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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
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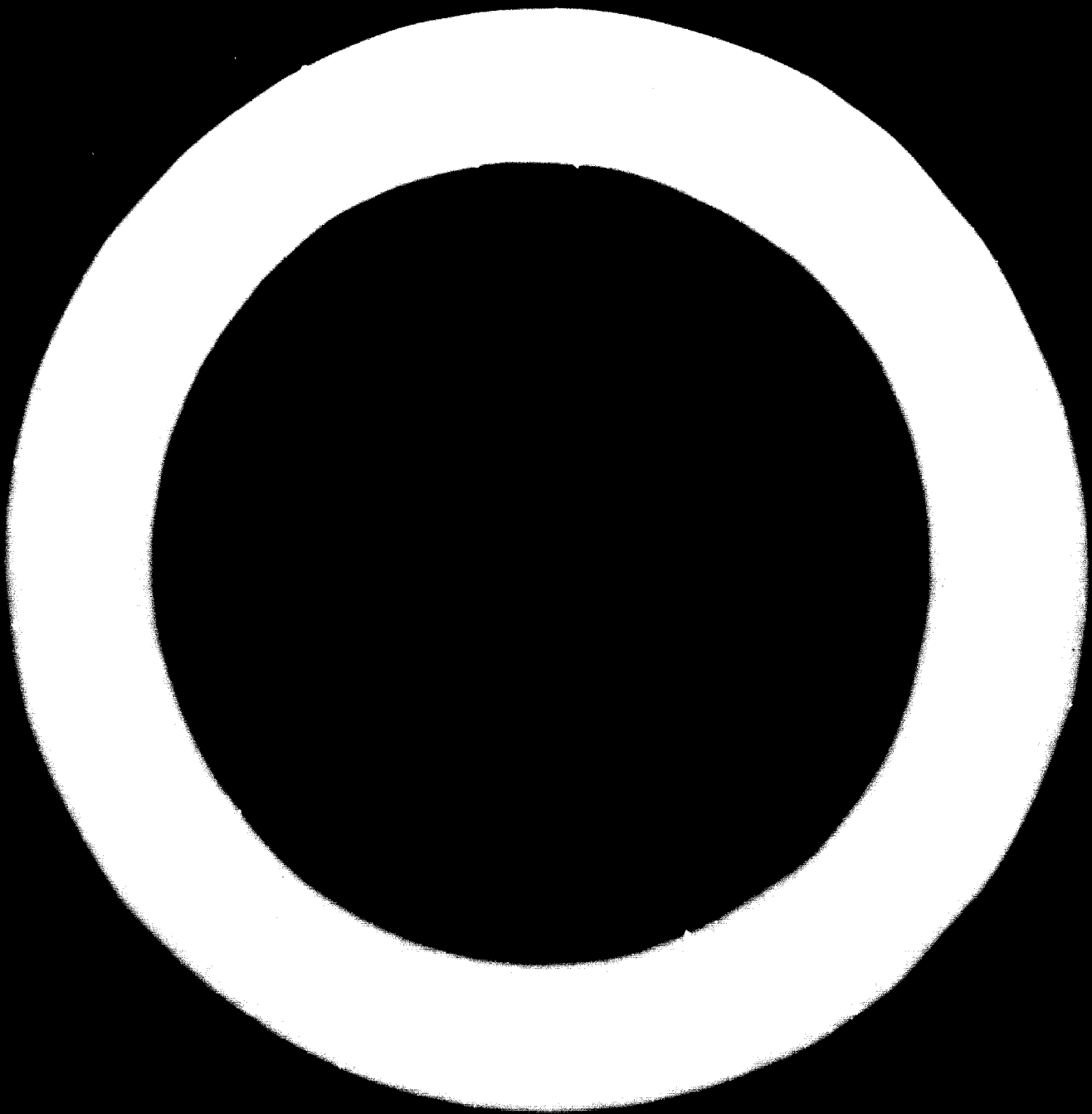
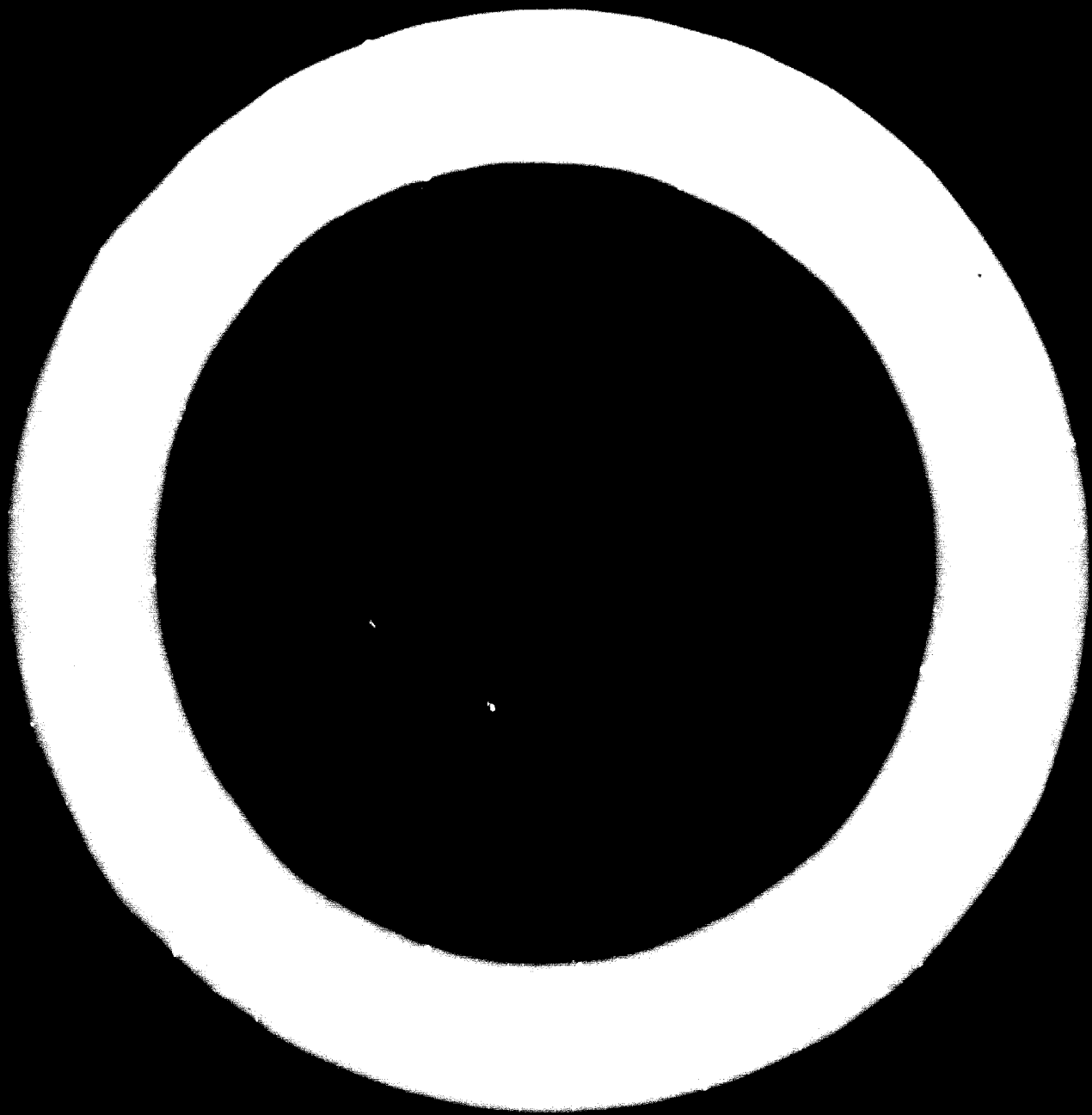
INDUSTRIAL STANDARDIZATION IN DEVELOPING COUNTRIES

UNITED NATIONS





Department of Economic and Social Affairs

INDUSTRIAL STANDARDIZATION IN DEVELOPING COUNTRIES

UNITED NATIONS
New York, 1964

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FOREWORD

Countries wishing to embark upon, and those already on their way towards, industrialization generally recognize the importance of standardization. Indeed, the task of establishing agreed standards is easier at an early stage of industrial development than at a later stage when difficulties caused by overlapping practices have to be disentangled and vested interests overcome. Increasing recognition is being given to the benefits contributed by standardization to the process of industrial development. This is clearly shown in the papers submitted under this heading to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas 1/ "all of which", in the words of the Conference Secretary-General, "agree on the importance of furthering national standardization efforts and promoting international co-operation. The agreement is independent of the degree of development, or of the political structure of the authors' home countries. The strongest appeal for action in this field comes from countries which are beginning to industrialize".

The purpose of this study is:

- to show the value of standardization as a means of furthering the industrial development and national economy of a country, independent of whether it is a highly industrialized one or one just beginning to industrialize;

- to show the need of creating in each country a central national supervisory and co-ordinating body, designated here as a National Standards Body (NSB), for making the most effective use of standardization, and to formulate recommendations concerning the initial steps to be taken towards the establishment of such a body in a country whose industry is still in an early stage of development;

- to explain the need for co-ordination of standardization at the international level and the benefits that accrue to participating countries from this activity;

- to show the advantages of industrial standardization at the plant level and to recommend standardization programmes to help in this respect.

Since the field of organized standardization is vast, there is a wide variety in the nature and form of its applications. To keep the over-all picture simple and focus attention on general principles, the accent in the present study is on the use of standardization in manufacturing operations. However, the fundamentals of organized standardization apply equally to other branches of industry, including such service industries as transportation, communications and supply of water, gas and electricity. They are applicable also to standardization of agricultural products.

1/ See annex VIII.

Experience has shown that a clear understanding of the fundamentals of organized standardization makes possible its application to widely varying problems and conditions. For this reason it is important that it be considered as a discipline in itself, requiring education and training of specialists to take charge of its operation in practice.

This study has been prepared in the Centre for Industrial Development of the Department of Economic and Social Affairs with the consultant help of Dr. John Gaillard and Mr. Madhu S. Gokhale, experts in the field of industrial standardization. It is hoped that it will be of use to those persons in government and industry who are interested in the introduction of standardization in their respective countries and industrial enterprises.

EXPLANATORY NOTE

The following abbreviations have been used:

AFNOR	French Standards Association
ASA	American Standards Association
ASTM	American Society for Testing and Materials
BS	Bureau of Standards
BSI	British Standards Institution
CSA	Canadian Standards Association
DGN	General Directorate of Standards of Mexico
DNA	German National Standards Body
EOS	Egyptian Organization for Standardization
IBWM	International Bureau of Weights and Measures
IEC	International Electrotechnical Commission
ISA	International Federation of National Standardizing Associations
ISI	Indian Standards Institution
ISO	International Organization for Standardization
NBS	National Bureau of Standards [United States of America]
NSB	National Standards Body
PSI	Pakistan Standards Institution
SES	Standards Engineers Society [United States of America]
SII	Standards Institution of Israel
TSE	Turkish Standardization Institute
UNSCC	United Nations Standards Co-ordinating Committee
WMA	Weights and Measures Administration

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

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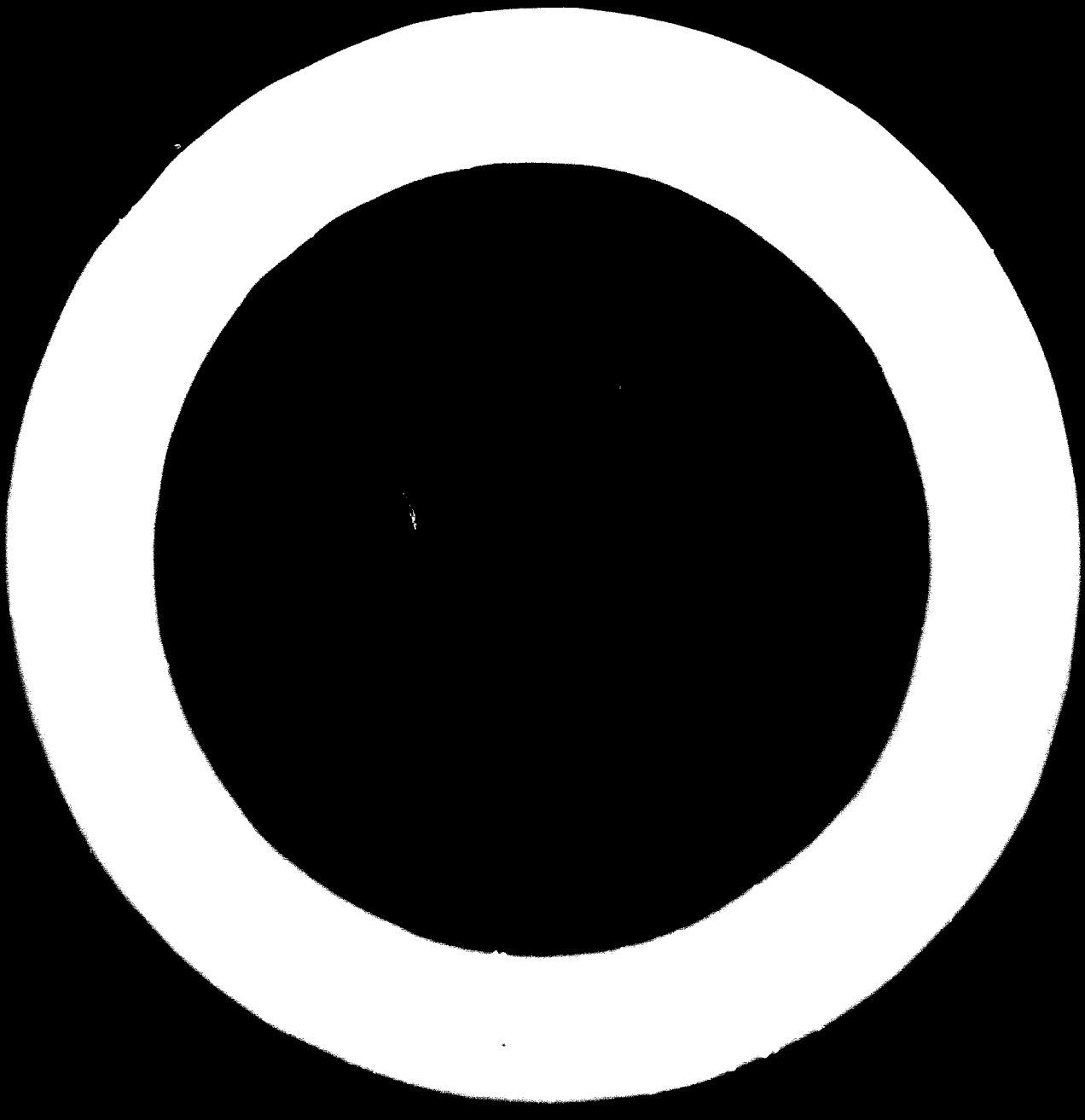


Chapter 1

FUNDAMENTALS OF STANDARDIZATION

Natural and organized standardization

What is a standard? Why do we need standards? A single example will answer both questions. All social and business activities throughout the world are based on a universal time standard which consists of a reference line (the Greenwich meridian) and standard units of time (the hour and its subdivisions). Without general agreement on this standard there would be utter confusion in communication and transportation, even in the same country.

Similarly, there would be confusion everywhere if there were no standards of weight and length. For many centuries such standards have been used in villages and towns, but having grown up independently they are all different and have given rise to much trouble. In fact, in contrast to the world time system, which is a universal standard, there are still in use, in the most highly industrialized countries, two systems of weight and length: the metric and the British. In addition, there are still many other systems in use, even in countries that officially have adopted the metric system.

Some of these systems are very old; they grew up long ago and since then have become so much a part of the common language in the market place, and later in more extensive trade activities (even with foreign countries), that for several reasons those using the systems are reluctant to part with them. To begin with, a change in system would force them to change their thinking about quantities. In addition, the old systems have some sentimental value because of their traditional use.

In languages, we have a similar situation. English, Spanish and French are widely spoken throughout the world, but efforts to create a single world language have so far had no practical success. Here again, it is not only the difficulty of making a change, but also the departure from an old tradition. On the other hand, the Morse code, designed as a standard system to meet the needs of a new method of communication (telegraphy), is understood by all concerned, whatever their native language. Here is a standard system that did not grow up in the course of centuries as a natural product of its surroundings, but was designed for a particular use and purpose.

We thus find that there is a distinction between standards that are the result of the growing up of a habit, custom or tradition, which we shall, therefore, designate as "natural standards", and other standards that are the result of planning. In accordance with this distinction, we shall speak of "natural standardization" and "organized standardization".

In applying standardization to industrial problems, we have to deal with both kinds. Our systematic approach to the problems concerned, such as the establishment of standards for technical performance and quality of manufactured

[illegible], will be [illegible] organized standardization. However, both the [illegible] of [illegible] by this method and their introduction into practice will be [illegible], [illegible] quite strongly, by the existence of natural [illegible]. [illegible] to change caused by adherence to natural standards [illegible] [illegible] which call for careful consideration in the introduction and operation of organized standardization.

The concepts "specification" and "standard"

In industrial and commercial practice we find many different interpretations of these two terms. In some quarters the term "specification" has the definite connotation of a document used in purchasing. However, there are many other kinds of specifications. In a manufacturing industry alone we have design, material, dimensional, product, tool and test specifications, to mention only a few. And building specifications cover an entirely different field.

Whatever may be its subject, we shall always find that a specification states one or more specific requirements that must be met. Why? The answer depends entirely on what the specifier had in mind when he drew up the specification. For example, if he wrote a material specification, he would write into it requirements of strength, or colour, or elasticity or the like, depending on the purpose for which he intended to use the material.

If a specifier finds a specification to be satisfactory in use, he may decide to use it every time he has to achieve the same purpose. This has the great advantage of saving him time and effort. His problem was solved by the writing of a specification. He can now keep the solution in readiness to be made effective whenever he wants, at short notice. The recurrent use of the specification becomes standard practice and the specification thus becomes a "standard specification", or, briefly, a "standard".

In accordance with the above reasoning, we shall here, for the purpose of our discussion, define a standard as a "specification intended for recurrent use". At the present time there is no general agreement, even among standards engineers, on the definitions of the concepts "specification" and "standard". However, the question is often raised, what is the difference between a specification and a standard? According to the definition just given, every standard is a specification, but not every specification is a standard. The difference lies in the intention of recurrent use.

Formulation of a standard

Since, as just explained, a standard is, to begin with, a specification - that is, a specific statement of requirements - the formulation of a standard is basically the writing of a specification.

A specification has in general to perform two functions. One is to tell another party what the specifier wants to have supplied to him in terms of goods or services. In this respect, the specification functions as a communication. When the other party supplies these goods or services, the specifier will use the specification as a basis for determining whether what he is offered complies

with the requirements written into the specification. The latter may function as a criterion for making a distinction between things that are acceptable and things that do not comply with the specification.

In either function, as a communication or as a criterion, the specification should be so complete and clear that it can be understood by the would-be complier without his having to ask for further information. Terms like "good workmanship", "commercial finish" or "superior quality" should, therefore be avoided. They may have a more or less definite meaning between parties regularly dealing with each other, but they are essentially unsuitable for making a distinction between things that should be accepted and those that need not, Those in charge of writing specifications, therefore, should always try to find, if at all possible, units and bases of measurement as a means of expressing specified requirements. In some cases this is not easy and may even be impossible. It will then be necessary to have recourse to judgement supported by the use of a sample or model serving as a basis of comparison.

Even where the use of measurement and hence the expression of requirements in numerical terms is possible, it is often more complicated to be specific than appears at first sight. The seemingly simple case of specifying the diameter of a cylindrical steel pin may illustrate this.

As the first step towards being specific in this case, we shall say that the pin must have a diameter of, for example, 20 millimetres. This might be held to be a specific requirement since it is expressed in a unit of measurement, the millimetre. Upon closer consideration, it appears that the requirement is specific only with some qualifications. The steel pin is subject to expansion and contraction with changes in temperature. Therefore, the question arises at what temperature the pin shall have a diameter of 20 millimetres. There is an International Organization for Standardization (ISO) Recommendation, which has been adopted as a national standard in several countries, specifying that in cases of this kind, when no specific temperature has been mentioned, the temperature of 20° C shall apply. It is known as the standard reference temperature.

A second step towards being specific has to be taken in the form of a statement of the extent to which the diameter of the pin as measured will be permitted to deviate from the basic value of 20 millimetres. Both parties, the specifier and the would-be complier, are likely to agree that in practice it is impossible to make a pin with mathematical accuracy, for example, with a diameter of exactly 20 millimetres. Hence, all that can be expected is that the diameter of the pin will be held within certain limits. The two parties, therefore, will have to agree on the question of how far apart these limits should be. The answer will depend on two conditions: the purpose for which the pin is to be used - that is, the performance for which it is intended - and the accuracy with which the manufacturer of the pin can make it. If it is agreed that any pin will be acceptable whose diameter is within the limits 19.995 and 20.005 millimetres, this statement will represent another step towards being specific in stating the required diameter.

A third step may be necessary because of the fact that it may make a difference in what way the diameter of the pin is inspected for size. Accordingly, the method to be used may have to be specified if the specification is to give

the supplier a complete picture of the conditions which he is expected to meet.

Similar considerations apply to the specification of a material. Here, the specifier may begin by stating the requirement of tensile strength as a basic value of, say, 100 kilogrammes per square millimetre, and complement this statement by a permissible deviation from this value and reference to the method of testing to be used - for example, a standard method approved by the National Standards Body or a technical society.

In general, then, the three steps towards specificity in requirements, illustrated by the examples just given, are:

(1) specification of the nature and basic value of a required characteristi (in the example, this is a dimension of length and its basic value is 20 millimetres);

(2) specification of the extent to which deviation from the basic value is permissible (in the example two limits were given; another way of stating this requirement would be to say that the maximum permissible deviation from the basic value is 0.005 millimetres either way);

(3) specification of the method by which compliance with the requirements mentioned under (1) and (2) shall be checked. (In the example, this may concern agreement on a system of gauging used to inspect parts of this kind.)

In conclusion, it may be emphasized again that those who are writing specifications and, therefore, also those who are formulating standards, should always aim at stating the requirements in these documents, whenever possible, in terms of measurement, this being the most specific way of expressing them. In some cases a method and unit of measurement may first have to be established - a problem that may call for research.

• Standardization and research

A valuable by-product of organized standardization may result from the necessity to find facts before deciding on requirements to be written into a standard. This necessity may appear when, in discussing the formulation of a standard, technical specialists are found to have opposite opinions on a given point, without either party having factual evidence in support of his opinion. It may then be decided to seek advice from research.

Research and standardization are complementary functions. Without standard units of measurement, standard solutions, standard equipment and countless other standards, no research laboratory could do its work. Its basic assignment is to find solutions for problems still to be solved. Standardization will distil from these solutions recommendations that will be readily available to those who need them in their work and these recommendations will be revised when research has made new progress.

This point is made here because there is still [illegible] that standardization hampers progress. Organized standardization [illegible] that can and should be carefully controlled, will keep standards flexible through timely revision.

Close co-operation between research and standardization may be found at all levels of standardization. A technical committee working on a national standardization project may refer a research problem to one of the interested parties represented on the committee, such as a technical society, a trade association, or possibly a research organization in the government. At the international level, a problem concerning automobile headlights which arose in an ISO Technical Committee some years ago was referred to the International Commission on Illumination for advice.

Actually, there are cases where the establishment of a central technological research agency in a country has clearly shown the need of the organization of the standardization work at the national level and thus has led to the creation of a National Standards Body. 1/

Forms of applied standardization

One of the basic principles of organized standardization is to keep to a minimum the variety of things necessary to meet a given set of objectives. For example, if somebody plans to go into the manufacture of containers for shipping agricultural or industrial products, he should determine with the closest accuracy possible how many different types and sizes he should make. Once he has made this decision, he should determine how the total number of containers can be manufactured with the fewest possible materials, operations and processes, production machines, etc. This analysis will result in keeping down the cost of manufacture and other operations.

The need to restrict variety to the necessary minimum through organized standardization calls for three kinds of application of this principle: simplification, unification and design of standards.

In an industry, especially an older one, where a large number of types and sizes of product have come into existence, a survey will very probably show that the variety is excessive and should be reduced. The existing situation can usually be greatly improved by the use of standardization in either of two forms: simplification or unification.

Simplification is the process of weeding out all varieties found not to be necessary or, conversely, keeping in existence, without change, only those varieties which are necessary. The opportunity for simplification should be expected to arise in any standardization project, whatever its level, where varieties of products or practices have grown up. A machine tool builder found that his firm was using fifty different lubricating oils when six would be sufficient. A manufacturer of radio and television sets listed 496 different control knobs - which were reduced to thirty.

1/ See also the section below entitled "Bureau of Standards; Weights and Measures Administration".

Unification leads to reduction of variety by combining two or more varieti This implies that all of the original varieties will undergo a change of some kind. A major example of unification is that of the British Whitworth screw threads and the American Standard screw threads which were national standards in their countries before the Second World War. They were merged into the Unified Thread System now in effect in Canada, the United Kingdom and the United States.

Simplification and unification are remedial measures: they are applied to cure a situation which for one reason or another has got out of control. Such a situation is more likely to be found in an old industry than in a young one; an old industry has had more time to create varieties. Also, the modern form of organized standardization, which aims at preventing the need of reduction of variety from arising, was not introduced until the beginning of the twentieth century.

Design of standards

In an old industry, where the application of simplification and unification may cause some difficulties, the remark may be heard that it would have been fortunate if organized standardization had been introduced when the industry was still in its infancy. The reasoning behind this is that the growing up of excessive variety could then have been prevented.

There is much merit in this remark. It is true that when an industry is young it is not possible to predict all the details of its future, but planning can do a lot to determine its course with standardization as a powerful aid. Particularly, much can be done to prevent excessive variety from growing up by carefully estimating future needs and plotting rational series of means to meet these needs. For example, if a new machine has been invented and is to go into production, it may be advisable to adopt a range of power ratings wide enough to cover all of the demands expected in the future market, and to divide that range into the minimum number of steps assumed to give the users of the machine a sufficient choice in rating. When adopted by an industry as a whole, such a series of ratings will cause all machines (still to be made) to be "interchangeable" in the sense that they have the same ratings - even though their design may be quite different and remains flexible.

The creation of standard ratings in advance of the industry's development will have several advantages. Production cost will be kept down. The user who wants a machine with a given rating will have a choice from different makes. Moreover, when the models of the machine are changed as a result of technical progress, the basic ratings may still be kept in effect. Finally, further standardization of machine details will be made easier. For example, standardization of the dimensions governing the connexion of the machines with other equipment may follow the standardization of the ratings in a rather short time.

This design of standards to take care of conditions still to develop should be of particular interest to newly industrializing countries. They may find opportunities for applying its principles in cases where young industries are being started and no existing domestic practice has to be considered.

- -

In some cases there may be an advantage, even where an existing variety would lend itself to simplification or unification, in replacing all of the varieties by a new standard series designed on the basis of a rational approach. Thus, in a number of European countries the numerous and uncoordinated old systems of paper sizes have been replaced by a national standard based on a sheet with an area of one square metre whose ratio between length and width is the square root of 2 (about 1.41). This ratio was adopted because it is the only ratio that, when a sheet is halved crosswise, will cause the two smaller sheets to have the same proportion between length and width. This is an advantage, for example, when pictures are reproduced on a smaller scale: the composition of the whole (picture and sheet) then remains the same.

Another illustration of more recent date is the adoption in India of a national standard series of steel beams which was designed on the basis of their "efficiency index", a measure of the load carrying capacity of a beam per unit of its cross-sectional area. In other words, this standard was designed on the basis of the analytical decision how to make the most of the material going into the beam, resulting in its economic use.

The three-part standards administration

At whatever level organized standardization is operated, it will be most effective if handled by administrative machinery comprising the three following functions.

One is to decide on the technical content of a standard. This involves decisions on the various questions arising in the formulation of a standard as previously discussed (nature and basic values of required characteristics, etc.). What is needed here is co-operation between technical specialists able to fill in most, if not all, of the essential details. In doing this, they may have to harmonize differences of opinion and, where essential details are lacking, research may have to be called upon.

Another function of organized standardization is to cast the standards that are being developed into the most effective form as specifications - that is, to make the wording of the standard specific, clear and complete, and to keep them as brief as possible. Still other things have to be watched here, for example, whether basic values are accompanied, where necessary, by limits of permissible variation, or whether proper clauses on inspection and testing are included.

It is sometimes assumed as a matter of course that any technical specialist will take care, not only of the technical data to be written into a standard, but also of the details of specification writing. This is not always the case. The technical specialist may have no time, or no ambition, to pay the necessary attention to these details. Also, a group of specialists deciding on the wording of a clause of a standard may leave it in a rather crude form simply because among themselves they are in perfect agreement on what the clause is intended to cover. However, trouble may arise later when two parties using the standard (say, a buyer and a seller) are at odds about the interpretation of the clause. The case may go to court and, independent of the outcome, the purpose of the standard to serve as a basis of mutual agreement and harmonious

relations will have been missed. For these reasons it may be necessary to provide the technical specialists with the assistance of one or more specifica writers. In practice this second function in the three-part standards administration is often performed by a standards engineer.

As the third function in the combination, there should be the supervisory and co-ordinating action of a body which does not take an active part in the formulation of standards but serves exclusively to keep order in the flow of work by making decisions on the significant phases in the handling of standardization projects, including final approval of proposed standards.

Main levels of standardization

The need for standards exists at all levels of human activity. Wherever men work together, they must agree, first, on the common objective they want to attain, secondly, on the practicable means of attainment and, thirdly, on the co-ordinated operation of these means.

From the viewpoint of the National Standards Body (see chapter 2), four major levels of industrial standardization may be distinguished, as follows:

(1) the level of the industrial enterprise, often referred to as the "company level";

(2) the industry (inter-company) level - usually the level of the trade association, or groups especially organized for the purpose of inter-company standardization;

(3) the national (inter-industry) level where the standardization activities of the trade associations or other groups mentioned under (2) and also those of technical societies, are co-ordinated; a

(4) the international level, at which national standards of two or more countries are co-ordinated, either on a regional basis or in a general global approach.

Within the individual enterprise there are additional levels of standardization, such as those in the departments where a manufactured product is designed, made, inspected and the like, and in the purchasing department which serves all the other departments. However, the standards established at these levels are not directly considered in the work of the National Standards Body with which we are particularly concerned here. Rather, they are the subjects of internal planning and control in each department of the company.

To help outline the relationships between these four levels of standardization, it would be of interest to review their areas of concern with the aid of a conceptual framework put forth by an Indian expert. 2/

2/ See Dr. Lal C. Verman (Director of the Indian Standards Institution), "Standards Space", a paper presented to the Standing Committee for the Study of Scientific Principles of Standardization (STACO), Amsterdam, the Netherlands, 1958.

Standards space

In order to get a correct perspective of the aims of standardization at various levels, it is important first of all to define these levels and establish their relationship with other major attributes of standards. This could conveniently be done by considering what may be called "standards space" with "subject", "aspect" and "level" constituting the three axes of reference.

Subject. Standards cover almost all aspects of the economic activity of man - engineering, industry, construction, agriculture, commerce, science, education, transport, food, forestry, and so on. Each of these fields deals with a large number of items; for instance, under engineering we have steel machines, fasteners, etc. Each item may be further subdivided into subjects suitable for being covered by a standard; for example, under fasteners, we may have a standard on screw threads, bolts and nuts, washers, rivets and the like. Corresponding to the subject matter of a standard, or rather the object covered by it, we may assign a point on the "X-axis" of what we have called the standards space.

Aspect. Standards differ in form and type depending on the particular aspect of a subject that may be covered. The aspect may be:

(1) a set of nomenclature, or definition of terms;

(2) a specification for the quality, composition or performance of a material, an instrument, a machine or a structure,

(3) a method of sampling or inspection to determine conformity with a specified requirement of a large batch of material by inspection of a smaller sample;

(4) a method of test or analysis to evaluate specified characteristics of a material or chemical;

(5) a scheme of simplification or rationalization, i.e., limitation of variety of sizes, shapes or grades designed to meet most economically the needs of the consumer. This also includes dimensional stipulation of component designs to ensure interchangeability, as also methods of grading and grade definitions for natural products, such as timber or minerals;

(6) a code of practice dealing with design, construction, operation, safety, maintenance of a building, an installation or a machine;

(7) a model form of contract or agreement.

There may be other aspects besides those enumerated above, but it will be appreciated that any or all aspects may be applicable to any or all of the subjects which we have arranged along the X-axis of the standards space (see figure 1). Thus, let us assign a point on the Y-axis to each of these aspects that may be of interest.

We now have an X-Y plane in which all discrete points corresponding to each subject-aspect combination assume significance. For each point, there may be a standard.

Level. Lastly, the third or Z-dimension defines the operational level of a standard, or the domain in which it may be applicable. The level is determine by the group of interests creating and using the standard in its day-to-day operations. Thus, the standard may be:

(1) an individual standard, specially laid down by an individual user, builder or corporate body to suit his specific needs, such as a specification for a piece of furniture, a house, a dam, a bridge or a factory;

(2) a company standard, prepared by common agreement between various departments of a concern for guiding its purchase, manufacture and sales operations;

(3) an association or trade standard prepared by a group of related interests in a given industry or within a trade or profession;

(4) a national standard promulgated after consulting all interests concerned, through a national standards organization which may be a governmental, a non-governmental or a quasi-governmental body;

(5) an international standard or recommendation, such as those of the ISO or the International Electrotechnical Commission (IEC), resulting from an international agreement between independent sovereign nations having common interests.

On the Z-axis of the standards space, points may be allotted to each of these levels.

