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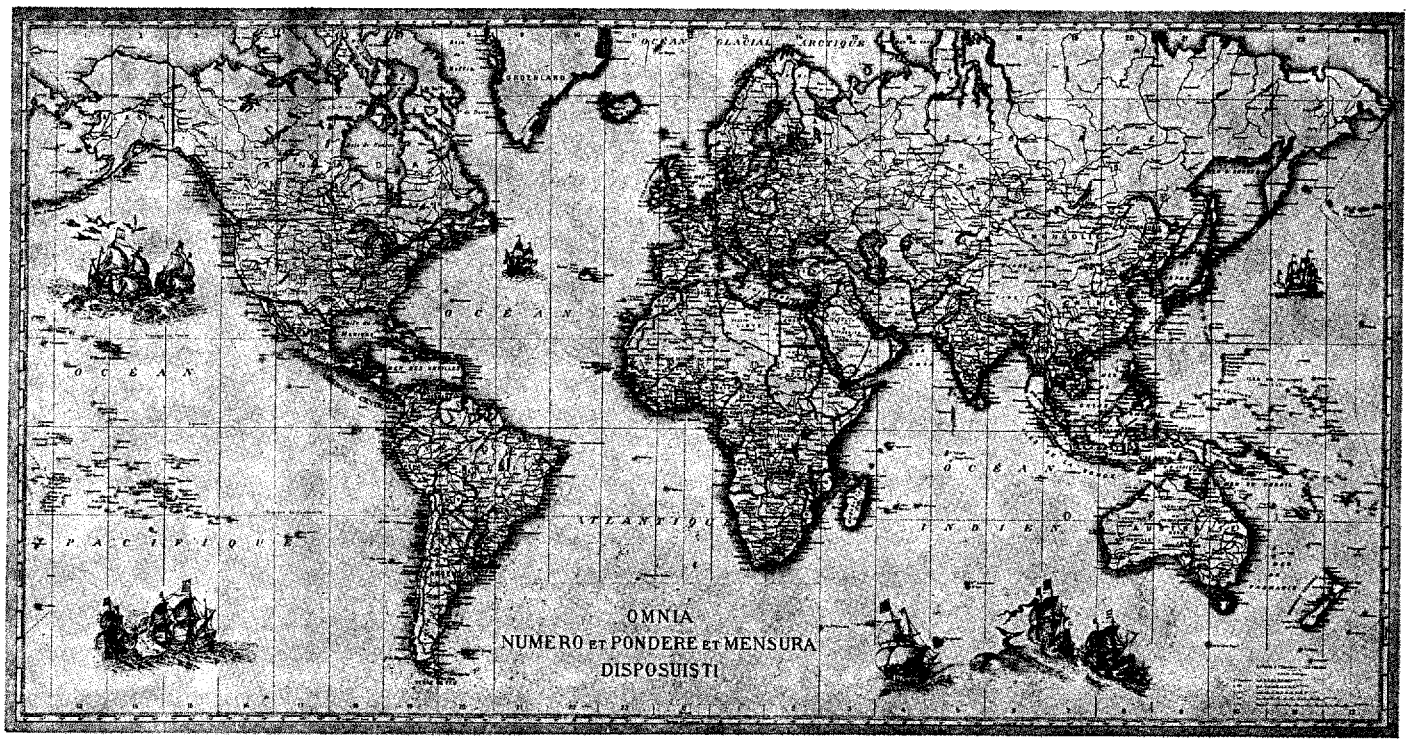

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QUE SE PASSE-T-IL A L'OIML ?

L'année écoulée a été riche en réunions importantes et nous pensons qu'il peut être intéressant pour ceux qui ne participent pas directement aux travaux des secrétariats-rapporteurs d'avoir un aperçu sur ces activités avant de lire le résumé annuel qui sera publié dans le numéro de mars 1987 du Bulletin de l'OIML.

Pesage non automatique

Le secrétariat-rapporteur SP 7-Sr 4 travaille sur des avant-projets d'une Recommandation qui a pour but de rassembler toutes les exigences sur les instruments de pesage non automatique ainsi que les procédures d'essais, en particulier pour des instruments ayant des charges maximales au-dessous de 30 kg et utilisés pour la vente directe au public. Ce travail est basé sur les Recommandations 3, 28 et 74. Les méthodes d'essais sont basées sur des procédés déjà utilisés dans plusieurs pays nordiques.

La nouvelle Recommandation comprendra toutes les particularités relatives aux balances électroniques ainsi qu'aux dispositifs de calcul poids-prix, sans oublier les exigences sur les instruments purement mécaniques qui continuent d'être utilisés. Puisque le progrès technique dans le domaine de l'électronique va très vite, le secrétariat estime qu'il sera nécessaire d'effectuer ce travail d'une façon accélérée. Les Etats Membres mais aussi les fabricants montrent un très grand intérêt pour ce travail. A la dernière réunion en novembre à Paris, il y avait au total plus de 40 participants. Le deuxième avant-projet, actuellement en préparation, fera l'objet d'une réunion en juin 1987.

Pesage automatique

Il y a deux sujets qui sont à présent activement traités par SP 7-Sr 5 et qui ont fait l'objet de discussions lors d'une réunion à Londres en septembre dernier.

Le premier concerne des wagons de chemins-de-fer qui sont pesés lorsque le train est en mouvement continu. Ce sujet a pour titre « Ponts-bascules ferroviaires à fonctionnement automatique ». Le troisième avant-projet, qui sera distribué aux collaborateurs en 1987, contiendra des exigences particulières à l'électronique selon les indications contenues dans la RI 74.

L'autre sujet concerne les instruments de pesage automatique à totalisateur discontinu, c'est-à-dire des balances ou bascules chargées et déchargées de façon automatique, sans opérateur, mais pour lesquelles chaque pesage individuel s'effectue de façon statique. Les bascules à trémie utilisées pour le pesage des produits en vrac en sont un exemple typique. Ce travail a maintenant atteint le stade de projet définitif qui sera distribué avant la fin 1986.

Fluides (liquides et gaz)

Les problèmes relatifs aux mesures de débit et de volume sont certainement très importants aussi bien du point de vue technique qu'économique. Bien que les prix des produits pétroliers aient fortement baissé ces dernières années, il demeure que l'exactitude des mesures de grandes quantités de liquides et de gaz représente un problème majeur pour les fabricants et pour les utilisateurs de dispositifs de comptage ainsi que pour les services nationaux de métrologie. De plus, il devient nécessaire de mesurer de nouveaux types de fluides afin de résoudre différents problèmes industriels et ceci exige de nouveaux types de compteurs et de nouvelles méthodes d'essais.

Pour ces raisons, les mesures de débit et de volume font souvent l'objet d'activités internationales : deux conférences internationales ont été organisées avec succès cette année, l'une à Glasgow par le National Engineering Laboratory * et l'autre à Washington par diverses institutions américaines, y compris le National Bureau of Standards. L'OIML était représentée aux deux conférences (lors de la deuxième conférence, M. Birkeland, Président du CIML, a fait un exposé sur la coopération internationale dans le domaine concerné).

Les activités techniques au sein de l'OIML sont également intenses :

— *mesurage de volume de liquides :* l'ensemble des Recommandations de base est actuellement en train d'être complété par SP 5D-Sr 1, de façon à inclure des Recommandations pour compteurs turbines, ensembles de mesure pour oléoducs et distributeurs de gaz de pétrole liquéfié. Le deuxième avant-projet sur les dispositifs électroniques incorporés dans les ensembles de mesure de liquides autres que l'eau sera bientôt distribué par SP 5D-Sr 6. Les deux nouveaux secrétariats sur les compteurs électromagnétiques (SP 5D-Sr 8) et sur les compteurs vortex (SP 5D-Sr 9) ont établi leurs programmes de travail lors d'une réunion commune avec SP 5D-Sr 1 à Paris en novembre 1986. Les travaux sur les méthodes et moyens de vérification des compteurs de volume progressent bien (SP 5D-Sr 7) et les travaux sur les liquides cryogéniques (y compris des tables de masse volumique) sont pratiquement terminés (SP 5D-Sr 2).

  Les compteurs d'eau (SP 5D-Sr 3) ont fait l'objet d'une réunion en octobre à Berlin, en liaison étroite avec ISO/TC 30/SC 7. La révision de la RI 49 comprendra des exigences sur des dispositifs électroniques, mais il n'a jusqu'ici pas

* Voir un rapport sommaire à la page 44 de ce Bulletin.

été possible d'obtenir un accord international sur la désignation des compteurs d'eau. Il a été décidé à la réunion de produire un Document International sur le contrôle statistique des compteurs d'eau. En ce qui concerne les mesures statiques, il faut signaler que les travaux sur les camions et wagons citernes (SP 5S-Sr 9) et sur les dispositifs automatiques de repérage de niveau (SP 5S-Sr 11) vont bientôt être terminés. Il faut également signaler l'organisation par l'OIML d'un séminaire sur la vérification des instruments de mesure de liquides, qui se tiendra à Arles, France, du 11 au 15 mai 1987.

— *mesurage de volume de gaz :* deux réunions ont été tenues en 1986 concernant la révision des Recommandations 6, 31 et 32, qui seront également complétées par des exigences sur des dispositifs électroniques et des méthodes d'essais (SP 6-Sr 1 et 2).

Pollution

Dans le résumé historique « L'OIML a 30 ans » (Bulletin N° 100), il était indiqué que, dès le début, les instruments de mesure de la pollution étaient un sujet de première priorité. Des événements récents en Europe et ailleurs semblent prouver que la pollution de l'air et de l'eau exige une attention particulière de la part des autorités légales.

Des exigences et des méthodes d'évaluation de performances des instruments sophistiqués pour la mesure de la pollution due aux pesticides et autres substances toxiques dans la terre et dans l'eau ont été établies ces deux dernières années. Deux types d'instruments sont déjà au stade de projets prêts à être soumis au CIML pour vote par correspondance : Chromatographes en phase gazeuse (SP 17-Sr 4) et chromatographes en phase gazeuse équipés d'un détecteur à spectromètre de masse (SP 17-Sr 2). Ces deux types d'instruments sont surtout utilisés pour la mesure de polluants organiques. Ceci est également le cas pour les récents chromatographes en phase liquide travaillant à haute pression et habituellement désignés comme chromatographes liquides à haute performance. Ces instruments ont aussi fait l'objet d'un avant-projet du SP 17-Sr 4, qui a été discuté lors d'une réunion des groupes de travail internationaux à Paris en septembre 1986. Les polluants inorganiques sont souvent mesurés à l'aide de spectrophotomètres à absorption atomique pour lesquels un premier avant-projet a été présenté à la même réunion.

Les déchets dangereux représentent un autre grand problème qui exige, dans bien des cas, le recours à des laboratoires mobiles et/ou des analyseurs portables. Le secrétariat SP 17-Sr 5, qui a nouvellement été créé, a présenté lors de la réunion à Paris un premier avant-projet de Document International dont le titre traduit en français est : Guide concernant les instruments portables servant à évaluer les polluants portés par l'air et provenant des déchets dangereux.

La pollution de l'air est, d'une façon plus générale, la tâche du SP 17-Sr 1 qui a cependant jusqu'ici limité son activité au seul mesurage des gaz d'échappement des automobiles. Le troisième avant-projet intitulé « Instruments de mesure du monoxyde de carbone contenu dans les gaz d'échappement » a été discuté lors d'une réunion à Berlin en octobre 1986. Il a cependant été constaté que plusieurs pays ont récemment établi des restrictions plus sévères sur les gaz d'échappement et que d'autres composants que le monoxyde de carbone doivent également être mesurés. Le titre de l'avant-projet doit par conséquent être changé et le texte doit inclure davantage de types de gaz et des exigences sur l'exactitude des instruments pour chaque gaz de façon à s'adapter aux différentes réglementations nationales et permettre aux fabricants et aux usagers de choisir la composition de l'équipement de mesure. Le secrétariat-rapporteur espère pouvoir terminer le projet lors d'une réunion prévue pour fin avril 1987.

Préemballages

Le travail du SP 20-Sr 1 « Contenu informatif de l'étiquetage » a été terminé et distribué aux membres du CIML pour vote par correspondance.

Les exigences pour le contenu net des préemballages et les méthodes statistiques de vérification (SP 20-Sr 2) ont fait l'objet de discussions lors d'une réunion à St-Gall, en Suisse, en août 1986. Ce travail a maintenant atteint le stade où il sera très bientôt présenté aux membres du CIML pour vote. Les exigences sur le contenu net sont les mêmes que celles qui sont déjà utilisées dans un grand nombre de pays (système de la moyenne). La méthode d'essai relative à ces exigences comporte un plan représentatif d'échantillonnage OIML. Les critères d'essais ont été choisis sur la base des données statistiques publiées dans des normes ISO.

WHAT IS GOING ON IN OIML ?

The last year has been rich in important meetings and we feel it may be interesting for those who do not directly participate in the work of the reporting secretariats to have a few glimpses of the work before reading the summarized annual report which will be published in the March 1987 issue of the OIML Bulletin.

Non-automatic weighing

The reporting secretariat SP 7-Sr 4 is working on pre-drafts of a Recommendation with the aim of including all the requirements for non-automatic weighing machines and also the test procedures for such machines, in particular for instruments below 30 kg capacity and used for direct sale to the public. This work is based on the present Recommendations RI 3, 28 and 74. The test procedures are based on a scheme already used in several Nordic countries.

The new Recommendation will include all necessary particulars about electronic scales as well as the price-computing devices without forgetting the requirements for mechanical scales which continue to be used. As the technical progress in electronics is very fast the secretariat considers that this work has to be done in accelerated manner. There is considerable interest from both Member States and manufacturers and there were altogether over 40 participants at the last meeting of the international working group in Paris, beginning November. The second pre-draft which is now being prepared will be discussed in May 1987.

Automatic weighing

There are two subjects which are actively being handled by SP 7-Sr 5 and were discussed during a meeting in London last September.

The first one concerns rail-way wagons which are being weighed when the train is in continuous motion. This subject has the title « Automatic railwaybridges ». The third pre-draft to be circulated in 1987 will incorporate the relevant requirements for electronics as laid down by RI 74.

The other subject is discontinuous totalizing automatic weighing machines i.e. machines which are fed in an automatic way without manual operation but where each individual weighing is made in the static state. Hopper scales for bulk to bulk weighing are typical for this mode of operation. This project has now reached the stage of a draft which should be distributed before the end of 1986.

Fluids (liquids and gas)

The question of flow measurements is surely a very important one, from both technical and economical points of view. Even if the price of petroleum products has considerably decreased these last years, the accuracy of measurement of big quantities of liquids and gas remains a key problem for manufacturers and users of metering devices, as well as for the national services of metrology. Besides, new types of fluids have to be measured, for solving different industrial problems, and this requires new types of meters, and new ways of testing.

Flow measurements are therefore the subject of many international activities : two international symposia have been very successfully organized this year, one

in Glasgow by the National Engineering Laboratory * and the other in Washington by several US bodies, including the National Bureau of Standards. OIML was represented in both (in the second one, a lecture on international cooperation in this field was presented by Mr. Birkeland, President of CIML).

The technical activities within OIML are also intense :

— *measurement of volume of liquids :* the set of existing basic Recommendations is being completed by SP 5D-Sr 1 to include Recommendations for turbine meters, measuring assemblies in pipelines, and LPG dispensers. The second predraft on electronic devices associated with volume meters will soon be circulated by SP 5D-Sr 6. The two new Secretariats on electromagnetic meters (SP 5D-Sr 8) and on vortex meters (SP 5D-Sr 9) established their work plans at a joint meeting with SP 5D-Sr 1 in Paris last November.

  The work on methods and means for the verification of volume meters is progressing well (SP 5D-Sr 7) whereas the work on cryogenic liquids (including tables of density) is practically finished (SP 5D-Sr 2). The measurement of water (SP 5D-Sr 3) has been the subject of an OIML meeting last October in Berlin in close relation with ISO TC 30 SC 7. The revision of RI 49 will include requirements for electronic devices but it has not been possible to reach international agreement on the designation of water meters. It was decided at the meeting to produce an International Document on the statistical testing of water meters. As for static measurements, work on road and rail tankers (SP 5S-Sr 9) and on automatic level gauges (SP 5S-Sr 11) are approaching their conclusion. Let us also mention that OIML is organizing a special seminar on the verification of instruments used for the measurement of volumes of liquids (both static and dynamic) to be held in Arles, France 11-15 May 1987.

— *measurement of gas :* two meetings were held in 1986 concerning the revision of the existing Recommendations Nos 6, 31 and 32, which will also be completed by requirements for electronic devices and test procedures (SP 6-Sr 1 and 2).

