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# metric measures

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# **metric measures**

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# Metric Convention & International Bureau of Weights & Measures

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HENRI MOREAU

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ON 28 December 1956 the Government of India published the Standards of Weights and Measures Act, 1956, adopting the metric system of weights and measures. Immediately afterwards India gave notice of its adhesion (1957) to the Metric Convention, a decision which thus forms part of the vast programme of reforms undertaken by India with a view to unifying and modernizing its weights and measures and gradually achieving the exclusive use of the metric system.

In the light of this decision it appears opportune to explain to the readers of *Metric Measures*, the origin of the Metric Convention and the functions of the bodies to which it gave rise, in particular, the International Bureau of Weights and Measures.

## Historical Background

It is well-known that the basic idea of those who promoted the reform of weights and measures in France at the end of the 18th century was to ensure that measures throughout the country would be invariable by linking them up with a model taken from nature or a standard of which the size was

adopted from natural phenomena. The new system would thus be founded on a natural unit which could be adopted by all countries without involving national susceptibilities. That is the idea which gave birth to the metric decimal system (Ref. 1).

This fiction of a 'universal natural unit'—originally a specific fraction of a meridian of the earth—gave powerful impetus to the extension of the use of the metric system by facilitating its adoption by other nations. Thus it was that shortly after its creation in France (1793—1795) the metric system began to make progress in other countries. The latter, attracted by the simplicity and the logical and rational conception of the new system, immediately realized what benefits they could obtain from the adoption of the metric system instead of their own more or less complicated systems of weights and measures, none of which could be extended to more than one country. Moreover, this need for a reform of measures on a national level was brought home even more vividly by the first symptoms of the necessity of world unification which arose in connection with the international exhibitions in

London (1851) and Paris (1867); and it thus came about that the 'Committee on Weights and Measures and Currencies' of the latter exhibition recommended that Governments substitute the metric system for the old systems.

All civilized nations thus tacitly recognized that the metric system was a universal system of weights and measures of which the units of length and weight (mass) had been given concrete form by the platinum standards deposited in 1799 at the Archives of the French Republic in Paris\*, whence the names of *Metre des Archives* and *Kilogramme des Archives* given to these standards, which have now become historical. However, those countries which had just adopted the metric system were forced to apply to France for accurate replicas of the standard metre and kilogramme. This dependency on a foreign country and the lack of uniformity in making national metric replicas of the Metre and Kilogramme des Archives threatened to prevent the desirable unification, and the metrologists and scientific organizations of the day could not fail to realize the inherent drawbacks of such a situation.

In 1867 the International Geodesic Conference meeting in Berlin, after noting the systematic differences in the great European triangulations then being made and recommending the metric system as the single system of weights and measures, in the interest of science in general and geodesy in particular, also adopted the following proposals:

(7) 'In order to define the common unit of measurement for all countries in Europe and for all time as accurately and invariably as possible, the Conference recommends the construction of a new European prototype metre. The length of this European metre should differ as little as possible

from that of the Metre des Archives in Paris, and must in any case be compared with it with the greatest accuracy....'

(8) 'The construction of the new prototype metre, as well as the making and comparison of its replicas intended for the various countries, should be entrusted to an international commission in which the Governments concerned would be represented'.

(9) 'The Conference proposes the creation of a European International Bureau of Weights and Measures'.

These proposals, which at the time were confined to the standard of length, were completed and supported by the Academy of Science of Saint Petersburg which, in 1869, suggested to the Academy of Science of Paris that these two institutions should take joint action to persuade the French Government to have new standards made with precise determination of their values by comparison with the Metre and Kilogramme des Archives. Conclusions to the same effect were reached in 1869 by the English Standards Commission. The Government of India, in turn, in view of the innumerable difficulties encountered in trade owing to the infinite variety of measures in use in that country, suggested as early as 1867 that France be asked for a complete series of carefully checked metric measures.

#### The Metric Convention

As a result of these proposals the French Government took the initiative of calling a meeting of representatives of foreign countries in Paris in August 1870. Owing to the Franco-Prussian War, which had just been declared, only fifteen States—out of twenty-four who had responded to the invitation—were able to send delegates, who constituted the *International Metre Commission*. No decision was, therefore, taken at the meeting, and the Commission's work was simply carried on by a 'Preparatory Research Committee' whose task was to study technical questions. Convened again in September

\*And not in Sevres, as stated in *Metric Measures*, Jan. 1959, p. 12.

## METRIC CONVENTION & INTERNATIONAL BUREAU OF WEIGHTS & MEASURES

1872 with the participation of thirty States, eleven of them belonging to the American continent, the International Metre Commission adopted some forty resolutions defining, *inter alia*, the conditions of construction (material, shape, type) of new metric standards and of their comparison with the standards of the Archives, and recommending the creation of an International Bureau of Weights and Measures to be both the place where the metric prototypes should be kept and the centre for the propagation of the metric system.

However, the members of this international Commission, most of whom were scientists and technicians, were not qualified to commit their Governments in connection with the creation of this International Bureau. It was only a few years later that the establishment of this body was officially sanctioned by the Diplomatic Conference on the Metre held in Paris in 1875, which led to the

signature of the *Convention du Metre* (Metric Convention) by the plenipotentiaries of eighteen countries (20 May 1875). This Convention put an end to the active existence of the International Metre Commission, which turned over the execution of its decisions to an International Committee on Weights and Measures.

### The International Bureau of Weights and Measures

Under the Convention of 1875 (amended in 1921 and now under revision) the signatory Governments undertook to found and maintain at joint expense a scientific and permanent *International Bureau of Weights and Measures* whose headquarters were established in France, the cradle of the metric system. The site chosen for these headquarters was the Pavillon de Breteuil estate, situated in the Saint Cloud Park near Paris, which the French Government placed at the disposal of the International Committee of Weights and Measures free of charge.

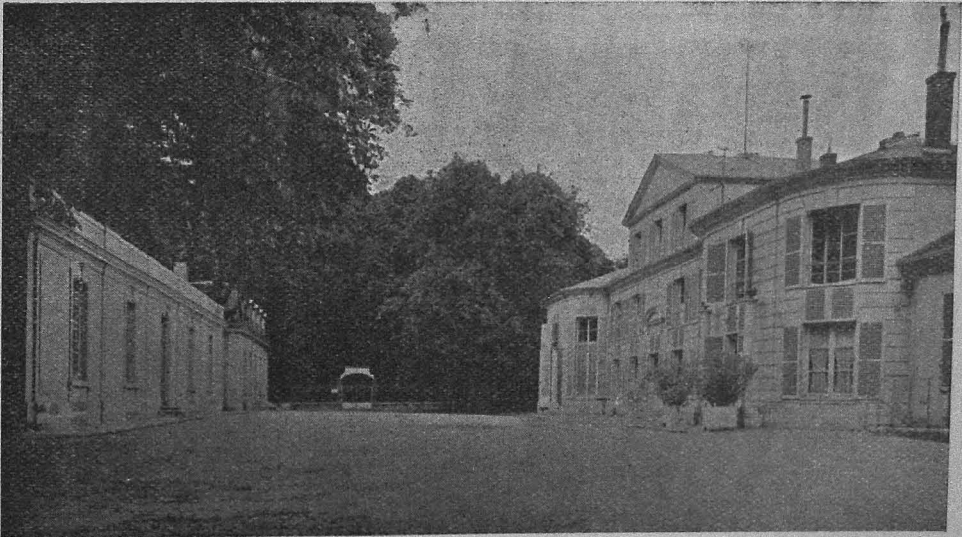


Fig.1 —The Pavillon de Breteuil, Headquarters of the International Bureau of Weights and Measures  
On the Right : Offices, Conference Hall, Residential Buildings.  
On the left : Laboratories.

Originally, the essential task of this International Bureau was to construct and preserve the final standards of the metre and kilogramme, to compare national standards to be supplied to the various countries and to perfect methods of measurement so as to promote progress in all fields of metrology (Ref. 2). In the course of the execution of this programme of work, the activity of the International Bureau was also directed to the study of various metrological problems and physical quantities likely to affect the precision of measurements. For some thirty years past the scope of the International Bureau has also been extended to the field of electrical and photometric units, and at present there is a project to put it in charge of the standards of measurement of ionizing radiations.

From the point of view of organization, the supreme authority under which the International Bureau is placed, is vested in the *General Conference on Weights and Measures*, consisting of delegates of all the countries who have adhered to the Metric Convention (Ref. 3). Normally, this Conference meets every six years in Paris and Sevres. The next session is to take place in October 1960. Its task is to discuss and initiate action for propagating and improving the metric system throughout the world and to sanction the results of fundamental metrological determinations, the various scientific resolutions of international scope and all important decisions relating to the organization and development of the International Bureau.

The decisions of the General Conference are executed by an *International Committee on Weights and Measures*, a Standing Committee which supervises the operation and management of the International Bureau. The International Committee, at present composed of the maximum of 18 members

belonging to different nationalities, meets at least every two years. The present Chairman is a Frenchman (Mr. A. Danjon), the Vice-Chairman is a German (Mr. R. Vieweg) and the Secretary an Italian (Mr. G. Cassinis); the member of Indian nationality is Prof. K. S. Krishnan, Director of the National Physical Laboratory of India.

The International Bureau, composed of scientific, administrative and technical staff comprising some twenty people who may be of any nationality, is managed by a Director (at present a Swiss, Mr. Ch. Volet); the Chairman and Secretary of the International Committee and the Director of the Bureau must be of different nationalities.

The International Bureau is maintained by contributions paid by each Government adhering to the Metric Convention. The Bureau's annual budget (now 400,000 Gold Francs or 131,000 dollars) is shared according to a scale based on the population of each country.

All the States contributing to the maintenance of the International Bureau are co-owners of its assets and equipment. Through it they can obtain first-class standards and are entitled to ask it to make metrological studies, which are undertaken free of charge. However, the States look upon these few material advantages as secondary privileges, for when they adhere to the Metric Convention they do so not merely in their own interest but because, above all, they wish to manifest their desire to collaborate with the other States in advancing the science of metrology, thus recognizing the necessity for all cultured nations to join in promoting world progress by which they themselves will benefit.

#### **Work of the International Bureau** *Standards of Length and Mass*

Immediately after its establishment the International Bureau turned its attention

## METRIC CONVENTION & INTERNATIONAL BUREAU OF WEIGHTS & MEASURES

to ensuring unification of measures of length and mass by the construction and definition of the International Metre and Kilogramme and of their copies to be distributed to all the States which had asked for them.

Studies made by H. Sainte-Claire Deville, had brought out the metrological properties of an alloy of 90 percent platinum and 10 percent iridium and this alloy was selected for the manufacture of the Metres and Kilogrammes.

For the Metres, a 'line standard' with an X-shaped cross-section calculated by H. Tresca was adopted. The advantage of this cross-section is that it has a high moment of inertia—which is the measure of the resistance of the bar to deformations—for a small quantity of material and permits of engraving lines on the plane of its neutral axis which remains exposed throughout

the length of the bar, so that the length of the standard is not affected by deflection under its own weight, whatever may be the method of supporting it. For Kilogrammes the same shape as that of the Kilogramme des Archives was retained: a perfectly polished cylinder having a diameter (39 mm) equal to its height, with very slightly rounded edges.

Once the Metres had been constructed, an important intercomparison was undertaken in 1888 of all the bars, to which had been added a provisional prototype compared directly with the Metre des Archives in 1882. On completion of these comparisons the bar of which the measurements were closest to those of the Metre des Archives was selected as the International Prototype Metre. The International Prototype Kilogramme was selected as early as 1883 following comparisons made between the

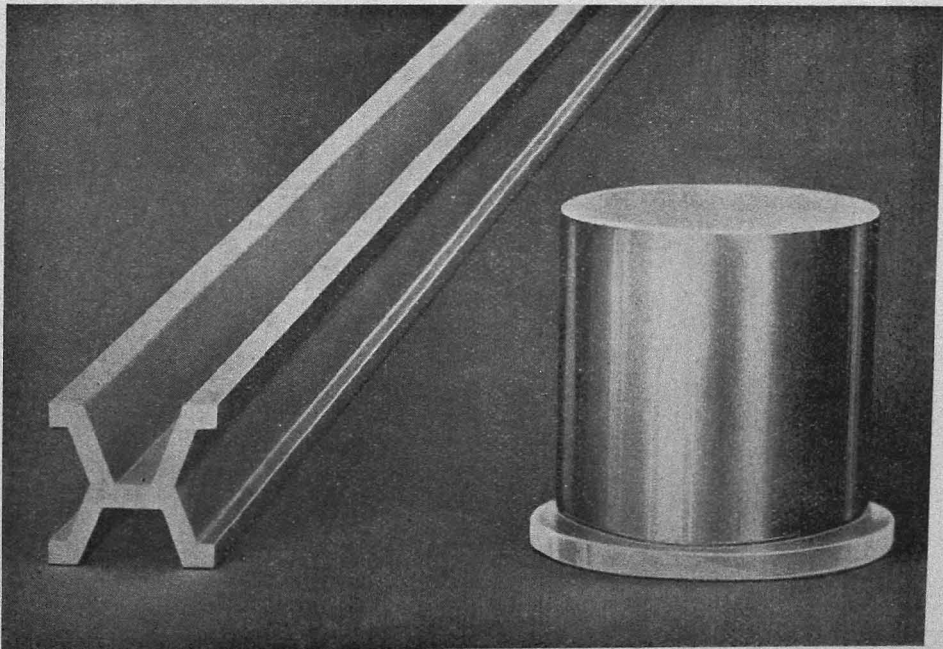


Fig. 2.—The International Prototypes of the Metre and Kilogramme (full size).

Kilogramme des Archives and three standards constructed in 1879, as it was found that the mass of one of them was practically the same as that of the Kilogramme des Archives. This method of selecting the International Kilogramme was dictated by the necessity of avoiding risks of wear and accidents and substantially reducing the number of weighings required to determine some forty national kilograms constructed about 1884. The International Prototypes and their 'companion replicas' are deposited in one of the vaults of the Pavillon de Breteuil 8 m below the ground, to which access can only be had by means of three keys in the possession of three different people: the Chairman of the International Committee, the Director of the Archives of France and the Director of the International Bureau.

In September 1889 the First General Conference on Weights and Measures sanctioned the results of this important work and lots were drawn for the general distribution of the national prototypes among the various States (Ref. 4). This was also the date when the new definitions of the metre and kilogram were sanctioned (length at 0°C and mass of the International Platinum-iridium Prototypes kept at the Pavillon de Breteuil in Sevres) which were substituted for the original definitions founded on a natural unit: one ten-millionth of the quadrant of the earth's meridian for the metre, mass of a cubic decimetre of water for the kilogram. Indeed, it would have been difficult to maintain these latter definitions, as they would have led to new values for the standards on each new measurement of the meridian and the mass of a cubic decimetre of water.

