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ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

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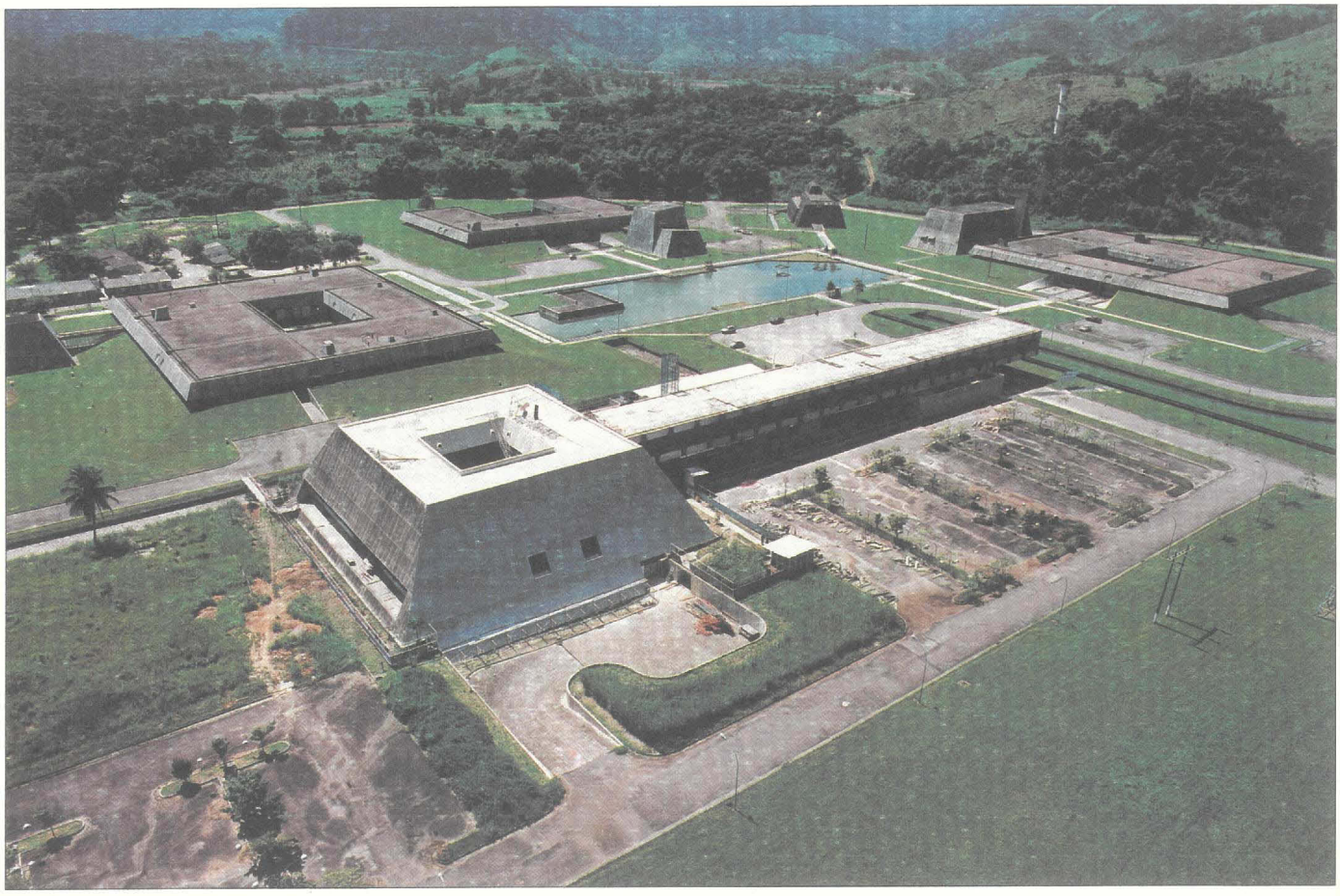

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CIML meets in Rio de Janeiro and visits INMETRO laboratories

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

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INMETRO LABORATORY COMPLEX AT XERÉM, BRAZIL

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Photo courtesy of INMETRO

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Editorial

Towards an auspicious 1998?

During the final months of 1997, a number of omens would seem to be indicating that positive events are in store for the OIML.

The Birkeland report was a key subject developed at the last meeting of the International Committee of Legal Metrology, and is already marking a decisive turning point in our Organization's long-term policy. Taking the metrological needs of society as its starting point, this report should come up with recommendations which aim to restructure and redirect OIML activity. The definitive conclusions of the report are due to be presented at the Committee's next meeting in Seoul in October 1998.

Cooperation between the OIML and a large number of other regional and international organizations should lead to interesting developments over the next few months: contacts with the World Trade Organization will be formalized, ties with the BIPM, IEC, ISO, ILAC along with the other organizations which cooperate in the context of the *"Joint Committee for Guides on Metrology"* will be developed, and responsibilities will be shared out in an equitable manner between international and regional levels.

An important step towards achieving this cooperation will be taken in June with the International Seminar on the economic and social role of metrology, jointly organized by the BIPM, IMEKO, OIML and the PTB and predominantly aimed at both developing countries and those in transition towards a market economy.

Lastly, it is anticipated that global involvement with the OIML will continue to expand with an increase in OIML Membership - in fact the number of Members recently overshot the symbolic one hundred mark.

So we wish both the OIML and all the readers of our Bulletin a very happy New Year. ■

Vers une bonne année 1998?

Un certain nombre de signaux annonciateurs d'événements peut-être heureux pour l'OIML ont été perçus au cours des derniers mois de l'année écoulée.

Sujet-clé de la dernière réunion du Comité International de Métrologie Légale, le rapport Birkeland semble d'ores et déjà constituer un tournant dans la politique à long-terme de notre Organisation. En partant des besoins de notre société en matière de métrologie, ce rapport devrait présenter des recommandations visant à restructurer et à réorienter l'activité de l'OIML. Les conclusions définitives sont attendues pour la prochaine réunion du Comité, en octobre 1998 à Séoul.

La coopération entre l'OIML et de nombreuses autres organisations régionales et internationales devrait connaître d'intéressantes évolutions au cours des mois à venir: officialisation des contacts avec l'Organisation Mondiale du Commerce, développement des liens avec le BIPM, la CEI, l'ISO, l'ILAC, et les autres organisations qui coopèrent au sein du *"Joint Committee for Guides on Metrology"*, répartition adéquate des responsabilités entre niveau international et niveau régional.

Une étape importante dans cette coopération sera franchie en juin avec le Séminaire International sur le rôle économique et social de la métrologie, organisé conjointement par le BIPM, l'IMEKO, l'OIML, et le PTB, et principalement destiné aux pays en développement et pays en transition vers une économie de marché.

Enfin, il est à prévoir que l'audience de l'OIML continuera de s'étendre avec l'augmentation du nombre de ses Membres, nombre qui a récemment dépassé le seuil symbolique de cent.

Bonne année donc à l'OIML! Et bonne année à vous tous, lecteurs de notre Bulletin! ■

PATTERN APPROVAL TESTING

Practical issues encountered in using simulation for EMS testing of fuel dispensers

K. BROWN, National Standards Commission, Australia

Abstract

Legal metrology refers to measurements performed for legal and trade purposes and includes a wide range of everyday measurements, such as for example petrol deliveries to motor vehicles. Inaccurate readings in instruments used for trade purposes can affect a large proportion of the population and can have significant economic consequences. A high level of accuracy and immunity to external influences such as temperature and electromagnetic interference (for example from mobile phones) is therefore necessary.

As a part of NSC's pattern approval testing (i.e. verification of an instrument's ability to retain calibration under various environmental influences) flowmetering devices can be tested for some patterns with flow simulation instead of their normal operation by fluid flow, in accordance with metrological requirements [1].

A number of recent publications have successfully addressed the need for manufacturers to have commonly accepted approved procedures and quality assurance systems for software used in measurement instruments [2, 3].

Similar requirements are now needed for those laboratories implementing control and simulation systems as an OIML requirement, both at product and generic levels.

This paper discusses the main issues involved in using additional control instrumentation for pattern approval testing, with particular reference to NSC's flow simulation system based on Labview software, used during electrical disturbance tests. Issues discussed include accuracy, implementation and traceable calibration.

1 Introduction

The use of simulation test systems in pattern approval testing introduces a number of new issues, such as:

- the need for guidelines for obtaining traceable calibration for the simulation system, and
- the evaluation of whether the modification to the instrument affects the essential nature or the severity of the test.

An example of a typical application of a simulation system in pattern approval testing is the simulation of the flow of liquid through a fuel dispenser: a stepper motor is used to drive the pulsar (the part of the meter which transforms rotational motion from the meter into electrical signals for the computer/indicator).

This method is implemented for radiated electromagnetic susceptibility (EMS) testing of fuel dispensers as it is undesirable to use actual fuel in the anechoic test chamber facility due to its associated occupational health and safety issues.

NSC's flow simulation system is basically comprised of the following hardware:

- computer;
- multi-function input/output card (which provides timing information for the pulse train generation and other signals);
- signal conditioning hardware;
- a motor driver board (which controls the rotational direction of the motor and the torque status);
- a stepper motor.

The software used in the configuration and design of the system is Labview, a program development application supplied by National Instruments [4] which uses a graphical programming language, G, to create code in block diagram form. The main control parameters are the stepper motor's speed, acceleration and direction of rotation, and the torque status. The motor is made to turn the measuring transducer, which transmits signals to the processor: the latter is the part of the meter which receives output signals from the transducer(s) and, possibly, from associated measuring instruments, transforms them and, if appropriate, stores the results in memory until they are used.

The dispenser's indicating device continually displays the measurement result in units of volume. In order to ensure correct flow simulation, the number of transducer revolutions must be accurate and reliable. A document has recently been drafted addressing the issues of quality, reliability and usability of computer systems used in metrology [5]. The guidelines specified therein are applicable to NSC's flow simulation system, and to all commercially acquired and in-house developed computer systems; they cover automated equipment used for the processing, manipulation, storage and retrieval of calibration or test data. Computer systems and/or automated equipment which do not have a direct impact on quality or whose functions and/or data are validated during use, or report-generated programs which may extract or report data, and equipment whose software is not treated as a discrete component of the automated system, may be treated as hardware and are not required to meet these guidelines.

The document describes the need to qualify the software systems used in the performance of critical or quality laboratory activities. This can be done in one of two ways:

- by verification and validation of software using the software life cycle approach [5], which requires a software quality plan to be in existence at the beginning of the cycle, and qualification of software development methods prior to use in laboratory activities;
- by validation of the software not using the life-cycle approach. This is applicable to software which has not been developed using the guidelines previously mentioned, and where testing should be the primary method of software validation - as in NSC's case. Testing and evaluation of the software system's correct functioning ensures that the code complies with software requirements.

Validation of modifications should be subject to testing, in order to detect errors introduced during the modification of systems or system requirements.

Measurements of the number of motor turns produced by NSC's flow simulation system have been performed to ensure that the software not only correctly performs all intended functions, but also that it does not perform any unintended functions which could degrade the entire system, either by itself or in combination with any other function. Measurements are performed by individuals other than those who designed the software.

Other metrological controls for software used in metrological instruments under test discussed in [2] and [3] (such as software sealing) could also be applied to simulation systems.

2 Experimental

2.1 Test set-up

2.1.1 Anechoic chamber

The radiated electromagnetic susceptibility tests of fuel dispensers are performed in an anechoic chamber, which is a shielded enclosure lined with material which absorbs electromagnetic field reflections. A broad-band antenna is used to generate an electromagnetic field in the test area over the required test frequency range, and a CCTV system is used to observe the EUT during the test.

2.1.2 Equipment under test (EUT)

EMS tests are carried out on the complete measuring instrument where size permits (for example a fuel dispenser for motor vehicles) as shown in Fig. 1, or otherwise a subsystem comprising at least the measuring transducer, calculator, indicating device, power supply devices and correction device (if applicable), as illustrated in Fig. 2.

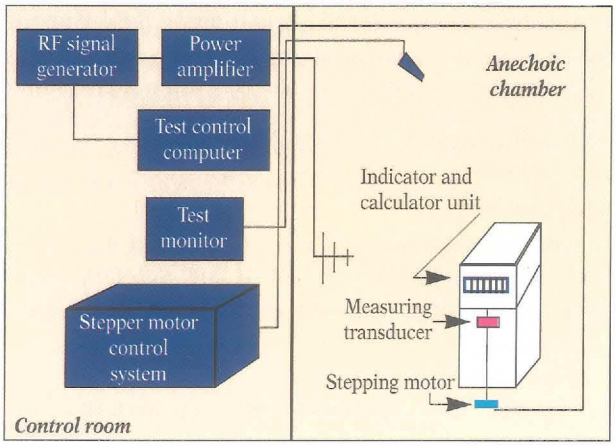

Fig. 1 Fuel dispenser

The instrument is tested in its final housing with or without the hydraulic devices.

When testing a subsystem, if all the devices are not in one housing, the electrical connections between the devices must be correctly made to ensure immunity from electromagnetic interference.

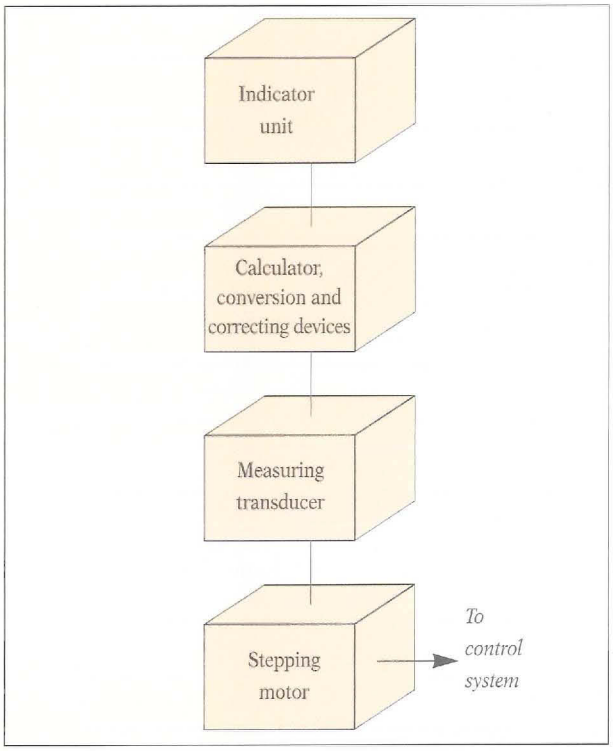

Fig. 2 Subsystem of the fuel dispenser

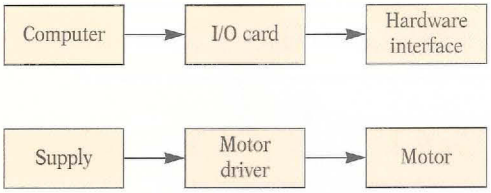

Fig. 3a System block diagram

A correction device is connected to (or incorporated in) the meter; this device automatically corrects the volume at metering conditions by taking into account the flow rate and/or characteristics of the liquids to be measured (viscosity, temperature) using associated measuring instruments, or stored in memory.

A conversion device automatically converts the volume at metering conditions into a volume at base conditions or into a mass [1].

2.2 Experimental design

2.2.1 Hardware

Figure 3 shows the main components of NSC's stepper motor system.

Two 82C53 16-bit counter timers on the I/O card are used (as well as the internal 2 MHz clock) to generate the required pulse train to the stepper motor. Some signal conditioning is applied between the motor driver and the computer.

The first counter timer (timer 0) is used to divide down the 2 MHz clock rate, and the second (timer 1) is used to keep count of the number of pulses applied.

The stepper motor/driver controls four main signals to the stepper motor, including the opto-isolator supply, pulse input to the motor (square wave), direction input and torque. The stepper motor is rated at 200 pulses per revolution (full step) and can be operated between 10–600 rpm for testing purposes.

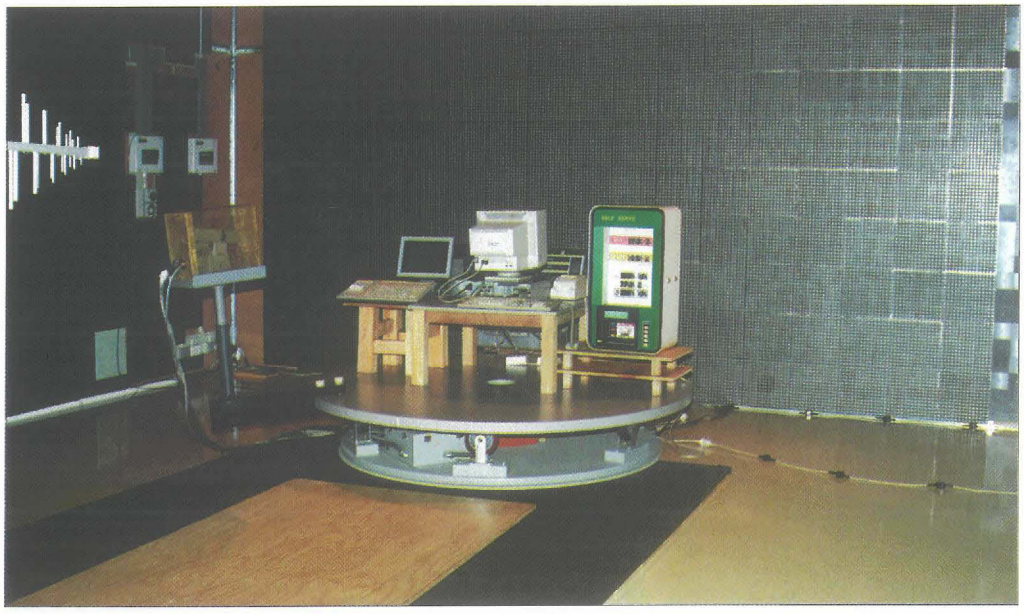

Fig. 3b Stepper motor system in NSC's chamber

2.2.2 Software

The Labview software includes libraries for data acquisition, data analysis, GPIB and serial instrument control, etc. Programs in Labview are called virtual instruments (VI's) because their appearance and operation can emulate actual instruments.

The software control program uses an algorithm to accelerate the motor to the required constant speed and to control the required number of motor turns (or pulses delivered to the motor). Acceleration control of the stepper motor is used to obtain the best performance at different motor speeds. A number of different methods or techniques could have been employed to achieve the same programming result; Figure 4 summarizes the main stages (including delays) of the simulation algorithm.

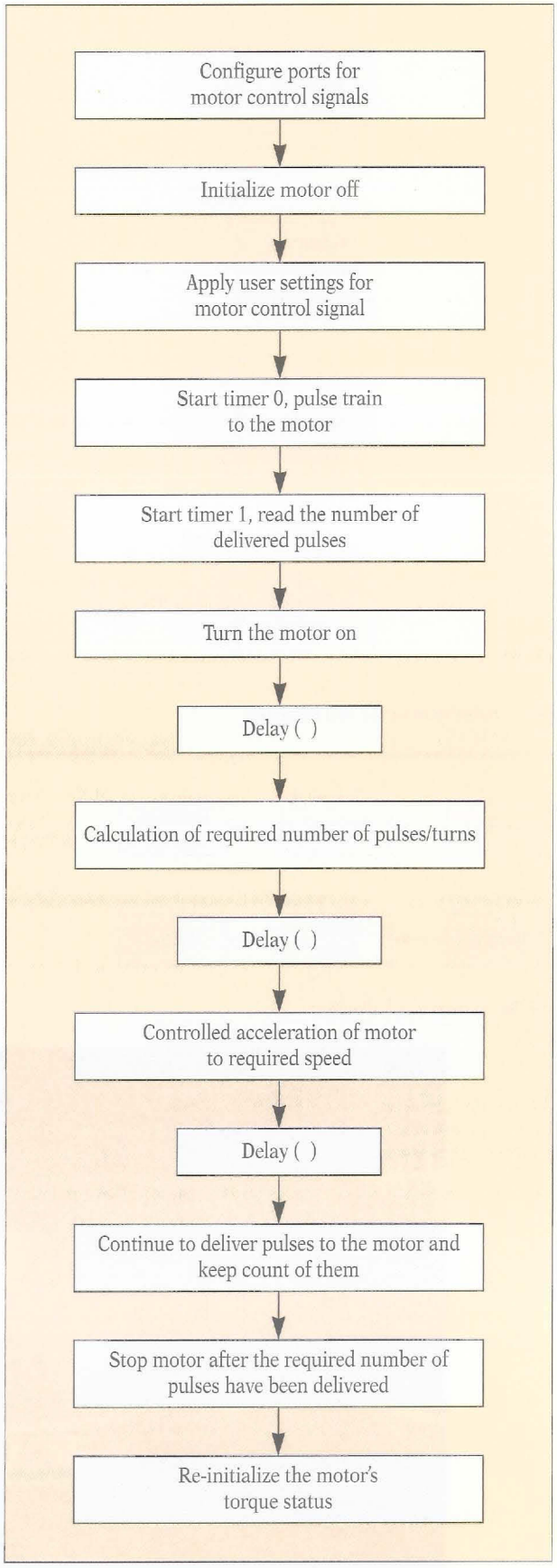

Fig. 4 Flow diagram of the stepper motor program

3 Experimental results

3.1 Introduction

Validation of NSC's stepper motor system was achieved by testing the accuracy and repeatability of the number of turns of the motor's shaft for a variety of different test conditions including motor speeds and initial acceleration rates, with and without radiated electromagnetic field interference over the required frequency range. The number of motor turns was fixed at 500, (i.e. $500 \times 200 = 10\,000$ pulses, compatible with the measurement uncertainty) counted by a mechanical counter which was attached to the stepper motor shaft. Being a purely mechanical device, the counter did not contribute to electromagnetic interference effects. Each test was repeated at least three times, over a range of motor speeds from about 100–350 rpm (equivalent to flow rates typical of fuel dispensers at motor vehicle service stations).

The inclusion of the stepper motor changes the shielding characteristics of the EUT, which is of particular significance in the case where the front covers of the EUT are not replaceable. This situation may result in a more severe test of the EUT's susceptibility to radiated electromagnetic fields.

3.2 Test results

There are basically three main data samples of results, each comprising 171 data measurements. One sample

was collected for horizontal antenna polarization without the effect of radiated electromagnetic field interference and the other two samples were collected for vertical antenna polarization, with the effect. The worst case accuracy recorded was 1.5 turns of the mechanical counter (which has a 5:1 ratio) which corresponds to 0.3 turns of the stepper motor - this only occurred once out of the total of 513 measurements.

Generally the standard deviation (i.e. the spread in the number of motor turns for a given input number of turns) is higher for horizontal antenna polarization and globally more consistent for the vertical antenna polarization for the frequency range.

3.3 Uncertainty

The mean and the standard deviation of the percentage errors (normal distribution) were calculated with the aid of a Windows compatible software program (*Uncertainty Calculator*) [6]. The uncertainty of each data sample was calculated for a 95 % confidence interval (CI) using the guidelines for evaluating measurement uncertainty [7] and a coverage factor of 2.

The method of measurement using a mechanical counter to determine the accuracy of the stepper motor system can be considered a primary method of measurement which was employed as described below [8].

A primary method of measurement is a method having the highest metrological qualities, whose operation can be completely described and understood, for which a complete uncertainty statement can be written down in terms of SI units, *and whose results are therefore accepted without reference to a standard of the quantity being measured.*

A primary method of measurement (such as counting with a mechanical counter) thus requires no additional calibration.

An initial experiment of the stepper motor's susceptibility to radiated electromagnetic fields showed an effect on the stepper motor's performance, i.e. the rotation speed varied at certain frequencies. Further shielding of the motor using techniques such as ferrite beads on control wires and shielded connectors eliminated these perturbations.

The calculated uncertainties of a motor turn for different antenna polarizations and with and without RFI did not exhibit significant statistical differences.

This means that the accuracy of the stepper motor system is slightly affected by the radiated electromagnetic field interference (EMI) but not significantly (the maximum deviation from the reference number of turns was not worse). This could possibly be due to EMI effects at the point of penetration of the motor shaft in the enclosure. The uncertainty for the horizontal antenna polarization (HP) was slightly larger than that for the vertical antenna polarization (VP), which indicates that the antenna polarization may have an effect on the accuracy of the stepper motor system and which may have been a function of the orientation of the stepper motor when tested.

4 Discussion

Mechanical alignment between coupling components such as the stepper motor shaft and the mechanical counter affects the accuracy of the system's performance. Poor mechanical connections in the motor set-up can lead to friction, noise and vibrations which are sufficient to produce an incorrect number of motor turns.

The radiated electromagnetic field is applied only when the stepper motor has reached the required constant speed.

Further validation of NSC's stepper motor system could be performed using a 1:1 mechanical counter rather than the existing 1:5 mechanical counter used for this paper (the only one available at that time for NSC testing). Any variation due to random errors in the mechanical counter were taken into account in the uncertainty calculation.

The uncertainty was evaluated as a proportion of the number of reference turns, i.e. the assumption that the error is dependent on the total number of rotations; further measurements could be made to finalize this. Interference is not noticeable at particular frequencies or n bands of frequencies.

5 Conclusion

The stepper motor system is adequately immune to radiated electromagnetic fields and has good accuracy and repeatability.

The uncertainty of NSC's flow simulation system has been calculated to be 0.036 of a turn (worst case) which corresponds to approximately 13 degrees of a complete rotation.

6 Acknowledgments

The technical assistance of Dr. Mark Gross, School of Electrical Engineering, University of New South Wales in Labview implementation is greatly appreciated.

The experimental assistance from Henry Li, NSC's EMC technical officer is valued. Also, the encouragement and editing by NSC staff is acknowledged. ■

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TRACEABILITY

Traceability and quality assurance

DR. D. KISETS, National Physical Laboratory, Jerusalem, Israel

Abstract

Two kinds of traceability hierarchies exist which interact to give the quality of measuring instruments or other entity: the tree of quality characteristics and the measurement traceability chains which ensure traceable measurements of all characteristics.

The significant problem which arises when carrying out quality assurance according to ISO 9000 standards is to establish a well-founded, unified and practical way of providing this interaction.

As a development of the author's papers Optimum traceability type hierarchies *and* Improvement of traceable measurements, *published in the April and October 1997 issues of the OIML Bulletin respectively, this third paper presents a method to consistently and successively select the quality characteristics and establish the appropriate measurement accuracy requirements for them.*

As in the previous two articles, the theses of this paper are based on the concept of systems, "Qualimetry and Theory of Information", and mathematical expressions, data and procedures which can be used in practice are also suggested. The author believes that this paper may be of interest both to the OIML and to all those concerned with metrology and quality assurance activities, since its major goal is to focus the attention of professionals in the fields of design/development, metrology, Quality Assurance (QA), Quality Control (QC) and standardization on the problem of combining measurement traceability and measurements in an industrial context with the hierarchy of quality characteristics, as well as to provide them with the general procedure for enriching QA activity on this subject.

1 Introduction

Both established theory and, more importantly, industrial experience serve to demonstrate that appropriate metrology is a vital element in any worthwhile quality program, as well as in a number of other aspects of manufacturing and service.

Metrology has an obvious role in determining whether a product "measures up" to a standard: given that it is essential that products are standardized for trade, metrology is assumed to be a fundamental pillar to ensure free and fair trade [1], covering a range of issues including the design, procedures, product analysis, production and quality control of measuring instruments and systems. Whatever issues affect the measuring equipment industry and the actual application of measuring instruments in the field also affect legal metrology.

Traceability is one of the key problems in question. Any kind of traceability is based on a systematic approach and on the hierarchy principle. This, together with the principle of *information cyclicity* (developed in [2] and [3]) allowed the accuracy coefficient (ρ) and confidence (C) in evaluating measurement uncertainty to be optimized. The USAC was developed and the optimum values $\rho_o = 1/2\pi$ and $C_o = 1 - 1/4\pi$ for the USAC levels were determined [2]. Subsequent development [3] concentrated on the optimum selection of uncertainty components for uncertainty budgets and on the calculation of their best values, with the objective of specifying the optimum expanded uncertainty and improving calibration, verification and validation activity.

