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metric measures

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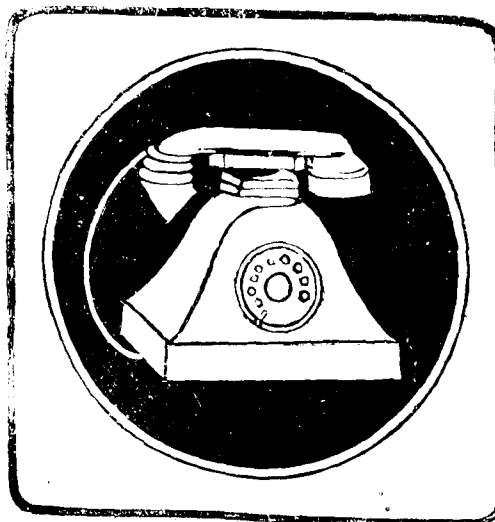
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Does Metric System Make Possible Economic Production ?

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THE joy and satisfaction with which the European metric countries have received the news of India's decision to adopt the metric system can hardly be exaggerated. The metric world block is thereby further strengthened and it is to be hoped that other countries will also follow India's example. England and the U.S.A. have already recognized the great advantages of the metric decimal system (*see* Report of the 'Committee on Weights and Measures Legislation, London, H.M. Stationery Office, 1951'). However, they have not taken any decision regarding the introduction of the metric system in practice; it is assumed that the advanced stage of industrialization in these countries stands as an obstacle. The unfortunate fact, therefore, remains that interrelations between countries are made difficult by the co-existence of several sys-

tems, and this state of affairs will presumably go on for a considerable time.

Comparison of the Systems

Physical quantities, such as measures, weights, etc. are designated by the product of the unit and the numerical value. A value by itself cannot represent a physical quantity; for example, the statement: 'the body has a weight equal to 50' has no meaning. To this numerical value the unit must be attributed, for example, 'kg'. The choice of the physical units is optional and it is necessary to specify the units to be used for measurements. The choice must be limited to a few basic units from which all the other units should be derived.

The question of physical and technical units obviously transcended the national scope so much so that the International Metric Convention was created in 1875. Today this Convention consists of 36 countries. At the same time the 'Bureau International des Poids et Mesures' was also formed. This Bureau is the trustee for the original standards of length and weight. The last plenary meeting for weights and measures which was held in

*Dr. Hermann Schmitz, Head of the Standards Department of AEG's Turbine Factory in Essen was deputed to India for 4 months from November 1959 by the West German Government under the Indo-German Exchange Programme. He worked in collaboration with the Indian Standards Institution and visited a number of factories in Calcutta, Bombay, Madras and other places and discussed problems of change-over to the metric system, particularly the conversion of engineering drawings and designs. His views would be of interest to Indian industries.

—Editor

1954 recommended the following basic units as the international system of units:

for length	metre
for mass	kilogram
for time	second
for electrical current	ampere
for temperature	degree Kelvin
for light intensity	candela

Despite the activities of the Metric Convention—which also includes the U.K. and the U.S.A. as members—we still have a long way to go to achieve unity regarding units. It is true that the ampere and volt are universally used and the same unit of time is also used, but for length, mass and temperature there are a medley of units in existence.

The 'metre' and 'kilogram' are defined as international basic units. On the other hand the so-called Imperial system of weights and measures is nothing but a heterogeneous collection of separate units which originated independently of each other and the system into which they were welded is not, therefore, homogeneous.

The 'yard', for example, was defined in the 12th century as the distance between the 'tip of the nose of His Majesty Henry I of England and the tip of the thumb of his outstretched hand'. In the 16th century the 'foot' was defined as 'the average tread of 16 men'. The legal 'rod' was $16\frac{1}{2}$ feet and the foot was divided into 12 inches. The difficulties of the inch system will become apparent only when we consider how the units in the two systems are subdivided. In the metric system we have the decimal subdivision, for example: 1 metre = 10 decimetres = 100 centimetres = 1,000 millimetres. On the other hand, the Imperial system requires mental acrobatics, for example, 1 mile = 8 furlongs = 320 rods = 1,760 yards = 5,280 feet = 63,360 inches.

In the case of weights the confusion is still worse. Besides the officially recognized

metric weights system there are also 5 Imperial weight systems.

Further trouble is caused by the fact that certain English and American units, though having the same name, are different. For example, the yard does not have the same value on both sides of the Atlantic ocean, the American gallon is about 20 percent less than the Imperial gallon and the English ton is 10 percent heavier than the American ton.

Units and measures are not only important for science but they form an inseparable part and parcel of industrial production. The quality of industrial products depends to a large extent on the stage of development of measuring techniques. Measuring plays an important role even in daily life. When we pay money for an article we like to know its correctly measured value. It has been universally recognized that the State must assume the task and responsibility of ensuring that the possibility for correct measurement is available and that the articles are correctly measured.

According to the Imperial system it is possible to measure correctly. However, as we have seen above, this requires plenty of mental acrobatics and arithmetic tables. Thus, for example, the requirements of the industry for units for precision measuring methods can no longer be met by dividing the inch into 64 parts. The consequence is that the inch has to be divided decimally so much so that two different systems appear in one numerical value.

Naturally, the correct application of any measuring system and its understanding is only a question of being accustomed to the system concerned. Only thus can those who are accustomed to the metric system understand that it is possible to achieve high precision in industrial production with the inch system.

DOES METRIC SYSTEM MAKE POSSIBLE ECONOMIC PRODUCTION ?

When the metric system with its precisely defined basic units and its logical decimal structure has taken root in India, it will be evident to all how difficult every operation had been to them before.

Metric System for Mechanical Engineering

The change of units naturally entails certain difficulties with regard to change in ideas, values and also change in the industrial production.

Teaching in schools is absolutely necessary; but first of all the teachers must readjust their ideas and become accustomed to the metric system. Textbooks are the most important means for education in the metric system. Merely using textbooks from metric countries such as Germany, France and Italy will not be sufficient nor will superficial conversion tables alone be of any use. The textbooks must be suitable for Indian conditions; they must illustrate the advantages of the metric system and make it easy for the student to readjust himself to this system.

The conversion of basic units like the yard or the inch to the metric system presents no difficulty because only a single value has to be converted. It is, however, more difficult when we come to compound units; for example, pressure is expressed as $\text{kg/cm}^2 = 1 \text{ atmosphere}$ in the metric system whereas in the Imperial system it is lb/sq. in. ; tensile strength or yield strength is given in kg/mm^2 in metric system and in tons/sq. inch in the Imperial system.

The difficulty here is not only in the conversion of a more complicated value, but the engineer is accustomed only to the values expressed in the inch system. A value in the metric system does not convey to him the precise technical significance. Tables with vivid schematic representations are in my opinion essential for this education.

This process of re-education will extend over a considerable period of time. If one starts only with this re-education, the danger will be that the young men after finishing their education will feel like fish out of water when they come in contact with daily life and enter into industrial production where the change-over has not yet been effected. Therefore, the education of the young men in the metric system and the change-over to the metric system must proceed side by side.

It appears to me of the utmost importance that the change-over should have its starting point in the manufacturing concerns; here, sufficient experience is available with regard to the units (weights and measures) whose application in daily practice must be thoroughly understood from the point of view of calculations and measuring techniques. If the change-over is first effected in the manufacturing concerns, the factory workers will imbibe the metric system, and will impress those who surround them and those who come into contact with them in the home as well as in society circles, with the advantages of the metric system.

It would be very complicated to enter into details regarding the implications of a change-over in all the branches of industry; we shall, therefore, confine ourselves to mechanical engineering and the supplying industries connected with it.

What is Economical Production ?

If one wishes to know whether the mere adoption of the metric system will guarantee economical production, it must first of all be clearly understood what is meant by economical production.

Drawings serve as the language in a manufacturing concern; they form the basis of a smooth production process, they guarantee the functional quality of the manufactured article. The clearer, more

precise and more comprehensive the drawing is, the easier will it be for the worker in the factory to produce according to the drawing. It is not sufficient for the designer to ensure that his designs are functionally satisfactory. A good working design should not only be functionally perfect, but it must also keep the material, equipment, cost and time to a minimum. For this the designer must have a good knowledge of the material to be used and he must also have a good knowledge of the methods and processes of production.

Naturally the designer cannot be omniscient. Standards and standard specifications are, therefore, an important help for him in his highly responsible work. First of all there are the national standards which constitute the basis for an understanding and co-operation between the various branches of industry (materials, accessories, etc.). The national standard, by itself, will not guarantee economical production for a particular manufacturing concern. It is absolutely necessary that a special department should be set up in the factory in order to examine the relevant national standards and if necessary revise them

according to the economical requirements of the factory; or even set up special standards on the basis of these national standards. Thus, apart from the designing office, we have the standards department under an experienced standards engineer.

The standards which are of great importance for obtaining a good design and which have to be prepared by the standards department for the requirements of the factory concerned, can be divided into the following groups:

(1) Basic Standards

It is not quite easy to give an exact definition of basic standards since they form the basis of all design and standardization work, and the limits of applicability thus depend on the branch of the industry concerned. Some of the most important basic standards in mechanical engineering are standards for limits and fits (round and flat fits), thread profile, thread dimension and thread tolerances, gear profiles, dimensions and tolerances for gears, connecting dimensions for coupling, piping flanges, etc. This may be illustrated by an example. Figure 1 represents a flange and the associated basic standards.

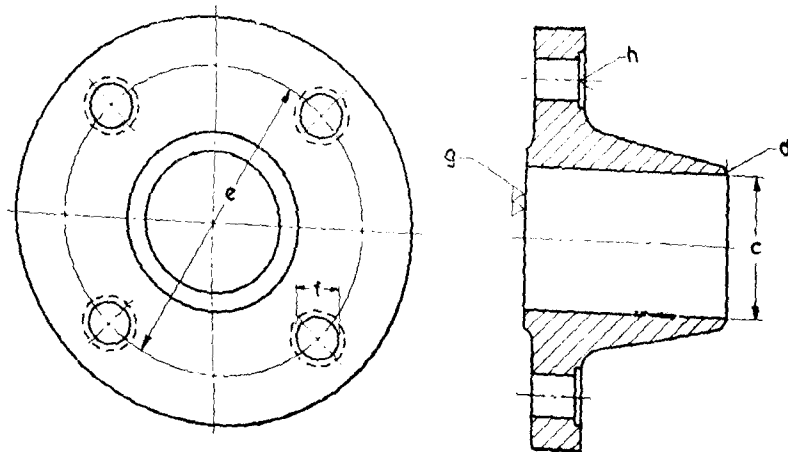


Fig. 1—Flange and Basic Standards

DOES METRIC SYSTEM MAKE POSSIBLE ECONOMIC PRODUCTION?

The following basic standards are necessary for the manufacture of this item :

- calculation standard for flanges,
- nominal pressure for determining the constructional dimension of the flanges,
- nominal widths,
- form of welded joint for pipe connection,
- bolt hole circle diameter and number of bolt holes,
- through holes for screws,
- surface finish, and
- counterboring and countersinking for nut seating.

It may be asked, why have so many basic standards when the finished product itself is in any case standardized? The answer is that these standards are not only meant for flanges but also for valves, slide valves, pipes, gaskets, etc. These standards further form the basis for a co-ordination, among others, between the work of the various standards committees. They are also the basis for the possibility of an obligatory deviation (necessitated by factory conditions) from the standard of the finished products, where, however, the connecting dimensions, for example, correspond to the basic standards. The scope of basic standards also includes the choice from national standards according to the factory conditions in order to limit the equipment and also for economical store keeping.

(2) Standards for a Uniform Interpretation of Drawings, Designations and Other Technical Data

Under this category may be included especially the drawing standards prepared at the national level. It must be possible to manufacture the parts represented, dimensioned or otherwise characterized and indicated on the drawing, either in one's own factory or if necessary outside. The drawing must be clearly understandable so that the

planning office can easily carry out their work according to this drawing, and the worker in the workshop can also work according to this drawing.

