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OIML BULLETIN

VOLUME XXXVIII • NUMBER 1 • JANUARY 1997

technique

conference: special feature

update

VANCOUVER, CANADA

10TH INTERNATIONAL CONFERENCE OF LEGAL METROLOGY (PAGES 23–41)

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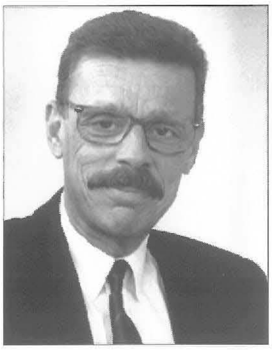
VOLUME XXXVIII • NUMÉRO 1 • JANVIER 1997

technique

spécial conférence

informations



Editorial

Deception – or grounds for hope?

Over the past eighteen months, the life of the OIML has been strongly marked by the prospect of a rapprochement and even possible merger with the other intergovernmental metrological organization, the *Bureau International des Poids et Mesures*, which operates under the umbrella of the *Convention du Mètre*.

The Tenth International Conference of Legal Metrology, which took place last November in Canada, gave our organization the opportunity to discuss in some depth the proposal of rapprochement and merger made by the French Government in June 1995, and to begin to evaluate the various aspects of this proposal.

These discussions were, inevitably, influenced and to a certain extent prejudiced by the conclusions which the *Comité International des Poids et Mesures* adopted during its meeting at the end of September 1996: increased cooperation between the OIML and the BIPM would be useful, but a complete merger would not offer any significant benefits.

Amalgamating two organizations is impossible if one of them is opposed to the idea. Consequently, our Conference primarily aimed to take positive steps towards increased cooperation on certain well identified subjects.

Nevertheless, a number of voices within OIML reclaimed that the door should, at least, not be definitively closed as far as possible future merger is concerned.

Our world is a fast-changing one and the field of metrology is no exception. The developments witnessed by national metrology structures, the reinforcement of regional cooperation, changes at international level in the field of accreditation and certification, and the need to help developing countries or countries in transition to establish their own national metrological structures to keep up with economic and technical progress – all these issues have an influence on cooperation between the OIML and the BIPM.

In five years, in ten years, who can claim that the benefits of a merger between the two organizations - or at least a high degree of integration - will not be clearly felt?

I am certain that the OIML will be ready to open up this file again and reply favorably to countries' needs. For it should always be borne in mind that international organizations do not work for themselves, nor merely to maintain their prerogatives. On the contrary, they exist to serve the interests of their members, and those of the international community as a whole. ■

G. J. Faber

G. J. Faber,
President of the Comité International de Métrologie Légale

GUIDE TO THE EXPRESSION OF UNCERTAINTY IN MEASUREMENT

Examples of uncertainty calculations

DR. G.M.S. DE SILVA, King Fahd University of Petroleum and Minerals, Saudi Arabia

Introduction

The Guide to the Expression of Uncertainty in Measurement, jointly developed by BIPM/IEC/IFCC/ISO/IUPAC/IUPAP and OIML and published on their behalf by ISO (revised edition 1995), is now widely used in all fields of metrology. However, in some specific cases one may sometimes face obstacles in implementing the very general provisions given in the Guide. These obstacles mainly relate to the complete identification of type B sources of uncertainties, the evaluation of degrees of freedom, etc.

It therefore seems appropriate to publish specific cases of implementation of the Guide. Two examples of uncertainty calculations have been developed by **Dr. G.M.S. de Silva** based on actual experiments; these are given below and it is the intent of the Editors of the OIML Bulletin to publish other examples based on typical and actual measurement situations.

Note: for the relevant definitions and formulae to be applied, please refer to the Guide.

Examples of uncertainty calculations

1 Example I: determination of the uncertainty of the value of a test mass

The value of a stainless steel mass of nominal value 1 kg is determined by carrying out double substitution weighings in a single pan balance, using a reference standard mass of known value and uncertainty.

1.1 Observations

The weighing results are as follows:

Weighing number	Mass (g)
1	1000.015
2	1000.012
3	1000.016
4	1000.014
5	1000.012
6	1000.015
7	1000.013
8	1000.011
9	1000.012
10	1000.010

Mean value, $\overline{q} = 1000.013$ g

Standard deviation, $s(q) = 0.00194$ g

$$s(\overline{q}) = \frac{0.00194}{\sqrt{10}} = 0.00061 \text{ g}$$

Type A standard uncertainty = 0.00061 g.

The other contributory uncertainty is that of the reference mass standard used, which is quoted as 0.001 g at 95 % confidence level with 14 degrees of freedom.

1.2 Estimation of combined standard uncertainty $U_c(y)$

The estimation of the combined standard uncertainty of the mean value is given below:

Source of uncertainty	Type of evaluation	Std. uncertainty	Degrees of freedom
Repeatability of observations	A	0.00061 g	9
Reference Mass Standard	B	0.0005 g	14

Combined standard uncertainty,

$U_c(y) = (0.00061^2 + 0.0005^2)^{1/2}$

$= 0.00079$ g

$= 0.0008$ g (rounded off to one significant figure).

1.3 Effective degrees of freedom

$$\upsilon_{eff} = \frac{0.00079^4}{\frac{0.00061^4}{9} + \frac{0.0005^4}{14}}$$

= 19.66 (round down to 19 degrees of freedom).

1.4 Expanded uncertainty

To determine the expanded uncertainty, it is necessary to choose a coverage factor k. The coverage factor is taken from the t–tables, corresponding to 19 degrees of freedom and 95 % confidence level, $t_{95,\,19} = 2.09$.

Expanded uncertainty, $U = 2.09 \times 0.000\,8$

$= 0.002$ g

1.5 Reporting of the result

The result may be reported as:

- Value of the test mass = 1000.013 g

  Expanded uncertainty = 0.002 g with k = 2.09 at 95 % confidence level and 19 degrees of freedom,

or:

- Value of the test mass = 1000.013 ± 0.002 g with k = 2.09 at 95 % confidence level and 19 degrees of freedom.

2 Example II: calibration of a digital thermometer

A digital thermometer having a resolution of 0.01 °C and a sensor of Type K thermocouple is calibrated in comparison with a standard reference platinum resistance thermometer. The comparison is carried out in a stirred oil bath in the temperature range 0 °C to 300 °C. The details of the standards used and the experiment are given below:

2.1 Standards used

2.1.1 Standard reference PRT

Calibration range: 0 to 630 °C

$a = -2.0307883 \times 10^{-4}$

$b = -2.8967225 \times 10^{-5}$

Uncertainty: ± 0.0025 °C at 95 % confidence level with 8 degrees of freedom

2.1.2 Oil bath

Uniformity: ± 0.006 °C

Stability: ± 0.006 °C

2.1.3 Resistance bridge

Type: DCC Bridge

Uncertainty: 2 ppm of reading + 1 step of digit 8

2.1.4 Resistance standard (R_s)

Value at 25 °C: 9.9998 Ω

Uncertainty: ± 2 ppm = $9.9998 \times 2 \times 10^{-6} = \pm 2 \times 10^{-5}$ Ω at 95 % with 9 degrees of freedom.

2.2 Summary of experimental results

See Table 1 for the summary of the experimental results.

2.3 Estimation of combined standard uncertainty of PRT temperature

The uncertainty of the temperature measured by the PRT consists of a number of components arising from different sources. An analysis of the prime sources is indicated in the Ishikawa diagram in Fig. 1. Each of these components is evaluated in sections 2.3.1 to 2.3.5.

Table 1 Experimental results of the comparison of the standard PRT and a digital thermometer

	PRT temperature			Digital thermometer temperature		
Set point °C	Value °C	Mean °C	Std. dev^{n} °C	Value °C	Mean °C	Std. dev^{n} °C
0 (Ice point)	– 0.003			– 0.08		
	– 0.002			– 0.08		
	– 0.003	– 0.003	0.000577	– 0.08	– 0.08	0
25	25.172			25.09		
	25.161			25.1		
	25.161	25.165	0.006351	25.13	25.107	0.020817
50	51.212			51.34		
	51.221			51.37		
	51.261	51.231	0.026083	51.37	51.36	0.017321
100	103.541			103.45		
	103.497			103.43		
	103.518	103.519	0.022008	103.43	103.437	0.011547
150	155.581			155.36		
	155.587			155.38		
	155.569	155.579	0.009165	155.36	155.367	0.011547
200	207.461			207.37		
	207.495			207.37		
	207.528	207.495	0.033501	207.42	207.39	0.026458
300	309.717			311.39		
	309.726			311.37		
	309.734	309.726	0.008505	311.28	311.347	0.058595
Pooled standard deviation = 0.0188				Pooled standard deviation = 0.0271		

2.3.1 *PRT*

The uncertainty of the PRT is mainly due to its calibration uncertainty, which is quoted as ± 0.0025 °C at 95 % confidence level, with 8 degrees of freedom.

$$u_{PRT} = \frac{0.0025}{2.31} = \pm 0.0011 \text{ °C}$$

Note: 2.31 is the t-value for 8 degrees of freedom at 95 % confidence level and $\nu_{PRT} = 8$.

2.3.2 *Resistance measurement*

The uncertainty of the measurement of resistance using a bridge arises from two components:

- the uncertainty of the bridge itself and
- the uncertainty of the standard resistor used for the comparison.

The uncertainty of the standard resistor itself consists of two components:

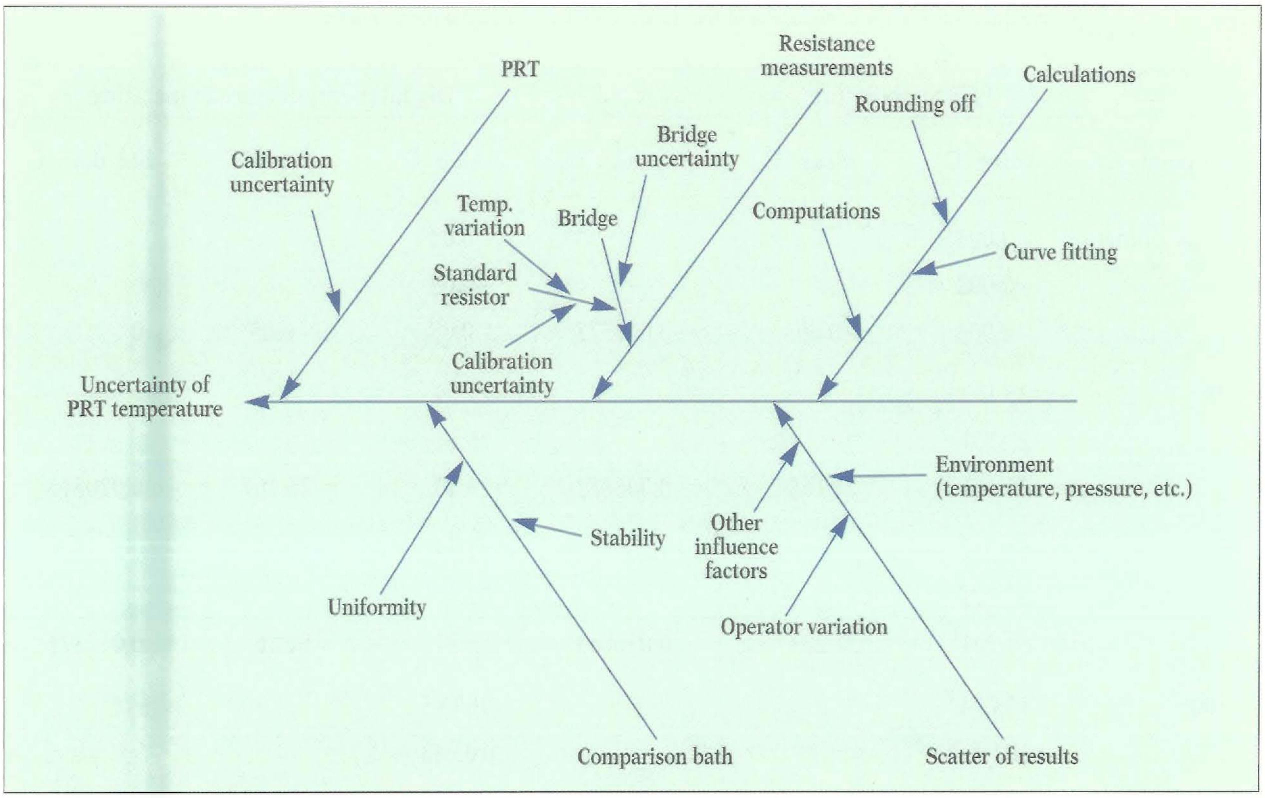


Fig. 1 Ishikawa diagram for uncertainty components of PRT temperature

i) Calibration uncertainty of the resistor, and
ii) Uncertainty arising from the temperature variation of the resistor. Refer to Fig. 1.

Effects (i) and (ii) are quantified as shown below:

Effect (i)

Calibration uncertainty of resistor $= 2 \times 10^{-6} \times 9.9998\ \Omega$

$= 19.9998 \times 10^{-6}\ \Omega$

$$u_{SRC} = \frac{19.9996 \times 10^{-6}}{2.26} = 8.8494 \times 10^{-6}\ \Omega$$

$\upsilon_{SRC} = 9.$

Effect (ii)

If the standard resistor is subject to a maximum variation of ± 1 °C (variation in the THV Lab):

$dt = 1\ °C$

$R_t = R_0\,[1 + \alpha\,(t - t_0) + \beta\,(t - t_0)^2]$

$dR_t = R_0\,(\alpha\,.\,dt + \beta\,.\,2t\,.(t - t_o)\,dt)$

$R_0 = 9.9998\ \Omega$

$\alpha = 9.9 \times 10^{-6}\ \Omega/°C$

$\beta = -5.8 \times 10^{-7}\ \Omega/°C$

$t = 23\ °C$ and $dt = 1\ °C$

$dR_t = 9.9998\,[9.9 \times 10^{-6} + (-5.8 \times 10^{-7})\,.\,2 \times (23 - 25) \times 1]$

$dR_t = 122.20 \times 10^{-6}\ \Omega$

Since the temperature variation in the laboratory could be taken to be approximately sinusoidal in time, with a finite period the standard uncertainty is obtained as:

$$u_{SRt} = \frac{122.20 \times 10^{-6}}{\sqrt{2}} = 86.41 \times 10^{-6}\ \Omega$$

The combined uncertainty due to the two effects is given by:

$u_{SR}^2 = (8.9685 \times 10^{-6})^2 + (86.41 \times 10^{-6})^2$

$u_{SR} = 86.87 \times 10^{-6}\ \Omega$

Uncertainty arising from the resistance bridge

In order to estimate the uncertainty arising from the inaccuracies of the bridge, we have to consider the combined effect of the uncertainty of the standard resistor and the bridge uncertainty.

The measured resistance of the PRT R_x is related to the value of the standard resistor R_s and the bridge reading ρ, by the following equation:

$$R_x = R_s \cdot \rho$$

Since R_s and ρ are quite independent, we can write the uncertainty propagation equation:

$$u^2_{Rx} = \left[\frac{\partial R_x}{\partial R_s} u_s \right]^2 + \left[\frac{\partial R_x}{\partial \rho} u_\rho \right]^2$$

Substituting in the above equation:

$$u_x^2 = (5.5654 \times 86.87 \times 10^{-6})^2 + (9.9998 \times 0.6416 \times 10^{-6})^2$$

$$= (483.47)^2 \times 10^{-12} + (6.42)^2 \times 10^{-12}$$

$u_x = 483.51 \times 10^{-6}\ \Omega$.

The effective degrees of freedom of the uncertainty of the standard resistor is:

$$\nu_{\text{eff, Rs}} = \frac{(86.87 \times 10^{-6})^4}{\frac{(86.41 \times 10^{-6})^4}{8} + \frac{(8.9685 \times 10^{-6})^4}{9}}$$

$\nu_{\text{eff, Rs}} = 8.17$

Round down to 8 degrees of freedom. The effective degrees of freedom of the uncertainty of the resistance measurement is obtained from:

$$\nu_{\text{eff, R}} = \frac{(483.51 \times 10^{-6})^4}{\frac{(483.47 \times 10^{-6})^4}{8} + \frac{(6.42 \times 10^{-6})^4}{8}}$$

$\nu_{\text{eff, R}} = 8.$

2.3.3 *Uncertainty due to bath temperature variations*

The uncertainty arising from the temperature variations of the bath consists of:

Bath stability ± 0.006 °C
Bath uniformity ± 0.006 °C

Since both of the above figures are given as upper and lower bounds, we may assume a rectangular distribution for each of them. Thus:

$$U_{bs} = \frac{0.006}{\sqrt{3}} = 0.003$$

$$U_{bu} = \frac{0.006}{\sqrt{3}} = 0.003$$

$$U_b = \sqrt{2 \times 0.003} = 0.004\ °C$$

The degrees of freedom are evaluated from the equation in the Guide:

$$\nu_i = \frac{u^2(\bar{q})}{2\sigma^2[u(\bar{q})]} = \frac{1}{2} \left[\frac{\Delta u(\bar{q})}{u(\bar{q})} \right]^{-2}$$

where:

$u(\bar{q})$ = standard uncertainty of $(\bar{q})$

$\sigma[u(\bar{q})]$, $\Delta u(\bar{q})$ = standard deviation of $u(\bar{q})$

$\frac{\Delta u(\bar{q})}{u(\bar{q})}$ = relative uncertainty of $u(\bar{q})$

The uncertainty on account of stability and uniformity of a bath may be relied upon to about 50 %.

$\nu = (1/2)\,[0.5]^{-2} = 2$ for each component;

$$\nu_{\text{eff, b}} = \frac{(0.004)^4}{2 \times \left[\frac{0.0034}{2} \right]} = 3.16 \text{ (round down to 3).}$$

2.3.4 *Scatter of results*

From the information given in Table 2 a pooled standard deviation is calculated from:

$$S_{pd} = \sqrt{\frac{S_1^2 + S_2^2 + \ldots + S_7^2}{7}} = 0.0188\ °C$$

The s.d. of the mean is:

$$\text{SDOM} = \frac{0.0188}{\sqrt{3}} = 0.0109\ °C$$

$u_R = 0.0109$ °C with 20 degrees of freedom $[(3 \times 7) - 1]$.

2.3.5 *Computational uncertainties*

The computational uncertainties consist of:

(i) Uncertainties arising from the truncation of values in computational software or calculators used;

(ii) Uncertainties of estimations based on curve fits.

Since most calculators and present day software have at least 8-digit numerical values, effect (i) could be neglected in computations where only about 4 to 5 decimal places are required, as in the present case. However, as reported in [4], errors due to both software and hardware of even the most sophisticated computers are not uncommon.

Uncertainties arising from values calculated from curve fitting equations should be estimated. In the present case ITS-90 temperatures of the PRT are estimated from a curve fitting equation. However, the uncertainty of this effect is already incorporated in the uncertainty of the PRT.

A summary of the uncertainty components is given in Table 2.

The combined standard uncertainty is:

$[0.011^2 + 0.006^2 + 0.001^2 + 0.004^2]^{1/2} = 0.013$ °C

This is stated as 0.01 °C to one significant figure.

2.4 Effective degrees of freedom

The effective degrees of freedom is obtained from:

$$\upsilon_{\mathrm{eff,T}} = \frac{0.013^4}{\dfrac{0.011^4}{20} + \dfrac{0.006^4}{8} + \dfrac{0.001^4}{8} + \dfrac{0.004^4}{3}} = 29.15$$

Round down to the nearest integer to give:

$\upsilon_{\mathrm{eff,T}} = 29$ degrees of freedom.

Table 2 Summary of uncertainty components

Section number in text	Source of uncertainty	Type of evaluation	Standard uncertainty (°C)	Degrees of freedom
2.3.1	**Platinum resistance thermometer**			
	Calibration uncertainty	B	0.001	8
2.3.2	**Resistance measurement**			
	Standard resistor calibration uncertainty	B	8.9685×10^{-6}	9
	Temperature variation of standard resistor	B	0.001	8
	Standard resistor, combined	B	0.001	8
	Bridge inaccuracy	B	3.05×10^{-5}	8
	Bridge and standard resistor, combined	B	0.006	8
2.3.3	**Temperature bath**			
	Uniformity	B	0.003	2
	Stability	B	0.003	2
	Uniformity and stability combined	B	0.004	3
2.3.4	**Scatter of results**	A	0.011	20

2.5 Expanded uncertainty

From the t-tables, t = 2.045 for 29 degrees of freedom at 95 % confidence level.

$$k = 2.05$$

and $$\mathbf{U} = 2.05 \times 0.013 = 0.026$$

Rounding off to one significant figure, **U** = ± 0.03 °C.

2.6 Reporting of results

The above uncertainty is calculated for the maximum experimental temperature of 300 °C. This figure may be treated as the limit of uncertainty for the lower temperatures as well, since the major component of the uncertainty is from the scatter of results (see Table 2) and is similar for the lower temperatures as well (except the ice point).

The uncertainty result may be reported as "the expanded uncertainty of the temperature measured by the reference standard platinum resistance thermometer evaluated as a combination of Type A and Type B uncertainties is ± 0.03 °C with k = 2.05 at 95 % confidence level with 29 degrees of freedom".

3 Acknowledgments

The support received from the Research Institute of the King Fahd University of Petroleum & Minerals, Dhahran, Kingdom of Saudi Arabia is gratefully acknowledged. ■

4 References

[1] Campion, P.J.; Burns, J.E. & Williams, A.: *A Code of Practice for the Detailed Statement of Accuracy*, National Physical Laboratory, UK, 1973.

[2] *Guide to the Expression of Uncertainty in Measurement*, corrected and reprinted edition, 1995.

[3] *International Vocabulary of Basic and General Terms in Metrology*, second edition, 1993.

[4] Grajera, J & Norans, I: *Unexpected Coprocessor Floating Point Errors*, NCSL Newsletter, V 36, No 3, July 1996, National Conference of Standards Laboratories, USA.

Errata - October 1996 Bulletin (Volume XXXVII Number 4)

The Editors of the OIML Bulletin wish to rectify two printing errors which appeared in the article by R. Husain and Dr. G. M. S. de Silva entitled *"Using networks to study and control the maintenance and surveillance of standards"*:

Page 15 - Fig. 1 (a): Node 5 is connected to standards 1, 2, 3 and 4

Page 19 - Right hand column, third line, u_{d1} should be u_{D1}

WEIGHTS

PRACTICAL TEST PROCEDURES
FOR CLASSES E_1 TO M_3 WEIGHTS
2 - 4 OCTOBER 1996 - BORÅS, SWEDEN

Statistical process measurement assurance used to ensure adequate confidence in the measurement process

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Abstract

Calibration laboratories are under increased pressure to reduce turn-around time for both new weights and also for weights sent in for re-calibration. As a result, the calibration laboratory must stream-line the measurement process by reducing the number of redundant measurements. Doing this will increase the probability that the total measurement uncertainty will not have a level of confidence close to 95 %.

