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INSTITUTE OF STANDARDS AND INDUSTRIAL RESEARCH, KARAJ

DP/IRA/69/534

IRAN

Technical report: Development of metrology services

Prepared for the Government of Iran
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Prem Prakash, weights and measures expert

United Nations Industrial Development Organization

Vienna

id. 77-3621

## Explanatory notes

Ostan is a Farsi word used in this text to denote one of the eleven provinces of Iran.

The monetary unit in Iran is the rial (Rls). During the period covered by this report the value of the rial in relation to the US dollar was $US1 = Rls 70.62.

A slash between dates (e.g. 1970/71) indicates a crop year, financial year or academic year.

The use of a hyphen between dates (e.g. 1974-1976) indicates the full period involved, including the beginning and end years.

The following abbreviations are used in this report:

| | |
|---|---|
| ASAC | Asian Standards Advisory Committee |
| BIPM | International Bureau of Weights and Measures |
| CEB | Comité European du Beton |
| CIE | International Commission for Illumination |
| CGPM | General Council of Weights and Measures |
| IEC | International Electrotechnical Commission |
| ISIRI | Institute of Standards and Industrial Research of Iran |
| ISO | International Organisation for Standardization |
| OIML | International Organisation of Legal Metrology |
| OIPM | International Organisation of Weights and Measures |
| RCD | Regional Co-operation for Development |
| SI | International System (bass measursment) |
| WAITRO | World Association of Industrial and Technical Research Organisations |

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## ABSTRACT

The Government of Iran wished to expand and develop the Metrology Centre established during the project "Institute of Standards and Industrial Researoh, Karaj" (DP/IRA/69/534), for which the United Nations Industrial Development Organization (UNIDO) acted as executing agency for the United Nations Development Programme (UNDP). The objective was to broaden the application to industry of scientific metrology and standardization, including materials testing and quality control, with particular reference to revising the Weights and Measures Law of Iran.

At the request of the Government for assistance, an expert in weights and measures was provided by UNDP for one year. The period was subsequently extended by four months ending in March 1976. The expert's duties were to:

(a) Advise on the development of the metrology services, including organizational, legal and managerial aspects;

(b) Recommend measures to improve facilities for checking calibration, inspection of weights and measures and measuring instruments;

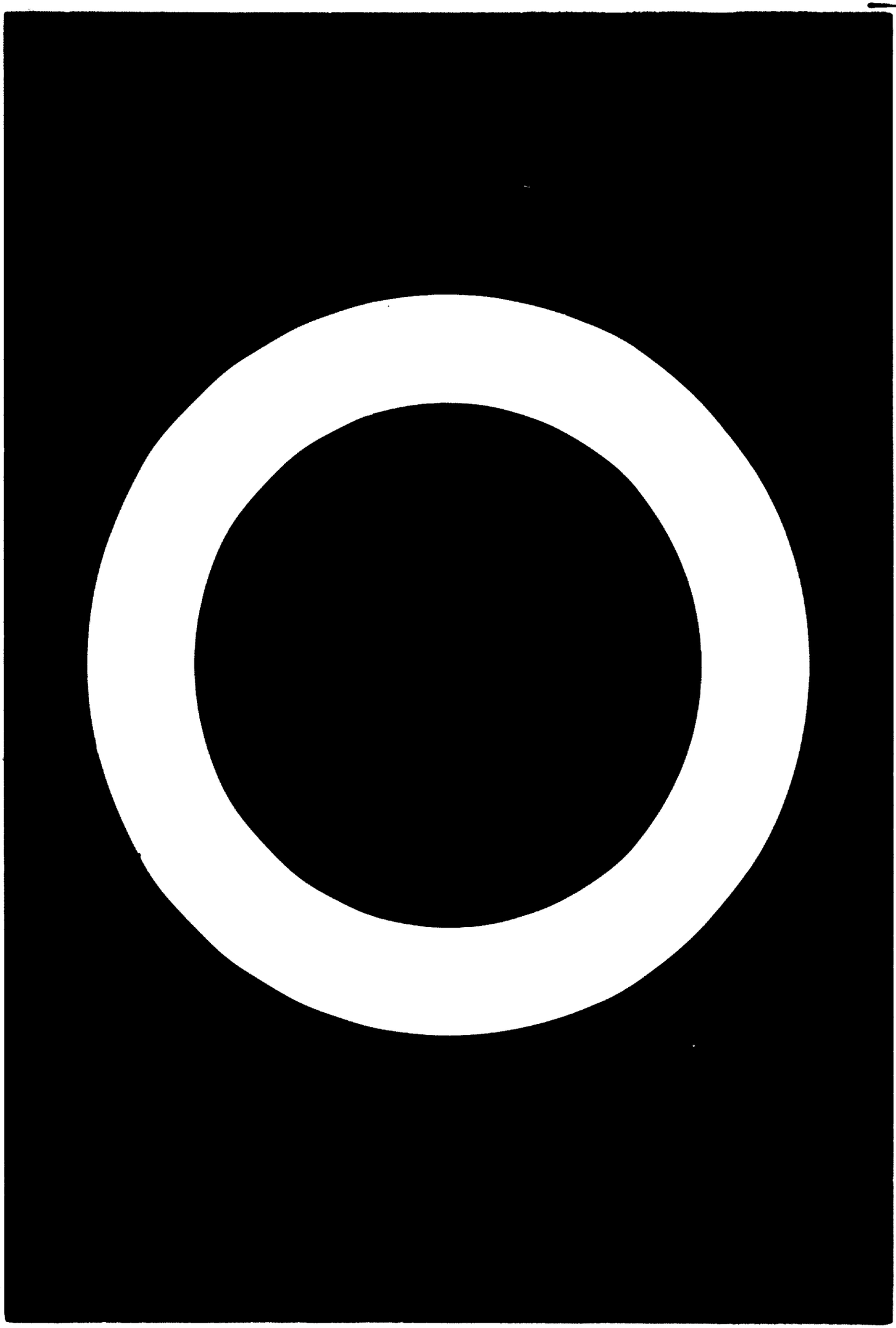
(c) Assist in planning a training programme for professional staff;

(d) Train local staff.

His recommendation was that the present project should be extended by three years, or that a new scientific/legal metrology project should be launched with the following aims:

(a) To ensure that the ISIRI has the competance to reproduce all base and derived International System (SI) units to the highest degree of accuraoy. The Institute should also be equipped adequately to enable it to undertake complicated measurement jobs and test and certify sophisticated manufactures;

(b) The Metrology Law will, sooner or later, encompass aspects of public welfare, health and safety, to equip the Legal Metrology Laboratories with equipment suitable for setting up a three- or four-level calibration chain to traoe and verify all the measures and measuring instruments to national standards.



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## INTRODUCTION

The first step towards the establishment of standards of weights and measures in Iran was taken as far back as 31 May 1925, when a Law enforcing the use of metric units was enacted and a Bureau of Weights and Measures created. The actual enforcement became more rigorous after the enactment of another Law on 1 January 1933. From May 1962 onwards, the Institute of Standards took over the responsibility of enforcing the Weights and Measures Law and in 1965 was renamed the Institute of Standards and Industrial Research of Iran (ISIRI). It was in this Institute that the most significant step, which promoted the cause of scientific and legal metrology and standardization in Iran, was taken as a consequence of the recommendation made by a United Nations Educational, Scientific and Cultural Organization (UNESCO) expert, Richard Vieweg, on an exploratory mission in his report of August 1966 on the setting up of a Metrology Centre at the ISIRI. The Governing Council of the United Nations Development Programme (UNDP) accepted the request of the Iranian Government for technical assistance in establishing the Centre and enlisted the United Nations Industrial Development Organization (UNIDO) with the execution of the project. The Plan of Operation was signed on 31 October 1971. The planning and designing of the laboratories and the purchase of important items of equipment were carried out by the Project Manager and his team of experts. The expert on weights and measures took up his assignment in November 1974. His duties were to:

(a) Advise and assist in the revision, amendment, extension and development of the existing field metrology services, including organizational, legal and managerial aspects of its activities;

(b) Recommend measures to improve, modify or update the methods and facilities used for checking, calibration and inspection of weights, measures and measuring instruments in the existing branch offices throughout the country;

(c) Assist in working out a programme for training professional staff in the specialized tasks of checking, calibration and inspection of weights and measures, including the organization of training courses for weights and measures inspectors;

(d) Train local staff in the above field.

His recommendations are contained in the body of this report.

Soon after the expert reported for duty, the Director General of the ISIRI requested that a comprehensive Note on the Revision of the Weights and Measures Law of Iran be prepared. This Note was subsequently translated into Farsi for presentation to Parliament. (English original, annex I).

The Note stresses the importance of scientific metrology, legal metrology and standardization in the economic growth of the country and suggests the revision of the existing Weights and Measures Law of Iran to make it all-encompassing. The authorities would then be able to exercise the control necessary in important fields relating to public welfare, health and safety, besides controlling the accuracy of measures and measuring instruments intended for everyday use.

The Weights and Measures Law, as such, has not been revised, although modifications have been made to the ISIRI Law, which includes the Weights and Measures Law. The revision of the Weights and Measures Law is expected to be implemented only when the proper authorities decide to include various aspects of public welfare, health and safety, in its ambit. The modification of the ISIRI Law will, for the present, enable the Institute to extend the Law to additional items, hitherto excluded. The safety aspect is, for the time being, taken care of by declaring some national specifications compulsory. In the long run, however, this will not be adequate as all aspects of safety cannot be covered properly in this manner. The Note on the Revision of the Law also contains a broad outline of ISIRI's programme of work. The work carried out in connection with laying down specifications for commercial grade weights which included the construction of experimental models in different shapes and the calculation of their dimensions is described in the Note entitled New Series of Commercial Grade Weights for Use in Iran (annex II).

Clauses relating to the Weights and Measures Law for inclusion in the composite ISIRI Law were suggested as an interim measure, pending the complete revision of the Weights and Measures Law itself at a later date (annex III).

A draft illustrated brochure on the structure and organization of the ISIRI which would later serve as background material for publicity relating to the revised Weights and Measures Law, was prepared in March 1976 (annex IV).

# I. FINDINGS

The duties of the weights and measures expert, as set out in the Job Description, cover practically every area necessary for the setting up of an efficient Legal Metrology Service, but would perhaps require a much longer time to accomplish than the period agreed. The more important jobs were, therefore, taken up first. Progress in some of them is given below.

## A. Revision of the Weights and Measures Law

One of the highest priority jobs assigned by the Director General of the ISIRI was the preparation of a comprehensive Note on the Revision of the Weights and Measures Law of Iran, required for presentation to Parliament. When finished it was translated into Farsi.

The chief points covered in this Note (annex I) are:

### 1. Importance of metrology

The Note stresses the importance of scientific and legal metrology to the general well-being of the people of a country, by the control it exercises over the accuracy of various measures and measuring instruments used in different areas of public health and safety.

The highest importance should be given to the testing of various diagnostic medical instruments and appliances, such as clinical thermometers, sphygmomanometers, hypodermic syringes, X-ray dosimeters, radiation monitoring badges, eyeball pressure testing devices, electrocardiographs and many other instruments used by the medical profession.

The next field to be covered should be the instruments used for ensuring safety during travel (altimeters fitted in transport aeroplanes, speed measuring and speed limiting devices used in road vehicles) and instruments for ensuring proper working conditions in factories, safety on roads, and domestic conditions in residential areas, as well as proper environmental conditions in schools and colleges etc. by the control of noise, light and similar factors.

The accuracy of measuring instruments, employed for measuring the pollution of land, water and air are equally important for the general well-being of the people, specially in thickly populated areas, but these can be taken up in a later phase of the Enforcement Plan.

Although a provision exists in the ISIRI Law for declaring a standard compulsory, if safety in the use of the item covered by it is to be ensured, this provision is not sufficient to extend to all important safety areas, which can best be controlled by the Metrology Law.

2. Rapid industrialization through legal metrology

The importance of legal metrology in the rapid industrialization of a country is stressed, particularly in the field of the engineering industries, by the carrying out of compulsory periodic verification of various measures and measuring instruments used in manufacturing processes. Although the actual calibration of such instruments is usually undertaken only in the Scientific Metrology Laboratories, as the Legal Metrology Laboratories are seldom equipped adequately for such sophisticated work, compulsion has to be enforced through the Metrology Law.

3. Better standards of scientific and technical education

As usually no provision exists for the control of the accuracy of the weights, linear or other measures and measuring instruments employed for educational purposes in schools and colleges, their quality has sometimes been found to be even poorer than the corresponding items available for trade purposes. This is because the commercial measures are compulsorily checked under the Metrology Law, whereas the educational measures are not checked at all. When the provisions of legal metrology are enforced for the control of the accuracy of measuring instruments and apparatus used in educational institutions, the standard of practical work carried out by the students automatically rises.

These important aspects of legal metrology and the question of revising the Metrology Law of Iran were discussed with the authorities concerned, and it was decided that it would be better to extend the Law to these areas only after the ISIRI and the Legal Metrology Laboratories have been adequately equipped. For the present, it would meet the requirements of the Enforcement Departments, if the ISIRI Law, which includes the Weights and Measures Law, is amended to include a few more appropriate clauses so that the Law could cover some of the more important additional items. Additional clauses suggested for inclusion in the ISIRI Law are given in annex III.

