BULLETIN
DE
L'ORGANISATION
INTERNATIONALE
DE MÉTROLOGIE LÉGALE

Organe de Liaison entre les États-membres

BUREAU INTERNATIONAL DE METROLOGIE LEGALE
11, Rue Turgot — 75009 PARIS — France
BULLETIN
de
L'ORGANISATION INTERNATIONALE de MÉTROLOGIE LÉGALE

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INTERCOMPARISON of the PRESSURE STANDARDS
of the CSIRO DIVISION of APPLIED PHYSICS
and the MATERIALS RESEARCH LABORATORIES
of AUSTRALIA

by J. I. GOSLING
CSIRO Division of Applied Physics (*)
and D.J. HATT and D.B. PROWSE
Materials Research Laboratories (**)
To enable readings be related with the mercury surface positions both sets of telescope, optical micrometer, scale and light source can be moved vertically relative to each mercury surface.

In 1969-70 the instrument was given a major overhaul in an attempt to isolate the cause of a systematic discrepancy between it and a Fortin barometer with had been calibrated at NPL, England. Several modifications were made, and an error of 30 µm discovered in the scale. This error was a result of the aluminised scale plates moving relative to each other and must be associated with the cement used to fix them to the backing plate. By 1973 a further change of 2 µm had occurred, but measurements indicated that the rate of change had decreased dramatically.

When the horizontal plane through a scale graduation is not more than a certain maximum distance from the horizontal mercury surface, two images of the graduation line may be seen in the eyepiece, one formed by direct vision and the second by reflection of the line in the horizontal mercury surface. Simple geometry indicates that the plane of the mercury surface will be equidistant between these two images. The magnification of the optical system has been arranged so that a factor of 2 is accounted for and enables the mercury surface to be read directly on the graticule as a displacement from the direct image of the scale marking.

Initially the zero of the scale is set to coincide with the plane of the mercury surface. This utilizes one of the graduations 0.5 mm adjacent to the zero graduation mentioned above.

For the column height reading, the second optical system is used to set one of the scale images to the zero of the graticule. The position of the other image, relative to the graticule, then measures the displacement of the plane of the mercury surface from the scale line. A typical reading is shown in Figure 2, where the mercury surface displacement from the scale division is 0.636 mm.

As would be expected with an instrument of this nature, vibration of the mercury surface is the major cause of problems in reading the instrument, with vibration of the upper surface always being more severe. Thus the instrument is read by setting on the upper surface and reading the position of the lower surface.

Another major source of uncertainty involves the temperature gradient of the mercury column. This is measured relative to a calibrated precision mercury-in-glass thermometer which is mounted in a dewar flask in distilled water, with five copper-constantan thermocouple reference junctions. The temperature of the mercury column is measured at five points using these thermocouples.

Since the scale is nominally correct at a reference temperature of 20 °C, barometer readings have to be corrected to standard conditions. It can be shown [2] that the temperature correction (C) is given by:

\[
C = \frac{(\beta - \omega t + 20\omega)}{1 + \beta t} R_t
\]

where \( R_t \) = barometer reading at \( t \) °C with index correction applied,
\( t \) = mean temperature of the mercury column,
\( \beta \) = cubical coefficient of thermal expansion of mercury per °C,
\( \omega \) = linear coefficient of thermal expansion of the scale per °C.

In addition to this correction the usual gravity correction must be applied.

(b) MRL Interferometric Manometer

This instrument and its operation have been described elsewhere [3, 4], so only a very brief description will be given here. It is a U-tube manometer in which the two mercury surfaces act as the mirrors for a Michelson type interferometer. A stabilized laser is used as the light source, and fringes are counted as the two mercury surfaces
move relative to each other. Pressure is obtained from the fringe counts by the usual equation for a hydrostatic column

\[ P = \rho gh \]

(2)

where \( h \) is obtained from the fringes counted by the interferometer. The instrument is considered to have an overall uncertainty of \( \pm 2 \) parts in \( 10^4 \) at 100 kPa.

(c) The Transfer Instrument

Three transfer instruments were used in this series of intercomparisons. They were gas-operated free-piston pressure gauges manufactured by CEC [5], two owned by CSIRO and the other by MRL. A free-piston pressure gauge establishes pressure by means of a force applied to a known area. The effective area of these instruments can be obtained from either the measured geometry of the piston and cylinder, or by calibration with pressure standards. It is the latter method which is adopted here. These instruments have a reproducibility of 1-2 parts in \( 10^4 \) and are easily transportable, as only the piston/cylinder combination needs to be transferred between laboratories.

2. Results

(a) MRL CEC with the Interferometric Manometer

The piston/cylinder combination of the CEC gauge of nominal area \( 8.1 \times 10^{-5} \text{ m}^2 \) was compared with the interferometric manometer over the range 11 - 101 kPa. From this comparison, it is possible to obtain the effective area \( A_e \) and the effective mass \( M_e \) of the piston/carrier assembly by fitting the values to an equation of the form:

\[ P = (M + M_e)g/A_e \]

(3)

where \( M \) is the true mass added to the piston/carrier assembly, \( g \) is the local value of the acceleration due to gravity, and \( P \) is the pressure obtained from the interferometric manometer. The results obtained are set out in Table 1.

(b) MRL CEC with CSIRO Primary Pressure Standard

In June 1976, the MRL CEC gauge was taken to Sydney and compared with the CSIRO primary pressure standard. The results are given in Table 2.

The CSIRO primary pressure standard has a readability of 0.66 Pa, but due to the effects of temperature and repetition of setting, the uncertainty is considered to be 1.3 Pa. Thus, by combining these the overall uncertainty for the intercomparison was found to be 1.9 Pa.

(c) CSIRO CEC#1 with the Interferometric Manometer

At the end of June 1976 the CSIRO CEC#1 gauge was taken to Melbourne for comparison with the interferometric manometer. Two independent sets of measurement were made and the results are given in Table 3.

(d) MRL CEC with CSIRO CEC#1

The MRL CEC gauge was taken to CSIRO and the two gauges were inter-compared by means of the technique of cross floating at ambient pressure. The results were unsatisfactory because of the pressure effect due to rotation which was observed subsequently and has been reported elsewhere [6], and also because the temperature of each gauge was not determined adequately.

(e) CSIRO CEC#2 with CSIRO Primary Standard

Just prior to the move of CSIRO from the Chippendale site to the new complex at Lindfield, several comparison readings were taken by comparing a new (second)
CEC gauge, which had been previously calibrated against the MRL Interferometric
Manometer, with the CSIRO Primary Standard barometer. The results are given in
Table 4.

3. Discussion

Two other interlaboratory comparisons of pressure standards have been reported
recently. These were between the NPL (UK) and CEV (France) [7], and between CEV
(France) and VNIIMS (Soviet Union) [8]. Both used a Crouzet Manometer type 10 as
the transfer standard, and either free-piston pressure gauges (NPL, VNIIMS) of the
Jaeger-BIPM interferometric barometer (CEV) as the standards. In the NPL-CEV
comparison, the uncertainty associated with the two standards for absolute pressure
calibration at 100 kPa (1000 mbar) was ± 8 Pa (± 0.08 mbar). For the CEV-VNIIMS
comparison, the VNIIMS standard conformed to its uncertainty of ± 5.3 Pa (± 0.053 mbar).
Considering that physically different types of standards were used, the agreement in
these comparisons is excellent.

In our case, the pressure standards are mercury columns and the transfer standards
free-piston pressure gauges. The two standards are quite different in concept, construc-
tion and method of determining the height of the mercury column, so that the
maximum difference between any two readings (Table 2) of 2.13 Pa is considered to
be excellent agreement.

The results obtained in (e) show a marked improvement in the scatter of the
discrepancies, although only four sets were obtained. It is believed that this may be due
to an improvement in the performance of the CEC gauge after additional precautions
were taken, particularly concerning magnetic and temperature effects.

The comparisons have shown that the CEC free-piston pressure gauge is an excel-
lent transfer standard, with only the piston and cylinders needing to be transferred
between laboratories. They also suggest that further work needs to be done to realise
the full potential of the free-piston gauge as a reliable transfer standard.

References

[1] HANDBOOK OF METEOROLOGICAL INSTRUMENTS, Part 1, Instruments for Surface
Observations, M.O. 577, Her Majesty’s Stationery Office 1956.
Manometers. NBS Monograph 8.
115-122.
[5] CONSOLIDATED ELECTRODYNAMICS CORPORATION, a subsidiary of Bell and Howell Ltd.,
Pasadena California.
[7] CLAPHAM P.B., DABORN J.E., SAMSON P. and CONGE G. Intercomparison of the
Pressure Standards of the National Physical Laboratory (UK) and the Centre d’Essais
### Table 1

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Value at 20 °C</th>
<th>Standard Deviation (15 degrees of freedom)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_s$</td>
<td>84.8652 g</td>
<td>1.8 in $10^5$</td>
</tr>
<tr>
<td>$A_c$</td>
<td>$8.06391 \times 10^{-5} m^2$</td>
<td>3.1 in $10^6$</td>
</tr>
<tr>
<td>Accuracy of the pressure generated by the CEC</td>
<td>11 to 100 kPa</td>
<td>4.5 in $10^8$ (at 100 kPa)</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Nominal Pressure kPa</th>
<th>CSIRO (PPS) — MRL (CEC) Pa</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>— 0.93</td>
</tr>
<tr>
<td></td>
<td>+ 0.13</td>
</tr>
<tr>
<td></td>
<td>+ 0.26</td>
</tr>
<tr>
<td>90</td>
<td>— 1.60</td>
</tr>
<tr>
<td></td>
<td>— 1.87</td>
</tr>
<tr>
<td></td>
<td>— 0.26</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>Average Value</td>
<td>— 0.61 (6.1 in $10^3$)</td>
</tr>
</tbody>
</table>
Table 3

