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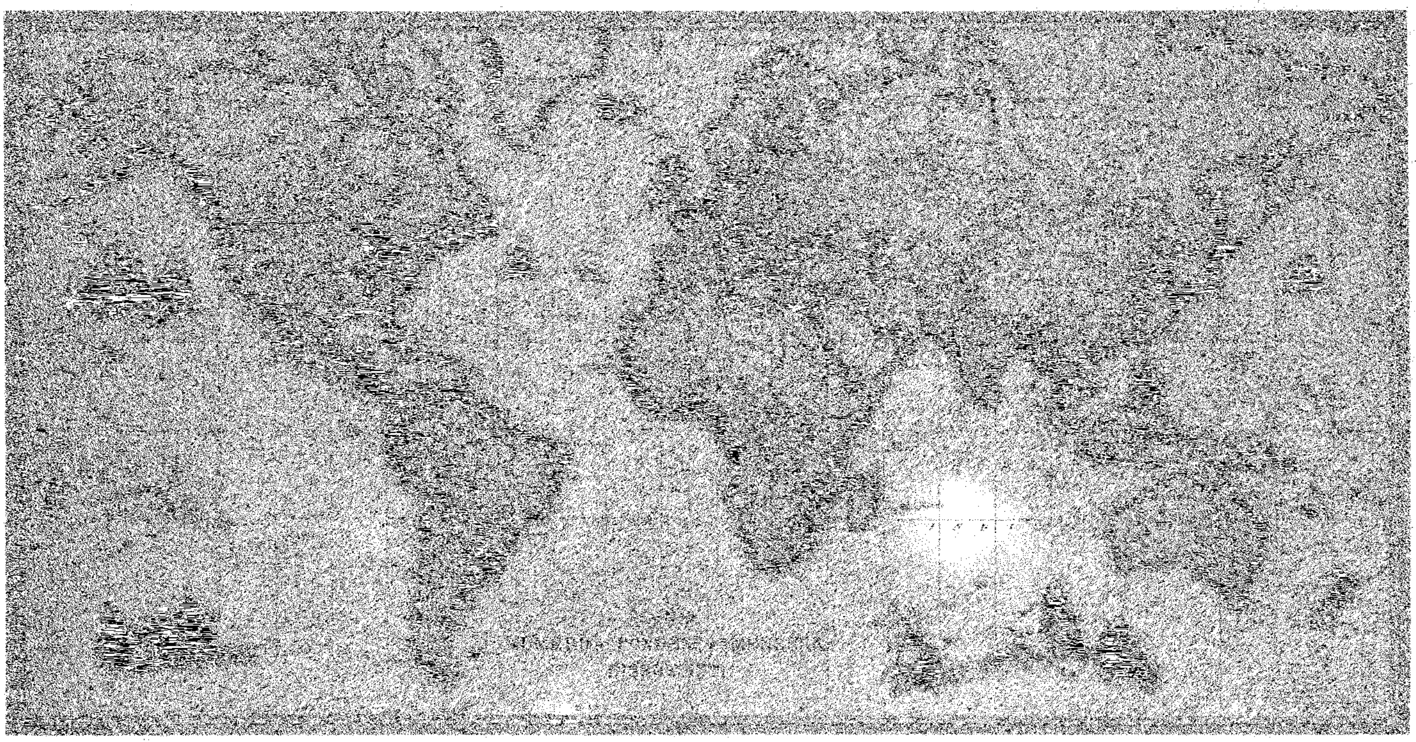

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SOMMAIRE

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CENTENAIRE DE LA LOI SUR LES POIDS ET MESURES DU JAPON

Le Japon a commémoré, le jeudi 28 novembre 1991, le centenaire de sa loi sur les poids et mesures.

Plusieurs centaines de personnes se sont à cet effet rassemblées à Tokyo, la communauté métrologique internationale étant représentée par MM. Kind, Président de la Physikalisch-Technische Bundesanstalt et du Comité International des Poids et Mesures (CIPM), Birkeland, Directeur Général du Service de Métrologie de Norvège et Président du Comité International de Métrologie Légale (CIML), et Athané, Directeur du Bureau International de Métrologie Légale.

La cérémonie s'est déroulée en présence de Sa Majesté l'Empereur du Japon et de l'Impératrice.

Tour à tour le Premier Ministre, les Présidents des deux Chambres du Parlement, le Président de la Cour de Justice et le Ministre de l'Industrie et du Commerce Extérieur (MITI) ont pris la parole pour évoquer le passé de la législation japonaise en matière de métrologie légale et la révision dont elle fait actuellement l'objet.

Une cinquantaine de personnalités japonaises ayant joué un rôle particulièrement éminent dans les développements de la métrologie légale se sont vues décerner des diplômes de reconnaissance; parmi les récipiendaires de diplômes de la plus haute catégorie, nous sommes heureux de mentionner tout spécialement le Dr K. Onada, PDG de KIMMON et Président de l'Association Japonaise des Poids et Mesures, qui participe depuis longtemps aux travaux de l'OIML sur les compteurs de gaz et d'eau et qui a ainsi établi des liens anciens et amicaux avec notre Organisation.

A l'issue de cette cérémonie, l'Empereur Aki Ito a pris la parole et a en particulier manifesté sa satisfaction pour la visite qu'il avait récemment effectuée au National Research Laboratory of Metrology dont le Directeur Général, Dr Hattori, est Membre du Comité International de Métrologie Légale.

La veille, une session de conférences avait réuni de très nombreux scientifiques japonais et les orateurs ont successivement parlé des divers développements de la métrologie scientifique, industrielle et légale au Japon.

MM. Kind et Birkeland ont également pris la parole pour exposer leurs vues sur l'avenir de la coopération métrologique internationale, le premier dans les domaines scientifiques, le second en ce qui concerne la métrologie légale.

Nous sommes heureux de reproduire dans ce Bulletin, et dans leur intégralité, ces deux conférences.

CENTENARY OF THE LAW ON WEIGHTS AND MEASURES IN JAPAN

The centenary of the Japanese law on weights and measures was celebrated on Thursday 28 November 1991.

The celebration took place in Tokyo in the presence of several hundred people. The international metrological community was represented by Mr Dieter Kind, President of the Physikalisch-Technische Bundesanstalt and President of the International Committee of Weights and Measures (CIPM), Mr Knut Birkeland, Director General of the Norvegian Metrology Service and President of the International Committee of Legal Metrology (CIML) and by Bernard Athané, Director of the International Bureau of Legal Metrology.

The ceremony took place in the presence of His Majesty the Emperor of Japan and the Empress.

Speeches were successively delivered by the Prime Minister, the Presidents of the two Chambers of the Parliament, the President of the Court of Justice and by the Minister of International Trade and Industry (MITI) who recalled the past of the Japanese legislation in metrology which is presently being revised.

About fifty Japanese distinguished persons which have played an eminent role in the development of legal metrology received awards of honour. Among those who received awards of highest distinction we are pleased to mention in particular Dr K. Onada, President Director General of KIMMON and President of the Japanese Association of Weights and Measures, who participates since long in the activities of OIML in the fields of gas meters and water meters and who has thus established old and friendly ties with our Organisation.

At the end of the ceremony the Emperor Aki Ito took the floor and expressed his satisfaction of the visit he had recently paid to the National Research Laboratory of Metrology the Director General of which, Dr Hattori, is Member of the International Committee of Legal Metrology.

The day before the ceremony a session of conferences had been held in the presence of a great number of Japanese scientists whereby the speekers had reviewed the various developments of scientific, industrial and legal metrology.

Mr Kind and Mr Birkeland then presented their views on the future of international cooperation in scientific metrology and in legal metrology respectively.

We are pleased to reproduce hereafter in full these two speeches.

TRENDS IN MODERN METROLOGY*

by **Dieter KIND**
President of PTB,
President of CIPM

SUMMARY – The establishment of world-wide trade in industrial goods and the development of international technology and science made evident the need for common units of measurements. Efforts to meet this demand finally resulted in the diplomatic treaty of the Metre Convention in 1875. Since then, metrology has developed in close international cooperation in which national metrology laboratories have acted as pacemakers. The increase in the complexity of modern technology is matched by continual demands for more accuracy, wider range and greater diversity in measurement standards. The discovery of new and well-understood physical phenomena has led to new methods and devices in metrology. This has enabled lines of traceability to international measurement standards to be established for some units, other than the traditional, hierarchical chain extending from national metrology institutes to the user.

1. Development towards the Metre Convention

Metrology is an essential constituent of science, since one can hardly think of any meaningful experiment without reference to reproducible measurement standards for the physical quantities involved. Galilei, to give an example, would certainly not have discovered the law of free fall without suitable standards for length and time. The standard for length was easy, he could take any suitable unit. As the standard of time he used the water clock, known from antiquity, in which the amount of water flowing through a hole in a container is proportional to the time it takes. He discovered that the height of fall is proportional to the square of the time of fall.

Indeed, many great physicists contributed to the development of metrology: Michael Faraday, Carl Friedrich Gauß, William Thomson (later Lord Kelvin), James Clerk Maxwell, to mention only some of the earlier scientists.

(*) Lecture at the centenary of legal metrology in Japan in November 1991.

In the early days, measurement units were set arbitrarily, quite often derived from individual measures designated by the potentate. The establishment of the Metric System in the 19th century goes back to an initiative of Talleyrand, aimed at the uniformity of weights and measures in France. Its founders, however, immediately set themselves a nobler aim: to base the measures of the new system on a "universal natural unit", which could be adopted by all countries without obstacles of national pride.

The final choice was a decimal system whose unit of length, the metre, was to be the ten millionth part of a quarter of the terrestrial meridian, and the unit of mass that of a cubic decimetre of water. This new system was legalized in France in 1795 and culminated in 1875 in the signing of the Convention du Mètre by 18 countries, and in the foundation of the International Bureau of Weights and Measures (BIPM). Today the Metre Convention comprises 47 member states.

The original task of the BIPM was "to establish new metric standards, conserve the international prototypes and carry out the comparisons necessary to assure the uniformity of measures throughout the world". The work was planned to start with the "preparation and determination of the values of the new metric prototypes of platinum iridium destined to become the national and international prototypes" for the metre and the kilogram. It was expected that after these first basic determinations the BIPM's activities would be reduced to periodic verifications of the national standards.

This modest expectation proved to be incorrect, as was the supposition that it would suffice to restrict the BIPM to "poids et mesures" (weights and measures) according to its name. The work of the BIPM was extended to other fields following the development of metrology, which to a large extent was carried by the national metrology institutes of the industrialized countries and in cooperation among them.

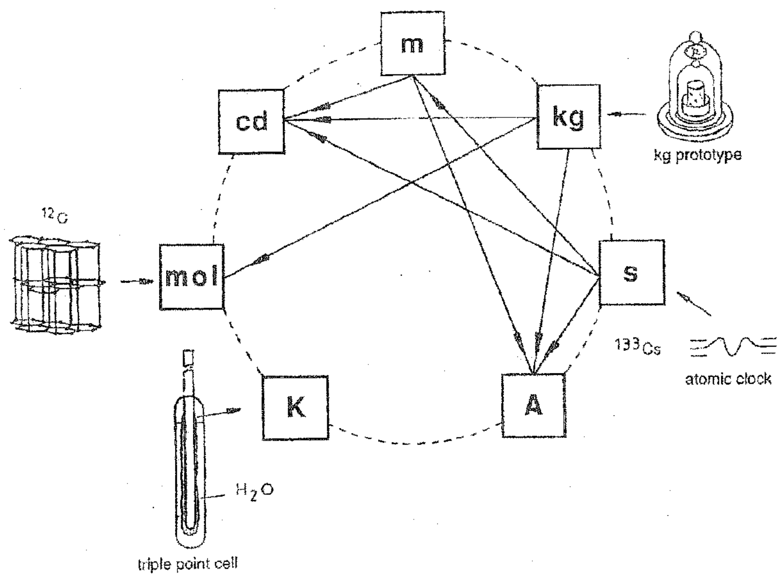


Fig. 1 – SI base units and their metrological interrelations

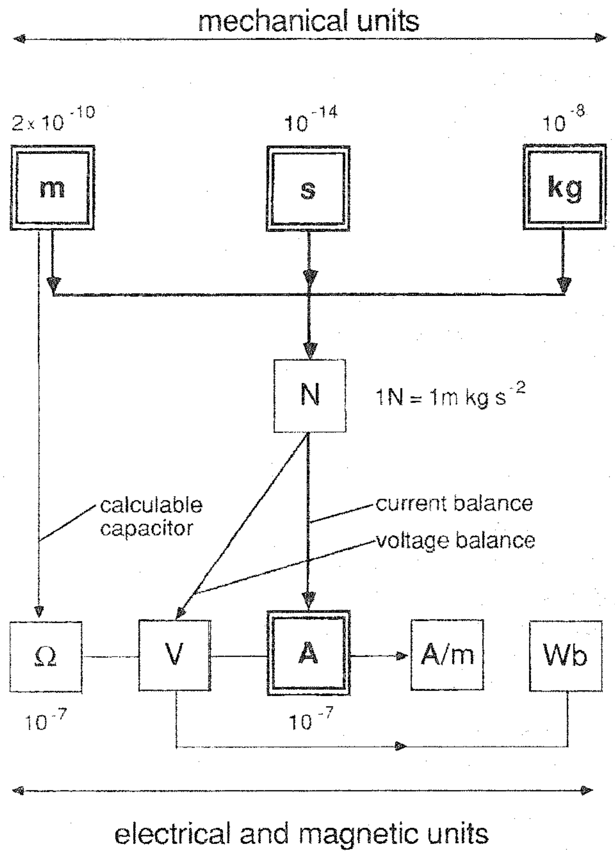


Fig. 2 – Electrical and magnetic units within the SI and the relative uncertainty of their dissemination.

2. Metrology and the development of trade and industry

It is quite surprising to see how the development of metrology during the 19th century was advanced by intensive international cooperation, despite the poor means of communication in those days without telephones, telefax and modern flight connections. Taking part in international conferences like the one on "Electrical Units and Standards" in Chicago in 1893 meant staying abroad for weeks or months on end and it is with some surprise and admiration that one learns to what advanced age such world-famous scientists as Hermann von Helmholtz and William Thomson continued to bear up to such physical strain.

It wasn't only science that showed the need for an international agreement on measurement standards; growing international trade with industrial products presented strong arguments in favour of such measures. Werner von Siemens, one of the forward-looking industrialists, demanded action from the German government in 1887: "Thus it is the responsibility of the government to provide for the setting up of an institution for electrical metrology and calibration. That this has not yet been achieved must be seen as a great default. At present there are contracts valued in millions based on electrical measures which have not yet been legally determined. There has arisen the danger that this lack of legislation regarding electrical measures will lead to great uncertainty and many law suits".

What he wrote in connection with electrical units was certainly true for other units of physical quantities of importance in trade and industrial production which, to a large extent, are today the domain of legal metrology. Nevertheless, it was not until after the Second World War that the Organisation Internationale de Métrologie Légale (OIML) was founded as an international organization to supplement the Metre Convention in the important field of legal metrology.

3. Metrology-related discoveries and developments

The 18th and the 19th centuries were periods of tremendous scientific progress in which physics became the most advanced experimental science. According to J.C. Maxwell, every physical quantity can be expressed as the product of a pure number and a unit, and the latter may be experimentally realized by a measurement standard of the same kind of quantity.

The discovery of basic laws in mechanics, thermodynamics, electricity etc. and of the interrelations between these led C.F. Gauß in 1832 to the realization that all physical quantities could be expressed by units of one single system. Later Maxwell wrote: "The phenomena by which electricity is known to us are of a mechanical kind, and therefore they must be measured by mechanical units or standards". Indeed, the CGS system, based on the three units, the centimetre, the gramme and the second, is such a system.

Science had to go a long way before agreement was finally reached on a system which satisfied the basic scientific concept and can still be understood as a further development of the Metric System. Stimulated by a proposal of Giovanni Giorgi in 1901, the International System of Units (SI) was adopted by the General Conference of the Metre Convention in 1960.

For pragmatic reasons, taking into account historical practice in various fields of physics, the SI has 7 base units to which all other physical units can be referred. All derived SI units can be expressed by a product of base units with integer exponents where no numerical factor other than 1 occurs. A system of this kind is called a coherent system. We may consider the establishment of such a system as *the* fundamental achievement in modern metrology.

A schematic diagram of the seven SI base units and their present definitions is given in fig. 1. It can be seen from the arrows that only the kg, s and K are independent of the other base units. The unit of thermodynamic temperature K stands by itself; however the m, A, mol, and cd are dependent on their relations to the kg and s. It is therefore extremely important to have means for precisely realizing these two base units. Any uncertainty therein is immediately transferred to other base units and from there to all derived units.

The precise realization of an SI unit with the highest achievable accuracy is not simply a measurement but a very sophisticated experiment. It usually takes many years of team-work to produce any results of significance. This is why even large national metrology laboratories achieve such realizations only once in a decade or so.

As an example, fig. 2 shows the position of the electrodynamic units within the SI system and the relative uncertainty of their dissemination. As can be seen from the indicated numbers, electric and magnetic units are only "weakly coupled" with the mechanical ones, which can be realized with great accuracy. The link according to the definition is a current balance experiment, while a voltage balance experiment appears as an interesting alternative. Another possibility of connecting electrical and mechanical units is the development of a calculable capacitance or inductance. The calculable cross capacitor according to Thompson and Lampard allows the ohm to be realized with a relative uncertainty of 10^{-7} or even better. As a result of recent international efforts the relative uncertainty of realization of the ampere was reduced to about 10^{-7}.

The exact relationship that exists between base units and derived units means that all physical units belong to a consistent network in which the so-called fundamental constants play the role of fixed supports, connected by well established laws of nature. It is therefore possible to make use of experimental effects, theoretically well understood or at least highly reproducible, in order to improve the consistency of the whole network of base and derived units.

Again, it was Maxwell who in 1870 gave the right advice as to what kind of properties we should look for in standards: "If we wish to obtain standards of length, time and mass which will be absolutely permanent, we must seek them not in the dimension or the motion or the mass of our planet but in the wavelength, the period of vibration and the absolute mass of these imperishable and unalterable and perfectly similar molecules."

It was about 100 years before science succeeded in fully meeting Maxwell's demand. The second is realized by atomic clocks, using a certain transition of the 133Cs atom. The metre is derived from the second via frequency measurements in the visible using stabilized lasers. Among the base units it is only the kilogram which so far has resisted all attempts to replace the present definition based on the artefact maintained at the BIPM by an experiment based on atomic properties. Substantial efforts are being made in the leading metrological laboratories all over the world to end this situation, though we are still far from any immediate prospect of success.

Two sensational discoveries, both since rewarded with the Nobel Prize, gave international metrology an enormous impetus:

- The Josephson effect of two weakly-coupled superconductors discovered by Brian Josephson in 1962.
- The Quantum Hall effect of two-dimensional electron gas discovered by Klaus von Klitzing in 1980.

The Josephson effect and the Quantum Hall effect are called "macroscopic quantum effects" since both are essentially based on quantum phenomena that are measurable in a macroscopic device. According to international agreement these two effects are used respectively for the reproduction of the volt and the ohm.

Since January 1, 1990, all laboratories use the same values of the relevant constants, thus reducing the uncertainty of realization within the SI world-wide to a few parts in 10^7. The reproducibility is even two orders of magnitude better. This can be achieved without circulating transfer standards.

4. Outlook into the future of international metrology

Some investigations under way are potentially significant for metrology in the future:

- The present intercomparison of national kg prototypes at the BIPM, the third since 1889, done with a much higher sensitivity than in the past, may reveal new insights into the cause of instability below 10^{-8}.

- The new determination of the Avogadro constant, based on the accurate measurement of the lattice parameter of a silicon crystal of known density and isotope abundance, may lead to a new definition of the kg. New methods of accurate measurements relating the kg to macroscopic quantum effects may have the same consequence.
- Another macroscopic quantum effect, single electron tunneling, is under investigation. It would allow the development of a quantum standard for electric current.

Apart from above projects which can be described clearly, a new discipline is infiltrating metrological practice and theory: information technology. It began with complicated experiments being controlled by computers with the aim of saving time by replacing man with automatic equipment. It soon became evident that highly accurate measurements must be fully automated because the presence of an experimenter disturbs the measurement. Laboratories now develop and apply special software for strategies in measurement data processing and even in their interpretation. Modern techniques using personal computers and work-stations allow effective storing and handling of data on line, providing new solutions, including collaboration between remote partners.

No one can reliably predict the result of research, we shall never be sure that we will not be confronted with unexpected discoveries that are of relevance for metrology. These may even revolutionize the International System of Units, but without consequences for the use of measurement standards in practice. New definitions will be made in such a way that the changes are kept to a minimum, as has happened in the past.

I now turn to the provocative question of how many national metrology laboratories are needed to safeguard the future development of international metrology.

Before trying to answer this question, it should be remembered that in every country, the national metrology laboratory must comply with the demands of the national users. A laboratory tailored to the demands of an industrialized country would therefore be very different to a laboratory tailored to those of a developing country. For the purpose of distinction I refer to the definition of measurement standards in the International Vocabulary of Terms in Metrology:

- A primary measurement standard has the highest metrological qualities in a specified field.
- The value of a secondary measurement standard is fixed by comparison with a primary standard.

Using these definitions I propose to use the term

"primary metrology laboratory"

for a laboratory which maintains a certain number of primary measurement standards. Although it may be true that only large laboratories can afford the outlay required to realize primary standards, it is more appropriate to use this term. Thus it is logical to speak of a

"secondary metrology laboratory"

when the dissemination of units is mainly based on secondary measurement standards. The establishment of lines of traceability, and recent important changes in the practice of metrology make such a distinction between primary and secondary metrology laboratories desirable.