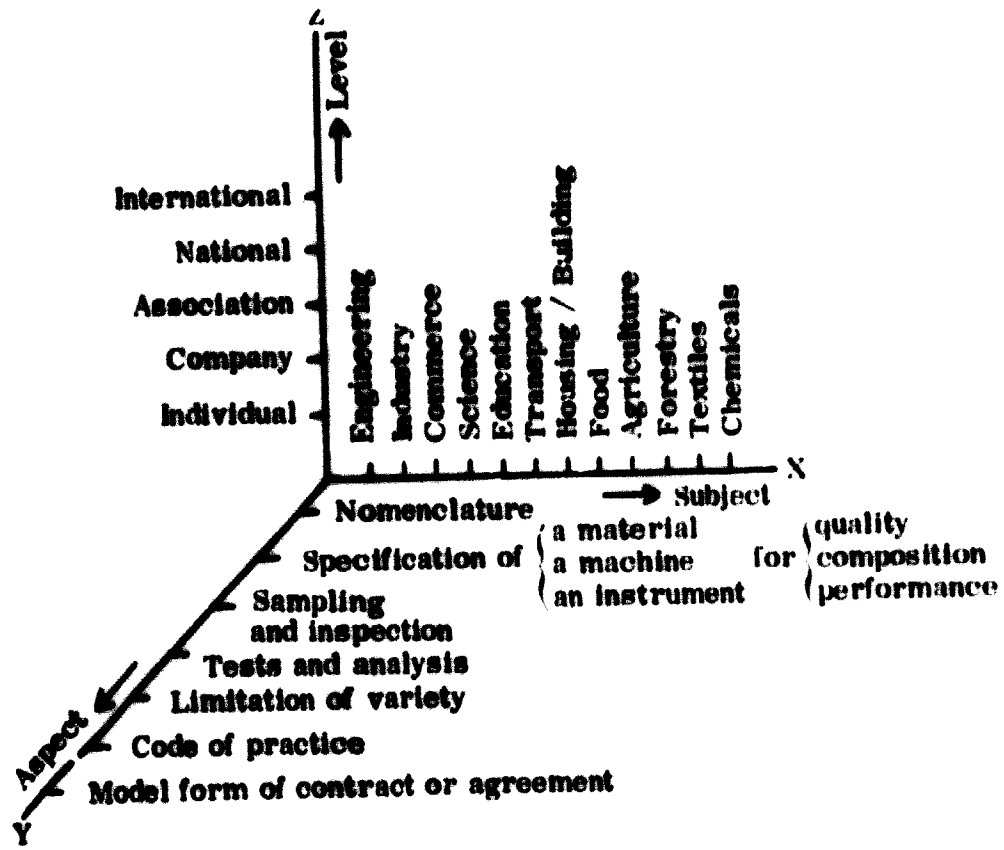
This three-dimensional characteristic of standards is diagrammatically illustrated in figure 1, with X, Y and Z axes respectively covering the three dimensions indicated above. In this diagram any standard can be fixed by a discrete point, provided the diagram is made sufficiently extensive and detailed in the X-direction. Certain standards may have to be represented by more than one point if they happen to deal with more than one subject or aspect, or if they happen to be adopted at more than one level.

It will be appreciated that for each subject-aspect combination, there can be only one point at the international level. But for national standards there may be as many points as there are nations having national standardization bodies. The multiplicity of points corresponding to each subject-aspect combination will progressively increase as one passes on to association, company and individual levels of the standards space. In order to provide for such pyramidal multiplicity of points in the standard space, it may be convenient to assign it a fourth dimension, but for our present purpose, it should suffice merely to take note of this fact and not to complicate our picture.

From the above description of the standards space, it will be clear that the field of standardization today has become much more extensive than it was,

Figure 1

DIAGRAMMATIC REPRESENTATION OF STANDARDS SPACE



let us say, about half a century ago, when it first began to develop as an engineering activity aimed chiefly at simplification and limitation of variety. Multiplicity of variables along the aspect axis of standards space shows the growth of this complexity during the past several decades, and there is no indication that this growth has reached a saturation point. On the contrary, judging from the rate of progress of present-day science and technology, there is every reason to believe that a great many new variables will continue to be added to the subject - as well as the aspect - axis of the standards space, although we may take it that the level axis may remain more or less as now conceived. It is obvious that the standards space as described above cannot be taken as a mathematical space of either continuous or discrete variables; it is to be regarded merely as a convenient device to illustrate the three important attributes of a standard.

One of the most important relationships between the various levels of standardization is concerned with the constant communication and exchange of information. By its very structure, the International Organization for Standardization depends heavily on the contributions made by its Member Bodies. These are processed and fed back to the members in the form of "Recommendations". Whether or not these international recommendations are called standards, they contain sufficient validity to warrant careful scrutiny by the Member Bodies and possible adoption as operating documents for use within their countries. The real strength of any decision, be it called a "recommendation" or a "standard", is its acceptance at the highest level within the user organization. This chain of events should eventually end in the international standard being adopted not only at the departmental level within a company, but at the individual level. The use of "preferred numbers" in the design of products is a case in point, where a company directive in support of this international recommendation may do no more than put a stamp of approval on what should be an obviously acceptable practice at all levels.

At its own level, the company or in-plant standards activity has a definite function to perform in either direction. It will examine and adopt standards from the upper levels for departmental or individual use, and in turn contribute to the making of valid standards and recommendations, which would go a long way towards having these documents reflect the national viewpoint. This is an important consideration for a developing country since its economic development will depend on its ability to manufacture and market its products, not only for domestic consumption but also for foreign markets.

After a nation's products have been made acceptable on the basis of the two primary aspects of standardization, nomenclature and size, the national and in-plant standardization efforts can then be concentrated on the other aspects - maintenance of adequate quality, reduction of cost by reduction in variety, establishment of an internal code of practices for administration, numbering of documents, drawings, and the like.

Consideration of standards at the association or industrial level is a phase a developing country cannot long ignore. Standardization at this level need not await the development of national or company levels in a developing country. While it is clear that the establishment of a National Standards Body is a prerequisite for the proper development of industrial standards, the formation of a standards body at the industry or association level would be a favourable

[illegible] the protection of the industrial [illegible] of the country. [illegible] interest to those countries where the [illegible] the National Standards Body not only to provide [illegible] country but also for guidance in the setting up of other [illegible] such as the in-plant level, which in turn would [illegible] implementation of national standards.

The items presented under "subjects" and "aspects" above are by no means exhaustive. In order to round out these lists, the following items are to be included among the subjects and aspects to be considered for standardization. Under subjects we may also include personnel administration; procurement manufacturing; sales; packaging, storage and shipping; materials handling, and maintenance. Similarly, under aspects, we may also include dimensional requirements; specification of finishes; performance requirements or operating characteristics; safety considerations, manufacturing practices, and procedures.

Status of a standard

The individual, group, organization or country that is considering the adoption of an existing standard will be interested not only in its content, but also in the way in which that standard came into being. Of particular interest are the questions as to who took part in the development, what parties they represented and what organization gave the standard its final approval.

It is the answers to these questions that will determine the status of the standard in the opinion of the prospective user. In this respect, a standard approved by the National Standards Body merits his special attention because of the latter's standing in the country and the fact that approval of a national standard is based on the support of its technical content by the various interested parties. 3/ Unless, therefore, the prospective user definitely needs something different, a national standard should be his first choice. If no such standard has been established, the prospective user should try to find out if there is a standard approved by a technical society, trade association or governmental agency that will serve his purpose, or possibly, a standard adopted by another company in his industry or even in another industry. If no existing standard meeting his requirements is available at any of the levels mentioned, he will have to formulate his own standard.

Advantages of standardization

The numerous advantages of organized standardization have been listed many times in recent years in papers, articles and reports dealing with the introduction and operation of standardization at one of the four major levels just mentioned.

Some of the main, and hence most frequently listed advantages are:

(1) Planning of the attainment of a given objective need not be repeated each time;

(2) The concepts in the minds of the parties concerned are given definite meanings;

3/ See chapter 2, particularly the section entitled "The consensus principle".

(3) More economic use of human effort, materials and time; hence, lower cost of the supply and distribution of goods and services;

(4) Variety of means necessary to cover a given range of needs is minimiz

(5) Interchangeability of component parts, assemblies and complete produc making possible long-run, highly repetitive manufacturing, and facilitating repair and replacement;

(6) Easier training or retraining of personnel, by means of instruction sheets, manuals, etc;

(7) Elimination of confusion and conflict between individuals and groups, resulting in their more harmonious and effective working together;

(8) Creation of a rational basis of understanding in contracts;

(9) Promotion of fair dealing in trade.

Analysis of these advantages shows that they can be traced back to either or both of the basic characteristics of a standard: one of these being the fact that a standard is a specification and the other, that a standard is intended for recurrent use. Thus, the fact that a standard is a specification clearly results, for example, in the advantages listed under (2), (7) and (8). Recurrent use of a standard as one of its typical features is a major factor in producing the advantages mentioned under (1) and (6). Again, the advantages listed under (3) and (5) result from both the specificity of requirements written into a standard and the latter's recurrent use.

Studies made in various countries and at different levels of standardizati have shown that, where industrial operations have been conducted without the use of organized standardization, its introduction, if properly planned, has always resulted in money savings and in other benefits, some of which are intangible yet which may perhaps be considered even more valuable than the monetary savings.

The benefits of organized standardization usually are most striking when this function is introduced into an enterprise that so far has not applied standardization in a systematic way. The results of simplification, unificatio or design of new standards to replace existing practice, are often quite surprising in this phase because they clearly bring out the contrast between the old conditions and the new. For example, the company that reduced the numb of control knobs for radio and television sets from 450 to thirty (five sizes and six functional styles) through design of a new standard series 4/ saved $83,000 in eighteen months on knobs used for its own sets, by cutting down the cost of production and eliminating special designs and tooling. In additio the low-cost production of the knobs permitted the company to sell them at a profit to other companies in the same industry. During the eighteen month period this profit was $35,000, making the total gain $118,000 on only one type of component out of many thousands.

4/ See the section above entitled "Forms of applied standardization".

However, even though a drastic reduction in variety was made [illegible] the new standard line of knobs was kept flexible with a view to future revisions. The company selected the materials and production methods in such a way as to permit easy adaptation of the designs to various colour schemes when new developments in the styling of the sets would call for them.

As to the intangible benefits yielded by organized standardization, we shall mention here only the avoidance of confusion and errors resulting from lack of effective standards. A common experience is to find that the same thing is designated by different names, or that different things are designated by the same name. Not only do such conditions cause loss of time, effort and money, they are also likely to spoil the spirit of co-operation which is so important in bringing about the co-ordination of human activities, which is one of the main purposes of organized standardization.

In this connexion, a large manufacturer of machinery in the United States wrote some years ago, in reply to a national survey made by the American Standards Association:

> "Aside from reduction of stock items, the greatest benefits of a standardization program are largely intangible. One cannot measure in dollars the countless petty arguments, needless conferences, time-consuming searches through catalogues, eliminated through standardization. As a training device for new personnel to obtain optimum performance in a minimum of time, the standards manual cannot be surpassed in effectiveness. Direct effects on consistency of high product quality and benefits obtained in reduction of scrap are not measurable in a tangible sense".

This statement, made on behalf of a large enterprise in a highly industrialized country applies equally to a small enterprise in a country that is just beginning to develop its industrial enterprises. The differences between the two cases is one of degree and not of principle.

Chapter 2

THE NATIONAL STANDARDS BODY

Significance of the National Standards Body

One of the essential functions of organized standardization is the co-ordination of human activities into harmonious and, hence, optimum co-operation. This co-operation is bound to expand from a lower level of operation to a higher one - in some cases all the way up to the international level.

The basic principles of the formulation of standards, the co-operation between parties interested in their establishment and the organization for operation of standardization work are the same for all of the four levels previously discussed. However, the organization and procedure of standardization work at the national level, and particularly the establishment and management of a National Standards Body (NSB), have special significance for the technical and economic development of a country, for two major reasons.

One reason is that an NSB is indispensable as the central co-ordinating agency for standardization work undertaken within the country. A major function of the NSB is to put the national house in order in regard to problems of industrial standardization. To perform this function effectively, the NSB must have the reputation of being both authoritative and impartial. All interested parties should be convinced that the NSB is there to assist them - not by dictating to them, but by making it possible for them to reach their own decisions on the standards they will want to use.

The second reason is that an NSB occupies a special position in the world-wide picture of standardization as the only agency in a country that can truly represent its national standardization activities at a regional or general international level.

Because of this special significance of a National Standards Body as an institution in its country, its functions, status, organization and procedure will be discussed here on the basis of a review of the National Standards Bodies now in operation throughout the world. 1/ This discussion is presented with the idea that in the course of time an NSB will be founded in every country planning to introduce organized standardization at the national level.

1/ The organization and procedure of the National Standards Bodies, Member Bodies of the International Organization for Standardization (ISO), are described in the publication ISO/INF-2, General Information on ISO Member Bodies.

Functions of a National Standards Body

By the National Standards Body in a country we shall understand the organization having the following main objects:

(1) to supervise and co-ordinate standardization work at the national level through co-operation of the interested parties with a view to the establishment of national standards;

(2) to serve as the national channel for co-operation in the co-ordination of standardization work in two or more countries, including work at a regional or at the general international level;

(3) to promote standardization as a technical activity and as an integral yet distinct function of management;

(4) to keep in touch with foreign National Standards Bodies for the exchange of information of common interest and

(5) to serve as the national centre of information on subjects in the field of standardization.

The concept "interested party" is an important one in organized standardization. The term is used here to designate an individual person, group or organization whose activities may or will be affected by the establishment of a standard. This designation is independent of the question of whether or not the party itself is aware of its interest. Sometimes a party may come to realize that it has an interest in a standard only after it has begun to be developed or even after it has been completed. Also, the term "interested party" should be taken to cover a party that is opposed to having any standard at all.

By a "national" standard we shall understand here a standard formally approved by the National Standards Body in the country concerned. This designation is, therefore, independent of (1) whether the standard is published by the national government or by a private organization, and (2) whether the standard is intended for voluntary adoption by those who want to use it or whether its use is made mandatory by the government. For example, a national standard may be published by the government because the NSB in the country concerned is a governmental agency. It may be designated as an "official" standard, yet its use may be voluntary and become mandatory only by special decision of the government. 2/

Organization and procedure of a National Standards Body

A National Standards Body may be organized upon the initiative of any group, organization or combination of organizations which have come to the conclusion that standardization in their country should be co-ordinated at the national level.

2/ In Mexico, the term "official standard" applies to a standard published by the Government and in Iran, to a standard made mandatory by the Government (see annex I).

[illegible] of the NSB's now in existence show a variety of administrative structures which fall into three main classifications. The NSB may be an agency of the national government coming, for example, under the Ministry of Industry and Commerce. 3/ Or it may be a private organization without any official ties with the government. Or again, the NSB may be governed by a board or council in which both private industry and the government are represented. 4/

Supervisory body

Whatever may be the administrative structure of an NSB, it must comprise an agency in charge of supervising the work and making judicial decisions on the major steps in the development of national standards and their final approval. This agency, which may appear under different names in the various countries, will be called here the Standards Council of the NSB. It may consist of representatives of the Member Bodies of the NSB, including private organizations and agencies of the government. 5/

As the NSB grows in size, the Standards Council may delegate some of its functions to smaller supervisory units, called here Standards Boards, each of which is responsible for the work in a particular field, such as mechanical engineering, civil engineering, safety standards, consumer goods standards, and the like. 6/

Standards Councils and Standards Boards do not take an active part in the formulation of standards. Their functions of supervision and co-ordination should be performed in a judicial manner.

Trained staff

Because of the functions the NSB is expected to perform, it needs the assistance of one or more trained standardization specialists - that is, specification writers or standards engineers. Both the supervision and co-ordination of standardization work at the national level and national co-operation in international standardization call for administrative services that can be rendered only by those conversant with the principles of organized

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3/ As in Mexico: see annex I.

4/ See annex I.

5/ In Colombia, the supervisory body is the High Council; in Egypt and Iran, the Council; in Pakistan, the General Council, and in Turkey, the General Assembly (see annex I).

6/ In Pakistan, the General Council has six Divisional Councils, each of which supervises a specific field of activity (chemical, textile, etc.) and appoints "sectional committees" in charge of preparing drafts of national standards in this field. See the section below on "Technical committee method" and annex I.

standardization, skilled in the application of these principles and capable of interpreting the NSB procedure. Even if all the members of the Standards Council or a Standards Board had these qualifications, they would not have the time to take care of the administrative details involved in handling the project work. This is clearly a staff assignment.

Trained staff is needed also if the NSB is to promote effectively the use of standardization, both as a technical activity and as a function of management. This is an educational job requiring much time and effort. Once individual enterprises have become convinced of the value of standardization, the NSB will receive requests for information on problems that have arisen in organizations desirous of setting up some standards of their own, or planning to systematize their internal standardization work. In addition, promotion of the NSB work, including efforts to secure financial support of its growing activities, will call for the preparation of articles and the presentation of talks and papers by members of the NSB staff.

Finally, contacts with foreign NSB's and information service to interested parties throughout the country - and even resulting from inquiries from abroad - will increase the workload on the NSB staff and call for more manpower.

In any newly industrializing country planning the introduction of organized standardization, the need for trained standardization specialists is likely to be a problem. Some suggestions on the solution of this problem will be made in the section below on "Organizational steps". 7/

Establishment of national standards

A national standard may be established by different methods, depending on the conditions existing in the country concerned and on the organization and procedure of the NSB. Thus, it may be possible that in the same country one standard is completely developed by an organization independent of the NSB and then submitted to the latter for approval, whereas another standard is developed from the beginning under the procedure and close supervision of the NSB. Or possibly the NSB may delegate this supervision to another organization which, as a "sponsor body", will be responsible for the progress of the work and observance of NSB procedure.

While there is great merit in keeping the method by which a national standard may be developed as flexible as possible, it is recommended that the decisions on the major steps in its development - particularly the final approval - be made on the basis of a consensus of the interested parties (see below, "The consensus principle").

The case of a national standard being developed from the beginning under the procedure of the NSB will be discussed here in some detail. The reasons for this are that this method clearly shows the basic procedure to be recommended for an NSB and, further, that it has some special interest for newly industrializing countries. If there is a need for a national standard in a

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7/ See also annex I.

[illegible] country has no previous experience, and no satisfactory [illegible] can be taken over from another country, it will be necessary to develo[illegible] and the chances are that the ISO will be the only organization with the authority and facilities needed to initiate and complete the project.

The major decisions to be made in handling a national standardization project of this nature are:

(1) initiation of a standardization project intended to lead to the development of one or more standards on the subject concerned;

(2) formulation of the scope (terms of reference) of the project;

(3) the method by which a standard, or standards, shall be developed; and

(4) approval of the proposed standards by the NSB.

The consensus principle

In various phases of the development of a standardization project a decison will have to be made on the basis of a vote. Examples are a vote in a technical committee on a draft standard formulated by its members and a vote in the Standards Council of an NSB on the approval of such a draft as a national standard. 8/

The vote of a member representing an interested party will carry a weight depending on the status of this party in the field covered by the standard. The consensus principle is based on the viewpoint that votes on important decisions - in this case, on steps in the NSB procedure - should not merely be counted as affirmative or negative votes, but that each vote should also be given a rating dependent on the importance of the party for which the vote is cast. The decision will then depend on the difference between the sum of the rated votes cast in the affirmative and the sum of the rated votes cast in the negative.

The assignment of a rating to a vote contains an element of judgement and hence is partly subjective. It is essential, therefore, that whenever the consensus principle is applied, those taking part in making the decisions maintain a strictly judicial attitude. Application of the consensus principle may be likened to the procedure of a jury in court whose members are expected to use their fair judgement in reaching a verdict, yet may weigh the various testimonies received on the basis of the honesty and credibility of those who made their depositions as witnesses.

The question may be raised why an NSB should not base its final approval of a national standard on the latter's technical content. The answer is that this would not be compatible with the principle that in developing a national standard all of the interested parties should be permitted to take part in the project and, hence, have an opportunity - as well as the responsibility - to be represented on the body developing the standard by their ablest technical

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8/ See the section below on "Technical committee method".

specialists. In other words, the body developing the [illegible] considered, collectively, as the highest authority in the [illegible] what the technical content of the standard should be. It would, therefore, be logical for the NSB, in deciding on final approval of a standard, to consider itself as a group having superior technical knowledge on the subject as compared to the body of technical specialists who developed the standard. Rather, the NSB should ask whether the specialists have reached consensus.

Initiation and scope

The initiation of a national standardization project may result from a request or proposal submitted to the NSB by any party having an interest in the establishment of a national standard or standards in the field concerned. The request may come from a group of user interests who are bothered by the lack of quality standards for the products they are regularly buying, or from a group of manufacturers concerned with the wastefulness of having to make too many varieties to the disadvantage of themselves and their customers. 2/ Or again, an industry, having reached the conclusion that safety measures in its field should be established and made mandatory by law, may request that such measures be developed, under the procedure of the NSB, as a basis for legislation by the national government.

Since it is a principle of organized standardization that standards shall be formulated by co-operation of the interested parties, it is the responsibility of the body in charge of the development of a national standardization project to determine to the fullest extent possible which parties should be assumed to be interested in the work. This survey should be made regardless of whether an interested party is or is not willing to co-operate in the project. It may happen that an interested party at first pays no attention to a project, only to decide later that it does have an interest in it and, in fact, wants representation on the group in charge of formulating the standard. Obviously, participation in a project by an interested party, even if proposed or requested at a late date, should be welcomed by the NSB, simply because nothing should be left undone to secure the most complete co-operation and ultimately the most complete expression of consensus obtainable.

The first question to be decided when considering a proposed national standardization project is whether there is a need for a standard or standards in the field concerned. In general, this question can be answered intelligently only if the proposal is accompanied by a statement of scope (terms of reference), that is, a statement of the ground which the project will be authorized to cover. Thus, the scope may indicate that the standards to be developed will deal only with the dimensions of a manufactured product, but not with the materials of which it is made. Or, it may show that its purpose is to set up a series of capacity ratings, say, of pumps, but that the design of the pumps will not be covered. It has been found that the concept of "scope" or "terms of reference" is apt to be confused with the programme adopted for the work on a project. Briefly stated, the scope indicates how much ground the project may cover,

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2/ See the explanation in chapter 1 of the term "simplification".

whereas the programme shows what subject matter will be dealt with, and in what order. Accordingly, the programme of work must remain within the boundar of the scope, but not all of the subject matter that may be dealt with under the scope will be taken up. For example, in the United States the scope of a national standardization project dealing with colours for industrial apparatus and equipment permits the committee in charge to develop standards for any colours it wants to take up. However, so far the committee has confined itsel to preparing a standard for only four grey colours. Upon its completion, the committee found that there was no general interest in a national standard for any other colour, at least for the time being. Being representative of the interested parties, the committee may make its own decision on when to start work on additional colours.

Formulation of a scope of work is necessary not only for those dealing wi a project as a guide which tells them how far they can go; is is also necessary to prevent overlapping of activities on two or more projects.

Methods of development

Once the initiation of a standardization project and its scope have been decided, the next question that arises is by what method the standard or standards shall be developed. (For the sake of simplicity we shall assume that only one standard is to be developed.)

Various methods of development have been adopted in the procedures of the NSB's now in existence. They were chosen with regard to the conditions prevailing in each country, as they should be wherever organized standardizatio is introduced at the national level. However, all of these methods show some guiding principles which will be discussed below.

Existing standards method

A national standard may be needed to replace a number of divergent practic and possibly standards, adopted by individual groups and organizations in a country.

If one of the existing practices or standards is found to merit approval as a national standard (this to be decided by a national consensus of the interested parties), there is a fair chance that the project may be completed in a rather short time. For example, the organization whose standard has been found to be suitable as a national standard may submit it to the NSB, with an exhibit of the national consensus supporting it. This will be sufficient for the NSB to approve the proposal formally as a national standard. 10/

Technical committee method

If there are in existence several traditional practices, and perhaps different standards adopted by individual organizations, and if none of these

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10/ For example, in the United States many standards developed by the American Society for Testing and Materials have been submitted to the American Standards Association and approved by this body as national standards.

fully meets the requirements of a national standard, the problem is often complicated. Every interested party is likely to try to get its own practice or standard adopted as the national standard or, at least, to get as much of its content as possible written into the national standard. The chances are, therefore, that many conflicts of interest may have to be resolved before a general agreement on a single national standard can be reached.

Experience shows that such agreement can usually best be reached - and, in some cases, can only be reached - by referring the development of the standard to a group of technical specialists known in various NSB procedures as "technical committees", "sectional committees", "working committees", or the like. We shall use here the term "technical committee" as being indicative of the nature of its membership. 11/

Organization of a technical committee

A technical committee may be organized directly by the NSB or by delegation of authority for guidance and supervision of the project by another organization designated as the sponsor. Usually this sponsor body is one of the interested parties. Often it is the organization that requested the initiation of the project and offered at the same time to be its sponsor if and when the initiation would be approved by the NSB. 12/

It should be clear that the position of the sponsor in regard to the handling of the project does not entitle it to any special privileges as compared with the other interested parties. On the contrary, the sponsor will have to be careful in handling the project in a truly judicial manner. Also, it will have to observe NSB procedure and keep the NSB informed about the progress of the work.

Technical committees in charge of developing national standards may or may not be part of the NSB. Whether organized by the NSB or by a sponsor, the technical committee should be free to develop the standard it has in charge on the basis of its best judgement. Thus, it will have the authority, for example, to organize sub-committees, and sometimes still smaller working groups, if this is found to be desirable for the quality or speed of its work.

The work of a technical committee may be done in meetings or by correspondence. Much of its success depends on the leadership of the chairman who may be elected by the committee or appointed by the body supervising the project, the NSB or the sponsor.

11/ Technical committees are found under this name in Iran, Turkey and the United Arab Republic, as "technical commissions" in Colombia and Venezuela and as "sectional committees" in Pakistan (see annex I).

12/ In the United States the sponsorship system is often used. Thus, the American Society of Mechanical Engineers is a sponsor or joint sponsor for many projects in the mechanical field being developed under the procedure of the American Standards Association.

Membership of a technical committee

This will consist mostly of representatives of interested parties who should preferably be appointed by their own organizations, upon invitation by the NSB or the sponsor. The interested party should be expected to know best who should be chosen as its most effective representative. By accepting an invitation from the NSB or the sponsor to appoint a man, the interested party has an opportunity to make its own choice. Also, it thereby assumes the responsibility to contribute actively to the work of the technical committee.

The membership of a technical committee may also include, in addition to representatives of interested parties, a number of "independent" members, such as research men, professors or consultants. They usually serve by invitation of the NSB, or the sponsor body, or of the technical committee itself. 13/

Balance of membership classification

Where a project involves representation of interested parties holding basically opposite views on certain matters - as may be the case with manufacturers and users - the NSB procedure should make provision for a balance of membership classification in the committee handling the project. This means that the membership should be so distributed between the different classes of representatives (say, manufacturers, users, distributors and general interests) that no single group can outvote the rest of the membership.

In some cases such a balance is difficult or even impossible to establish. The NSB may then waive this requirement provided that the membership groups who may be outvoted declare that they do not object to the lack of balance. In fact, it may happen that a technical committee, operates quite smoothly in spite of the lack of a balance of membership classification. However, for reasons just stated, the NSB may make it a rule that the membership of a technical committee has to be submitted to and approved by it before the committee starts its work.

National canvass

In order to give all interested parties - even those which are not represented on a technical committee - a chance to express their opinion on a proposed national standard, its draft may be published and circulated for comment and criticism. The returns are then reviewed by the technical committee and usually lead to some amendment of the draft.

When the technical committee has reached general agreement - possibly after having sent out several drafts - the final proposal is submitted to the NSB for approval as a national standard. If the NSB is satisfied that a national consensus exists, it will give its approval. Otherwise, it may refer the proposed standard back to the technical committee for further consideration and an effort to establish the required consensus.

13/ Independent members vote on the basis of their personal opinion, in contrast with representatives of interested parties who are expected to vote on the basis of the collective opinion of their organization or group.

Assistance in the formulation of standards

There are various ways in which assistance may be given to the technical committee with a view to casting the standard being developed into the most effective form as a specification.

A member of the committee may possibly qualify not only as a technical specialist but also as a standardization specialist. For example, a trade association or technical society having a trained standards engineer on its staff may appoint him as a representative. Such an expert may render valuable service in the writing of specifications by serving both as a member of the committee and as its secretary.

If no arrangement of this kind can be made, the sponsor body may be able to supply the necessary assistance by assigning one of its own trained specification writers or standardization specialists to the committee work. Again, if this is not possible, the NSB may have a staff member available to serve with the technical committee - not as a member, but as its secretary and without a vote. However, in principle, this latter arrangement should be entered into only as a last resort. An advantage of the sponsorship system is that it relieves the NSB of direct supervision of national projects. Staff assistance given by the NSB, having the opposite effect, increases the load on the NSB, and there is a practical limit to the possibility of such service. Especially in the early period of its existence, an NSB may not be able to spare any staff and may itself, in fact, be looking for more trained help.

New fields of work

In discussing the technical committee method, it has been assumed that its use was made necessary by various groups or organizations. The technical committee method may also be needed, however, where a standard is to be established in an entirely new field, that is, one where no standards have as yet been set up and no traditional practices crystallized.

Where such practices are lacking, there may exist the concomitant disadvantage that technical information is not available, but this may be compensated for in part by the fact that no resistance need be expected from interested groups reluctant to abandon their established methods. Hence, those in charge of formulating the standard will have a free hand to "design" it on the basis of an analysis of the problems involved, without having to compromise with traditional practice.

Such cases should be of particular interest to newly industrializing countries. The very fact that they have not so far established standards may permit them to start projects for the development of national standards on a rational basis.

Conference method

If a national standard to be developed is of a simple character, it may be possible to handle the project without the organization of a technical committee. It may be sufficient to have a temporary small drafting committee prepare a proposal, submit it to a general conference of representatives of interested

parties, have it approved (probably with some modifications) and sent to a natio canvass of interested parties, to determine if it is backed by a consensus. 14/

Co-operation with foreign National Standards Bodies

For many years, what is now the British Standards Institution, founded in 1901, was the only NSB in the world. During and shortly after the First World W a series of additional NSB's was organized (Germany, 1916; Netherlands, 1917; United States, 1918, and so forth). They soon found that it was important to exchange information on their activities, particularly with a view to co-ordinat or, if possible, unifying the national standards in their respective countries. Increasing international trade and transportation influenced these trends. The then existing NSB's also decided to keep each other informed, not only on what had been done or was being done, but also on what was being planned to be done. This conclusion was based on the consideration that once a national standard has been established, possibly after a number of difficulties between interested parties have been resolved, a country will probably not be inclined to revise it solely for the purpose of reaching agreement with another country or countries. The chances of compromise and agreement on a uniform multinational standard appea to be better while a national standard is still in the course of development. Therefore, at a conference held in London in 1921, the NSB's present arranged to keep each other informed about the status of their projects from the beginning. 1

Use of national standards

One function of an NSB is to promote the establishment of national standards Another is the promotion of standardization as a function of management.

Voluntary or mandatory use

The NSB should make every effort to have the national standards introduced into the widest possible use. In this connexion the question arises whether the adoption of a national standard should be voluntary or mandatory - that is, wheth the decision to use, or not to use, a national standard should be left to each of the interested parties or whether its use should become a requirement once it has been approved by the NSB. This question is not a simple one. Its answer depends mainly on the character of the standard under consideration and on the status of NSB in its country.

Let us first consider the case of an NSB as an autonomous body controlled solely by private industry or jointly by private industry and the government. After a national standard has been approved by the NSB, it may be published by that body or by the sponsor of the project under which the standard was developed.

14/ In the United States, the ratio 25:4 between the inch and the millimetre was made American standard for industrial use by the conference method (1933

15/ Another example of regional co-operation in standardization is the Permanent Technical Committee for Standards formed by the Arab League.

review shows that in many cases national standards are in practice recommendations by the NSB for voluntary adoption in practice, [illegible] being based on the consensus in favour of the standard reached by the interested parties.

The government, as an interested party, may decide to make the standard mandatory for the government services. For example, it may be concerned with a commodity regularly purchased by the government; in this case the government action in making its use mandatory is similar to that of a private organization adopting it in its transactions. However, the government may also make the use of a national standard mandatory for certain branches of industry or for the protection of the health and safety of the general public. Thus, a safety standard developed under the procedure of the NSB may serve as the basis for legislation to protect workers, say, in chemical plants or foundries, or to protect the general public against hazards of transportation, as in the case of traffic codes and the like.

In such cases the NSB has nothing to do with the decision to make the use of the standard mandatory or with the enforcement of compliance with the standard. However, it may, at the request of any interested party (including the government), make its procedure available for the development of a national standard intended to become the basis for legislation. The advantage to all parties will be that the national standard thus developed, when submitted to the legislative body, will already have obtained the backing of a national consensus.

The principle that a national standard shall be considered as a recommendation for voluntary use may be adopted also by an NSB which is a governmental agency that follows a procedure whereby national standards are developed through the co-operation of the interested parties. Here, the government may even publish the national standards as "official" standards, though without any obligation for their use except in cases where it explicitly makes them mandatory.

Finally, there is the case where the NSB is a governmental body and all standards approved by it are made mandatory and are, therefore, enforced by law. 16/

Fundamental standards of measurement

Among the standards needed by a country, the fundamental ones of measurement (weight and length) are in a class by themselves. They are the basis for accuracy in scientific and industrial work and, hence, are indispensable in the formulation of specifications and standards. Without them, there can be no question of a specification meeting its two essential requirements: that of serving as a clear and complete communication and that of serving as a criterion for acceptance or rejection.

16/ In the seventeen countries reviewed as examples in annex I, the use of national standards is mostly voluntary. In the Soviet Union, all national standards are "state standards" and their use is made mandatory for all organizations and enterprises. Czechoslovakia and Hungary are two countries where most of the national standards are mandatory (deviations being possible by special permission), and the balance are considered as recommendations only.