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Quantity</th>
<th>Value</th>
<th>Standard Deviation (3 degrees of freedom)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$M_c$</td>
<td>85.0597 g</td>
<td>3.5 in $10^5$</td>
</tr>
<tr>
<td>2</td>
<td>$M_c$</td>
<td>85.0585 g</td>
<td>3.8 in $10^5$</td>
</tr>
<tr>
<td>1</td>
<td>$A_c$</td>
<td>$8.06424 \times 10^{-5} m^2$</td>
<td>6.0 in $10^6$</td>
</tr>
<tr>
<td>2</td>
<td>$A_c$</td>
<td>$8.06422 \times 10^{-5} m^2$</td>
<td>6.2 in $10^6$</td>
</tr>
<tr>
<td>1</td>
<td>Uncertainty in the pressure generated by the CEC over 11-110 kPa</td>
<td>0.56 Pa</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Uncertainty in the pressure generated by the CEC over 11-110 kPa</td>
<td>0.56 Pa</td>
<td></td>
</tr>
</tbody>
</table>

Table 4

<table>
<thead>
<tr>
<th>Nominal Pressure kPa</th>
<th>CSIRO (PPS) — CSIRO (CEC #2) Pa</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>— 0.80</td>
</tr>
<tr>
<td></td>
<td>— 0.13</td>
</tr>
<tr>
<td></td>
<td>— 0.27</td>
</tr>
<tr>
<td></td>
<td>— 0.53</td>
</tr>
<tr>
<td>Average Value</td>
<td>— 0.44 (4.4 in $10^3$)</td>
</tr>
</tbody>
</table>
TELESCOPE

OPTICAL SYSTEM
FIG. 1

FIELD OF VIEW
FIG. 2
SUEDE

DIRECTIONS for SWEDISH VERIFICATION OFFICERS
CONCERNING SAMPLING INSPECTION
of PREPACKED COMMODITIES

La Suède nous a communiqué la traduction anglaise ci-dessous des instructions en vigueur dans ce pays pour la vérification légale d'articles préemballés (SP-FOR 1974:5).

The following is an English translation of the instructions for legal inspection of prepacked goods as applied in Sweden (SP-FOR 1974:5).

Introduction

According to paragraph 2 of the Swedish law (1971:1081) on the measurement of volume and weight, the correctness of information about weight or volume on pre-packaged commodities shall be inspected using random sampling methods. Such inspections may be made at the manufacturer, importer, packager, wholesaler and retailer. According to paragraph 7 of the Government Decree (1973:85) on the measurement of volume and weight, etc., Statens provningsanstalt (*) is authorized to carry out inspection in accordance with paragraph 2 of the law. Inspection of foodstuff shall be done in consultation with Statens livsmedelsverk (**).

Definitions

Pre-packaged commodity — Commodity which has been packaged before the time of delivery to the customer and which is intended to be opened by the customer (SFS 1971:1081, par. 1).

Lot — Number of pre-packaged commodities of the same kind manufactured in running sequence and under the same conditions;
for inspection at the manufacturer or packager, the size of a lot is limited to the number of commodities packed in one hour; however at least 150 units;
for inspection at importers, wholesalers and retailers, a lot is limited to the packaged commodities belonging to a single delivery; however, 10000 units at the most. In lots of less than 150 units 100 % inspection should be used.

Sampling — That part of a lot chosen at random for inspection of the net quantity of pre-packaged commodities.

Defectively packed commodity — Commodity which has a minus error greater than the specified limit.

Defective lot — Lot of pre-packaged commodities whose average quantity is less than the stated one, or a lot of pre-packaged commodities containing a larger number of defectively packed commodities than permitted.

(*) The National Testing Institute.
(**) The National Food Administration.
Validity

These directions are valid for pre-packaged commodities which are labelled with information about volume or weight, where the labelling shall indicate the net volume or the net weight of the contents at the time of packaging. These directions are not valid for commodities with volume less than 25 millilitre or more than 25 litre or with weight less than 25 gram or more than 25 kilogram.

Labelling

The lot may contain pre-packaged commodities labelled either with varying net quantities or with constant net quantities. The inspections are limited to net weight or net volume of the entire contents of the packages. Surveillance of labelling is the responsibility of Statens livsmedelsverk.

Rules for sampling of pre-packaged commodities

Quantity information about commodities in a lot is inspected by sampling with the following purposes: verification that the net volume or net weight for the commodities of a lot in average agrees with the indicated net volume or net weight, and verification that indicated quantities of the individual packages are within permissible limits.

In judging the latter requirement, it shall be considered whether the commodities are easy or difficult to pack as well as the size of labelled quantity.

Commodities difficult to pack are those labelled with constant net quantity and characterized by the fact that they
— are liquid products,
— require considerable technical efforts in flowing or feeding at a constant rate,
— contain several components of various densities or in various physical states, and which require several operations during packaging,
— are subjected to post-processing after filling such as heat treatment, during which the weight is irregularly affected,
— consist of components of large unit weight; that is commodities which are in pieces or grains whose unit weights are of the same or larger magnitude than the tolerances applicable to commodities easy to pack according to the table below.

Other types of commodities labelled with a constant net quantity, as well as lots containing commodities labelled with varying net quantities are considered easy to pack.

Maximum permissible deviations

The quantity specified for pre-packaged commodities is acceptable if 97.5 % of the packages do not have at 20 °C higher negative deviations than those below, unless otherwise has been indicated for special products.

<table>
<thead>
<tr>
<th>Quantity g or ml</th>
<th>Goods easy to pack</th>
<th>Goods difficult to pack</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of quantity</td>
<td>g or ml</td>
</tr>
<tr>
<td>25— 50</td>
<td>4.5</td>
<td>—</td>
</tr>
<tr>
<td>50— 100</td>
<td>—</td>
<td>2.25</td>
</tr>
<tr>
<td>100— 200</td>
<td>2.25</td>
<td>—</td>
</tr>
<tr>
<td>200— 300</td>
<td>—</td>
<td>4.5</td>
</tr>
<tr>
<td>300— 500</td>
<td>1.5</td>
<td>—</td>
</tr>
<tr>
<td>500— 1 000</td>
<td>—</td>
<td>7.5</td>
</tr>
<tr>
<td>1 000—10 000</td>
<td>0.75</td>
<td>—</td>
</tr>
<tr>
<td>10 000—15 000</td>
<td>—</td>
<td>75</td>
</tr>
<tr>
<td>15 000—25 000</td>
<td>0.5</td>
<td>—</td>
</tr>
</tbody>
</table>

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Modification concerning poultry products

The deviation tolerance on prepacked whole poultry is at maximum minus 5 % of indicated net weight.

However the average weight of the lot shall not be less than indicated net weight.

Modification concerning bakery products

Prepacked bakery products will be considered as being within accepted limits if 97.5 % of the packages do not have higher negative deviations than indicated below.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>% of quantity</th>
<th>Negative tolerance g</th>
</tr>
</thead>
<tbody>
<tr>
<td>25—50</td>
<td>13.5</td>
<td>—</td>
</tr>
<tr>
<td>50—100</td>
<td>—</td>
<td>6.75</td>
</tr>
<tr>
<td>100—200</td>
<td>6.75</td>
<td>—</td>
</tr>
<tr>
<td>200—300</td>
<td>—</td>
<td>13.5</td>
</tr>
<tr>
<td>300—500</td>
<td>4.5</td>
<td>—</td>
</tr>
<tr>
<td>500—1000</td>
<td>—</td>
<td>22.5</td>
</tr>
<tr>
<td>1000—10000</td>
<td>2.25</td>
<td>—</td>
</tr>
</tbody>
</table>

However the average weight of the lot shall not be less than indicated net weight.

Sampling methods

Place for inspection

Inspection of prepackaged commodities at the manufacturer or packager should be done close to the time of packaging. Imported commodities are inspected at the stores of the importer, wholesaler or retailer.

Principles for determining the quantity

The weight of pre-packaged commodities is measured with the aid of suitable scales approved by Statens provningsanstalt;

the volume of a pre-packaged good is either measured directly using a graduated standard volume measure or, indirectly, by weighing and then measuring the density of the product.

The inaccuracy of measurement in determining the net quantities may not exceed 20 % of the tolerance permitted for the commodities.

As previously mentioned, a lot may contain pre-packaged commodities which are labelled either with constant net quantity or with varying net quantity. Therefore, when checking the quantity of filling, the following alternatives are possible :

1. Lot containing commodities labelled with constant quantity
   a) determination of net volume by means of gross and tare weighings (non-destructive testing, see inspection procedure 1)
   b) determination of net volume by means of gross and tare weighings and measuring the density of the product (non-destructive testing, see inspection procedure 2)
   c) determination of net quantity (weight or volume) (destructive testing, see inspection procedure 3)

2. Lot containing commodities labelled with varying net quantities
   a) determination of net weight by means of gross and tare weighings (non-destructive testing, see inspection procedure 4)
b) determination of net weight by means of opening the package (destructive testing, see
inspection procedure 5)

The methods described in 1c and 2b are used only when there are large variations
in tare weight (see below).

**Sampling**

Pre-packaged commodities to be included in the inspection are drawn at random from
the lot. The probability of each pre-packaged unit being included in the sample shall
be the same.