The number of primary laboratories necessary follows from the fact that work on primary measurement standards needs to have sufficient competitors in order to allow a comparison of independent results. This means that all leading industrial countries should operate highly-efficient primary laboratories. Their work must be performed in close cooperation with the BIPM, which will remain the centre to which basic precision measurements must be traceable. The BIPM and the experts of the primary metrology laboratories, working together in the Consulting Committees of the International Committee for Weights and Measures (CIPM), must act as a neutral platform for intercomparison and for the exchange of knowledge.

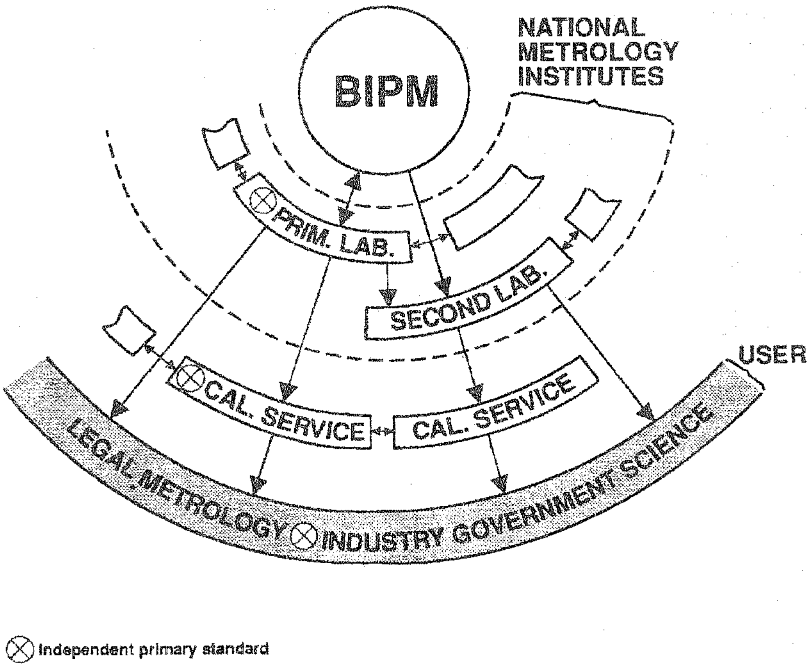


Fig. 3 – Lines of traceability within the international metrology system.

Apart from such work at the highest metrological level, national metrology institutes must also render high quality services to national trade and industry, government bodies, research establishments, etc. These must all have easy access to secondary measurement standards, maintained at the national laboratory, providing traceability according to their need. From this it follows that all countries wishing to provide a national metrology service must operate a secondary metrology laboratory at least.

An alternative to the traditional hierarchical chain extending from the user at the shop floor to the national metrology institute stems from recent developments, allowing the independent reproduction of certain units with the highest metrological quality:

- The standard of length by means of recommended laser radiation.
- The standard of voltage by means of the Josephson effect.
- The standard of electrical resistance by means of the Quantum Hall effect.

These should be considered as independent primary measurements standards.

Any laboratory, national or industrial, which operates such a standard can, in principe, be considered to be independent of the line of traceability to a primary laboratory or even BIPM for a given unit. Periodical intercomparisons are, however, indispensable.

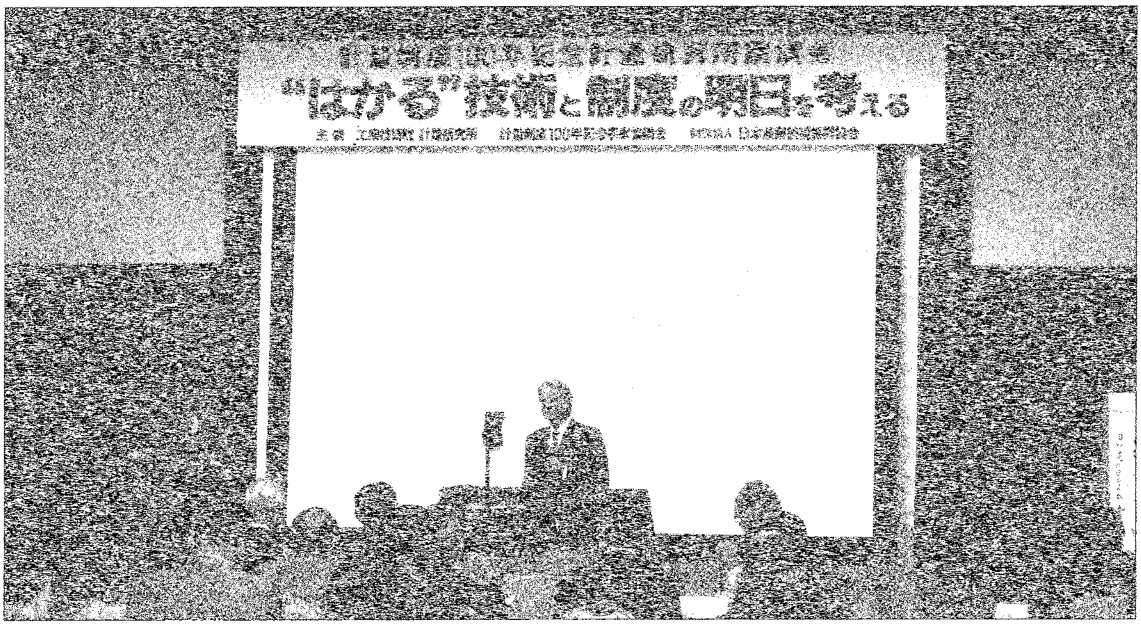
Fig. 3 is an attempt to illustrate the envisaged system of international metrology with lines of traceability between the users and primary or secondary metrology laboratories. Independent primary measurement standards are especially marked. National Calibration Services could handle most of the calibrations needed by the users. Laboratories of legal metrology normally prove the traceability of their measurements via primary and secondary metrology laboratories.

I would guess that the lines of traceability for the international system of metrology are today established by about 10 primary laboratories in cooperation with about 50 secondary laboratories. However, it must be considered that the terms "primary" and "secondary" were originally related to the standards of certain physical quantities, and that a national metrology institute would generally operate primary standards for some units, and secondary standards for others.

Such load-sharing in metrology between countries all over the world should in the future also make it possible to fulfill both demands:

reasonable costs for every country, and

good service for every user.



LEGAL METROLOGY FACING THE FUTURE*

by **K. BIRKELAND**
Director General of the Norvegian Metrology Service,
President of CIML

SUMMARY – This paper discusses the main trends of legal metrology as seen from an international point of view.

The double requirement of international uniformity and relevant accuracy makes legal metrology susceptible to influence both from scientific and technical as well as political and economical factors. Some of the main influencing factors of major importance for legal metrology facing the future will be discussed.

Legal metrology may be defined as metrology concerned with measuring instruments and measurements subject to governmental or official regulatory control. This leaves the field wide open for national differences both with regard to metrological requirements and to what instruments and measurements should be subject to regulatory requirements. These problems can be approached and solved only by efficient international cooperation.

The international harmonization of metrological requirements is the objective of the intergovernmental treaty of OIML, of which Japan is an important member.

(*) Lecture at the centenary of the law on weights and measures in Japan.

The present trend towards focusing on metrological requirements is supported by reproducible verification methods, leaving much of the technical standardization of instruments as such to the past. There is also an important regional development of the implementation of these reproducible verification methods, to eliminate duplication of work. This concerns the test methods applied for type approval in particular.

The balance between the three elements of the metrology infrastructure, i.e. scientific, regulatory and non regulatory metrology is changing, and the paper looks at the consequences for legal metrology. The political and economical development lately has had an important influence on the division of work between regulatory and non regulatory metrology. Many countries have seen changes of the areas of application of legal metrology, and increased systematization in the non regulatory field through laboratory accreditation.

The future will leave no room for the isolation of legal metrology, neither on the national nor on the regional level. The present, comprehensive international cooperation will be further developed, strengthend and extended accordingly.

Introduction

The title of this paper implies a rather ambitions, perhaps even presumptuous attempt to look into the future of legal metrology. I believe Winston Churchill once said it this way:

It is wise to look ahead, but foolish to look further than you can see.

The question of course is, how far ahead *can* you see. It is well known that some consider themselves more farsighted than others. However justified that may be, I shall keep a low profile and only make some reasonable suggestions about the most likely ways in which legal metrology will develop in the next few years.

In all worthwhile human activity such as legal metrology there must be evolution as well as continuity. It may therefore be a reasonable guess that looking back to review briefly and to analyze recent developments in legal metrology will give us some suggestions for an extrapolation into the future. So that's what I'll do, look back and extrapolate. Looking back briefly seems all the more appropriate, since we are here together to celebrate the centenary of legal metrology in Japan.

What is legal metrology?

If we want to talk about the past and the future of legal metrology, we must first establish some ideas about what legal metrology is. Then the example of legal metrology in Japan becomes very significant, I believe. I know well of course, that even if we are now commemorating a centenary, legal metrology is very much older in Japan. The first known law of metrology goes back about 1 300 hundred years, to the year 701. Now, this is actually 500 years before the gallon was legalized by Magna Charta in England. But thousands of years before that again, the organized societies of the Sumerians in the Middle East had their laws of metrology.

With such very old traditions in human history, in every organized society in fact, what is it then that has made legal metrology so important? Well, all these laws focuses on one main aspect, they were all established to regulate measurements where there was conflicting interest.

In the measurement of land, quantity of food etc., buyer and seller might have conflicting interests. So the law established the neutral ground by deciding on the units, the measurement standards, the metrological requirements of accuracy *and* that the state should be responsible for the implementation and maintenance of the system. For thousands of years this has been the case, legal metrology has been the metrology in the area of conflicting interests, or if you prefer, in the area where special confidence in the measurement result was required. And it has been a responsibility to be maintained and implemented by the state.

This still is and will remain a key, but certainly not the complete answer to the question, what is legal metrology? As a consequence of scientific, technical and economical developments, the areas of conflicting interests or requirement of special confidence has widened very much, and complicated the matter.

Modern examples of new measurement fields of conflicting interest may be the measurement of industrial pollution, and of that of confidence requirement the measurement of alcohol or drug content in the blood of car drivers. These concepts of legal metrology as the area of metrology, where you find conflicting interests and official responsibility for establishing neutral ground and confidence in measurement, lead us to the more complete concept of legal metrology as *the metrology concerned with measuring instruments and measurements subject to governmental or official regulatory control.*

To maintain confidence, the neutrality of decisions, it was the governmental or official domain not only to issue the regulations, but also to exercise or implement them. However, in our technically complicated world the regulatory field of establishing confidence in measurement has increased considerably, far beyond the resources of governments. So, what do we do? We share the task by delegation. Delegation with responsibility and supervision.

We call it *accreditation.*

Some may think that accreditation is only for the non regulatory field. How wrong!

Accreditation

Accreditation itself is highly regulated and internationally harmonized; it must be, to satisfy the basic need for confidence. And it is officially controlled and supervised both on the national and the international level, again to satisfy the need for confidence.

Of course accredited laboratories, accredited bodies for inspection and product certification do a lot of work in the non regulatory area, but as the regulatory area grows, accredited bodies are likely to be invited to compete or work hand in hand with legal metrology in the new domains of the regulatory area.

Why this seeming paradox, increasing liberalization, delegation, and at the same time increasing regulations? Well, it is all traceable to the two keywords, the need for confidence in measurement and the need for international harmonization. Thus, if legal metrology is metrology concerned with measuring instruments and measurements subject to governmental or official regulatory control, then modern legal metrology stretches far beyond the traditional concept, the area of conflicting interests.

And it includes all those accredited bodies and others working in the area of confirmation or verification of accordance with official regulations, be it instruments, measurements or measurement results or any other area of metrology. You notice that I am suddenly talking about *who* is doing the job of legal metrology.

Legal metrology is not a kind of people, it is an area of responsibility in metrology. For instance, the moment the government decides that a voluntary standard on, say, the measurement of pollution, should be mandatory, it becomes legal metrology. Regardless of who is doing the job. Legal metrology faces a future where the regulatory area is expanding. The limits are set only by the criterion that it is the concern of the regulatory area. We can clearly see a dynamic and very challenging development in the delegation of responsibilities where official accreditation will be a key word. Accredited bodies will certainly, in one way or another, assume responsibilities in many fields of legal metrology in the future. Particularly in the new fields. In some countries and to some degree, probably also in the more traditional fields.

What will the near future bring?

Now, that is to the best of my ability to analyze the crystal ball, some of what the near future will bring.

The responsibilities and areas of interest for legal metrology will widen as the world becomes more complicated and internationalized. Growing awareness of the need of real confidence in measurement and what efforts that requires will bring in new partners like official accreditation, to share the responsibilities in the widening area of legal metrology. We will also find a corresponding increase of the human resources available to hammer out international harmonization in this field.

You may now think it has taken me a long time just to define legal metrology. But that has also given me a chance to draw your attention to the consequential fact that the expanding area of legal metrology rapidly engages new groups of people in the work. One challenge of the future will be to attract the attention of these people, new to the responsibilities and principles of legal metrology, to the significance of developments in national and international harmonizing cooperation.

Failing that, the all important internationalization of legal metrology will suffer. And that of course brings us to the core of international harmonization in this field, to OIML, the International Organization of Legal Metrology, of which Japan is a very important member. I do not say that just because I stand here today, I have two very good reasons, which I will return to in a moment.

But OIML is not the beginning of everything

In 1875, the Metre Convention, the very first scientific-technical intergovernmental treaty, was signed. It was needed because the immense upsurge of international trade demanded international harmonization of units of trade, of measurement standards and requirements. That is of course why the Metre Convention initially was restricted to the two units of vital importance to the world trade.

By this treaty scientific metrology satisfied the most pressing needs of legal metrology, and even more important, we saw the birth of the internationalization of metrology. The metrication of Japanese legal metrology that we are celebrating here now was a proud part of that.

When OIML emerged on the scene in the middle 50's its objective was to achieve international harmonization of national metrological requirements. This was done by creating international regulations, or recommendations as they are called, linked with the moral obligation of the member countries to adopt these as national regulations as quickly as possible.

Japan is an important Member of OIML

Now, why did I say that Japan is an important member of OIML, so important that it merits particular mention at this Centenary Symposium? For one thing, it can be said with a certain element of truth that OIML was a European brainchild, a product of Europe. OIML had to get off the ground somehow, and started of with a certain European inclination. When Japan joined OIML, that inclination was very noticeable to Japan, and Japan has never hesitated making everybody aware of it. Including the Europeans! As a consequence, Japan has made OIML, the International Organization, think more internationally. That reason is good enough for Japan to be considered important to OIML.

The other reason is that Japan has pioneered industrial and other relevant participation in the working bodies of OIML, the Secretariats. Japan has inspired other member countries to do likewise: to have a broad and relevant representation in the OIML bodies. This development has been of great importance in the evolution of OIML up till now, but will be of even greater importance in the future. The successful development of OIML and the international harmonization of legal metrology will very much depend on active participation of all the new participants in the regulatory field: manufacturers, legislators, scientists, accredited bodies and their customers.

What is going to influence the future of OIML most?

Now, what are OIML's most important recent achievements and what is going to influence the future of OIML most?

If one wanted to single out one particular thing, one particular angle to view it from, it is the OIML Certificate System. If it succeeds it will bring important changes to OIML, if it does not succeed, OIML might be left behind as legal metrology moves into the future. And I'll tell you why I think so.

What is the OIML certificate system?

The OIML Certificate is a written confirmation that the type, or pattern of an instrument fully satisfies all the requirements of specified OIML International Recommendations. Briefly, the system radically simplifies the process of pattern approval of instruments in the member countries. When a manufacturer applies for the pattern approval of an instrument or a measuring system in a member country, he may also apply for an OIML Certificate. The testing authority must be able to substantiate the Certificate it has issued by documentation of their tests and test results in a test report that will have to be kept available to other member countries upon request.

So, what good is this?

Well, it opens up the possibility for any other member country to grant pattern approval if it so wishes, based on the evidence of the OIML Certificate, instead of repeating all the tests in each of all the member countries where the manufacturer wishes to market his instrument. Now, that is lifting a tremendous and totally unnecessary work burden off the shoulders of the pattern-approval authorities as well as a powerful boost to achieve confidence between them. The transparent condition of fully available test reports will not only create such confidence between pattern-approval authorities, manufacturers, users etc., but will also encourage a realistic appreciation of the reproducibility of test results.

And what a gift to the manufacturers of instruments and measurement systems! As soon as they realize that the OIML Certificate System, fully operative, will signify the possibility of being granted pattern approval in all the member countries where they wish to market their product, based on the test results of a thorough and comprehensive pattern approval test in *one* member country only, they will be pushing very hard to help us getting the OIML Certificate System off the ground.

A bit of helpful encouragement

And we might need a bit of helpful encouragement. It is clear that such a system will require that the OIML International Recommendations be completed with harmonized, reproducible test methods and standardized test reporting format. It will simply not work unless that requirement is satisfied. And it some time is still required before the majority of the most important OIML Recommendations will be completed in this way. But I am sure that the manufacturers will contribute through relevant channels, not only by making sure that the instruments satisfy the test requirements, but also by contributing their experience to the development within OIML of relevant test procedures.

Impact on the future OIML Recommendations

I am sure that you immediately realize that this is going to have a tremendous impact on the format of future OIML Recommendations. It really means that future OIML Recommendations will be concentrated around metrological performance requirements for pattern approval and verification, the relevant test methods to verify compliance with these requirements, and standardized test report formats.

In the future, I am sure, there will be no metrological performance requirement unless there is a corresponding well-proven and reproducible test method. Neither will there be any test required unless it corresponds to a well-defined metrological performance requirement. And what is even more more important, as long as the metrological requirements are met, nearly all technical requirements that previously were considered so essential will become less relevant and considered a serious restraint on the technical development. They will be phased out in the future OIML Recommendations.

Less focus on the instrument

Now, I feel sure that you have already realized that dropping or minimizing the technical requirements opens up Recommendations to be developed in areas that are less instrument focused. That brings us back to the question of how OIML will tie into the future of legal metrology. Or even create the future of legal metrology. It gives us a clue as to how OIML will maintain its leadership in the field.

OIML's main contribution to legal metrology are the Recommendations and the harmonizing consequences of the cooperative work of creating those. Up till now the Recommendations have traditionally been instrument focused. Which is understandable. When you wish officially to issue regulations concerning mass, or weight if you like, it is tempting and easy to concentrate on regulations concerning the instruments, the weighing machines.

The measurement result

But modern legal metrology regulations in less traditional areas of measurements are less instrument oriented and more concerned with the measurement result. The regulations will for instance be concerned with the measurement result of a quantification of pollution, with a number of parameters specified, regardless of instrumentation. It is certain that all measurements must be done by instruments, but it is not so certain that a satisfying instrument always gives a satisfying measurement result. In our swiftly developing technical world, certainly measurement methods, and sometimes even measurement competence are rapidly becoming of equal importance to the instrument itself.

I am personally confident that OIML not only should, but also will maintain its leadership in the international field of legal metrology. It will do so by gradually but deliberately developing from focusing on the instrument alone, to a broader consideration including the measurement result.

Building the future of legal metrology

In the challenge of building the future of legal metrology and maintaining the leadership of OIML, I believe that some member countries have a special responsibility and opportunity to contribute. Those are the member countries who already have a tradition of a wide national involvement by instrument manufacturers, users, legislators, scientists etc., in the work of OIML. I could mention quite a few, such as the US, but I am absolutely sure that Japan will play a very important and vital role in this by thinking internationally and by involving all relevant actors in the regulatory field of metrology.

Conclusion

So, in conclusion, this is what I have tried to tell you about how I see the near future of legal metrology on these last days of the first century of legal metrology in Japan.

I have tried to convince you that legal metrology is the metrology of the regulatory area and that the future will bring new actors such as officially accredited bodies, into an expanding world of legal metrology.

That OIML is determined to maintain its leadership in legal metrology by concentrating the emphasis on metrological requirements and the relevant test methods in its Recommendations. And by becoming less instrument focused and more oriented towards measurement results. All in order to be able to meet the needs of the legal metrology of tomorrow.

The legal metrology of the future above all needs international thinking and acting, and I believe this will suit Japan very well.

THE PATTERN APPROVAL AND VERIFICATION OF AREA MEASURING INSTRUMENTS IN AUSTRALIA

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SUMMARY – This paper describes the principles of operation and the methods involved in the pattern approval and verification of electronic instruments used for measuring the area of leather for trade purposes in Australia. The National Standards Commission has approved eight electronic area measuring instruments and although the procedures may be straightforward, some special considerations and methods are involved. The manufacture and verification of area templates used for testing are also described.

1. Introduction

The production of leather is an important secondary industry associated with Australia's primary beef industry. As leather is sold by area, measuring instruments are used to determine the area of the hide, to stamp the hide with the area and to total the area of hides in lots. As the instruments are in use for trade, pattern approval and verification are required.

Since 1966 all area measuring instruments approved by the National Standards Commission have used electronic components to determine area. Prior to that date, mechanical pinwheel types of instruments were approved by the State Weights and Measures authorities [6] and although this type is no longer made, a number of machines are still used in industry. This paper deals with electronic area measuring instruments.

Under the National Measurement Act 1960 [1], any measurement used for legal purposes, has to be made in terms of a legal unit specified in the National Measurement Regulations [2] and must be traceable to an Australian primary standard of measurement. The National Measurement Act (1960) empowers the Commission to carry out pattern approval of instruments used for trade in accordance with the National Measurement (Patterns of Instruments) Regulations [3].

The verification and re-verification of area measuring instruments are carried out by various Australian State verifying authorities. A uniform Trade Measurement Bill has been agreed upon by all states, with New South Wales being the first to adopt it in 1989 [4].

The relationship of the Commission and the verifying authorities with other metrology organisations, both within Australia and internationally, is described in the booklet "The National Measurement System of Australia" [5].

