Editorial

Ten Years of OIML Certification

Launched in 1991 following several years of reflection within the OIML culminating in a decision made by the International Committee of Legal Metrology, the *OIML Certificate System for Measuring Instruments* is now ten years old.

Initial developments were very slow and in fact the first certificate was not issued until 1992. Over the following two years, the number of certificates issued only just exceeded 20 (in 1993) and 40 (in 1994). However from 1995 on there was a significant acceleration and one decade later the number of certificates issued annually now exceeds 100, as may be seen from the bar chart on the front cover of this Bulletin.

A number of other key figures also illustrate the growing success of this activity:

- Some 20 OIML Member States (out of 57) have now established national authorities for issuing OIML certificates, and a number of other Member States are considering doing likewise.
- More than 30 categories of measuring instruments (weighing devices, fuel dispensers, clinical thermometers, breath analyzers, etc.), may receive OIML certificates and this number is progressively increasing with the issuing of new or revised Recommendations applicable within the System.
- Over 200 manufacturers or importers of measuring instruments from some 30 countries have successfully applied for OIML certificates.
- More and more countries accept OIML certificates and associated test results to accelerate and facilitate the granting of national or regional type approvals.

More detailed statistics concerning certificates issued, including information on those manufacturers that have been granted such certificates, may be found on the OIML web site and information is also published in the *Assessment of OIML Activities* (see page 43).

However, major improvements still have to be made over the next few years, in particular:

- To simplify the certification of "families" of measuring instruments, i.e. instruments from the same manufacturer, based on the same technology and differing only in certain characteristics (e.g. the maximum capacity) in which case it is not necessary to repeat all the tests on all the instruments belonging to the family.
- To develop the certification of "modules", e.g. indicating devices, sensors and electronic equipment, with a view to facilitating the certification of an instrument made up of certified modules.
- To develop the certification (in fact the initial verification) of mass-produced instruments, since up to now the OIML Certificate System applies to *types (patterns)* of instruments.
- Above all, the objective is to develop multilateral agreements of recognition of test results associated with OIML certificates in order to eliminate multiple testings and thus apply the WTO directives concerning testing in the legal metrology field.

This is the responsibility of the OIML Technical Subcommittee TC 3/SC 5 under a joint USA/BIML secretariat and significant progress in this field is expected to be made by the end of 2002. This activity is conducted taking due consideration of the views of certification bodies as well as those of manufacturers of measuring instruments, and in line with the general principles on conformity assessment, testing and accreditation developed within the WTO, ISO/CASCO, ILAC and IAF. ■

BIML

UNCERTAINTY

Uncertainty of the calibrating instrument, confidence in the measurement process and the relation between them

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Abstract

For a given error distribution, confidence in the measurement process depends on the test uncertainty ratio (TUR) and on the confidence interval. When selecting a measuring instrument or measurement standard to carry out a calibration or verification or, in general, a measurement, this dependence becomes a vital issue.

The author has considered the effect of several TURs encountered in practical situations on incorrect test decisions. This consideration has also been extended to the effect on correct test decisions, reliability of test results and confidence in the measurement process for normal error distribution, for both the equipment under test (EUT) and the calibrating instrument, at two confidence interval specifications.

This paper contains a short presentation of specific relevant definitions and issues, results of the study and discussion, and two examples of a lack of specific information on the TUR in certain standards. The analysis has been performed for TURs ranging from 1:1 to 100:1 and for confidence interval specifications of 2σ and 3σ.

Both the information given and the conclusions which have been drawn can be used in calibration and verification and, generally, also in measurement.

1 Introduction

Measurements and the calibration of measuring instruments are essential aspects of activities such as maintaining quality control and quality assurance in production, complying with and enforcing laws and regulations, conducting research and development in science and engineering and calibrating and verifying measurement standards and instruments in order to achieve traceability to national standards.

Calibration is the determination, by measurement and comparison with a measurement standard, of the correct value of a reading on a measuring instrument. The calibration system considered in this paper is shown in Fig. 1. The calibrator (standard) is the source of the standard signal, and the standard value of the calibrator is compared with the measurement result indicated by the EUT.

Verification is an activity performed by a national measurement service in which similar measurement procedures are used as for calibration.

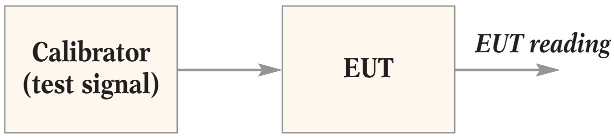

Fig. 1 Measurement system used in calibration

The overall measurement error consists of two components: the error arising in the EUT and that originating from the measurement standard [1]. It is worth mentioning that good measurement has its origins as much in the study of errors or uncertainties of the measurement as it does from the choice of the principle of measurement [2]. When reporting the result of a measurement of a physical quantity, it is therefore also necessary to state the relevant error or uncertainty of the measurement.

Uncertainty of measurement is a parameter associated with the result of a measurement that characterizes the dispersion of the values that would reasonably be attributed to the measurand [3].

Figure 2 illustrates the meaning of uncertainty and error of measurement using the normal distribution curve and shows a situation where the confidence interval ranges from – 2σ to + 2σ which corresponds to an uncertainty of 2σ at about 95.45 % confidence level, where σ is the standard deviation. In metrological practice the confidence interval is usually assumed to be from – 2σ to + 2σ or from – 3σ to + 3σ [3, 4]. In Fig. 2, the true value is – 1σ and the EUT reading is 0, so the error is + 1σ.

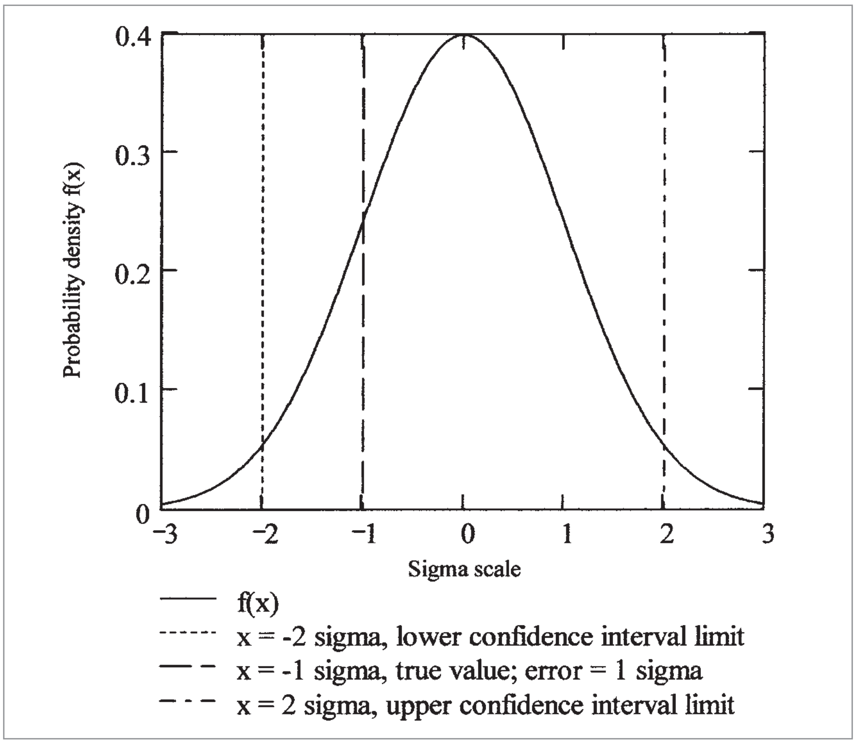

Fig. 2 Error and uncertainty

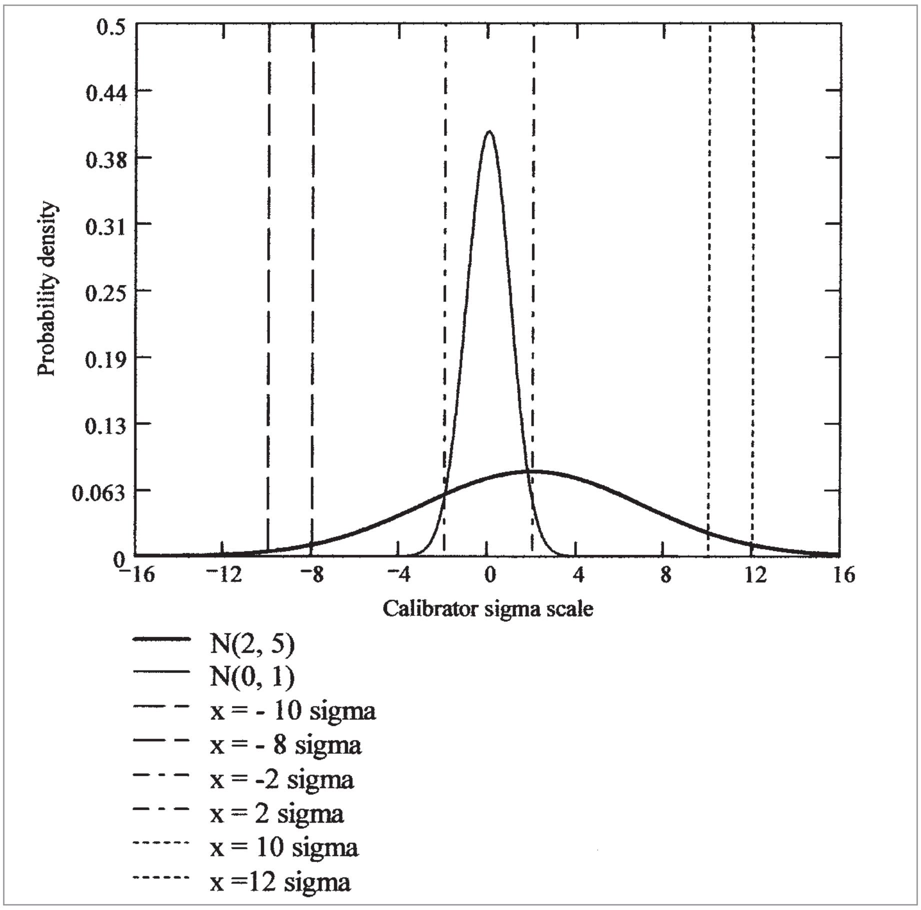

Fig. 3 Illustration of incorrect test decisions for 2σ specifications for calibrator and EUT and normal distribution of errors in their populations

2 Test uncertainty ratio (TUR)

The TUR for a measurand is defined as the standard uncertainty of the EUT divided by that of the calibrating instrument (measurement standard) used to test it [4, 5, 6]. A reliable TUR is only obtained when the specifications for the EUT and the calibrating instrument are correlated according to their error distributions and confidence intervals. It can be said that a reliable TUR is a *sine qua non* condition for good quality calibration. The purpose of calibration is to gain confidence that the EUT is capable of making measurements within the specifications. And, generally, the purpose of measurement is to gain confidence that the value of the measurand is within its tolerance limits. Testing laboratories need to use measuring instruments that have uncertainty specifications which are adequate for the measurements they perform.

3 Incorrect test decisions and confidence in the measurement process

Actual measuring instrument test results can contain four kinds of test decisions:

- acceptance of good units,
- rejection of bad units,
- rejection of good units, and
- acceptance of bad units.

The "ideal" situation is that the results consist of only the first two kinds of test decisions, the second two being the results of uncertainty in the specifications for both the EUT and the calibrating instrument.

An accepted "good" unit is a calibrated instrument that is within its specified tolerance limits and a rejected "bad" unit is one that is outside its tolerance limits. Thus, the actual test results contain correct and incorrect test decisions. Correct test decisions contain acceptance of good units and rejection of bad units whereas incorrect test decisions contain rejection of good units (incorrect "fail") and acceptance of bad units (incorrect "pass"). This situation is shown in Fig. 3 for a 5:1 TUR, normal error distribution and 2σ specifications for both the EUT and the measuring instrument (calibrator). In this example, the normal distribution curve N (0, 1) - where 0 is the mean value and 1 is the standard deviation - illustrates the error distribution for the calibrator and the normal distribution curve N (2, 5) shows the error distribution for the EUT.

As illustrated, the actual output of the calibrator is larger than the nominal output by the maximum permissible error, i.e. by $+ 2\sigma$. Relative to the EUT specification, the calibrator output is at $+ 0.4\sigma$. In terms of the test limits, the EUT readings which are truly within the tolerance limits are in the range from $- 1.6\sigma$ to $+ 2.4\sigma$. This is due to the fact that the readings have a normal distribution and so they are symmetrically distributed on either side of a stimulus that is displaced by $+ 0.4\sigma$ from its nominal value. That is why the EUT readings between $+ 2\sigma$ and $+ 2.4\sigma$ will be incorrectly outside the tolerance limits and the readings between $- 2\sigma$ and $- 1.6\sigma$ will be incorrectly within them. As the distribution of errors is normal, the number of EUT units within the tolerance limits that are incorrectly rejected exceeds the number of EUT units which are outside the tolerance limits that are incorrectly accepted.

Furthermore, as the error distribution is normal so the curve is symmetrical, and analogous results of the analysis will be obtained when the output of the calibrator is displaced to $- 2\sigma$, i.e. to $- 0.4\sigma$ relative to the EUT specification.

The decimal fraction of correct test decisions equals 1 minus the decimal fraction of incorrect test decisions (incorrect "fail" plus incorrect "pass"). The larger is the fraction of correct test decisions, the larger will be the confidence in the measurement process. It is generally assumed that 100 % correct test decisions is unattainable at any cost. On the other hand, there is usually a target value for the correct test decision percentage. This percentage depends on the activity supported by the testing. The percentage of correct test decisions below the target value will significantly decrease reliability of test results and confidence in the measurement process and may be assumed to have unacceptable effects on such factors supported by the test as human health, safety and lives, and cost of manufacturing or quality of product, to mention just a few of them.

4 Results of analysis and discussion

The incorrect test decisions have been studied as a function of the TUR value ranging from 1:1 to 100:1 at 2σ and 3σ confidence intervals and normal error distribution for both the EUT and the calibrator.

The results of the study are given in the form of graphs in Figs. 4–7. The graphs contain the error of the calibrator in standard deviations, as an independent variable, and the following decimal fractions of the EUT population as dependant variables:

- good units rejected (incorrect "fail" units) in Figs. 4 and 6, and
- bad units accepted (incorrect "pass" units) in Figs. 5 and 7.

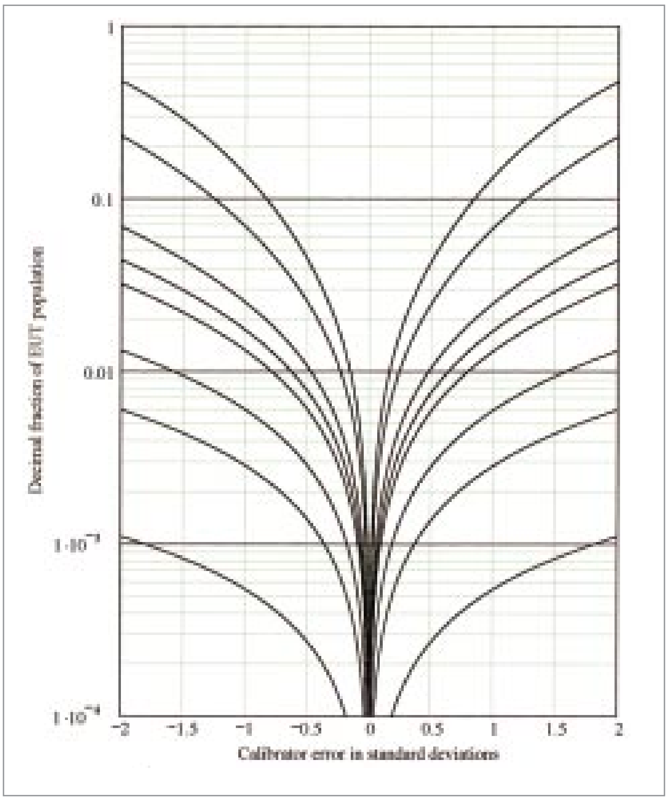

Fig. 4 Distribution of incorrect fail test decisions as a function of calibrator error for 2σ specifications

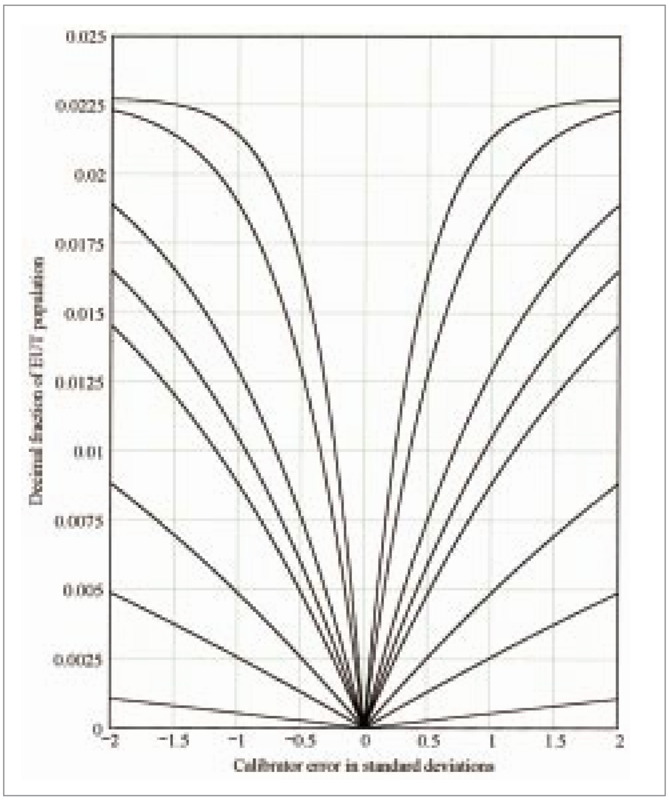

Fig. 5 Distribution of incorrect pass test decisions as a function of calibrator error for 2σ specifications