Figures 2—6 are examples of correct and wrong representation. They show the importance of following a standard practice in drawing.

(3) Standards for Delivery Conditions, Test and Acceptance

These standards specify the quality of the products required by the consumer and contain methods of test and acceptance. The designer can give in his drawing the reference to these standards, thereby making clear his requirement regarding quality. Thus, the drawings need not be encumbered with detailed explanation, text etc.

(4) Standards for Materials

An absolutely necessary requirement for the designer is the standards containing conventional designations, properties of strength and chemical composition of the materials. Other similar properties of the materials, such as weldability, high temperature stability, brittleness, bendability are also of great value.

National standards specify the materials which are being or are to be produced in the country. The task of the individual manufacturing concern is to choose the material best suited for its own purposes. In order to be economical in store-keeping it is necessary to have only a few qualities of the materials.

(5) Standards for Semi-finished Products

When a finished product is manufactured, the designer must know what semi-finished product is to be used. He would, therefore, be required to give the desired basic materials in the part list, for example, round material, rolled or forged, forged bushing,

etc. He has to make his choice on the basis of the standards for semi-finished products, which have to represent, for the factory concerned, a selection from the national standards for keeping the stock to a minimum.

(6) Standards of Finished Products

These are of great help to the designer since he does not have to design the finished products himself. They merely have to be indicated in the part list by their full designation. The standard of finished product also guarantees the best design and the national standard guarantees that standardized parts would be available. It would be uneconomical if a machine factory has to produce their own screws, washers, nuts and locking plates. The standardized and, therefore, commercially popular tools such as drills, screw taps, milling cutters, etc. can be procured at a cheaper rate from factories which are specially set up to produce these tools.

These are the main groups of standards which may be supplemented in a particular factory with the factory standards.

To give a further instance of economical production, we may mention the importance of limitation of types. The cost of switch-over from one type to another is possibly the main concern of the factory manager. Unfortunately, there are certain customers who are not satisfied to limit their choice to standard products. They, therefore, place orders for special types of products. For instance, in a factory of cutter tools 80 percent of the orders were for non-standardized designs. These orders, however, represented only 10 percent of the returns. Educating the consumer by demanding higher prices for non-standardized products and refusing orders in cases where the manufacture according to the

special order is uneconomical is the only way to limit the number of types.

A lot more could be said about setting up, implementation and the economical results of standards, but that would be a divergence from our subject. It may be merely stated here that standardization is indispensable for a good design and economical production.

Change-over in Factories

Up to now we have elaborated the theme that drawings and standards are the basis of an economical production. We shall now discuss the question as to whether a mere change and conversion of a drawing (prepared in the Imperial system) to the metric system will guarantee an economical production.

From the comparison between the two systems given at the very beginning of the article, it may be gathered how much more advantageous and comprehensive the metric system is.

Unfortunately, the view has often been put forward that in order to render universal satisfaction and guarantee interchangeability a mere conversion of inch values into metric values would suffice. It is wrong to countenance such compromises which do no justice to the metric system, whose advantages are thereby thrown away, because the converted values will have to be expressed up to one hundredth or even one thousandth of a millimetre. Let us assume, for example, that a worker places an order for a drill by stating its outside diameter as 15.875 mm

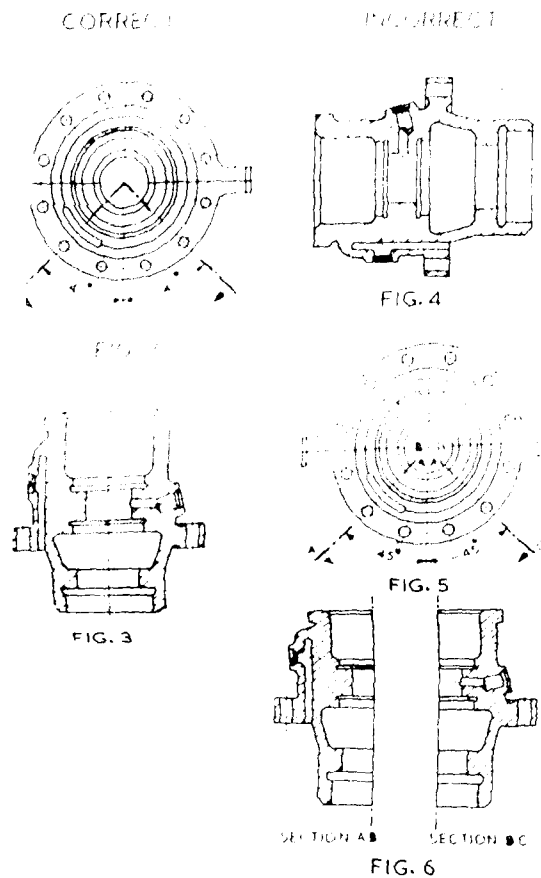


Fig. 2 to 6—Representation of Section
The standard for the representation of section is IS : 696 (see figs. 2-6). The direction of view is represented by an arrow. The line of cut is represented by a thick dot-dash line and designated by capital letters.

If it is necessary to show the position of bores, channels, etc., the angle must be shown in addition to the cut (see fig. 2). If the position of the cut is clear from the figures, the line of cut may be omitted.

The line of cut need not be designated by letters—if only one section is represented, or if the section is represented according to IS : 696 with the same scale as the perspective.

The example shows a part with fitting for pressurized oil and leak-gas exhaust. Figure 3 conforms to IS : 696 whereas figure 4 is not correct, but turned by 90 degrees. Figures 5 and 6 are correct; however, the sectional representation is separated and has no common middle line. This may lead to errors.

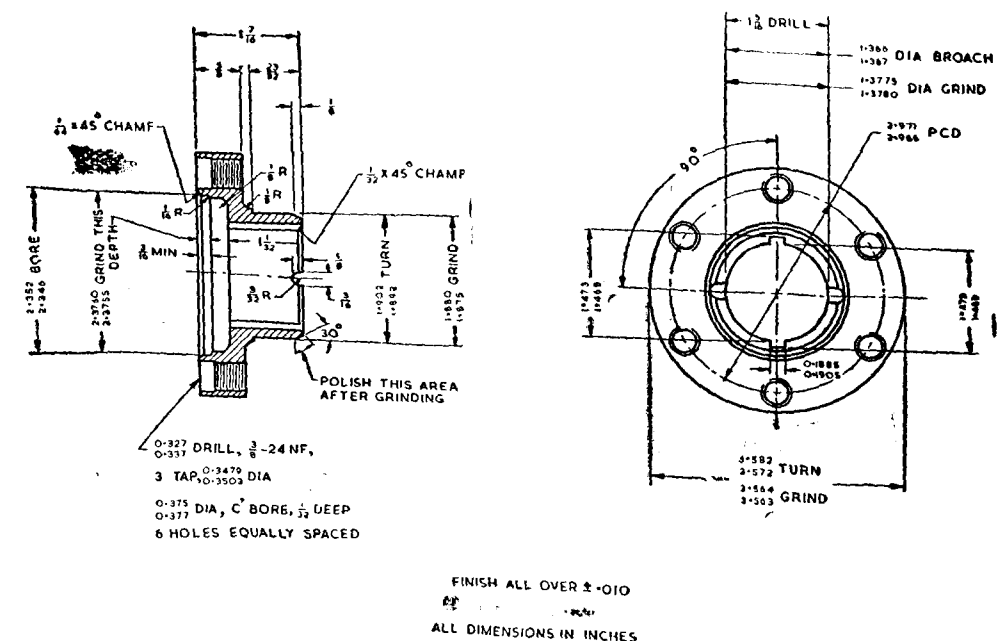


Fig. 7—Main Drive Flange—American Drawing in original Inch System

(instead of 5/16 in). Now, it is not only cumbersome to express this value orally, but to write down the three unnecessary digits takes time and may lead to errors. Such a conversion to the metric system in a way ensures economical production and entails only needless expense.

The following drawings show two ways of conversion.

Figure 7 shows an American drawing in the original inch system. Figure 8 shows the same drawing converted into the metric

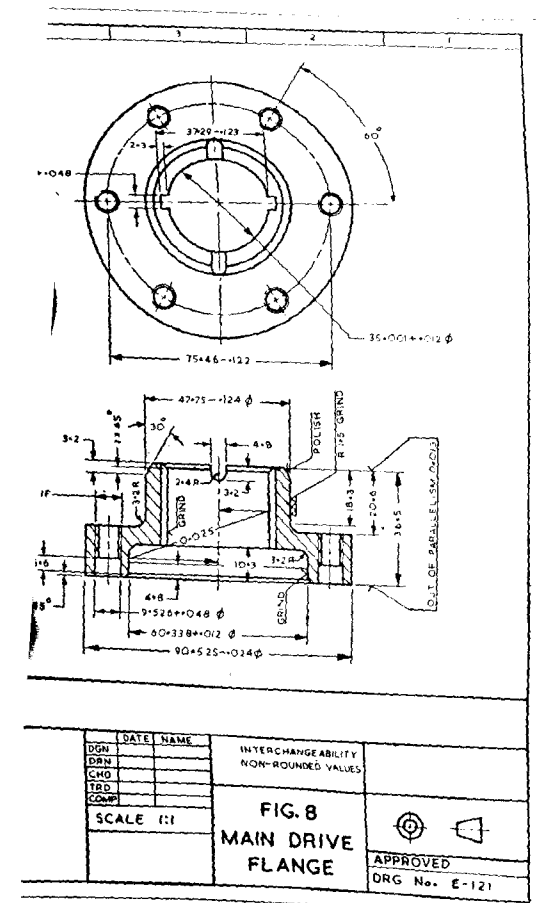


Fig. 8—Main Drive Flange

system in such a way that interchangeability is assured. (Certain German basic standards for surface finish, material and deviations of dimensions without tolerance specification were taken into consideration).

Figure 9 represents the same part, no longer interchangeable but in correct metric values. Metric thread is used as well as the German basic standards on limits and fits, deviation of form and position, etc.

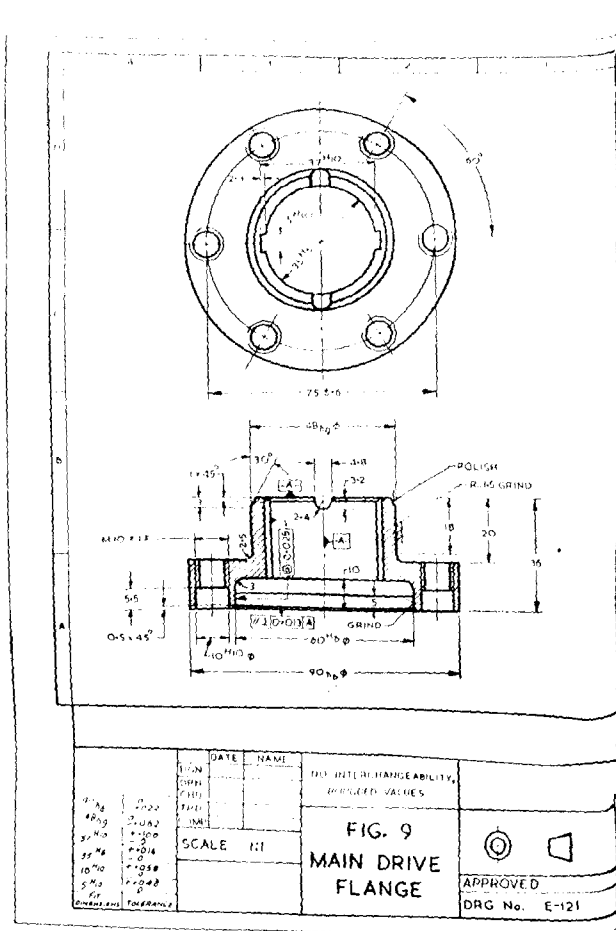


Fig. 9—Main Drive Flange

DOES METRIC SYSTEM MAKE POSSIBLE ECONOMIC PRODUCTION?

Now, many may ask why a drawing should be converted to the correct metric system with straight dimensions, etc.? Are not the disadvantages of non-interchangeability so great that one has to expect dislocation of the manufacture and considerable expense?