With regard to the metre, the 1889 definition in terms of an arbitrary *material* standard will very probably be changed at the end of 1960, a definition in terms of a *natural*

phenomenon, the length of a light-wave, being reverted to. As early as the end of the last century the International Bureau was studying the question of constituting a secondary natural basis for the unit of length. This work led to the first determination of the value of the wave-length of the lines of the cadmium spectrum in terms of the metre (A.A. Michelson and J. R. Benoit, 1892-1893), thus definitely fixing the spectroscopic scale in terms of the metric unit. One of these lines (the red line  $\lambda = 0.643\ 846\ 96\mu$ ) was taken for the two fold purpose of furnishing a secondary natural standard for the metre and the fundamental reference for light-waves. Although so far the permanency of the platinum-iridium Prototype has been confirmed within the present limits of precision of the measurements of line standards (approximately  $0.1\mu$ ), it cannot be asserted that no doubt will be thrown on this stability by new and more accurate means of observation to within one-hundredth of a micron. It was, therefore, wise to contemplate reverting to a natural standard which could be reproduced as desired in all places, whereas a material standard, subject to inevitable variations, must necessarily be kept in a specific place and open to dangers of destruction.

The idea of linking the unit of length to a quantity in terms of a physical phenomenon ensuring permanent stability is of very long standing. As early as 1829 the French Physicist, J. Babinet made the suggestion of using the length of a light-wave as a natural standard of length. But it has only been during the last few years that the favourable possibilities of the use of such a standard have been definitely brought out by the considerable research on the interference of light-waves carried out at the International Bureau and in the large national metrological laboratories, at the request



of the General Conference on Weights and Measures in 1948. The additional knowledge thus gained about the structure of radiations and, above all, the recent developments of light sources the monochromatic radiations of which afford hitherto unattained metrological accuracy, led the International Committee, in October 1858, to adopt a draft resolution recommending\* the definition of the metre as the length equal to 1 650 763.73 wave-lengths *in vacuo* of the orange radiation ( $2p_{10}-5d_5$ ) of the krypton atom of atomic mass 86. At its eleventh session, in October 1960, the General Conference on Weights and Measures will have to take a decision on this new definition, which will make it possible to define the metre with an accuracy of  $10^{-9}$  ( $0.001 \mu$  for 1 m), or 100 times greater than with the present platinum-iridium standard. To this increased accuracy will be added the advantages of reproducibility, indestructibility and universality of the natural reference standard constituted by the length of a light-wave.

Apart from periodic verifications of national prototype metres and kilograms, which is one of its essential tasks, the International Bureau has carried out numerous activities of which the following account is merely a brief outline:

(1) studies in barometry, hygrometry and thermometry (gas thermometers, properties of thermometric liquids for low temperatures, glass and fused quartz mercury thermometers, etc.);

(2) determination of the expansion of solids and liquids, the density of water, solids and gases;

(3) studies of flat and spherical ended gauges, methods of calibration of line standards and series of masses, elasticity and deformation of solids;

(4) research on nickel steels (development by Ch. Ed. Guillaume of the *invar*,

*elinvar*, *anibal*, *platinite*, *nichrome* alloys used in metrology, chronometry and industry);

(5) determination of the volume of one kilogram of water, leading to the adoption of the relation 1 litre = 1.000 028 cubic decimetres;

(6) development and improvement of the Jaderin method of measurement of geodesic bases by means of *invar* geodesic wires, and calibration of these wires;

(7) interferential research (index of the air, end standards made of crystallized quartz ends, studies of spectral lines and measurement of wave-lengths, measurement of gauges of the Johansson type, etc.);

(8) determination of the acceleration due to gravity (an absolute measurement of *g* made in 1958 at the Pavillon de Breteuil by the method of the free fall of a divided scale, gives a new proof that the value of the Potsdam reference system, the revision of which is now under discussion, is too high).

In another field, that of the unification of measures, the International Bureau has had occasion to define the metric equivalence of certain national units, both old ones and others which are still legal, such as French and foreign toises, the yard and pound. It is also consulted on questions relating to measures, and was recently responsible for the international investigation which led to the development of the International System of Units (SI) for international relations. This system based on the six fundamental units: metre, kilogram (mass), second, ampere, degree Kelvin, candela, was adopted by the Tenth General Conference on Weights and Measures in October 1954.

All this work is reported in the 21 volumes of the *Travaux et Memoires* of the International Bureau, the *Procès-Verbaux* of the meetings of the International Committee and in various scientific periodicals, both French and foreign.

*Electrical and Photometric Units*

In 1927 and 1933 the Seventh and Eighth General Conferences on Weights and Measures instructed the International Bureau to take charge of keeping the standards of electric and photometric units, to compare them with the national standards and to study the improvements to be made in the standards, measuring instruments and methods of observation in these fields.

Following up these decisions the principal national laboratories (Ref. 5) were requested to send periodically to the International Bureau secondary electric standards (1-ohm resistances and Weston cells) and photometric standards (electrical incandescent lamps) so that they could be compared with each other. The values attributed to these secondary standards represent the magnitude of the unit made in each national laboratory, as found from absolute determination of the ohm and ampere (*i.e.*,

directly in terms of the fundamental mechanical quantities: length, mass and time) and from the primary standard of light (black body at the solidification temperature of platinum).

The results of these periodical comparisons make it possible to calculate the relative value of national electrical and photometric units and to give the standards kept at the International Bureau a value in a *mean international unit*, the said standards being international prototypes of the ohm, volt, candela and lumen. In this way the International Bureau ensures world-wide unification of the units of electricity and light just as it ensures unification of the units of length and mass, though by different methods.

**Advisory Committees of the International Committee on Weights and Measures**

In view of the considerable expansion of the scope of work of the International Bureau,

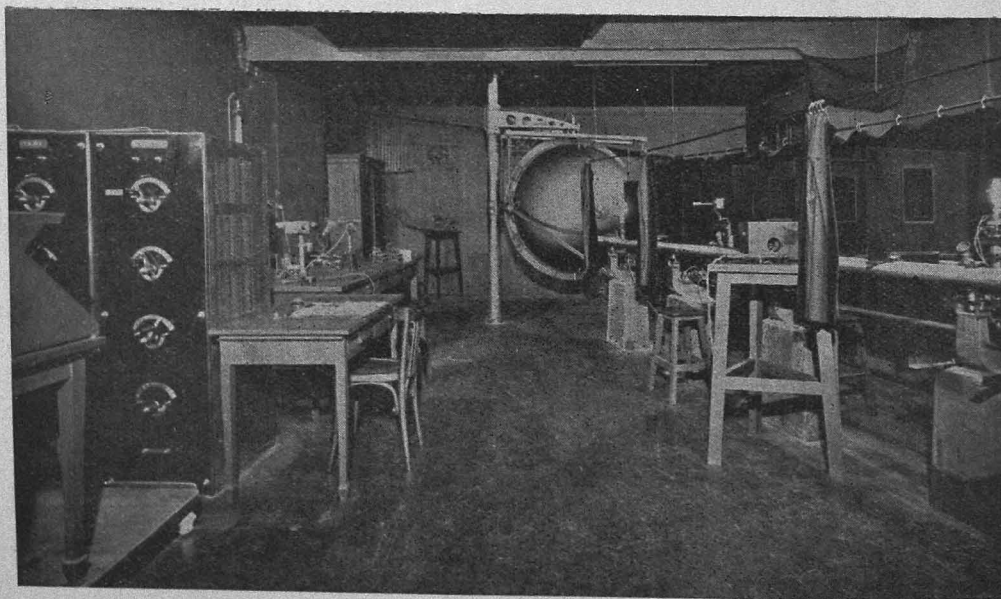


Fig. 3.—The Photometry Laboratory of the International Bureau.

the International Committee considered it necessary to form *Advisory Committees* to work with it and co-ordinate all research and studies in the new fields under its jurisdiction and to submit recommendations on changes to be made in the existing definitions and values of units, in a word, to advise it on all decisions it has to take directly or to submit for approval by the General Conference on Weights and Measures.

These Advisory Committees, under the chairmanship of a member of the International Committee, are composed of representatives of national laboratories and institutes and specialized experts. There are at present six of them. They meet at irregular intervals. They are :

(1) *The Advisory Committee on Electricity*, formed in 1927;

(2) *The Advisory Committee on Photometry*, formed in 1933 (from 1930 to 1933 the preceding Committee also dealt with questions relating to photometry) ;

(3) *The Advisory Committee on Thermometry*, formed in 1937.

Among the principal decisions taken as a result of the work of these three Committees the following need mention: substitution, on 1 January 1948, of 'absolute electrical units' for so-called 'international' units which had been in force since 1908; fixing conversion ratios between the former units and the new units and definition of the latter; adoption of the new unit of luminous intensity, the *candela*, defined in terms of the luminosity of the black body at the solidification point of platinum; adoption of the 1948 International Temperature Scale (now under revision); definition of the thermodynamic scale of temperature in terms of the triple point of water (273.16° K) as the fundamental fixed point; use of the *joule* to replace the 'calorie' as the unit of quantity of heat.

(4) *The Advisory Committee for the Definition of the Metre*, formed in 1952, whose work led to the proposal that the metre be defined in terms of the wave-length of the orange radiation of krypton 86 (see earlier).

(5) *The Advisory Committee for the Definition of the Second*, formed in 1956 to co-ordinate, at the international level, the research being done with a view to basing the unit of time on the observation of physical phenomena and to submit to the International Committee all recommendations for improving the reference standard of time.

Although units of measurement of time are not within the jurisdiction of the International Bureau of Weights and Measures, it was nevertheless decided to form this Committee on the Second because, owing to their official character, the International Committee and the General Conference on Weights and Measures—the delegates to the latter being appointed directly by their respective Governments—are alone qualified to propose to the Governments of the various States, the decisions taken at the international level to bring about and maintain uniformity of units of measurement the said decisions then being incorporated, frequently without change, in the metrological legislation of the various countries.

(6) *The Advisory Committee for the Standards of Measurements of Ionizing Radiations*, formed in October 1958. This Committee, which met for the first time in April 1959, recommended that the jurisdiction of the International Bureau be extended to the fields of radioactivity and ionizing radiations, and that the Bureau be appointed as the central body for : (i) the definition of quantities and units; (ii) the establishment of international standards of measurement of activity and of ionizing radiations, including neutrons,

Such is the general outline of the genesis of the bodies brought into being as a consequence of the Metric Convention—the International Committee and its Advisory Committees, the International Bureau of Weights and Measures—and of their achievements over a period of more than eighty years.

It is thus seen that the International Bureau, probably the oldest inter-Governmental scientific institution in the world, is not solely, as some people may think, a place where the Prototype Metre and Kilogramme are kept. It is above all an international centre of precision metrology working in close co-operation with the principal national metrological laboratories on the international co-ordination of all scientific research relating to the maintenance and improvement of reference standards and world-wide unification of units of measurement founded on the metric system.

#### References

(1) For a more detailed account about the genesis of the metric system and the work of the International Bureau of Weights and Measures, see the author's paper published in *J. Chem. Education* (U.S.A.) **30**, 1953, pp. 3-20.

(2) These fields are essentially those of scientific and precision metrology, problems of practical and legal metrology being under the jurisdiction of the International Organization of Legal Metrology created in 1956 (see *Metric Measures*, May 1958, p. 5).

(3) 36 States are now members of this Convention: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Czechoslovakia, Denmark, Dominican Republic, Finland, France and Algeria, Germany, Hungary, India, Ireland, Italy, Japan, Republic of Korea, Mexico, Netherlands, Norway, Poland, Portugal, Rumania, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, United States of America, Uruguay, U.S.S.R., and Yugoslavia.

It is to be noted that this list does not give all the countries which have adopted the metric system, but only those—metric or not—which have adhered to the Metric Convention.

(4) In 1958 the Government of India acquired the platinum iridium Metre No. 4 (which since 1890 had belonged to the Paris Observatory and on which new lines will be engraved) and platinum iridium Kilogram No. 57, made in 1954 by Johnson, Matthey & Co. of London, then adjusted and checked at the International Bureau in 1954-55.

(5) These Laboratories are at present: National Research Council (Canada), Conservatoire National des Arts et Metiers (France), Physikalisch-Technische Bundesanstalt and Deutsches Amt für Mass und Gewicht (Germany), Electrotechnical Laboratory (Japan), National Physical Laboratory (United Kingdom), National Bureau of Standards (United States of America), D.I. Mendeleev Institute of Metrology (USSR).

# Metric Units for Retail Trade

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L. RAJU

Ministry of Commerce & Industry,  
New Delhi

THE common man comes into closest contact with weights and measures when he goes to purchase his daily necessities like vegetables, provisions, cloth etc. in the retail market. Here he asks for the price of materials in terms of certain units of weights or measures or simply numbers. For example, potatoes are quoted to him in annas or nP per seer, lady's fingers in annas or nP per pao. Saffron may be quoted in terms of tolas, while biscuits, confectionery, vanaspati may be available by the pound.

The variety of weights and measures in India and the innumerable differences in the mode of weighing and measuring are evident in the retail trade. For example, in the Delhi market retail prices of materials may be quoted in terms of the seer of 80 tolas or the pound or maund. In Bombay city, besides these units, another unit called 'rattal' is also used. This rattal has got a capacity for confounding newcomers to the city and even the local people. The rattal is exactly equal to 1 pound, and 28 such rattals are supposed to make a 'maund' and 3 1/2 rattals make '5 seers' in the Bombay parlance. And, of course, the usual maund and 'pasari' are also current. Examples are not a few when people who had ordered

'5 seers' of sugar, found to their utter surprise that they had received really less than the 2 seers of their concept. Another peculiarity is that for ordinary retail transactions, the rattal is taken as equal to half a seer *i.e.* 40 tolas. In actual fact the rattal is a little less than 39 tolas, but the ordinary citizen not knowing this relationship is easily duped.

As we go further south and reach Madras, we find that the units there are entirely different. The seer there consists of 24 tolas and 5 such seers make one viss, 8 such viss make one maund. Thus the Madras maund is equal to 12 seers of 80 tolas each, and is, therefore, smaller than the so-called 'Bombay Maund'. Therefore, unless you are sure in your knowledge of weights and measures you may find that the maund of wheat which you have ordered is nowhere near the maund you had in mind.

When we reach the furthest corner of India, in Kerala, we find that the most popular unit of weight used there is the rathal. Now it must be remembered that this rathal is not the same as the rattal of Bombay, because the Kerala rathal is some 42 tolas. The other common unit is the 'thulam' which is about 15 such rathals.

This brief description is enough to give us an idea of the most popular units of weights in the retail trade in India. Most of these are recognized by law. The other units of weights and measures still being used where there is no weights and measures law in force are innumerable and in many cases undefinable.

#### Seer Weight and Seer Measure

Another trouble that the retail purchaser has to face very often is the confusion between the seer weight and the seer measure. For example, many people feel that the seer of milk measured out by the seer measure also weighs one seer. This is not so. Only water measured out in this manner weighs one seer.

To add to this confusion, we also use the subdivisions of the gallon and its progeny. For example, in the purchase of kerosene, it is the trader's bottle which is standard and not any other. This is because the average purchaser is not aware of the capacity of the bottle that should be used for measuring kerosene and there are so many sizes of bottles available in the bazaars. The same applies to methylated spirit. Here the bottle is supposed to contain some  $26\frac{3}{4}$  fluid ounces. Again we must remember that the fluid ounce is entirely different from the ounce weight. The relationship between the fluid ounce and gallon and the seer is not easily understandable. Therefore, the trade in such materials is more a question of faith than of knowledge.