Pollution

In the historical review « 30 years of OIML » (Bulletin No 100), it was mentioned that pollution measuring instruments were a top priority already from the very start. Recent events in Europe and elsewhere confirm that both air and water pollution require particular attention by legal authorities.

Requirements and performance evaluation of advanced instrumentation for measuring pollution due to pesticides and other toxic substances in soil or water have been laid down during the last two years. Two kinds of instruments have already reached the stage of drafts to be submitted to CIML for voting by correspondence : Gas chromatographs (SP 17-Sr 4) and gas chromatographs equipped with a mass spectrometer detector (SP 17-Sr 2). Both instruments are used basically for the measurement of organic pollutants. This is also the case for the still more recent liquid column chromatographs working with high pressure and usually called High Performance Liquid Chromatographs. The latter have also been the subject of a pre-draft produced by SP 17-Sr 4 and which was discussed during a meeting of the international working group in Paris last September. Inorganic pollutants are frequently measured with atomic absorption spectrophotometers for which a first pre-draft was also discussed during the Paris meeting.

Hazardous waste is another big problem requiring in many cases mobile laboratories and/or portable analyzing equipment. The new reporting secretariat SP 17-Sr 5 produced for the Paris meeting a first pre-draft for an International Document with the title : « Guide to portable instruments for assessing airborne pollutants arizing from hazardous waste ».

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* See summary report on page 46 of this Bulletin.

Air pollution in a more general way is the task of SP 17-Sr 1 which, however, so far has limited its activity to the measurement of automobile engine emissions. The third pre-draft of « Exhaust carbon monoxide instruments » was discussed at a meeting in Berlin in October 1986. It was found however that several countries have recently issued more stringent restrictions on exhaust gases and that also other components than carbon monoxide will have to be measured. The title of the pre-draft will thus have to be changed and the project will include more gases and instrument accuracy requirements for each gas so as to fit the various national regulations and leave to the manufacturers or users the choice in the composition of the equipment. The reporting secretariat hopes to reach the stage of a draft at a meeting planned for the end of April 1987.

Prepackages

The work by SP 20-Sr 1 « Information on package labels » has been completed and presented to the CIML members for vote by correspondence.

The requirements for the net content of prepackages and the methods for statistical testing (SP 20-Sr 2) were discussed at a meeting in St-Gall, Switzerland, last August. This work has now reached the point where it will very soon also be presented to CIML for voting. The requirements for packages are those already in use in a great number of countries (average system). The suggested way of testing to these requirements comprises an OIML representative sampling plan based on a choice of statistical concepts published in ISO standards.

R.F. D'ALLEMAGNE

On the CALIBRATION of HARDNESS TEST BLOCKS

by **Wolfgang W. WEILER**
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SUMMARY — The hardness values of a hardness test block determined during calibration may depend to an inadmissible extent on the test force rise time and/or on the duration of test force application. Possible deviations and their causes are described and regulations derived on the basis of these findings proposed for the calibration procedure.

In how far the statements made for hardness test blocks can apply to the industrial hardness testing of materials or component parts depends in the individual case on the permissible deviation from a specified nominal value.

1 Influencing parameters

On the condition that the test is carried out correctly, the hardness value according to Rockwell obtained in the calibration and use of hardness test blocks can depend on the following parameters :

— time t_1 for the rise of the test force ; i.e. the time in which the test force increases from preliminary test force to total test force

— time t_2 for the duration of test force application ; i.e. the time in which the test force acts before it is reduced to the preliminary force for the purpose of reading the hardness value.

In the following sections, a description will be given of the kind and extent of these influences and of the causes which are to be found in the « standard machine » used and/or in the material. The first observations were made quite a number of years ago [1, 2].

2 Influence of the rise time of the test force

The forces acting during the indentation process can be described by the following differential equation [3] :

$$F - F_d - F_s - m \cdot \frac{d^2h}{dt^2} = 0 \qquad (1)$$

Where :

F = test force

F_d = counterforce of the hardness standard machine or hardness testing machine

F_s = resistance of the sample, including the frictional force between sample and indenter

$m \cdot \frac{d^2h}{dt^2}$ = accelerating force of force realizing masses used (in the case of standard machines, the force is generated by deadweights).

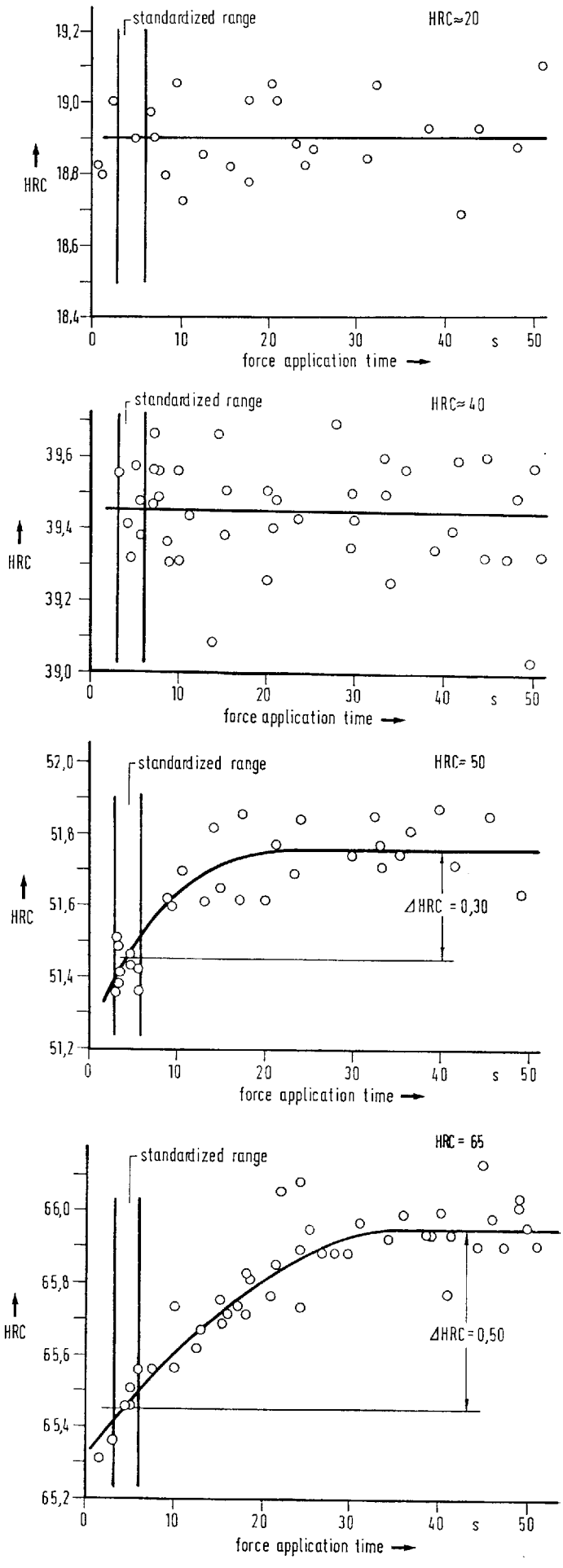

Figure 1 : Result of the hardness measurement according to Rockwell C as a function of the rise time of the test force on hardness test blocks made of steel.

A theoretical investigation [4] did not furnish satisfactory results as the counter-force from the hardness testing machine which has a considerable influence on the indentation process had to be neglected. As can be seen from the test results which will be discussed later, it is not the accelerating force which is of importance, but the initially high rate of deformation of the sample material. Fig. 1 shows the results of measurements on hardness test blocks made of steel. While no influence of the force rise time can be observed on hardness test blocks of the hardness 20 HRC and 40 HRC, this influence becomes obvious in the case of hard blocks. In order to find out the reasons it is important to know that all hardness test blocks were made of steel of the same grade subjected to different heat treatment. The sructure of the 20 HRC test block consists of granular cementite in ferritic basic substance and the structure of the 65 HRC test block of cementite and martensite. In the case of the 50 HRC hardness test block the martensite has been tempered. On the hardness standard machine used the indentation process is controlled by a hydraulic system as it is done in a similar way in all standard machines used in the world [5]. Fig. 2 shows a diagram of the development of test force and indentation depth during the indentation process.

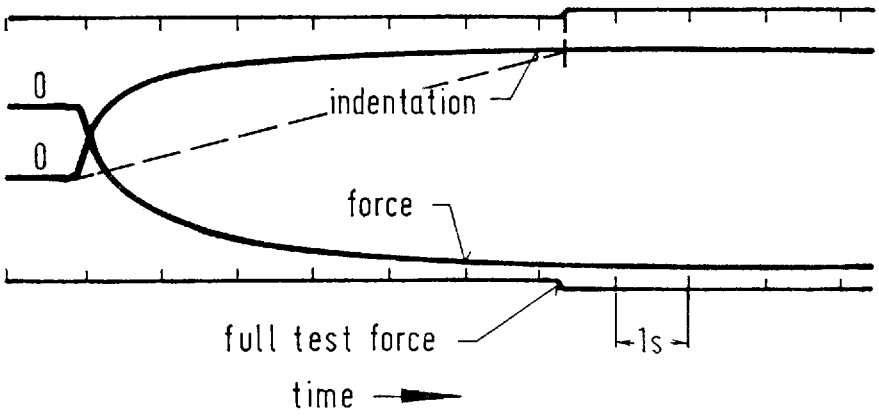

Figure 2 : Curves of test force and indentation depth as a function of time.

At the beginning of the indentation process, test force and indentation depth increase very quickly, the consequence being high rates of deformation which lead to temperature increases and thus to tempering processes in the material. If the test force is applied only for short periods, the hardness measured is falsified to a lesser extent as a result of the high rate of deformation and the heat effect associated with it. The true hardness of a meterial will only be measured if a time of force application is chosen which results in the stabilized maximum value. This statement can be supported by results obtained with the hardness test according to Vickers carried out with a commercial hardness testing machine. The material of the samples used is shown in Table 1, the measurement values obtained have been compiled in Table 2.

Due to the different shape of the indenter — pyramidal point instead of ball point — hardened steel reacts only at extremely short force rise times as do two of the nonferrous materials. It must be mentioned here that in the case of a force rise time of about 1 s, dynamic processes certainly also play a role. AlMg3 shows a significant dependence.

The following solutions offer themselves in practical application for the calibration of hardness test blocks where the hardness value depends to an inadmissible extent on the test force rise time :

— The control system of the standard machine is designed in such a way [6] that the indentation curve shown in Fig. 2 is a straight line (broken line), i.e. the

TABLE 1 — Material of the samples

Sample No.	Material
1	AlMg3
2	Copper
3	Brass
4	Steel C 15
5	Aluminium alloy
6	Hardness test blocks HRC = 20
7	Hardness test blocks HRC = 50.3
8	Hardness test blocks HRC = 64.8

TABLE 2 — Results of Vickers hardness measurements for different materials and rise times (HV 10 for samples 1 to 5 and HV 30 for 6 to 8)

Sample No.	Force rise time in seconds								
	120	60	30	15	5	3	2	1	< 1
1	67.2	67.8	66.0	66.5	65.8	62.9	63.0	60.1	52.7
2	93.5	95.6	96.0	95.8	97.6	94.3	95.8	94.7	83.7
3	110.0	111.2	109.8	114.0	110.0	105.2	106.4	108.4	95.8
4	122.0	121.6	121.6	123.2	123.0	123.4	122.6	122.0	115.2
5	130.4	127.6	125.4	128.8	127.2	125.2	124.8	122.0	104.0
6	239	242	236	242	242	239	239	232	225
7	552	552	540	552	552	544	545	543	320
8	833	845	831	836	825	823	822	708	—

indentation velocity is constant. The accelerating force in equation 1 becomes zero and no excessive rates of deformation develop at the beginning of the indentation process. As a matter of fact, this is certainly the best solution, but it involves the purchase of new equipment.

— The hardness test block is calibrated with force rise times which no longer have any influence on the result. Also in this case the block is correctly calibrated. The hardness measured corresponds to the true hardness of the block material. As the time influence depends both on the material and the standard machine — curve in Fig. 2 — the minimum time still admissible for the application of the test force must be determined for each standard machine.

Although only a small part of all cases is concerned, these rise times are regarded as too long for practical application and rejected for economic reasons. Another argument is that the times used in practical materials tests are shorter and that calibration procedures should be much more in compliance with practical requirements. This is a widespread error. It cannot be of any help for practical test work when a hardness test block whose hardness value is, objectively seen, incorrect is handed over to the testing staff for the control of the hardness testing machine. The right thing to do would be to draw the staff's attention to the additional errors involved in shorter force rise times.

With all reservations a third possibility can be considered. The force rise time t_c for the calibration is so chosen that the deviations from the hardness value obtained with the time t_p used in practical materials tests and with the time used to obtain the true hardness value t_t are of the same magnitude (Fig. 3).

If the deviations ΔH are sufficiently small, the rise time can be reduced to 1/3 as has been done in this case.

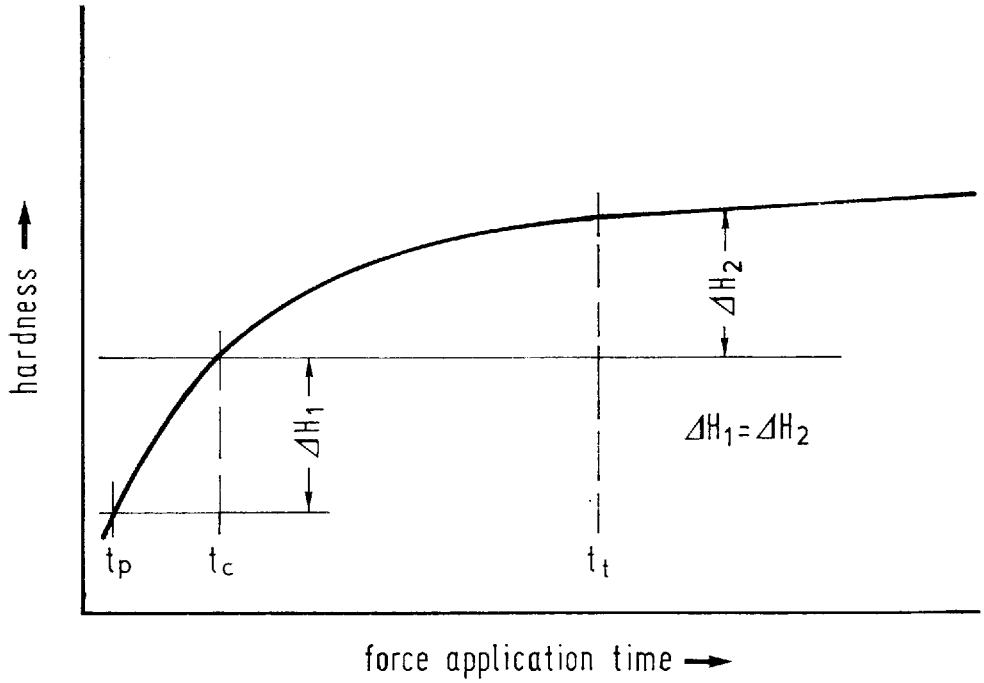

Figure 3 : A possibility of choosing the force rise time.