Fundamental standards of measurement, therefore, are among those whose use must be made mandatory by the government. The major reason for this lies in the importance of these standards to every citizen in the country. They affect the things he daily buys and sells, as well as the scientific and technological progress of the world in which he lives. Consequently, these standards are a primary matter of public interest.

Another reason for legal enforcement is the fact that the introduction of these standards usually meets with considerable resistance. Those expected to use them are loath to part with their traditional practices and are unlikely to accept the new standards unless their use if made mandatory.

Bureau of Standards; Weights and Measures Administration

It thus appears that the effective introduction of industrial standardization under the procedure of an NSB depends in practice on the establishment of two additional organizations.

One of these is an agency whose main function is the custody, maintenance and development of national standards of measurement and the provision of means and methods for making measurements consistent with those standards. We shall call this agency, for the purpose of this discussion, the country's Bureau of Standards (BS).

The other agency is to be in charge of the enforcement of compliance with the weights and measures standards. This agency will be called here the Weights and Measures Administration (WMA).

The BS will require a central laboratory and the WMA in general will need testing laboratories throughout the country for the local enforcement of the use of the standard weights and measures and to assist industry and commerce in solving their problems in this field. To perform their functions, the BS and the WMA also need special equipment and staff specially trained in the principles and application of metrology.

Their functions are thus essentially different from those of the NSB, and these two agencies, indispensable as they are in the complete picture of national industrial standardization, should not, therefore, be considered as integral parts of the NSB organization. However, because of their importance to national (and international) standardization, they are considered here in their relationship to the NSB.

When a newly industrializing country has still to establish all three agencies mentioned here (the NSB, the BS and the WMA), they may have to combine them to begi with in a single department located, for example, in the Ministry of Industry and Commerce. However, as the standardization work grows it may be found preferable to create three separate units, two of them (the BS and the WMA) remaining government agencies and the third (the NSB) becoming an autonomous unit supported by industry and the government.

In practice we find that a country's NSB may have originated as a central national institute for industrial or technological research, or as a central

[illegible] national testing laboratory, which was later reorganized [illegible] two or more divisions, one of which became the [illegible].

Certification: conformity mark

In some countries the NSB permits those complying with [illegible] to certify this by placing a conformity mark, adopted by the [illegible], on the products they are making or selling. Such a plan has its value in that conformity with a national standard is apparent at first sight. It also gives the assurance of [illegible] of performance or quality.

However, the organization and administration of such a plan do not belong to the essential functions of an NSB and may, in fact, be assigned to a separate organization.

Financing a National Standards Body

The expenses of an NSB consist mainly of the salaries of the technical and clerical staff, their travel and other expenses, operation and maintenance of the headquarters office (and, sometimes, branch offices), publication of standards and other material, membership dues (such as those paid to the International Organization for Standardization) and the like. Income is mainly from membership fees and contributions made by private enterprises or the government or both, from the sale of standards and, sometimes, from licence fees for the use of a conformity mark.

The typical NSB is a non-profit organization dedicated to serving industry, commerce, the general public and the government, and taking a strictly judicial attitude towards problems and conflicts arising in its activities.

Financing an NSB may be a problem in itself. The NSB may reasonably hold that in principle every business enterprise in the country, and its national government, should share in its financial support since they all benefit from the results of its work. However, it may take a long time for this idea to become generally accepted and the NSB, unless it is a governmental agency, may depend for its income mostly on contributions made by the relatively few organizations having a special interest in some of the projects handled under its procedure. In fact, some of these projects might not be undertaken at all unless financial support from one or more of the interested parties was forthcoming.

Contributions of this kind should be welcomed, though with the definite understanding that they cannot be permitted to affect the judicial attitude which the NSB must maintain.

Organizational steps

The organization and operation of industrial standardization at the national level is a complicated problem. To be most effective, it requires the establishment of a National Standards Body with an organization and procedure closely fitted to the conditions of the country concerned.

Moreover, the functions of the NSB and the results of its work depend direc[tly] on the efficient operation of the Bureau of Standards and the Weights and Measur[es] Administration. If it is held that the standardizer should always try to specif[y] his requirements in terms of measurement - this being the highest form of being specific - then he should have the essential standards of measurement at his disposal.

It follows that to cover the entire field of industrial standardization at the national level, a country should have in operation all of the three agencies just mentioned (the NSB, the BS and the WMA).

This chapter is concerned solely with the organization of an NSB and the steps to be taken to put it into operation, including the training of staff.

To any newly industrializing country considering the introduction of organiz[ed] standardization, it can be generally recommended that:

(1) a standardization specialist be invited to survey the situation in the country and given the widest possible opportunity to explain the fundamentals and practical application of organized standardization to interested groups;

(2) consideration be given to the question of whether it would be advantageous to join with other countries in the same region in establishing a common standards body;

(3) the consultant, in co-operation with the interested groups, draft a constitution, by-laws and procedure for the future NSB;

(4) attention be given, in the meantime, to the initiation of some importan[t] projects to demonstrate the way in which organized standardization work[s] and, at the same time, that a start be made to improve existing conditi[ons]

(5) the consultant start the training of staff by means of lectures, semina[rs] and conferences;

(6) one or more staff members be sent on a study trip abroad to visit forei[gn] NSB's, BS's and WMA's and such other organizations, private or governme[ntal] as may be of interest to their own country;

(7) the country consider affiliation with the ISO, or, for the time being, with an organization for regional international co-operation in standardization; and

(8) a review be made of the lists of ISO Recommendations and foreign nationa[l] standards to determine if any of these are suitable for adoption in the country concerned.

It is of interest to summarize here the recommendations on the conduct of national programmes of standardization made by the second session of the Middle Ea[st] Standardization Conference, which met in Cairo, Egypt, in February 1961.

"The establishment of national standardization [illegible] expedited in those countries which have [illegible]. These national organizations should [illegible] the International Organization for Standardization and other international [illegible] concerned with specifications and measurements, and in particular the International Organization for Legal Metrology, and should also participate [illegible] the activities of the technical committees of these international organizations to gain experience and to assist in international industrial co-operation in the fields of specifications and measurements.

National and international organizations should be requested to grant financial and technical assistance to those countries which have not yet established technical bodies for specifications and measurements, to enable these countries to form such bodies.

Member countries and international organizations should work towards the co-ordination and unification of standardization systems to develop their industries and to raise the standard of the quality of their production.

Symposia and training courses should be organized in the fields of specifications, measurements, technical inspection and quality control. Immediate action should be taken for training personnel, at all levels, for specifications and measurements work, and for laying down a special system for the interchange of specialists, in co-operation with national and international organizations.

In the fields of specifications and measurements, it is necessary to establish technical committees working in co-operation with other organizations concerned with the unification of scientific and technical terms in different languages."

Chapter V

INTERNATIONAL STANDARDIZATION ACTIVITIES

Structure and functions of the International Organization for Standardization

In 1926 the National Standards Bodies of twenty countries met together and formed the International Federation of the National Standardizing Associations (ISA). The ISA became functus officio in 1942. In 1944, the United Nations Standards Co-ordinating Committee (UNSCC), comprising the national standards bodies of eighteen allied countries, succeeded the ISA, and was primarily a war-time organization. On 14 October 1946, the UNSCC met in London, together with representatives of seven other countries not members of the UNSCC, to discuss the creation of a new international standardization body. The London Conference constituted itself as the International Organization for Standardization (ISO) and held a provisional General Assembly at once, during which the ISO Constitution and Rules of Procedure were adopted. On 15 February 1947, with the receipt of the fifteenth ratification, the ISO began its official existence. The object of the Organization, given in article 2 of its Constitution, is "to promote the development of standards in the world with a view to facilitating international exchange of goods and services and to developing co-operation in the sphere of intellectual, scientific, technological and economic activity".

The ISO, "as a means to these ends, inter alia, ... may:

Take action to facilitate co-ordination and unification of national standards and issue necessary recommendations to Member Bodies for this purpose;

Set up International Standards provided, in each case, no Member Body dissents;

Encourage and facilitate, as occasion demands, the development of new standards having common requirements for use in the national or international sphere;

Arrange for exchange of information regarding work of its Member Bodies and of its Technical Committees;

Co-operate with other International Organizations interested in related matters, particularly by undertaking at their request studies relating to standardization projects."

The members of the ISO are the National Standards Bodies, one for each country, most representative of standardization in that country. As of 1 January 1964, there were fifty Member Bodies, the represented countries being as follows:

[illegible]	Germany (Federal Republic of)	[illegible]
[illegible]	Greece	[illegible]
Australia	Hungary	[illegible]
[illegible]	India	[illegible]
[illegible]	Indonesia	[illegible]
Brazil	Iran	[illegible]
Bulgaria	Israel	Spain
Burma	Italy	Sweden
Canada	Japan	Switzerland
Chile	Korea (Republic of)	Turkey
Colombia	Lebanon	Union of Soviet Socialist Republics
Cuba	Mexico	
Czechoslovakia	Morocco	United Arab Republic
Denmark	Netherlands	United Kingdom
Eire	New Zealand	United States of America
Finland	Norway	Venezuela
France	North Korea	Yugoslavia

Also of that date, the ISO had about 100 Technical Committees and had issued 361 Recommendations.

During the early period of its existence, an NSB of a developing country may not have much opportunity of taking an active part in the work of the various Technical Committees, but it may be greatly interested in the development of particular standards and Recommendations. In this way, it will have the benefit of thousands of man-hours of the time of front-rank specialists in the field, resulting in a product which meets up-to-date technological standards.

The structure of the ISO comprises the following organs.

(1) The General Assembly. This is constituted by a meeting of delegates nominated by Member Bodies. As a rule, it meets at least once every three years. Since the inception of the ISO, the General Assembly has held meetings in Paris in July 1949, in New York in June 1952, Stockholm in June 1955, Harrogate in June 1958 and Helsinki in June 1961. A sixth meeting is scheduled to be held in New Delhi in November 1964.

(2) The Council. Composed of the President and fourteen elected representatives from the General Assembly, the Council is the administrative organ of the ISO. It meets at least once a year to inquire into the activities of the Organization and to prepare its annual report to the General Assembly. The Council appoints a Supervisory Committee to assist the President in supervising the activities of the General Secretariat. It is the General Secretary who, as the chief administrative officer of the Organization, effects liaison between Member Bodies and the Council and represents the Organization in its relations with other international organizations. At the technical level, he co-ordinates the activities of the Technical Committees.

(3) Technical Committees. These are composed of the representatives of such Member Bodies as wish to take part. A member which does not actually participate in a Technical Committee can be kept informed of the proceedings by registering as an observer.

(4) The International Electrotechnical Commission (IEC). The IEC had its origin in 1904 when the International Congress of Electricity first created a representative Commission to perform functions of co-operation and liaison between different countries. In 1947, it was affiliated to the ISO. While preserving autonomy, in practice it functions as the Electrical Division of the ISO.

The IEC is an international non-governmental organization enjoying consultative status (category B) with the United Nations Economic and Social Council. A representative of the IEC at United Nations Headquarters ensures liaison with the United Nations and other liaison officers perform similar functions vis-à-vis the various specialized agencies and regional commissions. 1/

A request to undertake a study of a technical subject may be initiated by any organization within or outside the ISO.

At the request of an ISO Member Body, a Technical Committee may be set up to conduct the work necessary to develop an international standards recommendation. Participation of five members is the minimum necessary to initiate a project. One member, usually the proposing country, is appointed to handle the secretariat of the Technical Committee which outlines a programme of work and circulates it to the other members of the Committee. As necessary, international meetings are held to facilitate the work through personal discussion. The decisions of the Committee (ascertained by voting) are embodied in a draft recommendation which is circulated to all members for acceptance, comment or disapproval. When a draft has been accepted by 60 per cent of the members voting, it is sent to the Council. Whatever the Council approves becomes an official ISO Recommendation. The acceptance or use of a Recommendation is entirely voluntary.

The Council may decide whether a Recommendation should be resubmitted to the Member Bodies for adoption as an ISO standard. As of 1 January 1964, this procedure has never been invoked.

The procedures of the IEC, with minor differences, more or less follow the ISO procedures.

The main divisions of the ISO classification, as of 1 January 1964, are given in annex VII.

1/ In its capacity as a non-governmental organization, the ISO transmitted a statement to the Council on co-ordination of international activities in the field of standardization (document E/C.2/240 dated 26 January 1950), in which attention was drawn to the need for co-ordination of standardization activities at the national level and proposing the ISO as the organ competent to ensure such co-ordination. In 1962, the President of the ISO made a statement before the Economic Commission for Europe on "Standardization as a means of achieving scientific, technical and economic progress" (E/ECE/NGO.4; see also resolution 4 (XVII) of the Economic Commission for Europe). The ISO has also declared its intention to be of assistance, wherever possible, in the development of national standardization work in newly developing countries.

I. [illegible] International Bureau of Weights and Measures

[illegible] people [illegible] International [illegible]
[illegible] International Bureau of Weights and Measures (IBWM). [illegible]
[illegible] French Government, some twenty-eight countries [illegible]
[illegible] subject. As a result of this preliminary [illegible]
International Bureau of Weights and Measures was established [illegible]. It
concerned itself only with the metric system; the British units were not yet
either were the American. In 1921 a new Convention came into being [illegible]
the scope to include electrical units and standards. These electrical units were
finally given world-wide recognition in 1948.

The functions of the IBWM include:

Comparisons, verifications and calibrations of international, national and other standards;

Custody and preservation of physical standards;

Investigations of new standards of weights and measures.

Its executive organs are:

A General Conference, usually convened once every six years, composed of government delegates and members of the International Committee;

An International Committee of Weights and Measures, composed of eighteen members, each from a different Member State;

Consultative Committee called to advise the International Committee;

The International Bureau, the structure and composition of which will be found in the Statute creating the Organization.

As of 1964, the membership of the IBWM, as given by the Bureau, is as follows:

Argentina	Hungary	Spain
Australia	India	Sweden
Austria	Indonesia	Switzerland
Belgium	Ireland	Thailand
Brazil	Italy	Turkey
Bulgaria	Japan	Union of Soviet Socialist Republics
Canada	Korea	United Arab Republic
Chile	Mexico	United Kingdom
Czechoslovakia	Netherlands	United States of America
Denmark	Norway	Uruguay
Dominican Republic	Poland	Venezuela
Finland	Portugal	Yugoslavia
France	Romania	
Germany	South Africa	

The IBWM is affiliated to the United Nations Educational, Scientific and Cultural Organization by Protocol dated 27 June 1949. Its headquarters are at the Pavillon de Breteuil, Sèvres, Seine-et-Oise, France.

Regional co-ordination of standardization

A country may be interested in co-ordination and, where possible, unification of its own national standards with those of other countries in the same geographical region. These countries may have mutual trade arrangements or they may supply to some kinds of products to other parts of the world. This common interest in certain standards, although important to the countries concerned, may not warrant initiation of projects at the general international level, for example, under ISO procedures. In fact, if fewer than five countries are interested in a project, it is not possible to organize an ISO Technical Committee.

A situation of this kind may lead to the organization of co-operation in standardization at a regional international level. In principle, this will require the organization of an NSB in each of the participating countries, with one of them functioning as the central co-ordinating agency. An example is the organization of the Pan American Standards Commission and, in a more restricted region, a plan for co-operation in standardization between five Central American countries which have recognized the value of standardization to their recently signed General Treaty for Central American Economic Integration.

Such regional co-operation may be of interest to many of the new nations. In the early stages of their standardization work, when representation at a level higher than their own regional level is not yet warranted, they may find it useful and sufficient to be represented at the higher level as a group until such time as individual representation becomes desirable. In this way each country may be able to proceed gradually from one level to another, ending up with representation at the ISO. Of course, the country may apply for membership at a much earlier stage if it wishes to do so.

Chapter 4

IN-PLANT STANDARDIZATION

While the principles of standardization are of general validity, their application in areas of activity of a manufacturing enterprise depends upon conditions which vary from country to country, from industry to industry and also from one location in industry to another. In developing countries, such factors as foreign collaboration, shortages of materials and the like, are additional considerations to be taken into account when formulating specific standardization programmes. The problems that any company faces will eventually be minimized by the establishment of an organized in-plant standardization programme, since the programme requires that once a recurrent problem is recognized and solved, the solution should always be recorded. The company will find it easier to establish better relations with its suppliers in the long run because they will realize that the company with a standards activity does not rely on guess-work and that its demands are stable. It will be in a better position to convince government authorities of the genuineness of its material and manpower requirements, and in the case of a subsidiary, to convince the "principals" in foreign countries that its requests are valid in relation to certain foreign standards requirements, which may otherwise be unnecessarily stringent if applied without regard to local conditions.

This chapter gives special attention to the questions which must be carefully studied if proper solutions are to be developed. It includes descriptions of standardization programmes from several industrially developed and developing countries, and a number of suggestions for the conduct of company and national programmes of in-plant standardization.

Since the subject of in-plant standardization has so far received little attention in most developing countries and is practised in only a handful of them, it is an important area where international action and technical assistance could obtain substantial results from the application of relatively modest resources.

Scope and advantages of in-plant standardization

The term "in-plant" or "company" standardization, in its broadest sense, includes all company activities for streamlining, co-ordinating and documenting routinized procedures within the company. A company standards department is the agency for producing company standards and spreading the knowledge of industrial standardization throughout the company.

Effective standardization in a company can be one of the most reliable tools that an executive can have to reduce management problems. Standard specifications for materials, finishes, processes and operating procedures, once formulated and properly implemented, cut down conferences, conflicting instructions and controversial discussions. Companies that have a well-rounded programme of valid standards in operation secure a substantial performance advantage over those that do not.

The scope and intensity of standardization activity at the in-plant or company level should be consistent with the readiness with which standardizat principles can be absorbed. Frequently, a premature over-emphasis on standardization or an overdose of it can have adverse effects similar to thos of over-indulgence in food or an overdose of a perfectly good drug, which may beneficial if taken in the right quantity at the right time. For this reason standardization in some companies might be limited to the activities of an engineer or a supply officer who would devote a portion of his time to this undertaking. In other instances, a complex organization, fully staffed, woul be the more appropriate instrument. In any case, the in-plant standardizatio activity may be viewed as a "missionary" effort in spreading industrial standardization throughout the company.

There are many reasons why in-plant standards are important for the incr of productivity in a developing country. Some of the essential ones are list below.

(1) More time may be devoted to the fundamentals of design when prolonge concentration is given to a few good designs rather than hurried attenti to a succession of minimally workable ones.

(2) Product designs may be simplified and the relations between product and process requirements studied more closely. More specialized equipme may be used, since payoff requirements can be met in long runs of standardized items instead of short runs of "specials".

(3) Fewer varieties of materials need to be stocked, so that the total inventory investment is cut down and losses from deterioration or changi market values are minimized through fast-moving inventories.

(4) Work planning, production control and other management procedures ca be simplified and their frequency of repetition reduced.

(5) Prompter and better service may be offered to customers in respect t original purchase and subsequent recorder, repair, part replacement or performance under warranty.

To increase productivity along these lines, the in-plant standards activi must work towards the introduction of procedures that offer the greatest gains This will consist mainly in a drive towards external standardization (i.e., national and international) and internal standardization through the guidance of company employees. Such efforts will require facilities for reconciling divergent opinions and for monitoring the standards so that they a consistent with industry practices as well as with internal procedures. In-pl standards should be such that they operate with the full support of the compan management on the basis that their cost is an investment that will be easily recouped through increased productivity and profits for the company.

The introduction of in-plant standardization into a developing country nee not follow a pattern different from that which took place in the industrially developed countries, unless special circumstances make it necessary. The firs three steps in starting an in-plant standards programme are: reduction of ite varieties: simplification of the product, and an approved charter for

standardization. "Standardization" is not to be looked upon merely as a "simplification" process. Simplification should be a part of the well-planned programme for standardization. Another important point is to avoid starting work on certain problems just because they are easy, attractive or have been brought up by individuals or groups requiring immediate solutions to their problems. An approved, planned approach, starting with these three steps, will avoid digressions from the main objective and help to achieve the primary goals of standardization.

Cost reductions through in-plant standardization

In-plant or company standardization provides cost reductions through the use of fewer raw materials, smaller parts inventories, lesser requirements for special machinery, reduced obsolescence in materials and equipment, more efficient use of man-hours by means of controlled production of standard parts, product simplification through interchangeability of parts, and fewer drawings. Additional advantages also accrue if standardization is applied to in-plant operations on a continuing basis.

Interest in company standardization has developed in industrially advanced countries because of its proved contribution towards cost reduction. In the United States, for each dollar invested in company standardization activity, a saving has been effected of seven to ten dollars per project. Similar results have been reported by industries in the United Kingdom.

United States experience

The American Standards Association (ASA) has recently released the results of a survey it conducted among a large number of United States companies. 6/ In its role as the main source of information on national and international standards in the United States, the ASA wanted to know about their experience with standards. In particular, it asked:

(a) how many companies have formal standards programmes:

(b) how their standards work is organized:

(c) how standardization is financed:

(d) how standards are used;

(e) whether the company co-operates in standards activities outside the comapny, and

(f) whether there are records of savings through standardization.

6/ American Standards Association, Company Standardization: Organization, Costs, Savings (New York, 1959).

While many companies stated their savings in a general way, several indicated that company policy prevented them from revealing dollar figures. A number of firms indicated that intangible savings probably exceeded the tangible ones for which figures were available.

The companies answering the survey ranged in size from a two-man, part-time technical writing firm to corporations with annual sales of several billions of dollars, their activities covering the following fields (listed in order of number of companies included):

Electrical manufacturing	Fasteners
General Machinery	Aircraft
Electrical utility	Building materials
Machine tools	Bearings
Chemical	Engineering and construction
Gas utility	Railroads
Steel and iron	Instruments and controls
Electronics and communications	Copper and brass
Petroleum	Office equipment
Valves and fittings	Photography

The survey indicated that those companies having formal standards programmes, with budgetary control of standards work, showed clearly the monetary benefits of standardization, which were not apparent to those firms whose standards activity is a part of other functions and under the control of a number of different departments. The survey seemed to indicate that the latter were missing the benefits of a standards programme and budgetary control of standards. However, more and more companies are beginning to realize the cost cutting potential of a standards programme. Several companies indicated that, as their new standards programmes get under way, and as results begin to be felt, they will find ways of pinning down the monetary results of their programmes.

One of the significant findings was that the companies reporting monetary value of savings also reported extensive use of standards and standards manuals. This would indicate a close link between organized standards work and recordable cost savings. Savings reported by the companies that were able to quote specific figures were as high as $50 saved per dollar spent on standards work. In terms of sales, savings ranged from 0.3 per cent to 5 per cent of sales, with an average close to one per cent.

Representative returns showed the following.

A contractor specializing in petroleum and chemical works estimated savings of one million dollars a year through the use of standards, or $8 in savings per dollar spent on standards activities. Areas in which substantial savings had been achieved were engineering and drafting time, purchasing, identification of materials on the job, and erection of correct parts in proper places.

/...

A manufacturer in the missile field saved 5 per cent of [illegible] sales of $216 million.

A chemical company with annual sales of $250 million reported on [illegible] standards programme. With a total budget of $35,000, the programme resulted in the establishment of twenty-eight standards in the first [illegible] months, and sixty-two other standards. In answering the questionnaire, this company did not supply the cost figures but only commented on the accomplishments in the form of published standards.

A machinery manufacturer with ten plants and annual sales of $155 million reported tangible savings of $250,000 a year through standards, and estimated that intangible savings per dollar spent on standardization ran as high as $35 to $50. Its yearly standards budget was $70,000.

Another heavy machinery maker mentioned annual savings of about $50,000 on a standards budget of $14,000.

A utilities company estimated savings of $50,000 to $75,000 annually as the result of a recently established standards programme budgeted at $15,000 a year.

Experience in collecting the above data on cost savings through standardization has shown that it is difficult to assess a negative factor (that is, not what a programme will cost, but what it will save). Usually the difficulty also arises because there is not sufficient valid data available to make a satisfactory estimate.

Principles of in-plant standardization

The theory of standardization recognizes the existence of a standard in a set of laws, manners, traditions or behaviours, for example, in architectural design, clothing fashions and the like. It is, ultimately, a process of conformity and equalization of conditions for the benefit of those concerned.

In promoting standardization in the developing countries, it would be important to explain carefully that standardization is basically the outgrowth of natural tendencies to conform and to obtain maximum benefit from existing successful processes: in its absence, it may take longer to develop new processes. The newly developed processes, unless properly recognized and guided, may also take off in unpredicted and unprofitable directions.

At this point a word of caution may be introduced. A lack of a standard need not automatically be interpreted as a need for a standard. The lack of a standard may be by intent and not by default. This is an important point, especially when, in a developing country, so many standards must be established. It is better that some be deferred, to avoid the danger of over-standardization, fear of which is expressed at the early stages of development.

An important point to remember in evaluating the need for a standard is its end performance. A standard is not an end in itself but a means to an end. If the end performance is already adequate without a standard (and it must be remembered that adequate performance is the raison d'être of a standard), a

/...

decision made against the adoption of a standard is a standard in itself, provided that such a decision is announced and recorded. A simple example of this practice is a page in a standards manual containing only the following information:

"THIS PAGE PROVIDES LOCATION
FOR A STANDARD ON _____
WHEN REQUIRED"

Even a superficial observation of industrial progress will reveal that a certain natural growth of standardization is inevitable in almost any location. This growth is not necessarily, and frequently is not, based on established disciplines. To obtain calculable results, however, it is necessary to channel the standardization efforts in an organized way.

For many years it was recognized that standardization was a tool for efficient industrial production. Many schools of business administration and industrial management were satisfied with teaching standardization in the context of time and motion study, which applies to wage rates and other such areas under the competence of the supervisory, financial, industrial engineering and personnel departments of the company.

For example, there is a close relationship between "time study" and "standardization". While the former is a study of manufacturing operations or production procedures and the time consumed by them for the purpose of devising methods of increasing efficiency of productivity of workers, the latter refers to the adoption of the best methods for a given purpose at the time adopted. Similarly, the functions of "production engineering" and "industrial engineering" are closely geared to supplying the essential background data for the setting up of valid standards.

However, the production of goods at optimum cost and time is not the sole function of standardization. A product must be of the <u>right</u> quality, and the criteria used in defining standards for quality will vary with the product itself. While they may be purity, taste and odour in food products, in a piece of steel they will be hardness, strength and dimensional accuracy. This introduces a phase of standards co-ordination for controlling the quality of the product by means of various types of standards, such as specifications, procedures and processes.

Complying with the requirements of quality at prices the customer can afford involves another area of co-ordination, that of control of production. This means controlling all steps in the manufacture of finished parts - from the receipt of the raw material, through inspection at various stages of production, proper delivery cycles from department to department, final inspection and proper packaging, to safe delivery to the customer.

The degree of co-ordination which a standards activity has to elicit between these various company operations depends upon the product, the size of the company and the support given by management to the standards activity. In any case, before a "management charter" can be issued, a company should engage for some time in an investigation or preliminary research of the types of operations it intends to pursue, to obviate the possibility of establishing controls beyond

actual requirements. A standards activity consisting of an officer, a committee, a group or a department can undertake such a preliminary analysis before recommending a standard or suggesting its postponement.

A point which will be developed further in this study is the technique of standardization whereby the participants in the programme are willing to look at each other's viewpoint. This, a first step in co-ordination, is one of the important earlier steps towards standardization.

Standards and industrial progress

An important consideration for a developing country in adopting organized standardization is the realization that because of inactivity in the past there is a need for accelerated effort. In all countries, large or small, industrially developed or developing, there is always a lag between the development of technology and its appearance in standardization.

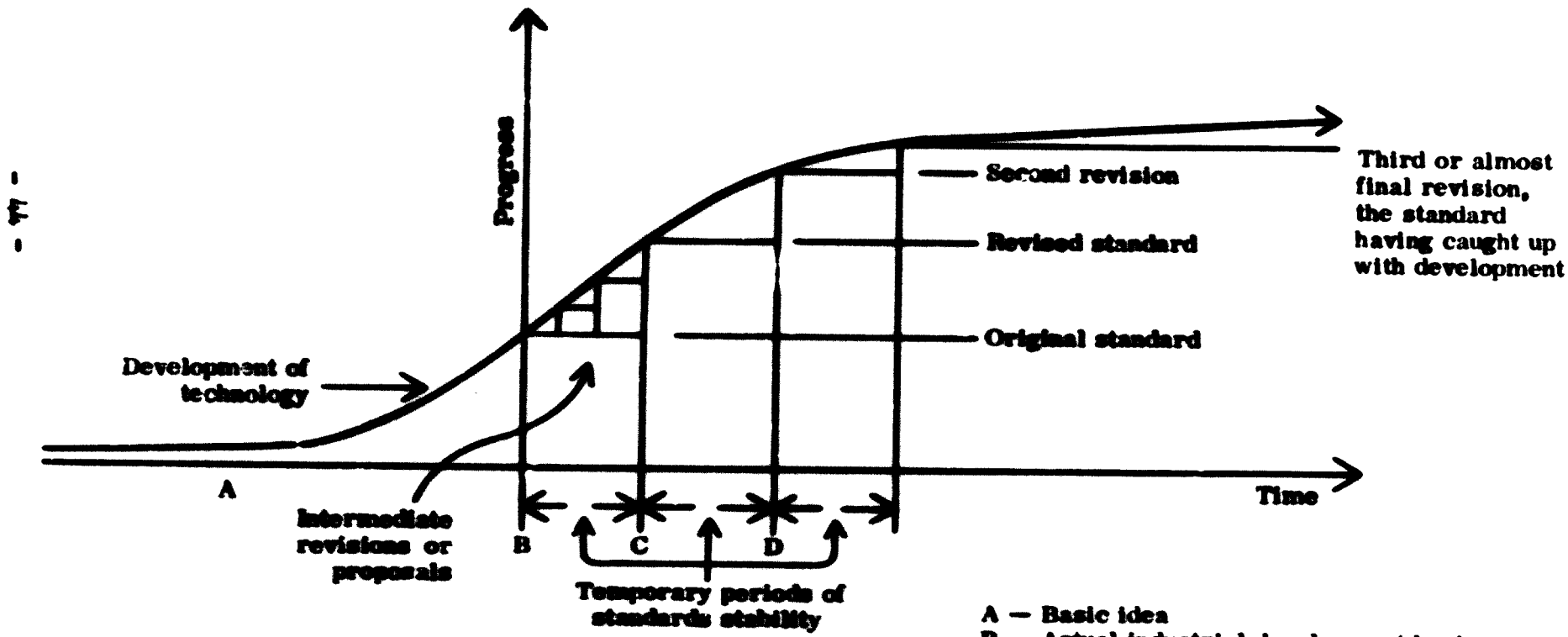
Taking a point on the horizontal axis of time as the starting point of modern industrial technology, we can envisage a progress curve, somewhat steep at first, with a gradual levelling off.

During this progress any standard that is set must acquire a temporary period of stability. It may be seen that by adopting the progress-time curve (figure 2) as a basis for organized standardization, individual standards may anticipate, but should not fluctuate with, the progress of technology until sufficient time for trial has elapsed. Here the word "sufficient" is significant. It need not be construed as preventing taking advantage of new techniques for production as they are developed, but it is equally important that an investment in tooling and current inventory not be scrapped merely in order to keep up with progress. The progress-time curve, as depicted in figure 2 should not be used for prediction purposes.

Industrial progress due to new basic ideas (discoveries and inventions) as plotted against time is represented by a continuously rising curve. The graph in figure 2 represents the development of the manufactured product. This development may be divided into various phases. The first phase begins with the conception of a basic idea (A) which may be the result of an invention or discovery. When the chain of events required for practical application is completed, the basic idea becomes the beginning of an actual industrial development (B). For example, it may be considered that the basic form of the present airplane was known to be suitable for mechanical flight many years ago: however, the airplane as a means of transportation had to wait for the development of an engine with high enough power-to-weight ratio. From point "B" on, the rate of progress will increase. At first, many problems of secondary importance have to be solved, such as ignition and the carburation systems of the gasoline engine in the early days. At "C" the product has found a market. Manufacture is started in greater volume and begins to lose its experimental character. Beyond point "D", the progress curve flattens out and approaches the horizontal direction. This phase of the curve might be called "saturation", and is meant to apply to the progress in the art, and not to the market of, the product.