These confusions do not, however, end the purchaser's difficulties. He has to face another problem. For example, when he purchases mangoes in Delhi, he does so by weight *i.e.* by the seer; but in Bombay, he gets mangoes by the dozen; if he wants in larger bulk he has to go in for the so-called hundred; but this hundred is not 100, but something more than hundred,

for example, 130 in certain cases. Some vegetables are sold by bundles in Bombay, but the same vegetables would be available by the seer in many other areas in India. Oil may be obtained in Madras by the measure called 'padi' and by weight in other areas.

These varieties can be multiplied many fold. Even the beam scales which are used in such retail trade have numerous shapes and dimensions and materials of construction. Even if the purchaser is sure about the accuracy of the weights he is uncertain whether the beam scale is correct. This only means that the opportunities for the trader to fleece the purchaser are legion.

#### Packed Materials

In the retail trade, we also come across ready-packed or tinned materials. There are two varieties of sealed packages and containers: one in which the contents vary but the price is fixed, for example, potato wafers. The other in which the quantity is fixed but the price is not. These are the more numerous. Examples of such type are tea and coffee, biscuits, confectionery, vanaspati and various types of ready-made packages for household materials like salt, sugar, soap etc.

At present there is no law which requires that the quantity contained in a package should be indicated on it. This is a serious flaw because the purchaser is not aware how much material he has bought and what price he should rightly pay. This situation is, however, being remedied in the new act which is now being enforced in all States and Union Territories. It has been made compulsory that every package which is sold by weight or measure should indicate the net weight or the volume or length of the material contained therein.

From this it will be apparent that the tremendous variety of weights and measures

## METRIC UNITS FOR RETAIL TRADE

and weighing and measuring practices in India requires to be remedied, if the purchaser is to be given a fair deal. This purchaser is not the big trader, but the so-called common man, *i.e.* practically everybody in the country. For this purpose, it is necessary that a single unit for pricing a commodity in retail trade should be used all over India, if the real benefits of the metric system are to reach the people. The mere adaptation of the present units to metric units will not only lead to confusion, but also to the continuation of malpractices which are now sought to be remedied.

### Suggestions for Consideration

A few suggestions are made here for consideration :

(1) Wherever the present unit for pricing is the pound, seer, rattal or any such unit, the price should now be quoted in terms of the kilogram. It must also be remembered that there is no weight of a quarter kilogram in the series of metric weights.

(2) Wherever the unit at present is the tola, one gram should be conveniently used.

(3) Wherever the unit is the maund, it is preferable to use 100 kilograms. It is possible that in pricing, the unit of 10 kg may also be desirable. For example, in the retail sale of charcoal the pricing of 10 kilograms may be more convenient than pricing 100 kilograms.

(4) *Capacity Measures*—In this case there is no doubt that the litre would serve the purpose most efficiently and it is not necessary to use its subdivisions for price quotation in retail trade, except in the case of the chemist and druggist trade which often requires a smaller unit, and units of 10 ml or 100 ml may be convenient for them. It should be noted that it is preferable to use units proceeding by powers of 10 *i.e.* 1, 10, 100 etc., so that calculations become easy. For

example, pricing of 50 ml or 500 grams will ultimately involve two or more calculations when paying, which is avoided by using 100 ml or one kilogram.

So far as the gallon and its subdivisions are concerned, they need not be used further and they would be replaced by the litre.

Thus for all transactions involving capacity measures, only the litre would be used in future. No more should we have bottles of  $26\frac{2}{3}$  fluid ounces or  $13\frac{1}{2}$  fluid ounces for pricing commodities.

(5) *Length*—The yard will be replaced by the metre. The old use of girah should be avoided under all circumstances so as not to create confusion in the minds of the purchaser. The term centimetre though longer, will replace it conveniently.

(6) *Square and Cubic Measures*—Very rarely is the use of these units required. However, for square measure we can use the square metre in place of the square yard and square centimetre in place of square inch. Similarly for cubic measure we can use cubic metre for cubic feet and the cubic centimetre for the cubic inch.

(7) *Packages*—So far as ready or sealed packages are concerned, it will now be necessary by law to mark the contents on them. It is, therefore, necessary to explore how best the metric system can be used for this purpose. For example, at present a large number of sealed packages are available either in terms of the pound and ounce or in terms of seer and its multiples and sub-multiples. In many cases, it has been noticed that the weight contained in a package is such that it corresponds to a single weight which is available in the series of these weights. For example, the packages in the pound series may be 1 pound,  $\frac{1}{2}$  pound,  $\frac{1}{4}$  pound, 2 ounces, 1 ounce and so on. In the seer series this may be one seer,

$\frac{1}{2}$  seer,  $\frac{1}{4}$  seer and so on. Alternatively, the packages may also be one seer, two seers and so on. It will be noted that single pieces of weights do exist for most of these units.

In metric weights, the weights proceed as follows:

|     |      |       |
|-----|------|-------|
| 1 g | 10 g | 100 g |
| 2 g | 20 g | 200 g |
| 5 g | 50 g | 500 g |
|     | 1 kg | 10 kg |
|     | 2 kg | 20 kg |
|     | 5 kg | 50 kg |

It would, therefore, be desirable to pack materials in such a manner that the contents are equal to any one of these weights. This would mean that a package of 250 g would be undesirable. Another danger in using a package of 250 g is that anybody who markets it may give room for confusing it with the 200 grams package. There may be even room for fraud in this case. Therefore, a package of 250 grams should be avoided. If there is a definite need for packages in between, say 200 g and 500 g, it would be desirable to increase the contents by 100 grams rather than 50 g. Thus the intermediate packages would be 300 g and 400 g and not

250 g. In the case of liquids similar principles would apply with equal force.

(8) *Sale*—The present variety in the sale of materials by weight, or measure or number should be done away with and a common practice introduced all over India. For example, mangoes could be sold all over India by number or by weight but not by both.

As an illustration of what units may be used in the retail trade, a few examples are given in Table 1.

#### Implementation

To achieve all-India uniformity in retail pricing units, which every person in the the country will have to use, it would be necessary that in the first instance the Controllers of Weights and Measures in the States should explain the principles of the new system to groups of representatives of Trade Associations and Chambers and Consortiums and consumers and gauge their reactions generally. These could then be discussed at an all-India level and the decisions enforced uniformly and faithfully throughout the country.

Great care should be taken that exceptions arise only rarely. Only then can we expect to achieve uniformity.



METRIC UNITS FOR RETAIL TRADE

TABLE 1

PROPOSED METRIC UNITS FOR RETAIL PRICING OF COMMODITIES

| Sl. No. | Commodity  | Units Now Used                                      | Proposed Metric Unit                                      |
|---------|--|---|---|
| (1)     | <i>Foodgrains, Cereals, Pulses, Spices etc.</i><br>Rice, wheat, jowar, bajra, ragi, gram, arhar, moong, masur, mot, lobia, urad, chillies, black pepper, betelnuts, etc. . . . . | 1 seer, 1 lb 1 rattal, dry measures etc.            | 1 kg  |
| (2)     | <i>Oil for Cooking</i><br>Til, mustard, coconut, groundnut, etc. . . . .   | 1 seer weight, also by measure                      | Either 1 kg or 1 litre, depending upon final decision.    |
| (3)     | Vanaspati, ghee etc . . . . .  | 1 seer, 1 lb or tin                                 | 1 kg or per tin.  |
| (4)     | Mangoes, bananas, apples and other fruits . . . . .  | weight or number                                    | Either per kg or number depending upon final decision.    |
| (5)     | Vegetables, meat, fish, fruits, sweetmeats and similar materials . . . . .   | 1 seer, 1 lb, 1 rattal, 1 viss etc.                 | 1 kg  |
| (6)     | <i>Prepacked materials</i><br>Tinned fruit, morabbas, achar, jams, marmalades etc. . . . .   | seer, lb or their sub-multiples                     | 100 g, 200 g, 500 g, 1 kg, etc. in the metric series.     |
| (7)     | Inks . . . . .   | 2 oz, 4 oz, 16 oz etc. bottles                      | 50 ml, 100ml, 500ml, etc. bottles in the metric series.   |
| (8)     | Tea, coffee, sugar, etc . . . . .  | 1 seer, 1 lb  | 1 kg  |
| (9)     | Milk . . . . .   | 1 seer, 1 lb etc.                                   | 1 litre   |
| (10)    | Bread . . . . .  | 1 lb  | 1 kg  |
| (11)    | Butter . . . . .   | 1 lb, 1 seer and packages of 1 oz, 2 oz, 4 oz, etc. | 1 kg or packages of 20 g, 50 g, 100 g, 200 g, 500 g, etc. |
| (12)    | Cloth and related materials . . . . .  | 1 yard  | 1 metre   |
| (13)    | <i>Precious Metals</i><br>Gold . . . . .<br>Silver . . . . .   | 1 tola<br>1 tola                                    | 1 g<br>1 g  |

## Will USA Go Metric?\*

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I have long been convinced that ultimately the United States must shift to the metric system. Outside of our Anglo-Saxon culture, practically every nation has made this shift during the past 150 years or so. Due to our delay in taking action and due to the complexity of our industrial system, this change will be more difficult for the United States than for other countries, but when achieved it will also be more useful.

The metric system is all around us. The problem, therefore, is not to make a revolution in measurement but to direct and accelerate the evolution which has been taking place. It is a matter of becoming conscious of this evolution and of giving it an assist. It is a matter of using the metric system more and more and the English system less and less.

Naturally this evolutionary process will take some time. We still have very considerable amounts invested in the English system of measurement. Our culture has long been entrenched in yards, pounds and gallons and a reduction will be necessary. Text-books will require revision and instruments will require recalibration or replacement. The changes in our machine tools and in much of our equipment—containers, for

example—will be most difficult and costly. The switch from inches to centimetres in industry must be accomplished with minimal disruption, but I do not think it will take years upon years.

We simply cannot remain static but must recognize the conditions of our time and meet rather than be forced into the inevitable and logical. The time has come when the Government should do something affirmative about a proposal which scientists have been reiterating since the days of Lord Kelvin.

Recently a committee to consider the problems of shifting to the metric system was established by the American Association for the Advancement of Science (AAAS), after it had approved in principle the general adoption of the metric system of weights and measurements.

What are the considerations that appear as though they will compel us to metricize ourselves? They are of two kinds, scientific and economic. The advances in research in the past 20 years lead but to one conclusion as far as measurement is concerned. We can no longer afford the luxury of national measurement systems which differ from those of the people with whom we want to trade. Furthermore, the metric system lends itself most easily to providing an interrelated network covering all scientific fields. The fact that science is on the metric system and that civil engineering and industry by and large are on the English system makes

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\*Summary of remarks by Mr. Lewis L. Strauss, Secretary of Commerce, before the American Physical Society, Washington, D.C. on 1 May 1959. Condensed from *Technical News Bulletin*, National Bureau of Standards, July 1959, pp. 124-125.

## WILL USA GO METRIC ?

for a great deal of unnecessary confusion and difficulty.

There are two compelling economic reasons for making the change. Our country is engaged in a broad technical assistance programme to aid other nations in taking advantage of technology and raising their living standards. Our experts are finding considerable difficulty in dealing with systems foreign to their own. Many other nations are having difficulty with our instruments because they are labelled in the archaic English system.

In the area of our foreign trade, we are beginning to be hurt by the fact that we do not produce and label our products in the metric system. We are engaged in a strong economic competition with the Soviet Union. It must be apparent to all that the uniformity of measurement systems between Russia and most of the world, including Western Europe, is an enormous advantage to the Soviets and a handicap to us. Further strengthening of the European Common Market will increase this problem. Our country also has adopted a system of military aid to our allies and friends. The effectiveness of this programme has suffered, I have little doubt, from the incompatibility of measuring systems.

In brief, a dynamic country like ours where new commodities are adopted incessantly and where inventories are replaced periodically has the capability of executing a change in its measurement system. What we need is a procedure by means of which the change can be carried out most expeditiously with the least cost, the least confusion and the least opposition. Such a change

will eventually allow us to give better technical training in our schools because of the relative simplicity of the system.

I propose to request the Director of the National Bureau of Standards to establish an advanced planning group to assemble all available documentation and to identify possible courses of action.

Through our advisory committee's contacts with business of all sorts, we will establish special industry committees to tell us of their special problems, and within the Department of Commerce the problems will be studied with a view towards determining, among other things, whether Government activities can be metricized and whether there are special legislative requirements which must be satisfied.

The work of the existing AAAS Committee on Metric Usage will receive the important consideration which it deserves, as well as that of the parallel committee of the British Association for the Advancement of Science. We will examine the experience of India and Japan in the fairly recent shift to the metric system in those countries. Japan's experience would be especially pertinent since that country faces a number of advanced technological problems similar to those faced by us.

In the meantime also I hope that a number of industries on their own will study the problem of converting to the metric system and advise us on their examination. Wherever possible I hope that they will take voluntary steps towards the effective transition to the metric system as has the pharmaceutical industry.

# *Controllers' Conference*

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A Conference of Controllers of Weights and Measures in the States and Union Territories was inaugurated by Shri Satish Chandra, Deputy Minister of Commerce and Industry, in Udyog Bhavan, New Delhi, on 4 September 1959. Besides the Controllers, representatives of the Indian Standards Institution, Government of India Mint, Bombay, National Physical Laboratory and the Ministry of Commerce and Industry attended the Conference.

### **Deputy Minister's Opening Remarks**

Inaugurating the Conference, the Deputy Minister said that the adoption of the metric system was one of the significant reforms initiated by Government since Independence. Earlier attempts to standardize weights and measures in this country had not been successful. The Government had decided to standardize weights and measures by adopting the metric system throughout the country. He was glad that the reform had made fair progress. It was expected that metric commercial weights would be in use in trade on a significant scale by the middle of 1960. The success of the reform would depend largely on the energy, zeal and devotion to duty of the Controllers and their staff. Experience in Bombay, Bihar, Punjab, Andhra and Mysore had shown that successful standardization was possible provided adequate organization was created for the purpose.

He was glad that preparations for enforcement of metric commercial weights

were at an advanced stage in most of the States. Legislation for enforcement had been enacted by the State Legislatures. Rules for enforcement had been notified in most of the States. The Rules being virtually identical, uniformity of enforcement procedure throughout the country would be assured. In many of the States, manufacturers and dealers had been licenced and verification and stamping of metric commercial weights had begun. He hoped, before the year was out, sufficient weights duly verified and stamped by the Inspectors would be available to trade. He suggested that the Controllers should get in touch with important trade associations, and seek their good offices in persuading their members to begin using metric weights in transactions.

While everything possible should be done to persuade the traders to adopt the new system, it would be good if in the initial stages, it was enforced with tact, discretion, leniency and restraint. While wilful defiance of the law with intention to commit fraud should, no doubt, be dealt with firmly, a lenient view might be taken of technical breaches due to ignorance or lack of experience. Enforcement should not cause needless irritation and annoyance to the public.

