

11.1 Definitions of quality

The meaning of the term quality is elusive: everybody has their own idea of what is meant by it but it is difficult to express the idea in a concrete form. However, in order to produce a quality product, manufacturers need to have a definition of quality which will allow them to measure how far their products meet the requirements. A number of different definitions of quality have been put forward [1]; each one has its strengths and weaknesses:

- 1 **Transcendent.** This is the meaning that many people connect with the word quality. It implies that the product has an elusive something that makes the product better than all the competing products. Another view is that the product is superior to all competing products in every way possible. The problem with this approach is that quality cannot be defined in a way that can be used for quality management.
- 2 **Product based.** In this definition quality is viewed as a quantifiable attribute based on the product's performance in fields such as durability or reliability. Because it is quantifiable then quality can be determined objectively.
- 3 **User based.** In this definition quality is considered to be an individual matter and the highest quality products are those that best satisfy the customer's preferences. The drawback of this definition is that consumer preferences vary widely so that it is difficult to aggregate these preferences into products that have sufficiently wide appeal.
- 4 **Manufacturing based.** This definition is concerned with engineering and manufacturing practices based on conformance to requirements or specifications. These specifications are set by design and any deviation from them implies a reduction in quality. Excellence is not necessarily in the eye of the beholder but rather in the standards set by the organisation.

- 5 **Value based.** Quality in this instance is defined in terms of costs and prices as well as a number of other attributes. The consumer's decision is then based on quality at an acceptable price so that the 'best buy' is not necessarily the cheapest or the one with the highest 'quality' but the one that offers the best combination of the two.

11.2 Types of quality

The actual manufacture of a product is not the only area where quality has to be considered. The parts of the process include the following.

Quality of design

This can be considered as the value inherent in the design. It is a measure of the excellence of the design in relation to the customer's requirements. The production of a quality product starts with its design. The initial meeting of the customer's requirements and the continued functioning of the product throughout its lifetime depend on choice of materials, construction and processes.

Quality of conformance

This is a measure of the fidelity with which the product taken at the point of acceptance conforms to the above design. This is the area that is usually thought of as the province of quality assurance. However, the overall quality depends also on the design as performance cannot be introduced at this stage if it is not present in the original design.

Quality of use

This is a measure of the extent to which the user is able to secure continuity of use from the product. Provided material is being produced which conforms to specification, the length of time the product lasts in use depends on the original design.

Quality of customer service

This is a measure of factors such as the speed of response to orders, the response to customer returns and complaints, the speed and quality of installation and servicing and the initial availability of the product.

11.3 Quality control

The term quality control used by itself has a very narrow meaning and it is generally taken to mean the maintenance of product quality by the regular inspection of critical stages in the manufacturing process. The inspection is carried out on a limited number of items selected as being representative of the current production and the results recorded chronologically on control charts. The appropriate sampling plan is determined by statistical quality control techniques which are also concerned with the monitoring of the sample means and ranges to give warning of the process moving out of control. Quality control is a process for maintaining current standards not for creating new or improved standards.

11.4 Quality assurance

The term quality assurance covers all the processes within a company that contribute to the production of a quality product. It does not just cover the final testing of the product before shipment and it is not solely concerned with testing the product.

11.5 ISO 9000

ISO 9000 is a standard for quality management system. It is different from and additional to any product standard that individual manufactured items have to conform to. The standard has evolved from BS 5750 which in turn had its origins in the needs of the armed forces to procure large quantities of goods from approved suppliers with the utmost reliability. It represents a move away from inspection of the product for conformity to specification towards the requirement as part of the placing of a contract for a proper quality management scheme to be in place. The aim is to do away with inspection of the goods by the purchaser as they arrive and to replace it with periodic checks on the manufacturers to see that they are conforming to the management standard.

The defence standards were rationalised by the British Standards Institute into one set of standards which could be applied to any organisation. The standard is therefore independent of company size, manufacturing methods or product. A quality system is set up that covers the whole company and the system is registered by an inspecting authority which inspects for conformance to the standard. This inspection can be carried out at any time thereafter to ensure that the company is maintaining its standards. A registered firm can then advertise that it conforms to ISO 9000 so that in theory other firms can buy their goods in confidence. In practice many large firms and organisations require that their suppliers are

registered so that companies have to register in order to be considered as suppliers.

ISO 9000 is based on the definition of quality which is found in ISO 8402 that is: 'the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs'.

The ISO 9000 standard itself consists of guidelines for selecting the correct quality system as there are three possible systems for manufacturing industry. The system that is relevant to a particular company depends on how much of the process from design to service is undertaken by that company. The systems for manufacturing are:

- ISO 9001 Quality Systems – Model for quality assurance in design/development, production, installation and servicing. This is the most comprehensive of the three systems and is intended for a company that is specifically required to design the product. The standard also covers the manufacture, installation and servicing of the product.
- ISO 9002 Quality Systems – Model for quality assurance in production and installation. This system is intended for a manufacturer who is producing an established specification or design. This is the most frequently encountered standard and most textile products fall into this category.
- ISO 9003 Quality Systems – Model for quality assurance in final inspection and test. This system is intended for companies whose business is in inspecting and testing products that are supplied to them.

The standard is not directly concerned with the actual properties or design of the product – these will have been decided earlier – but with guaranteeing that the product is always manufactured in the same way, to the same specifications, that no substandard raw material is used in production and that any rejects do not find their way into the output.