Introduction

The previously accepted NIST (*National Institute for Standards and Technology*) method for calculating the uncertainty of the measurement process involved the linear addition of the uncertainty of the standard plus 3 times the pooled long term standard deviation of the process. New guidelines for calculating measurement uncertainty set forth in NIST Technical Note 1297 are based on the ISO *Guide to the Expression of Uncertainty in Measurement*.

The new method for calculating measurement uncertainty involves identifying all components of the total uncertainty and separating the individual components into two groups labeled Type A and Type B uncertainties. Type A are those components which are evaluated by statistical methods, and Type B are those components which are evaluated by other means. The Type A and B uncertainties are then combined by the root sum square method and multiplied by a coverage factor k that defines an interval having a level of confidence close to 95 %.

In mass measurement uncertainty, the major component of the Type A uncertainty is the sample standard deviation (s). To ensure that the number assigned to the type A uncertainty adequately represents the process, it is necessary to make numerous repeated measurements. As the number of measurements increases, the degree of freedom in "s" increases. When it is not feasible to make large numbers of repeated measurements, the sample standard deviation can be determined based on the history of the measurement process.

Statistical process measurement assurance integrated into the process is used to assure the level of confidence in the measurement and monitor the condition of standards and mass comparators. This involves the introduction of a second calibrated standard (known as a check standard) into the measurement process. The resultant check standard measurements are then analyzed using control charts and statistical methods.

Statistical process measurement assurance

Check standard control chart

Control charts of check standard values are dependent both on the weighing design and on the standards, check standards and balance used. For each check standard measurement these parameters must remain constant. The only variables should be the time and day of the measurement, laboratory environmental conditions and additional weights in the calibration process. The process that will be evaluated involves the check standard measurements made using a 3-1 weighing design and an electronic mass comparator.

The 3-1 weighing design

The 3-1 weighing design uses 3 weights of equal nominal value. The measurements are performed in the order shown in Table 1.

Table 1 Order of measurements in the 3-1 weighing design

A–B–A substitution	Measurement number	Weights on pan	Observation
1	1	S	01
	2	X	02
	3	S	03
2	1	S	04
	2	Sc	05
	3	S	06
3	1	X	07
	2	Sc	08
	3	X	09

where:

S = Calibration standard
Sc = Check standard
X = Weight being calibrated

Calculations

For each A–B–A substitution, the measured differences a_1, a_2 and a_3 are calculated using the following formulae:

$$a_1 = [\,(01 + 03) / 2\,] - 02$$
$$a_2 = [\,(04 + 06) / 2\,] - 05$$
$$a_3 = [\,(07 + 09) / 2\,] - 08$$

The formula for calculating the *"within-process"* standard deviation is as follows:

$$Sw = 0.577\,(\,a_1 - a_2 + a_3\,)$$

Note: This standard deviation has one degree of freedom.

Compute the least-squares measured difference Dsc of Sc from S.

$$Dsc = (\,-a_1 - 2a_2 - a_3\,) / 3$$

Compute the mass of Sc, Msc

$$Msc = \frac{Ms\,(\,1 - Pa/Ps\,) + Dsc}{(\,1 - Pa/Psc\,)}$$

where:

Ms = Mass in a vacuum of the calibration standard
Pa = Density of air at the time of calibration
Ps = Density of the calibration standard
Psc = Density of the check standard

Establishing a control chart for checking standard values

We have established a process which involves repeated measurements of a check standard for each nominal value of weights that are calibrated in the laboratory. A control chart is then established for each check standard, calibration standard and balance combination.

The initial control chart is drawn up using at least 30 individual measurements, which should be performed by different technicians and at different times during the normal working week. This is necessary so that the chart accurately reflects the measuring process. A rectangular coordinate system (x- and y-axis) is used to plot the measurements. The x-axis is marked off as the number of measurements. A mean value for the initial measurements is calculated and plotted on the chart. The next step is to establish upper and lower control limits on the chart.

Calculate the standard deviation of the initial control chart measurements. Upper and lower control limits are established equal to the mean value ± 2 times and ± 3 times the sample standard deviation (s). The control limits are drawn parallel to the mean intersecting the y-axis. The y-axis is labeled with the mean and control limit values.

Now that the initial chart has been established, additional measurements are plotted. Each new data point should fall within the control limits. Approximately 95 % of the data points should fall within the ± 2 s limits and 99 % should fall within the ± 3 s limits. Data points that fall outside the 3 sigma limits are considered "outliers": additional points will need to be plotted to establish whether the outliers are random or whether they are an indication of a problem with the measurement process. If the outliers are random and fall relatively close to the control limits, the values should be included when the mean and standard deviation are recalculated. If the outliers are well outside the limits and/or repeating, the measurement process should be investigated to determine the cause.

Analysis and testing of additional data

Visual analysis

As additional data points are generated and plotted, a visual analysis of the control chart will give a good indication of process stability. The points should be randomly distributed around the mean and should lie within the upper and lower control limits (see Fig. 1).

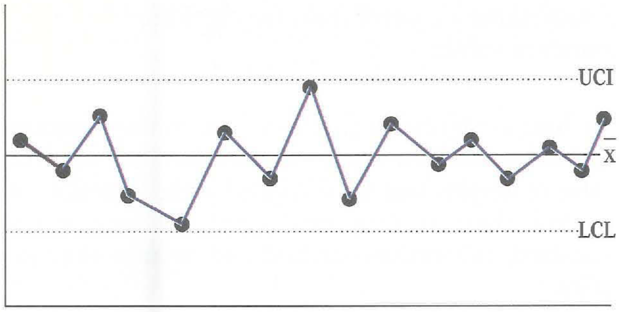


Fig. 1 Process in statistical control

Any apparent trends, systematic biases and increases in variation should be investigated before adding additional data points (see Figs. 2–5).

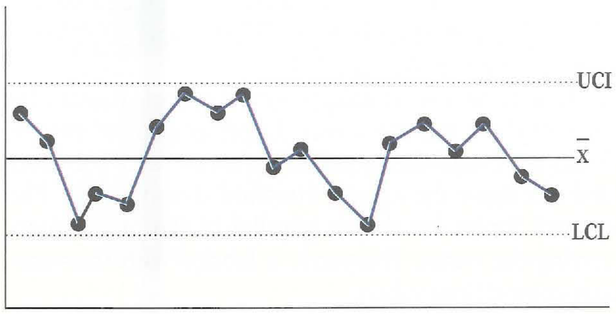


Fig. 2 Cyclic variations

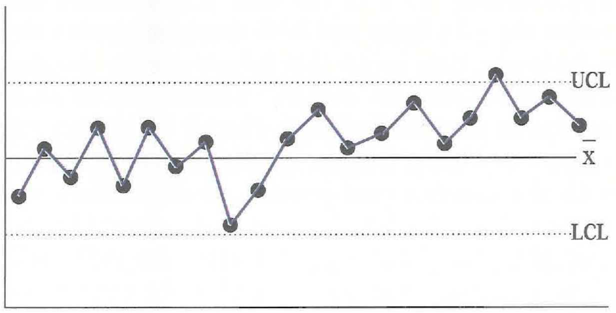


Fig. 3 Shift in the average

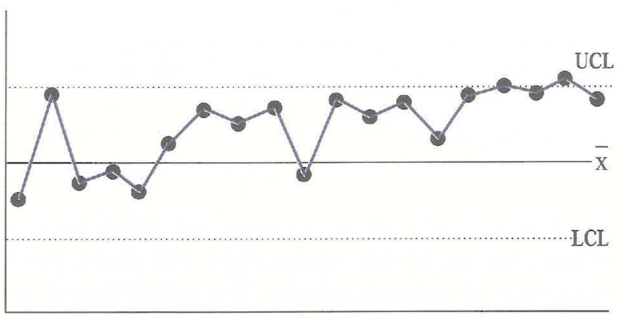


Fig. 4 Trend

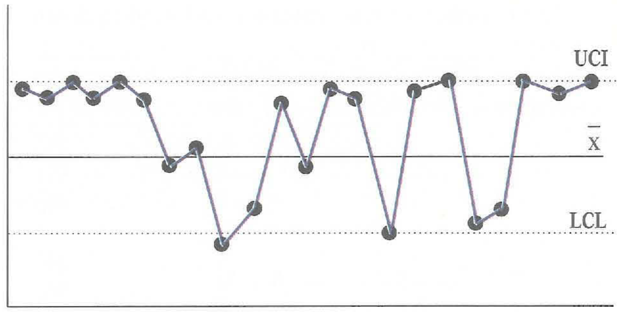


Fig. 5 High proportion of observations near the control limits

T-test for comparison of mean values

The mean value of additional groups of 10 – 15 check standard measurements is compared to the existing mean value using the statistical t-test. The t-test is used to determine if the mean value of the new measurements can be combined with the existing control chart mean.

$$t = \mathrm{ABS}\,[\,(m_o - m_n) / (s_o^2 / j + s_n^2 / k)^{1/2}\,]$$

where :

m_o = mean of the old measurements
m_n = mean of the new measurements
s_o = standard deviation of the old measurements
s_n = standard deviation of the new measurements
j = number of old measurements
k = number of new measurements

The total degrees of freedom for the denominator is calculated using the formula $(j + k - 2)$.

From the table of Student's t critical points, the maximum t value for the corresponding confidence level and degrees of freedom can be obtained. If the calculated value is less than or equal to the value obtained from the table, the test is passed and the means can be pooled.

Formula for pooling mean values:

$$m_p = (j\,m_o + k\,m_n) / (j + k)$$

where:

m_p = pooled mean value

F-test for comparison of standard deviations

The statistical F-test is used to compare the standard deviation of the new measurements with the standard deviation of the old measurements.

$$F = (s_n / s_o)$$

where:

s_n = new standard deviation
s_o = old standard deviation

The calculated F statistic is then compared to a percentiles of the F distribution table value listed for the associated degrees of freedom in the numerator and denominator. If the calculated F statistic is less than the table value, the standard deviations can be pooled. If the value is greater, further analysis is needed to determine whether the change in precision is significant enough to warrant further action.

Formula for pooling standard deviations:

$$s_p = [\,(v_n s_o^{\,2} + v_o s_o^{\,2}) / (v_n + v_o)\,]^{1/2}$$

where:

s_p = pooled standard deviation
v_n = degrees of freedom for the new standard deviation
v_o = degrees of freedom for the old standard deviation

Note: Degrees of freedom = no. of measurements – 1.

Trend analysis

It is possible for a significant change in the mean value to occur over time even though individual t-tests of new groups within the time period have been passed. It is therefore necessary to t-test each new group of measurements against the group of measurements used to establish the control chart, and record the results. When the test value for the t-statistic approaches the table value, the standard and check standard calibration should be checked.

Testing and combining *"within-process"* standard deviations

For each nominal weight size tested, a series of *"within-process"* standard deviations (Sw) are pooled and recorded. Each new Sw is then tested against the pooled value using the F-test to verify that the weighing process at the time of calibration has not significantly changed. If the test is passed, the new Sw is combined with the pooled value. The pooled value is then used as a component in the type A uncertainty calculation.

Automated process measurement assurance

In order to maintain an effective process measurement assurance system at Troemner, the storage, transfer and control charting of check standard values is accomplished using a custom-developed, menu-driven computer software package.

The following is an example of check standard values collected and control charted over an eight day period using Troemner's custom process measurement assurance control chart software (see Figs. 6–8 and Tables 2–4).

Table 2 Listing of 30 initial 10 g check standard measurements used to establish the base line mean and control limits for the chart in Fig. 6

Test n°	Weight	Test date
1	10.0001280	21/08/96
2	10.0001280	21/08/96
3	10.0001240	21/08/96
4	10.0001280	26/08/96
5	10.0001270	28/08/96
6	10.0001150	29/08/96
7	10.0001140	29/08/96
8	10.0001100	29/08/96
9	10.0001250	29/08/96
10	10.0001210	29/08/96
11	10.0001260	03/09/96
12	10.0001270	03/09/96
13	10.0001150	03/09/96
14	10.0001150	03/09/96
15	10.0001100	03/09/96
16	10.0001150	03/09/96
17	10.0001200	03/09/96
18	10.0001160	03/09/96
19	10.0001170	03/09/96
20	10.0001170	03/09/96
21	10.0001100	03/09/96
22	10.0001180	03/09/96
23	10.0001210	04/09/96
24	10.0001220	04/09/96
25	10.0001160	04/09/96
26	10.0001220	04/09/96
27	10.0001160	04/09/96
28	10.0001220	04/09/96
29	10.0001150	04/09/96
30	10.0001310	04/09/96

Table 3 1st set of 10 successive check standard measurements. Each was checked and found to be within the 2 sigma upper and lower control limits. Their mean and SD were checked against the mean and SD of the initial 30 measurements using t- and F-tests (see results below). Both groups are combined using polling methods described earlier.

Weight tested:	10.000000 g
Pooled deviation:	0.0000060
Pooled mean:	10.0001197
Number pooled:	30
t-test value:	2.045 Pass
Calculated value:	0.353
F-test value:	2.22 Pass
Calculated value:	0.67284

Test n°	Weight	Test date	2 (sigma) Pass/Fail
2	10.0001130	04/09/96	PASS
3	10.0001160	04/09/96	PASS
4	10.0001280	05/09/96	PASS
5	10.0001170	05/09/96	PASS
6	10.0001190	05/09/96	PASS
7	10.0001120	05/09/96	PASS
8	10.0001180	05/09/96	PASS
9	10.0001220	05/09/96	PASS
10	10.0001210	05/09/96	PASS
11	10.0001240	05/09/96	PASS

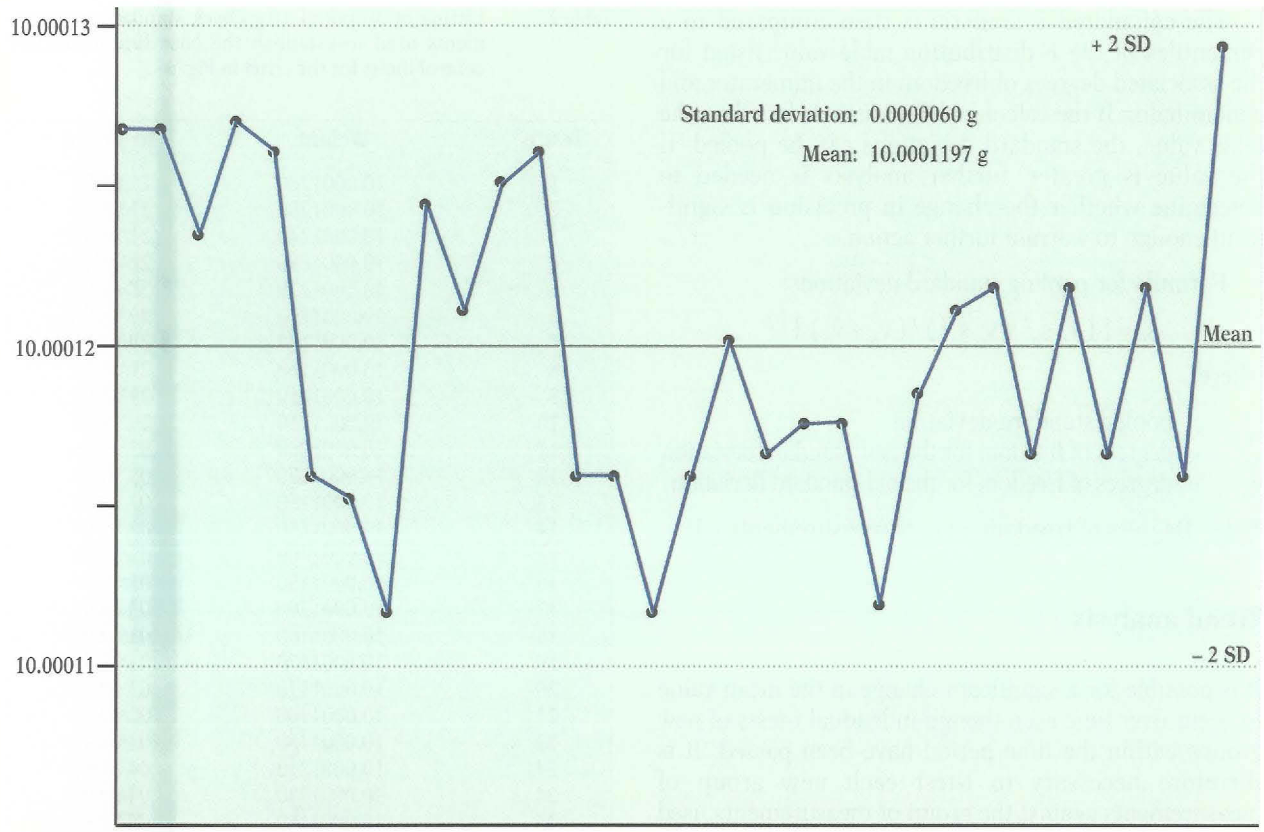


Fig. 6 Plot of 30 initial check standard measurements

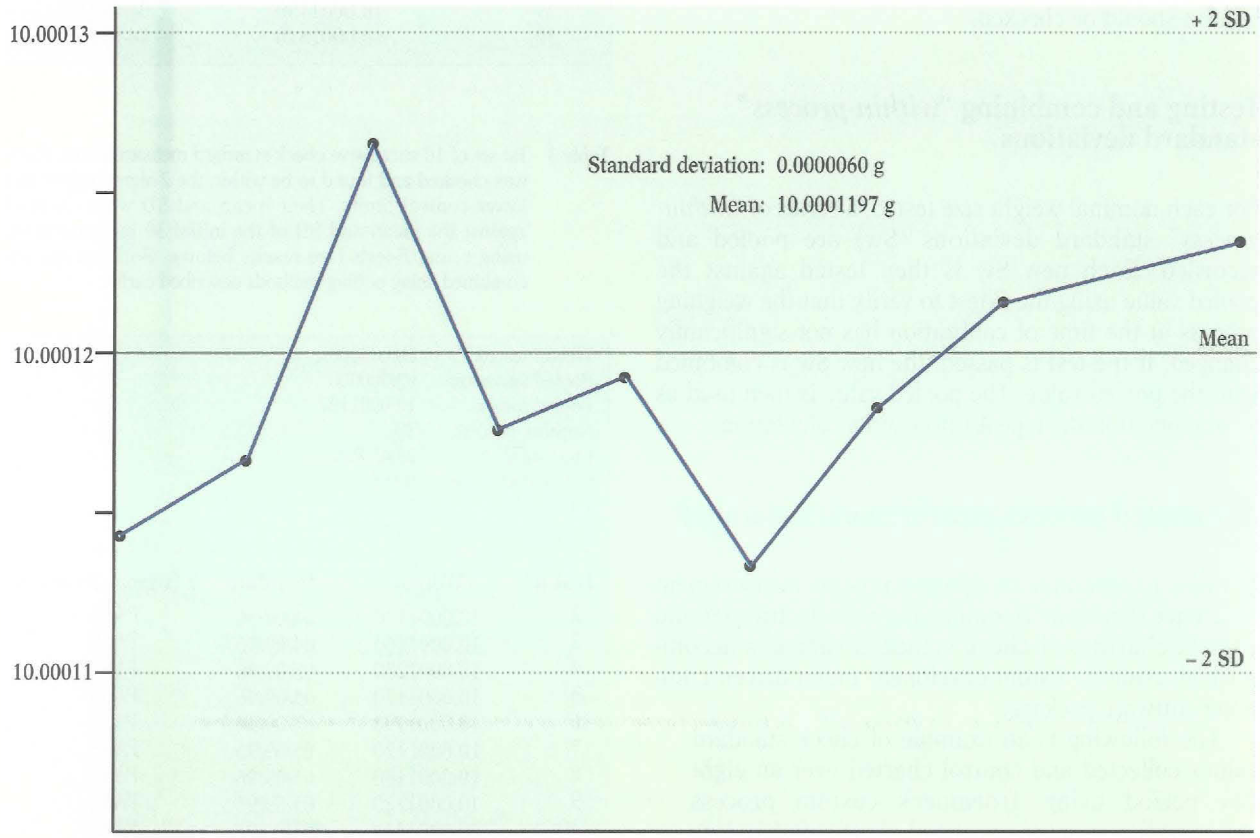


Fig. 7 Plot of the first set of 10 successive check standard measurements listed in Table 3

To check for trends, any group of successive measurements can be tested against the initial 30 measurements. Periodically, the check standards should be changed to check for simultaneous drift of the initial standard and check standard combination.

Summary

A process measurement assurance program is most effective when it is integrated into the calibration process. At Troemner, this has been accomplished using custom developed calibration and control chart software. Check standard measurements and *"within-process"* standard deviations along with other associated process information is stored in selected data bases. Using a menu-driven control chart program, the stored information can be accessed and charted. ■

References

[1] Henry V. Opperman, 03/19/1984, The Use of Control Charts in State Laboratories

[2] L. F. Nanni and J. Mandel, March 1986, NBS Special Publication 700-2, Industrial Meas. Series

[3] Taylor, J. K. and Opperman, H. V., NIST [NBS] Handbk 145, Handbook for the Quality Assurance of Metrological Measurements, November 1986.

Table 4 Listing of the 2nd set of 10 successive check standard measurements. The 2nd set of 10 measurements is tested against the pooled values for the 40 previous measurements.

