately six weeks longer to complete than a regular type approval.

With technology changing at an increasing pace it will serve market interests if legislation is technology independent, a development that was recognized as one of the key issues of the new Measurement Instrument Directive (MID) [4] in the European Union. To this end the current OIML Recommendations for gas meters are under revision, which has resulted in a first Committee Draft [5], which is technology independent. Gas meters are generally part of an entire installation and so a new Recommendation for gas metering systems is being developed [6]. These new Recommendations necessarily form a compromise between the dreams of experts and the interests of participating countries. However, we know that these are going to be revised in the future. So today is an excellent starting point to dream about legal gas metering.

Walt Disney, famous for his creations of Mickey Mouse and Donald Duck, used a method for his creative work that was later called the "Disney strategy". Any problem is viewed from three different perspectives: the dreamer, the critic and the realist. The dreamer thinks of anything that would be nice. Even the sky is not a limit. The critic tells why the new ideas are not possible or why they are actually bad ideas. The realist looks at what can be achieved and how problems can be solved. When changing his perspective Walt Disney actually changed seats and body posture in order to stimulate the new line of approach in his thinking. For the purpose of this paper we will concentrate on dreaming, criticism and realism being left to one side for the time being. Since gas metering is a combination of metrology, economy and technology, we will focus on our dreams concerning these three areas.

## Metrology

The first field of developments to be mentioned here is metrological. Metrology is the science of taking measurements. In scientific metrology metrologists focus on the development of new standards or the improvement of existing standards. Here, scientists are dreaming of a couple of new quantum phenomena that will contribute to the development of standards based on fundamental physical constants. In industrial metrology people working in research and development need measurement standards to test the equipment developed. The focus here is the development of more accurate instruments. Legal metrologists focus not only on the application of measuring methods for custody transfer purposes but also on the regulations required for fair trade, health, safety, the environment and consumer protection. A concise overview of the different metrology areas can be found in *Metrology – in short* [7], a publication issued by DFM, the Danish National Metrology Institute.

In the past decades metrology has undergone a paradigm shift, leading to the publication in 1993 of the *Guide to the expression of Uncertainty in Measurement* (GUM) [8]. The major implication of the GUM is that uncertainties are part of the measurement results. Instead of saying the length of the table is 1.80 m, we represent the length of the table by (1.80 ± 0.01) m, 0.01 m being the measurement uncertainty.

Also terminology has changed. Terms like *true value* and *error* have lost their practical significance in metrology. Instead of *error* the word *deviation* is used and *true value* is changed to *value*. The best-known estimate of the *value* of a quantity is the reference value obtained from a standard, which is used to determine the deviation of an instrument reading. *Maximum permissible error* is now better replaced by *tolerance*.

Terminology is an important aspect of the language in which we communicate measurement results. In metrology there are currently two dictionaries that contain terminology and definitions that are currently agreed on in metrology. The *Vocabulaire International de Métrologie* (VIM) [9] is general to metrology; the other is the *Vocabulaire International de Métrologie Légale* (VIML) [10], which is specific to legal metrology. In these vocabularies a number of terms exist that are not defined in a quantitative way: accuracy, inaccuracy, precision, repeatability, reproducibility.

Some terms actually demonstrate the opposite of their intention. For example if we look at repetitive measurements for *repeatability* or *reproducibility* we will find that the instrument shows small reading fluctuations that makes it not entirely repeatable or reproducible. In fact our search for repeatability leads to the opposite. Consequently, *repeatability* and *reproducibility* are nowadays treated as uncertainty sources.

In this information era it is an idea to divide all terms into two categories. One group of terms represents *available information*. Here we have *measured value*, *reference value* and *deviation*. The other group of terms refers to *missing information*, i.e. *measurement uncertainty*. Here we can include all the terminology that results in measurement uncertainty: *repeatability*, *reproducibility*, *drift* and *uncertainty*. Now it is also clear that if a correction is not applied for a known deviation, this will result in an additional uncertainty. Terms such as *accuracy* and *inaccuracy* have a little of both categories, which make them confusing. On one hand accuracy expresses a small deviation, on the other hand an accurate instrument also has a low uncertainty. The term inaccuracy has the same ambiguity.

The concept of uncertainty as a measure of missing information has proven to be a very useful instrument to help people to master the basic concepts of metrology. An illustration of this idea with examples can be found in a paper by the author [11].

Uncertainties cannot be avoided and that means that these play a role when taking measurement based decisions [12]. Examples are speeding tickets for people that drive too fast and approval of instruments with respect to legal tolerances. The probability that a decision is taken correctly is called *confidence level*. The probability of taking an erroneous decision is called *risk*, which is 1 – confidence level. If the instrument deviation equals the tolerance, then the probability of taking a correct decision is 50 %. So the point of standardization in legal metrology is the minimum confidence level (e.g. 95 %) required for metrological decisions.

## The economy

Apart from any metrological and technological developments, the gas markets are liberalized in some countries. As a result the trade and transport responsibilities are split up into different companies. Gas transportation and gas distribution companies will not own the gas and receive only a fee for transporting the gas to the end user. As a result the gas balance of these companies will obtain more attention, requiring more accurate gas meters.

Another consequence of the liberalized market is that gas will be supplied from many more different sources than today. As each source has a different gas quality with different calorific values there will be a tendency to bill the supplied gas on an energy basis. However, normal gas appliances such as stoves and central heating boilers are not capable of handling entirely different gas qualities. A stove manufactured for a calorific value of 35 MJ/m$^3$ will be damaged if gas of 42 MJ/m$^3$ is used. So a constant gas quality is of importance to domestic users of natural gas. The solution here is an intelligent pressure regulator that reduces the gas pressure on the appliances if a higher quality of gas is supplied. This will be possible after the development of a new and miniaturized measurement method for determining the gas composition, which will be also useful for gas metering on an energy basis.

The prices of energy are expected to rise in the near future and this will stimulate market demand for more accurate meters, new measurement principles, gas meters that meter on an energy basis, automatic reading or telemetry via the internet, and gas meters with multiple tariff registers.

However, there is another development that will require new metrological methods. The person that manufactures a product or provides services has to demonstrate that his products or services comply with regulations, standards and consumer specifications. Quality systems have been accepted as a means to control design, production, and final product inspection. Product malfunction will lead more and more to liability lawsuits, which involves high costs of lawyers and possible compensation payments. These payments have increased over the past decades and there is no indication that this tendency will change in the next years. Especially, the new economies will implement legislation on liability according to principles that are used in other countries. The manufacturer wants to know the risk he runs. Statistical and metrological methods will be further developed to assist the manufacturer to maintain his risk at the preset level.

Manufacturers will act on a global market with local needs. Language support will be of vital importance, not only for documentation but also in interpreting error messages that are transmitted in case of instrument malfunction or maintenance requests.

Consumers that are offered a free choice of gas supplier may become the owners of the gas meter, in which case they will become much more interested in possible meter deviations and measurement uncertainty. Consumers will appreciate more and more clear invoices based on transparent measurement systems that measure gas quantities traceably in energy units.

## Technology

The last decade has shown rapid technological developments in the field of gas metering. Compared to the existing diaphragm, rotary piston and turbine gas meters a range of new metering technologies has been developed. Ultrasonic meters and coriolis meters are now used for custody transfer purposes, the latter measuring gas quantities in mass units. New metering principles are being developed that have potential for custody transfer measurements and existing mechanical measurement principles will be upgraded with electronics to add diagnostic and telemetric functions. Velocity based gas meters, such as the turbine gas meter and the ultrasonic meter will be able to compensate asymmetric velocity profiles and even swirl. Clamp-on meters have been developed that are able to measure the flow rate from the vortex noise of the gas flowing in the pipeline [13].

Recently, manufacturers have endeavored to develop compact equipment to measure gas in energy units. Although the response time of miniaturized gas chromatographs is much better than the existing process gas chromatographs [14], further miniaturization is to be expected with almost real time determination of the gas composition. From the gas composition the calorific value of the natural gas can be determined using the ISO 6976 algorithm [15].