3 Influence of the duration of test force application

After the total test force has been reached, for a certain duration a constant test force acts on the hardness test block or the sample before the hardness value is

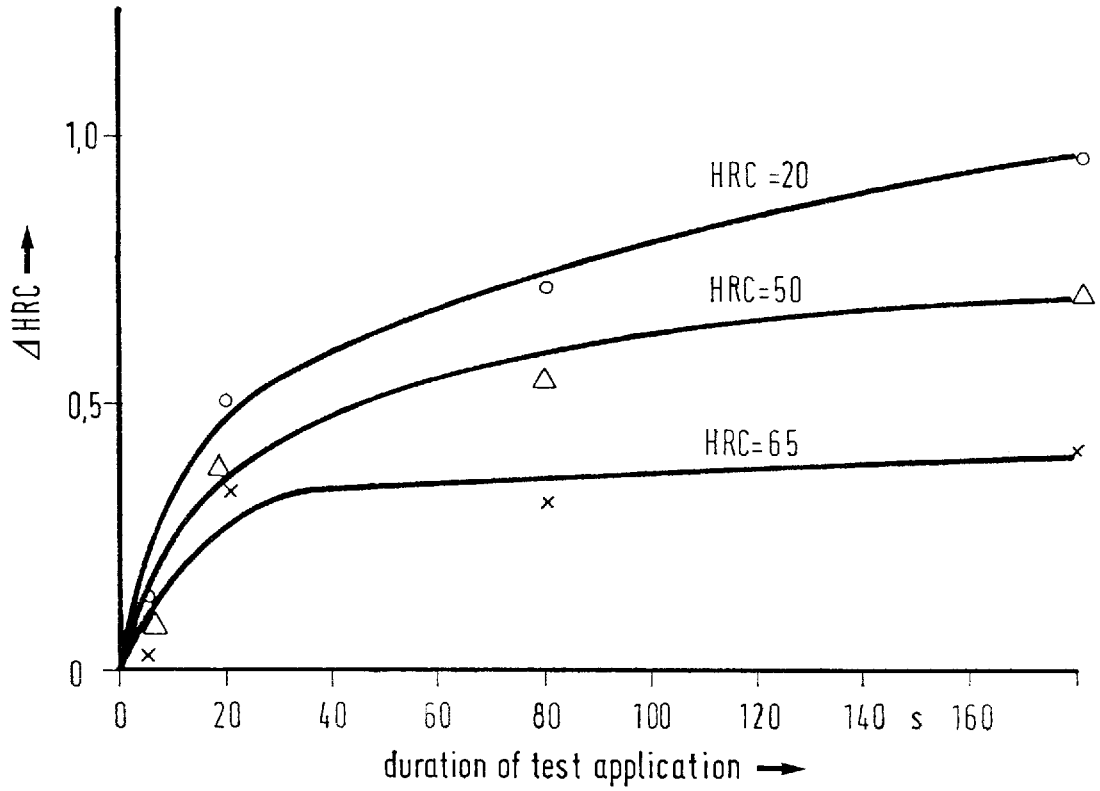

Figure 4 : Dependence of the hardness values of hardness test blocks according to Rockwell C on the duration of test force application.

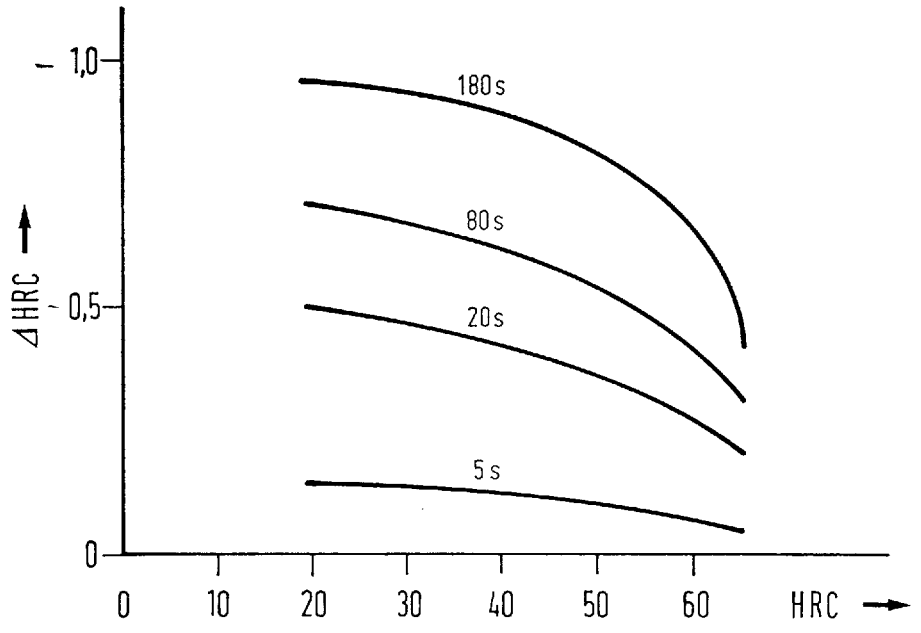

Figure 5 : Influence of the duration of test force application on the hardness values of hardness test blocks according to Rockwell C.

determined. During this time, all materials undergo deformation. The materials differ, however, with regard to the extent of the effect of this creep under constant force as a function of the duration of force application. In hardness tests, the creep depends on the material examined as well as on the amount of the test force and the state of stress which in turn depends on the indenter shape. An indenter according to Rockwell C has been chosen for this general examination as for the time being, this procedure is still the one most commonly used for series measurements and as — with regard to the stress maxima to be expected — the state of stress produced lies between those which occur with the indenters according to Vickers and Brinell.

Basically, it must be mentioned that — as a result of the creep of the material — according to their definition, the hardness values become smaller with increasing duration of constant force. The results of corresponding measurements carried out on hardness test blocks according to Rockwell C are shown in Fig. 4.

Before the results are interpreted and conclusions drawn, they are represented once again in a different form in Fig. 5. The curves are drawn on the basis of the true measured values and not derived from the fitted curves of Fig. 4.

The results can be formulated as follows :

— The influence of creep on the hardness values reaches up to one HRC unit.

— The maximum amount of the hardness deviation caused by creep decreases with increasing hardness of the material.

— At the beginning, the tendency to creep is almost the same for all hardness test blocks investigated ; with hard blocks, it strongly decreases with time.

— A constant and thus true hardness value is not obtained during this time.

A duration of test force application must be agreed upon in order to obtain comparable hardness values during the calibration of hardness test blocks. When economic aspects are also taken into account, a duration of 30 $\pm$ 2 s must be recommended, as after this time, the curves shown in Fig. 4 are no longer as steep as before. As a « true hardness value » cannot be determined in this way, it is also possible to agree upon a shorter duration. However, as the hardness values change very quickly in the range of shorter durations, the tolerances of time must be the narrower the smaller the duration is.

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R.P. DE CHINE **ITALIE**

COMPARISON of HARDNESS MEASUREMENTS BETWEEN CHINA (NIM) * and ITALY (IMGC) * *

by **Giulio BARBATO, Sergio DESOGUS, Fuxin LI, Qicheng WENG**

1. Introduction

Hardness measurements play an important role in the control of technological processes of materials and in checking the quality of products. In order to ensure accuracy and uniformity in hardness measurements, several countries have developed a number of hardness standards.

A Rockwell hardness standard and a superficial Rockwell hardness standard were constructed in China in 1962 and in 1965, and two new laser-type hardness standards, a Rockwell and a superficial Rockwell, were finished in 1981. Both standards have replaced the old ones. A Vickers hardness standard was set up in China in 1965.

Italy has developed a laser-type standard machine for Rockwell, superficial Rockwell and Vickers hardness, which was completed in 1977.

Comparisons of hardness measurements between China and Italy have been made at two different times. The first time Italian experts took their hardness blocks and standard indenters to China, and the second time the Chinese experts brought their hardness blocks and standard indenters to Italy. The present paper gives the results of the comparisons and makes an analysis of such comparisons.

2. Rockwell scales

Both the IMGC and NIM machines use an interferometric laser method for the measurement of indentation depth ; this gives good comparison possibilities, as one of the most difficult measurements involved in the definitions of Rockwell scales can thus be made with very satisfactory accuracy.

Measurements were carried out using the two machines with their own indenters, and the same indenter on the two different machines. In 1983 the Italian indenter was used in China ; therefore the difference between the two machines was obtained with the Italian indenter and the difference of the indenters was obtained, on the contrary, on the Chinese machine. Conversely, in 1984 the Chinese indenter was used in Italy and, consequently, the difference between the indenters was observed on the Italian machine, whereas the difference between the two machines was obtained by means of the Chinese indenter. This makes it possible to separate indenter effects from machine performances. The indenters themselves were examined at IMGC and the results of geometrical measurements are given in Table 1. The interferograms in Fig. 1 represent the sides and the apex of the Italian indenter

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TABLE 1 — Geometrical measurement of Rockwell indenters

Indenter	Generatrix				Mean Value	Radius r mm
	0	90°	180°	270°		
1146 (China)	55°54'	60°00'	55°59'	55°53'	119°53'	0.197
2272 (China)	59°57'	60°09'	59°56'	60°00'	119°59'30"	0.198
79712 (China)	60°00'	60°10'	60°09'	60°00'	120°09'30"	0.196
C15 (Italy)	59°59'	60°02'	60°04'	60°01'	120°03'	0.200

TABLE 2 — Results of HRA, HRB and HRC comparisons

SCALE	DIFFERENCE NIM-IMGC		DIFFERENCE NIM-IMGC SAME INDENTER		DIFFERENCE OF INDENTERS		INDENTERS		
	1983	1984	1983	1984	1983	1984	IMGC	NIM 1983	NIM 1984
HRA							C15	79712	2272
30	0.42		— 0.85		1.27				
50	0.34		— 0.58		0.92				
75		0.42		0.04		0.38			
84	0.04		— 0.15		0.19				
85		0.23		0.00		0.23			
HRB									
42	— 0.65								
56	— 0.68								
82	— 0.15								
88		+ 0.27		— 0.09		+ 0.36			
98		+ 0.20		+ 0.04		+ 0.16			
HRC							C15	79712	2272
22		0.45		— 0.22		0.67			
28		0.58		— 0.10		0.68			
31	0.61		0.08		0.53				
40		0.61		— 0.05		0.66			
45	0.69	0.71	0.13	— 0.11	0.56	0.82			
50		0.58		— 0.07		0.65			
55	0.36		— 0.05		0.41				
61		0.25		+ 0.01		0.24			
65	0.29		0.03		0.26				
66		0.18		+ 0.04		0.14			

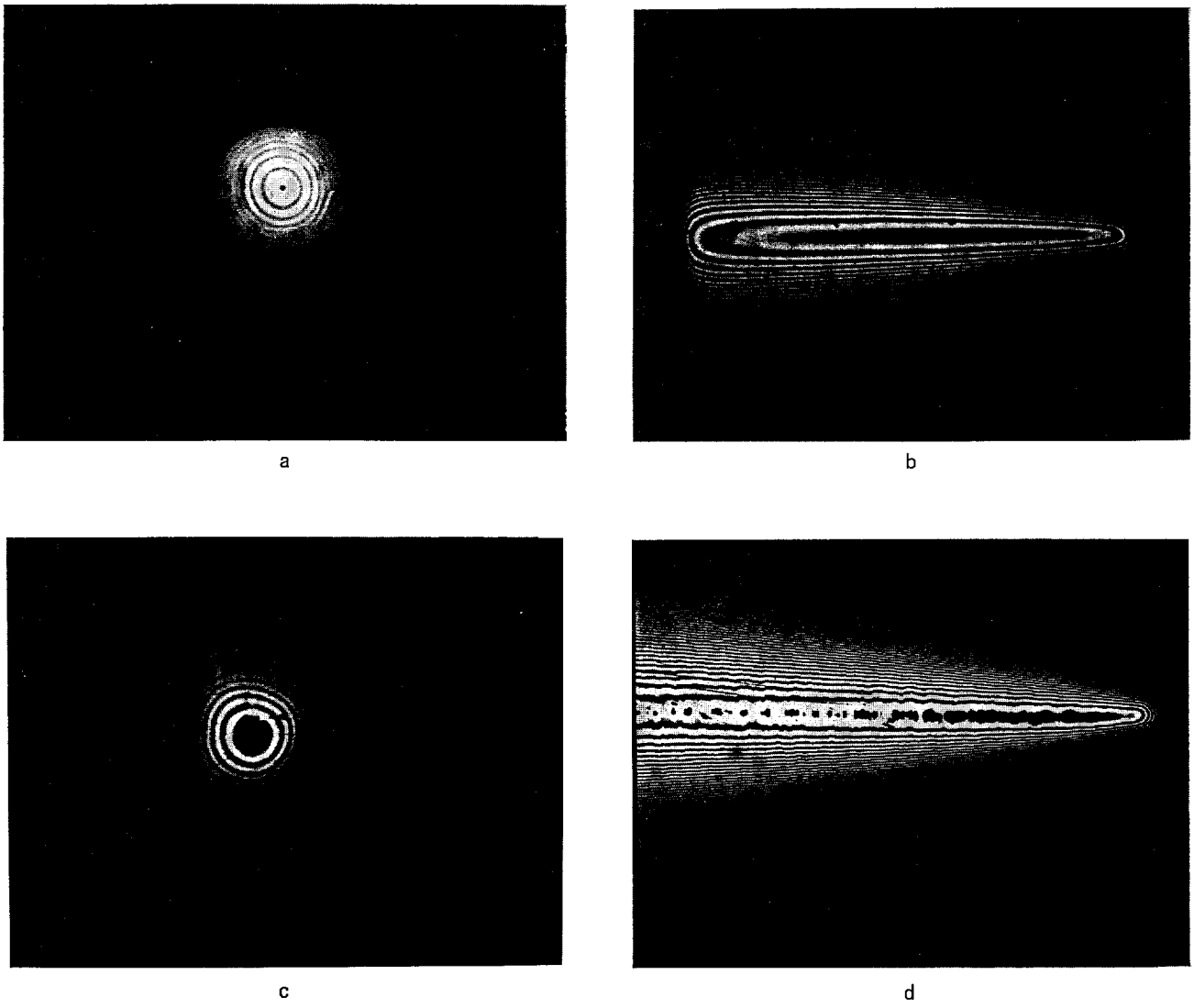

Fig. 1 : a) Interferogram of the apex of C15 indenter
b) Interferogram of side of C15 indenter
c) Interferogram of the apex of 2272 indenter
d) Interferogram of side of 2272 indenter

C15 and Chinese indenter 2272. The indenter C15 has a better surface finish, whereas the 2272 indenter has straighter sides. The length of the straight part of C15 side is 0.35 mm.

Furthermore, the two machines control the indentation driving mechanism in a different way : the NIM machine has a dashpot system, the IMGC machine has a feedback computer-controlled system. With this latter system it is possible to change the movement of the driving mechanism whenever desired, and experiments showed — as was suggested by Marriner of NPL, G.B. [1] — that to keep results constant it is necessary to maintain speed constant in the last part of the indentation process. For the IMGC machine, this speed is established as 9 μm/s [2].

The kinematics of the NIM machine is defined by establishing that the minor load must have a rising time of 3 to 4 s, and the major load a rising time of 8 to 9 s. For both machines the dwelling time was established to be 15 s.

TABLE 3 — Results of HRN15, HRN30, HRN45, HRT15, HRT30, HRT45

SCALE	DIFFERENCE NIM-IMGC		DIFFERENCE NIM-IMGC SAME INDENTER		DIFFERENCE OF INDENTERS		INDENTERS	
	1983	1984	1983	1984	1983	1984	IMGC	NIM
HR15N							C15	1146
91		0.13		— 0.21		0.34		
HR30N							C15	1146
42		1.22		0.38		0.84		
48		0.91		0.26		0.65		
51	0.31		— 0.32		0.63			
64	0.71		— 0.33		1.04			
69		0.87		0.08		0.79		
72	0.63		— 0.68		1.31			
83		0.84		0.07		0.77		
HR45N							C15	1146
29		1.00		0.33		0.67		
50		1.04		0.40		0.64		
67		1.12		0.40		0.72		
HR15T								
87		0.17		0.01		0.16		
HR30T								
43	0.09							
53	— 0.15							
71	— 0.11							
73		0.45		0.18		0.27		
HR45T								
59		0.15		— 0.11		0.26		

TABLE 4 — Results of HV30 and HV10 scales

SCALE	DIFFERENCE NIM-IMGC	
	1983	1984
HV30		
305	2.9 (0.95 %)	
430		— 6.8 (— 1.6 %)
605	— 5.3 (— 0.88 %)	
730	— 5.3 (— 0.73 %)	
HV10		
450		— 7.6 (— 1.7 %)

TABLE 5 — Differences in the measurement of diagonals of indentations

Mean diagonal (μm)	143.5	203.7	360.0
Difference NIM-IMGC (μm)	— 0.02	— 0.39	0.46

2.1 Normal Rockwell scales (HRA, HRB, HRC)

The results of HRA, HRB and HRC scales are summarized in Table 2. The results of the two comparisons, which were made at an interval of 1 year, are in very good agreement as regards the overall difference in HRA and HRC, and in good agreement for HRB. As regards machine performances, it can be said that the agreement between the two comparisons is generally very good, and it can also be emphasized that the differences of performances of the two machines are really negligible, excepting the lowest part of the HRA and HRC scales.

The differences of indenters are greater, as compared with the differences of the machines, and cannot be explained by geometrical differences ; it may be suggested that these differences are mainly due to the difference in surface finish.

2.2 Superficial Rockwell scales

The results of superficial scales — HR15N, HR30N, HR45N, HR15T, HR30T, HR45T — are sumarized in Table 3. The HR30N was compared both in 1983 and 1984, and the agreement of the two comparisons is not so good as it was for the HRC scale.

The overall differences between HR30N scales, as observed in 1983 and 1984, are sufficiently similar, but the differences between the performances of the machines and the performances of the indenters are incomprehensible. Nevertheless, the results obtained for machine performance in the 1984 comparison as regards all the superficial scales are consistent, account being that 1 HRN is measured by 1 μm indentation depth.