The manufacturers of products with long working life may ask what about the supply of spare parts and repairs? For example, a factory which has manufactured more than 20,000 stationary single cylinder Diesel engines in the inch system will have to continue to manufacture the old parts as spare parts, if the inter-changeability with the new metric parts is no longer ensured. Thus the variety of types will increase.

These are pertinent questions which serve to show how deep one has to go into these problems in order to make practical suggestions to the manufacturer. Naturally the solution for the different branches of industry would appear different.

It may, therefore, be stated that a mere conversion to the metric units will not guarantee economical production. Adopting the true metric system forms the only basis for this.

The Indian machine industries manufacture majority of their products under licences and according to foreign drawings. It even happens that a factory has licence contracts not only with different firms of a foreign country but with different firms of different foreign countries. It is, therefore, hardly to be expected that these foreign drawings can guarantee economical production since Indian standards of the group mentioned earlier are not used, not to mention company selections and standards of the local industry. The drawings must,

therefore, be revised to suit conditions in India regarding available parts, semifinished products etc., and the possibilities for economical production existing in a factory; in revising, functional qualities such as efficiency, strength, manipulatability etc. should not be affected.

The metric system can be introduced along with the revision of the drawings. For this change-over it is necessary to have suitable standards which specify what metric values should be adopted to replace the old inch values. The most important bases for economical production are, as already mentioned, selection from national standards, setting up dimensional standards (for example, standards for thread diameter, bore diameter, selection of fits, etc.) as well as company standards for semifinished products and finished products.

Certain company standards from Germany which can also be used for the industry here may be given as examples.

Table 1 shows a conversion table from Whitworth to metric threads. Besides the conversion of threads, such items as the oil core areas, through holes, widths over flat as well as their new values which again correspond to the values from the national standards are given.

Table 2 shows a selection for fit holes with H 7 tolerance. For making those fit hole 3 different tools (drill, special drill and reamer) as well as a limit gauge are needed. Since such tools are expensive preferred nominal diameter must be specified apart from a selection of fits, (for example, use of basic hole) for each factor, and the drawings must be changed according to these values.

Table 1—CONVERSION TABLE—WHITWORTH THREAD TO METRIC THREAD

Thread Whitworth	Metric	Major Dia	Minor Dia	Core Area cm ²	Depth of Thread	Pitch Dia	Pitch	Core Drill Dia	Through Hole Dia	Width Across Flats
1/2"	M 12	12	9.726	0.743	1.137	10.863	1.75	10	14	19
		12.700	9.990	0.784	1.355	11.345	2.117		15	22
5/8"	M 16	16	13.402	1.41	1.299	14.701	2	13.75	18	24
		15.876	12.918	1.311	1.479	14.397	2.309		18	27
3/4"	M 20	20	16.752	2.20	1.624	18.376	2.5	17.25	23	30
		19.051	15.798	1.960	1.627	17.424	2.540		22	32
7/8"	M 24	24	20.102	3.17	1.949	22.051	3	20.75	27	36
		22.226	18.611	2.720	1.807	20.419	2.822		25	36
1"	M 27	27	23.102	4.19	1.949	25.051	3	23.75	30	41
		25.401	21.335	3.575	2.033	23.368	3.175		28	41
1 1/8"	M 30	30	25.454	5.09	2.273	27.727	3.5	26	33	46
		28.576	23.929	4.497	2.324	26.253	3.629		32	46
1 1/4"	M 33	33	28.454	6.36	2.273	30.727	3.5	29	36	50
		31.751	27.104	5.770	2.324	29.428	3.629		35	50
1 3/8"	M 36	36	30.804	7.45	2.598	33.402	4	31.5	39	55
		34.926	29.505	6.837	2.711	32.215	4.233		38	55
1 1/2"	M 39	39	33.804	8.97	2.598	36.402	4	34.5	42	60
		38.101	32.680	8.388	2.711	35.391	4.233		42	60
1 3/4"	M 45	45	39.154	12.04	2.923	42.077	4.5	40	48	70
		44.452	37.946	11.310	3.253	41.199	5.08		48	70
2"	M 52	52	45.504	16.26	3.248	48.752	5	46.25	56	80
		50.802	43.573	14.912	3.614	47.187	5.645		55	80
2 1/4"	M 56	56	48.856	18.75	3.572	52.428	5.5	50	61	85
		57.152	49.020	18.873	4.066	53.086	6.35		62	85

DOES METRIC SYSTEM MAKE POSSIBLE ECONOMIC PRODUCTION?

TABLE 2

Selection of Fit Holes with H 7 Tolerance

Nominal Diameter	
3	42
4	45
5	46
6	47
7	48
8	50
9	52
10	55
11	60
12	62
13	65
14	68
15	70
16	75
17	78
18	80
20	82
21	85
22	90
23	92
24	95
25	98
26	100
27	105
28	110
30	118
32	125
34	
35	
38	
40	

a national revolution in the Indian industry. Not only should the change-over to the metric system be undertaken, but the production data must enable optimum co-operation to be achieved between the various branches of the industry and the basis for an economical production must be ensured. Thus will it be possible to draw economical advantage from the change-over. Even if the change-over to the metric system appears at the moment to be difficult and costly, it is nevertheless the most economical in the long run. If, however, the metric system is spoilt by direct conversion from inch values, the result will be even economically disadvantageous. This point can hardly be overemphasised. Setting up of standard departments in factories is essential for a smooth change-over. The cost of setting up and running such a department will be more than offset by the economical effects always resulting from a good working of the standards department.

If the questions dealt with above, unfortunately in too brief a manner, are properly integrated and handled, economical success in industry will be assured.

The conversion to the metric system is one of the main tasks of the company standards department, a task whose importance should not be underestimated. Whereas at the national level, the conversion is done under the authority of the Indian Standards Institution, in the factory this task must be entrusted to the standards department. The question of the most economical change-over for a particular factory must be understood and tackled here. The 'how' of the change-over should be determined. In the above mentioned example of the Diesel

engines, the dimensions for pistons, connecting rods, crank shafts—also supplied as spares—may even now be in the metric system and only the outside diameter of the cylinder sleeves and bearing bushes need have the inch dimensions. Thus only these bushes have to be manufactured and stored in two systems. By correctly studying the problem it is possible, in changing over, to limit the number of types to a minimum.

Conclusion

We can say that the conversion represents

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A Suggested Scheme of Studies in Mathematics for Primary Classes

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IN view of the introduction of the metric system in our country it has become necessary to revise the mathematics syllabus which has so far been in use in our schools in the primary classes. This attempt at revising this syllabus has been prompted by the articles of Guy Knoche, which have appeared in these pages.

There are no two opinions about the need of imparting knowledge of the basic elements of arithmetic to children during the first six or seven years of their going to school. For this reason arithmetic must occupy a very important place in the time-table and at least four hours a week must be allotted to it. It is on this understanding that the present syllabus has been prepared. The syllabus has to be drawn up in such a way that there is room for gradual progress and for the fulfilment of the various purposes of teaching arithmetic. These purposes may be reduced to the following:

- (1) To train the mind through accurate solution of difficult problems.
- (2) To develop ability to do intricate processes in computation.

- (3) To master and understand those arithmetical processes which are required for common activities of every day life and to carry them through with speed and accuracy.

Little children love to observe and compare and even question. Hence in the *first* standard progress should be very gradual. The danger of allowing ideas to become too abstract for their age should be carefully avoided. The emphasis, according to experts in this field, should be on practical work and visualization with the help of apparatus, on the use of terminology taken from their day-to-day vocabulary and on the presentation of factual data. All this is a continuation of the pre-primary or Montessori stage, except that at the end of the year the child will be familiar with the first hundred numbers. This stage being the pure memory stage, tables of addition, subtraction and multiplication also form an important feature.

The calculation stage commences in the *second* standard. A number of concepts have also to be acquired: the concept of unit, of length, of weight, of capacity, of time, of lines. The child is gradually introduced in

a concrete way to the metric system. The decimal point, however, and decimal numbers are avoided as being still too abstract.

In the *third* standard the foundations laid in the *second* standard are strengthened through revision. But the syllabus is not restricted to revision only. New concepts of time, of angles, of space are placed before the child. At this stage the child has reached an age when he will welcome problems from his daily life and around his centres of interest, especially around his home, his neighbourhood, his town.

In the *fourth* standard the pupil is prepared to acquire the concepts of abstract and decimal numbers. He can also absorb the notion of fraction, of average, of areas, and volumes. Further progress in the mastery of these basic concepts, so essential to the pupil in making the practical applications he will be called upon to do once he leaves the primary classes behind, is made in the *fifth* and *sixth* standards. Column graphs, simple equations, factors, percentages, are so many mathematical tools added to the pupil's collection with which to face his secondary education. It is also time to initiate him into the units of other systems, as for example, the British system.

Standard First

Number Study.—Counting, understanding and reading of numbers through concrete experiences from 1 to 5, then from 5 to 10 and finally from 10 to 100. Writing numbers in figures from 1 to 10, then from 10 to 100. Use of the abacus and the hundred-squares board. Meaning of ordinals.

The Four Operations.—Grouping of objects into sets as an introduction to addition and subtraction. Number combinations first within the limits of 10, then of 100. Tables of addition and subtraction (e.g. $1+2=3$; $6-2=4$). Concrete exercises in addition,

comparison, subtraction of two-figure numbers within the limits of 100. Multiplication tables of 2 and 5 up to 2×10 and 5×10 .

Money.—Recognition of current coins from 1 nP to 100 nP.

NOTE—In this standard arithmetic learning should be related to everyday living. Stress should be laid on the child's experiences of the size and shape of an object, an oral addition and subtraction of objects (apples, pencil coins...) first up to 10, then up to 100.

Standard Second

Number Study.—Formation of number from 1 to 100. Counting, reading and understanding of numbers up to hundreds and thousands. Counting in twos, tens, five and fours (note the order!).

The Four Operations.—Extension of addition and subtraction (with carrying). Mental addition and subtraction of one-figure numbers. Tables of multiplication and division at least up to 10×10 and $10 \div 10$. (The following order of tables is recommended: 2, 5, 10, 3, 6, 4, 8, 9, 7). Multiplication and division by not more than two-figure numbers.

Metric System.—Study of the standard units of the metric system without using the decimal point.

Money.—Simple shopping sums using Indian money only and round centres of interest.

Time.—Meaning and use of the terms: minute, hour, day. Telling the time.

Measurement.—Measuring experiences with centimetres and metres. Study of lines.

NOTE—Everyday life should continue to be the basis of arithmetic. Stress to be laid on simple experiences, especially those round centres of interest such as sports, pets, school activities and so on. Concrete experiences in cutting, pasting, weighing, measuring and so on.

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Standard Third

Number Study. Revision and extension of numeration and notation up to six-figure numbers.

The Four Operations. Revision and extension of addition and subtraction. More difficult examples. Simple problems taken from daily life and centres of interest. Revision of multiplication and division (by not more than two-figure numbers). Simple Problems.

Metric System. Revision of standard units in simple problems.

Time.—Extension of notions about time, month, day.

Measurement.—Introduction to the study of right angles, squared-off surfaces and cubes. Ideas of space. Comparison of lengths.

Elementary Aspects of Economic Life.—Buying and selling, profit and loss, earnings, savings, expenses, time and speed.

NOTE—Free practice in oral and written exercises bearing on subjects of practical use in everyday life, as indicated above, is recommended throughout.

Standard Fourth

Number Study.—Extension of numbers up to millions and down to thousandths.

The Four Operations.—Extension of multiplication and division to three-figure numbers as multipliers and divisors. Tests of divisibility by 2, 3, 5 and 11. Checking answers by casting off nines.

Decimal System.—Changing of units. The four operations. Application to the metric system. Decimal fractions (addition and subtraction).

Fractions.—Common fractions introduced through the decimal system.

Unitary Method.—Simple examples in direct proportion.

Average. Introduction to the concept of average.