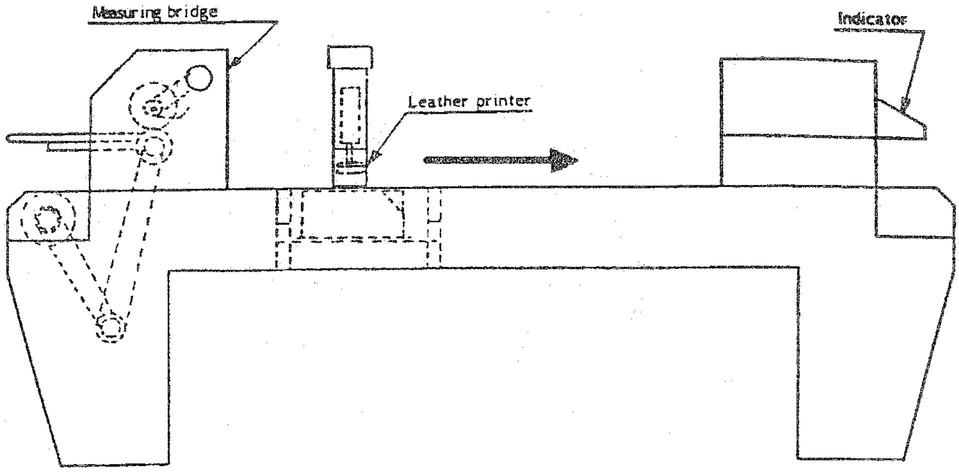


Fig. 1 – Area measuring instrument.

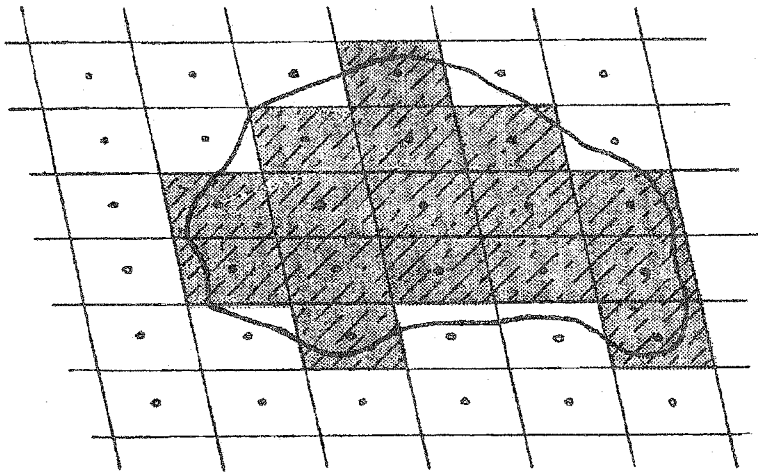


Fig. 2 – Principle of area measurement.

2. Area measuring instruments

The basic principle of measurement involves a series of light-sensitive detectors, evenly spaced across the machine in a measuring bridge. A light source is interrupted by the passage of a leather under the bridge and the affected detectors provide a pulse output. This output is counted in conjunction with another series of pulses provided by a detector which measures the longitudinal movement of the leather, as it passes under the measuring bridge (see Figure 1).

As a result the machine counts the number of squares of a basic unit of area (determined by the spacing of the detectors) and this is equivalent to the area of the leather (see Figure 2). The pulse count is then divided by an appropriate factor and corrections are applied for edge effects to arrive at the area in recognised units of measurement.

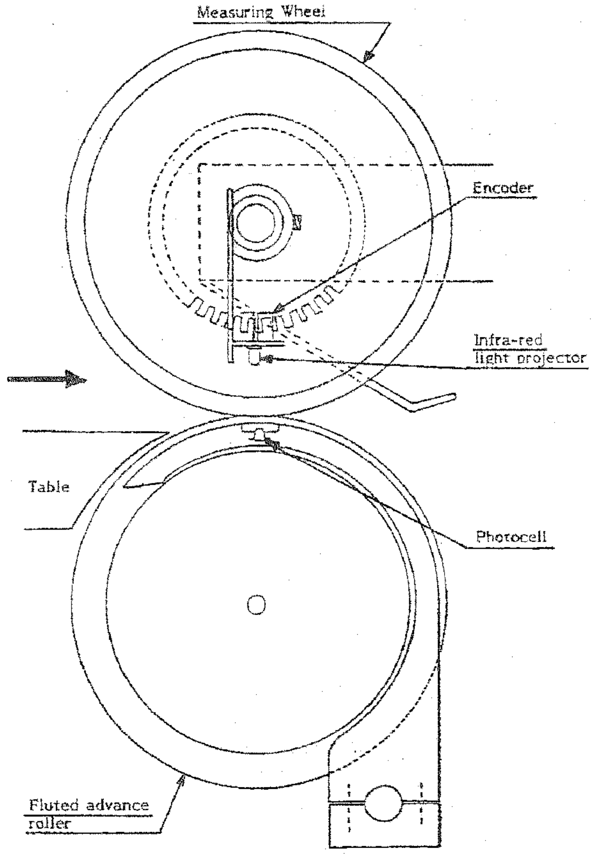


Fig. 3 – Measuring unit.

2.1 Light Source and Detectors

The measuring bridge contains a light source on one side of the leather and photo-detectors on the other side.

The light source may be a single fluorescent tube or a series of light sources such as incandescent bulbs or infra-red light emitting diodes (see Figure 3).

The detectors are photo-electric cells such as photo-transistors, photo-resistors, etc. and are spaced at even intervals along the bridge in a single line. The spacing is of the order of 2 to 2.5 cm or 1 inch.

The longitudinal movement of the leather under the bridge is also measured by a light source and detector which measures a series of "holes" in the periphery of a disc attached to the leather-transporting mechanism. These holes are spaced to give an equivalent 1 to 2.5 cm or 1 inch longitudinal measurement. Each time one of these longitudinal detectors is activated, the transverse pulses are counted. The spacings of the transverse and longitudinal detectors determine the basic unit of area. For example, if both spacings are 2.5 cm, the basic unit is 6.25 cm^2. As 16 of these units make up 1 dm^2, the pulses are divided by 16 to give the area in square decimetres.

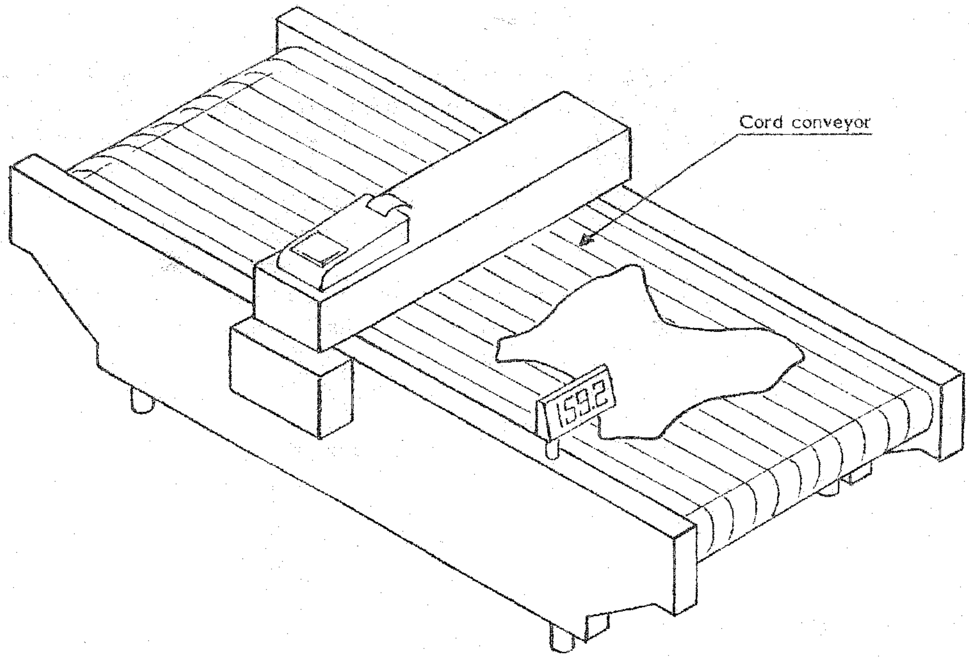


Fig. 4 – Conveyer type instrument.

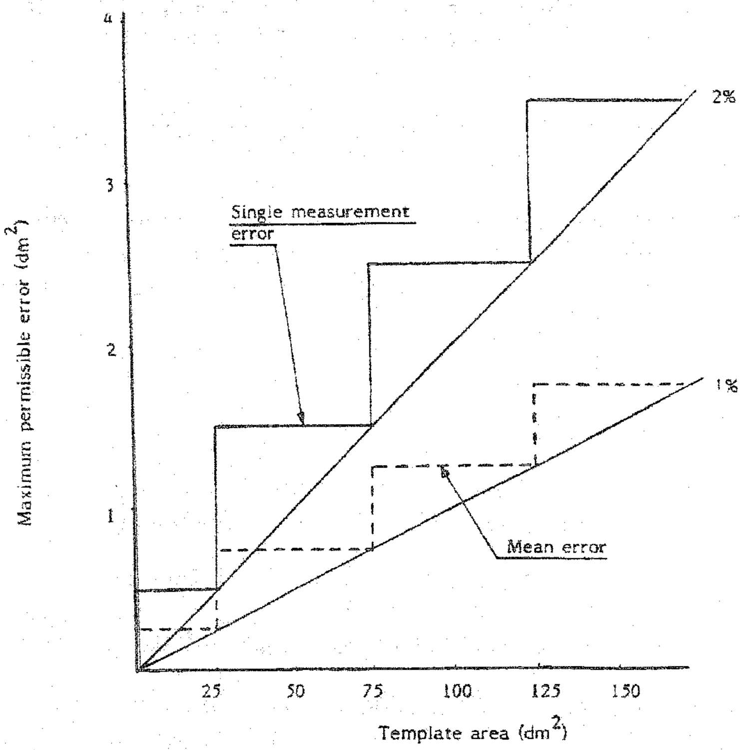


Fig. 5 – Maximum permissible errors for area measuring instruments.

2.2 Edge Effects

As most leathers have an irregular perimeter, there will be a number of partial squares around the edge which may or may not be counted as full squares, depending on whether the photo detector for that square was triggered or not (see Figure 2). The measurement of these partial squares is the main source of any errors and various methods are used to "adjust" the output. Such methods include the addition of extra pulses proportional to the number of pulses counted, the adjustment of the division factor, or a combination of both.

One system counts the difference between two rows of pulse measurements which gives an indication of the number of partial squares for that part of the periphery measured. Further adjustment is made by varying the division factor for these additional pulses and this is usually determined by testing a standard template. Other systems adjust the division factor by small increments and once again this is determined by testing.

As well as electronic adjustments, mechanical adjustment of the rotation of the longitudinal pulse measuring device may also be used.

2.3 Leather Transport Mechanism

The measurement is carried out while the leather is fed under the measuring bridge. As longitudinal measurements are as important as transverse measurements, it is important for the leather movement to be synchonised with the longitudinal measurement device.

One method uses a conveyor made up of a number of nylon cords equally spaced across the machine (see Figure 4). The leather is placed on the conveyor and carried under the bridge. This method relies on friction between the leather and the conveyor to ensure that the leather travels at the correct speed. The longitudinal measurement is made on the conveyor drive mechanism.

It is essential for the leather to be smoothed out before placing it on the conveyor to prevent wrinkles giving false measurement.

Another method uses two rollers mounted in the measuring bridge which nip the leather and feed it through (see Figure 3). The longitudinal measurement is made on one of the rollers. This method helps smooth out the leather although it still requires careful feeding by the operator.

2.4 Safeguards

As with all electronic instruments, there are a number of factors which can cause incorrect measurement due to a change in, or failure of, one or more components.

Incorrect measurements may be due to the failure of the light source or the photo-detectors, either in total or individually. In some instruments the light beam passes through slits or holes in the feed drums, if these apertures become blocked or misaligned errors may occur.

A check of all light sources and photo-detectors must therefore be carried out at least at switch-on of the machine. Checks for both light "on" and "off" must be carried out. A warning signal or disabling of the instrument must be the result of the failure or any one light source or detector.

Similarly, a check of all indicating lights and digital readouts should also be carried out. If the digital indicator consists of multi-segment displays, then an "all eight" and "all blank" check is required.

The instrument is required to perform satisfactorily under all influence factors (e.g. temperature changes) and disturbances (e.g. electrical interference) and must be designed accordingly.

Provision is usually made to rezero the instrument automatically after each measurement. The end of the leather has therefore to be determined and the method used has to ensure that this is so. Sufficient time has to be provided after the leather has been measured and before rezeroing so that the measurement can be recorded. Measurement of the next leather also has to be prevented before the previous measurement has been rezeroed.

Usually, the measurement is relayed to a memory or to a ticket printer to record each measurement, and to provide a total area of a batch of leathers. The operation of this function must be compatible with the rezeroing process and must not have any influence on the measurement. This also applies to any printer which stamps each leather with its area.

The provision of a battery back-up to maintain measurement information in the event of a power failure has to be considered.

The correct measurement of the leather depends on its progressing through the measurement bridge at the same speed as the longitudinal measurement device. If the leather can be pulled back and an incorrect measurement occurs, a means of detecting this would have to be provided.

3. Pattern approval

Area measuring instruments are examined for pattern approval by the Commission, in accordance with Manual n° 5, Design Manual for Area Measuring Instruments for Trade Use [7]. The tests are carried out using verified area templates.

3.1 Maximum Permissible Errors

The maximum permissible errors cover the measurement of a single template, as well as the mean of a number of measurements. Also, allowance is made for the rounding error of digital indicators.

The maximum permissible error for a single measurement is 0.5 dm^2 up to 25 dm^2 with an additional 1 dm^2 for each additional 50 dm^2, or part thereof. This is a step tolerance which has a minimum relative error of 2 % and a varying maximum error of around 3 % (see Figure 5). To allow for rounding error on digital indicators, 0.5 of the scale interval is added to the maximum permissible error.

The measurement of each template includes a random error due to the edge effects which depend on the position of the template with respect to the detectors and a systematic error caused by incorrect calibration of the instrument; both errors may be affected by influence factors and disturbances.

To check the systematic error, the mean of 20 measurements of a template is calculated and the result should not differ from the denominated value of the template by more than one-half of the maximum permissible error for the single-measurement error of the template. For digital instruments, the 0.5 scale interval can be added to the maximum permissible error for the mean, but in practice it can be considered a random error and would be reduced in the calculation. However, adding it to the maximum permissible error for the mean is less restrictive.

To minimise problems with the rounding error on digital indicators, the templates should have values which are an integral number of square decimetres.

3.2 Influence Factors and Disturbances

The instruments are required to operate within the maximum permissible errors under normal operating conditions. Factors which can change and therefore influence the electronic instrument include: temperature, humidity and variation in supply voltage to the instrument.

The Commission's requirements include a temperature variation of 0 to 40 °C and a supply voltage variation of – 15 % and + 10 % of nominal voltage. The International Organisation of Legal Metrology (OIML) has published International Document n° 11, General Requirements for Electronic Measuring Instruments [8] which includes requirements and test procedures for other influence factors.

The effect of humidity is important but the Commission has not applied this test. There are difficulties in deciding on the most appropriate tests, as well as providing equipment to carry out the tests.

Requirements for disturbances are also given in International Document N° 11 and these include the effects of short time power reduction, electrical bursts, electrostatic discharge and electromagnetic susceptibility. Special equipment described later is required to perform these tests. At present the Commission does not carry out these tests.

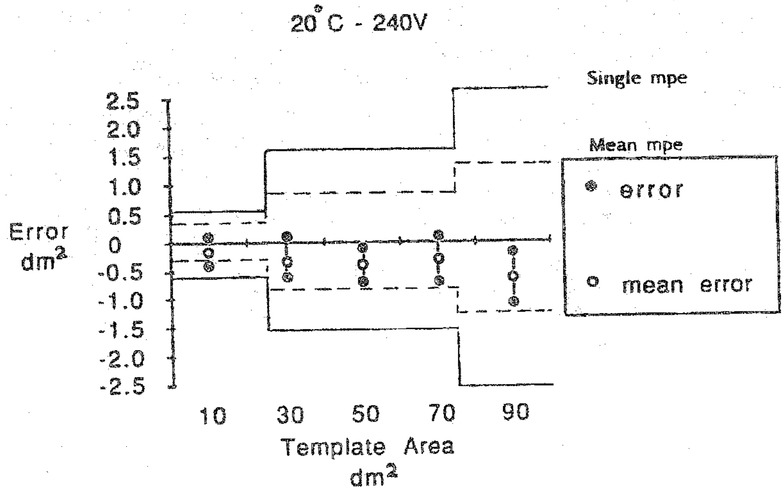
A significant fault would have to be prescribed for these instruments if the effect of disturbances are examined. This would be related to the smallest maximum permissible error (0.5 dm^2) and the scale interval (0.1 or 1 dm^2).

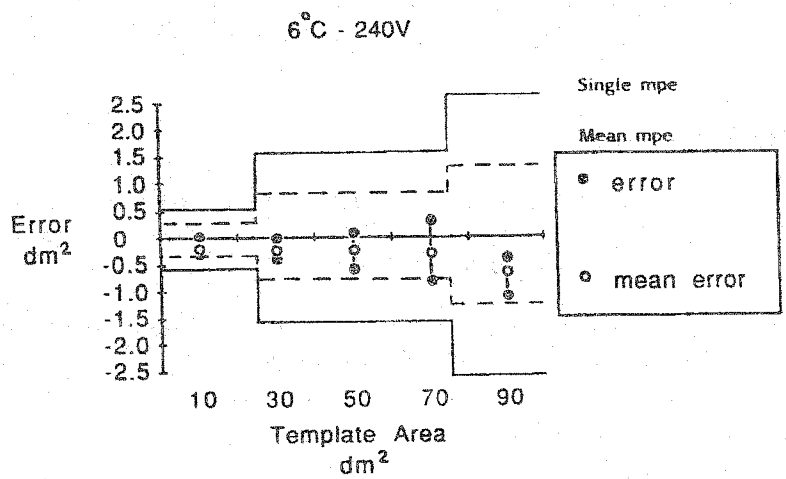
3.3 Minimum Area

There are a number of factors included in the measurement which cause a fixed error and hence become significant for small areas if the maximum permissible error is not to be exceeded.

The basic unit of area determined by the spacing of the detectors is one factor. Using the example quoted previously of 6.25 cm^2, this is equivalent to a maximum permissible error of 2 % for an area of approximately 3 dm^2.

Another limiting factor is the resolution of the indicator. If the scale interval is 1 dm^2, then this is equivalent to the maximum permissible error of 2 % for an area of 50 dm^2. If the scale interval is 0.1 dm^2, then this is equivalent to 5 dm^2. The common scale intervals used are 1 dm^2 and 0.1 dm^2.





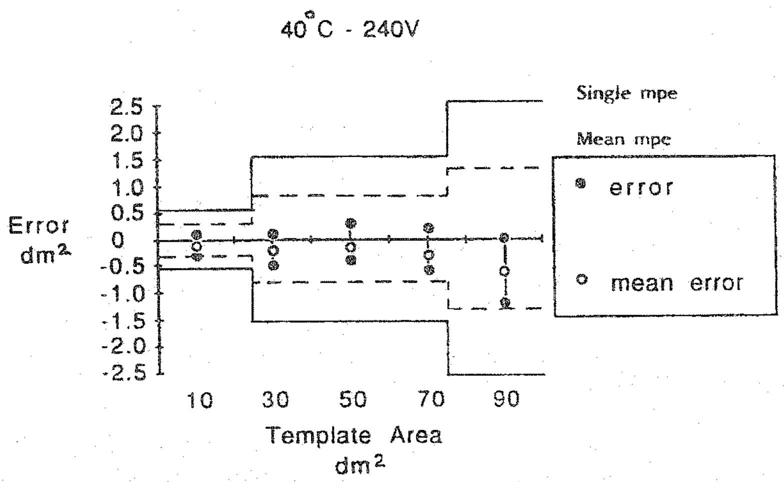


Fig. 6 – Typical errors of an area measuring instrument at the temperatures of 20, 6 and 40 °C.

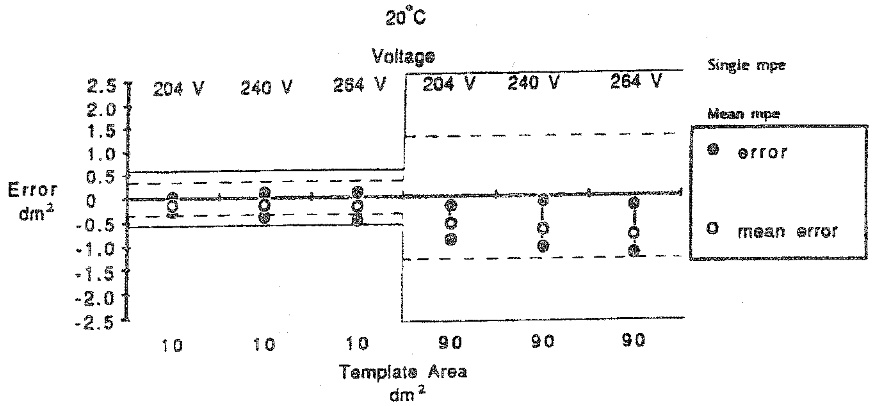


Fig. 7 – Typical errors of an area measuring instrument at mains supply voltages of 204, 240 and 264 V.

The area of leather measured can vary between 20 and 400 dm² and the scale interval should be chosen to suit the areas to be measured so that the errors due to the resolution of the scale interval is minimised. A minimum area is specified and marked on each machine.