When developing Rockwell and superficial Rockwell hardness standards, China and Italy established two standard indenter groups ; within each group the indenters were very similar. On the other hand, the great observed difference in the results between the indenters of China and Italy is a problem that must be further investigated.

3. Vickers scales

The main difference between the instruments used for maintaining Vickers scales at IMGC and NIM lies in the methods applied for measuring the diagonals of Vickers indentations. NIM uses an optical microscope with an eyepiece micrometer ; at IMGC an optical microscope is used only to establish a reference line ; the measurement of the translation necessary to bring the two vertices under the reference line is made by a laser interferometer.

3.1 Results of Vickers measurements

The results of Vickers measurements are given in Table 4 both for HV30 and HV10. A HV5 comparison was not made, since the IMGC machine implements the HV3, but not the HV5 scale.

The agreement between the 1983 and 1984 comparisons is not very good. In attempting to find the cause of this unsatisfactory result, the agreement between the diagonal measuring devices was checked, and the results given in Table 5 are very satisfactory.

As the IMGC measuring system was modified just before the 1984 comparisons, extra checking was carried out on a reference block used for the comparison made with OMH in 1979[3] ; the difference of HV30 measurements made by IMGC at five years interval and with different measuring devices was — 0.5 %, which is in an opposite direction and cannot explain the overall differences found between the IMGC and NIM results.

4. Conclusions

The results obtained in the comparisons carried out show that good agreement is generally obtained between the hardness standard machines of China and Italy, though better agreement in overall performances could be derived from a more exhaustive study of indenter characteristics.

In fact, when examining the results obtained in Rockwell and superficial Rockwell comparisons, the outstanding agreement between the machines is evident ; on the other hand, the reasons for the differences observed clearly depends on indenter performances.

Also with Vickers scales, problems can be suspected to be caused by indenters or abnormal block-performances : in fact, checkings on diagonal measuring devices actually showed only small differences, and it is difficult to attribute the cause of the observed overall differences to the machines, since the very good agreement obtained for Rockwell with similar (identical, for IMGC) machines has just been remarked.

Consequently, the general conclusion to be drawn is that further study of the geometry and performances of indenters is necessary, if better agreement is to be obtained.

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CUBA

The NATIONAL SERVICE of LEGAL METROLOGY in the REPUBLIC of CUBA

by **Luis REVUELTA FORMOSO**
Technical Vice-Director of the Metrology Research Institute

The State Committee for Standardization (CEN) of Cuba was created, ten years ago, as an organization assigned to develop the National System of Standardization, Metrology and Quality Control (SNNMCC). With this action, an important step was taken on the way to the achievement of a high quality level of our traditional and nontraditional export goods.

Together with CEN and annexed to it, the Metrology Research Institute (INIMET) was created, which has, in recent years, kept the development of the National Service of Legal Metrology as one of its main aims with the essential purpose of reaching a satisfactory level in metrological assurance of industrial production, technology, scientific research as well as of public health services and national and international trade and other activities. This effort has been developed in the following directions :

1 — Elaboration of the technical-standardizing basis to create, develop and improve the National Service of Legal Metrology.

2 — Creation of Territorial Centers of Metrology (TCM).

3 — Creation of metrology laboratories and repair shops of measuring instruments in Ministries, enterprises, industries and other bodies.

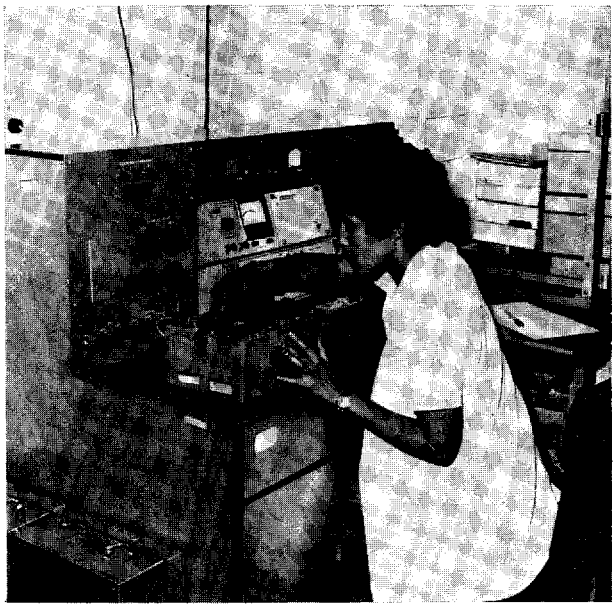
Elaboration of the technical-standardizing basis for the National Service of Legal Metrology

Since its very creation, the INIMET began working on the elaboration of a system of Metrological Assurance Standards (SNAM) within the SNNMCC with the essential goal of allowing the National Service of Legal Metrology to count upon the technical-standardizing and legal support which is indispensable for its proper functionning.

In accordance with the planned programme for the period 1981-1985, a total of 327 technical-standardizing documents were elaborated, of which 56 % are concerned with methods and means of verification.

These documents have been elaborated using the OIML International Recommendations, ISO standards, CMEA standards and national standards from different other countries.

This legal, standardizing activity will continue in the next years during which the elaboration of 140 other documents about verification methods and means is foreseen in view of perfectioning SNAM in accordance with the planned development of metrology, including accuracy levels which are to be reached and the enlargement of the Verification Service to new patterns of measuring instruments.



Calibration activities at INIMET

Creation of Territorial Centers of Metrology

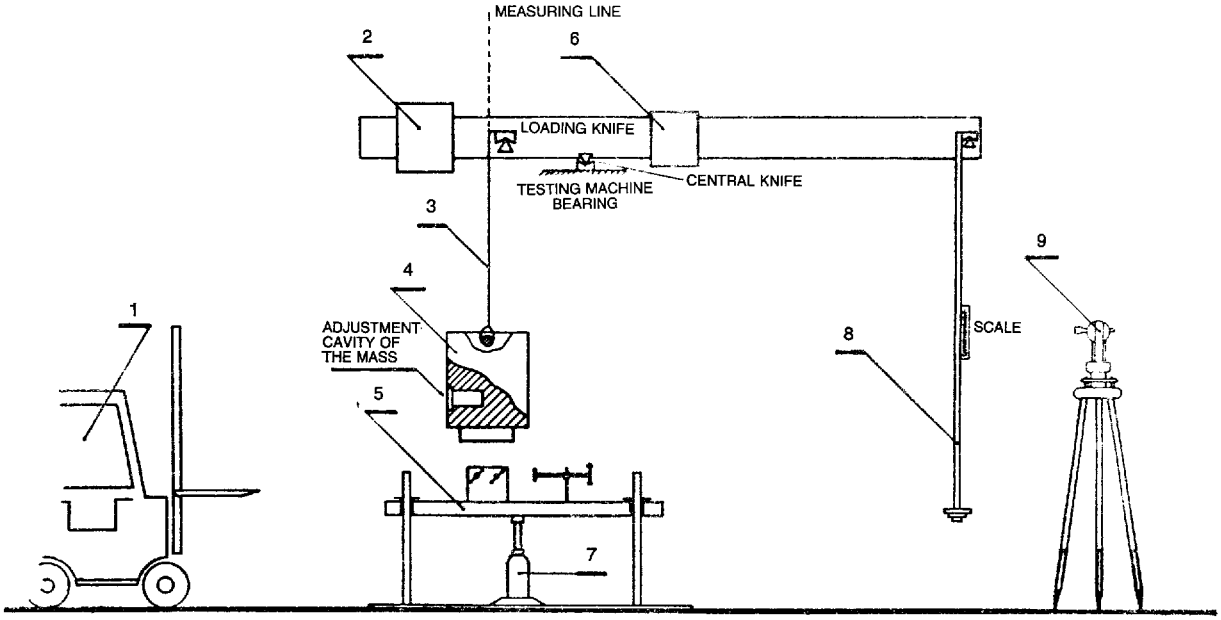
The first Territorial State Center of Metrology in the country was constituted by the Metrology Research Institute in Havana, created in 1976, which is the nation-wide guiding center of the metrological activity.

Nowadays, INIMET relies upon a series of fixed and mobile laboratories, furnished with modern equipment for the verification of measuring instruments. It is charged with the safe-keeping of the most accurate national standards in the country and is responsible for the implantation of the International System of Units ; it carries out the metrological evaluation of measuring instruments ; it elaborates the technical-standardizing documentation as regards metrology and is responsible for guiding the activities of metrological assurance in ministries, production units and commercial enterprises, scientific research and public service centers in the country.

The work started already in 1976 on the design, building and installation of the other Territorial State Centers of Metrology (TCM), which are also annexed to the State Committee for Standardization and, when completed, offer metrological services in the territory of their competence. In this manner, the following centers were inaugurated and are operating at the present time :

— the TCM in the City of Santa Clara
— the TCM in the City of Santiago de Cuba
— the TCM in the City of Camagüey
— the TCM in the City of Holguín

These TCMs have fixed laboratories capable of satisfying the verification necessities in their field of action regarding physical quantities such as : length, angle, mass, force, volume, electricity, temperature and physico-chemical characteristics. They have in addition universal mobile laboratories for the verification of different quantities mainly in the field of industrial measurements of mass and volume.



1 — HOIST
2 — COUNTERWEIGHT
3 — TENSION MEMBER
4 — MASS TO BE CERTIFIED
5 — FREIGHT ELEVATOR DEVICE
6 — SLIDE PYLON
7 — HYDRAULIC JACK
8 — HANGING PYLON
9 — THEODOLITE

A mechanical mass comparator constructed at INIMET for the verification of 1 000 kg mass standards and described in INIMET Scientific-Technical Bulletin 1-1986

The existing TCMs carry out, yearly, about 1 million verifications of standards and ordinary measuring instruments.

Creation of metrology laboratories and repair shops of measuring instruments

In order to reach a higher metrological assurance level, a series of laboratories and repair shops of measuring instruments have been created in industrial complexes, factories, health and scientific research entities, etc.

This work, accomplished in cooperation by specialists from INIMET and from the interested Ministries and Enterprises, has nowadays resulted in the creation of 105 metrological laboratories and 35 accredited repair shops for measuring instruments. These are equipped with the necessary standards, auxiliary instruments and tool-sets and are distributed all over the country.

The process of evaluation, approval and registration of these laboratories and workshops is carried out in accordance with the provisions of the relevant technical-standardizing documents, which enact the requirements to be met concerning aspects such as : existence of the necessary standards and auxiliary equipment, existence of the necessary climatic conditions, existence of the proper technical staff, kind of measuring instruments for which the laboratory and/or repair shop merits approval, and existence of the necessary technical documentation.

After having approved and registered such metrological laboratories and repair shops, they are submitted to a periodic metrological inspection accomplished by INIMET specialists, so as to check on the permanency of the conditions required to reach correct and efficient performance.

Conclusions

As it can be noticed, it has been possible to build up in Cuba, within a few years, a National Service of Legal Metrology which keeps pace with the structure and technical, industrial development of the whole national economy and continues to develop and perfect itself so as to play an important role in maintaining the quality of the country's production, services and other scientific and commercial activities.

FINLANDE

The new PRIMARY STANDARDS LABORATORY of the TECHNICAL INSPECTION CENTRE in HELSINKI

by M. KARI, P. KARP, U. LÄHTEENMÄKI, E. RAITANEN and K. RISKI

Introduction

Technical Inspection Centre (TTK) is the central metrological authority in Finland. In addition to the activities in legal metrology The Weights and Measures Office of the TTK maintains the national standards for the quantities length, mass, temperature and volume. For primary calibrations a new laboratory of high metrological quality was constructed. The building project was started 1978. The active building period was approximately one and a half years and it was completed in 1985. The total cost of the laboratory was about 12 million Finnish marks.

In the design of the laboratory special attention was paid to the analysis and, when possible and necessary, to the control of influence quantities such as temperature, humidity, mechanical vibrations, mechanical and chemical air impurities, atmospheric pressure and electric disturbances. The aim of the design was optimum use of the measurement standards and measuring instruments.

The total area of the laboratory building is 813 m^2 out of which the laboratories take 327 m^2. The laboratories are divided into three categories according to their use (Fig. 1).

The calibration laboratory I is designed for accurate mass and length measurements. Masses up to 10 kg can be calibrated. For length measurements a primary calibration bench utilizing an iodine stabilized He-Ne laser will be constructed in near future. The temperature variations along the bench will stay below 10 mK. For measurement tables two pneumatically suspended vibration isolation bases are provided.

The calibration laboratory II contains two 30 m long benches for length measurements. They are used for calibration of line standards and measurement tapes by laser interferometry or by the direct comparison method. The temperature of one of the benches can be varied between 10 °C and 60 °C.

The calibration laboratory III is used mainly in temperature measurements and the requirements for temperature stability are not as high as in laboratories I and II.

The air conditioning of the laboratories is based on computer controlled regulation by partly standard and partly specially designed air conditioning instruments.

Construction

The laboratory is situated in the centre of Helsinki City within the same block as the other buildings of the TTK. It is constructed in a cave blasted into the bedrock and is entirely underground (Fig. 2).

The changes of temperature in the whole structure are slow due to thick reinforced concrete structures and an efficient thermal insulation provided by polyurethane. The thermal stability is still improved by the large heat capacity of the bedrock and its almost constant temperature.

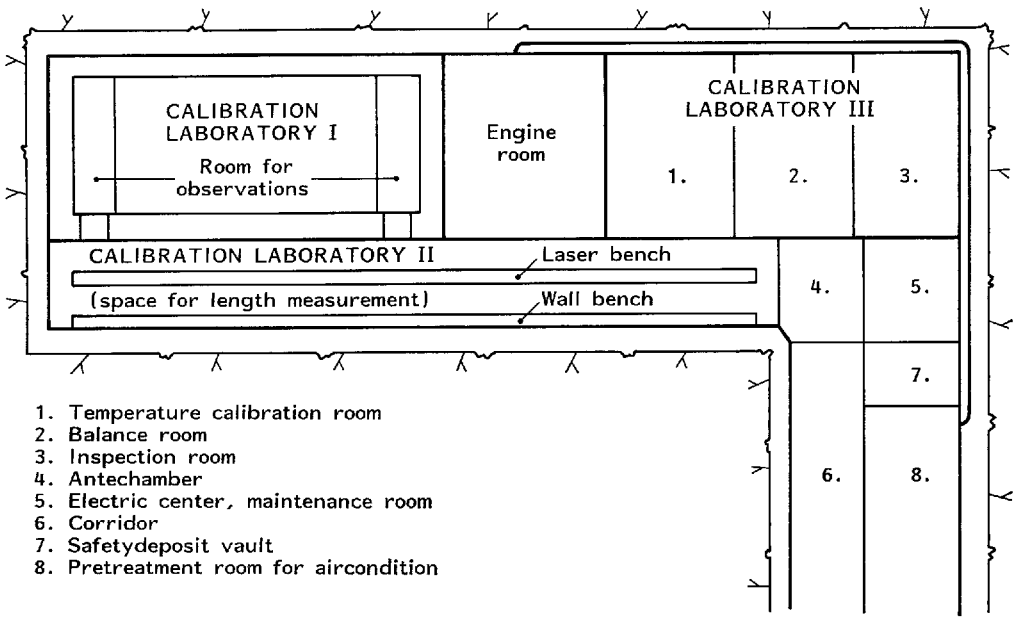


Fig. 1 : The calibration Laboratory at TTK

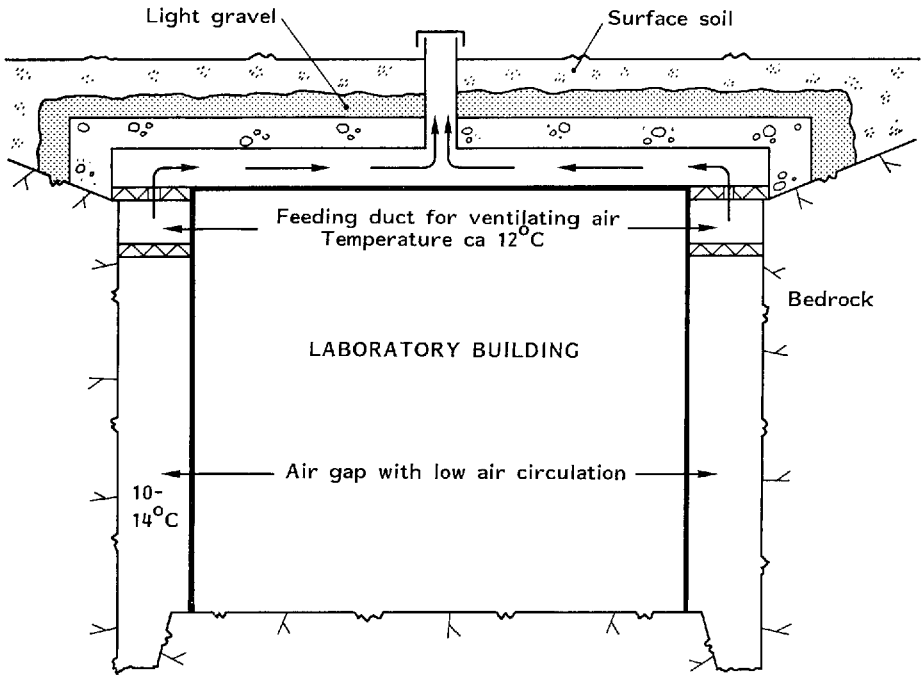


Fig. 2 : Cross-profile of laboratory

Special attention has been paid to make the heat flux out of the building uniform. The wall and ceiling structures are separated by means of an air gap from the rockwalls and from the concrete slab under the surface soil. The air gap is ventilated and its temperature remains within the range from 10 °C to 14 °C all the year round. The air gap also prevents the outside mechanical vibrations to emerge into the laboratory.