The technological and metrological challenges associated with these developments are numerous. As many gas meters are sensitive to flow disturbances, velocity profiles, pulsations and acoustic disturbances adequate tests need to be developed and standardized. Currently, only standardized tests exist for flow disturbances [3], [5]. Laser Doppler velocity profile measurements for these disturbance tests under high-pressure conditions are described in [16]. The objective of this study is to find flow conditioning methods. These methods can be used to provoke in a straight pipe the velocity profile and swirl corresponding to two out of plane 90° bends. Such devices will actually reduce the cost of full-scale tests of large diameter gas meters under high-pressure conditions. Ultrasonic Doppler methods are already used for instant determination of velocity profiles in liquids [17].

The influence of pulsating flows [18] and pipe vibrations [19] was investigated by TNO in The Netherlands. These tests are not yet performed on a routine basis as part of the product certification of flow meters, but this is likely to change in the future.

A special chapter in technology is the determination of the thermodynamic properties of natural gases. Today there are several standards to calculate the real gas factors of natural gases from the full gas composition [20] or some components and the calorific value [21].

Also for the speed of sound a standard is available [22]. However, traceability is still poorly documented despite the many computer programs that determine the viscosity and the isentropic coefficient, etc. from the gas composition, pressure and temperature. Especially, for differential pressure devices the accuracy of the measurement is dependent on the uncertainty of the calculated values of thermodynamic properties.

## Conclusion

At the end of this overview of the metrological, economical and technological aspects our dreams are summarized as below.

As new insights in metrology become clearer to metrologists, developers and users of instruments, this will give an impulse to the improvement of instrumentation and the quality of products will improve. The introduction of the concept of available information (deviation, measured value) and missing information (uncertainty) helps people to find their way in the terminology that exists in metrology today.

In a competitive liberalized market consumers will be more aware of value for money. As a result there will be a market demand for metering the energy of gas supplied. Also gas meter accuracy will attract more attention, certainly if energy prices increase.

Technologically gas meters will be developed that are based on new techniques such as pulsations, vibrations and acoustic noise. Disturbance tests of flow profile and swirl generation can be performed with devices that can be installed in straight pipe lengths, thus avoiding the costs of full-scale tests with large diameter gas meters under high-pressure conditions. The thermodynamic properties of natural gases need to be known in a traceable way in order to improve metering accuracy.

The research on gas metering and adjacent areas will certainly be very interesting for the future metering principles. Also energy meters will be developed. Instrumentation to measure gas composition will become much smaller in size, faster in response and cheaper. For prototype testing of new gas meters, standardized tests will be introduced.

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*To contact the author:*

Jos G.M. van der Grinten

NMi Certin B.V.
P.O. Box 394
NL-3300 AJ Dordrecht
The Netherlands

E-mail: JvanderGrinten@nmi.nl

# OIML Certificate System:

## Certificates registered 2004.08–2004.10

### Up to date information (including B 3): www.oiml.org

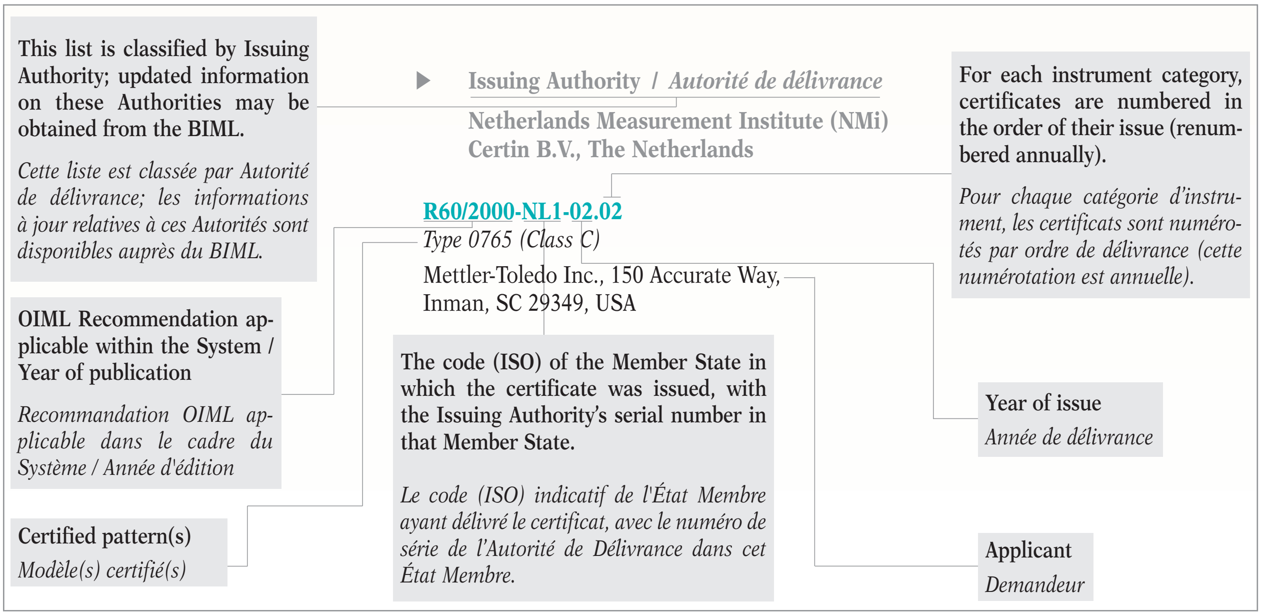
The *OIML Certificate System for Measuring Instruments* was introduced in 1991 to facilitate administrative procedures and lower costs associated with the international trade of measuring instruments subject to legal requirements.

The System provides the possibility for a manufacturer to obtain an OIML Certificate and a test report indicating that a given instrument pattern complies with the requirements of relevant OIML International Recommendations.

Certificates are delivered by OIML Member States that have established one or several Issuing Authorities responsible for processing applications by manufacturers wishing to have their instrument patterns certified.

The rules and conditions for the application, issuing and use of OIML Certificates are included in the 2003 edition of OIML B 3 *OIML Certificate System for Measuring Instruments.*

OIML Certificates are accepted by national metrology services on a voluntary basis, and as the climate for mutual confidence and recognition of test results develops between OIML Members, the OIML Certificate System serves to simplify the pattern approval process for manufacturers and metrology authorities by eliminating costly duplication of application and test procedures. ■




# Système de Certificats OIML:

## Certificats enregistrés 2004.08–2004.10

### Informations à jour (y compris le B 3): www.oiml.org

Le *Système de Certificats OIML pour les Instruments de Mesure* a été introduit en 1991 afin de faciliter les procédures administratives et d'abaisser les coûts liés au commerce international des instruments de mesure soumis aux exigences légales.

Le Système permet à un constructeur d'obtenir un certificat OIML et un rapport d'essai indiquant qu'un modèle d'instrument satisfait aux exigences des Recommandations OIML applicables.

Les certificats sont délivrés par les États Membres de l'OIML, qui ont établi une ou plusieurs autorités de délivrance responsables du traitement des demandes présentées par des constructeurs souhaitant voir certifier leurs modèles d'instruments.

