Standardization and Quality

D. Pandita
Asst. Director (Implementation and Training), Bureau of Ceylon Standards

Although man has used all kinds of standards from very early times, standardization as an organized activity started with the Industrial Revolution which took place about two centuries ago. The implements used by primitive man as tools, exhibited striking similarlarity in materials, shapes and even dimensions. Archeological evidences indicate a great deal of standardization of clay bricks, pottery, earthenware seals and other products made in large numbers in the ancient sites of civilization in Babylonia, Egypt and Mohenjodaro which are dated about 5000 years B.C.

Standards of measure began when man found it necessary to estimate dimensions and distances for construction, food gathering and production. First he used standards nature gave him, namely his digits and limbs. For measuring objects and short distances he used such units as the breadth of the first joint of the forefinger, the palm, the span of the hand, the length of the foot, the forearm, and the distance between the tips of the fingers with the arms outstretched. For longer distances his measures were 'a day's journey'. These standards became integrated into many systems of measures which persisted for a long time in many parts of the world. The need to weigh came much later than the need to measure. It is known that the balance was first used for weighing precious metals for temple use or for the king and his governors. The earliest manmade weights which came down to us are cylindrical stone weights belonging to the archaic 'bega' system of Egypt and dating from about 1000 B.C.

The development of human speech as a means of communication of thought is another brilliant example of standardization achieved by the human race in the early days of civilization.

Standardization of products and processes in industry evolved towards the end of the 18th century when an American manufacturer, Eli Whitney, who is considered to be the father of mass production technique in the United States, made a very effective and large scale use of standardization for interchangeability. Whiteney who received a large order for 10,000 muskets, planned to fulfil this large order by appointing an army of skilled workers each of whom produced one part of the product, which was thereafter assembled to form the whole instrument.

The modern phase of industrial standardization in the developed countries began when the Industrial Revolution brought about the factory system of production. The skill which earlier resided in the worker passed to the machine which produced, through repetitive operations, standardized products, the characteristics of which varied within certain pre-determined limits. As production increased, more and more products reached the consumer and the lack of dimensional interchangeability became a source of annoyance and wastage. Various types of nuts and bolts would not fit. Electric plugs and sockets of different makes, manufactured in the same country would not mate.

The first and second World Wars brought to the forefront the importance of international standardization. Particularly during the second World War, the supply and maintenance facilities of the Allies were severely strained because of different standards leading to lack of interchangeability of tools and common engineering stores. Complete workshop equipment had to be taken from the United States to European theatres of war at considerable cost.

National Standards Organizations were set up in a number of industrially developed countries during the early part of the 20th century. These organizations grew out of the need to co-ordinate, adjust and bring about economy and harmony in the existing patterns of industry which were quite confused. An International Federation of National Standardization Organizations was formed in 1926 which made great efforts to bring about unification of national standards. The work of this organization got disrupted at the out-break of the second World War and later ceased to function. The present International Organization for Standardization (ISO) was formed in 1946 by the representatives of some of the Standardization Organizations with the objective of promoting the development of standards in the world with a view to facilitating international exchange of goods and services and developing mutual co-operation in the sphere of intellectual, scientific, technological and economic activity.

Standards organizations in developing countries where the industry is far from being developed to warrant harmony and adjustment as in the case of developed countries, were set up for quite different reasons. These countries which had to operate within limited resources, faced with severe problems of processing the necessary raw materials, had to pre-plan the development of industry assisted by standardization. In the case of emerging countries like Sri Lanka where the economy has been based on primary agricultural commodities, standardization received attention much later with the development of the industrial sector.

However, the basic principles and purposes of standardization remain the same whether it is applied to a developed or a developing country. These are summarised in the ISO definition for standardization which reads:

> "Standardization is the process of formulating and applying rules for an orderly approach to a specific activity, for the benefit and with the co-operation of all concerned, and in particular for the promotion of optimum overall economy taking due account of functional conditions and safety requirements.
>
> It is based on consolidated results of science, techniques and experience. It determines not only the basis for the present but also for future development, and it should keep pace with progress."

A standard is the result of a particular standardization effort approved by a recognized authority. It may take the form of:

1. A document containing a set of conditions to be fulfilled.
2. A fundamental unit or physical constant (e.g. ampere, absolute zero, pascal etc.)
3. An object of physical comparison (e.g. metre, kilogramme, etc.)

A standard specification is a concise statement of a set of requirements to be satisfied by a product, a material or a process, indicating wherever appropriate, the procedure by means of which it may be determined whether the requirements are satisfied, and approved by a recognized authority. A standard may be prepared at a number of levels depending on the group of persons who are to use the standard. We may talk of a company standard used by a company, an association standard used by an association, a national standard used by a country, a regional standard used by a group of countries in a given region or an International Standard.

The aims of standardization in general are to achieve overall economy, protection of consumers' interests and safety and protection of health and life.