An insulation layer of polyurethane covers the outer surfaces of the concrete walls of the laboratory and electric heating cables have been placed under the layer to keep the inner surfaces of the concrete walls at the same temperature as the circulating air in the laboratory space. The concrete bases for instruments are heated according to the same principle.

The building has been made moisture-resistant by means of an effective sub-surface drainage and a special plastic mat under the concrete floor. The ceiling structures have been made waterproof in the same way.

The laboratory building has two floors. The vibration dampers and some devices for the air-conditioning are in the basement (Fig. 3).

The floor of the laboratory rooms is made of reinforced concrete plates mounted on steel beams. The vibrations of the floor are damped by means suitable underpinning and rubber dampers. The floor is not in direct contact with the device tables. Several of these tables are installed on a specially constructed vibration damper.

The calibration laboratory I has been built according to room-in-room principle. The lamps producing heat are placed above the ceiling of opal plastic. Air is conveyed to the rooms via ducts under the floor and though nozzles uniformly distributed around it, and leaves the room through valves placed in the ceiling. Then it comes to an air gap outside the walls and is finally returned through a duct in the basement for processing.

The laser bench in the calibration laboratory II is supported directly on the bedrock. An essential part of the support is a large concrete tubing (length 30 m) through which air is conveyed uniformly into the laboratory.

Air-conditioning

The air-conditioning technique is an essential factor for creating good basic conditions. The system has to maintain stable temperature and relative humidity in the zone of measurement and remove dust and chemically foreign matters from the spaces. It also has to inform the user about the current state of the air-conditioning process. The appropriate execution of these tasks requires a special air-conditioning system regulated by a computer.

The air-conditioning of the calibration laboratories I and II requires a large volume of air (ca 2 m^3/s) which is circulated in the spaces according to the scheme in figure 3. As the air in the laboratories continuously tends to warm up, cooling is needed. The maximum cooling power for measurement instruments is approximately 8 kW. Cooling is carried out by replacing 10 percent of the return current with cold fresh air which is suitably heated by means of the computer controlled system. The relative humidity is maintained at 50 percent by the aid of cold air which has the relative humidity of 100 percent and the temperature of 9.2 °C before the heating. By the time the temperature of air has increased up to 20 °C, the humidity has also settled down to the level required. The processing of air is described in greater detail in figure 4.

The control system of the air-conditioning for the calibration laboratory I is the most accurate one. It is based on a HP 3054 A Automatic Data Acquisition/Control System programmed for this purpose. It was designed and installed by the TTK.

The measurements are carried out by means of thin thermocouples with a heavy and well-insulated copper block housing the reference junctions. The temperature of

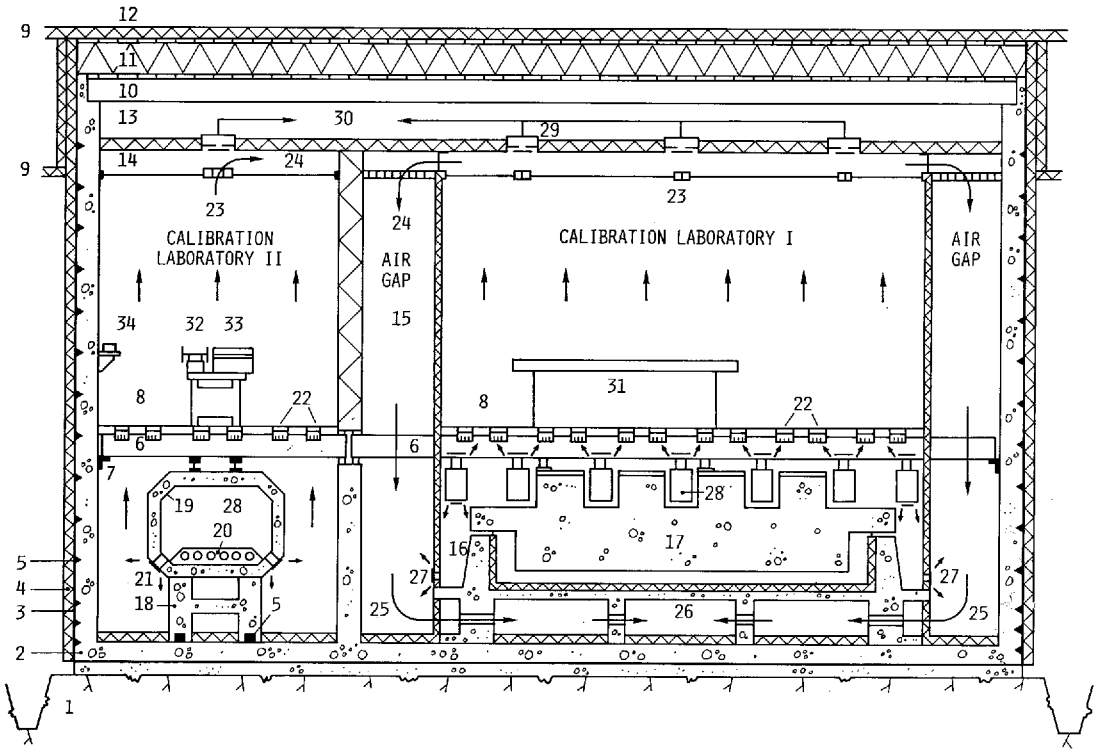


Fig. 3 : Cross section of laboratories I and II

1 Bedrock
2 Reinforced concrete wall
3 Waterproof mat
4 Polyurethane insulation
5 Heating cables
6 Floor supporting beams
7 Fixing rubber seals of floor
8 Reinforced concrete plates
9 Heat barriers in the bedrock air gap
10 Reinforced concrete slab of ceiling
11 Heat insulation
12 Waterproof coverage
13 Polyurethane layer
14 Opal plastic sheet
15 Polyurethane walls
16 Bedding for damped slab base
17 Damped slab base
18 Base for the bench of length measurement
19 Concrete tubing through which air is conveyed to the basement
20 Temperature stabilizing bath
21 Air nozzles
22 Vortex air nozzles
23 Valves in the ceiling
24 Air gap for return air
25 Dust filter
26 Suction duct for circulating air
27 Nozzles for exhaust air from vibration dampers
28 Feeding ducts of incoming air
29 Lamps cooled by exhaust air
30 Suction of exhaust air
31 Damped stone table
32 Laser bench
33 Tables for Väisälä interference comparator
34 Bench for tape calibration by the comparison method, heat bath for the determination of thermal expansion coefficients

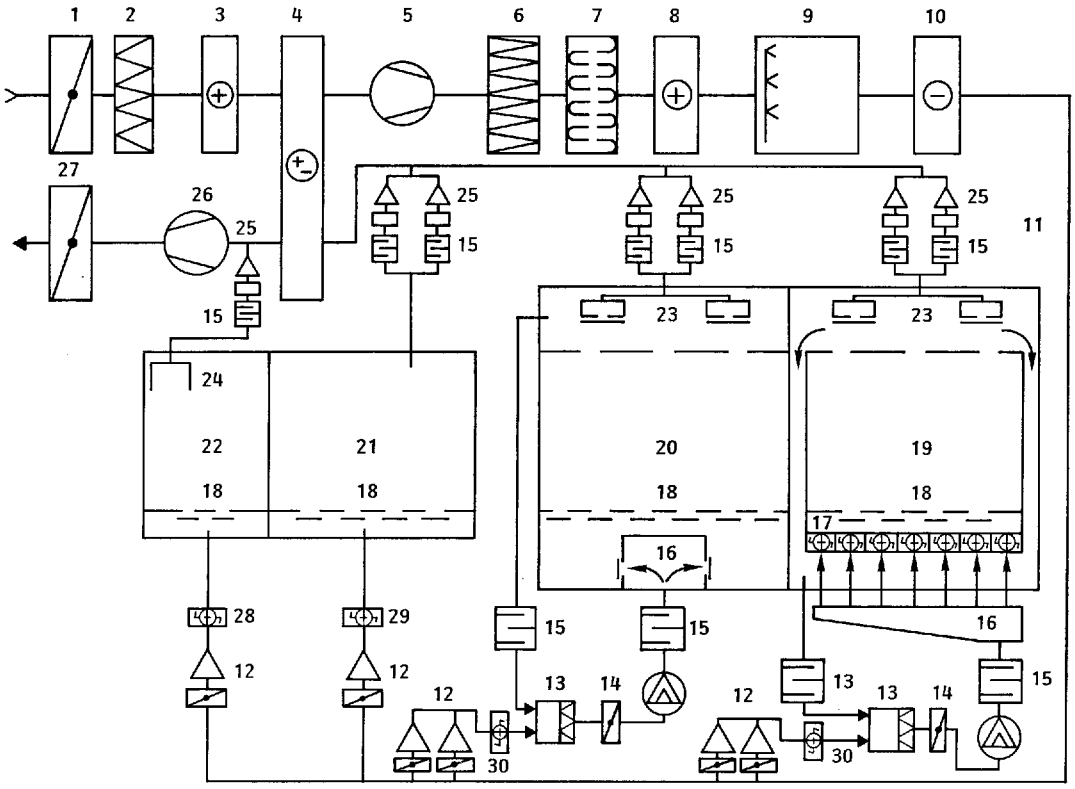


Fig. 4 : Process diagram of air-conditioning

1 Gate valve for fresh air
2 Coarse filter
3 Preheaters
4 Rotating heat exchanger
5 Blower
6 Fine filter
7 Absorbent carbon filter
8 Postheaters
9 Humidifier
10 Cooling radiator
11 Cold air duct in the bedrock air gap
12 Regulators for constant volume of fresh air
13 Mixing chamber and filter
14 Return air blower
15 Sound damper
16 Balancing and distributing box for return air
17 Electric precision radiators
18 Vortex nozzles in the floor
19 Calibration laboratory 1 (Basic comparison)
20 Calibration laboratory 2 (Length measurement)
21 Calibration laboratory 3 (Balances)
22 Calibration laboratory 3 (Temperature measurement)
23 Illuminators cooled by exhaust air
24 Suction fan
25 Regulators for constant volume of exhaust air
26 Fan for exhaust air
27 Gate valve for exhaust air
28 Heater of incoming air for the room of temperature measurement
29 Heater of incoming air for the balance room
30 Coarse heaters for the calibration laboratories 1 and 2

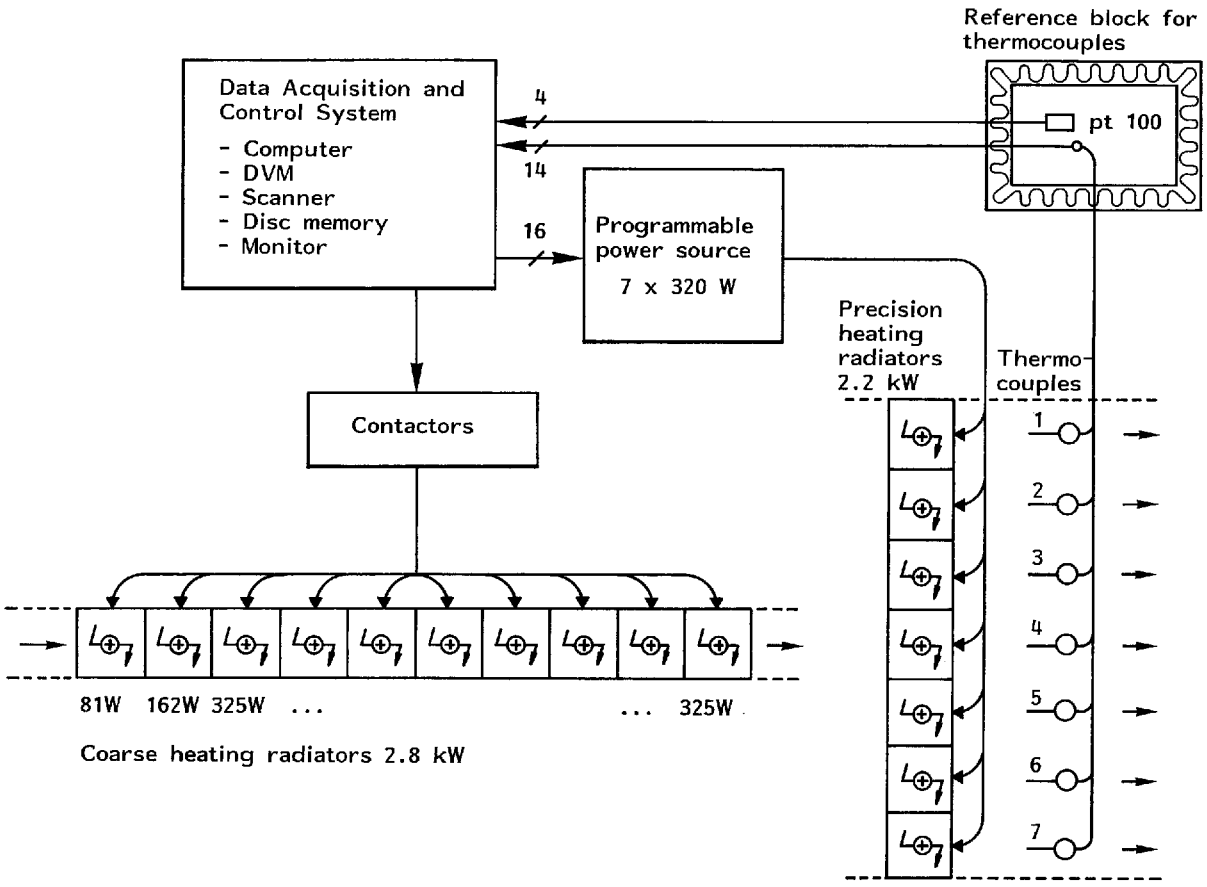


Fig. 5 : Temperature control for the air-conditioning of the calibration laboratory I

the block is measured by means of a Pt 100 sensor. This made it possible to use fairly long copper wires between the reference junctions and the computer. The computer calculates the final values of temperatures from the data obtained (Fig. 5).

The temperature of the cold fresh air used for cooling the circulating air is controlled by the aid of electric coarse heaters. The final heating of the circulating air is done by means of special precision heaters and programmable power sources.

The temperature of the calibration laboratory I in the zone of measurement can be kept constant at 20 °C within the accuracy of + 0.01 °C. The relative humidity is within 50 ± 1 %.

The control system of the calibration laboratory II is otherwise similar to that of laboratory I but does not contain precision heaters. The performance characteristics are 20 ± 0.05 °C and 50 ± 1 %. The largest local variations along the 30 m laser bench are ca 0.06 °C.

Isolation of mechanical vibrations

The isolation against vibrations in the calibration laboratory I is based on the use of air cushion dampers. They effectively cut the mechanical vibrations of above 5 Hz reaching the bedrock floor of the laboratory.