Quality measurements do not resolve themselves only in the framework of measurement traceability. In terms of ISO 9000 standards, initial quality characteristics data to be measured are created by the major components of the quality loop which, as a feedback, affect the quality of measurement information on product quality. In other words, the optimization of the completeness of the characteristics to be measured and the measurement information to be obtained must be carried out at each level of product creation. QA and QC encompass all these aspects together with other problems including measurement traceability itself.

Along with the latter [4] the author feels to a certain extent that the following OIML fields also ought to be classified as QA and QC activities:

- metrological supervision of measuring instruments: verifying that a measuring instrument is manufactured to a quality level which respects the prescribed technical and metrological characteristics [5];
- assessment of stability and metrological reliability of measuring standards: studying and examining the design, construction and principles of operation of a standard, and evaluating the materials and methods used during its manufacture and assembling [6];
- verification and test: performing the initial verification of measuring instruments by QC [7], and the functional tests and metrological examination of verification equipment [8].

Unfortunately, QA currently merely serves to link together measurement traceability and the hierarchy of product/production characteristics. The critical intermediate link between these two hierarchies through ρ and C is either absent, or at best far from optimal. This situation results either in ignoring significant measurements or in being a generally incorrect philosophy and strategy for dramatically reducing measurement uncertainty and, consequently, both the quality of the product and the effectiveness of measurements at all stages of production and test are significantly decreased. The purpose of this paper is therefore to help eliminate this QA gap.

2 Diverse hierarchies

The concept of systems is at the core of current theories, and attempts to create effective activities in the field of QA and QC. At least three well-known names may be singled out as sources which developed this concept:

- Charles Sanders Peirce with his system of science called *Pragmaticism* - Peirce sought quality in *reasoning* and *measurements* and was equally concerned with errors in measurement, as were Shewhart and Deming [9];
- W. Edwards Deming with *Profound knowledge*, and
- Walter A. Shewhart with his *Theory of quality management*.

Reasoning and measurements are two core subsystems forming the quality of an entity, when considered in conjunction with the concept of systems. Despite the fact that these subsystems are closely interconnected, they also relate to completely different hierarchy types, and are consequently based on the different traceability principles. Whilst measurements refer to applied metrology and measurement traceability, the reasoning refers to qualimetry [10] and to a type of traceability which may be called "functional traceability".

In terms of the ISO conception of quality planning, the notion of functional traceability has a bearing on identifying, classifying and "weighting" the quality characteristics. This notion directly results from qualimetry principles, amongst which the following are of prime importance in this context:

- a quality is considered to be a hierarchy of the quality characteristics which has undergone both measurements and some other estimation, while characteristics of any "i" hierarchy level are dependent (as functions or a correlation) on the (i + 1) level. This system represents the so-called "hierarchical tree" of quality characteristics;
- each quality characteristic is determined by two quantitative parameters: the relative characteristic (estimate) and weight (significance). The estimates and weights of the "i" level are, in turn, dependent on those of the (i + 1) level;
- the sum of weights belonging to each level is constant (generally $\Sigma = 1$).

In terms of ISO 9000 standards, design/specification engineering and product development are the main phases of the quality system for defining those characteristics which are important for the quality of the product or service, including performance target values, tolerances, acceptance and rejection criteria, test and measurement methods and equipment.

Some other phases of the quality loop, such as procurement, process planning and development, production, testing and examination, directly define requirements for the measurement of quality characteristics. The hierarchy tree of quality involves all the information, adapted to the quality characteristics according to the above sources. The identifications recorded (conformity of parts and materials to appropriate specifications before being used in production) are also to be taken into consideration when constructing the hierarchy tree and relevant quantitative limitations.

As for measurement traceability, it is well known how important it is to ensure the proper dissemination of measurement units in order to ensure reliable and effective quality measurement information. Both the USAC and various methods for improving traceable measurements are useful to this end, and all are based on the systematic approach and on the principle of information cyclicity.

The problem is how to combine measurement and functional traceability to the best advantage as a common system aimed at carrying out QA at the level of engineering analysis (to follow ISO 9000 general requirements). Unity of objectives, principle and procedure are features that can combine both hierarchies.

Optimum information on the quality of an entity is the objective of the hierarchies considered, i.e.:

1) the optimum completeness of quality characteristics to be measured (carried out in the framework of functional traceability), and
2) the optimum accuracies of measurements (carried out in the framework of measurement traceability hierarchies).

The principle of optimal proportion (through ρ_o) inherent in the Unified Scale of Accuracy Classification (USAC) is fully applicable for the optimization of completeness of quality characteristics (by their weights) at each hierarchy level of functional traceability.

The procedure which aims to achieve the objective of combining the hierarchies' directions is presented in section 3. Figure 1 illustrates the conventional link between the two hierarchies in question.

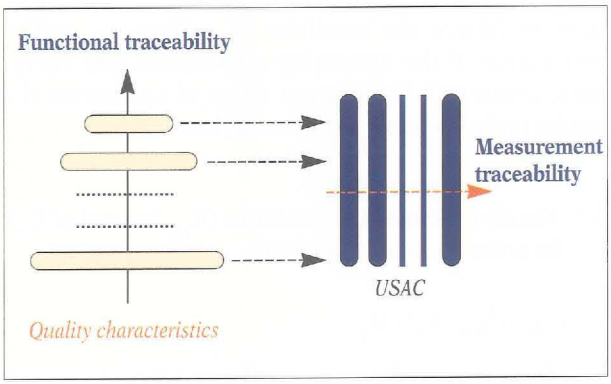

Fig. 1 The link between functional and measurement hierarchies

The hierarchy levels are indicated as horizontal bars for the quality characteristics, and vertical bars for measuring instruments. The dotted arrows indicate that for all characteristics of each hierarchy level concerning functional traceability, the defined Measurement Methods and Equipment (MME) are subject to treatment in terms of measurement traceability and are therefore to be considered in the framework of the USAC.

Thus the proper way to solve the problem is by optimizing functional traceability in respect of measurement information and by using the same optimization criteria as those accepted for measurement traceability. It should be emphasized that, as distinct from the USAC, the optimization of the functional traceability hierarchy in question is of a local nature. This means that the optimization does not concern the values of quality characteristics or their functional couplings which fall into the field of qualimetry and not metrology.

3 QA procedure

The principles and calculation methods of qualimetry and statistical process control (SPC) are common practice. The IQ-criterion and the principle of information cyclicity [2, 3] may also be readily used in practice. The following procedure briefly explains the QA of joint functional and measurement traceability.

3.1 Ensuring initial data

The initial totality of n_i measurable (and other) quality characteristics (X_{ij}) and their tolerances (D_{ij}), if any, are defined at each (i) level of the quality tree hierarchy (i = 1, 2, . . . , m levels; j = 1, 2, . . . , n_i characteristics at each level). The totality of the quality characteristics (mainly those of the 1st level, which are in fact the object of quality estimation as a whole), are to be determined to ensure maximum customer satisfaction.

3.2 Determination of weights (K_{ij}) for the characteristics of the 1st level (and further levels up to m)

$K_{11}, K_{12}, \ldots, K_{1n1}$

$K_{21}, K_{22}, \ldots, K_{2n2}$

. . . . . .

. . . . . .

$K_{m1}, K_{m2}, \ldots, K_{mnm}$

The following ought to be taken into consideration when determining the weights:

(a) the calculation of weights of level (i + 1) is to be carried out allowing for those weights which belong to the characteristics of the i level, functionally or by correlation coupled with the respective characteristics of level (i + 1), and

(b) the weights of each level are calculated to satisfy the condition

$$\sum_{j=1}^{ni} K_{ij} = 1$$

The method of statistical treatment of experts' estimates is generally used for determining the weights of the 1st level. Any applicable mathematical methods (functional and correlation analysis, experiment planning, etc.) are useful for determining weights at the other levels. In the case of correlated characteristics, a reasonable method of calculating the weights is one similar to that described in [3] for the determination of combined uncertainty. The observance of the qualimetry principles mentioned above is of great importance when calculating the weights.

3.3 Calculation of the lower limits of weights ($K_{i\varphi}$) at all hierarchy levels according to one of the following expressions:

- General expression:

$K_{i\varphi} = \arg [K_i(j)]$, when $j = \varphi$,

where:

$$\varphi = \exp \left[- \sum_{j=1}^{ni} K_{ij} \ln K_{ij} \right]$$

- Simplified expression:

$K_{i\varphi} = K_{1j} / 2\pi$

3.4 To complete the first part of the procedure (related to the functional traceability), the informative quality characteristics of each hierarchy level are extracted by the following formula:

$K_{ij} \geq K_{i\varphi}$

3.5 Process capability assessment

In this statistical process control (SPC) phase of QA every individual manufacturing operation is analyzed and efforts are made to reduce process variability by achieving a process capability index of $C_{Pij} \geq 1.33$ [11]. These efforts involve all manufacturing equipment and include the process environment (e.g. temperature and humidity), the materials used, the work force and the manufacturing methods employed. These elements form part of the initial data (see point 1), and are individually studied using statistically designed experiments to reduce variability and achieve the required C_{Pij}.

On this subject, the determination of process variation widths (Δ_{ij}) as parts of the absolute design specification tolerances (D_{ij}) is of particular concern and is carried out as follows:

$\Delta_{ij} = D_{ij} / C_{Pij}$

All the following points are related to the creation of traceable measurements regarding measurable quality characteristics.

3.6 Accuracy coefficients (ρ_{ij}), confidences (C_{ij}), uncertainties (u_{ij}) and their relative values (U_{ij}) are calculated according to the formulae presented in Table 1.

Table 1 Accuracy coefficients, confidences and uncertainties

ρ_{ij}	C_{ij}	u_{ij}	U_{ij}
$K_{\varphi i} / K_{ij}$	$1 - 0.5\,\rho_{ij}$	ρ_{ij} / Δ_{ij}	u_{ij} / X_{ij}

The uncertainties obtained (U_{ij}) are so-called intrinsic optimum relative uncertainties, which can be used to relieve the condition of calibration and/or verification of the measuring instruments and equipment concerned. However, in terms of unification the results probably ought to be recalculated.

3.7 Recalculation of uncertainties (U_{ijR} instead of U_{ij}) in order to meet the USAC:

$U_{ijR} = (k_{0.92} / k_{ij}) \cdot U_{ij}$

where: $k_{0.92}$ = the coverage factor which is related to the optimum confidence $C_o = 1 - 1/2\pi = 0.92$ inherent in the USAC traceability hierarchy;

k_{ij} = the coverage factor which is related to the obtained value of C_{ij}.

3.8 Selection of MME corresponding to the obtained uncertainties U_{ijR}

3.9 Determining the place of each established MME in the USAC

3.10 Follow-up

The preceding analysis is complemented with the requirements for calibration, validation or verification

of MME, including the traceability chain, calibration or verification intervals, place of calibration/verification, etc., and their fulfillment. It is important at this QA stage to demonstrate that the integrity of traceable measurements is ensured [3]. At least two problems must be solved:

1) the measuring instruments and measuring sections of production equipment must be calibrated or verified with an accuracy level corresponding to the optimum accuracy coefficients found according to the present procedure, and
2) the calibrations, verifications and metrological validations must be carried out by competent metrological services which meet the requirements of ISO Guide 25 [12].

Clearly, the proposed method represents a very high level of generalization which corresponds to the requirements or recommendations usually reflected in generic metrology and standardization documents. That is, incidentally, why it is impossible here to give detailed examples of how the method is actually applied - this would require data emanating from extensive studies in the sphere of qualimetry rather than metrology, and the variety of specific aspects which may be considered would require a more specific method anyway.

Use of the proposed QA procedure does not present any difficulty if its consideration is limited to the general form presented here, though difficulties may occur when the initial data are not sufficient to carry out reliable calculations. The competence and professionalism of those involved in constructing or assessing the functional hierarchy on the one hand and the reliability of methods used for calculating the weights of quality characteristics on the other hand are always of prime importance.

4 Estimation qualities

The proposed procedure allows the optimization of measurement accuracy for all measurements at all stages of production or service. Moreover, it optimizes the number of measured parameters and measurement operations. Theoretical evaluation indicates that on average 16 % of the initial quality characteristics of the lowest weights are expected to be rejected from those undergoing measurement, when the proposed method of quality analysis is applied.

Accordingly, what is the evidence of a reliable estimate in this case? Three important qualities ought to be considered for each hierarchy level, detailed in 4.1–4.3.

4.1 Accuracy persistence

The accuracy persistence may be defined as a quality of estimation which ensures that any restriction of the initial quality characteristics does not lead to a deterioration in measurement accuracy. Brief conclusive proof of the existence of this quality may be readily achieved in terms of the "informational theory of accuracy" [13] as described below.

The value of $(-\ln K_{ij})$ is considered in this case as being the measure of the so-called "partial information" obtained due to the measurement of a single (j) characteristic (since the weights are considered as probability estimates). As any rejection of characteristics from their initial totality leads to a proportional increase in the weights of the remaining ones due to the mandatory condition (Σ weights = 1), the remaining partial information also increases. The more information there is, the higher the accuracy must be. This tendency is fulfilled due to the proportional decrease in ρ_{ij} and increase in C_{ij} for the remaining characteristics and the constancy of the highest optimum accuracy coefficient, i.e. $\rho_{i1} = 1/2\pi$. The result is that the quality of measurement information does not decrease.

4.2 Estimation reliability

The estimation reliability (P_{Qi}) may be defined in terms of the quality of measurement information as a function of relative quality loss (L_{Qi}) [3] and is determined as follows:

$$P_{Qi} = 1 - L_{Qi}$$

$$= 1 - (1/K_{i1}n_i) \cdot [K_{i\varphi o} + K_{i\,(\varphi o + 1)} + K_{i\,(\varphi o + 2)} + \ldots + K_{i\,\varphi oM}]$$

where: φ_{io} and φ_{ioM} = the minimum (when $\rho_{io} = 1/2\pi$) and maximum (when $\rho_{io} = 1/4\pi$) permissible number of informative characteristics respectively.

The representative values of P_{Qi} may be obtained by using the best model of weights diagram, i.e. the linear diagram ($\Delta K_{ij} = K_{ij} - K_{i(j+1)}$ = constant). In this instance the following expression is true:

$$P_{Qi} = 1 - 0.125\,[(0.75/\pi^2) + (1/n_i\pi)]$$

Numerical values of $P_{Qi}(n_i)$ are presented in Table 2, and illustrate a very high and stable reliability estimate.

Table 2 Estimation reliability

n_i	2	7	14	20	26	38	∞
P_{Qi}	0.971	0.985	0.988	0.989	0.989	0.989	0.990
C_{Qi}	0.90	0.89	0.88	0.88	0.88	0.88	0.87
k_i	1.63	1.56	1.55	1.54	1.54	1.53	1.50

4.3 Estimation confidence

The total confidence of the quality estimation at each hierarchy level (C_{Qi}) depends on the total coverage factor (k_i) which, in turn, is calculated as an average weighted function of the coverage factors (k_{ij}) corresponding to $C_{ij} = 1 - 0.5\,\rho_{ij}$. Thus the general expression ($k_{i\,(G)}$) and the expression which is true for the linear diagram of weights (k_i) are as follows:

$$k_{i\,(G)} = \Big(\sum_{j=1}^{\varphi i} K_{ij}\,k_{ij}\Big) \Big/ \sum_{j=1}^{\varphi i} K_{ij}$$

$$k_i = \frac{\Big[\sum_{j=1}^{\varphi i} 2(n_i - 1 + j)k_{ij} / n_i(n_i + 1)\Big]}{\Big[\sum_{j=1}^{\varphi i} 2(n_i - 1 + j) / n_i(n_i + 1)\Big]}$$

The calculated data of k_i and the respective values of C_{Qi} for the linear diagrams and the normal distribution are given in Table 2. Similar to P_{Qi}, they illustrate high stability within the range of n_i.

The following condition must be satisfied according to the principle of information cyclicity with regard to the relative estimation error ($\Delta k_i/k_i$) in order to judge the quality of the obtained results with total confidence:

$$(1/2\pi) \geq (\Delta k_i/k_i) \geq (1/4\pi)$$

where: $\Delta k_i = \max(k_i) - \min(k_i)$;
$\max(k_i) = 1.63$;
$\min(k_i) = 1.50$ (see Table 2).

The value of $\Delta k_i/k_i$ is found to lie within narrow limits, i.e. from $(1/3.99\,\pi) \approx 0.080$ to $(1/3.67\,\pi) \approx 0.087$, and can therefore be considered as proving the above condition as well as confirming the above estimation stability.

5 Conclusions

5.1 Functional traceability forms the basis of quality creation and therefore demands a circumstantial analysis aimed at encompassing all the initial quality characteristics which undergo measurement and estimate. This analysis is needed for the accurate calculation of the characteristics' weights.

5.2 Measurement traceability and traceable measurements provide the quality with the required measurement information. The measurements also have an active influence on quality through the measuring instruments and measuring sections of production equipment, thus ensuring the necessary feedbacks in a manufacturing context.

5.3 The concept of systems, IQ-criterion and principle of information cyclicity render it possible to harmonize the two different traceability systems and combine them into a unified optimum system. In this way QA becomes more logical, and the relevant ISO 9000 requirements are enriched with a practical method for fulfilling them.

5.4 Stability and the restriction of quality characteristics are the key features of the unified traceabilities system; any restriction automatically results in increasing measurement and estimation accuracy.

5.5 Among the various planned and systematic activities which can be implemented within a quality system (according to ISO 9000) the proposed QA procedure is:

- of special importance because it uses facts and figures directly related to quality characteristics as well as to the measurement information and the efficiency of their estimation;
- universal, as it is applicable at all stages and levels of design/development and production activities and for both kinds of QA, i.e. internal (providing confidence to management) and external (providing confidence to customers);
- fully unifiable, as it is based on relative values and can be universally applied for all entities irrespective of their physical, operational or other features;
- characterized by accuracy constancy, high and stable estimation reliability and estimation confidence.

5.6 The procedure appears to be sufficiently formalized for it to be considered as a basis for the preparation of generic standard recommendations

in the framework of OIML and other international organizations. In the author's opinion the most reasonable way might be the development and publication of such a document under the aegis of the OIML and ISO. Besides this, the procedure appears to be suitable for widespead use. ■

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32nd meeting of the International Committee of Legal Metrology

Rio de Janeiro, 29–31 October 1997

*At the invitation of the Brazilian Government, the **32nd meeting of the International Committee of Legal Metrology** was held in Rio de Janeiro, Brazil, from 29 to 31 October 1997.*

The 32nd meeting of the International Committee of Legal Metrology, a Workshop entitled *Metrology Development in the World* and a meeting of the OIML Development Council (see articles) were jointly organized in the Hotel *Le Méridien* on the picturesque Copacabana sea-front in Rio de Janeiro.

With a population of around six million Rio is a major city, offering eye-opening natural sites such as the world-famous Sugar Loaf and the Corcovado mountain with its dominating statue of Jesus Christ the Redeemer, to name but two.

Seventy-four delegates from thirty-eight Member States, together with four BIML Technical Agents, were present at the meeting. ■

Opening of the meeting

Mr. Gerard J. Faber, President of the International Committee of Legal Metrology, opened the 32nd meeting by introducing and welcoming three guests: Mr. Oscar Lourenzo Fernandez, Secretary for Industrial Technology at the Ministry of Industry and Commerce, Mr. Julio Cezar Carmo Bueno, President of INMETRO and finally the CIML Immediate Past President, Mr. Knut Birkeland. ■

Opening address by Mr. O. Lourenzo Fernandez

On behalf of the Minister of Industry and Trade, Mr. Fernandez warmly welcomed all those attending the 32nd CIML meeting.

He emphasized that this was the first such event in Brazil, and acknowledged the growing importance of metrology, which was becoming an increasingly popular activity due to the granting of labels and INMETRO seals of approval for consumer products - a highly successful action.

Opening addresses were given by (left to right):

Mr. Gerard J. Faber, President of the International Committee of Legal Metrology
Mr. Oscar Lourenzo Fernandez, Secretary for Industrial Technology at the Ministry of Industry and Commerce
Mr. Julio Cezar Carmo Bueno, President of INMETRO

This meeting, he declared, was an important exchange for the continued successful development of Brazil's metrological activities, regarded as key for the future. ■

Opening address by Mr. J. C. Carmo Bueno

"I have great pleasure in welcoming everybody to the 32nd meeting of the International Committee of Legal Metrology, here in Rio de Janeiro. I am particularly proud, as this is the first time that a Latin American country has had the honor of hosting an event of such great importance in the legal metrology field.

It is important to point out that Brazil constructed a very large industrial sector, based on the strategy of a closed economy, in which imports were discouraged, for about forty years. This policy was only changed at the beginning of the nineties, with the opening up of our economy. Consequently, competition became a determining factor in the success and even in the permanence of business in the globalized market. In this manner, metrology, standardization and quality assumed a crucial role in the Brazilian scenario.

Another fundamental question is that of the process of reconstructing democracy in Brazil, a process which began in around 1984. Civil society took on a more relevant role within the national context. A modern consumer protection code was adopted, and a large number of non-governmental organizations emerged which were dedicated to this area. The result of this movement was the progressive awareness of the Brazilian public as to the importance of metrology, standardization and quality. Well informed consumers result in more demanding consumers, which leads to the general promotion of quality of products and services.

It is worth observing that the process of technological development, which is accelerating the globalization process, uses metrology as its basis. Brazil's first great effort within this movement has been in the creation of the economic block of the MERCOSUR, together with our neighbors and partners Argentina, Paraguay and Uruguay, using the harmonization of metrology, standardization and conformity assessment systems as a starting point. Another relevant effort for economic integration, which has been promoting these issues, is the creation of the FTAA (the Free Trade Area of the Americas).

It is important to emphasize that in Brazil, the National Institute of Metrology, Standardization and Industrial Quality, INMETRO, which forms part of the Ministry of Industry, Trade and Tourism, is responsible for promoting and developing these activities at national and international levels. INMETRO has twenty laboratories in operation, which are installed on the national metrology laboratory campus in Xerém, near Rio de Janeiro, and which maintain the national metrological standards.

It is INMETRO's clear philosophy that it is of vital importance to participate in international fora, such as the OIML and the BIPM, the IAF, SIM, IAAC etc. in order to influence the preparation of international and multilateral agreements, as well as to participate in events such as this.

At present, Brazilian society is making an enormous effort in terms of searching for both quality and productivity. ISO 9000 has become a popular term, synonymous with quality, and metrology, the science of measures, forms the basis of this movement. More specifically, it is the area of legal metrology which is directly concerned with the health and safety of citizens, environmental protection and the economic defense of the consumer. The legal metrology network, with INMETRO acting as the national coordinator, is responsible for controlling this field. It is also important to point out that legal metrology sponsors the scientific and industrial metrology activities, and plays a role of progressive importance in the Brazilian economy, especially in the light of the government's privatization policy.

Delegates attending the 32nd CIML meeting

Today's meeting is part of Brazil's strategy to show the world that we are serious about quality, and that a product made in Brazil is made with quality. Today we are realizing a dream which began two years ago in China, when I discussed the possibility of hosting this Conference in Brazil with the President of the CIML, Dr. G. J. Faber. We are grateful to have this opportunity to show you our city, and to finish, I would like to quote the Pope John Paul II who, on his recent visit to Brazil, said that the divine architecture of this beautiful city illuminates all who visit it.

Thank you, and please enjoy your stay". ■

Opening address by Mr. Gerard J. Faber

"This is the third meeting of the International Committee of Legal Metrology that I have the honor of chairing and it is always with the same pleasure that I see so many of you responding positively to my invitation to our autumn rendez-vous.

Both last year's and this year's meetings have something in common from a geographical point of view, both being held on the American continent; however, the latitudes of the two meetings are somewhat different: last year, the Canadian maple-trees were already flaunting their magnificent autumn colors; today in Rio, it is the spring which welcomes us and I do hope that you will be able to resist the attraction of Copacabana beach so that our discussions may continue with the necessary number of participants!

In this opening address, I will try to paint a condensed but clear picture of the situation of our Organization and of the general orientations we should follow. But before that, let me welcome our new Members.

First of all, it is with great pleasure that we have been informed that the Islamic Republic of Iran, one of the OIML founder countries, recently decided to rejoin our Organization which it had left some twenty years ago. Today, this Member is represented by Mr. Moslem Khorram whom I am glad to welcome.

Concerning the CIML itself, the changes since our last meeting are as follows:

- for Bulgaria, Mr. Temniskov has replaced Mr. Zhelev;
- for Cameroon, Mr. Ela Essi has replaced Mr. Nssilak à Nssok;
- for Israel, Mr. Deitch has replaced Mr. Ronen;
- for Japan, Mr. Imai has replaced Mr. Kurita;
- for the Republic of Korea, Mr. Yoo-Jin Koh has replaced Mr. Yoon Kyo Won;
- for Romania, Mr. Ocneanu has replaced Mr. Stoichitoiu.

To all these new Members I am pleased to extend my warmest welcome and to thank them for their continued interest in our work.

I shall now summarize the main events in the life of the OIML since our last meeting, which coincided with the Tenth International Conference of Legal Metrology.

This Conference was without doubt an important milestone in the life of the Organization. From the discussions held and the resulting decisions taken, a number of significant actions have been launched and I would like to report back to you concerning their progress.

In my opinion the most significant action consists in reflecting on the role legal metrology and, more generally, metrology, will play in tomorrow's society. The Conference had already discussed certain of these aspects when considering the OIML long-term policy; following these discussions, the Presidential Council, assisted by a small group consisting of myself, the two Vice-Presidents and the Director of the Bureau, devoted a lot of time and effort to this reflection.

One of the conclusions you are already aware of was to appoint our Immediate Past President, Knut Birkeland, as OIML Consultant with a view to developing a paper in this respect.

I will not elaborate more on this topic: Knut Birkeland is participating in our meeting and sufficient time will be allowed for him to inform us about his views and the ways in which he has set about the matter, and for us to react to his initial proposals and to discuss them.

Another topic which seems to be progressing satisfactorily is the reflection on accreditation in legal metrology. I asked our Vice-President Dr. Chappell to chair a working group consisting of a number of experts; the group met earlier this year at NWML and will meet again here on Saturday. In between, Sam Chappell will have reported on the progress made.

A third topic deals with developing countries. As you remember, this was a subject for possible close cooperation between the BIPM and our Organization. I have been informed that interesting progress has been made, which was discussed this morning during the Development Council meeting and about which a report will be presented to us later this week.

Other interesting information will be given to us, for example concerning the developing cooperation between the World Trade Organization and OIML, and the Joint Committee for Guides in Metrology which will supersede ISO/TAG 4 and which will hold its first meeting at the BIML within two weeks.

Does this mean that everything is going well in our Organization? Unfortunately not, and indeed there are a number of aspects of our activity which will soon have to be reconsidered, addressed and improved to the greatest extent possible.

First of all we must recognize that it has not been possible to implement immediately all the decisions taken at the Tenth Conference.

For example, the excellent idea of convening a meeting with representatives of industry and of legal metrology has not been realized; in fact, it is probably worthwhile to wait until we have reached a more mature reflection on the future of legal metrology before starting discussions with our industrial partners.

Concerning cooperation between the OIML and other institutions, I must recognize that some dark points still exist: it seems obvious that cooperation with the BIPM will not increase as much as some of us had hoped and, for some years at least, will be limited to developing countries. Another unsatisfactory aspect of this cooperation concerns the European Union, where the compatibility of the future metrological regulations with existing OIML Recommendations cannot be taken for granted.

The developments of the OIML Certificate System have been quite satisfactory if we just consider the number of certificates issued, but far less satisfactory if we take into account other important aspects of this System, such as wider acceptance of certificates or a significant increase in the number of categories of measuring instruments for which manufacturers are interested in receiving certificates.

Last but not least, the global technical activity of the OIML seems to be decreasing significantly, as can be seen from the number of technical committees and subcommittees which are actually active, and from the number of draft Recommendations presented for approval at this CIML meeting.

Several explanations may be given, for example the decreasing human and financial resources of our Member States, or the necessity to devote more time to regional cooperation.