Measurement. Recognition of simple geometrical figures. Surface units and volumetric units. The circle, the cone, the cylinder. Construction of perpendiculars, squares, rectangles, regular triangles, and regular hexagons. Use of pair of compasses and of squared paper. Comparing areas.

Elementary Aspects of Economic Life. The post office, camping, different means of travel and so on.

NOTE—Free practice in oral and written exercises as recommended in the previous standard should continue in this standard as well.

Standard Fifth

The Four Operations. Extension of multiplication and division to more than three-figure numbers as multipliers and divisors. Multiplication and division by factors. Prime factors. Divisibility by 3, 4, 6, 8, 9, H.C.F. and L.C.M. by factors.

The Decimal System.—Revision and extension of work, especially in units of length and longitudinal measurement.

Fractions.—Extension of previous work to half, fourth, third, sixth, fifth, tenth. Reduction to the lowest terms. Comparison of fractions. Proper, improper and mixed fractions. The four operations.

Time.—Second, year. Simple problems. Compound addition, subtraction, multiplication and division of units of time.

Measurement.—Angles and measurement of angles with a protractor. The Mariner's compass. The triangle and its construction. Reading and construction of column graphs. Circumference of circle, surface of circle, lateral surface of cylinder.

Generalized Arithmetic.—Concrete, easy and direct problems using letters for numbers. Introduction to simple equations.

A SUGGESTED SCHEME OF STUDIES IN MATHEMATICS FOR PRIMARY CLASSES

Elementary Aspects of Economic Life.—Ways of making a living, taxes, cost of operating a home and so on.

NOTE—Revision of the unitary method and of the elementary aspects of economic life as indicated in the previous standards should be carried on in this standard. The Indian metric units should be used throughout.

Standard Sixth

British Units.—Study of the British units of length, weights and measures and money. Extension of compound additions, etc., to these units.

Decimal System.—Simple problems on the four operations. Reduction of decimals to fractions. Approximate results.

Fractions.—Combined operations, including the 'of' operation. Reduction of fractions to decimals. Introduction to ratio, proportion and partnership. Introduction to percentages, with and without regard to time.

Unitary Method.—Extension to fractional method and to direct and inverse proportion.

Measurement.—Scales, scale drawing and finding distances on maps. Areas of rectangular surfaces only, such as floor, room, door, window, wall, field, etc. Use of graph paper. Breaking up of simple figures into triangles, rectangles, lateral surfaces of simple geometrical figures. Practical ideas on volumes: the cube, the rectangular parallelepiped, the straight prism and the cylinder. Correspondence of volume, capacity and weight in the metric system. Extension of construction: e.g. bisecting an angle, drawing various circles connected with the triangle, demonstrating angle-sum property of the triangle, and the congruence of triangles. Continuous graphs, as exhibiting to the eye a series of values for comparison.

Generalized Arithmetic.—Extension of oral and written work in symbolic expressions. Problems connected with such expressions. Simple equations, formulae substitution.

NOTE—Simple, well-graded and concrete example and problems drawn from everyday life should be set throughout. Revision of matter learnt in the previous standards should be insisted upon.

CORRECTION

In the article "Conversion to Metric System in Machine Tool Industry" by Shri R.M. Apte, Assistant Works Manager (Design), Machine Tool Prototype Factory (Ministry of Defence), Ambarnath, appearing in the January 1960 issue, the following technical errors may be corrected:—

On page 18, para 3 the first and second lines may be corrected to read as 'Round numbers are of value as a simple means of designating products'.

On page 19, for lines 3-4 from the top read; 'may be designated by metric values or inch values which are not identical'.

On page 19, 'Example', may be corrected to read as $(1 + 0.016) \text{ inch} = (25 + 0.4) \text{ mm}$

Metric System in Railways

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THE Commercial Departments of the Indian Railways have switched over to the metric system of weights and measures from 1 April 1960. These departments are responsible for all work connected with the weighing and measurement of goods tendered for despatch, fixation of rates and fares according to distance and the realization of the charges due to the Railways for the carriage of goods and passengers. From 1 April 1960, the units of weight and distance are as under :

Unit of Weight

(1) The unit of weight in the case of general merchandise is one quintal (100 kilograms) which is equal to 2.67923 maunds. Fractions of a quintal will be charged in units of 10 kilograms in the case of goods traffic and in units of 5 kilograms in the case of parcels traffic.

(2) The unit of weight in the case of coal is one tonne (1,000 kilograms) which is equal to 0.9842 ton. Fractions of a tonne will be charged in units of 200 kilograms.

Unit of Distance

(1) The unit of distance is a kilometre which is equal to 0.62137 mile. Fraction of a kilometre will be taken as one kilometre.

The Commercial Departments come into direct contact not only with the trade and industry but also the large body of travelling public. Consequently, the decision to change over to the metric system will affect the large clientele of the Railways.

Also, unless the Railways change over to the metric system, there will be no inclination or even inducement for the trade and commerce to think in terms of metric units, much less to adopt the metric system. From that point of view, the decision of the Railway should be a very welcome step.

Compilation of New Distance Tables

The change-over was not a simple process just involving a few decisions of equivalents and notification thereof. Before the change-over could be effected, it became necessary for the Civil Engineering Branch of the Railways to work out the actual distances in metric units between adjacent stations on the Indian Railways and furnish the distances to the Commercial Department. There are about 8,000 stations.

After the initial task of working out the distances between the adjacent stations had

been completed by the Civil Engineering Branch, the Commercial Department had to undertake the compilation of distance tables showing the distance between each pair of stations on a Railway and junction kilometre tables showing the distance between each station and junction with other Railways. The former is intended for the calculation of the charges due in respect of traffic passing locally over that Railway and the latter for the calculation of charges for through traffic between two or more Railways. Each Railway has on an average 1,000 stations and from each station the Railway had to calculate the distance to every other station and to each junction with the adjacent Railway. In other words, calculation of distances for all possible combinations as above between 1,000 stations was involved over each Railway. The number of computations was thus of the order of 5,00,000. Having made the computations each Railway had to print and publish local distance tables showing the distance from each station to every other station on that Railway. Further, the distance from each station to each junction for booking through traffic to another Railway had also to be printed and published.

The calculations and the printing of these distance tables running into several hundreds of pages, had to be arranged by the Railways at short notice, particularly at a time when the Railway presses were busy with the printing of time-tables and other Railway publications.

Recalibration of Weighing Machines

Recalibration of the weighbridges and weighing machines in the metric units and the stencilling of tare weight, carrying capacity, floor area etc., on each wagon in new units had also to be arranged.

There are about 400 weighbridges and 8,000 weighing machines on the Indian Rail-

ways which have so long recorded the weight in the foot-pound system and which will have to be recalibrated in metric units. Some of the weighing machines only could be recalibrated so far with dual marking in the foot-pound system and the metric units. In respect of weighbridges and other weighing machines, recalibration will be done in the course of time. Till then, the Railway staff will actually make the weightment in maunds and seers but invoice the consignments in metric units with the help of conversion tables.

Rates and Fares

The rates and fares prescribed and published in terms of the maund and the mile had to be converted into metric units and renotified. As has been earlier stated, this was not a simple matter. There are certain rules of rounding off which are a basic part of the rules for charging. While care had to be taken to ensure, on the one hand that there was no appreciable increase in the rates and fares charged between specific points or for specific commodities so that the public can have no cause for complaint that the introduction of the metric system has served as an opportunity for the Railway to increase the rates and fares, it had naturally to be ensured at the same time that the Railways do not stand to lose by this change over.

For example, in calculating passenger fares or freights between any two stations, the existing practice is to take any fraction of a mile as one mile. With the introduction of the metric system, any fraction of a kilometre will be taken as one kilometre. A kilometre being a smaller unit than a mile, the Railways would lose if the basis of rate or fare is converted into exact equivalents. Similarly, in respect of the amount, fractions are rounded off to one anna at present. Under the proposed system, fractions will be rounded off to 5 nP., which again is a small

unit than one anna and will, if unadjusted, result in loss to the Railways.

The adoption of the exact equivalent bases of rates and fares, it was estimated, would result in an annual loss of revenue to the Railways of about Rs. one crore. To avoid such a loss, slight adjustments in the rates bases had to be made. The contemplated rate bases had to be tested as to their exact effects. For this purpose, the Railway staff had to make enormous calculations. In respect of passenger fares alone about 1 lakh of calculations had to be undertaken. Similar is the case of the rates for goods, parcels and other traffic.

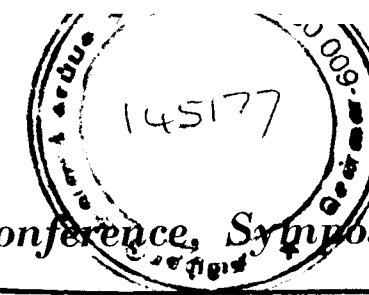
After the completion of these calculations, different calculated ready fare and freight tables running into about 400 pages (as distinct from the distance tables earlier referred to) had also to be printed—and in record time.

All these items involved hard and accurate work on the part of a large number of staff both in the office of the Railway Board and in the offices of the Railways. In the Railway Board's office alone, the number of man-days involved was about 2,000 and on each Rail-

way the number of man-days involved was about 8,000.

In view of the various units involved and the difference between the units, it was impossible to work out the rates and fares in the new units which will not affect at least some people. But, as the Railway Minister mentioned in his budget speech, care has been taken to ensure that these variations are kept down to the minimum.

While those in whose case the rates have been reduced might welcome it, there is likely to be some criticism from others in whose case the rates have been increased. They are likely to ask as to what the necessity was for introducing the metric system. The answer is simple. The Standards of Weights and Measures Act was passed in 1956 and unless important wings of Government take action to implement it, there will be little inclination for the private sector to adopt this system. In the long run, the benefits of the metric system are unquestionable, and there can be no doubt that the effort that has been put in and the cost that has been incurred in effecting the change, are an insignificant price to pay for the advantages that will accrue.



Controllers' Conference, Symposium & Visits

I

CONTROLLERS' CONFERENCE

The Second Conference of Controllers of Weights and Measures in the States and Union Territories was held on 7 and 8 March 1960, at Rajgir, in Bihar. It was inaugurated by Shri B.C. Patel, Minister for Agriculture, Supply and Health, Bihar. Besides the Controllers, representatives of the Indian Standards Institution, Government of India Mint, Bombay, National Physical Laboratory and the Ministries of Steel Mines and Fuels, Information and Broadcasting, Commerce and Industry attended it.

Minister's Opening Remarks

Inaugurating the Conference, Shri B.C. Patel, said that the Conference would deliberate over the complex problems of one of the most important reforms which we have undertaken to accomplish by 1966. It looked rather strange that we are adopting after centuries what was our own. The onerous responsibility of enforcing weights and measures dwelt on the State Governments and consequently on the State Controllers of Weights and Measures.

He said that we should not remain satisfied with notifying areas and industries. From the Inspector's level to the national level we must plan thoroughly for supply of commercial weights, train the personnel,

appoint them well in time and equip them with weights, balances and other necessary equipment. Simultaneously, publicity measures should be undertaken and the masses should be educated. He said that as in all planning, in the introduction of the metric system, there were processes which were interlinked and there should be no time lag between them. Careful co-ordination in planning and execution between these stages was necessary. For instance, we should not be satisfied merely with placing the demand for commercial weights, but should ensure supply of the raw materials, especially pig iron, to the manufacturers. Again, if the supply of commercial weights was taken care of, but the Inspectors were not supplied with working standard weights and balances, then the commercial weights could not be verified, stamped and sold, and the very purpose of the Act would be defeated.

He then reviewed the Organisation of Weights and Measures in Bihar and said that arrangements were made for educating the masses through extensive publicity and propaganda work. The State Department of Education was also taking up the work of changing the syllabus with a view to incorporating in the curriculum the use of the metric system. Arrangements were being also made for training courses to educate Government servants. In rural areas, the services of the Gram Panchayat and Village Level Workers were being utilized.