Figure 2

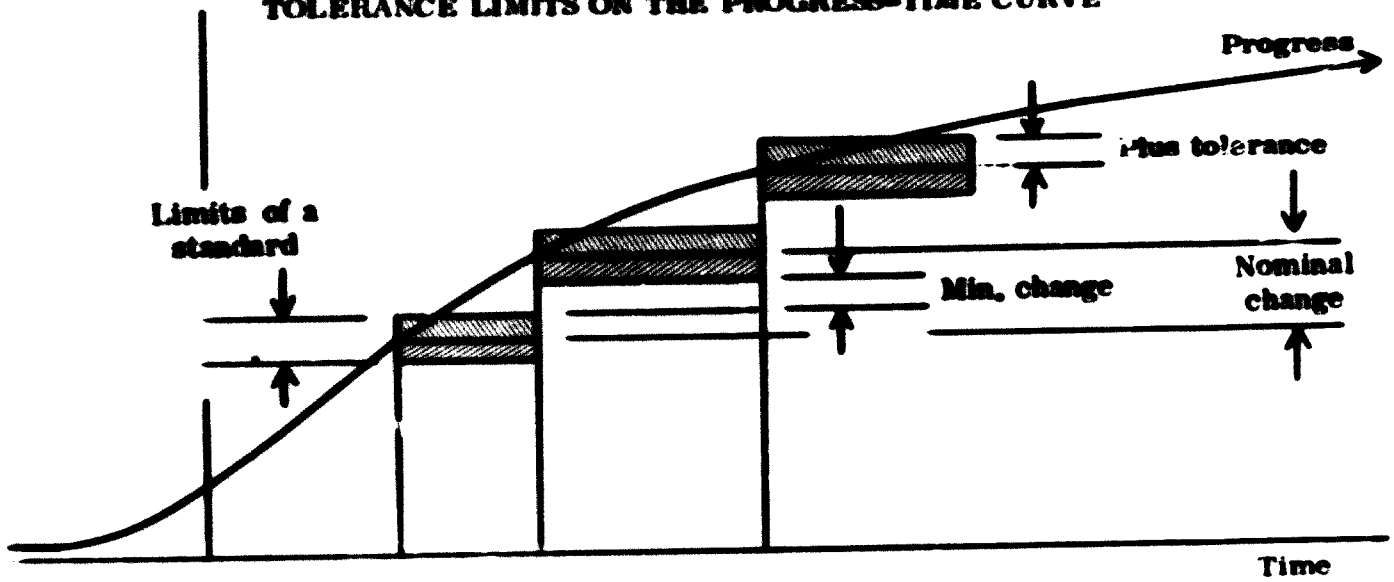
PROGRESS–TIME CURVE OF ORGANIZED STANDARDIZATION

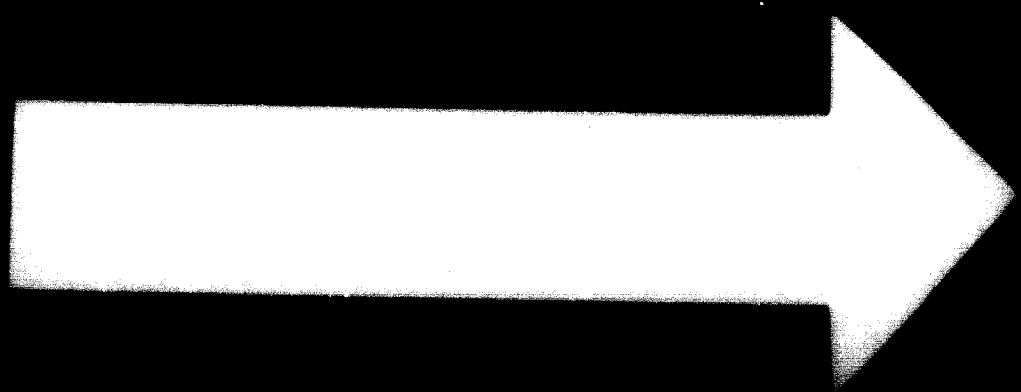


A — Basic idea
B — Actual industrial development begins
C — Marketable product
D — Completion of development of idea

Figure 3

TOLERANCE LIMITS ON THE PROGRESS–TIME CURVE





10.7.74

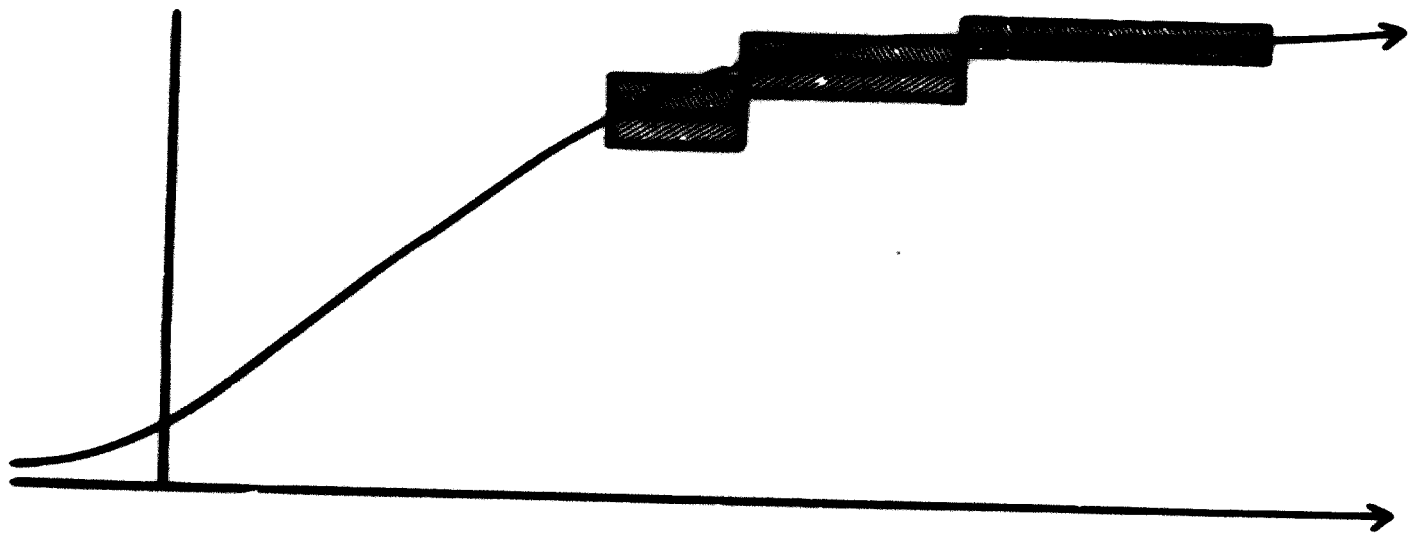
2 OF 3

DO

3781

Figure 4

SMOOTH TRANSITIONS BETWEEN A STANDARD AND ITS REVISIONS



To avoid giving standards the appearance of rigidity, it is necessary to accept the theory of "tolerance" as being applicable to the actual concept of a standard. This may be done at successive segments of the progress-time curve. The theory of the limits based on permissible tolerances is illustrated by figure 3.

It is important in a developing country to controvert at the outset the idea that standards are "tools of regimentation, additional restrictions and rigidity" and also to have a proper understanding of the conclusions that may be drawn from the above corollary (figure 3) to the progress-time curve (figure 4).

These are that:

(a) established standards should be used within the tolerance limits specified;

(b) by allowing a generous positive tolerance where possible, the standard may be able to follow the progress curve ahead of the actual revision time of the standard, and

(c) a reduced gap between the negative tolerance of the new standard and the positive tolerance of the old standard would permit smoother conversion, if standards with adequately generous tolerances are adopted. When the high limit of the previous standard and the low limit of the new standard overlap, the transition from the old to the new may be even easier. This is, however, more feasible in the later stages of development (see figure 4).

Relationships between in-plant standards and other company activities[1/]

While the major emphasis in standardization in an industrial enterprise is normally placed on engineering or technical standards, a well-rounded in-plant programme cannot disregard the influences that other activities may wield in the creation and subsequent implementation of standards.

In the accounting department, for example, standard costing can provide a norm against which actual costs can be measured and thereby determine the quality of performance. (This is distinct from the quality of the product).

In an administration department a company may develop administrative standards for training as well as operational purposes. These involve management duties, responsibilities, authority and the like, and are recorded in a company Standard Practices or Policy Manual. A study conducted by the American Management Association, though, points out that it is not easy to establish standards in this area.

A company's advertising department can capitalize on the fact that the products meet national, industry or military standards and make this an effective selling point.

1/ John T. Milek, "The Role of Management in Company Standardization", Magazine of Standards (New York), April 1962, published by the American Standards Association.

The design and engineering departments are expected to be staunch supporte of the company's standardization programme. The major portion of this chapter is devoted to in-plant standardization efforts in this area.

Maintenance and construction departments are interested in an in-plant standards activity which will put out specifications for plant lay-out, piping arrangements, pumps, fire protection systems, and other areas of plant maintenance. This would also include, for example:

Reports of malfunction of equipment:

Uniform column spacing within the building:

Standard colour schemes;

Office and factory partitions:

Industrial lighting fixtures:

Office equipment, furniture, duplicating machines, etc.

Purchasing departments are also strong supporters of standards, as they have direct evidence of the advantages of purchasing standard parts. By a co-ordinated effort between purchasing and standardization, one company reduced thirty different paints to fifteen, 120 different cutting fluids to ten, fifty different tool steels to six and twelve different aluminium casting alloys to three.

A quality control department can also be a strong partner in the in-plant standardization programme, since it is the enforcement agency for company standa It is a function of standardization to determine the method of measurement to be employed by the company in order to avoid the manufacture of non-uniform (in quality and interchangeability) products. Gauging responsibility, to ensure that measurement standards are followed, lies with quality control.

Reliability department - In order to overcome the rates of failure which cannot be tolerated in critical equipment, a new concept of reliability has entered the industrial picture, and standardization must be ready, too, for co-ordination efforts on this score. 8/

The research department of a company may be the only in-plant activity to consider standards as a strait jacket, inhibiting creativity. However, properly handled through adequate co-ordination emphasis, the research facilities of a company can be used to provide an advanced knowledge of technology to keep abreast of the progress-time curve (see figure 2 above). This gets into an area known as "anticipatory standards" and may be treated as a special project of the standardization activity.

A market research department, on the other hand, could very well be the agency to persuade high management to plan future standardization geared to future consum needs. This area is potentially fruitful in the design of highly competitive products such as automobiles and home furnishings.

8/ Reliability has been defined by the United States military agencies as: "the probability that a system will perform a required function under specifie conditions, without failure, for a specified period of time" (MIL-R-27542 (USAF)).

Co-ordination of standards with safety and health departments is important to companies that must design and manufacture their products to comply with national and local standards of safety and health.

In the shipping department, standard parts and standardized methods of packing and crating mean quicker delivery to the customer. Proper identification systems not only expedite the shipping of correct parts, but also facilitate re-orders and repairs.

Value engineering. 2/ In those companies where value engineering has been set up as a formal engineering activity, co-ordination with in-plant standards will be necessary to derive maximum utility from this effort.

Among the important value-analysis techniques, use of standards ranks high. A design should be evaluated for use of standards - that is, standard parts, materials and processes. There are many designs which contain special fasteners, for instance, where a little redesigning may allow the use of standard hardware from the stock rooms. The cost differential between standard and special items should always be compared and these facts should be ready for analysis.

Types of standards

In the context of in-plant standardization, various types of standards acquire a formalized meaning apart from their academic definitions. It is necessary, therefore, to describe various types of standards which are necessary for in-plant use in terms of their immediate and daily applications.

Among the various types of standards suitable for in-plant use are:

Reference standards·

Functional standards:

Specifications·

Processes:

Practices;

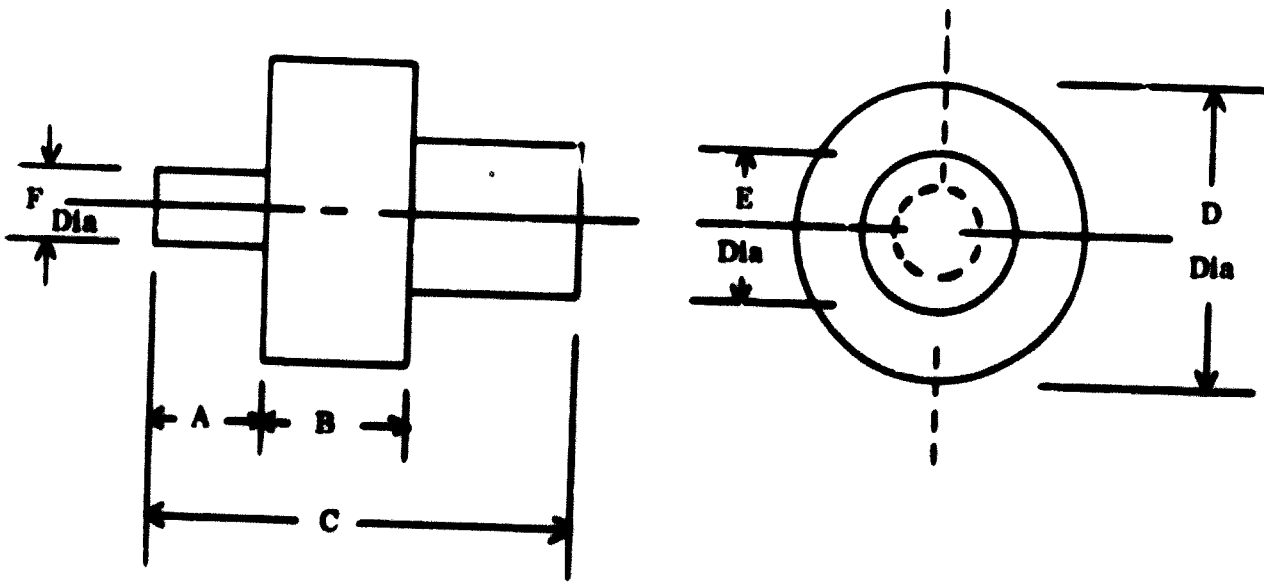
Procedures

There are dictionary definitions for these terms. However, many of them acquire routine meanings which are given below, supported by the dictionary definitions which should also be taken into consideration.

2/ The United States military specification on value engineering defines it as: "an objective appraisal of all elements of design, construction, procurement, installation and maintenance of an equipment, including applicable equipment specifications in order to achieve necessary functions, maintainability and reliability of an equipment at minimum cost (MIL-E-55051 (USAF))".

Figure 5

EXAMPLE OF A REFERENCE STANDARD



A	B	C	D	E	F	Reference
.60	.80	2.20	1.60	.80	.40	123456-3
.60	.80	2.20	2.00	.80	.40	123456-5
.80	1.00	3.00	2.00	1.00	.80	123458-5
.60	.80	2.20	2.00	1.00	.80	123458-7

Standard - Anything established by authority, custom or general consent, as proper and adequate for a given purpose.

Specification - Notation of limits: the designation of particulars in a written or printed description.

Process - Series of actions or operations or a treatment. The way or order in which anything is done.

Practice - Frequent, systematic and customary action.

Procedure - Order or system of performing or operating: a set of rules: established method of conducting business.

Reference standards. In order to establish an in-plant standardization programme and obtain optimum benefit therefrom, it will be necessary to recognize and utilize various types of standards documents that must be created and properly categorized. While all outputs of a standards activity should appear on readily recognizable formats with proper headings, their message and effectiveness will depend on the manner of presentation. The most basic standards document is the "reference" standard.

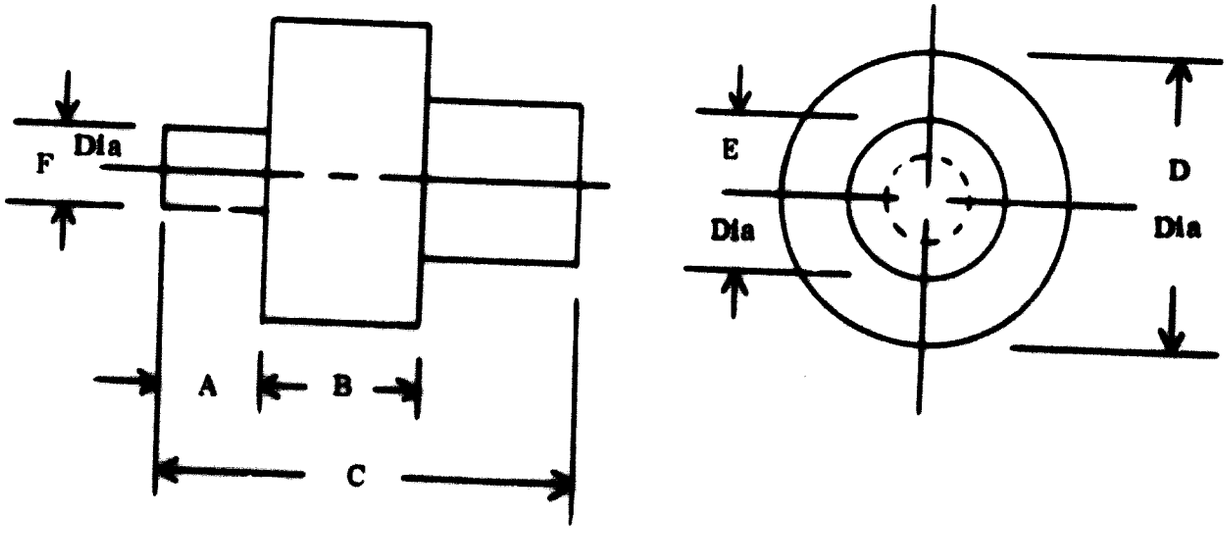
After searching and researching, a standards activity arrives at the proper selection of standard parts, materials, finishes, etc., that the company should use. The publication of data of this nature - i.e., recommendations or directives, depending upon the charter of the standards activity - will normally be in the form of reference standards. For example, a company standard sheet will list the screws, washers, lockwashers, hinges, electrical switches, capacitors or resistors and other electrical and mechanical components selected from other existing company documents, or from vendors' catalogues. A reference document simply indicates at the proper part or selection of desirable items suitable for in-plant use. Thus, a reference standard will combine or delete references from other documents on to a single document identified by the subject matter, for the convenience of the company's employees. A reference standard may select only certain parts from a drawing which may contain many non-standard parts, combine standard parts from several drawings, or, if all parts or a certain drawing are suitable for standard use, publish the entire drawing on a reference standard format. After a certain period of time, due to progress and development of better manufacturing or assembly methods, it may become necessary to withdraw the reference listing of existing standard parts. The reference standards scheme makes it possible to revise the standard, delete references to obsolete standards and invoke more up-to-date references without upsetting the existing drawings or documents from which previous references were drawn. This flexibility will be lost if the in-plant standards activity uses the operating documents directly as its standards documents. However, operating or "functional" documents can also be used advantageously as standards, as described below.

Functional standards. While reference standards refer to, or indicate, suitable references from other documents, functional standards are existing operating documents which are adopted as in-plant standards directly and completely. These operating documents may be the company's internal drawings, such as drawings, where all parts are suitable as standards; or they could be company specifications for raw materials, purchased parts, or applications of

Figure 6

EXAMPLE OF A FUNCTIONAL STANDARD

XYZ company standard		12-345-6	
Mfgr code	Commodity code	Date	



Dash No	A	B	C	D	E	F
-1	.60	.80	2.20	1.60	.80	.40
-2	.60	.80	2.20	2.00	.80	.40
-3	.60	.80	2.20	2.00	1.00	.80
-4	.80	1.00	3.00	2.00	1.00	.80

plated and organic finishes, etc. Operating documents from outside sources cannot and must not be used as in-plant functional standards. In a functional standards scheme the identification number of the operating document itself is used as the number to designate the standard. The utility of such a document is somewhat limited inasmuch as it is not conducive to obsolescence in case of development of newer methods and practices. The only way in which this type of standard can be made obsolete is by its outright withdrawal and replacement by a reference standard or another more up-to-date functional standard.

The following example of a functional standard will show that the identification number of the standard is also the functional number for the part. While 12345B-5 is a number taken from drawing numbered 12345B, the same part on the functional standard can be identified as 12-345-6-4.

Functional standards are used when standards for drawing can be organized at the beginning of a standards programme.

Specifications. It is not always easy for users of company standards to differentiate between a company specification and a company standard, other than to say that the implementation of a standard is accomplished by the writing of a specification. A specification may be defined as a statement of requirements to be met.

A standard is also defined as a recorded solution to a recurrent problem. When a specific requirement, to be put into effect when needed, is recorded, it becomes a "standard specification" or, briefly, a "standard".

Specifications are in the category of a "functional" standard, as described above, and as such are not radically changed. Instead, they are rendered obsolete when they no longer serve their purpose.

Typical specifications may contain:

Statements of manufacturing tolerances:

Statements of acceptable degree of workmanship:

Requirements for raw materials;

Requirements for industrial finishes, surface treatment, protective coatings, and paints;

Requirements for safety, reliability and inspection:

Listing of assignments of drawing numbers, codes, systems of identification, etc.

Processes. Processes are, as the name implies, approved methods of manufacture and are recorded for the purpose of guiding the designers. To a limited degree, these processes may be changed, provided the change is always towards upgrading the product, without increasing its cost. Otherwise, a new process, identified by a different number, for use on new designs, must be written. The old process, should not be superseded or automatically replaced by the new, lest additional expense inadvertently be authorized by the standards activity.

Practices. As discussed previously, the recurrent use of a specificatio becomes standard practice and creates a certain synonymy between terms descri in this section. "Practices" thus are recordings of the best and approved me which have been labelled "standard". This is especially true when there are or more equally good ways of doing something, but for the sake of practicabil and avoidance of confusion, one must be arbitrarily chosen. Practices, there are at best compromises, and are sometimes more difficult to establish than a specification or a process where only the best way is to be selected.

A practice type of a standard is a drafting practice, or an engineering practice.

Procedure. In many companies, a procedure is where standardization start and ends. It is as near a mandatory standard as can exist without giving standardization a bad name. Many people may ignore a standard, by-pass a specification, not follow all the steps in a process; but a procedure is seldo questioned. The reason is that procedures encompass areas other than engineer and manufacturing and apply to technical as well as non-technical personnel.

For example, how we get paid is frequently determined by the operating procedure of a payroll department. A procedure controls vendor-purchasing relations, flow of material from one department to another, responsibility of one department to another, and so forth. At times, if all else fails, and som is trying hard to get out of doing something, he finally says, "Well, where is the procedure that says it has to be done that way?" If there is a likelihood a new standard may not be effective because of reluctance to change, and manage support is not assured, then this standard may be established in the form of a procedure. Caution must be taken, however, that there are not too many procedu of this type. The strength of a standard lies in its voluntary acceptance. A standard that does not sell on its merit eventually should be reviewed and refi until it meets with majority approval.

A programme for standardization[10/]

In any company operations, there are at least three basic areas where principles of standardization can be applied: design, manufacturing and qualit control. There are also other areas where standardization may be applied in a more specialized form - marketing, writing of contract proposals, administratio time and motion study, wage and salary, personnel, safety, plant facilities, forms control, inspection of incoming materials, packing and shipping, sales and customers services, training and inspection manuals, specification for company products and a products catalogue. However, in many of these specialized areas standardization assumes the status of procedures and as such does not follow the normal patterns for the development of in-plant standards.

10/ Developed as a result of a workshop session which took place in connexion w the Seminar on In-Plant Standardization sponsored by the Indian Standards Institution, through United Nations Technical Assistance Programmes, at Camp Mussoorie, U.P., India, 15 to 28 May 1963.

The following check-list may be used in developing a programme of standardization to regulate in-plant activities.

Design

(1) Drafting practice
(2) Formats
(3) Methods of coding and numbering
(4) Standard parts and material catalogue
(5) Design manual
(6) Machine equipment data

Materials (raw materials, externally purchased components and tools)

(1) Standard material data, including methods of testing, sampling and inspection. Requisition and ordering procedure
(2) Coding systems
(3) Purchase specifications
(4) Stores catalogue
(5) Value analysis

Manufacture

(1) Process sheets
(2) Process specification
(3) Coding of tools, etc.
(4) Coding of operations
(5) Grouping and coding of machines and equipment
(6) Time and method standards
(7) Production planning
(8) Material handling procedure

Controls

Production

(1) Incoming inspection and testing
(2) In-process inspection
(3) Progress (procedure and pro forma)
(4) Workmanship
(5) Final inspection
(6) Packaging and labelling

Maintenance

(1) Preventive maintenance manual

(2) Calibration of test instruments and test equipment

(3) Documentation of breakdown maintenance

Technical education

The level of technical education will play an important part in determi how soon, how easily and how far in-plant standardization can progress. Whil considerable progress can be made by teaching standardization principles and techniques to company personnel engaged in design, procurement, manufacture a shipping, such teaching will have to be tailored realistically on the basis o existing technical education, which tends to be more academic in some develop countries than in the industrially developed countries.

In many of the developing countries, present technical education is patterned after the older academic systems - where more emphasis is laid on theoretical subjects - which qualified graduates for jobs mainly in the cleri teaching and research fields. With the emphasis on the need for technological manpower, that is, for engineers who can undertake analysis of production problems, cost control, standardization and similar areas of industrial development, technical training will have to supplement academic education in some of the developing countries. New schools of technology may provide the basis for industrial progress by teaching practical applications of theoretic knowledge.

The study of industrial statistics will also help to change the emphasis from pure mathematical research to practical applications of statistical analysis, such as reliability and quality control.

In the developing countries, training in industrial standardization will, at the beginning, have to be provided on a special seminar basis since it will not normally be available in the present educational system. Successful demonstration of the utility of such practical training will help to eliminate prejudice against it among some educators. Such attitude may not be typical in all developing countries but their possible existence should be recognized in planning the training of personnel for in-plant standardization.

To accelerate the establishment of industrial standardization, co-operati with the "National Productivity Councils" or similar bodies is highly recommend These councils, usually appointed under a country's Department of Commerce, may enjoy technical and financial assistance from the industrially developed countr

Much has to be done in the developed countries generally to overcome the scarcity of technologically trained personnel and the prevailing prejudice amon some educators against practical training. This attitude is not typical of any one developing country, but exists in more or less degree in all countries. As a result of United Nations Technical Assistance in some areas, and through a wi distribution of technical papers prepared on this subject for the United Nation Committee for Industrial Development, it is expected that there will be ready acceptance in the future of industrial training in general and standardization

training in particular as ancillary to the academic curricula in universities and schools of technology.

Typical outlines for the courses of seminar studies on industrial and company standardization are included in annexes II and III.

Once it is recognized that a specialized type of training is necessary for promoting industrial standardization, and that some training for this purpose must be given either as ancillary to the academic curricula in seats of learning or at an industry seminar level, the trainees participating in this course should be briefed in the manner of:

(a) conducting a survey of the status of standardization;

(b) assessing the results of the survey, and

(c) making recommendations for the future, based on the survey and the assessment.

A typical questionnaire, which may be used in conducting the survey and investigating future possibilities for in-plant standardization, is included in annex V. This questionnaire was used successfully in assessing the status of in-plant standardization in India as part of the survey training programme outline reproduced in annex II.

The activity of in-plant standardization

Responsibility for standards activity

An in-plant standards activity needs a company management charter for its initiation and continued operation. The validity of a standard can only be ensured by the amount of responsibility assumed by the in-plant standards activity and shared jointly with the users of the standard.

While a company standardization programme may be started at many different points, it will not succeed without the support of management. Responsibility for a full-fledged programme should be assumed by a standards group, but the programme will require a proper understanding on the part of management.

Thus, a company standardization programme should start with a pronouncement by management that they support and mean to implement it within their organization by the publication of policies and procedures. This may appear to be an unnecessary emphasis on a minor detail, but many good ideas may be lost for lack of proper management support. "Standardization" in a company is not what one thinks the ideal to be, but what the company supports and says it is. A company standardization programme is first and foremost a company directive; only when this is understood will its structure (specifications, procedures, manuals, practices, qualifications for standards engineers, etc.) make sense.

A company standards department having been created through a management charter, a problem of responsibility also arises for the use of standards, whi requires a definite policy. A policy on "responsibility" for the company personnel must be promulgated, requiring the users of standards to utilize the whenever they are suitable for their assignments and to report any valid reaso for non-compliance with them.

Preparation of a standard

While it may be taken for granted that a standard should be published by a standards activity, in the same manner that a draftsman is expected to prepare drawing, this fact alone will not guarantee the validity of a standard. A very good drawing of sheet metal parts may not be suitable in a foundry, nor a cast drawing in a sheet metal shop; similarly, a standardizer, when preparing a standard, must keep in mind the user of the standard. If the standardizer does not arrive at appropriate criteria for his standards, he may find himself "blowing hot and cold" every time someone is unable to understand the standard criticizes it for being too elementary. Standards must be carefully attuned to the needs of the users. It is important to take this fact into consideration s the conclusions may vary from one company to another, depending upon the type o manufacture and the degree of responsibility assigned to or assumed by the standardizer. The following are some of the factors which prescribe the conten of a valid standard.

The length of time the company has had the standards activity. Initial issues of standards may be elementary and may be directed to all levels of technical personnel. In time, the standards may "graduate" to more technic and complex contents, even to the point of requiring some pre-knowledge on the part of the users. A drafting standard, for example, is written for a qualified drafsman.

The number of people using the standard is also important. It is necessary to remember this fact when designing one. A standard should not only communicate but should do so to as large a number of people as possible. A standard, in other words, cannot afford to be academic in its manner of presentation.

Tools for standardization

In promoting in-plant standardization in a developing country, certain available facilities or tools must be utilised to obtain maximum results. Existence of these facilities may vary from country to country. A comprehensive listing would provide some guide-lines for their creation where necessary and fo their proper utilization.

The fact that the introduction of an in-plant standardization scheme will require conviction on the part of management and its full support has already been mentioned in one of the preceding paragraphs. This is not only a prerequisite for the successful implementation of an in-plant standards programme once established, but is also definitely needed as a primary tool for starting the programme.

The following are prerequisites of an in-plant standardization programme:

Management support;

Standards engineers and supporting staff;

Co-ordination; liaison between departments; participation in national, industrial and international standards; in-plant standardization committee activity; adequate conference room availability;

Variety reduction; simplification; specialization;

Use of national standards; external standards; foreign standards;

Preferred numbers for use in design and other in-plant areas; identification systems for stores; cataloguing; drawings, etc.; stores catalogue; purchased parts analysis;

Proper housing for standards (i.e. ring binders or similar); placement and storage for standards (bookshelf, consulting table, etc.);

Facilities for making samples; facilities for testing new products and techniques to be standardized.

While most of these items are discussed in appropriate places throughout this study, a few are explained below.

Standards engineers

Among the requisites for in-plant standardization, the availability of qualified standards engineers ranks very high. In the early stages of in-plant standardization, however, men without full qualifications may be employed and trained on the job to develop them into standards engineers.

A check-list of qualifications, which may be consulted for selecting a proper individual, is included herein as annex VI. These qualifications are not listed in any particular order of preference, as the emphasis will change depending upon the company itself - its organization, past history, and lines of activity.

Committee activity

Even with a management directive, it is necessary to realize that any in-plant standardization activity will require specific efforts for achieving co-ordination between two or more departments engaged in the same type of work or doing work that affects the activities of other departments. The following committee activities may be cited as typical for illustrative purposes.

A top committee for standardization, for example, could have the main responsibility for standards policy and might be called "Executive Committee for Standards" or "Standards Policies Committee". Its function would be, broadly

speaking, to give proper status to the company standardization programme. Th committee should not be termed an "executive" committee or a "policies" commi in name only. Since its membership is expected to be drawn from a high executive level, the meetings need not and should not go into problems of technical detail. The major function of this top committee would be to bring policy-making executives, such as the chief design engineer, the chief supply officer, the manufacturing manager and the quality control specialist (or thei designated representatives), around the table at least twice a year to assess what the company has gained through its standardization effort, what future go should be set and what particular change in operation or emphasis is needed. man in charge of company standardization should act as chairman to see that t discussion on company standardization problems does not drift towards the prob of each participant, unless they have a bearing on the establishment of a futu standards policy. Only the man who is primarily responsible for company stand can chair the discussion. Even if this top committee provides a forum for a limited discussion on other executive problems, it should work towards establi general co-ordination, which is also listed as one of the tools for in-plant standardization.

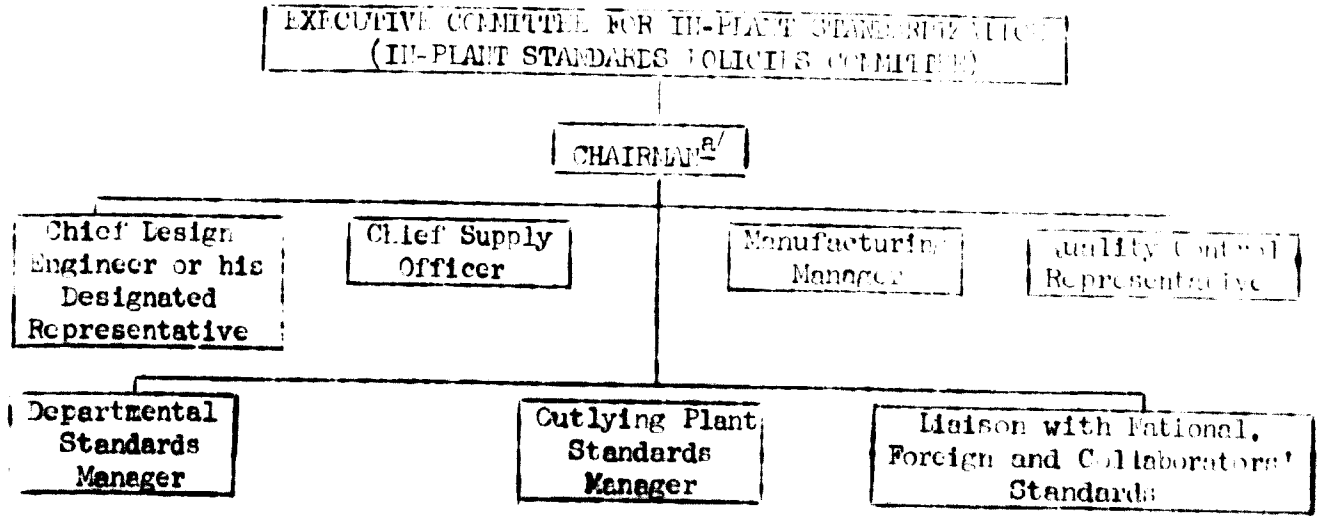
As additional support to the top policy-making Executive Committee on Standardization, the In-plant Standards Department should establish:

(a) Committees for people doing the same type of work in different areas, such as the chiefs of several drawing offices, 11/ and

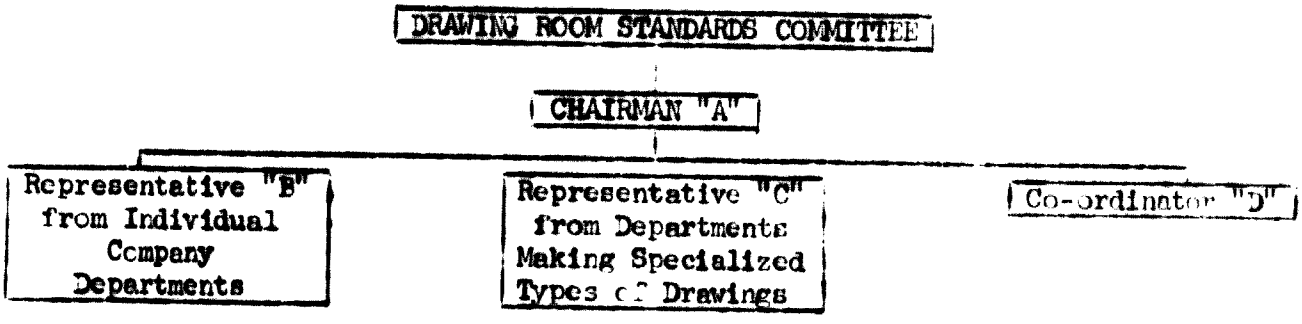
(b) Committees for co-ordination between people doing different lines of work but whose output has a bearing on the work done by other departments. An example of this would be the "Shop Practices Committee". In this group membership would consist of duly appointed representatives from engineerin and manufacturing, with in-plant standards activity personnel providing the secretariat.