We must also recognize the fact that a portion of our current technical work does not generate much interest from many of our Members. This perhaps means that most of the legal metrology field has already been covered at international level and that there is not so much need for additional work. If this is the case, we should perhaps examine whether it would not be appropriate to redirect our technical activity, for example by further limiting our technical program but, at the same time, undertaking a systematic revision of existing OIML Recommendations with a view to simplifying them by eliminating that which is not strictly relevant to essential metrological performance and testing.

These are, my dear Colleagues, my views concerning the present situation and the future of the OIML. With your agreement, it is bearing these facts and reflections in mind that I would like to conduct our discussions.

Thank you for your attention, and thank you for your active participation in our discussions". ■

Rio by night, seen from the Sugar Loaf

Agenda

Opening address

Roll call - Quorum

Approval of the Agenda

1 Approval of the minutes of the 31st CIML Meeting

2 Member States and Corresponding Members
2.1 New Members - Expected accessions
2.2 Situation of certain Members

3 Financial matters
3.1 Adoption of the auditor's report for 1996
3.2 Examination of the financial situation for 1997 and estimates for 1998

4 General information concerning the implementation of decisions made at the Tenth Conference
4.1 The OIML long-term policy and the Birkeland study

5 Activities linked with accreditation and establishment of mutual confidence regarding legal metrology activities within the OIML Members

6 Technical committees and subcommittees
6.1 Examination of the situation of certain TCs/SCs

7 Approval of International Recommendations

8 OIML Certificate System
8.1 General information regarding the operation of the System
8.2 Revision of the paper governing the operation of the System
8.3 New Recommendations applicable within the System

9 Liaisons with other international or regional institutions
9.1 BIPM/OIML rapprochement and liaisons with ILAC
9.2 Co-operation within the recently established JCGM (Joint Committee for Guides in Metrology), successor to ISO/TAG 4
9.3 World Trade Organization
9.4 Other liaisons (see also item 10.2)

10 Developing countries
10.1 Information regarding the Development Council meeting of 29th October 1997
10.2 Planning of an international seminar to be held in Germany in cooperation with BIPM, IMEKO and PTB

11 BIML staff
11.1 General situation
11.2 Appointment of an Assistant Director

12 Report on BIML activities

13 Other matters
13.1 OIML Bulletin
13.2 OIML on Internet (general information, meetings and proceedings, OIML certificates, OIML publications, etc.)

14 Future meetings
14.1 33rd and 34th meetings of the CIML
14.2 Eleventh Conference

15 Closure

Proceedings of the meeting

The roll of delegates was called; it was found that 45 CIML Members were present or represented and that the necessary quorum was reached. The Agenda was approved, as were the minutes of the 31st CIML meeting held in Vancouver last year.

Information was given by the Bureau concerning new (Argentina, Bosnia and Herzegovina, Estonia and Ukraine) and expected (South Africa and possibly some other) accessions.

It was stated that the financial situation of the OIML was satisfactory, as well as the estimates for 1998.

The Birkeland study

During the Presidential Council meeting in February 1997, it was agreed to appoint Mr. Birkeland (CIML Immediate Past President) as OIML consultant to prepare a paper dealing with the development of an international measurement system, including all aspects of scientific and legal metrology, calibration, accreditation, etc. This study is entitled *"Conditions and potential of Legal Metrology at the dawn of the 21st century"*.

Mr. Birkeland presented a detailed intermediate report on the progress of his study, including what is happening to metrology, what metrology is worth, and the steps to be taken towards a global measurement system.

K. Birkeland,
CIML Immediate Past President

The global measurement system should provide a coherent formal system which ensures that measurements can be made on a consistent, appropriately accurate, transparent and internationally recognized basis throughout the world.

After stating that this preliminary report was intended to stimulate and provoke fresh, untraditional creative thinking and discussion on the current potential of legal metrology, Mr. Birkeland went on to say that legal metrology is currently characterized by fragmented legislation and multiple authority, with the result that there are a multitude of measurement systems with many new actors involved, many of whom have only vague links with metrology.

Some activities might be carried out to counteract this fragmented legislation and multiple authority, such as revising OIML Document D 1, using more extensively the requirements for traceability in legislation, and establishing a technical advisory group to coordinate these activities and develop international models.

Mr. Birkeland went on to make some suggestions as to areas where improvements could be made.

- *International equivalence of verification standards and methods*

This is of vital importance for maintaining confidence at user level and for underpinning free trade agreements. Two types of program can be applied to demonstrate equivalence, one not excluding the other:

  - accreditation of legal metrology (in accordance with ISO Guide 25 and all relevant interpretation documents);
  - a comprehensive OIML program of key comparisons in very close and well-organized cooperation with regional legal metrology organizations.

- *Modern approach to training*

It is timely for the OIML to study how a modern pedagogical approach to training, applying modern technology including electronic communication technology, may make relevant, internationally harmonized professional training and retraining available.

- *Economic benefits*

The fact that the global measurement system has economic advantages is taken for granted by metrologists, but not by other key decision makers, who need to be convinced of this.

• *Ideal international cooperation*

International cooperation should remain at an advisory level, including representatives of all relevant areas and levels of legal metrology, in particular those representing satellite measurement systems. To succeed in creating a global measurement system suitable for use as a key tool for commercial, technical and societal progress in the 21st century, it is essential to include and directly involve important decision makers such as the World Bank, the World Trade Organization, the most important regional developing banks, etc. Once an adequate consequential analysis has been performed to ensure a better understanding of the economic benefits of metrology infrastructures and a global measurement system, bridging the gap between metrologists and decision makers, an annual conference could be set up to pave the way towards ideal international cooperation.

An inquiry and questionnaire have been prepared by Mr. Birkeland, with the objective of developing this preliminary study and putting forward final propositions. A copy of the preliminary draft, which includes the questionnaire, can be obtained from the BIML. ■

Activities linked with accreditation

As President Faber stated during his introductory speech, a task group on accreditation was established in line with the decisions taken at the Tenth International Conference.

Members of this group are:

- S. Chappell (Chairman);
- S. Bennett (UK);
- J. Birch (Australia);
- J-F. Magana (France);
- W. Gögge (Germany);
- B. Athané (BIML).

Mr. Chappell reported on the previous year's activities in this field, as well as developments which could be envisaged for the coming year.

Information on this topic was given during the Workshop *"Metrology Development in the World"*, reported in this issue of the OIML Bulletin. ■

Technical activities

The Committee took note of a report by Vice-President Chappell concerning the general situation of the OIML technical committees and subcommittees and agreed that a small working group should be set up in order to reexamine the OIML technical program and redefine priorities. ■

Approval of International Recommendations

Five draft Recommendations (see titles below) were approved by the Committee; these had been studied by the secretariats and members of the working groups concerned, but improvements were to be envisaged before their publication should certain CIML Members have comments:

- Measuring systems for the mass of liquids in tanks;
- Automatic level gauges for measuring the level of liquid in fixed storage tanks (revision of R 85);
- Evidential breath analyzers;
- Instruments for measuring vehicle exhaust emissions - this text, a revision of R 99, is intended to become a joint ISO/OIML international publication;
- Dynamic measuring devices and systems for cryogenic liquids (revision of R 81). ■

OIML Certificate System

Considering the experience gained from five years' operation of the System and following the report concerning the present situation, the CIML encouraged the following actions:

- More effective promotion of the System: all interested parties shall be informed of the existence of the System and its advantages, e.g. the "added value" which may result from OIML certificates, in particular in fields where measuring instruments are usually not subject to regulations;
- Revision of the paper governing the operation of the System.

The two new Recommendations on level gauges and evidential breath analyzers will become applicable within the System as soon as published. ■

Liaisons

The following main points were developed:

- Cooperation BIPM/OIML, in particular in the field of developing countries;
- Cooperation with ILAC;
- Establishment of the Joint Committee for Guides in Metrology (JCGM), successor to ISO/TAG 4 and future cooperation within this Committee;
- Initial contacts between OIML and World Trade Organization (WTO): the Bureau applied for the status of observer to be granted to OIML by WTO; a representative of the WTO will participate in the international seminar which will be organized jointly by the BIPM, OIML, IMEKO and PTB on 15–19 June 1998 in Germany. Detailed in-

Mr. Nava-Jaimes (Mexico), SIM President *(pictured right)*, and Mr. Faber (CIML President) signing the Memorandum of Cooperation between the two organizations

formation on this meeting is given in the *Update* section of this Bulletin;

- Cooperation with the *Sistema Interamericano de Metrologia* (SIM) whose President and Mr. Faber signed a Memorandum of Cooperation between the two organizations (see photo);
- Cooperation with the Asia Pacific Legal Metrology Forum (APLMF) and development and formalization of cooperation between the OIML and regional legal metrology bodies. ■

Developing countries

The OIML Development Council met on 29th October 1997. The report of this meeting was presented by Vice-President Kochsiek who agreed to act as Chairman for the forthcoming year. A complete account of this meeting can also be found in the *Update* section. ■

BIML staff

Ms. Nathalie Dupuis-Désormeaux was elected as Assistant Director; she will take up duty as soon as possible after 1st January 1998. ■

Future meetings

The CIML took note of information concerning the preparations for the 33rd CIML meeting which will be held in Seoul, Republic of Korea, during the week following the ILAC meeting in Sydney in conjunction with other OIML meetings or workshops, and an APLMF meeting. The 34th CIML meeting will be held in 1999 in Paris unless a Member State is willing to invite the Committee.

The Eleventh Conference of Legal Metrology might be held in the year 2000 in Paris, a final decision having to be made within one or two years. ■

Closure

The Committee took note of closing remarks by Mr. J.C.C. Bueno, President of INMETRO and Mr. G.J. Faber, CIML President. The Committee expressed its sincere thanks to all those involved for their perfect organization of the meeting. ■

Participants in the SIM meeting, held in parallel with the OIML meetings

32ème réunion du Comité International de Métrologie Légale

Rio de Janeiro, 29–31 octobre 1997

Suite à l'invitation du Gouvernement brésilien, la ***32ème réunion du Comité International de Métrologie Légale*** *s'est tenue à Rio de Janeiro, Brésil, du 29 au 31 octobre 1997.*

La 32ème réunion du Comité International de Métrologie Légale, un atelier intitulé *Metrology Development in the World* et la réunion du Conseil de Développement (voir articles) ont été organisés conjointement à l'hôtel *Le Méridien* situé sur la plage pittoresque de Copacabana à Rio de Janeiro.

Avec une population d'environ six millions d'habitants, Rio est une ville importante, offrant de merveilleux sites naturels comme le Pain de Sucre et la montagne du Corcovado avec la statue de Jésus-Christ le Rédempteur, pour ne citer que ces deux sites mondialement connus.

Soixante-quatorze délégués de trente-huit États Membres ainsi que quatre Agents Techniques du BIML étaient présents. ■

Ouverture de la réunion

M. Gérard J. Faber, Président du Comité International de Métrologie Légale, a ouvert la 32ème réunion en présentant et en accueillant trois invités: M. Oscar Lourenzo Fernandez, Secrétaire d'État pour la Technologie Industrielle au Ministère de l'Industrie et du Commerce, M. Julio Cezar Carmo Bueno, Président d'INMETRO, et enfin, le Président sortant du CIML M. Knut Birkeland. ■

Discours d'ouverture de M. O. Lourenzo Fernandez

Au nom du Ministre de l'Industrie et du Commerce, M. Fernandez a accueilli chaleureusement tous les participants à la 32ème réunion du CIML.

Il a présenté cet événement comme étant le premier du genre au Brésil et a reconnu l'importance grandissante de la métrologie qui devient une activité de plus en plus populaire grâce aux certificats et approbations d'INMETRO pour des produits de consommation - activité qui a été très fructueuse. Cette réunion, a-t-il déclaré, constitue un échange important pour le succès

Ouverture de la réunion du CIML: de g. à d.: K. Birkeland, B. Athané, G. Faber, O. Lourenzo Fernandez et J. Carmo Bueno

et la continuation du développement des activités métrologiques au Brésil, considéré comme essentiel pour l'avenir. ■

Discours d'ouverture de M. J. C. Carmo Bueno

"J'ai le grand plaisir de vous souhaiter la bienvenue à tous pour cette 32ème réunion du Comité International de Métrologie Légale, ici, à Rio de Janeiro. Je suis particulièrement fier, étant donné que c'est la première fois qu'un pays d'Amérique Latine a l'honneur d'organiser un événement d'une telle importance dans la domaine de la métrologie légale.

Il est important de souligner que le Brésil a construit un très large secteur industriel basé sur l'économie nationale, dans laquelle les importations étaient découragées, depuis quarante ans. Cette politique a seulement changé au début des années 90, avec l'ouverture de notre économie. En conséquence, la compétition est devenue un facteur déterminant pour aboutir au succès, voire même pour continuer à être présent sur le marché mondial. De cette manière, la métrologie, la normalisation et la qualité ont un rôle crucial à jouer dans le scénario brésilien.

Une autre question fondamentale est le processus de reconstruction de la démocratie au Brésil, processus qui a vu le jour en 1984. La société civile a pris une importance plus significative dans le contexte national. Un code moderne de protection du consommateur a été adopté et un grand nombre d'organisations non gouvernementales ont émergé dans ce secteur. Le résultat de ce mouvement a été la prise de conscience progressive du citoyen brésilien de l'importance de la métrologie, de la normalisation et de la qualité. Des consommateurs bien informés sont des consommateurs qui demandent plus, ce qui mène à la promotion générale de la qualité et des services.

Il y a lieu d'observer que le processus de développement technologique qui accélère la mondialisation utilise la métrologie comme base. Le premier gros effort du Brésil dans ce mouvement a été la création du bloc économique du MERCOSUR en partenariat avec ses voisins: Argentine, Paraguay et Uruguay, avec comme point de départ, l'harmonisation de la métrologie, de la normalisation et des systèmes d'évaluation de la conformité. Un autre effort significatif pour l'intégration économique, qui a servi à promouvoir ces développements, a été la création de la FTAA (*Free Trade Area of the Americas*).

Il est important de souligner qu'au Brésil, l'Institut National de Métrologie, Normalisation et Qualité Industrielle, INMETRO, faisant partie du Ministère de l'Industrie, du Commerce et du Tourisme, est responsable du développement de ces activités tant au niveau national qu'international. INMETRO a vingt laboratoires en activité, qui sont installés sur le site du laboratoire national de métrologie à Xerém, à proximité de Rio de Janeiro, et qui conservent les étalons métrologiques nationaux.

Il est clair pour INMETRO que la participation aux forums internationaux tels que l'OIML et le BIPM, IAF, SIM, IAAC, etc. a une importance capitale afin d'avoir une influence sur la préparation des accords internationaux et multilatéraux et de participer à des événements comme celui-ci.

Aujourd'hui, la société brésilienne fait un effort considérable en matière de recherche de qualité et de productivité. ISO 9000 est devenu un terme populaire synonyme de qualité, et la métrologie, la science des mesures, constitue la base de ce mouvement. En particulier, c'est le domaine de la métrologie légale qui est directement concerné quand il s'agit de la santé publique, de la protection de l'environnement, et de la défense du consommateur. Le réseau de métrologie légale, coordonné par INMETRO, est responsable du contrôle des ces activités. Soulignons également que la métrologie légale soutient les activités de métrologie scientifique et industrielle et joue un rôle grandissant dans l'économie brésilienne, étant donné, en particulier, la politique de privatisation du gouvernement.

La réunion d'aujourd'hui fait partie de la stratégie brésilienne pour montrer au monde que nous sommes sérieux en matière de

Délégués participant à la réunion du CIML

qualité et qu'un produit *made in Brazil* est fabriqué avec qualité. Aujourd'hui, nous réalisons un rêve qui avait pris corps il y a deux ans en Chine, lors des premières discussions que j'avais eues avec le Président du CIML, Dr. G. J. Faber, sur la possibilité d'organiser cette réunion au Brésil. Nous sommes reconnaissants pour avoir eu cette opportunité de vous faire découvrir notre cité, et pour conclure, je citerai le Pape Jean-Paul II qui a dit, lors de sa récente visite au Brésil, que l'architecture divine de cette belle cité illumine tous ceux qui la visitent. Merci, j'espère que vous apprécierez votre séjour". ■

Discours d'ouverture de M. Gérard J. Faber

"C'est la troisième réunion du Comité International de Métrologie Légale que j'ai l'honneur de présider et c'est toujours avec le même plaisir que je vois tant de personnes parmi vous répondre positivement à mon invitation pour notre rendez-vous automnal.

Les réunions de l'année dernière et de cette année ont quelque chose en commun d'un point de vue géographique, toutes deux se tenant sur le continent américain; cependant, les latitudes des deux réunions sont quelque peu différentes: l'année dernière, les érables canadiens arboraient déjà leurs magnifiques couleurs d'automne; aujourd'hui à Rio, c'est le printemps qui nous accueille et j'espère que vous serez capables de résister à l'attraction de la plage de Copacabana en sorte que nos discussions puissent continuer avec un nombre suffisant de participants!

Dans ce discours d'ouverture, je vais essayer de brosser un tableau condensé mais clair de la situation de notre Organisation et des orientations générales que nous devrions suivre. Mais avant cela, permettez-moi d'accueillir nos nouveaux Membres.

Tout d'abord, c'est avec le plus grand plaisir que nous avons été informés que la République Islamique d'Iran, l'un des pays fondateurs de l'OIML, a décidé récemment de rejoindre notre Organisation qu'elle avait quittée il y a environ vingt ans. Aujourd'hui, ce Membre est représenté par M. Moslem Khorram à qui je suis heureux de souhaiter la bienvenue.

En ce qui concerne le CIML lui-même, les changements intervenus depuis notre dernière réunion sont les suivants:

- pour la Bulgarie, M. Temniskov a remplacé M. Zhelev;
- pour le Cameroun, M. Ela Essi a remplacé M. Nssilak à Nssok;
- pour Israël, M. Deitch a remplacé M. Ronen;
- pour le Japon, M. Imai a remplacé M. Kurita;
- pour la République de Corée, M. Yoo-Jin Koh a remplacé M. Yoon Kyo Won;
- pour la Roumanie, M. Ocneanu a remplacé M. Stoichitoiu.

A tous ces nouveaux Membres j'ai le plaisir d'adresser des voeux chaleureux de bienvenue et de les remercier de leur intérêt continu pour notre travail.

Je vais maintenant résumer les principaux événements intervenus dans la vie de l'OIML depuis notre dernière réunion, qui a coïncidé avec la Dixième Conférence Internationale de Métrologie Légale.

Cette Conférence était sans aucun doute une étape importante dans la vie de l'Organisation. A partir des discussions qui ont eu lieu et des décisions qui en ont résulté, un certain nombre d'initiatives significatives ont été entreprises et j'aimerais vous rendre compte de leur déroulement.

A mon avis l'action la plus importante consiste à réfléchir sur le rôle que la métrologie légale et, de façon plus générale, la métrologie, va jouer dans la société de demain. La Conférence a déjà discuté de certains de ces aspects en réfléchissant à la politique à long terme de l'OIML; suite à ces discussions, le Conseil de Présidence, aidé d'un petit groupe constitué de moi-même, des deux Vice-Présidents et du Directeur du Bureau, a consacré beaucoup de temps et d'efforts à cette réflexion.

L'une des conclusions que vous connaissez déjà a été de nommer notre Président sortant, Knut Birkeland, Consultant OIML dans le but d'élaborer un document sur ce point.

Je ne m'étendrai pas plus sur ce sujet: Knut Birkeland participe à notre réunion et il disposera de suffisamment de temps pour nous informer de ses conceptions et des moyens qu'il a mis en place concernant cette question, et nous aurons également le temps de réagir à ses propositions initiales et d'en discuter.

Un autre sujet qui a semblé progresser de façon satisfaisante est la réflexion sur l'accréditation en métrologie légale. J'ai demandé à notre Vice-Président le Dr. Chappell de présider un groupe de travail consistant en un certain nombre d'experts; le groupe s'est réuni au début de cette année au NWML et se réunira à nouveau ici samedi. Entre-temps, Sam Chappell aura fait un rapport sur les progrès effectués.

Un troisième sujet traite des pays en développement. Comme vous vous en souvenez, c'était le sujet d'une étroite coopération possible entre le BIPM et notre Organisation. J'ai été informé que des progrès intéressants ont été effectués, ce qui a été discuté ce matin durant la réunion du Conseil de Développement et à propos de quoi un rapport nous sera présenté plus tard dans la semaine.

D'autres informations intéressantes nous seront données, par exemple concernant la coopération

se développant entre l'Organisation Mondiale du Commerce et l'OIML, et le *Joint Committee for Guides in Metrology* qui va remplacer ISO/TAG 4 et dont la première réunion se tiendra au BIML d'ici deux semaines.

Est-ce que cela veut dire que tout va bien dans notre Organisation? Malheureusement non, et il y a même un certain nombre d'aspects de notre activité qui auront bientôt à être reconsidérés, examinés avec soin et améliorés le plus largement possible.

Avant tout nous devons reconnaître qu'il n'a pas été possible de mettre en oeuvre immédiatement toutes les décisions prises à la Dixième Conférence.

Par exemple, l'excellente idée de convoquer une réunion avec des représentants de l'industrie et de la métrologie n'a pas été réalisée; en fait, il est probablement valable d'attendre jusqu'à ce que nous ayons atteint un degré de réflexion supplémentaire sur l'avenir de la métrologie légale avant de commencer des discussions avec nos partenaires industriels.

Concernant la coopération entre l'OIML et les autres institutions, je dois reconnaître que des points d'ombre existent encore: il semble évident que la coopération avec le BIPM ne deviendra pas aussi importante que certains d'entre nous l'avaient souhaité et, pendant quelques années au moins, se limitera aux pays en développement. Un autre aspect peu satisfaisant de cette coopération concerne l'Union Européenne, où la compatibilité entre les règlements futurs de la métrologie et les Recommandations actuelles de l'OIML ne peut être considérée comme acquise.

Les développements du Système de Certificats de l'OIML ont été tout à fait satisfaisants si nous tenons simplement compte du nombre de certificats émis, mais beaucoup moins satisfaisants si nous prenons en considération d'autres aspects importants de ce Système, tels que l'acceptation de plus en plus répandue des certificats ou l'augmentation significative du nombre de catégories d'instruments de mesure pour lesquels des constructeurs aimeraient recevoir des certificats.

Et ce qui n'est pas le moindre, l'activité technique globale de l'OIML semble décroître singulièrement, comme on peut le voir d'après le nombre de comités et de sous-comités techniques qui sont actuellement en activité, et d'après la faible quantité de projets de Recommandations soumis à l'approbation de cette réunion du CIML.

Plusieurs explications peuvent être données, par exemple la diminution des ressources humaines et financières de nos États Membres, ou la nécessité de consacrer plus de temps à la coopération régionale.

Nous devons aussi reconnaître le fait qu'une part de notre travail technique actuel n'engendre pas beaucoup d'intérêt chez plusieurs de nos Membres. Ceci veut peut-être dire qu'une grande partie du domaine de la métrologie légale est déjà couverte au niveau international et ne nécessite pas un tel supplément de travail. Si c'est le cas, nous devrions peut-être examiner s'il ne serait pas approprié de rediriger notre activité technique, par exemple en limitant plus encore notre programme technique mais, en même temps, en entreprenant une révision systématique des Recommandations OIML existantes dans le but de les simplifier par une élimination de ce qui ne relève pas strictement des performances et des essais métrologiques essentiels.

Voilà, mes chers Collègues, mes vues concernant la situation présente et l'avenir de l'OIML. Avec votre accord, celles-ci tiennent compte des faits et des réflexions dont j'aimerais qu'ils soient le fil conducteur de nos discussions.

Merci de votre attention, et merci de votre participation active à nos discussions". ■

La célèbre plage de Copacabana vue de l'hôtel *Le Méridien*

Déroulement de la réunion

L'appel des délégués a été effectué; il a été constaté que 45 Membres du CIML étaient présents ou représentés et que le quorum nécessaire était atteint. L'ordre du jour a été approuvé, ainsi que le compte rendu de la 31ème réunion du CIML qui s'est tenue à Vancouver l'année dernière.

Le Bureau a donné des informations concernant les nouvelles accessions à l'OIML (Argentine, Bosnie-Herzégovine, Estonie et Ukraine) et celles qui sont attendues (Afrique du Sud et peut-être d'autres pays).

Il a été constaté que la situation financière de l'OIML était satisfaisante, ainsi que les prévisions pour 1998.

L'étude Birkeland

Au cours du Conseil de Présidence en février 1997, il a été convenu de nommer M. Birkeland (Président sortant du CIML) consultant OIML pour préparer une étude traitant du développement d'un système de mesure international, incluant tous les aspects de la métrologie scientifique et légale, l'étalonnage, l'accréditation, etc. Cette étude est intitulée "Réalités et perspectives de la métrologie légale à l'aube du 21ème siècle".

M. Birkeland a présenté un rapport intermédiaire détaillé sur l'état actuel de son étude, incluant la situation actuelle de la métrologie, ce qu'elle vaut, et les étapes par lesquelles il faut passer pour arriver à un système de mesure global.

Le système de mesure global devrait fournir un système formel cohérent qui garantisse que les mesures puissent être effectuées sur une base uniforme, précise, transparente et internationalement reconnue dans le monde.

Après un constat que ce rapport préliminaire avait pour but de stimuler et de provoquer un nouveau mouvement de réflexion et de discussion, créatif et original, sur les possibilités actuelles de la métrologie légale, M. Birkeland a poursuivi en disant que la métrologie légale est actuellement caractérisée par une législation fragmentée et une autorité multiple, ce qui aboutit au fait qu'il existe une multitude de systèmes de mesure avec de nombreux nouveaux protagonistes impliqués, dont beaucoup n'entretiennent que de vagues liens avec la métrologie.

Certaines activités pourraient être entreprises pour contrecarrer cette législation fragmentée et cette autorité multiple, par exemple la révision du Document OIML D 1, l'utilisation plus extensive des exigences de traçabilité dans la législation et l'établissement d'un groupe technique consultatif pour cordonner ces activités et développer des modèles internationaux.

M. Birkeland a poursuivi en suggérant dans quels domaines devraient s'effectuer des améliorations.

- *Équivalence internationale des étalons et des méthodes de vérification*

Ceci est d'une importance vitale pour maintenir la confiance au niveau de l'utilisateur et pour le soutien des accords commerciaux de libre échange. Deux types de programmes peuvent s'appliquer pour démontrer l'équivalence, l'un n'excluant pas l'autre:

- l'accréditation de la métrologie légale (en accord avec ISO Guide 25 et tous les documents d'interprétation concernés);
- un vaste programme d'intercomparaisons en coopération très étroite et bien organisée avec les organisations régionales de métrologie légale.

- *Approche moderne de la formation*

Il est opportun pour l'OIML d'étudier comment une approche pédagogique moderne de la formation, appliquant la technologie actuelle incluant les méthodes de communication électronique, peut permettre la formation professionnelle et les mises à niveau adéquates et harmonisées sur le plan international.

- *Bienfaits économiques*

Le fait que le système de mesure global comporte des avantages économiques est considéré comme un fait acquis par les métrologistes, mais non par les autres décideurs importants, qui ont besoin d'en être convaincus.

- *Coopération internationale idéale*

Il convient que la coopération internationale reste à un niveau consultatif, incluant des représentants de tous les secteurs et niveaux concernés de la métrologie légale, en particulier ceux représentant des systèmes de mesure satellites. Pour réussir à créer un système de mesure global approprié, pierre angulaire du progrès économique, technique et social au

21ème siècle, il est essentiel d'inclure et d'impliquer directement d'importants décideurs tels que la Banque Mondiale, l'Organisation Mondiale du Commerce, les plus importantes banques de développement régional, etc. Une fois qu'une analyse importante et adéquate aura été effectuée pour assurer une meilleure compréhension des bienfaits économiques des infrastructures de métrologie et d'un système de mesure global, comblant le fossé qui sépare les métrologistes et les décideurs, une conférence annuelle pourrait être organisée pour préparer la route vers une coopération internationale idéale.