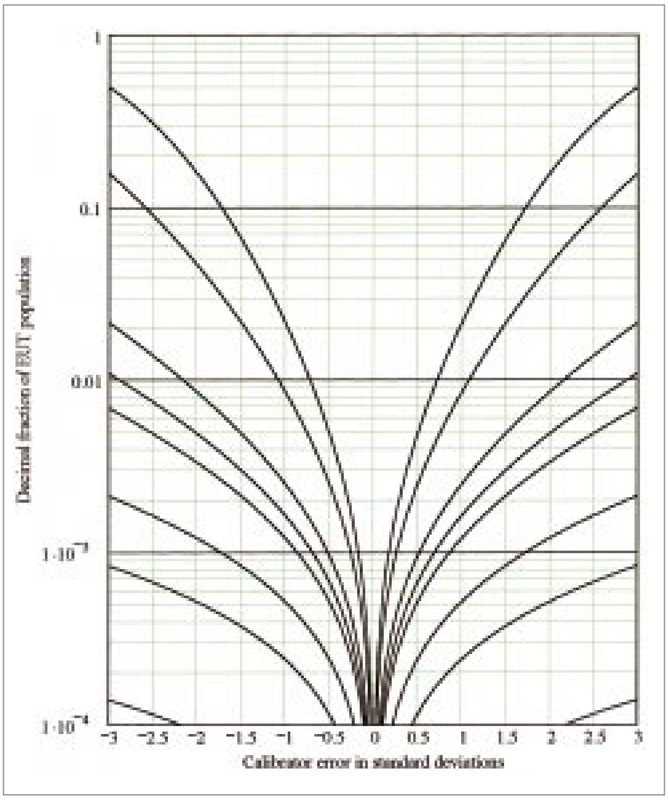

Fig. 6 Distribution of incorrect fail test decisions as a function of calibrator error for 3σ specifications

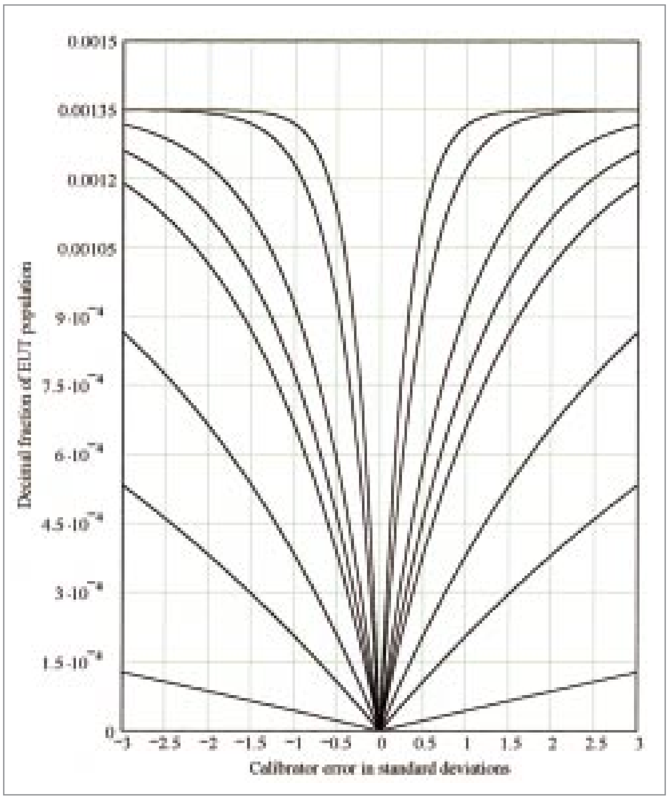

Fig. 7 Distribution of incorrect pass test decisions as a function of calibrator error for 3σ specifications

Graphs 4 and 5 refer to 2σ specifications and graphs 6 and 7 refer to 3σ specifications for both the EUT and calibrator populations and normal distribution in the EUT population. The curves given in Figs. 4–7 refer to the following TUR values (curves from top to bottom): 1:1, 1.5:1, 3:1, 4:1, 5:1, 10:1, 20:1, 100:1. The incorrect fail unit fraction and incorrect pass unit fraction of the EUT population can be obtained from relevant values of the cumulative distribution function. It can be seen from the data in the Figures that the percentages of incorrect test decisions, and thus the percentage of correct test decisions, depend strongly on the TUR value and the confidence interval. The percentage of correct test decisions increases when the TUR or confidence interval increases.

But increasing the TUR requires the use of measuring (calibrating) instruments of higher accuracy, which can be more costly. An increase in the confidence interval increases the uncertainty of measurement. As long as the minimum TUR is met or exceeded, the uncertainties of the measurement standard when assigning an uncertainty to the calibration can be ignored.

The results of analysis indicate that 2σ confidence interval specifications require a much larger TUR value than 3σ confidence interval specifications in order to ensure the same percentage of correct test decisions. For example, assuming the 3:1 TUR, the percentage of incorrect fail test decisions is circa 6.85 % (see Fig. 4) and the percentage of incorrect pass test decisions is circa 1.89 % (see Fig. 5) for 2σ specifications when the calibrator output is just within specifications at the ± 2σ limit. For the same TUR, the percentage of incorrect fail test decisions is circa 2.14 % (see Fig. 6) and the percentage of incorrect pass test decisions is circa 0.13 % (see Fig. 7) for 3σ specifications when the calibrator output is just within specifications at the ± 3σ limit.

It is necessary to increase the TUR more than two times, i.e. to more than 6:1 for 2σ specifications if the percentage of incorrect fail test decisions is not to exceed 2.14 % too. The percentage of incorrect pass test decisions circa 0.13 % for 2σ specifications is at circa 85:1 TUR. The last condition requires using very accurate measurement standards to perform the measurement.

In some cases it is possible to find measured instruments with the uncertainty being *de facto* nearly the same as the uncertainty of the calibrating instrument used to calibrate them, i.e. the TUR is about 1:1. In the case of 2σ specifications, taking into consideration the data from Figs. 4 and 5 for 1:1 TUR, one can say that about 50 % of test decisions would be incorrect, i.e. about 47.7 % of the good EUT units would be rejected (Fig. 4) and about 2.27 % of the bad EUT units would be accepted (Fig. 5), when the calibrator output is just within specifications at the ± 2σ specification limit. Similarly, in case of 3σ specifications, the percentage of incorrect test decisions would be about 50 % too, i.e. about 49.8 % of the good EUT units would be rejected (Fig. 6) and about 0.14 % of the bad EUT units would be accepted (Fig. 7), when the calibrator output is just within specifications at the ± 3σ specification limit. As one assumes normal error distribution in the calibrator population, about 2.28 % of that population for 2σ specifications and about 0.14 % for 3σ specifications will fall under this condition.

There are some practical activities in science and technology fields where TUR values as large as 100:1 are required. Such TUR values enable a high reliability of test results and high confidence in the measurement process to be obtained. In such cases the percentage of incorrect test decisions would be as low as about 0.22 % when the calibrator error is just within specifications at the ± 2σ specification limit (see Figs. 4 and 5) for 2σ specifications and incorrect test decisions as low as about 0.027 % when the calibrator error is just within specifications at the ± 3σ specification limit (see Figs. 6 and 7) for 3σ specifications.

5 Two examples of a lack of specific information on the TUR

A lack of adequate or complete specific information on the TUR can be noticed even in some official documents and measurement procedures. In effect, in such cases inexperienced persons can have some difficulties in making proper measurements. For illustration, two examples concerning measurement uncertainty requirements of standards are discussed below.

ISO 10012-1 standard [7]

The requirements on the TUR arise from clause 4.3 of this standard, which reads: "The error attributable to calibration should be as small as possible. In most cases of measurement, it should be no more than one third and preferably one tenth of the permissible error of the confirmed equipment when in use". If normal error distribution is assumed for both the EUT and the calibrating instrument then the TUR is 3:1 for the lower permissible limit of error ratio, according to the above-mentioned requirements of the standard.

Thus, even for 3σ specifications (see Figs. 6 and 7), there will be about 2.28 % of incorrect test decisions when the calibrating instrument error is just within specifications at the ± 3σ specification limit, and as much as about 8.7 % of incorrect test decisions for 2σ specifications (see Figs. 4 and 5) when the calibrating instrument error is just within specifications at the ± 2σ specification limit.

IEC 60373 [8] and IEC 60645-1 [9] standards

The requirements on measurement uncertainty for the mechanical coupler arise from clause 5.1 of IEC 60373, which reads: "The calibration uncertainty shall not exceed 1.0 dB for frequencies up to and including 2 kHz nor shall it exceed 2 dB for frequencies up to and including 8 kHz". The mechanical coupler is a piezo-electric transducer, which is used in calibrating the stimulus level of the audiometer bone conduction. The mpe for the stimulus level of the audiometer is ± 3 dB for frequencies up to and including 4 kHz [9].

Assuming normal error distribution for the stimulus level for both the audiometer and mechanical coupler one has a 1.5:1 TUR value at 3 kHz. At this frequency, taking into consideration results of the analysis given above (see Figs. 4–7) one can draw the following conclusions. If the mechanical coupler used for calibration of audiometers and the audiometers are calibrated according to these standards, there will be about 15.9 % of incorrect audiometer test decisions for 3σ specifications, i.e. 15.9 % of incorrect rejections or incorrect acceptances of audiometers, when the error of the mechanical coupler is just within specifications at the ± 3σ specification limit and as much as about 25.2 % of incorrect audiometer test decisions for 2σ specifications when the error of the mechanical coupler is just within specifications at the ± 2σ specification limit.

6 Conclusions

Results of the study indicate the way in which the TUR and confidence interval affect the incorrect test decisions and thus the correct test decisions, reliability of test results and confidence in the measurement process.

Larger TUR values and confidence intervals signify lower percentages of incorrect test decisions, higher reliability of test results and higher confidence in the measurement process.

But larger TUR values require the calibrating instrument to be of higher accuracy, which usually implies a higher cost. A larger confidence interval signifies a higher uncertainty of measurement.

As long as the minimum TUR is met or exceeded, at an assumed value of confidence interval, the uncertainties of the measurement standard (or, generally, of the measuring instrument) when assigning an uncertainty to the calibration or measurement can be ignored. ■

7 References

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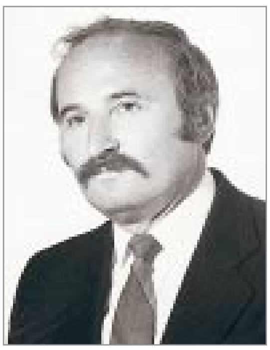

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WEIGHTS

Test procedures for Class E_1 weights at the Romanian National Institute of Metrology: Calibration of mass standards by subdivision of the kilogram

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Abstract

The provision of the mass scale below one kilogram is achieved by subdivision. This paper describes one of the methods used by INM including details of the weighing techniques, weighing schemes, equipment used and the uncertainty of measurement of all the standards involved.

1 Introduction

INM is the custodian of the Prototype Kilogram No. 2. As such, it is INM's task to propagate the Romanian mass scale by subdivision and multiplication of the kilogram.

Class E_1 weights ensure traceability to the national mass standard (the value of which is derived from the International Prototype of the kilogram, maintained by the BIPM) and weights of Class E_2 and lower [1]. They are used as standards at the thirteen Romanian calibration laboratories.

2 Test procedures

The set (500...1) g of Class E_1 weights usually has the following composition:

500 g, 200 g, 200* g, 100 g
50 g, 20 g, 20* g, 10 g
5 g, 2 g, 2* g, 1 g

The 1 kg reference standard, of known mass, is used for calibration. Mass determinations are carried out by subdivision (to link standards having different nominal values up with a reference standard). Depending on the weighing scheme, this procedure requires a specific minimum number of standards. By the method of least squares adjustment, the mass departures and their standard deviations are calculated.

Weighing is always carried out as substitution weighing, i.e. single weights or combinations are always compared with another combination of the same nominal value. The difference between the balance indications has the symbol Δm and it is necessary to apply air buoyancy corrections to the observed weighing differences.

If "y" is the new corrected difference, this gives:

$$y = \Delta m + (\rho_a - \rho_o)(V_1 - V_2) \quad (1)$$

where:

- y is the corrected indication;
- Δm is the difference in balance readings calculated from one weighing cycle (RTTR, where R is the reference standard and T is the test weight);
- ρ_o = 1.2 kg · m^{-3}, the reference air density;
- ρ_a = air density at the time of the weighing; and
- V_1, V_2 are the volumes of the standards (or the total volume of each group of weights) involved in the measurement.

In designing the scheme, all the masses from 1 kg to 1 g are broken down into decades. A weighing scheme with 12 equations per decade is used in the calibration [1]. The first decade includes the 1 kg standard.

For subsequent decades the role of the standard is taken by the "1" from the previous decade; thus the 100 g, 10 g masses become intermediate standards, whose uncertainty is propagated directly to masses in the decade they head and hence to those in subsequent decades.

With the reference standard, the mass having nominal values: 500 g, 200 g, 200* g, 100 g, Σ100 g (the sum of 50 g, 20 g, 20* g and 10 g from the next decade) shall be calibrated using a 1 kg mass comparator. The observations are of the same accuracy (for all mass comparisons the same balance was used in the first decade).

Once all the weighings have been completed, the first step consists in the formation of the design matrix.

Matrix "X" contains the information about the equations used (the weighing scheme) and matrix "Y" contains the measured differences from these equations.

Denote:

$X = (x_{ij})$;
$i = 1 \ldots n$;
$j = 1 \ldots k$;
$x_{ij} = 1, -1$ or 0;
β is (β_j) vector of unknown departures; and
Y is (y_i) vector of measured values (including buoyancy corrections).

X =

1000 g	500 g	200 g	200* g	100 g	Σ100* g
–1	1	1	1	1	0
–1	1	1	1	0	1
0	1	–1	–1	–1	0
0	1	–1	–1	0	–1
0	0	1	–1	1	–1
0	0	1	–1	1	–1
0	0	1	–1	–1	1
0	0	1	–1	–1	1
0	0	1	0	–1	–1
0	0	1	0	–1	–1
0	0	0	1	–1	–1
0	0	0	1	–1	–1

$$Y = \left| \begin{array}{c} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \\ y_8 \\ y_9 \\ y_{10} \\ y_{11} \\ y_{12} \end{array} \right|$$

$$\beta = \left| \begin{array}{c} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \\ \beta_6 \end{array} \right|$$

The first row of the matrix represents difference in mass between the +1 and the –1 weight, for example: $(500 + 200 + 200^* + 100) - 1000 = y_1$

If $(X^T \cdot X)$ is the matrix of the normal equations, this gives:

$$(X^T \cdot X) \cdot \beta = X^T \cdot Y \qquad (2)$$

where X^T is a transpose of X:

$$X^T = \left| \begin{array}{cccccccccccc} -1 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 & 0 & 0 & 1 & 1 \\ 1 & 0 & -1 & 0 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 \\ 0 & 1 & 0 & -1 & -1 & -1 & 1 & 1 & -1 & -1 & -1 & -1 \end{array} \right|$$

$$X^T \cdot X = \left| \begin{array}{cccccc} 2 & -2 & -2 & -2 & -1 & -1 \\ -2 & 4 & 0 & 0 & 0 & 0 \\ -2 & 0 & 10 & 0 & 0 & 0 \\ -2 & 0 & 0 & 10 & 0 & 0 \\ -1 & 0 & 0 & 0 & 10 & 0 \\ -1 & 0 & 0 & 0 & 0 & 10 \end{array} \right|$$

The next step introduces two matrices: $(X^T \cdot X)^{-1}$ is termed the inverse of $(X^T \cdot X)$ and the product $(X^T \cdot X)^{-1} X^T$.

The matrix design contains only the weighing equations. For this reason, the system can not be solved because the determinant of $(X^T \cdot X)$ is zero and the inverse $(X^T \cdot X)^{-1}$ does not exist.

To overcome this problem the Lagrangian multipliers method is applied [3, 4] which consists of adding the reference standard (restraint m_R) to the vector "Y", the Lagrangian multipliers λ to the vector "β", a line k + 1 and a column k + 1 (both containing the elements 1,0,1) to the normal equation and to the matrix X^T as follows:

$$X^T \cdot X = \left| \begin{array}{ccccccc} 2 & -2 & -2 & -2 & -1 & -1 & 1 \\ -2 & 4 & 0 & 0 & 0 & 0 & 0 \\ -2 & 0 & 10 & 0 & 0 & 0 & 0 \\ -2 & 0 & 0 & 10 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 10 & 0 & 0 \\ -1 & 0 & 0 & 0 & 0 & 10 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \end{array} \right|$$

$$Y = \left| \begin{array}{c} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \\ y_8 \\ y_9 \\ y_{10} \\ y_{11} \\ y_{12} \\ m_R \end{array} \right|$$

$$X^T = \begin{vmatrix} -1 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & -1 & 0 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 & 0 \\ 0 & 1 & 0 & -1 & -1 & -1 & 1 & 1 & -1 & -1 & -1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{vmatrix}$$

$$\beta = \begin{vmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \\ \beta_6 \\ \lambda \end{vmatrix}$$

The inverse of $X^T \cdot X$ will be:

$$(X^T \cdot X)^{-1} = \begin{vmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1/4 & 0 & 0 & 0 & 0 & 1/2 \\ 0 & 0 & 1/10 & 0 & 0 & 0 & 1/5 \\ 0 & 0 & 0 & 1/10 & 0 & 0 & 1/5 \\ 0 & 0 & 0 & 0 & 1/10 & 0 & 1/10 \\ 0 & 0 & 0 & 0 & 0 & 1/10 & 1/10 \\ 1 & 1/2 & 1/5 & 1/5 & 1/10 & 1/10 & 0 \end{vmatrix}$$

The last column and row contains the factor $h_j = m_j/m_r$, the ratios between the nominal values of the unknown weights (m_j) and one of the reference (m_r).