He then referred to the sugar industry which occupied an important place in the State of Bihar. For weighing of cane, the industry made use of weighbridges through which they bought cane from about 5 lakh growers. Some 8 sugar factories in the State had changed over to the new system up to the 1959 season, the rest would change-over shortly.

He wished the Conference success.

Shri K.V. Venkatachalam, Joint Secretary, Ministry of Commerce and Industry, while thanking the Minister for inaugurating the Conference, said that a symbolic beginning had been made in October 1958 to permit metric weights in certain restricted areas and trades. The idea was to bring the concept of the metric system to the notice of the people and trade and use the transition period to make the public familiar with the new concept. Experience has shown that mere talking did not carry us very far. Certain amount of actual use, if necessary certain compulsive processes would be required for that purpose. Such compulsion would come through the adoption of the metric system in their commercial transactions by the Railways from 1 April 1960, as also when Customs and Central Excise Department, Ports and Shipping and the Posts and Telegraphs Department change over later this year. Most of the major industries like textiles, jute, coal, engineering, cement, sugar, petroleum and the like would be changing over before the end of the year.

In view of all these, 1960 would be a crucial year in the change-over to the metric system. It was, therefore, necessary that the public should be brought into it more effectively than was the case in the past.

The primary purpose of the Conference, apart from devising solutions for the various problems that had arisen, would be to find

ways and means to get across the metric idea to the public during this year and assess what measures were necessary to make the public take to it without much hardship. During the next few months, the publicity and educative processes would have to be stepped up and concentrated.

The Conference then discussed the various items of the agenda. The important recommendations are given below:

(1) Extension of Weights to the Whole Country

It was agreed that metric weights should be made legally permissible in the rest of the country from 1 April 1960. The period of transition should be two years.

(The effect of this recommendation which has now resulted in the issue of a Notification (*see News & Views*) is to bring in the use of metric weights in remaining parts of the country not notified earlier. So far as metric weights are concerned, they will become compulsory in all transactions by 1 October 1960 in the areas already notified in October 1958 and by 1 April 1962 in the rest of the country, as now notified. As a result, all the industries and trades which use weights would be covered by the new Notification and no separate Notifications may be issued for any further industries permitting the use of metric weights—*Editor*.)

(2) Introduction of Capacity Measures

It was recommended that capacity measures should be introduced all over the country on a fixed date. Although no date was fixed, it was generally agreed that the date should not be later than 1 April 1961.

So far as the petroleum industry is concerned, the use of capacity measures has been allowed from 1 March 1960 and in Delhi, they have been allowed for general use from 1 April 1960 (*see News & Views*).

CONTROLLERS' CONFERENCE, SYMPOSIUM & VISITS

(3) Compulsory Use of Weights in Areas Notified

In the industries and areas already notified on 1 October 1958, metric weights would be made compulsory from 1 October 1960.

In order to enforce this decision, the Conference considered that the equipment, organization and personnel were sufficient for the purpose and there would be no difficulty in the compulsory introduction of metric weights.

In order to utilize the remaining period most usefully, the Controllers of Weights and Measures had been meeting Associations of wholesale traders and fixing dates for the change-over to metric weights well in advance of 1 October 1960. It is being ensured that the wholesalers purchase the weights without delay. The Inspectors of Weights and Measures have been in turn contacting retail traders and their Associations and fixing up suitable dates for the complete change-over. The efforts would be intensified. This would ensure that there would not be a last minute rush on the manufacturers of weights during September and October 1960 and avoid dislocation at the eleventh hour.

(4) Pricing Units for Trade

The metric units for the quotation of prices for wholesale and retail transactions were accepted.

Wherever statutory recognition of these units was possible, it would be examined.

(These units have been published in the March 1960 issue of *Metric Measures*, page 22).

(5) Permissible Errors for Petrol Dispensing Pumps

It was agreed that the errors for petrol dispensing pumps should be checked for deliveries of 2, 5, 10 and 20 litres and the permissible error should be a maximum of half the tolerances prescribed for metric conical measures.

(6) Quota for Brass Weights

It was agreed that the State Directors of Industries should recognize the manufacture of weights for allocating quota of brass. The Controllers should indicate to the State Directors of Industries the minimum quota of brass required for the manufacture of brass weights.

(7) Inspectors' and Precision Balances

At the first Controllers' Conference it was decided that the manufacture of Inspectors' and precision balances should be encouraged in the country. A committee was set up with the Assistant Director, National Physical Laboratory, as Convener.

The Convener gave a report on the steps taken and said that two or three firms were already preparing test sets of balances. The firm of Saple's Scales Manufacturing Company (Private) Ltd., Bombay, would also be increasing their production in the near future. It was felt that the future production in the country may be enough to meet the demands of Inspectors' balances.

The question of manufacture of precision balances was under consideration and one firm had already carried out preliminary work in this connection.

(8) Marking of Contents on Packages

One of the provisions of the State Acts relates to the marking on the containers the weight or volume of the contents of scaled packages. It was recommended that this provision should be brought to the notice of the general public.

(9) Specifications for Measures for Hot Milk

In the halwai trade in certain parts of the country, it is necessary to use measures with long handles to measure out hot and boiling milk. It was agreed that the specifications for capacity measures should be suitably amended to cover this requirement.

The Conference concluded at 1 p.m. on 8 March 1960.

II SYMPOSIUM

A symposium on 'Enforcement of weights and measures with special reference to the law, procedures for enforcement and special difficulties experienced in the situation of this country' was held on 9 March 1960 at Rajgir, Bihar, along with the 2nd Conference of Controllers. An exhibition of weights and measures was also held on the occasion. The symposium was presided over by Shri S.V. Sohoni, Commissioner, Patna Division. The Controllers of Weights and Measures of the various States gave a short account of the work they were doing and the progress made.

Shri M. Srikishen Pillay, (Andhra Pradesh), said that considerable publicity had been carried out among all sections of the people. The next step would be to bring the metric commercial weights into use in trade.

Shri V.N. Singh, (Bihar), said that one of the most important tasks was to teach the metric system to children in schools. The masses would adapt themselves to the reform. This was evident from the experience of 8 sugar factories which had already changed over to the metric system and where the illiterate cane growers, who supplied cane to these factories, had become accustomed to it. Inspectors should reach the masses and educate them in the metric system.

Shri V.M. Pednekar, (Bombay), said that the old weights and measures were being enforced legally for the last 25 years. Nevertheless, all sections of the public welcomed the reform. He said that it was necessary to seek the co-operation of traders for smooth implementation of the reform. He pleaded for patience, discretion and tact in implementation in the early stages of the reform.

Shri H.L. Mehandru, (Delhi), said that Delhi had taken steps to persuade traders to change over on specified dates well before October 1960. This was arranged at meetings of representatives and members of the Association of various trades. Steps had been taken to ensure that the traders purchased metric weights at the earliest opportunity.

Shri Qazi Ghulam Rasul, (Jammu & Kashmir), said that the Standards of Weights and Measures Act, 1956, was being extended to Jammu and Kashmir. A Bill to enforce the metric system was being drafted. An organization for enforcement of weights and measures was being established.

Shri T.P.K. Nayar, (Kerala), said that people were willing to change as soon as weights were available. To ensure supply of weights, a number of manufacturers had been licensed. He suggested that tables for the conversion of prices from present units to metric units should be published for the convenience of trade.

Shri R.R. Visuvasam, (Madras), said that the people in Madras were taking to the metric system with greater enthusiasm than was anticipated. He was of the opinion that the reform should be completed as quickly as possible.

Shri C.A. Jamakhandimath, (Mysore), said that sale of their products in markets was an important operation for the farmers. The 'khandies' in use in different parts of Mysore were different. Moreover, the weights in the rest of India were also different from those of Mysore. As a result, trade was hampered and co-operative societies found difficulties in comparing rates in important marketing centres. The adoption of metric system and the acceptance of uniform pricing units for commodities would facilitate trade.

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Shri R.N. Dwivedi, (Orissa), said that metric weights were being enforced in mandies and there was very little opposition to them. He stressed the need for a quick change-over because the existence of many systems side by side created confusion.

Shri Kanwarjit Singh, (Punjab), urged enforcement of the metric system scientifically and democratically.

Shri K.N. Mathur, (Rajasthan), said that the general tendency of traders everywhere was to wait and see. It was, therefore, necessary to be firm in the enforcement of weights and measures, so that this 'wait and see' policy was not encouraged.

Shri B.B.K. Dev Verman, (Tripura), said that Tripura had an organization for enforcement, but weights from Bihar took up to one month to reach Tripura.

Shri J.B. Sen, (West Bengal), said that the three essentials for implementation were availability of weights, possession of necessary equipment and setting up of an adequate organization. West Bengal had licensed a number of manufacturers and were getting the necessary equipment. An enforcement organization had been set up and was being strengthened.

Representatives of certain industries present addressed the meeting.

Shri S.M. Dutt of Burmah-Shell gave an indication of how the change-over would be carried out by April 1960 in the petroleum trade.

Shri R.R. Jain of Hasanpur Sugar Factory said there were 22 sugar mills in Bihar and quite a few of them had already adopted the metric system. The mills were anxious to use decimal coinage and the metric system. However, there should not be unnecessary compulsion.

Shri R.N. Sharma of Behata Sugar Factory said that it was good that the metric

system would be applied from the Himalaya to Kanya Kumari, but it should be implemented with understanding and tact. Inspectors should go to the villages and explain the purposes of the reform patiently and sympathetically to the villagers. If this was done, he felt people would happily adopt even in advance of the date fixed. The cane growers around his factory were becoming familiar with the metric system.

Shri C.N. Sharma, Cane Inspector, Muzaffarpur, felt that the Weights and Measure Enforcement Rules and the Bihar Sugar Factories Control Rules should be aligned to remove contradictions.

Shri S.N. Pandey, Weights and Measure Inspector, Gaya, said that the first essential for the success of the reform was that the people should start thinking in the metric system.

Shri K.V. Venkatachalam, Joint Secretary Ministry of Commerce and Industry, summing up the discussion, said that India had arrived at the stage where opposition to the metric system was fast disappearing. It was now necessary that metric weights should come into day-to-day use. It was important to adhere to the dates announced for the change-over. In order to make the best use of the time left before the use of metric weights became compulsory, careful planning and implementation were necessary. He suggested meetings of wholesale dealers to fix dates for the various trades. Later the Inspectors should ensure that the trader concerned order weights and are helped to obtain supplies of stamped weights. The Inspectors should contact traders, particularly, retailers. This would ensure a steady flow of stamped weights to trader and avoid last minute rush.

In conclusion, Shri S.V. Sohoni, Commissioner, Patna Division, said that the reform should be carried to the villages

through Panchayats, Block Development organizations and the like. He stressed that the question of postponement should not at all be considered. People had a store of commonsense and their adaptability to new conditions was remarkable. In the light of these, the success of the reform was assured.

With a vote of thanks to the Chair, the Symposium concluded at 1 p.m.

III VISITS

An instructive part of the programme was the visits arranged by the Controller of Weights and Measures, Bihar.

On arrival in Patna on 6 March 1960, the delegates paid a visit to the Training Centre for Inspectors of Weights and Measures in Patna. This Centre has so far trained 48 persons: 4 from West Bengal, 2 from Tripura, 1 from Assam and the rest from Bihar. The Centre is well equipped for imparting instruction in the principles and practice of verification of weighing and measuring instruments and so on. The syllabus is so designed that variation in the educational background of the trainee is not a handicap to him in learning his job.

At Khagaul, Bihar Agricultural Industries have undertaken a programme of manufacture of metric weights, both cast iron and brass. The concern is supplying weights to far off places like Tripura. The firm was among the first to produce metric weights and their workmanship is good.