Weight tested:	10.000000 g
Pooled deviation:	0.0000057
Pooled mean:	10.0001195
Number pooled:	40
t-test value:	2.042 Pass
Calculated value:	0.574
F-test value:	2.21 Pass
Calculated value:	0.78793

Test n°	Weight	Test date	2 (sigma) Pass/Fail
2	10.0001120	05/09/96	PASS
3	10.0001270	05/09/96	PASS
4	10.0001220	05/09/96	PASS
5	10.0001220	05/09/96	PASS
6	10.0001250	05/09/96	PASS
7	10.0001250	05/09/96	PASS
8	10.0001190	06/09/96	PASS
11	10.0001180	06/09/96	PASS
12	10.0001130	06/09/96	PASS
14	10.0001230	06/09/96	PASS

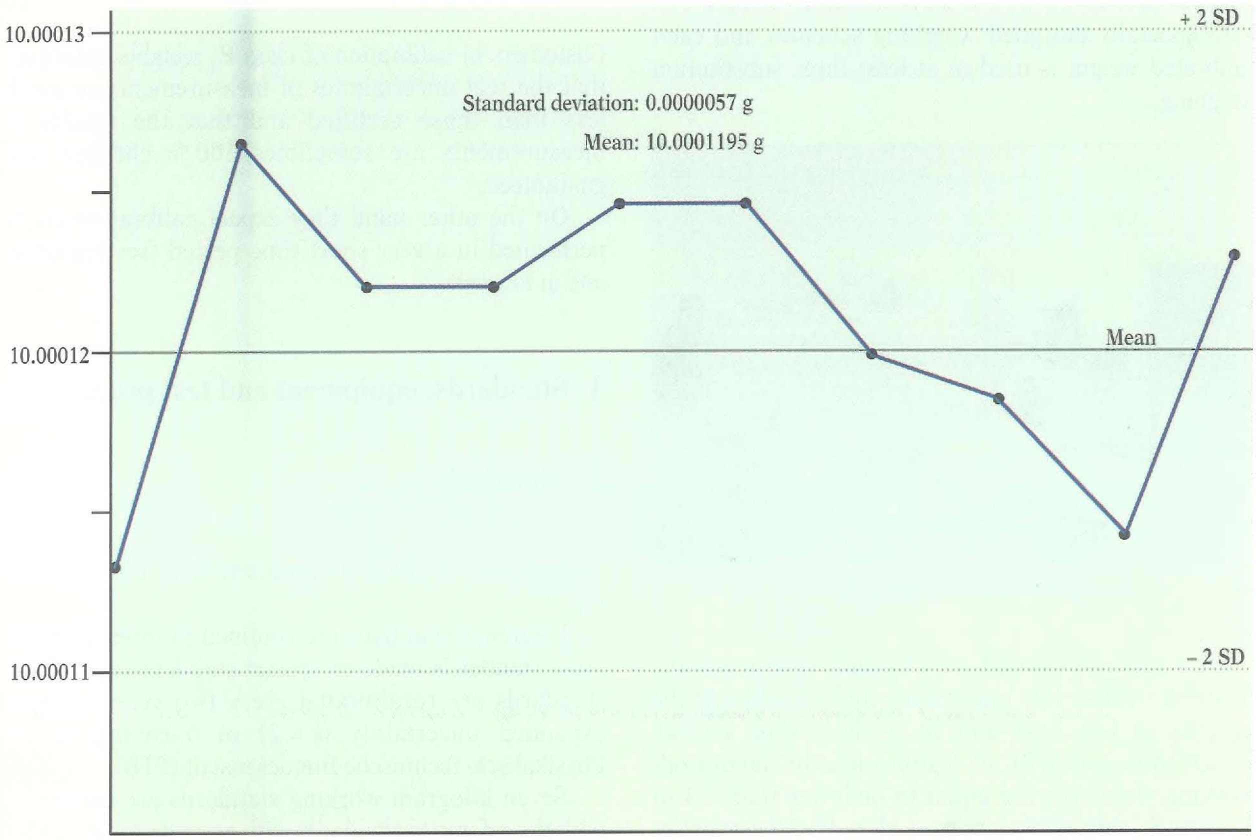


Fig. 8 Plot of the second set of 10 successive check standard measurements

CALIBRATION OF WEIGHTS

PRACTICAL TEST PROCEDURES
FOR CLASSES E_1 TO M_3 WEIGHTS
2 - 4 OCTOBER 1996 - BORÅS, SWEDEN

Test procedures for class E_1 weights at the State Verification Office, Brandenburg, Germany

GÜNTER MISSUWEIT, Landesamt für Meß- und Eichwesen, Brandenburg, Germany

1 Introduction

The calibration laboratory for class E_1 weights (Fig. 1) was established at the Brandenburg State Office of Weights and Measures in 1991, due to an increasing need for standards at the 16 State Verification Offices in Germany and for calibration of new manufactured weights. In addition, customers increasingly request that new manufactured weights be tested.

Three kilogram mass standards with an expanded uncertainty ($k = 2$) of 0.050 mg are used almost exclusively as reference standards for mass determinations. Mass of weights is determined by comparison with specially designed weighing schemes and each calibrated weight is used in at least three substitution weighings.

Fig. 1 General view of the mass laboratory

Test procedures used were optimized to reach the required reliable low uncertainty and to calibrate the weights at low cost and in a short time period. Uncertainties ($k = 2$) of calibration of laboratory working standards are equal to or lower than 1/4 of maximum permissible errors of class E_1. Uncertainties of kilogram working standards are 0.06 mg.

These weights are now used as standards at the 16 Offices and at 5 DKD calibration laboratories.

The laboratory took over the equipment and staff of the dissolved mass laboratory of the former German Democratic Republic (G.D.R.) national metrology institute ASMW. Many years of experiments in realizing the mass scale were good prerequisites for high precision mass determinations, and the mass laboratory has also attained an accreditation by the Physikalish-Technische Bundesanstalt (PTB) for DKD calibrations.

2 Customer requirements

Customers of calibration of class E_1 weights anticipate that the real uncertainties of measurement are much less than those certified and that the results of measurements are sometimes 100 % checked and guaranteed.

On the other hand they expect calibration to be performed in a very short time period (several days) and at low cost.

3 Standards, equipment and test procedures

3.1 Standards

Traceability of mass determination is presented in Fig. 2.

Reference standards are confined to three kilogram mass standards made of special stainless steel. These standards are recalibrated every two years with an expanded uncertainty ($k = 2$) of 0.050 mg at the Physikalisch-Technische Bundesanstalt (PTB).

Seven kilogram working standards are compared with the reference standards with an uncertainty ($k = 2$) of 0.06 mg. Working standards and sets of weights from

1 mg to 10 kg are calibrated against the kilogram working standards. 20 kg and 50 kg weights are calibrated against 10 kg standards.

The recalibration interval of working standards is equal to or less than two years. Advantages in confining the reference standards to a nominal value of 1 kg are:

- Relative mass stability of kilogram standards which are not used for routine calibrations, can easily be kept within $5 \cdot 10^{-8}$. Standard deviation of comparisons with kilogram reference standards is not greater than 1/10 of its expanded uncertainty.

- Mass stability of working standards can be checked every time at the laboratory by itself, whereas mass changes of reference standards can not be corrected.

- The uncertainty component of the standard for calibration of sets of weights from 50 g to 1 mg is less than the uncertainty of class "E_0" weights (see Fig. 3).

- Costs for calibration of two sets of reference standards of class "E_0" from 1 mg to 50 kg would be much more expensive.

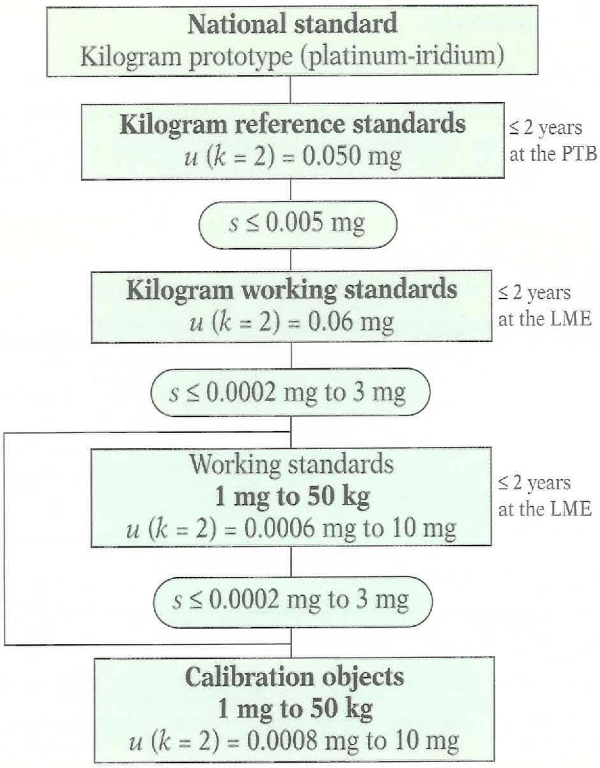


Fig. 2 Traceability of mass calibration at the LME Brandenburg

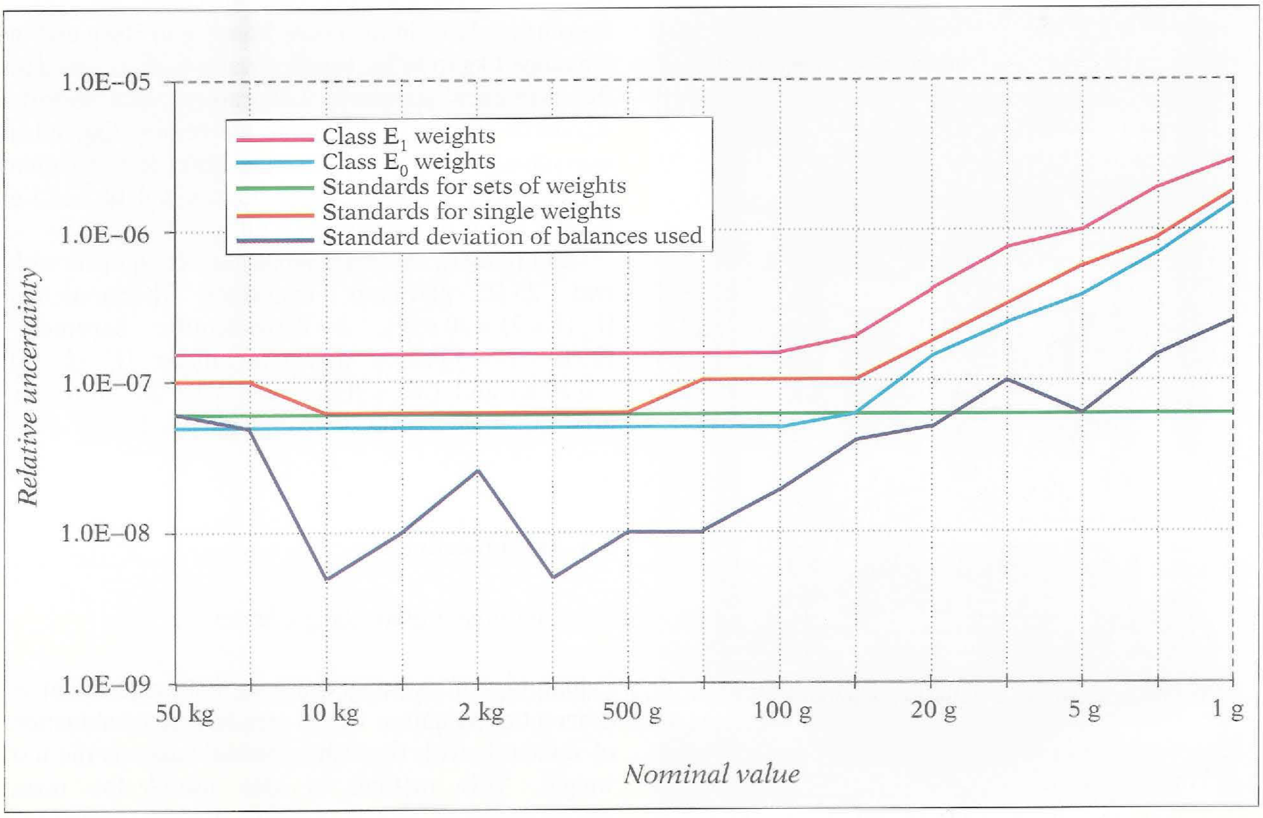


Fig. 3 Required relative uncertainty of class E_1 and "E_0" weights related to relative uncertainty of used standards and relative SD of used balances

3.2 Equipment

Mass comparators used are listed in Table 1. Accuracies of 10 kg and 50 kg equal arm balances have been improved by installing electromagnetic force compensation systems to indicate the rest point position.

The 10 kg mass comparator shown in Fig. 4 was manufactured by the Ceskoslovenský Metrologiský Ústav (CSMÚ) Bratislava in 1987 [1]. This comparator, with 6 exchange positions of the rotating table, facilitates comparisons of any combination of weights [2].

Table 1 Standard deviation of used mass comparators

Type	Weighing range	Standard deviation
C5S	1 mg to 1 g > 1 g to 5 g	0.20 µg 0.3 µg
AT106	> 5 g to 20 g > 20 g to 100 g	1.0 µg 2.0 µg
C1000S	100 g, 200 g 500 g, 1 kg	2.0 µg 5 µg
Special construction	> 1 kg to 10 kg	0.05 mg
107/20	> 10 kg to 20 kg	1.0 mg
106/50S	> 20 kg to 50 kg	3 mg

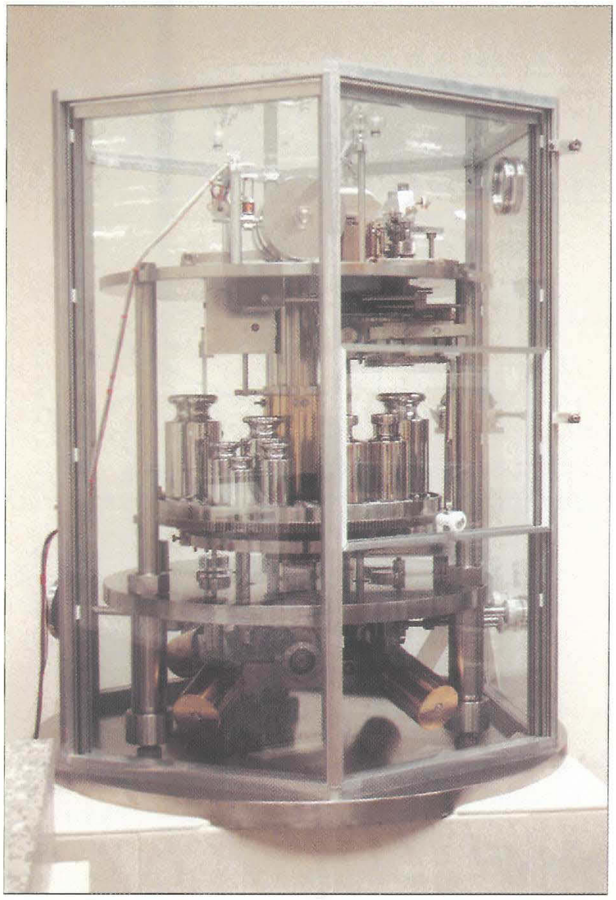


Fig. 4 10 kg mass comparator

Volume and density of weights and of laboratory solid density standards are determined according to the hydrostatic method on two specially developed measuring places in the range from 1 g to 500 g and in the range 1 kg to 50 kg. Distilled water is always used as the reference standard. Laboratory solid density standards are used to examine the results. Expanded uncertainty (k = 2) of volume and density determination of laboratory solid density standards is $4 \cdot 10^{-3}$ of 1 g weights to $1.0 \cdot 10^{-4}$ of weights ≥ 100 g.

Additionally, the mass laboratory is equiped with two 25 Ω platinum resistance thermometers [U_t (k = 2) = 20 mK], a Paroscientific barometer [U_p (k = 2) = 5 Pa], a dew-point meter [U_{tp} (k = 2) = 0,20 K] and two self-designed 1 kg air buoyancy artefacts for air density determination (see Fig. 5).

3.3 Test procedures

3.3.1 Advantages of weighing schemes

Calibrations of test weights are normally carried out as differential weighings with a standard or combination of standards with the same nominal value as the test weight. This method is also useful for mass determination of class E_1 weights, if a high number of single pieces has to be calibrated or if the standard

Fig. 5 The 1 kg mass comparator with air buoyancy artefacts

deviations of balances used are about 1/10 of required uncertainty or less.

However in most cases it is more suitable to use weighing schemes for calibration of class E_1 weights.

Advantages are:

- Decrease of uncertainty component of reference weight in the range 50 g to 1 mg.
- Including of check weights with known mass value, i.e. working standards, to examine the results of the calibration.
- Examination of internal consistency of the observed weighing differences or the absence of systematic errors, respectively.
- Results of test weights of different nominal values are connected. For this reason, the results can be checked for systematic deviation caused by the standard.
- Each test weight is used in at least three weighings. Normally the number of equations per test weight is not greater than three, whereas direct calibration against a reference standard can demand more weighings.
- The calibration of sets of weights required only one standard and one check weight per decade. Therefore the limited space inside the mass comparator can contain more test weights.

3.3.2 *Weighing schemes for calibration of submultiples of the kilogram*

3.3.2.1 *Calibration of sets of weights*

Normally a weighing scheme with 12 equations per decade is used (see Table 2). The set of weights to be calibrated (T1 to T4) is completed with check weights (C) so that each nominal value appears twice. A piece of the lowest nominal value generally has to be a check weight. A further check weight is used to examine the standard (R).

Test weights take part in 5 or 6 weighings, whereas the number of weighings in a decade (12) is three times higher than the number of test weights (4). The number of weighings per test weight is decreased a little to 2.75 for a set of weights from 500 g to 1 mg.

A cylindrical 500 g check weight and a 100 g disk weight are included in the decade from 500 g to 100 g to handle the weights on the automatic 1 kg mass comparator. Disk weights are usually avoided when investigating mass stability of check weights with a recommended shape.

Table 2 Weighing scheme for calibration of submultiples of the kilogram

10	10	5	5	2	2·	1	1
R	**C**	**T1**	**T2**	**T3**	**T4**	**T5**	**C**
+ 1	– 1	0	0	0	0	0	0
+ 1	0	– 1	– 1	0	0	0	0
0	+ 1	– 1	– 1	0	0	0	0
0	0	+ 1	– 1	0	0	0	0
0	0	+ 1	0	– 1	– 1	– 1	0
0	0	+ 1	0	– 1	– 1	0	– 1
0	0	0	+ 1	– 1	– 1	– 1	0
0	0	0	+ 1	– 1	– 1	0	– 1
0	0	0	0	+ 1	– 1	0	0
0	0	0	0	+ 1	0	– 1	– 1
0	0	0	0	0	+ 1	– 1	– 1
0	0	0	0	0	0	+ 1	– 1

The solution of the weighing equation is well known. Here, the method used is to add restraint to the normal equations; this is called the Lagrangian multipliers method. Refer to Bibliography [3] and [4]. Furthermore, a weight matrix is introduced to take into consideration the various standard deviations of different balances [4]. For this reason, no search of an orthogonal weighing scheme is performed.

3.3.2.2 Calibration of single weights

Weighing schemes are less efficient for the calibration of single pieces (see Table 3). However it remains the advantage of the use of weighing schemes to check the calibration results by a laboratory working standard.

Table 3 Weighing scheme for calibration of single weights

2	2	1	1
10	**10**	**5**	**5**
R	**C**	**T**	**C**
+ 1	– 1	0	0
+ 1	0	– 1	– 1
0	+ 1	– 1	– 1
0	0	+ 1	– 1
0	0	+ 1	– 1

3.3.3 Weighing schemes for calibration of multiples of the kilogram

Only 1 kg or 10 kg working standards are used for calibration of weights from 2 kg to 50 kg. The efficiency of the weighing scheme increases, of course, with the number of test weights. Only 8 equations are needed, i.e. for the calibration of 3 weights (see Table 4).

Table 4 Weighing scheme for calibration of multiples of the kilogram

5 × 1	5	5	5	5
R	**T1**	**T2**	**T3**	**C**
+ 1	– 1	0	0	0
+ 1	0	– 1	0	0
+ 1	0	0	– 1	0
+ 1	0	0	0	– 1
0	+ 1	– 1	0	0
0	+ 1	0	0	– 1
0	0	+ 1	– 1	0
0	0	0	+ 1	– 1

4 Conclusion

The test procedures described lead to an efficient calibration of sets of class E_1 weights. These test procedures are also used to calibrate laboratory working standards with lower uncertainty. Single weights are preferably combined to use specially designed weighing schemes.

Routine calibration of class E_1 weights requires many experiments in mass determination including mass stability and cleaning of weights.

All working standards are marked with a small number, letter or point to avoid confusion. A general marking would simplify and ensure the correct use of all weights intended to be used with certified values, for example class E_1 weights. ■

References

[1] Spurný, R.: 10 kg standard balance of the CSMÚ for calibration of working standards from 1 kg to 10 kg, CCM/85-28.

[2] Missuweit, G.: Massebestimmung höchster Genauigkeit mit einem 10 kg-Komparator im ASMW, PTB-Mitteilungen 100 (1990) 6, S. 444-449.

[3] Cameron, J.M.; Croarkin, M.C.; Raybold, R.C.: Designs for the Calibration of Standards of Mass, NBS Technical Note 952 (1977).

[4] Schwartz, R.: Guide to mass determination with high accuracy, PTB-Bericht PTB-MA-40, April 1995.

Tenth International Conference of Legal Metrology

Vancouver, 4–8 November 1996

*At the invitation of the Canadian Government, the **Tenth International Conference of Legal Metrology** was held in Vancouver, Canada from 4 to 8 November 1996.*

The 31st meeting of the International Committee of Legal Metrology and the Tenth International Conference of Legal Metrology were jointly organized in the splendid Pan Pacific Hotel, located in the very heart of Vancouver (population 2 million).

Opening speech by Mr. G. Redling, Industry Canada Operations Sector

Opening of the Conference

The Conference was officially opened by Mr. G. Redling, Executive Director of the Industry Canada Operations Sector, who welcomed the 137 delegates from 41 Member States, nine Corresponding Members, nine international or regional Institutions, Observers, and Technical Agents from the BIML.

Six interpreters provided simultaneous translation of delegates' speeches into English, French and Russian.

Following the roll-call, verification of credentials and the quorum, Mr R. Knapp, past CIML Member for Canada, was elected as President of the Tenth Conference; Mr. L. Revuelta Formoso (Cuba) and Mr. P. Pákay (CIML Member for Hungary) were elected as Vice Presidents.

Speech by the CIML President

Mr. G. J. Faber, President of the International Committee of Legal Metrology, spoke about the main developments in OIML matters during the four years since the Ninth Conference in Vouliagmeni in November 1992. He described this four-year period as having being catagorized by three predominant characteristics: ***consolidation, development*** and ***opening up***. Mr Faber's report is printed in full, below.

Delegates attending the Tenth International Conference of Legal Metrology

Speech by the CIML President, Mr. G. J. Faber

Mr. President,
Ladies and Gentlemen Delegates,
Dear Colleagues,

It is the duty of the President of the International Committee of Legal Metrology to present to the Conference a report which describes the Organization's activities over the four years which have elapsed since the last Conference, in line with our current rhythm.

I was elected as President of the Committee in October 1994, so my report will cover the two years during which the Committee was still presided by Knut Birkeland, followed by the two years under my own presidency.

I do not think that this change in presidency represented a "revolution" for the OIML. Of course, each President has his own personality; each has his own views on international cooperation and his own way of working with his Committee colleagues - in particular with those who are members of the Presidential Council - and with the Director of the Bureau.

However, the main OIML policies remain the same as those laid down by the Conference, and are applied under the Committee's control.

It is for this reason that I am able to speak globally about OIML activities over the past four years without any risk of contradicting my predecessor.

I would cite these four years as having three main aspects: **consolidation, development** and **opening up**.

Let us first consider what I mean by **consolidation**.

Up until the end of the 1980's, the OIML had functioned on the basis of the policy and work structures which had been fixed by the Conference in 1972.

The need for two fundamental reforms was felt: firstly redefining the Organization's long term policy and secondly establishing new work structures.

The need to redefine the Organization's long term policy was most noticeable during a general discussion held four years ago during our Ninth Conference.

At national level, legal metrology has witnessed developments linked to the introduction of test laboratories accreditation, the development of certification of instrument manufacturers' quality assurance, the emergence of new partners in both the fields of standardization and maintenance and verification of in-service instruments, the trends towards deregulation and privatization, and lastly to the development of regional cooperation.