It may not be out of place to mention here that a Legal Metrology Department is concerned only with verifying the accuracy of various measuring instruments used in important public welfare areas, it is not concerned with controlling

any of these areas themselves, i.e. a Legal Metrology Department is not responsible for controlling Public Health Departments, Safety Departments, Anti-Pollution Departments or industrial establishments, its duty ends when it has checked the accuracy of the instruments employed by these departments. If any department violates the compulsory checking proviso, the Legal Metrology Department can bring such departments to book. Its chief objective is to ensure that no damage is done to anyone through inaccurate measurements. The general impression that the Legal Metrology Department wants to control everything in which a measurement is involved, is not correct.

B. Steps to be taken when the Law is revised

It has been pointed out in the Note that as and when the Law of Iran is revised to cover any or all of the above-mentioned sophisticated areas, it would be necessary to:

(a) Equip the Metrology Centre adequately to enable it to achieve the quality level for calibrating the remaining important International System (SI) units of measurement;

(b) Arrange for all the State Enforcement Laboratories to be provided with sufficient space and equipment, to enable them to discharge their functions efficiently and effectively;

(c) Arrange for further training and regular refresher courses for existing enforcement personnel;

(d) Recruit qualified additional staff for strengthening various Enforcement Laboratories and provide training for them in legal and scientific metrology;

(e) Formulate schedules, i.e. specifications for measures and measuring instruments governed by the Metrology Law;

(f) Lay down verification and Model Approval procedures and to equip the ISIRI Laboratories for carrying out the Model Approval of sophisticated measures and measuring instruments. This equipment should not be restricted to the Metrology Centre, but extended to those laboratories concerned with facilitating Model Approval of some of the measuring instruments relating to public welfare;

(g) Draw up a complete verification programme and arrange for the regular verification of standards and ancillary equipment belonging to all the State Enforcement Laboratories;

(h) Prepare brochures and publicity material to familiarize the public and industry etc. with the benefits of the new Law and the role of ISIRI in the industrial development of Iran;

(i) Participate actively in the technical work of the International Organization of Legal Metrology (OIML);

(j) Set up a Legal Metrology Cell at the ISIRI, for co-ordinating related work.

## C. Technical assistance to manufacturers of weights and measures

Visits were paid to manufacturers of commercial grade balances and weights, most of whom work on a cottage industry basis. Works of several manufacturers of weighing machines and of weighbridges were also visited to discover the level at which manufacturing was being carried out, and whether the ISIRI could provide assistance to enable the manufacturers to improve the quality of their products.

The two pan Beranger-type balances are being used throughout Iran for every-day trade transactions and the total requirement of the country is being met by local manufacture. The quality of these balances is fairly good but there is still scope for improving their sensitivity and reliability by properly advising manufacturers, after careful tests have been made on their balances.

## D. Assistance to industry other than through legal metrology

The ISIRI is responsible for several associated disciplines, namely (a) the custody of national standards and scientific metrology, (b) legal metrology, (c) formulation of national standard specifications and codes of practice etc., including a quality marking scheme and quality control, and (d) industrial testing and industrial development research.

An institute of this type is of great advantage to the country. It avoids unnecessary duplication of administration, library, workshop, services and other common facilities, including items of equipment, and it has also rendered useful service to industry in the most economical manner. However, this Institute is capable of playing a key role in bringing about the rapid industrialization of Iran through import substitution of engineering products and export promotion, provided it is furnished with the proper equipment immediately. Once properly equipped, the Institute will be able to diversity and its combined metrology and testing activities will enable it to detect defects in locally manufactured articles by the use of appropriate calibration methods. Thereafter it will be possible to take up industrial research and development projects for improving the quality of the product in question and advising the manufacturers on the correct procedure. It could be said that testing is the basis of practical industrial research (see annex I).

Besides the Note on the Revision of the Weights and Measures Law of Iran twelve other Notes were preapred relating to subjects suoh as the laying down of specifications and tolerances for standard and commercial grade weights, working out new shapes and designs for these weights, suggesting items of equipment for carrying out verification work and legal metrology, the collection of data for compiling registers for legal metrology for facilitating the Enforcement Programme and related topics. The more important subjects are dealt with below.

## E. Controlling the accuracy of legal metrology standards at various levels

Arrangements were suggested and tolerances laid down for seven grades of weights (four for standard weights and three for commercial grade weights), for relating the accuracy of the commercial grade weights tested by the Weights and Measures Inspectors to the national standard specifications of the Metrology Centre by means of a calibration chain. Tables of tolerances have been provided for the operation of the calibration chain. The Level - I legal metrology standards will possess the highest accuracy and will be calibrated against the national standards of the Metrology Centre, and maintained in the ISIRI. These will be used for calibrating the reference standards (Level II) held by all the major states in the country, which in turn will be used for calibrating the secondary standards (Level III) held by every Legal Metrology Laboratory. These Level III standards will be used for checking the Level IV, i.e. the working standards, employed by the Inspectors of Weights and Measures for the verification of commercial grade weights.

The conoept of the calibration chain will be introduoed as soon as the Weights and Measures Law is revised and arrangements made for the proper checking of standards at all levels of the chain.

## F. Review of the speoifioations for balances

Speoifioations dealing with the designs and teohnical requirements for weights, balanoes and other measuring instruments were reviewed and a few modifications proposed. Closer acouracy and sensitivity figures were suggested for various oapacities of balanoes. These would be incorporated in the relevant standards when the oonditions of manufacture are further improved.

## G. New series of commercial grade weights for use in Iran

After carrying out a good deal of experimental work and making investigations on the designs and shapes, as well as tolerances of commercial grade weights, a proposal was put forward for the grading of weights into three degrees, namely coarse grade, fine grade and special grade.

Detailed work was undertaken on the choice of new shapes for cast iron weights, as a high priority job, as it was intended to replaoe all the old weights in the country with those made in the new shapes. Recommendations are laid down in the Note entitled New Series of Commercial Grade Weights for Use in Iran (see annex II).

The idea is put forward also that by changing over gradually to the use of the automatic indicator-type balances for everyday trade throughout the country, the need for the verification of commercial grade weights which is a comparatively tedious process, will be eliminated ultimately. The checking of automatic balances is a very much simpler procedure and is oarried out with a set of standard weights, which an Inspector can carry easily. However, it will be worthwhile to pursue the concept of automatic balances only when these can be manufactured within the country.

## H. Collection of data and preparation of registers

In order to eliminate the use of untested weights and measures, it is necessary to compile registers containing essential information regarding manufacturers, dealers and repairers, as well as all users of weights and measures (i.e. all shops and trading establishments), together with a list of the sets of weights and measures possessed by them. Suoh registers will also be helpful in preparing periodic verification programmes every one or two years, as may be required under the Law.

## I. Purchase of verification equipment

A list of essential items of equipment for oarrying out the day to day enforcement work required under the existing Law was compiled. This inoludes laboratory equipment as well as portable equipment for use in various Weights and Measures Laboratories and also in temporary oamp laboratories. Camp

laboratories are set up in villages during enforcement campaigns. The purchase of these items is important because the Enforcement Laboratories do not at present possess suitable equipment. Well equipped mobile laboratories will be needed also for verification work.

## J. Publicity

When the Law is revised, a good deal of publicity will be required to familiarise the public with the benefits of the new Law, as well as about the part played by the ISIRI. Although no publicity had so far been necessary for legal metrology as such, a request was made to assist ISIRI in the preparation of a suitable brochure highlighting the role of the Institute in the industrial development of Iran. Subsequently, various laboratories of the ISIRI were visited to collect necessary information regarding their work patterns. All the laboratories were also asked to send a write-up describing in detail (a) the chief areas of their activities, (b) items of equipment owned and (c) plans for future development.

A draft was immediately prepared on the basis of the information gathered verbally (see annex IV).

Preparation of another brochure which will describe, in greater detail, the work and the role of each of the Laboratories under the ISIRI (more than 30 in number), as well as their plans for expansion were also initiated, on the basis of the written information provided by the Laboratories.

Both brochures are to be produced in English and Farsi.

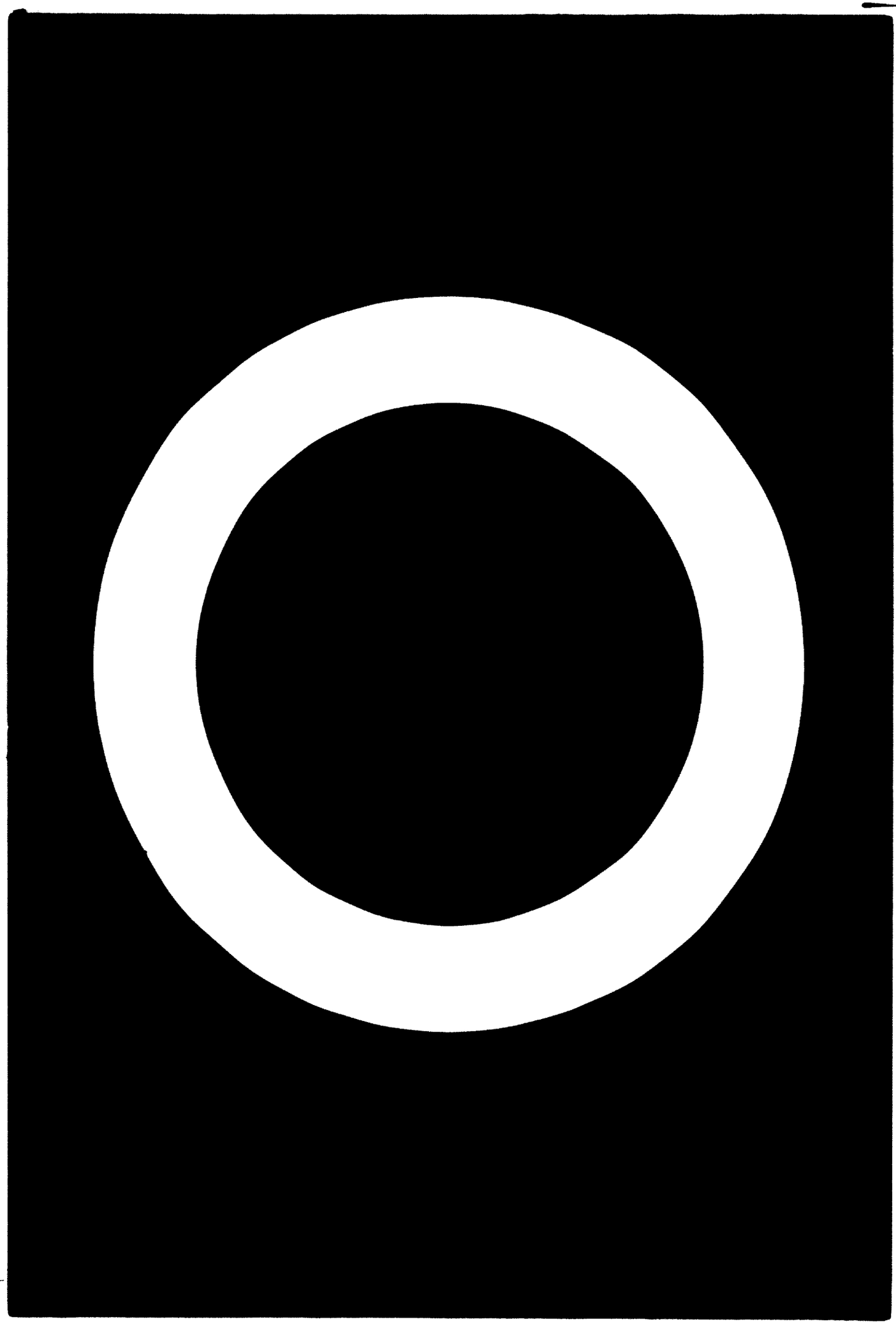
## II. RECOMMENDATIONS

The Metrology Centre of the Institute of Standards and Industrial Research of Iran has developed into a fine metrology laboratory in Iran as a result of the great efforts made by the Institute authorities, as well as the project personnel. The early stages of a huge project such as this one, where new buildings have to be designed and constructed and every price of equipment has to be procured and properly installed, usually take longer than planned. Although all the plans envisaged have now been implemented, more or less, rate of industrial development in Iran over the past ten years, when the existing project was first conceived, calls for the immediate expansion of the facilities of the ISIRI, especially the Metrology Centre, to enable it to meet current demands of the country's growing industry. It would be in the best interest of the industrial development of Iran, if, either the existing project could be revised and extended by another three years, or, if this is not feasible, a new composite scientific/legal metrology project should be formulated forthwith and made operative at the earliest moment.

The new project should aim at making the ISIRI self-sufficient in the reproduction of all important base and derived SI units, to the highest degree of accuracy, similar to the work carried out by other international organizations. It should also be possible for the ISIRI to undertake complicated and fine measurement jobs and be competent to test and certify the sophisticated items manufactured today as well as those on the planning board.

Sooner or later, the Metrology Law is going to cover areas of public welfare, health and safety, which will necessitate equipping adequately all the Legal Metrology Laboratories with essential items of equipment for the setting up of a three- or four-level calibration chain permitting the traceability of all measurements, including the verification of measures and measuring instruments, to national standards.

When the ISIRI possesses all the items of equipment necessary for testing and standardization, it will be possible for it to diversify its activities and take up practical industrial research and development in the larger interest of the country's economy and the well-being of its people.



## Annex I

## A NOTE ON THE REVISION OF THE WEIGHTS AND MEASURES LAW OF IRAN

### SUMMARY

After pointing out the importance of metrology in building up the economy of a country and in the well-being of its people, reference is made to the necessity of revising the Law of Iran for Weights and Measures, in the context of modern legal metrology, under which a Government can exercise control on any measurable quantity in any field which is considered to be of importance either for the country as a whole, or for the individuals living in it. The revised Law, which will be based on the draft OIML Law, will recognise all important metric units of measurement, namely all the SI base, supplementary and derived units, presently 56 in number, and 24 other important units, as against only five units recognised by the present Law. The names of various units and the quantities which they measure, have been mentioned to demonstrate the vastness of the scope of modern legal metrology. Various fields in which the Law will be made applicable in suitably phased stages, as the implementation of the earlier phases progresses satisfactorily, have also been mentioned.