In conclusion the Deputy Minister emphasized the need to stimulate the manufacture in India of precision balances and other equipment used by Weights and Measures Departments. It would not be right or proper for the country to depend

indefinitely on imported equipment. He invited the Controllors to suggest how the production of balances and other equipment might be augmented.

#### Recommendations

After the inaugural address, the Conference discussed the items on the agenda. Some of the conclusions and recommendations of the Conference are summarized below :

(1) *Preparatory Measures*—Weights and measures enforcement legislation had been enacted in all the States and some of the States had also notified Rules, granted licences to manufacturers and dealers, and begun stamping metric commercial weights. It was agreed that all the States should notify the Rules, licence manufacturers and dealers of weights and provide facilities for stamping weights before November 1959.

(2) *Controllors to Contact Trade Associations*—Although the use of metric commercial weights had been permitted in selected areas they had not actually come into use to a significant extent anywhere. Individual traders might not adopt the new weights in trade without directives from their Associations. It was agreed, therefore, that Controllors should contact representative Associations of Trade and seek their good offices in persuading the members to adopt the new weights from a specified date, say, the Divali day or 1 January 1960.

(3) *Organization for Enforcement*—The success of the reform would depend largely on the strength and efficiency of the Enforcement Organization. In every State there should be a wholetime Controller of Weights and Measures of the status of the Head of a Department. Inspectors should be wholetime officers and must not be saddled with other responsibilities. There should be at least one Inspector for every 3 000 establishments. In areas which are mainly

rural and have poor communications, an Inspector may not be able to serve more than 2 000 establishments. The work of Inspectors should be supervised by an Assistant Controller for each district and a Deputy Controller for each Division. The Controller should be provided with adequate clerical and administrative staff at Headquarters. In larger States the staff should include at least one Deputy Controller and one or more Assistant Controllors. The Controllors should have at their disposal facilities for training of personnel. There should be one Manual Assistant for each Inspector and Regional Officer. The salaries and terms of employment of Inspectors should be sufficient to attract men with good education and personality.

(4) *Manufacturer to be Licenced by State in which He is Situated*—Every manufacturer of weights and measures must obtain a licence from the Government of the State in which he is situated. It was not necessary for him to seek a licence from the Government of any other State even if his weights and measures were used in the other State. It was agreed, however, that the manufacturer must appoint a sole agent in every State where there was a market for his weights and measures. This agent would apply for a dealer's licence from the State Government concerned. It would be his responsibility to get the weights and measures stamped by the Inspectors before they were sold to traders or public.

(5) *Provision for Continued Use of Existing Machines*—There were weighing machines and other instruments in use which did not conform strictly to the specifications in the Rules. It was neither practicable nor desirable to do away with these machines when the Rules came into force. Provision should be made in the Rules to permit the continued use of all such machines. All new machines

must, however, be according to the specifications in the Rules.

(6) *Exemptions from Provisions of Weights and Measures (Enforcement) Acts*—The Acts did not give the State Governments or the Controllers the power to grant exemptions from any of their provisions. Such power would be found necessary to permit the continued use of certain types of existing weighing and measuring instruments. Further it might not be practicable to convert all the machines in use to the metric system before the system was legally brought into force. The machines not converted would have to be used with the help of conversion tables. These machines would have to be exempted from certain provisions of the Act until they were converted. It was, therefore, agreed that the State Weights and Measures (Enforcement) Acts be amended to empower the State Governments to exempt particular classes of undertakings or types of weights, measures or instruments from any or all the provisions of the Act.

(7) *Testing of Inspector's Balances Produced in India*—At present there was only one establishment producing Inspector's balances in India. Certain other establishments were trying to manufacture them. The first set of balances produced by every new manufacturer would be sent to the National Physical Laboratory for testing. He would be treated as an approved manufacturer for the supply of Inspector's balances only after his set was approved and certified by the NPL. Every set of balances supplied would be tested first by the Controller of the State in which it was manufactured and later by the Controller who bought it.

(8) *Production of Balances in India*—It was agreed that the present output of Inspector's balances in India was inadequate. Precision balances were not being made in

India at all. It was agreed that the possibility of increasing the production of Inspector's balances and manufacturing precision balances in India should be explored. A Committee was set up to study the subject and make recommendations to the Government.

(9) *Fees for Stamping Weights, Measures and Instruments*—In Bombay, Punjab, Bihar, Andhra and Delhi the Weights and Measures Departments would be verifying and stamping metric weights and measures as well as weights and measures on the pound or seer system. They would also be verifying new machines calibrated in metric units, existing machines converted to metric units, and machines calibrated in the older units. But the scale of fees laid down in Weights and Measures (Enforcement) Rules, 1959 would apply to metric weights and measures and to all machines calibrated in metric units whether they were new machines or the old ones converted to metric units. The fees for machines calibrated in other units would continue to be as laid down in the earlier Weights and Measures Rules.

(10) *Weights, Measures and Instruments in Government Departments*—Weights, measures and instruments used by Government Departments for commercial purposes were liable to verification and stamping by the Inspectors. No exemption should be granted on the ground that the users were Government Departments. The Directorate General of Supplies and Disposals and the purchase agencies of the State Governments should be advised that all weights, measures and instruments purchased for Government Departments must conform to the specifications in the State Weights and Measures (Enforcement) Rules.

(11) *Introduction of Metric System in the Distribution of Petroleum Products*—Petrol and other petroleum products would be

sold in metric units from 1 April 1960. The Controllers of Weights and Measures would render necessary assistance to the petrol companies particularly in respect of the following:

(a) The oil companies would notify to the Inspector of Weights and Measures concerned before a pump or flowmeter is converted. The Inspector would verify and stamp the pump or flowmeter as soon as possible after its conversion. The oil companies would be allowed to use pumps or flowmeters pending their verification and stamping.

(b) The Inspectors would calibrate tank lorries and drum fillers of the oil companies as speedily as possible. Till they were able to do so, the companies would be allowed to use tank lorries and drum fillers calibrated by themselves.

(c) The 3 main oil companies proposed to purchase metric capacity measures from certain establishments in Bombay. The Deputy Controller of Weights and Measures, Bombay, would arrange for the verification and stamping of these measures before 1 April 1960. He would be supplied with a few sets of working standard capacity measures (10 litres and 100 millilitres only) by the end of the year. If any of these measures were used in States other than Bombay, the companies would get them stamped again by the Inspector of the area where they were used. Pending such verification, their use would be allowed.

(d) It was agreed that a tank truck calibrated in one State might be used for a short period, not exceeding 3 months, in an adjoining State without having to be calibrated again by the Weights and Measures Department of the latter.

(12) *Metric Units for Transactions in Various Commodities*—It was agreed that a table of units for transactions in various commodities should be prepared. A draft table of units had been prepared and circulated to Government Departments and representative organizations of the interests concerned. The draft would be considered and finalized after replies were received. The table of units would be recommended for use by all concerned. The possibility of giving statutory recognition to it under the Agricultural Markets Act or any other existing legislation, would be considered.

(13) *Verification & Stamping of Non-metric Weights & Measures*—In Bombay, Bihar, Punjab, Andhra, Delhi and Mysore, the present standard weights and measures (such as standard seer and pound weights) would continue to be verified and stamped so long as their use was permitted. In other States, it would not be practicable to stamp non-metric weights even though their use would be tolerated for some years. Since the Weights and Measures Departments did not have the standard weights and measures for the purpose, the present state of affairs would have to continue in regard to these weights so long as they were tolerated.

### Metric System in Levy and Collection of Customs Duties

**T**HE Government of India have decided to introduce from 1 April 1960 metric system with regard to the levy and collection of customs duties. This is another important stage in the country's switch over to the new system.

### Phased Programme in Building Works

The suggestion that the target date for the introduction of the metric system of weights and measures in building works, architecture and town planning should be fixed as 1 April 1960, was made by the Conference convened by the Union Ministry of Works, Housing and Supply, to draw up a phased programme for the adoption of the system.

The Conference, held on 2-3 September 1959, was presided over by Shri M.R. Sachdev, Secretary, Union Ministry of Works, Housing and Supply. It was attended by representatives of various State Governments, Union Ministries and Technical Institutions in the country.

According to the phased programme proposed by the Conference, the change-over to the metric system would be in three stages. During the first two stages, covering the period up to 1966, the date fixed for the complete adoption of the metric system by the Government of India, both the metric and the

foot-pound systems would be in use. The switch-over to the metric system would be completed by 1966. The programme during the interim period was phased to stimulate production of building materials to metric standards.

### Publicity for Metric Weights and Measures

Multan Engineering Works, Mir Jumla, Lal Kuan, Delhi-6 have decided to offer to all Government bodies, educational and charitable institutions a rebate of 10 percent on metric weights, weighing machines, length and capacity measures required for demonstration purposes. They are willing to allow those heads of Departments and State Governments who have already been loaned these items to retain them without paying for them.

### Change-over to Metric System in Australian Hospitals

The Princess Margaret Hospital would change soon to the metric system for all measurements. Three big Melbourne hospitals have already changed. The first hospital in Australia to change to the metric system was the Royal Melbourne, last year. Other Melbourne hospitals to use it were the Royal Children's and the Queen Victoria.

The hospitals reported that the system was working well now it was established. All measurements of height, weight, temperature and medicine were now done metrically.



# Metric Progress in Industries

(In December 1956, the Standing Metric Committee recommended that conferences should be convened with the cooperation of associations or organizations concerned, for groups of industries, to recommend programmes for the adoption of the metric system. This is being done. The progress made in chalking out and implementing the programmes in various industries is reported. Earlier reports appear in the previous issues of *Metric Measures*)

In the following table, full details are given about the notifications issued by the Government of India regarding the introduction of metric weights and measures in various industries. Information about the progress in these industries has been reported in earlier issues of *Metric Measures*.

## INDUSTRIES CHANGING OVER TO METRIC SYSTEM

| Sl. No. | Name of Industry  | Change Begins on | Transition Period | Notification No. / Date  |
|---------|---|------------------|-------------------|--|
| (1)     | Jute mills for purchase of raw jute and sale of jute products   | 1-7-58           | 2 years           | S. O. 698, dated 26th April 1958<br>S. O. 699, dated 26th April 1958 |
| (2)     | Associations recognized by the Central Government under section 6 of the Forward Contracts (Regulation) Act, 1952 (74 of 1952) for regulation and control of forward contracts in raw and manufactured jute | 1-7-58           | 2 years           | S. O. 1033, dated 30th May 1958<br>S. O. 1281, dated 24th June 1958  |
| (3)     | Cotton textile mills for purchase of cotton or sale of cloth  | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |
| (4)     | Iron & steel factories for purchase of raw materials or sale of iron & steel products   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |
| (5)     | Engineering industries factories for sale of their products   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |
| (6)     | Heavy chemicals factories for purchase of raw materials or sale of their products   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |
| (7)     | Cement factories for sale of cement   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |
| (8)     | Salt factories for sale of salt .. ..   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |
| (9)     | Paper, pulp or paper board factories for sale of paper, pulp or paper board   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |
| (10)    | Refractories factories for sale of refractories   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958 |

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| Sl. No. | Name of Industry   | Change Begins on | Transition Period | Notification No. / Date  |
|---------|--|------------------|-------------------|--|
| (11)    | Coffee Board for sale of coffee from the surplus pool either by itself or through its agents   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958   |
| (12)    | Factories manufacturing copper, aluminium, lead, antimony and tin for sale of copper aluminium, lead, antimony and tin including alloys and products of these metals                     | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958   |
| (13)    | Associations recognized by the Central Government under section 6 of the Forward Contracts (Regulation) Act, 1952 (74 of 1952) for regulation and control of forward contracts in cotton | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958   |
| (14)    | Sale of raw rubber   | 1-10-58          | 2 years           | S. O. 1251, dated 24th June 1958<br>S. O. 1252, dated 24th June 1958   |
| (15)    | Cotton textile mills for sale of yarn and cotton textile products (other than cloth) or the stamping of cloth, yarn and other cotton textile products                                    | 1-4-59           | 2 years           | S. O. 613, dated 28th Feb. 1959<br>S. O. 614, dated 28th Feb. 1959     |
| (16)    | Coir factories engaged in processing coir yarn or manufacture of coir products for purchase of coir or coir yarn or sale of coir, coir yarn and other coir products                      | 1-10-59          | 2 years           | S. O. 1978, dated 25th Aug. 1959<br>S. O. 1979, dated 25th Aug. 1959   |
| (17)    | Central Coir Co-operative Marketing Societies for purchase of coir or coir yarn or sale of coir, coir yarn and other coir products   | 1-10-59          | 2 years           | S. O. 1978, dated 25th Aug. 1959<br>S. O. 1979, dated 25th Aug. 1959   |
| (18)    | Sugar factories for purchase of sugarcane or sale of sugar   | 1-11-59          | 2 years           | S. O. 414, dated 31st Jan. 1959<br>S. O. 415, dated 31st Jan. 1959     |
| (19)    | Vanaspati factories for sale of vanaspati  | 1-4-60           | 6 months          | S. O. 1540, dated 26th June 1959<br>S. O. 1541, dated 26th June 1959   |
| (20)    | Paint factories for sale of paints . . . .   | 1-4-60           | 1 year            | S. O. 1687, dated 9th July 1959<br>S. O. 1688, dated 9th July 1959     |
| (21)    | Biscuit factories for sale of biscuits . .   | 1-4-60           | 2 years           | S. O. 1822, dated 29th July 1959<br>S. O. 1823, dated 29th July 1959   |
| (22)    | Soap factories for purchase of raw materials and for sale of soap  | 1-4-60           | 6 months          | S. O. 2253, dated 25th Sept. 1959<br>S. O. 2254, dated 25th Sept. 1959 |

NAVIN SAINIK ANKAGANIT TATHA REKHA GANIT (Hindi)—By Lt Col S. S. Mukand and Capt S. J. L. Bhutani, published by the Military Educational Stores, East Sion, Bombay 22; Pp. 164; Price, Rs. 2.50.

The Book 'Sainik Ankaganit' published by the Military Educational Stores, Bombay, represents a laudable effort to bring out an arithmetic book containing lessons and exercises in the metric system of weights and measures.

The book, which runs into about 160 pages, is based upon the new syllabus in arithmetic for Army Third Class and Second Class Certificates of Education. It is, therefore, bound to be a useful textbook for teachers and students of these classes.

The subject matter is grouped into three sections which are further divided into 22 chapters dealing with the various arithmetical concepts and processes. Section first emphasizes simple multiplication, division, fractions and maintaining accounts which have been prescribed for Third Class Certificate of Education.

Sections two and three provide additional drill in fundamental operations with fractions, decimals, percentage, averages, unitary method etc. These make the book useful for Second Class Certificate of Education. The contents have been organized in a sequential manner thus making every new process or concept an extension of the old principles and relationships. Introduction to each new concept is precise and complete. The same concept is met again and again in different settings.

The language of the book is simple and makes use of soldiers' own vocabulary thus making the book understandable to all. It contains conversion tables which will be of great help to the teachers and the students during the transition period.