Les règles et conditions pour la demande, la délivrance et l'utilisation de Certificats OIML sont définies dans l'édition 2003 de la Publication B 3 *Système de Certificats OIML pour les Instruments de Mesure.*

Les services nationaux de métrologie légale peuvent accepter les certificats sur une base volontaire; avec le développement entre Membres OIML d'un climat de confiance mutuelle et de reconnaissance des résultats d'essais, le Système simplifie les processus d'approbation de modèle pour les constructeurs et les autorités métrologiques par l'élimination des répétitions coûteuses dans les procédures de demande et d'essai. ■

## INSTRUMENT CATEGORY
## *CATÉGORIE D'INSTRUMENT*

### Diaphragm gas meters
### *Compteurs de gaz à parois déformables*

R 31 (1995)

► Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

**R031/1995-NL1-2004.01**
*G4(A) /G4(S)*
Ecometros S.L., C/Urgel, 240 2 °C, E-08036 Barcelona, Spain

## INSTRUMENT CATEGORY
## *CATÉGORIE D'INSTRUMENT*

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

R 51 (1996)

► Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

**R051/1996-NL1-2004.04**
*LI-3600, LI-3600E, LI-Compact and MI-3600 for Accuracy Class Y(a) or Y(b)*
Digi Europe Limited, Digi House, Rookwood Way, Haverhill CB9 8DG, Suffolk, United Kingdom

**R051/1996-NL1-2004.05**
*AC9000plus for accuracy class X(1) or Y(a)*
Thermo Electron B.V., Hardwareweg 3, NL-3821 BL Amersfoort, The Netherlands

► Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB), Germany

**R051/1996-DE1-1999.03 Rev. 1**
*Checkweigher for static weighing type CS... for accuracy class X(1)*
Optima Machinenfabrik GmbH, Steinbeisweg 20, D-74523 Schwäbisch Hall, Germany

**R051/1996-DE1-2004.02**
*SIWAREX FTA for accuracy classes X(0,2) and Y(a)*
Siemens AG, Östliche Rheinbrücken Straße 50, D-76187 Karlsruhe, Germany

**R051/1996-DE1-2004.03**
*KWE 40xx for accuracy classes X(1) and Y(a)*
Robert BOSCH GmbH, Stuttgarter Straße 130, D-71332 Waiblingen, Germany

**R051/1996-DE1-2004.04**
*DIDO NT for accuracy classes Y(a) and Y(b)*
RK Prozeßtechnik, Riedstraße 10, D-79787 Lauchingen, 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*

Centro Español de Metrologia, Spain

**R060/2000-ES1-2004.01**
*TCC-4 (Class C)*
Transdutec S.A., C/ Joan Miró 11, E-08930 Sant Adrià de Besós - Barcelona, Spain

▶ Issuing Authority / *Autorité de délivrance*

National Weights and Measures Laboratory (NWML), United Kingdom

**R060/2000-GB1-2004.03**
*T302i (Class C)*
Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP, West Midlands, United Kingdom

▶ Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V., The Netherlands

**R060/2000-NL1-2004.09**
*CPA and CPA SL (Class C)*
Captels S.A., B.P. 34, Z.A.E. des Avants, F-34270 St-Mathieu de Tréviers, France

**R060/2000-NL1-2004.11**
*MBF (Class C)*
Campesa S.A., Avinguda Cova Solera, 25-29, E-08191 Rubi-Barcelona, Spain

**R060/2000-NL1-2004.12**
*SBS (Class C)*
Mettler-Toledo (Changzhou) Scale & System Ltd., 111 Changxi Road, Changzhou, Jiangsu 213001, China

**R060/2000-NL1-2004.13**
*C2G1 (Class C)*
Minebea Co. Ltd., Kuruizawa Factory Miyota-Machi, Kitasakugun, Nagano-Ken, Japan

**R060/2000-NL1-2004.14**
*CB14 (Class C)*
Minebea Co. Ltd., Kuruizawa Factory Miyota-Machi, Kitasakugun, Nagano-Ken, Japan

▶ Issuing Authority / *Autorité de délivrance*

Office Fédéral de Métrologie, Switzerland

**R060/2000-CH1-2004.01**
*ED21/SA (Class C)*
DIGI SENS AG, Freiburgstrasse 65, CH-3280 Murten, Switzerland

▶ Issuing Authority / *Autorité de délivrance*
OIML Chinese Secretariat,
State General Administration for Quality Supervision and Inspection and Quarantine (AQSIQ), China

**R060/2000-CN1-2004.01**
*YZ563 for accuracy class C3*
Youngzon Transducer (Hangzhou) Co., Ltd., No. 1, Building Yile Industry Garden, No. 75 Wenhua Rd., 310012 Hangzhou, China

▶ Issuing Authority / *Autorité de délivrance*
DANAK The Danish Accreditation and Metrology Fund, Denmark

**R060/2000-DK1-2004.02**
*DT4650 (Class C)*
Dan-Transducer ApS, Thorsvang 11, DK-3400 Hillerod, Denmark

**R060/2000-DK1-2004.03**
*DT4650 (Class C)*
Elite Transducers, Unit 6A Mercury House, Calleva Park, Aldermaston, Reading RG7 8PN, United Kingdom

## INSTRUMENT CATEGORY
*CATÉGORIE D'INSTRUMENT*

## Automatic gravimetric filling instruments
*Doseuses pondérales à fonctionnement automatique*

**R 61 (1996)**

▶ Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB), Germany

**R061/1996-DE1-2004.02**
*Minipond 25 / SWA 2000 M for accuracy class Ref (0.2)*
B+L Industrial Measurements GmbH, Hans Bunte Straße 8-10, D-69123 Heidelberg, Germany

**R061/1996-DE1-2004.03 Rev. 1**
*SIWAREX FTA for accuracy class Ref (0.2)*
Siemens AG, Östliche Rheinbrücken Straße 50, D-76187 Karlsruhe, Germany

**R061/1996-DE1-2004.05**
*SpeedAC NXT for accuracy class Ref (0.2)*
Chronos Richardson GmbH, Reutherstr. 3,
D-53773 Hennef, Germany

## 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*

International Metrology Cooperation Office,
National Metrology Institute of Japan (NMIJ)
National Institute of Advanced Industrial Science and Technology (AIST), Japan

**R076/1992-JP1-2004.01**
*AUW-D / AUW / AUX / AUY series (Class I)*
Shimadzu Corporation, 1, Nishinokyo-Kuwabara-cho,
Nakagyo-ku, 604-8511, Kyoto, Japan

▶ Issuing Authority / *Autorité de délivrance*

National Weights and Measures Laboratory (NWML),
United Kingdom

**R076/1992-GB1-2004.07**
*IX Series (Class III)*
Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP,
West Midlands, United Kingdom

**R076/1992-GB1-2004.08**
*GM Series (Class III)*
Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP,
West Midlands, United Kingdom

**R076/1992-GB1-2004.09**
*E1005/E1010 (Class III)*
Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP,
West Midlands, United Kingdom

▶ Issuing Authority / *Autorité de délivrance*

Netherlands Measurement Institute (NMi) Certin B.V.,
The Netherlands

**R076/1992-NL1-2004.13**
*DS-980 (Class III)*
Shanghai Teraoka Electronic Co., Ltd., Tinglin Industry Developmental Zone, Jinshan District, Shanghai 201505, China

**R076/1992-NL1-2004.14**
*SB, SB530 and SB730 (Class III)*
Bright Advance Corporation, N° 3217 Hong Mei Road,
201103 Shangai, China

**R076/1992-NL1-2004.15**
*POScale (Class III)*
CAS Corporation, CAS Factory # 19 Kanap-ri,
Kwangjeok-myon, Yangju-kun Kyungki-do, Korea (R.)

**R076/1992-NL1-2004.16**
*ER-series (Class III)*
CAS Corporation, CAS Factory # 19 Kanap-ri,
Kwangjeok-myon, Yangju-kun Kyungki-do, Korea (R.)

**R076/1992-NL1-2004.17**
*DB-II (Class III)*
CAS Corporation, CAS Factory # 19 Kanap-ri,
Kwangjeok-myon, Yangju-kun Kyungki-do, Korea (R.)

**R076/1992-NL1-2004.18**
*FX, MC, B, G, BK, HL or S-series (Class III)*
Avery Weigh-Tronix, Foundry Lane, Smethwick B66 2LP,
West Midlands, United Kingdom

**R076/1992-NL1-2004.19**
*CW-11 / CD-11 / CKW55 (Class III)*
Ohaus Corporation, 19A Chapin Road, Pine Brook,
New Jersey 07058, United States

**R076/1992-NL1-2004.20**
*DB-II (Class III) - 6 kg <= Max <= 150 kg*
CAS Corporation, CAS Factory # 19 Kanap-ri,
Kwangjeok-myon, Yangju-kun Kyungki-do, Korea (R.)