It has been pointed out that the revision of the Law will be meaningful only if all necessary steps for its effective and efficient implementation are taken simultaneously. Complete responsibility for revising the Law and administering it properly throughout the country will have to be passed on to the ISIRI, which in order to make the implementation of the Law a success, will be required to take the following essential steps to:

(a) Equip itself further to enable the Metrology Division to realize the values of all the base and other important units;

(b) Equip itself for verifying reference standards and other ancillary equipment necessary for Chief Laboratories in all the Ostans in the country and for maintaining a constant periodic check on their values (the Chief Laboratories being in turn responsible for supplying verified standards to all the other laboratories in the Ostan and for maintaining a constant periodic check on their values);

(c) Recruit suitably qualified staff, in stages, to fill various posts in the heirarchy of legal metrology throughout the country;

(d) Impart necessary training to the existing staff as well as to the newly recruited staff to enable them to discharge their duties efficiently;

(e) Provide necessary assistance to the Legal Metrology Laboratories throughout the country to enable them to equip themselves adequately for carrying out complicated types of verification work in various fields, to the desired level of accuracy;

(f) Formulate necessary schedules, i.e. specifications for various measures and measuring instruments governed by the metrology law, including schedules suitable for carrying out Model Approval tests;

(g) Carry out testing for the Model Approval of every measure and measuring instrument before any such is permitted to be manufactured in the country or imported into it, and issue Approval Certificates;

(h) Carry out verification of complicated measures and measuring instruments, which can not be verified by the Legal Metrology Laboratories in the initial stages of the implementation of the Law and to continue such work till the Metrology Laboratories are in a position to take up such work independently;

(i) Arrange for the necessary publicity to educate the public regarding the new Law and its benefits, in the interest of smooth implementation;

(j) Actively participate in the technical work of the OIML, specially in connection with the formulation of international recommendations, i.e. specifications for measures and measuring instruments governed by legal metrology;

(k) Set up a Legal Metrology Cell at the ISIRI, which after carrying out the initial planning of the implementation will become the Institute of Legal Metrology of Iran and will ultimately be responsible for the complete administration of the Law and its extension into newer fields, as well as responsible for imparting training to the newly recruited staff and for holding refresher courses for the existing staff.

The ISIRI is one of the most important institutes in the country as it combines the functions of several important institutes under one roof, namely:

(a) The institute for maintaining national standards;

(b) The institute for the administration of legal metrology;

(c) The institute for the formulation of national standard specifications;

(d) The Industrial Research Instituete of Iran, for carrying out research on various industrial problems.

Those of the above-mentioned institutes, which have not yet been properly developed, should be developed as early as possible. It has been pointed out in this Note, that when the ISIRI equips itself fully for carrying out work regarding national standards, it will incidentally be able to take up other testing work, with the same equipment and boost the quality control of even those items which are not governed by the Metrology Law. Careful and exhaustive testing often feeds the industrial research laboratories with practical research problems, which the ISIRI will automatically be able to identify when it undertakes large quantities of industrial testing work. Work on such practical problems is bound to result in rapid industrialization and production of high quality goods in the country, whioh will easily find an export market. This is also an important reason for revising the present law immediately.

Finally, annex III gives the draft of various important sections, which are to be included in the Law. It has been suggested that in the interest of effective implementation, it should be made as complete as possible. Implementation of the Law should not depend on any subordinate document. Various powers required for its effective implementation and the powers to make rules and formulate schedules, should also form a part of the main Law.

## INTRODUCTION

Metrology, the science of measurement, has acquired great importance during the past two decades. The recent phenomenal developments in science and technology such as the harnessing of atomic energy, landing man on the moon, the unparalleled innovations in weaponry making it possible to blow up targets located thousands of kilometres away etc., which were considered to be scientists' and technologists' dreams only, became realities on account of modern metrological techniques. Control on the accuracy of defence equipment and on measuring equipment used in industry has been found to be essential for ensuring a country's safety and for the rapid growth of its economy. Similarly, control of the accuracy of various appliances in everyday public use has been found to be essential for ensuring the health and safety of the inhabitants. In short, the extent to which a country can progress in scientific, technological and industrial fields, and ensure the health and prosperity of its people, is directly proportional to the level of development of its metrology. All the developing countries of the world are, therefore, attaching a very great importance to the systematic development of metrology and its application at all necessary levels of accuracy.

Experience has shown that the surest and the quickest way of attaining the desired accuracy in various important fields is to impose a minimum accuracy requirement for each and every measure and measuring instrument used anywhere in the country, through a suitable law. Such a control under the aegis of law is called legal metrology. Modern legal metrology is a suitable extension of the older concept of the Weights and Measures Law and it covers many additional and important fields over and above the earlier field which covered only weights, length measures and capacity measures used in the market for everyday trade and transactions.

## 1. Present Weights and Measures Law of Iran

The present National Law of Iran for Weights and Measures recognizes three base units, namely the unit of length the metre (m), the unit of mass the kilogram (kg), and the unit of time the second (s), and two derived units, namely the unit of area the square metre ($m^2$) and the unit of volume the cubic metre ($m^3$). On the usual pattern of the older laws of Weights and Measures, the scope of the Law of Iran is also limited to the control of accuracy of weights and measures used in everyday trade and transactions and in official actions involving weighing and measuring. The Law in its present form is accordingly not broad-based enough to look after all the interests of an industrially growing country like Iran, which would like to improve its economy and ensure the health and prosperity of its people.

### A. Necessity of revising the Law

It has been observed that importance of control on the accuracy of weights and measures and measuring instruments etc., is usually very much underestimated even by knowledgeable persons. Many of them think that small inaccuracies in measures and measuring instruments can be easily overlooked without any detriment to anybody. This is not correct. They are not aware of the fact that, even if we do not take into consideration the control of medical and other important instruments, the inaccuracies could often be detrimental to the general public. Such small inaccuracies as 1% even in the ordinary weights and measures employed in everyday trade and transactions in various parts of the country may mean a loss of millions of Rials daily to the unsuspecting buyers and an equal gain to a handful of clever traders. It may be interesting to note that errors of the order of 5% are quite common in the ordinary weights and measures being used in all the markets and that such errors cannot ordinarily be detected. The only way to ensure the desired accuracy is by taking special steps to verify every weight and measure and measuring instrument in use anywhere in the country and to rectify, repair or destroy, the incorrect ones and to maintain a periodic and strict control of the accuracy of all of them. It has been found that whatever errors there are in the common measures, they always affect adversely the retail purchasers the most. The magnitude of such daily losses to the common man, though tremendous, is not so glaring because the entire loss is shared by a large number of persons everyday. The point made here can be fully appreciated if one considers the daily trade figures for the whole of the country.

Errors in the instruments and equipment used for assessing the exoise duty and other revenues levied by the Government, suoh as postal oharges, railway charges etc., may mean a similar colossal loss to the Government as well, everyday.

This example illustrates the gravity of situation which exists in the absence of a suitable law and proper control on the aocuracy of measures and measuring instruments, and stresses the need for an immediate revision of the existing Law.

## II. BASIS AND SCOPE OF THE PROPOSED REVISED LAW

### B. Basis of the proposed revised Law

The revised Law of Iran will be based on the draft law prepared by the International Organization of Legal Metrology, of which Iran is an active member. The law will include all necessary regulations to empower the Government to exercise a strict control on the accuracy of measures and measuring instruments used in industry and in many other vital fields, over and above the usual field of customary trade and transactions etc. A provision will also be made in the law to enable the Government to enforce various regulations in suitably phased stages, as and when considered necessary in any particular part of the country, or the whole of the country.

### C. Scope of the proposed revised Law

The revised Law will be made applicable in suitably phased stages, as may be considered necessary by the Government, in the following important fields:

#### 1. Control of measures and measuring instruments for everyday use

In the first phase, the law will be enforced in the customary field of weights, length measures and volume measures etc., used in everyday trade and and transactions and contracts etc., as well as in controlling the aocuraoy of various equipment, applianoes and measuring instruments employed in everyday public use, such as taximeters, gas meters, water meters, electricity meters, petrol pumps, tank lorries and similar appliances, and all such measures and measuring instruments which are used for determining wages and bonus etc., being paid to the workers, as well as all such instruments which are used for determining excise duties, postal charges, railway charges or any other similar oharges levied by the Government.

2. Control of measuring equipment used in the industry

The measures, measuring instruments, gauges and other measuring equipment used for controlling the dimensions or other important properties of various products manufactured by the local industry, will be subjected to a strict control, in order to ensure high quality for each and every product made in the country, so that it is readily accepted in the market, in spite of competition with the imported products. After the trustworthiness of these produots is well established in the local market, efforts should be made to introduce them into foreign markets. Special attention will have to be paid to the engineering industries producing precision components, in order to ensure complete interchangeability of components manufactured by different factories in the country with those manufactured in other countries.

The revision of the old law and the efficient implementation of the new law will be able to provide the much needed guidance to Iran's growing industry right from the stage of its infancy.

3. Control of measuring equipment used in other important fields

The other important fields in which the legal metrology regulations will be applied in subsequent phases, but as early as possible, will include instruments and equipment used in the medical profession, such as those required for dispensing poisonous drugs, for determining dosages for exposure to X-rays and Y-rays, medical thermometers, blood pressure instruments, electrocardiograms, instruments for determining the fluid pressure inside the eye-ball etc., for ensuring the correct diagnosis of various ailments; instruments for measuring noise-level for imposing a control on undesirable noises, such as traffic noise, noise from loudspeakers and radios, noise inside as well as outside the factory buildings etc.; instruments for measuring luminous intensity for ensuring proper illumination inside the class-rooms in the schools, inside various factories, on the roads etc.; altimeters such as those used in aircraft for finding out their height above the ground, for ensuring their safety during flight as well as making a landing; instruments and equipment used in educational institutions; various instruments used for measuring the pollution of air, water and land.

The above-mentioned important areas have been selected only for illustrating the wide ramifications of modern legal metrology. There are many other important areas, which have not been listed. Whatever is oonsidered to be of

importance either for the country as a whole or for the individuals living in it, will be brought, in suitable stages, under the jurisdiction of legal metrology. This will, however, have to wait for the proper development of necessary facilities in the legal metrology laboratories in various Ostans of the country. It is obvious that it would be in the best interest of the country to give the highest priority to the systematic development and speedy and effective implementation of this service throughout the country.

## D. Units of measurement to be recognized in the revised Law

The revised Law will recognize all important metric units of measurement, namely all the units of the international System (SI), i.e. all the seven base units, two supplementary units and 47 derived units, as well as 12 units outside the SI units, which are required to be retained with the SI units on account of their importance for general use and for research in science and technology, as well as some other units which are being retained only for a definite period for use with the SI units.

### 1. Base units of the International System

The International System of units is based on seven well-defined units, which are called the base units. The names and symbols of these are given below:

| Quantity | Unit | Symbol |
|---|---|---|
| length | metre | m |
| mass | kilogram | kg |
| time | second | s |
| electric current | ampere | A |
| Thermodynamic temperature (practical temperature | kelvin degree celsius | K °C) |
| luminous intensity | candela | cd |
| amount of substance | mole | mol |

### 2. Supplementary units of the International System

This class of unit, for the time being, contains only two purely geometrical units, namely the SI unit of plane angle and the SI unit of solid angle. The names and symbols of these units are given below:

| Quantity | Unit | Symbol |
|---|---|---|
| plane angle | radian | rad |
| solid angle | steradian | sr |

3. Derived units of the International System

The derived units are expressed algebraically in terms of the base (or the base and the supplementary) units by means of the mathematical symbols of multiplication and division. Several derived units have been given special names and symbols which may themselves be used to express other derived units in a simpler way than in terms of the SI base units. The names and symbols of various derived units are given below:

| Quantity | Unit | Symbol |
|---|---|---|
| area | square metre | $m^2$ |
| volume | cubic metre | $m^3$ |
| speed, velocity | metre per second | $m/s$ |
| acceleration | metre per second squared | $m/s^2$ |
| wave number | 1 per metre | $m^{-1}$ |
| density, mass density | kilogram per cubic metre | $kg/m^3$ |
| concentration (of amount of substance) | mole per cubic metre | $mol/m^3$ |
| activity (radioactive) | 1 per second | $s^{-1}$ |
| specific volume | cuibc metre per kilogram | $m^3/kg$ |
| luminance | candela per square metre | $cd/m^2$ |
| frequency | hertz | Hz |
| force | newton | N |
| pressure | pascal | Pa |
| energy, work, quantity of heat | joule | J |
| power, radiant flux | watt | W |
| quantity of electricity, electrical potential | volt | V |
| capacitance | farad | F |
| electric resistance | ohm | Ω |
| conductance | siemens | S |
| magnetic flux | weber | Wb |
| magnetic flux density | tesla | T |
| inductance | henry | H |
| luminous flux | lumen | lm |

| Quantity | Unit | Symbol |
|---|---|---|
| illumination | lux | lx |
| dynamic viscosity | pasoal seoond | Pa.s |
| moment of force | metre newton | N.m |
| surface tension | newton per metre | N/m |
| heat flux density, irradiance | watt per square metre | $W/m^2$ |
| heat capacity, entropy | joule per kelvin | J/K |
| specific heat capacity, specific entropy | joule per kilogram kelvin | J/(kg.K) |
| specific energy | joule per kilogram | J/kg |
| thermal conductivity | watt per metre kelvin | W/(m.K) |
| energy density | joule per cubic metre | $J/m^3$ |
| electric field strength | volt per metre | V/m |
| electric charge density | coulomb per cubic metre | $C/m^3$ |
| electric flux density | coulomb per square metre | $C/m^2$ |
| permittivity | farad per metre | F/m |
| current density | ampere per square metre | $A/m^2$ |
| magnetic field strength | ampere per metre | A/m |
| permeability | henry per metre | H/m |
| molar energy | joule per mole | J/mol |
| molar entropy, molar heat capacity | joule per mole kelvin | J/(mol.K) |
| angular velocity | radian per second | rad/s |
| angular acceleration | radian per second squared | $rad/s^2$ |
| radiant intensity | watt per steradian | W/sr |
| radiance | watt per square metre steradian | $W.m^{-2}.sr^{-1}$ |

## 4. Units outside the International System

Twelve units, outside the SI units, which have been recommended by the CGPM for permanent use with the SI units on account of their importance for general use and in scientific research, include: minute, hour and day (time); degree, minute and second (angle); litre, ton, electronvolt, unified atomic mass unit, astronomical unit and parsec. Units recommended for use for only a limited period include: nautical mile, knot, angstrom, are, hectare, barn, bar, standard atmosphere, gal, curie, rontgen and rad. The use of these will be discontinued as and when considered appropriate.