It is not the intent of this study to go into details of committee structu However, a diagrammatic representation will help to clarify some of the points outlined above. The following charts are for illustrative purposes only.

11/ This is particularly applicable in multi-plant, multi-department companies.



a/ Preferably the individual in charge of the in-plant standards programme, or, if this office does not exist, a technical man reporting directly to the managing director or to a vice-president.



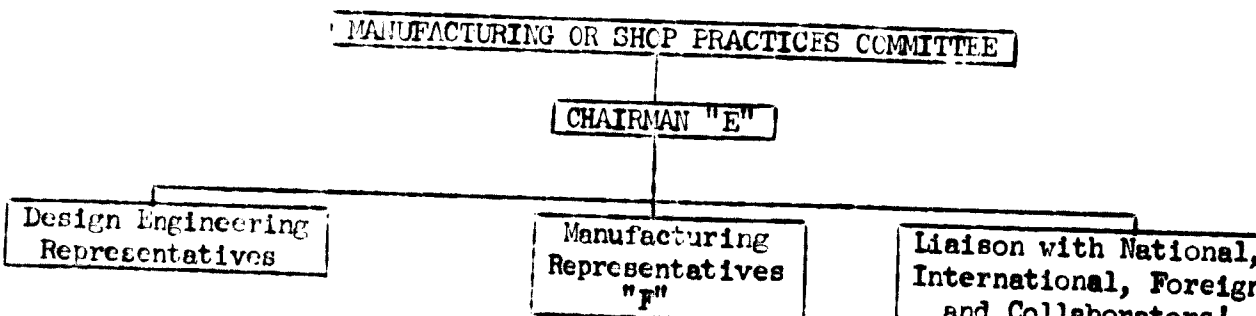
A - The chairman should be a member of the in-plant standards activity and be cognizant with drawing room problems so as to be able to monitor the decisions. He should be responsible for editing and maintaining the Drawing Room Manual.

B - This representative is especially needed in a company having multiple product lines, multiple plants and so forth.

C - The specialized types of drawings include mechanical, electrical, electronic, architectural and others.

D - This member of the committee should be responsible for maintaining liaison with national drafting standards, drafting standards of collaborators or of foreign countries and the like.

The structure of the Draw Standards Committee is shown as a typical examp only, since the structure of such a committee is to be construed as a tool for standardization. When a committee is needed, decisions will have to be made o type of committee to be formed, similar to those a man makes when selecting an other tool, such as a hammer, that is, when to use a hammer, what type of hamm should be used, or should some other tool be used instead.



E - Member of the in-plant standards activity, cognizant of engineering and sh problems and a good moderator.

F - Since "manufacturing" includes activities subsequent to the design of the product, members of this committee may be selected from among those respon for interpreting the designers' needs in terms of the manufacture of the product. A manufacturing process engineer or an industrial engineer may b considered for this assignment.

No discussion on committee activity can be considered complete without some points of guidance on the selection of the chairman and the members constituting the committee and the subjects to be dealt with by it. Much has been said for and against committee activities, 12/ but, since co-ordination is avowedly the most valuable tool for standardization, this study recognized the validity of committee operation and includes information designed to avoid the pitfalls of a unworkable committee structure.

Selection of a chairman. The ideal chairman should be an expert on the subject under discussion though not to the extent of having a fixed opinion. He should be able to analyse a complex problem quickly and put it before the commit in a simple form. He must be slightly aggressive and a finished diplomat, but also something of a dictator and at the same time completely fair and unbiased. In practice, it may not be easy to find a person with all these qualities. However, a "high-pressure salesman" should be avoided, and whoever is selected should be appointed for a fixed period only, so that he may be removed without embarrassment if he proves unsuitable.

Selection of subjects to be discussed. With a clear agenda before him, the chairman will be able to by-pass aimless discussion during the committee's meetings. When there is a genuine need for a standard, the selection of a subjec that produces solid results is very important.

12/ See, for instance, H.R. Terhune, "What Good are Committees?", Standards Engineering, September 1955.

Selection of members. For a standards committee meeting to be effective, its membership must be drawn from people at the working level who will have to live with and use the resulting standards. Those who are detached from day-to-day problems on account of their high executive position should be members of the Policies Committee; a committee for discussion of standards at the working level should be staffed with people having appropriate technical knowledge. It is equally important that the technical members of the standards committee should be authorized to speak for the departments and activities they represent.

Identification systems

Drawings prepared in a company to delineate parts and assemblies; materials which are procured from vendors; parts fabricated in a manufacturing area; items which are to be stocked and later released for use; parts grouped by similar characteristics, and others, require a system of identification for adequate production control. The development of such a system should be among the initial undertakings of an in-plant standards programme. Some of the advantages of an identification system are that:

- it facilitates preparation of a standards catalogue;
- it simplifies the search for, and use of, proper standards by company personnel, and that
- it guarantees the delivery of the right item.

These advantages become more apparent when it is realized that without proper identification a wrong part may be delivered to the manufacturing floor and incorrectly machined or assembled because it bears inadequate identification.

Faulty identification has resulted in uneconomic in-plant operations and has delayed delivery of correct materials to customers. A typical example is that of an assembly line which came to a halt because of lack of proper identification of parts, until the production engineer remembered that what one designer called an "impeller gear" was identified by another as a "timing gear". A quick substitution was made, and production was resumed.

There are many systems of identification which may be considered for adoption in company standards activities, but their selection must depend on their application. Various systems based on significant, sequential, alphabetical and alpha-numerical emphasis should be tested for the purpose.

Listed below are several frequently used identification systems. Other systems may be developed to serve specific needs, but the variety should be kept to a minimum and increased only when one of the existing systems will not apply.

Functional numbers;

Reference numbers;

Date code;

Manufacturer's number;

Commodity code;

Stock number.

Functional numbers. In a previous section of this chapter, when discussing various types of standards, a distinction was drawn between the reference and the functional types of standards. Identification numbers used for these standards are also based on the distinct purposes they must serve.

A standards document is created to perform a function: one of these functions is to communicate proper information for the designing, purchasing, inspecting, manufacturing and shipping of quality products. This is accomplished directly by means of a functional or operating document, or indirectly by means of a reference document.

Functional or operating documents are generated as soon as they are needed and the numbering system for such documents should not be too elaborate and cumbersome nor require approval by a committee. The scheme for numbering functional or operating documents, then, must be simple and straightforward. There is no simpler system than a serial numbering system. Here an in-plant standards activity can be the custodian of a block of numbers ranging from one to 1,000,000 depending on the size of the company and the diversity of its products. These numbers may be broken into smaller blocks of 10,000, 1,000 or 100 for convenient record-keeping purposes, but no attempt should be made to suit the whims of users who claim affinity to certain desirable number combinations.

Functional numbers are used to identify a drawing or a specification, which in turn is used to describe the part to be manufactured or purchased and the methods or processes used to fabricate the parts or assemble the equipment.

Reference numbers. For the grouping of like parts by name, an alphabetical index may be prepared as soon as sufficient data have been accumulated. This alphabetical index may be identified by a numbering scheme and, through this correspondence, the latter will identify a certain family of parts, items, subjects, categories and the like. The numbers used for this purpose may be assigned serially in blocks and may later acquire significance through repeated use. A reference number may be used to re-identify a revised standard and as such should never be used for a functional purpose, such as identifying a drawing or a part to be purchased.

Numbering of functional documents. Figure 7 illustrates the numbering of functional documents in sequence; the numbering is systematically broken down from a series of one million numbers as follows:

0	to	999,999	(one million)
0	to	199,999	(two hundred thousand)
100,000	to	199,999	(one hundred thousand)
120,000	to	129,999	(ten thousand)
123,000	to	123,999	(one thousand)
123,400	to	123,499	(one hundred)

1.3,459 to 1.3,459 (...)

1.3,460 (...)

The parts identified in this manner may range from armature to [illegible] leads, depending entirely upon what document is required next. [illegible] made to categorize by name or numbering.

Numbering of reference documents. Figure 8 illustrated identification of reference documents by use of numbers only. The contents of the [illegible] related to the first two digits (i.e., 12, 13, 18, 25). Thus,

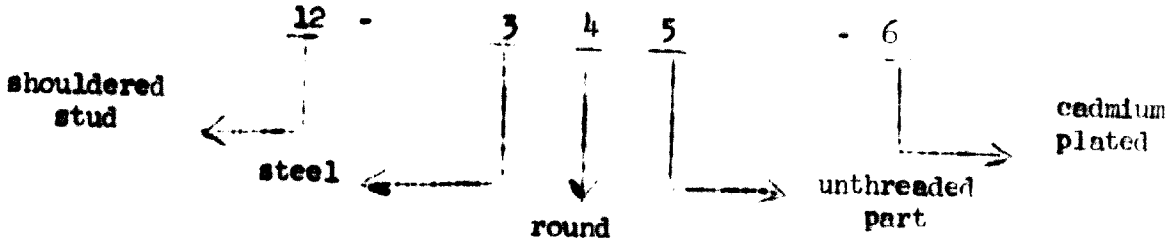
12 may mean "shouldered stud"

13 may mean "flat washer"

18 may mean "switch"

25 may mean "capacitor"

The next category, i.e., 345, 301, 216 or C03, may mean certain types of studs or capacitors, while the last hyphenated number may mean a sequence in further significant indexing, thus:



This type of document, with a reference number rather than a serial functional number, brings like items together for convenient reference. This may also be accomplished by a significant alpha-numerical system.

Date code. As the name implies, this is a significant identification based on the numerical counterpart (in a predetermined manner) of the day, month and year combination. This identification is very useful in keeping track of the amount of production of a certain item on a certain production line on a certain day. This code is also useful for administrative purposes (such as in the establishment of wage incentives) and quality control (for example, which line or what day produced defective parts, if any).

Manufacturer's number. When more than one manufacturer is supplying the same item to the same customer, a code number prefixed to the manufacturer's functional and reference numbered documents is very useful for identification purposes. This unique number identifying a specific manufacturer is also useful in subsequent correspondence in case of re-orders, correction of faults, suggestions for redesign and the like. This number should be established by co-ordination between the in-plant standard and the national standard to avoid unnecessary duplication.

Figure 7

NUMBERING OF FUNCTIONAL DOCUMENTS

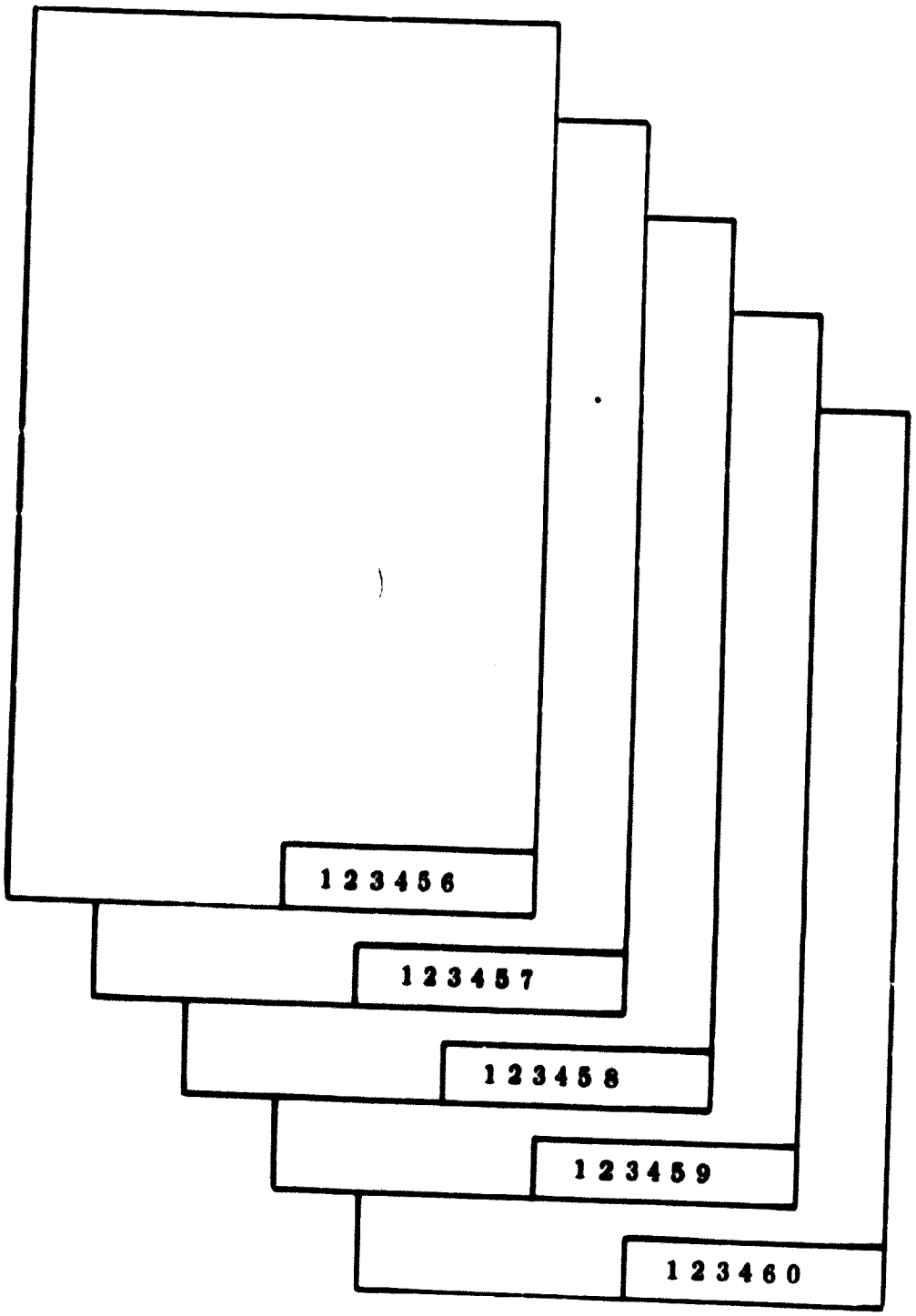
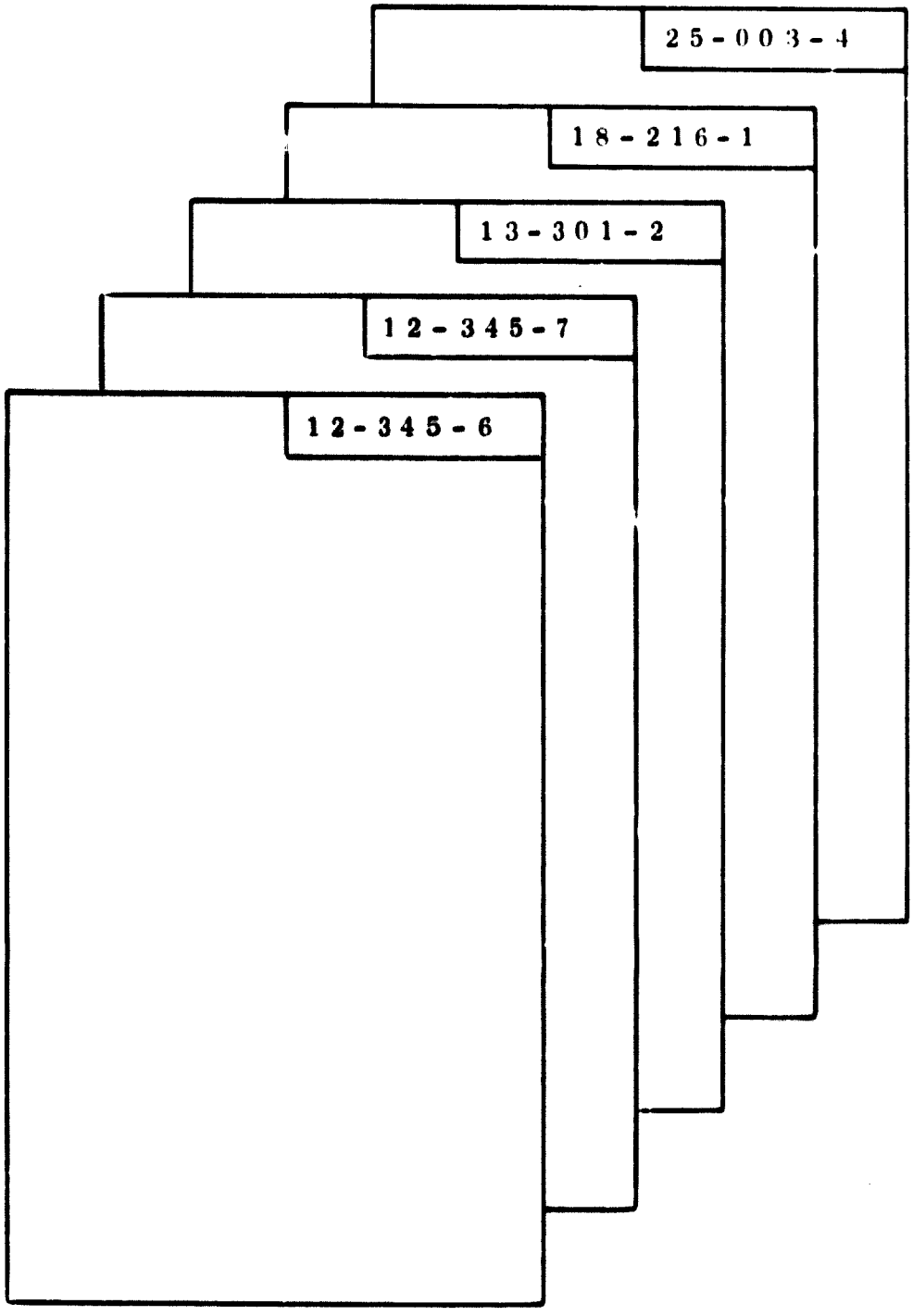


Figure 8

NUMBERING OF REFERENCE DOCUMENTS



Quantity code. This system of numbering is a further refinement over the [illegible] and reference numbers for parts and equipment, but does not apply to identification requirements. When a series of serially numbered items have the same [illegible] nomenclature, but require a system of coding for purposes of quantity [illegible] records or over-all usage of the family of parts or components, the quantity code numbering becomes useful.

Stock number. It is frequently asked why parts to be stocked for future needs or manufactured for resale cannot be identified by the functional number. One of the important advantages of having a stock number, which is generally a serial number with partial significance, is that it is possible to combine several sequentially numbered parts, having omnibus features of more than one part. Thus when needed, a stock numbered part can be withdrawn from stock and altered to suit the specific application which would normally be filled by a functional part. Here, the standardization principle of simplification (that is, the combining of several parts into one, for stock-room facility only) is applied by selecting a stock number coding system of identification.

Sources of standards

Though the actual sources of standards in a developing country may be limited, the potential ones are many, since there will be little inhibition attached to their origins. On the other hand, in industrially developed countries the sources may be many, but not all are suitable for all companies.

From a general point of view, let us examine the sources which would normally be considered valid, provided they actually exist. If they do not exist, alternate sources, or sources which provide similar data, may be considered.

If we place in-plant standards or company standards at the hub of a wheel to receive the data from all the sources on the periphery, the results will be as shown in figure 9.

The primary source of in-plant standards in any country should be the National Standards Body (NSB). This would normally be the first point of reference.

A typical American company may derive its standards for internal use from the following sources (not necessarily in this order of preference).

A. External sources

(1) American Standards Association (ASA)

American standards for gear inspection, sheet metal sizes, screw thread forms, surface roughness, etc. would be used as a basis for company standards for commercial goods.

(2) National Bureau of Standards (NBS)

These standards would be used as a basis for weights and measures, traceability for calibration of inspection instruments, etc.

(3) International Organization for Standardization (ISO)

ISO Recommendations acceptable to the National Standards Body (ASA) would be used as a source for written in-plant standards.

Example - the ISO Recommendation on preferred numbers.

(4) International Electrotechnical Commission (IEC)

Standards on grades of mica, for example, may be applied to the creation of in-plant standards.

(5) Other standards include industry, association and customer prime contractor's standards, such as those of:

Electronic Industries Association (EIA)

American Gear Manufacturers Association (AGMA)

American Society for Testing and Materials (ASTM)

Society of Automotive Engineers (SAE)

Department of Defense (MIL)

XYZ Aircraft Comapny (XYZ)

(6) Standards of National Standards Bodies of foreign countries

British (BSI), French (AFNOR), German (DIN), Soviet Union (GOST) and similar foreign standards, as needed for sub-contract work for European or other foreign trade.

B. Internal sources

(1) Company procedures for:

(a) Charter for standards activity.

(b) Liaison between standards and other groups (facilities group, plant engineering group, departmental standards groups, forms control, etc.).

(c) Calibration and upkeep of testing equipment.

(2) Company practices for drawings, workmanship, manufacturing tolerances, manufacturing processes, etc.

(3) Charter for in-plant committee activities for:

(a) Liaison with industry standards bodies:

(b) Liaison for international standards.

(4) Approved budget and appropriations for testing of new materia to be approved for use and for possible future standards, for testing of samples, preparation of display boards for standardization, display materials for promotion of in-plant standards, etc.

Many of the above sources may apply in the case of a developing country. A typical company there may be able to use standards evolved by the National Standards Body of the country, where one exists, and this would be the source with the highest priority. Frequently, too, a developing country will be abl to draw upon the standards of the National Standards Body of some advanced country abroad.

Where no National Standards Body exists, a company may find it desirable to encourage the creation of one by joining forces with government agencies a other industrial companies (including foreign subsidiaries). Financial suppor and participation in some sort of advisory body or organizing committee would needed for the purpose.

The other sources already mentioned, such as company policies and procedu results of co-ordination and ability to make samples for validation of standar follow the same order of preference as in any industrially developed country. The only question which may arise would be, if these are lacking, in what orde should they be developed? The following normal order is suggested for this purpose:

(1) Company policies and procedures;

(2) Co-ordination;

(3) Company practices;

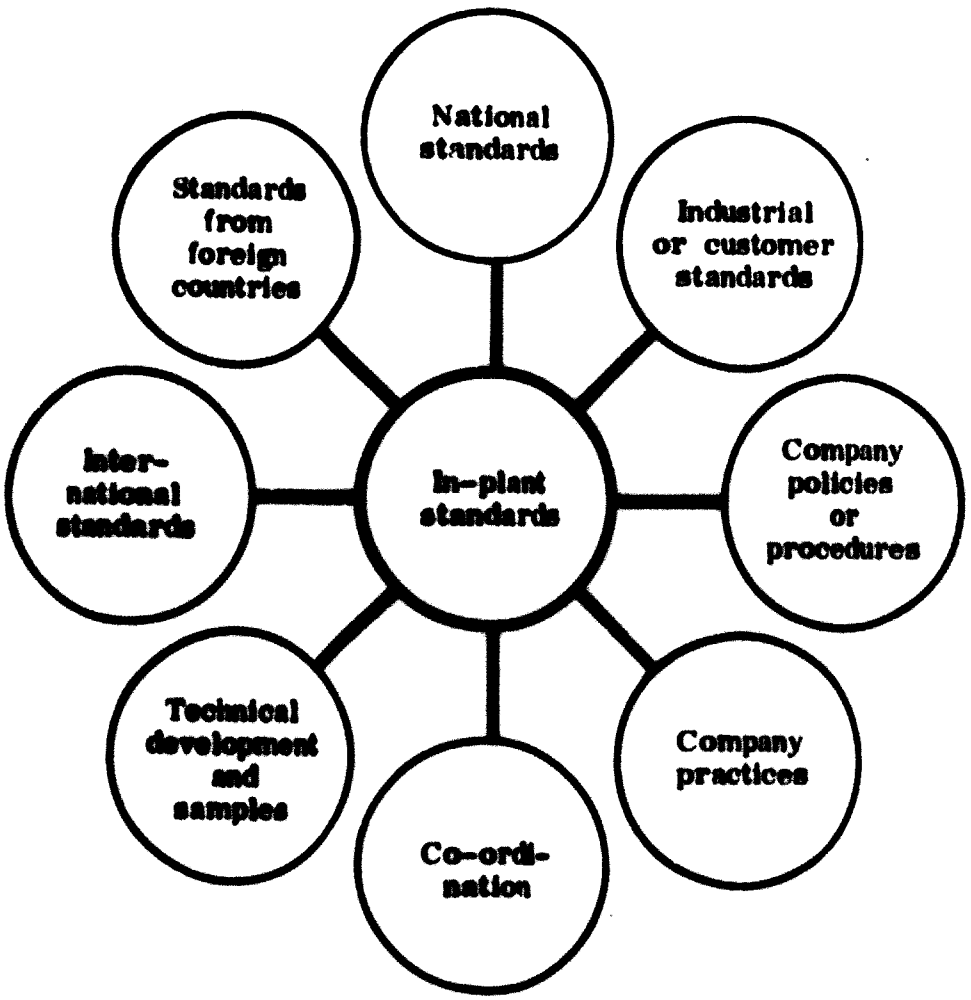
(4) Technical development and samples.

Any organized company will have some internal policies and procedures. Since these are the most basic requirement for starting any enterprise, their existence will be felt even though they may not be written down. Companies mus hire people, establish wages, schedule holidays, have systems for indenting for and dispersal of material, and the like. All this may be going on without formalities, especially in a family-owned business, which may have been in the same family for generations. Some sort of standardization in the form of inflexible routine will exist in a bureaucratic file, in old trunks and even in time-worn ledgers where information has been handed down from father to son or by the senior partner to a junior associate. The big job now is to get these people to help in recording all they know, which may be locked up in their head or scribbled on pieces of paper. This information must then be organized as a standards document, which will be in a recognized format, numbered, dated and circulated for use.

Co-ordination. This first step - recording existing in-plant policies and procedures - will require the application of the principles of co-ordination. All the talents at the command of the in-plant standardization group will be put to the test in accomplishing this in order to develop the background of a standa Guidance in this connexion is given in another section of this chapter dealing with a committee type of activity.

Figure 9

SOURCES OF IN-PLANT STANDARDS



A company standards department is also required to take the initiative for or participate in other in-plant activities which may contribute towards standardization, such as forms control, facilities standards, safety standards, technical suggestions programmes and participation in national and international standardization, through committee activities. In order to arrive at authentic standards, a well-organized company standards department will have to resort to the machinery of co-ordination through a company-approved committee activity. Here, the committee participants would be considered as consultants to the company standards activity. The formulation of the standard will rest with the company standards department, which in the final analysis is responsible to the management for the success of the standardization programme.

Company practices are also to be treated in a manner similar to that described for recording company policies and procedures. In some companies in developing countries these practices may not be as fully developed as the latter and may, therefore, require stronger co-ordination efforts.

Technical development and samples. In the discussion on the progress-time curve earlier in this chapter, it was stated that standards must be up-dated in accordance with progress in technical development. Consequently, development of new techniques may also be considered as a source of new and revised standards. In a developing country, no definite assumption can be made as to technical development, and its importance as a valid source can only be judged by an on-the-spot assessment.

This assessment can be made by various methods of sampling the validity of the new technique. For example, if the existing methods of fastening by screw, lockwasher and net were to be replaced by a method using a welded stud, it would be necessary to provide the designers with data on the relative strengths and reliability of the new fastening device. This may be accomplished by making a sample panel with a series of studs welded on to it, which are then tested for strength against impacts and torque, leading to the adoption of the new standards only after the test samples have supplied adequate proof of the superiority of the new technique.

National standards. The existence of a National Standards Body may be considered as a normal prerequisite for the activity of organized in-plant standardization. As stressed in other sections of this chapter, national standards are to be given preference whenever possible. Though in-plant standardization can proceed even in the absence of a National Standards Body, it cannot do so without fundamental standards of weights and measures. The most casual study of the history of standardization in any country will prove that most societies recognize the value of basic standards of measurements, such as length, weight, volume and the like. The inch, the pound, the metre and the kilogramme are all needed as basically as the language itself in expressing technical requirements. Furthermore, before any solution to a recurrent problem can be recorded, the method of expression must be standardized. This is an accepted prerequisite for standardization at all levels.

Main areas of in-plant activities

General areas of in-plant standardization activities have been discussed in various sections of this chapter. However, the following activities are listed to pin-point the main areas within the scope of in-plant activities in order to emphasize the distinction between the national and in-plant levels of standardization.

Reduction of variety. If no company standardization exists, it would be impractical to build a complete in-plant organization from the start; this is something that has to be done gradually. The first step should be to survey areas where standardization principles may be applied immediately. One of these principles is "variety reduction". Any company, large or small, that maintains a stock-room and builds equipment or parts, can benefit from the application of this principle. Here, variety reduction is a natural target. One of the foremost functions of even a minimum standardization activity is to establish a stock control system. An examination of the company's activities will reveal minor inefficiencies, duplication of parts, improper records, lack of continuity of policies and the like, simply because no attempt has been made to reduce variety. This is an activity ideally suited for inclusion in a company standardization programme: it differs to a marked degree from the normal activities of a National Standards Body.

Simplification is another active step in a company standardization programme. After unnecessary variety has been eliminated, there should follow simplification of parts, materials, products and procedures through the analysis and elimination of minor differences. This activity, too, is peculiar to the company as distinct from the National Standards Body.

Specifications for in-plant use. After adequate emphasis on "variety reduction" and "simplification", an in-plant standards programme may embark on an analysis of additional activities, such as standards for processes, practices and procedures, and specifications for parts. Specifications are of primary importance. Before any company, large or small, can do any manufacturing or processing, it must bring in raw materials or parts on which to perform additional operations. The degree of success with which it performs these operations will depend greatly on the control under which the raw materials and parts are received at the plant. This obviously introduces a need for preparing company specifications for the purchase of these items. In the interests of economy and ready availability, specifications should be patterned, wherever possible, first after the national standards and then after the international standards, or the standards of foreign countries.

Specifications can be of various types. A "purchase specification" is one of the most important. A company may also have many internal practices developed for its own use. These, known as "manufacturing" or "process" specifications, are the ones which keep quality uniform in a company's manufactured or assembled products, which in turn guarantees the customer full value for the purchase price.

Some companies hesitate to publish their intricate and internally developed specifications as their standards, even for internal use, but publishing them does not necessarily take them out of the category of "company standards". It may, however, require a certain amount of extra control over such documents. They may be kept under lock and key and distributed on a restricted basis, but they still form a part of the "company standardization" programme.

Standard parts. An activity within a company which does not parallel that a National Standards Body is the creation of internal standards for parts and equipment to be used by the company's engineering and manufacturing personnel. Here, use of non-company standards will not do, since the range and sizes of parts as standardized by someone else may not fit the company's internal requirements. A company must have its own standards for parts which it recommend for use by its engineers and designers, for parts it selects for minimum and maximum stocking, and parts it decides to buy for tooling, fabrication, and testing and inspection purposes. Only the company with its full knowledge of its internal operations can develop these standards and make them effective as company standards.

Standard practices. Another valid area for company standardization is that of internal practices. In a well-run company these practices are made available to all persons concerned, in the form of documented manuals. For the draftsman, there should be "drafting practices", based on national standards. The draftsman will use them as a guide, but will at no time deviate from them without a valid reason. Actually, standard practices allow him sufficient leeway to engage his technical talents without jeopardizing the family resemblance required in a company's drawings. Drafting practices also record a definite company policy on numbering, filing, legibility, reproducibility, proprietary notes and the like on the drawings, which are definitely controlled by the company for use within all its plants and decentralized operations. Company standard processes, shop practices and procedures are generally agreed on by conferences between engineering and manufacturing personnel and are then published for use as a shop practice manual, manufacturing specifications, finishing specifications or others. These are highly specialized and unique to the company for which they are prepared but they should be based, wherever possible, on national or industry standards.

Use of standards of "foreign" origin

Generally speaking, it has been the custom to associate some of the problems or difficulties connected with in-plant standardization, especially in the developing countries, to the necessity of absorbing "foreign" standards, in particular those derived from foreign countries. Here, the implication is that, since the company using the standard was not a party to its formulation, it would find it difficult to live with. Because of this prejudice, which may be justifiabl in some instances, the problem of adopting a foreign standard must be dealt with on the basis of an intelligent appraisal of its utility. A number of factors must be considered in this assessment.

A standard may have been derived from a company, an industry or a national standard of a foreign country, but it is not its point of origin being outside the country that makes the standard "foreign". It has been noted that, even within a company, a "manufacturing standard" established unilaterally by an

"engineering standards" activity will be less well received by the manufacturing department than a well-considered, seriously thought-out standard derived from a source outside the country. Hence, the term "foreign standard" can lose its significance as to national boundaries, but retain its validity based on the means used towards its establishment. That one division of a company does not recognize the standard of another is sometimes more of a threat to an in-plant standards programme than the problems arising from the foreign origin of a standard.

Problems do exist in the adoption of standards of foreign countries for immediate use, but a serious analysis must be made lest genuine advantages be lost by overemphasizing local standards.

A few recommendations on the appraisal and adoption of foreign standards by a company are given below.

(1) National standards for nomenclature, units of measurement, drawing room practice, safety codes and the like should be adopted (to the appropriate extent) for the promotion of industrial discipline. Particular standards relating to company activities should be adopted after tailoring them to company needs. When complete conformity with national standards is not practicable, they should be adopted with modifications, without jeopardizing the over-all national interest. In such cases, it is essential to feed these data back to the National Standards Body.