The number of written problems is quite sufficient but most of them are isolated text problems. As such, the number of situations presented is too great and at times involves work which would never occur in life. Thus the fractions Rs. 10/7 or Rs. 13/14 do not occur in everyday business. They could be replaced with the most common fractions of a rupee. There is ample provision for drill but the real purpose of written problems has not been nicely achieved. It would have been very useful if they were organized in certain 'functional' units which alone can develop objective thinking in terms of real life.

The chapter on geometry contains mainly definitions and exercises for the students. Geometry offers a great opportunity for interesting work with compass and ruler. It would have been better if the definitions were introduced incidentally through recognition of geometric forms in nature and simple applications of the same in Army life.

There are a few inaccuracies due to misprint. However, the format and size are good. On the whole, the book represents a commendable effort and the soldiers for whom it has been written will find it understandable and useful in daily life.

Research Officer,  
Central Bureau of Textbook  
Research, Delhi

R. C. Saxena

1

**SLIDE TABLES FOR INTER-CONVERSION OF VALUES**  
(In accordance with IS:786-1956)

Metric ← FPS to Metric → FPS

**LENGTH**

1 ft = 30.48 cm  
1 yd = 0.9144 m  
1 mile = 1.609344 km

1 mm = 0.03937 in.  
1 cm = 0.3937 in.  
1 m = 39.37 in.  
1 km = 0.62137 mile

**AREA**

1 sq yd = 0.83613 sq m  
1 acre = 0.404686 hectare  
1 sq mile = 2.58999 sq km

1 sq m = 1.19599 sq yd  
1 hectare = 2.47105 acre  
1 sq km = 0.386102 sq mile

**VOLUME**

1 cu ft = 28.3168 cu dm  
1 cu yd = 0.76455 cu m

1 cu dm = 0.0353147 cu ft  
1 cu m = 1.35795 cu yd

**CAPACITY**

1 pint = 0.56824 litre  
1 quart = 1.13649 litres  
1 gal(imp) = 4.54596 litres

1 litre = 1.75980 pints  
1 litre = 0.87990 quart  
1 litre = 0.219976 gal(imp)

**WEIGHT**

1 oz(avp) = 28.3495 g  
1 cwt = 50.802 kg  
1 ton = 1.01605 tonne

1 g = 0.0352740 oz(avp)  
1 kg = 0.0143841 cwt  
1 tonne = 0.98421 ton

**PRESSURE**

1 lb/in<sup>2</sup> = 0.07031 kg/cm<sup>2</sup>  
1 lb/ft<sup>2</sup> = 4.88243 kg/m<sup>2</sup>

1 kg/cm<sup>2</sup> = 14.2233 lb/in<sup>2</sup>  
1 kg/m<sup>2</sup> = 0.204816 lb/ft<sup>2</sup>

1 kg/sq cm = 14.2233 lb/sq in.  
1 kg/sq mm = 142.233 lb/sq in.

Metric ← FPS to Metric → FPS

INDIAN STANDARDS INSTITUTION  
9, MATHURA ROAD  
NEW DELHI-1

Face 1 of Conversion Slide

2

**SLIDE TABLES FOR INTER-CONVERSION OF VALUES**  
(In accordance with IS:786-1956)

**TEMPERATURE**

°F to °C:  $(F - 32) \times \frac{5}{9} = C$   
°C to °F:  $C \times \frac{9}{5} + 32 = F$

**INCHES**

0 1 2 3 4 5  
6 7 8 9 10 11

1000 °F  
500 °F to 400 °F

**INCHES**

0.036 mm 0.045 mm 0.056 mm 0.063 mm 0.071 mm 0.080 mm 0.090 mm 0.100 mm

0.005 mm 0.006 mm 0.007 mm 0.008 mm 0.009 mm 0.010 mm

NOTE: Standard Wire and Sheet Gauges of other countries have been replaced by Indian Standard Thicknesses of Sheet and Diameters of Wire expressed in millimetres as follows—

**Indian Standard Thicknesses of Sheet and Diameters of Wire**

| mm    | mm    | mm    | mm   | mm    | mm   | mm |
|-------|-------|-------|------|-------|------|----|
| 0.036 | 0.112 | 0.355 | 1.12 | 3.55  | 11.2 |    |
| 0.040 | 0.125 | 0.400 | 1.25 | 4.00  | 12.5 |    |
| 0.045 | 0.140 | 0.450 | 1.40 | 4.50  | 14.0 |    |
| 0.050 | 0.150 | 0.500 | 1.50 | 5.00  | 15.0 |    |
| 0.056 | 0.180 | 0.560 | 1.80 | 5.60  | 18.0 |    |
| 0.063 | 0.200 | 0.630 | 2.00 | 6.30  | 20.0 |    |
| 0.071 | 0.224 | 0.710 | 2.24 | 7.10  | 22.4 |    |
| 0.080 | 0.250 | 0.800 | 2.50 | 8.00  | 25.0 |    |
| 0.090 | 0.280 | 0.900 | 2.80 | 9.00  |      |    |
| 0.100 | 0.315 | 1.000 | 3.15 | 10.00 |      |    |

For Coarser and Finer Sizes and other Details Refer to IS:1137 Thicknesses of Sheet and Diameters of Wire

2

Face 2 of Conversion Slide

(Indian Standards which have a particular bearing on the change-over to the metric system are indicated here. Copies would be available from the Indian Standards Institution, Manak Bhavan, 9 Mathura Road, New Delhi, or their branch offices at Bombay, Calcutta and Madras).

### Slide Tables for Interconversion of Values

The Conversion Slide (the picture of both sides of which appear here) has been designed by the Indian Standards Institution for facilitating the work of interconversion of values from metric to non-metric systems of units and *vice versa*. It comprises: (1) an outer envelope or guide, open at both ends; and (2) a leaf which slides within the envelope. Both these parts are made of anodized aluminium which resists wear and tear, and is proof against corrosion, oil, grease and perspiration.

On the leaf are printed interrelated numerical data and the envelope has a number of windows so placed that each set of related windows enables the user to set a given value in one window and read off the converted value in another corresponding window.

Face 1 of the Conversion Slide deals with units of length, area, volume, capacity, weight and pressure. The other face is designed for converting temperature, values from Fahrenheit to Centigrade scale and *vice versa*, and vulgar inch fractions up to 12 inches into millimetres in steps of one-sixty-fourth of an inch, and for reading off wire and sheet gauge thickness in millimetres. This face also includes a table of Indian Standard Thicknesses of Sheet and Diameters of Wire, which replace the customary wire gauge, according to the latest Indian Standard practice introduced.

This Conversion Slide in plastic case is priced at Rs. 15.00 each (excluding postage) and can be obtained from ISI Headquarters

at New Delhi and also its Branch Offices at Bombay, Calcutta and Madras.

### Indian Standard General Plan for Metric Screw Threads with ISO Profile (IS: 1330-1958)

The Indian Standards Institution has issued a general plan for Metric Screw Threads with ISO Profile (IS: 1330-1958) which deals with the general plan for metric screw threads with ISO profile, for the diameter range 0.25 to 300 mm.

This is one of a number of Indian Standards, being prepared by ISI, consequential to the decision of the Government of India to introduce a uniform system of weights and measures in the country, based on the metric system. This standard is a general plan, intended to provide a series of diameter and pitch combinations from which selection can be made for various applications. It is based on a draft general plan for screw threads, with triangular profile, for the diameter range 0.25 to 300 mm, prepared by the International Organization for Standardization (ISO).

On the basis of the draft ISO Recommendation No. 84, for Screw Threads, ISI had already published below 6 mm (IS : 886-1957). It has now been decided to withdraw that standard and to issue another standard covering the range 0.25 to 39 mm, and based on the corresponding ISO work.

**Price: Rs. 1.50**

### Draft Indian Standard for Equivalent Metric Units for Quantities in Mechanical Engineering [DOC: EDC 1 (498)]

A draft Indian Standard Specification for Equivalent Metric Units for Quantities in Mechanical Engineering [DOC : EDC 1 (498)], laying down the equivalent metric units for various dimensions and quantities met within mechanical engineering field—and hitherto expressed in fps units—has been

drafted by the Indian Standards Institution for eliciting comments from the concerned manufacturers, consumers, major industries and other interests.

It may be recalled that ISI has already published a series of Indian Standards of metric weights and measures and for inter-conversion of inch and metric units, with a view to assisting the industries in the change-over to the metric system.

This draft standard prescribes the equivalent metric units, which have hitherto been expressed in the fps system for various quantities in mechanical engineering. In the choice of these units two important considerations have been kept in mind; first, the new unit chosen should be rational, and secondly it should have a directly understood relationship with the basic units. Besides these, due regard has also been given to the existing practices in metric countries.

**Draft Code of Practice for Primary Elements in the Design of Library Buildings, Fittings and Furniture [DOC: BDC 27(435)]**

The Government of India and the State Governments have been giving considerable importance to the development of library facilities in the country. The Union and the State Governments and the University Grants Commission have underway extensive schemes for the setting up of new libraries. Consequently, many library buildings are under construction. During the last fifty years or so, considerable experience has been gained by librarians in the use of these libraries under Indian conditions. Similar experience is available in the West, specially in regard to the functional design of libraries, library fittings and library furniture.

Feeling that this accumulated knowledge should be utilized in the design of new libraries that are now being built, to make them functionally efficient and economical and

to provide the architects guidance in the basic elements of designs pertaining to library buildings, library fittings and library furniture, the Indian Standards Institution has drafted a Code of Practice Relating to Primary Elements in the Design of Library Buildings, Fittings and Furniture [DOC : BDC 27 (435)]. The standard deals with the design of principal elements in library buildings, library fittings and library furniture. Though the standard does not cover private libraries, the design of which will depend on individual needs, facilities available and the extent of use, the basic data given in this code could be used in the design of private libraries as well.

In preparing this code, the advances that have been made by library science during the past three decades, the research data that is available with regard to the habits of the reading public, the facilities necessary to create awareness of libraries and to increase their usefulness etc. have been kept in view.

**Draft Indian Standard Specifications for Milk Strainers and Milking Pails [DOC : AFDC 12(72) and DOC: AFDC 12(73)]**

The Indian Standards Institution has drafted the following two draft standards for wide circulation among the interests concerned. The drafts are important for dairy industry.

1. *Milk Strainers, Mild Steel, Tinned* [DOC : AFDC 12(72)] which prescribes the requirements for mild steel tinned milk strainers of 12 litres capacity, for use with single service straining materials.

2. *Milking Pails (Hooded Type), Mild Steel, Tinned* [DOC : AFDC 12(73)], which prescribes the quality and dimensional requirements for hooded type mild steel tinned milking pails of 10,15 and 20 litres capacity.

**Draft Indian Standard Specification for Boilers and Superheater Tubes [DOC: SMDC 5 (100)]**

The Indian Standards Institution has circulated for eliciting comments from interested manufacturers, consumers, technologists, laboratories and others concerned, a draft Indian Standard Specification for Boiler and Superheater Tubes [DOC: SMDC 5 (100)] covering the requirements for the following series of boiler and superheater tubes, made from carbon steel:

Cold drawn seamless tubes

(31.5 kg/sq mm minimum ultimate tensile stress)

Cold drawn seamless tubes

(42.5 kg/sq mm minimum ultimate tensile stress)

Hot finished seamless tubes

(31.5 kg/sq mm minimum ultimate tensile stress)

Hot finished seamless tubes

(42.5 kg/sq mm minimum ultimate tensile stress)

Electrically welded tubes

(31.5 kg/sq mm minimum ultimate tensile stress)

Cold drawn electrically welded tubes

(31.5 kg/sq mm minimum ultimate tensile stress)

**Draft Indian Standard for Methods for Gauging of Petroleum and its Products [DOC: CDC 22 (1024)]**

The accurate gauging of bulk quantities of liquid petroleum products is essential

for stock accounting, loss, control, customs and excise purposes, and for blending and similar operations. Taking into consideration the views of interests concerned, the Indian Standards Institution has drafted Indian Standard Methods for Gauging of Petroleum and its Products [DOC: CDC 22 (1024)] in order to provide a general standard of uniformity. The standard prescribes methods for determining the liquid contents of tanks, ships and barges, tank cars and tank trucks and pipe lines.

**Indian Standard Specification for Hoses for use in Fire Fighting Service (IS: 636-1958).**

The Indian Standards Specification for Rubber-Lined, Woven-Jacketed Hose for Use in General Fire Fighting Service (IS : 636-1958) has just been issued by the Indian Standards Institution. It prescribes the requirements and the methods of test for 50 mm (or 2 in.) 65 mm (or 2½ in.) and 70 mm (or 2¾ in.) internal diameter rubber-lined; woven-jacketed hose for use in general fire fighting service.

This standard, which is one of a series of Indian Standards on hoses, forms a useful adjunct to the Indian Standards on fire fighting equipment. It is hoped that the formulation of standard specifications for various items of fire fighting equipment, and their implementation through the Ministry of Home Affairs and the Fire Insurance Association of India, will secure for the country an integrated system of fire fighting units.

Price Rs. 1-50

# *Licensed Manufacturers, Dealers and Repairers of Weights and Measures(4)*

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*Metric Measures* has been publishing lists of manufacturers, dealers and repairers of weights and measures and weighing and measuring instruments licensed by the various States and Union Territories under their respective Weights and Measures (Enforcement) Acts. In the March, July and September 1959 issues of *Metric Measures* lists of licensees have been published covering the States of Andhra Pradesh, Bombay, Punjab and the Union Territory of Delhi. The fourth instalment now published covers licensees from Bombay, Delhi, Kerala and Madras.

Similar steps are also being taken for licensing manufacturers, dealers and repairers in other States and further lists of licensees would be published in *Metric Measures* as this work progresses.

The number in bracket against the name of the State or Union Territory indicates the instalment number of the list for that State or Union Territory. The issues of *Metric Measures* in which previous lists appear are also indicated suitably.

## B O M B A Y (3)

In the March and July 1959 issues of *Metric Measures* lists of licensed manufacturers and dealers of weights and measures in Bombay State were published. The following is a list of manufacturers, dealers and repairers subsequently licensed by the Govt. of Bombay under the Bombay Weights and Measures (Enforcement) Act, 1958.