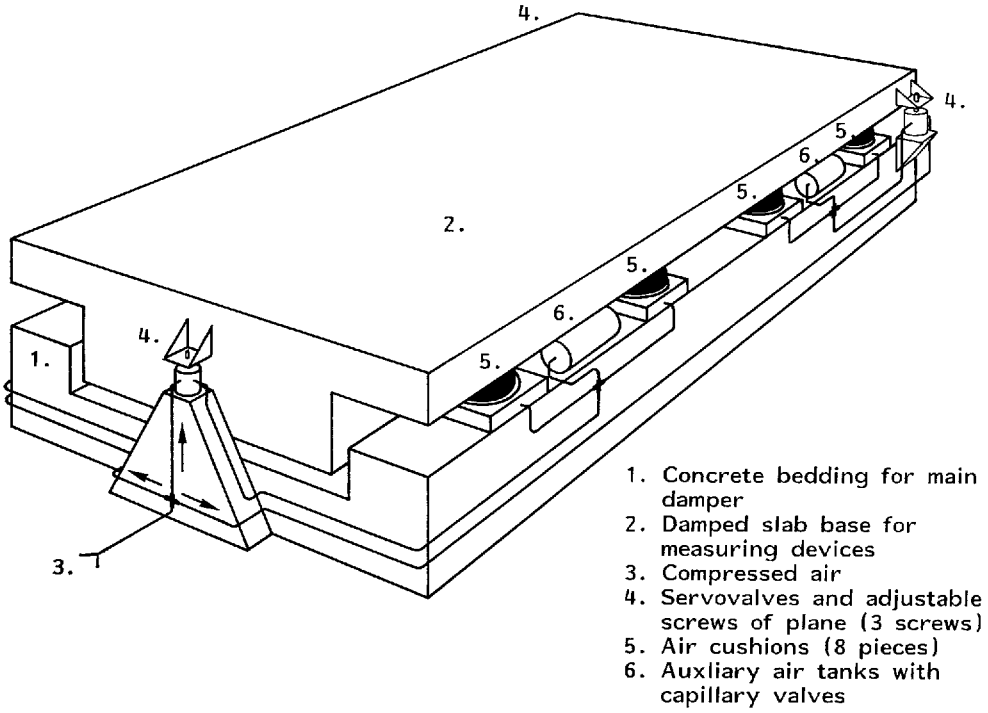


Fig. 6 : Construction scheme of main damper

There are two damped slab bases for measuring instruments mounted in the basement under laboratory I each weighing 32 tons. The bases are made of steel beams and concrete blocks. Each damper lies on 8 pneumatically controlled air cushions which are divided into three groups. The air pressure in each group is regulated by a level sensitive precision valve (Fig. 6). Horizontal movement is restricted by adjustable cone centralizers. The bases may be lowered to the bedding built on the bedrock with a displacement of 2 mm. The characteristic frequency of the base is from 2 to 4 Hz depending on the direction of vibration.

Conclusion

The standards laboratory of the TTK has been in use for approximately 1 year. Its temperature stability and vibration isolation properties fill the highest requirements. Because of the large mass of the vibration isolated slab bases even primary mass comparators can be installed on them. Figures 7 and 8 show photographs of laboratories II and III with their present instrumentations.

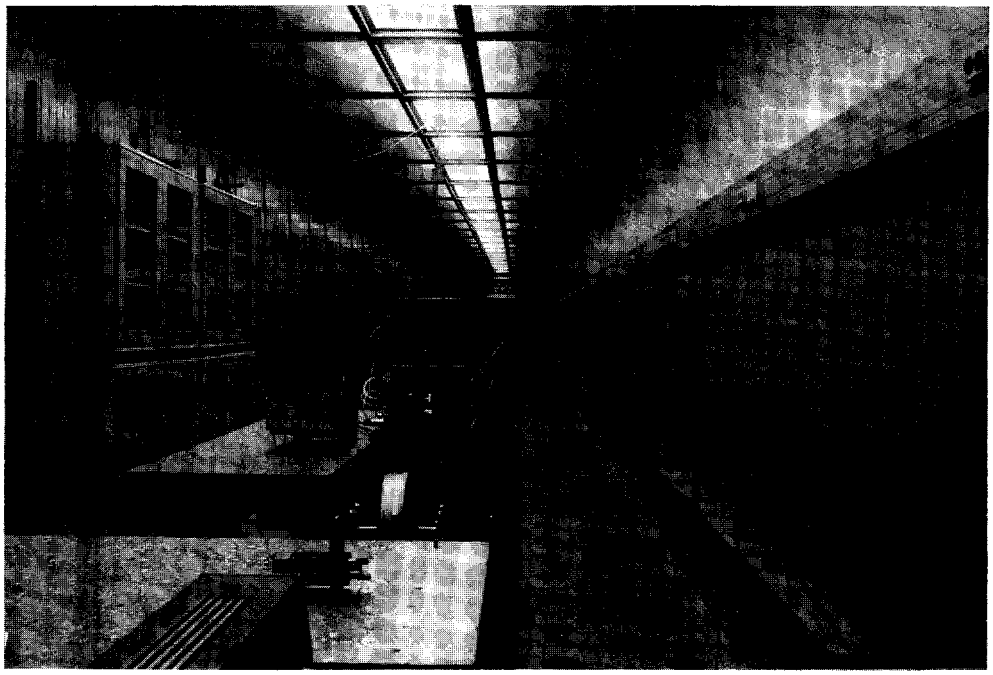


Fig. 7 : View of calibration laboratory for length measurements

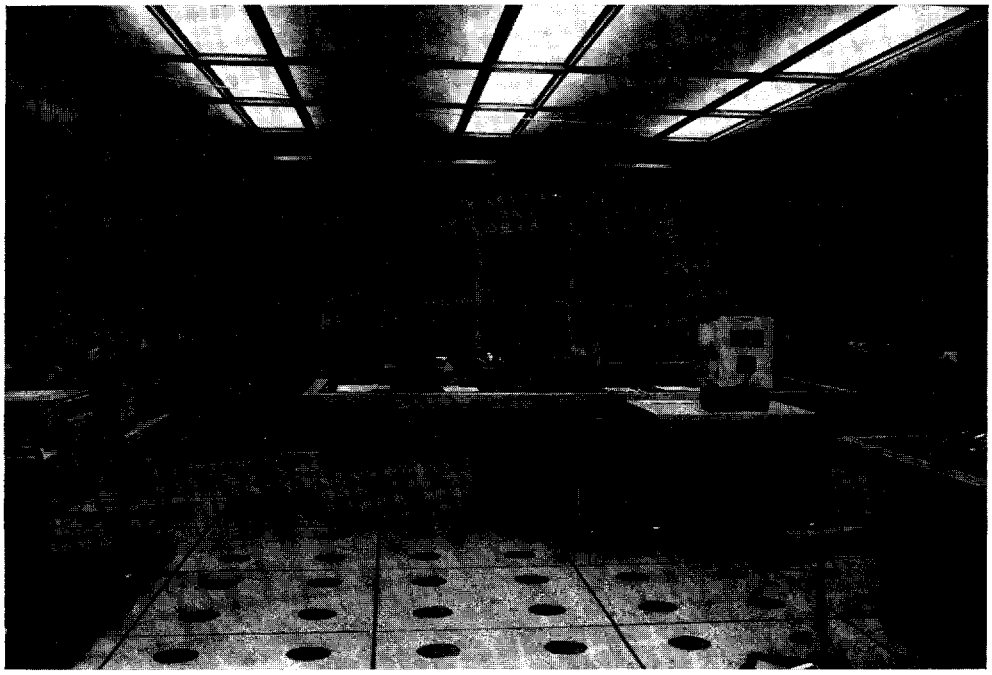
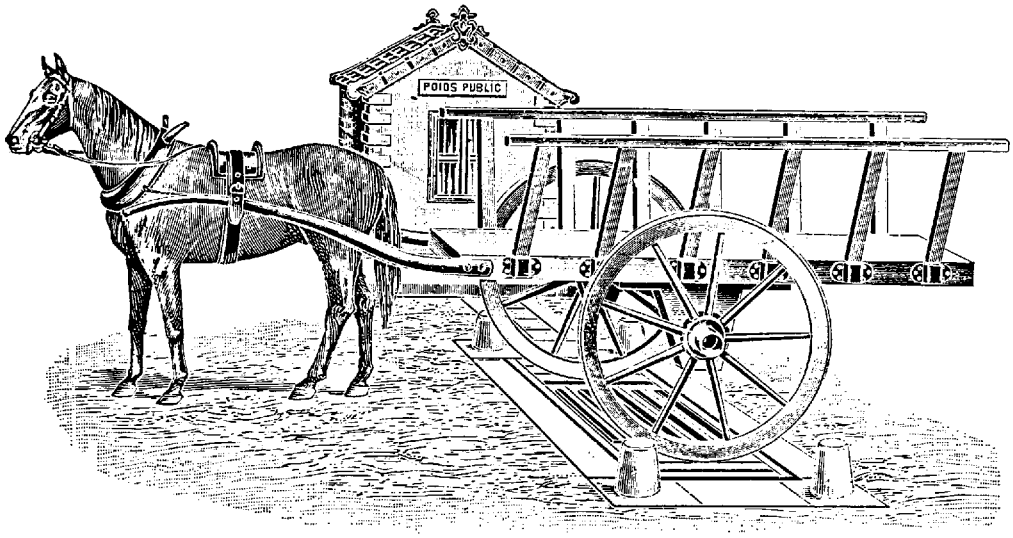


Fig. 8 : Balance room

LITTERATURE



Métrologie historique

Nous signalons la parution d'une compilation importante intitulée « Histoire du Pesage en Région Lyonnaise » par R. Giraud. La première partie, une centaine de pages, concerne la balancerie et les réglementations jusqu'à l'instauration définitive du système métrique en France (1837). La deuxième partie de plus de deux cent soixante pages décrit en détail, et avec un grand nombre d'illustrations (voir ci-dessus), l'évolution des fabrications de balances et bascules des ateliers de la région lyonnaise depuis cette époque jusqu'aux environs de 1970. Cet ouvrage, présenté dans une belle édition, tiré à peu d'exemplaires, peut être acheté (prix : 380 FRF) en s'adressant au service régional de la métrologie, à l'adresse suivante : DRIR Rhône-Alpes, Division MQN, 11, rue Curie, 69456 Lyon Cedex 06.

La métrologie historique intéresse également souvent nos membres du CIML. Certains font des recherches sur ce sujet et publient des livres, généralement dans la langue de leur pays. Ceci est notamment le cas de notre collègue suédois M. Rolf OHLON qui vient de publier une nouvelle version de son livre : Gamla Mått och Nya (Mesures anciennes et nouvelles), Ingenjörsförlaget, Stockholm 1986. Nous avons pris la liberté de reproduire, dans la version anglaise « Literature » de ce Bulletin, une partie de la couverture de ce livre qui montre le mesurage de masses et de volumes en Suède au 16ème siècle. La gravure originale figure dans un livre sur l'histoire des peuples nordiques par Olaus Magnus : « Historia de gentibus septentrionalibus », Rome, 1555.

Pesage

Monsieur Dieter BUER, Directeur du Service de Métrologie de la ville de Brême que nous connaissons en tant que collaborateur au sein du SP 7-Sr 4, a passé quelques temps à New-Delhi en 1985 au titre de la coopération de la R.F.A. Il a à cette occasion tenu une conférence sur les comparateurs de masse pour agents de vérification. Cette conférence intitulée « Weight comparators. Metrological requirements of verification agencies » ainsi qu'un catalogue sur ces comparateurs peuvent être obtenus en s'adressant à Sartorius GmbH, P.O. Box 3243, 3400 Goettingen, R.F. d'Allemagne.

Approbation de modèle au Royaume-Uni

Un guide sur les formalités et procédures d'essais de modèle a été publié par le National Weights and Measures Laboratory : « Pattern Examination of Weighing or Measuring Equipment, NWML May 1986 ».

On trouve en annexe à ce guide une liste de documents publiés par NWML qui donnent des détails sur les exigences techniques et les procédures d'essais en laboratoire, voir la version anglaise « Literature » de ce Bulletin pour les titres de ces publications.

Application des accords GATT au Japon

Le Ministère du Commerce International et de l'Industrie du Japon a publié un guide en anglais intitulé : « Guidelines for acceptance of foreign test data in Japanese standards and certification systems, Ministry of International Trade and Industry, September 1986 ».

Le but de ce document est d'indiquer les produits soumis aux réglementations au Japon et d'expliquer comment des demandeurs étrangers doivent procéder pour faire admettre leurs produits dans ce pays. Les pages 123 à 143 concernent les instruments de mesure et les emballages figurant dans la loi de métrologie.

Electricité

Le National Bureau of Standards des Etats-Unis d'Amérique a publié dernièrement un recueil de 66 articles publiés ces dernières deux décennies sur les méthodes de mise en œuvre pratique des étalons électriques et sur les mesures de puissance, courant, tension et autres grandeurs électriques. Cette compilation : « Precision Measurement and Calibration : Electricity, SP 705 (stock 003-003-02699-6) » peut être achetée auprès du Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402.

Compteurs d'énergie électrique et de gaz

La Suisse vient d'éditer une nouvelle réglementation sur les compteurs d'énergie électrique : « Ordonnance sur les appareils mesureurs pour l'énergie et la puissance électriques, 4 août 1986 » ainsi que des directives d'application éditées par l'Office Fédéral de Métrologie en date du 1er octobre 1986.

Les conditions d'approbation de modèle sont basées sur des normes CEI. On note dans les Directives un chapitre intéressant concernant le contrôle statistique par échantillonnage indiquant les critères pour ce contrôle.

L'Ordonnance de la Suisse sur les compteurs de gaz du 4 août 1986 ainsi que les Directives de l'Office Fédéral de Métrologie du 15 septembre 1986 sont en tous points conformes aux Recommandations Internationales de l'OIML auxquelles il est fait référence dans ces deux publications.

La Direction de la Métrologie légale du Canada vient également d'éditer en date du 15 septembre 1986 un important document, 122 pages, sur les « Caractéristiques pour l'approbation des types de compteurs d'électricité, transformateurs de mesure et appareils auxiliaires ». En plus de définitions et limites d'erreurs, le texte traite également avec des illustrations les essais sur l'influence des interférences applicables en particulier aux compteurs statiques (électroniques). Un grand nombre d'autres dispositifs sont également réglementés : compteurs de maximum, compteurs de perte, transducteurs, indicateurs de zéro, transformateurs de mesure, appareils à impulsion, etc.

Enseignement de la métrologie

M. Aurel MILLEA vient de nous adresser son cours de métrologie intitulé « CARTEA METROLOGULUI — Metrologie generală » qui a été édité par Editura Technică à Bucarest, 1985.

Nous avons plusieurs fois signalé l'abondance de livres de métrologie publiés en Roumanie et regrettons encore une fois que nos amis roumains n'entreprennent pas des traductions en français ou en anglais de ces excellents ouvrages de base.

Aux Etats-Unis l'enseignement de la métrologie légale dispensé aux Agents de vérification est largement facilité par l'initiative de la Conférence Nationale des Poids et Mesures (NCWM) d'éditer des modules d'enseignement comprenant pour chaque spécialité un manuel destiné à l'agent et un manuel pour l'instructeur-enseignant. Voir la version anglaise « Literature » pour plus de détails sur les modules édités à ce jour.

Etalonnages

Un certain nombre de pays éditent de temps à autre des publications sur les étalonnages qui peuvent être effectués dans leurs laboratoires nationaux. Ces répertoires indiquent les ressources matérielles et l'exactitude des moyens disponibles et contiennent souvent des informations techniques très utiles pour ceux qui ont besoin des services d'étalonnage. Ceci est notamment le cas de la récente publication des Etats-Unis d'Amérique qui a pour titre :

NBS Calibration Services — Users Guide 1986-88, NBS SP250 (183 pages)
and Fee Schedule NBS SP 250 Appendix (93 pages)

Cette publication couvre la plupart des domaines de mesurage et contient également de nombreuses références bibliographiques.

Les étalons nationaux français ainsi que leurs incertitudes et moyens de raccordement sont répertoriés dans une publication récente du Bureau National de Métrologie ayant pour titre « Catalogue des Références Métrologiques Nationales, Réalisations et Performances, BNM, septembre 1986 ».

Les activités de recherche dans le même domaine sont décrites dans le rapport « Recherches et Développements — Chaînes d'étalonnage — Activité 1985 » BNM 00089-86.

Pollution

Les travaux de l'OIML viennent de commencer (SP 17-Sr 5) en ce qui concerne les instruments de mesure de la pollution due aux déchets toxique (non-radioactifs). Les déchets radioactifs sont cependant également un problème pour beaucoup de gouvernements et fut notamment le sujet de la 21ème réunion annuelle du National Council on Radiation Protection and Measurements à Washington en avril 1985. Les exposés présentés sont publiés dans « NCRP-Proceedings No. 7 — Radioactive Waste » qui peut être obtenu en écrivant à NCRP-Publications, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814, U.S.A.

Matériaux de référence

Un catalogue sur les matériaux de référence disponibles du National Bureau of Standards USA est publié tous les deux ans. Le dernier a été publié en juin 1986 et comprend 153 pages. Il comporte, en plus d'une grande quantité de produits métallurgiques et chimiques et mélanges de gaz utilisés pour des étalonnages d'analyseurs, également des points fixes pour la thermométrie, des filtres et solutions pour la spectrophotométrie, des étalons d'indice de réfraction, de résistivité, radioactivité, pH, etc. :

NBS Standard Reference Materials Catalogue 1986-87, NBS Special Publication 260.