(2) The standards department of the company (if there is no department, an informed person) should insist on following the national standards in purchasing and subcontracting and, as a policy, give preference to goods certified by the National Standards Body. The standards department should undertake to promote standards consciousness among all the company's employees, particularly in the drawing, design, requisitioning and purchase departments, regarding available national standards and the advantages of adopting them for company use, especially in manufacturing the company's products to national specifications and in obtaining a licence for certification.

(3) When there is a national standard that is equivalent to a foreign standard, the national standard should be given preference.

(4) When a fully equivalent standard does not exist, a comparative chart of corresponding foreign and national standards should be made indicating the various elements. The company's standards department should then examine to what extent basic national standards for the product, components, etc. may be used, keeping in view the functional requirements of the company's product.

(5) The company's standards department should feed back information to the National Standards Body on subjects where the existing national standards require modification. It should send specific proposals to the National Standards Body for formulating national standards for new products, together with all the data available from the company. The company's standards department may also refer the matter to other members of the industry for similar action. This could be the initial action for the creation of an in-between level of standardization, say, the industry or association level.

Additional decisions may be based on the analysis of the problems of standards collaboration with foreign companies. Whenever possible, the nationa standards or the company standards, indigenously derived, should be given prima consideration. Foreign standards should be used only on account of technical collaboration agreements with the foreign manufacturers, if they are intrinsica better than domestic standards, or when a domestic standard does not exist. Th main areas for orderly collaboration with foreign standards are: 13/

(1) Use of non-indigenous materials;

(2) Variety of materials, parts and tools;

(3) Improvement of the product through redesigning, where necessary;

(4) Assistance by an outside collaborator in the establishment of in-plant standardization. In this connexion, the following points should be noted:

(a) Collaboration with foreign standards should be based, as far as practicable, on available national standards and materials. A realistic assessment of standards and materials should be made and the relevant information sent to the foreign collaborator;

(b) The assessment of national standards and materials should be projected to the immediate future so that it will be possible to use any developments taking place before the collaboration comes into effect and production begins;

(c) To reduce the variety of parts, tools and equipment, the national counterpart, if it is a new enterprise being established, should ask for the standards of the collaborating firm; but if the national counterpart is already established in manufacturing, it should provide the foreign collaborator with its own standards so that these may be incorporated into the project;

(d) In any projected agreement, there should be a provision enabling the national counterpart to redesign to the extent necessary to introduce national standards and the company's own standards of materials and parts, as may be developed from time to time;

(e) Standards, domestic or foreign, are essential even as early as the pre-planning stage of a project, and every manufacturing project, therefore, should provide for a standards organization and activity;

(f) It would be helpful if, as part of the collaborator's assistance, he were asked to provide the know-how for organizing the company's standards activity;

13/ Based on the discussions at the workshop session referred to in foot-note 10.

(g) The increase of the indigenous materials content of a product through the development of feeder industries, establishment of equivalent materials, value analysis and the like will be expedited by the presence of an effective company standardization programme.

Organization of an in-plant standards activity

In any normal human activity there is a tendency towards the formation of habit patterns evolved as the result of solutions to repeated problems. A survey of in-plant operations similarly will reveal improvised solutions to industrial problems, sometimes recorded but frequently communicated by word of mouth. However, an integral part of good management consists in not having to repeat the same guidance; more can be accomplished efficiently through organized standardization. While a formal survey may be conducted through a series of questions (such as those suggested in annex V), a preliminary informal evaluation of casual day-to-day operations may also provide information useful in deciding upon the type of standards organization best suited to the company. One of the simplest - and almost automatic - inputs into this type of survey is a log of the problems that cross a company executive's desk. If the executive finds that he is answering the same questions more than once, and perhaps in different ways because he has no record of how he solved the problem the previous time, there is a definite need for a recorded practice, a memorandum, a directive or a standard. Sometimes, however, even the publication of such a directive is not the whole answer since employees must be trained to implement it and report back any difficulties in making it work. It may be that the solution to the problem does not rest merely with people in authority but needs a technical examination. This will not deprive the executive of his decision-making function but simply delegate his authority to an officer who would advise him of a solution based on a study of the technical aspects of the problem.

The company may be convinced by several such problems arising that a standards officer would not only investigate problems as they occur, but also anticipate difficulties before they arise. Frequently the introduction of new technology requires the simultaneous publication of operating standards in order that company operations are not allowed to deteriorate into makeshift solutions.

The complexity of an industrial organization requires a gradual transition from top executive decisions to solutions developed and recorded by a standards officer, and later to a committee activity consisting of representatives from several company departments.

A general analysis of the incidence of repetitive problems is not the only clue to the need for a standardization programme in a company. Some of the factors that need checking are:

- Does the company have an organized training programme for employees? If yes, what manuals or company documents are available to make such a programme effective?

- Do the stock-room people have knowledge of inventory records in sufficient detail to prevent excess of variety of materials and parts?

- What system is in effect for purchasing tools and equipment for in-plan use, that is, materials not incorporated into the final products? A check of a few items, such as work gloves, soldering irons and typewrit might reveal that procurement is being done on a personal preference ba rather than on a qualified performance basis. Can specifications for these supplies be prepared to take advantage of repetitive and quantity buying?

- Are the supply officers or purchasing agents buying low-priced, high-consurption items or high-priced, low-consumption items? What is the percentage ratio for each?

- The presence of many employees doing similar work in different location points to an area for potential standardization.

- Certain areas of company activity which are frequent or continuous trouble spots can probably be helped through the application of standardization.

The person designated to make spot checks of the type described above and who arrives at successful solutions is a likely candidate for setting up and operating the company's standards activity. A standards programme may be organized in graduated steps. First the survey, then the selection of a standa officer, followed by a company charter to confer formal status on the activity. The activity can proceed from a one-man unit, supported by a typist and a clerk, to a committee activity. In a larger company which makes a variety of products in several locations, problems of standards co-ordination between plants may be solved by installing a regular standards department. The chart in figure 10 shows the structure of a typical standards department.

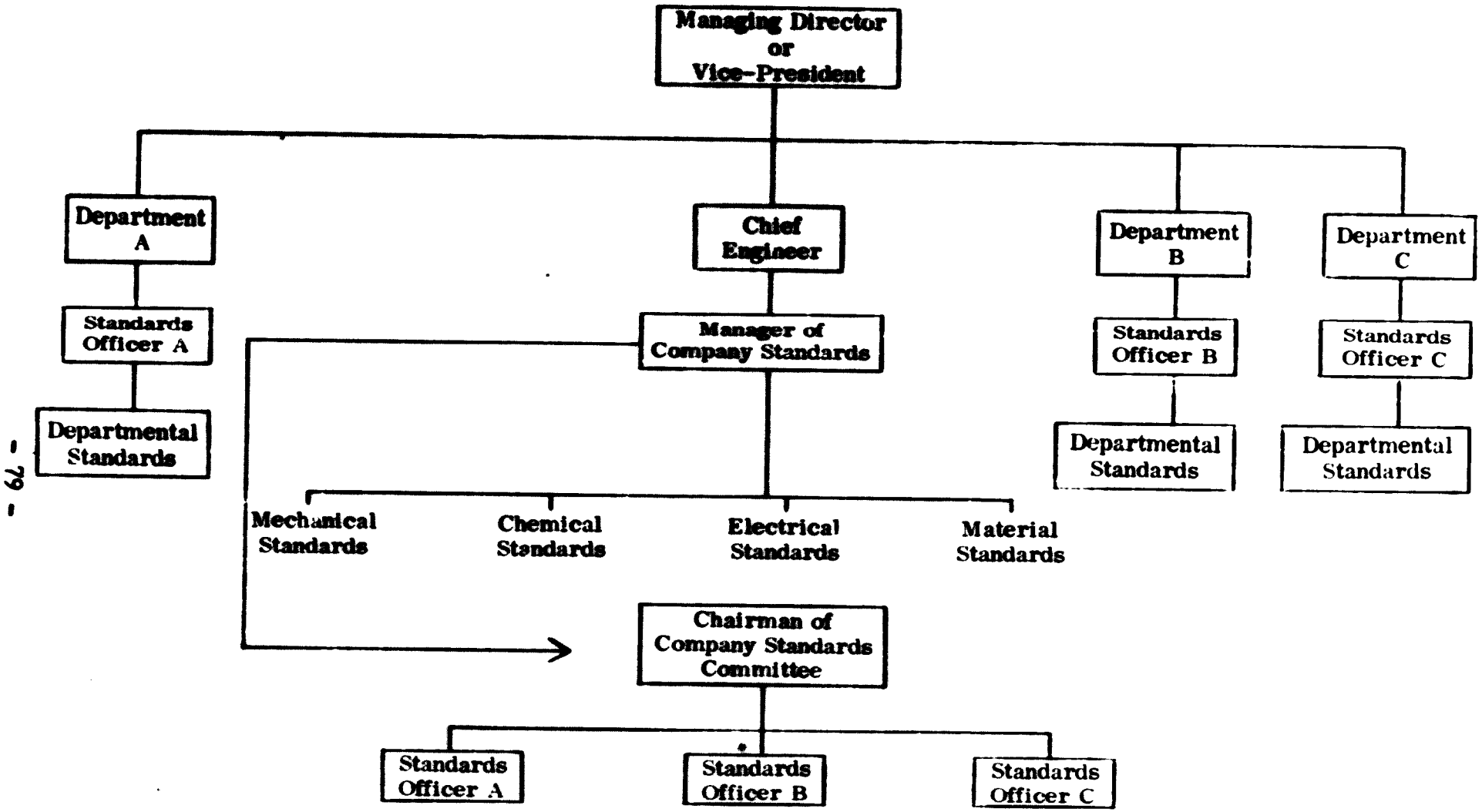
Many variations can be made around this basic organization structure. The following guide lines should be observed.

(1) The Manager of Standards derives his authority from top management; in the case of engineering standards, for instance, it should be from the company's Chief Engineer; in the case of safety standards, from the Chief Safety Engineer, and so on. He has under him those activities most urgentl needed in the company.

(2) If the company produces various products in decentralized plants, there will be particular needs for departmental standards, in addition to the over-all company or corporate standards. Departmental standards will alway be supplementary, but never contrary, to corporate standards. The corporate standards activity will be cognizant with the standards activities of the departments without exerting direct supervision. The departmental standards officers will be directly responsible only to their own department's supervision, but at the same time will work in complete co-ordination with the company standards activity through the medium of membership in the Company Standards Committee. The chairmanship of the Company Standards Committee will normally be held by the corporate standards activity, which will also provide the secretariat for manning the committee proceedings.

Figure 10

STRUCTURE OF A TYPICAL STANDARDS DEPARTMENT



(5) If a department of the company acquires a multi-product, multi-plant status, the departmental standards officer may acquire the status of a company standards manager, within his department, and will co-ordinate the inter-departmental standards activities.

Promotion of in-plant standardization in a developing country

One of the first steps in the promotion of in-plant standardization in a developing country is the compilation of information on the status of standardization in that country and on its importance to the nation's economy. Literature on standardization should be made available for study to the officials most directly concerned with the country's over-all manufacturing problems. Since many developing countries lack organized standardization at the industry level, to get the programme moving it would be necessary to work with the government officials directly responsible for such activities as commerce, export promotion, quality and the like.

As already emphasized, a directive or charter issued by a responsible agency of the government and recognizing the importance of industrial standardization and establishing it as a national policy is the "action" step which must closely follow the initial step - factual assessment of the need for standardization. A study of the beginnings of standardization in some of the industrially developed and relatively advanced developing countries would also suggest ideas for adoption for local use and prevent a certain amount of discouragement which might ensue as a result of a lack of immediate success.

Subsequent to the chartering of the project on in-plant standardization, therefore, a thorough review should be undertaken of the contents of this study and other similar material with a view to drawing whatever guidance is possible from the manner in which standardization in general, and in-plant standardization in particular, was developed in other countries. A review of such data from a country at a stage of industrial development similar to that of the country making the study would be beneficial and encouraging, whereas the steps taken many years ago by a now industrially developed country, with the financial resources at its command, would act only as a deterrent to undertaking a programme which may appear too ambitious and costly.

As a next step, a programme for training people in industry and responsible officials in the technical ministries is highly recommended. Guidance for training must come from areas where standardization at national and industry levels has been established and has proved its utility. Any attempt to create a training programme based only on the knowledge and talent available within the developing country would be analogous to "lifting oneself by one's bootstraps"; technical assistance from established sources must be sought. Wherever possible, as pointed out in the "Sources of standards" section above, the first area of reference should be the National Standards Body. This facility lacking, the standards or Recommendations of the ISO and the IEC, foreign standards, collaborators' standards and the company's internal policies, practices and procedures would serve as excellent areas for source material. In any case, before plunging deeply into automatic acceptance of these standards as background material for in-plant standards, a critical analysis should be made to differentiate between the areas suitable for over-all standardization for the

country as a whole and those of specific interest to the [illegible] companies within that country.

The differences between national and in-plant standardization have been reviewed in an earlier section of this chapter and may be used to investigate such similar areas in a developing country.

Since the steps for establishing standardization (subsequent to the creation of a charter for the programme) are based on a co-ordinated effort between the government of the country and its industries and would take into account the country's trade policies, it would be necessary to explore the possibilities of co-operation and assistance available both within the country and outside it. In addition to the governmental agency assigned the responsibility for national standardization and the promotion of standardization within industries, co-operation may also be sought from educational institutions and educational foundations in the form of study grants and other economic assistance. Even moral support, loans of books, meeting places, guest lecturers and the like will go a long way towards making this programme a success.

Visits to industries for on-the-spot surveys of their activities falling within the orbit of in-plant standardization, are highly recommended.

A report of findings by a standardization expert or a recognized team of experts, giving constructive suggestions to the company managements for improvements in their existing methods of operation would provide the basis for a detailed programme.

There are some techniques which may be of help in the task of convincing managements of companies to install in-plant standardization, which are based on graduated steps additional to the normal submission of a report on the problems of in-plant standardization in their factories. An outline of these steps is attached as annex IV to this report.

Convincing industries of the importance of standardization by giving them positive information on its advantages is not always as straightforward a job as would appear from the steps outlined in annex IV. Frequently, in addition to supplying technical information and cost data on the benefits of standardization, answers must be provided to overcome general reactions, such as the fear of mechanization, over-standardization and the introduction of rigidity into company operations. It is necessary to realize that these views are sometimes held by influential people. Clear explanations of the true aims and scope of in-plant standardization will have to be made in positive terms.

In order to allay the fear that standardization may impose unwarranted control over technical and administrative operations, the following points should be put forth to describe what company standardization does <u>not</u> attempt to do.

(1) It is not an attempt to standardize the company, as some people seem to feel the term implies. The term "company standardization", however, is used so widely and internationally that it would not be advisable to tamper with it now. Company standardization is not an attempt to freeze or regiment the internal management procedures of a company.

(2) Company standardization is not an attempt to stifle the creative efforts of any employee of the company, such as design engineers or the manufacturing people.

(3) Company standardization does not apply only to large companies having many employees, to multi-plant, decentralized companies and companies having modern automated equipment. In-plant or company standardization is a management tool available to all industries, large or small.

It will be necessary to explain that the introduction of standardization into the companies is not simply a technical problem; standards acceptance will not automatically follow the introduction of a system of organized documentation. Human problems encountered as a result of the introduction of standards must also be recognized, and guidance provided for facilitating the transition from unrecorded habit patterns to written specifications. Recognition must be given to the many established practices in use.

Another trend which should be encouraged in the developing countries with reference to standardization is the development of trade or industrial association standards. This movement is firmly rooted in industrially developed countries. The development of trade or association standards would furnish an exemplary effect of increased co-operation by solving common problems, without necessarily involving the sharing of internal know-how or proprietary information.

The above recommendations are set out in summarized form below.

(1) Compile background information on the present status of standardization in a country.

(2) Work with the governmental agency most likely to be responsible for standardization.

(3) Encourage the issuance of a charter recognizing the importance of standardization for the economy, the growth of the national product and the assurance of quality to the consumer.

(4) Review the data from other countries which have recently organized for standardization.

(5) Install a training programme in standardization for people in industry.

(6) Seek technical assistance in standardization from established sources.

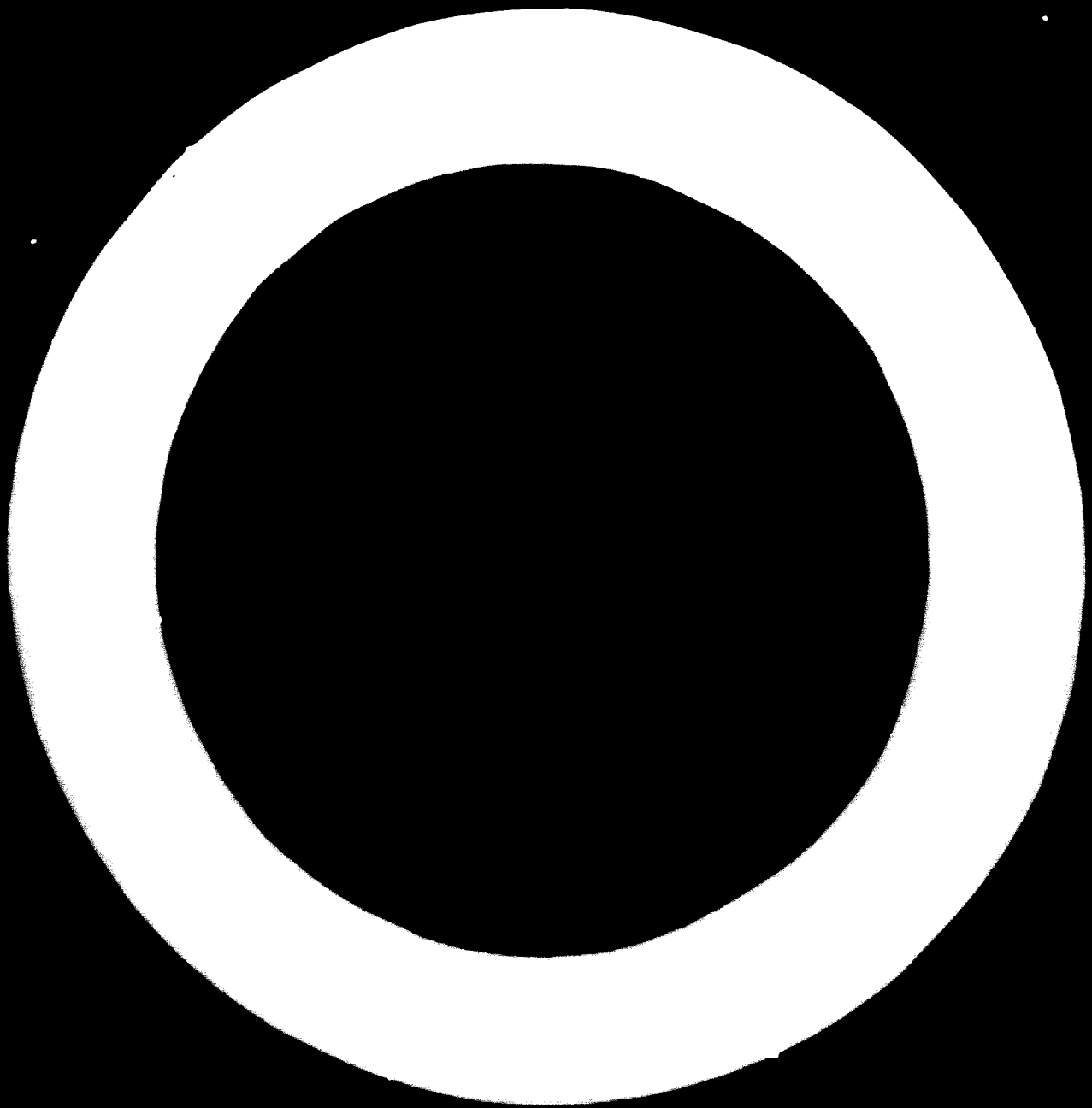
(7) Review standards from other countries as a source material.

(8) Visit industries for a survey of their activities falling within the orbit of in-plant standardization, which may not have been recognized as such.

(9) Follow a planned procedure for convincing management of the benefits of standardization (see annex IV).

(10) Recognize the human problems in standardization, in promoting in-plant as well as industrial association standards.

ANNEXES I to VIII



ANNEX I

STANDARDIZATION IN SOME OF THE INDUSTRIALLY DEVELOPED AND DEVELOPING COUNTRIES

Guidance on how to proceed with national and industrial standardization programmes with the facilities that are immediately available in a developing country are contained in the main body of this report. A description of what has been accomplished by some industrially developed and developing countries may also be useful in guiding the approach to be taken by a newly developing country. National standardization structures and their influence on the establishment of standards by manufacturing companies are described herein for eighteen countries, for illustrative purposes only. The descriptions are not placed in any order of preference nor do they constitute an indication of the degree of technical development of the respective country. Each one should be studied and evaluated in its context for maximum consultative value.

BULGARIA

Origin

Standardization activity in the People's Republic of Bulgaria began in 1948 with the creation, by decree of the National Assembly, of the Standardization Institute (INRA), having the task of directing standardization and invention activities and of setting up State standards and standards for industry.

In 1950, by decree of the Council of Ministers affiliated with the Standardization Institute, the Higher Committee for Standardization was set up as the central organ in the field of standardization.

The Higher Committee for Standardization is a state organism. Associated with it are the offices and committees for standardization subordinate to the ministries, the central institutions concerned with economic activity, and the standardization services in the various administrative districts. In the ministries, committees are in charge of standardization activities, each one in its respective field.

All standardization work is financed by the State.

The Bulgarian Standardization Committee consists of a president (the INRA Director), a vice-president and seven members, experts from other institutions. Twenty people work in the standardization services: eleven engineers, two technicians and two agriculturists who are in charge of drawing up draft standards, one secretary and three translators. At the beginning of 1961, a department was formed entrusted with the controlling of introduction of standards into production. Eight people work in this department: a head, two engineers and five technicians.

The organic structure is as follows: at the head is the Higher Committee for Standardization. Subordinate to it are the ministerial committees and the standardization bureaus set up in the various industrial concerns, the scientific institutes and in the administrative districts.

Functioning

In our country, standardization is a planned activity, provided for in the annual plans approved by the State Council and linked to the economic plan for the nation.

Methods used for drafting standards

The subjects projected in the annual plan for standardization are drawn up by the industrial concerns, the scientific institutes and the services in the administrative districts, and are then submitted to the relative standardization committees under the ministries, which in turn present the draft for consultation to all the ministries concerned. Once their comments have been received, the draft is reformulated and sent to the Higher Committee for Standardization for approval. Before this, however, each draft is thoroughly studied by experts of the Standardization Institute, with other specialists from scientific institutes and laboratories, etc., also participating. The final form is then given to the draft and it is submitted for approval to the Higher Committee for Standardization

Nature of standards

The only form of standardization in the People's Republic of Bulgaria is the Bulgarian State standard which uses the insignia BDS, the number in the series and the year of approval. The BDS approved standards are published and become obligatory throughout the People's Republic of Bulgaria.

To date, there are 4,500 state standards.

Each month, the Standardization Institute edits an Information Bulletin on Bulgarian standardization in which are given the resolutions of the Higher Committee for Standardization, newly approved BDS standards, amendments made to existing standards and annulled or replaced standards.

BURMA

The State Industrial Research Institute established in 1947 was reorganized and expanded in 1953 into the Union of Burma Applied Research Institute (UBARI) by contract with the Armour Research Foundation of the Illinois Institute of Technology (USA).

The UBARI has twelve departments, one of which is the Department of Standards This is composed of two sections: the National Physical Laboratory and the Burma Standards Association.

The work is financed by the Government of Burma.

The Canadian Standards Association (CSA) is a non-profit-making, non-governmental association of technical committees, incorporated by dominion charter to provide a National Standards Body for Canada.

The objectives of the Association are to promote the establishment of uniform and nation-wide standards of products, processes and procedures, by providing an organization to receive requests for standardization, investigate their desirability and arrange for the formation of committees, comprising representatives of manufacturers, users, scientific and technical societies, inspection authorities and government departments, to formulate standards that will be acceptable to all interests concerned.

Advisory Committee

The function of an advisory committee, which is created by and under the authority of the Board of Directors, is to give advice and necessary assistance on special problems that may arise. The Committee consists of not less than ten or more than twenty individuals, such as eminent industrialists conversant with and interested in the objectives of the Association.

Technical Council

The Technical Council is created under the authority of the Board of Directors, consisting of not less than fifty and not more than a hundred members, nominated by and representing specific groups or interests, including professional organizations, industrial associations, dominion and provincial government departments and agencies, the National Research Council of Canada, public utilities, the Canadian Electrical Association, the Canadian Electrical Manufacturers Association, the Canadian Manufacturers Association, universities and special members appointed by the Board of Directors.

The Technical Council is the final authority within the Association for the approval of the technical provisions of completed, proposed specifications, prior to publication, and of subsequent revisions thereof.

Sectional Committees

Under the Technical Council, various Sectional Committees are appointed by the Board of Directors for the development of standards. Their responsibility is to supervise the work of standardization within the scope of their respective sections. They are responsible for the approval of specifications developed by their respective Specification Committees and for submitting the same to the Technical Council for final approval.

Specification Committees

Under the authority of the Sectional Committees are appointed Specification Committees on specific subjects, the chairmen of which are appointed directly by the Board of Directors. The members of these committees are selected fr

the interests directly concerned and comprise representatives of both manufacturers and users, with a sufficient number of technical advisers to ensure thorough review of the work undertaken.

Procedure in standardization

The CSA procedure for formulation of standards is based on the principle that any group having an interest in setting up a standard has the right to give its technical knowledge, ideas and experience towards the development of that standard. The CSA standards are developed on a mutual accord basis - acceptable alike to both producer and consumer.

Policy

The policy of the CSA in standardization is that new projects will be initiated only if there is an expressed or obvious need for standards on specific subjects and assurance that their establishment will be of general benefit to both producer and consumer interests.

Standards and codes of practice are prepared by balanced committees of diversified interests to ensure that the views of all interested parties are considered. They are voluntary and recommendatory, and become mandatory only when adopted by an authority (municipal, provincial, federal or the like) having jurisdiction. All standards are subject to periodic review and revision as conditions warrant.

Order of development

A trade association, technical society, government department or any other interested group, submits to the Canadian Standards Association the request for standardization on any specific subject or for the revision of an existing standard. If the need is apparent and broad application is assured, the request is submitted to the Board of Directors for its acceptance and instructions to proceed with the work.

The Board of Directors authorizes the undertaking and appoints a chairman of a Specification Committee to set up the standard. The committee plans its work and appoints, where necessary, sub-committees to draft the various sections of the proposed standard.

The committee and sub-committees work through successive meetings and by correspondence until agreement is reached upon a draft of the standard. Acceptance by Specification Committees of a proposed standard or revision to an existing standard is by letter ballot, and an affirmative vote from two-thirds of the committee members entitled to vote constitutes approval.

The standard is then submitted for final approval of the Technical Council through the Sectional Committee concerned. In both the Sectional Committee and the Technical Council an affirmative vote from two-thirds of those voting constitutes approval.

A CSA standard is a document in which [illegible] technological requirements of a product [illegible] described and defined.

Co-ordination

Through the National Research Council, the CSA is in close co-operation with the Canadian Government Specifications Board. Liaison is maintained with departments of both the Federal and Provincial Governments.

In the international field, the CSA is the member for Canada of both the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

The Canadian Standards Association is responsible for and publishes the Canadian Electrical Code.

The CSA Laboratories are a testing authority which carries out testing, examining and reporting, together with a follow-up factory inspection service, of electrical appliances, devices and materials.

The CSA-approved equipment is accepted by all electrical inspection authorities and fire marshals in all provinces of Canada.

District offices of the Laboratories are located in Montreal, Vancouver and London (England). Associate Laboratories are the British Columbia Research Council, BSI/CSA Approvals Agency (British Standards Institution) and KEMA in the Netherlands. For test and examination of electrical components and their installation on gas burning devices, the American Gas Association, Inc., Cleveland, Ohio, acts as a co-operating laboratory.

CEYLON

The need for instituting standards has been felt in Ceylon for some time while the Government has been taking ad hoc steps administratively to cover various sectors of the economy. In 1949, the Food and Drugs Act was passed, but its effectiveness in implementation has been admittedly less than was expected at that time. This Act is enforced by the various local bodies through their medical officers and food inspectors, the analytical work on the samples submitted being performed by approved public analysts and/or the Government Analyst Department. Implementation has been restricted owing to policies of the different local bodies and the availability of funds for this purpose.

In 1954, a Standards Laboratory for Weights and Measures was established by the Department of Commerce. Inspectors of weights and measures under the supervision of examiners of standards check on weights and measures in use. There have been proposals by the Department of Commerce to establish laboratories in the ports of Colombo and Galle for the testing of export products and particularly of graphite and citronella oil. The Coconut Board intends setting up its own laboratory for the administration of desiccated coconut regulations. The Government Analyst has a control laboratory, at the coconut oil mills installations in [illegible],

for testing coconut oil and this service is rendered on behalf of the Department of Commerce. Export products, such as papain, are analysed by approved public analysts before licences are issued for export under Export Control Regulations.

Standards Advisory Council

A Standards Advisory Council was established on 15 October 1955 by an order of the then Minister of Industries, Housing and Social Services, with the following terms of reference: to prescribe

(a) standards for the quality and grades of local goods intended for domestic circulation, and

(b) standards for quality and grades of local goods intended for export.

The Council is essentially an advisory body. In its work, it is guided by specifications already prepared by other institutions, and these specifications are modified to suit the special circumstances prevailing in Ceylon. The Council nominates the members to different technical sub-committees - which have power to co-opt any additional members in order to ensure adequate representation of all viewpoints - to formulate specifications, observing the following principles:

(a) the standards shall be in accordance with the needs of the industry and fulfil a generally recognized want, and

(b) the interests of both producer and consumer shall be considered.

Before embarking on any standard, it must be satisfied that there is a strong body of opinion in favour of proceeding and that there is a recognized need to be met. These specifications are approved, in a modified form where necessary, by the Council before publication. Sixty-seven Ceylon standard specifications have been approved to date; most of them have been published, while the remainder are in the course of print. These standards, on publication, are circulated among government departments, embassies in Ceylon and interested institutions in Ceylon and abroad. The sub-committee responsible for drafting a standard is maintained as a standing committee so that it can be called together at short notice to amend the standard should experience in its use reveal any defect or difficulty. The committee is also required to review the standard at specified intervals in order to ensure that its requirements are kept abreast of developments. This procedure helps to eliminate the often expressed fear that standards will inhibit manufacturing progress and retard development.

Adoption of standards

None of the Ceylon standards at present has any legal force. They could, however, constitute a basis for a contract of sale of goods, particularly between vendor and purchaser. For instance, the purchaser of tiles for government building in Ceylon must comply with Ceylon Standard No. 4:1957. It is up to the buyer to specify compliance with the relevant specification. No certification mark is administered by the Standards Advisory Council on standard products.

Standards under investigation

Among the standards under investigation and formulation by the Standards Advisory Council and its various sub-committees are patent fuel, [illegible], knives, coconut oil, sole leather, vegetable and chrome tanned leather, [illegible], barbed wire, lead pencils, curry powder, shoe polish, manhole covers, [illegible], office furniture and coir fibre.

The Standards Advisory Council has been able to do a considerable amount of useful work, but has failed to keep pace with the progress of industry. With the present Government's policy of stepping up industrialization by approving large-scale and small-scale industries for the manufacture of products, the need has been felt for a Standards Institution with broad-based functions and duties to co-ordinate the efforts of producers and users for the improvement, standardization and simplification of engineering and industrial materials; to simplify production and distribution; to eliminate waste of time and material involved in the production of an unnecessary variety of patterns and sizes of articles for one and the same purpose, and to set up standards of quality and dimensions. It is considered necessary that the functions of this institution should be centralized so that the needs of the quality of products meant for internal consumption as well as for export are adequately met.

Standards Council and its work

With the objects in view described above, the Government of Ceylon has approved, by an Act of Parliament called the Standards Act, the setting up of a Standards Council and a Standards Bureau to act as an independent corporate body with the powers and duties of the Bureau vested in the Council. The objects of the Bureau of Standards, in addition to the implementation of the Food and Drugs Act, shall be as follows:

(a) to promote standardization in industry and commerce and to prepare, frame, modify or amend specifications and codes of practice;

(b) to make arrangements or to provide facilities for the testing and calibration of precision instruments, gauges and scientific apparatus and for the issue of certificates in regard thereto;

(c) to make arrangements or provide facilities for the examination and testing of commodities and any material or substance from or with which, and the manner in which, they may be manufactured, produced, processed or treated;

(d) to encourage or undertake educational work in connexion with standardization and quality control;

(e) to assist in the rationalization of industry by co-ordinating the efforts of producers and consumers for the improvement of appliances, processes, raw materials and products;

(f) to provide for the registration of standard marks applicable to materials, commodities and products conforming to standards issued by the Bureau;

(_) to provide for co-operation with any person, association or organization outside Ceylon having objects similar to those for which the Bureau is established;

(n) to provide for the testing, at the request of the Minister and on behalf of the Government, of locally manufactured or imported commodities, with a view to determining whether such commodities comply with any law established or to be established and dealing with standards of quality;

(i) to establish, form, furnish and maintain libraries and laboratories for the purpose of furthering the practice of standardization.

Standards approved by the Bureau will in no way be made automatically compulsory. However, in those instances where the reputation of the country is endangered through the unsatisfactory quality of its export, where there is risk to public health and safety or where there is gross malpractice, the Minister of Industries may, on the recommendation of the Council, declare that a product or process should be brought under compulsory standard. The Bureau will administer the compulsory standard through factory inspection and stringent tests.

COLOMBIA

In 1957 a National Congress of Engineering was attended by delegates of all Colombian organizations engaged in engineering. One of the subjects discussed was the trouble caused by lack of national standards for products, methods and processes. As a result of these discussions, the Colombian Standards Institution (Instituto de Normas Colombianas (INORCOL)) was established as one of the three institutes forming part of the Division of Scientific Research of the Industrial University of Santander, which had shown the greatest interest in the problem. The two other institutes are the Institute of Pure and Applied Research and the Institute of Industrial Consultants.