For this inspection, a single sampling plan is used, meaning that usually only one
sample is drawn from a lot.

The size of the sample selected for determination of gross and net quantity, respectively,
shall include 32 units. The same number of units shall be used for the determination of tare
weight.

**Symbols used**

- \( y_j \) = measured gross weight of the jth package in the sample.
- \( x_j \) = measured net quantity of the jth package in the sample.
- \( z_j \) = measured tare weight of the jth package in the sample of packaging.
- \( \bar{y} \) = mean value of the gross weight of the packages in the sample.
- \( \bar{x} \) = mean value of the net quantity of the packages in the sample.
- \( \bar{z} \) = mean value of the tare weight of the packages in the sample.
- \( j \) = failure (error) limit, that is the specified net quantity minus the permissible negative
deviation.
- \( m_o \) = specified net quantity of pre-packaged commodities belonging to a lot containing units
labelled with a constant net quantity.
- \( s_{y,g}^2 \) = estimator of the variance of the gross quantity, or of the difference between gross
weight and indicated net weight.
- \( s_{x,g}^2 \) = estimator of the variance of the tare weight.
- \( s_{\bar{y},z}^2 \) = estimator of the variance of the net quantity or of the variance of the difference
between measured net weight and indicated net weight.
- \( s \) = estimator of the standard deviation for the difference between gross and tare weight.
- \( s_o \) = estimator of the standard deviation for the difference between gross and tare
volume.
- \( u_j \) = net quantity indicated on pre-packaged commodities j of a lot labelled with varying
net quantities.
- \( \bar{u} \) = mean value of the indicated net quantity of a lot labelled with varying net
quantities.
- \( e \) = density of the product.
- \( v_j \) = calculated volume of the pre-packaged commodity j of the sample.
- \( \bar{v} \) = mean value of the calculated volumes of the pre-packaged commodities in the sample.

**Inspection procedures for lots containing commodities with constant net quantity**

**PROCEDURE 1**: determination of net weight by gross and tare weighings as follows:

a) Measure the gross weights, \( y, \) of the 32 units of pre-packaged commodities.

Calculate the mean value \( \bar{y} \).

\[
\bar{y} = \frac{\sum_{j=1}^{32} y_j}{32}
\]
Calculate the variance of the gross weights, \( s_g^2 \),
\[
 s_g^2 = \frac{\sum_{j=1}^{32} (y_j - \bar{y})^2}{31} = \left[ \frac{\sum_{j=1}^{32} y_j^2}{32} - \left( \frac{\sum_{j=1}^{32} y_j}{32} \right)^2 \right] / 31
\]

b) Weigh 32 units of empty packages.
Calculate the mean value, \( \bar{z} \).
\[
 \bar{z} = \frac{\sum_{j=1}^{32} z_j}{32}
\]
Calculate the variance of the tare weight, \( s_t \).
\[
 s_t^2 = \frac{\sum_{j=1}^{32} (z_j - \bar{z})^2}{31} = \left[ \frac{\sum_{j=1}^{32} z_j^2}{32} - \left( \frac{\sum_{j=1}^{32} z_j}{32} \right)^2 \right] / 31
\]
c) Calculate \( q \) defined as
\[
 q = \frac{s_t^2}{s_g^2 - s_t^2}
\]
If \( q \geq 0.09 \), the determination of net weight should be done in accordance with procedure 3, or the inspection should be limited to the determination whether the labelled quantity for the lot corresponds to the average (see point e below).

d) Limit for defective fraction.
If the number of defective units exceeds 2, the lot is considered to be unacceptable.

e) Determination of average weight.
In order to determine if the average weight is acceptable the standard deviation \( s \) for the difference between gross weight and tare weight is first to be calculated.
\[
 s = \sqrt{s_g^2 - s_t^2}
\]
Then calculate the ratio,
\[
 \frac{(\bar{y} - \bar{z} - m_0) \sqrt{32}}{s}
\]
The lot is considered unacceptable if \( \frac{(\bar{y} - \bar{z} - m_0) \sqrt{32}}{s} < -2.7 \)
The number 2.7 is derived from the \( t \)-distribution such that the probability of rejecting a correct lot does not exceed 0.5 %.

If the value of \( q \), according to c above, exceeds the limit given (0.09), the inspection may be limited to the above determination of average weight, providing the packages are difficult to open. However if \( q > 1 \), direct measurements of net weight are to be made for controlling the labelled average quantity.

**PROCEDURE 2**: determination of net volume by measuring product density and gross and tare weights as follows:

a) determination of product density \( (\rho) \).
This is either measured directly using a hydrometer or indirectly by using a standard-volume measure and weighing a known volume of the product.

Information about the density obtained from the packager may be used in calculating the volume of the contents.
However, the inaccuracy of the volume determination due to errors in the value of the density, are not to exceed 5 % of the relevant failure limit in the table. Special care must be taken in measuring the density of viscous products, foaming products or liquid products that contain gas and when measuring the bulk density of solid products.

b) Measure the gross weight, $y_i$, of 32 units of the pre-packaged commodities.

Calculate the mean value, $\bar{y}$.

$$\bar{y} = \frac{\sum_{i=1}^{32} y_i}{32}$$

Calculate the variance of the gross weight, $s_y^2$.

$$s_y^2 = \frac{\sum_{i=1}^{32} (y_i - \bar{y})^2}{31} = \frac{\sum_{i=1}^{32} y_i^2 - \left( \sum_{i=1}^{32} y_i \right)^2}{32}$$

c) Weigh 32 units of empty packages.

Calculate the mean value, $z$.

$$z = \frac{\sum_{i=1}^{32} z_i}{32}$$

Calculate the variance of the tare weight, $s_z^2$.

$$s_z^2 = \frac{\sum_{i=1}^{32} (z_i - \bar{z})^2}{31} = \frac{\sum_{i=1}^{32} z_i^2 - \left( \sum_{i=1}^{32} z_i \right)^2}{32}$$

d) Calculate $q$ defined as

$$q = \frac{s_y^2}{s_y^2 - s_z^2}$$

If the value of $q \geq 0.09$, the determination of net quantity should be done in accordance with procedure 3 or the inspection should be limited to the determination whether the labelled volume for the lot corresponds to the average (see point f below).

e) Limit for defective fraction.

Calculate volume values $v_i = \frac{y_i - z}{\bar{e}}$.

If the number of defective units exceeds 2, the lot is considered to be unacceptable.

f) Determination of average volume.

In order to determine if the average volume is acceptable the standard deviation $s$ for the difference between gross and tare weights is first to be calculated.

$$s = \sqrt{s_y^2 + s_z^2}$$

Then calculate $s_o = \frac{s}{\bar{e}}$

$$\bar{v} = \frac{\bar{y} - \bar{z}}{\bar{e}}$$

$$\frac{(\bar{v} - m_o) \sqrt{32}}{s_o}$$

The lot is considered unacceptable if $\frac{(\bar{v} - m_o) \sqrt{32}}{s_o} < -2.7$. 

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The number 2.7 is derived from the t-distribution, such that the probability of rejecting a correct lot does not exceed 0.5%.

If the value of $q$, according to $d$ above, exceeds the limit given (0.09), the inspection may be limited to the above determination of average volume if the packages are difficult to open. However if $q > 1$, direct measurements of net volume are to be made for controlling the labelled average volume.

**PROCEDURE 3**: determination of net quantity (weight or volume) by opening the packages as follows:

a) Weigh or measure the net contents, $x_j$, of 32 units of pre-packaged commodities after completely emptying the packages.

Calculate the mean value, $\bar{x}$.

$$\bar{x} = \frac{\sum_{j=1}^{32} x_j}{32}$$

Calculate the variance, $s_n^2$:

$$s_n^2 = \frac{\sum_{j=1}^{32} (x_j - \bar{x})^2}{31} = \left[ \frac{\sum_{j=1}^{32} x_j^2}{32} - \left( \frac{\sum_{j=1}^{32} x_j}{32} \right)^2 \right] / 31$$

b) Limit for defective fraction.

If the number of defective units exceeds 2, the lot is considered to be unacceptable.

c) Determination of average quantity.

In order to determine if the average quantity is acceptable the standard deviation, $s_n$, is first to be calculated.

$$s_n = \sqrt{s_n^2}$$

Then calculate the ratio, $\frac{(\bar{x} - m_0)\sqrt{32}}{s_n}$

The lot is considered unacceptable if $\frac{(\bar{x} - m_0)\sqrt{32}}{s_n} < -2.7$.

The number 2.7 is derived from the t-distribution such that the probability of rejecting a correct lot does not exceed 0.5%.

**Inspection procedures for lots containing commodities labelled with varying net quantities**

**PROCEDURE 4**: determination of net weight by gross and tare weighings as follows:

a) Measure the gross weights, $y_j$, of 32 units of pre-packaged commodities.

Calculate the mean value, $\bar{y}$.

$$\bar{y} = \frac{\sum_{j=1}^{32} y_j}{32}$$

Calculate the mean value, $\bar{u}$, of the labelled net quantities.

$$\bar{u} = \frac{\sum_{j=1}^{32} u_j}{32}$$
Calculate the variance of the difference between gross weight and labelled net weight, $s_\delta^2$.

$$s_\delta^2 = \frac{\sum_{j=1}^{32} (y_j - u_j)^2}{31} = \left[ \frac{\sum_{j=1}^{32} (y_j - u_j)^2}{32} - \frac{\left( \sum_{j=1}^{32} (y_j - u_j) \right)^2}{32} \right] / 31$$

b) Weigh 32 units of empty packages.