The OIML owed it to itself to react to these evolutions in order to maintain its international leadership in the field of legal metrology, to be able to cooperate with an increasing number and variety of national organisms, and to respond better and more rapidly to the growing needs for both the harmonization of legal metrology regulations or standards, and their application.

It was the Presidential Council which was instrumental in the task of redefining the OIML long term policy.

Based on ideas put forward during the Ninth Conference, my predecessor - then I myself - devoted a number of days to studying the various aspects of this question and to discussing the matter with members of the Council or, sometimes, just with the two Vice Presidents, in order to be able to provide appropriate guidelines so that the Director of the Bureau could draw up the successive projects for what which became, in 1995, the OIML long term policy.

Naturally the other Members of the International Committee of Legal Metrology were significantly involved in this work; they were repeatedly consulted, and participated in supplementary discussions at each Committee meeting.

As soon as it was published, this long term policy text was widely distributed not only within the spheres of legal metrology to OIML members, but also to all the international and regional organisms whose activities can influence international cooperation in the field of legal metrology.

I do not wish to dwell further on this subject, albeit important, as it will be discussed under item 6 on the agenda.

The second area in which action started only a few years ago has enabled us to consolidate the foundations of the OIML is that of work methods.

The old work methods of Pilot and Reporting Secretariats had, little by little, shown their weaknesses: too complex with two successive levels of approval, and at the same time there was a lack of rigor in the processes of approval and work program definition.

So new work methods were set up, taking account of the experience - positive or negative - gained from the old work methods, and also largely inspired by the work methods of the ISO and IEC technical committees and subcommittees.

In parallel, the OIML technical work program was reexamined, mainly with a view to eliminating all subjects which did not represent a certain degree of priority for the majority of our members; at the same time, the work methods of other international organizations were examined in order to best ensure that duplication was eliminated.

The third aspect of the consolidation of OIML technical activities consisted in setting up the new structures of technical committees and subcommittees, in line with the new methods and according to the work program I have just spoken about.

In carrying out this task, great effort was taken not to disturb work in progress, even in the event that secretariats were changed; I must say that thanks to the understanding of all the technical experts concerned, and thanks also to the Bureau's coordination work, the transition to the new structures was accomplished without any major problems.

So what impact on the quantity and quality of our work did this consolidation of our technical bases have?

It is still early to draw any final conclusions. Nevertheless, certain observations lead one to deduce that the result constitutes a real **development** for our Organization.

Indeed, one notices that, on the basis of a reduced work program, the OIML has produced more during the past four years than in previous four-year periods. This is particularly demonstrated by the number of publications drawn up by the technical committees and subcommittees and by the Bureau, either directly or under the supervision of the Presidential Council. More information on this subject will be given to us under item 7 on the agenda. I would however note straight away that our Organization has participated in producing two key works of reference for metrology: the *International vocabulary of basic and general terms in metrology*, which is in its second edition, and the *Guide to the expression of uncertainty in measurement*, both of which were produced in close collaboration with six other international institutions.

Furthermore, recent technical publications have considerably more substance than before: they increasingly contain the three sections deemed necessary for an OIML Recommendation: requirements for metrological performances, test methods and the format for the test results report.

The application of Recommendations within national regulations is progressing steadily, as shown by a recent inquiry, the results of which will be made available to you shortly.

As for the quality of the texts, it is perhaps in this area that a sustained effort must be made. By "quality" I mean not only clarity and readability of requirements, but also (and especially) the fact that only those elements which affect the metrological performance of instruments should be dealt with by OIML; the standardization of the conception or manufacture of instruments is obviously outside the scope of the OIML.

The second field in which the OIML has witnessed very interesting developments is in the field of certification.

The OIML Certificate System for Measuring Instruments was launched five years ago but, at the time of our Ninth Conference, the number of certificates delivered or in progress was practically zero.

Over the four years, more than 200 certificates have been delivered and the rhythm has accelerated every year. Moreover, the number of categories of instruments for which certification seems to be of interest to manufacturers is progressively increasing and should continue to increase in the future, with the publication of new Recommendations which will allow the System to be applied to new categories.

Quite clearly, we must not be content merely with this initial success and must do everything possible to ensure that the development of this new certification activity is pursued.

The System will be enlarged to include modules, and not remain limited to whole instruments. Indeed, the increasing specialization of manufacturers, the specific needs of customers and the need to be able to make measurement systems evolve will lead modules (the compilation of which will form the definitive instrument) to be examined and certified separately.

But there is another development, equally if not more vital to confirm the success of the System - namely the degree of acceptation of the certificates. If this degree is low, if very few legal metrology services accept to take the test results contained in OIML reports into consideration, then instrument manufacturers will manifest less interest in the System. I do hope that the next inquiry which the Bureau will conduct on this subject will demonstrate progress made in this area.

Lastly, I would mention a final indicator which confirms the development of our Organization: the total number of our Members, Member States and Corresponding Members has significantly increased from eighty-four at the time of our ninth Conference to a current total of ninety-six.

I now come to the third aspect of my report - **opening up** - and I would seize this occasion to look into the future and outline some views which may well guide future OIML work.

Since it was created, our Organization has always striven to be open to the outside world and to develop contacts with all the other international and regional organisms with which it shares common work aspects or common actions.

However, the necessity to be even more open seems obvious to me.

The interconnection between aspects of all the technical activities, both at national and international levels and for all countries, is ever increasing.

Legal metrology, which up until now could be considered as being a clearly identified activity, now finds itself a part of a huge mass embracing, amongst other things, accreditation, quality assurance and self-verification.

To take a concrete example of the evolution of certain things, I would quote the relations between the OIML and ILAC. Even a few years ago, these relations were limited to a mutual information exchange and to the possibility which the OIML offered to publish texts drawn up in the context of ILAC work groups. You can see that cooperation only existed to a limited extent, rather passive, and mainly unilateral.

Things are changing fast - there is a foreseeable move towards a certain type of accreditation of organisms whose role it is to carry out tests in the context of legal metrology. In fact we will be devoting a morning to discussions on this subject. I foresee that relations between OIML and ILAC will become much wider, active and two-sided.

Another field in which the OIML will have to review its policy and no doubt become more open is that of development aid. In my opinion, the field of legal metrology is not sufficiently widespread to justify individualized development aid action. It therefore seems to me that the choice which was put forward to associate ourselves with the BIPM and IMEKO - and why not with other organizations as well - in order to carry out more large-scale actions in which legal metrology could be involved, is an excellent idea.

In concluding, I would say that this reappraisal of the conditions of partnership and opening up towards the outside will have to be accomplished by the OIML in conjunction with a large number of other international and regional organizations. One of the next tasks that the Presidential Council will undertake will be to study these questions; in my opinion, OIML's responsibility to coordinate certain activities of the regional legal metrology organisms is an essential aspect of our long term policy which is not yet completely solved.

I now come to a key question which arises in conjunction with the policy of opening up our Organization: that of the rapprochement and possible fusion with the BIPM.

We will be covering this subject in detail later so I will refrain from anticipating the conclusions that the Conference may draw. However I may say straight away that total fusion does not seem feasible at present; in any event that was the outcome of discussions in the context of the International Committee of Weights and Measures, as reported to us during the recent BIPM/OIML work group meeting.

However, what should be noted is the clear wish of both parties to develop cooperation between the Metre Convention and OIML.

Whatever the outcome may be, I am certain that there is a need to create a kind of world metrology center - a center which would represent and convey the various governments' metrological interests at international level and which would constitute the basis and model for the metrological systems which might exist in each country, at national or regional level.

Fusion of the BIPM and OIML would of course have been a unique occasion to create such a center; we will have to reflect on other ways of approaching the subject. Maybe this Conference will provide the occasion to go into further depth on this subject.

Rest assured that during these five days of meetings, I will constantly be on the lookout for your ideas and suggestions.

As President of the Committee, it is my responsibility to generate in-depth discussions on the developments and future of the OIML.

To assist me in this task and to enable me to put propositions to the Committee which have been well thought-out, I am supported by two Vice Presidents and by a Council, about which I would like to say a few words.

Even though this is not explicitly provided for by the Convention, the Presidential Council has, over the years, proved to be of immense utility.

Apart from the President and two Vice Presidents, the Council is made up of a small number of Committee Members chosen by the President.

My choice in the current composition of the Council was predominantly guided by the level of interest shown in OIML activities, without forgetting of course to include a degree of "geopolitical variety", the aim of which is to ensure that diverse tendencies and opinions may be expressed; this facilitates obtaining subsequent consensus at Committee level.

When the Committee elected me as President two years ago, apart from the two Vice Presidents Messrs. Chappell and Kochsiek, Messrs. Bennett, Birch and Issaev were also on the Council.

I recently deemed it appropriate to enlarge the composition of the Council, for the reasons of diversity already mentioned, and I proposed to Messrs. Li Chuanqing, Kurita and Magana to join us.

So this is the group whose role is to advise me as President of the Committee, especially concerning our Organization's long term policy.

As far as shorter term decisions are concerned, I know I can fully count on the advice of the two Committee Vice Presidents, to whom I have entrusted specific responsibilities: Sam Chappell is supervising technical activities and Manfred Kochsiek is dealing with questions concerning developing countries and certification.

Mr. President,
Ladies and Gentlemen Delegates,
My dear Colleagues,

My report, which aimed to retrace the main lines of OIML activity since the Ninth Conference, has also touched on the future and has allowed you to discover how future actions would be undertaken.

But I would not wish to close my report before once more returning to the past.

Forty years ago the First International Conference of Legal Metrology was held in Paris, thus marking the first steps of a newly created Organization. Very few of those who participated in that Conference are still alive, and perhaps amongst the Member States delegates Messrs. Mühe and Liers, who went on to become CIML Members for the Federal Republic of Germany and the former German Democratic Republic, are the sole survivors.

Following a proposal by Manfred Kochsiek, I felt it appropriate to commemorate this fortieth anniversary by sending our two former Committee colleagues a message of sympathy and recognition, and by offering a mark of thanks to several key people who played a special role in OIML work.

In this way, those who contributed to the creation and development of our Organization will know that their efforts continue to bear fruit.

Thank you for your attention. ■

Vancouver, Canada

Developing countries

Following the presentations made by Prof. M. Kochsiek, Vice-President of the CIML, in charge of matters concerning developing countries, and Mr. G. M. Putera, President of the OIML Development Council, the Conference expressed its satisfaction with the numerous activities which were organized to encourage the development of metrology in these countries during the period from 1993 to 1996:

- Symposia, training courses and workshops;
- Increased cooperation between the OIML and international and regional Organizations in order to successfully accomplish development action plans;
- Distribution of information of particular interest to developing countries: various Documents and Recommendations, Vocabularies, Guides and Directories.

The Conference confirmed the utility of the Development Council as a forum where representatives from both industrialized and developing countries could meet, thus allowing not only the real needs of the latter to be discussed but also to formulate recommendations during CIML meetings and organize multi-level interaction.

Prof. M. Kochsiek reporting on activities in developing countries

It was decided to pursue activities in the above-mentioned fields; in the future, the following points should also be taken into consideration:

- Research and distribution of information concerning available technical and financial assistance;
- Extension of liaisons with those institutions concerned;
- Promotion of the OIML Certificate System in developing countries: wider acceptance of the certificates and of the test results, coupled with the possibility for these countries to issue certificats themselves will be a major advantage for the development of their metrological activities and also for their manufacturers of measuring instruments.

Some of the Organizations involved in liaison activities. Left to right (center table): M. Stoll, H. Eigenmann, J. Anthony (CECIP); A. Ben Hadid (Marcogaz); J. Senave (Facogaz)

Liaisons

OIML liaisons with other international or regional Institutions can be qualified as being very good; after a brief reminder of the importance of cooperation between the various organizations in the field of metrology and its application (especially within ISO TAG 4), the representatives of the various manufacturers' Institutions and Federations were given the opportunity to evoke the progress they had made.

Amongst others, those concerned were:

- APLMF (Mr. J. Birch)
- BIPM (Mr. T.J. Quinn)
- CECIP (Mr. J. Anthony)
- CIMET (Mr. B.S. Mathur)

- COOMET (Mr. L.K. Issaev)
- FACOGAZ (Mr. J. Senave)
- ILAC (Mr. P. van de Leemput)
- MARCOGAZ (Mr. Ben Hadid)
- OIV (Mr. J. Tremblay)
- WELMEC (Mr. S. Bennett)

Emphasis was also put on the fact that regional legal metrology organizations serve as an additional "anchoring" element for the world-wide implantation of the OIML. As one essential objective is to eliminate technical barriers which may block interaction, it was felt appropriate to encourage simultaneous regional and international work, based on cooperation between technical committees having identical or related fields of activity.

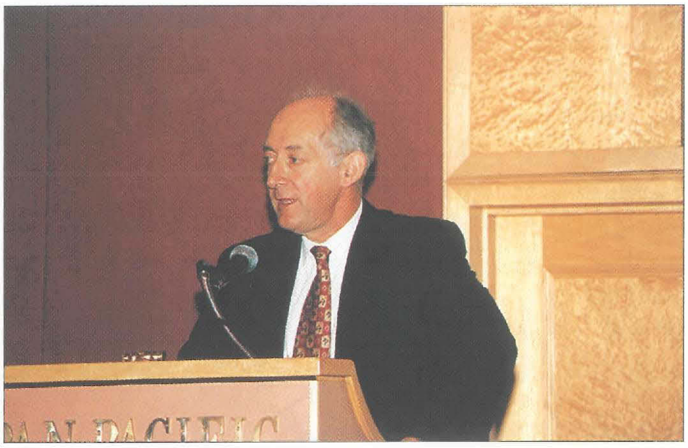
Moreover, closer collaboration is desirable as regards regional or international standardization work - indeed, certain regional technical standards (for example, those developed by CEN and CENELEC in Europe) have diversified from the strictly voluntary domaine by way of the European *new approach*: the conformity of a measuring instrument to a harmonized standard does imply a presumption of conformity to the main requirements, such as they appear in *new approach* type European directives.

Rapprochement with the BIPM

The Conference expressed its satisfaction to the President of the CIML, Mr. G. J. Faber, for his work with a view to studying the possibilities of a rapprochement between OIML and BIPM.

A mixed working group held two meetings in February and September 1996; the present conclusion of this work is that a merger is premature and that a more in-depth study is necessary before proceding further.

The Conference nevertheless underligned the fact that cooperation between the two Organizations must be reinforced immediately concerning a certain number of subjects of common interest.



Mr. T. J. Quinn (Director of the BIPM) evoking issues concerning possible rapprochement, on behalf of the *Convention du Mètre*

Long term policy

The Organization's long term policy document, published in 1995, was unreservedly approved by the Conference. Nonetheless, some new guidelines did appear:

- Analysis of the metrological needs of industry and better taking into account of these in the future; an international Conference could be organized whose theme would be *"How to help industry effectively?"*;
- Drawing up of a document describing a coherent approach which binds together all the aspects of the concept of a "measurement system" at regional and international levels;
- Reinforcing cooperation with those international and regional organizations who are responsible in the field of accreditation and especially ILAC (see our report on the accreditation Round Table, pp. 39–41);
- Improvement of the efficiency of communications by making full use of computer systems sucy as Internet, e-mail, etc.

Technical work

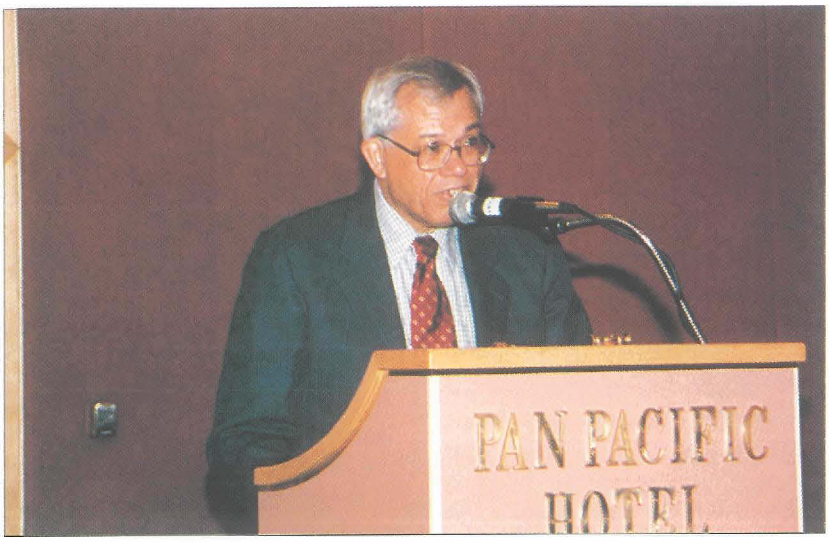
Mr. S. E. Chappell, Vice-President in charge of following up on the Organization's technical work, gave a general overview on the status of work undertaken by OIML technical committees and sub-committees:

- The establishment of the new OIML technical structure (TC/SC) was successfully achieved during the period 1993–1996;
- New work methods were developed and applied;
- The 23 OIML Recommendations or Annexes which had been approved by the CIML from 1993 to 1995 were formally sanctioned by the Conference; their application by Member States therefore becomes mandatory. Five additional projects were directly submitted to the Conference for sanctioning: please refer to the list below.

- Revision of R 25 *Sound level meters;*
- Revision of R 88 *Integrating-averaging sound level meters;*
- *Refractometers for the measurement of the sugar content of grape musts;*

- Revision of R 79 *Information on package labels;*
- Annex to R 50 *Test procedures for continuous totalizing automatic weighing instruments.*

The results of an inquiry concerning the degree of application of OIML Recommendations by Member States were presented and commented on. The Conference encouraged technical committees to continue their efforts to produce Recommendations of an even higher quality and even faster; Member States were also invited to put as many OIML Recommendations into practice as possible.



Mr. S. E. Chappell, giving a general overview on OIML technical activities

OIML Certificate System

Mr. B. Athané, Director of the BIML, described the System, its objectives and the way it functions.

Mr. M. Kochsiek (Vice-President of the CIML, responsible for certification), then presented a report on the developments of the OIML Certificate System since its creation in 1991.

It was noted that these developments were quite considerable both in terms of the progression of the number of certificates recorded and also by the increase in the number of categories covered by the System. (See page 38).

Mr. K. Birkeland, Past CIML President

A consultative technical group on certification (TAG_{cert}) was created. It began its work in 1995 and held a meeting in Paris at the beginning of 1996.

The guidelines for the future development of the System are as follows:

- Development of national structures with a view to better applying the System;
- Revision of OIML Recommendations with a view to including them in the System;
- Study to adapt the System to individual instruments;
- Application of the System to modules and parts of instruments;
- Establishment of criteria for mutual agreement on recognition of Certificates and test results;
- Utilization of inter-comparisons organized by other international or regional institutions with a view to harmonizing test procedures based on OIML Recommendations, and publication of the results;
- Definition of the principles of legal protection of OIML Certificates;
- Coordination of the development of the System with the corresponding activities of the other institutions dealing with tests, certification, evaluation of conformity, accreditation, etc.

Budget

The Tenth Conference approved the management of the budget during the years 1992–1995 (and the estimations for 1996) and voted a new budget for 1997–2000.

Thanks and Awards

To commemorate the 40th anniversary of the First International Conference of Legal Metrology, letters of thanks were sent to Messrs. Mühe and Liers, who were present at that time as Members of the German delegation. Similarly, three Awards were made to individuals who were notably active in contributing to the development of the OIML:

- Mr. Referowski, Past CIML Member for Poland, and Assistant Director at the BIML from 1974 to 1981,
- Mr. Warnlof, NIST, President of OIML technical committee TC 9, and
- Mr. Eigenmann, Mettler-Toledo, Switzerland, and CECIP.

Future meetings

The venue of the 11th International Conference of Legal Metrology has been provisionally fixed as Paris and will be held in the year 2000.

The next two CIML meetings will respectively take place:

- In Rio (Brazil) in 1997, in conjunction with the seminars organized by the SIM (Sistema Interamericano de Metrologia) on legal metrology in Latin American countries and on medical measuring instruments, a General Assembly of the SIM and a meeting of the OIML Development Council;
- In Seoul (Rep. of Korea) in 1998.

The Conference expressed its thanks to the Canadian Organizers -
Top, left to right: Mr. A. E. Johnston, Mr. G. Redling, Mr. R. Knapp
Bottom, left to right: Mrs. H. Bradbury, Mrs. S. Murphy

Awards were presented by Mr. Faber to:
Left to right: Mr. Referowski, Mr. Warnlof and Mr. Eigenmann

The BIML expresses its sincere thanks to our Canadian hosts for their highly efficient organization of the Conference and of the various meetings (CIML, commissions, round table), and equally for the opportunity the delegates had to discover the beauty and geographic variety of Vancouver and the warm hospitality of the Canadians. ■

Agenda

1 Organization of the meeting

1.1 Opening
1.2 Roll-call - Verification of credentials - Quorum
1.3 Voting procedures during Conference sessions
1.4 Election of President and Vice-Presidents of the Conference
1.5 Adoption of the agenda
1.6 Constitution of working committees
1.7 Establishment of the schedule
1.8 Approval of the minutes of the Ninth Conference
1.9 Report on activities, by the President of the International Committee of Legal Metrology
1.10 Miscellaneous information

2 Member States and Corresponding Members

2.1 New Members - Expected accessions
2.2 The situation of certain Members

3 Developing Countries

3.1 Report on activities for the period from 1993 to 1996
3.2 Guidelines for future activity

4 Liaisons with International Institutions

4.1 Report on liaisons
4.2 Addresses by Representatives of Institutions

5 Rapprochement with BIPM

5.1 Endorsement of the Resolution adopted by the Committee in 1995
5.2 Updated information and discussion

6 Long-term Policy

6.1 Examination of the long-term policy paper published in 1995
6.2 Reflections on the OIML long-term policy in the light of discussions under item 5

7 Work of OIML Technical Committees and Subcommittees

7.1 Work undertaken - State of progress
7.2 Formal sanction of Recommendations already approved by the Committee in 1993, 1994 and 1995
7.3 Draft Recommendations directly presented for sanctioning by the Conference

8 OIML Certification

8.1 Report on the situation of the *OIML Certificate System for Measuring Instruments*
8.2 Guidelines for future developments

9 Administrative and financial matters

9.1 Examination of the management of the budget from 1992 to 1995 and 1996 estimates
9.2 Bureau personnel and retirement scheme
9.3 Credits for the financial period from 1997 to 2000
9.4 Member State contributions from 1997 to 2000

10 Other business

11 Closure

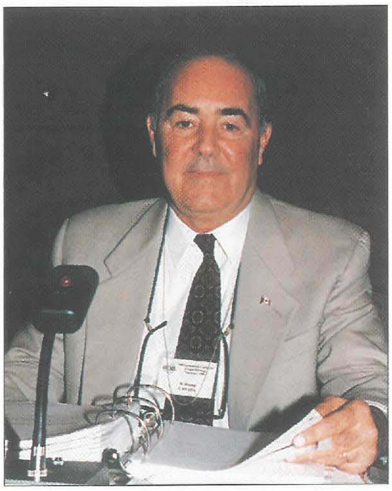
Date and place of the next Conference

Dixième Conférence Internationale de Métrologie Légale

Vancouver, 4–8 novembre 1996

Suite à l'invitation du Gouvernement canadien,
la ***Dixième Conférence Internationale de Métrologie Légale***
s'est tenue à Vancouver du 4 au 8 novembre 1996.