## III. MEASURES NECESSARY IF THE LAW IS TO BE REVISED

Once a decision is taken in respect of replacing the existing Law with a revised one, based on the OIML pattern, necessary steps to present it to Parliament and to get it passed as the new Metrology Law of Iran, will have to be taken. Action will also have to be taken simultaneously to gear up all necessary machinery to secure an early and effective enforcement of the revised law throughout the whole of Iran. The ISIRI will have to play a leading role in the enforcement of the new law. Some of the important steps which will be required to be taken are given below.

### A. Drafting of the new law and other related documents

A suitable draft of the new law in Farsi will have to be prepared for getting it passed as the new Metrology Law of Iran. A suitable committee will have to be appointed for this and other related work. This committee will first carry out all work relating to the law and the rules to be made under the law, and then take up the work of preparing a large number of important schedules and manuals, for the effective implementation of the law. The schedules and manuals required during the first phase of implementation will be taken up first. These will be for the guidance of the technical staff working in various Legal Metrology Laboratories, specially the Verification Agents, and will deal with subjects such as specifications of all important measures and measuring instruments used in everyday public trade and transactions etc., which will be subjected to metrological control under the new law, and the verification methods for these Rules for the Approval of Models and their Registration which will be applicable to all the measures and measuring instruments, required in the country, whether they are manufactured locally or imported, Rules Regarding the Control of Packaged Commodities and a large number of other similar manuals on metrological subjects. The whole work will require careful planning.

### B. Further development of facilities at the ISIRI

During the past few years the ISIRI has made good progress in acquiring several important items of equipment for standardization and calibration work in various branches of metrology. It is now in a position to carry out the verification and certification of many important items. However, for implementing the revised law effectively, the existing facilities will have to be considerably

enlarged to enable the Institute to carry out the practical application of all the base units as well as of all important derived units. This work should be completed in the shortest possible time, in a suitably phased manner. Equipment for those standards which are considered to be of immediate importance for the country's needs should be obtained first.

1. Joining the Convention of the Metre

It is understood that steps have already been taken by the Government for acceding to the Convention of the Metre, i.e. for subscribing to the membership of the General Conference of Weights and Measures (GCPM), the highest authority on physical standards. The International Bureau of Weights and Measures (BIPM), which works under the direction of the General Conference, is responsible for calibrating and certifying standards belonging to various countries against the International Standards held by them. These calibrated standards are used by countries as their national standards. When Iran's membership of the General Conference is established, the International Bureau of Weights and Measures will undertake the initial, as well as subsequent regular periodic calibration, in accordance with internationally established conventions, of all the national standards, as well as all related ancillary equipment and objects necessary for the realization of the values of various base units and of some other important units. For member countries, the Bureau carries out the calibration work free of charge. Such a constant control ensures the highest possible accuracy of the national standards of a country and, therefore, also ensures the accuracy of the values of all the lower grade of standards derived from them for various levels of metrological work, down to the lowest grade of standards given to the Verification Agent for carrying out the actual verification work. The accuracy is, in turn, reflected in the accuracy of all the measures and measuring instruments calibrated by the Verification Agent against his standards.[a/] Various industrial undertakings and other important users of measuring equipment in the country will thus be assured of the requisite accuracy in their instruments. By employing measuring instruments calibrated in this manner, all industrial undertakings will be able to fabricate very high quality products, ensuring at the same time

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a/ The terms Verification Agent and Verification Agent's standards have been used in a very wide sense. Depending on the accuracy requirements of any particular job, any suitably qualified officer, irrespective of his rank, who carries out the verification work, will usually be referred to as a Verification Agent. The accuracy and the grade of standards employed by him for the job will naturally have to be commensurate with the accuracy demanded by the job.

the complete interchangeability of various engineering components, not only within the country, but also with those manufactured in other developed countries. This will be possible because the national standards of Iran as well as those of all other countries will have the same values, because they have been calibrated by the same single authority. To be able to obtain early benefits from the services rendered by the Bureau, which are indispensable for a country like Iran, which wants to become industrially developed, no time should be lost in joining the Convention of the Metre. Incidentally, it may be pointed out that in order to make it more attractive for those countries which have so far not acceded to the Convention of the Metre, the CGPM has liberalized the terms of admission during the last few years. It is much less expensive to become a member now than it was a few years ago, as the admission fee has been reduced from the equivalent of three additional subscriptions with the first year's annual subscription, at the time of joining, to the equivalent of only one additional subscription now.

### C. Supply of standards to Legal Metrology Laboratories

One of the most important jobs for the ISIRI will be to supply calibrated standards to all the Legal Metrology Laboratories in all the Ostans. In the first phase these standards will comprise the standards of length, mass, area and volume, such as a suitably calibrated metre bar, standards tapes for longer lengths, some items of equipment for carrying out the measurement of small dimensions; necessary standards of mass, such as a set of standard weights consisting of all necessary weights from the largest to the smallest weight required for verification work; and a complete set of volume measures, together with all the ancillary equipment, such as some measuring instruments, sets of suitable balances etc. for the reproduction of necessary standards and for carrying out verification work. Slowly as the country becomes industrially developed, standards of all other base units and all important derived units will also have to be supplied to some of the important Legal Metrology Laboratories, in suitably phased stages, to enable them to carry out more complicated types of verification work.

The following will be the general pattern of the Legal Metrology Service in the country: Each Ostan will have one main Legal Metrology Laboratory, situated in the capital of the Ostan, which may be called the Head Metrology Laboratory of the Ostan with as many subordinate laboratories in the Ostan as the work load may demand. All these laboratories will have to be supplied with various

grades of standards for carrying out their duties efficiently. There will be three grades of standards in the heirarchy of legal metrology standards, each with a definite purpose. These will be:

(a) Reference grade standards, which will be of the highest grade of accuracy for use in the Legal Service and will be kept in the custody of the Head Laboratory in each Ostan. These standards will be supplied by the ISIRI after being authenticated against the national standards held by them and will regularly thereafter be periodically checked by them in order to maintain the accuracy of all the standards at the required level;

(b) Secondary grade standards, which will be kept in the custody of each Legal Metrology Laboratory including the Head Laboratories. These standards will be verified periodically against the reference grade standards maintained in the Head Laboratories;

(c) Working grade standards, which will be for the use of Verification Agents for their actual field verification work. These will be verified periodically against the secondary standards held in each respective laboratory, and not against the reference standards which will be used very sparingly and only for the verification of secondary standards.

When the Legal Metrology Service is fully developed, the ISIRI will be responsible only for verifying the reference grade standards periodically, the other grades of standards being verified by the Legal Metrology Laboratories themselves, against the appropriate standards held by them. However, in the early stages of the implementation, it will be necessary for the ISIRI to supply all grades of authenticated standards, as well as maintain a regular periodic check on their accuracies.

In order to be able to supply various grades of standards to the Legal Metrology Laboratories, the ISIRI, in addition to equipping itself with all the national standards, will also have to acquire all the necessary equipment to be able to verify and supply various grades of standards to all of them.

## D. Recruitment of suitably qualified staff for the Verification Service

With the progress of the implementation work, a large number of suitably qualified officers will be required for looking after the entire implementation work properly. A regular cadre of Legal Metrology Service personnel will have to be introduced from the very beginning. The chief of each Head Ostan Laboratory may be disignated as the Controller of Legal Metrology (of that Ostan). Each of the other subordinate laboratories may be headed by a Deputy Controller or an Assistant Controller. When the work increases, in the latter stages of implementation, additional categories of higher staff, such as Additional

Controllers and Joint Controllers, may have to be appointed. The actual field work will be carried out under the supervision of these officers, by the senior and the junior Verification Agents, with the help of necessary supporting staff. The ISIRI will have to make arrangements for recruiting suitably qualified staff for all the technical posts. The minimum qualifications for the technical staff will necessarily have to be either a Bachelor's degree in science, physics or chemistry, or a degree in engineering.

Although the verification work in the early stages of the enforcement will be restricted more or less to the conventional type of work relating to the measures and measuring instruments required for everyday trade and transactions only, the sophisticated type of work will very soon have to be taken up. Recruitment of staff will, therefore, have to be undertaken from the early stages, to enable the ISIRI to impart the necessary training to all the selected officers in time. Recruitment will have to be carried out in stages, the need for the required staff being foreseen well in advance, so as to enable the service to make use of the new officers as and when necessary.

## E. Imparting training to the Legal Metrology personnel

Another very important duty of the ISIRI will be to impart the necessary theoretical and practical training in scientific and legal metrology to all the officers now working in various weights and measures laboratories in the country, to enable them to handle effectively all the verification work envisaged under the new law for the first phase of its implementation. Similar training will also have to be given to all the newly recruited staff. Such training courses will have to be held from time to time, as and when new staff is recruited with the increase of load in the verification work. In subsequent phases of the implementation of the law, courses on newer subjects will have to be organized at regular intervals. Refresher course will also have to be held from time to time, for the existing staff.

## F. Equipping Legal Metrology Laboratories

A network of a large number of well equipped Legal Metrology Laboratories, spread all over the country, will ultimately be required for carrying out necessary verification work, when all the provisions of the revised Law have been enforced. However, during the first phase of the implementation, it will be sufficient if we have only one Laboratory in each Ostan. Although some of the

Ostans have a Weights and Measures Department having a laboratory building and some officers working in it, other Ostans possess no suitable nucleus to start the laboratory work. In the case of those Ostans which possess laboratory buildings, these could be developed into suitable Legal Metrology Laboratories for carrying out the enforcement of the new Law, but those possessing no facilities may have to be helped by the ISIRI to acquire suitable premises for starting a laboratory and for acquiring all necessary basic equipment. As far as the standards are concerned, the ISIRI is going to supply these to all the Legal Metrology Laboratories anyway.

As the enforcement work gathers momentum, more and more new laboratories will have to be started and as each new laboratory comes up, the ISIRI will have to render necessary assistance to it to enable it to reach the required level of accuracy etc. Mobile units will have to be provided for enforcement in the villages.

During the latter phases of enforcement, many of the Legal Metrology Laboratories will have to be equipped with highly sophisticated measuring equipment, so that they could carry out all types of fine verification work independently. In the final stage, it is expected that all the Legal Metrology Laboratories will carry out even the verification of their own standards, except the reference grades one, which the ISIRI will always have to continue to verify against the national standards, of which they will have to remain custodians. The ISIRI will also have to continue work regarding calibrations of the highest order, for which it will be the only authority in the country.

### G. Undertaking testing for the Approval of Models

After the enforcement of the revised Law, only such measures and measuring instruments will be permitted to be used for everyday public trade and transactions, which will conform in all respects with the specifications of an Approved Model. For ensuring that only the approved type of measuring instruments find their way into the market, only such instruments etc. will be permitted to be manufactured in the country or allowed to be imported, which carry a Model Approval Certificate issued by the Government of Iran. The Model Approval scheme will have to be introduced as soon as the new law comes into force. The ISIRI will be the authority to operate this scheme and will be required to carry out tests on all the first prototypes of various measures and measuring instruments proposed for manufacture in the country or intended to be imported into it. This

will be done in accordance with the Model Approval Specifications enforced under the law, with a view to finding out if the prototype under test conforms to the prescribed specifications in all respects. A Model Approval Certificate will be issued for such of the measures and instruments which meet all the requirements. Only after the issue of such a Certificate, will the manufacturer be allowed to proceed with the large scale production of the measure or the instrument in question or its import permitted into the country, as the case may be.

In the case of such an item which is wanting in some respects, the manufacturer will be asked to carry out the necessary modifications and improvements in its performance and re-submit it for the prescribed tests. An Approval Certificate for it will be issued only after it comes up to the required level of workmanship and satisfactorily passes all the specified tests.

The Model Approval rules will also make it compulsory for the manufacturers to re-submit fresh samples for type approval, if they carry out any modifications in the design of any approved model or change the material of its construction This provision will also be applicable to such cases, where after carrying out tests on a random sample drawn from the market, the item is found not to conform fully to the approved model. The licence for the manufacture of the item under dispute will be suspended pending the issue of a fresh Approval Certificate. These regulations will also be fully applicable to the imported measures and measuring instruments. If on a testing sample from any lot, it is found not to conform to the approved model, the entire lot held in stock will be confiscated and further import banned.