Visits in Rajgir

On the evening of 6 March 1960, the party proceeded to Rajgir, where the Controllers' Conference and the Symposium took place. The Controller of Weights and Measures in Bihar, Shri V.N. Singh, had informed the

delegates that the markets in Rajgir and nearby places had changed over to metric weights completely. It was a pleasant surprise to find that metric weights were being used in the village shops, while the seer weights had been voluntarily discarded by some traders. The traders, mainly village folk, did not have any difficulty in quoting prices and weighing materials in kilograms and grams. Actually, when asked to convert prices from the kilogram basis to the seer basis many of them could do it easily. Even the customers were able to make their purchases with the new weights. It appeared that as long as both the seer and kilogram weights were used side by side, there was no occasion for the use of the kilogram weights because, the customer always thought and purchased in terms of seers and chhataks. But when the exclusive use of only the kilogram and gram weights was brought in the situation changed radically and rapidly.

Visits to Sugar Factories

After the Conference and the Symposium, the delegates proceeded to visit two sugar factories near Muzaffarpur. The factories had adopted the metric system in the purchase of sugar cane.

At the Motipur Sugar Factory, about 15 miles from Muzaffarpur, which was working partially, the machine for the weighment of cane carts and cane waggons has been calibrated only in the metric system. The use of seer system had been completely done away with.

The second factory was the Champaran Sugar Company Ltd., at Chakia. The delegates visited their cane weighment section before going through the factory. The weighbridge for the weighment of cane carts was calibrated only in the metric system in terms of kilograms. A row of carts loaded with cane had either been weighed earlier or were to be weighed. The invoices given

to the cartmen were made out in terms of quintals and kilograms and the prices given per quintal. The conversion factor for maunds to kilograms was merely rubber stamped on the invoice. When questioned about weight of their carts and cane as indicated on the invoice, the cartmen quoted it correctly in terms of quintals and kilograms. They do not convert these metric figures into maunds and seers and they could easily understand the relation between the quintal and the kilogram. Many of the cartmen said that they found it more convenient to calculate in terms of the metric system and the decimal coinage than in the older systems of maund and rupees, annas and pies.

Many cartmen had brought cane from cane growers for sale to the factory. These cartmen on return, quoted the weight of the cane in maunds to the grower and got their hire charges accurately.

Commonsense of Common People

What impressed most was that here was the so called common man, illiterate but not ignorant, in whose name the metric reform is often opposed by the educated, but who,

if properly trained, could pick up the use of the metric system, metric nomenclature magnitudes of the various units and use of all these without getting into difficulty. Within the space of one sugar season, normally 4 to 5 months, they had got accustomed to the new system and had begun to like it more than the old system. The adoption of the new weights to the exclusion of the old did not lead to any instance of misunderstanding between the growers and the factories. This great result has been obtained by the co-operative effort of the factories, the Publicity and the Weights and Measures Departments of the Government of Bihar. The example deserves to be emulated elsewhere.

The visits were instructive because they shook the commonly held belief that the common man would find great difficulty in adopting the metric system. They also showed that the so-called common man in India has a good deal of commonsense and can adapt himself easily to reforms which are in his own interest, as in the case of metric system and the decimal coinage, if given the right lead at the right time.

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News & Views

Recent Notifications

The Government of India have recently issued the following notifications to bring in the use of metric weights and measures in certain spheres of activities :

(1) Tea Industry

No. S.O. 421 dated : the 10th February 1960.

In exercise of the powers conferred by sub-section (3) of section 1 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby appoints the 1st day of March, 1960, as the date on which the provisions of the said Act shall come into force in respect of tea factories in so far as they undertake the sale of manufactured tea or make payments to labourers for plucking tea leaves.

No. S.O. 424 dated : the 10th February 1960.

In exercise of the powers conferred by section 14 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby permits, in respect of the class of undertaking referred in the notification of the Government of India in the Ministry of Commerce and Industry, Notification No. S.O. 421 dated the 10th February 1960, the continuance of the use, for a period of one year from the 1st day of March, 1960, of any weight or measure which, immediately before that day, was in use in respect of the said class of undertaking.

No. S.O. 422 dated : the 10th February 1960.

In exercise of the powers conferred by sub-section (3) of section 1 of the Standards

of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby appoints the 1st day of April, 1960, as the date on which the provisions of the said Act shall come into force in respect of the classes of undertakings specified below to the extent specified therein :

(1) The Tea Board in so far it undertakes the licensing of areas to be grown with tea, grant licences for exporting manufactured tea, or keep statistics and accounts relating to the production and marketing of tea.

(2) The Calcutta Tea Traders Association and the Cochin Tea Traders Association in so far as they regulate auctions in manufactured tea.

No. S.O. 423 dated : the 10th February 1960.

In exercise of the powers conferred by section 14 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby permits, in respect of the classes of undertakings referred in the notification of the Government of India in the Ministry of Commerce and Industry, Notification No. S.O. 422 dated the 10th February 1960, the continuance of the use, for a period of one year from the 1st day of April 1960 of any weight or measure which, immediately before that day, was in use in respect of the said classes of undertakings.

(2) Petroleum Industry

No. S.O. 478 dated : the 18th February 1960.

In exercise of the powers conferred by sub-section (3) of section 1 of the Standards of

Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby appoints the 1st day of March, 1960 as the date on which the provisions of the said Act shall come into force in respect of crude petroleum and petroleum products, produced, manufactured, distributed, bought or sold, whether by a producer, manufacturer or distributor of crude petroleum or petroleum products or by an agent, dealer or retailer engaged in buying and selling crude petroleum or petroleum products.

No. S.O. 479 dated : the 18th February 1960.

In exercise of the powers conferred by sub-section (1) of section 14 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby permits the continuance of the use in respect of crude petroleum and petroleum products referred to in the Notification of the Government of India in the Ministry of Commerce and Industry No. 478 dated the 18th day of February, 1960, for a period of one year from the 1st day of March 1960, of any weight or measure which, immediately before that date, was in use in respect of crude petroleum and petroleum products aforesaid.

(3) Railways

No. S.O. 553 dated : the 25th February 1960.

In exercise of the powers conferred by sub-section (3) of section 1 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby appoints the 1st day of April, 1960, as the date on which the provisions of the said Act shall come into force in respect of the Indian Railways in so far as they undertake the transport of passengers, animals or goods.

(4) Capacity Measures in Delhi

No. S.O. 801 dated : the 14th March 1960.

In exercise of the powers conferred by sub-section (3) of section 1 of the Standards of

Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby appoints the 1st day of April, 1960 as the date on which the provisions of the said Act in so far as they relate to units of capacity shall come into force in respect of transactions involving sale and purchase of goods in the Union Territory of Delhi.

No. S.O. 802 dated : the 14th March 1960.

In exercise of the powers conferred by section 14 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby permits, in respect of transactions involving sale and purchase of goods in the Union Territory of Delhi referred to in the notification of the Government of India in the Ministry of Commerce and Industry S.O. No. 801 dated 14th March, 1960 the continuance of the use, for a period of one year from the 1st day of April, 1960 of any units of capacity which, immediately before that day, were in use in respect of the Union Territory of Delhi.

(5) Extension of Weights to the Entire Country

No. S.O. 839 dated : the 31st March 1960.

In exercise of the powers conferred by sub-section (3) of section 1 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central Government hereby appoints the 1st day of April, 1960 as the date on which the provisions of the said Act in so far as they relate to units of mass, shall come into force in respect of transactions involving sale and purchase of goods in the whole of India except the State of Jammu and Kashmir and except in those areas in which, or in those classes of undertakings or those classes of goods in respect of which, the said provisions have already come into force.

No. S.O. 840 dated : the 31st March 1960.

In exercise of the powers conferred by section 14 of the Standards of Weights and Measures Act, 1956 (89 of 1956), the Central

Government hereby permits, in relation to transactions referred to in the Notification of the Government of India in the Ministry of Commerce and Industry S.O. No. 839 dated 31st March 1960 the continuance of the use for a period of two years from the 1st day of April, 1960 of any weight which immediately before that date was in use in relation to such transactions.

Metric System and Decimal Coinage for Pakistan

It is learnt that the Pakistan Government has decided to introduce decimal coinage in that country from January 1961. It appears that the value of rupee would remain unchanged. It is further understood that the metric system of weights and measures would also be introduced there early in 1961.

Metric System in Shipping

The Government of India have decided to introduce the metric system of weights and measures on the commercial side of shipping and at the major ports of Bombay, Calcutta, Madras, Cochin, Kandla and Vizagapatnam from August 1960. This is meant to synchronize with the change-over in the levy and collection of Customs duties and duties of Central Excise.

The exact date on which the new system is to be introduced would be announced later.

Sale of Paints by Volume

It is well known that the sale of liquid paints by weights has led to malpractices. In 1953, the Paints and Allied Products Sectional Committee of the Indian Standards Institution recommended that Government purchasing agencies should buy liquid paints only by volume. This recommendation has now been accepted by the Paint Panel of the Development Council for Oil-based and Plastics Industries, at its 6th meeting on 1 March 1960. The State Government have

the power under their respective Weights and Measures (Enforcement) Acts to enforce sale of paint by volume. Steps to issue notifications to cover sale of paint by volume are being taken. The Indian Standards Institution has already laid down standards for the packing of paints in containers of 4 litres, 2 litres, 1 litre, 500 ml, 200 ml, 100 ml and 50 ml. As reported earlier, the paint industry will begin its change-over on 1 April 1960, with a change-over period of one year.

Adoption of Metric Weights in Bombay State

It is understood that the Poona Grain and Grocery Merchants' Association have resolved in their meeting on 21 December 1959, to adopt the metric weights with effect from 28 March 1960 which coincides with the beginning of the new year. They have requested all the wholesale and retail traders to adopt metric system on the same day so as to have uniformity of adoption.

Sale of Salt by Weight in Madras

It is understood that the sale of salt in the districts of Madras, Chingleput, North Arcot and South Arcot will be by weight from 1 October 1960.

The Salt Experts Committee appointed by the Government of India in 1949 suggested that with a view to improve the quality of the salt produced in the State, the sale of salt, both wholesale and retail, should be by weight only and not by measure. In view of the change-over to the metric system, the Government of Madras have now taken the decision to introduce the sale of salt by weight in the four districts in which metric weights were introduced from 1 October 1958. This is being done under the powers conferred by section 8 of the Madras Weights and Measures (Enforcement) Act, 1958 (Madras Act XX of 1958). The Controller of Weights and Measures has been put in charge of the enforcement of sale of salt by weight.

Licensed Manufacturers, Dealers and Repairers of Weights and Measures (7)

Metric Measures has been publishing a series of lists of manufacturers, dealers and repairers of weights and measures, weighing and measuring instruments licensed by the Governments in the various States and Union Territories under the Weights and Measures (Enforcement) Acts in their respective jurisdiction. This is the seventh list. The first list appeared in the March 1959 issue.

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

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

An analysis of the licensees, including the present list, shows that the total number of licensees in 9 States and 2 Union Territories is 174 manufacturers, 723 dealers and 126 repairers. The details of published information are as follows:—

Sl. No.	State/Union Territory	Licensees		
		Manu- facturers	Dealers	Repa- rers
(1)	Andhra Pradesh	25	25	16
(2)	Bombay	23	160	52
(3)	Delhi	13	59	18
(4)	Kerala	4	74	0
(5)	Madras	38	74	14
(6)	Madhya Pradesh	10	0	0
(7)	Mysore	9	106	8
(8)	Orissa	4	5	0
(9)	Punjab	13	212	9
(10)	Tripura	0	8	0
(11)	West Bengal	35	0	9
		174	723	126

DELHI (4)

In the July and September 1959 and March 1960 issues of *Metric Measures* lists of licensed manufacturers, dealers and repairers of weights and measures in Delhi area were published. The following is a list of manufacturers, dealers and repairers subsequently licensed by the Delhi Administration.

Manufacturer

Sl. No.	Name and Address of Manufacturer	Details of Articles Manufactured
(1)	Indian Kanta Works, 8170, Chemni Mill, Bara Hindu Rao, Delhi.	Beam Scales Class C & D of capacities 10 kg & above.