The best estimate of β, $\langle\beta\rangle$ for an over-determined system of equations "X" is given by:

$$\langle\beta\rangle = (X^T \cdot X)^{-1} X^T \cdot Y \qquad (3)$$

3 Example of a least-squares analysis: Equipment, standards and results

3.1 Equipment

The balances used in the measurements in the range from 1 g to 500 g are listed below:

Type	Max	Standard deviation, mg	Indication
AT 1005 (Mettler)	1 kg	0.01 – 0.02	Digital
H20 (Mettler)	160 g	0.01	Optical
2405 (Sartorius)	30 g	0.002	Optical

Additionally, the mass laboratory is equipped with instruments to measure:

- the pressure, measured using a standard barometer (U = 2 mbar, k = 2);
- the relative humidity, measured using a standard psychrometer (U = 3 %, k = 2); and
- the temperature, measured using a standard thermometer (U = 0.4 K, k = 2).

From the air parameters, the air density is calculated using the equation recommended by the CIPM [2].

3.2 Standards

The 1 kg reference standard is used as the known mass for the calibration, where:

- $V = 127.7398\ \text{cm}^3$,
  expanded uncertainty $U_V = 0.0024\ \text{cm}^3$, $k = 2$.
- conventional mass $m_{cr} = 0.999\ 996\ 891$ kg,
  expanded uncertainty $U(m_{cr}) = 0.044$ mg, $k = 2$.

The observed mass differences read:

$$Y = \begin{vmatrix} 3.780 \\ 3.3911 \\ -0.04 \\ -0.05 \\ 0.01 \\ 0.01 \\ 0.025 \\ 0.028 \\ 0.017 \\ 0.017 \\ 0.020 \\ 0.022 \\ -3.109 \end{vmatrix}$$

The vector $\langle\beta\rangle$ with the unknown masses, according to equation (3) above, gives:

$$\langle\beta\rangle = \begin{vmatrix} 1000\ \text{g} - 3.109\ \text{mg} \\ 500\ \text{g} + 0.115\ \text{mg} \\ 200\ \text{g} + 0.075\ \text{mg} \\ 200\ \text{g} + 0.061\ \text{mg} \\ 100\ \text{g} + 0.020\ \text{mg} \\ \Sigma\ 100\ \text{g} + 0.029\ \text{mg} \end{vmatrix}$$

The value assigned to the summation Σ 100 g by the first decade constitutes the restraint for the second decade with the individual weights in the summation being calibrated separately in the second series. The summation of weights Σ 10 g becomes the restraint for the third decade. Then, the same procedure is used for the second and the last decades.

4 Analysis of uncertainties

4.1 Type A uncertainty

If the adjusted mass difference of the weighing equations is $\langle Y \rangle = X \cdot \langle \beta \rangle$, the residual for each equation is calculated as follows:

$$\langle e \rangle = Y - \langle Y \rangle \qquad (4)$$

The calculation of $\langle e \rangle$ for the example gives the results:

$$\langle e \rangle = \begin{vmatrix} -2 \cdot 10^{-3} \\ 2.1 \cdot 10^{-3} \\ 10 \cdot 10^{-4} \\ 0 \\ 5 \cdot 10^{-3} \\ 5 \cdot 10^{-3} \\ 2 \cdot 10^{-3} \\ 5 \cdot 10^{-3} \\ -9 \cdot 10^{-3} \\ -9 \cdot 10^{-3} \\ 8 \cdot 10^{-3} \\ 8 \cdot 10^{-3} \end{vmatrix}$$

The standard deviation "s" of the observations is calculated by:

$$s = \sqrt{\frac{1}{v} \sum_{i=1}^{n} res_i^2} \qquad (5)$$

The residuals "res." are the elements of the vector $\langle e \rangle$; "v" = n – k + 1 represents the degrees of freedom ("n – k" is the difference between the number of performed observations and the number of unknown weights; "1" is the number of the restraints). According to this equation the standard deviation is:

s = 0.007 mg

$$V_\beta = \begin{vmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1/4 & 0 & 0 & 0 & 0 & 1/2 \\ 0 & 0 & 1/10 & 0 & 0 & 0 & 1/5 \\ 0 & 0 & 0 & 1/10 & 0 & 0 & 1/5 \\ 0 & 0 & 0 & 0 & 1/10 & 0 & 1/10 \\ 0 & 0 & 0 & 0 & 0 & 1/10 & 1/10 \\ 1 & 1/2 & 1/5 & 1/5 & 1/10 & 1/10 & 0 \end{vmatrix} \cdot 0.000049$$

The variance – covariance matrix for $\langle \beta \rangle$ is given by:

$$V_\beta = s^2 (X^T \cdot X)^{-1} \qquad (6)$$

where the variances on the values of the solutions $\langle \beta \rangle$ are given by the diagonal elements of the matrix $(X^T \cdot X)^{-1}$ denoted by c_{ij}. The off-diagonal elements of the matrix give the covariance between the weights.

The standard deviation (uncertainty of type A) of a particular unknown weight is:

$$u_{A(\beta j)} = s\sqrt{c_{ij}} = \begin{vmatrix} 0 \\ 0.0035 \\ 0.0022 \\ 0.0022 \\ 0.0022 \\ 0.0022 \end{vmatrix} \text{mg}$$

The random uncertainty $u_{A(\beta j)}$ has a "local" component arising from measurements in the current decade and after the first decade, a propagated component arising from random uncertainty in the intermediate standards.

4.2 Type B uncertainty

The components of type B uncertainties are:

4.2.1 Uncertainty associated with the reference standard

$$u_{r(\beta j)} = h_j \cdot u_{mcr} = \begin{vmatrix} 0.0220 \\ 0.0110 \\ 0.0044 \\ 0.0044 \\ 0.0022 \\ 0.0022 \end{vmatrix} \text{mg} \qquad (7)$$

where h_j is described above.

4.2.2 Uncertainty associated with the air buoyancy corrections

$$u^2_{b(\beta j)} = (V_j - h_j V_r)^2 \cdot u^2_{\rho a} + (\rho_a - \rho_o)^2 (u^2_{Vj} + h_j u^2_{Vr}) \qquad (8)$$

where:

V_j, V_r = volume of test weight and reference standard, respectively;
$u^2_{\rho a}$ = uncertainty for the air density;
ρ_o = 1.2 kg·m^{-3} is the reference air density;
u^2_{Vj}, u^2_{Vr} = uncertainty of the volume of test weight and reference standard, respectively.

$$u_{b(\beta j)} = \begin{vmatrix} 0 \\ 0.0030 \\ 0.0011 \\ 0.0011 \\ 0.0006 \\ 0.0006 \end{vmatrix} \text{ mg}$$

4.2.3 Uncertainty due to the display resolution of a digital balance

For the first decade where a digital balance with the scale interval of d = 0.01 mg is used, the uncertainty due to resolution is [1]:

$$u_d = \left(\frac{d/2}{\sqrt{3}} \right) \times \sqrt{2} = 0.0041 \text{ mg} \qquad (9)$$

4.3 Combined standard uncertainty

The combined standard uncertainty of the conventional mass of the weight βj is given by:

$$u_{c(\beta j)} = [u^2_{A(\beta j)} + u^2_{r(\beta j)} + u^2_{b(\beta j)} + u^2_d]^{1/2} \qquad (10)$$

The summation contains all the contributions described above.

$$u_{c(\beta j)} = \begin{vmatrix} 0.0220 \\ 0.0126 \\ 0.0064 \\ 0.0064 \\ 0.0051 \\ 0.0051 \end{vmatrix} \text{ mg}$$

4.4 Expanded uncertainty

The expanded uncertainty "U" (with k = 2) of the conventional mass of the weights βj is as follows [8]:

$$U = k\, u_{c(\beta j)} = \begin{vmatrix} 0.0440 \\ 0.0252 \\ 0.0128 \\ 0.0128 \\ 0.0102 \\ 0.0102 \end{vmatrix} = \begin{vmatrix} 0.044 \\ 0.03 \\ 0.01 \\ 0.01 \\ 0.01 \\ 0.01 \end{vmatrix} \text{ mg} \qquad (11)$$

5 Uncertainty budget for the first decade

Table 1 on page 16 shows the results obtained from the least squares analysis of the weighing data and their associated uncertainties. It also lists the contribution due to the uncertainty in the value of the standard, in the buoyancy correction and in the balance.

6 Conclusions

A calibration scheme for mass standards below 1 kg has been described. The whole set of masses is calibrated, decade by decade, in terms of a 1 kg standard.

The test procedure described leads to an efficient calibration of sets of class E_1 weights, also used to calibrate laboratory standards with lower uncertainty.

The subdivision weighing scheme and the electronic mass comparator used lead to an appreciable reduction in uncertainty in each mass value, compared with previous calibrations.

One way to reduce the uncertainty and to obtain better results is to use balances of much greater accuracy and in near perfect environmental conditions. ■

Table 1 and References on page 16

Weights:	1 kg	500 g	200 g	200* g	100 g	Σ 100 g
$u_{mr} \cdot h_j$ mg	0.022	0.011	0.0044	0.0044	0.0022	0.0022
$V_r \cdot h_j$ cm^3	127.7398	63.8699	25.5480	25.5480	12.7740	12.7740
$u_{Vr} \cdot h_j$ cm^3	0.0012	0.0006	0.0002	0.0002	0.0001	0.0001
V_j cm^3	-	62.428	24.975	24.976	12.485	12.506
u_{Vj} cm^3	-	0.014	0.004	0.004	0.002	0.001
ρ_a mg/cm^3	1.196					
$u_{\rho a}$ mg/cm^3	0.002					
$(V_j - V_r h_j)u_{\rho a}$ mg	-	$2.9 \cdot 10^{-3}$	$1.15 \cdot 10^{-3}$	$1.15 \cdot 10^{-3}$	$5.8 \cdot 10^{-4}$	$5.4 \cdot 10^{-4}$
$(\rho_a - \rho_o)(u_{Vj}^2 + u_{Vr}^2)^{1/2}$ mg	-	$5.6 \cdot 10^{-5}$	$1.61 \cdot 10^{-5}$	$1.61 \cdot 10^{-5}$	$8 \cdot 10^{-6}$	$4.3 \cdot 10^{-6}$
u_b mg	-	0.003	0.0011	0.0011	0.0006	0.0005
u_d mg	0.004					
u_A mg		0.0035	0.0022	0.0022	0.0022	0.0022
u_c mg	0.022	0.0126	0.0064	0.0064	0.0051	0.0051
k	2					
U mg	0.04	0.03	0.01	0.01	0.01	0.01

Table 1 Uncertainty budget for the first decade

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MOISTURE MEASUREMENT

Near infrared transmittance for measuring the moisture content of grains

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Introduction

Determining the moisture content of grain and oleaginous foods is just as important as determining their protein content prior to their sale. If the moisture content is too high, the grain must first be dried to achieve a moisture content that is low enough for the grain to be stored - this is a costly and time-consuming process. In addition, comminution of grain demands a specific moisture content and this requirement must be complied with as closely as possible. The moisture content of grain and oleaginous foods thus has a considerable influence on the sale price which can be obtained; consequently rapid and exact determination of the moisture content during harvesting, storage and processing is of utmost economic importance.

In Germany, hygrometers used in official or commercial transactions must be verified before they can be used in the field - in fact these instruments must be type approved by the Physikalisch-Technische Bundesanstalt (PTB) for the grains and oleaginous foods they are intended to measure.

In accordance with the procedure applied, hygrometers are classified into measuring instruments used:

- to determine the moisture content by drying; and
- to measure a moisture-dependent physical quantity such as electrical resistance, capacitance or reflection, or absorption of near infrared radiation.

Measurements whereby the moisture content is determined by drying the grain and subsequently determining the loss of mass are generally too expensive and time-consuming for trade in cereals: results are obtained more rapidly by devices which determine the moisture content by measuring a physical quantity.

Near infrared transmission spectral analyzer

In April 1998, a device which works on a new measuring principle was approved in Germany for the measurement of the moisture content of wheat, rye, barley and triticale in the range from 10 % to 20 % (See Fig. 1). Further approvals have been granted in the USA (FGIS), Canada (CGC), Argentina (I.A.S.C.A.U), Denmark (Plant Directory) and South Africa (Wheat Board).

Description of the measurement principle

The functional principle of an N.I.T. (Near Infrared Transmission) device is depicted in Fig. 2:

- Light from a halogen lamp is directed onto a monochromatic mirror.
- This mirror generates monochromatic radiation in the wavelength range between 800 nm and 1100 nm.
- With the aid of an electronic-mechanical control technique, the wavelength range from 850 nm to 1050 nm is applied to the sample at wavelength steps of 2 nm.
- Part of the light is reflected or absorbed by the sample; the other part, the transmitted light, is received by a detector.

The absorption of light varies as a function of the composition of the different sample components, such as moisture, protein, fat and fiber structure, the absorbance being decisively determined by the layer thickness of the sample. Measuring vessels with a layer thickness of 18 mm are used for wheat, rye, barley and spelt and a measuring cell with variable layer thickness is used for other grains to be measured. The required layer thickness is set in line with the grains to be measured with the help of a servomotor.

Fig. 1 The Foss Infratec 1229 Grain Analyzer

Measurement is started with a scan, without the sample, carried out as a reference measurement over the whole wavelength range. The detector system thus determines the light intensity furnished by the system. Subsequently, after having been filled into the sample funnel, the sample is automatically transported to the measuring vessel. In the course of the measurement, the intensities of the 100 selected wavelengths are determined. Then the absorbance values are calculated by the computer system. The values obtained furnish a spectrogram with peaks which are characteristic of the sample measured.

From Fig. 3, the moisture and protein values can then be determined with the aid of a calibration transcribed via the network (see below) or copied from a floppy disk.

The calibrations for the individual components are defined by the instrument manufacturers, in terms of suitable laboratory reference procedures, by an adjustment calculus according to the least squares method. The PTB then checks these calibrations and, if correctness has been proved, grants an approval. From the verification law point of view, only the moisture value is of significance though various interested parties also request a verified determination of the protein content. This is why the possibility is being considered of evaluating the calibrations with respect to the protein content within the scope of a special test.

The advantages of the N.I.T. procedure over the other methods of measurement are the following:

- the sample must not be bruised for the analysis;
- prompt measurement results;
- the measurement results are independent of sample temperature and ambient temperature;
- simultaneous determination of several quality characteristics (e.g. moisture and protein);
- measuring devices with networking capability.

During a single measurement process the device carries out ten individual measurements. The sample quantity (which varies between 300 g and 500 g) is fed to the device without having been bruised (see Fig. 4). The measuring cycle then takes approximately 40 seconds, following which the measurement result is indicated on the digital display. In addition, the standard deviation of the ten individual measurements can be retrieved, which allows conclusions to be drawn concerning sample homogeneity.

The NITNET network

The analyzers can be used most efficiently when they are interconnected by a network. At present, four N.I.T. networks exist in Germany:

- Doemens Calibrierdienst (DOEMENS-NITNET) near Munich;
- Raiffeisen HG Nord (RHG-NITNET) in Hanover;
- Network Rhineland-Palatinate (RLP-NITNET) in Leideneck;
- VDLUFA Network (VDLUFA-NITNET) in Kassel.

Approximately 180 N.I.T. analyzers are interconnected within these four networks which are independent of each other. They are connected as satellites to their network operator in a star pattern via a modem and transcription to, or modification of, the calibrations on the individual devices is possible only via this modem from the central processing unit of the network operator. This prevents manipulation of the calibrations by the measuring instrument user.

Verification

In contrast to the laboratory reference procedure and the electrical hygrometers, the N.I.T. devices determine only the water fraction which is molecularly bound in the grain and not the water possibly adherent to the

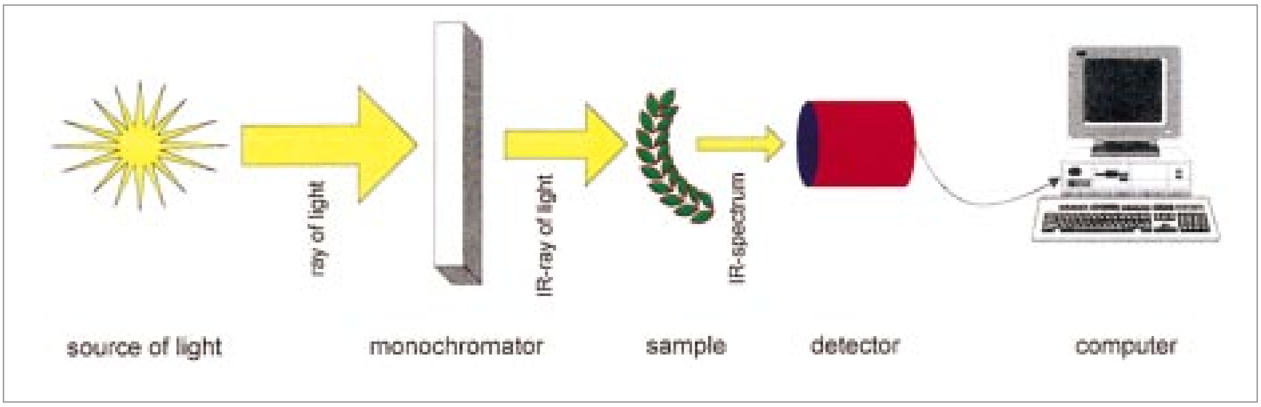


Fig. 2 Functional principle of an N.I.T.