Coopération régionale

Le Commonwealth Science Council vient de publier le rapport sur la 3ème réunion de APMP (Asia/Pacific Metrology Programme), Nouvelle-Delhi, Déc. 1985, pendant laquelle fut également tenu un séminaire technique. Les exposés présentés par des conférenciers spécialement invités pour cette occasion sont énumérés dans la version anglaise « Literature » ci-dessous.

Le BIML a commencé à échanger des publications avec la nouvelle organisation régionale « Standardization and Metrology Organization for G.C.C. Countries ». Cette organisation groupe les six pays suivants : Arabie Saoudite, Bahrein, Emirats Arabes Unis, Koweit, Oman et Qatar. Elle fut créée le 17 juillet 1984 dans le cadre du Gulf Cooperation Council.

Le secrétariat est installé dans les locaux de la Saudi Arabian Standards Organization (SASO) à l'adresse postale P.O. Box 85245 à Riyadh 11691, Royaume d'Arabie Saoudite. L'organisation édite une revue bilingue arabe-anglais « Standards Magazine » dont le premier numéro a paru en décembre 1985 et le deuxième en mai 1986. Le texte décrivant les buts de la nouvelle organisation et figurant au dos de la couverture de cette revue, est partiellement reproduit dans la version anglaise « Literature » de ce Bulletin.

ASMO catalogue de normes

Un nouveau catalogue de normes a été publié en 1986 en version bilingue, anglais-arabe, par l'Organisation Arabe de Normalisation et de Métrologie (ASMO). Le chapitre Métrologie (ASMO TC 7) comporte une soixantaine de normes, basées sur les Recommandations Internationales de l'OIML pour environ la moitié et le restant sur des normes ISO. Ce catalogue peut être obtenu auprès de ASMO, P.O. Box 926161, Amman, Jordanie.

LITERATURE

Historical metrology

Metrology in old times is frequently a subject of interest to CIML Members. Some of them carry out research on the subject and publish books, generally in the language of their country. This is in particular the case of our Swedish Member Mr Rolf OHLON who has recently published a new and enlarged version of his book : Gamla Mått och Nya (Old and new measures), Ingenjörsförlaget, Stockholm 1986. We have taken the liberty of reproducing above a part of the cover page of this book which shows measurement of mass and dry volume in Sweden in the 16th century. The original engraving is printed in a book about the history of the Nordic people by Olaus Magnus : « Historia de gentibus septentrionalibus », Rome 1555.

We would also like to mention the publication of an important compilation in French with the title « Histoire du Pesage en Région Lyonnaise » by R. Giraud. The first part, about hundred pages, deals with weighing machines and regulations up to the definite application of the metric system in France (1837). The second part of more than two hundred sixty pages describes in detail, and with many illustrations, the evolution of the manufacture of weighing machines in the workshops in the region of Lyons, since this time up to about 1970. This book very well printed, but in small number, can be purchased (380 FRF) from the French regional metrology service at the following address : DRIR Rhône-Alpes, Division MQN, 11, rue Curie, 69456 Lyon Cedex 06.

Weighing

Mr Dieter BUER, Chief of the Metrology Service of Bremen, who we know as collaborator within SP 7-Sr 4, visited New-Delhi in 1985 within the framework of technical assistance of the Federal Republic of Germany. On this occasion he gave a lecture on mass comparators for weights and measures inspectors. This lecture « Weight comparators. Metrological requirements of verification agencies » as well as a catalogue of such comparators can be obtained from : Sartorius GmbH, P.O. Box 3243, 3400 Goettingen, F.R. of Germany.

Pattern approval in the U.K.

A guide describing the procedures for obtaining pattern approval in the U.K. has been published by the National Weights and Measures Laboratory : « Pattern Examination of Weighing or Measuring Equipment. NWML May 1986 ».

The following other NWML publications for pattern examination are listed in an annex to this guide :

0300 National pattern approval application form
0301 National/EC pattern approval registration form
0302 National/EC pattern approval requirements
0303 National/EC variant approval application form
0304 EC pattern approval application form
0305 Requirements relating to limited national approval
0308 Procedure for pattern examination

Design assessment criteria

0310 Design assessment criteria list
0311 DAC general information
0320 Immunity to electrical disturbances
0321 Ticket printout requirements
0322 Interworking with computers
0323 Immunity to environmental disturbances
0340 LMIs for retailing motor fuel
0341 Non-automatic weighing equipment
0342 Non-automatic weighing equipment interfaced with computer (Retail)
0343 Automatic weighing machines of the gravimetric filling type
0344 Automatic weighing equipment of the discontinuous type
0345 Beltweighers
0346 In motion weighing railway weighbridges
0347 Non-automatic weighing equipment interfaced with computers (Industrial)
3006 Acceptance of design proving test data

Laboratory test procedures

0371 Warm up test
0372 Span stability test
0373 Eight hour duration at full load
0374 Variation on return to zero
0375 Linearity and hysteresis
0376 Eccentricity tests
0377 Temperature tests
0380 Tilt test
0384 Line borne electrical disturbance test
0385 Electrostatic discharge disturbance tests
0386 Electromagnetic radiation disturbance tests
0387 Induction field disturbance tests
0403 Fees for national pattern approval including variants

Application of the GATT agreement in Japan

The Ministry of International Trade and Industry of Japan has recently published « Guidelines for acceptance of foreign test data in Japanese standards and certification systems, September 1986 ».

The aim of this document is to indicate the products subject to regulations in Japan and to explain to foreign applicants how to proceed for their admission in that country. The pages 123 to 143 of the publication deal with measuring instruments and measuring containers subjected to the metrology law.

Electricity

The National Bureau of Standards, USA has recently issued a compilation of 66 selected papers published during the last two decades on the practical realization of electrical standards and the measurement of power, current, voltage and other electrical quantities. This publication : « Precision Measurement and Calibration : Electricity SP 705 (stock 003-003-02699-6) » can be procured from the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402.

Electrical energy meters and gas meters

Switzerland has recently published a new regulation on electrical energy meters : « Ordonnance sur les appareils mesureurs pour l'énergie et la puissance électriques, 4 août 1986 » as well as application Directives issued by the Federal Office of Metrology on 1 October 1986.

The pattern approval requirements are basically those of IEC. There is however also an interesting chapter on statistical control by sampling indicating the acceptance criteria in such testing.

The Swiss regulation for gas meters issued on 4 August 1986 and the Directives by the Federal Office of Metrology of 15 September 1986 are on all points conforming to the OIML International Recommendations on gas meters which are referred to in both publications.

The Legal Metrology Branch of Consumers and Corporate Affairs of Canada has also issued on 15 September 1986 an important document, 122 pages, with the title « Specifications for Approval of Type of Electricity Meters, Instrument Transformers and Auxiliary Devices ». In addition to definitions and error limits, this document also treats the tests of influence of interferences applicable in particular to static (electronic) meters. A great number of other devices are also subject to regulations : demand meters, loss meters, transducers, null balancing instruments, instrument transformers, pulse devices, etc.

Metrology training

Mr Aurel MILLEA has sent us a metrology course with the title « CARTEA METRO-LOGULUI — Metrologie generală » edited by Editura Technică, Bucarest 1985.

We have several times mentioned the abundance of metrology books published in Romania and we once more regret that our Romanian friends do not produce translations into French or English of these excellent basic texts.

In the USA training of weights and measures inspectors is now largely facilitated by the initiative of the National Conference on Weights and Measures (NCWM) to issue training modules which comprise for each specialty one manual for the inspector and one manual for the instructor.

The latter contains projection slides and is therefore more expensive (generally 70 US dollars). The inspector's manuals (price generally 30 dollars) can, however, be purchased and used separately as they contain reproductions of the slides.

Although these modules are largely based on U.S. regulations (Handbook 44) they may in several cases be adapted for training in other countries. We are listing below the modules which have been issued so far.

Module No.	Title
1	Retail Computing Scales — Mechanical
2	Retail Computing Scales — Electronic
5	Vehicle and Axle-Load Scales
6	Meat Beams and Monorail Scales
8	Retail Motor-Fuel Dispensers and Consoles
10	Checking the Net Content of Packaged Good
27	Introduction to Electronic Weighing and Measuring Systems

The manuals may be ordered from National Conference on Weights and Measures P.O. Box 3137, Gaithersburg, MD 20878, USA.

Calibration

Some countries issue from time to time publications listing the calibration possibilities in their national laboratories. These publications describe the available facilities and their accuracy and contain frequently also other technical information for those who need calibration services. This is particularly the case of the recent U.S. publication :

NBS Calibration Services - Users Guide 1986-88, NBS SP 250 (183 pages)
and Fee Schedule NBS SP 250 Appendix (93 pages)

This publication covers most fields of measurement and contains also numerous bibliographic references.

The French national measurement standards and their accuracy are listed in a recent publication by Bureau National de Métrologie : « Catalogue des Références Métrologiques Nationales - Réalisations et Performances, BNM septembre 1986 ».

The research activities in the same field are described in the report « Recherches et Développements — Chaînes d'étalonnage — Activité 1985 » BNM 00089-86.

Pollution

The work of OIML has started within SP 17-Sr 5 concerning measuring instruments for dangerous waste (non-radioactive). The radioactive waste is however also a problem for many governments and was the special subject chosen for the 21st annual meeting of the National Council on Radiation Protection in Washington in April 1985. The presentations at this meeting are now published as « NCRP — Proceedings No. 7 — Radioactive Waste » which can be obtained from NCRP-Publications, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814, U.S.A.

Reference materials

The standard reference materials available from the National Bureau of Standards, USA, are listed in a catalogue which is published every two years. The last issue, published in June 1986, contains 153 pages. It includes in addition to a great number of metallurgical and chemical products used for calibrating analyzers, also fixed points for thermometry, optical filters and solutions for spectrophotometry, standards for refractive index, resistivity, radioactivity, pH, etc. :

NBS Standard Reference Materials Catalogue 1986-87, NBS Special Publication 260.

Regional cooperation

The Commonwealth Science Council has now published the report of the 3rd meeting of APMP (Asia/Pacific Metrology Programme), New-Delhi, Dec. 1985 in connection with which there was a regional workshop for developing countries on individually selected fields of metrology. The following presentations by specially invited lecturers are included in this report referenced CSC (86) ISP-15 :

A.R. Verma — Measurement system in India through the ages

G. Girard — The organs of the Convention du Mètre, the kilogram and special researches in mass measurements

J.H. Buckingham — The measurement of length, angle and form

T.P. Jones — Temperature calibration facilities

S. L. Hahn — Von Klitzing effect and the quantized Hall resistance

K. Chandra — D.C. & A.C. (electrical) measurements

J.H. Hinken, E. Vollmer, J. Niemeyer — D.C. voltage standard using Josephson array junctions

S. Chandrasekharan — Legal metrology in India and at the international level.

The BIML has started to exchange publications with a new regional body, the « Standardization and Metrology Organization for G.C.C. Countries ». This organization groups the following six countries : Saudi Arabia, Bahrain, Kuwait, Oman, Quatar and United Arab Emirates. It was created on 17 July 1984 within the framework of the Gulf Cooperation Council.

The secretariat is hosted within the premises of the Saudi Arabian Standards Organization (SASO) with the address P.O. Box 85245, Riyadh 11691, Kingdom of Saudi Arabia. The organization edits a bilingual « Standards Magazine », the first issue of which was published in December 1985 and the second in May 1986. The constitution and aims of the organization are described on the second page of the cover of this magazine from which we are extracting as follows :

« The Organization undertakes the legislative aspects of standardization in the GCC countries ; and is the sole body in the Gulf which is empowered to prepare, approve and publish Gulf Standards ; it follows up the proper implemention of Gulf Standards through the appropriate institutes of the member states.

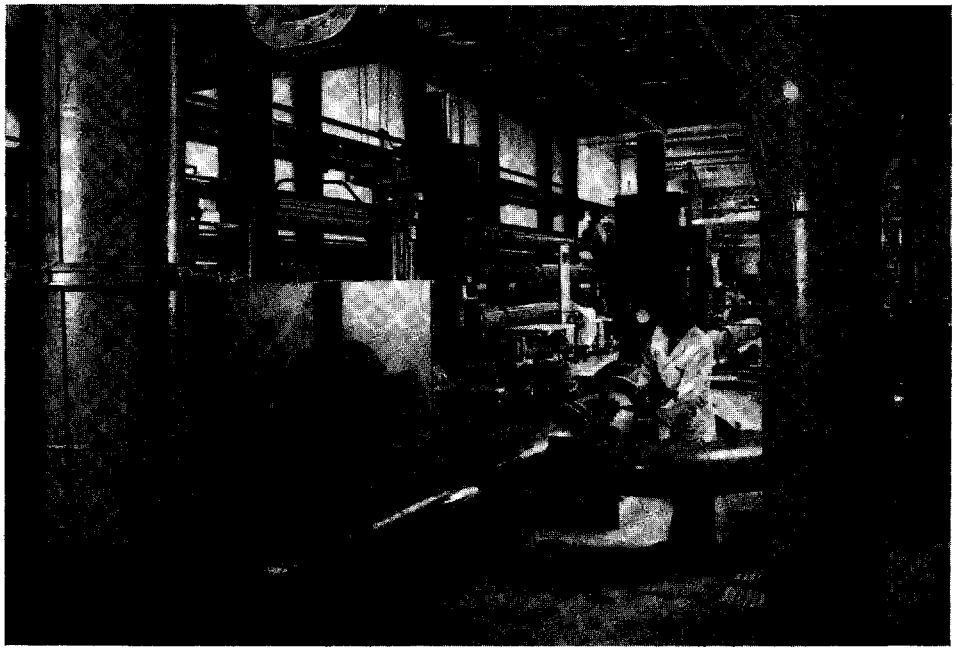
The Organization is currently preparing a comprehensive plan to monitor standardization activities in the GCC Countries, and each member body is being allocated a portion of the task commensurate with its material and human resources.

The Organization also collects, stores and retrieves relevant information and makes it available to the bodies concerned. It compiles, studies and conducts research in support of its activities. It is now taking all necessary measures to establish systems for legal and industrial metrology, for conformity certification and quality marking, and for the dissemination of knowledge and awareness of standardization.

Inter alia, the Organization also organizes appropriate training courses, provides the member states with technical assistance, and participates as an observer in the activities of regional and international standards bodies. »

ASMO standards catalogue

A new catalogue of standards in English and Arabic has been published in 1986 by the Arab Organization for Standardization and Metrology (ASMO). The chapter on Metrology (handled by ASMO TC 7) contains about sixty standards about half of which are based on OIML International Recommendations and the remainder on ISO standards. The catalogue may be obtained from ASMO, P.O. Box 926161, Amman, Jordan.



CONFERENCE SUR LES MESURES DE DEBIT

Une conférence internationale sur la mesure de débit « Flow Measurement in the Mid 80's » était organisée par le National Engineering Laboratory du Royaume-Uni du 9 au 12 juin 1986, à laquelle ont participé des représentants de plusieurs services de métrologie légale, y compris le Président du CIML et un Adjoint au Directeur du BIML.

Trente-quatre exposés étaient présentés en version abrégée. L'évolution historique a été évoquée en ouverture par le Dr E.A. Spencer. Les autres exposés étaient répartis sur 11 sessions : compteurs turbines, débit de deux phases, compteurs vortex, mesurage des gaz, appareils déprimogènes, modèles mathématiques, méthodes d'étalonnage, débits d'eau, divers et compteurs ultrasoniques.

Une partie dominante des exposés fut en fait directement et indirectement consacrée à la méthode déprimogène à diaphragme qui semble toujours, malgré son âge et ses inconvénients, être le procédé favori dans l'industrie pétrolière. Des essais effectués en Europe (comparaisons des pays de la CEE) mais aussi aux Etats-Unis semblent indiquer que l'on doit réviser les valeurs des coefficients utilisés à ce jour dans les équations pour ces systèmes à diaphragme.

L'influence de l'installation de compteurs est dans bien des cas importante et fut analysée par plusieurs orateurs en ce qui concerne la rugosité et la longueur des parties droites des tuyaux de connexion.

Les compteurs vortex prennent de l'importance et il semble, selon un exposé de Mr Hayward, qu'ils peuvent maintenant être utilisés pour des transactions commerciales, de gros débits de gaz avec une perte de pression moindre et une meilleure exactitude que les compteurs déprimogènes à diaphragme.

Un compteur vortex expérimental, sans pièces mobiles, pour le comptage de gaz domestique fut présenté par des spécialistes de compagnies de gaz du Japon. Il utilise deux oscillateurs fluidiques de dimensions différentes connectés en série de façon à permettre le comptage de très faibles débits.