Calculate the mean value, $\bar{z}$.

$$\bar{z} = \frac{\sum_{j=1}^{32} z_j}{32}$$

Calculate the variance of the tare weight, $s_\delta^2$.

$$s_\delta^2 = \frac{\sum_{j=1}^{32} (z_j - \bar{z})^2}{31} = \left[ \frac{\sum_{j=1}^{32} (z_j - \bar{z})^2}{32} - \frac{\left( \sum_{j=1}^{32} z_j \right)^2}{32} \right] / 31$$

c) Calculate $q$ defined as

$$q = \frac{s_\delta^2}{s_\delta^2 + s_\delta^2}$$

If $q \geq 0.09$, the determination of net weight should be done in accordance with procedure 5, or the inspection should be limited to the determination whether the labelled quantity for the lot corresponds to the average (see point e below).

d) Limit for defective fraction.

If the number of defective units exceeds 2, the lot is considered to be unacceptable.

e) Determination of average weight.

In order to determine if the average weight is acceptable the standard deviation $s$ for the difference between gross weight and tare weight is first to be calculated.

$$s = \sqrt{s_\delta^2 + s_\delta^2}$$

Then calculate the ratio, $\frac{(\bar{y} - \bar{u} - \bar{z})/\sqrt{32}}{s}$

The lot is considered unacceptable if $\frac{(\bar{y} - \bar{u} - \bar{z})/\sqrt{32}}{s} < -2.7$

The number 2.7 is derived from the $t$-distribution such that the probability of rejecting a correct lot does not exceed 0.5 %.

If the value of $q$ according to point c above, exceeds the limit given (0.09), the inspection may be limited to the above determination of average weight if the packages are difficult to open.

However, if $q > 1$, direct measurements of the net weight are to be made for controlling the labelled average quantity.

**PROCEDURE 5 :** determination of net weight by opening the packages as follows:

a) Weigh the net contents of 32 units of pre-packaged commodities after completely emptying the packages.

Calculate the mean values, $\bar{x}$ and $\bar{u}$.

$$\bar{x} = \frac{\sum_{j=1}^{32} x_j}{32} \quad \bar{u} = \frac{\sum_{j=1}^{32} u_j}{32}$$

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Calculate the variance $s^2_n$ of the difference between the measured net weight and the labelled net weight.

$$s^2_n = \frac{\sum_{j=1}^{32} (x_j - \mu_j) - (\bar{x} - \bar{\mu})^2}{31} = \left[ \frac{\sum_{j=1}^{32} (x_j - \mu_j)^2}{32} - \frac{\left( \sum_{j=1}^{32} (x_j - \mu_j) \right)^2}{32} \right] \bigg/ 31$$

b) Limit for defective fraction.

If the number of defective units exceeds 2, the lot is considered to be unacceptable.

c) Determination of average weight.

In order to determine if the average weight is acceptable the standard deviation $s_n$ is first calculated.

$$s_n = \sqrt{s^2_n}$$

Then calculate the ratio, $\frac{(\bar{x} - \bar{\mu})\sqrt{32}}{s_n}$

The lot is considered unacceptable if $\frac{(\bar{x} - \bar{\mu})\sqrt{32}}{s_n} < -2.7$

The number 2.7 is derived from the $t$-distribution such that probability of rejecting a correct lot does not exceed 0.5 %.
The STRUCTURE and the FUNCTION
of a NATIONAL SERVICE of LEGAL METROLOGY

FINAL REPORT BY SP 25-Sr 2 (SRI LANKA)


Preamble

The existence of a National Service of Legal Metrology presupposes
— the Legal recognition in the country of a system of measurement units
— the existence of a National Law on Metrology.

This document therefore is based on these premises and reference is directed to International Document No. 1 « Law on Metrology » and International Document No. 2 « Legal Units of Measurement », in the event that this infra-structure is not set up. The document itself is divided into two parts. The first part setting out the different stages of planning that have to be carried out to set up such a service and the second part ( Annexes A, B, C) consisting of three models taken from a Developing Country analysing the requirements of basic Legal Metrology Offices for controlling measuring instruments used in general commercial transactions.

1. Introduction

An analysis is made of the need for a National Metrology Service in a National Economy for its technological and social development and the means of setting up a Service of Legal Metrology.

Since measurement implies the recognition and the use of a system of measurement units, it is assumed that this will be the International System of Units with the adoption of those units which are outside SI, but permitted for use with it, as may be deemed necessary.

2. Establishment of a national metrology laboratory

2.1. The following studies should be made :

2.1.1. Estimate of current measurement capabilities of the measurements performed in the country (see Annex A for notes on method).

2.1.2. Estimate of measurement capabilities to be achieved.

2.2. The following points will have to be considered :

2.2.1. Resources.

2.2.2. Availability of suitable competent staff.
2.2.3. Projection of level of measurement accuracy required over the next 10 to 15 years in relation to the development programmes of the country.

2.2.4. Further training of technical specialists in the field of metrology.
   This could be considered in two stages.
   The first, a short intensive restricted programme in the National Metrology Laboratories of another country to enable them to pick up calibration techniques etc., so as to make them operative.
   The second stage which will follow after a few years of active metrological work in their country. It will entail the obtaining of a requisite post graduate qualification in metrology.

2.2.5. Purchase or manufacture of necessary standards of measurement and equipment for the National Metrology Laboratory.
   In purchasing these standards the hierarchy of standards necessary for the country would be according to the results of studies obtained under point 2.1.
   Consideration should be paid to the use of the existing facilities in the neighbouring countries of the region where it is practical to do so.
   NOTE: It is necessary that this National Laboratory be the centre for the Service of Legal Metrology and the Metrology offices in the country.

3. **Law on metrology**

3.1. This could initially be a part of a Law on Units or could form a separate set of laws. Where a country is starting afresh it would be better to have them separate. In drafting the Law, OIML International Document No. 1 should be used against the background of the accepted principles of Law in the Country (*).

3.2. The first of these laws should be a law relating to measuring instruments used in commercial transactions.

3.3. Other aspects are dealt with in paragraph 5.

4. **Establishment of a service of Legal Metrology (first phase - weights and measures service)**

4.1. The establishment of Metrology offices in the country.
   The number will depend on:
   (a) the size of the country — the extent and the population.
   (b) number of commercial establishments and the types of weighing and measuring apparatus used by them.

4.2. The purchase or manufacture of verification agents standards. The nature of the standards to be acquired depend on:
   (a) the sectors of commercial transactions which are to be controlled and supervised.
   (b) the kind of measurement devices which are used in these sectors.

4.3. The setting out of procedures for verification agents.

4.4. Recruitment and training of verification agents (*).

4.5. The drafting of rules setting out technical and metrological specifications for weights, measures and weighing and measuring instruments.
5. **Extension of the law on metrology to the state control of other measuring devices**

5.1. This would depend on the priorities for the extension of the metrology service which each country will have to decide on for itself.

These areas could be for example, the control of measuring instruments used in the following fields:
(a) the checking of contents of prepacked commodities;
(b) the levying of taxes on excisable goods;
(c) public health;
(d) the hire of motor vehicles and control of vehicular traffic;
(e) the protection of the environment, etc.

5.2. Once priorities are established as to the kinds of measuring devices to be subjected to the procedures of State Control, a decision will have to be made as to which State Institution will carry out the task — i.e. whether this would be done directly by the service of Legal Metrology or by another State Institution. This is a matter which lies strictly within the purview of each country.

5.3. Laws and regulations setting out the metrological and other technical characteristics for the measuring devices to which state control is to be applied (based on relevant OIML Recommendations) (*).

5.4. Establishment of physical standards or standard methods for the calibration of these measuring devices (*).

5.5. Setting out of procedures for calibration (*).

5.6. Instructions to verification agents or other personnel who will perform the calibration (*).

(*) In liaison with the competent OIML Pilot and Reporting Secretariats.
Annex A

Example of the planning of a Local Verification Bureau

A.1. INTRODUCTION

This particular model is for a small district which is primarily agricultural, in that it raises two crops, rubber and tea, but both of which require processing at the plantation itself.

A.2. PARAMETERS

A 2.1. Demographic

<table>
<thead>
<tr>
<th>Extent</th>
<th>1988 square kilometres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>361 000</td>
</tr>
<tr>
<td>No. of administrative sub-divisions</td>
<td>6</td>
</tr>
<tr>
<td>Principal Towns</td>
<td>1 (Extent 10.4 square kilometres Population 31 000)</td>
</tr>
</tbody>
</table>

A.2.2. Production

The area is predominantly agricultural, the principal crops being:

(a) Tea 8 113 ha
(b) Rubber 8 213 ha
(c) Coconut 8 115 ha
(d) Paddy 6 890 ha
(e) Others 8 803 ha

Of these crops only the first two use a complex manufacturing process which require a factory. In all the processes the principal quantity measured is that of mass. Although temperature and humidity are also measured, the verification of these instruments are not being considered for the present.

The maximum capacity of the weighing instruments used are in the region of 500 kg. Each tea or rubber unit has a series of instruments of different types and capacities.

All other crops too require weighing instruments except in the case of paddy where the producer will use a volume measure, but transactions will be done either by volume or by weight.

A.2.3. Trade

The bulk of the trading activities are those of the distribution of food and other necessities. The principal cash crops, tea and rubber, would in the main be sent to the Capital City by larger producers. Produce dealers service the smaller holdings. There are two separate categories of trade, the first is that of general trade and the other that of the specialised trade, that of Jewellers, Chemists, etc. The latter is a much smaller but important aspect as jewellery is used not only for ornamental purposes but also represents savings.