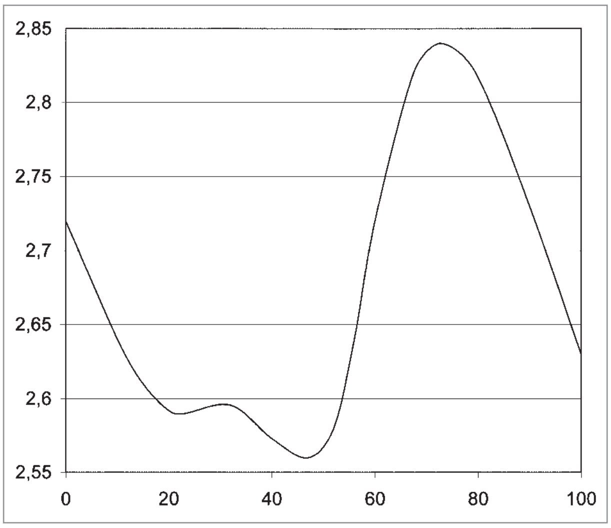


Fig. 3 Graphical representation of a spectral analysis of wheat with the following component values:

Moisture:	20.4 %
Protein:	14.0 %
Spectral measuring range:	850 nm to 1050 nm
Points of measurement:	100 (corresponding to a resolution of 2 nm)

Fig. 4 Filling of the grain sample to be measured

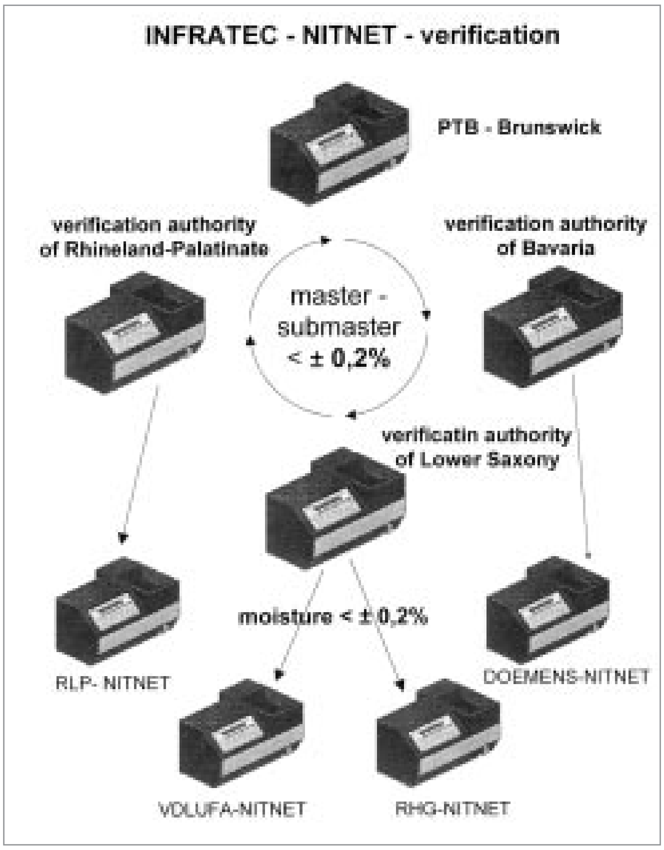


Fig. 5 Connection of submasters to PTB's master device

dish. It was, therefore, necessary to open up new paths for the verification of these measuring instruments.

Foss submits the calibrations developed to the PTB for examination and approval. These calibrations are transcribed to the PTB's master device and checked for correctness. After that, the three submasters available at the verification authorities of Bavaria, Lower Saxony and Rhineland-Palatinate are compared with the PTB's master (see Fig. 5). A maximum deviation of ± 0.2 % is permissible. With the aid of these submasters, the users' measuring instruments are then verified in accordance with the approval.

The first verification of grain analyzers in Germany took place in Rhineland-Palatinate in July 1998. To date, about 80 devices have been verified in Rhineland-Palatinate and if subsequent verifications are included the total result is 125 verifications.

Verification test

The verification technological test comprises:

(i) Functional test with granulate

Three measurements are carried out in succession with a granulate specially produced for this purpose. The indication must lie in the interval 100 ± 0.5. If this condition is not complied with, testing of the device is stopped.

(ii) Comparison of the device tested with the submaster

Comparisons between the device tested and the master are carried out with two samples of each type of grain approved. Any commercial grain or seed can be used as sample material. The moisture content of one of the samples must be between 11 % and 12 %, that of the other between 14 % and 15 %. The grain may also be moistened; care must, however, be taken that the sample material is thoroughly moistened. This can be achieved by ensuring a sufficiently long mixing time (about three days).

Each sample must be measured three times by the submaster and three times by the device tested. The mean values of the measurement results obtained by the submaster and the device tested must not deviate by more than ± 0.2 %.

A problem encountered upon verification, in particular on hot days in rooms without air-conditioning, is that samples with higher moisture values may dry out during measurement. Practical applications have shown that the moisture value may change by 0.1 % during a test cycle involving a sub-master and the device tested. When several devices are verified it is, therefore, necessary to recheck the moisture value on the master after each measurement comprising three individual measurements. The time and effort required for this procedure are such that only four to six devices can be verified each day. Solutions are therefore being sought which will allow the annual subsequent verification to be carried out in future together with the network operator in the form of an intercomparison.

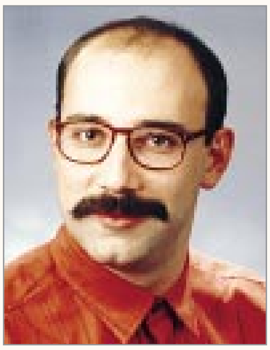
It is difficult to furnish reliable figures about measurement stability due to the fact that all the devices which were verified were subsequently also calibrated for various grains - this was carried out just prior to the subsequent verification. Furthermore the devices will be maintained and if necessary repaired. Therefore, the measurement error during verification cannot be compared to the measurement error of moisture determination after the device has been in operation for one year. However, the reproducibility with a deviation of ± 1 digit (0.1 %) measurement results is very good.

Summary and conclusions

The new N.I.T. devices offer the possibility to determine the important quality characteristics of grain and oleaginous foods quickly and without the risk of operator errors. Devices operated in a network furnish results with very small deviations not only for moisture measurements, but also for other parameters such as protein.

Practical application will still have to show to what extent the correctness is guaranteed, in particular in the case of grain whose biological characteristics deviate from those serving as a standard, where measurement stability is higher compared to hygrometers which measure electrical resistance or capacity.

Furthermore it has been shown that N.I.T. network instruments considerably improve relations between producers and traders, since producers are certified and every trader who is connected to the network can supply and certify a certain product quality. ■



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ITALIAN HISTORY

The decimal units system and San Giovanni Bosco: *A singular meeting between science and pedagogy*

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One of Don Bosco's most noteworthy pieces of work is of particular relevance to the teaching of metrology: *"Il sistema metrico decimale ridotto a semplicità preceduto dalle quattro operazioni dell'aritmetica ad uso degli artigiani e della gente di campagna"* (literal translation: *"The decimal metric system reduced to simplicity, preceded by the four arithmetical operations of use to craftsmen and country people"*), published by Paravia, Turin in 1846.

In Italy the decimal units system was introduced at the same time as a number of other innovations - this also happened to be the time when the French armies headed by Napoleon Bonaparte invaded the Kingdom of Piemonte - although discussions on the uniformity of the units system as a useful scientific tool had already started some time before.

In 1793 when the French National Assembly began studying a new units system based on the length of the Earth meridian, some Italian States (*Granducato di Toscana, Repubblica Cisalpina, Repubblica Ligure, Regno di Sardegna, la Repubblica Piemontese*) contributed to the French project, which is considered to be the most excellent example of scientific cooperation over the times.

When the French armies arrived in Italy, conquering its most important nations, they introduced by law the "metrication" of the units system - thus eliminating *"de iure"* the preceding systems.

In Piemonte that happened in 1809, but while the metrication law began to be applied by sending the new unit standards and the related conversion tables to the municipalities, the Congress of Wien (1814) also restored *"inter alia"* the old units system all over Europe.

But the charm and the force of the initial idea on which the decimal units system was based soon began to be recognized by intellectuals, although scientific interests were often mixed in with political motivations.

So, in Piemonte, a Royal Decree was promulgated which provided for the decimal metric system to be adopted as a mandatory units system.

But the promulgation of a new law is not enough to change long-standing habits based on the use of traditional weights and measures units and on multiples and sub-multiples originally determined by means of continuous multiplying and dividing by two.

Disadvantaged people were a major hurdle to the diffusion of the new decimal system because they predominantly continued to use the ancient weights and measures in their everyday businesses.

On the other hand, Public State Schools, which were introduced in Piemonte in 1822, were not mandatory and thus not able to help to efficiently spread the word about the new system amongst ordinary people.

However Public State Schools did contribute to promoting the new decimal system by means of teaching courses - though these courses were of more relevance to educated people than to the common mortal lacking a sound mathematical and scientific background!

The Central Government invited the local authorities to do their best to increase the coverage and usage of the new units system throughout society.

The Roman Church, with its network structure and authority based on the medieval custom of acquiring and applying knowledge, played a primary role in contributing to spreading the word concerning the new units system.

Don Bosco's work was initiated in a very complex historical and social landscape with the clear intention of encouraging disadvantaged people to use the new decimal units in their everyday businesses. His book is conceived as a dialog and such a choice was not by chance since he knew, as a well established teacher, that he would have to use a friendly teaching tone to capture the masses' attention.

The choice of the dialog form for his work was determined as a means to reduce or even eliminate the cultural distance between the writer and disadvantaged readers, in order to involve them in a knowledge acquisition process as gradually as possible.

Don Bosco "dramatized" his work by means of a theater play, which was performed in the rising Oratories of the Salesian Congregation where the play combined amusement, reflection and learned instruction.

Don Bosco's work was published four years before the mandatory introduction of the metric system in Piemonte and even before that, Vicar Apostolic General Mons. Filippo Ravina advised parish priests to contribute to spread word about the new units system.

The challenge that Don Bosco faced with enthusiasm was not only a pedagogic one but a social one too: by allowing common people to understand the decimal metric units system, he raised them to the rank of "citizens" who were able to actively share in the economic and social life of their community.

Don Bosco's work was very successful among contemporaries and that is witnessed by the twenty-eight thousand copies and more that were sold, as well as by the praise of Monsignor Filippo Farina, Bishop of Asti.

Efforts made by such illustrious men - Don Giovanni Bosco and others - should encourage our contemporaries to reflect on the need to foster and promote the "metrology culture" in order to equally extend the scope and application of metrology to non-academic environments.

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Tutto Misure
L'insegnamento del Sistema metrico decimale
Edizione Mortarino


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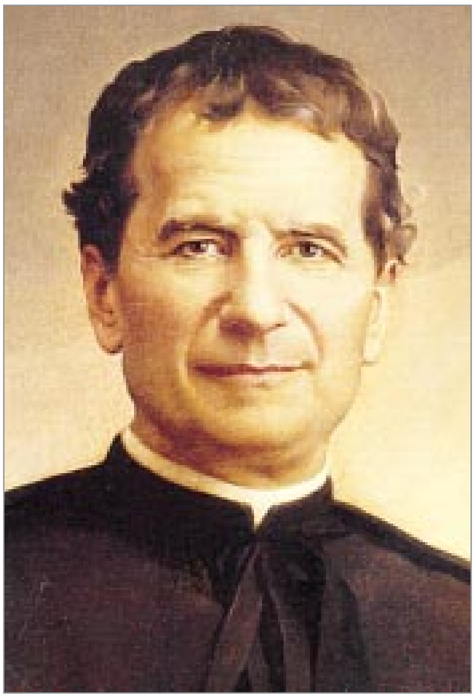


IL

SISTEMA METRICO
DECIMALE

RIDOTTO A SEMPLICITÀ

PRECEDUTO DALLE QUATTRO PRIME OPERAZIONI
DELL' ARITMETICA

AD USO

DEGLI ARTIGIANI

E

DELLA GENTE DI CAMPAGNA

PER CURA DEL SACERDOTE
BOSCO GIO.

Edizione seconda migliorata ed accresciuta.

REDUCING TECHNICAL TRADE BARRIERS

Second Triennial Review of the WTO Agreement on Technical Barriers to Trade (TBT) – Results and Scope

PROF. HENRI SCHWAMM, Honorary Professor of Economics, University of Geneva

Introduction to the TBT Agreement

The WTO (World Trade Organization) Agreement on Technical Barriers to Trade (TBT) - sometimes referred to as the Standards Code - aims to reduce impediments to trade resulting from differences between national regulations and standards.

Standards may vary from country to country. Having too many different standards makes life difficult for producers and exporters. The need for them to comply with different standards often involves significant costs. If the standards are set arbitrarily, they could be used as an excuse for protectionism. Standards could then become obstacles to trade. In order to prevent too much diversity, the TBT Agreement encourages countries to use international standards where these are appropriate. It fully recognizes the important contribution that international standards and conformity assessment systems (ensuring that the requirements of standards are met by given products and services) can make to improving efficiency of production and facilitating international trade.

The development of international standards does indeed reduce potential market access across barriers for imports on the home market of each WTO member country, and reduces the potential barriers to its exports to third country markets as well. ■

This article was first published in the February 2001 edition of the ISO BULLETIN and the BIML is grateful to the Editor of the ISO Bulletin for kindly granting permission to reprint it.

Why was there a need for a Triennial Review of the operation and implementation of the WTO Agreement on Technical Barriers to Trade?

In the first place, such a Review provides answers to why the Agreement was set up and how it has functioned up to the present time. It offers members of the WTO a chance to ask for clarifications on the functioning of the Agreement, and also allows them to agree on improvements that should be made to it. It is an opportunity for the active participation of ISO (as an Observer) in the discussions.

Four other Standards Organizations have Observer status in the TBT Committee: the IEC (International Electrotechnical Commission); OIML (International Organization of Legal Metrology); the UN/ECE (United Nations Economic Commission for Europe); and the OCED (Organization for Economic Cooperation and Development).

This Review equally allows thought to be given to the means that may be brought in to facilitate the effective participation of developing countries in the international standardization and conformity assessment work.

Results of the Second Triennial Review in Geneva which ended in late 2000

The role of international standardization

International standards represent a vital element within the TBT Agreement and play a major role in its implementation.

However - and herein lies a challenge - the TBT Agreement does not provide any precise definition of what a "relevant international standard" actually is. This omission can be the source of serious confusion in trade exchanges, and so the TBT Committee has therefore sought to put this right. A broad and thorough debate took place in Geneva between the Committee Members and the Observers; below are some of the problems raised and the solutions offered.

WTO member countries needed to agree on the economic circumstances where particular standards cannot be regarded as "relevant". Japan, as party to no regional trade agreement, has proposed that international standards under the TBT Agreement must not have adverse effects on competition in the relevant market such as, for instance, preventing technological development, and should not be given preference over characteristics or requirements of specific regions when the needs or interests exist in other regions as well.

Japan is also of the opinion that international standards can no longer cope with technological development, thereby lacking universality, and consequently relevance, under the TBT Agreement.

In the wake of the GATT

The provisions of the GATT 1947 contained only a general reference to technical regulations and standards. A GATT working group, set up to evaluate the impact of non-tariff barriers in international trade, concluded that technical barriers were the largest category of non-tariff measures faced by importers.

After years of negotiations at the end of the Tokyo Round in 1979, 32 GATT Contracting Parties signed the pluriannual Agreement on Technical Barriers to Trade (TBT) which laid down the rules for preparation, adoption and application of technical regulations, standards and conformity assessment procedures.

The new WTO Agreement on Technical Barriers to Trade, or TBT Agreement, negotiated during the Uruguay Round, strengthens and clarifies the provisions of the Tokyo Round Standards Code. It clearly distinguishes between technical regulations and standards.

The difference between a standard and a technical regulation lies in compliance. While conformity with standards is voluntary, technical regulations are by nature mandatory. They have different implications for international trade. If an imported product does not fulfill the requirements of a technical regulation, it will not be allowed to be put on sale. In the case of standards, non-complying imported products will be allowed on the market, but then their market share may be affected if consumers prefer products that meet local standards.

Conformity assessment procedures are defined by the TBT Agreement as technical procedures - such as testing, verification, inspection and certification - which confirm that products fulfill the requirements laid down in regulations and standards. Generally, exporters bear the cost of these procedures. Non-transparent and discriminatory conformity assessment procedures can become effective protectionist tools. ■

Canada and India highlighted ***the importance of a consensus-based decision-making process in international standardization bodies.*** The criteria required include: a balanced representation of interest categories, broad geographical representation, an appeals mechanism for the impartial handling of any substantial or procedural complaints, and notification of standardization activities in suitable media to afford interested persons or organizations an opportunity for meaningful contributions.