3.4 Construction Requirements

A number of the construction requirements applied to area measuring instruments are the same as those applied to other instruments, i.e., the arrangement of the indicating device, including the digits, denominations and scales, if applicable.

The most important construction features are those safeguards mentioned in clause 2.4 which prevent fraudulent use of the instrument. In particular, examination of the following features are carried out:

(a) failure of light source
(b) failure of detectors
(c) digital indication
(d) zero function
(e) ticket printer operation
(f) totalising function
(g) power failure
(h) pull back protection and
(i) pre-setting devices.

Finally the required markings are checked and the provisions made for sealing calibration devices and for applying the verification mark are examined.

3.5 Pattern Approval Test Results

Figure 6 shows some typical results obtained for a leather measuring instrument with a scale interval of 0.1 dm². Templates of 10, 30, 50, 70 and 90 dm² were each passed through the machine 20 times and the maximum and minimum readings and the mean value were recorded. The tests were repeated at 20, 6 and 40 °C and at 204, 240 and 264 V at each temperature.

The results show that the random errors increase with template size and that there is a slight systematic error which increases negatively as the area increases. Figure 7 shows that there is an effect due to voltage change but not sufficient to cause the instrument to exceed the maximum permissible error.

4. Verification

Instruments are verified in the field by the various State verifying authorities responsible for trade measurement using verified area templates and a uniform test procedure. The uniform test procedure entitled Test Procedure N° 1: Area measuring Instruments is included in Inspector's Handbook N° 1 [9].

4.1 Visual Inspection

The instrument is first checked visually to ensure that it is in good operating condition and that the operator is not hindered in using it correctly. All markings are checked for correctness, and for compliance with the pattern approval certificate. All necessary details are noted in the inspectors notebook.

4.2 Performance Testing

The instrument is tested in the same manner and to the same maximum permissible errors as specified in the pattern approval certificate, using verified templates of various sizes. In addition, tests are carried out using several templates in combination but making sure they do not overlap or extend beyond the limits of measurement of the machine.

4.3 Additional Tests

If the instrument is fitted with additional indicators or ticket or leather printers, these are checked to ensure that they repeat the indication of measurement shown on the main indicator. If a totalising function is included, this is also checked for correct addition. The format of the printed record is checked for correctness.

5. Test equipment

Area measuring instruments are tested using templates of known area which are passed through the instrument under test. The same templates are used for pattern approval and verification tests. Additional equipment is needed for carrying out tests for influence factors and disturbances.

5.1 Area Templates

Templates used in Australia are made of insertion rubber which is 1.5 to 2.5 mm thick and circular in shape. The circular shape is preferable to the rectangular or square shape, as it more closely resembles the irregular shape of animal skins.

The templates are cut on a machine which clamps the rubber between two circular plates of the required diameter and the plates are rotared against a cutting device to trim the rubber to the correct size. The rubber can then be measured using a dial gauge in place of the cutting device. A description of the machine and the method of manufacturing the templates is contained in a paper prepared by J.W. Bell [10] called The Manufacture and Calibration of Standard Templates for Leather Measuring Machines.

The templates are also reverified by two methods described in the Verifying Authorities Handbook [11]. One method involves the measurement of a number of diameters to find a mean diameter from which the area is calculated. This is satisfactory if the diameter is reasonably constant. Another method involves the measurement of a number of radii and finding the area of each segment between two radii. The area of the template is the total area of all segments.

Table 1 gives the results of measurements made for a set of templates over eight years. Although the measurements vary, it is not possible to say whether the templates show regular growth or shrinkage. The Verifying Authorities Handbook [11] requires reverification of templates every three years and this set of templates has remained within the maximum permissible variations for eight years.

TABLE 1 – RESULTS OF VERIFICATION OF AREA STANDARDS

Template Identification	Thickness (mm)	Measured area (dm^2) and date of verification				Maximum permissible variations ($\pm$ dm^2)
		1980	1982	1985	1988	
M 7832/4	1.6	100.09	100.25	100.40	100.25	0.50
M 7832/3	2.5	50.08	50.07	49.95	50.06	0.25
M 7832/2	1.6	20.04	20.06	20.08	20.02	0.18
M 7832/1	1.6	10.00	10.01	10.03	10.02	0.18

The draft OIML international recommendation entitled Instruments Measuring the Area of Leathers [12], includes methods for verifying the area of rectangular as well as circular templates.

Rectangular templates can give significant errors if the template is passed through the machine with the long edge perpendicular to the row of detectors in the measuring bridge. The error depends on the relative position of the edge with respect to a pair of detectors, see Figures 8 (a) to (c). The best results are obtained with a rectangular template if it is passed through at an angle to the bridge. This is a more realistic test when considering the shape of the leathers. If a leather is cut with a long straight edge, it should also be passed through with the straight edge at an angle to the measuring bridge.

5.2 Test Equipment for Influence Factors

The Commission tests for the influence of hot and cold temperatures and high and low voltage supply.

As area measuring instruments can be quite large, they usually do not fit within the Commission's temperature chambers. Therefore, a chamber has to be constructed around the instrument, including the floor, using slabs of 100 mm polystyrene foam held together with adhesive tape. A portable room, reverse-cycle air conditioner, suitably modified to reach the high and low temperatures, is used to heat and cool the chamber. At high ambient temperatures this test equipment is not efficient enough to reach low temperatures, such as – 10 °C.

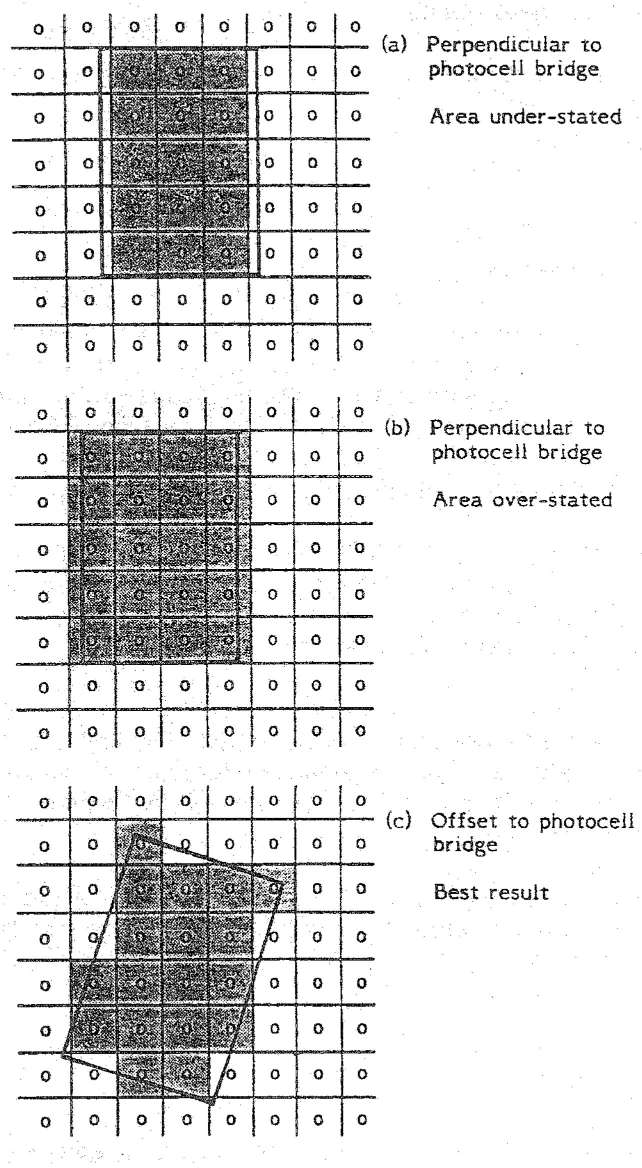


Fig. 8 – Passage of a rectangular template.

Voltage variation is achieved using a variable transformer, together with a voltmeter to accurately determine the voltage.

The effect of humidity should also be tested, but as with the temperature tests, generally the size of area measuring instruments make it extremely difficult to construct a chamber which can control the humidity according to the requirements of OIML International Document N° 11: General Requirements for Electronic Measuring Instruments [8].

As an alternative, the electronic equipment could be dismantled from the instrument and placed in the chamber, subjected to the humidity cycling and then reassembled on the instrument and tested to determine the effects of humidity.

5.3 Tests Equipment for Disturbances

Special equipment is needed to carry out the tests for electrical interference which include tests for:

(a) short time power reduction
(b) bursts
(c) electrostatic discharge and
(d) electromagnetic interference.

The first two tests are carried out by connecting the test equipment to the power supply line of the instrument under test and applying the specified procedure. It is important to be able to closely monitor the disturbances. A procedure for determining the effect on the instrument would also have to be established. The power reductions and bursts would have to applied during the passage of a template under the measuring bridge. The time for the template to be measured would therefore, have to be greater than the time for the test to be applied.

An electrostatic discharge is applied to the external surfaces of the instrument which would normally be handled by the operator. This test simulates static discharge from the operator which can happen under certain conditions. Once again, the test would have to be applied during the passage of a template under the measuring bridge.

Electromagnetic interference is caused by transmission from radio stations, television stations, radar transmitters and other industrial equipment. The test is carried out using variable frequencies transmitted by various types of equipment to set the required field strength at the location where the instrument is to be tested. Once the field strength is set, the instrument is moved to that position and tested.

An anechoic, shielded enclosure should be provided for this test to prevent interference to (or from) other equipment, but as area measuring instruments are usually quite large, such an enclosure would be very costly.

6. Conclusions

Although leather area measurement is not as common as weighing or flow measurement in the trade measurement field, it is nevertheless important. The maximum permissible errors are not as small as they are for other trade instruments but this does not lessen the quantity and quality of testing required.

The Commission has tested a number of area measuring instruments and has established a satisfactory pattern approval test program. However, the program does not include tests for electrical interference and humidity, although these effects could influence the performance of the instruments.

Over the last few years uniform methods of verifying area templates and verifying instruments in the field have been developed and these have been put into practice successfully, by the State verifying authorities.

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[12] OIML Third Preliminary Draft International Recommendation: Instruments measuring the area of leathers (1989), International Organisation of Legal Metrology.

TESTING OF DISCONTINUOUS TOTALISING AUTOMATIC WEIGHING INSTRUMENTS (HOPPER SCALES)

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SUMMARY – This paper is based on a presentation made in 1989 at a seminar on industrial weighing hosted by Statens Provningsanstalt in Borås, Sweden. At first the methods and experience on discontinuous totalising automatic weighing instruments in Norway are described. The metrological and technical requirements according to the OIML Draft International Recommendation are thereafter discussed. The final section describes how the in situ tests are performed.

1. Introduction

The plan is to have the OIML Recommendation concerning discontinuous totalising automatic weighing instruments, often called hopper scales, approved by CIML in 1992. This will be the first International Recommendation for these types of weighing instruments. In this paper I will present some of the essential parts of the draft of this Recommendation.

I shall mainly concentrate on the type of automatic instruments which are used as a control instrument thus applying the integrated verification method which is described in the Draft Recommendation.

2. Testing of hopper scales in Norway

As early as in the thirties automatic weighing instruments were given pattern approval in Norway. Previously, from 1876, the Metrology Service required that complete construction drawings of weighing instruments, including automatic weighing instruments should be submitted. In the fifties, hopper scales as we know them today, with filling and emptying hatches (closing system) and throttle valves which are wholly or partly automatically controlled, were given pattern approval. At that time the scales were built in an open system, see the left sketch in Fig. 1.

Later, in the seventies, the concerns for the environment etc. became more important. This meant that the hopper scales had to be enclosed and fitted with a dust extractor system, see the right sketch in Fig. 1.

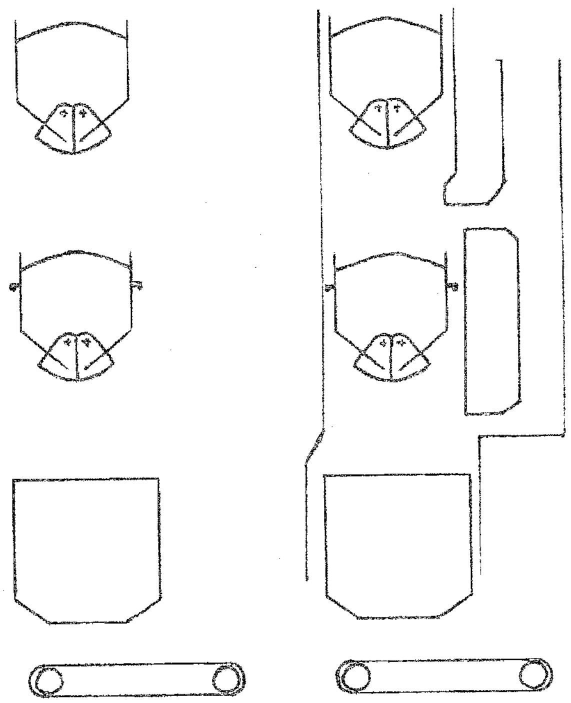

Fig. 1 – Left: Automatic weighing system with a surge hopper above and below the instrument.
Right: Enclosed automatic weighing system with a dust extractor system and an air evacuation system.

The enclosing of the scales resulted in problems from a metrological point of view. The reason was that the hopper became influenced by the difference in the air pressure above and below the hopper. Simultaneously with the growing external influences, the weighing procedure has become quicker, thus shortening the time for evacuation of the air (pressure levelling). The "weighing procedure" lasts from time 2 to 3 in Fig. 2.

Automatic weighing instruments are often equipped with a motion detector. This is a part of the weighing procedure. A no-motion situation exists if the results of a selectable number of consecutive weights are all within a selectable tolerance band.

In Norway, automatic hopper scales are constructed in such a way that when they are set in static mode they are used as a control instrument for the automatic mode. Other weighing instruments (e.g. weighbridges) have been used only as control instruments for hopper scales at internal controls.

A Norwegian regulation which was to take the above problems into consideration was developed by the National Measurement Service during the seventies. This regulation came into force in 1980. The problems were resolved by demanding that during the material tests a special facility (e.g. a special switch) should be used to stop the automatic operation twice during each weighing cycle required to weigh and discharge a sub-division of the test load. The automatic operation shall continue, however, until the filling is completed/emptying and the gross/tare value is obtained (see Fig. 2).

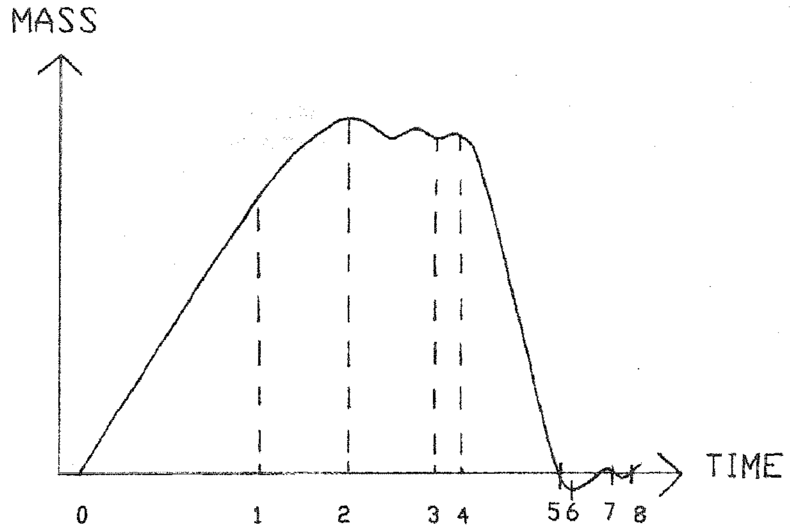

Fig. 2 – The automatic weighing cycle.
0 The material flow starts
1 Closing of the hatches above the hopper
2 The weighing procedure starts
3 The gross value is obtained
4 Opening of the hatches on the hopper
5 Closing of the hatches on the hopper
6 The weighing procedure starts
7 The tare value of the empty hopper is obtained
8 The material flow starts.

During the timespan between 0 and 3 it shall be possible to use the special switch for the interruption of the automatic operation. In addition to this, it shall be possible to use the switch from the time the hatches open, 4, until the tare value of the empty container is obtained, 7. It is important that this switch may be used during the entirety of this time span, thus giving sufficient time to interrupt the automatic operation. However the automatic operation shall continue until the filling/emptying is completed and the gross/tare value indication is obtained as normal for automatic weighing. The only change to take place when using this facility is that the hopper shall not discharge/fill after the gross/tare value is obtained. Fig. 3 shows what we have chosen to call the traceability for this test method.

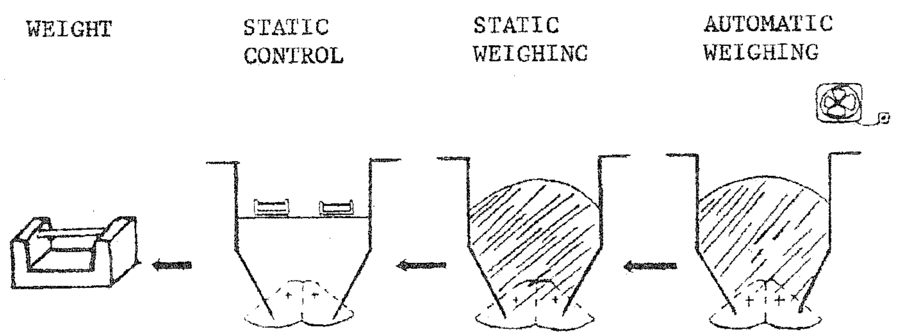

Fig. 3 – The traceability for the test procedure when using the automatic weighing instrument as a control instrument.

The weighing value which is obtained in the automatic mode, is compared to the value obtained under static weighing conditions. The indications on the hopper scale when we have static weighing conditions, have in advance been tested with standard weights. By this method we can therefore determine whether the value which is obtained in the automatic weighing is correct and if it is not correct, then determine how much it deviates from the static value. Static conditions mean that the conveyors, dust extractors etc. have been stopped. This is the integral verification method described in the new International Recommendation for hopper scales.

Because, as far as we know, we are one of the first countries to make use of this test method, there have been problems with the scale suppliers since they have not had sufficient knowledge of how this method works. When using the special switch one must also often stop the transport system to and from the scale in a simple way, thus making it easy to carry out the control. Otherwise there might easily be too much material accumulated in the transport system which is connected to the scale.

This switch can also be used to verify whether there is a leak in the hatches (closing systems) above the instrument and on the instrument, by leaving the instrument at a standstill for a longer period of time with material in the hopper (5 to 10 minutes). This is an advantage because it is often difficult to do an adequate visual verification of the hatches, and during our control we have from time to time come across problems with the hatches. The drawback of this test is of course, that it does not detect a leak if it is identical above the instrument and on the instrument.

In Norway, hopper scales which are subject to mandatory control of the National Measurement Service, are used mainly for farming products, grain etc. Such hopper scales are also used in heavy industry for process control, but the instruments are then not subject to mandatory legal control.

During the past years an average of about three new hopper scale constructions per year, have been given pattern approval in Norway. The number of pattern approvals for such instruments seems to increase. Each year, we verify about 250 automatic weighing instruments, which is a sizable number considering that the population in Norway are only 4.2 million. This number comprises both hopper scales and automatic gravimetric filling machines.

3. Important metrological and technical requirements in the new OIML Recommendation

The errors for the static tests that we perform on a hopper scale are the same as for non-automatic weighing instruments. When a hopper scale can be used as a non-automatic weighing instrument, it shall satisfy the actual metrological requirements given in the Recommendation for non-automatic weighing instruments (R 76).

In the cases where the automatic weighing instrument can be used as a control instrument, the load receptor (hopper) shall have a facility to support a quantity of standard weights in accordance with the table below.

Maximum capacity (Max)	Minimum quantity of standard weights
Max ≤ 5 t	Max
5 t < Max ≤ 25 t	5 t
25 t < Max ≤ 50 t	20 % Max
50 t < Max	10 t

There have been problems in Norway, because instruments have been installed that did not have any facility to support a quantity of standard weights. This will hopefully end once the International Recommendation is published and used by the different OIML member countries. In most cases the weighing instruments are constructed in such a manner that the weights are placed on weight receptors on the outside of the hopper. These weight receptors can in some cases be taken off the instruments after use.

In the Recommendation, the automatic weighing instruments are divided into 4 accuracy classes, see the second table below where the maximum permissible errors for each class are given.

Accuracy class	Percentage of the mass of the totalised load	
	Initial verification	In-service
0.2	± 0.10 %	± 0.2 %
0.5	0.25	0.5
1	0.50	1.0
2	1.00	2.0

The values in this last table shall be rounded to the nearest whole number of totalisation scale intervals. The mpe for a weighing instrument in accuracy class 0.2 shown is shown in Fig. 4.

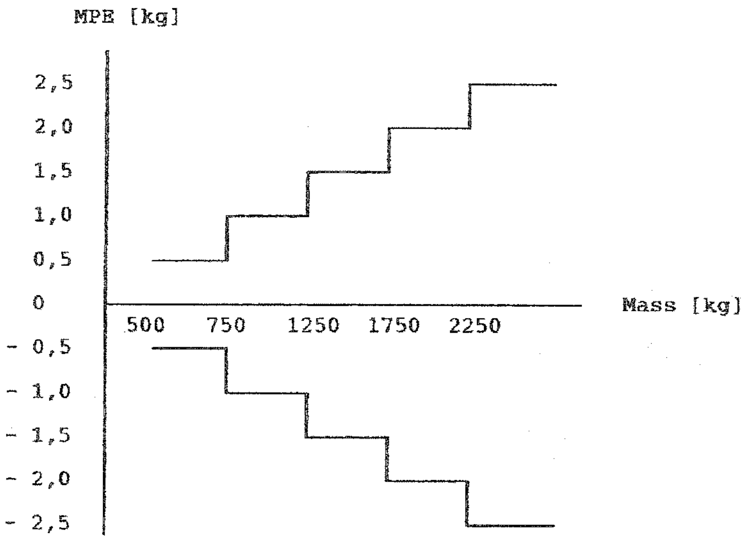

Fig. 4 – The maximum permissible error at initial verification for a weighing instrument in accuracy class 0.2 with Max = 500 kg, totalisation scale interval d = 0.5 kg and minimum totalised load Σmin = 500 kg.