▶ Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB),
Germany

**R076/1992-DE1-2004.02**
*MCD10-3000-EBR210-L (Class III)*
PESA Waagen AG, Witzbergstr. 25, CH-8330 Pfäffikon,
Switzerland

**R076/1992-DE1-2004.03**
*WD-KDS (Class III)*
Ditting Maschinen AG, Bramenstrasse 11,
CH-8184 Bachenbülach, Switzerland

**R076/1992-DE1-2004.04**
*XP…S (Classes I and II)*
Mettler-Toledo A.G., Im Langacher, CH-8606 Greifensee,
Switzerland

Issuing Authority / *Autorité de délivrance*
OIML Chinese Secretariat,
State General Administration for Quality Supervision and Inspection and Quarantine (AQSIQ), China

**R076/1992-CN1-2004.02**
*XK3190-A9 (Class III)*
Shanghai Yaohua Weighing System Co., Ltd, No. 4059,
Shangnan Road, 200124 Shanghai, China

**R076/1992-CN1-2004.03**
*PA8101S (Class III)*
Yuyao Pacific Auto-Control Engineering Co., Ltd,
285 Tanjialing East Road, Yuyao, Zhejiang Province,
China

Issuing Authority / *Autorité de délivrance*
DANAK The Danish Accreditation and Metrology Fund, Denmark

**R076/1992-DK1-2004.01**
*Scanvaegt System 410 (Classes III and IIII)*
Scanvaegt International A/S, P.O. Pedersens Vej 18,
DK-8200 Aarhus N, Denmark



## INSTRUMENT CATEGORY
*CATÉGORIE D'INSTRUMENT*

### Discontinuous totalizing automatic weighing instruments (Totalizing hopper weighers)
*Instruments de pesage totalisateurs discontinus à fonctionnement automatique (Peseuses totalisatrices à trémie)*

R 107 (1997)

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

**R107/1997-DE1-2004.02 Rev. 1**
*SIWAREX FTA for accuracy class 0.2*
Siemens AG, Östliche Rheinbrücken Straße 50,
D-76187 Karlsruhe, Germany

## INSTRUMENT CATEGORY
*CATÉGORIE D'INSTRUMENT*

### Fuel dispensers for motor vehicles
*Distributeurs de carburant pour véhicules à moteur*

R 117 (1995) + R 118 (1995)

Issuing Authority / *Autorité de délivrance*
Russian Research Institute for Metrological Service (VNIIMS) of Gosstandart of Russian Federation,
Russian Federation

**R117/1995-RU1-2003.01 Rev. 1**
*MIDCO Fuel Dispensing Pump (MEB/MPD/MMS series) for accuracy class 0.5*
Mercantile & Industrial Development Company Ltd.,
39/44, Scheme 6, Road 2, Sion (East), 400022 Mumbai,
India

**R117/1995-RU1-2003.02 Rev. 1**
*MIDCO Flow meter for Fuel Dispensing Pump for accuracy class 0.5*
Mercantile & Industrial Development Company Ltd.,
39/44, Scheme 6, Road 2, Sion (East), 400022 Mumbai,
India

## *In memoriam*

### Knut Birkeland, 1929–2004

### CIML President, 1980–1994

Our former CIML President passed away on 12 September 2004 from the sequels of a brain tumor.

Knut Birkeland was born in Stavanger on 27 January 1929, but his family soon moved away to Svolvær, a small town in the Lofoten whose principle resource was fishing. He spent some ten years there, which no doubt goes to explain why certain regional metrology meetings that Knut would later go on to organize in Norway in the framework of NORMET, NORJUST or even AELE, would generally culminate in fishing expeditions in his childhood islands.

For some time he lived in Bergen and in 1958 he graduated in applied physics (metrology of very high frequencies) from the Norwegian Institute of Technology.

After obtaining his degree, he worked for two years et NERA Bergen SA, an electronics manufacturer, then for four years at P.A. Madshus, a geophysics consultancy firm, before joining the Norwegian Metrology Service, Justervesenet, in 1964 where he would spend the rest of his career.

At that time Justervesenet was principally orientated towards legal metrology, but was also Norway's primary laboratory with standards directly linked to the BIPM's international standards.

This goes to explain why Knut very soon sharpened his skills in a number of metrological fields: legal metrology and the measurement of lengths, quantities of liquids and masses, and scientific metrology with length, temperature and electricity standards. From 1967 to 1973 he made numerous trips to France and to the United Kingdom to study interferometry and thermometry.

He very soon came to realize the importance of both international and regional cooperation and as early as in 1965 he participated in a large number of OIML working groups; he also became heavily involved in the activities of the CGPM and in ILAC right from its outset, as well as in the work of the regional organizations that existed at that time, namely NORMET, AELE, WEMC and WECC.

In 1974 he took over from Sture Koch as Director of Justervesenet and became the CIML Member for Norway, and it was in June 1980 on the occasion of the OIML meetings held in Washington D.C. that he was elected CIML President - a mandate that was renewed in 1986 and again in 1992 for a duration of two years corresponding to his term of national office.

These fourteen years represented a period of intense activity at national, international and regional levels for Knut. His primary concern was always to see his country endowed with a top level national metrology service, and in parallel he developed scientific metrology, legal metrology and accreditation activities. In May 1994 his efforts culminated in the laying of the foundations of the new Norwegian Metrology Service laboratories and buildings some twenty kilometers north of Oslo. At regional level he saw to it that Norway participated in all the cooperation forums (mainly those of EUROMET, WELMEC and the EA) and that Norway was in a position to follow the work of the European Union, even though his country was not a member. At international level, his primary objective was to promote OIML activities alongside the other international metrology organizations (Metre Convention), accreditation organizations (ILAC), standardization organizations (ISO and the IEC) or economic cooperation organizations (GATT), not forgetting those involved in development assistance. For the OIML, these same fourteen years during which Knut presided the CIML were years of strong growth, the impetus of which we are still seeing today.

May Knut Birkeland's family and past colleagues find in these words a testimony of the OIML's deepest appreciation for his outstanding achievements. ■

BA

# *In memoriam*

## Knut Birkeland, 1929–2004

## Président du CIML, 1980–1994

Notre ancien Président s'est éteint le 12 septembre dernier, des suites d'une tumeur au cerveau.

Il était né à Stavanger le 27 janvier 1929, mais rapidement sa famille partit pour Svolvær, une petite ville des Lofoten dont la principale ressource était la pêche. Il y passa une dizaine d'années, ce qui explique sans doute que certaines réunions régionales de métrologie que Knut organisa plus tard en Norvège dans les cadres de NORMET, NORJUST ou encore l'AELE, se soient terminées par des parties de pêches dans les îles de son enfance.

Il vécut ensuite à Bergen et termina ses études en 1958 avec un diplôme de physique appliquée (métrologie des très hautes fréquences) de l'Institut Norvégien de Technologie.

Il travailla alors deux ans à NERA Bergen SA, un fabricant d'électronique, puis quatre ans à P.A. Madshus, société conseil en géophysique, avant d'intégrer en 1964 le Service Norvégien de Métrologie, Justervesenet, où il passera le reste de sa carrière.

Justervesenet était alors un service principalement tourné vers la métrologie légale, mais constituait aussi le laboratoire primaire de Norvège, avec des étalons directement rattachés aux étalons internationaux du BIPM.

Cela explique que, très vite, Knut développa ses compétences dans de nombreux aspects de la métrologie, métrologie légale avec les mesurages de longueurs, quantités de liquides et masses, métrologie scientifique avec les étalons de longueur, température et électricité. Entre 1967 et 1973 il fit de nombreux séjours en France et au Royaume-Uni pour étudier l'interférométrie et la thermométrie.

Il prit également très rapidement conscience de l'importance de la coopération tant internationale que régionale et dès 1965 participa à de nombreux groupes de travail de l'OIML; il s'impliqua aussi fortement dans les activités de la CGPM et, dès sa création, de ILAC, ainsi que dans celles d'organismes régionaux de l'époque, NORMET, AELE, WEMC et WECC.

En 1974 il succéda à Sture Koch comme Directeur de Justervesenet et comme Membre du CIML pour la Norvège et c'est en juin 1980, à l'occasion des réunions OIML tenues à Washington D.C., qu'il fut élu Président du CIML, mandat dans lequel il fut reconduit en 1986 puis en 1992 pour une durée de deux ans correspondant au terme de ses fonctions nationales.