The TBT Committee noted that situations could arise where no relevant international standards for a given product existed. Could ***the concept of equivalency*** as proposed by New Zealand be applied as an interim measure? New Zealand does not see any conflict between use of equivalency and the development of international standards. Indeed, the former can be an important stepping stone towards the latter and has merit as a means of reducing unnecessary obstacles to trade. Hong Kong shared this view. The TBT Committee found it useful to further explore the equivalency of standards as a temporary measure to facilitate trade in the absence of relevant international standards.

The Committee also considered the particular role of international standards used as a basis for technical regulations. Assuming that ***differing international standards covering the same issue*** exist, they would impose on countries adopting technical regulations a choice between several relevant international standards. The effect of such a choice would in turn create unnecessary regulatory barriers to trade and thus negatively impact on the objectives of the TBT Agreement. When raising this question, the European Union (EU) illustrated the point by the following example. If use of a specific standard within a technical regulation is made mandatory, and country A incorporates one among the variety of different international standards devoted to the same subject, it is thereby complying with the obligation of the TBT Agreement for member countries to use international standards as a basis for technical regulations. If countries B and C adopt technical regulations covering the same subject but use different international standards as a basis for their mandatory regulation, they are also observing the Agreement. Nevertheless the market remains fragmented, as countries A, B and C, although each is complying with the Agreement, would require different standards as a basis for mandatory regulation. Consequently those countries could reject imports of products meeting different international standards but covering the same issue.

Such a result would certainly not correspond to the spirit and purpose of the TBT Agreement, the objective of which is to facilitate trade and to reduce market fragmentation, among others, by means of the use of international standards. It is the EU's understanding that for achieving this purpose ***such standards should be coherent.*** The EU therefore supports the ISO/IEC procedures the aim of which is to avoid ***the coexistence of conflicting standards***. The EU also supports the ***principle of singularity*** proposed by Brazil, according to which for each area of standardization no more than one international standardizing body should be active. This body should produce a single and coherent set of international standards. International standardizing bodies should act jointly or in cooperation in cases of overlapping when their areas of activity converge, be it for scientific, technological or regulatory reasons. This is also Mexico's point of view: in the case of two international standardizing bodies working in the same area, a coordination mechanism should be put in place so as to ***avoid duplication***.

ISO gave its assurance that it would report to the TBT Committee on action taken to avoid duplication and ensure consistency between international standards. ISO also promised to report on its activities to address the specific needs of developing countries.

Taking these suggestions fully into account, and in order to clarify and to strengthen the concept of international standards under the Agreement and to contribute to the advancement of its objectives, ***the TBT Committee adopted a list of six principles that should be observed by international standardizing bodies***: transparency, openness, impartiality, and consensus, effectiveness and relevance, coherence, development dimension.

Transparency. All essential information on current work programmes, as well as on proposals for standards under consideration and on the final results should be made accessible to all interested parties in all WTO member countries.

Openness. Membership of an international standardizing body should be open on a non-discriminatory basis to relevant bodies of all WTO member countries. This would include openness with respect to participation at the policy development level and at every stage of standards development, such as: proposal and acceptance of new work items, technical discussions on proposals, submission of comments on drafts, reviewing existing standards, voting and adoption of standards and dissemination of adopted standards.

Impartiality and consensus. All relevant bodies of WTO member countries should be provided with meaningful opportunities to contribute to the development of an international standard so that the standard development process will neither privilege nor favour the interests of a particular supplier, country or region. Consensus procedures should be established that seek to take into account the views of all parties concerned and to reconcile any conflicting arguments.

Impartiality includes: access to participation in work, submission of comments on drafts, consideration of views expressed and comments made, decision-making through consensus, obtaining of information and documents, dissemination of the international standards, fees charged for documents, right to transpose the international standards into regional or national standards, revision of the international standards.

Effectiveness and relevance. To facilitate international trade and prevent unnecessary trade barriers, international standards need to be relevant and effectively respond to regulatory and market needs, as well as scientific and technological developments in various countries. They should not distort the global market, have adverse effects on fair competition, or stifle innovation and technological development. In addition, they should not give preference to the characteristics or requirements of specific countries when different needs and interests exist in other countries or regions. Whenever possible, international standards should be performance-based rather than based on design or descriptive characteristics.

Coherence. In order to avoid the development of conflicting international standards, it is important that international standardizing bodies avoid duplication of, or overlapping with, the work of other international standardizing bodies. In this respect, cooperation and coordination with other relevant standardization bodies is essential.

Development dimension. Constraints on developing countries, in particular, to effectively participate in standards development should be taken into consideration in the standards development process. Tangible ways of facilitating developing countries' participation in international standards development should be sought. Developing countries should not be excluded de facto from the process. Provisions for capacity building and technical assistance within standardizing bodies are important in this context.

According to the TBT Committee, these principles and procedures should also be observed when guides and recommendations are elaborated. ISO confirmed that they are observed in the preparation process of the CASCO guides.

The Committee agreed that regular information-exchange with relevant bodies involved in the development of international standards was useful and should be reinforced.

The Committee is perfectly aware of the fact that ***international standardization is an area in which developing country participation is still limited and constrained***. Some of the reasons identified for this situation are the lack of technical capacity, the location of technical secretariats and technical meetings, the translation of international standards into national languages, as well as other constraints in the areas of financial and human resources which handicap participation in meetings. To assist in resolving this problem, the Committee noted that it was important to prioritize the international standardization activities related to products of particular interest to developing countries. It is also critical for those countries to assess products/sectors of priority interest to them for international standardization, so that resources can be appropriately targeted. Another solution is to facilitate effective participation by means of information technologies, such as using e-mail and video-conferencing as alternatives to traditional meetings. Switzerland expressed its hope that the Committee would develop a demand-driven technical cooperation programme related to the TBT Agreement.

Conformity assessment procedures

The goal of conformity assessment is to ensure that the requirements of standards and technical regulations are met by given products and services. This is critical in order for buyers of those goods and services to have confidence that legitimate regulatory objectives are met and that the goods and services meet their health, safety and other needs. Undoubtedly, confidence in the conformity assessment practices and procedures of other countries is also important to the facilitation of trade.

Indeed, there is broad support from both developed and developing countries for working towards the goal through ***the principle of "one standard, one test", and if required, "one certification, one time"***, as stated in the First Triennial Review of the TBT Agreement.

Where debate continues, however, is as to the different methods of pursuing the principle. Different mechanisms exist to facilitate acceptance of results of conformity assessments: mutual recognition agreements (MRAs), voluntary cooperative agreements between domestic and foreign conformity assessment bodies, government designation, unilateral recognition of results of foreign conformity assessment, manufacturers'/suppliers' declarations.

Japan thinks that the three principles of the standards' development process (transparency, openness and impartiality) should apply equally to the development process of conformity assessment guides and recommendations (such as CASCO Guides and standards) and documents developed by international and regional systems for conformity assessment (such as IAF - International Accreditation Forum - Guidelines for CASCO documents).

A new development, encouraged by the TBT Agreement, is the conclusion of MRAs on the results of conformity assessment procedures, concluded between countries having established confidence in each others' testing bodies and procedures. The trend to conclude such MRAs is confined - to date - to the developed countries. For example, the European Union has concluded MRAs for the results of conformity assessment with Australia, Canada, New Zealand, Switzerland and the United States. Plurilateral MRAs seem to be more cost-effective than bilateral ones.

Accreditation, that is based on international standards and Guides, represents an independent test of the technical competence of conformity assessment bodies. Broad global acceptance of accreditation, which addresses both regulatory requirements and market needs, has provided the basis for the emergence of a number of international and regional examples of accreditation agreements. Further work is needed to encourage greater acceptance of these agreements, particularly among regulators and the public, and stronger participation from developing countries in their development.

The examination of other less formal approaches to conformity assessment, including ***suppliers' declaration of conformity***, could be encouraged in order to determine the costs and benefits and which industrial sectors would most benefit. The supplier may be a manufacturer, distributor, importer, assembler or service organization. The TBT Committee noted a broad support for the suppliers' declaration procedure as specified in ISO/IEC Guide 22.

Private multilateral agreements between certification organizations, such as the successful IEC system for Conformity Testing and Certification of Electrical Equipment (IECEE CB Scheme) should also be studied to assess applicability to other sectors.

Chile stated that conformity assessment was the most serious problem for developing countries, requiring further concrete steps to be taken by the Committee. Developing country exporters, in particular SMEs, in some cases find themselves faced with conformity assessment requirements in export markets that are difficult to meet. According to the Committee, this can be due to the limited physical and technical resources for national conformity assessment, insufficient numbers of accredited laboratories at the national or regional level, high costs as well as legal difficulties in obtaining foreign accreditation, difficulties in establishing internationally recognized accreditation bodies, difficulties in participating in international conformity assessment systems, as well as difficulties related to the implementation of ISO/IEC Guides on conformity assessment procedures.

Canada is promoting ***a common global approach to conformity assessment*** and believes that ISO/IEC Guide 60 (Code of Good Practice for conformity assessment), which is designed to promote equal right of access to conformity assessment worldwide, provides a good framework for the performance of all conformity assessment bodies whether governmental or non governmental, domestic or international. However, this Guide is not widely used and needs to be reviewed and updated, if necessary, to better meet the objectives of the TBT Agreement. In the meantime, the ISO Committee on Conformity Assessment (CASCO) has decided to undertake the necessary work.

Before making a final decision on the best way to proceed, WTO negotiators must at all costs keep a number of key questions in mind:

a) determine the costs versus advantages of the various approaches;
b) eliminate any duplication of trial prescriptions;
c) foresee the same procedures for local, national and regional or international bodies whether governmental or non governmental;
d) reduce the charges weighing on industry and regulation bodies;
e) take into account the needs of consumers;
f) favour non-discriminatory and transparent approaches that facilitate exchanges; and
g) assess the respective advantages of bilateral as against multilateral approaches, unisectoral as against multisectoral.

Overall assessment of the Second Triennial Review

The Second Triennial Review of the TBT Agreement has allowed substantial progress to be achieved in the right direction. Most members of the Committee welcomed its balanced and forward-looking outcome, which represents a good basis for future discussions. Everybody highlighted the importance of having set guidelines to be used by international standards organizations for standards development. While these guidelines are viewed as a good achievement, it remains to be seen how they will work in practice. For the United States, these principles can at any rate be used in the future to evaluate adverse trade implications if and when they arise.

ISO welcomes the fact that the TBT Committee wishes to strengthen the cooperation between the international standardizing bodies and its governmental delegations. For strengthened cooperation goes hand in hand with greater mutual trust.

The unanimous agreement on the positive spirit and outcome of this Second Triennial Review augurs well for the future because it represents, for developing as well as for developed countries, a better functioning and better balanced tool for trade facilitation in the interest of the international trading community as a whole. ■

More information on the TBT Agreement can be found on the following web site:
http://www.wto.org/wto/english/tratop_e/tbt_e/tbt_e.htm

OIML Certificate System:

Certificates registered 2001.02–2001.04

For up to date information: www.oiml.org

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

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

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

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

This list is classified by Issuing Authority; updated information on these Authorities may be obtained from the 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

R61/1996 - NL - 00.01

Type MP ... (Class X(1))

Atoma GmbH, Traunreuter Straße 2-4, D-84478 Waldkraiburg, Germany

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

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

OIML Recommendation applicable within the System / Year of publication

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

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

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

Year of issue

Année de délivrance

Certified pattern(s)

Modèle(s) certifié(s)

Applicant

Demandeur

Système de Certificats OIML:

Certificats enregistrés 2001.02–2001.04

Pour des informations à jour: www.oiml.org

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

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

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

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

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

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

R 51 (1996)

▶ Issuing Authority / *Autorité de délivrance*

National Weights and Measures Laboratory (NWML), United Kingdom

R51/1996-GB1-01.01
Type 8060 (Classes X(1) and Y(a))
Pelcombe Ltd, Main Road, Dovercourt, Harwich, Essex CO12 4LP, United Kingdom

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

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

R 60 (2000)

▶ Issuing Authority / *Autorité de délivrance*

OIML Chinese Secretariat, St6ate Bureau of Technical Supervision, China

R60/2000-CN-00.01
Type CZL-3 (Class C)
Zhongyuan Electrical Measuring Instruments Co., P.O. Box 2, Hanzhong 723007, Shanxi, China

R60/2000-CN-00.02
Type CZL-8C (Class C)
Zhongyuan Electrical Measuring Instruments Co., P.O. Box 2, Hanzhong 723007, Shanxi, China

R60/2000-CN-00.03
Type CZL-6G (Class C)
Zhongyuan Electrical Measuring Instruments Co., P.O. Box 2, Hanzhong 723007, Shanxi, China

R60/2000-CN-00.04
Type CZL-6E (Class C)
Zhongyuan Electrical Measuring Instruments Co., P.O. Box 2, Hanzhong 723007, Shanxi, China

R60/2000-CN-00.05
Type CZL-6D (Class C)
Zhongyuan Electrical Measuring Instruments Co., P.O. Box 2, Hanzhong 723007, Shanxi, China

▶ Issuing Authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB), Germany

R60/2000-DE-01.01
Type C16 i (Class D1 up to C4)
Hottinger Baldwin Messtechnic Wägetechnik GmbH, Im Tiefen See 45, D-64293 Darmstadt, Germany

R60/2000-DE-01.02
Type PW2 (Classes D1, C3, C3MR and C3MI)
Hottinger Baldwin Messtechnic Wägetechnik GmbH, Im Tiefen See 45, D-64293 Darmstadt, Germany

R60/2000-DE-01.03
Type RTN .. (Class C3 to C5)
Schenk Process GmbH, Landwehrstraße 55, D-64293 Darmstadt, Germany

▶ Issuing Authority / *Autorité de délivrance*

Danish Agency for Development of Trade and Industry, Division of Metrology, Denmark

R60/2000-DK-01.01
Compression, strain gauge load cell, type SC (Class C)
Esit Elektronik Sistemler Imalat ve Ticaret Ltd. STI, Mühürdar Cad. 91 Kadiköy, TR-81300 Istanbul, Turkey

R60/2000-DK-01.02
Shear beam, strain gauge load cell, type SBS (Class C)
Esit Elektronik Sistemler Imalat ve Ticaret Ltd. STI, Mühürdar Cad. 91 Kadiköy, TR-81300 Istanbul, Turkey

R60/2000-DK-01.03
Single point, strain gauge load cell, type SP (Class C)
Esit Elektronik Sistemler Imalat ve Ticaret Ltd. STI, Mühürdar Cad. 91 Kadiköy, TR-81300 Istanbul, Turkey

▶ Issuing Authority / *Autorité de délivrance*

Laboratoire National d'Essais
Service Certification et Conformité Technique
Certification Instruments de Mesure, France

R60/2000-FR2-00.01
SCAIME bending beam load cell with strain gauges, Types AP...C.SH5e, AP...C.SH10e, AP...C.SH15e (Accuracy class C)
Scaime S.A., Z.I. de Juvigny, B.P. 501,
F-74105 Annemasse cedex, France

▶ Issuing Authority / *Autorité de délivrance*

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

R60/2000-NL1-01.01
Type LBD1 (Class C)
Charder Electronic Co., Ltd, 103, Kuo Chung Road,
Dah Li City, Taichung Hsien 412, R.O.C., Taiwan

R60/2000-NL1-01.02
Type 1130 (Class C)
Tedea Huntleigh International Ltd., 5a Hatzoran St.,
Netanya 42506, Israël

R60/2000-NL1-01.03
Type 0795 (Class C)
Mettler-Toledo Inc., 1150 Dearborn Drive, Worthington,
Ohio 43085-6712, USA

R60/2000-NL1-01.04
Type GD... or 0782 (Class C)
Mettler-Toledo Changzhou Scale Ltd.,
111 Changxi Road, Changzhou, Jiangsu 213001, China

R60/2000-NL1-01.05
Type CPI (Class C)
Precia S.A., BP 106, F-07001 Privas cedex, France

R60/2000-NL1-01.06
Type 0785 (Class C)
Mettler-Toledo Inc., 150 Accurate Way, Inman,
SC 29349, USA

R60/2000-NL1-01.07
Type MED-400 (Class C)
HBM Inc., 19 Bartlett Street, Marlboro,
MA 01752, USA

R60/2000-NL1-01.08 Rev. 1
Type CA40X... (Class C)
Scaime S.A., Z.I. de Juvigny, B.P. 501,
F-74105 Annemasse cedex, France

R60/2000-NL1-01.09
Type 1130 (Class C)
Tedea Huntleigh International Ltd., 5a Hatzoran St.,
Netanya 42506, Israël

R60/2000-NL1-01.10
Type BCS (Class C)
CAS Corporation, CAS Factory # 19 Kanap-ri,
Kwangjeok-myon, Yangju-kun Kyungki-do,
Rep. of Korea

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Automatic gravimetric 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-NL1-01.01
*Types CCW-M-****(*)-*/**-**, CCW-EM-****(*)-*/**-**, CCW-NZ-****(*)-*/**-**, CCW-RZ-****-*/**-**-N, CCW-DZ-****-*/**-**-N (Class X(1))*
Ishida Co., Ltd., 44, Sanno-cho, Shogoin, Sakayo-ku,
Kyoto-city 606-8392, Japan

R61/1996-NL1-01.02
Type WT-WMA-2 (Class Ref(1))
Weté B.V., Minervum 1719, 4817 ZK Breda,
The Netherlands

R61/1996-NL1-01.03
Type Duplex Weighmaster (Class X(1))
Thiele Technologies Inc., 315, 27th Avenue Northeast,
Minneapolis, Minnesota 55418-2715, USA