In this connection, I find it important to mention that NORJUST, which is an informal cooperation organisation in legal metrology between the Nordic countries, has written test procedures including a pattern evaluation report which can be used when testing hopper scales in accordance with this International Recommendation. In 1990 this group, including also U.K. and USA, became a Task Group within OIML.

4. Testing of hopper scales in situ

The final pattern approval tests shall be done on a completely installed instrument at a typical site, according to the new Recommendation.

I will therefore discuss in more detail how a test is done when the automatic weighing instrument is used as a control instrument in situ.

The reason for using the automatic weighing instrument as a control instrument, is that most of the automatic weighing instruments we know are placed in such a way that it is difficult to collect and control the material which has gone through the system.

The testing of the instruments is made considerably easier if the scale interval of the indicator can be chosen ten times smaller than it is during normal use. In weighing instruments where this option can not be used, it is necessary to use standard weights to assess the rounding error, which is necessary in order to assess the static error.

4.1 Non-automatic tests

These tests are done in the same manner as for regular non-automatic weighing instruments:

In situ the following tests are usually carried out:

- Weighing test
- Eccentricity test
- Discrimination test
- Repeatability test

For the time being we do not perform the repeatability test in situ.

These tests shall, because of the accuracy, be carried out immediately before the material tests.

4.2 Material tests

These tests are meant to determine how the automatic weighing instrument behaves under the influence of the moving material, and other working conditions.

According to the Draft Recommendation, the materials used as the test load should be the same as those to be weighed by the instrument when in normal use. We have experienced in particular that it is important to consider e.g. the particle size and how much humidity the material contains. Especially, we have found differences between fish flour and grain when weighed on the same hopper.

In connection with these tests, different problems have occured. Controlling these weighing instruments in such a way as to identify the different influences, has been very difficult. According to the new International Recommendation the tests shall be performed under normal conditions of use. Our experience has shown that this is especially important. One of the reasons for this is that the transport system in the entire system influences the weighing values in different ways depending on which instruments/conveyors that are switched on.

It is therefore very important to do a very good inspection of the whole system before the testing. A sketch of the pipes etc. can often be shown on the video display. This will give you a good advice when you shall decide e.g. which conveyors etc. that have to be on during the tests.

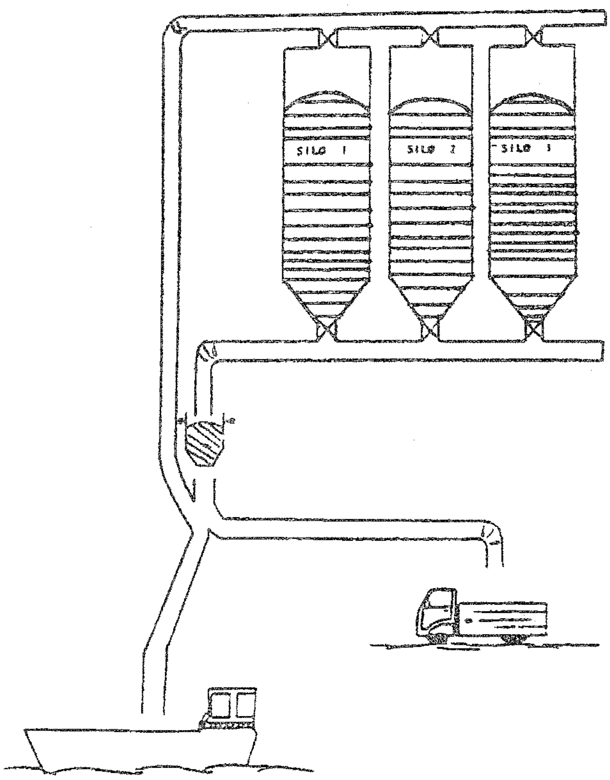

Fig. 5 – A silo-system with a discontinuous totalising automatic weighing instrument.

The material is often transported in different pipes depending on whether the material shall be delivered to e.g. a ship or a truck. In such places there are often long pipes below the weighing instrument, and the transport systems have dust extractors because of the environmental demands.

When testing an automatic weighing instrument at a place like the one mentioned above, you have to test the weighing instrument both when delivering to the ship and to the truck. Many plants also have the facility to run the material in a cycle. By this is meant that the material comes from a silo, passes through the weighing instrument and after having been weighed is transported back to the silo.

The latter method has in fact been much used, as it eliminates the necessity of having for instance a ship present during the test.

In many cases when we have run the material in a closed cycle, the weighing instrument has worked correctly, but we have found large errors when the material has been delivered to a ship. This is often due to the low pressure in the pipes below the weighing instruments, and this has caused wrong weighing results. We have therefore had to require those in charge of the weighing instrument to install an air bypass system for efficient pressure compensation both above and below the instrument.

At certain places, the difference between the values obtained by testing the instruments when a delivery of materials to a ship is made, and testing by running a round cycle test, has been as high as 5 %.

According to the Draft Recommendation, when a material test is performed, the automatic operations shall not be interrupted on consecutive weighing cycles if the instrument is constructed as an air enclosed system. The majority of weighing instruments in Norway are constructed as an air enclosed system, so that we can stop the automatic operation at random chosen weighings. This is done because we want to control the instrument under realistic conditions of use. It has to be done this way in order to let the air be in complete circulation when we stop the automatic operation.

4.2.1 TEST PROCEDURES

The test procedures will normally be as follows:

1 – Start the automatic weighing system, including the equipment near the scale which normally is being used when the scale is used. This equipment must be in operation in order to see whether it produces vibration or other disturbances which influence on the accuracy of the automatic weighing instrument.

2 – Run the system until it has reached normal conditions of use.

3 – Gross indication. During the filling phase, the automatic operation is interrupted by the previously mentioned special switch or another facility. The gross value is obtained as when it is in normal automatic mode. Then, while the material is still in the hopper, all surrounding equipment, such as dust extractors, conveyors etc. which can influence the weighing results, is to be shut off. Wait until the system has come to complete rest and the conditions are as they were when the instrument was tested with standard weights.

4 – Only when this condition is attained, the control weighing value may be read. The point of balance for the indicator is determined with weights of 1/10 d_t (totalisation scale interval), or by direct reading of the control indicating device.

5 – All surrounding equipment is turned on again.

6 – The weighing operation is started again.

7 – Tare indication. This is done in the same manner as when we obtained the gross value indication, but the automatic operation is now interrupted immediately before the hopper is filled again. All surrounding equipment shall again be stopped.

8 – Repeat point 4 with an empty hopper.

9 – The entire system is then turned on again, and one waits until the instrument has again attained normal conditions of use before undertaking the next weighing control. This usually involves running several complete weighing cycles.

In accordance with the new Recommendation, at least 3 material tests shall be conducted, at the maximum number of weighing cycles per hour, whereby each test will normally consist of 5 control weighings.

4.2.2 CALCULATION OF ERROR

(a) First all weight values that are obtained automatically are totalised for each materials test. For each weighing, this is the difference between the values obtained in points 3 and 7 above.

(b) Then all weight values that are obtained under static conditions are totalised for each materials test. For each weighing cycle, this is the difference between the values obtained in points 4 and 8 above.

The difference between the values obtained under points (a) and (b) represents the automatic weighing error.

5. Conclusion

The National Measurement Service in Norway has used the integral verification method for more than eleven years. So far there have been only minor problems with this method.

It is important to have uniform test procedures so the OIML certificate system may be applied as widely as possible including hopper scales.

References

OIML Draft Recommendation: Discontinuous totalising automatic weighing instruments, December 1991.

TI 014: Verification of hopper scales, National Measurement Service, Norway 1980.

ROYAUME-UNI

IN-MOTION RAIL WEIGHBRIDGES AND CONTINUOUS BELT WEIGHERS*

by **R.G. YARWOOD**
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SUMMARY – This article first stresses the need for commonality of the regulations for in-motion rail weighbridges and belt weighers with those of nonautomatic weighing instruments.

The author also reviews some of the important operational considerations which must be taken into account when regulating and testing these categories of weighing machines.

1. Introduction

This new decade will see the transformation of individual EEC member countries Weights and Measures regulations into common regulations based upon the OIML recommendations. Testing and approval of the various categories of weighing machines will no longer by necessity be done through the state monopolies. A variety of public and privately funded test laboratories will compete for the business throughout Europe.

Submitters of equipment for regulatory controlled weighing machines and systems will not only want the testing laboratory to fulfil the requirements laid down for the particular type of weighing machine, but for the other categories of tests for which the equipment must also be approved. For automatic weighing machines there will be the EMC Directives and the Safety Directives to be met, as well as the Weights and Measures Directive.

Hence these approved laboratories will be expected to test products throughout the EEC to a uniform standard for not only Weights and Measures approval but of a variety of additional approvals prior to stamping with the EC mark.

It is vital therefore that the tests particularly for Weights and Measures approval are as common as is possible for all categories of weighing machines in order to minimise the possibility of unequal test standards being applied through misunderstanding of the rules.

2. The Specialist Categories of Automatic Weighing Machines

In-motion rail weighbridges and the approved categories of continuous belt weighers represent the two most specialist and least understood of all weighing machines. By the very nature of their function they are technically complex and can only be built and installed by specialist engineers who understand the unique considerations needed in their design.

(*) This paper was prepared for the OIML seminar Weighing in Braunschweig, 15-18 May 1990.

The approved laboratories will not be asked to test such equipment as often as is normal to test nonautomatic weighing machines. However, if the test standards wherever possible are the same as those for nonautomatic weighing machines, then although the laboratory is not as familiar with the equipment, it is familiar with the common test procedure and standards criteria. Therefore the opportunity to ensure that uniform standards are applied regardless of test laboratory are maximised.

In-motion rail weighbridges and continuous belt weighers represent the two categories of weighing machine, where calibration and accuracy checking is a lengthy and costly process.

I would not pretend that calibrating and testing a large discontinuous totaliser is simple, but by comparison, it is less arduous than these two specialist machines. However testing to common prescribed limits of error will permit the regulations to be applied with least chance of misinterpretation. Tests on these types of equipment cannot easily be repeated if a procedural error is discovered at the end of a three day test.

3. The Special Considerations

Having expressed the benefits of common regulations with the nonautomatic weighing machines for limits of accuracy, general machine features, environmental tests and electromagnetic disturbances, there are operational considerations, which due to the specialist nature of these machines, must be taken into account.

3.1. In-motion Rail Weighbridge

Many applications of in-motion rail weighing systems necessitate the use of an axle or bogie weighbridge because of the variable length of the rail traffic passing over the bridge.

Full draught weighing by definition assumes that the weighbridge will be long enough to accomodate both axles or bogies of the wagon, but not too long as to include the weight of axles of other wagons. Hence this type of full draught weighbridge is only suitable if it is only used to weigh a limit range of axle or bogie lengths.

The axle or bogie weighbridge is far better suited to mixed traffic as it can tolerate a much greater range of wagon length. However additional track switches are associated with this design to enable the computer to deduce which axles belong to which wagons.

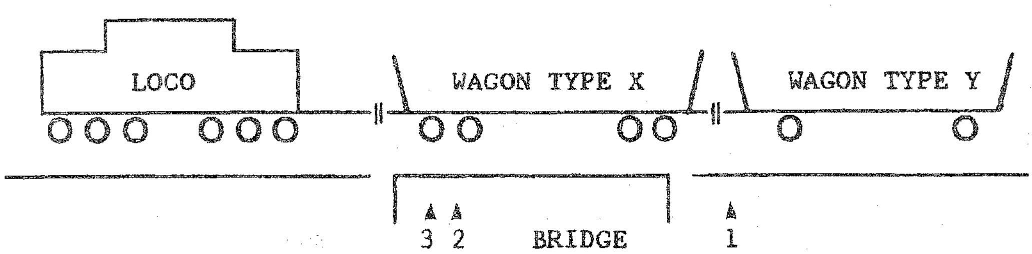

Fig. 1 – Full draught weighbridge.

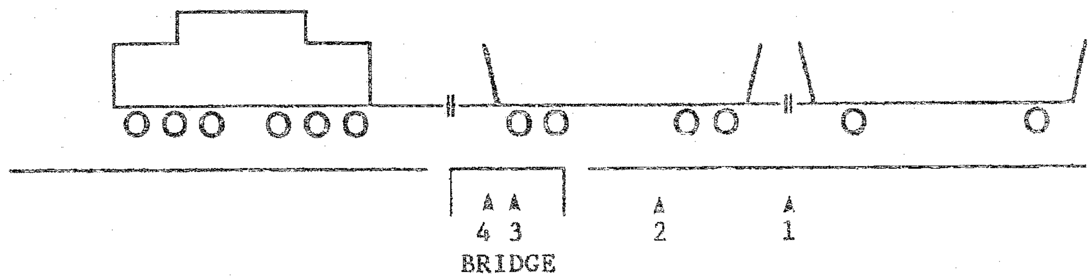

Fig. 2 – Axle or bogie weighbridge.

Figure 1 shows wagons passing over full draught weighbridge. The trackswitches 2 and 3 on the weighbridge indicate to the computer when to start and when to stop weighing each wagon. The additional trackswitch off the weighbridge is used in conjunction with one on the weighbridge to determine whether the vehicle is a locomotive or a wagon, i.e. a count of 6 on trackswitch 1 when trackswitch 2 receives its first count must be a loco. A count of 4 or 2 must be wagon type X or Y. When trackswitch 3 equals the count of trackswitch 1, then the entire train has cleared the weighbridge and a weighbill can be produced.

Figure 2 shows an axle or bogie weighbridge and how it must take two weight readings to get the wagon weight. The loco is eliminated in a similar manner to the full draught bridge. Trackswitches 4 and 3 determine when to start and stop weighing, but trackswitches 2 and 1 deduce the wagon identification as 4 or 2 wheeled. Hence it can calculate which weights are associated with which wagon.

Testing a system's ability to cope with variable traffic is often unique to a site and could never be included in common regulations of in-motion rail weighbridges. However, the principle of allowing single or multiple weighing operations is vital for this type of equipment. Other site variables can be included in common in-motion rail weighing regulations as follows:

- wagon position in train
- speed detection
- wagon couplers
- track quality
- wagon suspension
- track switches/detectors.

3.1.1 WAGON POSITION IN TRAIN

This is the single biggest reason for incorrect weight recording. The first wagon is the worst, the last wagon is the best. The tension in a laden train of say 40 wagons causes the first wagons to be partially lifted off the track. 100-200 kg weight loss is typical of a wagon at the front of the train when the loco accelerates as the wagon passes the weighbridge. Even if the loco is in automatic crawler gear the speed controller sometimes operates at the most inconvenient time for weighing. A fixed "wagon offset" which adds to the first wagon recorded weight can neatly correct this problem. Other wagons suffer less of a problem as the buffer heights are common. The first wagon rides low on the loco buffers when laden, and high when unladen.

3.1.2 SPEED DETECTION

High speed seriously degrades weighing as weights are transferred from wagon to wagon due to buffer interaction. The weighbridge suffers shock loading at speed and is slow to recover yet it has less time to record the weight. A weighbridge speed limit solves this problem.

3.1.3 WAGON COUPLERS

Couplers play an important role in accuracy as I have just described. The design of a nation's rolling stock couplers cannot be changed at the desire of an inspector. However over-tight couplers and badly worn couplers can be noted by the inspector and even the railways will act upon reasonable requests.

3.1.4 TRACK QUALITY

If the inspector and the specialist manufacturer are consulted prior to the customer deciding where the weighbridge must be sited, problems of the track itself can be eliminated. It is better to avoid the following:

- curves in the track for at least 10 - 15 wagons before the weighbridge
- uphill gradients
- track too narrow that it brakes the wagons
- badly worn track or loose sleepers
- short run on and run off concrete aprons.

3.1.5 WAGON SUSPENSION

Wagon suspension is an A.C. component superimposed upon a D.C. weight signal. It can be reduced by digital filtering and recording weights over a longer time period. Hence speed and weighbridge length are important.

3.1.6 TRACK SWITCHES/DETECTORS

European countries prefer to use mechanical track switches, whilst the U.S.A. prefer track detectors of the eddy current loop type. Both work reliably. The track switch can be kicked by people passing, which would only be embarrassing if the correct sequence of hits are made, otherwise it is ignored. Track detectors are only triggered by a large mass of metal passing over them. They are less precise, and go out of tune if a stationary wagon sits above a detector for a long period. Detectors rarely fail however.

3.2 Continuous Belt Weighers

Belt weighers have their own unique special considerations. Not only will these weighers not perform with the desired degree of accuracy if these critical design features are not correctly engineered, but checking the accuracy directly or providing a simulator to check accuracy is difficult.

The major considerations are as follows:

- rigidity of the idler structure
- temperature of belt and bearings
- rapid stabilisation upon switch on
- slow feedrate technique
- no auto zero tracking.

3.2.1 RIGIDITY OF IDLER STRUCTURE

Rigidity (structural stiffness) is critical to achieve and maintain adequate belt weighing standards.

3.2.2 TEMPERATURE OF BELT AND BEARINGS

Temperature compensation is vital for good accuracy and must be included in all good designs. Temperature variations affect belt length and bearing friction.

3.2.3 RAPID STABILISATION UPON SWITCH ON

Belt weighers are normally never switched off during normal operation. If the recommendations require a system check out upon switch on as proposed for nonautomatic weighing machines, then for belt weighers an alternative "Test" button should be included to satisfy this point. A belt weigher never knows when it must commence weighing a product, therefore rapid stabilisation of the electronics is vital if power is lost then recovered. It is quite pointless to permit a half hour warm up of a belt weighing system before testing commences, as in real life it must be able to start weighing immediately.

3.2.4 SLOW FEEDRATE TECHNIQUE

For some designs where the speed of the belt cannot be changed they must weigh down to 10 % or even lower dependant upon the bulk density of the material. There is normally however a lower cut off point where the accuracy of the belt weigher can no longer be maintained.

Where the speed of the belt can be varied, it is done in order to keep the load on the belt within the best accuracy range. The frequency of control updates may reduce in order to prevent over reaction at slow speeds, this way errors are minimised.

3.2.5 NO AUTO ZERO TRACKING

Auto Zero Tracking is dangerous on belt weighers and the practice should be outlawed. At the end of all runs of material a trickle of material flows due to wear on silo gates and many other reasons. "1 % tailings" are common place for lengthy periods after the bulk of material has passed. This must also be weighed and not eliminated by zero tracking. Only manual zeroing should be permitted after firstly checking the belt. A good design of belt weigher should eliminate build up of material by good scraper design and no ledges.

4. Conclusions

I have outlined the reasons for my belief in common regulations for automatic and nonautomatic weighing machines wherever possible. This principle is vital as not only more national Weights and Measures bodies adopt the OIML Recommendations into their nations legal metrology, but also as independent testing laboratories appear. It is the best way to ensure that uniform testing occurs.

For in-motion rail weighbridges and continuous belt weighers it is just as important as these machines tend to be less understood anyway because of their lower sales volume and their technical complexity. Tying them into common regulations will remove their mystique.

However, these machines demand special considerations in their design for them to operate to the required standards of accuracy. I hope that this paper has gone some way to expose there special considerations.

ROYAUME-UNI

TRADE BY DRAFT SURVEY OR BY BELT WEIGHING?

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SUMMARY – The author discusses the accuracy of cargo draft surveys which continue to be used in some cases for international shipments of bulk materials and compares it with the accuracy obtainable with verified beltweighers.

The article is reproduced from the review Bulk Solids, Volume 11, Number 1, March 1991.

Introduction

In the area of the international trade in bulk commodities, there is an intriguing, and to some extent puzzling, anachronism as regards the methods used to determine the quantities of materials traded, which if allowed at retail level would be ridiculed and scorned, let alone be illegal!

Overview

Trade involves the buying and selling of a commodity on the basis of its qualitative and quantitative properties which are to be determined in a way which is mutually acceptable to both parties to the contract. The qualitative properties are usually determined by some form of assay, be it human or instrumental, whilst the quantitative properties are more easily controlled by absolute measurement of weight, volume or length.

Whilst both the means and the laws exist to satisfactorily control the measurement or weight under controlled conditions, the means of determining quality are more obscure, particularly in the early days of trade in bulk solids, i.e. metalliferous ores. This perhaps explains the role of the early assayer at mines and plants, and the necessity for him to be seen to be independent and working to "classical" criteria having some basis in science. Even today, the question of the qualitative definition of a traded material is a matter entirely private to the parties concerned, and they are free to choose or abide by whatever method is acceptable to both.

However, when it comes to the quantitative determination of the bulk material, there is a confusing and curious situation which exists, having its basis perhaps in history. With the possible exception of grains and their derivatives, the majority of trade in bulk solids across the world is quantified by reference not to its weight, but to the amount of water it displaces when contained in a vessel.

This use of Draft Survey for such trading is a relic of the days when accurate and reliable means for weighing large quantities of bulk solids did not exist, but whilst that situation has been corrected in the last 10-15 years, the use of surveys still commands a large following in the bulk trade. Why should this be so, and what are the attractions of using such techniques, which are inherently less accurate than weighing and which have no basis in legal metrology?

Clearly, a whole industry has developed to supply a service to traders over a long period of time, and the independent surveyor is a respected member of the community of traders. However, his craft has been overtaken by technology in the weighing field such that it is now indisputably possible to carry out the weight determination to a far higher accuracy than by survey, and most importantly, to a set of laws which have wide commonality across the world – indisputable because Certified weighing installations have proven traceability which is controlled by the legal Metrology Authority concerned.