Une enquête et un questionnaire ont été préparés par M. Birkeland, avec l'objectif de développer cette étude préliminaire et de faire des propositions finales. Une copie du projet préliminaire, qui inclut le questionnaire, peut être obtenue au BIML. ■

Activités liées à l'accréditation

Comme le Président Faber l'avait expliqué pendant son discours d'ouverture, un groupe de travail sur l'accréditation a été créé en accord avec les décisions prises lors de la Dixième Conférence Internationale.

Les membres de ce groupe sont:

- S. Chappell (Président);
- S. Bennett (Royaume-Uni);
- J. Birch (Australie);
- J-F. Magana (France);
- W. Gögge (Allemagne);
- B. Athané (BIML).

M. Chappell a présenté un rapport sur les activités de l'année passée dans ce domaine, ainsi que les développements envisagés pour l'année prochaine.

Des informations sur ce point ont été données à l'occasion de l'Atelier *"Développement de la métrologie dans le monde"*, présenté dans un article du présent Bulletin OIML. ■

Activités techniques

Le Comité a pris note d'un rapport de son Vice-Président Chappell relatif à la situation générale des comités techniques et sous-comités OIML et a donné son accord pour qu'un petit groupe de travail soit établi afin de réexaminer le programme technique de l'OIML et redéfinir les priorités. ■

Approbation des Recommandations Internationales

Cinq projets de Recommandations (voir titres ci-dessous) ont été approuvés par le Comité; ceux-ci avaient fait l'objet d'études très sérieuses de la part des secrétariats et des membres des groupes de travail concernés, mais des améliorations pourraient être envisagées au cas où certains Membres du CIML auraient des commentaires à formuler:

- Systèmes de mesure de la masse des liquides dans les réservoirs;
- Jaugeurs automatiques pour le mesurage des niveaux de liquide dans les réservoirs de stockage fixes (révision de R 85);
- Éthylomètres;
- Instruments de mesure des gaz d'échappement des véhicules - ce texte, qui est une révision de la R 99, doit devenir une publication internationale conjointe ISO/OIML;
- Dispositifs et systèmes de mesure dynamique des liquides cryogéniques (révision de R 81).

Système de Certificats OIML

Considérant l'expérience acquise lors des cinq années de fonctionnement du Système et suite au rapport sur la situation actuelle, le CIML a encouragé les actions suivantes:

- Promotion plus active du Système: toutes les parties intéressées doivent être informées de l'existence du Système et de ses avantages, par exemple la "valeur ajoutée" qui peut résulter des certificats OIML en particulier dans les domaines où les instruments de mesure ne sont en général pas soumis à des réglementations;
- Révision du document fixant le fonctionnement du Système.

Les deux nouvelles Recommandations sur les jaugeurs automatiques et les éthylomètres deviendront applicables au Système dès qu'elles seront publiées. ■

Liaisons

Les points principaux suivants ont été développés:

- Coopération BIPM/OIML, en particulier dans le domaine des pays en développement;
- Coopération avec l'ILAC;
- Création du Comité Mixte pour les Guides en Métrologie (JCGM), qui succède à ISO/TAG 4, et coopération future au sein de ce Comité;
- Premiers contacts entre l'OIML et l'Organisation Mondiale du Commerce (OMC): le Bureau a demandé pour l'OIML un statut d'observateur auprès de l'OMC; un représentant de l'OMC participera au séminaire international organisé conjointement par le BIPM, l'OIML, IMEKO et la PTB, du 15 au 19 juin 1998 en Allemagne. De plus amples infor-

mations sur cette réunion sont données dans la section *Informations* du présent Bulletin;

- Coopération avec le *Sistema Interamericano de Metrologia* (SIM) dont le Président et M. Faber ont signé un Mémorandum de Coopération entre les deux Organisations (voir photo);
- Coopération avec *Asia Pacific Legal Metrology Forum* (APLMF), et développement et formalisation de la coopération avec les organisations régionales de métrologie légale. ■

Pays en développement

Le Conseil de Développement de l'OIML s'est réuni le 29 octobre 1997. Le rapport de cette réunion a été présenté par le Vice Président Kochsiek qui a accepté d'occuper la fonction de Président du Conseil pour l'année à venir. Un compte-rendu complet sur cette réunion peut également être trouvé dans la section *Informations* du présent Bulletin. ■

Le Président Faber signe le Mémorandum de Coopération entre l'OIML et le SIM

Clôture de la réunion en présence de certains représentants du SIM

Personnel du BIML

Mlle Nathalie Dupuis-Désormeaux a été élue comme Adjoint au Directeur; elle prendra ses fonctions aussi rapidement que possible après le 1er janvier 1998. ■

Prochaines réunions

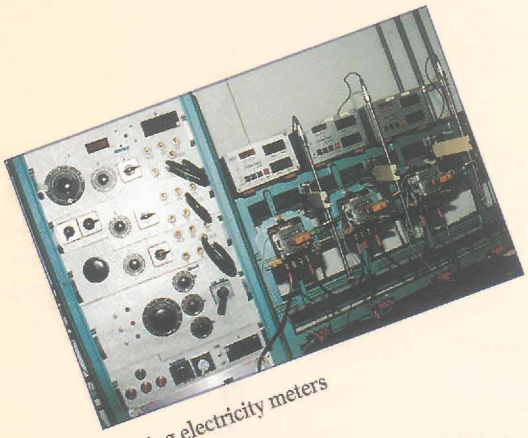
Le CIML a pris note d'informations concernant les préparatifs pour la 33ème réunion du CIML qui se déroulera à Séoul, en République de Corée, pendant la semaine qui suivra la réunion de l'ILAC à Sydney, conjointement avec d'autres réunions et ateliers OIML ainsi qu'une réunion APLMF. La 34ème réunion du CIML se tiendra à Paris en 1999, sauf si un État Membre souhaite inviter le Comité.

La Onzième Conférence de Métrologie Légale pourrait se tenir en 2000 à Paris, une décision définitive devant être prise d'ici un an ou deux. ■

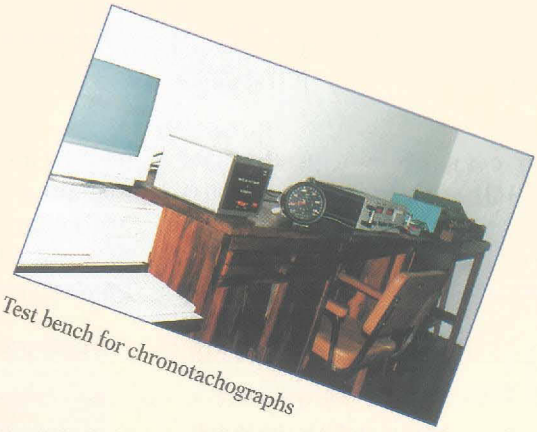
Clôture

Le Comité a pris note des discours de clôture de MM. J.C.C. Bueno, Président de INMETRO et G.J. Faber, Président du CIML. Le Comité a exprimé sa très profonde appréciation à tous ceux qui ont été impliqués dans l'organisation parfaite de la réunion. ■

CIML visits INMETRO in Xerém, Brazil

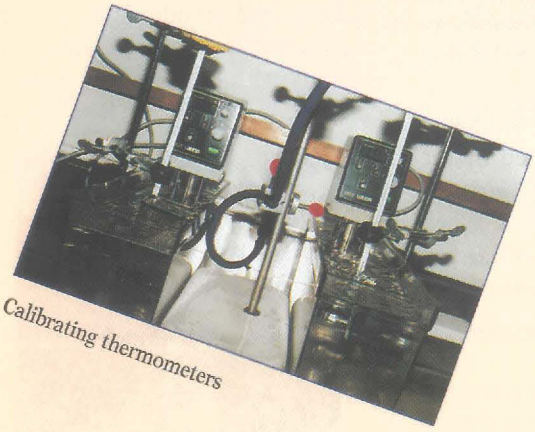


Testing electricity meters

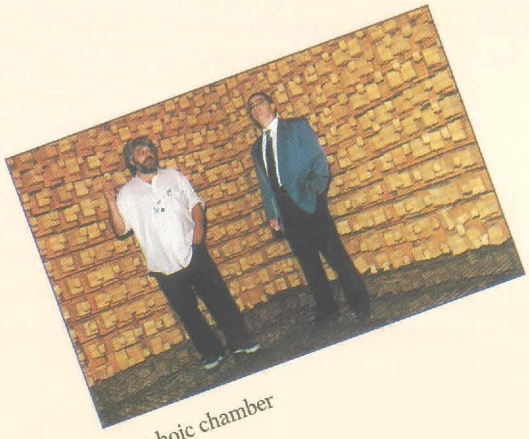


Test bench for chronotachographs

Delegates being welcomed at INMETRO laboratories



Calibrating thermometers



Anechoic chamber

International Exchange Workshop

METROLOGY DEVELOPMENT IN THE WORLD

Rio de Janeiro, 27th October 1997

In conjunction with the 32nd CIML meeting, INMETRO organized a workshop entitled *Metrology Development in the World* and a meeting of the *Sistema Interamericano de Metrologia* (SIM) in the hotel *Le Méridien* on Monday 27th October 1997. The objective was to exchange views on recent developments in the field of metrology, particularly legal metrology, regional or international harmonization and cooperation, certification and accreditation. A brief report is given below for each of the lectures.

Regional harmonization in European metrology

J-F. Magana, France

The main topic of this presentation was the elimination of barriers to trade. The treaty of the European Union obliges its Member States to accept the free circulation of goods, persons and capitals - no Member of the European Union is allowed to put up barriers to trade. So long as the product in question is legally put on the market, other countries must accept it. But all laws are not uniform - a country must justify the introduction of more stringent laws, for example on the grounds of national security or consumer protection.

The European Court of Justice frequently takes up position on barriers to trade and the rule is that products which conform in one country are deemed to conform in every other European Union country.

J-F. Magana

To limit technical barriers to trade, all drafts of national regulations must be submitted to other EU countries before being adopted - this is a very organized process which allows the latter to make observations, for example too demanding, unreasonable, etc. Such comments *must* be taken into account.

European regulations, adopted by the EU Council of Ministers, are directly applicable by Member States; European Directives (which are also adopted by the EU Council of Ministers) are approved by the European Parliament and *must* be transposed to national law. When national regulations create barriers to trade, the European authorities harmonize them by introducing European Directives.

In the field of legal metrology, in addition to the new approach European Directive 90/384/EEC on nonautomatic weighing instruments, the *Measuring Instruments Directive* (MID) is being prepared with a clear objective in mind: the total harmonization of metrological regulations and, as a consequence, the free circulation of the instruments which conform to the requirements of the Directive. This should be achieved at the beginning of the next century (around 2002).

The role of WELMEC in this process is undoubtedly important (cf. Mr. Bennett's report below). ■

The EC Directive on measuring instruments (MID)

W. Schulz, Germany

The concept of a "new approach European Directive" was explained as relating to consumer protection in the fields of health, safety and the environment; these Directives are limited to essential requirements. Technical requirements or specifications are given in the harmonized standards which are not mandatory but assume conformity with the essential requirements laid down in the Directives.

W. Schulz

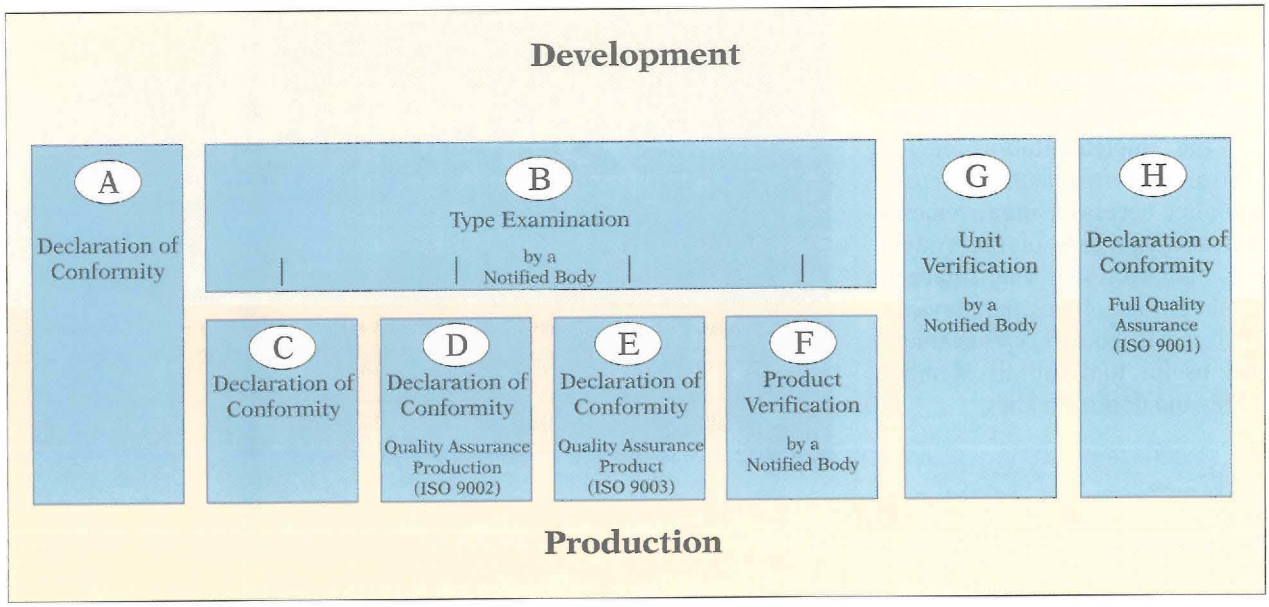


Fig. 1 Conformity assessment modules

Additional basic principles are *total harmonization*, a series of applicable *conformity assessment procedures* (modules - see Fig. 1), the CE mark and a written declaration of conformity. Notified bodies (nominated by the Member States and published in the Official Journal of the EC) are responsible for a module (or a combination of modules) e.g. type examination (module B), product verification (module F), etc.

The bodies shall:

- have the necessary personnel, means and equipment;
- have the necessary technical competence and professional integrity;
- work independently of persons having an interest in the field in question;
- respect the professional secret;
- take out a civil liability insurance (if not covered by the State).

The *Measuring Instruments Directive* (MID) drafted by the European Commission will be a new approach Directive including the following sections:

- Scope;
- Legal control;
- Assessment of conformity;
- Harmonized standards;
- Committees;
- Markings;
- General;
- Annexes on product requirements, conformity assessment, designation of notified bodies, technical documentation and test programs. ■

Establishment of a European data base for the pattern approval of measuring devices

H. Apel, Germany

Created in 1990 by a WELMEC resolution and sponsored by the European Commission, the European Metrology Type Approval Service (EMeTAS) started with a pilot system in 1995 and continued with a full system from 1996; only type approvals of nonautomatic weighing instruments are concerned. As a consequence of the obligations in the Directive 90/384/EEC, each country shall provide all concerned notified bodies (and vice-versa) with the following information:

- Request for EC type approval of a measuring device;
- EC type approval certificates issued (or refused);
- Amendments to approvals;
- Expiry of validity;
- Withdrawal of type approval.

Three services are provided by the data base:

- *Service A:* on-line service with characteristic data;
- *Service B:* central archive of published documents and translation on request (temporarily not available);
- *Service C:* CD-ROM with the data from service A, complete texts, certificates, texts of regulations, glossary of terms in various languages.

This system presents many advantages and is easy to handle; with the inclusion of other categories of measuring devices (following the implementation of the *Measuring Instruments Directive*) and after necessary improvements and developments of the system (e.g. connections via Internet, combinations of existing services, etc.), it will be a very convenient and useful tool for all Member States and notified bodies. ■

Opening of the Workshop: B. Athané, R. Balbino Figueiredo, R. Luiz de Lima Guimarães

The OIML Certificate System

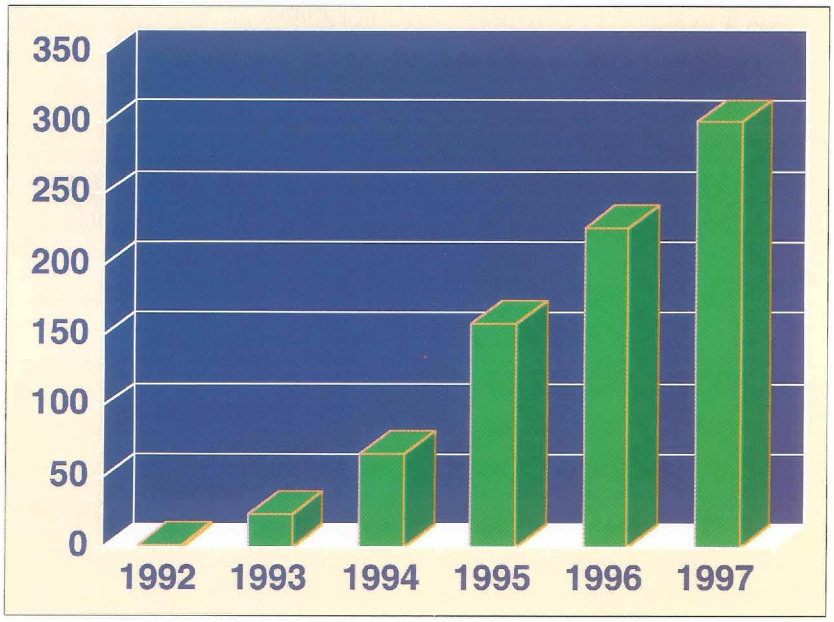
B. Athané, BIML

Whilst the OIML Certificate System for Measuring Instruments is recent (it was established in 1991 and the first certificate was issued in 1992), it does however have a rather long history.

In the middle of the seventies a working group was set up to study the possibility of creating an OIML "mark" which would prove that an instrument conformed to the relevant OIML requirements.

After some four or five years, work on the OIML mark was stopped, for several reasons. Firstly, at this time countries were not ready to accept an international certification system which would replace national pattern approvals and initial verifications. Secondly, a number of intercomparisons carried out within the OIML and the European Community had shown that the testing procedures played a very important role in the result of an evaluation: it was not sufficient to specify metrological requirements, it was also necessary to indicate clearly how the testing had to be conducted and the metrological characteristics of the equipment used for testing. A third reason was the rapid development of electronics in measuring instruments; unfortunately, at this time, the general OIML requirements for electronic measuring instruments were not yet finalized, and the certification of modern instruments would not immediately have been possible.

At the beginning of the eighties, the International Committee of Legal Metrology decided to stop the study on the OIML mark, pending more favorable circumstances. However, some decisions were made with a view to permitting CIML Members to issue certificates declaring the conformity of given instruments with the requirements of the relevant OIML Recommendation. These certificates, designated as "export certificates", were mainly intended to assist developing countries in choosing the instruments they had to import. I cannot say that this action was very successful; however, in fields not yet covered by the OIML Certificate System such as liquid meters or level gauges for tanks, certain manufacturers used



Cumulative OIML certificates issued

to apply for such certificates from a number of national legal metrology services. It should be noted that these certificates cannot be designated as "OIML certificates"; however, in most cases, their value cannot be questioned.

It was in the middle of the eighties that work restarted with a view to creating an OIML Certificate System for Measuring Instruments. Contrary to the OIML mark, it was decided that the System should initially cover patterns of instruments, not the instruments themselves. The OIML System may therefore be considered as being equivalent to a pattern evaluation and pattern approval decision, whereas the OIML mark would also have covered initial verification.

It was also decided that the System would only apply to instruments covered by one or several OIML Recommendations which contain the three following elements: metrological specifications, testing procedures, and the format for reporting test results.

The first two elements are obviously necessary for certification; the third element, the test report format, is perhaps not absolutely necessary, though it is at least considerably useful. In fact, as I will explain later, the success of the OIML System is largely based on mutual confidence. In order to facilitate such mutual confidence, the obligation to present test results in a standardized format is a decisive step; it permits everybody to rapidly and unambiguously obtain the information required. To reiterate an image from our Vice-President Chappell, when you open your daily newspaper you know that international information is to be found on page 3, financial information is on page 6, the obituary is on page 12, sports are on page 25 and so on - that is to say you go directly to your own preferred subjects of interest. The same applies to OIML test reports.

Other main features of the OIML System are its voluntary and non-binding character: no Member State is obliged to issue certificates, nor to accept certificates issued in other Member States, and the fact that it operates under the responsibility of CIML Members.

In an OIML Member State willing to participate in the issuing of OIML certificates, the CIML Member appoints "Issuing Authorities" for the various categories of instruments covered by the System, or for some of these categories only. The issuing authorities are responsible for designating the laboratories which will perform the tests as described in the relevant OIML Recommendations, and for the delivery of test reports and certificates of conformity. Manufacturers' own tests may be accepted in certain cases. The CIML Member is responsible for making sure that the operating rules of the System are duly implemented. When issued, OIML certificates must be registered by the BIML, copies are sent to all OIML Members and information is published in the OIML Bulletin. Since the beginning of 1997, this information is also available on the OIML Internet site.

When a manufacturer of a measuring instrument wishes to obtain an OIML certificate, it has to apply to the CIML Member of its choice, either in its country or in any other country which participates in the System, and submit samples of the instrument to the relevant issuing authority with a view to their examination and testing. If conformity is proven and after having paid the testing and registration fees, the manufacturer receives an OIML certificate and the associated test report.

The certificate may then be used to facilitate the commercialization of the instruments concerned in other countries. Without being bound by any obligation, OIML Members are encouraged to make use of OIML certificates whenever national or regional pattern approvals are requested. The national legal metrology service may for example issue a pattern approval directly based on the OIML certificate and associated test report, or perform a limited number of tests and, if the results are compatible with those in the test report, deliver the pattern approval. In some countries, the OIML certificate may even be considered as equivalent to a national pattern approval.

It should be noted that since (for the time being) the OIML Certificate System only applies to the pattern of a measuring instrument, the acceptance or initial verification of individual instruments manufactured according to the pattern remains the responsibility of national or regional authorities.

I will not enter into more details concerning the operation of the OIML Certificate System, responsibilities of manufacturers and how appeals are dealt with, etc. since an OIML Guide covers these areas. I would however like to give you some information concerning the positive and negative aspects of the System after some five years of actual operation and the possible developments for the future.

The first certificate was issued in 1992 and a significant increase appeared in 1993–1995 with slightly more than twenty, forty and ninety certificates issued during these three years respectively.

In 1996, the number decreased to slightly less than seventy whereas some seventy-five certificates have already been issued in 1997, with around twenty currently under registration. The final number for 1997 will therefore exceed the 1995 figure, and the cumulative number of certificates since 1992 is more than three hundred.

Now, to which categories of measuring instruments does the System apply?

There are presently some twenty Recommendations or sets of Recommendations which permit the issuing of OIML certificates, and additional ones will be published in the near future. However, it should be noted that certificates have been issued for six categories only, covering automatic and non-automatic weighing instruments, roadside fuel dispensers and clinical thermometers. In fact at present, OIML certificates are of real interest only for manufacturers of weighing instruments and of gasoline pumps.

This may perhaps be due to a lack of information for manufacturers of other categories concerned, or to a lack of interest from these manufacturers. The BIML intends to try to contact manufacturers or associations of manufacturers in order to improve our communication and information system, or to identify the reasons for such lack of interest. In fact, there is no reason for developing the OIML Certificate System in fields where manufacturers do not need such certificates.

But the most crucial aspect of the OIML System is the degree of acceptance of certificates by national legal metrology authorities.

The BIML periodically carries out inquiries among OIML Members concerning this matter; we also try to obtain information directly from manufacturers.

The most recent inquiry shows that more and more OIML Members (i.e. Member States and Corresponding Members) accept OIML certificates as a basis for granting pattern approvals. Information received directly from manufacturers shows that the actual number of such countries who accept OIML certificates is actually larger than it appeared from the replies to the inquiry. This is due to the fact that a number of OIML Members did not reply to the inquiry and that, in certain of these countries, the CIML Member is not directly involved in the national pattern approval process. In addition, it seems that non-OIML Members (especially certain developing countries) are aware of the existence of the OIML Certificate System and make use of our certificates.

Another very positive result is the implementation of the OIML System by regional bodies.

For example, within the Asia-Pacific Legal Metrology Forum (APLMF), the use of OIML certificates and the benefits that developing countries in the region may obtain from their use have been the subject of very interesting discussions. As a result of such talks at Asia-Pacific and other levels, the Conference requested the BIML to carry out a specific inquiry concerning the use of the System by developing countries.

At European level, things are even going further with the WELMEC Type Approval Agreement which, for the signatories, results in a systematic recognition of national pattern approvals made in accordance with OIML Recommendations, including in most cases the issuing of OIML certificates.

However, there is still a significant number of OIML Members who do not accept to consider OIML certificates, or impose conditions (e.g. the accreditation/certification of issuing authorities or testing laboratories) such that in fact practically no certificate will be accepted. In addition, certain countries may be willing to accept certificates provided that they have been issued by countries in which they have confidence.

For the time being, we have considered that it was not appropriate to publish a list of the countries that accept or do not accept OIML certificates; this should result from a decision of the International Committee of Legal Metrology and would necessitate a specific inquiry.

Undoubtedly, we have to improve the situation if we wish to make the OIML Certificate System successful and render it useful both for manufacturers of measuring instruments and national and regional legal metrology authorities.

The development and improvement of the System is the responsibility of a technical advisory group, TAG_{cert}, which works under the supervision of the CIML.

The TAG met once at the beginning of last year and certain of the decisions made are now being implemented step by step.

Delegates attending the Workshop, including many Latin American countries

Concerning the operation of the System, certain administrative aspects will be improved. The kinds of instruments which may be certified should increase with the inclusion of modules or parts of instruments. The BIML and certain OIML TCs/SCs have already started work in this respect.

It will also be necessary to introduce more flexibility in the operation of the System, without decreasing its value and the confidence we may have in it. For example, new instruments and new technologies appear and it would be disappointing if modern instruments could not rapidly be certified.

An effort will have to be made to better inform more manufacturers about the benefits of the System. For the time being, mainly those manufacturers of instruments which fall in the classical field of legal metrology are aware of the possibility of obtaining national pattern approval through OIML certificates more rapidly and at a lower cost. We have to convince other manufacturers that OIML certificates may represent an interesting added value and may be useful even for instruments that are not covered by legal metrology regulations.

Last but not least, we must devote time and effort to ensuring the acceptance of certificates.

The implementation of accreditation procedures for testing laboratories, the establishment of bi- and multilateral agreements concerning the recognition of test results, the use of intercomparisons for demonstrating the capability of testing laboratories to implement OIML procedures, and better coordination with what is done within other international bodies, are some of the directions in which we should move forward.

A working group on accreditation has already been set up and will meet for the second time here in Rio at the end of this week. In addition, we are reinforcing our cooperation with ILAC, ISO/IEC and IAF.

When all these improvements of the OIML Certificate System are completed, we will then be able to begin studying the feasibility of taking a very fundamental step forward, i.e. the certification of individual instruments, to replace initial verification. I am confident that, within some four or five years, the OIML will have succeeded in its task and will have been able to contribute to the elimination of technical barriers to trade and of multiple testing. ■

Regional organizations

Reports were presented by Mr. J. Birch (Australia) for the Asia Pacific Legal Metrology Forum (APLMF), Mr. S. Bennett (United Kingdom) for the European Cooperation in Legal Metrology (WELMEC), Mr. M. Nogueira Frota (Brazil) for the *Sistema Interamericano de Metrologia* (SIM) and Mr. L. Sutek (Slovakia) for the Metrological Cooperation for Central and Eastern European Countries (COOMET). ■

Accreditation and legal metrology

R. Balbino Figueiredo, Brazil

As President of the Inter-America Accreditation Cooperation (IAAC), Mr. Balbino presented this Organization and its main objectives:

- To give support to the Free Trade Area of the Americas (FTAA) to eliminate the technical barriers to trade in the scope of conformity assessment through Multilateral Recognition Agreements (MLA) among accreditation bodies;
- To support the market in the demands of MLA;
- To maintain the equivalence in the accreditation programs for:
  - certification (quality system, product, personnel, environment, EMS);
  - laboratories (testing, calibration).