### Manufacturers

| Sl. No. | Name and Address of Manufacturer  | Details of Articles Manufactured |
|---------|---|----------------------------------|
| (1)     | Chavan & Sons, 1905, Tiwandha, Nasik .. .. .  | Weights                          |
| (2)     | Laxmi Engineering Works, 197, Corner, Grant Road, Bombay-8 ..                             | Weights                          |
| (3)     | Parvat Revji Mistry, Malegaon Motor Stand, Panchavati, Nasik                              | Beam Scales                      |
| (4)     | Patil Iron & Brass Works, Panchavati, Nasik .. .. .                                       | Weights                          |
| (5)     | Shah Moulding Works, Sir Chinubhai Baronet Compound, Shapur, Ahmedabad.                   | Weights                          |
| (6)     | Standard Mechanical & Iron Works, Jetha Street, Patel Compound, Lamington Road, Bombay-8. | Weights                          |
| (7)     | Steel Industries of Hindustan Private Ltd. Magazine Street, Darukhana, Bombay-10.         | Weights                          |
| (8)     | Zenith Textile Engineering Co., 250, Ripon Road, Bombay-8                                 | Weights                          |



Dealers

| Sl. No. | Name and Address of Dealer   | Details of Articles Sold                    |
|---------|--|---|
| (1)     | Abudulalli Babalbhai & Sons, Mahatma Gandhi Road, Rajkot   | Weights, Measures and Weighing Instruments. |
| (2)     | Adamji Pirbhai & Sons, Opposite Green Lodge, Garedia Kuva Road, Rajkot.                            | Weights, Measures and Weighing Instruments. |
| (3)     | Ahmedali Adamji, Gujari Bazar, Rajkot  | Weights, Measures and Weighing Instruments. |
| (4)     | Ahmedji M. Abdulhusain, Opposite Post Office, Taloda, Dist. West Khandesh.                         | Weights, Measures and Weighing Instruments. |
| (5)     | Akbarali Abdulali, Tajna Peth, Akola   | Weights, Measures and Weighing Instruments. |
| (6)     | Akbarally Lookmanji & Bros., Para Bazar, Rajkot  | Weights, Measures and Weighing Instruments. |
| (7)     | Alexandra Scale Co. H.O. 1115/1, Pankornaka, Ahmedabad-1   | Weights, Measures and Weighing Instruments. |
| (8)     | Ambalal Damodardas Shah, Bazar, At-Tharsa, Dist Kaira  | Weights, Measures and Weighing Instruments. |
| (9)     | Asgarali, Umreth-Varvad, Dist. Kaira   | Weights, Measures and Weighing Instruments. |
| (10)    | Asgarally Akabarally Kantawalla Hakim, 448, Madhavrao Rokade Rd., Bombay-9.                        | Weights, Measures and Weighing Instruments. |
| (11)    | Asia Engineering Corporation, Post Box No. 713, 13-A, Bruce Street, Fort, Bombay-1.                | Weights, Measures and Weighing Instruments. |
| (12)    | Babasaheb Usmansaheb Manger, 1842, 'C' Ward, Hatti Mahal Road, Kolhapur.                           | Weights, Measures and Weighing Instruments. |
| (13)    | Bhagwandas Gokuldas Gandhi, Nira, Taluka Purandhar, Dist. Poona, P.O. Nira (Rly Stn).              | Weights, Measures and Weighing Instruments. |
| (14)    | Bharat Cane & Hardware Mart, Opposite Maskati Market, Kapasia Bazar, Ahmedabad-2.                  | Weights, Measures and Weighing Instruments. |
| (15)    | Bharat Home Industries, C 1609, Bindu Chowk, Kolhapur  | Weights, Measures and Weighing Instruments. |
| (16)    | Bharat Scale Company, 200, Cutlery Bazar, Bombay-3   | Weights, Measures and Weighing Instruments. |
| (17)    | Chokshee Bros., Mandi Bazar, Sidhpur, Dist. Mehsana  | Weights, Measures and Weighing Instruments. |
| (18)    | Crown Engineering Corporation, Shop No. 39, 1st Gaoghari Mohalla, Bombay-3.                        | Weights, Measures and Weighing Instruments. |
| (19)    | Datta Marotrav Kolapkar, Brassware Merchant, Wardha  | Weights, Measures and Weighing Instruments. |
| (20)    | Dhondiram Harackchand Lodha, 718, Mahatma Gandhi Road, Shrirampur, Dist. Ahmednagar.               | Weights, Measures and Weighing Instruments. |
| (21)    | A. Dinkarra & Bros., Lokhand Bazar, Bhavnagar  | Weights, Measures and Weighing Instruments. |
| (22)    | Durlabhaji Devashi & Bros., Gujri Bazar, Rajkot  | Weights, Measures and Weighing Instruments. |
| (23)    | East Khandesh District Co-operative Marketing Society Ltd., Visanji Nagar, Jalgaon, East Khandesh. | Weights, Measures and Weighing Instruments. |

Dealers (contd.)

| Sl. No. | Name and Address of Dealer  | Details of Articles Sold                    |
|---------|---|---|
| (24)    | Ebrahim Mulla Abdultayeb, 69, Sarang Street, Bombay-3 .. ..                   | Weights, Measures and Weighing Instruments. |
| (25)    | Ezufali Karimji & Sons, Dondaicha, Dist. West Khandesh ..                     | Weights, Measures and Weighing Instruments. |
| (26)    | Fidali Gulamali, 163, Janjekar Street, Bombay-3 .. ..                         | Weights, Measures and Weighing Instruments. |
| (27)    | C.P. Foundry Works, Kamptee Road, Pilinadi, Nagpur-4 .. ..                    | Weights, Measures and Weighing Instruments. |
| (28)    | J. Himatlal & Company, Post Box No. 10, Lokhand Bazar Bhavnagar.              | Weights, Measures and Weighing Instruments. |
| (29)    | Inayatulla Nanalal Patel, Khargate, Bhavnagar .. ..                           | Weights, Measures and Weighing Instruments. |
| (30)    | Jantilal Nanalal Patel, Khargate, Bhavnagar .. ..                             | Weights, Measures and Weighing Instruments. |
| (31)    | Jiwaji Esmailji & Sons, Loha Itwari, Nagpur-2 .. ..                           | Weights, Measures and Weighing Instruments. |
| (32)    | Kapurchand Panachand Mehta, Para Bazar, Rajkot .. ..                          | Weights, Measures and Weighing Instruments. |
| (33)    | A.A. Kantawalla, 194, Janjekar Street, Bombay-3 .. ..                         | Weights, Measures and Weighing Instruments. |
| (34)    | E.G. Kantawalla, 203, Cutlery Bazar, Bombay-3 .. ..                           | Weights, Measures and Weighing Instruments. |
| (35)    | N.S. Kantawalla, 175, Dimtimkar Road, Shop No. D-2, Bombay-8                  | Weights, Measures and Weighing Instruments. |
| (36)    | Karachi Hardware Stores, Gujari Bazar, Rajkot .. ..                           | Weights, Measures and Weighing Instruments. |
| (37)    | Kate Sarote Wala, Gupta Market, Amravati .. ..                                | Weights, Measures and Weighing Instruments. |
| (38)    | Khanbhai Hiptullabhai Amerliwalla, Near Subhash Chowk, Bohara Bazar, Jalgaon. | Weights, Measures and Weighing Instruments. |
| (39)    | Luhar Ishwarlal Maganlala & Bros., Vallabhai Patel Road, Junagadh.            | Weights, Measures and Weighing Instruments. |
| (40)    | Manohar & Co., 743, Shukrawar Peth, Poona-2 .. ..                             | Weights, Measures and Weighing Instruments. |
| (41)    | Mazharhusain & Nomanali, Rawool Building, Dondaicha, Dist. West Khandesh.     | Weights, Measures and Weighing Instruments. |
| (42)    | Mohammad Ali & Bros., Itwari, Loha Lines, Nagpur .. ..                        | Weights, Measures and Weighing Instruments. |
| (43)    | Moizabhai Ebrahimbhai Co., Dondaicha Dist. West Khandesh ..                   | Weights, Measures and Weighing Instruments. |
| (44)    | Musaji Alibhal Bharmal & Sons, Garedia, Kuva Road, Rajkot ..                  | Weights, Measures and Weighing Instruments. |
| (45)    | Nagraj Shivnath Sarda, 138/139, Bhawani Peth, Satara City ..                  | Weights, Measures and Weighing Instruments. |
| (46)    | National Scale Co., Gokuldas Pasta Road, Dadar, Bombay-14. ..                 | Weights, Measures and Weighing Instruments. |
| (47)    | Navyug Hardware Mart, 1629, C. C. Haya Building, Shivaji Road, Kolhapur.      | Weights, Measures and Weighing Instruments. |

LICENSED MANUFACTURERS, DEALERS AND REPAIRERS OF WEIGHTS AND MEASURES

Dealers (contd.)

| Sl. No. | Name and Address of Dealer  | Details of Articles Sold                    |
|---------|---|---|
| (48)    | Nikals Scale & Weight Stall, Opposite Nikals Mandir, Itwari, Nagpur.          | Weights, Measures and Weighing Instruments. |
| (49)    | Noble Scale Repairing Works, Bhutani Ambli, Gheekanta Road, Ahmedabad.        | Weights, Measures and Weighing Instruments. |
| (50)    | Ostwal Brothers, 134, Vakhar Bhag, Sangli. . . . .                            | Weights, Measures and Weighing Instruments. |
| (51)    | Pandurang Govind Khuntale, 299, Guruwar Peth, Karad, Dist. North Satara.      | Weights, Measures and Weighing Instruments. |
| (52)    | H.S. Parbatani Kantawalla, Gokuldas Pasta Road, Dadar, Bombay-14.             | Weights, Measures and Weighing Instruments. |
| (53)    | J.M. Parbatani, 3, Gokuldas Pasta Road, Dadar, Bombay-14 . .                  | Weights, Measures and Weighing Instruments. |
| (54)    | Y.M. Pathare & Co., 41, Medows Street, Post Box No. 1428, Bombay-1.           | Weights, Measures and Weighing Instruments. |
| (55)    | S.M. Photate, 262, Chatigali, Sholapur . . . . .                              | Weights, Measures and Weighing Instruments. |
| (56)    | Ramesh & Co., 514 New Mill Road, Opposite Model Cinema, Kurla, Bombay-31.     | Weights, Measures and Weighing Instruments. |
| (57)    | V. Ramesh & Co., 115, Lohar Chawl, Maskati Mahal, Bombay-2                    | Weights, Measures and Weighing Instruments. |
| (58)    | Sakriwala & Co., Station Road, Dondaicha, Dist. West Khandesh                 | Weights, Measures and Weighing Instruments. |
| (59)    | G.H. Samel & Co., 162, Hill Road, Bandra . . . . .                            | Weights, Measures and Weighing Instruments. |
| (60)    | Saran & Company, Mangalwari, Sadar, Nagpur . . . . .                          | Weights, Measures and Weighing Instruments. |
| (61)    | Saurashtra Paint & Hardware Mart, Garedia Kuva Road, Rajkot                   | Weights, Measures and Weighing Instruments. |
| (62)    | Sirajuddin Harunbhai & Co., General Merchant, Dondaicha, Dist. West Khandesh. | Weights, Measures and Weighing Instruments. |
| (63)    | Vinayak Narayan Bapat & Co., 683, Dharampuri, Wai, Dist. North Satara.        | Weights, Measures and Weighing Instruments. |
| (64)    | C.A. Zaveri & Co., 44, Abdul Rehman Street, Bombay-3 . .                      | Weights, Measures and Weighing Instruments. |

Repairers

| Sl. No. | Name and Address of Repairer   | Details of Articles Repaired                |
|---------|--|---|
| (1)     | Abdul Rehman Chikte, Ahmed House, 25, Mastan Tank Road, Shop No. 3, New Nagpada, Bombay-9. | Weights, Measures and Weighing Instruments. |
| (2)     | Asgarally Akbarally Kantawalla Hakim, 448, Madhavrao Rokade Road, Bombay-9.                | Weights, Measures and Weighing Instruments. |
| (3)     | Avery Co. of India Private Ltd., 16, Dougall Road, Ballard Estate, Bombay-1.               | Weights, Measures and Weighing Instruments. |
| (4)     | Crown Engineering Corporation, Shop No. 39, Ast Ghoghani Mohalla, Near Pydhoni, Bombay-3.  | Weights, Measures and Weighing Instruments. |

Repairers (contd.)

| Sl. No. | Name and Address of Repairer  | Details of Articles Repaired                |
|---------|---|---|
| (5)     | Damodar Bhikabhai Kantawalla, 4A, Masjid Siding Road, Dana Bunder, Opposite Sailor's Home, Bombay-9.                      | Weights, Measures and Weighing Instruments. |
| (6)     | Ebrahim Mulla Abdultayeb, 69, Sarang Street, Bombay-3 .. ..   | Weights, Measures and Weighing Instruments. |
| (7)     | Fidali Gulamali, 163, Jankikar Street, Bombay-3 .. ..   | Weights, Measures and Weighing Instruments. |
| (8)     | Gurudata Workshop, 79, Sidheshwar Peth, Sholapur .. ..  | Weights, Measures and Weighing Instruments. |
| (9)     | B.R. Herman & Mohatta (India) Pte. Ltd., People's Building, Sir P.M. Road, Fort, Bombay-1.                                | Weights, Measures and Weighing Instruments. |
| (10)    | A. M. Kantawalla, 112, Pakomodia Street, Bombay-3 .. ..   | Weights, Measures and Weighing Instruments. |
| (11)    | N.S. Kantawalla, 175, Dimtimkar Road, Bombay-8 .. ..  | Weights, Measures and Weighing Instruments. |
| (12)    | Manohar & Co., 736, Shukrawar Peth, Poona-2 .. ..   | Weights, Measures and Weighing Instruments. |
| (13)    | Markanday Workshop, 79, Sidheshwar Peth, Sholapur .. ..   | Weights, Measures and Weighing Instruments. |
| (14)    | A. M. Master & Co., Haiderali Kasamji's Chawl, 179/81, Janjikar, Bombay-3.  | Weights, Measures and Weighing Instruments. |
| (15)    | N. J. Mehata & Co., 10, Keshavji Naik Road, Laxmi Niwas, Bombay-9.  | Weights, Measures and Weighing Instruments. |
| (16)    | Misrilal Motilal, 71, Sarang Street, Bombay-3 .. ..   | Weights, Measures and Weighing Instruments. |
| (17)    | Mohammad Ibrahim Fakirshaheb Chowdhary, 79, Sidheshwar Peth, Sholapur.  | Weights, Measures and Weighing Instruments. |
| (18)    | Noble Scale Repairing Works, Gheekanta Road, Bhutani Ambli, Ahmedabad.  | Weights, Measures and Weighing Instruments. |
| (19)    | Nobval Scale Works Co., Farida Manzil, Shop No. 7, 26, Byculla Station Road, Bombay-11.                                   | Weights, Measures and Weighing Instruments. |
| (20)    | Prakash Co., 65, Vetal Peth, Poona-2 .. ..  | Weights, Measures and Weighing Instruments. |
| (21)    | Ranchodbhai Fakirbhai Panchal, Opposite Bhadra Kacheri, Baroda.   | Weights, Measures and Weighing Instruments. |
| (22)    | Ravji Ramchandra & Co., Shop No. 56, Surat Street, Dana Bunder, Bombay-9.   | Weights, Measures and Weighing Instruments. |
| (23)    | Ripon Road Iron Foundry, Lamington Road, North Allana Compound, Opposite Agripada Police Stn., Bombay-11.                 | Weights, Measures and weighing Instruments. |
| (24)    | Rojani, 142, Upper Duncan Road, Bombay-8 .. ..  | Weights, Measures and Weighing Instruments. |
| (25)    | Saple's Scale Manufacturing Co. Pte. Ltd., 180-B, Gaiwadi, Girgaum, Bombay-4.   | Weights, Measures and Weighing Instruments. |
| (26)    | S.F. & Co., 1481, Shukrawar Peth, Poona-2 .. ..   | Weights, Measures and Weighing Instruments. |
| (27)    | Shankar Bala Dusane's Workshop, Premises of Phosphate Ginning & Pressing Factory, Mosum Bridge, Malegaon, Dist. Nasik. .. | Weights, Measures and Weighing Instruments. |
| (28)    | B.G. Shinde, 761, Shukrawar Peth, Poona-2 .. ..   | Weights, Measures and Weighing Instruments. |

Repairers (concl'd.)

| Sl. No. | Name and Address of Repairer                                      | Details of Articles Repaired                |
|---------|---|---|
| (29)    | Shrikrishna & Co., 738, Shukrawar Peth, Poona-2 .. ..             | Weights, Measures and Weighing Instruments. |
| (30)    | Union Metal Works, 28/30, Dhaku Prabhuwadi, Ghorupdeo, Bombay-10. | Weights, Measures and Weighing Instruments. |
| (31)    | Vishwas Co., 757, Shukrawar Peth, Poona-2 .. ..                   | Weights, Measures and Weighing Instruments. |

DELHI (2)

In the July 1959 issue of *Metric Measures* a list of licensed manufacturers, dealers and repairers of weights and measures in the Delhi area was published. The following is a list of manufacturers, dealers and repairers subsequently licensed by the Delhi Administration.