Ces quatorze années ont été pour Knut une période d'intense activité tant au niveau national que régional et international. Soucieux de voir son pays doté d'un service national de métrologie de haut niveau, il développa en parallèle les activités de métrologie scientifique, de métrologie légale et d'accréditation et ses efforts aboutirent, en mai 1994, par la pose de la première pierre des nouveaux laboratoires et bâtiments du Service Norvégien de Métrologie à une vingtaine de kilomètres au nord d'Oslo. Sur le plan régional il veilla à ce que la Norvège participe à tous les forums de coopération, principalement EUROMET, WELMEC et EA, et puisse suivre les travaux de l'Union Européenne, bien que son pays n'en fisse pas partie. Sur le plan international enfin, ses efforts visèrent à promouvoir l'action de l'OIML au côté des autres organismes internationaux de métrologie (Convention du Mètre), d'accréditation (ILAC), de normalisation (ISO et CEI) ou de coopération économique (GATT), sans oublier l'aide au développement. Pour l'OIML, ces mêmes quatorze ans pendant laquelle il présida le CIML ont été une période de forte croissance qui se poursuit toujours.

Que la famille de Knut Birkeland et ses anciens collègues trouvent ici le témoignage de profonde reconnaissance que l'OIML tient à marquer à l'égard de son ancien Président. ■

BA

DECISIONS & RESOLUTIONS

# Twelfth International Legal Metrology Conference

## Berlin, Germany

## 26–29 October 2004

## 1 Organization of the Meeting

**1.1** The Conference took note of opening and welcome addresses delivered by Dr. Tacke, Vice-Minister of the Federal Ministry of Economics and Labour, Dr. Röhling, Pr. Göbel, President of the PTB, and Pr. Kochsiek, CIML Acting President.

**1.2** The roll of Delegates was called and it was found that 54 Member States were present out of a total of 59; the statutory quorum of two-thirds was therefore reached.

The Conference also noted the participation of Observers from certain OIML Corresponding Members, observer countries and International and Regional Liaison Organizations, the CIML Immediate Past-President, one CIML Honorary Member and members of BIML Staff.

**1.3** Information concerning voting procedures during Conference sessions was given.

**1.4** The Conference unanimously elected Dr. Röhling as Conference President with Pr. Kochsiek (Germany) standing in as and when required, and Mrs. Annabi and Dr. Zhagora as Conference Vice-Presidents.

**1.5** The Conference adopted the proposed agenda without modification.

**1.6** The Conference established two Working Commissions, one for Financial Matters and one for Technical Work.

**1.7** The Conference adopted the proposed schedule.

**1.8** The Conference approved the Minutes of the Eleventh Conference without modification.

**1.9** The Conference took note of a report presented by the President of the International Committee of Legal Metrology describing the activities of the Organization for the period 2001–2004.


## 2 Member States and Corresponding Members

### 2.1 New Members - Expected accessions

The Conference noted that the number of OIML Members had significantly increased since the Eleventh Conference, although a number of Corresponding Members had been delisted for not having paid their subscriptions for over three years. The Conference noted that certain Corresponding Members were envisaging joining as Member States and that a number of countries/economies were expected to join as Corresponding Members.

### 2.2 The situation of certain Members

The Conference noted that Zambia had been struck off the list of Member States for not having complied with the requirements laid down by the Eleventh Conference.

It was also noted that the situation of two Member States would first be examined by the Finance Commission, which would then report to the Conference under Item 8.2.

## 3 Long-term policy

### 3.1 Report on actions carried out since the Eleventh Conference

The Conference took note of a report presented by the BIML Director.

### 3.2 Guidelines for the period 2005–2008

The Conference noted that most of the information concerning the actions carried out since the Eleventh Conference, including the development of an Action Plan for 1999–2002 with extension to 2004, had been given in the report on activities delivered by the CIML Acting President. The Conference also noted that the Long-Term Policy and the Action Plan shall be revised under the supervision of the newly elected CIML President, and requested the CIML to monitor its implementation.

## 4 Liaisons with international and regional institutions

### 4.1 Report on liaisons

The Conference took note of a report presented by the BIML Director.

### 4.2 Addresses by Representatives of Institutions

The Conference also noted the reports presented by the representatives of:

- ILAC/IAF, Mr. Pierre
- UNIDO, Dr. Loesener-Diaz
- Metre Convention, Dr. Castelazo
- WELMEC, Mr. Freistetter
- APLMF, Dr. Ooiwa
- EMLMF, Mr. Lagauterie
- SADCMEL, Mr. Carstens
- CCE, DG Enterprise, Mrs. Höke
- CECIP, Mr. Anthony.

**4.3** The Conference took note of a report presented by the BIML Director concerning the main aspects of cooperation between the OIML and certain International and Regional Organizations. It was noted that a number of matters should be considered in order to globally improve OIML activities in fields connected with, for example, market surveillance, increased use of the work of other international or regional bodies, etc.

The Conference expressed its appreciation for the work carried out jointly with other Organizations.

The Conference invited the CIML President and BIML Director to work actively towards an even closer cooperation with the Metre Convention and a common presentation of international metrology to the public.

As a conclusion, the Conference requested the CIML to duly consider all the comments and proposals put forward during the Conference and to take appropriate measures in order to implement those that are considered as being most appropriate to improve OIML activities.

## 5 Work of OIML Technical Committees and Subcommittees

### 5.1 Work undertaken - State of progress

The Conference took note of a report concerning the activities of OIML Technical Committees and Subcommittees and requested the CIML to continue to monitor the situation and to find solutions in order to ensure a better distribution of technical responsibilities amongst OIML Member States.

### 5.2 Implementation of Recommendations by OIML Members

The Conference took note of information given by the Bureau concerning the implementation of OIML Recommendations in national regulations or voluntary standards. It noted that due to the low level of responses, no comprehensive report could be given.

Member States that had not yet replied to the BIML inquiry were requested to do so urgently. The Conference encouraged the Bureau to convert this information and inquiries into a permanent interactive facility on the OIML web site.

### 5.3 Formal sanction of Recommendations already approved by the Committee in 2001, 2002, 2003 and 2004

The Conference decided that OIML Test Report Formats, which are of an informative nature concerning their implementation in national regulations, shall be approved by the CIML according to the rules applicable to International Documents, without having to be sanctioned by the Conference.

The Conference sanctioned those new or revised Recommendations already approved by the Committee in 2001, 2002, 2003 and 2004.

*Recommendations approved in 2001:*

- R 16-1 *Mechanical non-invasive sphygmomanometers* (Edition 2002)
- R 16-2 *Non-invasive automated sphygmomanometers* (Edition 2002)
- R 75-1 *Heat meters. Part 1: General requirements* (Edition 2002)
- R 75-2 *Heat meters. Part 2: Type approval tests* (Edition 2002)
- R 133 *Liquid-in-glass thermometers* (Edition 2002)

*Recommendations approved in 2002:*

- R 84 *Platinum, copper, and nickel resistance thermometers (for industrial and commercial use)* (Edition 2003)
- R 134-1 *Automatic instruments for weighing road vehicles in motion. Total vehicle weighing* (Edition 2003)

*Recommendations approved in 2003:*

- R 48 *Tungsten ribbon lamps for the calibration of radiation thermometers* (Edition 2004)
- R 49-1 *Water meters intended for the metering of cold potable water. Part 1: Metrological and technical requirements* (Edition 2003)
- R 49-2 *Water meters intended for the metering of cold potable water. Part 2: Test methods* (Edition 2004)
- R 52 *Hexagonal weights - Metrological and technical requirements* (Edition 2004)
- R 61-1 *Automatic gravimetric filling instruments. Part 1: Metrological and technical requirements - Tests* (Edition 2004)
- R 87 *Quantity of product in prepackages* (Edition 2004)
- R 135 *Spectrophotometers for medical laboratories* (Edition 2004)

*Recommendation approved in 2004 by CIML postal approval:*

- R 111-1 *Weights of classes* $E_1$, $E_2$, $F_1$, $F_2$, $M_1$, $M_{1-2}$, $M_2$, $M_{2-3}$ *and* $M_3$. *Part 1: Metrological and technical requirements* (Edition 2004)

### 5.4 Draft Recommendations directly presented for sanctioning by the Conference

The Conference sanctioned one new Recommendation *Instruments for measuring the area of leathers* (R 136).