R61/1996-NL1-01.04
Model TW-.... (Class X(1))
Neupak, 3680-1 Dodd Road, St. Paul, MN 55122, USA

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-00.09 Rev. 1
Type iso-TEST (Classes I, II, III and IIII)
Sartorius A.G., Weender Landstraße 94-108, D-37075 Göttingen, Germany

▸ Issuing Authority / *Autorité de délivrance*

Danish Agency for Development of Trade and Industry, Division of Metrology, Denmark

R76/1992-DK-01.01
Type M1100-Cx (Classes III and IIII)
Marel hf, Hofdabakka 9, IS-112 Reykjavik, Iceland

▸ Issuing Authority / *Autorité de délivrance*

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

R76/1992-NL1-01.04
Type 8217 (Class III)
Mettler-Toledo Inc., 1150 Dearborn Drive, Worthington, Ohio 43085-6712, USA

R76/1992-NL1-01.05
Type SC600 (Class III)
Shekel Electronics Scales, Kibbutz Beit Keshet, M.P. Lower Galilee 15247, Israël

R76/1992-NL1-01.06
Type DT-15... (Class III)
DATECS Ltd.A, 125, Tsarigrag shosse, bl 26B, Sofia 1113, Bulgaria

R76/1992-NL1-01.07
Type IWQ-series (Class III)
Ishida Co., Ltd., 44, Sanno-cho, Shogoin, Sakayo-ku, Kyoto-city 606-8392, Japan

R76/1992-NL1-01.08
Types AB-S, GB-S and PB-S (Classes I, II and III)
Mettler-Toledo A.G., Im Langacher, CH-8606 Greifensee, Switzerland

R76/1992-NL1-01.09
Type BM-3 (Class III)
Digital Scales S.A., Poligono Industrial Larrondo, Beheko Etorbidea, no. 2 Naves 2, 3, 4, 48180 Loiu Vizcaya, Spain

▸ Issuing Authority / *Autorité de délivrance*

Gosstandart of Russian Federation, Russian Federation

R76/1992-RU-00.03
Scale "SHTRIKH M" (Class III)
SHTRIKH-M, 1, Kholodilny pereulok, Moscow, 113191, Russian Federation

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

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 85 (1998)

▸ Issuing Authority / *Autorité de délivrance*

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

R85/1998-NL1-01.01
Model Micropilot S FMR 530 DN 150 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1, D-79689 Maulburg, Germany

R85/1998-NL1-01.02
Model Micropilot S FMR 530 DN 200 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1, D-79689 Maulburg, Germany

R85/1998-NL1-01.03
Model Micropilot S FMR 530 DN 250 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1, D-79689 Maulburg, Germany

R85/1998-NL1-01.04
Model Micropilot S FMR 533 DN 450 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1, D-79689 Maulburg, Germany

R85/1998-NL1-01.05
Model Micropilot S FMR 531 1,5" Rod (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1,
D-79689 Maulburg, Germany

R85/1998-NL1-01.06
Model Micropilot S FMR 532 DN 150 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1,
D-79689 Maulburg, Germany

R85/1998-NL1-01.07
Model Micropilot S FMR 532 DN 200 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1,
D-79689 Maulburg, Germany

R85/1998-NL1-01.08
Model Micropilot S FMR 532 DN 250 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1,
D-79689 Maulburg, Germany

R85/1998-NL1-01.09
Model Micropilot S FMR 532 DN 300 (Class 2)
Endress + Hauser GmbH + Co., Haupstrasse 1,
D-79689 Maulburg, Germany

R85/1998-NL1-01.10
Model 973 with antenna F08 and DC power supply (Classes 2 and 3)
Enraf B.V., Röntgenweg 1, 2624 BD Delft,
The Netherlands

R85/1998-NL1-01.11
Model 973 with antenna F08 and AC power supply (Classes 2 and 3)
Enraf B.V., Röntgenweg 1, 2624 BD Delft,
The Netherlands

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-NL1-01.01
Model DPC, DPBA and DPX-XX (Class 0.5)
Nuovo Pignone S.p.A, Via Roma 32,
I-23018 Talamona (SO), Italy

R117/1995-NL1-01.02
Model DPC, DPBA and DPX-XX (Class 0.5)
Nuovo Pignone S.p.A, Via Roma 32,
I-23018 Talamona (SO), Italy

R117/1995-NL1-01.03
Model DPC, DPBA and DPX-XX (Class 0.5)
Nuovo Pignone S.p.A, Via Roma 32,
I-23018 Talamona (SO), Italy

R117/1995-NL1-01.04
Fuel Dispensers for Motor Vehicles, model Quantium-T (with PAS-V3 gas elimination device) (Class 0.5)
Tokheim Europe & Africa, Koppens Automatic Fabrieken B.V., Industrieweg 5, 5531 AD Bladel,
The Netherlands

R117/1995-NL1-01.08
Fuel Dispensers for Motor Vehicles, model Quantium-T (with EPZ gas elimination device) (Class 0.5)
Tokheim Europe & Africa, Koppens Automatic Fabrieken B.V., Industrieweg 5, 5531 AD Bladel,
The Netherlands

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Evidential breath analyzers
Éthylomètres

R 126 (1998)

Issuing Authority / *Autorité de délivrance*

Laboratoire National d'Essais
Service Certification et Conformité Technique
Certification Instruments de Mesure, France

R126/1998-FR2-00.01 Rev. 1
Type 679E
Société SERES, 360, rue Louis de Broglie, BP 87000,
F-13793 Aix en Provence, France

OIML TC 8/SC 7

Gas metering

Brussels, 5–9 March 2001

R. Eggermont,
Chef de la Division de Métrologie Légale,
Service de la Métrologie, Ministère des Affaires Économiques, Brussels, Belgium

Participation:

Australia, Belgium, Canada, France, Germany, Israel, Japan, Netherlands, United Kingdom, United States

Liaison institutions:

ENGVA and IANGV

Co-Secretariat:

Belgium and France

Two meetings were held in Brussels from 5 to 9 March 2001 at the Belgian Ministry of Economic Affairs.

First meeting

This meeting was given over to examining the Second Committee Draft (2 CD) entitled *Measuring systems for gaseous fuel* which had been distributed to Sub-Committee members at the beginning of 2001. The minutes of the previous meeting were approved, with certain comments being taken into account.

The working group approved the appointment of Mr. J.L. Deschutter as Chairman of the meeting; Mr. Deschutter is currently employed by the Belgian gas transport company. Only remarks requiring discussion were examined at this session, editorial comments being dealt with by the secretariat.

The Recommendation will be applicable both to very large gas metering stations located between two States, and also to small ones. The Recommendation will also focus on volume indication at base conditions or on energy indication, it being possible for energy to be obtained directly on the basis of local measurements (volume at base conditions, determination of calorific value) or on the basis of remote measurements by management of the calorific value.

The subjects retained are determination of energy (certain methods of evaluating energy are not based on local measurement of the calorific value and could be considered as not belonging to legal metrology), clear identification of mandatory elements of a measurement system and an improvement of certain definitions with a view to facilitating interpretation of the Recommendation (taking into account its broad scope and the wide differences in approach, much choice has been left to the Member States).

As present day techniques do not permit instantaneous energy output to be quantified, it has been suggested that minimum time intervals needed to determine the calorific value be evaluated. The Secretariat will distribute amended proposals for the calorific value determination device (CVDD) by e-mail and will put forward proposals for the test report format of the gas measurement module, the conversion and calculation devices, the indicating device, the calorific value determination device and the associated measuring instruments. The Secretariat aims to be able to present this draft to the CIML at its Autumn 2002 meeting after having held the two preliminary ballots among Sub-Committee members and then Committee Members. No further meetings are planned.

Second meeting

The previous two meetings were given over to examining the Second Committee Draft (2 CD) entitled *Measurement systems for compressed natural gas (CNG) for vehicles*, which had been drawn up by the Secretariat in line with the decisions of the OIML TC 8/SC 7 Sub-Committee meeting held in March 2000 in Paris.

Comments had been received from Australia, France, Canada, Netherlands, Japan, from a manufacturer, from the International Association for Natural Gas Vehicles, and the NGV of the Japan Gas Association. The meeting allowed the essential issues resulting from the comments to be examined. There were many long and fruitful discussions on the pattern approval tests and initial verification, problems concerning stable flowrate tests or an increase in the number of transitory flowrate tests, of minimum delivery, of permissible error of the minimum delivery, of temperature range, of endurance tests (equivalent to 10 000 deliveries in under six months), and on the necessity for an on-site initial verification test.

The Secretariat especially thanked Mr. Hien Ly from the International Association for Natural Gas Vehicles (IANGV) for his contribution and explanations both prior to and during the meeting.

It is the Secretariat's wish to also present this Draft to the CIML at its Autumn 2002 meeting, after having held the two preliminary ballots among Sub-Committee members and then Committee Members. No further meetings are planned.

OIML TC 8/SC 7

Mesurage des gaz

Bruxelles, 5–9 mars 2001

R. Eggermont,
Chef de la Division de Métrologie Légale,
Service de la Métrologie, Ministère des Affaires Économiques, Bruxelles, Belgique

Participation:

Allemagne, Australie, Belgique, Canada, États-Unis, France, Israël, Japon, Pays-Bas, Royaume-Uni

Organisations en liaison:

ENGVA et IANGV

Co-Secrétariat:

Belgique et France

Deux réunions se sont tenues à Bruxelles du 5 au 9 mars 2001 dans les locaux du Ministère Belge des Affaires Economiques.

Première réunion

Cette réunion fut consacrée à l'examen du Deuxième Projet de Comité (2 CD) intitulé *Systèmes de mesure des combustibles gaseux* qui avait été distribué aux membres du sous groupe dans les tous premiers jours de 2001. Le compte rendu de la réunion précédente fut approuvé moyennant la prise en compte de certaines remarques.

Le groupe de travail accepta la nomination de Monsieur J.L. Deschutter comme Président de la réunion; Monsieur Deschutter travaille pour la société belge de transport de gaz. Seules les remarques nécessitant discussion ont été examinées en séance, les remarques rédactionnelles étant traitées par le Secrétariat.

La Recommandation va s'appliquer aussi bien aux très grandes stations de mesure qui se trouvent entre deux États qu'aux petites stations de mesure. La Recommandation portera aussi sur l'indication du volume aux conditions de base ou sur l'indication en énergie, l'énergie pouvant être obtenue directement sur base des mesures locales (volume aux conditions de base, détermination du pouvoir calorifique) ou sur base de mesures à distance par gestion du pouvoir calorifique.

Les sujets retenus sont la détermination de l'énergie (certaines façons de déterminer l'énergie n'étant pas basées sur la mesure locale du pouvoir calorifique et pourraient être considérées comme n'étant pas de la métrologie légale), une identification claire des éléments obligatoires d'un ensemble de mesurage et une amélioration de certaines définitions en vue de faciliter l'interprétation de la Recommandation (étant donné le très large champ d'application de la celle-ci et les grandes différences d'approche, beaucoup de choix a été laissé aux États Membres).

Comme il n'est pas possible dans l'état actuel de la technique de faire la somme des énergies instantanées délivrées, il a été proposé de définir des intervalles de temps minimum pour la détermination du pouvoir calorifique. Le Secrétariat va faire circuler les propositions amendées des dispositifs de détermination du pouvoir calorifique (CVDD) par e-mail et va faire des propositions pour le format du rapport d'essai pour le module de mesurage gaz, les dispositifs de conversion et le calculateur, le dispositif indicateur, le dispositif de détermination du pouvoir calorifique et des instruments de mesure associés. Le souhait du Secrétariat est de pouvoir présenter ce projet à la réunion du CIML de l'automne 2002 en ayant préalablement fait les deux tours de vote au sein des membres du sous groupe puis des membres du Comité. Il n'est pas prévu de tenir d'autres réunions.

Deuxième réunion

Les deux dernières réunions ont été consacrées à l'examen du Deuxième Projet de Comité (2 CD) intitulé *Systèmes de mesure de gaz naturel comprimé (GNC) pour véhicules*, qui avait été préparé par le secrétariat suite aux décisions de la réunion du sous comité OIML TC 8/SC 7 de mars 2000 à Paris.

Des commentaires avaient été reçus de l'Australie, France, du Canada, Pays Bas, Japon, d'un constructeur, de la "International Association for Natural Gas

Vehicles", et de NGV de Japan Gas Association. La réunion a permis d'examiner les points essentiels des commentaires. Il y a eu de nombreuses, longues et fructueuses discussions sur les essais en approbation de modèle et en vérification primitive, problème des essais à débit stable ou nombre accru d'essais à débit transitoire, de la livraison minimale, de l'erreur tolérée sur la livraison minimale, de l'étendue de température, de l'essai d'endurance (équivalent à 10 000 livraisons en moins de 6 mois), de la nécessité d'un essai sur site en vérification primitive.

Le secrétariat remercie tout particulièrement Monsieur Hien Ly de "International Association for Natural Gas Vehicles" (IANGV) pour sa contribution et ses explications aussi bien avant que pendant la réunion.

Ici aussi le souhait du secrétariat est de pouvoir présenter ce projet au CIML en l'automne 2002 en ayant préalablement fait les deux tours de vote au sein des membres du sous groupe puis des membres du Comité. Il n'est pas prévu de tenir d'autres réunions. ■

Photo taken during the 2nd meeting on compressed gas

Photo prise lors de la 2ème réunion sur la gaz comprimé

RLMO MEETING

COOMET Working Group on Legal Metrology: Second Meeting

Minsk, 28–30 March 2001

HARTMUT APEL, Head of Section, "Legal Metrology", PTB, Germany

COOMET is the Regional Organization for the *European-Asian Cooperation of National Metrological Institutions* and comprises twelve member countries.

The second international meeting of the COOMET Working Group (WG) on Legal Metrology was held at the Belarus State Institute of Metrology (BelGIM) in Minsk, from March 28 to 30, 2001. The meeting was organized by BelGIM staff under the leadership of its Director, Mr. N. Zhagora. Over 20 delegates attended, representing the following COOMET member countries:

Belarus, Bulgaria, Cuba, Germany, Kazakhstan, Lithuania, Moldova, Russia, Slovakia, Ukraine

The session was chaired by the Rapporteur of the WG, Hartmut Apel (PTB, Germany) who had also invited the Sub-Working Group on *Testing of Software for Measuring Instruments*, headed by Dr. U. Grottker (PTB). The aim of this Subgroup is to coordinate their national policy and testing procedures on software by the exchange of documentation and experience with a view to promoting the development of test procedures. The result of the work will be presented to OIML TC 5/SC 2 for further consideration. The Sub-Working Group, established one year ago in Braunschweig, met for the first time and held its meeting in Minsk on the same occasion as the WG on Legal Metrology, partly in a parallel session.

COOMET, traditionally an organization for scientific metrology and hitherto mainly concerned with intercomparison of measurement standards, is recognizing the increasing importance which legal metrology is gaining world-wide in connection with the facilitation of free trade. Six project proposals for further cooperation in the field of legal metrology were therefore identified and discussed; among these, for example, are projects on:

- the harmonization of the information contained in type approval descriptions;
- agreements on mutual recognition of test results and certificates of initial verification of measuring instruments; and
- development of a Recommendation on the expression of uncertainty in legal metrology.

The project regarded as being by far the most important one is that concerning the *Development of a Recommendation on the Testing of Software for Measuring Instruments,* for which Belarus is the project coordinator.

A questionnaire addressed to all COOMET member countries was handed over by Dr. Grottker, the intention being to get an overview of the current state of software testing and future developments in this field. The active members of the Sub-Working Group from six countries agreed to meet again in Braunschweig in September 2001 to exchange information and know-how and to evaluate the existing software requirements laid down in various national and international documents, among them WELMEC Guide 7.1.

In view of the forthcoming COOMET Committee Meeting in Moldova, the Resolution below was drawn up to be submitted for adoption one month later in Kishinev.

Resolutions (Excerpt)

1. The mutual exchange of documents and information should continue. A number of documents are already available on the Internet and can be downloaded. This distribution method should be intensified.
2. The growing importance of market surveillance was recognized and the participants were requested to send their comments on the new Committee Draft of the revision of OIML Document D 9 to the actual WG secretariat at PTB Braunschweig in order to be focussed and forwarded to the BIML.
3. The increasing importance of the calculation of measurement uncertainties in metrology has been recognized as one indicator of the quality of measurement and it substantially contributes to creating mutual confidence in measurement capabilities.

   This topic should be dealt with at two different levels:

   - the general application and interpretation of the GUM for purely calibration purposes within COOMET member countries should be dealt with again on the agenda of the Committee meeting at Moldova;

- the introduction and application of methods on calculating measurement uncertainties should be dealt with within a particular Sub-Working Group of legal metrology of COOMET and should be interrelated with the work progress obtained so far in the OIML TC 5/SC 2.

4. After having agreed upon a common interpretation of the procedures as to how to apply calculation of measurement uncertainties in legal metrology, a "virtual intercomparison" of measurement results should be initiated among interested NMIs.

5. Training courses on calculating measurement uncertainties for COOMET member countries and the accompanying interpretation guides should be made available in workshops on the basis of practical examples.

6. It is the objective of the Sub-Working Group on Software to develop a guide for software evaluation and testing on the basis of the structure of the WELMEC Guide 7.1, however, with the restriction that members' comments (e.g. Ukraine, Russia) are taken into consideration and with the option that additional levels and requirements are defined, if necessary.