C'est dans le splendide Pan Pacific Hotel au coeur même de Vancouver (population 2 millions d'habitants) qu'ont été organisées conjointement la 31ème réunion du Comité International de Métrologie Légale et la Dixième Conférence Internationale de Métrologie Légale.



Mr. R. Knapp, élu Président de la Dixième Conférence

Ouverture de la Conférence

La Conférence a été officiellement ouverte par M. G. Redling, Directeur Exécutif au sein du *Operations Sector (Industry Canada)*, qui a souhaité la bienvenue aux 137 délégués représentant 41 Etats Membres, neuf Membres Correspondants, neuf institutions internationales ou régionales, des Observateurs et des Agents Techniques du BIML.

Six interprètes ont assuré la traduction simultanée (en anglais, en français et en russe) de toutes les interventions des délégués.

Après l'appel des délégués et la constatation des pouvoirs (quorum), M. R. Knapp, ancien Membre du CIML pour le Canada, a été élu Président de la Dixième Conférence; M. L. Revuelta Formoso (Cuba) et M. P. Pákay (Membre du CIML pour la Hongrie) ont été élus Vice-Présidents.

Discours du Président du CIML

M. G. J. Faber, Président du Comité International de Métrologie Légale, s'est alors exprimé sur les développements principaux de l'OIML pendant les quatre années écoulées depuis la Neuvième Conférence à Vouliagmeni en novembre 1992. Cette période quadriennale a été placée sous le triple signe de la **consolidation**, du **développement** et de l'**ouverture**. (Ce rapport d'activité est repris *in extenso* en pages 24 – 27, en anglais seulement).

Consolidation

Les évolutions en matière de métrologie légale sont largement influencées par l'introduction de l'accréditation des laboratoires d'essai, le développement de la certification des systèmes d'assurance de qualité des constructeurs d'instruments, l'apparition de

Délégués participant à la Conférence

Quelques Membres de la délégation des États-Unis. De gauche à droite:
G. M. Ugiansky, G. Lameris, B. L. Collins, J. B. Hitchcock, S. E. Chappell

nouveaux partenaires tant en matière de normalisation que de maintenance et de vérification des instruments en service, les tendances à la déréglementation et à la privatisation, et enfin le développement de la coopération régionale.

Afin de s'adapter à ces évolutions, l'OIML a réalisé deux réformes fondamentales: la redéfinition de sa politique à long terme et l'établissement de nouvelles structures de travail.

Avec la collaboration précieuse des autres Membres du Comité, le Conseil de la Présidence a mené à terme ce projet qui a abouti avec la publication et la très large diffusion d'un document clé sur la politique à long terme de l'Organisation.

De nouvelles méthodes de travail ont été établies en s'inspirant du fonctionnement de l'ISO et de la CEI, et une nouvelle structure de comités techniques et de sous-comités a été mise en place; par la même occasion, le programme de travail technique a été réexaminé.

Développement

L'OIML a sensiblement progressé au cours de ces quatre dernières années par:

- le nombre de ses Etats Membres et Membres Correspondants;
- le nombre et la qualité des publications élaborées (Recommandations, Documents, Vocabulaires, Guides);
- l'élargissement du Système de Certificats OIML et l'augmentation du degré d'acceptation des certificats émis.

Ouverture

Étant donné la complexité croissante des structures et les interactions de plus en plus nombreuses entre les diverses activités techniques et administratives ayant un impact sur la métrologie légale, la nécessité pour l'OIML de s'ouvrir d'avantage apparaît comme évidente:

- vers les autres institutions internationales et régionales dont les travaux présentent des intérêts communs avec la métrologie légale (BIPM, ILAC, IMEKO, ISO, CEI, EAL, etc.);
- vers les organismes régionaux chargés de la métrologie légale (WELMEC, APLMF, etc.).

M. Faber a terminé son discours en précisant la composition du Conseil de Présidence, élargi par la nomination de Messieurs Li Chuanqing (Chine), Kurita (Japon) et Magana (France). Il a également rappelé qu'il y a 40 ans la première Conférence Internationale de Métrologie Légale se tenait à Paris; afin de commémorer cet anniversaire, des marques de sympathie et de reconnaissance ont été manifestées à un certain nombre de personnes qui ont joué un rôle particulier en métrologie légale.

Délégation de la République Populaire de Chine. De gauche à droite:
Jiang Yong Ping, Ms. Kong Xiaokang, Li Chuanqing, Dai Runsheng, Dong Zheng

Pays en développement

Après les présentations du Prof. M. Kochsiek, Vice-Président du CIML, chargé des questions concernant les pays en développement, et du Président du Conseil de Développement de l'OIML, M. G. M. Putera, la Conférence a exprimé sa satisfaction pour les nombreuses activités qui ont été organisées pendant la période 1993-1996 et qui favorisent le développement de la métrologie dans ces pays:

- Symposia, cours de formation et ateliers;
- Coopération accrue entre l'OIML et les Organisations internationales et régionales afin de mener à bien des plans d'action de développement;
- Dissémination d'informations intéressant particulièrement les pays en développement: divers Documents et Recommandations, Vocabulaires, Guides et Répertoires.

La Conférence a confirmé l'utilité du Conseil de Développement comme forum de rencontre entre représentants de pays industrialisés et en développement, permettant de discuter des besoins réels de ces derniers, de formuler des recommandations à l'occasion des réunions du CIML et d'organiser la coopération à différents niveaux.

M. G. M. Putera, Président du Conseil de Développement de l'OIML

La poursuite des activités dans les domaines cités ci-dessus a été décidée; pour l'avenir, les points suivants doivent également être pris en considération:

- La recherche et la distribution des informations relatives aux soutiens technique et financier disponibles;
- L'extension des liaisons avec les institutions concernées;
- Promotion du Système de Certificats OIML dans les pays en développement: une plus large acceptation des certificats et des résultats d'essai ainsi que la délivrance de certificats par ces pays seront des atouts majeurs pour le développement de leurs activités métrologiques et pour leurs constructeurs d'instruments de mesure.

M. J. Birch (APLMF), présente les derniers développements de cette Organisation régionale dont il est Président.

Liaisons

Les liaisons de l'OIML avec les autres institutions internationales ou régionales peuvent être qualifiées de très bonnes; après un bref rappel de l'importance de la coopération des différentes organisations dans le domaine de la métrologie et de sa mise en œuvre (au sein notamment de l'ISO TAG 4), les représentants des différentes institutions et fédérations de constructeurs ont eu l'opportunité d'évoquer les différents progrès effectués.

Il s'agissait, entre autres, de:

- APLMF (M. J. Birch)
- BIPM (M. T. J. Quinn)
- CECIP (M. J. Anthony)
- CIMET (M. B. S. Mathur)

- COOMET (M. L.K. Issaev)
- FACOGAZ (M. J. Senave)
- ILAC (M. P. van de Leemput)
- MARCOGAZ (M. Ben Hadid)
- OIV (M. J. Tremblay)
- WELMEC (M. S. Bennett)

L'accent a également été mis sur le fait que les organisations régionales de métrologie légale constituent une base supplémentaire de l'ancrage de l'OIML dans le monde. L'un des objectifs essentiels étant d'éliminer les barrières techniques aux échanges, il y a lieu d'encourager le travail simultané et en étroite collaboration, au niveau régional et international, des comités techniques qui ont des activités dans des domaines identiques ou proches.

En outre, une meilleure collaboration est souhaitable en ce qui concerne les travaux régionaux ou internationaux de normalisation: en effet, certaines normes techniques régionales (par exemple, celles élaborées par le CEN et le CENELEC en Europe) ont quitté le domaine strictement volontaire par le biais de la *nouvelle approche* européenne: la conformité d'un instrument de mesure à la norme harmonisée implique en effet la présomption de conformité aux exigences essentielles reprises dans les directives européennes de type *nouvelle approche*.

Rapprochement avec le BIPM

La Conférence a exprimé sa satisfaction au Président du CIML M. G. J. Faber, pour son action entreprise en vue d'étudier les possibilités de rapprochement entre l'OIML et le BIPM.

Deux réunions d'un groupe de travail mixte ont eu lieu en février et en septembre 1996; la conclusion actuelle de ces travaux est qu'une fusion est prématurée et qu'une étude approfondie s'impose.

M. P. van de Leemput présente l'ILAC.

M. B. S. Mathur présente le CIMET.

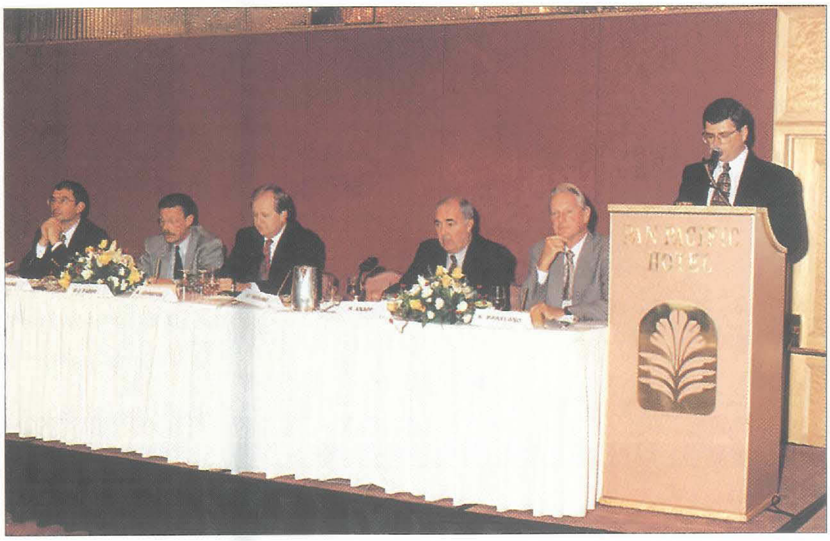
La Conférence a néanmoins souligné qu'il est indispensable de renforcer immédiatement la coopération entre les deux Organisations sur un certain nombre de sujets d'intérêt commun.

Politique à long terme

Le document sur la politique à long terme de l'Organisation, publié en 1995, a été approuvé sans réserve par la Conférence. De nouvelles lignes directrices sont néanmoins apparues:

- Analyse des besoins de l'industrie en matière de métrologie et meilleure prise en considération de ceux-ci dans l'avenir; une Conférence internationale pourrait être organisée avec pour thème *"Comment apporter une aide efficace à l'industrie?"*;
- Élaboration d'un document décrivant une approche cohérente

Les délégations française et hongroise. De gauche à droite: M. G. Lagauterie, M. J-F. Magana, Mme. M. Berniau, M. K. Schmalhofer, M. A. Szilvássy, M. P. Pákay



La Tribune Présidentielle. De gauche à droite:
M. B. Athané, M. G. Faber, M. A. Johnston, M. R. Knapp, M. K. Birkeland, M. G. Redling

du concept de "système de mesure" aux niveaux régional et international;

- Renforcer la coopération avec les organisations internationales et régionales responsables dans le domaine de l'accréditation et en particulier l'ILAC (voir notre rapport sur la table ronde sur l'accréditation pp. 39 – 41);
- Améliorer l'efficacité en matière de communications par l'exploitation de systèmes informatiques, par exemple Internet, e-mail, etc.

Travaux techniques

Un aperçu global de l'état d'avancement des travaux entrepris par les comités techniques et sous-comités OIML a été donné par M. S. E. Chappell, Vice-Président chargé du suivi des travaux techniques de l'Organisation:

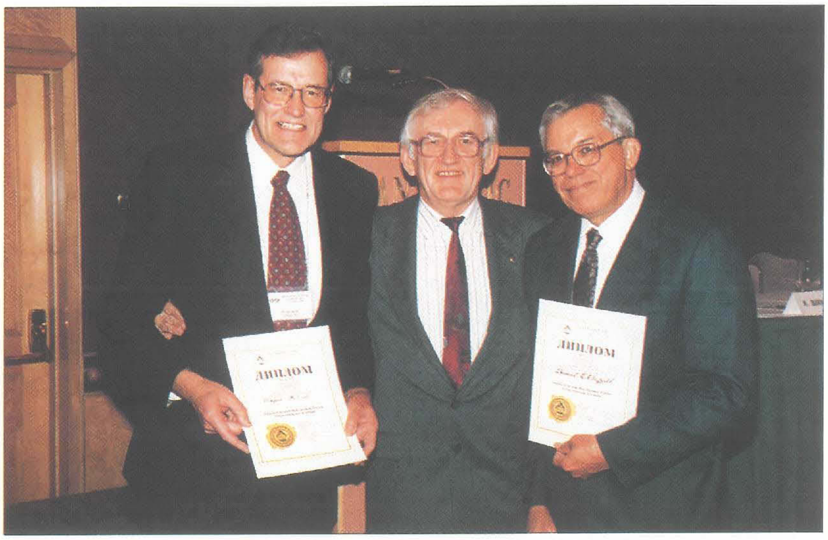
- L'établissement de la nouvelle structure technique de l'OIML (TC/SC) a été réalisé avec succès pendant la période 1993–1996;
- De nouvelles méthodes de travail ont été élaborées et appliquées;
- Les 23 Recommandations OIML ou Annexes qui avaient été approuvées par le CIML de 1993 à 1995 ont été sanctionnées formellement par la Conférence; leur mise en application par les États Membres devient donc obligatoire. Cinq projets additionnels ont été soumis directement à la sanction de la Conférence:
  - Révision de R 58 *Sonomètres*;
  - Révision de R 88 *Sonomètres intégrateurs-moyenneurs*;
  - *Réfractomètres pour la mesure de la teneur en sucre des moûts de raisin*;
  - Révision de R 79 *Etiquetage des préemballages;*
  - Annexe à R 50 *Procédures d'essai pour les instruments de pesage totalisateurs continus à fonctionnement automatique.*

Les résultats d'une enquête sur le degré de mise en application des Recommandations OIML par les États Membres ont été donnés et commentés. La Conférence encourage les comités techniques à continuer leurs efforts pour produire plus rapidement des Recommandations de qualité encore meilleure; les États Membres sont également invités à mettre en application le plus grand nombre de Recommandations OIML.

Système de Certificats OIML

M. B. Athané, Directeur du BIML, a procédé à une description du Système, de ses objectifs et de son fonctionnement.

M. M. Kochsiek (Vice-Président du CIML, chargé de la certification), a alors présenté un rapport sur les développements du Système de Certificats depuis sa création en 1991.



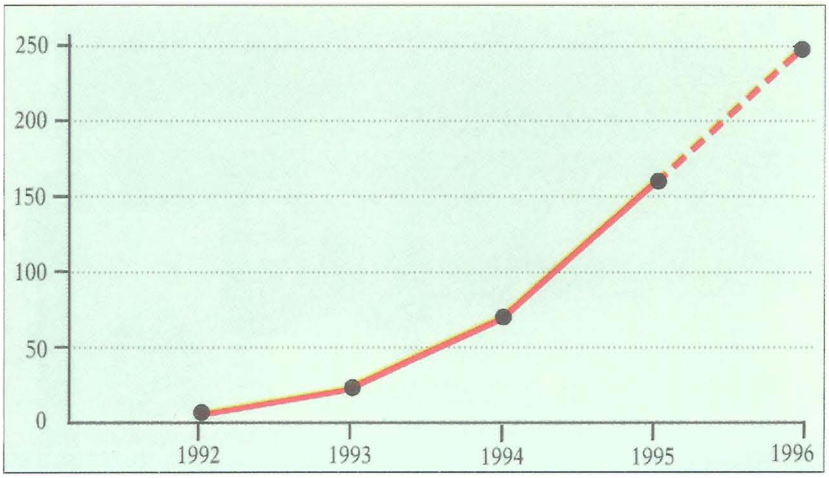
A la fin de la Conférence, M. Issaev a remis à MM. Kochsiek et Chappell un diplôme de Membre d'Honneur de l'Académie Russe de Métrologie

Il a été constaté que ces développements ont été considérables tant par la progression du nombre de certificats enregistrés que par celle du nombre de catégories d'instruments couvertes par le Système.

Un groupe technique consultatif sur la certification (TAG_{cert}) a été créé, a déjà commencé ses travaux en 1995 et a tenu une réunion à Paris début 1996.

Les lignes directrices de l'évolution future du Système sont les suivantes:

- Développement des structures nationales en vue d'une meilleure mise en application du Système;
- Révision des Recommandations OIML en vue de leur insertion dans le Système;
- Étude pour une adaptation du Système aux instruments individuels;
- Application du Système aux modules ou parties d'instruments;
- Établissement des critères pour les accords mutuels de reconnaissance des Certificats et des résultats d'essais;
- Utilisation des intercomparaisons organisées par d'autres institutions internationales ou régionales en vue d'une harmonisation des procédures d'essais basées sur les Recommandations OIML, et publication des résultats;
- Définition des principes de protection juridiques des Certificats OIML;
- Coordination du développement du Système avec les activités correspondantes des autres institutions traitant des essais, de la certification, de l'évaluation de la conformité, de l'accréditation, etc.



Nombre total de certificats OIML enregistrés
Total number of registered OIML certificates

Budget

La Dixième Conférence a approuvé la gestion du budget des années 1992 à 1995 (et les estimations pour 1996) et a voté un nouveau budget pour les années 1997 à 2000.

Remerciements et "Awards"

Afin de commémorer le 40ème anniversaire de la Première Conférence Internationale de Métrologie Légale, des lettres de remerciement ont été adressées à MM. Mühe et Liers, présents à l'époque en tant que Membres de la délégation allemande. De même, trois *Awards* ont été remis à des personnalités particulièrement actives dans le développement de l'OIML:

- M. Referowski, Ancien Membre du CIML pour la Pologne, et Adjoint au Directeur du BIML de 1974 à 1981,
- M. Warnlof, NIST, Président du comité technique OIML TC 9, et
- M. Eigenmann, Mettler-Toledo, Suisse, et CECIP.

Prochaines réunions

En principe, la 11ème Conférence Internationale de Métrologie Légale aura lieu à Paris en l'an 2000.

Les deux prochaines réunions du CIML auront lieu respectivement:

- à Rio (Brésil) en 1997, en conjonction avec des séminaires organisés par le SIM (Sistema Interamericano de Metrologia) sur la métrologie légale dans les pays d'Amérique Latine et sur les instruments de mesure médicaux, une Assemblée Générale du SIM et une réunion du Conseil de Développement de l'OIML;
- à Séoul (République de Corée) en 1998.

Le BIML exprime sa reconnaissance profonde et ses remerciements aux hôtes canadiens pour leur organisation efficace de la Conférence et des diverses réunions (CIML, commissions, table ronde), et également pour les occasions offertes aux délégués de découvrir la beauté et la diversité géographique de la ville de Vancouver, et la chaleureuse hospitalité des Canadiens. ■

INTERNATIONAL EXCHANGE

The OIML round table on "Accreditation"

TENTH INTERNATIONAL CONFERENCE
OIML
4 - 8 NOVEMBER 1996 - VANCOUVER, CANADA

VANCOUVER, 7th November 1996

Following the success of the 1995 round table on "Confidence in type approval", held in Beijing in conjunction with the 30th CIML meeting, the OIML decided to organize a second such event during the 10th International Conference of Legal Metrology in Vancouver last November.

The objective of this second round table was primarily to explore in some depth the complex but necessarily important subject of accreditation, whilst providing some answers to points arising from the first round table.

What should OIML policy be concerning accreditation? And in which way could the OIML increase its interaction with accreditation bodies such as ILAC and EAL?

Following Mr. G. J. Faber's opening address as President of the CIML, the Chairman of the round table, Mr. Alan Johnston (Canada) requested Mr. Van de Leemput (who, as Secretary of ILAC '96, represented this Organization at the Conference together with Mrs. Collins (USA), ILAC Vice-President) to outline the structure, operation and objectives of ILAC together with future plans for development.

The new ILAC

At its recent conference in Amsterdam, ILAC established itself as a formal international Organization - the International Laboratory Accreditation Cooperation. It was explained that the "C" in the acronym previously stood for "Conference" and had been changed to "Cooperation" in line with new policy. Initially, 43 Members from 41 countries signed the Memorandum of Understanding which created the new entity. One of the motivating factors in taking this step was to facilitate communication and co-operation with other more formally established bodies such as OIML and BIPM.

ILAC will develop structures to enable it to make corporate decisions, develop corporate positions and policies, and be represented as an identifiable entity in various international and regional fora. Its inability to fully participate at this level in the past has inhibited realization of its full potential.

An international panel led discussions on accreditation. Pictured from left to right: J-F. Magana (France), S. Bennett (UK), A. Johnston (Canada), P. Van de Leemput (Netherlands)

Memorandum of Understanding

The MoU creates a more formal framework within which this activity can be focused. The new ILAC has:

- an Executive Committee with responsibility for the management of ILAC. Its consists of nine members, with representation from accreditation bodies throughout the world, the Chairmen of Committees and the laboratory community;

- 3 standing committees for
- accreditation policy development (multi-lateral agreements and their legal implications, etc.);
- technical issues (general issues such as traceability, qualification of assessors, etc.);
- public relations (this third committee is responsible for publishing ILAC documents and equally for liaison with laboratories and public affairs).

ILAC main aims

The new ILAC essentially has the same charter and objectives as in the past, namely to encourage international harmonization of practices in accreditation and to promote the acceptance of reports and certificates from accredited laboratories and inspection bodies.

It also promotes mutual recognition agreements between members as an important element in the achievement of these objectives. In fact, ILAC has decided not to create a world-wide multi-lateral agreement, but rather to encourage the establishment of regional multilateral agreements, for reasons of cost and time efficiency.

Round table discussions

Seton Bennett, who chaired the round table last year, reminded participants that accreditation is a useful tool for creating confidence: at national level, an accreditation system should create a degree of transparency, and at international level it should be optional, and sufficiently flexible to avoid the creation of a "club" of elite accreditation bodies or accredited laboratories.

Accreditation simply constitutes an "added value" tool which should be used in a flexible way. But an important issue to determine is whether the additional cost arising from accreditation procedures is justified.

Jean-François Magana (CIML Member for France) agreed with Mr. Bennett's views and added that accreditation bodies work towards the assessment of a laboratory by means of comparison with reference standards laid down, but that they should not constitute a "superior authority" having signatory powers for signing mutual agreements.

Mr. Magana also mentioned that in France, accreditation is in addition used as a tool for selecting private bodies that have certain specific know-how in given fields - i.e. when there exists a large number of laboratories, the authority does not have sufficient time to examine the capabilities of each one. So the authority delegates this task to the accreditation body, having first defined the requisite reference criteria. Mr. Magana concluded by stating that accreditation is an excellent means of increasing confidence between geographically distant laboratories.