Overall economy comprises economy of human effort, materials and machines, power and energy. This also involves simplification, reduction of variety of products and components, elimination of avoidable waste during handling of materials, processing, transport and transport of goods.

Consumers' interests are looked after not only through the attainment of high quality or performance but also through non-material services such as the ready availability coupled with serviceability.

In the preparation of standard specifications for electric appliances, safety is ensured through the incorporation into these standards, of essential safety provisions. Installation and maintenance of electrical equipment are also covered under standard codes of practice to ensure safety. In the case of food items which can cause health hazards, standards stipulate the maximum permissible limit of toxic elements such as arsenic, lead, etc, food additives, bacteria and contaminants and thus help to protect health and human life.

Mass production of any industrial product necessarily focusses the attention of the manufacturer on mass distribution. Apart from the retail price of an article the other vital factor which determines the successful invasion of a permanent market is the quality of the article. This is particularly so in an industrially developed economy where the consumer has a wide variety of products to choose from. In emerging countries like Sri Lanka, the production of goods of minimal quality is conditioned by factors such as lack of adequate foreign exchange to procure raw material and testing facilities, necessary spare parts and in certain cases lack of technical know-how. Often there prevails a sellers'market as a result of which the manufacturer tends to disregard his social responsibility towards the consumer in providing goods of minimal quality. The situation should prevail only till the monopoly enjoyed by certain industrialists is removed by the establishment of more industrial units. Criteria such as raw material, chemical and mechanical requirements, dimensional requirements, performance, safety packing,

labelling, transport and storage which are spelt out in a standard, taken together determine the quality of an article. Standardization is therefore an important means of ensuring quality. The above only conveys a very vague picture of the term 'quality' but does not define it in precise terms. Attempts to define the term 'quality' have proved to be rather difficult. A dictionary definition of quality given as the degree of excellence may not help very much in describing the quality of an engineering article. The European Organization for Quality Control (EOQC) first defined the term as 'fitness for purpose'. This definition was not successful because of its incompatibility with common usage. This would be evident when comparing an expensive Rolls Royce car built to last for many decades with a standard mass produced car produced with the expectation that it would develop troubles after a few years. The latter costs comparatively much less. Since both these makes of cars satisfy the demands of its own particular market i.e. 'fitness for purpose intended', both are quality cars. But this conclusion would not receive much support among the public. EOQC later modified this definition as 'the degree to which a product meets the requirements of the customer.' With manufactured products, quality is a combination of quality of design and quality of manufacture. The British Standards Institution gave the following definition: "The totality of features and characteristics of a product or service that bear on its ability to satisfy a given need." This definition too lacks precision and measureability and therefore as a base for an engineering activity is unsatisfactory.

Turning our attention back to standards we may define quality 'as conformity to an agreed specification.' This definition will help the customer in recognizing quality.

The means by which we achieve conformity to quality specifications is known as Quality Control. Thus Standardization and Quality Control go hand in hand, one being complementary to the other. Modern Quality Control is an effective system for co-ordinating the quality maintenance and quality improvement efforts of various groups in an organization so as to enable production at the most economical levels which allow for full customer satisfaction.

In some of the Western countries like the United States, statistical methods were used for the control of quality in mass production. It was possible through these Statistical Quality Control methods to achieve the most efficient use of raw materials and the manufacturing process and to reduce the cost of production in turning out the maximum quantity of goods of standard quality.

Dr. W. A. Shewhart of the Bell Telephone Laboratories was the founder of the Statistical Quality Control Technique and Movement, which has now become an integral part of standards work in many countries which have achieved very significant progress in enhancing the quality of industrial products. In the pre-war period, Japanese foods had a bad reputation for cheapness, both in price and quality. Generally products "Made in Japan" had a poor quality image and received little customer's acceptance. The end of the Second World War witnessed a complete destruction of her industry. But soon she found herself on her feet once again. New knowledge techniques and practices of management were introduced in industry. It is through the application of Statistical Quality Control techniques that today Japanese goods can compare with the best from any country. The American educator and Quality Control specialist Dr. W. E. Deming after whom a number of Quality Control prizes offered in Japan, have been named, was largely responsible for the introduction of SQC techniques to the Japanese industry.

Realising the importance of Statistical Quality Control as a means of improving the quality of local products, the Bureau of Ceylon Standards organized Training Programmes to factory personnel both at the management and foreman levels. This is now a regular part of the Bureau's work which has been instrumental in training a large number of factory personnel in SQC techniques. Feedback information received from trainees show that satisfactory results have been achieved in a number of state sector and private sector organizations which had instituted methods of Statistical Quality Control. Through sustained efforts and consistent application of these techniques there is no doubt that the quality of our products will improve to the satisfaction of the consumer.

References

1. Standardization a new discipline—Dr. Lal C. Vermen
2. More through Quality—Van Ettinger and Sittig
3. Million years of standards—Paul Agnew