After having discussed the role of ISO/IEC, IAF and ILAC as well as the fundamental differences between accreditation and certification, the specific roles of accreditation for legal metrology were presented and finally some interesting proposals to OIML concerning its cooperation with IAF and ILAC. ■

OIML activities for accreditation in legal metrology

S. E. Chappell, USA

As chairman of the OIML Task Group on accreditation, Mr. Chappell presented a report on the recent activities of this group which includes five experts: S. Chappell (USA), S. Bennett (UK), J. Birch (Australia), J-F. Magana (France), W. Gögge (Germany).

The objectives are:

- Confidence in the OIML Certificate System;
- Mutual recognition of certificates;
- Confidence that individual instruments conform to the pattern.

The OIML Task Group met in the UK in May 1997 and in Rio de Janeiro in October 1997; another meeting is scheduled with representatives of ILAC at the BIML in February 1998.

Some documents are being prepared on the application of accreditation in legal metrology; OIML D 13 will be revised and a list of Member States accepting OIML certificates, including mutual arrangements and conditions, shall be prepared in 1998. ■

METROLOGICAL INFRASTRUCTURES

Metrology in Egypt

DR. A. B. EL-SEBAI, President, Egyptian Organization for Standardization and Quality Control, Cairo - CIML Member

In our modern society which has been created on the basis of the progress achieved in the field of natural sciences, technology and international trade, measurements are of utmost importance.

Every product, whether it be food or electrical energy, must be measured. Even the physician bases his diagnosis on measured values, which give information about our state of health. Measurements have become a normal part of everyday life.

Diverse organizational forms and structures of the metrology system have been developed. Broadly speaking, metrology can be divided into three fields which can be described by specific organizational structures and tasks: scientific, legal and industrial metrology. Work in these three fields is closely interrelated, and the fields are even mutually dependent.

In Egypt there are three main organizations responsible for metrology, as presented below.

• Egyptian Organization for Standardization and Quality Control (EOS)

The EOS is responsible for *Industrial metrology*.

Activities carried out:

1 Elaboration of Egyptian national standards for raw materials, industrial products, testing and measurement equipment, methods of testing and inspection, quality control, calibration, metrology, etc.;
2 Testing and inspection activities;
3 Certification of products and systems;
4 Technical consultation and training services in the field of standardization;
5 Representing the country in the international and regional corresponding organizations.

• Assay Weight and Measures Administration

This Administration is responsible for *Legal metrology*. The main aim is to calibrate measuring instruments related to trading.

Activities carried out:

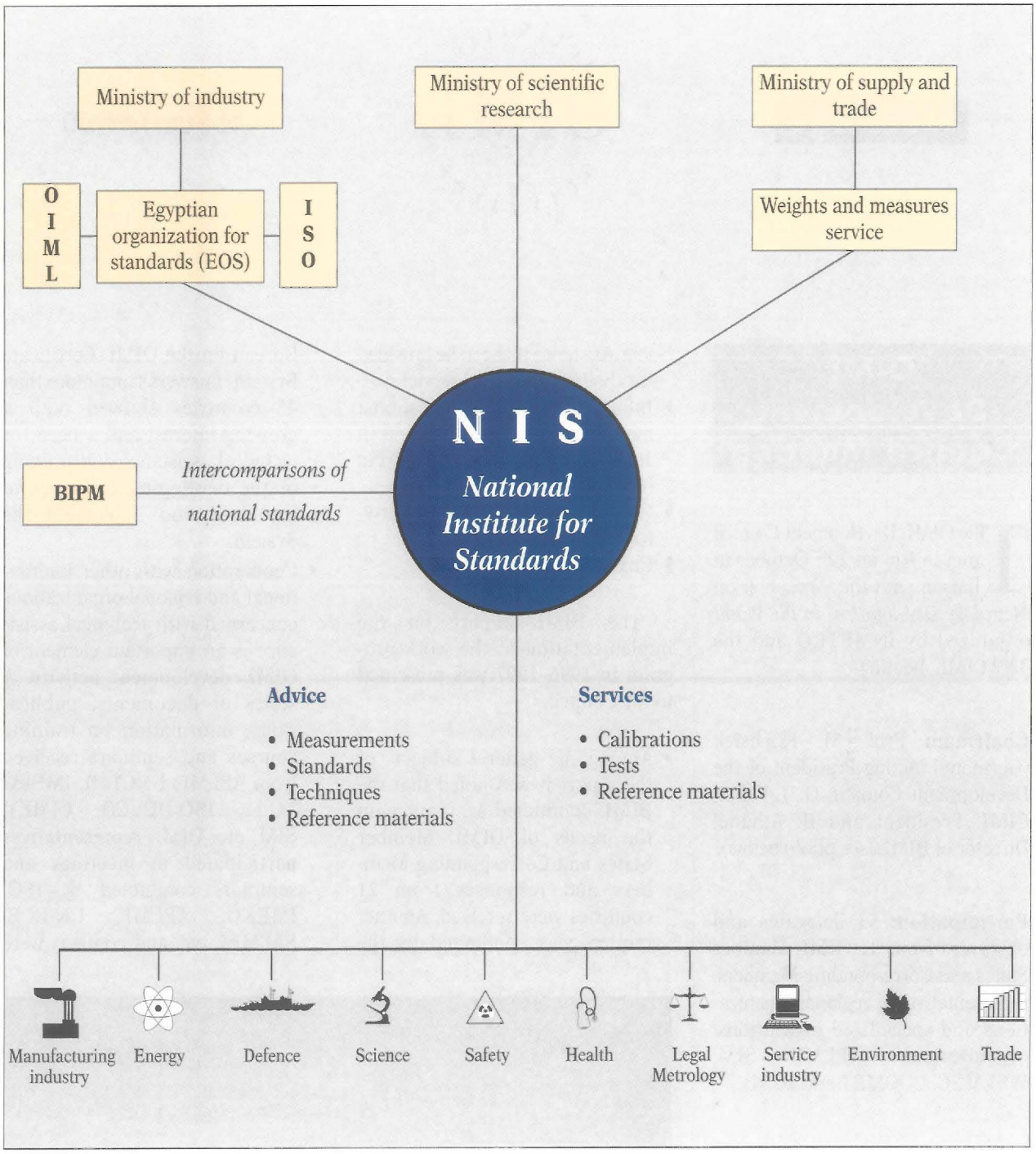
1 Calibration of measuring instruments, weights, volume meters, gas and water meters;
2 Maintenance of measuring instruments related to trading;
3 Stamping and testing of new measuring instruments.

• National Institute for Standards (NIS)

This Institute is responsible for *Scientific metrology* and for the custody of the National Measurement Standards.

Activities carried out:

1 Calibration of measurement equipment against National Standards;
2 Training of personnel on accurate measurement;
3 Exchange of information and measurement capabilities;
4 Participation in Standard specification Committees. ■



Link between the NIS and other organizations

Meetings — OIML activities activités — Réunions

OIML Development Council Meeting

The OIML Development Council met in Rio on 29th October in liaison with the Workshop on *Metrology Development in the World* organized by INMETRO and the 32nd CIML meeting.

Chairman: Prof. M. Kochsiek (Germany), Acting President of the Development Council, G. J. Faber, CIML President and B. Athané, Director of BIML (see photo below).

Participation: 53 delegates and observers from 32 OIML Member States and Corresponding Members, representatives of regional organizations and specialized institutions/ organizations (APLMF, SIM, WELMEC, COOMET and DAM).

Main points

- BIML report on the activities of the Council since its last meeting in October 1995 in Beijing;
- Information and discussion concerning the SIM meeting, the Workshop and the visit to INMETRO laboratories;
- Discussion on the needs of developing countries and the possible assistance that can be provided for their metrological services;
- Information on the international metrology Seminar to be held in June 1998 in Braunschweig (Germany);
- Guidelines for the future activities of the Council;
- Chairperson of the Council.

The BIML report on the implementation of the work program in 1996–1997 was presented to the Council.

- Among the general subjects of the report it was noted that the BIML conducted an inquiry on the needs of OIML Member States and Corresponding Members and responses from 21 countries were received. Another inquiry was conducted by the Bureau on the OIML Certificate System. Answers from more than 45 countries showed both a growing interest and a need for technical assistance and training of the developing countries to introduce and implement the System.
- Cooperation with other international and regional organizations concerned with technical assistance is an important element of OIML development activity. A series of documents, publications, information on training courses and seminars received from APLMF, UNCTAD, IMEKO TC 11, ISO/DEVCO, CIMET, SIM, etc. OIML representatives participated in meetings and seminars conducted by ISO, IMEKO, APLMF, UN/ECE, SALMEC etc. and contacts were

Left to right: B. Athané, M. Kochsiek, G. Faber

maintained with national metrology services of many OIML developing countries. There is however a need both to strengthen cooperation with regional organizations and also to expand cooperation with international and regional economic institutions such as WTO, UNCTAD, World Bank and other bodies for development to gain support for the Council's activities.

- Inquiries made by the BIML demonstrated a great need for documentation and information on legal and applied metrology. During the reported period, the BIML distributed a great number of OIML and other documents of interest for developing countries and provided the necessary information as requested.

In 1997 the BIML started updating the OIML publication *Metrology training - Synthesis of facilities and bibliography* (issued in 1987) on the basis of new information, lists of training manuals and other publications received from a number of national metrology services and other bodies concerned. In addition to these directories on metrology published in 1995–1997 by OIML, other organisms such as WELMEC, EUROMET, COOMET and CIMET are also very useful sources of information for developing countries.

Training of metrology staff from developing countries is one of the main on-going activities of the Council, since the majority of OIML developing countries show permanent interest in training. A number of training courses and seminars were organized during the last two years:

- After the very important and successful OIML Symposium on *Metrological activities in developing countries* held in October 1995 in Beijing, a brochure of selected lectures was widely distributed together with the recommendations of the Symposium and the most interesting lectures were published in OIML Bulletin in 1996–1997;
- Training workshops on *Checking the net content of prepackages* were organized by PTB-DAM in cooperation with OIML in 1996–1997 in Germany. Representatives from various developing and transition countries were selected for the workshop;
- An annual training course on legal metrology and a Symposium Metrology-96 was held in Cuba with the participation of a number of Latin American trainees sponsored by the Cuban National Bureau of Standards;
- The training seminar *Metrology serving economic development* for representatives from countries in transition to a market economy, held in April 1996 in Slovakia, was jointly organized by UN/ECE, OIML and the Slovakian metrology service.

Activities of the Council's working group on training were reported by its Convenor, Dr. Wallerus, DAM (Germany). Besides the training courses and seminars mentioned above, the DAM organized workshops on flow and volume measurement standards, weighing machines and it was mentioned that DAM had developed several training modules (e.g. for weighing machines, tanks and prepackages), and video films for upgrading metrology staff in other countries. These materials and documents are available for interested institutes from developing countries.

The Council took note of the information from Mr. de Lima Guimarães on the SIM meeting and on the preparation of a Memorandum of Cooperation between OIML and SIM which was signed during the CIML meeting.

In the course of the discussion it was emphasized that this kind of cooperation with regional organizations (formal or informal) is most effective and contributes to worldwide propagation of OIML activities.

Since most of the delegates of the Council participated in the seminar organized by INMETRO and visited INMETRO laboratories, the Council appreciated the seminar as being very useful and congratulated the representatives of INMETRO for the remarkable development of the institute and for its staff which is well trained and dedicated to the job.

The Council noted that the results of the inquiry conducted by the BIML on the needs of OIML Member States and Corresponding Members based on the responses from 21 countries will serve as a reference for donor organizations, for further analysis of national metrology services as well as for the elaboration of the long-term program of the Development Council.

The Council requested the BIML to continue developing cooperation between the OIML and regional legal metrology bodies and to accelerate contacts with donor agencies and countries under the supervision of the acting chairman and the CIML with a view to improving and increasing assistance in the development of national metrological infrastructures and cooperation among the various developing economies in the world.

Prof. Kochsiek informed the Council of the recent joint decision of the BIPM, BIML, IMEKO and PTB to organize an international Seminar on *The Role of Metrology in Economic and Social Development* in June 1998 in PTB (Germany) (see announcement in this Bulletin). It is envisaged to have four kinds of actions during the seminar, i.e. lectures and poster sessions, visits to PTB laboratories and to industrial companies and as

well the organization of small discussion groups to survey and discuss the main topics of the seminar in order to formulate recommendations for several aspects of metrology.

It was emphasized during the discussion that the circulation of information on the seminar and on the economic and social impacts of legal metrology at a necessary level, the involvement and persuasion of policy and decision makers to participate and obtain financial support to facilitate the participation of developing OIML Members are of vital importance for the success of the seminar. This event will also serve to link metrology with economic and social development.

Future activities of the Council were discussed; the acting Chairman and the BIML were requested to pursue the activity of the Development Council in line with the 1996–1997 program and with the outputs of the inquiry recently carried out by the BIML, and it was decided that a draft long-term program should be prepared for postal examination before the next Council meeting on the base of:

- the outputs/recommendations of the international Seminar to be held in June 1998 in Germany;
- further discussions on co-operation with BIPM, IMEKO and other organizations concerned, and
- the proposals to be received from OIML Member States and Corresponding Members.

The Council expressed its thanks for the past activity of its President, Mr. G. M. Putera (Indonesia) taking note of his decision to cease his responsibilities and thanked its Vice-President, Prof. Kochsiek who accepted to act as Chairman until the next Council meeting. The Council requested its Acting Chairman and the BIML to initiate necessary actions in order to identify appropriate candidates for the position of President of the Development Council, preferably from OIML Members that are developing countries or countries in transition.

It was decided that the next Development Council meeting will be held in October 1998 in Seoul in conjunction with the 33rd CIML Meeting.

Decisions of the OIML Development Council meeting were approved at the 32nd CIML Meeting. ■

Réunion du Conseil de Développement

Le Conseil de développement de l'OIML s'est réuni le 29 octobre 1997 à Rio en liaison avec l'atelier sur le *Développement de la métrologie dans le monde* organisé par l'INMETRO, et avec la 32ème réunion du CIML.

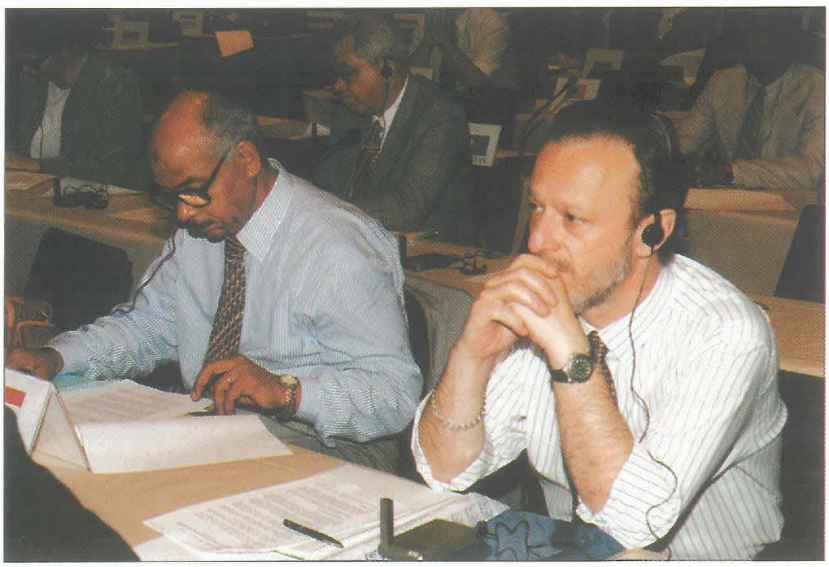
Présidence: Prof. M. Kochsiek (Allemagne) Président faisant fonction du Conseil de Développement, G. J. Faber, Président du CIML et B. Athané, Directeur du BIML (voir photo, page 42).

Participation: 53 délégués et observateurs des États Membres et Membres Correspondants de l'OIML, représentants d'organisations régionales et d'institutions/ organisations spécialisées: APLMF, SIM, WELMEC, COOMET et DAM.

Points principaux

- Un rapport du BIML sur les activités du Conseil depuis sa dernière réunion en octobre 1995 à Pékin;
- Informations et discussion concernant la réunion du SIM, l'atelier et la visite dans les laboratoires d'INMETRO;
- Discussion sur les besoins des pays en développement et sur l'assistance possible qui pourrait être offerte à leur services métrologiques;
- Informations concernant le séminaire international en métrologie prévu pour juin 1998 à Braunschweig (Allemagne);
- Directives pour les activités futures du Conseil;
- Présidence du Conseil.

Le rapport du BIML sur la réalisation du programme de travail en 1996–1997 a été présenté au Conseil.



Delegations from Egypt and Argentina (new OIML Corresponding Member)

- Parmi les sujets généraux du rapport, il a été noté que le BIML a organisé une enquête sur les besoins des États Membres et des Membres Correspondants de l'OIML et les réponses de 21 pays ont été reçues. Une autre enquête a été organisée par le Bureau sur le Système de Certificats OIML. Les réponses de plus de 45 pays ont indiqué un intérêt croissant des pays en développement, ainsi qu'un besoin d'assistance technique et de formation, pour introduire le Système et le mettre en application.
- La coopération avec les organisations internationales et régionales s'occupant d'assistance technique est l'un des éléments importants de l'activité de développement de l'OIML. Une série de documents, de publications et d'informations sur les cours de formation et sur les séminaires a été reçue de: APLMF, CNUCED, IMEKO TC 11, ISO/DEVCO, CIMET, SIM, etc. Des représentants de l'OIML ont participé à des réunions et séminaires organisés par ISO, IMEKO, APLMF, UN/ECE, SALMEC, etc. et des contacts ont été maintenus avec les services nationaux de métrologie de nombreux pays en développement. Toutefois, il est nécessaire de renforcer la coopération avec les organisations régionales et d'élargir la coopération avec les institutions économiques internationales et régionales comme l'OMC, la CNUCED, la Banque Mondiale et avec les autres organismes pour le développement en vue d'obtenir de l'aide pour les activités du Conseil.
- Les enquêtes organisées par le BIML ont révélé un besoin important de documentation et d'informations sur la métrologie légale et appliquée. Pendant la période concernée par le rapport, le BIML a distribué un grand nombre de documents de l'OIML et d'autres documents d'intérêt pour les pays en développement et a fourni sur demande les informations nécessaires.

En 1997, le BIML a commencé l'actualisation de la publication de l'OIML *Formation en métrologie - Synthèse et bibliographie* (publiée en 1987) sur la base d'informations récentes, de listes de manuels de formation et autres publications reçues de nombreux services nationaux de métrologie et d'autres organismes concernés. De plus, les répertoires de métrologie publiés en 1995–1997 par l'OIML et d'autres organismes comme WELMEC, COOMET, CIMET, etc. sont également des sources utiles d'informations pour les pays en développement.

La formation en métrologie du personnel des pays en développement est l'une des activités courantes du Conseil puisque la majorité des pays en développement Membres de l'OIML ont manifesté un intérêt permanent pour la formation. Certains cours de formation et séminaires ont été organisés pendant la période des deux dernières années:

- Après le Symposium sur les *activités métrologiques dans les pays en développement*, très important et bénéfique, tenu en octobre 1995 à Pékin, une brochure des présentations sélectionnées a été largement distribuée en même temps que des recommandations du Symposium; les présentations les plus intéressantes ont été publiées dans le Bulletin OIML en 1996–1997;
- Des ateliers de formation sur le *contrôle du contenu net des préemballages* ont été organisés par PTB-DAM en coopération avec l'OIML en 1996–1997 en Allemagne. Des représentants de nombreux pays en développement et de pays en transition ont été sélectionnés pour l'atelier;
- Un cours de formation annuel sur la métrologie légale et le Symposium *Métrologie-96* se sont tenus à Cuba avec la participation d'un certain nombre d'étudiants d'Amérique latine, sponsorisée par l'Office cubain de Normalisation;
- Le séminaire de formation *Métrologie au service du développement économique* pour les représentants des pays en transition vers une économie de marché, tenu en avril 1996 en Slovaquie était organisé en commun par la CEE/ONU, l'OIML et le Service de Métrologie de Slovaquie.

Un rapport sur les activités du groupe de travail du Conseil chargé de l'enseignement de la métrologie a été présenté par son président, Dr. Wallerus, du DAM (Allemagne). Outre les cours de formation et séminaires mentionnés ci-dessus, le DAM a organisé des ateliers sur les étalons de mesure de débit et de volume, sur les instruments de pesage et il a été mentionné que le DAM a développé divers modules de formation (par exemple, sur les instruments de pesage, les réservoirs et les préemballages) ainsi que des films vidéo pour donner, dans d'autres pays, des cours de perfectionnement au personnel chargé de la métrologie. Ces matériels et documents sont disponibles pour les instituts intéressés des pays en développement.

Le Conseil a pris note de l'information de M. de Lima Guimarães sur la réunion du SIM et sur la préparation d'un Mémorandum de Coopération entre l'OIML et le SIM, qui a été signé pendant la réunion du CIML.

Au cours de la discussion il a été souligné que ce type de coopération avec des organisations régionales (formalisée ou non) est le plus efficace et qu'il contribue au rayonnement des activités de l'OIML dans le monde entier.

Comme la plupart des délégués du Conseil ont participé au sémi-

naire organisé par l'INMETRO et ont visité les laboratoires de l'INMETRO, le Conseil a apprécié le séminaire comme très utile et profitable et a également félicité les représentants de l'INMETRO des progrès remarquables de l'institut et de son personnel qui est très qualifié et dévoué à sa profession.

Le Conseil a noté que les résultats de l'enquête organisée par le BIML sur les besoins des États Membres et des Membres Correspondants de l'OIML basés sur les réponses de 21 pays serviront de référence aux organisations donatrices, pour des analyses ultérieures des services nationaux de métrologie et également pour l'élaboration d'un programme à long terme du Conseil de Développement.

Le Conseil a demandé au BIML de continuer à développer la coopération entre l'OIML et les organismes régionaux de métrologie légale et d'accélérer les contacts avec les agences et les pays donateurs, sous la supervision du Président faisant fonction et du CIML, afin d'améliorer et d'augmenter l'aide au développement des infrastructures nationales de métrologie et la coopération entre les différentes économies en développement dans le monde.

Le Prof. Kochsiek a informé le Conseil de la décision commune du BIPM, du BIML, d'IMEKO et du PTB d'organiser un séminaire international sur le rôle de la métrologie dans le développement économique et social, en juin 1998 au PTB (Allemagne) (voir l'annonce dans ce Bulletin). Il est envisagé d'entreprendre quatre types d'actions différentes pendant le séminaire, à savoir des présentations et des sessions parallèles, des visites des laboratoires du PTB et d'entreprises industrielles, ainsi que des petits groupes de discussion pour débattre des sujets principaux du séminaire afin de formuler des recommandations pour plusieurs aspects de la métrologie.

En cours de discussion, il a été souligné que la circulation au niveau approprié des informations sur le séminaire et sur l'impact économique et social de la métrologie légale, l'implication et la persuasion des décideurs et des autorités politiques pour leur participation et l'obtention de fonds pour faciliter la participation des État Membres de l'OIML en développement, sont importants pour la réussite du séminaire. Cet événement jettera un pont entre la métrologie et le développement économique et social.

Les activités futures du Conseil ont été discutées. Il a été demandé au Président faisant fonction et au BIML de poursuivre l'activité du Conseil de Développement conformément au programme de travail pour 1996–1997 et aux résultats de l'enquête organisée tout récemment par le BIML, et il a été décidé qu'un projet du programme à long terme devrait être préparé pour consultation par courrier avant la prochaine réunion du Conseil sur base:

- des résultats et recommandations du séminaire international qui se tiendra en juin 1998 en Allemagne;
- des discussions ultérieures sur la coopération avec le BIPM, l'IMEKO et les autres organisations concernées, et
- des propositions devant être envoyées par les États Membres et les Membres Correspondants de l'OIML.

Le Conseil a exprimé sa reconnaissance à son Président, G. M. Putera (Indonésie) pour son activité passée, a pris note de sa décision de mettre fin à ses responsabilités et a remercié son Vice-Président, le Prof. Kochsiek qui a accepté d'assurer la présidence jusqu'à la prochaine réunion du Conseil. Le Conseil a demandé à son Président faisant fonction et au BIML d'entreprendre des actions afin de sélectionner les candidats les plus appropriés au poste de Président du Conseil de Développement, de préférence parmi le États Membres de l'OIML en développement ou en transition.

Il a été décidé que la prochaine réunion du Conseil de Développement se tiendrait en conjonction avec la 33ème réunion du CIML en octobre 1998 à Séoul.

Les décisions du Conseil de Développement de l'OIML ont été approuvées lors de la 32ème réunion du CIML. ■

TC 13

▶ Measuring instruments for acoustics and vibration

Secretariat: Germany

TC 13 held a meeting in Hamamatsu, Japan, on 10th October 1997 in connection with other ISO/IEC meetings in the field of acoustics.

Chairman:
Mr. Klaus Brinkmann
(PTB, Germany)

Participation: 13 delegates representing 8 P-member countries.

Main points

- The Chairman reported that the *Test report format* (Annex F) for OIML R 104 *Pure-tone audiometers* was issued in 1996 and that the revisions of OIML R 58 *Sound level meters* and OIML R 88 *Integrating-averaging sound level meters* were sanctioned by the Tenth International Conference of Legal Metrology in 1996.

The secretary of TC 13 had received the final layouts of these two Recommendations from the BIML for final remarks prior to publication.

- The Chairman asked the delegates present whether they were aware of any OIML certificates issued on an acoustic instrument or of any respective application; this was not the case. During the ensuing discussion on the possible reasons for the apparent lack of manufacturers' interest of it was mentioned that:
  - measuring instruments for acoustics and vibration are under legal control in only a very few countries;
  - OIML certificates might not yet be well recognized by manufacturers and users of such instruments;
  - additional costs connected with issuing an OIML certificate due to reduced flexibility in the performance of tests compared with a national type approval might discourage manufacturers from applying for a certificate.

This last item led to the conclusion that the general tendency observed in recent IEC Standards on acoustic instruments (i.e. that the number of detailed performance characteristics and thus the extent of related conformity tests required increase with each revision of an IEC Standard) should be reversed to keep the cost of type approval tests down to a reasonable level.

The Chairman was asked to address this subject at the IEC/TC 29 plenary meeting in Hamamatsu on 13th October. Moreover, it was recognized that prescriptions reporting test results in an OIML certificate which are too detailed also considerably increase costs and should therefore be kept to a strict minimum whilst still ensuring clarity and transparency.

- ***Reports from Working Groups***

- The Convener of **WG 2** *Audiometers* (Mr. U. Richter) reported that a first Committee Draft of the Annex to R 122 *Equipment for speech audiometry* had been prepared on the basis of extensive written comments received from WG members based on a Working Draft which had been circulated. A meeting of the WG had not been deemed necessary.

- The Convener of **WG 3** *Filters* (Mr. G. Wong) reported that the second Committee Draft on *Octave-band and fractional octave-band filters* had been prepared at a meeting of the WG in Liverpool based on comments on the first CD and on the decisions taken at the last TC 13 meeting in Pretoria.

- The Convener of **WG 4** *Sound Calibrators* (Mrs. S. Dowson) reported that a first Committee Draft of the revision of R 102 *Sound Calibrators* (based on the FDIS version of a new IEC Standard) had been prepared by the WG by correspondence. No meeting has yet been held.

- ***Resolutions***

Resolution No. 1

OIML TC 13 requests WG 3 to prepare a 3rd Committee Draft for an OIML Recommendation *Octave-band and fractional octave-band filters* on the basis of comments received on the 2nd CD and on discussions held at the TC 13 meeting on 10th October 1997 with a view to circulating the 3rd CD to TC 13 members for comments and voting. Target date: 28 February 1998.

Resolution No. 2

OIML TC 13 approves document TC 13/N 48 "Annex C to R 122 *Equipment for speech audiometry*" as amended at the meeting on 10th October 1997 and requests the Secretariat to submit it to the BIML for further processing.

Resolution No. 3

OIML TC 13 decides to postpone further work on the revision of R 102 *Sound calibrators* until IEC/TC 29 has prepared a new edition of IEC 942 which is supported by a sufficiently large number of OIML TC 13 member countries.