Reference standards used

- *ISO/IEC Guide 25 (currently being revised).* This Guide is referred to during the assessment of the technical competence of laboratories.
- *ISO/IEC Guide 58.* Used for peer evaluations, i.e. international teams of experts who evaluate the activities of other accreditation bodies.
- *ISO 9000 series.* Used for the assessment of the quality management systems.

An important conclusion of the round table was that there should not exist a conflict between applicable reference standards. On the contrary, a coherent system should be in place which harmonizes the different concepts or philosophies. In addition, it was recognized that there is a need for clarification and revision:

Mrs. B. L. Collins, Vice-President of ILAC, presented her views on accreditation issues at the Conference.

- Which reference standards should be applied? For example, a national authority responsible for granting pattern approvals of measuring instruments is considered by certain countries as being a body having responsibility for product certification activity, and by others as a testing laboratory.
- Revision of ISO/IEC Guide 25. The section of this Guide which deals with the quality system (quality management) should be expanded in order to better clarify its applicability in a wider range of testing services. This can be done by making clear references to the applicable requirements of the ISO 9000 series and introducing additional requirements where needed. These modifications should be written in terms that are understandable to laboratory staff, and should be structured in line with the characteristics of the testing and calibration processes rather than the generic production process.

Note: OIML has participated in the revision of Guide 25 in order to ensure its application to legal metrology control laboratories.

Who will benefit from accreditation?

A large majority of the participants held the view that accreditation presents many advantages for:

- laboratories, which once accredited, are recognized at national or even at international level, since they must comply with certain stringent levels of performance;
- clients, who (as explained by CECIP) can equally rest assured that the accredited bodies, laboratories or manufacturers are capable of respecting the requirements laid down by a given set of international reference standards.

Policy for the future

OIML has been formally represented at every ILAC Conference since 1977 and at a number of meetings of technical working groups. Both OIML and ILAC wish to foster and develop this long-held relationship and will welcome requests for participation in relevant committees and technical activities.

A resolution was passed at the Conference to this effect:

The International Conference recognizes the importance of the issues raised during the round table discussion on accreditation held on 7 November 1996; appreciates the participation of a representative of ILAC in those discussions; instructs the CIML to give further consideration to these issues and to develop closer cooperation with ILAC. ■

The newly appointed Chairman of ILAC is Mr. John Gilmour, Chief Executive of NATA, Australia and the secretariat will be held for an initial period to the end of 1998 within NATA. The address is:
ILAC Secretariat, 7 Leeds Street, Rhodes NSW 2138, Australia.
Tel: 61 2 97 36 82 22. Fax: 61 2 97 43 59 80.

En bref: La table ronde OIML sur l'accréditation

Suite au succès de la table ronde de 1995 "Confiance dans les approbations de modèle", tenue à Pékin en liaison avec la 30ème réunion du CIML, l'OIML a décidé d'organiser un événement similaire pendant la 10ème Conférence Internationale de Métrologie Légale, tenue à Vancouver en novembre dernier.

Après le discours d'ouverture de M. G.J. Faber, Président du CIML, le Président de la table ronde, M. Alan Johnston (Canada) a demandé à M. Van de Leemput de présenter l'ILAC et sa politique.

Lors de sa récente conférence à Amsterdam, l'ILAC a été établie formellement en tant qu'Organisation Internationale: *International Laboratory Accreditation Cooperation*. Initialement, 43 membres de 41 pays ont signé le *MoU*.

Le nouvel ILAC est composé d'un Comité Exécutif et de 3 comités spécialisés sur:

- le développement de la politique d'accréditation;
- les questions techniques;
- les relations publiques et la publication de documents ILAC.

ILAC: objectifs principaux

Le nouvel ILAC a essentiellement le même statut et les mêmes buts que par le passé, c'est-à-dire encourager l'harmonisation internationale des pratiques d'accréditation et promouvoir l'acceptation des rapports et certificats émis par des laboratoires et organismes d'inspection accrédités. Sont également encouragés les accords de reconnaissance mutuelle entre membres. L'ILAC a décidé de ne pas créer un accord multilatéral unique, mais plutôt d'encourager l'établissement d'accords multilatéraux régionaux (moindre coût et gain de temps).

Accréditation - un outil utile pour tous

Seton Bennett, qui avait présidé la table ronde l'année dernière, a rappelé aux participants que l'accréditation est un outil utile pour créer la confiance: au niveau national, un système d'accréditation favorise la transparence et au niveau international, celui-ci doit rester suffisamment flexible pour éviter la création d'un "club" d'organismes d'accréditation ou d'une "élite" de laboratoires accrédités.

La plupart des experts ont estimé que l'accréditation est utile et présente de nombreux avantages pour:

- les laboratoires qui, après avoir été accrédités, sont reconnus au niveau national et même international;
- les clients eux-mêmes qui, comme l'a précisé le CECIP, ont l'assurance que les organismes, les laboratoires ou les fabricants accrédités respectent les exigences sévères des référentiels internationaux applicables (Guides ISO/CEI 25 ou 58, ISO 9000, etc.).

La Conférence a pris la résolution:

La Conférence Internationale de Métrologie Légale:
Reconnaît l'importance des discussions soulevées lors de la table ronde sur l'accréditation;
A apprécié la participation d'un représentant de l'ILAC à cette discussion;
Charge le CIML de donner suite à ces discussions et de développer une coopération plus étroite avec ILAC. ■

M. A. Johnston, Canada, a présidé la table ronde sur l'accréditation.

MEETINGS

activities
OIML
activités

REUNIONS

INTERNATIONAL COMMITTEE OF LEGAL METROLOGY

The International Committee of Legal Metrology held its 31st meeting on 4th and 8th November 1996.

The meeting, hosted by Industry Canada in conjunction with the Tenth International Conference of Legal Metrology, took place in the conference rooms of the Pan Pacific Hotel, Vancouver, Canada.

Participation: More than 90 people, representing 41 of the 54 OIML Member States.

Mr. G. J. Faber presided over the discussions, which led the Committee in making the following decisions:

Main points

- The Committee accepts the proposals of its President concerning the organization, presidency and agenda of the 10th International Conference of Legal Metrology.

- Three new categories of measuring instruments will be covered by the OIML Certificate System in the near future:
  - continuous totalizing automatic weighing instruments (OIML R 50), as soon as the test procedures and test report format have been issued;
  - sound level meters (OIML R 58) and integrating-averaging sound level meters (OIML R 88), as soon as these Recommendations have been issued.

- *Technical activities:*
  - new work project within OIML subcommittee TC 9/SC 4 *Densities:* hierarchy scheme for density measuring instruments.
  - exceptional acceptance of the joint responsibility of two countries (France and Belgium) for the OIML TC 8/SC 7 (*Gas metering*) secretariat.

- Election of a new BIML Assistant Director, Mr. A. Szilvássy, Hungary, who will replace Mr. A. Vichenkov when the latter's contract expires.

- The next CIML meetings will take place in Rio (Brazil) from 27th to 31st October 1997 and in Seoul (Republic of Korea) either at the end of October or beginning of November 1998.

Presidential Table: *Left to right:* Mr. B. Athané, Director of BIML; Mr. G. J. Faber, President of CIML; Mr. K. Birkeland, Past CIML President

COMITE INTERNATIONAL DE METROLOGIE LEGALE

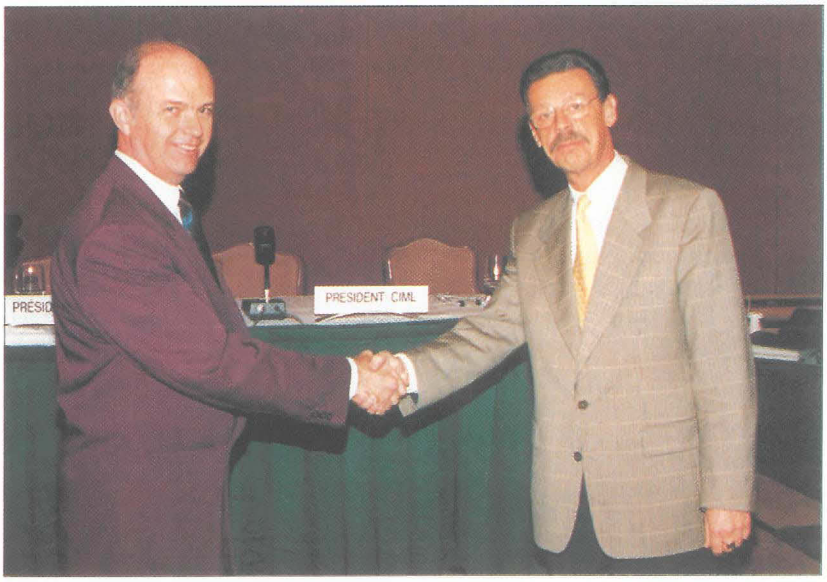
Le Comité International de Métrologie Légale a tenu sa 31ème réunion les 4 et 8 novembre 1996, en conjonction avec la 10ème Conférence Internationale de Métrologie Légale, sur invitation du gouvernement canadien, dans les locaux du Pan Pacific Hotel à Vancouver.

Participation: plus de 90 personnes représentant 41 des 54 Etats Membres de l'OIML.

Monsieur G. Faber a présidé les débats qui ont permis au Comité de prendre les décisions suivantes:

Points principaux

- Le Comité a accepté les propositions de son Président, concernant l'organisation, la présidence et l'ordre du jour de la 10ème Conférence Internationale de Métrologie Légale.
- Trois nouvelles catégories d'instruments de mesure entreront dans le Système de Certificats OIML dans un avenir proche:
  - les instruments de pesage totalisateurs continus à fonctionnement automatique (OIML R 50), dès la publication des procédures d'essai et du format des rapports d'essai;
  - les sonomètres (OIML R 58) et les sonomètres intégrateurs-moyenneurs (OIML R 88), dès la publication des Recommandations les concernant.
- *Activités techniques:*
  - nouveau projet de travail pour le sous-comité OIML TC 9/SC 4 *Masses volumiques*: schéma de hiérarchie pour les instruments de mesure de la masse volumique;
  - acceptation exceptionnelle de l'attribution d'un secrétariat à deux pays (France et Belgique) responsables pour le sous-comité OIML TC 8/SC 7 *Mesurage des gaz.*
- Élection d'un Adjoint au Directeur du BIML, Monsieur A. Szilvássy, Hongrie, qui remplacera M. A. Vichenkov au terme de son contrat.
- Les prochaines réunions du CIML auront lieu à Rio (Brésil) du 27 au 31 octobre 1997 et à Séoul (République de Corée) fin octobre ou début novembre 1998.



M. G. J. Faber félicite M. A. Szilvássy, élu Adjoint au Directeur du BIML
Mr. G. J. Faber congratulates Mr. A. Szilvássy, elected Assistant Director of the BIML

TC 7/SC 5

Dimensional measuring instruments

Secretariat: Australia

The National Standards Commission, Australia, hosted a meeting of OIML TC 7/SC 5 in conjunction with the National Institute of Standards and Technology, USA at NIST, Gaithersburg (USA) from 28 to 30 October 1996.

Chairman: Mr. Ian Hoerlein, NSC

Participation: Delegates representing 5 P-Members and 1 O-Member attended the meeting. In addition, 11 delegates attended representing CECIP and other manufacturers and users.

Main points: The meeting discussed the second committee draft, *Multi-dimensional Measuring Instruments*, published in March 1996, and comments submitted by members of the working party. The main topics discussed were:

- definitions including dimensional weight;
- minimum dimension;
- fraudulent use;
- zero and tare requirements;
- indicating and printing devices;

- markings and sealing;
- laboratory tests including ambient light, acoustic and air pressure tests;
- limitations of objects to be measured;
- test report.

Satisfactory conclusions were reached on all of the above except for the special laboratory tests. A working party was set up to investigate requirements for these tests and to report to the secretariat by March 1997. The minutes of the meeting will be distributed to the members of the sub-committee by the end of November 1996 with comments / agreement to be returned to the secretariat by the end of January 1997. A draft will then be prepared for voting by the P–Members and distributed by April / May 1997. The need for another meeting will then be decided.

TC 7/SC 5

Instruments de mesures dimensionnelles

Secrétariat: Australie

Le *National Standards Commission*, Australie, a organisé une réunion du sous-comité technique OIML TC 7/SC 5 au National Institute of Standards and Technology (NIST), à Gaithersburg (USA) du 28 au 30 octobre 1996.

Président: M. Ian Hoerlein, NSC

Participation: Délégués représentant 5 pays membres–P et 1 pays membre–O; 11 délégués supplémentaires représentant le CECIP, des constructeurs et des utilisateurs.

Points principaux: Le deuxième projet de comité *Instruments de mesures dimensionnelles,* établi en mars 1996, a été discuté lors de la réunion, ainsi que les commentaires soumis par les membres du groupe de travail. Les points principaux étaient:

- définitions, y compris le poids dimensionnel;
- dimension minimale;
- usage frauduleux;
- exigences pour le zéro et la tare;
- dispositifs indicateurs et imprimeurs;
- marques et scellement;
- essais en laboratoire y compris les essais de lumière ambiante, les essais acoustiques et les essais de pression de l'air;
- limitations des objets à mesurer;
- rapport d'essai.

Des conclusions satisfaisantes ont été tirées sur les points ci-dessus à l'exception des essais spéciaux en laboratoire. Un groupe de travail a été constitué afin d'examiner les exigences pour ces essais, qui rendra compte au secrétariat en mars 1997. Le compte rendu de cette réunion sera distribué aux membres du sous-comité à la fin du mois de novembre 1996; d'éventuels commentaires / avis positifs sont à communiquer au secrétariat avant la fin du mois de janvier 1997. Un projet sera alors préparé en vue d'un vote par les membres-P et distribué en avril / mai 1997. Une décision sera alors prise sur la nécessité de tenir une réunion supplémentaire.

Contact information:
Mr. Ian Hoerlein,
Head Trade Measurement,
National Standards Commission (NSC),
12 Lyonpark Road, North Ryde
NSW 2113, Australia.
Tel: 61 2 9888 3922
Fax: 61 2 9888 3033.

TC 7/SC 5 - Informations

Nous rappelons à nos lecteurs qu'un article de Nathalie Dupuis-Désormeaux a été publié (en anglais seulement) dans le Bulletin de janvier 1996 sur les dispositifs de mesures multi-dimensionnelles. Nous en reprenons ci-dessous quelques idées.

Dans un marché en pleine expansion, ces instruments sont de plus en plus utilisés pour mesurer rapidement les dimensions d'objets afin d'en déterminer les tarifs de fret, de frais postaux et de stockage.

Les autorités compétentes pour ce type d'instrument ont donc mis en place des exigences techniques et des essais au niveau national ou régional (par exemple: coopération USA-Canada).

Afin d'éviter que ces exigences et procédures d'essai ne divergent d'un pays à l'autre et que ne se créent de nouvelles barrières techniques aux échanges, il est essentiel de les harmoniser au niveau international.

C'est dans cette optique que le sous-comité OIML TC 7/SC 5 a été créé en 1993 et poursuit ses travaux actuellement.

Mr. I. Hoerlein - Chairman, OIML TC 7/SC 5

Atelier OIML

PRACTICAL TEST PROCEDURES

FOR CLASSES E_1 TO M_3 WEIGHTS

2 - 4 OCTOBER 1996 - BORÅS, SWEDEN

OIML Workshop

Procédures pratiques d'essai des poids des classes E_1 à M_3

La Recommandation OIML R 111 *Poids des classes E_1, E_2, F_1, F_2, M_1, M_2, M_3*, approuvée par le CIML en 1993 et publiée en 1994, avait été développée avec un double objectif: réunir les anciennes Recommandations R 1, R 2, R 20 et R 25 en un seul texte synthétique et réviser l'ensemble des exigences afin de répondre aux impératifs actuels de qualité métrologique des poids.

Il manquait donc deux éléments essentiels pour garantir une mise en application et une interprétation correctes des prescriptions de la Recommandation: des procédures d'essai et un format du rapport d'essai harmonisés.

Le travail de rédaction d'un projet a été confié au Groupe des Pays Nordiques, qui avait déjà réalisé avec succès un tel projet préliminaire pour les instruments de pesage à fonctionnement non automatique (OIML R 76) avant de le transmettre comme 1er projet de comité au TC 9/SC 1.

Presentation
by Håkan Källgren

Welcome address
by Hans Anderson

L'atelier OIML *Procédures pratiques d'essai des poids des classes E_1 à M_3*, organisé conjointement par l'OIML et le groupe des pays nordiques, a présenté pour la première fois au niveau international ce projet de procédures d'essai et de format de rapport d'essai, fruit d'un travail appréciable, de nombreuses réunions et d'une intercomparaison effectués par les pays nordiques.

Il s'agissait donc de réunir un certain nombre de scientifiques spécialistes, de métrologistes, de vérificateurs, de techniciens de laboratoire et de constructeurs afin d'étudier et de mettre en application les exigences de la Recommandation OIML R 111, et d'effectuer les mesures dans des laboratoires spécialisés en suivant les procédures d'essai proposées ainsi que le format de rapport d'essai.

Practical test procedures for classes E_1 to M_3 weights

OIML Recommendation R 111 *Weights of classes E_1, E_2, F_1, F_2, M_1, M_2, M_3*, which was approved by the CIML in 1993 and published in 1994, had been developed with a twofold objective: firstly to group together the old Recommendations R 1, R 2, R 20 and R 25 in one single concise text and secondly to revise all of the requirements in order to respond to current metrological quality imperatives for weights.

However, two essential elements were lacking in order to guarantee the correct implementation and interpretation of the requirements of the Recommendation: harmonized test procedures and a test report format.

The task of drawing up a project was allocated to the Nordic Countries Group; this Group had already previously successfully concluded a preliminary project concerning nonautomatic weighing instruments (OIML R 76) prior to sending it to TC 9/SC 1 in the form of a 1st committee draft.

The OIML Workshop *Practical test procedures for classes E_1 to M_3 weights*, which was jointly organized by OIML and the Nordic Countries Group, presented this test procedures and test report format project for the very first time at international level; the project is the result of a considerable amount of work, numerous meetings and inter-comparison on the part of the Nordic Countries.

Workshop participants during a plenary session

The objective was, therefore, to bring together a certain number of scientific specialists, metrologists, verification officers, laboratory technicians and manufacturers in order to study and implement the requirements of OIML Recommendation R 111, and carry out measurements in specialized laboratories according to the test procedures and test report format proposed.

Programme:

1er jour - mercredi 2 octobre 1996

Matin:

- Discours d'ouverture par Hans Anderson, Directeur Technique de l'Institut National Suédois d'Essai des matériaux et de Recherches (SP) qui accueillait l'atelier.
- Présentation de l'OIML par Philippe Degavre, Adjoint au Directeur, BIML.
- Le projet du groupe des pays nordiques par Thor Myklebust, Service de Métrologie et d'Accréditation, Norvège.
- Introduction à la Recommandation OIML R 111 par Håkan Källgren, Chef de la Section Masse, SP, Suède.
- Détermination de la densité par Peter Lau, SP, Suède.
- Le magnétisme et ses influences par Thor Myklebust, Ingénieur Principal, Service de Métrologie et d'Accréditation, Norvège.

Après-midi:

- Préparation et exercice (3 heures).
- Procédures d'essai des poids E_1 au Bureau de vérification de Brandenburg par G. Missuweit, Allemagne.

Visite du musée de Borås et réception offerte par la ville - Conférence de Fredrik Lindgren, Vice-Président du Conseil Communal de Borås.

2ème jour - jeudi 3 octobre 1996

Matin:

- Étalonnage des poids par Kari Riski, Centre pour la Métrologie et l'Accréditation, Finlande.
- Préparation et exercice (3 heures).

Après-midi:

- Les incertitudes de mesures par Leslie Pendrill, SP, Suède.
- Préparation et exercice (3 heures).
- Contrôle automatique des poids de 20 kg à 50 kg en grand nombre par Arend Helms, MSES GmbH, Allemagne.
- Processus statistique de mesure utilisé pour l'obtention d'un niveau de confiance adéquat dans les processus de mesures par Marcus Harwitz, Troemner Inc, USA.

Dîner offert par l'OIML

1st day - Wednesday 2 October 1996

Morning:

- Opening speech by Hans Anderson, Technical Director of the Swedish National Testing and Research Institute (SP), which hosted the Workshop.
- Presentation of the OIML by Philippe Degavre, Assistant Director, BIML.
- Nordic Countries Group project, by Thor Myklebust, Norway Metrology and Accreditation Service.
- Introduction to OIML Recommendation R 111 by Håkan Källgren, Head of Mass Section, SP, Sweden.
- Determination of density, by Peter Lau, SP, Sweden.
- Magnetic properties and their influence, by Thor Myklebust, Senior Engineer, Norway Metrology and Accreditation Service.

Afternoon:

- Preparation and exercise (3 hours).
- Test procedures for E_1 weights at the Brandenburg Verification Bureau, Germany, by G. Missuweit.

Visit of the Borås museum and reception offered by the town - Conference by Fredrik Lindgren, Vice-President of the Borås County Council.

2nd day - Thursday 3 October 1996

Morning:

- Calibration of weights, by Kari Riski, Center for Metrology and Accreditation, Finland.
- Preparation and exercise (3 hours).

Afternoon:

- Uncertainties in measurements, by Leslie Pendrill, SP, Sweden.
- Preparation and exercise (3 hours).
- Automatic control of weights from 20 kg to 50 kg in large numbers, by Arend Helms, MSES GmbH, Germany.
- Statistical process measurement assurance used to ensure adequate confidence in the measurement process by Marcus Harwitz, Troemner Inc, USA.

Dinner offered by OIML

Programme (cont'd):

3ème jour - vendredi 4 octobre 1996

Matin:

- L'intercomparaison des pays nordiques sur la Recommandation OIML R 111 par Esten Koren, Service de Métrologie et d'Accréditation, Norvège.
- Préparation et exercice (3 heures).

Après-midi:

- Discussions des résultats de chaque groupe et évaluation de l'atelier.

Left to Right: P. Lau, Z. Jabbour, A. Ebbesson (CIML Member for Sweden) in the density laboratory

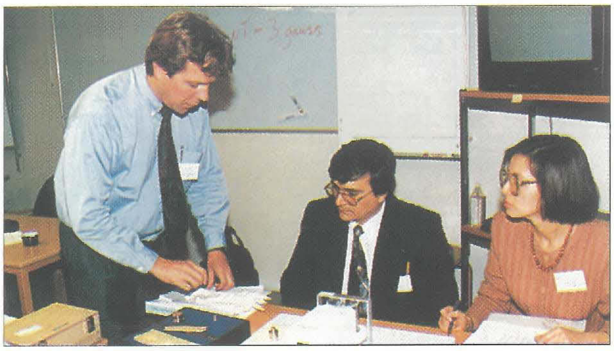
3rd day - Friday 4 October 1996

Morning:

- Inter-comparison of the Nordic countries on Recommendation OIML R 111 by Esten Koren, Norwegian Metrology and Accreditation Service.
- Preparation and exercise (3 hours).