Manufacturers

| Sl. No. | Name and Address of Manufacturer                            | Details of Articles Manufactured  |
|---------|---|-----------------------------------|
| (1)     | Avery Company of India, 1-Ansari Road, Darya Ganj, Delhi .. | Weights and Weighing Instruments. |
| (2)     | Standard Scales (India), 24, Darya Ganj, Delhi .. ..        | Person Weighing Scales            |

Dealers

| Sl. No. | Name and Address of Dealer  | Details of Articles Sold                                  |
|---------|---|---|
| (1)     | Adarsh Engineering Works, 16/2522, Beadonpura, Karol Bagh, New Delhi. | Weights, Measures and Weighing and Measuring Instruments. |
| (2)     | Atma Ram Hari Ram, 4539, Pahari Dhiraj, Delhi .. ..                   | Weights, Measures and Weighing and Measuring Instruments. |
| (3)     | Avery Company of India (P) Ltd., 1 Ansari Road, Darya Ganj, Delhi.    | Weights, Measures and Weighing and Measuring Instruments. |
| (4)     | Baij Nath Ram Chander, 2425, Chawri Bazar, Delhi .. ..                | Weights, Measures and Weighing and Measuring Instruments. |
| (5)     | Banwari Lal Radha Kishan, 3635, Chawri Bazar, Delhi .. ..             | Weights, Measures and Weighing and Measuring Instruments. |
| (6)     | Bhagirath Mal Gobind Prasad, 24, Chawri Bazar, Delhi .. ..            | Weights, Measures and Weighing and Measuring Instruments. |
| (7)     | Bharat Machine Tools Company, Naya Bazar, Delhi .. ..                 | Weights, Measures and Weighing and Measuring Instruments. |
| (8)     | Bharat National Foundry, Motia Khan, New Delhi .. ..                  | Weights, Measures and Weighing and Measuring Instruments. |
| (9)     | Brij Bhushan Kishori Lal, Iron Merchants, 3642, Chawri Bazar, Delhi.  | Weights, Measures and Weighing and Measuring Instruments. |

Dealers (contd.)

| Sl. No. | Name and Address of Dealer  | Details of Articles Sold                                   |
|---------|---|--|
| (10)    | Chaman Lal Kesho Nath, Iron and Hardware Merchants, 1950, Lal Kuan Bazar, Delhi   | Weights, Measures and Weighing and Measuring Instruments.  |
| (11)    | Chuni Lal Gupta, 3691, Chawri Bazar, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (12)    | Delhi Tin Workshop, 2931, Hamilton Road, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (13)    | Deoki Nandan, Old Dharm Kanta, Kacha Bagh, Chandni Chowk, Delhi.  | Weights, Measures and Weighing and Measuring Instruments.  |
| (14)    | Dharam Chand Amar Nath, 14/4864, Bara Hindu Rao, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (15)    | Fakir Chand Mohan Lal, 3688, Chawri Bazar, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (16)    | Gulati Samiana & Elective House, Shop No. 55, B. No. G, Karbla, Lodi Colony, New Delhi.                                   | Weights, Measures and Weighing and Measuring Instruments.  |
| (17)    | Gupta Iron Company, 4962, Hauz Qazi, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (18)    | Hari Kishan Shiri Kishan & Bros., Chawri Bazar, Delhi   | Weights, Measures and Weighing and Measuring Instruments.  |
| (19)    | Hari Ram Ravi Shanker, 3629, Chawri Bazar, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (20)    | India Steel Corporation, VI/2856, Bazar Sikriwalan, Delhi   | Weights, Measures and Weighing and Measuring Instruments.  |
| (21)    | Jai Bharat Engineering Co-operative Industrial Society Ltd., Tarzan House, Anand Parbat Estate, N. Rohtak Road, New Delhi | Weights, Measures and Weighing and Measuring Instruments.  |
| (22)    | Jai Krishna Industries, 661-662, Churiwalan, Chawri Bazar, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (23)    | Jansons Patent Scale Industries, IV/625 Vishwas Nagar, Shahdara, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (24)    | Kansi Ram Rameshwar Dass, 502, Main Bazar, Subzimandi, Delhi.   | Weights, Measures and Weighing and Measuring Instruments.  |
| (25)    | Kapila Brothers, Kapila Building, 3999-4000, Naya Bazar, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (26)    | Kesho Dass Hari Chand, 52, Main Bazar, Subzimandi, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (27)    | Kundan Lal & Sons, 94, Ghaffar Market, Karol Bagh, New Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (28)    | Lachaman Dass Jai Dayal, Hardware Merchants, Chawri Bazar, Delhi.   | Weights, Measures and Weighing and Measuring Instruments.  |
| (29)    | Lekhu Ram Madan Gopal, XII/174, Main Bazar, Subzimandi, Delhi.  | Weights, Measures and Weighing, and Measuring Instruments. |
| (30)    | Nawal Kishore Ram Kishore, 1647, Lal Kuan, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (31)    | Partap Industries, 1655, Mangal Market, Bhagirath Palace, Chandni Chowk, Delhi.   | Weights, Measures and Weighing and Measuring Instruments.  |
| (32)    | Pratap Singh Harnam Singh, Chawri Bazar, Delhi  | Weights, Measures and Weighing and Measuring Instruments.  |
| (33)    | Punjab Tool Stores, 1094, Maliwara, Delhi   | Weights, Measures and Weighing and Measuring Instruments.  |

LICENSED MANUFACTURERS, DEALERS AND REPAIRERS OF WEIGHTS AND MEASURES

Dealers (concl'd.)

| Sl. No. | Name and Address of Dealer  | Details of Articles Sold                                  |
|---------|---|---|
| (34)    | Ramji Lal Raja Lal, 688, Near Tram Terminal, Subzimandi, Delhi                                | Weights, Measures and Weighing and Measuring Instruments. |
| (35)    | Rattan Lal & Sons, 3690, Chawri Bazar, Delhi .. .. .  | Weights, Measures and Weighing and Measuring Instruments. |
| (36)    | Roshan Lal Jain & Co., 3674, Chawri Bazar, Delhi .. .. .                                      | Weights, Measures and Weighing and Measuring Instruments. |
| (37)    | Sardari Lal Sat Pal, III Desbandhu Gupta Market, Karol Bagh, New Delhi.                       | Weights, Measures and Weighing and Measuring Instruments. |
| (38)    | Sat Pal Sudershan Kumar, Karol I-Church Road, Opposite Police Station, Karol Bagh, New Delhi. | Weights, Measures and Weighing and Measuring Instruments. |
| (39)    | H. C. Sen & Co., Fountain, Delhi .. .. .  | Weights, Measures and Weighing and Measuring Instruments. |
| (40)    | J. M. Suraj Bhan Aggarwal & Sons, Chawri Bazar, Delhi .. .. .                                 | Weights, Measures and Weighing and Measuring Instruments. |
| (41)    | M. L. Tara Singh & Sons, VI/6525, Fatehpuri, Delhi-6 .. .. .                                  | Weights, Measures and Weighing and Measuring Instruments. |

Repairers

| Sl. No. | Name and Address of Repairer  | Details of Articles Repaired   |
|---------|---|--|
| (1)     | Chawala Metal Works, G. T. Road, Delhi-Shahdara .. .. .                   | Weights and Beam Scales (Class C and D).                                 |
| (2)     | Deoki Nandan, Old Dharm Kanta, Kacha Bagh, Chandni Chowk, Delhi           | Bullion Weights & Beam Scales Class B.                                   |
| (3)     | Jai Krishna Industries, 661-662, Chawri Bazar, Delhi .. .. .              | Weights and Weighing Instruments.  |
| (4)     | Janson's Patent Scale Industries, IV/1625, Vishwas Nagar, Delhi-Shahdara. | Weights and Weighing Instruments.  |
| (5)     | Lyallpur Hardware & Tin Mfg. Co., VII/2925, Shahganj, Delhi .. .. .       | Beam Scales (Class B, C and D) and Weights inclusive of Bullion Weights. |
| (6)     | Mohd. Ifaq, 1409, Haveli Kalu Khawas Bazar, Chittli Kabar, Delhi.         | Brass Bullion Weights  |
| (7)     | Multan Engineering Works, 1773, Mir Jumla, Lal Kuan, Delhi                | Weights and Weighing Instruments.  |

KERALA

Manufacturers

| Sl. No. | Name and Address of Manufacturer                     | Details of Articles Manufactured        |
|---------|--|---|
| (1)     | South India Metal Co., Shoranur, South India .. .. . | Commercial weights from 50 kg to 100 g. |

## Dealers

| Sl. No. | Name and Address of Dealer  | Details of Articles Sold                                  |
|---------|---|---|
| (1)     | Avery Co. of India Ltd., 8/110, Silk Street, Calicut .. .. .                | Weights, Weighing Machines and Petrol Pumps.              |
| (2)     | Avery Co. of India Ltd., 6/78 Kalvetty Road, Ernakulam .. .. .              | Weights, Weighing Machines and Petrol Pumps.              |
| (3)     | A.N. Guna Shenoy & Co., Quilon .. .. .                                      | Weights and Measures.                                     |
| (4)     | P.M. Imbichi Koya, Hardware Merchant, Near 1st Railway Gate, Kozhikode.     | Weights.  |
| (5)     | Kurien Philip, Kadavil Veedu, Kundara .. .. .                               | Weights, Measures and Scales.                             |
| (6)     | Mather Stores Pulimood, Main Road, Trivandrum .. .. .                       | Weights, Measures and Weighing and Measuring Instruments. |
| (7)     | V.I. Mathew & Bros., General Merchants, Ranny .. .. .                       | Weights and Measures.                                     |
| (8)     | New Guna Shenoy & Co., Quilon .. .. .                                       | Weights, Measures and Weighing and Measuring Instruments. |
| (9)     | K.M. Parthasarathi & Sons, Hardware Merchants, 13/34 Palayam Road, Calicut. | Weights, Measures and Weighing and Measuring Instruments. |
| (10)    | M.S. Ramakrishna Pillai, M.S. & Co., Main Road, Quilon .. .. .              | Weights and Measures.                                     |
| (11)    | S.R.A. Reddiar & Co., Big Bazar, Quilon .. .. .                             | Weights, Measures and Scales (Balances).                  |
| (12)    | Y.N. Shenoy, Hardware Merchant, Adoor .. .. .                               | Weights and Measures.                                     |
| (13)    | Thomas Kunju, Hardware Merchant, Pathanamthitta, Quilon .. .. .             | Weights, Measures and Scales                              |
| (14)    | Thomas Varghese, Hardware Merchant, Kunnamkottu, Thodupuzha                 | Weights and Measures.                                     |
| (15)    | S. Velukutty Pillai & Sons, Hardware Merchants, Quilon .. .. .              | Weights, Measures and Weighing and Measuring Instruments. |
| (16)    | K. Yoosuf Kunju, Hardware Merchant, Mukunda Bazar, Quilon                   | Weights and Measures.                                     |

## MADRAS

### Manufacturers

| Sl. No. | Name and Address of Manufacturer  | Details of Articles Manufactured                          |
|---------|---|---|
| (1)     | Avery Company of India Limited, 16-17, Armenian Street, Madras-1                                    | Weights and Weighing Instruments.                         |
| (2)     | Common Central Tool Room and Model Foundry Unit, Erode, Coimbatore District.                        | Iron Weights.   |
| (3)     | Elseetee Industries, Trichy Road, Signanellur, Coimbatore .. .. .                                   | Weights, Measures and Weighing and Measuring Instruments. |
| (4)     | Government Pressure and Die Casting Unit, Industrial Estates, Guindy, Madras-16.                    | Commercial Weights.                                       |
| (5)     | Gurunath A., 10, Muthiya Mudali Street, Old Washermanpet, Madras-21.                                | Cast Iron and Brass Weights.                              |
| (6)     | India Scales, 45, Erukkancheri High Road, Vyasarpadi, Madras-12                                     | Weights and Weighing Instruments.                         |
| (7)     | Inthera, K.N.K., Jothi Engineering Works, K. Pudur Post, Madurai.                                   | Cast Iron Weights.  |
| (8)     | Jayshree Engineering Works, Private Ltd., 16, Bazullah Road, T. Nagar, Madras-17.                   | Cast Iron and Brass Weights.                              |
| (9)     | Lakshmana Nadar, V.A.A. and Brothers, Virudhunagar Industrial Works, Muthuramanpatti, Virudhunagar. | Cast Iron and Brass Weights.                              |



LICENSED MANUFACTURERS, DEALERS AND REPAIRERS OF WEIGHTS AND MEASURES.