The general trade uses the following measuring instruments and this list will hold for some time in the future.

(a) Weighing instruments up to a capacity of 1 000 kg
(b) Measures of volume up to a capacity of 20 litres
(c) Measures of length
   (1) Metre sticks (for textiles)
   (2) Tapes (20 m and 30 m for timber etc.)
(d) Petrol pumps.
A.2.4. Trade Practices

Most of the trading practices involve a direct measurement at the time of transaction, generally in the presence of the purchaser or the agent. Prepacked commodities will in general be those packed in other districts, although there will be a small number of local producers of confectioneries and beverages like tea and coffee, who put out packs locally. The volume is small at present but could increase.

A.2.5. Data on number of Trades premises and weights, measures, etc. in use

1. No. engaged in general trade : 2,800 (approximately)
2. No. of petrol filling stations : 4
3. No. of specialised trade premises : 33
   (Jewellers, Chemists, etc.)

A.2.6. Number of weights and measures, etc.

1. Weights (general) : 17,000 (approximately)
2. Measures of length (1 metre) : 800
3. Measures of length greater than 1 metre : 50
4. Measures of volume (liquid) : 3,500
5. Measures of volume (dry) : 2,700
6. Weighing instruments : 3,370
7. Petrol pumps : 10
8. Jewellers and Chemists weights : 250
9. Jewellers and Chemists balances : 50

A.3. THE FUNCTIONING OF THE VERIFICATION BUREAU

A.3.1. The functions of the Bureau are based on a number of assumptions:

A.3.1.1. that the National Metrology Law requires annual verification and

A.3.1.2. that stamping tours will be arranged, setting up temporary stamping centres in the various sub-divisions of the district to which equipment will be transported and the verification agent will stay at the centre for a number of days. The duration of the stay being dependant on the quantum of work. There are exceptions:

(i) jewellers and chemists weights and balances will be tested only at the Verification Bureau;

(ii) special tours will be arranged for the verification of platform type weighing instruments above 100 kg at site and for petrol pumps.

A.3.1.3. a verification agent would visit on inspection at least 75 % of the premises on one occasion on routine surprise inspection.

A.3.1.4. that all complaints by the public would be investigated as quickly as possible.

A.4. LOCATION OF VERIFICATION BUREAU, STAFF, EQUIPMENT

Location — The verification bureau should be located in the principal town of the district, since the work will be heaviest there. The Bureau should consist of:

(a) a Laboratory for keeping a complete set of standards, storage for additional standards, a testing area for weighing machines, an office for the Inspectors, a waiting area for the public, toilet, and garage for a vehicle. The floor area
is based on the following staff: One Supervising Officer and two Verification Agents plus two assistants. The Supervising Officer should be a Verification Agent who has after a certain period of service been promoted to this grade.

(b) Offices and waiting rooms etc. 25 m²
Laboratory and stores 50 m²
Garage 20 m²

A.5. EQUIPMENT

A.5.1. Laboratory Standards

(a) Set of verification agents standards of mass: 20 kg - 1 mg
(b) Sets » » 100 g to 1 mg
(c) Set of metric carat weights 100 carat to 0.01 carat
(d) Verification Agents balances (portable) 25 kg
(e) » » 5 kg
(f) » » 50 g
(g) » » 2 g
(h) Verification Standards of volume 5 litre, 2 litre, 1 litre
(i) » (glass) 500 ml; 200 ml; 100 ml; 50 ml
(j) » Cylindrical glass measures 200 ml and 100 ml
(k) » Pipettes 100 ml to 5 ml
(l) » Standard metre tape
(m) » » 15 metre tape
(n) 15 cast iron test weights of 20 kg plus one set of test weights 10 kg to 10 g
(o) Accessories

A.5.2. Field Standards

(a) Set of standard weights 20 kg to 1 mg
(b) » » 100 g to 1 mg
(c) Sets of verification agents volume standards, 5 litre, 2 litre, 1 litre, and 500 ml
(d) Set of subdivided glass standards 200 ml and 100 ml
(e) Set of pipettes 100 ml to 5 ml
(f) Verification agents metre tape
(g) Portable beam scale 20 kg
(h) » » 3 kg
(i) 15 cast iron test weights of 20 kg and one set from 10 kg to 100 g
(j) Petrol standards 20 litre, 10 litre, 5 litre, 2 litre
(k) Glass measures for oil 1 litre, 500 ml, 200 ml
(l) Accessories

A.5.3. Inspection

(a) Portable weighing instruments (OIML Class III) capacity 5 kg
(b) Test measures
(c) Metre tape
(Portables standards for field equipment too could be used for this purpose when the need arises)
(d) Vehicle: 1 tonne passenger/goods van
A.6. PROCEDURE OF WORK FOR VERIFICATION OF ADMINISTRATION

The work will be organised as follows:

A.6.1. The Verification Bureau will be open throughout the year providing facilities to any trader to have their measuring appliances tested and certified. It will also have a planned programme of work for the principal town and the surrounding villages up to a radius of 7 kilometres.

A.6.2. 18 temporary centres will be held throughout the year to service the other traders. This will consist of 20 tours. The verification agent will spend a total of 75 working days at these centres.

A.6.3. Three stamping tours per year to test and certify weighing instruments of capacity of 250 kg or greater used in district. This will take up 15 working days.

A.6.4. One stamping tour per year to test and certify measuring instruments for liquid fuel.

Note: In each instance the ideal solution would be to notify each trader/user individually, but this is a costly and time consuming process. Hence other means of official notification prevalent in a country could be used.

A.7. INSPECTIONS

Each verification agent should spend at least 6 days on inspections of measuring appliances per month. On these occasions specific complaints could be looked into or a separate number of days set apart for this work.

A.8. REPORTING

Verification Agents should be provided with forms for reporting the nature and quantum of work done each day. These forms will be sent for scrutiny and evaluation by the Supervising Officer who in turn should summarize the data for inclusion in a national information pool. The forms should be simple and explicit and reduce to a minimum paper work. Each verification agent however should maintain a diary/log book which will indicate the details of the work done by him. This will be scrutinised at periodic intervals by the Supervising Officer.

A.9. MAINTENANCE AND CARE OF STANDARDS

A manual for the use and the maintenance and care of equipment should be provided to each verification agent. The Supervising Officer should at intervals of 3 - 4 months check on the condition of the equipment and the performance of the balances. The Supervising Officer should arrange for the periodic verification of the standards against the Regional Secondary Standards before the period of validity expires. The quantum of equipment specified makes it possible for this to be done in rotation so that all times the officers will have access to a set of standards, provided they are sent in rotation.
Annex B

Model II

B.1. INTRODUCTION

The District which has been chosen as Model II is primarily Agricultural with the emphasis on growing of a cereal, namely paddy and a commercial agricultural crop — i.e. coconut. In both instances, there is very little processing of the finished product unlike in the case of tea and rubber.

B.2. PARAMETERS

B.2.1. Demographic

Extent : 4 776 Square kilometres
Population : 1 137 000
No. of administrative sub divisions : 13
Principal towns : 2 (Extent 10.4. square kilometres
4.1. square kilometres respectively)

B.2.2. Production

(a) Tea 367 hectares
(b) Rubber 6 245 ”
(c) Coconut 156 746 ”
(d) Paddy (major season) 56 788 hectares
(e) Paddy (minor season) 36 100 ”
(f) Miscellaneous Agricultural Crops :
   (major season) 14 752 hectares
   (minor season) 16 623 ”

The extents under tea and rubber are too insignificant to have any effect on the kind of measuring equipment used in this District particularly as the holdings for each particular crop would be in the nature of small holdings. Hence green tea leaves will be sold to larger processing units and in rubber the basic processing will be done and the sheet sold to a dealer. In both cases the producer will only use a weighing machine of low capacity.

In the case of coconut, the product is sold by number unless the coconut kernel is dried when it is sold by weight. Similarly there are other products like coconut fibres which again are sold by weight.

Paddy the major agricultural crop again does not require much processing, only milling and here again the units of transaction are those by volume or mass. Transactions by volume are being replaced by that of weight and with the change to metric they will cease.

Although the state purchasing organisations use moisture meters for the measurement of moisture content of paddy, this is not considered a part of the study as in the case of latex-o-meters and humidity-meters in Model I. They form part of the next stage of development.

B.2.3. Textiles

The District has two major textile mills and a number of small scale hand looms and power looms. However, in one of the textile mills there is a weigh-bridge, but this has not been taken into account as it is to be considered as part of work of « weigh-bridge testing unit » which will form part of Model III.

Hence the maximum capacity of the weighing instrument used in these need not exceed 500 kg.

B.2.4. Trade

The trade categories are very similar to that of Model I.
B.2.5. Trade Practices

They are identical to that of Model I.

B.2.6. Data on number of trades premises and weights, measures, etc. in use

(a) 1. No. engaged in general trade (approximately) : 9 000
    2. No. of Petrol filling stations : 45
    3. No. of specialised trade premises
       Jewellers, Chemists
       : 250

(b) No. of Weights and Measures in the District :
    1. No. of weights : 60 000
    2. No. of measures of length (1 metre) : 1 800
    3. No. of measures of volume (liquid) : 4 100
    4. No. of measures of volume (dry) : 6 300
    5. No. of weighing instruments : 12 000
    6. No. of petrol pumps : 125
    7. No. of jewellers and chemists weights : 1 500
    8. No. of jewellers and chemists balances : 300

B.3. FUNCTIONS OF THE VERIFICATION BUREAU

The functions are the same as in Model I.