Legal Metrology

Legal Metrology is the practice of controlled measurement of an item, be it by weight, volume or length, with reference to known standards and subject to periodic inspection by the Authority concerned. This is usually the National Weights & Measures Authority of the country concerned, but since long there have been continual efforts to internationalise the laws on all weighing equipment, which will culminate in the new EEC Directives which take force in the coming years. In the case of belt weighing, this will mean that each member of the EEC will submit to the new standards which will apply across the Community, but which have also been agreed by the whole community of legal metrology bodies across the world. The International Organisation of Legal Metrology (OIML) co-ordinates the law-making process of all National Authorities, and soon there will be a common set of standards for belt weighing, and other types of instrument, which can be used by bulk traders for the purpose of achieving legally-controlled weighing of their materials.

However, if their actions thus far are at all indicative, then the traders will continue to ignore this development. In contrast, any trader who trades on a domestic basis, *must* submit to the laws applying to legal metrology, and the so-called "private treaty", whereby the parties to the trade agree their own method of weight determination, is strictly illegal.

How curious that what is illegal domestically, is tolerated internationally for far greater quantities of materials having correspondingly astronomic values. Whilst it is appreciated that International Law is of little consequence in this specialist area, one would expect that at least the buyer of raw materials would want the very best method of weighing used if it possibly affected the amount of money he would be paying.

Imagine your street trader trying to convince the keen-eyed housewife shopping for the week's supplies, that instead of weighing the potatoes, he should put them in a bucket which be would then place in a bath full of water, and then measure the volume of water displaced, and knowing the specific gravity of same, he would then calculate the weight!

Yet this is what is done for the majority of trade in bulk cargoes such as coal, iron ore, phosphates etc. Legally approved belt weighing installations are known to be accurate to at least ± 0.5 % and in recent years, more than hundred such installations have been completed by INFLO in the greater European area, at ratings up to 8 000 t/h. Nevertheless, many traders and their customers refuse to even consider the alternative to draft survey, although quantitative proof exists of the superiority of the belt weighing technique. By using belt weighing at either, or both, the ports of loading and discharge, it is possible to measure more accurately, in a shorter time, to legally-approved methods subject to third party inspection, and at a lower cost than by using surveying techniques.

Why then, do so many traders and their customers, cling to the surveying route? What is so different in their trade to those trades or customers who have suffered from the relative inaccuracies and higher costs associated with surveying, and converted successfully to trading solely by belt weighing? What possible disadvantage can there be in measuring to smaller tolerances, at lower cost and shorter time, and to legally controlled procedures?

Some years ago, attempts were made within the bulk trades, to adopt belt weighing as a means of trading, but unfortunately both the techniques then used and the regulatory situation applicable, resulted in some unsatisfactory experiences for those involved. This was seized upon by those with a contrary interest, for the purpose of damning forevermore the principle of legal belt weighing.

The situation has now improved to the extent that users can be confident, based on the proven experience elsewhere, of obtaining a well-engineered and legally-controlled installation which will bear scrutiny to the highest standards by any authority. The cost of an appropriate belt weighing installation at a bulk terminal, will be recovered by the savings in dispensing with surveys within a very short time, depending on the size of vessel handled, and whether full or partial surveys are involved.

It is interesting to note that *Jan Merks,* author of the widely respected book "Sampling and Weighing of Bulk Solids" [1] advocates the use of belt weighing for the highest accuracies, and positively discourages the use of surveys for high value shipments, especially on partial shipments – and that from a former surveyor! This is a clear indication that the claimed accuracy of surveying of ± 0.5 % is at best fanciful, and at worst misleading.

Surveying Techniques

Consider the techniques used in draft surveying for a moment.

- Draft readings – are taken of the vessel at forward, middle and after positions on both port and starboard, preferably by boat rather than from a swinging rope ladder. Forward and after drafts are to be corrected, when necessary, for stem and stern corrections.

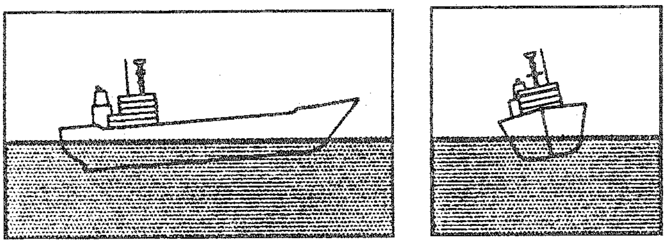

Fig. 1 – Squat Effects – trim, heel and listing.

- Density of the dockwater – representative samples of the dockwater must be taken by a special sampling device on the stern and midships at various depths. The "true" density is then determined by a draft survey hydrometer.

- Deductible liquids on board – these have to be measured by sounding, at both initial and final survey, and corrected for trim and heel. Ballast tanks should preferably be completely full or empty at these times, but this is rarely possible.
  The density of these liquids must also be determined.
- Stores – these have to be determined on every trip by conducting a light draft survey, and any variations which may be known used to correct the final survey.
- Displacement – this is determined by reference to the vessel's deadweight scale, which is based on a calculation made by the shipyard at the time of the vessels construction.

None of the above procedures is absolutely accurate, and we therefore have to assign a tolerance to each in order to be able to assess the probable overall accuracy of the survey technique.

The sources of error in each case are:

- Draft readings
  - accuracy of visual sighting
  - degree of disturbance of the water
  - current/bow wave effects
  - squat effects (Fig.1)
- Density of dockwater
  - sampling of water
  - measurement of density
- Ballast determination
  - fuel, freshwater, saltwater, oils
- Stores
  - quantities can change significantly over a voyage
- Displacement
  - the builder's calculation, based on weight of steelwork used in constructing the vessel plus boiler water if a steamer, crew, baggage etc.

The deadweight figure varies continually by unknown amounts for which estimates have to be made, and includes the weight of mud in double bottom ballast tanks, marine growth on the hull etc.

Assessing Errors

Thus is it seen that there are at least 9 separate sources of possible error in the surveying technique, which are recognised and for which allowances have to be made by the surveyor if he is to declare the weight of the cargo to within an overall precision, as is his practice.

Using conventional statistical techniques to assign these individual tolerances, we shall consider two levels of overall precision: ± 1.0 % and ± 0.5 %. If the stated levels of precision are to be actually achieved to a confidence level of 95 %, (i.e. of all the surveys done, 95 % will lie within the stated tolerance) then the standard deviation (σ) of a series of surveys has to be contained within the limits:

Overall precision	*Standard deviation*
± 1.0 %	$\sigma \leq 0.5$ %
± 0.5 %	$\sigma \leq 0.25$ %

In a survey conducted in the presence of at least 9 random variables, then the tolerance on each individual variable must be contained within the limits:

Overall precision	*Tolerance on each variable*
± 1.0 %	0.166 %
± 0.5 %	0.083 %

Space limitations do not allow a detailed examination of the impact of this level of tolerance for each of the variables, but the reader should consider carefully that a tolerance of ± 0.1 % equates to 1 part in 1,000, i.e. with a ship's draught of say 15 m, this requires the draught to be observed to within ± 15 mm or approximately the thickness of the top joint of the little finger! Try doing that on a cold day in the North Sea!

Suffice it to say that the sheer complexity and the laborious nature of the complete exercice *must* introduce significant errors into each of the measurements taken, before any consideration is even given to the "corrections" which necessarily have to be applied to take account of the vessels hog/sag and trim/heel characteristics under different loading conditions, and so on.

Conclusion

In the final analysis, draft survey can only, at best, involve the surveyor using his best endeavours, without any traceability or audit trail, such as is common practice in industry at large. In those locations when it has been possible to compare the results of "blind" draft survey with certified belt weighing equipment, there has been a clear indication of significant and consistent differences, which usually act against the receiver of the cargo.

Because of the unchallengeable traceability of certified belt weighing equipment, it must be accepted that the survey technique is inferior because it is merely an inferential, yet highly complex method with inherent uncertainties, conducted in a hostile environment.

It is high time that the purchaser of bulk cargoes received the same protection afforded by the Law as the common shopper in the supermarket!

Literature

[1] *Merks, Jan W.:* "Sampling and Weighing of Bulk Solids", Trans Tech Publications, Clausthal-Zellerfeld, Germany 1985.

[2] *Bibby Line:* "Draught Surveys".

[3] *SGS Van Bree:* "Draught Survey Methodology".

TRAVAUX de l'OIML — WORK of OIML

1991-1992

Nous indiquons ci-après sous une forme condensée et bilingue l'état de préparation des Recommandations Internationales, Documents Internationaux et autres travaux de l'OIML tel qu'il découle des rapports annuels et autres informations reçues par le BIML.

Dans cette liste ne sont pas inclus les sujets dont les travaux ont donné lieu à des publications définitives parues avant 1991.

Les avant-projets et projets indiqués dans cette liste ne sont disponibles que pour les membres des groupes de travail concernés.

We are hereafter indicating in a condensed and bilingual form the stage of preparation of International Recommendations, International Documents and other work of OIML as it appears from the annual reports and other information received by BIML.

This list does not include work which has been subject to final publication before 1991.

The preliminary drafts and drafts mentioned in this list are available only to the members of the respective working groups.

LEGENDES

AP	=	Avant-projet *Preliminary draft*
P	=	Projet *Draft*
Enquête	=	*Enquiry*
Préparation	=	Élaboration d'un avant-projet *Preparation of a preliminary draft*
Étude Sr	=	Observations et nouvelle version étudiées par Sr *Comments and new version studied by Sr*
Étude SP	=	Étude du projet par le Secrétariat Pilote *Study of the draft by the Pilot Secretariat*
Vote CIML	=	Vote par correspondance sur le projet *Vote by correspondence on the draft*
CIML	=	Approbation ou présentation pour approbation par le CIML *Approval by, or presented for approval to the CIML*
D	=	Document International
RI	=	Recommandation Internationale.

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publication *Status*	État de préparation *Stage of preparation* 1991	1992
SP 1	TERMINOLOGIE *TERMINOLOGY*			
Sr 3	Conformité terminologique *Conformity of terminology*		Activité permanente	
SP 2	MÉTROLOGIE LÉGALE, GÉNÉRALITÉS *LEGAL METROLOGY, GENERAL*			
Sr 2	Unités de mesure légales (révision D 2) *Legal units of measurement*	D	1 AP	2 AP
Sr 6	Exigences générales pour les instruments électroniques (révision D 11) *General requirements for electronic instruments*	D	P	Vote CIML
SP 4	MESURES DE LONGUEURS, SURFACES, ANGLES *MEASUREMENT OF LENGTH, AREA, ANGLE*			
Sr 1	Calibres à bouts plans (révision R 30) *End measures of length*	R 30	En attente nouvelle norme ISO *Awaiting new ISO standard*	
Sr 6	Appareils de mesure de la superficie des peaux *Instruments measuring the area of hides*	R	4 AP	P
Sr 7	Terminologie utilisée en métrologie dimensionnelle *Terminology used in dimensional metrology*	D	Étude Sr	P
SP 5S	MESURE STATIQUE DES QUANTITÉS DE LIQUIDES *STATIC MEASUREMENT OF QUANTITIES OF LIQUIDS*			
SR 3	Pipettes automatiques en verre *Glass delivery measures (Automatic pipettes)*	R	4 AP	Étude SP
Sr 4	Seringues médicales *Medical syringes*	R	4 AP	P
Sr 9	Installations pour le jaugeage des camions et wagons citernes *Calibration equipment for road and rail tankers*	D		2 AP
Sr 11	Mesure automatique des niveaux de liquides (révision R 85) *Automatic measurement of the level of liquid in tanks*	R 85	1 AP	2 AP
Sr 12	Mesurage statique de masses de liquides *Direct static mass measuring for quantities of liquids*	R	Étude Sr	3 AP,P

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation*	
			1991	1992
SP 5D	MESURE DYNAMIQUE DES QUANTITES DE LIQUIDES *DYNAMIC MEASUREMENT OF QUANTITIES OF LIQUIDS*			
Sr 1	Ensembles de mesurage de liquides autres que l'eau (compilation) *Measuring assemblies for liquids other than water (compilation)*	R	3 AP	P
Sr 2	Compteurs et ensembles de mesure de liquides cryogéniques (révision R 81) *Meters and measuring systems for cryogenic liquids*	R 81		Préparation
Sr 3	Compteurs d'eau froide (révision R 49) *Cold water meters*	R 49	2 AP	Étude Sr
Sr 7	Étalons de volume utilisés pour la vérification des ensembles de mesure *Standard volume measures used for verification of measuring assemblies*	R	P	Vote CIML
	Tubes étalons utilisés pour la vérification des ensembles de mesure *Pipe provers used for verification of measuring assemblies*	R	3 AP,P	Vote CIML
	Méthodes d'essai de compteurs routiers de carburant liquide *Testing procedures for liquid fuel dispensers*	R	3 AP, P	Vote CIML
Sr 9	Compteurs vortex *Vortex meters*	D	2 AP, P	Vote CIML
Sr 10	Compteurs massiques *Direct mass-flow measuring instruments*	R	P, Vote CIML	CIML
	Rapport d'essai *Test report*			Préparation
SP 6	MESURE DES GAZ *MEASUREMENT OF GAS*			
Sr 1	Compteurs de gaz à parois déformables (révision R 31) *Diaphragm gas meters*	R 31	1 AP	2 AP
Sr 2	Annexe B de R 32 - Compteurs de volume de gaz à pistons rotatifs *Appendix B to R 32 - Rotary piston gas meters*	R 32	Étude Sr	P
	Annexe C - Rapport d'essai *Appendix C - Test report*			Préparation

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation*	
			1991	1992
SP 6	MESURE DES GAZ (suite) *MEASUREMENT OF GAS*			
Sr 4	Mesure des hydrocarbures gazeux distribués par pipeline *Measurement of hydrocarbon gases distributed by pipeline*	D	Étude Sr	4 AP
Sr 9	Correcteurs de volume de gaz *Correctors of gas volumes*	R	1 AP	2 AP
Sr 12	Gaz pour l'étalonnage de calorimètres *Calibration gases for gas calorimeters*	R	1 AP	2 AP
	Instruments de mesure pour la valeur calorifique brute de gaz *Measuring instruments for the gross calorific value of gas*	R	1 AP	2 AP
SP 7	MESURE DES MASSES *MEASUREMENT OF MASS*			
Sr 2	Instruments de pesage électroniques (révision R 74) *Electronic weighing instruments*	R 74	Vote CIML	CIML
Sr 4	Instruments de pesage non automatiques (révision R 76) *Non-automatic weighing instruments*	R 76	CIML	
Sr 5	Instruments de pesage totalisateurs discontinus *Discontinuous totalising weighing machines*	R	Vote CIML	CIML
	Ponts-bascules ferroviaires à fonctionnement automatique *Automatic rail-weighbridges*	R	Vote CIML	CIML
	Instruments de pesage totalisateurs continus (révision R 50) *Continuous totalising weighing machines*	R 50	4 P	Étude SP
	Trieuses pondérales et groupes d'étiquetage poids-prix (révision R 51) *Automatic catchweighing instruments*	R 51	Étude Sr	2 AP
	Doseuses pondérales (révision R 61) *Gravimetric filling instruments*	R 61	4 AP	Étude Sr
Sr 8	Réglementation métrologique des cellules de pesée méthodes et rapport d'essai *Metrological regulations for load cells - Test procedures and report*	R 60		Préparation

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation*	
			1991	1992
SP 8	POIDS *WEIGHTS*			
Sr 1, Sr 5, Sr 6	Spécifications métrologiques pour les poids (compilation) *Metrological specifications for weights (compilation)*	R	P	2 P
SP 9	MESURE DES MASSES VOLUMIQUES *MEASUREMENT OF DENSITY*			
Sr 1	Tables alcoométriques internationales (révision R 22) *International alcoholometric tables*	R 22	Enquête	1 AP
SP 10	INSTRUMENTS DE MESURE POUR VÉHICULES *MEASURING INSTRUMENTS FOR VEHICLES*			
Sr 2	Instruments de mesure de vitesse et distance dans les véhicules (révision R 55) *Speed and distance measuring instruments for vehicles*	R 55	1 AP	2 AP
Sr 3	Taximètres électroniques *Electronic taximeters*	R	Étude Sr	2 AP
SP 11	MESURE DES PRESSIONS *MEASUREMENT OF PRESSURE*			
Sr 3	Manomètres à piston *Pressure balances*	R	3 P	Étude Sr
Sr 4	Manomètres pour pneumatiques (révision R 23) *Tyre pressure gauges*	R 23	3 AP	P
	Manomètres étalons à éléments élastiques *Reference manometers with elastic sensors*	R	P, vote CIML	CIML
	Manomètres usuels à élément élastique (révision R 101) Méthodes et rapport d'essai *Indicating and recording pressure gauges (ordinary instruments)* *Test procedures and report*	R 101	1 AP	Étude Sr
	Caractéristiques des éléments récepteurs élastiques (révision R 53) *Characteristics of elastic sensing elements*	R 53	1 AP	P
Sr 5	Manomètres pour la pression artérielle (révision R 16) *Manometers for instruments measuring blood pressure*	R 16	Étude Sr	4 AP

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation* 1991	1992
SP 12	MESURE DES TEMPÉRATURES ET DE L'ÉNERGIE CALORIFIQUE *MEASUREMENT OF TEMPERATURE AND HEAT*			
Sr 3	Capteurs à résistance de platine, de cuivre ou de nickel Rapport d'essai *Resistance-thermometer sensors made of platinum, copper or nickel - Test report*	R 84	1 AP	Étude Sr
	Thermomètres à résistance de semi-conducteur *Semiconductor resistance thermometers*		Annulé *Cancelled*	
Sr 5	Thermocouples, tables de f.e.m. et tolérances *Thermocouples, tables of EMF and tolerances*	R	Étude Sr	2 AP
Sr 6	Pyromètres à radiation totale *Total radiation pyrometers*	R	Vote CIML	CIML
	Lampes à ruban de tungstène pour l'étalonnage de pyromètres optiques, révision R 48 et rapport d'essai *Tungsten ribbon lamps for calibration of optical pyrometers, revision and test report*	R 48	P	Vote CIML
Sr 7	Thermomètres électriques médicaux à maximum *Clinical electrical thermometers with maximum device* Rapport d'essai *Test report*	R	3 P	Vote CIML Préparation
	Thermomètres électriques médicaux pour mesures continues *Clinical electrical thermometers for continuous measurement* Rapport d'essai *Test report*	R	3 P	Vote CIML Préparation
Sr 8	Compteurs d'énergie thermique (révision R 75) *Heat meters*	R 75		Préparation
	Perturbations électromagnétiques influant les compteurs d'énergie thermique *Electromagnetic disturbances influencing heat meters*	D		1 AP
Sr 9	Méthodes de vérification des thermocouples en métaux usuels *Verification methods for thermocouples of common metals*	R	1 AP	2 AP
SP 13	MESURES ÉLECTRIQUES ET MAGNÉTIQUES *MEASUREMENT OF ELECTRICAL AND MAGNETIC QUANTITIES*			
Sr 3	Compteurs d'énergie électrique active (révision R 46) *Active electrical energy meters*	R 46	Préparation	

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation*	
			1991	1992
SP 14	ACOUSTIQUE ET VIBRATIONS *ACOUSTICS AND VIBRATION*			
Sr 1	Calibreurs acoustiques *Sound calibrators*	R 102	CIML	
	Rapport d'essai *Test report*	R 58,88 R 102	2 AP	3 AP
Sr 2	Audiomètres à son pur *Pure-tone audiometers*	R 104	CIML	
	Rapport d'essai *Test report*			Préparation
	Audiomètres pour la parole *Speech audiometers*	R	1 AP	2 AP
Sr 3	Instruments de mesure de vibrations *Measuring instruments for response to vibration*	R 103	CIML	
	Rapport d'essai *Test report*			Préparation
SP 15	OPTIQUE *OPTICS*			
Sr 1	Frontofocomètres - Rapport d'essai *Focimeters - Test report*	R 93		1 AP
SP 16	RAYONNEMENTS IONISANTS *IONIZING RADIATIONS*			
Sr 3	Mesure des pollutions par radionucléides *Measurement of radionuclide in the environment*	R	1 AP	2 AP
SP 17	MESURE DES POLLUTIONS *MEASUREMENT OF POLLUTION*			
Sr 1	Instruments de mesure des gaz d'échappement Rapport d'essai *Exhaust emission measuring instruments - Test report*	R 99		Préparation
Sr 2	Spectrophotomètres à absorption atomique pour la mesure des polluants métalliques dans l'eau - Rapport d'essai *Atomic absorption spectrometers for measuring metal pollutants in water - Test report*	R 100		Préparation
	Spectromètres à plasma couplés inductivement *Inductively coupled plasma emission spectrometers*	R	1 P	2 P
	Chromatographe en phase gazeuse/spectromètre de masse (révision R 83) *Gas chromatograph/mass spectrometer*	R 83		Préparation