## H. Undertaking testing of the more complicated items

As already mentioned, the first phase of enforcement of the law, will cover only the traditional field of weights and measures, i.e. the verification of only such measures and measuring instruments which are used in everyday trade and transactions. However, according to the new law, many more new items will be covered by the term public transactions than were covered by the old Weights and Measures Law. Besides the usual measures used in the market places (the term measures includes weights, which are the measures of mass), many other measures and measuring instruments being used everyday, such as taximeters, gas meters, water meters, electricity meters, petrol pumps, tank lorries and many other similar items will also be included amongst the ordinary measures to be covered by the new law, in the first phase.

As regards the verification of various items, it is proposed that in the early stages of implementation, the Legal Metrology Laboratories should carry out the verification of the simpler items only, verifications of a more complicated nature being left over for the ISIRI to handle. The ISIRI will, therefore, be required to equip itself with all necessary equipment for carrying out the testing of such items as well. The competence of the legal metrology staff has to be built up, by giving them the necessary practical training in the verification of all instruments which are of a somewhat complicated nature before such work is entrusted to them. The equipment which the ISIRI will install for such test work will also be useful for training purposes. As the load of work increases and the legal metrology staff gets trained, the test rigs, together with the verification work, could be passed on to the Legal Metrology Laboratory of Teheran, which will be the biggest amongst all the Legal Metrology Laboratories in the country. At a later date, when the load o work justifies, similar verification work could be started in as many other Legal Laboratories as may be considered necessary.

Installing the first test rig for the verification of each of the instruments at the ISIRI in the first instance, and then passing it on to the Legal Metrology Laboratories, after perfecting the test procedure and giving necessary training to the legal metrology staff, will be a more or less continuous process, not only during the first phase of the implementation of the revised law, but even during the subsequent phases, when the law is enforced in respect of the verification of the measuring equipment used in industry, or in other important fields like the verification of medical instruments or instruments used for measuring pollution etc.

However, duplicates of much of the test equipment will also have to be retained by the ISIRI for carrying out the test work relating to the Approval of Models, which may have to be continued by the ISIRI for a considerably long time. In the ultimate stages of the implementation of the law, it may be desirable to pass on even the Model Approval Scheme to the Legal Metrology Laboratories.

## I. Arranging for publicity of the provisions and benefits of the new law

One of the most important factors governing the success of implementation of the new law will be the co-operation received from the general public, for whose benefit the new law is being introduced. However, in the absence of

proper knowledge about the law and its benefits, there is bound to be some resistance and a tendency to evade the law, as has been the experience in several other countries. A proper atmosphere is, therefore, required to be created in the country, by educating the public well in advance of the enforcement of the revised law, by explaining various implications and benefits of the new law. It is necessary to impress upon them the fact that the new law is being introduced in their interest only. Suitable publicity material will have to be prepared and propagated through several media, such as putting up suitable hoardings at important places, putting up colourful posters in various shops and trading premises, through the free distribution of suitably designed calenders, diaries and calender cards resembling playing-cards, through match box labels and through cinema slides etc. Features broadcast on the radio, television programmes and documentary films in the form of interesting stories have been found to be the most effective methods for the popularization of such topics. A small Publicity Committee could perhaps be entrusted with this job.

J. To participate actively in the work of the OIML

It is very important for the industrially developing countries, to take an active part in the technical work of the OIML, specially in the formulation of various International Recommendations, i.e. specifications for those measures, measuring instruments and other items, which are governed by legal metrology and which are expected to be implemented by various member countries. By putting forth their views and offering suggestions while laying down various specifications, the developing countries can ensure the interest of their industry by pressing for the adoption of more meaningful and practical specifications.

It may be worthwhile if the OIML is approached for passing on to Iran the Secretariat of some of the Technical Committees and the Working Groups. Since the officers working in the ISIRI are already familiar with the procedures of laying down various types of general specifications, they will be able to make a good contribution to the work of the OIML, with a bit of guidance.

Proposals for the adoption of a new series of tolerances for commercial grade weights and the modification of another series, which were adopted some years back, have already been sent to the OIML. It is also proposed to work out some new designs for the shapes of commercial grade weights. The question of their adoption at the OIML level will also be taken up as soon as the work is completed. Work of this type will provide a good training for the officers working in various sections of the Metrology Centre.

## K. To set up a Legal Metrology Cell at the ISIRI

Various important steps required to be taken for the efficient and effective implementation of the law have already been enumerated above. It is important to point out here that merely revising the old law is not going to take us far. The revision will be meaningful only if all these steps also are taken simultaneously, and in accordance with the general plan of enforcement. Each of these steps, starting with the drafting of the law and the compiling of various connected documents, through the steps of equipping the ISIRI and various Legal Metrology Laboratories, the recruitment of qualified persons and imparting training to them, as well as to the existing staff etc., down to the implementation in actual practice, requires very careful and detailed planning, in order to ensure maximum possible efficiency in enforcement in the shortest possible time and with the minimum of expenditure. This detailed planning should be entrusted to a small committee, which may be called the Legal Metrology Cell. The major responsibilities of this Cell will be broadly to:

(a) Carry out a complete analysis of the entire work involved in starting the Enforcement Service, to categorize the same job-wise and to assign necessary priorities;

(b) Prepare a job-responsibility chart, putting a time target for each of the jobs involved;

(c) Suggest suitable administrative arrangements and the heirarchical set up of the Metrological Service of Iran, to ensure the smooth functioning of the enforcement machinery;

(d) Make necessary arrangements for visiting the existing Weights and Measures Departments in various Ostans, to take stock of their existing facilities and to assess their requirements in respect of space, equipment and personnel during the first five year period of enforcement (in those Ostans where a new laboratory is required to be put up, necessary care will have to be taken to design the laboratory in such a manner that as the load of work increases, the building could be suitably extended every few years to enable the laboratory to handle efficiently all the new work);

(e) Make arrangements for carrying out survey and data collection work all over the country with a view to the compilation of necessary registers, such as registers of:

(i) All shops and similar trading establishments making use of any measures and measuring instruments, including weights which are the measure of mass (any measures etc. used purely for household purposes, such as are usually employed by the housewife in her kitchen, will not be covered by the Enforcement Law);

(ii) All industrial establishments, large-scale as well as small-scale, making use of any measures or measuring equipment during the process of manufacture;

(iii) All other users of various types of measuring instruments, such as educational and similar institutions and organizations, hospitals and individual medical practitioners etc.;

(iv) All importers and exporters in the country;

(v) Or of any other items or establishments which may be considered to be necessary from the point of view of the enforcement of the law (full use will also be made of any existing data which may be readily available from any Government source);

(f) Suggest a suitable and an easy procedure for maintaining all the registers up to date by editing and correcting them from time to time at suitable intervals;

(g) Act constantly as a link between the scientific side of the ISIRI and the Legal Metrology organization as a whole, to ensure that all the requirements of all the Legal Metrology Laboratories are met expeditiously;

(h) Carry out any other planning work, which may be entrusted to it, in the interest of efficient enforcement.

After the Legal Metrology Cell has carried out all the work relating to the initial stages of the implementation of the Enforcement Programme, it may be desirable to rename it the Institute of Legal Metrology of Iran, which should function as an independent wing of the ISIRI. It may perhaps be given some other suitable name, if there is any difficulty in having another institute within the Institute of Standards and Industrial Research of Iran. It should take over most of the legal metrology responsibilities of a routine nature from the ISIRI, to enable it to devote most of its time to scientific metrology, development and investigational research problems either to provide further technical guidance for the implementation authorities or for the benefit of local industries.

The Institute of Legal Metrology should acquire all the necessary additional equipment to be able to render independently all necessary assistance to the Legal Metrology Service, in all the routine matters, without making use of the metrology equipment belonging to the Metrology Centre.

It would also be desirable to put together all the training facilities, developed during the earlier stages of implementation and to expand these into a fully-fledged Legal Metrology Training Centre, which will be responsible for imparting all necessary theoretical and practical training to the newly appointed staff as well as give refresher courses from time to time to the existing staff. This training centre should also form a part of the Institute of Legal Metrology.

The possibilities of equipping the Training Centre, under some suitable bilateral agreement, could be explored if an early decision is taken in favour

of extending the Law on Metrology to the more sophisticated fields of controlling the accuracy of measures and measuring instruments used in industry, in the medical profession, in the measurement of the extent of pollution of land, water and air etc. and in other similar fields, in addition to the usual field of Bazzar weights and measures. If the scope of the law is to be wide, a lot of sophisticated measures and measuring instruments, as well as several other items of equipment will be necessary for imparting training in the testing of delicate and more complicated measures and measuring instruments. Such equipment will be easier to obtain through a bilateral agreement than otherwise.

## IV. INCIDENTAL BENEFITS OF ENFORCING THE REVISED LAW

The ISIRI is a very important Institute in Iran, as it is a combination of several institutes under one roof. There of these institutes are the following:

(a) The Bureau of Standards of Iran, the chief functions of which are to:

(i) Act as the custodian of the national standards of the country, by physically maintaining standards, representing the values of some of the units of measurement and by realizing practically the values of those remaining units, whose physical representation is either not practicable or considered to be not accurate enough for the present-day requirements (these standards are to be the highest-accuracy standards in the country and will be checked for their accuracy, initially as well as at regular periodic intervals thereafter, by the International Bureau of Weights and Measures (BIPM), Sèvres, France);

(ii) Supply and/or calibrate reference standards all over the country;

(iii) Undertake research and development projects, as well as the designing of simple measuring instruments etc. relating to measurement in terms of various SI units;

(iv) Undertake any other work which may become necessary in connection with efficient execution of the work relating to the units of measurement;

(b) The Legal Metrology Authority of Iran, the chief functions of which are to:

(i) Enact a Law on Metrology;

(ii) Frame all necessary rules and regulations for the efficient enforcement of the Law;

(iii) Formulate all necessary schedules, i.e. complete specifications for Model Approval, for initial checking and for periodic and surprise checking, of all those measures and measuring instruments and other related items, which will be governed by the Law on Metrology, and which will be required to be subjected to a 100%

oheoking by the Legal Metrology authorities and the stamping of only such measures and instruments etc., whioh pass the tests in all respeots, as distinot from the testing under the quality mark soheme for qualitatively ensuring the overall quality of various produots or complianoe with safety regulations etc. and which involves only cheok-testing of a small peroentage of the total produoation, on the basis of whioh the manufaoturers are authorized to put the quality mark on the entire production;

(iv) Implement the Enforoement Programme effeotively and efficiently throughout the country;

(v) Undertake any other work, whioh may beoome necessary in the interest of efficient administration of the Metrology Law.

(c) The Institute of Standards of Iran, the chief functions of whioh are to:

(i) Undertake the formulation of national standard specifications for various raw materials and finished products, industrial and household applianoes and equipment, maohinery and a large variety of other items, which are not governed by the Metrology Law;

(ii) Lay down standard methods of test and/or evaluation;

(iii) Compile codes of practioe and other similar documents;

(iv) Operate a quality marking soheme, which may either be on a voluntary basis, when only general compliance with some standard(s) is sought or on a compulsory basis, when compliance with some safety regulations is to be ensured;

(v) Undertake any other work, which may become necessary in the interest of efficient formulation or implementation of national standard specifications.

Soope of eaoh of these three disciplines, which are all oommonly called standards work, is quite distinct from one another as can be seen from the elaboration of each at (a), (b) and (c) above. In many countries there are separate departments for looking after each of these jobs and somehow, in some of these countries, there has not be sufficient co-ordination between their activities and an amount of confusion exists in the soope of each. Iran is in an advantageous position beoause there is only one institute, namely the ISIRI, to look after all the three types of standards work and it will thus be possible for it to define olearly the activities of each of the three wings and fully develop their faoilities.

The fourth important funotion of the ISIRI is to oarry out industrial research. This also oombines a number of research institutes each working in a different field. It is again an advantageous position for Iran, as the ISIRI oan very easily take up such test jobs as well as research projeots whioh require the collaboration of several different disoiplines. In many oountries

suoh work poses difficult problems, as there are separate institutes dealing with various subjects and quite often these institutes are located in different cities, making it rather difficult for them to take up any inter-laboratory test work or research projects.

As and when the new Law on Metrology is enforced in Iran, the ISIRI will have to acquire all the necessary equipment for the maintenance and supply of standards, for the scheme for Approval of Models and for the testing of delicate and complicated measures and measuring instruments. This equipment will be so comprehensive and versatile, that it will enable the ISIRI to undertake the testing of a very large variety of items, in addition to those covered by legal metrology. It will immediately boost the entire test work in respect of engineering products, industrial and household appliances and many other types of equipment, which the ISIRI may be called upon to test.

The following are some of the additional activities which the ISIRI can take up almost immediately.

A. Development testing for assisting local industry

It has already been stated that ISIRI will be the authority for operating the Model Approval scheme. For those items which are proposed to be manufactured in Iran, the Approval scheme will involve the testing of the first models of various measures and measuring instruments made by different manufacturers, in compliance with the requirements of the relevant Model Approval specifications specially laid down for the purpose. Model Approval Certificates will be issued for such of the items that pass all the prescribed tests, whereas rejection reports will be issued for those items that fail in one respect or the other. In the case of industrially developed countries, the testing authorities would not normally bother about the rejected items. However, in the case of those countries where the industry is in a state of infancy, testing institutes like the ISIRI have been largely responsible for the bringing-up of various industries in their oountries and there is no doubt that the ISIRI will also be able to do the same for various industries, still in the stage of infancy, in Iran.