Afternoon:

- Discussions on the results of each group and evaluation of the Workshop.



Left to right: T. Myklebust (Norway), J. Dajes (Peru), I. Milkamanaviciené (Lithuania) - magnetic susceptibility

Plus de 50 experts en provenance de 22 pays (voir liste) ont participé activement à cet atelier qui, pour la première fois, a permis à un large groupe d'experts internationaux de tester des procédures d'essai et un rapport d'essai avant même que ces textes ne soient discutés formellement au sein du comité technique OIML (en l'occurrence TC 9/SC 3). Toutes les nouvelles exigences définies dans la Recommandation OIML R 111 ont été examinées avec soin, en particulier dans les domaines des 4 exercices effectués en laboratoire:

R. Nater - Switzerland

More than 50 experts from 22 countries (see list) actively participated in this workshop which, for the first time, allowed a large group of international experts to assess test procedures and a test report format even before these texts are formally discussed by an OIML technical committee (in this case TC 9/SC 3). All the new requirements defined in OIML Recommendation R 111 have been carefully examined, particularly in the 4 fields of the exercises carried out in the laboratory:

22 Participants:

Albania	**France**	**Norway**	**Switzerland**
Brazil	**Germany**	**Peru**	**United Kingdom**
Czech Republic	**Ghana**	**Poland**	**United States of America**
Denmark	**Italy**	**South Africa**	**Yugoslavia**
Estonia	**Lithuania**	**Spain**	
Finland	**Netherlands**	**Sweden**	

- Étalonnage des poids et calcul des incertitudes
- Propriétés magnétiques des poids et leur mesure
- Détermination de la masse volumique
- État de surface et liste de contrôle (construction, marques, etc.)

Les discussions ont permis des échanges de vues très fructueux entre experts de métrologie scientifique et de métrologie légale d'une part, et avec les constructeurs de poids et d'instruments de pesage d'autre part. Une exposition permanente était également organisée par ces derniers, qui avaient également prêté un grande partie du matériel de laboratoire nécessaire aux travaux pratiques.

Left to right: E. Koren (Norway), D. Wohlers (Sweden), M. Madec (France), J. Verbeek (Netherlands)

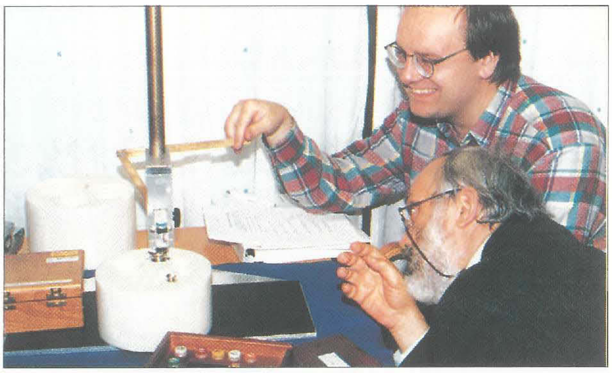
Conclusions et remerciements

Cet atelier fut un succès tant par la qualité des exposés que par l'excellent niveau des compétences des participants et leur volonté de progresser dans ce domaine particulier de la métrologie des masses, en constante évolution grâce aux considérables progrès technologiques.

Le BIML souhaite remercier le groupe des pays nordiques pour son remarquable travail de préparation des exposés et des travaux pratiques; il exprime son appréciation au SP et en particulier à Håkan Källgren, Chef de la Section Masse au SP, qui a parfaitement organisé ce séminaire à Borås: plus de 12 agents du SP ont été mobilisés pendant les trois jours pour aider à l'organisation des travaux pratiques et au secrétariat (Mme Birgitta Hammarström n'a pas ménagé ses efforts). Que soient aussi remerciés la ville de Borås et Fredrik Lindgren, Vice-Président du Conseil Communal, pour son accueil chaleureux lors de la réception suivie de la visite du musée de la ville mercredi soir, ainsi que Peter Lau, qui a eu la bonne idée de faire venir la chorale de Borås à la fin du dîner offert par l'OIML pour un concert surprise qui nous a fait découvrir la beauté des chants typiques du répertoire nordique. ■

- Calibration of weights and calculation of uncertainties
- Magnetic properties of weights and their measurements
- Determination of voluminal mass
- Surface roughness and checklist (construction, marks, etc.)

Highly constructive exchanges of points of view resulted from the discussions between scientific metrology and legal metrology experts on the one hand, and manufacturers of weights and weighing instruments on the other hand. The latter also organized a permanent display and had in addition lent most of the laboratory equipment necessary for the practical work sessions.



Front: M. Mosca (Italy); back: C. Persson (Sweden). Magnetic properties of weights: attraction method

Conclusions and acknowledgments

This Workshop was a success due not only to the quality of the presentations but also due to the outstanding level of competence of those who participated, coupled with their desire to progress in the specific domain of weights metrology, a field which is constantly evolving thanks to the considerable technological progress made.

The BIML wishes to express its thanks to the Nordic Group of Countries for its remarkable work in preparing the presentations and practical work; it also extends its appreciation to the SP, in particular to Håkan Källgren (Head of the Mass Section), who perfectly organized the Borås Workshop: more than 12 SP agents were mobilized during the three days to assist with organizing the practical sessions and the secretarial work (Mrs. Birgitta Hammarström worked particularly hard). We would also like to thank the town of Borås and Fredrik Lindgren, Vice-President of the County Council, for his warm welcome during the reception which was followed by a visit to the town's museum on Wednesday evening, and also Peter Lau, who had the good idea of inviting the Borås choir which allowed us to discover the beauty of typical Nordic songs during a surprise concert at the end of the dinner offered by OIML. ■

activités OIML activités

International Bureau of Legal Metrology

Report on activities: November 1995 – October 1996

Follow-up on the 30th CIML Meeting

- Editing and distribution of the "Decisions and Resolutions"
- Editing and distribution of the minutes
- Implementation of the decisions (see detailed information below under the various headings)

Presidential Council

- Organization of a meeting in Paris

Preparations for the 10th Conference and the 31st CIML Meeting

- Papers and arrangements for the meetings in liaison with the Canadian administration (see detailed information below under the various headings)

Development Council

- Editing and distribution of the conclusions of the October 1995 meeting and of the CIML Symposium on this subject
- Development of a work program for 1996–1997
- Preparation of discussions at the 10th Conference
- Contacts with various persons and organisms

Technical Committees and subcommittees

- Inquiries for annual reports
- Follow-up on certain activities (see participation in meetings, below)
- Reports on 1993–1996 activities and implementation of Recommendations, for the 10th Conference

Participation in OIML technical meetings

- TC 9 and TC 9/SC 2 (Braunschweig, May 1996)
- TC 8/SC 7 (Brussels, June 1996)
- Workshop on weights, jointly organized by BIML and the "Nordic Group" (Borås, October 1996)

Certification

- Organization of a TAG_{cert} meeting (Paris, February 1996); minutes; implementation of certain conclusions
- Follow-up of certification activities; registration of certificates; Members information
- Report on certification for the 10th Conference

Technical publications

- Editing, translation, publication and distribution of a dozen texts (International Recommendations and Documents, leaflets) in French and in English
- Editing and translation of texts for future publications
- Study on a new layout of Recommendations (in progress)
- Study with a view to DTP production of publications by the BIML

OIML Bulletin

- Production of four quaterly issues (now completely produced by the BIML using in-house DTP)

Computers

- Study on the development of data-bases; Internet liaison and e-mail (in progress)

Activities in liaison with certain Members

- PTB/DAM/OIML workshop on checking net content in packages (Munich, May 1996)

Liaisons with other institutions (including participation in meetings)

- BIPM (numerous contacts with the Director - Organization of a meeting of the BIPM/OIML group at BIML in September 1996)
- ILAC
- IMEKO and IMEKO TC 11
- ISO (General Assembly - DEVCO - CASCO - TAG 4)
- UNIDO
- APLMF
- COOMET
- EAL
- ECE-UNO
- EUROMET
- WELMEC

Note on the Second Meeting of the Joint Working Group of the *Convention du Mètre* and the OIML, held at the BIML on 27 September 1996.

The second meeting of the joint working group of the *Convention du Mètre* and the OIML foreseen by the parallel Resolutions of the CGPM and of the CIML took place on 27 September 1996. At the invitation of the President of the CIML, the meeting was held at the Bureau International de Métrologie Légale. Present were:

Convention du Mètre: D. Kind (President of the CIPM), J. Kovalevsky (Secretary and elected President of the CIPM), W. R. Blevin (Vice-President and elected Secretary of the CIPM), K. Iizuka (Vice-President of the CIPM) and T. J. Quinn (Director of the BIPM).

OIML: G. Faber (President of the CIML), S. Chappell (Vice-President of the CIML), M. Kochsiek (Vice-President of the CIML), J. Birch (member of the Presidential Council of the CIML) and B. Athané (Director of the BIML).

The working group reviewed the events that took place since the first meeting in February 1996. During the CIPM meeting held in September 1996, it was concluded that merging the two organizations would not result in a gain in efficiency nor in a significant saving in cost to member states, mainly because of the fundamental difference in scope and objectives of the two organizations and the absence of significant overlap in their activities. The OIML's position in this respect would not be established before the 10th OIML Conference in November 1996.

However, it was recognized that increased cooperation between the two organizations on well identified topics would serve the present and future needs of metrology. In this respect, information was given concerning the finalization of a report on *National and International Needs relating to Metrology* recently presented to the CIPM, and of plans for reorientating and extending the activities of the BIPM and of the Consultative Committees attached to the CIPM.

At the next meeting of the joint working group, scheduled for 19 February 1997, discussions will focus on practical possibilities for closer cooperation between the two organizations; matters of cooperation with other international bodies (in particular ILAC) are also intended to be addressed.

B. ATHANÉ
BIML Director / Directeur du BIML

Note sur la Seconde Réunion du Groupe de Travail Commun de la Convention du Mètre et de l'OIML, tenue au BIML le 27 septembre 1996.

La seconde réunion du groupe de travail commun de la Convention du Mètre et de l'OIML prévue par les Résolutions parallèles de la CGPM et du CIML a eu lieu le 27 Septembre 1996. À l'invitation du Président du CIML, la réunion s'est tenue au Bureau International de Métrologie Légale. Étaient présents:

Convention du Mètre: D. Kind (Président du CIPM), J. Kovalevsky (Secrétaire et Président élu du CIPM), W. R. Blevin (Vice-Président et Secrétaire élu du CIPM), K. Iizuka (Vice-Président du CIPM) et T. J. Quinn (Directeur du BIPM).

OIML: G. Faber (Président du CIML), S. Chappell (Vice-Président du CIML), M. Kochsiek (Vice-Président du CIML), J. Birch (membre du Conseil de la Présidence du CIML) et B. Athané (Directeur du BIML).

Le groupe de travail a passé en revue les événements qui se sont déroulés depuis la première réunion en février 1996. Lors de la réunion du CIPM tenue en septembre 1996, il a été conclu qu'une fusion des deux organisations ne résulterait ni en une plus grande efficacité ni en des économies significatives pour les états membres, en raison principalement des différences fondamentales dans les responsabilités et objectifs des deux organisations et de l'absence de recouvrements significatifs dans leurs activités. La position de l'OIML à ce sujet ne sera pas établie avant la 10e Conférence de l'OIML en novembre 1996.

Il a cependant été reconnu qu'une coopération accrue entre les deux organisations sur des sujets bien identifiés satisferait les besoins présents et futurs de la métrologie. À ce sujet, des informations ont été données sur la mise au point d'un rapport sur les *Besoins nationaux et internationaux en matière de métrologie* récemment présenté au CIPM, et sur les réorientations et développements des activités du BIPM et des Comités Consultatifs rattachés au CIPM.

À la prochaine réunion du groupe commun, prévue pour le 19 février 1997, les discussions se concentreront sur les possibilités pratiques de coopération accrue entre les deux organisations; il est également prévu d'aborder les questions de coopération avec d'autres organismes internationaux (ILAC en particulier).

T. J. QUINN
BIPM Director / Directeur du BIPM

REGISTERED OIML CERTIFICATES - *CERTIFICATS OIML ENREGISTRÉS*

1996.09 - 1996.11

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

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

Issuing authority / *Autorité de délivrance*

Physikalisch-Technische Bundesanstalt (PTB), Germany

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

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

R 76/1992 - DE - 93.01
Sartorius AG
Weender Landstraße 94-108, D-37075 Göttingen, Germany
BA BA 200, BA BB 200, ...

OIML Recommendation applicable within the System / Year of publication

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

Year of issue
Année de délivrance

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

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

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

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

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

R 51 (1996)

Issuing Authority / Autorité de délivrance

Physikalisch-Technische Bundesanstalt (PTB), Germany

R51/1996-DE-96.01
Tamtron Oy, Vehnämyllynkatu 18, FIN - 33700 Tampere, Finland

Type PKV, Max ≥ 2000 kg, e ≥ 20 kg, Min ≥ 200 kg, n ≤ 300

INSTRUMENT CATEGORY
CATÉGORIE D'INSTRUMENT

Load cells
Cellules de pesée

R 60 (1991), Annex A (1993)

Issuing Authority / Autorité de délivrance

Danish Agency for Development of Trade and Industry, Denmark

R60/1991-DK-96.04
Cardinal Scale Manufacturing Co., 203 East Daugherty St., Webb City, Missouri 64870, USA

Bellows load cell type CB6 (Class C)

R60/1991-DK-96.05
Cardinal Scale Manufacturing Co., 203 East Daugherty St., Webb City, Missouri 64870, USA

Compression load cell model SCA (Class C)

- **Issuing Authority / Autorité de délivrance**

  National Weights and Measures Laboratory (NWML), UNITED KINGDOM

R60/1991-GB-96.03
Transdutec S.A., C/ Joan Miró 11, 08930 - Sant Adrià de Besós, Barcelona, Spain

Load Cell Model GS-1A (Class C)

R60/1991-GB-96.04
Veccer Ltd., 5 Trafford Road, Reading, Berkshire, RG1 8JP, Great Britain

Load Cell Model No KOE 5593 (Class C)

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**

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

R76/1992-NL-95.25 Rev. 1
Teraoka Seiko Co., Ltd., 12-13 Kugahara, 5-Chome, Otha-ku, Tokyo 146, Japan

DC-150 (Class III)

R76/1992-NL-96.09
A&D Instruments Ltd., Abingdon Science Park, Abingdon, Oxford, OX14 3YS, Great Britain

HV.. and HW.. (Classes III and IIII)

R76/1992-NL-96.10
Yamato Scale Co., Ltd., 5-22 Saenba-cho, Akashi 673, Japan

DP-6100GP (Class III)

R76/1992-NL-96.13
Ishida Co., Ltd., 44, Sanno-cho, Shogoin, Sakayo-ku, Kyoto, 606, Japan

MTB (Class III)

Two new categories of instruments are now covered by the OIML Certificate System

With the publication of OIML Recommendations R 51-1 & 2 *Automatic catchweighing instruments* and OIML R 61-1 & 2 *Automatic gravimetric filling instruments*, two new categories of instruments are now covered by the OIML Certificate System.

These instruments are widely used during product packaging before the products are put onto the market: for example, the gravimetric filling of prepacked products (covered by OIML R 61), sorting (or checking) of their weight, or labelling (covered by OIML R 51).

Due to the importance of these fields of activity, there was an urgent need for OIML to harmonize the metrological and technical requirements as well as the procedures put into place for the testing of such instruments. The possibility to deliver OIML certificates together with test results presented in standardized format is certainly an important contribution in this field.

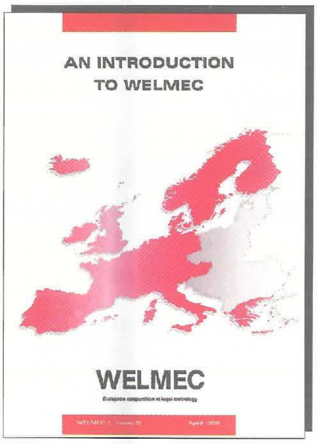
Deux nouvelles catégories d'instruments couvertes par le Système de Certificats OIML

Avec la publication des Recommandations OIML R 51-1 & 2 *Instruments de pesage trieurs-étiqueteurs à fonctionnement automatique* et OIML R 61-1 & 2 *Doseuses pondérales à fonctionnement automatique*, deux catégories d'instruments de pesage ont fait leur entrée dans le Système de Certificats OIML.

Ces instruments sont très largement utilisés pour le conditionnement des produits avant leur mise sur le marché: par exemple, le dosage pondéral des produits préemballés (OIML R 61) et le tri (ou le contrôle) du poids de ces produits ou leur étiquetage (OIML R 51).

L'importance de ces secteurs d'activité étant considérable, il était urgent que l'OIML harmonise les exigences métrologiques et techniques ainsi que les procédures mises en œuvre pour l'essai de tels instruments. La possibilité de délivrer des certificats OIML, accompagnés par des résultats d'essai présentés de façon normalisée, constitue assurément une contribution importante dans ce domaine.

General Information



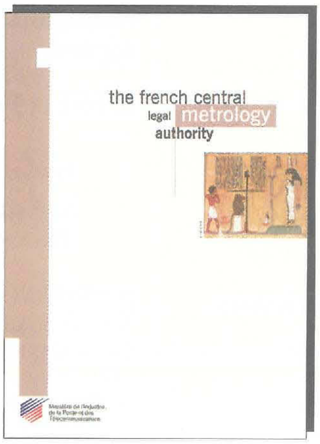
Introduction to Welmec

At a meeting in Bern in June 1990, a Memorandum of Understanding was signed which formally established **WELMEC** as the European Cooperation in legal metrology.

All 15 countries of the European Union (EU) and 3 countries from the European Free Trade Association (EFTA) signed the Memorandum.

WELMEC is a free cooperation whose aim is to reach agreement on a range of issues of mutual interest and to establish a harmonized and consistent approach to legal metrology in the light of, amongst other points:

- political changes in central and eastern Europe;
- increasing international trade in measuring instruments, and
- the different coverage of legal metrology in various countries. ■

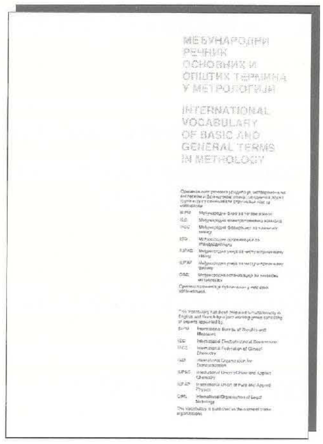


The French legal metrology authorities

In France, the *Sous-Direction de la Métrologie (SDM)* and the regional directorates for industry (DRIRE) are the authorities which permit the government to intervene in certain categories of measuring instruments or operations. The aim is to provide users of measuring instruments a guarantee covering:

- the accuracy of instruments within the limits of uncertainty
- the prevention of unfair use.

The 39 principal categories of instruments under government control in France fall into the fields of **public safety** (chronotachographs, speed meters, ethylometers, etc.), **health and environment** (pollution control meters, sound level analyzers, thermometers) and **trade** (weighing machines, gas, electricity, water and fuel meters, taximeters etc.) ■



Serbian Vocabulary of Metrology

The *International Vocabulary of basic and general terms in metrology* has been published in the Serbian-English version by the Federal Bureau of Measures and Precious Metals.

The *Directory of Metrological Laboratories in FR Yugoslavia* (1995 edition) and a booklet about the Federal Bureau of Measures and Precious Metals are also available.

The publication in other languages of the *Vocabulary* goes one step further towards harmonizing metrology at international level since it is important that each term has the same meaning for all of its users.

The four main international metrological organizations therefore embarked on a joint action which culminated in the coordination, preparation and publication of a draft vocabulary, now accepted world-wide. ■

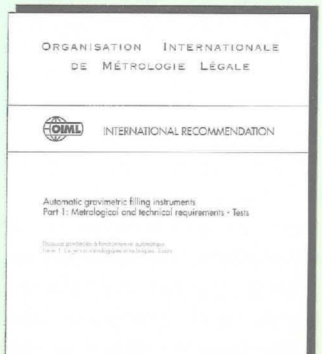
New Publications
Nouvelles Publications

R 61-1 **Automatic gravimetric filling instruments**
Part 1: Metrological and technical requirements - Tests

Doseuses pondérales à fonctionnement automatique
Partie 1: Exigences métrologiques et techniques - Essais

R 61-2 **Automatic gravimetric filling instruments**
Part 2: Test report format

Doseuses pondérales à fonctionnement automatique
Partie 2: Format du rapport d'essai



OIML in China

Dai Runsheng, State Bureau of Technical Supervision, PRC

Introduction

China joined the OIML in 1985 through the China State Bureau of Technical Supervision (CSBTS). In order that OIML matters could be dealt with more effectively, a China Secretariat for OIML matters was established within the CSBTS in 1990. Under the leadership of the China CIML Member, the Secretariat has made significant progress in promoting OIML throughout China.

Initiatives taken

1 Establishment of an information center to make OIML publications readily available, including International Recommendations and Documents, together with material concerning the development of the latter and comments emanating from Member States. The center has already proved to be of benefit not only to a number of metrology institutes and manufacturers, but also in aiding the development of Chinese Verification Regulations, since material is readily available for consultation at the center. One of the consequences is that China Verification Regulations have been able to achieve greater compatibility with OIML Recommendations - for example, the requirements for prepackaged goods in China are identical to those of OIML R 79 and R 87.

2 Publication of the OIML leaflet *"OIML Information"* containing information about OIML TC meetings, Symposiums and training courses, the OIML Certificate System, the list of OIML Publications and available Chinese translations of important papers from the OIML Bulletin. Over 500 copies of the leaflet are published six times a year.

3 Publication of the Chinese translations of International Recommendations and International Documents: so far, three volumes have been published and over 2000 copies of each have been sold; a new collection of ID's including an introduction to the OIML and Directives for OIML Technical Work has also recently been published.

4 Organization and running of training courses to introduce IR's and ID's: so far, courses have been run for OIML R 76, R 60, R 112 and R 113. The Chinese Society for Weighing Instruments assisted in running the R 76 course, which was attended by about 150 manufacturers.

5 Promotion of the OIML Certificate System for measuring instruments. To accomplish this the CSBTS has:

- issued two documents: *Announcement on the Implementation of the OIML Certificate System in China* and *Procedure for the Implementation of the OIML Certificate System in China.*
- published a brochure in 1992 containing the two documents mentioned above as well as the document *OIML Certificate System for Measuring Instruments* in both English and Chinese.
- held two symposiums, one for R 76 and the other for R 60.

To date, 7 manufacturers have applied for OIML Certificates for weighing instruments and 4 Certificates have been issued. Several manufacturers have shown interest in obtaining Certificates for load cells and testing according to R 60. This makes China the first and only developing country to have issued OIML Certificates.