The Institution is financed by the University, by fees paid by four kinds of members and by the sale of standards. Staff assistance is provided by the University.

National standards are developed by technical commissions; they are published in draft form for comment and criticism and get their final approval from INORCOL's High Council.

CZECHOSLOVAKIA

Origin

Technical standardization work was first undertaken in Czechoslovakia by the Czechoslovakian Electrotechnical Association, founded in 1919, and the Czechoslovakian Standards Association, founded in 1922. In 1951, the standardization activities of these two organisms were combined and the Standardization Office (CSN), which is a state institution, was founded. In 1959, the Office of Weights and Measures was joined to the Standards Office.

...s the Standards Office is a state institution, it has no workers.

The activities of both the Standards Office and [illegible] financed by the state budget. Expenses resulting from the activities of the ministries and of industrial enterprises are covered by the [illegible] industries and enterprises. The Standards Office has a staff of [illegible] and administrative personnel.

Organizational structure

The Standards Office is connected with the State Committee for Technical Development, which is subordinate to the Government. It includes two specialized sections: standardization, and weights and measures; these are subdivided into services. Furthermore, different specialized services deal with standardization in the field of mechanical construction, electrotechnics, metallurgy, chemistry, etc.

Other services handle questions of interest to the above-mentioned sections: international relations, documentation, etc. The Publishing Department is also part of the Standards Office.

The Office is directed by a President, who decides on important questions with the aid of other responsible officials and of a council of experts. The latter is made up of specialists qualified in the industrial, scientific and technical domains. The majority of the staff of the specialized services are engineers.

Functioning

The duties and rights of the Standards Office are set out in the law concerning Technical Standardization, as well as by the government ordinance of 1957 on technical standardization.

Standardization activity is carried out in accordance with the annual state plan for technical standardization drawn up by the Standards Office. The latter directs the drafting of state standards as well as work on a lower level (standards for sectors and for the industrial concerns). It is in charge of international collaboration and supervises the development of standards in Czechoslovakia. The ministries direct technical standardization in enterprises subordinate to them.

In the different sectors of production, standardization centres have been formed (in industrial concerns, research institutes, etc.) which have the right to approve standards valid in their own sector.

Methods used for drafting standards

The drafting of state standards is carried out according to the plan. During the plan's establishment, the Standards Office examines the proposals of the industrial concerns, the standardization centres and the ministries. The plan determines the orientation for standardization work and the organizations entrusted with the work, as well as the time-limits allowed.

The agency concerned must prepare a first draft standard, keeping in mind the objective set out in the plan, the directives of the Standards Office, the

production requirements and the consumer needs. The draft standard is distributed for comment to all interested parties. It is then discussed within the standardization commission.

The agency concerned then returns the draft to the Standards Office for the carrying out of the last phase of the procedure. The final discussion takes place within the framework of the standardization commission, called in by the Office. A shorter procedure can also be used: examination of the draft by the Standards Office on the basis of a report written by the parties concerned. During this final stage, the Office settles the issues on which compromise could not be reached through discussion. The final ratification of draft standards is made by the President of the Standards Office.

Nature of standards

Most Czechoslovakian standards are compulsory. It is, however, possible to depart from this rule when the competent agency has so authorized the body requesting an exception to the general rule. These exceptions are authorized by the agency which has approved the standard. About 17 per cent of CSN standards are recommended standards.

At present, there are about 13,000 state standards. The number of CSN standards published to date is estimated to be about 50 million.

The Publishing Department of the Standards Office puts out the monthly journal Normalizace with its appendix, the "Bulletin of the Standards Office", as well as the bi-monthly bulletin of the Office entitled Measurement Service and the monthly bulletin of the Publishing Department of the Office. The Publishing Department, moreover, publishes the Catalogue of State Standards (as a general rule, once every two years) and various publications on technical standardization, the list of standards for the various sectors, etc. Finally, the Publishing Department of the Standards Office also puts out publications and journals for the Bureau of Patents and Inventions.

Three kinds of marks are used to indicate conformity of products with CSN standards.

FRANCE

Subsequent to the Second World War, in order to improve production, it became necessary for the Government of France to orient the work of standardization into the most promising channels and to ensure that the standards be applied as soon as possible. This is now accomplished in a threefold manner.

The Commission of Standards, a government organization, has been entrusted with the work of:

(a) establishing a policy of standardization best suited to the needs of the country;

(b) supervising the preparation of the standards;

(c) [illegible] to the application of the [illegible] economy.

The French Standards Association (AFNOR), a private enterprise, has been entrusted with the preparation of the programme of standardization [illegible] direction of the Commission.

The Association co-ordinates the activities of the various bureaux and prepares plans of standardization which become official only after approval by the Commission. These plans are only submitted to the Commission after comments have been obtained from all those affected by means of a survey.

Standards offices have been created within the organizations of the various industries affected and are to study, within their terms of reference as laid down by AFNOR, plans of standardization which are then to be submitted to AFNOR for finalization.

The attributes of these different organizations show the layout of the standard-setting machinery in France. The preparatory work, generally speaking, is carried out by the bureaus attached to the various producers' federations, but the results of their studies are then submitted to a survey in which all interested parties, including especially the consumers, take part.

One of the essential attributes of the Commission on Standards is the adoption of the standards throughout the country's economic structure. To this end, the Commission takes all necessary measures or causes the Government to take such decisions as will enable industry to adopt the official system of standardization or speed up such adoption.

In looking at the French example, the developing countries may note that pressure can also be exercised in other ways on industry so as to encourage the adoption of the standardization plan. Taking advantage of the existence of shortages and price controls, the rationing and allocation authorities can facilitate supply of raw materials only to such industries which manufacture standardized products. In certain cases, the price policy applied has been calculated so as to favour the adoption of standardization plans.

Another method, subtly designed to favour the adoption of standardization, is to authorize the marking of standard products with the sign "NF" (Norme française).

This trademark, known as the "National Mark of Standardized Products", gives those manufacturers authorized to use it a privileged position with regard to their competitors.

Consumers can, by insisting on the national mark, be certain of purchasing an unvarying quality of product suitable for its intended use.

This method is especially well adapted to standard products requiring particular qualities, defined clearly by precision methods of test or analysis, which can be clearly stated in the relevant regulations.

AFNOR is the organization dealing with the use of the national mark, and has a statutory legal standing in the supervision of its employment.

[illegible] provides that the organization is empowered to enter into international relationships, either for the purpose of obtaining or giving information, and to promote the organization of studies and execution of decisions emanating therefrom, on an international scale.

France also takes an active part in the work of the International Organization for Standardization (ISO).

INDIA

National standardization

Though standardization in certain spheres of activity has existed in India for many years, an organized attempt at the national level was made only with the establishment of the Indian Standards Institution (ISI) in 1947. ISI, which is a joint venture of both Government and industry, is the National Standards Body for India. Its main objects include preparation, promotion and general adoption, at the national and international levels, of standards relating to materials, commodities, structures, practices and operations. The Institution also provides for the registration of standard marks applicable to materials, commodities, etc., conforming to standards issued and recognized by it. The over-all control of ISI is exercised by a General Council consisting of representatives of the Union and State Governments, leading trade, scientific and technological organizations and subscribing members of the Institution. The Union Minister for Commerce and Industry is the ex officio President of ISI.

The technical activity of the Institution is carried out through seven Division Councils, one each for Agricultural and Food Products, Building, Chemical, Electrotechnical, Engineering, Structural and Metals, and Textile. All technical work relating to the formulation and revision of standards is done by committees consisting of experts drawn from manufacturing units, technical institutions, purchase organizations and other bodies appointed by the respective Division Councils. During the last sixteen years of its existence, ISI has issued more than 200 Indian standards covering a wide range of subjects to meet the needs of the developing indigenous industry. Considerable benefits have accrued to industry as a result of standardization of materials, methods of test, codes of practice, etc. In several cases, reduction in varieties of products and materials has been brought about; for example, in IS:502-1953, sixty-three sizes of solid bobbins for dry jute have been reduced to three. Again, in IS:395-1959 and IS:985-1958 (which have been recently revised), 232 sizes of lead acid storage batteries have been reduced to nine. Similarly, in the case of automobile lamps, a reduction from 500 to forty-three types has been effected in IS:1606-1960. In the field of structural steel, the new hot-rolled sections standardized by ISI, based on a 25-mm module, have effected about 10 per cent economy in material, being that much lighter for equivalent load carrying capacity. These sections, along with the revised design codes which have liberalized factors of safety, are likely to lead to a further economy of about 10 per cent. The new series of Indian standard structural sections is now being produced in the new steel mills established in the country; the old mills have also plans for producing these sections.

For formulation of Indian standards, ISI has set up some 230 committees, about 600 sub-committees and panels having a committee membership of 13,000 drawn

[illegible] various interests concerned. [illegible] rate [illegible], the Institution [illegible] officers and some 160 other [illegible] year. [illegible] published in 1963 [illegible] 160 [illegible] first five-year plan, i.e., in March [illegible].

Standardization at company level

There are very few companies in India which have form[illegible] for establishing documented specifications to co-ordinate and [illegible] operations of the company. However, company-type standardization [illegible] number of units though it is not formally identified as standardization [illegible]. Many companies rely on the experience of their long-term employees for uniformity and continuity of their operations, but the importance of written procedures for regulating these operations is now being generally recognized.

A large number of manufacturing units in India have [illegible] or are associated with their principal companies in other countries. In the attempt to use standards of their principals, Indian companies often create demand for supplies in accordance with the requirements of foreign standards. This [illegible] in the way of achieving economy through rationalization of production and consumption in the country. The difficulties which companies are experiencing in obtaining supplies in accordance with the foreign standards, coupled with other disadvantages due to lack of their own standardization, have made the managements of Indian industries more and more receptive to the idea of establishing internal company standards.

In order to sustain this interest and to promote development of company standardization activity in Indian industries, the Indian Standards Institution has taken up a project under which training opportunities and other assistance have been made available to Indian industries to evaluate the present status of in-plant standardization practices in their factories and to establish organized standardization activity. The two types of programmes, namely "Survey programmes for evaluation of company standardization practice" and "Training programmes for establishment of company standardization activity", have been conducted this year with the assistance of a United Nations expert in the National Productivity Council (India) and the local Productivity Councils co-operated in organizing the "survey programmes", whereas the "training programmes" were sponsored directly by ISI. The three survey programmes at Calcutta, Bombay and Madras have been attended by nominees from some fifty manufacturing units covering the automobile, textile, chemical, engineering and steel industries, among others. The training programmes, held at Hyderabad and Mussoorie, have been attended by nominees from some forty companies representing equally diversified interests. Participants in these programmes have been suitably indoctrinated on the benefits of organized standardization activity within a company and on the techniques for establishing such an activity at the plant level. It is expected that they would initiate, in the near future, action within their organizations in accordance with their individual requirements.

The Standards Organization of Iran (SOI) is a government organization, established in 1960 to co-ordinate the efforts of agriculture and the manufacturing industries in setting up standards for domestic and foreign commerce. It has a laboratory staff of engineers and technicians who prepare drafts of national standards. These are then submitted for study to a technical committee and sent out to a general canvass. Their final approval is by the SOI Council.

The use of national standards is voluntary, but they may be made mandatory, either as "official" standards for the government services, or generally, for the protection of the public. The SOI is financed by grants from the Government.

ISRAEL

The Standards Institution of Israel (SII) is a public organization operating in accordance with the Standards Act, promulgated by the Knesset in 1953. It was founded as the Materials Testing Laboratory by the Association of Engineers and Architects of Israel.

The income of the Institution is derived from the following sources: test fees (87 per cent); research (6 per cent); government grant (6 per cent); miscellaneous (1 per cent).

Standardization

The work of standardization is done by seven central committees and 220 standardization committees, on which about 1,500 experts from all branches of the Israel economy are taking part.

The Standards Library of the SII contains about 120,000 foreign standards.

The Standardization Department of the SII maintains contact with more than forty-five national standards institutions all over the world, with whom standards are exchanged.

During its existence, the SII has prepared and issued about 440 Israel standards (catalogues are available free of charge to all interested).

Standards mark

In accordance with the powers vested in the Institution by the Standards Act, permission to affix the standards mark has been approved up to the present for approximately 200 products. The application of the mark certifies that these commodities comply with the requirements of their respective Israel standards.

Research

Applied technical research is carried out by the Institution in the following fields:

- research for the purpose of standardization;
- research for establishing methods of test;
- research for quality of industrial products;
- research in the field of raw materials for industry and exploitation of industrial by-products.

Laboratories

Approximately 200 producers in Israel have placed the manufacture of their products under the permanent supervision of the Institution. The Institution inspects the quality of building materials and carries out soil engineering tests for the Israel Government and public building corporations.

Besides laboratory testing and control of quality of building and production, the laboratories render technical advice in the following fields: building materials; metallurgy and machinery; electrical and electronical products; chemical products, and textiles.

Instruction

In 1961, the SII established the first course of instruction for quality control inspectors in the metals branch. In 1962, further courses will be established for inspectors in other industrial fields.

Procedure for the preparation of standards

A subject for a standard may be proposed by bodies and persons specified in the rules. Proposals are sent to the Director.

The Director passes the proposal, with his comments, to one of the central standards committees for decision as to whether to accept or reject the proposal. The decision is conveyed to the proposer. An adverse decision requires the approval of the Executive Committee.

An approved subject is then dealt with for drafting by one of the standing technical committees, with a technical officer acting as co-ordinator for the Committee. If no suitable technical committee already exists capable of dealing with the subject, the Central Committee may set up a new committee for the purpose.

The draft standard is then distributed for observations and comments to all Institutions members of the ISO, and to a large number of interested parties. The draft is sent with an English translation.

fixed [illegible] allowed for receipt of comments, usually three months but in no case more than six months, as the Director may decide. At the end of the period for receipt of comments, the technical committee considers comments received and in the light of them, revises the draft and submits a final draft for approval by the Central Committee.

In submitting the final draft for approval, the technical committee submits a report of the proceedings leading to the final draft, including details of discussions on comments.

The Central Committee also resolves differences of opinion, if any, submitted to it by the technical committees in connexion with the test of the final draft.

The Central Committee submits the approved draft for final assent by the Director, who records his assent by signing the minutes of the meeting of the Central Committee wherein the draft was approved. With such signature of the minutes, the approved draft becomes an Israel standard.

The Director forwards a report of the proceedings and copies of the standard to the Standards Officer and publishes the standard.

MEXICO

In 1944 the General Directorate of Standards (DGN) (Dirección General de Normas: Departamento de Normalización) was established as a branch of the Government's Secretariat of Economy, which in 1958 was changed to the Secretariat for Industry and Commerce. This has legal authority to develop and establish standards for the quality, functioning and nomenclature of industrial products and to approve them as official standards.

The Standardization Council is entructed with the drafting of national standards. It consists of official members who are civil servants and private members representing industry, commerce and certain educational institutions.

The work is financed exclusively by the Government and staff services are provided by government personnel.

The standardization work is carried out with the assistance of the Department of Inspection and Surveillance and of laboratories and workshops, all of which are under the direction of the DGN.

Use of national standards is optional, except for those that are made mandatory by the Government. These include standards affecting the health and safety of the general public and standards applying to products to be exported.

The DGN has a conformity mark which is administered by the Secretariat for Industry and Commerce. Its use requires a licence which, when granted, becomes binding on the licensee as to compliance with the standard concerned. This is regularly checked by the Government. Use of the mark is mandatory for certain products to be exported.

In 1951 the Government of Pakistan set up the Pakistan Standards Institution (PSI) as a small unit attached to the Central Institute of Industries. In 1956, the PSI became a unit of the Department of Industry and Development. Explaining the decision, the Government decided "to follow the example set by a number of countries in regard to a national standards institution as an autonomous body". The PSI became autonomous in 1957.

The PSI has three classes of membership, comprising governmental agencies, private enterprises, institutions and individuals. It is financed by grants from the Government, voluntary contributions, membership fees and the sale of publications. It has a staff of engineering and scientific workers assisted by administrative personnel.

Standards are developed by sectional committees appointed by the PSI Divisional Council in the field concerned. Both the Council and the sectional committees are representative of the interested parties. Draft standards are widely circulated for criticism and comment.

The top managerial body of the PSI is the General Council whose Executive Committee gives final approval to national standards.

The PSI staff assists the Divisional Councils and sectional committees in the preparation of drafts and in the editing and publication of the approved standards.

Use of PSI standards is voluntary, except where the Government makes them mandatory to control the quality of goods to be exported, to protect the life and health of the general public or to preclude gross deception.

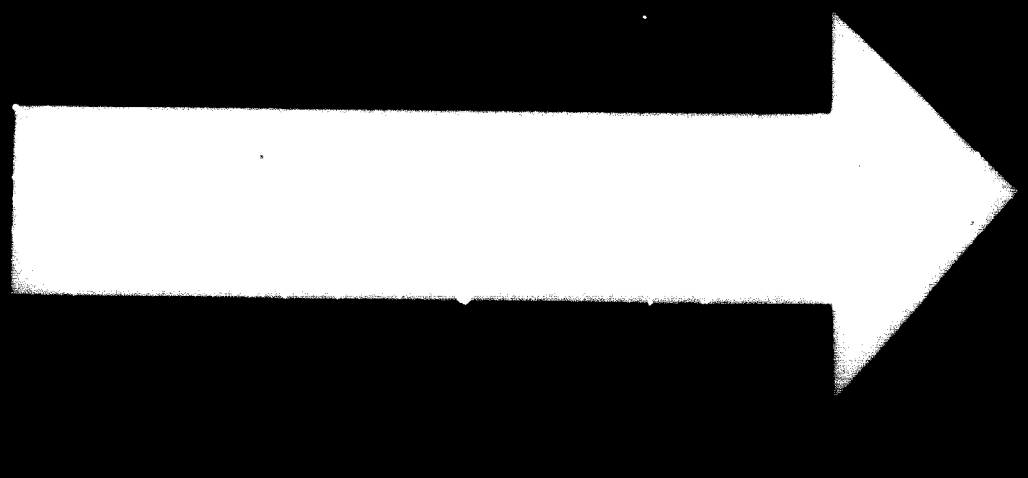
TURKEY

The Turkish Standardization Institute (TSE), the National Standards Body in Turkey, was organized with the advice of a consultant appointed by the United Nations Technical Assistance Administration who spent two periods in Turkey for this purpose, one of thirteen months and one of five and one-half months.

During the first period, the TSE was set up, upon recommendation by the consultant, as an autonomous institution affiliated with the Union of Chambers of Commerce, Industry and Commodity Exchanges of Turkey. Also, a TSE staff member was trained in Europe (on a United Nations fellowship).

During the interval between the first and second periods, the TSE prepared a programme of work and made a preliminary study of some proposals for standards submitted by various organizations.

During the second period, consultation was focused on in-service training of a small initial staff consisting of the General Secretary of the TSE, an agricultural engineer, one mechanical engineer, a draftsman and a secretary. This training consisted largely in handling projects by the committees of the TSE, the



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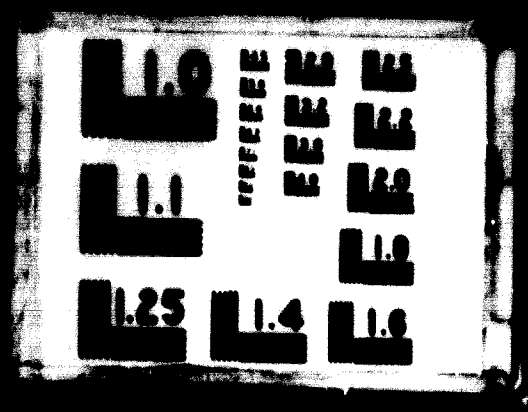

[illegible] procedure. In this way the TSE staff, as well as the committee members representing private enterprises and the Government, became acquainted with the working principles of a modern standards organization.

The TSE consists of a General Assembly, with representatives of various ministries, universities, chambers of commerce and industry. It has a secretariat, a number of sections in charge of the preparation of standards and a special section which decides on the application of standards after they have been approved.

The General Assembly is the highest authority and elects five of the seven members of the Board of Directors, the other two being representatives of the Union of Chambers of Commerce, Industry and Commodity Exchanges in Turkey.

The TSE is financed by membership fees, voluntary contributions by the Government and private enterprises and by the sale of publications.

The TSE sections may set up technical committees or working groups to make investigations or surveys necessary for the careful preparation of drafts. The sections are permanent bodies; the technical committees are either permanent or temporary, whichever is the more useful.

Approval of a proposed national standard is by the General Assembly which judges the proposal on the basis of co-ordination and compliance with TSE procedure, but does not make any technical changes. The use of national standards in Turkey is voluntary, unless made mandatory by the Government.

Staff assistance in the development of standards is supplied mainly by the TSE secretariat. It was suggested that, as the TSE work would grow, it might be necessary to get additional assistance from specialists not on the TSE staff who might act, for example as secretaries of technical committees.

UNION OF SOVIET SOCIALIST REPUBLICS

Origin

State standardization activities were organized in the Soviet Union in 1925. Up to that time, standardization work had been limited to the activity of isolated industrial enterprises and institutions, and affected only a few limited aspects of the economy concerning production, stocking for national use or exportation. The organization of work for state standardization is inextricably bound up with the necessity of resolving, in the general interest of the State, numerous problems of a technical and economic nature relative to the diversification and the characteristics of production, to tooling and to instruments, and of providing the national economy with the appropriate technical documentation on raw materials and other materials and products. To this end, it is indispensable to establish technical conditions, standards and uniform characteristics for all branches of the national economy.

At the end of 1923, a temporary bureau of standardization was organized by the People's Commissariat for Workers and Peasants Inspection; this bureau studied the work to be done in the field of standardization and thus laid the basis for the establishment of a central state standardization agency. The governing body in the field of industry was organized in 1924.

On 1st September 1[illegible], a central state standardization [illegible] of the Soviet Union, called the Standardization Committee of [illegible] for reference. During its existence, its organization has undergone various changes. Today, the central standardization body is the Committee of Measurements and Measuring Instruments of the Council of Ministers. It [illegible] of nine members, namely, the Committee President, two Vice-Presidents and six Committee members.

The state budget takes care of the expenses necessary for the upkeep of the Committee. Expenses involved in the local development of standards are covered by the state budget and are included in the calculation of the production sale prices.

Organizational structure

The Committee on Standards, Measurements and Measuring Instruments is composed of a central administration and of a number of subordinate bodies. The central administration of the Committee comprises the following subdivisions:

- the Council of Experts;
- the Technical Department;
- the Department of Measuring Instruments and Equipment;
- sections dealing with various branches of industry;
- the Financial and Economic Department.

The Committee's Council of Experts is chaired by the first Vice-President of the Committee and is composed of qualified industry specialists and of associates of the scientific research institutes of the Academy of Sciences of the Soviet Union and of institutions of higher education. Its work is to appraise the chief state standard drafts and the scientific work connected therewith.

The Technical Department establishes the pattern for work in the matter of state standardization, exercises methodical supervision over its execution, checks on the application and observance of state standards, technical conditions and standardized rules for mechanical construction and follows the development of the work in connexion with the participation of the Soviet Union in standardization on the international level.

Sections concerned with the various branches of industry study and draw up the drafts for state standards which are submitted to them by the Committee. The Committee has under its authority the scientific institutes for metrology and standardization, the state testing laboratories and the specialized publishing house, "Standardgiz".

The Committee has representatives attached to the Councils of Ministers of all the federated Republics.

Functions

State standards which bear on all aspects of industrial and agricultural production are approved by the Committee, except for standards concerning construction materials, construction itself and connected matters, which are approved by the State Committee for Construction attached to the Council of Ministers of the Soviet Union.

For certain classes of products of special importance, as listed by the Council of Ministers, the draft state standards, after being studied by the Committee, are submitted to the Council of Ministers for ratification.

In its regular sessions, the Committee examines and approves the state standards. It studies also the drafts of work programmes for standardization, and the service of measurements and of measuring instruments, matters of practical direction and drafts of the most important decrees and directives. It receives reports of the departments and sections of the Committee, as well as of institutions, enterprises and other bodies subordinate to it.

When the Committee is in session, representatives of the interested agencies, the best qualified specialists, builders, technologists, scientific associates and innovators in industry are invited to take part in the examination of the draft state standards, so that their experience in connexion with the product to be standardized may be profitably tapped.

The decisions of the Committee are made operative by the decrees of the Committee President.

The Committee supervises the activities of the agencies assigned to see to the adoption of state standards and technical specifications, to their observance and correct application, as well as to the production and the revision of measures and measuring instruments.

At the moment, about 8,000 government standards are in force in the Soviet Union. Of these, 40 per cent concern machines, mechanical installations, instruments, equipment and fittings; 39 per cent concern raw materials and other materials; 21 per cent, products for national consumption.

Work effected in the Soviet Union in the field of state standards covers, in fact, the principal categories of mass, or belt-line, production. Thus, for example, the principal sectors of the metallurgical industry, of the wood industry and the greater part of solid fuels, oil products and chemical products, as well as of other classes of industrial and agricultural production, are subject to state standards. Five hundred state standards in force in the Soviet Union regulate the different types, basic dimensions and parameters for machines and tooling and mechanical equipment. Standards also fix the fundamental characteristics of blunt instruments. More than 1,000 standards concern elements and joints of machines.

Methods used for drafting standards

Work in standardization matters is considered a governmental affair in the Soviet Union. This is why the central standardization agency which directs them is the Committee of Standards, Measurements and Measuring Instruments, attached to the

Council of Ministers of the Soviet Union. The work done in the field of standardization is inextricably tied in with the essential objectives of the national economy as a whole.

The establishment of state standards in the Soviet Union aims to introduce new techniques, to perfect the quality of production in such a way as to economize raw materials and other materials, power and fuel, to unify and to ensure the interchangeability of mechanical parts and joints, to contribute to the development of specialization and of co-operative associations, to augment productivity, to lower cost prices and, finally, to cut down the number of diverse stages of planning and to facilitate the adoption of new forms of production.

State standards are the only form of standards which exist in the Soviet Union. They are considered, once adopted, as obligatory throughout all the territory of the Soviet Union and applicable by all organizations and enterprises. The non-application of state standards entails direct material responsibility. Systematic non-application is punishable by law.

Work in matters of state standardization is carried out in conformity with plans established in advance and adopted each year by the Committee, on the basis of the latest developments in science and techniques, and keeping in mind the needs of the national economy as a whole as well as the interests of the population.

A large number of institutes of scientific research and study organizations have been called upon to collaborate, in order that the regulations and specifications fixed in the state standards may reflect the latest developments in technique and science, may take into account the experiments of the pioneering enterprises and may be based on the results of scientific research and the practical data of exploitation.

In the Soviet Union, the systematic work of state standardization has been assigned to more than 180 institutes of scientific research and planning and to pilot enterprises which have been assigned the responsibility of functioning in this field as basic organizations. Among this number appear more than eighty organizations for the construction of machines and equipment, more than fifty for raw materials and other materials, and about thirty for goods for national consumption. Apart from these organizations, 400 others share in the work of applying the plans.

Thousands of engineers, constructors and scientists, working in numerous institutes of scientific research, laboratories, research departments and organizations establishing projects, take part in the drafting of state standards.

Systematic work is done with a view to the verification of standards in force, taking into consideration the progress of science and techniques and the constant increase of the needs of the national economy as far as the diversification and the quality of production is concerned, which, in turn, require the most well-developed scientific and technical justification for the indications and specifications contained in the standards.

Nature of standards

The fundamental types of state standards in the Soviet Union are:

- Parametric standards, determining the production in series, the types, sorts and marks most rational for the national economy, the dimensions of products and of their parts manufactured in the Soviet Union, with a view to the optimum satisfaction of the demands of the diverse branches of the national economy and to bringing about the greatest unification;

- Standards for the required technical conditions, establishing indices characterizing production from the point of view of quality, solidity when in use and the over-all appearance;

- Standards for test methods and means for checking, tending towards the unification of test methods for production, based on the latest developments of science and techniques as well as on the utilization of new equipment and new installations, and destined to ensure checking with a minimum of expense;

- Standards for marking, packaging, transportation and preservation, providing for marking regulations and conditions required for packaging, as well as the transportation and preservation of products with a view to the best safeguarding of their properties and their quality;

- Standards supplying complete technical conditions, including the following sections:

  (a) Types of (kinds, marks) - parameters and basic dimensions;

  (b) Requisite technical conditions;

  (c) Test methods;

  (d) Marking, packaging, transportation, preservation;

- General technical standards, setting up rules and general specifications, the scientific and technical terms, the units of measure, the symbols, the limits and fits and tolerances, the regulations for technical design and other technical documentation, classification, the standards for calculation and planning, elements having to do with construction, etc.

Since the introduction of state standardization in the Soviet Union, more than 25,000 state standards have been published, with a general run-off of 250 million copies.

The Committee publishes the following periodical publications: Standardization; Measuring Techniques; the newspaper, Standards; compilations of state standards, and, annually, a Catalogue of State Standards. It publishes, in addition, compilations of state standards and standard rules for mechanical construction, as well as other publications or standardization and documents on the standardization of measurements and measuring instruments.

State standards provide for a marking system designed for the consistent and composed of a symbol and the reference number of the standard in conformance with which the merchandise must be supplied.

In accordance with the arrangements established in the Soviet Union, the supply of technical or industrial products and goods destined for national consumption is subject to obligatory **marking** indicating conformity with state standards specifications, technical specifications or agreements. The supplier is obliged to guarantee the good quality of the products furnished during the time limit set forth in the standard or by technical specifications, and also to take into account the factory instructions as to their preservation and use. Any supplier delivering non-market merchandise, in violation of state standards specifications, is liable to a fine.

By these means, the numerical reference to a state standard appearing on the marking itself replaces, in the Soviet Union, the use of marks indicating conformity with standards.

UNITED ARAB REPUBLIC

The Egyptian Organization for Standardization (EOS) is a government body under the Ministry of Industry. It has the responsibility for:

Elaborating standard specifications for materials and products of all industries;

Securing reference standards for calibration and verification of measures and measuring instruments;

Ensuring the existence of a standard system for technical classifications, terms and symbols;

Taking the necessary measures for quality control of raw materials and products, in conformity with the standard specifications and establishing a central laboratory for metrology and quality control;

Co-ordinating the standardization work in the Republic in accordance with other international standardization work.

In addition to producing specifications and standards, the EOS is also in charge of metrology. It comprises three bodies: a Specifications Committee; a Metrology Committee, and a Technical and Administrative Secretariat consisting of the staff of the specification and calibration divisions of the Industry and Planning Department.

The Metrology section has plans for establishing a national physical laboratory, a central laboratory for metrology and material testing and three district laboratories and offices.

UNITED KINGDOM OF GREAT BRITIAN AND NORTHERN IRELAND

The British Standards Institution (BSI) was founded in 1901 and granted a royal charter in 1929.

The BSI recognizes that there are two main groups of standards: fundamental standards, and industrial standards. Fundamental standards are physical entities which require to be maintained at an accurate and permanent value, e.g., standards of length, volume and weight. In the United Kingdom, they are maintained by the National Physical Laboratory. Industrial standards are maintained by the BSI and are expressed by means of specifications which are issued as British standards. These relate to materials, articles, appliances, machines, etc., and define methods of test, properties, chemical composition, limits for impurities, dimensions, rules and regulations, symbols, definitions, etc. British standards represent present-day knowledge, and are used to assess the fitness for purpose of a material or article; they provide a basis for assessment to enable comparisons to be made on an equivalent basis in whatever laboratory the measurements are made.

As industrial standards represent up-to-date knowledge, it is essential to provide a means for reviewing and revising the standards as often as advance in knowledge justifies it. It must not be overlooked that while scientific knowledge advances continuously, changes in design must, in general, take place at intervals, in view of the necessity for each production run to pay for the costs incurred and to avoid the loss in value of stocks already on the market. Thus, there is a time lag between the availability of new knowledge and the availability of improved material. Since new materials and appliances are being increasingly produced, additional standards are being called for at an ever-increasing rate.

An analysis of the 1,500 British standards which have been issued during the past years shows that they take one or more of the following forms:

(a) Methods of test. Standard methods of test are necessary in order that the results of tests carried out in different places can be compared;

(b) Standards of quality. The ideal is to prepare a standard which defines ultimate performance. It is not, however, to define performance in such a way that it can be assessed objectively. Much research has been and is being done towards this end, but in the meantime it is necessary to include requirements which can only be assessed subjectively.

(c) Dimensional standards. These are, in general, for the purpose of securing interchangeability with a view to facilitating replacements and obtaining parts from many sources. Dimensional standards are also laid down for the purpose of eliminating from the market an unnecessary number of types and sizes;

(d) Sampling and certification marking. A study of the subject of sampling has made practical the control of the use of certification marks on goods, as it provides a means of securing that the product is being manufactured up to the required standard;

(e) Terms, definitions and symbols. British standard terms, definitions and symbols cover a wide field. There are glossaries of terms for use by the

aircraft, automobile, electrical, highway engineering, railway, building and gas industries;

(f) Rules and regulations. These give conditions governing the installation of appliances from the point of view of protecting the health or safety of persons, together with information concerning the economic use of the appliances. These are known as codes of practice;

(g) Codes of practice. British Standard Codes of Practice (covering such varied matters as the design of steel structures for buildings, the factors to be used for steel-girder bridge design and temperature measurement) are required in order to give guidance in the use of materials and appliances for which standards have been prepared. They are generally prepared in co-operation with the professional institutions concerned.

Systems of measurements

The growth of high-precision engineering brought into use such a high degree of accuracy in the production of engineering parts that it became necessary to ensure that the accepted ratio between the length of the yard and the metre should be the same in all the countries concerned with precision engineering. After many discussions with western Europe and the United States, the ratio of 25.4 millimetres to one inch was agreed for use in connexion with gauges. This decision makes it possible to convert from one to the other by mechanical means.