Resolution No. 4

OIML TC 13 approves the TC 13 work program as published in document TC 13/N 52 and amended in respect to Project No. 9 (see Resolution No. 3) at the OIML TC 13 meeting on 10th October 1997.

- ***Next meeting***

The next TC 13 meeting will be held in Frankfurt, Germany, on 5th March 1999 in conjunction with the plenary meeting of IEC/TC 29.

TC 13

▶ Instruments de mesure pour l'acoustique et les vibrations

Secrétariat: Allemagne

Le TC 13 a tenu une réunion à Hamamatsu, Japon, le 10 octobre 1997 en conjonction avec d'autres réunions ISO/CEI dans le domaine de l'acoustique.

Président: M. Klaus Brinkmann (PTB, Allemagne)

Participation:
13 délégués représentant
8 pays membres-P.

Points principaux

- Le Président a rapporté que le *Format du rapport d'essai* (Annexe F) pour OIML R 104 *Audiomètres à sons purs* a été publiée en 1996 et que les révisions des Recommandations OIML R 58 *Sonomètres* et OIML R 88 *Sonomètres intégrateurs-moyenneurs* ont été sanctionnées par la Dixième Conférence Internationale de Métrologie Légale en 1996. Le secrétaire du TC 13 a reçu du BIML les versions définitives de ces deux Recommandations pour dernières remarques avant publication.
- Le Président a demandé aux délégués de lui rapporter s'il existait des certificats OIML ou des demandes de certificats OIML pour des instruments de mesure pour l'acoustique; les réponses furent négatives. Dans la discussion qui a suivi, concernant le manque d'intérêt apparent des fabricants, il a été expliqué que:

- les instruments de mesure pour l'acoustique et les vibrations sont soumis à un contrôle légal dans seulement quelques pays;
- il se peut que les certificats OIML ne soient pas encore bien reconnus par les fabricants et les utilisateurs de tels instruments;
- il se peut que les coûts supplémentaires des certificats OIML, étant donné la flexibilité réduite dans la réalisation des essais, comparés à une approbation de modèle nationale, aient découragés les fabricants à demander des certificats.

La conclusion sur ce dernier point est que la tendance générale observée pour les récentes normes CEI relative aux instruments pour l'acoustique (à savoir que le nombre de caractéristiques de performance détaillées et donc l'étendue des essais de conformité requis par celles-ci augmente au cours des révisions successives de chaque Norme) devrait se renverser afin de garder les coûts des essais d'approbation de modèle à un niveau raisonnable.

Le président a été chargé de s'exprimer sur ce sujet lors de la réunion plénière de CEI/TC 29 à Hamamatsu le 13 octobre 1997. De plus, il a été reconnu que des exigences nécessitant des résultats d'essais trop détaillés dans le rapport d'un certificat OIML, augmente aussi considérablement les coûts et qu'il convient que celles-ci soient limitées au strict minimum qui permette d'assurer la clarté et la transparence.

• *Rapports des groupes de travail*

- Le rapporteur du **WG 2** *Audiomètres* (M. U Richter) a expliqué qu'un premier Projet de Comité pour l'Annexe à R 122 *Équipement pour l'audiométrie vocale* a été préparé sur base des commentaires écrits des membres du WG et d'un Projet de Travail qui avait été distribué. Une réunion du WG n'a pas été jugée nécessaire.

- Le rapporteur du **WG 3** *Filtres* (M. G. Wong) a signalé que le deuxième Projet de Comité *Filtres d'octaves et de fractions d'octaves* a été préparé pendant une réunion du WG à Liverpool sur base des commentaires sur le 1er CD et des décisions prises au cours de la dernière réunion du TC 13 à Pretoria.

- Le rapporteur du **WG 4** *Calibreurs acoustiques* (Mme S. Dowson) a déclaré qu'un premier Projet de Comité pour la révision de la R 102 *Calibreurs acoustiques* (basé sur une Norme FDIS et une nouvelle Norme CEI) a été préparé par le WG par courrier. Aucune réunion n'a été tenue jusqu'à présent.

• *Résolutions*

Résolution no. 1

OIML TC 13 demande au WG 3 de préparer un troisième Projet de Comité *Filtres d'octaves et de fractions d'octaves* sur base des commentaires sur le 2ème CD et des discussions tenues au cours de la réunion du TC 13 le 10 octobre 1997, afin de distribuer ce 3ème CD aux membres pour commentaires et votes, avant le 28 février 1998.

Résolution no. 2

OIML TC 13 approuve le document TC 13/N 48 "Annexe C à R 122 *Équipement pour l'audiométrie vocale*" tel que modifié au cours de la réunion du TC 13 le 10 octobre 1997 et demande au secrétariat de le soumettre au BIML pour continuer la procédure.

Résolution no. 3

OIML TC 13 décide de postposer le travail sur la révision de la R 102 *Calibreurs acoustiques* jusqu'à ce que le CEI/TC 29 ait préparé une nouvelle édition de CEI 942 qui est supportée par un nombre suffisamment grand de pays membres de l'OIML TC 13.

Résolution no. 4

OIML TC 13 approuve son programme de travail tel que publié dans le document TC 13/N 52 modifié en fonction du Projet n° 9 (voir Résolution n° 3) à la réunion du TC 13 le 10 octobre 1997.

• *Prochaine réunion*

La prochaine réunion du TC 13 se tiendra le 5 mars 1999 à Frankfurt, Allemagne, en conjonction avec la réunion plénière du CEI/TC 29. ■

liaison activities
OIML
activités de liaison

31st ISO/DEVCO meeting

The 31st meeting of the ISO Committee on matters concerning Developing Countries (DEVCO) was held on 20–21 September 1997 in Geneva in conjunction with a workshop and the ISO General Assembly in commemoration of the 50th anniversary of this organization.

The DEVCO meeting was attended by 130 delegates from 62 national bodies, plus international, regional and specialized technical assistance bodies including ITC UNCTAD/WTO, OIML, UNIDO, World Bank, AIDMO, ARSO, COPANT and Resource. ISO policy committees CASCO, COPOLCO, REMCO, INFCO were also represented at the meeting.

Key items on the agenda were:

- implementation of the ISO/DEVCO program for developing countries in 1995–1997;
- the DEVCO program for 1998–2000;
- contribution from ISO Members for development activities, and
- promotion of the ISO 9000 and ISO 14000 series of standards.

A new development manual on *"Establishing a Testing Laboratory"*, related to measurement and metrology activities, was prepared by a group of authors including Dr. S. Thulin, the BIML former staff member. Another manual entitled *"Environmental Management"* was planned in the context of the DEVCO work program.

Results of a project for upgrading analytical laboratories in the Caribbean were reported as a joint DEVCO-REMCO activity based on the application of ISO/IEC Guides 25 and 43, IUPAC Protocols, and distribution of certified reference materials (CRM) donated by REMCO members. This project also included training seminars in three countries in this region.

More than twenty regional training seminars were organized in Asian, African and Latin American countries by ISO/DEVCO together with such national bodies as NIST, AFNOR, DIN, UNI, SIS, the Swiss Government, ITC and Resource. The topics of these seminars were:

- the role of standards, quality, testing, metrology and certification in a market economy;
- environmental management and ISO 14000;
- implementation of ISO 9000 standards;
- WTO agreement on technical barriers to trade and the role of standards in trade promotion.

During the DEVCO meeting and a follow-up workshop on upgrading standardization infrastructures, much information was provided concerning technical assistance for developing countries on behalf of national and international institutions.

A representative of the BIML reported on the activities of the OIML Development Council and its cooperation with ISO and other international and regional organizations. An announcement was made about the seminar *"The role of metrology in economic and social development"* which is to be co-sponsored by the OIML, BIPM and IMEKO and to be hosted by the PTB in Germany on 15–19 June 1998; this information was received with enthusiasm.

Detailed information on ISO/DEVCO and OIML Development Council may be obtained as follows:

Contact points:

[1] ISO Central Secretariat
Dr. Anwar El-Tawil
Director, ISO Development Program
1, rue de Varembé
Geneva, Switzerland
Tel: (+41) 22-749 01 11
Fax: (+41) 22-733 34 30

[2] Bureau International de Métrologie Légale (BIML). ■

Report of the Asia-Pacific Legal Metrology Forum (APLMF)

The Fourth Forum meeting, meetings of Working Groups together with workshops and seminars were held in Tsukuba, Japan from 22 September to 3 October 1997, hosted by the National Research Laboratory of Metrology (NRLM). The Forum was attended by a total of seventeen economies and more than fifty delegates and observers from the following countries:

Australia
Canada
People's Republic of China
Indonesia
Japan
Republic of Korea
Malaysia
Mongolia
New Zealand
Papua New Guinea
Philippines
Russia
Singapore
Chinese Taipei
Thailand
United States of America
Vietnam

The Director of the BIML, Mr. B. Athané, represented the International Organization of Legal Metrology (OIML) at the Forum. The meetings, workshops and seminars were held on the following dates:

22–24 September	Workshop/seminar on introduction to high capacity flow measurement
24–26 September	Workshop/seminar on legislation and administration
27 September	Working parties meeting on utility metering, pre-packed goods (goods packed by measure) and mutual recognition agreements
29–30 September	Fourth APLMF meeting
1–3 October	Training workshop on the implementation of OIML Recommendation R 76 on nonautomatic weighing instruments

The workshop/seminar introducing high capacity flow measurement was aimed at developing an understanding of the principles involved in the verification of high capacity petroleum and gas volumetric flowmeter systems. Two technical experts, Mr. Ian Hoerlein from Australia and Mr. George Smith from Canada presented the course.

The workshop/seminar on legislation and administration was presented by a panel comprising Mr. J. Birch, Convenor of APLMF and Executive Director of the National Standards Commission, Dr. K. Birkeland, the former Director General of the Norwegian Metrology Service and immediate past President of the OIML (1980–1994), Mr. R. Bruce, Program Manager, Measurement Canada and Mr. R. Knapp, the former Director General, Legal Metrology Industry Canada.

The workshop addressed a range of issues associated with modernizing the legislative and administrative systems, namely:

- Current challenges to legal metrology;
- The national measurement system;
- Trade measurement legislation;
- Trade measurement administration;
- Utility meters legislation and administration;
- Privatization, cost recovery, competition policy contestability;
- Legal metrology administration; and
- Accreditation of legal metrology.

Arising from the workshop, a resource document on modernization of legislative and administrative structures will be prepared and circulated to member economies. This will provide valuable information to those countries wishing to make reference to various aspects of legislation and administration as well as the other areas discussed during the workshop.

The training workshop on the implementation of OIML Recommendation R 76 on nonautomatic weighing instruments is an extension of the joint Australia-China collaboration project on measurement skills, which had recognized the need for such training to promote the development and harmonization of measurement skills of personnel involved in trade and legal metrology. This workshop was presented by technical experts Professor Shi Changyan from P.R. China and Mr. Keith Mann from Australia.

APLMF work programs for 1997/98

- Publication in 1997 of a *Handbook of Legal Metrology in the Asia-Pacific*, to include the second edition of the *Directory of Legal Metrology in the Asia-Pacific*.
- Information on specialized testing facilities is to be included in a *Directory of Specialized Testing Facilities* to be published by the APLMF; alternatively this information could be included in the 1997 Handbook.
- A Working Group is to be established to study rice moisture meters. The Secretariat will circulate the scope and objectives of this WG and seek interest from members.
- A Working Group on medical measurements with a project on sphygmomanometers (blood pressure meters). The Secretariat will circulate the scope and objectives of this WG and seek interest from members.
- Translation of the legislation into English is to be pursued for those economies whose legislation is currently not in English.
- A survey is to be conducted to determine the extent of involvement of consumers with the Forum and to determine ways in which they can participate in Forum activities.
- The intercomparison on load cells and mass to commence in 1997.
- Organization of a train-the-trainer workshop on implementation of R 76 in Shanghai in July 1998.
- Translation of the R 76 video into languages other than English (Indonesian, Spanish, French and others).
- Development of a train-the-trainer course on verification and reverification of nonautomatic weighing instruments.
- Extend the survey on goods packed by measure by obtaining information from other economic areas.
- Contact CIML on the establishment of an international system of certification of packers of goods packed by measure and accreditation applied to such certification.
- Finalization and publication of a resource document on modernization of legislative and administrative systems.
- Revision of the survey on utility meters to include heat meters.
- Survey on refurbishment/reconditioning of utility meters.
- Approach CIML to give high priority to utility meter Recommendations and their incorporation in the OIML Certificate System.
- Approach CIML to develop Recommendations on statistical sampling plans.
- Secretariat to circulate information on metrological control of telephone meters and consideration be given to a presentation on this issue at the Forum meeting in 1998.
- Development of a workshop/seminar on introduction to high capacity weighing for presentation in 1998.
- Secretariat to circulate proposed elements on mutual recognition agreements together with outcomes of APEC SCSC Round Table on mutual recognition and WELMEC Type Approval Agreement.
- Facilitate access of members to the APLMF Internet web site (address: http://www.aplmf.org).
- Establish a program on analyzing the economic impact of legal metrology within member economies and the region.
- Secretariat to notify all members of their APEC SCSC representative and provide information on APEC issues relevant to legal metrology.
- Secretariat to liaise with OIML in making a submission to the World Trade Organization (WTO) on the harmonization of metrological regulations.
- Secretariat to facilitate the entry of OIML and the other regional legal metrology organizations as Corresponding Members of APLMF.
- Organize and hold the Fifth APLMF meeting in Seoul, Republic of Korea in association with the 33rd CIML meeting in October/November 1998. ■

WELMEC - 12th Committee Meeting

WELMEC, the European organization for cooperation in legal metrology, held its 12th Committee meeting on 11 and 12 September 1997 in Reykjavik, following an invitation from the Icelandic Bureau of Legal Metrology (Löggildingarstofa).

The WELMEC Chairman, Dr. S. Bennett, welcomed the 25 participants representing 16 European countries, the European Commission, EUROMET and the OIML.

He then presented a report on WELMEC activities since the 11th meeting. This report covered subjects such as the European data bank on pattern approval, exchange of information between members, structure of the new European Accreditation body, the Measuring Instruments Directive and a new WELMEC strategy document.

Many of these topics are of direct interest to the OIML. For example, the development of information exchange among countries through Internet is the subject of active thought and experiments in both organizations. The "compatibility" of the future MID with relevant OIML Recommendations (i.e. the fact that an instrument which fulfills OIML requirements should not be rejected for technical reasons when submitted to European pattern evaluation) is essential to avoid creating technical barriers to trade between Europe and the rest of the world. Last but not least, the implementation of accreditation procedures in testing activities connected with legal metrology responsibilities is a topic for thorough discussion at international and regional levels.

This significant number of matters of common interest for WELMEC and for OIML, and the fact that there is no duplication nor conflict in the work of the two Organizations, give rise to excellent cooperation between them and make it possible to benefit from the specific features and complementarity of each sphere of cooperation. It should be noted that this is not unique to WELMEC and OIML: the same kind of excellent relationship exists between the OIML and the APLMF, supplemented by direct links between the two regional bodies (see information concerning the APLMF Committee meeting held in Japan in September 1997 in this issue of the OIML Bulletin).

To conclude the discussions, the Chairman submitted a number of resolutions to the WELMEC Committee, which were approved. Finally, it was decided to hold the next WELMEC Committee meeting in Prague, Czech Republic, on 11–12 June 1998.

Decisions and Resolutions

The WELMEC Committee:

1	**Welcomes**	the clear indication of Italy's intention to play a full part in WELMEC.
2	**Approves**	for publication the *Guide for Load Cells*.
3	**Approves**	the text of the *Guide to Testing Modules* subject to editorial review by the Secretariat.
4	**Recognises**	the need for a new strategy document and requests the Chairman to prepare a draft, taking account of comments made by members and invites members to send further proposals to the Chairman.
5	**Accepts**	the Chairman's proposals for the future development of EMeTAS and expresses its continuing support for the project and instructs WG 5 to establish a User Group.
6	**Accepts**	the proposal from the EMeTAS Consortium for development of the WELMEC web site and authorises the Secretariat to select information to be included.
7	**Instructs**	Working Group 5 to proceed with arrangements for an enforcement seminar, preferably in the Spring of 1998.
8	**Requests**	members to comment on the WG 4 paper by 14 November 1997.
9	**Expresses**	its willingness to endorse the UNISTOCK Charter on weighing grain for export, subject to comments from members.

REGISTERED OIML CERTIFICATES – *CERTIFICATS OIML ENREGISTRÉS*

1997.09 – 1997.11

This list is classified by issuing authority; updated information on these authorities may be obtained from BIML.

Cette liste est classée par autorité de délivrance; les informations à jour relatives à ces autorités sont disponibles auprès du BIML.

▶ **Issuing authority** / ***Autorité de délivrance***

Physikalisch-Technische Bundesanstalt (PTB), Germany

For each Member State, certificates are numbered in the order of their issue (renumbered annually).

Pour chaque Etat Membre, les certificats sont numérotés par ordre de délivrance (cette numérotation est annuelle).

R 76/1992 - DE - 93.01

Sartorius AG
Weender Landstraße 94-108, D-37075 Göttingen, Germany
BA BA 200, BA BB 200, ...

OIML Recommendation applicable within the System / Year of publication

Recommandation OIML applicable dans le cadre du Système / Année d'édition

Year of issue
Année de délivrance

The code (ISO) of the Member State in which the certificate was issued.

Le code (ISO) indicatif de l'Etat Membre ayant délivré le certificat.

Manufacturer / *Fabricant*
Certified pattern(s) / *Modèle(s) certifié(s)*

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

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

R 51 (1996)

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

Physikalisch-Technische Bundesanstalt (PTB), Germany

R51/1996-DE-97.02 Rev. 1
Optima Control Systems GmbH, Steinbeisweg 20, 74523 Schwäbisch Hall, Germany
Types EC.... (Class X(1))

R51/1996-DE-97.03
RK Prozeßtechnik, Riedstraße 10, 79787 Lauchingen, Germany
Type DIDO 2000-16 with and without load cell amplifier type WK 2000-1 (Class Y(b))

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

Sous-direction de la Métrologie, France

R51/1996-FR-97.03
Société Testut (ex Lutrana), 50 avenue du Président Kennedy, 91170 Viry-Chatillon, France + Société Testut, 957 rue de l'Horlogerie, BP 11, 62401 Béthune, France
Modèle EL 20 (Classe Y(a))

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Load cells
Cellules de pesée

R 60 (1991), Annex A (1993)

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

Physikalisch-Technische Bundesanstalt (PTB), Germany

R60/1991-DE-97.01
Mettler-Toledo Inc., 1150 Dearborn Drive, Worthington, OH 43085-6712, USA
Strain-gauge beam load cell model 0776 (Class C)

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

Sous-direction de la Métrologie, France

R60/1991-FR-97.02
Scaime S.A., Le bois de Juvigny, B.P. 501, 74105 Annemasse, France
Cellules de pesée à jauges de contrainte Master-K types CP50X ... C3 (Classe C)

R60/1991-FR-97.03
Scaime S.A., Le bois de Juvigny, B.P. 501, 74105 Annemasse, France
Cellules de pesée à jauges de contrainte Master-K types AM ... (Classe C)

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

National Weights and Measures Laboratory (NWML), United Kingdom

R60/1991-GB-97.02
Avery Berkel Weighing, Foundry Lane, Smethwick, Warley, West Midlands, B66 2LP, United Kingdom
Shear Beam Load Cell Type T204 (Class C4)

R60/1991-GB-97.03
Transdutec S.A., C/ Joan Miró 11, 08930 - Sant Adrià de Besós, Barcelona, Spain
Load Cell Model TPF-1 and TPF-1/E (Class C)

R60/1991-GB-97.04
Active Load and Pressure Systems Ltd., Unit 48, Vanalloy Industrial Estate, Busgrove Lane, Stokes Row, Near Henley-on-Thames, Oxon, RG9 5QB, United Kingdom
Load Cell Type: GRADUATE (Class C1)

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

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

R60/1991-NL-97.18
Teraoka Seiko Co., Ltd., 13-12 Kugahara, 5-Chome, Ohta-ku, Tokyo 146, Japan
Type K (Class C)

R60/1991-NL-97.19
Hottinger Baldwin Messtechnic GmbH, Im Tiefen See 45, D-64293 Darmstadt, Germany
Type U2AD1 (Class D)

R60/1991-NL-97.20
Balea, 8 avenue du Grand Chêne, Z.A. Les Avants, 34270 Saint-Mathieu de Tréviers, France
Type SWRC-601.C+ (Class C)

R60/1991-NL-97.21
Scaime S.A., Le bois de Juvigny, B.P. 501, 74105 Annemasse, France
Type C50X..t C. (Class C)

R60/1991-NL-97.22
Revere Transducers Europe BV, Ramshoorn 7, 4824 AG Breda, The Netherlands
Type 5103 (Class C)

R60/1991-NL-97.23
Teraoka Seiko Co., Ltd., 13-12 Kugahara, 5-Chome, Ohta-ku, Tokyo 146, Japan
Type N (Class C)

R60/1991-NL-97.24
Revere Transducers Europe BV, Ramshoorn 7, 4824 AG Breda, The Netherlands
Type SSB (Class C)

R60/1991-NL-97.25
Minebea Co. Ltd., Measuring components div., Kuruizawa Factory Miyota-Machi, Kitasakugun Nagano-Ken, Japan
Type CB14 (Class C)

R60/1991-NL-97.26
Minebea Co. Ltd., Measuring components div., Kuruizawa Factory Miyota-Machi, Kitasakugun Nagano-Ken, Japan
Type U2D1-F (Class C)

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Automatic gravimentric filling instruments
Doseuses pondérales à fonctionnement automatique

R 61 (1996)

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

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

R61/1996-NL-97.01
Ishida Co., Ltd., 44, Sanno-cho, Shogoin, Sakayo-ku, Kyoto 606, Japan
*Types CCW-NZ-****-*/**-**, CCW-RZ-****-*/**-**, CCW-DZ-****-*/**-** (Class X(1))*

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*

Physikalisch-Technische Bundesanstalt (PTB), Germany

R76/1992-DE-95.02 Rev. 1
Sartorius A.G., Weender Landstraße 94-108, D-37075 Göttingen, Germany
Nonautomatic electromechanical weighing instrument Types BC BC 100, KA BC 100, MB BC 100 (Class I), BA BC 200, MA BC 200 and MD BC 200 (Class II)

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

Sous-direction de la Métrologie, France

R76/1992-FR-97.01
Société Testut (ex Lutrana), 50 avenue du Président Kennedy, 91170 Viry-Chatillon, France + Société Testut, 957 rue de l'Horlogerie, BP 11, 62401 Béthune, France
Instrument de pesage à fonctionnement non automatique, étiqueteur de prix, modèles EL 17 GP, EL 18 GP, EL 19 GP, EL 20, interdit pour la vente directe au public (Class III)

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

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

R76/1992-NL-97.12
Shinko Denshi Co., Ltd, 3-9-11 Yushima, Bunkyo-ku, Tokyo 113, Japan
Models with: n <= 15 000 divisions; 150 g <= Max <= 6 000 g or 750 ct <= Max <= 30 000 ct; e >= 0.02 g or e >= 0.1 ct; e = d or e = 10 d; T <= -Max (Class II)

R76/1992-NL-97.13
Tokyo Electric Co., Ltd., 6-78, Minami-cho, Mishima-shi, Shizuoka-ken 411, Japan
Type SL 9000 (Class III)

R76/1992-NL-97.14
Measurement Systems International, Inc., 14240 Interurban Avenue South, Seattle, Washington 98168-4660, USA
Type MS-3360 Challenger 2 (Class III)

R76/1992-NL-97.15
Tanita Corporation (Brand names: Tanita, Rhewa), 14-2, 1-Chome, Maeno-cho, Itabashi-ku, Tokyo 174, Japan
Type TLC-100A (Class III)

R76/1992-NL-97.16
Allegany Technology, Inc., 11400 PPG Road, Cumberland, MD 21502, USA
Type ELTIS-3 / LFT (Classes III or IIII)

R76/1992-NL-97.17
Teraoka Seiko Co., Ltd., 13-12 Kugahara, 5-Chome, Ohta-ku, Tokyo 146, Japan
Type SM-8500 (Class III)

R76/1992-NL-97.18 Rev. 1
Mettler-Toledo A.G., Im Langacher, 8606 Greifensee, Switzerland
Type PG-S (Classes II and III)

R76/1992-NL-97.19
Teraoka Seiko Co., Ltd., 13-12 Kugahara, 5-Chome, Ohta-ku, Tokyo 146, Japan
Type DS-860 (Class III)

R76/1992-NL-97.20
Mettler-Toledo Inc., 1150 Dearborn Drive, Worthington, OH 43085-6712, USA
Type Mentor (Class III)

R76/1992-NL-97.21
Teraoka Seiko Co., Ltd., 13-12 Kugahara, 5-Chome, Ohta-ku, Tokyo 146, Japan
Type SM-25.. (Class III)

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*

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

R117/1995-NL-97.04
Tokheim Europe B.V., Reaal 5C, 2353 TK Leiderdorp, The Netherlands
Fuel dispensers for motor vehicles, model Premier with Tokheim 855 combined pump (Class 0.5)

R117/1995-NL-97.05
Tokheim Europe B.V., Reaal 5C, 2353 TK Leiderdorp, The Netherlands
Fuel dispensers for motor vehicles, model Premier with Bennett T-75 combined pump (Class 0.5)

ERRATUM
REGISTERED OIML CERTIFICATES
JULY 1997 ISSUE OF THE OIML BULLETIN

An error appeared on page 45 of the July 1997 issue of the OIML Bulletin for Instrument Category *Automatic Catchweighing Instruments* - R 51 (1996). This is corrected below:

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

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

R 51 (1996)

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

Sous-direction de la Métrologie, France

R51/1996-FR-97.01
Société ASCOREL, Z.I. de Montplaisir, Rue du Champ de Courses, BP 5, 38780 Pont-Evêque, France
MC 250 pour chargeuses à godet (matériau en vrac), Max = 5 t : e = 50 kg, n = 100; 5 t < Max ≤ 10 t : e = 100 kg, n ≤ 100 (Class Y(B))

With the publication of OIML Recommendations R 58 *Sound level meters*, R 88 *Integrating-averaging sound level meters* and R 123 *Portable and transportable X-ray fluorescence spectrometers for field measurement of hazardous elemental pollutants*, these three new categories of measuring instruments are now covered by the OIML Certificate System. ■

New measuring instrument categories covered by the OIML Certificate System

Nouvelles catégories d'instruments de mesure couvertes par le Système de Certificats OIML

Avec la publication des Recommandations OIML R 58 *Sonomètres*, R 88 *Sonomètres intégrateurs-moyenneurs* et R 123 *Spectromètres à fluorescence de rayons X portatifs et déplaçables pour la mesure sur le terrain d'éléments polluants dangereux*, ces trois nouvelles catégories d'instruments de mesure sont à présent couvertes par le Système de Certificats OIML. ■

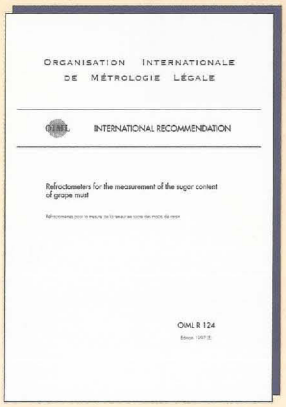
NEW OIML PUBLICATIONS
NOUVELLES PUBLICATIONS OIML

R 58 **Sound level meters**
Temporarily only available in English

R 88 **Integrating-averaging sound level meters**
Temporarily only available in English

R 123 **Portable and transportable X-ray fluorescence spectrometers for field measurement of hazardous elemental pollutants**
Temporarily only available in English

R 124 **Refractometers for the measurement of the sugar content of grape must**
Réfractomètres pour la mesure de la teneur en sucre des moûts de raisin


ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL RECOMMENDATION

Refractometers for the measurement of the sugar content of grape must

OIML R 124

Committee drafts received by BIML

September 1997 – November 1997

Stage of development	Title	TC/SC	Secretariat
3 CD	Multi-dimensional measuring instruments	TC 7/SC 5	Australia

2nd European Conference on Weigh-in-motion of road vehicles

Lisbon, 14-16 September 1998

This Conference is organized by the Management Committee of COST 323, the Committee for European cooperation in the field of weigh-in-motion and is supported by the Transport Directorate of the European Commission.