   Correctness of measurement algorithms and data should be subject of the work program.

7. The Sub-working Group on Software should continue the exchange of information and intensify the submissions of their results to the international context of the OIML. ■

RLMO MEETING

Seventeenth WELMEC Committee Meeting

Malahide, 24–25 May 2001

LINDSAY CRAWFORD, WELMEC Secretary

The 17th meeting of the WELMEC Committee was held in Malahide, near Dublin, Ireland, on 24–25 May 2001. The meeting was hosted by the Legal Metrology Service, Ireland.

The Committee was given a warm welcome to Ireland by Mr. Noel Treacy, Irish Minister for Science, Technology and Commerce, who praised WELMEC's contribution to maintaining consumer confidence in measurement.

The first item on the agenda involved presentations on the legal metrology structures in different countries. Mr. Farragher (Ireland) and Dr. Bennett (Chairman, UK) gave informative presentations, describing the way in which their respective organizations had dealt with an organizational review.

An important feature on the agenda was the Measuring Instruments Directive (MID). Discussions about the MID centered on progress in the Council Working Group, WELMEC Working Group 8, and normative documents. The Committee heard that under the Swedish Presidency, the Council Working Group had so far discussed the main text of the MID, and Annex I. Two more meetings are scheduled, at which Annexes II and III will be discussed. The Committee was informed that WG 8 had been discussing the technical Annexes to the Directive, and that the proposed amendments to these have brought them in line with OIML Recommendations. Mr. Magaña, BIML Appointed Director, gave a short presentation to the Committee on the issue of normative documents. He said that several Member States had expressed concern about these normative documents, and after discussion with the Committee members, it was agreed that Mr. Magaña and Dr. Bennett should meet with the Commission to explore acceptable solutions.

The WELMEC Working Groups had been very busy since the last Committee meeting.

The Committee approved the publication of the new **WG 2** Guide - WELMEC 2.6 *Guide for the testing of automatic catchweighing instruments*.

It instructed **WG 4** to proceed with further work in view of the importance of the harmonized application of the conformity assessment modules.

WG 5 was asked to facilitate a submission under the new grant theme three which supports specific cross-border market surveillance actions involving at least two member states.

The Committee asked **WG 6** to report on identified differences in requirements and practices for e-marked pre-packages, and asked **WG 8** to examine modules A-H1 (conformity assessment modules) to identify areas for clarification and improvement.

WG 7 has submitted an application for EU funding under the dedicated call 10/00 of the GROWTH program.

WG 10 had two publications approved by the Committee: WELMEC 10.1 *Guide for Pattern Examination of a family of volumetric rotating meters for liquids other than water*, and WELMEC 10.2 *Guide to metrological devices for transferring measured quantities* (DTMQ).

Representatives from several Observer Organizations also attended the meeting, and the WELMEC Committee heard reports from EA, EOTC, Euromet and OIML.

The WELMEC Secretary presented the new WELMEC web site to the Committee. The new site is now under the direction of the WELMEC Secretariat and was designed with three objectives in mind: to make it easier for people to use, to ensure it can be updated more quickly and to make it more attractive to new users.

Key features of the new site include a "tour" of WELMEC, a link-rich style, reduced download time for documents, a choice of formats in which to view the WELMEC Guides, and a search facility. The Committee members generally welcomed the new look site.

Finally, Dr. Bennett informed the Committee that this would be his last meeting as Chairman of WELMEC, and that he was leaving WELMEC after 11 years with some very real regrets. He said that WELMEC had made significant progress since the signing of the original Memorandum of Understanding, to the point where it held the future of legal metrology in Europe in its hands. He congratulated the Committee for all that has been achieved to date, and added that he wished his successor, and all the WELMEC members, every success in the future.

The WELMEC Committee discussed the election of a new Chairman, and agreed to continue the process of identifying potential candidates for the Chair with the objective of holding a postal ballot in September.

The next WELMEC Committee meeting will be held in Madrid, in May 2002, at the kind invitation of Mr. Robles, of the Centro Español de Metrología. ■

WELMEC

European cooperation in legal metrology

The WELMEC Committee, meeting in Malahide on 24 – 25 May 2001:

1. Instructs the Chairman to contact the Commission in order to explore the future recognition of WELMEC's role including the possibilities of a Memorandum of Understanding;

2. Instructs the Chairman to investigate an alternative criterion for admitting candidate countries as Associate Members;

3. Instructs the Chairman to discuss with the Commission and BIML possible alternative arrangements for recognizing "Normative Documents";

4. Instructs WG 8 to examine MID modules A-H1 to identify areas for clarification and improvement;

5. Approves the publication of WELMEC 2.6, 10.1 and 10.2;

6. Instructs the Chairman and Secretariat to rationalize the numbering of published guides;

7. Instructs WG 4 to proceed with further work in view of the importance of the harmonised application of the conformity assessment modules;

8. Instructs WG 6 to report on identified differences in requirements and practices for e-marked pre-packages;

9. Approves a 3 % increase in subscriptions for 2002;

10. Instructs all Members to send views on the relationship between Regional Legal Metrology Organizations and the OIML to the Chairman by 31st July;

11. Instructs the Chairman and Vice-Chairman to supervise the identification and election of a new Chairman for WELMEC;

12. Thanks the Irish Legal Metrology Service for hosting the 17th meeting;

13. Accepts the invitation to hold the next meeting in Madrid in 2002.

RLMO INFO

SADCMEL News

Brian Beard, Technical Specialist - Legal Metrology, SABS, Pretoria, South Africa

The Southern African Development Community Co-operation in Legal Metrology (SADCMEL) was established in 1996 mainly to give effect to the SADC Protocol on Trade which aims to promote trade within the Region. SADCMEL meets bi-annually to discuss issues pertaining to the aims of the Organization. Briefly these aims are as follows:

1 Harmonize legislation to promote trade and ensure compatibility with international requirements.
2 Facilitate training.
3 Arrange intercomparisons to ensure uniformity.
4 Exchange metrology-related information and provide assistance to members where possible.

The present priority is the drafting of harmonized legislation dealing with prepackages.

Meetings

Activities covered in this article concern discussions held during the last two meetings of SADCMEL. These were held in Arusha, Tanzania on 30 November and 1 December 2000 and Maseru, Lesotho on 26 April 2001. SADCMEL Technical Committees met on 24 April 2001. The OIML was represented in Arusha by Mr. Bernard Athané and in Maseru by Mr. Jean-François Magaña who both gave valuable input. Forty-three delegates attended the Maseru meeting and these included associate members and observers from non member countries and international organizations.

Harmonization of legislation

Quantity declaration on prepackages

A draft document has been prepared using the requirements of OIML R 79 but also including Annexes which give more details regarding the sale of specific commodities. The Annexes follow the generic requirements of OIML R 79 but specify exemption from marking, units of measurement to be used and prescribed package sizes. Problem areas discussed at the last meeting of TC 1 which deals with this matter include the following:

i) Height of prescribed markings for which two alternative models are given in OIML R 79 meaning that packages marked according to one may not comply in countries requiring the other. More research needs to be done to determine most common practice and when OIML R 79 is amended we will strongly support a single normative requirement.

ii) The requirement that the declared quantity shall be on the principal display panel seems to be ignored by various countries judging by the markings on many products imported into the SADC Region. It appears that the definition of "Principal display panel" is interpreted very loosely and this will be discussed with our largest trading partners.

iii) Misleading packaging appears to be on the increase and further research into legislation of other countries must be conducted to determine how best to legislate in addition to R 79 and R 87 requirements, to prevent such practices.

2 Tolerances on prepackages

The SADCMEL document dealing with this issue has been put on hold until the Revision of OIML R 87 is completed. During our November 2000 meeting comments to the 1st Committee Draft were discussed, as were comments to the 2nd Committee Draft during the meeting of TC 1 in April 2001. We are now awaiting with interest, the distribution of international comments to the 2nd CD of R 87.

3 Instruments

TC 2 deals with harmonization of legislation for instruments. OIML Recommendations are being adopted by members but for certain instruments such as mechanical equal armed counter and beam scales, which are still extensively used in the SADC Region, stand-alone technical requirements are being drafted. This is not a priority and at present documents for the aforementioned instruments are in rough draft form only.

Training

TC 4 deals with training issues. A document setting out a training curriculum for inspectors is being drafted and a list of possible training institutions compiled. Various international courses have been attended by legal metrologists from member countries and it is the intention to institute "train the trainer" courses within the region.

A two day seminar on the requirements of the new OIML R 49-1 was held in Arusha prior to the November 2000 meeting. The seminar was funded by the PTB and presented by Mr. Frank Schink of Spanner - Pollux, Germany. As the accuracy of water meters is becoming the responsibility of the legal metrology organization in most member countries, the seminar was of great assistance to the Region.

At the time of writing an in-depth analysis of training and infrastuctural needs of member countries is being undertaken in order to prepare a project proposal for the securement of donor funding to uplift legal metrology within the region.

Exchange of information

A directory of legal metrology within the SADC Region was published in March 2001. Information is covered in a similar format to that of the OIML document. Within the Region assistance is given wherever possible at the request of member countries and type approval documentation is exchanged. At present the legal metrology organizations of Kenya and Uganda are associate members of SADCMEL.

Contact details

The current Chairperson of SADCMEL is Mr. Ali Tukai of Tanzania and the Regional Co-ordinator is Brian Beard of South Africa.

Information about SADCMEL can be obtained from the Regional Co-ordinator at the following address:

Brian Beard
Technical Specialist - Legal Metrology
SABS
Private Bag X191
Pretoria 0001
South Africa
Tel.: + 27 12 4287001 – Fax: + 27 12 4286552
E-mail: beardbe@sabs.co.za
Web site: www.sadc-sqam.org

NIST Celebrates its First Century of Service

For 100 years, the National Institute of Standards and Technology has helped to keep U.S. technology at the leading edge. Over the years, NIST has made solid contributions to metrology, image processing, DNA diagnostic "chips," smoke detectors, and automated error-correcting software for machine tools. NIST also has had major impact on atomic clocks, X-ray standards for mammography, scanning tunneling microscopy, pollution-control technology, law enforcement equipment standards and high-speed dental drills. Consumers trust the mass or volume on package labels and in their other purchases thanks in large part to NIST, which convened the first meeting of U.S. weights and measures officials in 1905. NIST's work to ensure fairness in the marketplace continues today through activities such as support of state, federal, and international legal metrology activities such as OIML.

Founded on March 3, 1901, NIST was the federal government's first physical science research laboratory. NIST's major accomplishments of the past 100 years and their impact on industry, science and technology, the nation's economy, and the public are described in NIST at 100: Foundations for Progress, an extensive, illustrated web site at

http://www.100.NIST.gov

Special events and meetings are planned throughout the year to celebrate the occasion. In July, the National Conference on Weights and Measures (NCWM) will hold its 86th Annual Meeting in Washington, D.C., in honor of the NIST centennial celebration. Special commemorative activities are planned during the meeting to recognize NIST's leadership role in maintaining the quality and integrity of the nation's measurement system and the 96 years of cooperation between NIST and NCWM in working toward uniformity in weights and measures laws, regulations, and practices.

The success of the joint efforts of NIST and NCWM are recognized in a new NIST publication SP 958, "A Century of Excellence in Measurements, Standards, and Technology." The publication contains vignettes describing some of the classic publications from NIST's first century. One section entitled "Uniformity in Weights and Measures Laws and Regulations" describes the history of NIST's collaboration with NCWM to develop such significant publications as NIST Handbooks 44, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices" and 130, "Uniform Laws and Regulations." Also recognized are the Reports of the NCWM, which serve as a legislative history of the requirements in the uniform laws adopted by the NCWM. A complete copy of the publication is available on the Internet at

http://nvl.nist.gov/pub/nistpubs/sp958-lide/cntsp958.htm

On March 6, 60 representatives of industry associations, embassy science counselors, and directors of other countries' National Measurement Institutes attended an industry open house in Gaithersburg. That evening a Gala Celebration was held at the Ronald Reagan Building and International Trade Center in Washington, D.C. The approximately 830 attendees dressed in their finest for the auspicious occasion, which featured an elegant dinner and entertainment. VIP speakers included U.S. Secretary of Commerce Don Evans, Visiting Committee Chair Thomas Manuel, and Representative Sherwood Boehlert, chair of the U.S. House of Representative's Science Committee. Also attending were former Secretary of Commerce Barbara Hackman Franklin; Senator Debbie Stabenow and Representatives Mark Udall, Gil Gutknecht, and Sheila Jackson Lee; and past NIST Directors Lewis Branscomb, Ernest Ambler, John Lyons, Arati Prabhakar, and Ray Kammer. Forty-nine organizations, including OIML presented plaques in honor of NIST's centennial to Acting Director Karen Brown.

On March 7, more than 200 people attended a Symposium on Standards in the Global Economy at NIST Gaithersburg. The event focused on past accomplishments, present activities, and future trends in standards for several sectors of importance to the U.S. economy. Attending were corporate VIPs; directors of professional societies, standards organizations, and other national standards laboratories; and all five living past NIST directors. A business meeting of the National Metrology Institute (NMI) directors was held at NIST Gaithersburg, followed by laboratory tours. Nearly 60 NMI representatives attended.

OIML joined NIST in celebrating its first 100 years through its delegation that included Gerard Faber, Dr. Manfred Kochsiek, Jean-François Magaña and Lev K. Issaev, Deputy Director, VNIIMS Gosstandart who attended the NIST Centennial festivities. ■

Assessment of OIML Activities

2000

Contents

Assessment of OIML Activities 2000

1 OIML Member States and Corresponding Members

Member States:	57		
Corresponding Members:	51	(+3)	Benin, Cambodia, Malta
Total:	**108**	**(+ 3)**	

2 New and revised OIML Recommendations, Documents and other Publications issued

New Recommendations issued:	2	R 128, R 129
Revised Recommendations issued:	3	R 49-1, R 60, R 65
Revised Vocabulary issued:	1	VIML
Joint ISO-OIML Standard/ Recommendation issued:	1	ISO 3930/OIML R 99

	1998	1999	2000
Total number of Recommendations:	108	108	111
Total number of Documents:	25	26	26
Total number of other Vocabularies:	3	3	3
Total number of other Publications:	17	17	17

3 OIML Technical Committees and Subcommittees: Meetings and degree of participation of OIML Members

TC 3/SC 5	27–29 June 2000	Paris	15 P-members present out of 23
TC 6	24–25 February 2000	Paris	16 P-members present out of 24
TC 8/SC 3	14–16 February 2000	Paris	14 P-members present out of 25
TC 8/SC 4	15–17 February 2000	Paris	14 P-members present out of 22
TC 8/SC 5	8–10 November 2000	Paris	12 P-members present out of 25
TC 8/SC 5 (WG 2)	8–10 February 2000	Paris	7 P-members of WG 2 present
TC 8/SC 7	20–24 March 2000	Paris	13 P-members present out of 20
TC 9/SC 2	8–9 June 2000	Teddington	8 P-members present out of 23
TC 12 (WG)	26 October 2000	Braunschweig	8 P-members of the WG present

4 Liaisons with other international and regional bodies

BIML representatives participated in the following meetings in 2000:

JCGM	7–10 March & 12–16 November	Sèvres	*WG 1 & WG 2 Meetings*
European Commission	22 March & 8 June	Brussels	*Meetings on the MID*
SADCMEL	10 April	Botswana	*Committee Meeting*
WELMEC	8–9 June	Moss	*Committee Meeting*
WTO TBT Committee	19–20 July	Geneva	*Seminar and Committee Meeting*
ISO/DEVCO & CASCO	25–27 September	Milan	*Annual Meetings & Workshop*
ILAC	1–4 November	Washington D.C.	*General Assembly*
UN/ECE	6–8 November	Geneva	*Working Party Meeting*

In addition, the CIML President, Immediate Past President, Vice-Presidents, Development Council Chairperson and certain CIML Members represented the OIML at meetings of:

APLMF - COOMET - EUROMET - ISO - SIM

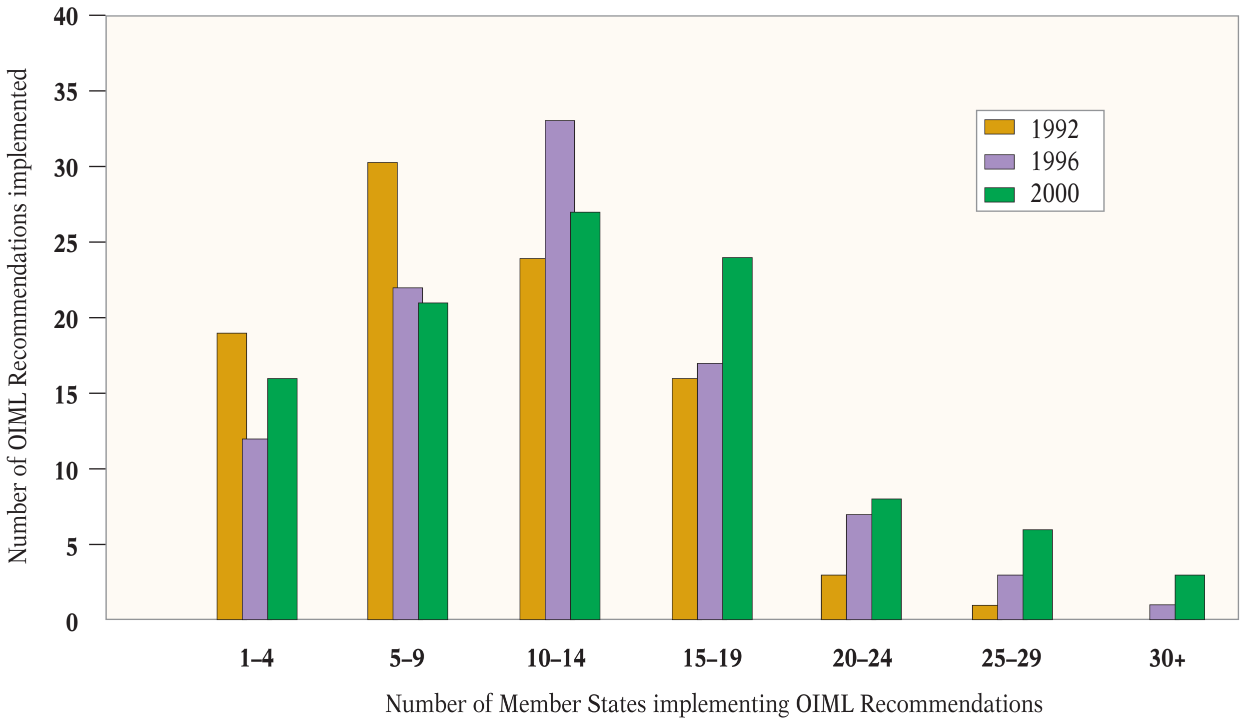
Concerning various technical activities of ISO, IEC, CEN, CENELEC and the European Commission, OIML experts participated in meetings and/or reports were given for the following fields:

- Water meters
- Draft European Directive on Measuring Instruments (MID); WELMEC WG 8
- Acoustic measurements
- Electromagnetic interference
- Vehicle exhaust emissions

5 Degree of implementation of OIML Recommendations by OIML Members

An inquiry on the implementation of OIML Recommendations was made in 2000. In comparison with the previous inquiries made in 1992 and in 1996, the significant increase in the number of countries implementing individual Recommendations and in the degree of implementation ensured is represented in the histogram on the following page, and the highest performing OIML Recommendations in 2000 were as in the table below:

R 76	Nonautomatic weighing instruments	*Implemented in 38 countries*
R 35	Material measures of length for general use	*Implemented in 32 countries*
R 111	Weights of classes E_1, E_2, F_1, F_2, M_1, M_2, M_3	*Implemented in 30 countries*
R 50	Continuous totalizing automatic weighing instruments	*Implemented in 27 countries*
R 31	Diaphragm gas meters	*Implemented in 26 countries*
R 117	Measuring systems for liquids other than water	*Implemented in 26 countries*



Histogram showing the degree of implementation of OIML Recommendations in force in 1992, 1996 and 2000

6 Categories of measuring instruments covered by the OIML Certificate System

Thirty-one categories of measuring instruments are covered by the following OIML Recommendations:

R 31	R 85	R 106	R 117/118
R 50	R 88	R 107	R 122
R 51	R 93	R 110	R 123
R 58	R 97	R 112	R 126
R 60	R 98	R 113	R 127
R 61	R 102	R 114	R 128
R 65	R 104	R 115	R 129
R 76	R 105	R 116	

Total number of categories	1996	1997	1998	1999	2000
	16	21	25	28	31
		+ 31 %	+ 19 %	+ 12 %	+ 11 %

7 Cumulative number of registered OIML certificates (as at the end of 2000)

Category:

Category		
Nonautomatic weighing instruments (R 76)	331	≈ 45.0 %
Load cells (R 60/1991)	225	≈ 30.6 %
Automatic catchweighing instruments (R 51)	60	≈ 8.1 %
Automatic gravimetric filling instruments (R 61)	33	≈ 4.5 %
Fuel dispensers for motor vehicles (R's 117/118)	27	≈ 3.7 %
Load cells (R 60/2000)	22	≈ 3.0 %
Gas meters (R 31)	15	≈ 2.0 %
Automatic weighing instruments (R 107)	7	≈ 1.0 %
Continuous totalizing automatic weighing instruments (R 50)	7	≈ 1.0 %
Automatic level gauges (R 85)	4	≈ 0.5 %
Direct mass flow measurement systems (R 106)	3	≈ 0.4 %
Evidential breath analyzers (R 126)	1	≈ 0.1 %
Clinical electrical thermometers (R 115)	1	≈ 0.1 %
Cumulative total, as at the end of 2000	**736**	

Cumulative number of registered certificates

1996	1997	1998	1999	2000
226	318	452	582	736

+ 40 % + 42 % + 29 % + 26 %

8 Degree of acceptance of OIML certificates by OIML Members

An inquiry was carried out by the BIML in 2000. Forty-two countries sent responses and the results can be summarized as follows:

- More than 190 certificates were accepted and more than 260 were taken into consideration to facilitate the process of national type evaluation and approval;
- Certificates were accepted by 10 Member States and 3 Corresponding Members;
- Certificates were taken into consideration by 18 Member States and 4 Corresponding Members;
- 209 manufacturers and applicants of measuring instruments from 31 countries were granted OIML certificates.

9 Distribution of the OIML Bulletin and revenue from the sale of OIML Publications

	1997	1998	1999	2000
Average number of **Bulletins** distributed quarterly	1039	1039	1044	1100
		=	+ 0.5 %	+ 5.4 %
... of which **Bulletin** subscribers	172	170	163	156
		– 1.1 %	– 4.1 %	– 4.3 %
Sales of **Publications** (FRF)	195 668	160 930	187 272	214 010
		– 18 %	+ 16.4 %	+ 14.2 %

10 Connections to and development of the OIML Internet site (www.oiml.org)

- 1998: average 500 connections per month
- 1999: average 1 000 connections per month
- 2000: average 2 500 connections per month

The site is regularly updated and there is now a Members Area with information on OIML events, deadlines for replies, etc.

Most customers now place orders via the form on the web site and secure online payment methods are being investigated.

11 Activities in support of development

Main activities:

- OIML Development Council Meeting (11 October 2000, London) with 74 participants;
- Increased activity in the Development Council working groups, following their new terms of reference and work programs;
- Contacts with international organizations (such as ISO DEVCO, UNIDO, UN/ECE, IMEKO, WTO TBT Committee, etc.), regional metrology and legal metrology organizations and with the national legal metrology institutes of a number of developing countries;
- Participation in a joint UNIDO - PTB - OIML project involving least-developed countries in Africa;
- Improvement in the Development Council section of the OIML web site;
- Increased participation by developing countries in the work of OIML technical committees and subcommittees;
- Establishment of a list of OIML Experts in legal and scientific metrology;
- Establishment of a list of metrology training courses in Member States;

BIML, June 2001

Press Release

On February 21, 2001 the Netherlands Organisation for Applied Scientific Research TNO acquired full ownership of Holland Metrology N.V., the holding company of NMi B.V., the Netherlands Metrology Institute.

Up until now the Ministry of Economic Affairs had been the sole shareholder of Holland Metrology. Mr. Kees Gouwens, currently managing director of TNO Building and Construction Research Institute, will be appointed as director general of Holland Metrology N.V. and NMi B.V. per March 1, 2001. Dutch parliament approved the acquisition on 6 February.

Perfect complement of qualifications and ambitions

The respective activities and ambitions of the TNO institutes and NMi complement each other perfectly, and the merging of activities offers a high added value to both parties. This is especially true for the development and maintenance of measurement standards and in the consolidation and expansion of their joint market position. TNO is also aiming to further develop its certification activities in order to extend its strong position in the Dutch knowledge infrastructure. TNO offers NMi significant opportunities and a new impulse to expand the prominent position it holds both in the Netherlands and worldwide.

Gouwens

Mr. Kees Gouwens (58) studied Civil Engineering at the Technology University of Delft. Between 1965 and 1978 he worked at TNO IBBC and from 1978 to 1994 as director Public Works and Environment for the city of Tilburg. Since 1994 he has been managing director of the TNO Building and Construction Research Institute as well as Professor of Sustainable Building Technology at Eindhoven's University of Technology from 1995 to 1999.

TNO

TNO is a leading independent Dutch contract research organisation that provides a link within the innovation chain between fundamental research as a source of knowledge and practical application in the use of knowledge in a wide field of activities. Its expertise and research make a substantial contribution to the competitiveness of businesses and organisations, to the economy and to the quality of society as a whole. TNO was established by the Dutch government in 1932. In 1999 the consolidated turnover was 440 million euros. TNO employs over 5000 professionals, mainly in the Netherlands.

For more information:

TNO Corporate Communications
Tel: +31 15 2694975

NMi
Dr. Jan Basten Tel: +31 15 2691666

February 21, 2001

ANNOUNCEMENT

Second International Conference on Metrology - Trends and Applications in Calibration and Testing Laboratories

4–6 November, 2003

Jerusalem, Israel

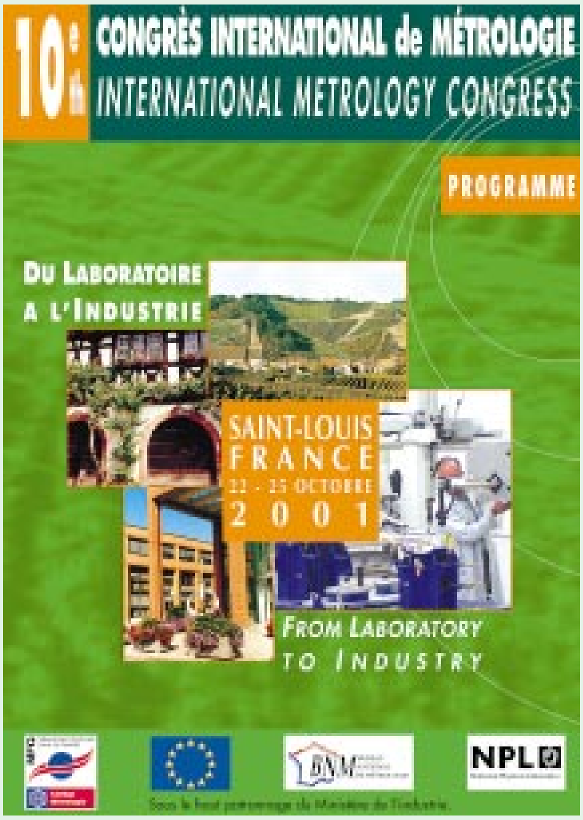
This event is being organized by:

- **The National Conference of Standard Laboratories - International (NCSL)**
- **Co-operation on International Traceability in Analytical Chemistry (CITAC) and**
- **The Israeli Metrological Society (IMS)**

Discussion topics and aims of the forum:

- **Metrology as a science and as an integral part of business in industry and trade**
- **Legal metrology**
- **Regional metrological organization**
- **Measurement methods and their validation**
- **Instruments and their qualification**
- **Measurement standards and reference materials**
- **Interlaboratory comparisons**
- **Proficiency testing**
- **Uncertainty in measurement and analysis**
- **Traceability**
- **Laboratory information management systems**
- **Accreditation of calibration and testing (analytical) laboratories**
- **Ethical problems in metrology and education**

For more information please contact:
Dr. Henry Horwitz – Conference Secretariat
ISAS-International Seminars
PO Box 34001 – Jerusalem 91340
Tel: +972-2-6520574 – Fax: +972-2-6520558
E-mail: congress@isas.com.il



The 10th International Metrology Congress, organized by the Collège Métrologie of the French Movement for Quality under the aegis of the Bureau National de Métrologie and with the scientific support of the National Physical Laboratory, will take place from 22 through 25 October 2001 in Saint-Louis (Alsace, France).

Le 10è Congrès International de Métrologie est organisé par le Collège Métrologie du Mouvement Français pour la Qualité, avec le concours du Bureau National de Métrologie et la participation scientifique du National Physical Laboratory, du 22 au 25 octobre 2001 à Saint-Louis en Alsace.

Further to the Call for Papers (see the October 2000 OIML Bulletin), the Organizing Committee received 237 proposals.

90 oral papers and 82 posters have been selected by the Scientific and Technical Committee and will be presented during Metrology 2001.

The speakers will come from 30 different countries: Algeria, Argentina, Belarus, Belgium, Brazil, China, Czech Republic, Denmark, France, Germany, Greece, Italy, South Korea, Mexico, the Netherlands, Poland, Portugal, Romania, Russia, Singapore, Slovakia, Spain, Sweden, Switzerland, Taiwan, Thailand, Tunisia, Ukraine, United Kingdom, USA.

This year, the Organizing Committee is expecting about 700 people to attend at Saint-Louis.

Below is the complete program of the Congress.

A la suite de l'appel à communications du Congrès, le Comité d'Organisation a reçu 237 propositions de conférences.

90 conférences orales et 82 conférences affichées ont été sélectionnées par le Comité Scientifique et Technique et seront présentées lors de la manifestation.

Les conférenciers proviennent de 30 pays différents: Algérie, Allemagne, Argentine, Biélorussie, Belgique, Brésil, Chine, Corée du Sud, Danemark, Espagne, États-Unis, France, Grèce, Italie, Mexique, Pays-Bas, Pologne, Portugal, République Tchèque, Roumanie, Royaume-Uni, Russie, Singapour, Slovaquie, Suède, Suisse, Taiwan, Thaïlande, Tunisie, Ukraine.

Le Comité d'Organisation du Congrès attend cette année près de 700 personnes à Saint-Louis.

Le programme de la manifestation est donné ci-dessous.

Tuesday (Mardi) 2001.10.23 Morning (Matin)	Wednesday (Mercredi) 2001.10.24 Morning (Matin)	Thursday (Jeudi) 2001.10.25 Morning (Matin)
Opening Plenary Session *(Séance Plénière d'Ouverture)*	***Oral Parallel Sessions*** *(Sessions Orales Parallèles)* • Mass/Force/Pressure (Masse/Force/Pression) • Dimensional (Dimensionnel) • Environment (Environnement) • Life Sciences (Sciences du Vivant) ***Poster Sessions*** *Sessions Affichées* • Quality/Accreditation (Qualité/Accréditation) • Optics (Optique) • Electricity (Electricité)	***Oral Parallel Sessions*** *(Sessions Orales Parallèles)* • Mass/Force/Pressure (Masse/Force/Pression) • Training (Formation) • Electricity (Électricité) ***European Programs in Metrology*** *Programmes Européens en Métrologie*

Tuesday (Mardi) 2001.10.23 Afternoon (Après-midi)	Wednesday (Mercredi) 2001.10.24 Afternoon (Après-midi)	Thursday (Jeudi) 2001.10.25 Afternoon (Après-midi)
Oral Parallel Sessions *Sessions Orales Parallèles* • Uncertainties (Incertitudes) • Quality/Accreditation (Qualité/Accréditation) • Electricity and Internet (Électricité et Internet) • Optics (Optique) ***Poster Sessions*** *Sessions Affichées* • Dimensional (Dimensionnel) • Chemical Metrology (Métrologie Chimique) • Temperature (Température)	***Oral Parallel Sessions*** *Sessions Orales Parallèles* • Chemical Metrology (Métrologie Chimique) • Temperature (Température) • Optics (Optique) • Quality/Accreditation (Qualité/Accréditation) ***Poster Sessions*** *Sessions Affichées* • Life Sciences (Sciences du Vivant) • Environment (Environnement) • Uncertainties (Incertitudes)	***Technical Visits*** *Visites Techniques*

Monday 22 is devoted to the registration of participants. In the afternoon there will be a special presentation organized by Euromet. In parallel with the papers there will be an exhibition of metrological equipment involving 50 stands.

La journée du lundi 22 est consacrée à l'enregistrements des arrivants. Dans l'après-midi une session spéciale est organisée par Euromet. Une exposition de matériel métrologique regroupant 50 stands se déroule en parallèle avec les conférences.

Information: Secrétariat Général Metrology 2001 - Collège Métrologie (Sandrine GAZAL)
Tel.: +33 (0)4 67 06 20 36 - Fax: +33 (0)4 67 06 20 35 - E-mail: sandrine.gazal@wanadoo.fr - Site: http://www.metrologie2001.com

The OIML is pleased to welcome the following new

CIML Member

Belarus:
Mr. Valery Nickolaevich Koreshkov

Corresponding Members

Comores, Islamic Federal Republic of
Uzbekistan

OIML Meetings

September 2001

24–27	36th CIML, Development Council & RLMO Meetings		Moscow

October 2001

9–10	TC 8/SC 5	Water meters (Date to be confirmed)	Brussels
TBA	TC 9/SC 2	Automatic weighing instruments (Date to be confirmed)	Teddington

Committee Drafts

received by the BIML, 2001.02.01 – 2001.04.30

Revision of D 6 and D 8: Measurement standards. Choice, recognition, use, conservation and documentation	E	2 CD	TC 4	Slovakia
Revision of R 101: Indicating and recording pressure gauges, vacuum gauges and pressure-vacuum gauges with elastic sensing elements (ordinary instruments)	E	1 CD	TC 10/SC 2	Russian Federation
Revision of R 109: Pressure gauges and vacuum gauges with elastic sensing elements (standard instruments)	E	1 CD	TC 10/SC 2	Russian Federation
Revision of R 75: R 75-1: Heat meters - general requirements R 75-2: Heat meters - pattern approval tests - and initial verification tests	E	3 CD	TC 11	Germany
FTIR spectrometer systems for measurement of air pollutants	E	1 CD	TC 16/SC 4	USA
Revision of R 51-1: Automatic catchweighing instruments Part 1: Metrological and technical requirements - Tests	E	1 CD	TC 9/SC 2	UK
Revision of R 51-2: Automatic catchweighing instruments Part 2: Test report format	E	1 CD	TC 9/SC 2	UK