The method of rendering neoessary assistance to suoh industry is quite simple and consists in carrying out a oomplete and detailed examination of suoh items which fail to obtain an Approval Certificate, with a view to locating each and every defect in them and to provide the manufacturers with a detailed

report listing all these defects. Sometimes pointing out various defects only may be sufficient to enable the manufacturers to remove all these defects. In case this is not so, the ISIRI will have to make necessary suggestions for the removal of various defects, which will enable the manufacturers to improve the quality of their products. The modified or the improved sample, is again tested in all respects and may, in all probability, be found to pass all the tests this time, or at least show considerable improvement in its quality. If the item in question is still lacking in some respects, further suggestions from ISIRI and another attempt by the manufacturer may be necessary to bring it up to the required level.

As the small-scale manufacturers do not usually possess any testing and development facilities and cannot find out by themselves whether their products are good enough or not, they may have to close down their works if their products do not come up to the required level, after the enforcement of the Model Approval scheme. It would, therefore, be in the interest of local industry and thereby of the country as a whole, if all necessary assistance is made available to the small-scale sector to enable them to improve the quality of their products. It may not be out of place to mention here that development testing has proved to be a very successful and, at the same time, a very economical method of improving the general level of quality of various industrial products.

The development testing facilities will be available not only to the manufacturers of items for which an Approval Certificate is required to be obtained under the Law of Metrology, but also to all other manufacturers irrespective of what they produce. However, as they will not be under any obligation to send their products for testing, they may have to be approached for apprising them regarding the availability of such testing service at the ISIRI. Suitable methods will also have to be evolved to induce them to send their products for tests to the ISIRI. Some sort of collaboration with the Department of Small-Scale Industries will go a long way in establishing contacts with various small-scale manufacturers and finding out the difficulties experienced by them in their manufacturing processes. They will also have to be suitably encouraged to send their products for tests to the ISIRI and derive full benefit from the facilities available in different Departments of the Institute.

An elegant and colourful brochure, with a large number of illustrations and photographs, describing in detail the scope and functions of each Department of the ISIRI, together with all necessary information regarding the tests

that they can carry out and all the technical assistance they can render to the growing industry, should be prepared immediately and sent out to all large, medium and small-scale manufacturers, educational institutions, government departments and to all other prospective users of the facilities available at the ISIRI. Such a step will be very helpful in familiarizing all the bodies concerned with the facilities that exist in the country. The broohure should be prepared both in Farsi and in English. The English version will also be very useful for sending to various counterpart organizations abroad.

It will also be desirable, at least during the earlier stages of industrialization, to give all necessary technical assistance free of charge or for a very nominal fee only.

Visits to the works of several manufacturers of balances, weighing machines and weigh bridges etc. revealed that if development testing facilities were to be extended to them and necessary advice given, they will certainly be able to turn out much better products than they are making at present, without incurring any additional expenses whatsoever. It is proposed to start the development testing programme with the manufacturers of balances of various types and then to extend these facilities to manufacturers of various other items.

B. Development and research projects for industry

As stated above, whenever any items under test, whether under the Law on Metrology or otherwise, are found to be below the prescribed standards, the ISIRI will try to assist the manufacturers by giving them necessary advice for making suitable modifications, which will enable them to improve the quality of their products. However, there are likely to be a few cases where the ISIRI may not be able to offer necessary suggestions to the manufacturers straightaway. It may have to carry out some investigative or development work in the Laboratory before it is able to do so. Thus careful and detailed testing can ultimately furnish the Laboratory with research or development problems, some of which may be very important and at the same time of immediate benefit to the industry. Such problems may quite often be of a very minor character, but once in a while there may be one that could be of a fundamental and complex nature. However, irrespective of the magnitude of such problems, each one of them will have a direct impact on industry as opposed to those which are more theoretical in nature.

Experience has shown that the best method of identifying really useful and practical industrial research problems is to carry out as much testing for industry as possible and to analyse very carefully the test results, particularly in respect of those requirements in which the item under test is found to be below the prescribed standards. This will automatically provide the necessary feedback to the research worker and enable him to pick out some suitable research problems.

In addition to working on such development and research problems, a good deal of investigation work for the enforcement organization will have to be undertaken at the ISIRI. In the first phase of implementation, it will be connected mainly with determining tolerances to being prescribed for various packaged commodities, especially in the case of those items which are likely to gain or lose moisture, on account of weather conditions; and tolerances on quantities delivered by weighing or by measuring, during trade transactions, so that any trader indulging in short weighing or in short measuring, in spite of possessing accurate measures and measuring instruments, could be suitably punished. Certain liquid commodities are sold either by weight or volume. In the interests of achieving uniformity, it may be necessary to specify which items are to be sold by weight and which by volume. Some investigatory work may perhaps be necessary for deciding upon the better of the two for each item individually, under the local conditions. There will be many other similar investigatory problems on which laboratory work may have to be carried out.

## C. Designing of measuring instruments

Even when a high precision measurement laboratory is very well equipped and possesses all necessary measuring machines and instruments etc., some small gadgets for carrying out certain particular measurements, in a simpler way, may sometimes be required for day to day work, especially if such measurement jobs are to be carried out quite often. In such cases it may be desirable to design and fabricate instruments for specific purposes and avoid the use of the usual measuring machines, which are not always very convenient to use for the smaller jobs.

Such simple gadgets may have to be used even more often in the enforcement laboratories, where a good deal of routine testing will have to be carried out everyday. The Metrology Centre will then be required to design and fabricate such equipment for their use as well. In case any equipment is required in

larger numbers, the ISIRI design could be passed on to the local industry for large-scale production, if necessary, under the supervision of ISIRI officers. After gaining some experience in the designing of simple items, the Laboratory could take up the designing of more and more complicated instruments. Such work may ultimately result in the building up of a good Instrument Division in the ISIRI and at the same time a flourishing measuring instrument industry in the country.

Designing work of this type need not be restricted to the different sections of the Metrology Centre only; it could as well be carried out by any other Departments of the ISIRI.

## V. DETAILED PLANNING FOR THE IMPLEMENTATION OF THE REVISED LAW

The detailed planning of the Legal Metrology Service has not been included in this Note as various requirements will depend largely on the extent to which the Service is to be ultimately enforced. As stated in the foregoing pages, the present trend is to cover not only the usual field of trade and commerce, which includes the verification of items such as taximeters, water meters, electricity meters, petrol dispensing pumps, takn lorries etc., but many other important fields as well, such as controlling measures and measuring instruments used in industry, in the medical profession, in educational institutions, for measuring pollution and in many other fields, vital for improving the economy of the country and for ensuring the overall health, safety and prosperity of its people.

If the scope of the Service is to be all-encompassing, the requirements in every respect will be very different from what they would be if the Service is extended to trade and commerce only. The number of verification laboratories, their size and design, the type of equipment required for each, the number of officers to be recruited, their qualifications, the level of technical training to be given them etc. will all be very different in the two cases. In the interest of the proper planning of the Service, it will be desirable to decide right at the beginning whether the Service is going to cover all the finer fields or not.

As soon as the authorities concerned take a decision in this respect, detailed planning will have to be taken in hand.

## VI. DRAFT OF VARIOUS SECTIONS OF THE REVISED LAW

In the interest of effective and efficient enforcement of the Law, it would be desirable to make it as complete as possible. All important sections, including those concerning the scope of the Law, the powers to make necessary rules, regulations and schedules etc., as well as all penalty clauses, should form a part of the Law. For its implementation, it should not be dependant on any sub-ordinate documents. These should deal only with details of technical matters.

The text of the draft Law is reproduced in annex III.

## Annex II

## NEW SERIES OF COMMERCIAL GRADE WEIGHTS FOR USE IN IRAN

### INTRODUCTION

A large number of commodities are sold by weight, in everyday retail transactions, throughout the country. The prices of various commodities sold as well as the quantities required to be weighed for different transactions, vary widely. Cheapest amongst these are items like coal etc., which are usually required to be weighed in terms of quintals. Next higher in price are items like food grains, vegetables, fresh fruit, dry fruit and similar other materials which are usually weighed in terms of kilograms. Spices, cardamoms, saffron and similar items are still more expensive and are usually weighted in terms of grams. Among the costly materials are silver, gold and other precious metals. These are weighed in terms of grams and milligrams and require the use of a higher precision balance. The costliest among the usual commercial items are precious stones like diamonds etc., which are also weighed in terms of grams and milligrams or in terms of carats (1 carat being equal to 200 milligrams). The weighing of them is required to be carried out with a still higher degree of precision. Apart from these usual weights is the question of the weighing of various medicines required for making prescriptions in pharmacies and dispensaries. These are required to be weighed very accurately, not because all the medicines are expensive but for other well known important reasons. The above are some examples of commercial weights of widely varying types and magnitudes that one comes across in everyday transactions.

In all the above-mentioned cases suitable weighing equipment is required. The modern trend is to use direct reading automatic balances of suitable sensitivities and capacities. These balances, in addition to indicating the weight of the material, indicate the price of the quantity weighed as well. Several countries have gone over to the automatic balances almost completely and some have expressed their regret that they are not able to send any weights as samples to us as no weights are being used there.

### A. Use of direct reading automatic balances in Iran

Keeping in mind the general trend of using automatic balances alone for carrying out all types of commercial transactions, it may well be expected that within the next few years practically all the major countries,

which can manufacture fine equipment within the country, will use automatic balances almost exclusively.

Apart from being very convenient, the use of automatic balances affords another important advantage, namely the elimination of weights which in turn simplifies the process of periodic verification. All that the Inspectors of Weights and Measures are required to do is to carry a few weights with them for checking the accuracy and the sensitivity of automatic balances at a few points over the whole range. The balance is tested in just a few minutes without, in any way, upsetting the normal business of a shop. The Inspectors do not have to carry fine balances from place to place for checking the weights on site nor have the shopkeepers any weights for presentation to the Weights and Measures Department. The introduction of automatic balances will be a welcome step for a place like Teheran.

Considering the advantages of automatic balances, it may not be out of place here to suggest that it would be desirable to take the necessary steps, in due course, for organizing the indigenous development and manufacture of such balances of various capacities, so that in a few years' time, the entire trade in the country could switch over to the use of automatic balances, in a suitably phased manner.

## B. Weights and balances already in use in Iran and verification system

Until such time as automatic balances are being made in Iran itself, it would be desirable to continue the use of the indigenously made Beranger-type balances, which are already in use throughout the country, together with such weights which have been properly adjusted, verified and stamped by the Legal Metrology Enforcement Authorities. Like the balances, the use of existing weights could have been continued, but the design of these presents some difficulties in their manufacture to the desired degree of finish. These are also difficult to adjust and stamp. It is, therefore, considered desirable to replace all the existing weights with weights of a new design, which will be easy to manufacture to the desired finish and be capable of being easily adjusted and stamped. All the trading establishments throughout the country, will be given the new weights after they have been properly verified and stamped. A proper register will be required to be maintained, from the very beginning at the Legal Metrology Office, which will enable them to trace the dates of supply of the weights to different shops, the number and the

denomination of the weights supplied etc. This register will enable to authorities to determine the dates on which the reverification of different weights is due and thereby enable them to maintain proper control over their accuracy. It goes without saying that all the old weights will be ultimately withdrawn and their use declared illegal from a certain date, to be announced by the Government, after the new weights have been supplied to various traders. When introducing the new weights, it will be necessary to do so throughout Iran according to a pre-planned phased programme.

With the introduction of the new weights, it will also be necessary to equip properly all the important Legal Metrology Centres throughout the country, so that proper reverification of the newly introduced weights could be taken up within one to two years of their being in service. The period after which reverification becomes compulsory and without which a weight in service will be considered as being illegal will be announced by the Government.

The present practice of reverification of weights, using a commercial grade Beranger balance and commercial grade cast iron weights as standards, will have to be discontinued with the introduction of new weights, as this method introduces undesirable additional errors in the weights under test and thereby in each commercial transaction carried out with the weights tested in this manner. The best among the Beranger balances being used have a readability of not finer than a 3 gram to 5 gram range and, therefore, in addition to introducing the error of the cast iron weight used as a standard, a much greater error, which is equal to the uncertainty of estimating the equilibrium of the balance (i.e. 3 grams to 5 grams), is introduced in the weight tested in this manner. The use of the weight so tested introduces an additional error of the same magnitude while making commercial weighings, i.e. the ultimate error is doubled. It is, therefore, a matter of the utmost importance to maintain the tolerances on all the weights to within the prescribed limits, so as not to introduce any additional errors. For the same reasons, it does not serve any useful purpose if we lay down tolerances which we cannot achieve in actual practice. Any tolerances which we prescribe should be adhered to rigorously. These must be arrived after necessary deliberations.

As already stated, it would be desirable to make sure that necessary enforcement machinery is set up all over the country, well in time to undertake proper enforcement of the Law. In case any delay is foreseen in being able to establish the necessary service within a reasonable time, it would be advisable to shift the introduction of the new weights accordingly. The setting up

of a strong enforcement department is itself a very important matter. The very existence of an efficient depar.ment is sufficient to frighten the undesirable element and to make them all law-abiding.