The Conference also decided to withdraw OIML Recommendations R 33 and R 62.

## 6 OIML Certificate System for Measuring Instruments

### 6.1 Report on the situation of the System

The Conference took note of a report describing progress made with this activity since the establishment of the System in general and since the 11th Conference in particular, including the results of recent inquiries carried out among OIML Members and manufacturers.

### 6.2 Mutual Acceptance Arrangement (MAA)

The Conference expressed its appreciation to the CIML for the setting up of the Mutual Acceptance Arrangement, and took note that this System will be implemented in 2005.

The Conference took note of proposals concerning the operation of the MAA and of the Certificate System. The Conference instructed the Committee to take appropriate decisions on these proposals and to begin a revision of this document once experience has been gained following its implementation.

### 6.3 Other developments

The Conference took note of a report concerning the results of various inquiries carried out by the BIML in order to ascertain the views of manufacturers and CIML Members concerning advisable developments of the System.

The Conference confirmed the urgency of addressing the problem of conformity to type of measuring instruments.

## 7 Developing Countries

### 7.1 Report on activities for the period 2001–2004

The Conference took note of a report concerning the Development Council meeting held on 25 October and expressed its appreciation to the Chairperson for the work accomplished.

The Conference noted in particular the report concerning the Forum: *Metrology – Trade Facilitator* held on 25 October 2004 and expressed its appreciation to the German Authorities for having organized this event.

### 7.2 Guidelines for future activity

The Conference noted the Committee's report that, notwithstanding Resolution 7.2 of the 6th International Conference of Legal Metrology which established the OIML Development Council, the OIML's work on Developing Country matters could be more efficiently managed by the establishment of a Permanent Working Group on Developing Countries (PWGDC), which would replace the Development Council.

The Conference therefore approved the decision of the 38th CIML Meeting to create a PWGDC, the terms of reference of which shall be established by the Committee. This Permanent Working Group shall act as an advisory body to the President of the Committee on aspects of the OIML's work relating to Developing Countries.

The Conference also decided to cease the activities of the current Development Council.

## 8 Administrative and financial matters

### 8.1 Examination of the management of the budget from 2000 to 2003 and the estimates for 2004

The International Conference of Legal Metrology,

HAVING EXAMINED the report on the management of the budget for the years 2000, 2001, 2002 and 2003;

NOTING that the budget was managed in conformity with the expenses necessary for carrying out the work of the Bureau and that the accuracy of the report has been certified by annual audits;

NOTING that the respective functions assigned by the Convention to the President of the International Committee of Legal Metrology and to the Director of the International Bureau of Legal Metrology have been fulfilled;

GIVES ITS DEFINITIVE DISCHARGE to the President of the Committee and to the Director of the Bureau for their management of the budget during the years mentioned above.

### 8.2 Decisions related to the debts of certain countries

The Conference adopted the following Resolution:

The International Conference of Legal Metrology,

HAVING EXAMINED the report on the management of the budget for the years 2000, 2001, 2002 and 2003;

NOTING that a large part of the holdings on December 31, 2003 consisted of debts owed by Member States;

URGENTLY REQUESTS that those Member States that are in arrears with their contributions pay their debts as soon as possible;

HAVING NOTED a report by the Director of the Bureau on the situation of certain Member States in arrears with their contributions,

MAKES the following decisions:

* D.P.R of Korea is permitted to remain a full Member of the OIML providing that:

  - its current contributions are paid, and
  - its arrears are progressively reimbursed over 10 years.

  The International Committee of Legal Metrology is requested to annually examine the situation of this Member State and take appropriate action in the event that these conditions are not met.

* The outstanding contribution of Spain related to the year 1992 is considered to have been paid by this country.

* Zambia will be permitted to become an OIML Corresponding Member providing that:

  - its current Corresponding Member fees are paid, and
  - its arrears are progressively reimbursed over 10 years.

  The conditions for the readmission of Zambia as a full Member State will be reconsidered when its arrears amount to less than 3 years' contributions.

  The International Committee of Legal Metrology is requested to annually examine the situation of this country and take appropriate action in the event that these conditions are not met.

* The International Committee of Legal Metrology is requested to annually examine the situation of any other Member State which might become more than three years late in the payment of its contributions and to report back about this at the Thirteenth Conference.

### 8.3 Revision of the OIML Financial Regulations

The Conference approved the revised *OIML Financial Regulations* as established by the Committee.

### 8.4 Bureau staff and Retirement scheme

The Conference took note of a report given by the BIML Director on this issue.

The Conference noted that the OIML Retirement scheme will be balanced for the period 2005–2008 without an additional endowment from the Organization being necessary.

The Conference noted that additional studies are necessary for assessing the rights of the Staff and the commitments of the Organization concerning the Retirement scheme and for examining how these commitments must be recorded in the Organization's accounts.

The Conference instructed the CIML to undertake these studies and to report and make proposals to the Thirteenth Conference.

### 8.5 Budget for the financial period 2005–2008

The Conference accepted (with one abstention) to consider the budgetary proposals as a whole and not in separate components.

The Conference adopted the following Resolution:

The International Conference of Legal Metrology,

ACCEPTING the budgetary proposals of the Director of the International Bureau of Legal Metrology for the financial period beginning January 1, 2005 and ending December 31, 2008;

APPROVES the fee structure and the budget for the Organization's expenses annexed to these Decisions and Resolutions;

INSTRUCTS the International Committee of Legal Metrology:

- to annually review the MAA fee structure approved above, and
- to amend it as necessary in order to ensure a fair implementation of the MAA, without compromising the balance of implementation costs and income.

INSTRUCTS the International Committee of Legal Metrology to take the necessary measures (such as calling for voluntary additional contributions or amending certain elements of the budget - with the exception of the Member State base contributory share and the Corresponding Member lump sum subscription fee) in the event that the inflation rate in France differs in a significant manner from the value used for determining the budget (i.e. 2 %) or in the event that other factors render a revision of the accepted budget appropriate;

INSTRUCTS the International Committee of Legal Metrology to annually review the situation of those Member States that benefit from a lower contributory class and requests the Committee to reallocate those Member States concerned to their normal contributory class as soon as their economic situation permits it.

### 8.6 Status of OIML Publications

The Conference approved the proposal to make all OIML Publications, except those which are published jointly with other Organizations, available free of charge in electronic format on the OIML web site and to cease publishing them on paper.

## 9 Other business

## 10 Closure

### 10.1 Adoption of the Decisions and Resolutions of the Conference

A second roll call of delegates was called and it was found that 53 Member States were present; the statutory quorum of two-thirds as fixed by the Convention was therefore reached.

The Twelfth International Conference adopted the above-mentioned Decisions and Resolutions (*Note:* the sanctioning of International Recommendations and the adoption of Resolution 8 were made through nominal votes).

### 10.2 Date and place of the next Conference

The Conference decided that it would wait for a period of up to two years, i.e. until 2006, to establish whether any Member State was willing to host the Thirteenth Conference in 2008. If no Member State was forthcoming, then the BIML would organize the Conference in France. ■

## Annex: 2005–2008 Budget

## Approved by the 12th International Conference of Legal Metrology

**(a) Fee structure approved by the Conference**

| Year | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| Base Member State contributory share | 12 620 € | 12 880 € | 13 130 € | 13 400 € |
| Corresponding Member Fee | 1 020 € | 1 020 € | 1 020 € | 1 020 € |
| Registration fee for OIML Certificates outside DoMCs | 150 € | 153 € | 156 € | 159 € |
| Registration fee for OIML Certificates covered by a DoMC | 500 € | 510 € | 520 € | 530 € |
| Fees for examination of the candidacy of an Issuing Authority for a DoMC | 1 500 € | 1 530 € | 1 560 € | 1 590 € |