Dealers

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(1)	Banarsi Dass Mahabir Pd. 1075, Gali Raja Uggar Sain, Bazar Sita Ram, Delhi.	Weights, Measures, Weighing and Measuring Instruments.
(2)	Das Mal Bhagat Ram, Iron, Steel and Hardware Merchants, 5058, Sirkiwala, Delhi.	Weights, Measures, Weighing and Measuring Instruments.
(3)	Lakshmi Chand Radha Kishan, 6524, Fatehpuri, Delhi	Weights, Measures, Weighing and Measuring Instruments.
(4)	Munna Lal Ram Dyal, Iron and Hardware Merchants, 19, Chawri Bazar, Delhi.	Weights, Measures, Weighing and Measuring Instruments.
(5)	Radha Kishan Ram Kumar, 247, Subhash Nagar, Nangal Ray, Central Jail, Delhi-Cantt. Road.	Weights, Measures, Weighing and Measuring Instruments.
(6)	Tara Chand Rameshwar Dass, Bichhal Barton Store, 11/109, Sadar Bazar, Delhi-Cantt.	Weights, Measures, Weighing and Measuring Instruments.

N.B.—The license issued to H. C. Sen & Co. Fountain, Delhi (item 39 of page 39 appearing in November 1959 issue) has since been cancelled by Delhi Administration.

Repairer

Sl. No.	Name and Address of Repairer	Details of Articles Repaired
(1)	Banarsi Dass Mahabir Pd. 1075, Gali Raja Uggar Sain, Bazar Sita Ram, Delhi.	Beam Scales (Class B, C, & D) and Weights.

KERALA (3)

In the November 1959 and March 1960 issues of *Metric Measures* lists of licensed manufacturers and dealers of weights and measures in Kerala State were published.

LICENSED MANUFACTURERS, DEALERS & REPAIRERS OF WEIGHTS & MEASURES (7)

The following is a list of dealers subsequently licensed by the Government of Kerala under the Kerala Weights and Measures (Enforcement) Act, 1958.

Dealers

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(1)	A.M. Ali Haji Bismilla, Hardware Stores, Big Bazaar, Palghat.	Weights, Measures and Weighing Instruments.
(2)	V. Gandhi, Vasavi Hardware Mart, G.B. Road, Palghat	Weights Measures and Weighing Instruments.
(3)	A.N. Guna Shenoy & Sons, Hardware Merchants, Thirunakara Market, Kottayam.	Weights, Measures, Weighing and Measuring Instruments.
(4)	Hajee M. Kunhamed, General Hardware Merchant, Perinthalmanna-Nilambur Road, Perinthalmanna Town, Palghat.	Weights, Measures, Weighing and Measuring Instruments.
(5)	S. Ibrahim & Co., 31/1834, Jooins Buildings, Chalai Bazaar, Trivandrum.	Weights.
(6)	A.G. Krishna Shenoy, Hardware Merchant, Kalarikal Bazaar, Kottayam.	Weights, Measures and Weighing Instruments.
(7)	T.P. Lonappan, Industrial Training Corporation, Chittur, Palghat.	Weights, Measures and Weighing Instruments.
(8)	K.P.G. Menon, Construction House, Ottapalam, Palghat	Weights and Measures.
(9)	C.A. Muthuswamy Pillay, Hardware Merchant, Chittur, Cochin.	Weights and Measures.
(10)	A.A. Narayana Mannadiar, A.N. Annimala Mannadiar & Sons, General & Hardware Merchants, Koduvayur, Dist. Palghat.	Weights, Measures, Weighing and Measuring Instruments.
(11)	Padinjarakara Ponnen Kurien & Sons, Ltd., P.B. No. 22, Kottayam.	Weights, Measures, Weighing and Measuring Instruments.
(12)	R. Parvatham Chetty, 28, Bazar, Munnar High Range, Kerala.	Weights, Weighing and Measuring Instruments.
(13)	V.V. Rangaswamy Iyer, General Merchant, Vadakkancherry, Dist. Palghat.	Weights, Measures and Weighing Instruments.
(14)	T.P. Rathnasabhapathi Chettiar's Sons, Big Bazaar, Palghat	Weights, Measures and Weighing Instruments.
(15)	C.S. Sankaranarayanan, Hardware Merchant, Kollengode P.O. Palghat Dist.	Weights and Measures.
(16)	C.N. Subbiah Chettiar, Hardware Merchant, Chittur, Palghat.	Weights, Measures and Weighing Instruments.
(17)	K. Thanulingam Pillai, Proprietor M/s K.S.T. Subbiah Pillai & Sons, Chalai, Trivandrum.	Weights & Measures.
(18)	N.M. Varoo, Hardware Merchant, Thathamangalam, Dist. Palghat.	Weights, Measures and Weighing Instruments.

MADHYA PRADESH (1)**Manufacturers**

Name and Address of Manufacturer	Details of Articles Manufactured
(1) Bhopal Auto Repairing Works, Motia Park, Bhopal	Weights, Measures, Weighing and Measuring Instruments.
(2) Central India Chemicals (P) Ltd. Sehore	Weights, Measures, Weighing and Measuring Instruments.
(3) Dalvi Industries Kampoo Gwalior, Gwalior	Weights, Measures, Weighing and Measuring Instruments.
(4) Gangwal Industries, Gangwal Bhavan, Lashkar, Gwalior	Weights, Measures, Weighing and Measuring Instruments.
(5) General Manager, Gwalior Engineering Works Kampoo Kothi, Lashkar, Gwalior.	Weights, Measures, Weighing and Measuring Instruments.
(6) General Manager, The Bhandari Iron and Steel Co. (P) Ltd., 5/8 Silnath Camp, Indore.	Weights, Measures, Weighing and Measuring Instruments.
(7) The Manager, Simplex Engineering and Foundry Works, Madan Mahal Nagpur Road, Jabalpur.	Weights, Measures, Weighing and Measuring Instruments.
(8) Patel Industries & Engineering Works, 1 Silnath Camp, Indore City.	Weights, Measures, Weighing and Measuring Instruments.
(9) Proprietor Swastic Engineering and Scientific Co. Swastic House Jawarganj, Jabalpur.	Weights, Measures, Weighing and Measuring Instruments.
(10) Tanibat Nib Factory Maharani Laxmibai Road, Lashkar, Gwalior.	Weights, Measures, Weighing and Measuring Instruments.

MYSORE (2)

In the March 1960 issue of *Metric Measures* a list of licensed manufacturers and dealers of weights and measures in Mysore State was published. The following is a list of dealers and repairers subsequently licensed by the Government of Mysore under the Mysore Weights and Measures (Enforcement) Act, 1958.

Dealers

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(1)	Abdul Gafoor, Stamp Vendor, Srirangapatna	Weights, Measures and Weighing and Measuring Instruments.
(2)	Ajjampur Bhogappa Setty & Sons, General Merchants Davenagere City.	Weights, Measures and Weighing and Measuring Instruments.
(3)	V.S. Akkasligar, Prop. Nageswar Repairing Works, Ron District, Dharwar.	Weights, Measures and Weighing and Measuring Instruments.
(4)	Annapurna Cooker Co., No. 36, Kankanhally Road, Bangalore.	Weights, Measures and Weighing and Measuring Instruments.

LICENSED MANUFACTURERS, DEALERS & REPAIRERS OF WEIGHTS & MEASURES (7)**Dealers (Contd.)**

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(5)	Asia Engineering Corporation, P.O. Box 13.A. Bruce Street, Fort, Bombay—C/o Best & Co. (P) Ltd., George Oakes Buildings, S Sri Narsimharaja Square, Bangalore.	Weights, Measures and Weighing and Measuring Instruments.
(6)	Basappa Channabassappa Chandrapattan, Hardware & Stationery Merchant, Byadgi.	Weights, Measures and Weighing and Measuring Instruments.
(7)	Best Co. Private Ltd., George Oakes Buildings, Bangalore	Weights, Measures and Weighing and Measuring Instruments.
(8)	Bhoopalamp, Virupaksha Setty & Sons, Importers & Exporters, Arsikere.	Weights, Measures and Weighing and Measuring Instruments.
(9)	Bidar Iron Works, M. Bidar Prop. M.A. Jabbar, Khuni Chabutra Bidar, Bidar District.	Weights, Measures and Weighing and Measuring Instruments.
(10)	Calcutta Machine Tools Corporation, No. 64, Silver Jubilee Park Road, Bangalore.	Weights, Measures and Weighing and Measuring Instruments.
(11)	R.K. Dhupatane, Jainpeth, Bagalkot, Dist. Bijapur	Weights, Measures and Weighing and Measuring Instruments.
(12)	Durgoji, Narayana Rao, C/o Vittala Rao, Merchant, Harihar Town, Chitradurga Dist.	Weights, Measures and Weighing and Measuring Instruments.
(13)	B.R. Gunde, Motor Mechanic, Station Road, Haveri, Dharwar District.	Weights, Measures and Weighing and Measuring Instruments.
(14)	C.S. Herur, General Merchant, Haveri	Weights, Measures and Weighing and Measuring Instruments.
(15)	Hiralal & Sons, Raviwarpeth, Shop No. 681, Belgaum	Weights, Measures and Weighing and Measuring Instruments.
(16)	V.C. Jakkappanavar, Hardware Merchant, Bazar Road, Bailhongal, Belgaum Dist.	Weights, Measures and Weighing and Measuring Instruments.
(17)	Kadur Taluk Agricultural Produce Cooperative Marketing Society Ltd., Kadur.	Weights, Measures and Weighing and Measuring Instruments.
(18)	Kalappa Bharmapa Kudachi, Raviwarpeth, Shop No. 834, Belgaum.	Weights, Measures and Weighing and Measuring Instruments.
(19)	Krishna Rao S/o Mohanlal, Pootani Galli, Gulbarga	Weights, Measures and Weighing and Measuring Instruments.
(20)	Mithal Balwant, Harwadkhar, Raviwarpeth, Belgaum	Weights, Measures and Weighing and Measuring Instruments.
(21)	Nagaraj S. Khodanpur, Prop. The Oriental Scale Co., Menasikai Galli, Hubli.	Weights, Measures and Weighing and Measuring Instruments.
(22)	K.H. Nara, Hardware Merchant, Bagalkot Dist., Bijapur	Weights, Measures and Weighing and Measuring Instruments.
(23)	Narayan Devendra Dhaval, 378 Dalalpeth, Nipani	Weights, Measures and Weighing and Measuring Instruments.
(24)	Narayana Setty & Sons, Hardware Merchants, Gandhi Bazaar, Shimoga.	Weights, Measures and Weighing and Measuring Instruments.
(25)	G.K. Narayana Setty & Sons, Merchants, Santhepet, Tiptur (Branch) Arsikere	Weights, Measures and Weighing and Measuring Instruments.

Dealers (Contd.)

Sl. No.	Name and Address of Dealer	Details of Articles Sold
26)	B. G. Oswal, Stationery Hardware Merchant, Bagawadi, Bijapur District.	Weights, Measures and Weighing and Measuring Instruments.
27)	Pai & Company (Regd.), 901, Bunder Road, Honavar, N.K. District.	Weights, Measures and Weighing and Measuring Instruments.
28)	Prabhakara Hardware Stores, Ragipet, Bangalore-2	Weights, Measures and Weighing and Measuring Instruments.
29)	S.V. Rathnaswamy & Sons, Merchants & Burmah-Shell Agents Chickmagalur P.O.	Weights, Measures, Weighing and Measuring Instruments.
30)	Regal Stores, Hardware Merchant, Opposite New Chitra Talkies, Mangalore-3.	Weights, Measures, Weighing and Measuring Instruments.
31)	Sangameshwar, Repairing Works, Station Road, Gadag	Weights, Measures, Weighing and Measuring Instruments.
32)	P.N. Satyanarayana, Merchant, Big Bazar Kolar	Weights, Measures, Weighing and Measuring Instruments.
33)	D.M. Shaha, Hardware Merchant, Gandhi Road, Haveri, Dharwar Dist.	Weights, Measures, Weighing and Measuring Instruments.
34)	Shriven & Co., 25, Surveyor Street, Basavangudi, Bangalore-4	Weights, Measures, Weighing and Measuring Instruments.
35)	Siddalingayya, Basayya Balulmath, Hardware Merchant, Bagalkot.	Weights, Measures, Weighing and Measuring Instruments.
36)	S.R. Sriranga Setty, Jeweller Chowk, Mercare, Coorg	Weights, Measures, Weighing and Measuring Instruments.
37)	Subbarayappa & Sons, General & Hardware Merchant, Chintamani.	Weights, Measures, Weighing and Measuring Instruments.
38)	V.R. Venkata Ram, Satyanarayana Book Stores, Main Road, Srirangapatna.	Weights, Measures, Weighing and Measuring Instruments.
39)	B.T. Yendigeri, Stationery Merchant, Kerur, Bijapur District	Weights, Measures, Weighing and Measuring Instruments.