B.4. LOCATION OF VERIFICATION BUREAU, STAFF, EQUIPMENT

The location again is the principal town in the District and the conditions for the laboratory and equipment are the same except that there will have to be additional standards and additional staff.

Using the same criteria as in Model I seven Verification Agents are needed for adequate coverage. In addition there will need to be an officer in the supervisory grade as in the case of Model I, plus a senior officer who would be responsible for the planning and administration. Although there are 7 Verification Agents, the number of sets of verification standards could be as follows:

(a) Four sets of verification agents standards of mass, length and volume for General Trade together with balances and other equipment;

(b) One set of verification agents standards and balances for testing Jewellers and Chemists weights;

(c) Two sets of standards for testing petroleum standards;

(d) Two sets of standards for checking weighing instruments up to a capacity of 1 tonne.

In all instances specifications for these are available in OIML Recommendation Numbers 25, 40, 41, 43, 47.

Procedure of work for verification of Commercial Weighing and Measuring Instruments

The procedures will be the same as given in Model I. However since the area is much larger and the number of measuring instruments used larger, more temporary centres will have to set up over a year. In this instance there will be a need to have:

(a) 32 Temporary Stamping Centres

(b) 4 Stamping tours to test and certify weighing instruments of capacity up to 1 tonne

(c) 2 Stamping tours to test and certify measuring instruments for liquid fuel.

The procedure for inspections and reporting will be the same as for Model I.
Annex C

Model III

C.1. INTRODUCTION

The District which was chosen for Model III has within it the Capital City of the Country and surrounding it a dense conurbation of suburbs as well as commercial and industrial establishments. The Capital City has not being considered as a separate unit, because, firstly in the previous models it was postulated that there would be a weigh-bridge testing unit in the centre. This unit will be considered within this model and as the number of weigh-bridges within the Capital City alone is not large enough for it to have a separate unit, it will operate for the whole country. Secondly, the largest number of manufacturers of weights and weighing instruments have their establishments outside the limits of the Capital City, but the maximum use of facilities and services could be utilised if they are considered together. Finally the testing of packaged products again is considered as a single unit, for the city and the district.

C.2. PARAMETERS

C.2.1. Demographic

<table>
<thead>
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<th>Value</th>
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<tbody>
<tr>
<td>Extent</td>
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</tr>
<tr>
<td>Population</td>
<td>2 972 000</td>
</tr>
<tr>
<td>No. of Administrative Districts</td>
<td>19</td>
</tr>
<tr>
<td>No. of Municipalities in District</td>
<td>3</td>
</tr>
<tr>
<td>No. of Urban and Town Councils</td>
<td>25</td>
</tr>
</tbody>
</table>

C.2.2. Production

C.2.2.1. Tea

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber</td>
<td>25 726 ha</td>
</tr>
<tr>
<td>Coconut</td>
<td>48 234 ha</td>
</tr>
<tr>
<td>Paddy (Major Season)</td>
<td>23 967 ha</td>
</tr>
<tr>
<td>Paddy (Minor Season)</td>
<td>10 523 ha</td>
</tr>
<tr>
<td>Misc.</td>
<td>11 334.431 ha</td>
</tr>
</tbody>
</table>

C.2.2.2. Industry

Note: These figures represent only the industries approved by the Ministry of Industries. They are put into two categories: the first, denoted as 'L' being those which have an annual turn-over of U.S. $ 50 000 and the second denoted as 'S' which have a turn-over of less than this amount.

It does not include a large number of small industries which have not been approved by or registred with the Ministry of Industries.

(a) Manufacture of Food, Beverage and Tobacco

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
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<tbody>
<tr>
<td>L</td>
<td>15</td>
</tr>
<tr>
<td>S</td>
<td>119</td>
</tr>
</tbody>
</table>

(b) Manufacture of Textiles, Weaving apparels and Leather Products

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>20</td>
</tr>
<tr>
<td>S</td>
<td>580</td>
</tr>
</tbody>
</table>
(c) Manufacture of Wood and Wood Products

\[ \begin{align*}
'L' &= 101 \\
'S' &= 217
\end{align*} \]

(d) Manufacture of Paper and Paper Products: Printing and Publishing

\[ \begin{align*}
'L' &= 50 \\
'S' &= 217
\end{align*} \]

(e) Manufacture of Non-metallic Mineral Products other than those of Petroleum

\[ \begin{align*}
'L' &= 4 \\
'S' &= 98
\end{align*} \]

(f) Base Metal Industries

\[ \begin{align*}
'L' &= 4 \\
'S' &= 11
\end{align*} \]

(g) Manufacture of Fabricated Metal Products: Machinery and Equipment

\[ \begin{align*}
'L' &= 54 \\
'S' &= 348
\end{align*} \]

(h) Other Manufacturing Industry

\[ \begin{align*}
'L' &= 1 \\
'S' &= 75
\end{align*} \]

Note: These data are based on a Report from Ministry of Industries and Scientific Affairs for the year 1978.

C.2.2.3. Manufacture of Weights, Measures of Length and Volume

No. of manufactured units tested and stamped by Inspector

1. Weights 180,711 (both Metric and British)
2. Linear measures 1,285 (metric measures only)
3. Volume measures 2,012 (metric measures only)
4. Weighing instruments 8,946 (both Metric and British)

Note: These figures are based on data obtained from the Measurement Standards and Services Division of the Department of Internal Trade for the year 1979-80.

C.2.3. Agriculture

The extents under Tea, Rubber and Coconut are too small to have any effect on the type of measuring equipment used in the district. Paddy, as in the case of Model II has some effect and that is in the number of weighing instruments that will increase as the number of volume measures used decrease. In the data given under point C.2.2.3, for the manufacture of volume measures only 79 of the 2012 measures manufactured are for the measurement of grain.

The effect of Industry in that region is two-fold, the first is that the commercial and industrial operations use weigh bridges and secondly, light engineering industry uses gauges of different kinds for engineering metrology. The former is provided for in this study but the latter as in the case of moisture meters etc. will form the part of the next stage of development.

C.2.4. Trade and trade practice

The categories are similar to those of Model I and Model II except that a number of trade establishments large and small do pack food and
other items in containers for sale to the public. In addition since the city also contains the main port, all importers of pre-packed goods distribute these goods from the Capital City. This adds a new dimension to the work of the Verification Bureau.

C.2.5. Data on number of trade premises and weights and measures etc. used in trade premises

(a) No. engaged in General Trade approx. 26 000
No. of Petrol Filling Stations 400
No. of Specialised trade premises 2 000
    (Jewellers, Chemists etc.)

(b) No. of weights, measures, weighing and measuring instruments in district.
    1. No. of weights 143 000
    2. No. of dry measures 36 000 (*)
    3. No. of liquid measures 13 101
    4. No. of linear measures 4 420
    5. No. of weighing machines 25 347
       (other than weigh bridges)
    6. No. of weigh bridges 75

C.3. THE FUNCTIONING OF THE VERIFICATION BUREAU

This will be the same as for Model I with the addition of the following additional facilities.

C.3.1. The establishment of a Weighbridge — Testing Unit (for the whole country). Special tours will be arranged.

C.3.2. The establishment of a unit to handle the testing of flowmeters for petroleum products in the City and the District (combined). Here again special tours will be arranged.

C.3.3. The establishment of a unit to check prepacked goods at factories and warehouses of importers.

C.3.4. The provision of facilities to manufacturers of weights measures and weighing instruments to have these tested and stamped before sale.

C.4. LOCATION OF VERIFICATION BUREAU, STAFF, EQUIPMENT

C.4.1. Unlike in the case of the Verification Bureau in models I and II there is a need for a unit at the Centre with at least two smaller units, one in the city itself to meet the requirements of the trading establishments in the city, and one about 25 km away from the city, which will handle the needs of the traders and that these units will be smaller and have less equipment.

C.4.2. The Verification Bureau should consist of the following.

C.4.2.1. Central Unit

(a) Laboratory for keeping sets of Standards, a testing area for weighing machines, provision for testing fine balances. Special area for testing and stamping of manufactured weights and measures, separate section for testing packaged products. Offices for the Inspectors, waiting area for Public, toilets and

(*) These are mainly cylindrical Quart and 1/2 Pint measures of volume used by the retail trade to sell rice. They will be completely done away with metricalation when rice will be sold only by weight.
garages for vehicles. The floor area is based in the following staff, one Supervising Officer, 3 Senior Verification agents and 7 Verification Agents and their assistants.

(b) Garage for vehicle of weighbridge testing Unit.

(c) Space:
   Laboratory and stores       75 m²
   Offices and waiting rooms   40 m²
   Garages                    50 m²

C.4.2.2. Sub-office in City
   (i) To consist of 1 Senior Verification Agent and 5 Verification Agents.
   (ii) Space as for model I.

C.4.2.3. Sub-office in District
   (a) Staff: To consist of 1 Senior Verification Agent, 3 other Verification Agents.
   (b) Space as for Model I.

C.5. EQUIPMENT

C.5.1.1. The basic equipment that will be needed is the same as that specified in points A.5.1. to A.5.3. in model I, except that the number of sets of equipment in points A.5.2. and A.5.3. will have to be increased.

C.5.1.2. A Weighbridge Testing Unit consisting of a heavy lorry fitted with 500 kg roller weights. The vehicle will be fitted with a motor driven small hoist for lifting the roller weights.

C.5.1.3. A series of weighing instruments and volume measures for checking packaged commodities at factories etc. The weighing instruments should have the accuracy of OIML class III and should be sufficient to cover the range of the packaged products in the market.

C.5.2. Sub-office in the Capital City
   2 sets of equipment as in points A.5.1. and A.5.3. of Model I.