**(b) Base Budget**

| Year | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| **Operating charges approved by the Conference (*)** | | | | |
| Staff | 874 k€ | 913 k€ | 947 k€ | 960 k€ |
| Premises | 51 k€ | 52 k€ | 52 k€ | 54 k€ |
| Offices | 69 k€ | 62 k€ | 62 k€ | 63 k€ |
| Bulletin | 44 k€ | 45 k€ | 45 k€ | 47 k€ |
| Printing | 14 k€ | 15 k€ | 15 k€ | 16 k€ |
| Documentation | 16 k€ | 16 k€ | 17 k€ | 18 k€ |
| Correspondence | 43 k€ | 43 k€ | 44 k€ | 46 k€ |
| Meeting costs | 156 k€ | 162 k€ | 168 k€ | 175 k€ |
| Travel | 52 k€ | 53 k€ | 53 k€ | 55 k€ |
| Bonuses and miscellaneous | 6 k€ | 7 k€ | 7 k€ | 8 k€ |
| **Total operating charges** | **1 325 k€** | **1 368 k€** | **1 410 k€** | **1 442 k€** |
| **Financial charges approved by the Conference** | | | | |
| Financial charges | 0 k€ | 0 k€ | 0 k€ | 0 k€ |
| **Exceptional charges approved by the Conference** | | | | |
| OIML 50th Anniversary | 180 k€ | | | |
| Expert studies | 30 k€ | 30 k€ | 30 k€ | 30 k€ |
| Others | | | | |
| **Total exceptional charges** | **210 k€** | **30 k€** | **30 k€** | **30 k€** |

*(*) Subject to the agreement of the CIML President, the BIML Director is allowed to operate compensations between the operating charges other than staff charges as far as the total operating charges do not exceed those approved by the Conference.*

**(c) Additional budget (MAA implementation)**

| Year | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| **Charges approved by the Conference** | | | | |
| Staff costs for one additional staff member | 82 k€ | 84 k€ | 91 k€ | 93 k€ |
| Operating costs for one additional staff member | 25 k€ | 25 k€ | 26 k€ | 26 k€ |
| **Total operating charges of the additional budget** | **107 k€** | **109 k€** | **117 k€** | **119 k€** |

TC/SC NEWS

# OIML TC 8/SC 8 Working Group Meeting

## Dordrecht, The Netherlands

## 11 October 2004

Jos G.M. van der Grinten
NMi Certin, The Netherlands

The TC 8/SC 8 Working Group for the combined revision of the International Recommendations on *Gas meters* (OIML R 6, R 31 and R 32) held a one-day meeting on 11 October 2004 in Dordrecht, The Netherlands. Thirty delegates from eleven countries (9 P-Members and 2 O-Members) attended the meeting, which was kindly hosted by NMi Certin.

The draft of the Recommendation on *Gas meters* is intended to replace the existing R 6, R 31 and R 32 and this First Committee Draft aims to modernize the existing Recommendations with respect to technology and metrology, taking into account the increasing pace of technological developments and the liberalization of the gas markets in the different parts of the world.

In May 2004 the 1 CD on Gas meters was sent out for comments; by early September more than 250 comments had been received from 23 countries.

The meeting was split into two parts. First the philosophy of the 1 CD was explained in a presentation by Jos van der Grinten. The contents of this presentation can be found in the paper *Dreams about legal gas metering*, published in this issue. This presentation clarified a number of remarks made by the various countries.

The second part of the meeting was devoted to the most important comments on the draft and the following issues were agreed upon:

- Implementation of technology independence, allowing electronics and new meter principles to be covered by the scope of the Recommendation;
- Remote displays are allowed under the condition that metering data is stored in the gas meter and that the consumer can access this data;
- Gas quantities can also be expressed in mass and energy units;
- Modernization of metrological terminology in a way that is compatible with the uncertainty approach of the VIM and the GUM; and
- Addition of a class 0.5.

In scientific and industrial metrology it is customary to correct for all known deviations. When this procedure is applied to an instrument there is no deviation left and only uncertainty remains. Due to uncertainty an instrument may deviate, but it is not possible to tell in which direction.

Applying corrections for known deviations to an instrument for legal metrology purposes would result in a “class 0” instrument. Although participants appreciate the added value of correcting for known deviations, many had reservations towards the “class 0” designation. It was decided to keep the “class 0” in the next draft for further discussion.

Discussions both during the meeting and during the breaks were vivid and constructive, and attendees learnt from each other’s viewpoints. Once again the OIML TC 8/SC 8 Secretariat would like to thank the participants, CIML Members and technical experts for their many useful comments. Further activities will include a new meeting between the Secretariats of TC 8/SC 7 and TC 8/SC 8 to harmonize the scopes of the drafts of the Recommendations *Measuring systems for gaseous fuels* and *Gas meters* in order to avoid any unnecessary overlap.

The detailed comments received by the TC 8/SC 8 Secretariat before and after the meeting will certainly lead to an improved 2 CD, which it is planned to publish in December 2004 or early January 2005. Comments on this 2 CD are welcomed before 31 March 2005.

The next meeting is scheduled to be held in June 2005 at a venue still to be decided. ■

# FORUM

## Metrology – Trade facilitator

### Berlin, 24 October 2004

In November 2003, the 38th Meeting of the International Committee of Legal Metrology decided to set up a Permanent Working Group on Developing Countries (PWGDC) to replace the OIML Development Council, so as to make the OIML's work for developing countries more effective and efficient, concentrating on concrete actions of assistance in the field of metrology, with the constraint that the OIML is not a funding agency.

The Chairman of this PWGDC decided to organize a Forum of interest to developing countries in conjunction with the 12th International Legal Metrology Conference, held in Berlin.

The aims of the event, called *Metrology – Trade facilitator*, were:

- To ascertain the needs of developing countries in the field of metrology;
- To find out what is offered in terms of support;
- To emphasize the importance of metrology as an essential part of the technical structure for conformity assessment;
- To discuss arguments for the development of such an infrastructure, according to the specific needs of a country or region;
- To stimulate discussion and exchange of information; and
- To facilitate the contact between donors and metrology organizations looking for support.

More than 150 people attended the Forum, at which a number of prominent speakers from international organizations as well as developing and industrialized countries gave presentations related to technical assistance in metrology, accreditation and standardization. A simultaneous poster session was organized, at which around 40 "needs", and 20 "offers" posters were presented. The preliminary outcomes of the Forum are as follows:

- Some of the needs were able to be satisfied immediately by matching them with offers of support, but others presented will require longer negotiation;
- All needs and offers posters will be made available in a "virtual Forum" to be developed by the end of the year on the OIML web site. OIML Member States will be invited to continue to submit such information to keep this virtual Forum "alive";
- A summary of the Forum, together with the recommendations for future actions proposed by the expert speakers will be prepared and used to plan the activities of the Permanent Working Group on Developing Countries over the coming year;
- This summary, which will also be available on the OIML web site, should also be of great help in facilitating metrology organizations' negotiations with decision makers at national and regional levels, as well as with donor agencies.

The possibilities of organizing follow-up events will also be examined, according to need. ■

# OIML Presents Awards to Key Metrologists in Berlin

John Anthony

Klaus Brinkmann

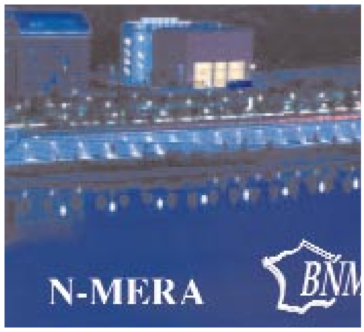
Gerard Faber

Hajime Onoda

# 40th CIML Meeting

# International Metrology Congress

## Lyon (France), 17–23 June 2005




The 40th CIML Meeting will be held from 17–20 June 2005 in conjunction with the 12th International Metrology Congress in Lyon, France, organized with the support of the "Bureau National de Métrologie" and N-MERA (Nordic Metrology Research Area). The OIML, which is also participating in the organization of this Congress, will celebrate its 50th Anniversary on this occasion.

This Congress, which will address a number of issues concerning legal metrology, represents:

- A meeting place for exchanges between 800 to 1000 industrialists and specialists through:
  - 200 oral and poster conferences, 4 round tables dedicated to industrialists' questions, and 5 technical visits.
- An exhibition of 70 stands with professional firms in the voluntary or regulated measurements domains.

Fees: Between 350 and 700 euros (VAT not included) according the number of participation days (reduction for CFM members).