Conference themes

- Tests of WIM systems
- *Data quality and management*
- Influence of environmental conditions
- Weighing for enforcement
- Road pricing applications
- Developments in sensor & system design
- Bridge WIM systems
- Theoretical aspects of WIM
- Vehicle-infrastructure interaction
- Vehicle dynamics and instrumentation
- Safety

Languages

- English
- French
- German
- Portuguese
- *with simultaneous translation*

Contact information

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Announcement of a Seminar on

The role of metrology in economic and social development

Metrology, the art of measurement, has to follow the economic and political developments which are characterized by liberalization of markets, globalization of trade and industrial activities, and ever faster technological innovations. Reliable measurements are a prerequisite for fair trade, quality assurance and certificates acceptable at international level; they are equally important for protecting both citizens and the environment against the harmful effects of these developments. Metrology is also necessary for the implementation of the fundamental program of action for achieving sustainable development (Agenda 21) adopted by the Rio Earth Summit in 1992.

Coherent development of metrological infrastructures at national, regional and international levels is one of the challenges for the years to come. Especially developing countries and countries in transition towards a market economy have to respond to this trend in order to become competitive on the world markets.

In their endeavor to assist these countries in overcoming their difficulties, the three international organizations of metrology,

- The International Bureau of Weights and Measures (**BIPM**) of the Metre Convention;
- The International Organization of Legal Metrology (**OIML**);
- The International Measurement Confederation (**IMEKO**), especially its Technical Committee TC 11 *Metrological Infrastructures*

and Germany's national metrology institute, the Physikalisch-Technische Bundesanstalt (**PTB**),

have called for a seminar. The aim is to discuss the global challenges and the necessity for developing appropriate and viable metrological infrastructures especially for developing countries, for countries in transition towards a market economy and for regional metrology organizations. The PTB will organize and host the seminar.

Anticipated participants

- Government officials and key decision makers responsible for metrology mainly in developing countries as well as countries in transition towards a market economy;
- Representatives of national metrology institutes;
- Representatives of donor agencies (World Bank, European Union, Regional Development Banks, and others);
- Representatives of international and regional metrology, standardization, accreditation and certification bodies.

BIPM

Objectives of the seminar

- to highlight the global challenges;
- to demonstrate the role of measurements and the operation of metrology systems and their benefits to industry, commerce and society;
- to inform about the necessity for national metrology services and for regional and international cooperation to assure world-wide traceability;
- to recommend actions for a consistent and effective approach to the development of metrological infrastructures based on national and regional requirements.

Anticipated outcomes of the seminar

- information specially targeted at developing countries and those in transition, on the subject of metrological requirements at regional and national levels;
- sensitization of decision makers and donor agencies with regard to the importance of metrology, calibration and verification services, accreditation of laboratories and the necessary investments;
- facts and advice to aid further development of metrological infrastructures at national, regional and international levels;
- publication of the proceedings.

Structure of the seminar

Sessions

1 Requirements to be met by metrology as a result of global challenges
2 Working programs of international organizations for metrology and other related activities
3 Assistance in the establishment of metrological infrastructures by national, regional and international donor organizations
4 Establishment and organization of adapted metrological infrastructures and of regional cooperation in metrology
5 Supporting activities: training, maintenance, professional associations.

Invited speakers will present their views. At the end of each session, round table discussions will provide the possibility to exchange views with the participants. Essential facts will be retained and recommendations for metrology made.

Posters

- *Technical cooperation projects in the field of metrology, standardization, testing, quality, accreditation and certification (MSTQ) of national, regional and international donor organizations;*
- *Regional cooperation in the field of MSTQ.*

Visits will also be made to PTB and local industry laboratories.

Date: 15–19 June 1998
Venue: Braunschweig, Federal Republic of Germany
Sponsored by: Federal Ministry for Economic Cooperation and Development of Germany (BMZ) and other sponsors
Organization: Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig
Telephone (49) 531 531 592 8200 - Fax (49) 531 592 8225

meetings OIML réunions

January 1998

26–28	TC 8/SC 7 Gas metering	BRUSSELS, BELGIUM

February 1998

24–25	Presidential Council meeting	PARIS, FRANCE

October 1998

26–30	33rd CIML meeting and other OIML meetings	SEOUL, REPUBLIC OF KOREA

NWML 1998 TRAINING COURSES

22–23 April and 16–17 September	Mass metrology and the calibration of weights
11 March and 7 October	Verification of nonautomatic weighing instruments under Directive 90/384/EEC
14–30 September	Legal metrology course
18–19 February and 18–19 November	Calibration and measurement uncertainties and the GUM

The OIML is pleased to welcome the following new

Corresponding Members:

Argentina

Chinese Taipei

info

3RD INTERNATIONAL SYMPOSIUM

6–8 April 1998, NPL (UK)

- **Humidity instrumentation**
- **Humidity applications**
- **Humidity standards and calibration**
- **Moisture in solids and liquids**

Humidity & Moisture

Objective

This Symposium will bring together leading international scientists, manufacturers and users of humidity and moisture measurement, review current technology, explore active research and developments and speculate on future needs and directions.

Conference summary

A wide range of fully refereed scientific papers will be presented in several parallel sessions grouped by topic, listed above. A poster display of papers not presented orally will provide further opportunity to meet and debate. An exhibition of humidity- and moisture-related technologies and applications will be open on each day of the Symposium.

Contact information

Tracey Collier, National Physical Laboratory (Building 17), Teddington, UK

Tel: (44) 181 943 6710

Fax: (44) 181 943 6306

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

SECRETARIAT
BUREAU INTERNATIONAL DE MÉTROLOGIE LÉGALE
11, RUE TURGOT, 75009 PARIS, FRANCE
TEL: 33 (0)1 48 78 12 82 OR 33 (0)1 42 85 27 11
FAX: 33 (0)1 42 82 17 27
E-MAIL: biml@oiml.org
INTERNET: http://www.oiml.org

CONTACT INFORMATION

Member States – Members of the International Committee of Legal Metrology
Corresponding Members – National metrology services

PUBLICATIONS

classified by subject and number

International Recommendations
International Documents
Other publications

MEMBER STATES

ALGERIA
Le Directeur
Office National de Métrologie Légale
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P 9 (1992) — 100 FRF
Guidelines for the establishment of simplified metrology regulations

P 17 (1995) — 300 FRF
Guide to the expression of uncertainty in measurement
Guide pour l'expression de l'incertitude de mesure

Measurement standards and verification equipment
Étalons et équipement de vérification

D 6 (1983) — 60 FRF
Documentation for measurement standards and calibration devices
Documentation pour les étalons et les dispositifs d'étalonnage

D 8 (1984) — 60 FRF
Principles concerning choice, official recognition, use and conservation of measurement standards
Principes concernant le choix, la reconnaissance officielle, l'utilisation et la conservation des étalons

D 10 (1984) — 50 FRF
Guidelines for the determination of recalibration intervals of measuring equipment used in testing laboratories
Conseils pour la détermination des intervalles de réétalonnage des équipements de mesure utilisés dans les laboratoires d'essais

D 18 (1987) — 50 FRF
General principles of the use of certified reference materials in measurements
Principes généraux d'utilisation des matériaux de référence certifiés dans les mesurages

D 23 (1993) — 80 FRF
Principles of metrological control of equipment used for verification
Principes du contrôle métrologique des équipements utilisés pour la vérification

P 4 (1986–*1981*) — 100 FRF
Verification equipment for National Metrology Services
Equipement d'un Service national de métrologie

P 6 (1987) — 100 FRF
Suppliers of verification equipment (bilingual French-English)
Fournisseurs d'équipement de vérification (bilingue français-anglais)

P 7 (1989) — 100 FRF
Planning of metrology and testing laboratories
Planification de laboratoires de métrologie et d'essais

P 15 (1989) — 100 FRF
Guide to calibration

Mass and density
Masses et masses volumiques

R 15 (1974–*1970*) — 80 FRF
Instruments for measuring the hectolitre mass of cereals
Instruments de mesure de la masse à l'hectolitre des céréales

R 22 (1975) — 150 FRF
International alcoholometric tables (trilingual French-English-Spanish version)
Tables alcoométriques internationales (version trilingue français-anglais-espagnol)

R 33 (1979–*1973*) — 50 FRF
Conventional value of the result of weighing in air
Valeur conventionnelle du résultat des pesées dans l'air

R 44 (1985) — 50 FRF
Alcoholometers and alcohol hydrometers and thermometers for use in alcoholometry
Alcoomètres et aréomètres pour alcool et thermomètres utilisés en alcoométrie

R 47 (1979–*1978*) — 60 FRF
Standard weights for testing of high capacity weighing machines
Poids étalons pour le contrôle des instruments de pesage de portée élevée

R 50-1 (1997) — 150 FRF
Continuous totalizing automatic weighing instruments (Belt weighers). Part 1: Metrological and technical requirements - Tests
Instruments de pesage totalisateurs continus à fonctionnement automatique (peseuses sur bande)
Partie 1: Exigences métrologiques et techniques - Essais

R 50-2 (1997) — 200 FRF
Continuous totalizing automatic weighing instruments (Belt weighers). Part 2: Test report format
Instruments de pesage totalisateurs continus à fonctionnement automatique (peseuses sur bande)
Partie 2: Format du rapport d'essai

R 51-1 (1996) — 100 FRF
Automatic catchweighing instruments. Part 1: Metrological and technical requirements - Tests
Instruments de pesage trieurs-étiqueteurs à fonctionnement automatique. Partie 1: Exigences métrologiques et techniques - Essais

R 51-2 (1996) — 300 FRF
Automatic catchweighing instruments. Part 2: Test report format
Instruments de pesage trieurs-étiqueteurs à fonctionnement automatique. Partie 2: Format du rapport d'essai

R 52 (1980) — 50 FRF
Hexagonal weights, ordinary accuracy class from 100 g to 50 kg
Poids hexagonaux de classe de précision ordinaire, de 100 g à 50 kg

R 60 (1991) — 80 FRF
Metrological regulation for load cells
Réglementation métrologique des cellules de pesée

Annex (1993) — 80 FRF
Test report format for the evaluation of load cells
Format du rapport d'essai des cellules de pesée

R 61-1 (1996) — 150 FRF
Automatic gravimetric filling instruments. Part 1: Metrological and technical requirements - Tests
Doseuses pondérales à fonctionnement automatique. Partie 1: Exigences métrologiques et techniques - Essais

R 61-2 (1996) — 250 FRF
Automatic gravimetric filling instruments. Part 2: Test report format
Doseuses pondérales à fonctionnement automatique. Partie 2: Format du rapport d'essai

R 74 (1993) — 80 FRF
Electronic weighing instruments
Instruments de pesage électroniques

R 76-1 (1992) — 300 FRF
Nonautomatic weighing instruments. Part 1: Metrological and technical requirements - Tests
Instruments de pesage à fonctionnement non automatique. Partie 1: Exigences métrologiques et techniques - Essais

Amendment No. 1 (1994) — NC

R 76-2 (1993) — 200 FRF
Nonautomatic weighing instruments. Part 2: Pattern evaluation report
Instruments de pesage à fonctionnement non automatique. Partie 2: Rapport d'essai de modèle

Amendment No. 1 (1995) — NC

R 106-1 (1997) — 150 FRF
Automatic rail-weighbridges. Part 1: Metrological and technical requirements - Tests
Ponts-bascules ferroviaires à fonctionnement automatique. Partie 1: Exigences métrologiques et techniques - Essais

R 106-2 (1997) — 250 FRF
Automatic rail-weighbridges. Part 2: Test report format
Ponts-bascules ferroviaires à fonctionnement automatique. Partie 2: Format du rapport d'essai

R 107-1 (1997) — 150 FRF
Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers). Part 1: Metrological and technical requirements - Tests
Instruments de pesage totalisateurs discontinus à fonctionnement automatique (peseuses totalisatrices à trémie) Partie 1: Exigences métrologiques et techniques - Essais

R 107-2 (1997) — 300 FRF
Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers). Part 2: Test report format
Instruments de pesage totalisateurs discontinus à fonctionnement automatique (peseuses totalisatrices à trémie) Partie 2: Format du rapport d'essai

R 111 (1994) — 80 FRF
Weights of classes E_1, E_2, F_1, F_2, M_1, M_2, M_3
Poids des classes E_1, E_2, F_1, F_2, M_1, M_2, M_3

P 5 (1992) — 100 FRF
Mobile equipment for the verification of road weighbridges (bilingual French-English)
Equipement mobile pour la vérification des ponts-bascules routiers (bilingue français-anglais)

P 8 (1987) — 100 FRF
Density measurement
Mesure de la masse volumique

Length and speed
Longueurs et vitesses

R 21 (1975–*1973*) — 60 FRF
Taximeters
Taximètres

R 24 (1975–*1973*) — 50 FRF
Standard one metre bar for verification officers
Mètre étalon rigide pour Agents de vérification

R 30 (1981) — 60 FRF
End standards of length (gauge blocks)
Mesures de longueur à bouts plans (cales étalons)

R 35 (1985) — 80 FRF
Material measures of length for general use
Mesures matérialisées de longueur pour usages généraux

R 55 (1981) — 50 FRF
Speedometers, mechanical odometers and chronotachographs for motor vehicles. Metrological regulations
Compteurs de vitesse, compteurs mécaniques de distance et chronotachygraphes des véhicules automobiles. Réglementation métrologique

R 66 (1985) — 60 FRF
Length measuring instruments
Instruments mesureurs de longueurs

R 91 (1990) — 60 FRF
Radar equipment for the measurement of the speed of vehicles
Cinémomètres radar pour la mesure de la vitesse des véhicules

R 98 (1991) — 60 FRF
High-precision line measures of length
Mesures matérialisées de longueur à traits de haute précision

Liquid measurement
Mesurage des liquides

R 4 (1972–*1970*) — 50 FRF
Volumetric flasks (one mark) in glass
Fioles jaugées à un trait en verre

R 29 (1979–*1973*) — 50 FRF
Capacity serving measures
Mesures de capacité de service

R 40 (1981–*1977*) — 60 FRF
Standard graduated pipettes for verification officers
Pipettes graduées étalons pour Agents de vérification

R 41 (1981–*1977*) — 60 FRF
Standard burettes for verification officers
Burettes étalons pour Agents de vérification

R 43 (1981–*1977*) — 60 FRF
Standard graduated glass flasks for verification officers
Fioles étalons graduées en verre pour Agents de vérification

R 45 (1980–*1977*) — 50 FRF
Casks and barrels
Tonneaux et futailles

R 49 (being revised - *en cours de révision*)
Water meters intended for the metering of cold water
Compteurs d'eau destinés au mesurage de l'eau froide

R 63 (1994) — 50 FRF
Petroleum measurement tables
Tables de mesure du pétrole

R 71 (1985) — 80 FRF
Fixed storage tanks. General requirements
Réservoirs de stockage fixes. Prescriptions générales

R 72 (1985) — 60 FRF
Hot water meters
Compteurs d'eau destinés au mesurage de l'eau chaude

R 80 (1989) — 100 FRF
Road and rail tankers
Camions et wagons-citernes

R 81 (being printed - *en cours de publication*)
Dynamic measuring devices and systems for cryogenic liquids (including tables of density for liquid argon, helium, hydrogen, nitrogen and oxygen)
Dispositifs et systèmes de mesure dynamique de liquides cryogéniques (comprend tables de masse volumique pour argon, hélium, hydrogène, azote et oxygène liquides)

R 85 (being printed - *en cours de publication*)
Automatic level gauges for measuring the level of liquid in fixed storage tanks
Jaugeurs automatiques pour le mesurage des niveaux de liquide dans les réservoirs de stockage fixes

R 86 (1989) — 50 FRF
Drum meters for alcohol and their supplementary devices
Compteurs à tambour pour alcool et leurs dispositifs complémentaires

R 95 (1990) — 60 FRF
Ships' tanks - General requirements
Bateaux-citernes - Prescriptions générales

R 96 (1990) — 50 FRF
Measuring container bottles
Bouteilles récipients-mesures

R 105 (1993) — 100 FRF
Direct mass flow measuring systems for quantities of liquids
Ensembles de mesurage massiques directs de quantités de liquides

Annex (1995) — 80 FRF
Test report format
Format du rapport d'essai

R 117 (1995) — 400 FRF
Measuring systems for liquids other than water
Ensembles de mesurage de liquides autres que l'eau

R 118 (1995) — 100 FRF
Testing procedures and test report format for pattern evaluation of fuel dispensers for motor vehicles
Procédures d'essai et format du rapport d'essai des modèles de distributeurs de carburant pour véhicules à moteur

R 119 (1996) — 80 FRF
Pipe provers for testing measuring systems for liquids other than water
Tubes étalons pour l'essai des ensembles de mesurage de liquides autres que l'eau

R 120 (1996) — 100 FRF
Standard capacity measures for testing measuring systems for liquids other than water
Mesures de capacité étalons pour l'essai des ensembles de mesurage de liquides autres que l'eau

R 125 (being printed - *en cours de publication*)
Measuring systems for the mass of liquids in tanks
Systèmes de mesure de la masse des liquides dans les réservoirs

D 4 (1981) — 50 FRF
Installation and storage conditions for cold water meters
Conditions d'installation et de stockage des compteurs d'eau froide

D 7 (1984) — 80 FRF
The evaluation of flow standards and facilities used for testing water meters
Evaluation des étalons de débitmétrie et des dispositifs utilisés pour l'essai des compteurs d'eau

D 25 (1996) — 60 FRF
Vortex meters used in measuring systems for fluids
Compteurs à vortex utilisés dans les ensembles de mesurage de fluides

D 26 (being printed - *en cours de publication*)
Glass delivery measures – Automatic pipettes
Mesures en verre à délivrer – Pipettes automatiques

Gas measurement
Mesurage des gaz (1)

R 6 (1989) — 80 FRF
General provisions for gas volume meters
Dispositions générales pour les compteurs de volume de gaz

R 31 (1995) — 80 FRF
Diaphragm gas meters
Compteurs de gaz à parois déformables

R 32 (1989) — 60 FRF
Rotary piston gas meters and turbine gas meters
Compteurs de volume de gaz à pistons rotatifs et compteurs de volume de gaz à turbine

Pressure
Pressions (2)

R 23 (1975–*1973*) — 60 FRF
Tyre pressure gauges for motor vehicles
Manomètres pour pneumatiques de véhicules automobiles

R 53 (1982) — 60 FRF
Metrological characteristics of elastic sensing elements used for measurement of pressure. Determination methods
Caractéristiques métrologiques des éléments récepteurs élastiques utilisés pour le mesurage de la pression. Méthodes de leur détermination

R 97 (1990) — 60 FRF
Barometers
Baromètres

R 101 (1991) — 80 FRF
Indicating and recording pressure gauges, vacuum gauges and pressure vacuum gauges with elastic sensing elements (ordinary instruments)
Manomètres, vacuomètres et manovacuomètres indicateurs et enregistreurs à élément récepteur élastique (instruments usuels)

R 109 (1993) — 60 FRF
Pressure gauges and vacuum gauges with elastic sensing elements (standard instruments)
Manomètres et vacuomètres à élément récepteur élastique (instruments étalons)

R 110 (1994) — 80 FRF
Pressure balances
Manomètres à piston

Temperature
Températures (2)

R 18 (1989) — 60 FRF
Visual disappearing filament pyrometers
Pyromètres optiques à filament disparaissant

R 48 (1980–*1978*) — 50 FRF
Tungsten ribbon lamps for calibration of optical pyrometers
Lampes à ruban de tungstène pour l'étalonnage des pyromètres optiques

R 75 (1988) — 60 FRF
Heat meters
Compteurs d'énergie thermique

R 84 (1989) — 60 FRF
Resistance-thermometer sensors made of platinum, copper or nickel (for industrial and commercial use)
Capteurs à résistance thermométrique de platine, de cuivre ou de nickel (à usages techniques et commerciaux)

D 24 (1996) — 60 FRF
Total radiation pyrometers
Pyromètres à radiation totale

P 16 (1991) — 100 FRF
Guide to practical temperature measurements

Electricity
Électricité

R 46 (being revised - *en cours de révision*)
Active electrical energy meters for direct connection of class 2
Compteurs d'énergie électrique active à branchement direct de la classe 2

D 11 (1994) — 80 FRF
General requirements for electronic measuring instruments
Exigences générales pour les instruments de mesure électroniques

Acoustics and vibration
Acoustique et vibrations (1)

R 58 (1998) — 80 FRF
Sound level meters
Sonomètres

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(1) See also "Liquid measurement" *D 25 – Voir aussi "Mesurage des liquides" D 25*
(2) See also "Medical instruments" – *Voir aussi "Instruments médicaux"*

R 88 (1998) — 80 FRF
Integrating-averaging sound level meters
Sonomètres intégrateurs-moyenneurs

R 102 (1992) — 50 FRF
Sound calibrators
Calibreurs acoustiques

Annex (1995) — 80 FRF
Test methods for pattern evaluation and test report format
Méthodes d'essai de modèle et format du rapport d'essai

R 103 (1992) — 60 FRF
Measuring instrumentation for human response to vibration
Appareillage de mesure pour la réponse des individus aux vibrations

R 104 (1993) — 60 FRF
Pure-tone audiometers
Audiomètres à sons purs

Annex F (1997) — 100 FRF
Test report format
Format du rapport d'essai

Environment
Environnement

R 82 (1989) — 80 FRF
Gas chromatographs for measuring pollution from pesticides and other toxic substances
Chromatographes en phase gazeuse pour la mesure des pollutions par pesticides et autres substances toxiques

R 83 (1990) — 80 FRF
Gas chromatograph/mass spectrometer/data system for analysis of organic pollutants in water
Chromatographe en phase gazeuse équipé d'un spectromètre de masse et d'un système de traitement de données pour l'analyse des polluants organiques dans l'eau

R 99 (being printed - *en cours de publication*)
Instruments for measuring vehicle exhaust emissions
Instruments de mesure des gaz d'échappement des véhicules

R 100 (1991) — 80 FRF
Atomic absorption spectrometers for measuring metal pollutants in water
Spectromètres d'absorption atomique pour la mesure des polluants métalliques dans l'eau

R 112 (1994) — 80 FRF
High performance liquid chromatographs for measurement of pesticides and other toxic substances
Chromatographes en phase liquide de haute performance pour la mesure des pesticides et autres substances toxiques

R 113 (1994) — 80 FRF
Portable gas chromatographs for field measurements of hazardous chemical pollutants
Chromatographes en phase gazeuse portatifs pour la mesure sur site des polluants chimiques dangereux

R 116 (1995) — 80 FRF
Inductively coupled plasma atomic emission spectrometers for measurement of metal pollutants in water
Spectromètres à émission atomique de plasma couplé inductivement pour le mesurage des polluants métalliques dans l'eau

R 123 (1997) — 100 FRF
Portable and transportable X-ray fluorescence spectrometers for field measurement of hazardous elemental pollutants
Spectromètres à fluorescence de rayons X portatifs et déplaçables pour la mesure sur le terrain d'éléments polluants dangereux

D 22 (1991) — 80 FRF
Guide to portable instruments for assessing airborne pollutants arising from hazardous wastes
Guide sur les instruments portatifs pour l'évaluation des polluants contenus dans l'air en provenance des sites de décharge de déchets dangereux

Physico-chemical measurements
Mesures physico-chimiques

R 14 (1995) — 60 FRF
Polarimetric saccharimeters
Saccharimètres polarimétriques

R 54 (being revised - *en cours de révision*)
pH scale for aqueous solutions
Echelle de pH des solutions aqueuses

R 56 (1981) — 50 FRF
Standard solutions reproducing the conductivity of electrolytes
Solutions-étalons reproduisant la conductivité des électrolytes

R 59 (1984) — 80 FRF
Moisture meters for cereal grains and oilseeds
Humidimètres pour grains de céréales et graines oléagineuses

R 68 (1985) — 50 FRF
Calibration method for conductivity cells
Méthode d'étalonnage des cellules de conductivité

R 69 (1985) — 50 FRF
Glass capillary viscometers for the measurement of kinematic viscosity. Verification method
Viscosimètres à capillaire, en verre, pour la mesure de la viscosité cinématique. Méthode de vérification

R 70 (1985) — 50 FRF
Determination of intrinsic and hysteresis errors of gas analysers
Détermination des erreurs de base et d'hystérésis des analyseurs de gaz

R 73 (1985) — 50 FRF

Requirements concerning pure gases CO, CO_2, CH_4, H_2, O_2, N_2 and Ar intended for the preparation of reference gas mixtures
Prescriptions pour les gaz purs CO, CO_2, CH_4, H_2, O_2, N_2 et Ar destinés à la préparation des mélanges de gaz de référence

R 92 (1989) — 60 FRF

Wood-moisture meters - Verification methods and equipment: general provisions
Humidimètres pour le bois - Méthodes et moyens de vérification: exigences générales

R 108 (1993) — 60 FRF

Refractometers for the measurement of the sugar content of fruit juices
Réfractomètres pour la mesure de la teneur en sucre des jus de fruits

R 121 (1996) — 60 FRF

The scale of relative humidity of air certified against saturated salt solutions
Échelle d'humidité relative de l'air certifiée par rapport à des solutions saturées de sels

R 124 (1997) — 80 FRF

Refractometers for the measurement of the sugar content of grape must
Réfractomètres pour la mesure de la teneur en sucre des moûts de raisin

R 126 (being printed - *en cours de publication*)

Evidential breath analyzers
Éthylomètres

D 17 (1987) — 50 FRF

Hierarchy scheme for instruments measuring the viscosity of liquids
Schéma de hiérarchie des instruments de mesure de la viscosité des liquides

Medical instruments
Instruments médicaux

R 7 (1979–*1978*) — 60 FRF

Clinical thermometers, mercury-in-glass with maximum device
Thermomètres médicaux à mercure, en verre, avec dispositif à maximum

R 16 (1973–*1970*) — 50 FRF

Manometers for instruments for measuring blood pressure (sphygmomanometers)
Manomètres des instruments de mesure de la tension artérielle (sphygmomanomètres)

R 26 (1978–*1973*) — 50 FRF

Medical syringes
Seringues médicales

R 78 (1989) — 50 FRF

Westergren tubes for measurement of erythrocyte sedimentation rate
Pipettes Westergren pour la mesure de la vitesse de sédimentation des hématies

R 89 (1990) — 80 FRF

Electroencephalographs - Metrological characteristics - Methods and equipment for verification
Électroencéphalographes - Caractéristiques métrologiques - Méthodes et moyens de vérification

R 90 (1990) — 80 FRF

Electrocardiographs - Metrological characteristics - Methods and equipment for verification
Électrocardiographes - Caractéristiques métrologiques - Méthodes et moyens de vérification

R 93 (1990) — 60 FRF

Focimeters
Frontofocomètres

R 114 (1995) — 80 FRF

Clinical electrical thermometers for continuous measurement
Thermomètres électriques médicaux pour mesurage en continu

R 115 (1995) — 80 FRF

Clinical electrical thermometers with maximum device
Thermomètres électriques médicaux avec dispositif à maximum

R 122 (1996) — 60 FRF

Equipment for speech audiometry
Appareils pour l'audiométrie vocale

D 21 (1990) — 80 FRF

Secondary standard dosimetry laboratories for the calibration of dosimeters used in radiotherapy
Laboratoires secondaires d'étalonnage en dosimétrie pour l'étalonnage des dosimètres utilisés en radiothérapie

Testing of materials
Essais des matériaux

R 9 (1972–*1970*) — 60 FRF

Verification and calibration of Brinell hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Brinell

R 10 (1974–*1970*) — 60 FRF

Verification and calibration of Vickers hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Vickers

R 11 (1974–*1970*) — 60 FRF

Verification and calibration of Rockwell B hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Rockwell B