   Sub-office in the District
   1 set of equipment as in point A.5.1. and
   3 sets of equipment as in points A.5.2. and A.5.3. of Model I.
INFORMATIONS

CONSEIL DE LA PRESIDENCE 1981

Le Conseil a commencé par une vaste consultation qui a permis aux participants de présenter leurs points de vues sur l'OIML, ses buts, ses méthodes de travail, et d'envisager la manière d'accroître son efficacité malgré l'actuelle pénurie de moyens matériels et financiers, qui résulte de la situation économique mondiale.

Parmi les points ayant fait l'objet de discussions, on notera en particulier :

— plus grande utilisation, par exemple, des normes de l'ISO et de la CEI comme bases des Recommandations de l'OIML,
— meilleure planification des travaux,
— recherche de méthodes nouvelles de vérification, mieux adaptées aux technologies modernes,
— extension des Recommandations aux « méthodes de mesurage » et non pas seulement aux instruments et à leur vérification,
— efforts dans des domaines peu explorés (santé, pollution...),
— étude approfondie de l'activité des Services nationaux de métrologie,
— efforts accrus en faveur de l'Information,
— réorganisation de l'activité tournée vers les pays en développement.

Le Bureau a été chargé de faire l'analyse de toutes les propositions qui seront discutées plus en détail lors de la prochaine réunion du Comité (mars 1982).

Le Conseil a ensuite examiné, entre autres, la situation administrative et financière de l'Organisation, le travail des divers Secrétariats Pilotes et Rapporteurs, l'état de la collaboration avec les Institutions Internationales à buts connexes.


A l'issue des deux journées de travail, M. BIRKELAND a remercié ses collègues pour leur participation positive et le vif intérêt manifesté à l'égard de l'avenir de l'OIML.

Il les a conviés à une réception donnée en l'honneur de M. et Mme van MALE, et à laquelle ont participé d'anciens membres du Comité et du Bureau : M. COSTAMAGNA, M. et Mme VIAUD, M. et Mme GOLDNER, M. et Mme ALLWRIGHT, Mme HOU-DOUIN, M. GOUZIL. Le Bureau International des Poids et Mesures et le Bureau National de Métrologie étaient représentés respectivement par M. et Mme QUINN et M. PRIDEL.

A cette occasion, M. BIRKELAND a évoqué l'activité incessante et le rôle joué par son prédécesseur, M. van MALE, dans le développement de l'OIML.
MEMBRES DU COMITE

L’Ambassade d’INDONESIE à Paris nous a fait connaître la désignation de Monsieur R. HAROEN comme nouveau Directeur de la Métrologie au Ministère du Commerce et des Coopératives en remplacement de Monsieur SOEPARTO qui cesse également de représenter son Pays au Comité International de Métrologie Légale. Nous remercions à cette occasion Monsieur SOEPARTO de la collaboration qu’il a bien voulu nous accorder et nous présentons nos meilleures salutations à son successeur, Monsieur HAROEN.

INSYMET 82

Il est prévu que le 6e International Symposium on Metrology, INSYMET 82, ait lieu à BRATISLAVA, en septembre 1982. Ce Symposium s’ouvre sur un vaste nombre de problèmes, concernant principalement les mesures de pression, débit, radiations ionisantes et matériaux de référence.

Pour tout renseignement, s’adresser à :

DOM TECHNIKY ESVTS
Jolana Kalinayová
Skultýtyho ul. 1
88130 BRATISLAVA
Tchécoslovaquie

INFOTERM

Ce centre d’information international pour la terminologie a été créé en 1971, dans le cadre des activités d’UNESCO. Cet Organisme a pour but de rassembler toute information sur la terminologie et édite un journal, Infoterm News qui peut être obtenu par l’intermédiaire du :

Centre for Terminology
Osterreichisches Normungsinstitut
Leopoldgasse 4
Postfach 130
A — 1021 WIEN, Autriche

Les comptes rendus des symposiums Infoterm comprenant, entre autre, un « International Bibliography of Standardized Vocabularies » peuvent être obtenus de :

Saur Verlag K 6
Postfach 711009
8000 MUNCHEN 71
Rép. Féd. d’Allemagne

ILAC


IMS World Publications Ltd
37, Queen Square
LONDON WC 1 N 3BL — Grande-Bretagne
CEE (Nations Unies)


La participation au Séminaire est ouverte aux personnes intéressées des pays de la CEE agréées par leur gouvernement et d'autres pays Membres de l'ONU, ainsi qu'aux représentants des institutions spécialisées et des organisations internationales, intergouvernementales et non gouvernementales participant normalement aux activités de la CEE.

Le programme du Séminaire abordera les thèmes suivants :
— Structure et fonctionnement des systèmes de garantie de la qualité utilisant des instruments de mesure de précision ;
— Conception, fabrication et utilisation des instruments de mesure de précision ;
— Application des techniques du traitement des données pour les systèmes : opérateur/instrument de mesure/fabrication ;
— Systèmes de mesure pour les machines-outils.

De plus amples renseignements peuvent être obtenus auprès de la

Division de l'Industrie
Commission économique pour l'Europe des Nations Unies
Palais des Nations
CH-1211 GENEVE 10, Suisse.

FLOW MEASUREMENT COURSES

When the National Engineering Laboratory held its first course on Flow Measurement in March 1977, few people would have predicted it would prove so popular that there would still be a demand for it 4 years later. More than 350 people have so far attended it.

The majority of the lecturers are members of the Laboratory’s Flow Measurement Division, which has a unique international reputation in this subject. The object of the five-day course is to transfer some of this expertise to industry and, in particular, provide in-depth information on flowmeters. The course consists not only of lectures but also of « hands on » practical sessions and numbers are therefore limited to 40 to enable individual tuition to be given to delegates.

The fiscal aspects of flow measurement are clearly related to Legal Metrology and among those attending the 9th course in the series earlier this year were students representing the Legal Metrology administrations of Jamaica, Mauritius, Kenya and Zambia. The next Flow Measurement Course will be held from 2-6 November 1981 and the Spring 1982 course from 10-14 May 1982.

Details of the courses can be obtained from

Conference Section
National Engineering Laboratory
East Kilbride
Glasgow G75 OOU
United Kingdom
Telephone : 03552 20222 Extension 2154
MANUEL DE PESAGE
KEMÉNY T. : Méreletechnikai Kézikönyv
Műszaki Könyvkiadó, Budapest, 1981

Un ouvrage volumineux sur la technique du pesage (680 pages) vient de paraître en langue hongroise. Le rédacteur — et l'auteur des trois quarts du texte — M. KEMÉNY — est connu dans les milieux spécialisés comme secrétaire de TC 3 « Mesurage de force et masse » de la Confédération Internationale de la Mesure IMEKO et comme chef d'un bureau d'études à Budapest.

L'introduction donne un court résumé de quelques principes et de la terminologie, suivi par la classification des instruments de pesage.

La première partie du livre (chap. 3-7) se rapporte à la présentation des différents systèmes de pesage et leurs éléments : Systèmes mécaniques, instruments de pesage électroniques, hydrauliques et pneumatiques, ensuite les dispositifs imprimers.

Dans la deuxième partie (chap. 8-18), les importants groupes d'instruments de pesage sont traités d'une façon plus descriptive. Les chapitres de cette partie sont les suivants : Balances de précision, balances de ménage, de santé et de poste, balances de commerce, ponts-bascules, pesage de véhicules, bascules à grue, balances à réservoir, balances de dosage et trieuses pondérales, systèmes de dosage programmés, instruments de pesage totalisateurs continus.

Etant donné que le livre s'adresse, tout d'abord, aux utilisateurs des instruments de pesage, tous les chapitres donnent une classification des instruments, leurs caractéristiques principales, une description des modèles les plus répandus. Les questions de mise en service, d'entretien, de contrôle et vérification sont abordées, et les données nécessaires pour faire la commande énumérées.

L'ouvrage est illustré par 1 131 figures. La liste de la littérature utilisée et recommandée se compose de 450 références. Les décisions des organisations internationales, entre elles, les Recommandations Internationales de l'OIML sont souvent indiquées ou citées.

Le tirage du volume s'élève à 1 750. Il faut espérer qu'une traduction permettra à cet ouvrage de valeur de sortir de son isolement linguistique.

HANDBOOK OF WEIGHING
KEMÉNY T. : Méreletechnikai Kézikönyv
Műszaki Könyvkiadó, Budapest, 1981

A thick volume on weighing technology (680 pages) has just been published in the Hungarian language. The editor, who is also the author of three-quarters of the text, Dr KEMÉNY, is well known among specialists of this field as the secretary of TC 3 « Measurement of force and mass » of the International Measurement Confederation IMEKO and as the head of a development bureau at Budapest, Hungary.

In the Introduction of the work, a brief summary of some principles and a terminology are given, followed by a classification of weighing machines.

The first part of the book (chapters 3 through 7) deals with various weighing systems and elements thereof : Mechanical weighing systems, electronic, hydraulic and pneumatic scales, and printing devices.

In the second part (chapters 8 through 18), the most important groups of weighing machines are discussed in a more descriptive way. The chapters of this part are the following : Precision balances, household, medical and post-office scales, weighers for commerce, weigh-bridges, weighing of vehicles, crane weighers, container weighers, bagging scales and check-weighers, programmable batch weighing systems, integrating conveyor belt weighers.

As the book is intended, above all, for users of weighing instruments, in each chapter weighing devices are classified, their main characteristics discussed, and the most frequently used models described in detail. Problems of installation, of maintenance, of checking and verification are discussed, and data necessary for ordering the correct type of weigher enumerated.