Repairers

Sl. No.	Name and Address of Repairer	Details of Articles Repaired
(1)	Amarappa Angadi, Repairer of Weights & Measures, Koppal.	Weights, Measures and Weighing Instruments.
(2)	Annapurna Cooker Co., No. 37, Kankanahally Road, Bangalore-4.	Weights, Measures and Weighing Instruments.
(3)	Bidar Weights and Measures Dealing and Repairing Company near Khuni Chabutra Bidar.	Weights, Measures and Weighing Instruments.
(4)	Karnatak Weights and Measures Adjusting Works, Abdul Salam Badal Mailapur Gate, Yadgiri, District Gulbarga.	Weights, Measures and Weighing Instruments.

LICENSED MANUFACTURERS, DEALERS & REPAIRERS OF WEIGHTS & MEASURES (7)

Repairers (Contd.)

Sl. No.	Name and Address of Repairer	Details of Articles Repaired
(5)	National Engineering Sales Corporation, Golikatta Bazaar Bunder, Mangalore.	Weights, Measures and Weighing Instruments.
(6)	OM Scale Repairing, Prop., H.R. Rao, Barun Qila, No. 3-4-020, Raichur.	Weights, Measures and Weighing Instruments.
(7)	Radhakrishna and Brother, Nehru Gunj, Mujguri Road, Gulbarga.	Weights, Measures and Weighing Instruments.
(8)	Shekarappa Andanappa Gugri, Repairer in Weights and Measures, Koppal	Weights, Measures and Weighing Instruments.

PUNJAB (4)

In the July and September 1959 and March 1960 issues of *Metric Measures* lists of licensed manufacturers, dealers and repairers of weights and measures in the Punjab State were published. The following is a list of manufacturers, dealers and repairers subsequently licensed by the Government of Punjab under the Punjab Weights and Measures (Enforcement) Act, 1958.

Manufacturers

Sl. No.	Name and Address of Manufacturer	Details of Articles Manufactured
(1)	Avon Scales Company, Amritsar	Weights Platform Machines of type 1001 and 1002 of 300 kg and 200 kg Capacity
(2)	Indian Weighing Machines, Hide Market, Amritsar	Platform Weighing Machines.

Dealers

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(1)	Aggarwal Iron & Hardware Stores, Shahbad, Dist. Karnal	Weights, Measures, Weighing and Measuring Instruments.
(2)	Atma Ram Ram Saroop, Handiaya Bazar, Barnala	Weights, Measures, Weighing and Measuring Instruments.
(3)	Bachan Singh Badan Singh, Kharar, Dist. Ambala	Weights, Measures, Weighing and Measuring Instruments.
(4)	Balha Ram Ram Rang, Karnal	Weights, Measures, Weighing and Measuring Instruments.
(5)	Bashambar Datt Sagar Chand, Iron Merchants, Mukerian	Weights, Measures, Weighing and Measuring Instruments.

Dealers (contd.)

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(6)	Bashesar Parshad, Rameshwar Dayal, Safidon	Weights, Measures, Weighing and Measuring Instruments.
(7)	Benarsi Dass Dewan Chand, Patiala	Weights, Measures, Weighing and Measuring Instruments.
(8)	Beni Parshad Paduman Kumar, Iron Merchants, Gandhi Chowk, Kalka.	Weights, Measures, Weighing and Measuring Instruments.
(9)	Bharat Iron Trading Company, Rly. Road, Pathankote ..	Weights, Measures, Weighing and Measuring Instruments.
(10)	Bhoja Ram Bham Ram, Abohar	Weights, Measures, Weighing and Measuring Instruments.
(11)	Dalip Singh and Sons, Deharaha	Weights, Measures, Weighing and Measuring Instruments.
(12)	Daya Ram Moti Ram, Utensil Merchants, Abohar, Patiala ..	Weights, Measures, Weighing and Measuring Instruments.
(13)	Daya Ram Payare Lal, Iron Merchants, Abohar, Patiala ..	Weights, Measures, Weighing and Measuring Instruments.
(14)	Devi Dayal, Railway Road, Patti, Dist. Amritsar	Weights, Measures, Weighing and Measuring Instruments.
(15)	Gupta Hardware Stores, Chowk Sudan, Jullundur City ..	Weights, Measures, Weighing and Measuring Instruments.
(16)	Gupta Iron Stores, Sadar Bazar, Nabha, District Patiala ..	Weights, Measures, Weighing and Measuring Instruments.
(17)	Hargolal & Sons, Ambala Cantt.	Weights, Measures, Weighing and Measuring Instruments.
(18)	Jai Parkash Satya Dev, Chhoti Mandi, Kaithal	Weights, Measures, Weighing and Measuring Instruments.
(19)	Jangi Ram Bhola Ram, Iron Merchants, Narnaul	Weights, Measures, Weighing and Measuring Instruments.
(20)	Joti Ram Bhika Ram, Iron Merchants, Sunam	Weights, Measures, Weighing and Measuring Instruments.
(21)	Kalu Ram Shubh Karan, Hansi	Weights, Measures, Weighing and Measuring Instruments.
(22)	Karam Chand Som Nath, Amritsar	Weights, Measures, Weighing and Measuring Instruments.
(23)	Kataria B. D. & Sons, Ludhiana	Weights, Measures, Weighing and Measuring Instruments.
(24)	Kishore Chand Lachhman Dass, Muktsar, Dist. Ferozepore	Weights, Measures, Weighing and Measuring Instruments.
(25)	Krishna Machinery Stores, Rohtak	Weights, Measures, Weighing and Measuring Instruments.
(26)	Lakhi Ram Radha Sham, Lotwali Bazar, Dharamsala, Dist. Kangra.	Weights, Measures, Weighing and Measuring Instruments.

Dealers (contd.)

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(27)	Madan Gopal Anand Lal, Kacheri Road, Moga, Dist. Ferozepore.	Weights, Measures, Weighing and Measuring Instruments.
(28)	Mangal Chand Parshotam Dass, Iron Merchants, Abohar Mandi.	Weights, Measures, Weighing and Measuring Instruments.
(29)	Mani Ram Dogra & Sons, Kotwali Bazar, Dharamsala, Kangra Dist.	Weights, Measures, Weighing and Measuring Instruments.
(30)	Milkhi Ram Charanji Lal, Jandiala	Weights, Measures, Weighing and Measuring Instruments.
(31)	Mohindera Brothers Kacheri Road, Ludhiana	Weights, Measures, Weighing and Measuring Instruments.
(32)	Munshi Ram Jado Ram, Brass Ware Merchants, Jagadhri ..	Weights, Measures, Weighing and Measuring Instruments.
(33)	Munshi Ram Surinder Kumar, Moga	Weights, Measures, Weighing and Measuring Instruments.
(34)	Munshi Singh Dharm Singh, Guru Har Sahai	Weights, Measures, Weighing and Measuring Instruments.
(35)	Nanha Mal Puran Chand, Iron Merchants, Kurukshetra ..	Weights, Measures, Weighing and Measuring Instruments.
(36)	Natha Mal Ram Singh, Shakkote	Weights, Measures, Weighing and Measuring Instruments.
(37)	National Tape Company, 198-Ikbal Road, Ludhiana ..	Weights, Measures, Weighing and Measuring Instruments.
(38)	Nirmal Singh Prem Singh, Malout Mandi, Dist. Ferozepur	Weights, Measures, Weighing and Measuring Instruments.
(39)	Pt. Charan Dass, Katra Hari Singh, Amritsar	Weights, Measures, Weighing and Measuring Instruments.
(40)	Piare Lal Prem Chand, Iron & Metal Merchants, Sadhaura ..	Weights, Measures, Weighing and Measuring Instruments.
(41)	Prem Nath Aggarwal and Sons, Chaura Bazar, Karnal ..	Weights, Measures, Weighing and Measuring Instruments.
(42)	Raj Kumar Kashmiri Lal, Iron Merchants, Abohar ..	Weights, Measures, Weighing and Measuring Instruments.
(43)	Rajasthan Machinery Stores, Narnaul	Weights, Measures, Weighing and Measuring Instruments.
(44)	Ram Chand Chhaju Ram Iron Merchants, Nabha (Patiala)	Weights, Measures, Weighing and Measuring Instruments.
(45)	Ram Lal Brij Lal, Dhuri, District Sangrur	Weights, Measures, Weighing and Measuring Instruments.
(46)	Ram Sukh Dass & Sons, Paints & Hardware Merchants, 46, Lower Bazar, Simla.	Weights, Measures, Weighing and Measuring Instruments.
(47)	Ramgopal Ramesh Chander, Iron Merchants, Hoshiarpur ..	Weights, Measures, Weighing and Measuring Instruments.

Dealers (concl.)

Sl. No.	Name and Address of Dealer	Details of Articles Sold
(48)	Rup Chand Dharm Pal, Iron Merchants, Samana Mandi (Patiala).	Weights, Measures, Weighing and Measuring Instruments.
(49)	Sat Parkash Singhal and Bros. Samrala	Weights, Measures, Weighing and Measuring Instruments.
(50)	Sikand Saini & Company, Weavers Colony, Panipat ..	Cast iron Weights 50, 20, 10, 5, 2, & 1 kg. 500, 200, 100 g. Brass Weights 50 & 20 g.
(51)	Sloke Chand Mittar Sain, Iron Merchants, Safidon	Weights, Measures, Weighing and Measuring Instruments.
(52)	Standard Sheet Metal Works, Saddar Bazar, Ambala Cantt.	Weights, Measures, Weighing and Measuring Instruments
(53)	Tara Chand Waliati Ram, Ludhiana	Weights, Measures, Weighing and Measuring Instruments.
(54)	Tulsi Dass Nagin Chand, Chaura Bazar, Ludhiana	Weights, Measures, Weighing and Measuring Instruments.
(55)	Tulsi Dass Ukam Chand, Ludhiana	Weights, Measures, Weighing and Measuring Instruments.
(56)	Udmi Ram Bhim Sain, Iron Merchants, Abohar	Weights, Measures, Weighing and Measuring Instruments.
(57)	Ved Parkash, S/o Pt. Som Datt, Gemetry Road, Putlighar, Amritsar.	Weights, Measures, Weighing and Measuring Instruments.

Repairers

Sl. No.	Name and Address of Repairer	Details of Articles Repaired
(1)	Agricultural Industries (Regd.), G.T. Road, Batala	Weights and Measures of Length and Capacity.
(2)	Avon Scales Company, Sultanwingh Road, Amritsar ..	Weights, Measures, Weighing and Measuring Instruments.
(3)	Balbir Singh & Sons, Kikar Bazar, Bhatinda	Weights (Cast Iron & Brass) Measures of Length and Capacity.
(4)	Chander Bhan (Mistri), S/o Shri Sheo Lal, Azad Chowk, Narnaul.	Weights (Cast Iron & Brass) Measures of Length and Capacity.
(5)	Khem Ram Ram Chander, Charkhi Dadri	Weights, Measures of Length and Capacity.
(6)	Krishna Foundry Works, Ambala City.. .. .	Weights (C.I.S. Brass) Measures of Length & Capacity.

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will be supplied in an
unbreakable plastic container

(Factor used : 1 kg. = 2.20462 lb)

Ruppes per lb to Ruppes per kg.

[illegible]

(Factor used : 1 kg = 2.20462 lb)

Naye Paise per lb to Rupees & nP. per kg

[illegible]