Information, details of the program, registration, CFM membership:

Tel.: +33 (0)4 67 06 20 36

Web site: www.cfmetrologie.com

E-mail: info@cfmetrologie.com

## Congress Program

| *Monday 20 June* | *Tuesday 21 June* | *Wednesday 22 June* | *Thursday 23 June* |
|---|---|---|---|
| | ***Oral Sessions***<br>■ Legal metrology<br>■ Fluids flow & volume<br>■ Round Table Salle Blanche | ***Oral Sessions***<br>■ Dimensional<br>■ Mass<br>■ Round Table Environment | ***Oral Sessions***<br>■ Sensorial & immaterial metrology<br>■ Materials<br>■ Temperature<br>■ RT Metrology function |
| | ***Poster Sessions***<br>■ Chemical metrology<br>■ Uncertainties<br>■ Health | ***Poster Sessions***<br>■ Thermal units<br>■ Electricity<br>■ Time-Frequency | ***Poster Sessions***<br>■ Optics, Training<br>■ Data processing<br>■ Process monitoring |
| ***Oral Sessions***<br>■ Euromet<br>■ OIML | ***Oral Sessions***<br>■ Traceability & uncertainty in chemistry<br>■ Fluids flow & speed<br>■ Uncertainties<br>■ Round Table Health | ***Oral Sessions***<br>■ Quality of measures<br>■ Electricity | ***Oral Sessions***<br>■ Data processing<br>■ Materials<br>■ Time-frequency |
| ***Closing of the CIML and Opening of the Congress***<br><br>***Reception offered by the OIML on the occasion of its 50th Anniversary*** | ***Poster Sessions***<br>■ Materials<br>■ Hydraulic units<br>■ Legal metrology | ***Poster Sessions***<br>■ Dimensional<br>■ Mass & mechanical units<br>■ Metrology organization | ***Closing of the Congress*** |

# 40ème Réunion du CIML

# Congrès International de Métrologie

## Lyon (France), 17–23 juin 2005

La 40ème Réunion du CIML se tiendra du 17 au 20 juin 2005 en conjonction avec le Congrès International de Métrologie à Lyon, qui est organisé cette année avec avec le support du Bureau National de Métrologie (France) et du N-MERA (Nordic Metrology Research Area). L'OIML, qui participe également à l'organisation de ce Congrès, célèbrera à cette occasion son 50ème Anniversaire.

Ce Congrès, qui abordera un certain nombre de sujets concernant la métrologie légale, représente:

- Un carrefour d'échanges entre 800 à 1000 industriels et spécialistes autour:
  - de 200 conférences orales et affichées, de 4 tables rondes dédiées aux questions des industriels, et de 5 visites techniques d'entreprises de la région.
- Une exposition de 70 stands avec un grand nombre de professionnels de la mesure du domaine volontaire et du domaine réglementé.

Tarifs: Entre 350 et 700 euros HT (+ TVA 19.6 %) selon le nombre de jours (réduction pour les adhérents du CFM).

Renseignements, détails du programme, inscription, adhésion au CFM:

Tél.: +33 (0)4 67 06 20 36

Site web: www.cfmetrologie.com

E-mail: info@cfmetrologie.com

## Programme du Congrès

| *Lundi 20 juin* | *Mardi 21 juin* | *Mercredi 22 juin* | *Jeudi 23 juin* |
|---|---|---|---|
| | ***Sessions orales***<br>■ Métrologie légale<br>■ Débit et volume des fluides<br>■ Table Ronde Salle Blanche | ***Sessions orales***<br>■ Dimensionnel<br>■ Masse<br>■ Table Ronde Environnement | ***Sessions orales***<br>■ Métrologie sensorielle et immatérielle<br>■ Matériaux<br>■ Température<br>■ TR Fonction métrologie |
| | ***Conférences Affichées***<br>■ Chimie<br>■ Incertitudes<br>■ Santé | ***Conférences Affichées***<br>■ Grandeurs thermiques<br>■ Electricité<br>■ Temps-fréquence | ***Conférences Affichées***<br>■ Optique, Formation<br>■ Traitement des données<br>■ Maîtrise des processus |
| ***Sessions orales***<br>■ Euromet<br>■ OIML | ***Sessions orales***<br>■ Traçabilité et Incertitudes en chimie<br>■ Débit et vitesse des fluides<br>■ Incertitudes<br>■ Table Ronde Santé | ***Sessions orales***<br>■ Qualité des mesures<br>■ Electricité | ***Sessions orales***<br>■ Traitement des données<br>■ Matériaux<br>■ Temps-fréquence |
| ***Clôture du CIML et Ouverture du Congrès***<br><br>***Réception offerte par l'OIML pour son 50ème Anniversaire*** | ***Conférences Affichées***<br>■ Matériaux<br>■ Grandeurs hydrauliques<br>■ Métrologie légale | ***Conférences Affichées***<br>■ Dimensionnel<br>■ Masse et grandeurs mécaniques<br>■ Organisation métrologie | ***Clôture du Congrès*** |

The OIML is pleased to welcome the following new

## Corresponding Members

- Qatar
- Tajikistan

**www.oiml.org**
*Stay informed*

## OIML Meetings

21–22 April 2005 - Vienna
TC 8/SC 1 *Static volume measurement*
Revisions of R 71, R 80 and R 85

9–10 May 2005 - Paris
TC 17/SC 7 *Breath testers*
Revision of R 126

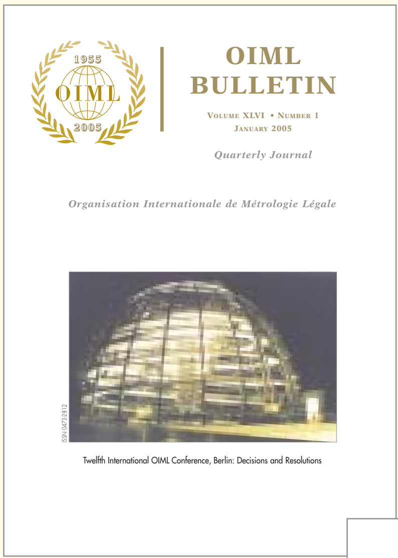
June 2005 - Date & venue to be confirmed
TC 8/SC 8 *Gas meters*
Combined revision of R 6, R 31 and R 32

17–20 June 2005 - Lyon
TC 8/SC 1 *Static volume measurement*
40th CIML Meeting

## Committee Drafts

**Received by the BIML, 2004.08 – 2004.11**

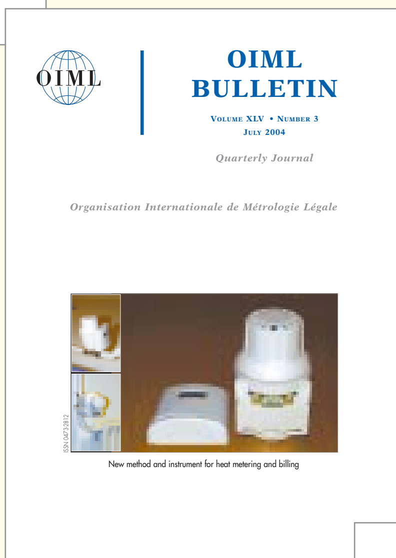
| | | | | |
|---|---|---|---|---|
| Vessels used for sale to the public (Combined revision of R 4, R 29, R 45 and R 96) | E | 1 CD | TC 8 | CH |
| Revision of R 49 (+ R 72): Water meters for metering cold potable water and hot water - Part 2 | E | 1 CD | TC 8/SC 5 | UK |
| General requirements for software controlled measuring instruments (Pre-draft) | E | 2 WD | TC 5/SC 2 | DE + FR |
| Revision of R 126: Breath alcohol analyzers | E | 1 CD | TC 17/SC 7 | FR |




# Call for papers

## OIML Members
## RLMOs
## Liaison Institutions
## 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.*

Papers selected for publication will be remunerated at the rate of 23 € per printed page, provided that they have not already been published in other journals. The Editors reserve the right to edit contributions for style, space and linguistic reasons and author approval is always obtained prior to publication. The Editors decline responsibility for any claims made in articles, which are the sole responsibility of the authors concerned. Please send submissions to:

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