The volume is illustrated by 1,131 figures. The list of recommended literature contains 450 references. Decisions of international organisations, among them the International Recommendations of OIML are frequently indicated and quoted.

The size of the Hungarian edition amounts to 1,750 copies. One can only hope that a translation will permit this valuable book to get out of its linguistic isolation.

F. PETIK

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## REUNIONS

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Séminaire OIML : Dispositifs électroniques incorporés dans les instruments de passage et mesurage de volumes de liquides et de gaz 21-25 sept. 1981 BORAS SUEDE

Conseil de Développement 22-23 mars 1982 PARIS FRANCE

Dix-huitième Réunion du Comité International de Métrologie Légale 24-26 mars 1982 PARIS FRANCE
CENTRE DE DOCUMENTATION

Documents reçus au cours du 3e trimestre 1981

BUREAU INTERNATIONAL DES POIDS ET MESURES — BIPM
Le Système International d’Unités (SI) 4e édition, 1981

ORGANISATION DES NATIONS UNIES POUR L’EDUCATION, LA SCIENCE ET LA CULTURE — UNESCO
Final report : Regional Latin American Seminar on Metrology (Sao Paulo, Brazil, 1-5 Dec. 1980)

ORGANISATION INTERNATIONALE DE NORMALISATION — ISO
ISO Normes (en français et en anglais)
ISO 31/0-1981 : Principes généraux concernant les grandeurs, les unités et les symboles
ISO 31/12-1981 : Paramètres sans dimension
ISO 31/13-1981 : Grandeurs et unités de la physique de l’état solide
ISO 835/1-1981 : Verrerie de laboratoire - Pipettes graduées - Partie 1 : Spécifications générales
ISO 835/2-1981 : Verrerie de laboratoire - Pipettes graduées - Partie 2 : Pipettes sans temps d’attente
ISO 835/3-1981 : Verrerie de laboratoire - Pipettes graduées - Partie 3 : Pipettes avec temps d’attente de 15 s
ISO 835/4-1981 : Verrerie de laboratoire - Pipettes graduées - Partie 4 : Pipettes à souffler
ISO 1770-1981 : Thermomètres à tige d’usage général
ISO 1771-1981 : Thermomètres à échelle protégée d’usage général
ISO 1925-1981 : Equilibre - Vocabulaire
ISO 6070-1981 : Tables auxiliaires pour générateurs de vibrations - Méthodes de description des caractéristiques
ISO 6142-1981 : Analyse des gaz - Préparation des mélanges de gaz pour étalonnage - Méthodes pondérales
ISO 6143-1981 : Analyse des gaz - Détermination de la composition de mélanges de gaz pour étalonnage - Méthodes par comparaison
ISO 6144-1981 : Analyse des gaz - Préparation des mélanges de gaz pour étalonnage - Méthodes volumétriques statiques
ISO 6326/2-1981 : Analyse des gaz - Détermination des composés soufrés dans le gaz naturel - Partie 2 : Méthode par chromatographie en phase gazeuse avec détecteur électrochimique pour la détermination des composés soufrés odorants
ISO 6556-1981 : Verrerie de laboratoire - Fioles à filtrer
ISO/TR 6567/1-1981 : Analyse des gaz - Dosage du dioxyde de carbone - Partie 1 : Principes directeurs pour le choix des méthodes
ISO 6706-1981 : Matériel de laboratoire en plastique - Eprouvettes graduées cylindriques
ISO 6711-1981 : Analyse des gaz - Vérification des mélanges de gaz pour étalonnage par méthode de comparaison

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CONFERENCE INTERNATIONALE SUR L’AGREMENT DES LABORATOIRES D’ESSAIS — ILAC

Actes de la Conférence sur l’Agrément des Laboratoires d’essais (CIALE/ILAC 80)

V International Laboratory Accreditation Conference (ILAC) from 26th to 30th October 1981:
  Doc No. II : Organization and Programme of the conference

ASSOCIATION EUROPEENNE DE LIBRE-ECHANGE — EFTA

Compulsory technical regulations : List of competent bodies in EFTA countries, Geneva - Mars 1981

COMMONWEALTH SCIENCE COUNCIL - CSC

Nouvelle publication périodique receue
Commonwealth Currents depuis juin 1981

REPUBLICQUE FEDERALE D’ALLEMAGNE

Richtlinie für die Kalibrierung von Beschleunigungsmessgeräten im Rahmen des Deutschen Kalibrierdienstes vom 1-4-1981

REPUBLICQUE DEMOCRATIQUE ALLEMANDE

Amt für Standardisierung, Messwesen und Warenprüfung

Ordnungen, Rundschreiben, Informationen:
VIII [August 1980] Information Betriebliches Messwesen:
Rahmenfunktionspfläne für ausgewählte Funktionen im betrieblichen

Standards (TGL):
31533 (5-80) : Prüfschemata für Messmittel; Gestaltung
31534 (5-80) : Prüfvorschriften für Messmittel; Gestaltung
31542/15 (6-80) : Staatliche Etalons; Staatliches Etalon der Einheit des Druckes
  Absoluter Druck 10⁻⁶ bis 1000 Pa
31543/08 (6-80) : ; Messmittel für den Druck Absoluter Druck 10⁻⁶ bis 1000 Pa
31542/15 (6-80) : : Staatliches Etalon der Einheit der Induktivität
31542/19 (6-80) : ; Staatliches Etalon der Einheit der Luftpfeuchte
31543/19 (6-80) : ; Messmittel für die Luftpfeuchte; Prüfschema
31542/20 (1-80) : : Spezialnormal für elektrische Wechselspannungen der Frequenz 50 Hz im Bereich von 1 bis 700 kV
31543/20 (1-80) : ; Messmittel für die elektrische Wechselspannung der Frequenz 50 Hz im Bereich 1 bis 700 kV; Prüfschema
31542/21 (1-80) : ; Staatliches Etalon der Einheit des Winkels für die Drehung der Polarisationsebene
31543/21 (1-80) : ; Messmittel zur Bestimmung des Winkels für die Drehung der Polarisationsebene; Prüfschema
31542/22 (1-80) : ; Staatliches Etalon der Einheiten der Energiedosis von Quantenstrahlung
31543/22 (1-80) ; ; Messmittel der Energiedosis von Quantenstrahlung; Prüfschema
31542/23 (1-80) : ; Staatliches Etalon der Einheiten von Beschleunigung, Gewindigkeit und Auslenkung bei mechanischen Schwingungen im Frequenzbereich von 10 Hz bis 12,5 KHz
31543/23 (1-80) ; ; SchwingungsMESSMETTEL; Prüfschema
31542/28 (6-80) ; ; Staatliches Etalon der Einheit der Länge
31543/28 (6-80) ; ; Messmittel für die Länge; Prüfschema

ASMW - Vorschriften Messwesen (VM)
160/01 (1. Abl., 4,75) : Masse; Nichtselbsttätige Waagen; Allgemeine Eichvorschrift
160/08 (5-80) ; ; Genauigkeitsklasse 3, Seilzugwaagen, Eichvorschrift
170 (9-80) : Spannung; Normalelemente; Beglaubigungs- und Sonderprüf vorschrift

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196/01 (2-80) : Volumen ; Kaltwasserzähler ; Zulassung- und Eichvorschrift
253/01 (2-80) : — ; Balengasszähler ; Zulassungs- und Eichvorschrift
422 (3. Ergänzung, 12-80) : — ; Volumenzähler und Volumenmessung einrichtungen mit Volumenzähler für Flüssigkeiten ausser Wasser ; Zulassungs- und Eichvorschrift
496 (7-80) : Prüflehren für Rechenlehren ; Beglaubigungsvorschrift
1257 (19-80) : Volumen ; Volumenmessung einrichtungen für Milch ; Zulassung- und Eichvorschrift
1252 (4-80) : Elektrischer Widerstand ; Gleichstrommesswiderstand ; Beglaubigung, Sonderprüfung
1253 (4-80) : — ; Gleichstrom- Widerstandmessbrücken ; Beglaubigungs- und Sonderprüfvorschrift

Zurückziehungen von ASMW/DAMW - Vorschriften
TGL RG 1055 (1-80) : Härtenormalplatten ; Technische Forderungen ; Beglaubigung

ETATS-UNIS D'AMÉRIQUE

National Bureau of Standards

Sixty-sixth National Conference on Weights and Measures (July 13-17, 1981 - St. Louis, Missouri)


AUTRICHE

Bundesamt für Eich- und Vermessungswesen

Amtsblatt für das Eichwesen : Nr 1 à 4/1981
Änderung der Eichvorschriften für Nichtselbsttätige Waagen der Genauigkeitsklasse (Handelswaagen) vom 16-4-1981
3. Änderung der Eichvorschriften für Wasserzähler (mit Erläuterungen) vom 6-5-1981
Mitteilung Nr 38 über das Zeitsignal des Bundesamtes für Eich- und Vermessungswesen (BEV), 1981

DANEMARK

Dansk Institut for Provning og Justering
Dantest : Arsberetning 1980

ESPAGNE

Comision Nacional de Metrologia y Metrotecnia


FRANCE

Réglementation

Décision ministérielle n° 81.1.01.900.0.0 du 28-1-1981 : Agrément des appareils équipeant les installations thermiques - Appareils de mesure en continu de l'indice de noircissement

Arrêté du 17-2-1981 relatif aux trieuses pondérales automatiques
Arrêté du 4-2-1981 : Commission Industrie-Administration pour la mesure (CIAME)

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