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation* 1991	1992
SP 17	MESURE DES POLLUTIONS (suite) *MEASUREMENT OF POLLUTION*			
Sr 4	Chromatographes à phase liquide de hautes performances pour la mesure de pesticides et autres substances toxiques *High performance liquid chromatographs for measuring pesticide and toxic substances pollution (HPLC)*	R	P	Vote CIML
	Chromatographes en phase gazeuse pour la mesure des pollutions par pesticides (révision R 82) *Gas chromatographs for measuring pollution from pesticides*	R 82		Préparation
Sr 5	Chromatographes en phase gazeuse portatifs pour polluants gazeux *Portable gas chromatographs for gaseous pollutants*	R	P	Étude SP
	Spectromètres rayons X à fluorescence *X-ray fluorescence spectrometers*	R	1 AP	Étude Sr
	Guide d'instruments portatifs pour le prélèvement des pollutions de l'air *Guide to sampling devices for air born pollutants*	D	1 AP	Étude Sr
SP 18	MESURE DES CARACTÉRISTIQUES DES PRODUITS ALIMENTAIRES *MEASUREMENT OF CHARACTERISTICS OF FOOD PRODUCTS*			
Sr 7	Réfractomètres pour des jus de fruits *Refractometers for fruit juice*	R	P, Vote CIML	CIML
SP 19	MESURE DES CARACTÉRISTIQUES DES MATÉRIAUX *MEASUREMENT OF CHARACTERISTICS OF MATERIALS*			
Sr 2	Exigences générales pour les machines d'essai des matériaux (révision R 64) *General requirements for materials testing machines*	R 64		Préparation
	Exigences pour les machines d'essai des matériaux en traction et en compression (révision R 65) *Requirements for machines for tension and compression testing of materials*	R 65		Préparation
Sr 3	Dureté *Hardness*			Étude Sr
Sr 4	Intercomparaison des étalons de dureté *Intercomparison of hardness standards*			Comparaisons

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publication *Status*	Etat de préparation *Stage of preparation*	
			1991	1992
SP 20	PRODUITS PRÉEMBALLÉS *PREPACKAGED PRODUCTS*			
Sr 1	Informations sur l'étiquetage des emballages (révison R 79) *Information on package labels*	R 79		Préparation
Sr 2	Contenu net des préemballages. Annexe C *Net content in packages. Annex C*	R 87	1 AP	
SP 22	PRINCIPES DU CONTROLE MÉTROLOGIQUE *PRINCIPLES OF METROLOGICAL CONTROL*			
Sr 4	Méthodes d'assurance de qualité appliquées dans le contrôle métrologique *Quality assurance methods applied to metrological controls*	D	P	2 P
SP 23	MÉTHODES ET MOYENS D'ATTESTATION DES DISPOSITIFS DE VÉRIFICATION *METHODS AND MEANS USED FOR CERTIFICATION OF VERIFICATION DEVICES*		Activités en attente de nouvelle structures *Activity pending new structures*	
Sr 4	Principes du contrôle métrologique des dispositifs de vérification *Principles for metrological conrol of devices used for verification*	D	Étude Sr	Publication
SP 26	INSTRUMENTS DE MESURE UTILISÉS DANS LE DOMAINE DE LA SANTÉ *MEASURING INSTRUMENTS USED IN THE FIELD OF HEALTH*			
Sr 1	Chambres pour numération des globules sanguins *Blood cell counting chambers*	R		P
Sr 4	Électrocardioscopes (Appendice 1)	R 90	P	Vote CIML
	Électrocardioscopes et électrocardiographes numériques (Appendice 2) *Digital electrocardioscopes and electrocardiographs*			
	Représentation des caractéristiques des instruments de mesure bio-médicaux *Presentation of metrological characteristics of bio-electrical measuring instruments*	D	P	Vote CIML
Sr 4	Électrodes pour cardiographes et encéphalographes *Electrodes for cardiographs and encephalographs*	R	P	Vote CIML
Sr 6	Ergomètres *Ergometers*	R	Préparation	1 AP

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation* 1991	 1992
SP 26	INSTRUMENTS DE MESURE UTILISES DANS LE DOMAINE DE LA SANTÉ (suite) *MEASURING INSTRUMENTS USED IN THE FIELD OF HEALTH*			
Sr 7	Photomètres à absorption *Absorption photometers*	R	Préparation	1 AP
SP 27	PRINCIPES GÉNÉRAUX D'UTILISATION DES MATÉRIAUX DE RÉFÉRENCE *GENERAL PRINCIPLES FOR THE USE OF REFERENCE MATERIALS*		Coopération avec ISO/REMCO	
SP 30	MESURES PHYSICO-CHIMIQUES *PHYSICO-CHEMICAL MEASUREMENTS*			
Sr 1	Échelle de pH des solutions aqueuses (révision R 54) *pH scale for aqueous solutions*	R	Activité en attente décision CIML *Activity pending decision CIML*	
Sr 2	Méthodes de mesure de la conductivité des électrolytes *Methods of conductivity measurement of electrolytic solutions*	R	P	
	Shéma de hiérarchie en conductométrie *Hierarchy scheme of conductometry*	D	P	
	Solutions-étalons de conductivité (révision R 56) *Standard solutions for conductivity*	R 56	1 AP	2 AP
	Étalonnage des cellules de conductivité (révision R 68) *Calibration of conductivity cells*	R 68	1 AP	2 AP
	Solutions pour la vérification de conductomètres *Solutions for the verification of conductometers*	R		Préparation
Sr 3	Échelle d'humidité relative de l'air utilisant des solutions salines saturées *Scale of relative humlidity of air using saturated salt solutions*	R		Étude SP
Sr 4	Vérification des dispositifs thermogravimétriques pour la mesure de l'humidité des solides *Verification of thermogravimetric devices for measuring the moisture content of solids*	R	P	
Sr 9	Liquides étalons pour l'étalonnage de viscosimètres *Standard liquids used for the calibration of viscometers*	R	Vote CIML	CIML
	Viscosimètres à bille. Méthodes d'étalonnage *Falling-ball viscometer. Calibration methods*	R		Étude SP

Secrétariat	Titres abrégés des sujets *Short-form titles of subjects*	Forme de publi-cation *Status*	Etat de préparation *Stage of preparation*	
			1991	1992
SP 30	MESURES PHYSICO-CHIMIQUES (suite) *PHYSICO-CHEMICAL MEASUREMENTS*			
Sr 9	Mesure de viscosité cinématique par des viscosimètres étalons *Measurement of kinematic viscosity by standard viscometers*	R	Étude Sr	P
Sr 10	Méthodes et moyens pour la vérification des instruments de mesure de la teneur pondérale des polluants dans l'air *Methods and means for the verification of instruments measuring the mass concentration of pollutants in air*	R	2 P	Étude SP
SP 31	ENSEIGNEMENT DE LA MÉTROLOGIE *TEACHING OF METROLOGY*		Activité en attente nouvelles structures *Activity pending new structures*	
	Programme des cours de mesures thermiques *Programme of the thermotechnical measurement course*	D		
	Programme des cours de mesures physico-chimiques *Programme of the physico-chemical measurement course*	D		

NOUVELLE ÉDITION DE LA RECOMMANDATION OIML SUR LES INSTRUMENTS DE PESAGE A FONCTIONNEMENT NON AUTOMATIQUE

Depuis la fin de janvier 1992 est disponible la nouvelle édition de la Recommandation Internationale OIML R 76: *Instruments de pesage à fonctionnement non automatique,* Partie 1: *Exigences métrologiques et techniques - Essais.* Cette nouvelle édition remplace l'édition précédente datée de 1988.

En fait, il s'agit d'une refonte assez fondamentale des anciennes dispositions OIML sur les instruments de pesage à fonctionnement non automatique. Les exigences métrologiques essentielles (erreurs maximales tolérées en particulier) ont cependant été conservées, ce qui permet aux instruments de pesage actuellement en utilisation de continuer à satisfaire à ces exigences. Un gros effort a par contre été réalisé par le groupe de travail OIML, auquel de nombreux constructeurs ont participé, pour éliminer dans toute la mesure du possible les exigences à caractère trop technique qui risquaient de freiner les progrès en la matière. Elles ont été remplacées par des exigences écrites en termes de performances métrologiques que les instruments doivent atteindre, les constructeurs étant totalement libres de trouver des solutions techniques adéquates.

C'est ainsi que beaucoup de dispositions ou d'exigences relatives aux sécurités de fonctionnement des dispositifs électroniques, aux interfaces, etc. ont disparu.

Les procédures d'essai ont fait également l'objet d'un réexamen profond, pour inclure les instruments de classe I mais aussi afin de permettre aux divers services nationaux chargés des approbations de modèle et des vérifications d'effectuer ces essais de manière harmonisée, et ainsi de faciliter la reconnaissance au niveau international des résultats d'essai.

En particulier en ce qui concerne les programmes d'essai des instruments électroniques, il a été tenu compte des évolutions décidées dans le cadre de la Commission Électrotechnique Internationale. Par ailleurs, les anciens "essais de durabilité" jugés peu utiles ont été remplacés par un "essai de stabilité de la pente" défini sur la base de l'"expérience acquise à ce sujet au Royaume-Uni.

La nouvelle édition de la R 76-Partie 2: *Rapport d'essai de modèle* est actuellement en cours d'impression et devrait être disponible dans le milieu de 1992. Ce fascicule reprend, en les résumant et en les présentant sous forme de tableaux, toutes les exigences de la partie 1 avec des cases vides permettant au responsable des essais d'inscrire les résultats de ceux-ci, soit par un simple "+" indiquant que l'instrument a satisfait à l'essai en question, soit chaque fois que cela est possible en donnant les résultats chiffrés de l'essai.

Un tel rapport d'essai, établi à l'occasion d'une approbation de modèle nationale, peut ensuite être communiqué à l'autorité de métrologie légale d'un autre pays qui peut ainsi prendre connaissance des résultats d'essai et éventuellement délivrer un certificat d'approbation nationale sans répéter tous les essais déjà effectués.

De même, dans le cadre du *Système de Certificats OIML pour les Instruments de Mesure,* la délivrance d'un certificat OIML devra s'accompagner de la délivrance d'un rapport d'essai établi selon OIML R 76-2. Là encore, il est prévu que les autorités nationales accepteront de prendre en considération les résultats d'essai mentionnés dans ces rapports pour accélérer la délivrance de certificats nationaux d'approbation de modèle.

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La réglementation européenne sur les instruments de pesage à fonctionnement non automatique a suivi de près le développement de la R 76-1.

Déjà en 1990 avait été publiée une Directive 90/384/CEE fixant les exigences essentielles applicables à ces instruments. Bien que la Directive ait été publiée un an avant la mise au point définitive de la R 76-1, les exigences contenues ont été exprimées en termes suffisamment généraux afin d'empêcher toute divergence avec les exigences correspondantes adoptées fin 1991 par l'OIML.

En application de cette Directive, la Commission des Communautés Européennes a donné au CEN et au CENELEC le mandat de développer une Norme Européenne d'accompagnement basée sur la Recommandation OIML. L'Association Européenne de Libre Échange, dont les membres font également partie du CEN et du CENELEC, a elle aussi participé à la définition de ce mandat.

Pendant plus d'un an, le Bureau International de Métrologie Légale a en fait assuré directement le développement du projet de Norme Européenne, en liaison étroite avec les experts de France et d'Allemagne, coresponsables des travaux de l'OIML dans ce domaine – l'Allemagne assurant par ailleurs la présidence du groupe CEN/CENELEC.

Après l'achèvement des travaux OIML, et une fois un projet de Norme Européenne établi en langues anglaise et française sur la base de la nouvelle R 76-1, le comité de normalisation allemand, DIN, a repris en main les tâches jusqu'alors assumées par le BIML et est actuellement en train de préparer les versions finales, en langues allemande, anglaise et française, de la Norme Européenne qui devrait être adoptée puis publiée dans le courant de 1992.

Par rapport à la R 76-1, la Norme Européenne ne présentera que des différences rédactionnelles et formelles; par exemple les "solutions acceptables" exposées dans la Recommandation OIML sont devenues des dispositions de la Norme Européenne. Par ailleurs, les instruments compteurs couverts par la R 76 ont été exclus de la Norme Européenne car la Directive de la CEE ne recouvre pas cette catégorie d'instrument.

Après sa publication, la Norme Européenne devra automatiquement être mise en application sous forme de norme nationale dans les 17 pays européens membres du CEN/CENELEC.

Mentionnons enfin que, dans le cadre du BCR (Bureau Communautaire des Références), se déroule actuellement une intercomparaison de résultats d'essai portant sur plusieurs modèles d'instruments de pesage. Les enseignements tirés de cette intercomparaison seront mis à profit, dans le cadre de l'OIML aussi bien qu'au niveau européen, pour parfaire les essais décrits dans la R 76-1 et dans la Norme Européenne.

NEW EDITION OF THE OIML RECOMMENDATION ON NONAUTOMATIC WEIGHING INSTRUMENTS

From end January 1992 the new edition is available of the International Recommendation OIML R 76 - *Nonautomatic weighing instruments,* Part 1: *Metrological and technical requirements - Tests*. This new edition replaces the preceding edition dated 1988.

The new edition represents in fact a quite fundamental revision of the OIML provisions for nonautomatic weighing instruments. Although the essential metrological requirements (in particular the maximum permissible errors) have been maintained so as to permit already existing weighing instruments to continue to be used, great efforts have been made by the OIML working group with which many manufacturers have cooperated, to eliminate as much as possible those technical requirements which could slow down development. These are replaced by requirements written in the form of metrological performance to be attained, the manufacturers being totally free to choose the appropriate technical solutions.

Several provisions or requirements concerning the operational security of the electronic devices, interfaces etc have thus been cancelled.

The test procedures have also been fully revised to include class I instruments and also to enable the various national metrology services responsible for pattern approval and verification to make tests in a harmonized manner so as to facilitate international recognition of the test results.

For electronic instruments the developments within the framework of the International Electrotechnical Commission have been taken into account as regards the test programmes. The former "durability tests" have been considered of little use and have been replaced by a "span stability test" defined on basis of the experience gained in the U.K. on this subject.

The new edition of R 76-Part 2: *Pattern evaluation report* is *presently* in press and will be available by the middle of 1992. This booklet summarizes in the form of tables the requirements of part 1 whereby the empty spaces should be used by the responsible testing metrologists to record the test results either by a simple "+" which indicates that the instrument conforms to the corresponding requirement, or whenever this is possible, by indicating the test result in figures.

Such a test report established during a national pattern approval may thereafter be communicated to the legal metrology authority of another country which is thus informed of the test results and has the possibility to issue a national pattern approval without repeating all the tests which have already been made.

In a similar way, within the framework of the *OIML Certificate System for Measuring Instruments* the issuing of an OIML certificate shall be accompanied by a test report established according to OIML R 76-2. Here again it is foreseen that the national authorities accept to take into account the test results mentioned in these reports so as to accelerate the issuing of national pattern approvals

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The European regulations on nonautomatic weighing instruments have closely followed the developments of R 76-1.

The Directive 90/384/EEC establishing the essential requirements for these instruments was published already in 1990. Although this Directive was published one year before the finalizing of the new version of R 76-1, the requirements are expressed in sufficiently general terms so as to avoid contradictions with the corresponding requirements adopted later by OIML.

The Commission of the European Communities has in application of the Directive mandated CEN and CENELEC to develop an accompanying European Standard based on the OIML Recommendation. The European Free Trade Association of which the countries also are members of CEN and CENELEC, have also participated in defining this mandate.

For more than one year the development of the draft of this European Standard was in fact handled directly by the International Bureau of Legal Metrology in close cooperation with the experts from France and Germany which together are in charge of the OIML activity in this field, Germany holding the chairmanship of the CEN/CENELEC working group.

After the completion of the work within OIML and once the draft European Standard based on the new R 76-1 had been written in English and French, the German Standardizing body DIN took over the work previously carried out by BIML and is presently preparing the final versions of the German, English and French versions of the European Standard which is planned to be adopted and published in 1992.

The European Standard will, compared to R 76-1, not certain other than editorial or formal differences. As an example the "acceptable solutions" contained in the OIML Recommendation become provisions in the European Standard. The counting instruments covered by R 76 will be excluded in the European Standard as the EEC Directive does not cover this kind of instruments.

After its publication the European Standard will automatically be applied as national standard in the 17 European member countries of CEN/CENELEC.

It may also be mentioned that within the framework of BCR (Bureau Communautaire des Références) there are presently intercomparisons of test results on several patterns of weighing instruments. The outcome of these intercomparisons will be used by OIML as well as on European level to perfectionnate the tests described in R 76-1 and in the European Standard.

SYMPOSIUM EUROLAB

500 participants de 25 pays se sont rencontrés, du 28 au 30 janvier 1992 à Strasbourg, pour échanger leurs expériences et points de vue sur l'assurance et la gestion de la qualité dans les laboratoires d'essais et d'analyses. Cet événement a constitué la première grande manifestation d'EUROLAB, l'Organisation pour les essais en Europe, créée à Bruxelles le 27 avril 1990.

Les Comités Nationaux d'EUROLAB dans les pays appartenant à la CEE et l'AELE ont attiré l'adhésion à EUROLAB de quelques 800 laboratoires impliqués dans le domaine de la R & D en matière d'élaboration de méthodes d'essais et de normes, ainsi que dans la fourniture de prestations d'essais et d'étalonnage liées à la certification.

Le 1er Symposium EUROLAB a démontré le besoin de constituer un forum pour la communauté des laboratoires d'essais et a été l'occasion d'échanges fructueux entre praticiens des laboratoires, organismes d'accréditation, institutions européennes et utilisateurs d'essais (industrie, consommateurs...).

Le thème choisi pour le Symposium – l'assurance et la gestion de la qualité dans les laboratoires – est d'une actualité toute particulière, compte tenu de la contribution attendue des laboratoires pour l'amélioration de la qualité et de la sécurité des produits et la protection de l'environnement; d'autre part, ce thème a permis aux laboratoires de démontrer leur volonté d'apporter leur soutien actif à la reconnaissance internationale des résultats des essais afin d'éviter à leurs clients leur répétition inutile.

En concluant le Symposium, M. Alan BRYDEN, Président d'EUROLAB et Directeur Général du Laboratoire National d'Essais a déclaré que, "conforté par le succès de ce 1er symposium, EUROLAB et ses Comités Nationaux vont développer et renforcer leurs activités et leur coopération avec les organismes d'accréditation et les instituts de normalisation pour améliorer et harmoniser la qualité des prestations d'essais et d'analyses au service de l'industrie et des consommateurs européens".

Secrétariat EUROLAB
1, rue Gaston Boissier
75015 PARIS
Tél.: (1) 40 43 38 33
Fax: (2) 40 43 37 37

Note: les Actes du Congrès (760 pages) sont disponibles auprès du Secrétariat EUROLAB (990 FF. HT.).

EUROLAB SYMPOSIUM

500 participants from 25 countries met, from January 28 to 30, in Strasbourg (France), to exchange views and experience on quality management and assurance in testing and analytical laboratories. This was the first large scale manifestation of EUROLAB, the organisation for testing in Europe, created in Brussels on April 27, 1990.

EUROLAB national committees in the countries belonging to EEC and EFTA have attracted a membership of some 800 laboratories, involved in R & D associated to the development of test methods and standards and in providing testing and calibration services in connection with conformity assessment.

The First EUROLAB Symposium demonstrated the need for providing a forum for the testing Community and was the occasion for fruitful exchanges between the laboratory practitioners, the accreditation bodies, European authorities and users of tests (industry, consumers...).

The main topic chosen for the presentation – quality management and assurance in laboratories – is of particular relevance considering the contribution expected from laboratories both to provide expert back-up to the improvement of quality and safety of products and the control of the environment and to facilitate the international acceptance of their results to avoid unnecessary duplication for their customers.

Comforted by the success of this First Symposium, EUROLAB and its national Committees will develop and reinforce their activities and their cooperation with accreditation bodies and standardization institutes to improve and harmonize the quality of testing and analytical services available for the European industry and users.

EUROLAB Secretariat
1, rue Gaston Boissier
75015 PARIS
Phone: (33) (1) 40 43 38 33
Fax: (33) (1) 40 43 37 37

Note: the proceedings of the Symposium (760 pages) are available at the EUROLAB Secretariat (FF 990 VAT excluded).

INFORMATION

MEMBRES DU COMITÉ

BRÉSIL – Le nouveau représentant au sein du CIML est Monsieur Cláudio Luiz FRÓES RAEDER, Président de l'INMETRO.

RÉPUBLIQUE DE CORÉE – Le nouveau membre est Monsieur Young-Chang KIM, Directeur de la division de métrologie du Bureau de Normalisation de ce pays.

MEMBRES CORRESPONDANTS – L'OUGANDA et le YEMEN ont récemment été admis comme membres correspondants de l'OIML.

ALLEMAGNE – Les dates des cours de métrologie annoncés dans le Bulletin N° 125, décembre 1991, ont été changées. Ces cours auront lieu comme suit:

- OIML-DAM-PTB Training course in the verification of weighing instruments du 22 juin au 3 juillet 1992
- Workshop on Medical Measuring Instruments du 17 au 28 août 1992.