Les compteurs ultrasoniques présentent des caractéristiques particulièrement intéressantes par suite de leurs faibles pertes de pression. Des compteurs de ce type à faisceaux multiples, mis au point par la compagnie British Gas, semblent avoir donné des résultats très satisfaisants.

Un exposé très intéressant était présenté sur les différentes méthodes de mesure de débit massique.

Sous le chapitre « méthodes d'étalonnage » il y avait seulement deux exposés : l'un concernant l'installation d'étalonnage de compteurs de British Gas à Bishop Auckland et l'autre fait par les spécialistes de NEL sur les essais avec une jauge à piston pour la mesure des gaz à forte pression (un article sur le même sujet, par d'autres auteurs, a été publié dans le Bulletin de l'OIML N° 100).

Des copies des exposés de la FM 80's Conference (en deux volumes) peuvent être achetées au National Engineering Laboratory, East Kilbride, Glasgow G75 OQU, Royaume-Uni.

A l'occasion de cette conférence, la revue Measurement + Control (éditée par the Institute of Measurement and Control, U.K.) a publié un numéro spécial sur les mesures de débit (Vol. 19, N° 5 juin 1986) comprenant plusieurs articles d'intérêt général, en particulier pour l'enseignement de la métrologie des fluides.

Malgré le grand nombre de manifestations internationales de ces dernières années dans le domaine des mesures de volume et de débit, on constate qu'il y a eu peu de communications sur les jaugeages et sur l'étalonnage de compteurs, en particulier pour des produits difficiles tels que gaz liquéfié. Nous espérons que cette lacune sera comblée par le séminaire de l'OIML :

VERIFICATION DES INSTALLATIONS DE MESURE DE VOLUME DE LIQUIDES

Arles, France, 11-15 mai 1987

FLOW MEASUREMENT CONFERENCE

The National Engineering Laboratory of U.K. organized, 9-12 June 1986 an international conference « Flow measurement in the Mid 80's » which was attended by staff from several legal metrology services including the President of CIML and a BIML staff member.

Thirty-four papers were presented in a summarized way. The historical evolution was first retraced by Dr E.A. Spencer, the other papers were distributed over 11 sessions : turbine meters, two phase-flow, vortex meters, gas metering, orifice plates, installation effects, numerical modelling, calibration methods, water flow, miscellaneous and ultrasonic meters.

A dominent part of the presentations and discussions concerned the orifice metering which seems to be the « still going strong » method in the oil industry. Practical measurements in Europe (EEC comparisons) but also in the USA seem to indicate there should be a revision of the values of the coefficients used so far in the orifice plate formulas.

The installation effects on flow meters are many times of considerable importance and the effect of streightness and roughness of tubing was analyzed by several authors.

Vortex meters are gaining interest and it seems from a paper presented by Mr Hayward that they can now be used for custody transfer of bulk gas with less pressure loss and better accuracy than orifice plates.

An experimental vortex meter with no moving parts for domestic gas metering was presented by specialists from gas companies in Japan. It uses two series-mounted fluidic oscillators of different dimensions so as to be able to cover the lowest range of flow.

Ultrasonic meters are also of increasing importance due to low pressure losses. Multiple beam ultrasonic meters developed by British gas were reported to give very satisfactory performance.

There was also an interesting review on different methods of mass flow metering.

Under the chapter « Calibration methods » there were only two presentations : one concerning the British Gas Test Facility at Bishop Auckland and the other by NEL staff on tests of a piston prover for high pressure gas (Similar to the work by other authors published in OIML Bulletin No. 100).

Copies of the proceedings of the FM 80's Conference (Two volumes) may be purchased from the National Engineering Laboratory, East Kilbride, Glasgow G75 OQU, U.K.

In connection with the Conference the magazine Measurement + Control (published by the Institute of Measurement and Control, U.K.) edited a Special Issue on Flow, Vol. 19, No. 5 June 1986, in which there are several review papers of particular interest for basic training programmes including the historical development of flow metering, the calibration of flowmeters, survey of industrial flowmeters, milk metering, metering in the oil industry, economic aspects, etc.

In spite of the numerous international events these last years within the field of flow measurements there have been few presentations on methods of gauging of reservoirs or on calibration of flow meters in particular for difficult products such as liquified gas. We hope that this gap will be filled by the OIML seminar on

CALIBRATION OF LIQUID VOLUME MEASURING INSTALLATIONS

Arles, France, 11-15 May 1987

INFORMATIONS

NOUVEAUX MEMBRES DU CIML — NEW CIML MEMBERS

Nous sommes heureux d'accueillir les nouveaux Membres suivants du CIML :
We are happy to welcome the following new CIML Members :

BRESIL	Mr MASAO ITO
EGYPTE	Mr M.K. SALEM
JAPON	Mr S. HATTORI
PAKISTAN	Mr M. ASAD HASAN

QUELQUES EVENEMENTS A VENIR — SOME COMING EVENTS

25-26 février 1987	1st Int. Conf. and Exhib. on Vibration Control in Optics and Metrology, London, UK Information : The Conference Office, Sira Ltd, South Hill, Chislehurst, Kent BR7 5EH, UK
30 mars-3 avril 1987	The Basic Principles and Practice of Flow Measurement, Five Day Course Information : Conference Section, National Engineering Laboratory, East Kilbride, Glasgow G75 OQU, UK
27 avril-1er mai 1987	Conf. on Lasers and Electro-Optics, MD, USA Information : Optical Society of America, 1816 Jefferson Place, NW, Washington, DC 20036, USA
26-28 mai 1987	2nd Symp. on Industrial Measurement of Electrical and Electronic Components and Equipment, Poland Information : IMEKO Secretariat, 1371 Budapest 5, PO Box 457, Hungary
10-12 juin 1987	6th Symp. on Signal Processing in Measurement, Budapest, Hungary Information : IMEKO Secretariat, 1371 Budapest 5, PO Box 457, Hungary
18-20 août 1987	4th IMEKO Symposium on Metrological Assurance for Environmental Control, Helsinki, Finland Information : IMEKO TC 8 Symposium, The Finnish Society of Automatic Control, P.O. Box 165, SF-00101 Helsinki, Finland
15-17 septembre 1987	3rd IMEKO Symp. on Thermal and Temperature Measurement in Science and Industry, Sheffield, UK Information : IMEKO TC 12 Symposium Secretariat, 87 Gower Street, London WC 1E 6AA, UK
22-24 septembre 1987	Eurosensors — 3rd Conference on Sensors and their applications, Cavendish Laboratory, Cambridge Information : The Institute of Physics, 47 Belgrave Square, London SW1X 8QX, UK
22-23 septembre 1987	International Conference on Industrial Flow Measurement, Onshore and Offshore, Marriott Hotel, London, UK Information : Suzanne Mayhew, IBC Technical Services, Ltd, Bath House (3rd Floor), 56 Holborn Viaduct, London EC1A 2EX, UK
septembre 1987	13th IMEKO TC 2 Symposium on Photondetectors (including applications in radiometry and photometry), PTB, Braunschweig, Fed. Rep. of Germany

REUNIONS OIML

	Groupes de travail	Dates	Lieux
SP 14	Acoustique et vibrations	6-7 avril 1987	BIML PARIS
SP 14 - Sr 1	Sonomètres		
SP 14 - Sr 2	Audiomètres		
SP 14 - Sr 3	Vibrations mécaniques et chocs		
SP 10 - Sr 1	Mesure de la vitesse des véhicules	avril 1987 *(provisoire)*	SUISSE
SP 17 - Sr 1	Mesure des pollutions de l'air	28-30 avril 1987 *(provisoire)*	
SP 12 - Sr 7	Thermomètres médicaux	5-8 mai 1987	BRAUNSCHWEIG R.F. D'ALLEMAGNE
SP 7 - Sr 4	Instruments de pesage à fonctionnement non automatique	1-5 juin 1987	BRAUNSCHWEIG R.F. D'ALLEMAGNE
SP 6	Mesure des gaz	15-19 juin 1987	BIML PARIS
SP 6 - Sr 1	Compteurs de gaz à parois déformables		
SP 6 - Sr 2	Compteurs de gaz à pistons rotatifs Compteurs de gaz non volumétriques		
SP 20 - Sr 1	Problèmes généraux pour les préemballages	juin 1987 *(provisoire)*	GÖTEBORG SUEDE
SP 2 - Sr 5	Contrôle par échantillonnage		

Conseil de la Présidence	4, 5, 6 février 1987	BIML PARIS
Séminaire sur la vérification des installations de mesure de liquides	11-15 mai 1987	ARLES FRANCE
22ème Réunion du Comité International de Métrologie Légale	septembre 1987	PARIS FRANCE

PUBLICATIONS

— Vocabulaire de métrologie légale
Vocabulary of legal metrology

— Vocabulaire international des termes fondamentaux et généraux de métrologie
International vocabulary of basic and general terms in metrology

RECOMMANDATIONS INTERNATIONALES

INTERNATIONAL RECOMMENDATIONS

RI N°

1 — Poids cylindriques de 1 g à 10 kg (de la classe de précision moyenne)
Cylindrical weights from 1 g to 10 kg (medium accuracy class)

2 — Poids parallélépipédiques de 5 à 50 kg (de la classe de précision moyenne)
Rectangular bar weights from 5 to 50 kg (medium accuracy class)

3 — Réglementation métrologique des instruments de pesage à fonctionnement non automatique
Metrological regulations for non automatic weighing instruments

4 — Fioles jaugées (à un trait) en verre
Volumetric flasks (one mark) in glass

5 — Compteurs de liquides autres que l'eau à chambres mesureuses
Meters for liquids other than water with measuring chambers

6 — Prescriptions générales pour les compteurs de volume de gaz
General specifications for volumetric gas meters

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

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

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

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

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

14 — Saccharimètres polarimétriques
Polarimetric saccharimeters

15 — Instruments de mesure de la masse à l'hectolitre des céréales
Instruments for measuring the hectolitre mass of cereals

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

17 — Manomètres, vacuomètres, manovacuomètres indicateurs
Indicating pressure gauges, vacuum gauges and pressure-vacuum gauges

18 — Pyromètres optiques à filament disparaissant
Optical pyrometers of the disappearing filament type

19 — Manomètres, vacuomètres, manovacuomètres enregistreurs
Recording pressure gauges, vacuum gauges, and pressure-vacuum gauges

20 — Poids des classes de précision E_1 E_2 F_1 F_2 M_1 de 50 kg à 1 mg
Weights of accuracy classes E_1 E_2 F_1 F_2 M_1 from 50 kg to 1 mg

21 — Taximètres
Taximeters

22 — Tables alcoométriques internationales
International alcoholometric tables

23 — Manomètres pour pneumatiques de véhicules automobiles
Tyre pressure gauges for motor vehicles

24 — Mètre étalon rigide pour agents de vérification
Standard one metre bar for verification officers

25 — Poids étalons pour agents de vérification
Standard weights for verification officers

26 — Seringues médicales
Medical syringes

27 — Compteurs de volume de liquides (autres que l'eau). Dispositifs complémentaires
Volume meters for liquids (other than water). Ancillary equipment

28 — Réglementation technique des instruments de pesage à fonctionnement non-automatique
Technical regulations for non-automatic weighing machines

29 — Mesures de capacité de service
Capacity serving measures

30 — Mesures de longueur à bouts plans (calibres à bouts plans ou cales-étalons)
End standards of length (gauge blocks)

31 — Compteurs de volume de gaz à parois déformables
Diaphragm gas meters

32 — Compteurs de volume de gaz à pistons rotatifs et compteurs de volume de gaz à turbine
Rotary piston gas meters and turbine gas meters

33 — Valeur conventionnelle du résultat des pesées dans l'air
Conventional value of the result of weighing in air

34 — Classes de précision des instruments de mesurage
Accuracy classes of measuring instruments

35 — Mesures matérialisées de longueur pour usages généraux
Material measures of length for general use

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

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

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

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

40 — Pipettes graduées étalons pour agents de vérification
Standard graduated pipettes for verification officers

41 — Burettes étalons pour agents de vérification
Standard burettes for verification officers

42 — Poinçons de métal pour agents de vérification
Metal stamps for verification officers

43 — Fioles étalons graduées en verre pour agents de vérification
Standard graduated glass flasks for verification officers

44 — Alcoomètres et aréomètres pour alcool et thermomètres utilisés en alcoométrie
Alcoholometers and alcohol hydrometers and thermometers for use in alcoholometry

45 — Tonneaux et futailles
Casks and barrels

46 — Compteurs d'énergie électrique active à branchement direct (de la classe 2)
Active electrical energy meters for direct connection (class 2)

47 — Poids étalons pour le contrôle des instruments de pesage de portée élevée
Standard weights for testing of high capacity weighing machines

48 — Lampes à ruban de tungstène pour l'étalonnage des pyromètres optiques
Tungsten ribbon lamps for calibration of optical pyrometers

49 — Compteurs d'eau (destinés au mesurage de l'eau froide)
Water meters (intended for the metering of cold water)

50 — Instruments de pesage totalisateurs continus à fonctionnement automatique
Continuous totalising automatic weighing machines

51 — Trieuses pondérales de contrôle et trieuses pondérales de classement
Checkweighing and weight grading machines

52 — Poids hexagonaux. Classe de précision ordinaire de 100 g à 50 kg
Hexagonal weights. Ordinary accuracy class, from 100 g to 50 kg

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

54 — Echelle de pH des solutions aqueuses
pH scale for aqueous solutions

55 — Compteurs de vitesse, compteurs mécaniques de distances et chronotachygraphes des véhicules automobiles - Réglementation métrologique
Speedometers, mechanical odometers and chronotachographs for motor vehicles. Metrological regulations

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

57 — Ensembles de mesurage de liquides autres que l'eau équipés de compteurs de volumes. Dispositions générales
Measuring assemblies for liquids other than water fitted with volume meters. General provisions.

58 — Sonomètres
Sound level meters

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

60 — Réglementation métrologique des cellules de pesée
Metrological regulations for load cells

61 — Doseuses pondérales à fonctionnement automatique
Automatic gravimetric filling machines

62 — Caractéristiques de performance des extensomètres métalliques à résistance
Performance characteristics of metallic resistance strain gages

63 — Tables de mesure du pétrole
Petroleum measurement tables

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

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

66 — Instruments mesureurs de longueurs
Length measuring instruments

67 — Ensembles de mesurage de liquides autres que l'eau équipés de compteurs de volumes. Contrôles métrologiques
Measuring assemblies for liquids other than water fitted with volume meters. Metrological controls

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

69 — Viscosimètres à capillaire, en verre, pour la mesure de la viscosité cinématique
Glass capillary viscometers for the measurement of kinematic viscosity.

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

71 — Réservoirs de stockage fixes. Prescriptions générales
Fixed storage tanks. General requirements

72 — Compteurs d'eau destinés au mesurage de l'eau chaude
Hot water meters

73 — 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
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

74 — Instruments de pesage électroniques (*)
Electronic weighing instruments (*)

75 — Compteurs d'énergie thermique (*)
Heat meters (*)

DOCUMENTS INTERNATIONAUX

INTERNATIONAL DOCUMENTS

DI N°

1 — Loi de métrologie
Law on metrology

2 — Unités de mesure légales
Legal units of measurement

3 — Qualification légale des instruments de mesurage
Legal qualification of measuring instruments

4 — Conditions d'installation et de stockage des compteurs d'eau froide
Installation and storage conditions for cold water meters

5 — Principes pour l'établissement des schémas de hiérarchie des instruments de mesure
Principles for the establishment of hierarchy schemes for measuring instruments

6 — Documentation pour les étalons et les dispositifs d'étalonnage
Documentation for measurement standards and calibration devices

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

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

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(*) Projet à sanctionner par la Huitième Conférence Internationale de Métrologie Légale - octobre 1988
Draft to be sanctioned by the Eighth International Conference of Legal Metrology - October 1988.

9 — Principes de la surveillance métrologique
Principles of metrological supervision

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

11 — Exigences générales pour les instruments de mesure électroniques
General requirements for electronic measuring instruments

12 — Domaines d'utilisation des instruments de mesure assujettis à la vérification
Fields of use of measuring instruments subject to verification

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

14 — Qualification du personnel en métrologie légale
Qualification of legal metrology personnel

15 — Principes du choix des caractéristiques pour l'examen des instruments de mesure usuels
Principles of selection of characteristics for the examination of measuring instruments

16 — Principes d'assurance du contrôle métrologique
Principles of assurance of metrological control

Note — Ces publications peuvent être acquises au / *These publications may be purchased from* Bureau International de Métrologie Légale, 11, rue Turgot, 75009 PARIS.

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