R 12 (1974–*1970*) — 60 FRF
Verification and calibration of Rockwell C hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Rockwell C

R 36 (1980–*1977*) — 60 FRF
Verification of indenters for hardness testing machines
Vérification des pénétrateurs des machines d'essai de dureté

R 37 (1981–*1977*) — 60 FRF
Verification of hardness testing machines (Brinell system)
Vérification des machines d'essai de dureté (système Brinell)

R 38 (1981–*1977*) — 60 FRF
Verification of hardness testing machines (Vickers system)
Vérification des machines d'essai de dureté (système Vickers)

R 39 (1981–*1977*) — 60 FRF
Verification of hardness testing machines (Rockwell systems B,F,T - C,A,N)
Vérification des machines d'essai de dureté (systèmes Rockwell B,F,T -C,A,N)

R 62 (1985) — 80 FRF
Performance characteristics of metallic resistance strain gauges
Caractéristiques de performance des extensomètres métalliques à résistance

R 64 (1985) — 50 FRF
General requirements for materials testing machines
Exigences générales pour les machines d'essai des matériaux

R 65 (1985) — 60 FRF
Requirements for machines for tension and compression testing of materials
Exigences pour les machines d'essai des matériaux en traction et en compression

V 3 (1991) — 80 FRF
Hardness testing dictionary (quadrilingual French-English-German-Russian)
Dictionnaire des essais de dureté (quadrilingue français-anglais-allemand-russe)

P 10 (1981) — 50 FRF
The metrology of hardness scales - Bibliography

P 11 (1983) — 100 FRF
Factors influencing hardness measurement

P 12 (1984) — 100 FRF
Hardness test blocks and indenters

P 13 (1989) — 100 FRF
Hardness standard equipment

P 14 (1991) — 100 FRF
The unification of hardness measurement

Prepackaging
Préemballages

R 79 (1997) — 60 FRF
Labeling requirements for prepackaged products
Exigences pour l'étiquetage des produits préemballés

R 87 (1989) — 50 FRF
Net content in packages
Contenu net des préemballages

OIML publications classified by number
Publications OIML classées par numéros

INTERNATIONAL RECOMMENDATIONS
RECOMMANDATIONS INTERNATIONALES

R 4 (1970–*1972*) — 50 FRF
Volumetric flasks (one mark) in glass
Fioles jaugées à un trait en verre

R 6 (1989) — 80 FRF
General provisions for gas volume meters
Dispositions générales pour les compteurs de volume de gaz

R 7 (1979–*1978*) — 60 FRF
Clinical thermometers, mercury-in-glass with maximum device
Thermomètres médicaux à mercure, en verre, avec dispositif à maximum

R 9 (1972–*1970*) — 60 FRF
Verification and calibration of Brinell hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Brinell

R 10 (1974–*1970*) — 60 FRF
Verification and calibration of Vickers hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Vickers

R 11 (1974–*1970*) — 60 FRF
Verification and calibration of Rockwell B hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Rockwell B

R 12 (1974–1970) — 60 FRF
Verification and calibration of Rockwell C hardness standardized blocks
Vérification et étalonnage des blocs de référence de dureté Rockwell C

R 14 (1995) — 60 FRF
Polarimetric saccharimeters
Saccharimètres polarimétriques

R 15 (1974–1970) — 80 FRF
Instruments for measuring the hectolitre mass of cereals
Instruments de mesure de la masse à l'hectolitre des céréales

R 16 (1973–1970) — 50 FRF
Manometers for instruments for measuring blood pressure (sphygmomanometers)
Manomètres des instruments de mesure de la tension artérielle (sphygmomanomètres)

R 18 (1989) — 60 FRF
Visual disappearing filament pyrometers
Pyromètres optiques à filament disparaissant

R 21 (1975–1973) — 60 FRF
Taximeters
Taximètres

R 22 (1975–1973) — 150 FRF
International alcoholometric tables (trilingual French-English-Spanish)
Tables alcoométriques internationales (trilingue français-anglais-espagnol)

R 23 (1975–1973) — 60 FRF
Tyre pressure gauges for motor vehicles
Manomètres pour pneumatiques de véhicules automobiles

R 24 (1975–1973) — 50 FRF
Standard one metre bar for verification officers
Mètre étalon rigide pour agents de vérification

R 26 (1978–1973) — 50 FRF
Medical syringes
Seringues médicales

R 29 (1979–1973) — 50 FRF
Capacity serving measures
Mesures de capacité de service

R 30 (1981) — 60 FRF
End standards of length (gauge blocks)
Mesures de longueur à bouts plans (cales étalons)

R 31 (1995) — 80 FRF
Diaphragm gas meters
Compteurs de gaz à parois déformables

R 32 (1989) — 60 FRF
Rotary piston gas meters and turbine gas meters
Compteurs de volume de gaz à pistons rotatifs et compteurs de volume de gaz à turbine

R 33 (1979–1973) — 50 FRF
Conventional value of the result of weighing in air
Valeur conventionnelle du résultat des pesées dans l'air

R 34 (1979–1974) — 60 FRF
Accuracy classes of measuring instruments
Classes de précision des instruments de mesurage

R 35 (1985) — 80 FRF
Material measures of length for general use
Mesures matérialisées de longueur pour usages généraux

R 36 (1980–1977) — 60 FRF
Verification of indenters for hardness testing machines
Vérification des pénétrateurs des machines d'essai de dureté

R 37 (1981–1977) — 60 FRF
Verification of hardness testing machines (Brinell system)
Vérification des machines d'essai de dureté (système Brinell)

R 38 (1981–1977) — 60 FRF
Verification of hardness testing machines (Vickers system)
Vérification des machines d'essai de dureté (système Vickers)

R 39 (1981–1977) — 60 FRF
Verification of hardness testing machines (Rockwell systems B,F,T-C,A,N)
Vérification des machines d'essai de dureté (systèmes Rockwell B,F,T-C,A,N)

R 40 (1981–1977) — 60 FRF
Standard graduated pipettes for verification officers
Pipettes graduées étalons pour agents de vérification

R 41 (1981–1977) — 60 FRF
Standard burettes for verification officers
Burettes étalons pour agents de vérification

R 42 (1981–1977) — 50 FRF
Metal stamps for verification officers
Poinçons de métal pour agents de vérification

R 43 (1981–1977) — 60 FRF
Standard graduated glass flasks for verification officers
Fioles étalons graduées en verre pour agents de vérification

R 44 (1985) — 50 FRF
Alcoholometers and alcohol hydrometers and thermometers for use in alcoholometry
Alcoomètres et aréomètres pour alcool et thermomètres utilisés en alcoométrie

R 45 (1980–1977) — 50 FRF
Casks and barrels
Tonneaux et futailles

R 46 (being revised - *en cours de révision*)
Active electrical energy meters for direct connection of class 2
Compteurs d'énergie électrique active à branchement direct de la classe 2

R 47 (1979–1978) — 60 FRF
Standard weights for testing of high capacity weighing machines
Poids étalons pour le contrôle des instruments de pesage de portée élevée

R 48 (1980–1978) — 50 FRF
Tungsten ribbon lamps for calibration of optical pyrometers
Lampes à ruban de tungstène pour l'étalonnage des pyromètres optiques

R 49 (being revised - *en cours de révision*)
Water meters intended for the metering of cold water
Compteurs d'eau destinés au mesurage de l'eau froide

R 50-1 (1997) — 150 FRF
Continuous totalizing automatic weighing instruments (Belt weighers). Part 1: Metrological and technical requirements - Tests
Instruments de pesage totalisateurs continus à fonction nement automatique (peseuses sur bande). Partie 1: Exigences métrologiques et techniques - Essais

R 50-2 (1997) — 200 FRF
Continuous totalizing automatic weighing instruments (Belt weighers). Part 2: Test report format
Instruments de pesage totalisateurs continus à fonctionnement automatique (peseuses sur bande). Partie 2: Format du rapport d'essai

R 51-1 (1996) — 100 FRF
Automatic catchweighing instruments. Part 1: Metrological and technical requirements - Tests
Instruments de pesage trieurs-étiqueteurs à fonctionnement automatique. Partie 1: Exigences métrologiques et techniques - Essais

R 51-2 (1996) — 300 FRF
Automatic catchweighing instruments. Part 2: Test report format
Instruments de pesage trieurs-étiqueteurs à fonctionnement automatique. Partie 2: Format du rapport d'essai

R 52 (1980) — 50 FRF
Hexagonal weights, ordinary accuracy class from 100 g to 50 kg
Poids hexagonaux de classe de précision ordinaire, de 100 g à 50 kg

R 53 (1982) — 60 FRF
Metrological characteristics of elastic sensing elements used for measurement of pressure. Determination methods
Caractéristiques métrologiques des éléments récepteurs élastiques utilisés pour le mesurage de la pression. Méthodes de leur détermination

R 54 (being revised - *en cours de révision*)
pH scale for aqueous solutions
Echelle de pH des solutions aqueuses

R 55 (1981) — 50 FRF
Speedometers, mechanical odometers and chronotachographs for motor vehicles. Metrological regulations
Compteurs de vitesse, compteurs mécaniques de distance et chronotachygraphes des véhicules automobiles. Réglementation métrologique

R 56 (1981) — 50 FRF
Standard solutions reproducing the conductivity of electrolytes
Solutions-étalons reproduisant la conductivité des électrolytes

R 58 (1998) — 80 FRF
Sound level meters
Sonomètres

R 59 (1984) — 80 FRF
Moisture meters for cereal grains and oilseeds
Humidimètres pour grains de céréales et graines oléagineuses

R 60 (1991) — 80 FRF
Metrological regulation for load cells
Réglementation métrologique des cellules de pesée

Annex (1993) — 80 FRF
Test report format for the evaluation of load cells
Format du rapport d'essai des cellules de pesée

R 61-1 (1996) — 150 FRF
Automatic gravimetric filling instruments.
Part 1: Metrological and test requirements - Tests
Doseuses pondérales à fonctionnement automatique. Partie 1: Exigences métrologiques et techniques - Essais

R 61-2 (1996) — 250 FRF
Automatic gravimetric filling instruments.
Part 2: Test report format
Doseuses pondérales à fonctionnement automatique. Partie 2: Format du rapport d'essai

R 62 (1985) — 80 FRF
Performance characteristics of metallic resistance strain gauges
Caractéristiques de performance des extensomètres métalliques à résistance

R 63 (1994) — 50 FRF
Petroleum measurement tables
Tables de mesure du pétrole

R 64 (1985) — 50 FRF
General requirements for materials testing machines
Exigences générales pour les machines d'essai des matériaux

R 65 (1985) — 60 FRF
Requirements for machines for tension and compression testing of materials
Exigences pour les machines d'essai des matériaux en traction et en compression

R 66 (1985) — 60 FRF
Length measuring instruments
Instruments mesureurs de longueurs

R 68 (1985) — 50 FRF
Calibration method for conductivity cells
Méthode d'étalonnage des cellules de conductivité

R 69 (1985) — 50 FRF
Glass capillary viscometers for the measurement of kinematic viscosity. Verification method
Viscosimètres à capillaire, en verre, pour la mesure de la viscosité cinématique. Méthode de vérification

R 70 (1985) — 50 FRF
Determination of intrinsic and hysteresis errors of gas analysers
Détermination des erreurs de base et d'hystérésis des analyseurs de gaz

R 71 (1985) — 80 FRF
Fixed storage tanks. General requirements
Réservoirs de stockage fixes. Prescriptions générales

R 72 (1985) — 60 FRF
Hot water meters
Compteurs d'eau destinés au mesurage de l'eau chaude

R 73 (1985) — 50 FRF
Requirements concerning pure gases CO, CO_2, CH_4, H_2, O_2, N_2 and Ar intended for the preparation of reference gas mixtures
Prescriptions pour les gaz purs CO, CO_2, CH_4, H_2, O_2, N_2 et Ar destinés à la préparation des mélanges de gaz de référence

R 74 (1993) — 80 FRF
Electronic weighing instruments
Instruments de pesage électroniques

R 75 (1988) — 60 FRF
Heat meters
Compteurs d'énergie thermique

R 76-1 (1992) — 300 FRF
Nonautomatic weighing instruments. Part 1: Metrological and technical requirements - Tests
Instruments de pesage à fonctionnement non automatique. Partie 1: Exigences métrologiques et techniques - Essais
Amendment No. 1 (1994) — NC

R 76-2 (1993) — 200 FRF
Nonautomatic weighing instruments.
Part 2: Pattern evaluation report
Instruments de pesage à fonctionnement non automatique. Partie 2: Rapport d'essai de modèle
Amendment No. 1 (1995) — NC

R 78 (1989) — 50 FRF
Westergren tubes for measurement of erythrocyte sedimentation rate
Pipettes Westergren pour la mesure de la vitesse de sédimentation des hématies

R 79 (1997) — 60 FRF
Labeling requirements for prepackaged products
Exigences pour l'étiquetage des produits préemballés

R 80 (1989) — 100 FRF
Road and rail tankers
Camions et wagons-citernes

R 81 (being printed - *en cours de publication*)
Dynamic measuring devices and systems for cryogenic liquids (including tables of density for liquid argon, helium, hydrogen, nitrogen and oxygen)
Dispositifs et systèmes de mesure dynamique de liquides cryogéniques (comprend tables de masse volumique pour argon, hélium, hydrogène, azote et oxygène liquides)

R 82 (1989) — 80 FRF
Gas chromatographs for measuring pollution from pesticides and other toxic substances
Chromatographes en phase gazeuse pour la mesure des pollutions par pesticides et autres substances toxiques

R 83 (1990) — 80 FRF
Gas chromatograph/mass spectrometer/data system for analysis of organic pollutants in water
Chromatographe en phase gazeuse équipé d'un spectromètre de masse et d'un système de traitement de données pour l'analyse des polluants organiques dans l'eau

R 84 (1989) — 60 FRF
Resistance-thermometer sensors made of platinum, copper or nickel (for industrial and commercial use)
Capteurs à résistance thermométrique de platine, de cuivre ou de nickel (à usages techniques et commerciaux)

R 85 (being printed - *en cours de publication*)
Automatic level gauges for measuring the level of liquid in fixed storage tanks
Jaugeurs automatiques pour le mesurage des niveaux de liquide dans les réservoirs de stockage fixes

R 86 (1989) — 50 FRF
Drum meters for alcohol and their supplementary devices
Compteurs à tambour pour alcool et leurs dispositifs complémentaires

R 87 (1989) — 50 FRF
Net content in packages
Contenu net des préemballages

R 88 (1998) — 80 FRF
Integrating-averaging sound level meters
Sonomètres intégrateurs-moyenneurs

R 89 (1990) — 80 FRF
Electroencephalographs - Metrological characteristics - Methods and equipment for verification
Electroencéphalographes - Caractéristiques métrologiques - Méthodes et moyens de vérification

R 90 (1990) — 80 FRF
Electrocardiographs - Metrological characteristics - Methods and equipment for verification
Electrocardiographes - Caractéristiques métrologiques - Méthodes et moyens de vérification

R 91 (1990) — 60 FRF
Radar equipment for the measurement of the speed of vehicles
Cinémomètres radar pour la mesure de la vitesse des véhicules

R 92 (1989) — 60 FRF
Wood-moisture meters - Verification methods and equipment: general provisions
Humidimètres pour le bois - Méthodes et moyens de vérification: exigences générales

R 93 (1990) — 60 FRF
Focimeters
Frontofocomètres

R 95 (1990) — 60 FRF
Ships' tanks - General requirements
Bateaux-citernes - Prescriptions générales

R 96 (1990) — 50 FRF
Measuring container bottles
Bouteilles récipients-mesures

R 97 (1990) — 60 FRF
Barometers
Baromètres

R 98 (1991) — 60 FRF
High-precision line measures of length
Mesures matérialisées de longueur à traits de haute précision

R 99 (being printed - *en cours de publication*)
Instruments for measuring vehicle exhaust emissions
Instruments de mesure des gaz d'échappement des véhicules

R 100 (1991) — 80 FRF
Atomic absorption spectrometers for measuring metal pollutants in water
Spectromètres d'absorption atomique pour la mesure des polluants métalliques dans l'eau

R 101 (1991) — 80 FRF
Indicating and recording pressure gauges, vacuum gauges and pressure vacuum gauges with elastic sensing elements (ordinary instruments)
Manomètres, vacuomètres et manovacuomètres indicateurs et enregistreurs à élément récepteur élastique (instruments usuels)

R 102 (1992) — 50 FRF
Sound calibrators
Calibreurs acoustiques

Annex (1995) — 80 FRF
Test methods for pattern evaluation and test report format
Méthodes d'essai de modèle et format du rapport d'essai

R 103 (1992) — 60 FRF
Measuring instrumentation for human response to vibration
Appareillage de mesure pour la réponse des individus aux vibrations

R 104 (1993) — 60 FRF
Pure-tone audiometers
Audiomètres à sons purs

Annex F (1997) — 100 FRF
Test report format
Format du rapport d'essai

R 105 (1993) — 100 FRF
Direct mass flow measuring systems for quantities of liquids
Ensembles de mesurage massiques directs de quantités de liquides

Annex (1995) — 80 FRF
Test report format
Format du rapport d'essai

R 106-1 (1997) — 150 FRF
Automatic rail-weighbridges. Part 1: Metrological and technical requirements - Tests
Ponts-bascules ferroviaires à fonctionnement automatique. Partie 1: Exigences métrologiques et techniques - Essais

R 106-2 (1997) — 250 FRF
Automatic rail-weighbridges. Part 2: Test report format
Ponts-bascules ferroviaires à fonctionnement automatique. Partie 2: Format du rapport d'essai

R 107-1 (1997) — 150 FRF
Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers). Part 1: Metrological and technical requirements - Tests
Instruments de pesage totalisateurs discontinus à fonctionnement automatique (peseuses totalisatrices à trémie). Partie 1: Exigences métrologiques et techniques - Essais

R 107-2 (1997) — 300 FRF
Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers). Part 2: Test report format
Instruments de pesage totalisateurs discontinus à fonctionnement automatique (peseuses totalisatrices à trémie). Partie 2: Format du rapport d'essai

R 108 (1993) — 60 FRF
Refractometers for the measurement of the sugar content of fruit juices
Réfractomètres pour la mesure de la teneur en sucre des jus de fruits

R 109 (1993) — 60 FRF
Pressure gauges and vacuum gauges with elastic sensing elements (standard instruments)
Manomètres et vacuomètres à élément récepteur élastique (instruments étalons)

R 110 (1994) — 80 FRF
Pressure balances
Manomètres à piston

R 111 (1994) — 80 FRF
Weights of classes E_1, E_2, F_1, F_2, M_1, M_2, M_3
Poids des classes E_1, E_2, F_1, F_2, M_1, M_2, M_3

R 112 (1994) — 80 FRF
High performance liquid chromatographs for measurement of pesticides and other toxic substances
Chromatographes en phase liquide de haute performance pour la mesure des pesticides et autres substances toxiques

R 113 (1994) — 80 FRF
Portable gas chromatographs for field measurements of hazardous chemical pollutants
Chromatographes en phase gazeuse portatifs pour la mesure sur site des polluants chimiques dangereux

R 114 (1995) — 80 FRF
Clinical electrical thermometers for continuous measurement
Thermomètres électriques médicaux pour mesurage en continu

R 115 (1995) — 80 FRF
Clinical electrical thermometers with maximum device
Thermomètres électriques médicaux avec dispositif à maximum

R 116 (1995) — 80 FRF
Inductively coupled plasma atomic emission spectrometers for measurement of metal pollutants in water
Spectromètres à émission atomique de plasma couplé inductivement pour le mesurage des polluants métalliques dans l'eau

R 117 (1995) — 400 FRF
Measuring systems for liquids other than water
Ensembles de mesurage de liquides autres que l'eau

R 118 (1995) — 100 FRF
Testing procedures and test report format for pattern evaluation of fuel dispensers for motor vehicles
Procédures d'essai et format du rapport d'essai des modèles de distributeurs de carburant pour véhicules à moteur

R 119 (1996) — 80 FRF
Pipe provers for testing measuring systems for liquids other than water
Tubes étalons pour l'essai des ensembles de mesurage de liquides autres que l'eau

R 120 (1996) — 100 FRF
Standard capacity measures for testing measuring systems for liquids other than water
Mesures de capacité étalons pour l'essai des ensembles de mesurage de liquides autres que l'eau

R 121 (1996) — 60 FRF
The scale of relative humidity of air certified against saturated salt solutions
Échelle d'humidité relative de l'air certifiée par rapport à des solutions saturées de sels

R 122 (1996) — 60 FRF
Equipment for speech audiometry
Appareils pour l'audiométrie vocale

R 123 (1997) — 100 FRF
Portable and transportable X-ray fluorescence spectrometers for field measurement of hazardous elemental pollutants
Spectromètres à fluorescence de rayons X portatifs et déplaçables pour la mesure sur le terrain d'éléments polluants dangereux

R 124 (1997) — 80 FRF
Refractometers for the measurement of the sugar content of grape must
Réfractomètres pour la mesure de la teneur en sucre des moûts de raisin

R 125 (being printed - *en cours de publication*)
Measuring systems for the mass of liquids in tanks
Systèmes de mesure de la masse des liquides dans les réservoirs

R 126 (being printed - *en cours de publication*)
Evidential breath analyzers
Éthylomètres

INTERNATIONAL DOCUMENTS
DOCUMENTS INTERNATIONAUX

D 1 (1975) — 50 FRF
Law on metrology
Loi de métrologie

D 2 (being printed - *en cours de publication*)
Legal units of measurement
Unités de mesure légales

D 3 (1979) — 60 FRF
Legal qualification of measuring instruments
Qualification légale des instruments de mesurage

D 4 (1981) — 50 FRF
Installation and storage conditions for cold water meters
Conditions d'installation et de stockage des compteurs d'eau froide

D 5 (1982) — 60 FRF
Principles for the establishment of hierarchy schemes for measuring instruments
Principes pour l'établissement des schémas de hiérarchie des instruments de mesure

D 6 (1983) — 60 FRF
Documentation for measurement standards and calibration devices
Documentation pour les étalons et les dispositifs d'étalonnage

D 7 (1984) — 80 FRF
The evaluation of flow standards and facilities used for testing water meters
Evaluation des étalons de débitmétrie et des dispositifs utilisés pour l'essai des compteurs d'eau

D 8 (1984) — 60 FRF
Principles concerning choice, official recognition, use and conservation of measurement standards
Principes concernant le choix, la reconnaissance officielle, l'utilisation et la conservation des étalons

D 9 (1984) — 60 FRF
Principles of metrological supervision
Principes de la surveillance métrologique

D 10 (1984) — 50 FRF
Guidelines for the determination of recalibration intervals of measuring equipment used in testing laboratories
Conseils pour la détermination des intervalles de réétalonnage des équipements de mesure utilisés dans les laboratoires d'essais

D 11 (1994) — 80 FRF
General requirements for electronic measuring instruments
Exigences générales pour les instruments de mesure électroniques

D 12 (1986) — 50 FRF
Fields of use of measuring instruments subject to verification
Domaines d'utilisation des instruments de mesure assujettis à la vérification

D 13 (1986) — 50 FRF
Guidelines for bi- or multilateral arrangements on the recognition of: test results - pattern approvals - verifications
Conseils pour les arrangements bi- ou multilatéraux de reconnaissance des: résultats d'essais - approbations de modèles - vérifications

D 14 (1989) — 60 FRF
Training of legal metrology personnel - Qualification - Training programs
Formation du personnel en métrologie légale - Qualification - Programmes d'étude

D 15 (1986) — 80 FRF
Principles of selection of characteristics for the examination of measuring instruments
Principes du choix des caractéristiques pour l'examen des instruments de mesure usuels

D 16 (1986) — 80 FRF
Principles of assurance of metrological control
Principes d'assurance du contrôle métrologique

D 17 (1987) — 50 FRF
Hierarchy scheme for instruments measuring the viscosity of liquids
Schéma de hiérarchie des instruments de mesure de la viscosité des liquides

D 18 (1987) — 50 FRF
General principles of the use of certified reference materials in measurements
Principes généraux d'utilisation des matériaux de référence certifiés dans les mesurages

D 19 (1988) — 80 FRF
Pattern evaluation and pattern approval
Essai de modèle et approbation de modèle

D 20 (1988) — 80 FRF
Initial and subsequent verification of measuring instruments and processes
Vérifications primitive et ultérieure des instruments et processus de mesure

D 21 (1990) — 80 FRF
Secondary standard dosimetry laboratories for the calibration of dosimeters used in radiotherapy
Laboratoires secondaires d'étalonnage en dosimétrie pour l'étalonnage des dosimètres utilisés en radiothérapie

D 22 (1991) — 80 FRF
Guide to portable instruments for assessing airborne pollutants arising from hazardous wastes
Guide sur les instruments portatifs pour l'évaluation des polluants contenus dans l'air en provenance des sites de décharge de déchets dangereux

D 23 (1993) — 80 FRF
Principles of metrological control of equipment used for verification
Principes du contrôle métrologique des équipements utilisés pour la vérification

D 24 (1996) — 60 FRF
Total radiation pyrometers
Pyromètres à radiation totale

D 25 (1996) — 60 FRF
Vortex meters used in measuring systems for fluids
Compteurs à vortex utilisés dans les ensembles de mesurage de fluides

D 26 (being printed - *en cours de publication*)
Glass delivery measures - Automatic pipettes
Mesures en verre à délivrer - Pipettes automatiques

VOCABULARIES
VOCABULAIRES

V 1 (1978) — 100 FRF
Vocabulary of legal metrology (bilingual French-English)
Vocabulaire de métrologie légale (bilingue français-anglais)

V 2 (1993) — 200 FRF
International vocabulary of basic and general terms in metrology (bilingual French-English)
Vocabulaire international des termes fondamentaux et généraux de métrologie (bilingue français-anglais)

V 3 (1991) — 80 FRF
Hardness testing dictionary (quadrilingual French-English-German-Russian)
Dictionnaire des essais de dureté (quadrilingue français-anglais-allemand-russe)

OTHER PUBLICATIONS
AUTRES PUBLICATIONS

P 1 (1991) — 60 FRF
OIML Certificate System for Measuring Instruments
Système de Certificats OIML pour les Instruments de Mesure

P 2 (1987) — 100 FRF
Metrology training - Synthesis and bibliography (bilingual French-English)
Formation en métrologie - Synthèse et bibliographie (bilingue français-anglais)

P 3-1 (1996) — 400 FRF
Legal metrology in OIML Member States
Métrologie légale dans les Etats Membres de l'OIML

P 3-2 (1996) — 300 FRF
Legal metrology in OIML Corresponding Members
Métrologie légale dans les Membres Correspondants de l'OIML

P 4 (1986–1981) — 100 FRF
Verification equipment for National Metrology Services
Equipement d'un Service national de métrologie

P 5 (1992) — 100 FRF
Mobile equipment for the verification of road weighbridges (bilingual French- English)
Equipement mobile pour la vérification des ponts-bascules routiers (bilingue français-anglais)

P 6 (1987) — 100 FRF
Suppliers of verification equipment (bilingual French-English)
Fournisseurs d'équipement de vérification (bilingue français-anglais)

P 7 (1989) — 100 FRF
Planning of metrology and testing laboratories
Planification de laboratoires de métrologie et d'essais

P 8 (1987) — 100 FRF
Density measurement
Mesure de la masse volumique

P 9 (1992) — 100 FRF
Guidelines for the establishment of simplified metrology regulations

P 10 (1981) — 50 FRF
The metrology of hardness scales - Bibliography

P 11 (1983) — 100 FRF
Factors influencing hardness measurement

P 12 (1984) — 100 FRF
Hardness test blocks and indenters

P 13 (1989) — 100 FRF
Hardness standard equipment

P 14 (1991) — 100 FRF
The unification of hardness measurement

P 15 (1989) — 100 FRF
Guide to calibration

P 16 (1991) — 100 FRF
Guide to practical temperature measurements

P 17 (1995) — 300 FRF
Guide to the expression of uncertainty in measurement
Guide pour l'expression de l'incertitude de mesure

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