Industry Standards Committees

British standards are prepared under the direct control of Industry Standards Committees, which are concerned with matters of policy.

Industry Standards Committees consist of representatives of the organizations within each industry (producers and users), together with representatives of government departments and professional institutions. After an Industry Committee has approved a draft standard, it is circulated for comment, both in the United Kingdom and overseas, and wide publicity is given to the availability of the draft for inspection and comment. After a suitable lapse of time, the comments are considered, and if it receives the general consent of the major interests concerned, it is issued as a British standard.

The British Standards Institution was initiated by the engineering industry, and now embraces practically all industries. It is recognized in the United Kingdom as the national organization for the issue of standards having a national application.

Its revenue comes from the following sources in practically equal proportions:

- government grants-in-aid;
- industrial contributions;
- proceeds from the sale of its publications.

The structure of BSI thus enables all sections of industry to co-operate in the preparation of national standards.

UNITED STATES OF AMERICA

National standards

The American Standards Association (ASA) is the National Standards Body in the United States of America. It is a federation of more than 100 trade associations, technical societies and consumer organizations, with 2,100 corporations affiliated as Company Members. Its main purpose is to provide the machinery for an orderly method of establishing American standards. American standards are developed by the national groups in each of the fields covered, ranging from civil engineering and construction, mechanical engineering and electrical engineering to chemicals and textiles.

The technical work of the ASA is carried on by committees representing all the national groups concerned under the sponsorship of one or more of these national associations or societies. For example, in the mechanical field one of the most important projects is the standardisation of ball and roller bearings which is being handled by a committee under the procedure of the American Standard Association and jointly sponsored by the American Society of Mechanical Engineers and the Society of Automotive Engineers. The ASA has a staff which includes specialists in a variety of fields, in order to provide technical assistance and service functions to those committees. In this capacity, it maintains a library of standards, specifications and related material from all over the world. It provides translation services for titles and scopes of foreign standards, and any of its material may be borrowed by ASA members. Members are continuously calling upon ASA's library facilities for information in connexion with submitting bids, filling orders and on matters of plant operation. All of this work, including official approval of standards and methods of procedure, is under the supervision of the Standards Council, composed of official representatives of all Member Bodies. The Board of Directors is responsible for the administrative policies and the financial affairs of the Association.

The procedure that is followed in developing a standard encourages the participation of all interested groups in the project. Some responsible group makes formal request for a new standard, or a revision of an old one, pointing out, for example, the need of cutting down grinding wheel accidents, or a nationally recognized need for graphical symbols for electronic devices. The American Standards Association canvasses the industries involved to see whether the interest is general. Limits are set as to the ground the standard shall cover, and frequently, one or more groups that have already carried on research or done some standardization work in the particular field under discussion are asked to take administrative leadership in the work.

A committee to develop the technical details of the standard is then organized, including representatives of manufacturers, trade associations, governmental bodies, insurance groups, employee organizations and independent specialists. Sub-committees work intensively on different phases of the problem, and when the committee decides it is necessary, research is carried on at the same time. When the committee finishes its work and the sponsor organization recommends it to the Association, the standard is carefully scrutinized to make sure that it has been accepted by all groups that have an important interest in it. If it has, it is formally approved as an American standard. Every American standard is frequently revised to keep it in line with industrial advances. The national committee that develops the standard usually continues in existence to clarify and interpret the provisions and to prepare for possible revision.

Standards for industry and in-plant use

The real value of any standardization programme, however, depends upon whether the standards are used in the companies which are manufacturing or purchasing the equipment, machinery or component parts for which the standards have been prepared. Since the Second World War, a strong interest in standardization has been noticed among these companies. One evidence of this is the Company Member Conference of the American Standards Association, through which standards engineers of the Association's Company Members come together. The active interest and work of this committee during the past three years has had a definite influence on the work of standardization committees operating under the procedures of the Association. As every Company Member can appoint a representative to the Company Member Conference, the needs of the companies for specific standards are brought directly to the attention of the committee by these representatives. Through this contact, some of the problems of the committees are better understood by the groups which eventually must use the product of their work.

Liaison with international standards

The ASA acts as the authoritative American channel of co-operation in international standardization matters and is the United States representative in the International Organization for Standardization. Through co-ordination of the United States National Committee of the International Electrotechnical Commission with the ASA Electrical Standards Committee, the ASA also handles representation of American electrical interests in the Commission which now acts as the electrical division of the ISO.

Co-ordination principle

The ASA has created the means by which industry can take the initiative in setting up standards to solve problems through the co-operation of all interested parties. By getting the co-operation of all interested parties, the ASA is assured that when it issues standards they represent general agreement by the maker, seller and user groups as to the best current industrial practice. In almost every state in the Union, industries operate under American Safety Standards.

ASA procedure is based upon the principle that any group having an interest in setting up a standard has the right to enter into and give its technical knowledge, ideas and experience towards the development of that standard. The ASA stamp of approval is not given to a standard until after it has been worked out to the satisfaction of all substantially interested groups. Only then does it become known as an American standard.

VENEZUELA

The Comisión Venezolana de Normas Industriales (COVENIN) was founded in 1958 as an agency of the Ministry of Development which allots COVENIN a special part of its budget. It consists of eight members, five of whom represent governmental agencies and three, private technical and economic organizations, such as the Federation of Chambers and Associations of Commerce and Production and the Pro Venezuela Association which represents the consumer interests.

The COVENIN has a technical and administrative staff under the direction of an Executive Secretary.

National standards are developed by seven technical commissions, each of which covers a particular field of activity, such as construction and construction materials, chemical industries, food industries, etc., and by a number of other technical commissions dealing with special projects, such as oils and fats, coffee, shoes, etc. Each technical commission appoints one of its members as the co-ordinator of its work.

A proposed standard prepared by a technical commission and given tentative approval by COVENIN is published for comment and criticism for a period of three to six months before final approval is given.

National standards are official recommendations for voluntary adoption in use. Their use may be made mandatory by agreement of all parties interested in their application, or by the Government "when reasons of public health or commercial integrity so require".

Annex II

OUTLINE OF A SURVEY TRAINING PROGRAMME OF IN-PLANT STANDARDIZATION

Standards Functions. Value of documented standards. Outline of major standards functions and other related functions, such as co-ordination, simplification and unification.

Types of company standards

(i) Purchasing specifications

(ii) Manufacturing specifications

(iii) Design and drafting manuals

(iv) Parts and components standards

(v) Inspection and packaging standards

Tools for standardization

(i) Preferred numbers

(ii) Numbering of drawings and parts

(iii) Coding of stores

Variety reduction. How standardization can be utilized for reduction of variety in parts, materials, products and stores within a company.

National, international and other standards. How national standards are prepared. Certification marks. Liaison with company standards. Impact of international and other standards.

Standardization activities. How to spot standards operations even when they are not identified as such. How to recognize standards problems which require solutions.

Check-list for company standards. How to spot and prepare an outline of subjects which are suitable for immediate standardization within a company and also a list of external standards suitable for company use. Quality control standards.

Assessment of the status of standards within a company. A series of questions to establish the present status of company standards activity. Method of evaluating possible cost saving through organized standards activity within a company.

Case histories. Case histories of successful company standards activities.

Planning. Planning a standards programme for the company.

Annex III

OUTLINE OF A FULL TRAINING PROGRAMME OF IN-PLANT STANDARDIZATION

First day

Session 1A. Opening of course

Introduction to the training programme. Explanation of programme objectives and method of conduct. Outline of assignments to be fulfilled by the participants.

Session 1B. Introduction to standardization

Concept and significance of standardization. Definitions of terms. Historical background.

Session 2A. Aims and objectives of standardization

Levels of standardization. Aims and objects at each level.

Session 2B. Standards functions

Outline of major standards functions and other related functions, such as co-ordination, simplification and unification.

Second day

Session 3A. Standardization versus progress-time curve

Changes in standards: rearrangement v. complete overhaul

Session 3B. Formulation of standards

Formulation at national level. Establishment of scope of standards.

Session 4A. Areas of standardization

Major types of national standards and their functions.

Session 4B. National standards

National Standards Body and its work. How national standards are prepared. Services available from the National Standards Body.

Third day

Session 5A. National standards

How standards are implemented. Liaison with industry standards groups.

Session 5B. National standards

Adoption and use of standards of measurement. Guidance for specification of standard weights and measures.

Session 6A. National standards

Certification marking scheme. Assurance of quality of the products to the consumer.

Session 6B. International standardization

ISO and IEC. Impact on national standards.

Fourth day

Session 7A. Company standards organization

Problems involved in organizing a standards activity in a company. Case histories of successful company standards activities.

Session 7B. Management support of standards

Place of standards in management. Responsibility of management to standardization. Discussion of areas within a company requiring immediate standardization. Characteristic values of standardization. Allocation of their importance and magnitude.

Session 8A. Company standards department

How to set up and operate a company standards department. Selection of personnel. Organization of committee activities.

Session 8B. Company standards department

Evaluation of standards from other countries for their applicability in company operations. Promotion of employee suggestions for standardization.

Fifth day

Session 9A. Formulation of standards

Various methods used, depending on the type of standard required. Committee method v. administrative action. Consensus principle.

Session 9B. Preparation of standards

Use of existing data on internal company practices: national standards, foreign standards, ISO Recommendations.

Session 10A. Channels of communication

Value of documented standards, such as manuals, specifications, etc. Format for standards.

Session 10B. Standards, specifications, procedures and practices

Media for documentation, bulletins, notices, memoranda, reports, minutes, etc., and their place in the standards scheme.

Sixth day

Session 11A. Review

Review of material covered to date, with emphasis on pertinent data.

Session 11B. Evaluation

Written answers to questions on organized standardization.

Session 12A. Workshop

Round-table group discussions on specific standardization situations.

Session 12B. Workshop

A summary and presentation to the entire group of solutions to the problems, as discussed.

Seventh day

Session 13A. Standards and specification writing

Limitations of a standard. Validity of contents of manufacturing specification, shop practice, etc.

Session 13 B. Workmanship requirements

Inspection standards. Assurance of a product. Criteria for reliability, serviceability, etc.

Session 14A. Materials management

Relation of standards to procurement practices. Value and use of purchase specifications.

Session 14 B. Materials management (continued)

Eighth day

Session 15A. Value analysis

What is it? How standards can be used to help this analysis.

Session 15B. Value analysis (continued)

Session 16A. Standardization of terms of measurement

Interpretation of limits and tolerances. Establishment of manufacturing standards for design guidance.

Session 16B. Techniques of standardization

Various types of standards and their purpose. Validity of certain standards. Problems of legibility and obsolescence. Timing of standards.

Ninth day

Session 17A. Tools for standardization

Preferred numbers; coding of parts, materials and documents.

Session 17B. Special standardization problems

Standardization for decentralized activities or multi-plant operations.

Session 18A. Cost of standardization programme

Evaluation of cost. Financing of standards. How to obtain data on cost saving resulting from standards.

Session 18B. Standards publicity

News bulletins; charts and posters for factory areas; graphs and reports for engineering use.

Tenth day

Session 19A. Standards engineering

Standards engineer and his responsibilities. What is standards engineering?

Session 19B. Summary of standardization principles

Evaluation of standardization principles for practical application. Establishment of standards primarily as a service to its users.

Session 20A. Workshop

Round-table group discussions on additional standardization situations.

Session 20B. Workshop

A summary and presentation to the entire group of solutions to the problems, as discussed.

Eleventh day

Session 21A. Review

Review of theory and material covered to date.

Session 21 B. Evaluation

Written answers to questions pertaining to standardization covered in the training programme.

Session 22A. Reporting session

Discussion of individual company standardization problems and assistance in the preparation of final reports. Review of reports and comments, as required.

Session 22B. Reporting session (continued)

Twelfth day

Sessions 23A and 23B. Final sessions

Discussion of individual or group problems. Questions and answers.

Questions relating to standardization

1. What is a standards concept? What is a standard?
2. What are the different levels of standardization and what is their interrelationship?
3. How do company standards differ from national standards? (Indicate scope, contents, etc.)
4. What are the major functions of a company standards activity?
5. What are the major tools of standardization?
6. List some of the national standards suitable for your in-plant use.
7. What are the advantages of creating in-plant standards?
8. What are the sources for company standards?
9. What advantages does the reference to the national standards present from the viewpoint of the in-plant standards activity?

10. List the areas in which company management may lend its support for in-plant standardization.
11. What are the essential requirements in designing a format for the publication of a standard?
12. What precautions should be taken to prevent a drop in a committee's efficiency?

Annex IV

STEPS NECESSARY TO CONVINCE MANAGEMENT TO INITIATE A STANDARDS PROGRAMME

1. Report to management

1.1 Indicating the general principles and practices of standardization and the advantages derived therefrom.

1.2 Indicating broad areas of standardization within the company.

1.3 Submitting a proposal to carry out standardization work which will show some tangible results in a selective area and subject, either in one's own sphere of activity or in an area of easy access. The choice of the subject should be such that the results can be achieved and evaluated within a reasonable period of time.

1.4 Suggesting an interview with management for personal discussion.

2. Pilot project

2.1 Carrying out the investigation as envisaged under 1.3.

2.2 Simultaneously, to the extent practicable and useful, enlisting the support of other departmental heads in an informal manner.

3. Staff meeting

3.1 Submission of a detailed report to management on the standardization work carried out (2.1) and requesting management's approval for convening a meeting of the heads of different departments for extending the standardization programme to other departments.

3.2 Convening the meeting of heads of departments.

3.3 Presenting to the meeting the results of the standardization work carried out and seeking the co-operation of all the heads of departments for the promotion of standardization activity in other departments. It is expected that some heads of departments will be prepared to co-operate in a standardization programme. The subjects for further investigation should be carefully selected so as to yield tangible results, keeping in view the covering of such fields of investigation as will demonstrate the need for a centralized standards activity.

4. Further studies

4.1 Carrying out further studies as agreed upon at the staff meeting with the collaboration of willing departmental heads (without at this stage asking for staff).

4.2 Submitting a report on the standardization activity carried out as per 4.1 above, indicating the necessity of initiating a centralized standardization programme and requesting approval for the organizing of a centralized standards department. If necessary, a further staff meeting may be called for formal support of the proposed programme.

5. Final proposal for organized standardization

5.1 On approval from management, submitting details of the company standardization programme with a standards department and the staff required.

Note: If the reaction of the first staff meeting is so favourable that step 4 becomes unnecessary, the final proposal may be formulated immediately.

Annex V

GUIDE FOR THE EVALUATION OF PRESENT COMPANY (IN-PLANT) STANDARDIZATION PRACTICE AND ITS FUTURE POSSIBILITIES

A. Survey of present status

1. General information

1.1 Name of company _____

1.2 Address _____

1.3 Company's main products _____

_____

_____

1.4 Size of company:

(a) No. of plants _____

(b) No. of employees _____

(c) Approximate area _____

(d) Annual budget (if available) _____

(e) Annual sales _____

2. Organization for company standards

2.1 Does the company have a standards department/activity? Yes ____ No ____

If yes, is there any charter for such activity? Yes ____ No ____

2.2 At what level does the standards department/activity report?

_____

_____

2.3 Is standardization activity now carried out:

(a) Centrally? _____

(b) Independently by each department? _____

2.4 Is there any system for implementation and control of use of standards?

Yes _____ No _____

3. Present degree of company standardization

3.1 In what areas are standardization activities now being carried out?

(a) Design _____

(b) Process _____

(c) Tools _____

(d) Materials and stores _____

(e) Inspection _____

(f) Other _____

_____

_____

_____

3.2 How many standards (by actual count) does the company use? List them under the following groups:

(a) Internal or company standards _____

(b) National standards _____

(c) Other agency standards (such as defence, railways, etc.)

_____

(d) Foreign standards (BSI, ASTM, DNA, etc.) _____

3.3 How many specifications have been formulated internally for:

(a) Drawing office practice _____

(b) Design of parts _____

(c) Manufacturing processes:

(i) Shop practices _____

(ii) Tolerances _____

(iii) Finishes _____

(d) Tools _____

(e) Purchase of raw materials and stores _____

(f) Inspection methods _____

3.4 Does the company use any code of classification for identification of documents, drawings, etc.? Yes ____ No ____

If yes, is the code described in any document? Yes ____ No ____

4. External participation

4.1 Does the company participate in outside standards activities for development of:

(a) Trade or association standards _____

(b) National standards _____

(c) ISO/IEC Recommendations _____

5. Cost of standardization

5.1 How is the standardization activity financed?

(a) From general overhead _____

(b) On a service rendered basis _____

5.2 Has the cost of standardization in the company been assessed? Yes __ No __

If yes, how much is it? _____

If no, is there a shortage of data for assessing it? Yes __ No __

B. Investigation for future possibilities

6. Select objectives for standardization, the possible objectives being:

(Examine problems in the factory, meet supervisors and discuss with managers; decide on the objectives of company standardization projects according to the needs of the organization.)

6.1 Variety reduction:

(a) Of practice

(b) Of products

(c) Coding of stores

6.3 Integration of design and production

6.4 Integration of purchase and design specifications

6.5 Development of standards (see 3.3)

6.6 Modular co-ordination

6.7 Other _____

_____

7. Use the survey data to assess the scope of company standardization and ensure that objectives are clearly defined as indicated below:

7.1 In qualitative terms

7.2 In quantitative terms

8. Collect data for the objectives set

Some of the records useful for collection of data are:

8.1 Sales records (volume and variety of products)

8.2 Production records (volume, varieties and percentage content of standard items, by number and value)

8.3 Inspection records

8.4 Purchasing records

8.5 Store log books

8.6 Company standards and manuals

8.7 Past experience

Note: Assess the following points:

(1) The value and adequacy of data for achieving the objective envisaged;

(2) Is the method of collection of data consistent with the time available?

9. Analyse the data

The following techniques may be useful:

9.1 Value analysis

9.2 Frequency chart

9.3 Sales analysis (see 8.1)

10. Prepare preliminary proposals

A check-list of areas is given below.

10.1 General:

(a) Charter of standards policy

(b) Organization of standards within the company

(c) Formats of company standards

(d) Numbering of company standards

(e) Control and use of company standards

(f) Catalogue of standard products (check for variety reduction)

10.2 Design standards:

(a) Design manual:

(i) Preferred numbers

(ii) Modular dimensions

(b) Standard parts book

10.3 Drawing office practice:

(a) Format

(b) Standard drawing instructions

(c) Drawing numbering

(d) Revision of drawings

(e) Storage and filing of original tracings and drawings

(f) Methods of reproduction

10.4 Purchasing specifications:

(a) Raw materials (list separately specifications in use and those to be developed)

(b) Fabricated parts

(c) Components

(d) Cross reference to national standards specifications and other equivalent specifications

10.5 Manufacturing standards:

(a) Manual of shop practices

(b) Specification for applied and chemical finishes

(c) Catalogue of available tools

(d) Limits and fits

10.6 Inspection standards:

(a) Standard test methods

(b) Gauges

(c) Workmanship standards

(d) Sampling inspection

10.7 Stores:

(a) Coding

(b) Variety reduction

(c) Purchase procedure

(d) Inventory control

(e) Preference to certified products

10.8 Packaging:

(a) Standard size of packages

(b) Simplification of packages

(c) Labelling

(d) Preservation in storage and transit

11. Prepare final proposals

Examine reactions to preliminary proposals. Make use of and give credit for feasible suggestions to men concerned. Discuss with senior management the results of the study and organization problems. Suggest a plan for implementation.

12. Extra information

When answering questions on survey of present status (Nos. 1 to 5) use extra sheets, where necessary, to clarify the answers or to add pertinent supporting information.

ANNEX VI

QUALIFICATIONS OF A STANDARDS ENGINEER

A standards engineer should have had practical experience with a variety of subjects. His knowledge of subjects should be consistent with the variety of products his company manufactures.

While he may be a specialist in his background and experience, as a standards engineer he should become a generalist, that is, be able to recognize the importance of subjects to be standardized in the same manner as a top executive who is called upon to make an over-all decision without being a specialist in every detail. The standards engineer, however, should be able to command specialized information when it is needed.

As a tool for in-plant standardization, he should be able to divest himself of picayune detail and disperse with all functions other than that of providing assistance and service to the individuals and departments of the company. As distinct from design engineers, research engineers or other exclusively creative individuals, he deals not only with materials but with men, not only with parts but with people, thereby finding ample opportunity for creativity of a different kind.

Analytical attitudes on the part of the standards engineer will go a long way towards making his job a success. He will be constantly faced with people, executives and others, bringing pressure to bear on him to provide on-the-spot answers, based sometimes only on what they want to hear. Here again, the standards engineer's talents must be such that he can quickly analyse the facts and render decisions of some permanence. If the answer is to be of a temporary or expedient nature, he should also have the courage to make this plain.

His analytical attitude should be preceded by a critical attitude. This does not mean that he should look askance at all ideas originating outside the standards area since many of his standards must be apposite for practical application.

It is necessary that a company standards engineer understand not only his own functions - which are primarily to record and document solutions to recurrent problems and provide on-the-spot assistance to company personnel - but also those of his colleagues; functions not only of people but of the equipment or material his company buys, manufactures and supplies to the trade and consumers. It is not the intention here to convey the impression that the standards engineer should be a paragon of virtue but only that he should be able to detect, understand, analyse and segregate what is good for the company from what is bad. The term "good", from the point of view of company management, means that which will put the company in a favourable and creditable financial position.

The company standards engineer must be able to meet with vendors' representatives and intelligently discuss their products, as these may be used to improve his own company's production capability. Similarly, he should be able to

[illegible] customers' representatives when required, in liaison with the sales department, as well as representatives of the foreign collaborators' standards people. In general, he should be able to represent the company and present its viewpoint at standards meetings at various levels.

Preparation of samples for the establishment of prototypes of standards is one of the functions of a standards engineer. Frequently, technical competence, technical data and information supplied by others may not be sufficient to validate a standard and it may be necessary to test the claims made in favour of establishing it by preparing and testing samples in a standards laboratory under the standards engineer's jurisdiction.

Since his field will remain a pioneering one for many years to come, the standards engineer will be expected to contribute to the technical literature on the subject. His experience in solving problems will serve to guide himself and others in advancing the cause of standardization in general and of in-plant standardization in particular.

In manning the secretariat of technical committees and for co-ordination and liaison outside the company, his ability to assist and serve will be further enhanced by his ability to act in an advisory and consultative capacity to individuals in the company at all levels, from management to shipping clerk. The standards engineer should seek opportunities for giving assistance as well as for taking advice and suggestions.

Annex VII

CLASSIFICATION OF STANDARDS OF THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

The main divisions of the classification of standards of the International Organization for Standardization related to the Universal Decimal Classification (UDC) are as follows:

UDC	Subject	Technical Committee
001.4	Terminology	37
003/050	Documentation	46
381.822.389.6	Conformity marks	73
389.16	Quantities, units, symbols	12
389.171	Preferred numbers	19
532.57	Fluid flow	30
534	Acoustics	43
536.5:531.7	Reference temperature	3
539.1	Nuclear energy	85
54	Chemistry	47
542.23	Laboratory glassware	48
551.58	Atmospheres for conditioning and/or testing	ACTO
553.677	Mica	56
614.8-084	Safety colours	80
614.88	Stretchers	75
621.642	Gas cylinders	58
621.643	Pipes and fittings	5
621.753	Limits and fits	3
621.791	Welding	44
621.795	Surface finish	57
621.798	Sealed metal food containers	52
621.822	Rolling bearings	4
621.824	Shafts (shaft heights)	13
621.824-45	Splines and serrations.	32

UDC	Subject	Technical Committee
621.83	Gears	60
621.851/.852	Pulleys and belts	41
621.855:621.86	Chains and chain wheels	100
621.869	Pallets	51
621.882.082	Screw threads	1
621.882.1/.6	Bolts, nuts and accessories	2
621.9	Machine tools	39
621.9	Small tools	29
629.113	Automobiles	22
629.12	Shipbuilding details	8
629.13	Aircraft	20
631.372	Agricultural tractors	22(T)
632.95	Pesticides	81
633/7	Agricultural food products	34
637.1/.3	Apparatus for testing milk	90
661.185	Surface active agents	91
662.6	Solid mineral fuels	27
662.75	Petroleum products	28
666.76	Refractories	33
667.6	Paints and varnishes	35
668.4	Lac	50
668.5	Essential oils	54
669:620.17	Co-ordination of mechanical testing of metals	METESCO
669-41/42	Sheet and wire gauges	62
669.13	Cast iron	25
669.14	Steel	17
669.3	Copper and copper alloys	26
669.5	Zinc and zinc alloys	18
669.71/.72	Light metals and their alloys	79
669.74	Manganese ores	65
676	Paper	6
677	Textiles	38
677.05	Textile machinery	72

UDC	Subject	Included [illegible]
678.4	Rubber	35
678.5/.8	Plastics	61
685.6	Gymnastics equipment	85
691.328.5	Products in asbestos cement	77
744	Technical drawing	16
77	Photography	1
778.1	Documentary reproduction	36
778.5	Cinematography	36

Annex VIII

LIST OF SELECTED REFERENCES

1. Papers on standardization contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas (UNCSAT)

Author	Title	Symbol[a/]
A.J.C. de Carvalho	Ceramic materials and products: techniques of scientific and technological control	E/CONF.39.D/5
L.C. Verman	Standardization: a prerequisite for development	E/CONF.39/D/20
J. Birle and M. Givelet	Standardization in industry	E/CONF.39/D/30
F. Pegurier	The necessity of technical standards for heavy mechanical industry and the Latin American Association of Free Trade	E/CONF.39/D/98
G. Weston	Standards and engineering efficiency	E/CONF.39/D/102
A.E. Vjatkin	Standardization as a means of achievement of scientific, technical and economic progress and the application of advanced experience in under-developed countries	E/CONF.39/D/111
M. Marín Gonzáles	The preparation and unification of standards	E/CONF.39/D/161
O.A. Taman	Specification and standards	E/CONF.39/D/179
F. García Ramos	Standards and specifications in the industrial consolidation of the less developed countries	E/CONF.39/D/184
P. Sohie	The place of standardization in economic development	E/CONF.39/J/1
Universal Postal Union	The introduction of standards, norms and terminology	E/CONF.39/J.2

a/ United Nations mimeographed documents.

Author	Title	Symbol a/
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P. Sa	Specifications, standards and terminology	E/CONF.39/J/51
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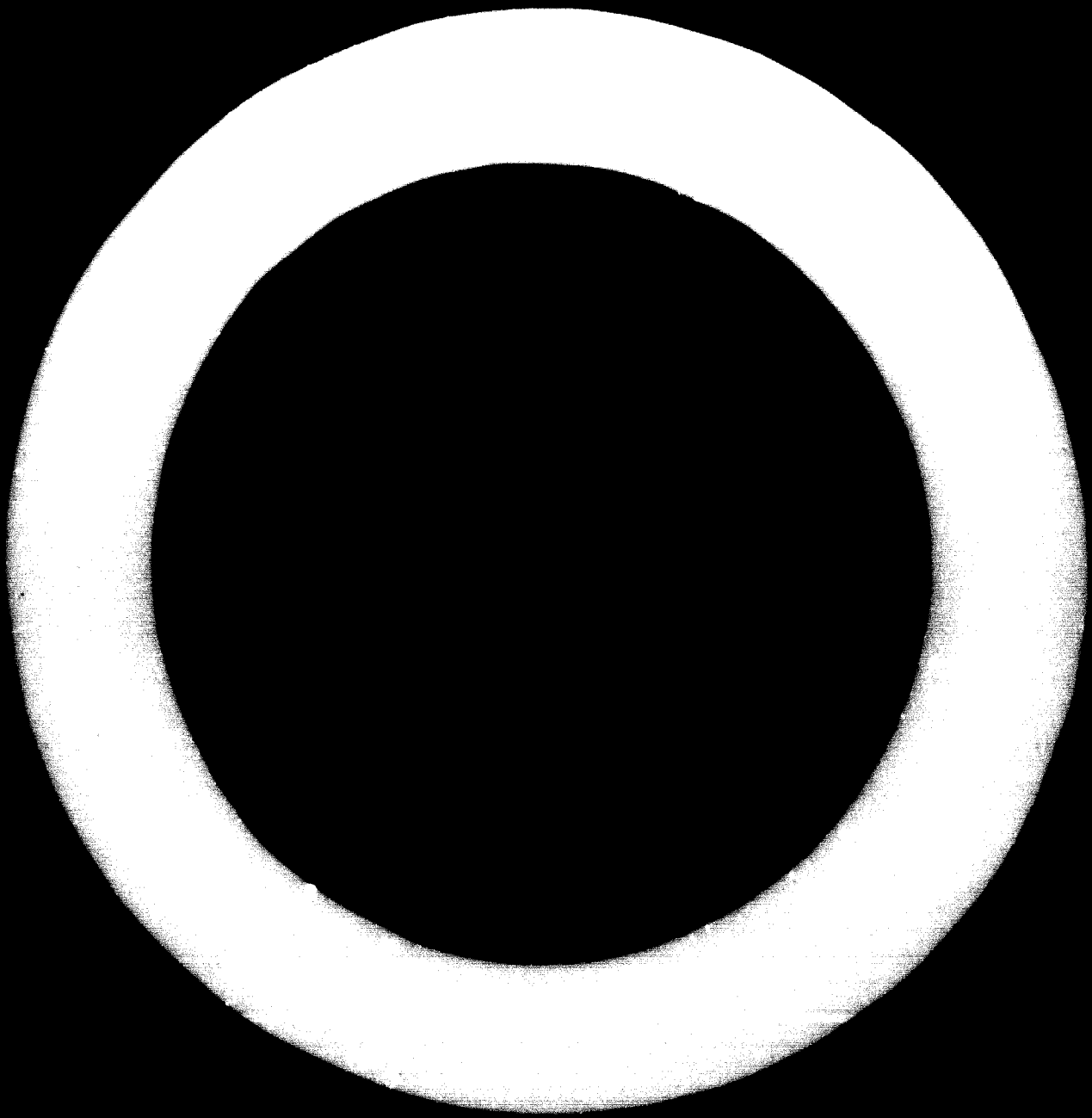

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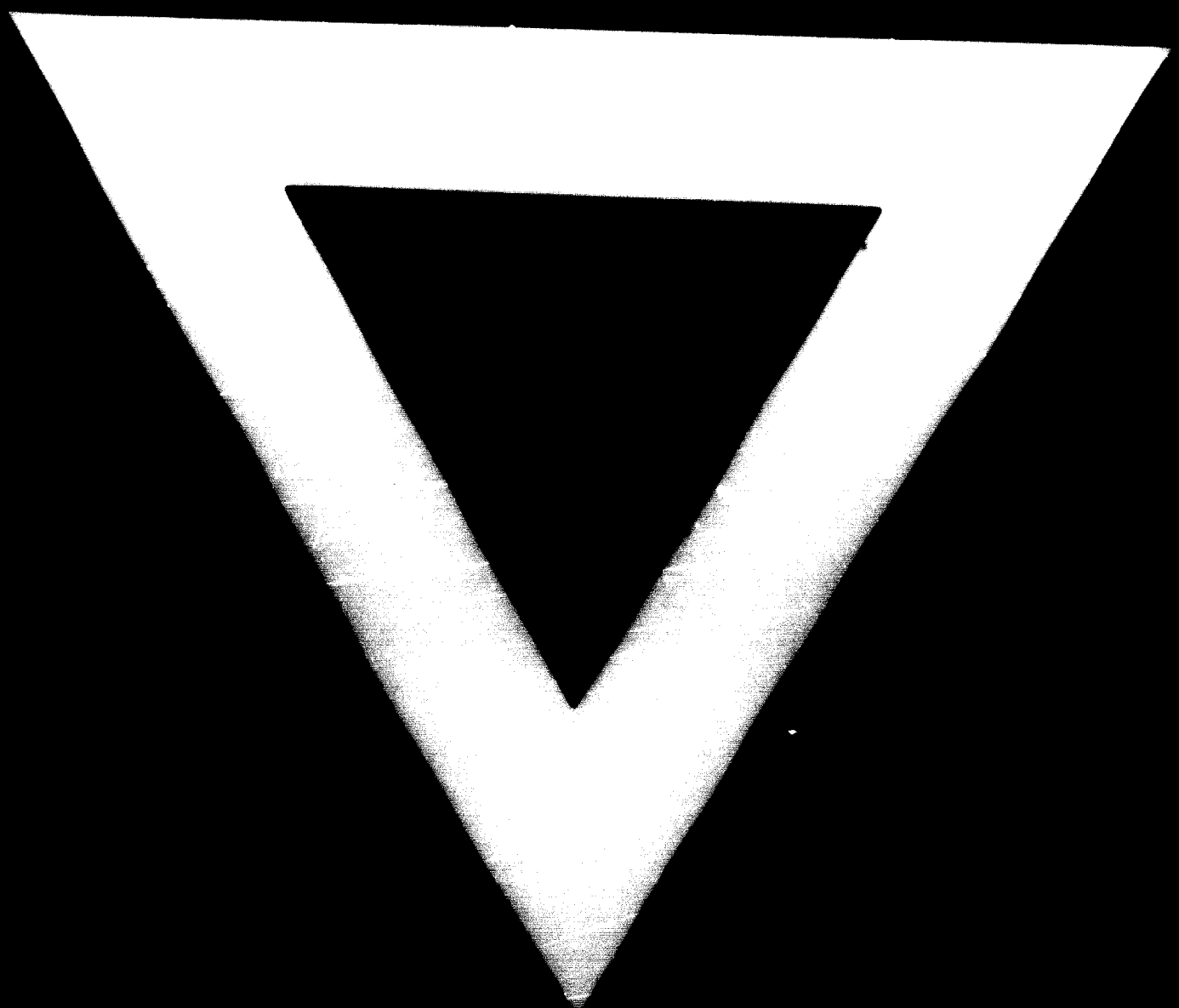

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