C. Selection of suitable series of new weights

Although hundreds of types of materials, ranging from coal to diamonds, are required to be weighed in varying quantities and with varying degrees of accuracy, it is certainly unnecessary and impractical to have so many types of weights and balances. All grades of commercial weights, including the accurate weights required in pharmacies, can be carried out with the help of a few well selected series of weights. It is necessary to lay down the necessary specifications for these, such as the composition of various series, designs and shapes of different weights in each series, as well as tolerances on different grades, after taking cognizance of all important factors.

The most important factor determining the suitability of the designs selected for different grades of weights is the convenience with which these designs can be executed for the manufacture of the weights to the required tolerances within the country and, at the same time, permit them to be easily adjusted and maintained to within the prescribed service tolerances during their normal use. It would also be very desirable to have different and distinctive shapes for different accuracy grades to enable the customers to see from a distance that the trader is using the correct tolerance weights. To find out whether a certain weight being used is a coarse tolerance weight or a fine tolerance weight when the two series of weights have been made in identical shapes, one has to look closely at the weight in order to see what is written on it. Such a close examination would be ridiculous for a customer in a crowd in a big shop, where the shopkeeper uses two grades of weights, one for the cheaper and the other for the costlier commodities. Although weights having identical shapes for different grades of accuracy, as recommended by the OIML, for example, the medium accuracy weights (Grade M2) and all the finer accuracies, specially the weights of the Grade M1, this can perhaps be workable as far as their use is confined to internal working within a laboratory or a department, but would be far from being suitable as commercial grade weights. The practice can hardly be recommended, as it can easily lead to malpractices.

Similar attention will have to be paid to the laying down of tolerances for each grade of weights. It should be remembered that the cost of production

of weights and balances as well as the time required for making each weight continue to increase very disproportionately as the accuracy requirements are made finer and finer. In the case of commercial transactions, weights have to be made rather quickly and economically and it, therefore, becomes necessary from the practical point of view, to lay down as coarse tolerances as possible, as it does not serve any useful purpose to weigh any more accurately than called for by the merits of the case. However, there is a limit to this and the tolerances have to be fine enough to give the minimum desired accuracy.

D. Specifications for the new series of weights

At the international level, the OIML has issued two specifications for weights of the medium accuracy class (M2), one for rectangular cast iron weights from 5 kg to 50 kg and the other for cylindrical weights in any suitable material from 1 g to 10 kg. There is a third specification, which deals with weights of finer accuracy classes, namely E1, E2, F1, F2 and M1 classes from 1 mg to 50 kg. This specification prescribes that the shape of the weights of class M1 accuracy should be the same as that for the M2 grade. The shapes of all the finer accuracy classes may also be the same as that of the M2 class. However, the OIML has not issued any specification for weights coarser than the M2 class.

For selecting a suitable series of weights for use in Iran, the practices prevalent in various other countries have also been closely studied. It has been found that in countries like France, Federal Republic of Germany etc., they have adopted the OIML medium class (M2) weights, either exactly or with some modifications. However, for coarser purposes, i.e. for internal trade in the everyday transactions of cheaper commodities, for which the OIML M2 tolerances are considered to be too fine, many European and other countries have adopted their own coarse series of weights. Specifications for these have been worked out at the national level. Coarse weights in several countries have been given a distinctive shape and have not been mixed up with the OIML shapes. Some countries have adopted the OIML specifications more or less as a matter of formality only because they are no longer making use of any weights.

A statement giving a brief description of the types of weights in use in various countries has been prepared for ready reference.

After detailed discussions with all concerned as well as keeping in mind the practices followed in various countries, the actual requirements for trade within the country and in view of all the important factors relating to the suitability of the design of weights, it has been concluded that the entire needs of everyday transactions will be met by the following three series of weights:

(a) Coarse grade weights from 5 g to 50 kg;
(b) Fine grade weights from 5 mg to 10 kg;
(c) Special grade weights for diamonds from 1 mg to 20 g.

## E. Coarse grade weights

First to be introduced in the new series of weights will be the coarse grade weights. From all necessary considerations, it has been found to be desirable to have a shape which is distinct from that of OIML medium accuracy weights, especially because no recommendation has so far been issued for such weights by the OIML. The following will be the broad specifications for the coarse series:

### Material and shape

The whole set of weights from 5 g to 50 kg can be broken up into two or three smaller series having different shapes or different materials, namely from 5 g to 50 g, from 100 g to 2 kg and from 5 kg to 50 kg. The shapes and the materials for each of these series have been given below:

a. The larger weights (from 5 kg to 50 kg )

These weights will be cast iron weights provided with a cast-in mild steel rod, to act as a handle for lifting the weight. The weights in this series can be made to any of the following four shapes. Various alternative shapes have been arranged in order of preference, the shape considered best, after taking into consideration all the important factors listed earlier, has been put as No. (i).

(i) Frustum of a cone with its smaller face on the top;
(ii) Tapering hexagonal pyramid with its smaller face on the top;
(iii) Tapering rectangular pyramid with its smaller face on the top (modified OIML shape);
(iv) Tapering rectangular pyramid with its smaller face on the top to the OIML shape.

b. The smaller weights (from 100 g to 2 kg )

These weights will also be cast iron weights. The weights in this series can be made in any of the following four shapes. Various alternative shapes have been arranged, as before, in order of preference:

(i) Flat nesting type weights; frustum of an inverted cone with its larger face on the top, so as to prevent its slipping from the hand;

(ii) Flat nesting type weights; tapering hexagonal pyramid with its larger face on the top, so as to prevent its slipping from the hand;

(iii) Knob weights (modified OIML shape);

(iv) Knob weights to the OIML shape.

c. The smallest weights (from 5 g to 50 kg )

Being very small weights, these cannot be conveniently made from cast iron and are, therefore, usually made from brass. They are required to be finished by machining. The weights in this series can be made to any of the following three shapes. Various alternative shapes have been arranged, as before, in order of preference:

(i) Flat nesting type weights; frustum of an inverted cone with its larger face on the top, so as to prevent its slipping from the hand. The 50 g weight, i.e. the largest amongst these weights, should nest on top of the 100 g weights in the series b. above, in the shapes (i) and (ii);

(ii) Knob weights (modified OIML shape). These weights should match the weights in the series b. above, in the shape (iii);

(iii) Knob weights to the OIML shape. These weights should match the weights in the series b. above, in the shape (iv).

d. Adjusting cavities

(a) <u>5 kg to 50 kg weights</u>

These weights will have a rectangular tapering cavity, with the smaller face on the outside, to prevent the lead from coming out. The cavity can be provided either on the underside or on the upper side. Cavities can also be OIML design.

(b) <u>100 g to 2 kg weights</u>
<u>Shapes (i) and (ii)</u>

These weights will have a circular tapering cavity, with the smaller face on the outside, to prevent the lead from coming out. The cavity can be provided, as in the case of above weights either on the underside or on the upper side.

Shapes (iii) and (iv)

Cavities on the top as per OIML design or open.

(c) 5 g to 50 g weights

Only the 50 g weight will be provided with an adjusting cavity. This will be of the type described in the series b. above.

Tolerances

The tolerances on this coarse series of weights will be about three times as coarse as on the medium accuracy (M2) OIML weights.

## Annex III

### REVISION OF THE COMPOSITE ISIRI LAW: SUGGESTIONS FOR INCLUSION REGARDING THE WEIGHTS AND MEASURES LAW

1. Wherever a reference is made in the Law to the expression "Ozan-e-Makiyaseha", it should be replaced by a translation of "National Law for Metrology".

2. A "specification" i.e. a "standard" issued under the "Law for Metrology" should be given a different name to distinguish it from the usual specification issued by the ISIRI as a national standard (which is called in Farsi "Estandard") equivalent of "Schedule" or another suitable word may be used for the "Legal Metrology Standards".

3. The following clauses may be added:

(a) "Regulations regarding the application of the Law to different classes of:

(i) Goods;

(ii) Undertakings;

(iii) Measures and measuring instruments;

(iv) Users of measures and measuring instruments;

will be issued from time to time as and when considered necessary";

(b) "Any schedule published under the "Law for Metrology", will be automatically compulsory and binding on all those users, who are covered by the "Regulations" issued under the Law";

(c) "A Standing Committee will be empowered to formulate Rules, Regulations and Schedules, as and when considered necessary and publish and issue the same on behalf of the Government";

(d) "Any measures or measuring instruments the use of which is covered by the "Metrology Law", will have to be of an "Approved Model". The approval of models will be carried out by or under the supervision of the ISIRI, and will apply equally to items manufactured in Iran as well as those imported into the country";

(e) "The Government may exempt either provisionally or permanently, certain categories of instruments or certain installations from some or all of the provisions of the Law for reasons of:

(i) Export promotion, or

(ii) National security".

## Annex IV

## ROLE OF ISIRI IN THE INDUSTRIAL DEVELOPMENT OF IRAN

### A. Historical development of ISIRI

From very early times Iran had been known for exporting a number of handicraft products and other items such as dry fruits etc., but difficulties were being experienced on account of multiplicity of the units of weights and measures in different parts of the country.

With a view to regulating the trade of various items within the country as well as for promoting its international trade, the Government of Iran took the important step of enacting the Weights and Measures Law of Iran, which recognized the use of the units of the metric system only as far back as 1933. The new Law brought about the much needed uniformity in the weights and measures being used all over the country.

The introduction of the metric system gave a great boost to the international trade of Iran and paved the way for the future development of its industries, specially because this system of units was already prevalent in other countries and was being adopted by many more countries. It is obvious that the universality and the importance of the metric system were realized by the Government of Iran almost half a century ago.

However, the Government also realized that the adoption of the metric system alone was not sufficient for taking adequate care of the rapidly growing industries of the country, some control on the quality of the products being made locally was also necessary. They, therefore, kept on taking further necessary steps from time to time to ensure the high quality of various items being produced either for internal consumption in the country or for export. A similar control on the quality of different items being imported into the country was also considered necessary.

The first major step in this direction was taken early in 1954, when it was decided to set up a Standards Bureau. Within three months the proposed Bureau was established in the Ministry of Commerce. Simultaneously a piece of land measuring 15,000 $m^2$ was bought on the Old Karaj Road for constructing a suitably designed building for the Bureau. The construction of this building was completed in 1958 and the Bureau moved to the new site soon

after. As the main function of this Bureau was expected to be the formulation of standard specifications and their implementation for controlling the quality of various products, it was renamed the Institute of Standards.

The Institute of Standards was formally inaugurated by His Imperial Majesty the Shahanshah Aria Mehr on 29 September 1959 and he signed its Law on 15 June 1960.

In March 1965, the Karaj Industrial Laboratories, which had been established sometime earlier to assist an industrial estate to be set up near Karaj, were merged with and put under the charge of the Institute of Standards. This step was taken after the proposal forsetting up the industrial estate had been dropped. After the merging of the two organizations, the Institute was renamed once again and it received its present name, i.e. the Institute of Standards and Industrial Research of Iran (ISIRI).

After operating for a few years in the Old Karaj Road buildings, the whole Institute was transferred in 1967 to the more spacious buildings of the Industrial Laboratories, which had been built on a plot of 280,000 $m^2$ and possessed an attached housing colony measuring about 100,000 $m^2$ with 20 houses already built.

It may be mentioned here that of all the steps taken for promoting the cause of standardization and effective control on the accuracy of various measures and measuring instruments in use throughout the country, the most significant step was the decision to set up a Metrology Centre under the ISIRI. This decision was based on the recommendation made by Richard Vieweg in his Report of August 1966, presented after his exploratory mission to the ISIRI under the auspices of UNESCO. The chief functions of such metrology centres are to maintain and/or to achieve in practice the values of various quantities representing different units of measurement, to calibrate and/or supply necessary standards to science, technology and industry and to maintain a strict control on the accuracy of every measure and measuring instrument in use anywhere in the country through suitably organized legal metrology departments.

The proper development of the Metrology Centre of the ISIRI is very important for the country, as it is now a well established fact that development of the science of measurement is essential for a country's security, the development of its economy and the safety and the health of its people. The extent to which a country can progress in scientific, technological and industrial fields is directly proportional to the level of development of its measurement capability.

In view of the importance of this matter, a suitable project was drawn up under the auspices of UNIDO. The project was initiated in 1970 and detailed planning and designing of various buildings etc. and the purchase of important items of equipment were taken in hand under the advice of a team of United Nations advisers working under the overall supervision of a chief technical adviser. Work has been steadily progressing over the past five years and the Metrology Centre is now fairly well equipped in most of its Divisions and undertaking proper calibration work. Steps are being taken to apprise all the prospective users of the calibration facilities available at the Institute to enable them to get all their measures and measuring instruments tested and calibrated. Necessary steps are also being taken to enlarge and extend the measuring capabilities of the Metrology Centre to enable it to carry out measurements of the highest accuracy in all the important fields.

The Metrology Centre was officially inaugurated by His Excellency Farrokh Najm Abadi, Minister of Industries and Mines, on 3 May 1975.

## B. Management of the ISIRI

The ISIRI derives its authority from the Constitution adopted under the enactment of 1960 (Law and Articles of Association of the Institute of Standards and Industrial Research of Iran) and operates as a Department of the Government of Iran under the Ministry of Industries and Mines.

A High Council under the Chairmanship of the Minister of Industries and Mines is the highest policy making and controlling organ of the ISIRI. The High Council is representative of both the private and public sectors of trade and industry, as well as of agriculture. It also includes some nominated experts. Under the High Council, the Director General of the ISIRI is responsible for carrying out the day to day administration of the Institute. He is assisted by six Assistant Directors General and twenty Departmental Heads.