Un symposium international en coopération avec IMEKO TC 12 sur la mesure de températures, intitulé TEMPERATUR 92, aura lieu du 8 au 9 octobre 1992 à Düsseldorf lors de l'exposition INTERKAMA. Pour obtenir des renseignements, s'adresser à

VDI/VDE Gesellschaft
Mess und Automatisierungstechnik
Postfach 101139
D-4000 Düsseldorf 1

CUBA – Le Comité d'État de Normalisation de Cuba a l'intention d'organiser du 23 au 26 mars 1993 son deuxième symposium international sur la métrologie. Une exposition internationale des instruments de mesure aura également lieu en liaison avec cette manifestation. Pour davantage de renseignements, s'adresser à

Monsieur Javier Acosta Alemany
Director of International Relations
Comité Estatal de Normalización
Egido 610, Habana Vieja, Cuba

Téléphone: 53-7-61-2068
Télex: 512245 cen
Fax: 53-7-62-7657

FINLANDE – La treizième conférence d'IMEKO sur la mesure de forces et de masses aura lieu à Helsinki du 10 au 14 mai 1993. Les sujets à traiter comprennent entre autres les étalons et les comparateurs de masses, méthodes d'étalonnage et de vérification d'instruments de pesage, pesage automatique, mesures de débit massique, capteurs, etc. Les auteurs d'exposés doivent faire parvenir des sommaires avant le 31 mai 1992 à l'adresse suivante:

Finnish Society of Automation
Asemapäällikönkatu 12 C
SF-00520 Helsinki, Finland

Téléphone: Int. + 358 0 1461 644
Fax: Int. + 358 0 1461 650

FRANCE – Un certain nombre d'écoles et d'instituts français organisent fréquemment des cours de formation de courte durée pour ingénieurs et techniciens. Nous indiquons ci-dessous les titres d'une sélection de ces cours qui auront lieu dans le deuxième semestre de 1992:

Laboratoire National d'Essais, 1 rue Gaston Boissier, 75015 Paris

Titres	Dates
Métrologie dans les laboratoires d'analyse.	6-8 octobre 1992
Métrologie pratique des températures.	17-18 novembre1992
Assurance qualité dans un laboratoire de métrologie: mise en place, exploitation.	24-25 novembre 1992

École Centrale de Lyon, Formation permanente, 36 avenue Guy de Collongue, BP 163, 69131 Écuilly Cedex

Titres	Dates
Technique de la mesure électrique industrielle et de laboratoire.	15-17 septembre 1992
Pesage industriel.	28 sept.- 2 oct. 1992
Gestion et étalonnage des moyens de mesure dimensionnelle.	6-9 octobre 1992 *
L'assurance qualité en mesure de la pollution atmosphérique et en analyse des gaz: application à l'étalonnage et à l'intercalibrage des analyseurs.	12-16 octobre 1992 *
Méthodes modernes optiques de mesure. Application aux lasers.	19-23 octobre 1992
Contrôle des doseuses et trieuses pondérales: utilisation des méthodes statistiques.	17-19 novembre 1992
Les mesures thermiques dans l'industrie.	17-20 novembre 1992
Débitmétrie.	24-27 novembre 1992
Capteurs et circuits associés.	8-11 décembre 1992
La mesure des pressions dans l'industrie.	15-17 décembre 1992 *

* Ces cours auront lieu à l'école des mines de Saint-Étienne.

ROYAUME-UNI – Une conférence internationale sur le thème pesage, étalonnage et normes de qualité est organisée à Sheffield du 12 au 13 mai 1992 par l'autorité régionale South Yorkshire Trading Standards Unit. Des renseignements peuvent être obtenus à l'adresse ci-dessous:

Mr M.J. Buckley
South Yorkshire Trading Standards Unit
Thorncliffe Lane
Chapeltown
Sheffield S30 4XX
United Kingdom
Téléphone: 44-742 463491
Fax: 44-742 402536

Le laboratoire national dans le domaine de la mécanique et des fluides, le National Engineering Laboratory (NEL), a commencé d'éditer un bulletin bi-annuel intitulé Flow Tidings.

Le cours annuel de débitmétrie "Basic principles and practice in flow measurements" aura lieu au NEL du 11 au 15 mai 1992. S'adresser à

National Engineering Laboratory
East Kilbride G75 OQU
United Kingdom

Le National Weights and Measures Laboratory (NWML) organise un cours de métrologie légale pour étrangers d'une durée de trois semaines à partir du 1er juin 1992. Pour obtenir des renseignements et l'inscription, s'adresser à

Mr C.B. Rosenberg
Course coordinator
National Weights and Measures Laboratory
Stanton Avenue
Teddington, Middlesex TW11 OJZ

ROUMANIE – L'Institut National de Métrologie a commencé d'éditer une revue intitulée MÉTROLOGIE qui constitue la succession de "Metrologia aplicata" dont la publication était interrompue en 1989 et 1990. Il y aura 6 parutions par an, les articles seront normalement en roumain mais avec des résumés en français et en anglais. Pour les abonnements ou échanges de publications, s'adresser à

Institutul National de Métrologie
Sos. Vitan Bîrzesti 11
75669 BUCAREST
Roumanie

ISO – L'adoption dans les différents secteurs d'activité de beaucoup de pays de la série de normes ISO 9000 a conduit cette Organisation à éditer un bulletin de gestion de la qualité dont la version française s'intitule ISO 9000 INFO. Ce bulletin paraîtra 6 fois par an et donnera des informations à jour sur

- les *normes de la série ISO 9000,* leur élaboration et leurs *révisions futures* probables;
- l'adoption et l'application de la *série ISO 9000* dans le cadre d'initiatives en matière d'assurance de la qualité des *entreprises*;
- la mise en place et le fonctionnement de procédures de certification ou d'enregistrement par tierce partie *attestant la conformité avec les normes de la série ISO 9000;*
- les sources d'information concernant des programmes de *formation* pour *responsables qualité* et auditeurs systèmes qualité;
- l'élaboration de programmes visant la *reconnaissance multinationale* de la conformité aux normes ISO 9000 sur la base de la reconnaissance obtenue dans un pays donné;
- les manifestations prévues concernant les systèmes de gestion de la qualité, à savoir un calendrier QM: *symposia, prix, journées d'étude, conférences.*

Pour les abonnements de ISO 9000 INFO, s'adresser au

Secrétariat central de l'ISO
Case postale 56
CH-1211 GENÈVE 20
Suisse

INFORMATION

CIML MEMBERS

BRAZIL – The new CIML member is Mr Cláudio Luiz FRÓES RAEDER, President of INMETRO.

REPUBLIC of KOREA – The new member is Mr Young-Chang KIM, Director of the metrology division of the Korean Bureau of Standards.

CORRESPONDING MEMBERS – UGANDA and YEMEN have recently been admitted as corresponding members of OIML.

GERMANY – The dates of the metrology courses announced in the Bulletin N° 125, December 1991 have been changed. These courses will now take place as follows;

– OIML-DAM-PTB Training course in the verification of weighing instruments from 22 June to 3 July 1992

– Workshop on Medical Measuring Instruments from 17 to 28 August 1992.

An international symposium in cooperation with IMEKO TC 12 on temperature measurements, TEMPERATUR 92, will take place 8 to 9 October 1992 at Düsseldorf in connection with the INTERKAMA exhibition. For details contact

VDI/VDE Gesellschaft
Mess und Automatisierungstechnik
Postfach 101139
D-4000 Düsseldorf 1

CUBA – The State Committee for Standardization plans to organize its second international symposium on metrology from 23 to 26 March 1993. An international exhibition of measuring instruments is also organized jointly with this event. For particulars contact

Mr Javier Acosta Alemany
Director of International Relations
Comité Estatal de Normalización
Egido 610, Habana Vieja, Cuba
Telephone: 53-7-61-2068
Telex: 512245 cen
Fax: 53-7-62-7657

FINLAND – The thirteenth IMEKO conferrnce on force and mass measurement will take place in Helsinki from 10 to 14 May 1993. The subjects to be presented comprise among others mass standards and mass comparators, methods of calibration and verification of weighing instruments, automatic weighing, mass flow measurement, sensor technologies and applications etc. Authors shall send summaries before 31 May 1992 to

Finnish Society of Automation
Asemapäällikönkatu 12 C
SF-00520 Helsinki, Finland
Telephone: Int. + 358 0 1461 644
Fax: Int. + 358 0 1461 650

FRANCE – Several French technical universities and institutes organise practical upgrading courses of short duration for engineers and technicians. The titles and dates of some of these courses are reproduced in the French version of the information in this Bulletin.

UNITED KINGDOM – An international conference on weighing, calibration and quality standards will take place at Sheffield on 12 and 13 May 1992. For information please apply to

Mr M.J. Buckley
South Yorkshire Trading Standards Unit
Thorncliffe Lane
Chapeltown
Sheffield S30 4XX
United Kingdom

Telephone: 44-742 463491
Fax: 44-742 402536

The National Engineering Laboratory (NEL) has started to publish a bi-annual news bulletin on flow measurements with the title Flow Tidings.

The annual course in flow measurements takes place at NEL from 11 to 15 May 1992. Enquiries and applications should be addressed to

National Engineering Laboratory
East Kilbride G75 OQU
United Kingdom

The National Weights and Measures Laboratory (NWML) organises a course in legal metrology for overseas weights and measures inspectors with a duration of three weeks starting 1 June 1992. Applications shall be addressed to

Mr C.B. Rosenberg
Course coordinator
National Weights and Measures Laboratory
Stanton Avenue
Teddington, Middlesex TW11 OJZ

ROMANIA – The National Institute of Metrology has started to publish a new review with the title METROLOGIE which is a follow-up of "Metrologia aplicata" the publication of which was interrupted in 1989 and 1990. There will be six issues per year. The papers will generally be in Romanian language but with French and English summaries. For subscription or exchange of publications apply to

Institutul National de Métrologie
Sos. Vitan Bîrzesti 11
75669 BUCAREST
Romania

ISO – The adoption in various activity sectors in many countries of the set of ISO 9000 Standards has led this Organisation to issue a special newsletter on quality management standards. The English edition is called ISO 9000 NEWS. There will be six issues per year which will give up-to-date information on

- the *ISO 9000 series standards,* their development and probable *future revisions;*
- adopting and applying the *ISO 9000* series in *company* quality assurance initiatives;
- setting up and operating independent third-party certification or registration procedures to *acknowledge conformity with ISO 9000* standards;

• information sources on *training* programmes for *quality managers,* and quality systems auditors;

• developing means to achieve *multi-national recognition* of ISO 9000 standards conformance based on recognition in one country;

• upcoming and newsworthy events, a Quality Management Calendar relating to management systems: *symposia - awards - workshops - conferences*

Subcriptions to ISO 9000 NEWS may be addressed to

ISO Central Secretariat
Case postale 56
CH-1211 GENEVA 20
Switzerland

OIML
REUNIONS – MEETINGS *

	Groupes de travail *Working Groups*	Dates *Date*	Lieux *Place*
SP 5D-Sr 3	Compteurs d'eau *Water meters*	Avril/*April* 1992 En liaison avec ISO/TC 30/SC 7 *In connection with* *ISO/TC 30/SC 7*	
SP 5S-Sr 11	Dispositifs de repérage des niveaux de liquides dans les réservoirs *Devices for gauging the levels of liquids in tanks*	18-20 Mai/*May* 1992	DELFT PAYS-BAS *THE NEDERLANDS*
SP 14-Sr 1	Instruments de mesure du son *Measuring instruments for sound*	11-12 Mai/*May 1992*	BIML, PARIS
SP 14-Sr 2	Instruments de mesure d'audiologie *Measuring instruments for audiology*		
SP 6-Sr 1	Compteurs de gaz à parois déformables *Diaphragm gas meters*	2-4 Juin/*June* 1992	DORDRECHT PAYS-BAS *THE NEDERLANDS*
SP 6-Sr 9	Correcteurs de volumes de gaz *Correctors of gas volumes*		PARIS FRANCE
SP 17-Sr 2, Sr 4, Sr 5	Mesure des pollutions *Measurement of pollution*		
SP 26-Sr 4	Instruments de mesure bio-électriques *Bioelectrical measuring instruments*		ALLEMAGNE *GERMANY*
SP 30-Sr 2, Sr 9, Sr 10	Mesures physico-chimiques *Physico-chemical measurements*	1-6 Juillet/*July* 1992	TBILISSI GEORGIE/*GEORGIA*
SP 22-Sr 4	Principes de la vérification primitive et ultérieure des instruments *Principles of initial and subsequent verification of instruments*	Automne/*Autumn 1992*	

* Ces indications doivent toutes êtres confirmées ou complétées
These indications shall all be confirmed or completed

OIML-DAM-PTB Training course in the verification of weighing instruments (in English)	*22 June-3 July 1992*	*MUNICH* *GERMANY*
Séminaire sur les instruments de mesure de la pollution de l'air *Seminar on air pollution measuring instruments*	28 Sept.-1 Oct. 1990	INTERLAKEN SUISSE *SWITZERLAND*
9e Conférence Internationale de Métrologie Légale (et 27e réunion du CIML) *9e International Conference of Legal Metrology (and 27th CIML meeting)*	2-6 November 1992	VOULIAGMENI ATHENES GRECE/*GREECE*

PUBLICATIONS

	Edition
Vocabulaire de métrologie légale *Vocabulary of legal metrology*	1978
Vocabulaire international des termes fondamentaux et généraux de métrologie *International vocabulary of basic and general terms in metrology*	en révision *being revised*
Dictionnaire des essais de dureté (français, anglais, allemand, russe) *Hardness testing dictionary (French, English, German, Russian)*	1991

RECOMMANDATIONS INTERNATIONALES
INTERNATIONAL RECOMMENDATIONS

R 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)*	1973
R 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)*	1973
R 4	— Fioles jaugées (à un trait) en verre *Volumetric flasks (one mark) in glass*	1970
R 5	— Compteurs de liquides autres que l'eau à chambres mesureuses *Meters for liquids other than water with measuring chambers*	1981
R 6	— Dispositions générales pour les compteurs de volume de gaz *General provisions for gas volume meters*	1989
R 7	— Thermomètres médicaux (à mercure, en verre, avec dispositif à maximum) *Clinical thermometers (mercury-in-glass, with maximum device)*	1978
R 9	— Vérification et étalonnage des blocs de référence de dureté Brinell *Verification and calibration of Brinell hardness standardized blocks*	1970
R 10	— Vérification et étalonnage des blocs de référence de dureté Vickers *Verification and calibration of Vickers hardness standardized blocks*	1970
R 11	— Vérification et étalonnage des blocs de référence de dureté Rockwell B *Verification and calibration of Rockwell B hardness standardized blocks*	1970
R 12	— Vérification et étalonnage des blocs de référence de dureté Rockwell C *Verification and calibration of Rockwell C hardness standardized blocks*	1970
R 14	— Saccharimètres polarimétriques *Polarimetric saccharimeters*	1978
R 15	— Instruments de mesure de la masse à l'hectolitre des céréales *Instruments for measuring the hectolitre mass of cereals*	1970
R 16	— Manomètres des instruments de mesure de la tension artérielle (sphygmomano-mètres) *Manometers for instruments for measuring blood pressure (sphygmomanometers)*	1970

R 18	—	Pyromètres optiques à filament disparaissant *Visual disappearing filament pyrometers*	1989
R 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*	1973
R 21	—	Taximètres *Taximeters*	1973
R 22	—	Tables alcoométriques internationales *International alcoholometric tables*	1975
R 23	—	Manomètres pour pneumatiques de véhicules automobiles *Tyre pressure gauges for motor vehicles*	1973
R 24	—	Mètre étalon rigide pour agents de vérification *Standard one metre bar for verification officers*	1973
R 25	—	Poids étalons pour agents de vérification *Standard weights for verification officers*	1977
R 26	—	Seringues médicales *Medical syringes*	1973
R 27	—	Compteurs de volume de liquides (autres que l'eau). Dispositifs complémentaires. *Volume meters for liquids (other than water). Ancillary equipment*	1973
R 29	—	Mesures de capacité de service *Capacity serving measures*	1973
R 30	—	Mesures de longueur à bouts plans (calibres à bouts plans ou cales-étalons) *End standards of length (gauge blocks)*	1981
R 31	—	Compteurs de volume de gaz à parois déformables *Diaphragm gas meters*	1989
R 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*	1989
R 33	—	Valeur conventionnelle du résultat des pesées dans l'air *Conventional value of the result of weighing in air*	1973
R 34	—	Classes de précision des instruments de mesurage *Accuracy classes of measuring instruments*	1974
R 35	—	Mesures matérialisées de longueur pour usages généraux *Material measures of length for general use*	1985
R 36	—	Vérification des pénétrateurs des machines d'essai de dureté *Verification of indenters for hardness testing machines*	1977
R 37	—	Vérification des machines d'essai de dureté (système Brinell) *Verification of hardness testing machines (Brinell system)*	1977
R 38	—	Vérification des machines d'essai de dureté (système Vickers) *Verification of hardness testing machines (Vickers system)*	1977

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

R 40 — Pipettes graduées étalons pour agents de vérification 1977
Standard graduated pipettes for verification officers

R 41 — Burettes étalons pour agents de vérification 1977
Standard burettes for verification officers

R 42 — Poinçons de métal pour agents de vérification 1977
Metal stamps for verification officers

R 43 — Fioles étalons graduées en verre pour agents de vérification 1977
Standard graduated glass flasks for verification officers

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

R 45 — Tonneaux et futailles 1977
Casks and barrels

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

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

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

R 49 — Compteurs d'eau (destinés au mesurage de l'eau froide) 1977
Water meters (intended for the metering of cold water)

R 50 — Instruments de pesage totalisateurs continus à fonctionnement automatique 1980
Continuous totalising automatic weighing machines

R 51 — Trieuses pondérales de contrôle et trieuses pondérales de classement 1985
Checkweighing and weight grading machines

R 52 — Poids hexagonaux. Classe de précision ordinaire de 100 g à 50 kg 1980
Hexagonal weights. Ordinary accuracy class, from 100 g to 50 kg

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

R 54 — Échelle de pH des solutions aqueuses 1981
pH scale for aqueous solutions

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

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

R 57 — Ensembles de mesurage de liquides autres que l'eau équipés de compteurs de volumes. Dispositions générales 1982
Measuring assemblies for liquids other than water fitted with volume meters. General provisions

R 58	—	Sonomètres *Sound level meters*	1984
R 59	—	Humidimètres pour grains de céréales et graines oléagineuses *Moisture meters for cereal grains and oilseeds*	1984
R 60	—	Réglementation métrologique des cellules de pesée *Metrological regulations for load cells*	1991
R 61	—	Doseuses pondérales à fonctionnement automatique *Automatic gravimetric filling machines*	1985
R 62	—	Caractéristiques de performance des extensomètres métalliques à résistance *Performance characteristics of metallic resistance strain gauges*	1985
R 63	—	Tables de mesure du pétrole *Petroleum measurement tables*	1985
R 64	—	Exigences générales pour les machines d'essai des matériaux *General requirements for materials testing machines*	1985
R 65	—	Exigences pour les machines d'essai des matériaux en traction et en compression *Requirements for machines for tension and compression testing of materials*	1985
R 66	—	Instruments mesureurs de longueurs *Length measuring instruments*	1985
R 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*	1985
R 68	—	Méthode d'étalonnage des cellules de conductivité *Calibration method for conductivity cells*	1985
R 69	—	Viscosimètres à capillaire, en verre, pour la mesure de la viscosité cinématique *Glass capillary viscometers for the measurement of kinematic viscosity*	1985
R 70	—	Détermination des erreurs de base et d'hystérésis des analyseurs de gaz *Determination of intrinsic and hysteresis errors of gas analysers*	1985
R 71	—	Réservoirs de stockage fixes. Prescriptions générales *Fixed storage tanks. General requirements*	1985
R 72	—	Compteurs d'eau destinés au mesurage de l'eau chaude *Hot water meters*	1985
R 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*	1985
R 74	—	Instruments de pesage électroniques *Electronic weighing instruments*	en révision *being revised*
R 75	—	Compteurs d'énergie thermique *Heat meters*	1988

R 76	—	Instruments de pesage à fonctionnement non automatique *Nonautomatic weighing instruments*	
		Partie 1 : Exigences métrologiques et techniques - Essais *Part 1 : Metrological and technical requirements - Tests*	1992
		Partie 2 : Rapport d'essai de modèle *Part 2 : Pattern evaluation report*	(*)
R 77	—	Ensembles de mesurage de liquides autres que l'eau équipés de compteurs de volumes. Dispositions particulières relatives à certains ensembles *Measuring assemblies for liquids other than water fitted with volume meters. Provisions specific to particular assemblies*	1989
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R 95	—	Bateaux-citernes - Prescriptions générales *Ships' tanks - General requirements*	1990
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R 99	—	Instruments de mesure des gaz d'échappement des véhicules *Instruments for measuring vehicle exhaust emissions*	1991
R 100	—	Spectromètres à absorption atomique pour la mesure des polluants métalliques dans l'eau *Atomic absorption spectrometers for measuring metal pollutants in water*	1991
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R 102	—	Calibreurs acoustiques *Sound calibrators*	1992
R 103	—	Appareillage de mesure pour la réponse des individus aux vibrations *Measuring instrumentation for human response to vibration*	(*)
R 104	—	Audiomètres à son pur *Pure-tone audiometers*	(*)

DOCUMENTS INTERNATIONAUX
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D 1	—	Loi de métrologie *Law on metrology*	1975
D 2	—	Unités de mesure légales *Legal units of measurement*	en révision *being revised*
D 3	—	Qualification légale des instruments de mesurage *Legal qualification of measuring instruments*	1979
D 4	—	Conditions d'installation et de stockage des compteurs d'eau froide *Installation and storage conditions for cold water meters*	1981

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

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

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

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

D 9 — Principes de la surveillance métrologique — 1984
Principles of metrological supervision

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

D 11 — Exigences générales pour les instruments de mesure électroniques — en révision
General requirements for electronic measuring instruments — *being revised*

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

D 13 — Conseils pour les arrangements bi- ou multilatéraux de reconnaissance des résultats d'essais, approbations de modèles et vérifications — 1986
Guidelines for bi- or multilateral arrangements on the recognition of test results, pattern approvals and verifications

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

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

D 16 — Principes d'assurance du contrôle métrologique — 1986
Principles of assurance of metrological control

D 17 — Schéma de hiérarchie des instruments de mesure de la viscosité des liquides — 1987
Hierarchy scheme for instruments measuring the viscosity of liquids

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General principles of the use of certified reference materials in measurements

D 19 — Essai de modèle et approbation de modèle — 1988
Pattern evaluation and pattern approval

D 20 — Vérifications primitive et ultérieure des instruments et processus de mesure — 1988
Initial and subsequent verification of measuring instruments and processes

D 21 — Laboratoires secondaires d'étalonnage en dosimétrie pour l'étalonnage des dosimètres utilisés en radiothérapie — 1990
Secondary standard dosimetry laboratories for the calibration of dosimeters used in radiotherapy

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

D 23 — Principes du contrôle métrologique des dispositifs utilisés pour les vérifications — (*)
Principles for the metrological control of devices used for verification

(*) Publication en cours d'impression/*Publication being printed.*

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