Manufacturers (contd.)

| Sl. No. | Name and Address of Manufacturer  | Details of Articles Manufactured                          |
|---------|---|---|
| (10)    | Madras Scales Company, 11-A, Nore Veeraswamy Iyer Street, Nungambakkam, Madras-6.                   | Weighing Instruments.                                     |
| (11)    | Nagaswamy Foundry, Subramaniapuram, Madurai .. ..   | Commerical Weights.                                       |
| (12)    | Narayanaswamy Damodram, 'Radhakrishna Nilayam', Railway Station Road, Tiruvallur.                   | Cast Iron and Brass Weights.                              |
| (13)    | Natrajan, R. 197, Market Road, Pollachi Town, Coimbatore District.                                  | Weights, Measures and Weighing Instruments.               |
| (14)    | National Industries (Rajapalayam) Ltd., Rajapalayam, Ramanathapuram District.                       | Commercial Weights.                                       |
| (15)    | Public Works Workshops & Stores, Old Jail Street, Madras-1 ..                                       | Weights and Measures.                                     |
| (16)    | Rabindernath, 'Massey's', 4-B-4V, North Railway Terminus Road, Royapuram, Madras-13.                | Cast Iron and Brass Weights.                              |
| (17)    | Ramakrishnan, R., Service Industrial Works, 33/2, Katpadi Road, Vellore.                            | Cast Iron and Brass Weights.                              |
| (18)    | Ramanujam Naidu, C. Bharat Mechanical Engineering Works, Keelayur, Tirukkoilur, South Arcot.        | Cast Iron and Brass Weights.                              |
| (19)    | Selvi Industries, Ganapathi Post, Coimbatore .. ..  | Weights and Measures.                                     |
| (20)    | Service Centre for Brassware and Cutlery Industry, Kumbakonam                                       | Weights and Measures.                                     |
| (21)    | Seshachalam P. and Brothers, 26, Netaji Subhas Chandra Bose Road, Madras-1.                         | Weights, Measures and Weighing and Measuring Instruments. |
| (22)    | Sheffield Scales Company, Madras-1 .. ..  | Weights and Weighing Machines.                            |
| (23)    | State Scales Company, 5/8, Choolai High Road, Madras-7 ..   | Weighing Machines and Apparatus.                          |
| (24)    | Subramania Naicker T. 'Mani's Foundry', 2, Muthumari Chetty Street, Madras-1.                       | Cast Iron and Brass Weights.                              |
| (25)    | Sundarams Private Limited, 'TVS' Buildings, West Veli Street, Madurai.                              | Weights and Measures.                                     |
| (26)    | Tiruvenkata Mudaliar, K.M., Shri Kowmari and Company, 8, Ebraham Sait Street, Kondithope, Madras-1. | Cast Iron and Brass Weights.                              |
| (27)    | Unicorn Private Limited, 29, Mount Road, Madras-2 .. ..   | Cast Iron and Brass Weights.                              |
| (28)    | Vasan Engineering Company, 9-B, Prithvi Avenue, Alwarpet, Madras-18.                                | Cast Iron Weights.  |
| (29)    | Venus Light Casting Works, 45-Erukkancheri High Road, Vyasaripadi, Madras-12.                       | Weights and Measures.                                     |
| (30)    | Vummudiars (Manufacturers) Limited, 162-Mount Road, Madras-2  | Weights and Measures.                                     |
| (31)    | West End Hardware, 187, Nainiappa Naick Street, Madras-1 ..   | Commercial Weights.                                       |

Dealers

| Sl. No. | Name and Address of Dealer   | Details of Articles Sold                                  |
|---------|--|---|
| (1)     | Abdul Azzez A.K., 3, Sembudoss Street, Madras-1 .. ..                  | Weights and Weighing Machines.                            |
| (2)     | Avery Company of India Ltd., 16-17, Armenian Street, Madras-1          | Weights, Measures and Weighing and Measuring Instruments. |
| (3)     | Bhaktavachalu Naidu, P. 39, Venkatachala Mudali Street, P.T. Madras-3. | Weights and Weighing Machines.                            |

Dealers (contd.)

| Sl. No. | Name and Address of Dealer  | Details of Articles Sold                               |
|---------|---|--|
| (4)     | Devarajulu, M., 35, Godown Street, Madras-1                                       | Weights, Measures, Weighing and Measuring Instruments. |
| (5)     | Excelsior Hardware Stores, 355, Rasappa Chetty Street, Madras-3                   | Weights and Weighing Machines.                         |
| (6)     | Gudiyattam Hardware Mart, Manaff Buildings, Santhapet, Gudiyattam.                | Cast Iron and Brass Weights.                           |
| (7)     | Gurunath, A. 10, MuthiYa Mudali Street, Old Washermanpet, Madras-21.              | Cast Iron and Brass Weights.                           |
| (8)     | Hardware and Mills Stores, 180-181, Long Bazaar, Vellore                          | Cast Iron and Brass Weights.                           |
| (9)     | Janakiram Pillai, V.G. 29, Govindappa Naick Street, Madras-1                      | Weights, Measures, Weighing and Measuring Instruments. |
| (10)    | Jayshree Engineering Works Ltd., 16, Bazullah Road, T. Nagar, Madras-17.          | Weights, Measures and Weighing Instruments.            |
| (11)    | Kannappa Pillai, S., 4, Perumal Mudali Street, Sowcarpet, Madras-1.               | Weights and Weighing Machines.                         |
| (12)    | Madras Commercial Corporation, 1/55, Mount Road, Madras-2                         | Weights, Measures and Weighing Instruments.            |
| (13)    | Madras Scales Company, 11-A, Nore Veeraswamy Iyer Street, Nungambakkam, Madras-6. | Weights and Weighing Machines.                         |
| (14)    | Metro Hardware Mart, 15-16, Rasappa Chetty Street, P.T. Madras-3.                 | Weights and Weighing Instruments.                      |
| (15)    | Mohamed Abdul Khader, N.K., 30, Mannadi Street, Madras-1                          | Commercial Weights.                                    |
| (16)    | Narasimhalu Chetty, K.N. 15, Bazar Street, Wallajahpet                            | Cast Iron and Brass Weights.                           |
| (17)    | Narayanaswamy Damodram, 'Radhakrishna Nilayam', Railway Station Road, Tiruvallur. | Cast Iron and Brass Weights.                           |
| (18)    | Narayanaswamy Nayagar, M., 195, Market Road, Arni                                 | Weights, Measures and Balances.                        |
| (19)    | Natarajan, R. 197, Market Road, Pollachi Town, Coimbatore Distt.                  | Weights, Measures and Weighing Instruments.            |
| (20)    | Rabindernath, Masseys, 4B-4C, North Railway Terminus Road, Royapuram, Madras-13.  | Weights and Measures.                                  |
| (21)    | Radhakrishna Reddiar, K.N. Bazar Street, Cheyyar                                  | Cast Iron and Brass Weights.                           |
| (22)    | Ramchandra Reddi Desu, A., Bazar Street, Wandiwash, North Arcot, District.        | Cast Iron, Bullion and Brass Weights.                  |
| (23)    | Ramlingam, A., 118, Bazaar Street, Wandiwash                                      | Cast Iron and Brass Weights.                           |
| (24)    | Ramanujam Naidu, C., Bharat Mechanical Engineering Works, Keelayur, Tirukkoilur.  | Weights and Measures.                                  |
| (25)    | Royal Hardware Mart, 30, Devaraja Mudali Street, Madras-3                         | Weights, Measures, Weighing and Measuring Instruments. |
| (26)    | Safety Hardware Mart, 12/14, Rasappa Chetty Street, P.T. Madras-3.                | Weights, Measures and Weighing Instruments.            |
| (27)    | Salaam, M.A. West End Hardware, 178, Nainiappa Naick Street, P.T. Madras-3.       | Cast Iron and Brass Weights.                           |
| (28)    | Sheik Abdul Khader, V.t., 224, Thamby Chetty Street, Madras-1.                    | Cast Iron and Brass Weights.                           |
| (29)    | Shroff Vyabarigal Sangham, 419/1, Main Bazaar, Vellore                            | Weights and Measures.                                  |
| (30)    | Srinivasan, A. 54, Market Road, Arni, North Arcot District                        | Weights and Measures.                                  |
| (31)    | State Scales Company, 5/8, Choolai High Road, Madras-7                            | Weighing Machines and Apparatus.                       |
| (32)    | Subramania Naicker, 2, Muthumari Chetty Street, Mannadi, Madras-1.                | Cast Iron and Brass Weights.                           |
| (33)    | Sulfi Hussai S.K.L. 3, Post Office Street, P.T. Madras-3                          | Weights and Measures.                                  |

Dealers (concl.d.)

| Sl. No. | Name and Address of Dealer   | Details of Articles Sold                                  |
|---------|--|---|
| (34)    | Sundarams Private Ltd., 'TVS' Buildings, West Veli Street, Madurai.        | Weights, Measures and Weighing and Measuring Instruments. |
| (35)    | Suravelu Chettiar, S.A. 791, Mundy Street, Maniambadi, North Arcot.        | Cast Iron Weights.  |
| (36)    | Thambu Reddy, K.M. 58, Gandhi Road, Arkonam . . . .                        | Cast Iron, Bullion and Brass Weights.                     |
| (37)    | Thanikachalam, M., Murugan, Hardware, 31-32, West Car Street, Chidambaram. | Weights and Measures.                                     |
| (38)    | Venkanna Chettiar, B. R. 201, Gandhi Road, Tiruvettipuram, Cheyyar.        | Cast Iron and Brass Weights.                              |
| (39)    | Venkatesam Pillai V., Gandi Bazaar, Krishnapuram, Gingee . .               | Weights, Measures and Weighing and Measuring Instruments. |
| (40)    | Venkoba Rao, J.A. 6, Peddy Naicken Street, Madras-3 . . . .                | Weights and Measures.                                     |
| (41)    | Venkobasa, P. S. 109-A, Chavadi Street, Sheikpet, Kancheepuram             | Weights and Measures.                                     |
| (42)    | Venugopal, M. 61, Arjuna Mudali Street, Gudiattam . . . .                  | Cost Iron and Brass Weights.                              |
| (43)    | Vummudiars (Manufacturers) Ltd., 162, Mount Road, Madras-2                 | Weights, Measures and Weighing and Measuring Instruments. |

Repairers

| Sl. No. | Name and Address of Repairer   | Details of Articles Repaired                               |
|---------|--|--|
| (1)     | Avery Company of India, 16-17, Armenian Street, Madras-1 . .                                     | Weighing and Measuring Instruments.                        |
| (2)     | Jayshree Engineering Works Ltd. 16, Bazullah Road, T. Nagar, Madras-17.                          | Weights, Measures, and Weighing and Measuring Instruments. |
| (3)     | Madras Scales Company, 11-A, Nore Veeraswamy Iyer St., Nungambakkam, Madras-6.                   | Weights and Weighing Machines.                             |
| (4)     | Natarajan, R. 197, Market Road, Pollachi Town, Coimbatore District.                              | Weights, Measures and Weighing and Measuring Instruments.  |
| (5)     | Sriramulu A. Siruvakkam Village, Anuppambatti Post Ponneri                                       | Weighing Machines.   |
| (6)     | State Scales Company, 5/8, Choolai High Road, Madras-7 . .                                       | Weighing Machines.   |
| (7)     | Subramania Naicker T. Mani's Foundry, 2, Muthumari Chetty Street, Mannadi, Madras-1.             | Weights and Measures.                                      |
| (8)     | Sundarams Private Ltd., 'TVS' Buildings, West Veli Street, Madurai.                              | Weights, Measures, Weighing and Measuring Instruments.     |
| (9)     | Thomas, A.V. & Co. (India) Ltd., Weighing Machines Department, 2/21, First Line Beach, Madras-1. | Weighing and Measuring Instruments.                        |
| (10)    | Vummudiars (Manufacturers) Private Ltd., 162, Mount Road, Madras-2.                              | Weights, Measures, Weighing and Measuring Instruments.     |

Due to a printing mistake in the July 1959 issue in the advertisement of Indian Telephone Industries Ltd., Bangalore, appearing in the July, 1959 issue of 'Metric Measures' the illustration of a Uni-selector appeared with the description of an inter-communication telephone. The error is regretted.

# CONVERSION OF WEIGHTS FOR ORDINARY PURPOSES

| (4)  |     | (3) |       | (2)   |       | (1)   | (N)    | (1A)  |                | (2A)          |       | (3A)     |               | (4A)             |               |
|------|-----|-----|-------|-------|-------|-------|--------|-------|----------------|---------------|-------|----------|---------------|------------------|---------------|
| tons | cwt | mds | seers | seers | tolas | tolas | Number | grams | milli<br>grams | kilo<br>grams | grams | quintals | kilo<br>grams | metric<br>tonnes | kilo<br>grams |
| 1    | 0   | 2   | 27    | 1     | 6     | 0·09  | 1      | 11    | 664            | —             | 933   | —        | 37            | 1                | 16            |
| 1    | 19  | 5   | 14    | 2     | 11    | 0·17  | 2      | 23    | 328            | 1             | 866   | —        | 75            | 2                | 32            |
| 2    | 19  | 8   | 2     | 3     | 17    | 0·26  | 3      | 34    | 991            | 2             | 799   | 1        | 12            | 3                | 48            |
| 3    | 18  | 10  | 29    | 4     | 23    | 0·34  | 4      | 46    | 655            | 3             | 732   | 1        | 49            | 4                | 64            |
| 4    | 18  | 13  | 16    | 5     | 29    | 0·43  | 5      | 58    | 319            | 4             | 666   | 1        | 87            | 5                | 80            |
| 5    | 18  | 16  | 3     | 6     | 34    | 0·51  | 6      | 69    | 983            | 5             | 599   | 2        | 24            | 6                | 96            |
| 6    | 18  | 18  | 30    | 7     | 40    | 0·60  | 7      | 81    | 647            | 6             | 532   | 2        | 61            | 7                | 112           |
| 7    | 17  | 21  | 17    | 8     | 46    | 0·69  | 8      | 93    | 310            | 7             | 465   | 2        | 99            | 8                | 128           |
| 8    | 17  | 24  | 5     | 9     | 52    | 0·77  | 9      | 104   | 974            | 8             | 398   | 3        | 36            | 9                | 144           |
| 9    | 17  | 26  | 32    | 10    | 57    | 0·86  | 10     | 116   | 638            | 9             | 331   | 3        | 73            | 10               | 160           |
| 19   | 14  | 53  | 23    | 21    | 35    | 1·71  | 20     | 233   | 276            | 18            | 662   | 7        | 46            | 20               | 321           |
| 29   | 11  | 80  | 15    | 32    | 12    | 2·57  | 30     | 349   | 914            | 27            | 993   | 11       | 20            | 30               | 481           |
| 39   | 7   | 107 | 7     | 42    | 69    | 3·43  | 40     | 466   | 552            | 37            | 324   | 14       | 93            | 40               | 642           |
| 49   | 4   | 133 | 38    | 53    | 47    | 4·29  | 50     | 583   | 190            | 46            | 655   | 18       | 66            | 50               | 802           |
| 59   | 1   | 160 | 30    | 64    | 24    | 5·14  | 60     | 699   | 828            | 55            | 986   | 22       | 39            | 60               | 963           |
| 68   | 18  | 187 | 22    | 75    | 1     | 6·00  | 70     | 816   | 466            | 65            | 317   | 26       | 13            | 71               | 123           |
| 78   | 15  | 214 | 14    | 85    | 59    | 6·86  | 80     | 933   | 104            | 74            | 648   | 29       | 86            | 81               | 284           |
| 88   | 12  | 241 | 5     | 96    | 36    | 7·72  | 90     | 1049  | 742            | 83            | 979   | 33       | 59            | 91               | 444           |
| 98   | 8   | 267 | 37    | 107   | 14    | 8·57  | 100    | 1166  | 380            | 93            | 310   | 37       | 32            | 101              | 605           |

How to use the Table:

(1) Find the required number from Column(N).

(2) Look up the required value under appropriate column.

(3) Columns(1) and (1A), (2) and (2A), (3) and (3A), (4) and (4A), should be read together.

For example, values from (1) and (1A) can be converted but not from (1) and (2A).

Example: (1) To convert 20 tolas into grams and milligrams, look up 20 under column(N) and find the equivalent under(1A) viz., 233 grams, 276 milligrams. For converting 20 grams look up under column 1. The value is 1·71 tolas.

(2) To convert 50 kilograms into seers, look up 50 under column (N) and find the equivalent under column (2), viz., 53 seers, 47 tolas. To convert 50 seers look up under column 2A. The value is 46 kg and 655 grams.

Based on IS:1020—1957 Indian Standard  
Conversion Tables for Ordinary Use