The six Assistant Directors General are in charge of each of the following Departments of the ISIRI:

Administration
Planning and Research
Affairs of Cities and Provinces
Agricultural and Animal Industries
Building and Chemical Industries
Electrical and Mechanical Industries

The twenty departmental heads are responsible for eaoh of the branoh offioes looated in different plaoes in the oountry.

Eaoh of the assistant Direotors General is assisted by a number of heads of offioes or laboratories working in various offioes and laboratories under them. Eaoh offioe and eaoh laboratory is staffed by offioe assistants, soientifio and teohnioal experts and teohnioians as well as helpers to look after the day to day work in their seotions.

## C. Broad funotions of the ISIRI

The ISIRI, as the name itself indioates, is a multifunotion Institute. Its ohief funotions are the following:

1. It is the Bureau of Standards of Iran, i.e. it is required to look after all the work pertaining to the oountry's national standards of various units of measurement, make the neoessary standards available to soienoe, teohnology and industry and to maintain control of the aoouraoy of various standards in uee in the whole of the oountry;

2. It is the Institute of Legal Metrology of Iran, i.e. it is required to implement various provisions of the Law on Metrology, commonly known as the Weights and Measures Law, suoh as controlling the aoouraoy of weights, measures and measuring instruments used in everyday trade and transaotions all over the country, as well as to ensure that oorreot quantitites are delivered to oustomers during various transaotions, whether these are made within the oountry or for export or import purposes.

3. It is the Institute of Standards of Iran, i.e. it is responoible for laying down the oriteria for the quality of various raw materials and finished produots by formulating and promulgating national standard speoifioations, as well as for laying down standards of performanoe, preparing oodes of praotioe, operating a quality marking soheme for ensuring a high standard in the quality of various artioles being manufaotured in the oountry and enforoing oompulsory inspeotion and teeting of suoh items; oompliano e to these national etandards ie oonsidered important either for ensuring safety and or proper quality for export purposes. All the items imported are also relased from the oustoms after they are found to oomply with relevent standards.

4. It is the Institute of Industrial Research of Iran, i.e. it is responsible for taking up research and development projects which are of direct interest to various industries in Iran.

The prudence of grouping together all the above-mentioned functions into a single Institute has resulted in a great saving to the Government of Iran. In discharging its multifarious duties in respect of all these functions, the ISIRI has to import only one set of important items of equipment, instead of three, and set up only one workshop, one library and one documentation centre. The total cost has thus been cut down to almost one third of what it would have otherwise been. The other great advantage of grouping is that it permits much better planning for each of these disciplines, eliminating all chances of unwanted duplication.

## D. ISIRI's participation in international activities

In order to carry out efficiently its day to day work and to maintain its standard at the international level, the ISIRI actively participated in the deliberations of various international organizations having a bearing on its work. It joined the following organizations on the dates shown:

| | |
|---|---|
| International Organization of Legal Metrology (OIML) | 1959 |
| International Organization for Standardization (ISO) | 1960 |
| International Electrotechnical Commission (IEC) | 1965 |
| International Commission for Illumination (CIE) | 1968 |
| International Organization of Weights and Measures (OIPM) | 1975 |

ISIRI also participates in the work of the following organizations of which it is also a member:

World Association of Industrial and Technical Research Organizations (WAITRO)

Comité European du Beton (CEB)

FAO/WHO Codex Alimentarius Commission

Regional Cooperation for Development (RCD)

Asian Standards Advisory Committee (ASAC)

At present the ISIRI is more intimately involved in the technical activities of the ISO than of any other international body. It holds the Secretariats of a number of ISO technical committees and contributes significantly to their work.

In the very near future, the ISIRI will also be participating significantly in the technical work of some of the OIML committees. A few proposals are already under preparation. Participation will become closer with the adoption of the new Weights and Measures Law of Iran and its enforcement throughout the country.

Besides affiliation with international organizations, the ISIRI maintains close relations with similar bodies in several countries. Exchange of information with these countries has been found to be very useful.

## E. Formulation of national standard specifications and codes of practice

The present demand from industry calls for the formulation of a much larger number of standard specifications and codes of practice etc. each year than the ISIRI can manage with its present resources. It has a number of limitations but the one which matters most is the insufficiency of trained scientists, engineers and technologists for handling the entire load of work. The preparation of such standards which have the highest priority only can, therefore, be taken up. To be able to prepare the largest number of standards in a limited time and with the assistance of a limited number of experts, the ISIRI has taken special steps to exercise a strict vigil on the time spent by each expert on each stage of the preparation of each of the standards. The whole process of the formulation of standards, starting from the receipt of the proposal to the printing of the finalized draft, has been divided into more than two dozen distinct stages, for the purpose of accounting and controlling the time spent by various experts.

The responsibility for approving new subjects for standardization lies mainly with the Director General, but before according his approval he has to satisfy himself regarding the adequacy of priority. Once a subject is approved, the preliminary draft is prepared by a Technical Working Group and then discussed in a Technical Committee consisting of experts, producers, consumers and other interested parties. After the necessary deliberations the draft is finished and circulated to industry and other interested bodies for their comments. The draft is further amended in the light of the comments received, if considered necessary, then finally edited by the Editing Committee and placed before the specific National Committee for further discussion and approval before being sent for printing.

The following eleven National Committees are responsible for approving national standards prepared by the ISIRI on different subjects:

Electrotechnical Industries
Textiles and Leather
Timber, Wood and Paper
Food and Agriculture
Building and Construction
Chemical Industries
Metals and Minerals
Mechanical Industries
Illumination
Office Documents and Furniture
Weights and Measures

The number of standards finalised to date is 1,471; of these over 1,400 have already been published. One hundred and one manufacturers have been granted Licences for Compulsory Standardisation, and 38 for Voluntary Standardisation; 49 manufacturers are being examined for the issuance of licences. Fourty three li ns of production have been closed down for want of compliance to relevant standards.

## F. ISIRI Laboratories

Besides the main laboratories of the Institute in Karaj the ISIRI has:

Administrative and Planning Divisions (6)
Central Workshop, library and Photography and Reproduction Section
City and Provincial Branches (13)
Import Control Laboratories (14)
Weights and Measures Laboratories (11)
Hallmarking of Precious Metals Laboratories (6)

The eightmain laboratories of the ISIRI at Karaj consist of a number of smaller laboratories. These are:

Mass Metrology Laboratory
Length Metrology Laboratory
Force and Pressure Laboratory
Electrotechniques Laboratory
Electronics Laboratory
Time and Frequency Laboratory

Thermal Metrology Laboratory
Photometry Laboratory
Strength of Materials Laboratory
Safety Glasses for Automobiles Laboratory
Fluid Control and Pressurized Containers Laboratory
Foundry Sand Testing Laboratory
Metallurgy and Corrosion Laboratory
Gas Burning Appliances Laboratory
Gas Cylinder Valves, Hose Pipes and L.P.G. Pressure Regulators Laboratory
Food and Agricultural Products Control Laboratory
Rubber, Plastics and Paints Control Laboratory
Oil and Petrochemicals Laboratory
Chemicals and Photochemistry Laboratory
Cosmetics and Detergents Laboratory
Metals and Minerals Laboratory
Soil Mechanics Laboratory
Road and Buildings Laboratory
Hides, Skins and Leather Laboratory
Meat and Dairy Products Laboratory
Fibre and Textiles Laboratory
Clothes and Covering Materials Laboratory
Wool and Carpets Laboratory
Timber, Wood and Paper Laboratory
Packing and Packaging Laboratory
Preservation of Food Products Laboratory

All these laboratories keep busy in formulating new standards and carrying out tests in their respective fields, either in connection with the Certification Marks Scheme or the Compulsory Standards Scheme. Some laboratories are also handling a few research and development projects for the benefit of various industries in Iran.

## G. Testing activities of the ISIRI

The ISIRI handles a considerable amount of test work each year in the main Karaj Laboratory as well as in the branches and other testing organisations under it. Various materials tested fall into one or the other of the following categories:

(a) General testing for industry or the calibration of standards and measuring instruments for scientific, technological and industrial institutions;

(b) Implementation of the Certification Marks Scheme;

(c) Implementation of the Scheme for enforcing Compulsory Standardization in respect of items for:

(i) Use within the country;

(ii) Export withing the country;

(iii) Imported items;

(d) Weights, measures or measuring instruments, in connection with the implementation of the Weights and Measures Laws;

(e) Hallmarking of precious metals.

Figures for the number of samples handled and the number of tests carried out in various laboratories from 1972 to 1975 are given below.

Test work handled in the main laboratories at Karaj from 1972-1975

| | 1972/73 (1,351) | 1973/74 (1,352) | 1974/75 (1,353) |
|---|---|---|---|
| No. of samples tested | 2,908 | 5,212 | 6,867 |
| No. of tests carried out | 11,215 | 32,267 | 38,941 |

Test work handled in 13 branch laboratories of the ISIRI from 1972-1975

| | 1972/73 (1,351) | 1973/74 (1,352) | 1974/75 (1,353) |
|---|---|---|---|
| No. of samples tested | 16,087 | 23,079 | 22,015 |
| Material exported (tonnes) | 269,579 | 383,291 | 231,781 |

Test work handled in 14 import control laboratories from 1972-1975

| | 1972/73 (1,351) | 1973/74 (1,352) | 1974/75 (1,353) |
|---|---|---|---|
| No. of samples tested | 55,757 | 90,615 | 107,478 |

Test work handled in 11 weights and measures laboratories from 1972-1975

| | 1972/73 (1,351) | 1973/74 (1,352) | 1974/75 (1,353) |
|---|---|---|---|
| No. of weights, measures and other items verified | 1,669,681 | 2,532,520 | 1,893,274 |

Test work handled in 6 laboratories from 1972-1975

| | 1972/73 (1,351) | 1973/74 (1,352) | 1974/75 (1,353) |
|---|---|---|---|
| No. of samples marked | 41,741 | 24,189 | 25,849 |

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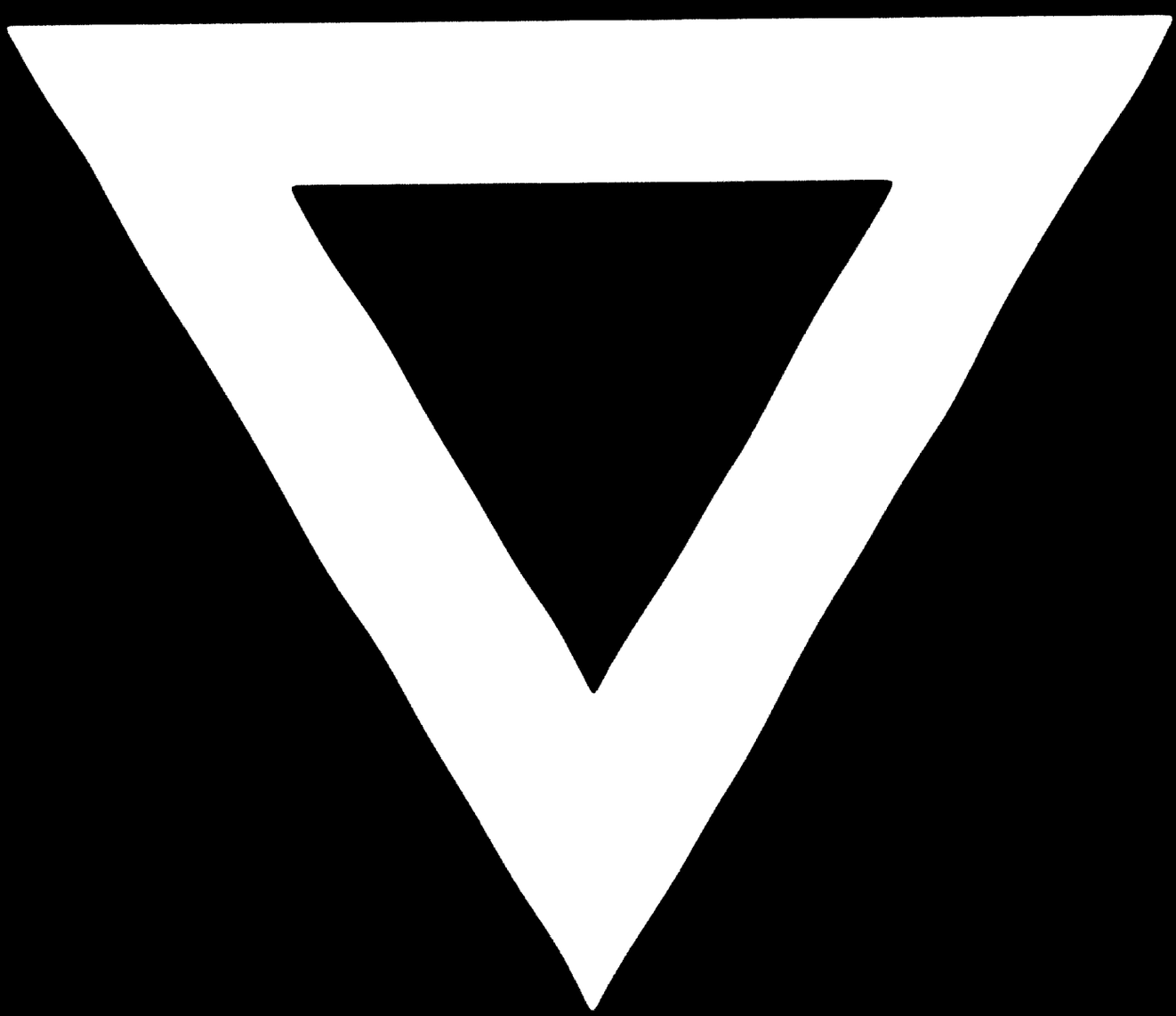

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