6 Since 1990, more Chinese experts have attended OIML Technical Committee meetings and have given their comments concerning the development or revision of International Recommendations and Documents. Now, China is a P-Member of OIML TC 2, TC 3, TC 6, TC 8, TC 9, TC 13 and TC 17 and is the Secretariat of OIML TC 17/SC 1. The China Secretariat for OIML Matters is well aware of the advantages of attending OIML technical activities and is endeavoring to organize more Chinese experts to attend them.

Summary

All of the above initiatives have resulted in more Chinese people knowing and understanding the importance not only of the OIML itself but also of its Recommendations. Initially, the latter were perceived as being of less importance than ISO Standards, the concept of a "Recommendation" being hitherto unknown to common Chinese people in the Chinese language. Today however, the two types of documents are treated with an equal degree of importance and Recommendations are regarded as "regulations".

More and more people are coming to the Secretariat seeking information about OIML and the OIML Certificate System, the implementation of which is promoting the manufacture of quality measuring instruments in China; as a result, China's Legal Metrology is becoming increasingly compatible with OIML requirements.

The author would like to acknowledge the editorial assistance of Ms Kerry Marston, NSC, Australia, in the preparation of this article.

meetings
OIML
réunions

February 1997

17–18	Presidential Council	PARIS, FRANCE
20–21	TC 17/SC 7 Breath testers (rescheduled from 1996.01.20)	PARIS, FRANCE

March 1997

10–12	TC 8/SC 7 Gas metering	BRUSSELS, BELGIUM

October 1997

10	TC 13 Measuring instruments for acoustics and vibration	JAPAN
27–31	32nd CIML meeting	RIO, BRAZIL

The OIML is pleased to welcome the following CIML Members:

Kazakhstan: Mr. A. Sadikov

Kenya: Mr. A. E. Ndegwa

Tunisia: Mr. M. Chaouch

We are also pleased to announce the readmittance of the **Islamic Republic of Iran**, as a **MEMBER STATE**; Iran had left the OIML in 1979. Pending the appointment of a CIML Member, all correspondence should be addressed to Mr. M. M. H. Zia at the address listed in the Contact Information section of this Bulletin.

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On trouvera ci-dessous une liste des publications OIML classées par sujets et par numéros. Les abréviations suivantes sont utilisées: Recommandation Internationale (R), Document International (D), vocabulaire (V) et autre publication (P). Ces publications sont disponibles en français et en anglais sous forme de fascicules séparés sauf indication contraire. Les prix sont donnés en francs-français et ne comprennent pas les frais d'expédition.

Ces publications peuvent être commandées par lettre ou fax au BIML (voir adresse plus haut).

General
Généralités

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

R 42 (1981-*1977*) 50 FRF
Metal stamps for verification officers
Poinçons de métal pour Agents de vérification

D 1 (1975) 50 FRF
Law on metrology
Loi de métrologie

D 2 (being printed - *en cours de publication*)
Legal units of measurement
Unités de mesure légales

D 3 (1979) 60 FRF
Legal qualification of measuring instruments
Qualification légale des instruments de mesurage

D 5 (1982) 60 FRF
Principles for the establishment of hierarchy schemes for measuring instruments
Principes pour l'établissement des schémas de hiérarchie des instruments de mesure

D 9 (1984) 60 FRF
Principles of metrological supervision
Principes de la surveillance métrologique

D 12 (1986) 50 FRF
Fields of use of measuring instruments subject to verification
Domaines d'utilisation des instruments de mesure assujettis à la vérification

D 13 (1986) 50 FRF
Guidelines for bi- or multilateral arrangements on the recognition of: test results - pattern approvals - verifications
Conseils pour les arrangements bi- ou multilatéraux de reconnaissance des: résultats d'essais - approbations de modèles - vérifications

D 14 (1989) 60 FRF
Training of legal metrology personnel - Qualification - Training programmes
Formation du personnel en métrologie légale - Qualification - Programmes d'étude

D 15 (1986) 80 FRF
Principles of selection of characteristics for the examination of measuring instruments
Principes du choix des caractéristiques pour l'examen des instruments de mesure usuels

D 16 (1986) 80 FRF
Principles of assurance of metrological control
Principes d'assurance du contrôle métrologique

D 19 (1988) 80 FRF
Pattern evaluation and pattern approval
Essai de modèle et approbation de modèle

D 20 (1988) 80 FRF
Initial and subsequent verification of measuring instruments and processes
Vérifications primitive et ultérieure des instruments et processus de mesure

V 1 (1978) 100 FRF
Vocabulary of legal metrology (bilingual French-English)
Vocabulaire de métrologie légale (bilingue français-anglais)

V 2 (1993) 200 FRF
International vocabulary of basic and general terms in metrology (bilingual French-English)
Vocabulaire international des termes fondamentaux et généraux de métrologie (bilingue français- anglais)

P 1 (1991) 60 FRF
OIML Certificate System for Measuring Instruments
Système de Certificats OIML pour les Instruments de Mesure

P 2 (1987) 100 FRF
Metrology training - Synthesis and bibliography (bilingual French-English)
Formation en métrologie - Synthèse et bibliographie (bilingue français-anglais)

P 3-1 (1996) 400 FRF
Legal metrology in OIML Member States
Métrologie légale dans les Etats Membres de l'OIML

P 3-2 (1996) 300 FRF
Legal metrology in OIML Corresponding Members
Métrologie légale dans les Membres Correspondants de l'OIML

P 9 (1992) 100 FRF
Guidelines for the establishment of simplified metrology regulations

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

Measurement standards and verification equipment
Étalons et équipement de vérification

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

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

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

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

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

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

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

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

P 15 (1989) 100 FRF
Guide to calibration

Mass and density
Masses et masses volumiques

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

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

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

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

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

R 50 (1994) 100 FRF
Continuous totalizing automatic weighing instruments
Instruments de pesage totalisateurs continus à fonctionnement automatique

Annex (being printed - *en cours de publication*)
Test procedures and test report format
Procédures d'essai et format du rapport d'essai

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

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

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

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

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

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

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

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

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

Amendment No. 1 (1994) free / *gratuit*

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

Amendment No. 1 (1995) free / *gratuit*

R 106 (1993) 100 FRF
Automatic rail-weighbridges
Ponts-bascules ferroviaires à fonctionnement automatique

Annex (being printed - *en cours de publication*)
Test procedures and test report format
Procédures d'essai et format du rapport d'essai

R 107 (1993) 100 FRF
Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers)
Instruments de pesage totalisateurs discontinus à fonctionnement automatique (peseuses totalisatrices à trémie)

Annex (being printed - *en cours de publication*)
Test procedures and test report format
Procédures d'essai et format du rapport d'essai

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

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

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

Length and speed
Longueurs et vitesses

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

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

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

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

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

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

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

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

Liquid measurement
Mesurage des liquides

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

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

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

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

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

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

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

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

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

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

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

R 81 (1989) 80 FRF
Measuring devices and measuring systems for cryogenic liquids (including tables of density for liquid argon, helium, hydrogen, nitrogen and oxygen)
Dispositifs et systèmes de mesure de liquides cryogéniques (comprend tables de masse volumique pour argon, hélium, hydrogène, azote et oxygène liquides)

R 85 (1989) 80 FRF
Automatic level gauges for measuring the level of liquid in fixed storage tanks
Jaugeurs automatiques pour le mesurage des niveaux de liquide dans les réservoirs de stockage fixes

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

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

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

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

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

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

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

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

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

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

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

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

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

Gas measurement
Mesurage des gaz [1]

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

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

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

Pressure
Pressions [2]

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

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

R 97 (1990) 60 FRF
Barometers
Baromètres

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

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

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

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

Temperature
Températures [2]

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

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

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

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

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

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

Electricity
Électricité

R 46 (1980-*1978*) 80 FRF
Active electrical energy meters for direct connection of class 2
Compteurs d'énergie électrique active à branchement direct de la classe 2

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

Acoustics and vibration
Accoustique et vibrations [3]

R 58 (being printed - *en cours de publication*)
Sound level meters
Sonomètres

R 88 (being printed - *en cours de publication*)
Integrating-averaging sound level meters
Sonomètres intégrateurs-moyenneurs

R 102 (1992) 50 FRF
Sound calibrators
Calibreurs acoustiques

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

R 103 (1992) 60 FRF

Measuring instrumentation for human response to vibration
Appareillage de mesure pour la réponse des individus aux vibrations

R 104 (1993) 60 FRF

Pure-tone audiometers
Audiomètres à sons purs

Annex (being printed - *en cours de publication*)
Test report format
Format du rapport d'essai

Environment
Environnement

R 82 (1989) 80 FRF

Gas chromatographs for measuring pollution from pesticides and other toxic substances
Chromatographes en phase gazeuse pour la mesure des pollutions par pesticides et autres substances toxiques

R 83 (1990) 80 FRF

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

R 99 (1991) 100 FRF

Instruments for measuring vehicle exhaust emissions
Instruments de mesure des gaz d'échappement des véhicules

R 100 (1991) 80 FRF

Atomic absorption spectrometers for measuring metal pollutants in water
Spectromètres d'absorption atomique pour la mesure des polluants métalliques dans l'eau

R 112 (1994) 80 FRF

High performance liquid chromatographs for measurement of pesticides and other toxic substances
Chromatographes en phase liquide de haute performance pour la mesure des pesticides et autres substances toxiques

R 113 (1994) 80 FRF

Portable gas chromatographs for field measurements of hazardous chemical pollutants
Chromatographes en phase gazeuse portatifs pour la mesure sur site des polluants chimiques dangereux

R 116 (1995) 80 FRF

Inductively coupled plasma atomic emission spectrometers for measurement of metal pollutants in water
Spectromètres à émission atomique de plasma couplé inductivement pour le mesurage des polluants métalliques dans l'eau

R 123 (being printed - *en cours de publication*)

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

D 22 (1991) 80 FRF

Guide to portable instruments for assessing airborne pollutants arising from hazardous wastes
Guide sur les instruments portatifs pour l'évaluation des polluants contenus dans l'air en provenance des sites de décharge de déchets dangereux

Physico-chemical measurements
Mesures physico-chimiques

R 14 (1995) 60 FRF

Polarimetric saccharimeters
Saccharimètres polarimétriques

R 54 (in revision - *en cours de révision*)

pH scale for aqueous solutions
Echelle de pH des solutions aqueuses

R 56 (1981) 50 FRF

Standard solutions reproducing the conductivity of electrolytes
Solutions-étalons reproduisant la conductivité des électrolytes

R 59 (1984) 80 FRF

Moisture meters for cereal grains and oilseeds
Humidimètres pour grains de céréales et graines oléagineuses

R 68 (1985) 50 FRF

Calibration method for conductivity cells
Méthode d'étalonnage des cellules de conductivité

R 69 (1985) 50 FRF

Glass capillary viscometers for the measurement of kinematic viscosity. Verification method
Viscosimètres à capillaire, en verre, pour la mesure de la viscosité cinématique. Méthode de vérification

R 70 (1985) 50 FRF

Determination of intrinsic and hysteresis errors of gas analysers
Détermination des erreurs de base et d'hystérésis des analyseurs de gaz

R 73 (1985) 50 FRF

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

R 92 (1989) 60 FRF

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

R 108 (1993) 60 FRF

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

R 121 (1996) 60 FRF

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

R 124 (being printed - *en cours de publication*)

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

D 17 (1987) 50 FRF

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

Medical instruments
Instruments médicaux

R 7 (1979-*1978*) 60 FRF

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

R 16 (1973-*1970*) 50 FRF

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

R 26 (1978-*1973*) 50 FRF

Medical syringes
Seringues médicales

R 78 (1989) 50 FRF

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

R 89 (1990) 80 FRF

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

R 90 (1990) 80 FRF

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

R 93 (1990) 60 FRF

Focimeters
Frontofocomètres

R 114 (1995) 80 FRF

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

R 115 (1995) 80 FRF

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

R 122 (1996) 60 FRF

Equipment for speech audiometry
Appareils pour l'audiométrie vocale

D 21 (1990) 80 FRF

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

Testing of materials
Essais des matériaux

R 9 (1972-*1970*) 60 FRF

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

R 10 (1974-*1970*) 60 FRF

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

R 11 (1974-*1970*) 60 FRF

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

R 12 (1974-*1970*) 60 FRF

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

R 36 (1980-*1977*) 60 FRF

Verification of indenters for hardness testing machines
Vérification des pénétrateurs des machines d'essai de dureté

R 37 (1981-*1977*) 60 FRF

Verification of hardness testing machines (Brinell system)
Vérification des machines d'essai de dureté (système Brinell)

R 38 (1981-*1977*) 60 FRF

Verification of hardness testing machines (Vickers system)
Vérification des machines d'essai de dureté (système Vickers)

R 39 (1981-*1977*) 60 FRF

Verification of hardness testing machines (Rockwell systems B,F,T - C,A,N)
Vérification des machines d'essai de dureté (systèmes Rockwell B,F,T -C,A,N)

R 62 (1985) 80 FRF

Performance characteristics of metallic resistance strain gauges
Caractéristiques de performance des extensomètres métalliques à résistance

R 64 (1985) 50 FRF

General requirements for materials testing machines
Exigences générales pour les machines d'essai des matériaux

R 65 (1985) 60 FRF

Requirements for machines for tension and compression testing of materials
Exigences pour les machines d'essai des matériaux en traction et en compression

V 3 (1991) 80 FRF

Hardness testing dictionary (quadrilingual French-English-German-Russian)
Dictionnaire des essais de dureté (quadrilingue français-anglais-allemand-russe)

P 10 (1981) 50 FRF

The metrology of hardness scales - Bibliography

P 11 (1983) 100 FRF

Factors influencing hardness measurement

P 12 (1984) 100 FRF

Hardness test blocks and indenters

P 13 (1989) 100 FRF

Hardness standard equipment

P 14 (1991) 100 FRF

The unification of hardness measurement

Prepackaging
Préemballages

R 79 (being printed - *en cours de publication*)

Information on package labels
Etiquetage des préemballages

R 87 (1989) 50 FRF

Net content in packages
Contenu net des préemballages

OIML publications classified by number
Publications OIML classées par numéros

INTERNATIONAL RECOMMENDATIONS
RECOMMANDATIONS INTERNATIONALES

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

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

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

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

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

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

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

R 14 (1995) 60 FRF
Polarimetric saccharimeters
Saccharimètres polarimétriques

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

R 46 (1980–1978) 80 FRF
Active electrical energy meters for direct connection of class 2
Compteurs d'énergie électrique active à branchement direct de la classe 2

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

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

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

R 50 (1994) 100 FRF
Continuous totalizing automatic weighing instruments (belt weighers)
Instruments de pesage totalisateurs continus à fonctionnement automatique (peseuses sur bande)

Annex (being printed - *en cours de publication*)
Test procedures and test report format
Procédures d'essai et format du rapport d'essai

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

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

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

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

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

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

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

R 58 (being printed - *en cours de publication*)
Sound level meters
Sonomètres

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

R 73 (1985) 50 FRF
Requirements concerning pure gases CO, CO_2, CH_4, H_2, O_2, N_2 and Ar intended for the preparation of reference gas mixtures
Prescriptions pour les gaz purs CO, CO_2, CH_4, H_2, O_2, N_2 et Ar destinés à la préparation des mélanges de gaz de référence

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

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

R 76-1 (1992) 300 FRF
Nonautomatic weighing instruments. Part 1: Metrological and technical requirements - Tests
Instruments de pesage à fonctionnement non automatique. Partie 1: Exigences métrologiques et techniques - Essais
Amendment No. 1 (1994) free / *gratuit*

R 76-2 (1993) 200 FRF
Nonautomatic weighing instruments. Part 2: Pattern evaluation report
Instruments de pesage à fonctionnement non automatique. Partie 2: Rapport d'essai de modèle
Amendment No. 1 (1995) free / *gratuit*

R 78 (1989) 50 FRF
Westergren tubes for measurement of erythrocyte sedimentation rate
Pipettes Westergren pour la mesure de la vitesse de sédimentation des hématies

R 79 (being printed - *en cours de publication*)
Information on package labels
Etiquetage des préemballages

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

R 81 (1989) 80 FRF
Measuring devices and measuring systems for cryogenic liquids (including tables of density for liquid argon, helium, hydrogen, nitrogen and oxygen)
Dispositifs et systèmes de mesure de liquides cryogéniques (comprend tables de masse volumique pour argon, hélium, hydrogène, azote et oxygène liquides)

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

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

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

R 85 (1989) 80 FRF
Automatic level gauges for measuring the level of liquid in fixed storage tanks
Jaugeurs automatiques pour le mesurage des niveaux de liquide dans les réservoirs de stockage fixes

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

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

R 88 (being printed - *en cours de publication*)
Integrating-averaging sound level meters
Sonomètres intégrateurs-moyenneurs

R 89 (1990) 80 FRF
Electroencephalographs - Metrological characteristics - Methods and equipment for verification
Electroencéphalographes - Caractéristiques métrologiques - Méthodes et moyens de vérification

R 90 (1990) 80 FRF
Electrocardiographs - Metrological characteristics - Methods and equipment for verification
Electrocardiographes - Caractéristiques métrologiques - Méthodes et moyens de vérification

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

R 92 (1989) 60 FRF
Wood-moisture meters - Verification methods and equipment: general provisions
Humidimètres pour le bois - Méthodes et moyens de vérification: exigences générales

R 93 (1990) 60 FRF
Focimeters
Frontofocomètres

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

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

R 97 (1990) 60 FRF
Barometers
Baromètres

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

R 99 (1991) 100 FRF
Instruments for measuring vehicle exhaust emissions
Instruments de mesure des gaz d'échappement des véhicules

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

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

R 102 (1992) 50 FRF
Sound calibrators
Calibreurs acoustiques

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

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

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

Annex (being printed - *en cours de publication*)
Test report format
Format du rapport d'essai

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

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

R 106 (1993) 100 FRF
Automatic rail-weighbridges
Ponts-bascules ferroviaires à fonctionnement automatique

Annex (being printed - *en cours de publication*)
Test procedures and test report format
Procédures d'essai et format du rapport d'essai

R 107 (1993) 100 FRF
Discontinuous totalizing automatic weighing instruments (totalizing hopper weighers)
Instruments de pesage totalisateurs discontinus à fonctionnement automatique (peseuses totalisatrices à trémie)

Annex (being printed - *en cours de publication*)
Test procedures and test report format
Procédures d'essai et format du rapport d'essai

R 108 (1993) 60 FRF
Refractometers for the measurement of the sugar content of fruit juices
Réfractomètres pour la mesure de la teneur en sucre des jus de fruits

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

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

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

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

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

R 114 (1995) 80 FRF
Clinical electrical thermometers for continuous measurement
Thermomètres électriques médicaux pour mesurage en continu

R 115 (1995) 80 FRF
Clinical electrical thermometers with maximum device
Thermomètres électriques médicaux avec dispositif à maximum

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

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

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

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

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

R 121 (1996) 60 FRF
The scale of relative humidity of air certified against saturated salt solutions
Échelle d'humidité relative de l'air certifiée par rapport à des solutions saturées de sels

R 122 (1996) 60 FRF
Equipment for speech audiometry
Appareils pour l'audiométrie vocale

R 123 (being printed - *en cours de publication*)
Portable and transportable X-ray fluorescence spectrometers for field measurement of hazardous elemental pollutants
Spectromètres à fluorescence de rayons X portatifs et déplaçables pour la mesure sur le terrain d'éléments polluants dangereux

R 124 (being printed - *en cours de publication*)
Refractometers for the measurement of the sugar content of grape musts
Réfractomètres pour la mesure de la teneur en sucre des moûts de raisin

INTERNATIONAL DOCUMENTS
DOCUMENTS INTERNATIONAUX

D 1 (1975) 50 FRF
Law on metrology
Loi de métrologie

D 2 (being printed - *en cours de publication*)
Legal units of measurement
Unités de mesure légales

D 3 (1979) 60 FRF
Legal qualification of measuring instruments
Qualification légale des instruments de mesurage

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

D 5 (1982) 60 FRF
Principles for the establishment of hierarchy schemes for measuring instruments
Principes pour l'établissement des schémas de hiérarchie des instruments de mesure

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

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

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

D 9 (1984) 60 FRF
Principles of metrological supervision
Principes de la surveillance métrologique

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

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

D 12 (1986) 50 FRF
Fields of use of measuring instruments subject to verification
Domaines d'utilisation des instruments de mesure assujettis à la vérification

D 13 (1986) 50 FRF
Guidelines for bi- or multilateral arrangements on the recognition of: test results - pattern approvals - verifications
Conseils pour les arrangements bi- ou multilatéraux de reconnaissance des: résultats d'essais - approbations de modèles - vérifications

D 14 (1989) 60 FRF
Training of legal metrology personnel - Qualification - Training programs
Formation du personnel en métrologie légale - Qualification - Programmes d'étude

D 15 (1986) 80 FRF
Principles of selection of characteristics for the examination of measuring instruments
Principes du choix des caractéristiques pour l'examen des instruments de mesure usuels

D 16 (1986) 80 FRF
Principles of assurance of metrological control
Principes d'assurance du contrôle métrologique

D 17 (1987) 50 FRF
Hierarchy scheme for instruments measuring the viscosity of liquids
Schéma de hiérarchie des instruments de mesure de la viscosité des liquides

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

D 19 (1988) 80 FRF
Pattern evaluation and pattern approval
Essai de modèle et approbation de modèle

D 20 (1988) 80 FRF
Initial and subsequent verification of measuring instruments and processes
Vérifications primitive et ultérieure des instruments et processus de mesure

D 21 (1990) 80 FRF
Secondary standard dosimetry laboratories for the calibration of dosimeters used in radiotherapy
Laboratoires secondaires d'étalonnage en dosimétrie pour l'étalonnage des dosimètres utilisés en radiothérapie

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

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

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

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

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

VOCABULARIES
VOCABULAIRES

V 1 (1978) 100 FRF
Vocabulary of legal metrology (bilingual French-English)
Vocabulaire de métrologie légale (bilingue français-anglais)

V 2 (1993) 200 FRF
International vocabulary of basic and general terms in metrology (bilingual French-English)
Vocabulaire international des termes fondamentaux et généraux de métrologie (bilingue français-anglais)

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

OTHER PUBLICATIONS
AUTRES PUBLICATIONS

P 1 (1991) 60 FRF
OIML Certificate System for Measuring Instruments
Système de Certificats OIML pour les Instruments de Mesure

P 2 (1987) 100 FRF
Metrology training - Synthesis and bibliography (bilingual French-English)
Formation en métrologie - Synthèse et bibliographie (bilingue français-anglais)

P 3-1 (1996) 400 FRF
Legal metrology in OIML Member States
Métrologie légale dans les Etats Membres de l'OIML

P 3-2 (1996) 300 FRF
Legal metrology in OIML Corresponding Members
Métrologie légale dans les Membres Correspondants de l'OIML

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

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

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

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

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

P 9 (1992) 100 FRF
Guidelines for the establishment of simplified metrology regulations

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

P 11 (1983) 100 FRF
Factors influencing hardness measurement

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

P 13 (1989) 100 FRF
Hardness standard equipment

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

P 15 (1989) 100 FRF
Guide to calibration

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

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