The concerns of the standard are really with good organisational practice and it involves complete documentation of the whole process together with internal and external checks to ensure that everything is being run according to these written instructions.

The standard places great stress on writing down all instructions for each stage of the process plus records which identify all work passing through and its status. This material is contained in a quality manual which is the main document for the standard; it contains samples of all documents such as forms that are in use. The system needs to be flexible in order to take account of improved production and testing methods and also to be responsive to customer feedback. One of the ways of doing this is to have controls over the issue and recall of documents so that there is no danger of out-of-date instructions being utilised.

The quality system includes consideration of the following areas.

11.5.1 Enquiries and orders

The quality system begins with the first contact a prospective customer makes with the company. It is suggested that there should be a standard form for recording all enquiries, which are then at some point entered into a central record. A procedure should also be in place so that the appropriate action is taken to follow up any enquiry.

11.5.2 Purchased material or services

The first requirement for incoming material is that a specification should exist for each separate type of material that is purchased. This specification can be either for the supplier's standard product, one that is demanded by the customer or one that is agreed between both parties. Material is only purchased from a list of qualified suppliers who meet one of the following criteria:

- The supplier delivers a product to an agreed national or international standard and there is an agreed system of checking the quality of supplied material in place. This could be either that the customer accepts the supplier's quality assurance system or each shipment is supplied with the appropriate test data or batch or sample testing is carried out by either party.
- There is on-site inspection and test by the customer.
- There is an ISO 9000 system installed by the supplier.

Once the material has entered the company it has to be controlled by strict record-keeping and labelling which includes the inspection status and whether the material has been verified as conforming to standard. There also should be guidelines for the maintenance, storage, handling and use of the material while it is in the manufacturer's possession.

11.5.3 Inspection and testing

Each test used must have its own written procedure together with a statement of the accuracy and suitability of any test equipment, details of the required test environment and personnel needs. The type accuracy and completeness of the data recorded needs to be considered. If, as is usually the case, not every item is tested then a sampling plan needs to be put forward. It is important to consider what purpose is served by the tests and what action is to be taken about any results.

If testing takes place throughout the manufacturing process rather than just on the final product, the inspected status of all material at all stages must be identifiable. Written control procedures are required to show

whether material has been inspected and approved. Reject material must be clearly marked as such and written procedures should exist detailing how it should be disposed of. It is not sufficient merely to remove non-conforming material, there must also be a feedback mechanism in place which finds the cause of defective material so that a reoccurrence of the fault is prevented and so that corrective action is promoted which will improve the system. Defects may be caused by incorrect working methods and failure to adhere to instructions. Alternatively the design or product specification may be at fault.

11.5.4 Calibration of test equipment

The test equipment in use must have the necessary accuracy and precision to measure the product to the required degree of accuracy. The equipment must be calibrated prior to use and then recalibrated at regular intervals. The calibration of all measuring equipment, including clocks and rules, must be traceable back to original national and international standards. There must be a statement of maximum allowed intervals between calibration and documentary evidence of the calibration.

11.5.5 Organisational structure

The lines of communication and authority within the company need to be defined, in particular any co-ordination between different activities and the specific quality responsibilities. The standard has to be put in place from the top down and it is considered necessary to have the person who is in overall charge of the quality programme at a suitable level in the company management, preferably at board level.

11.5.6 Quality audit

A quality audit is a check of all the various operations to see whether they conform to the company's own standards. The check can be internal in the first instance but if a company wishes to be registered to ISO 9000 then the audit has to be carried out by an external body licensed to grant the necessary certificate. The audit has also to be carried out at intervals to guarantee continuing conformity.

11.5.7 Training

A requirement of the standard is that staff should be trained to the appropriate level to fulfil their function. Records should be kept of each individual's training which are updated whenever any courses are completed.

11.6 Textile product labelling

There are two types of information conveyed by labels on textile products: some information is optional such as size, manufacturer's identification, country of origin or care instructions; other information, however, has statutory requirements which include fibre content and flammability warning (only on certain garments) [2, 3].

11.6.1 Fibre content

Under the Trade Descriptions Act it is a legal requirement to show the fibre content of clothing and other textile products for retail sale. For these purposes a textile product is defined as one that contains not less than 80% by weight of textile fibres. Where the percentage by weight of a fibre is given it must be accurate to within 3% of the weight of the total. When calculating the weights for percentage composition the standard moisture allowances have to be included.

The fibre content can be marked on either the product or on the packaging. As most clothing is displayed without packing the fibre content is usually marked on a sewn-in label. Small items such as socks or tights are labelled on the package since a sewn-in label would be awkward to position without affecting the product. Fabric sold on rolls need not be labelled directly but the roll itself must be.

Generally the constituent fibres of a textile product should be quoted in decreasing order of percentage content. However, if one component accounts for at least 85% of the total fibre content then the product may be marked either by the name of the main fibre with its percentage by weight or by the name of the main fibre with the words '85% minimum', for example 'cotton 85% minimum' without direct reference to the minor components.

If the product contains two or more fibres none of which accounts for 85% of the total then the names and percentages by weight of the two main fibres should be stated followed by the names of any other constituent fibres in descending order of weight, with or without a figure for their percentage by weight. If the minor component has a special sales appeal such as '5% cashmere' it must not be quoted out of place and its percentage must be given clearly.

Many garments have more than one type of fabric such as linings, interlinings and trimmings. Major linings need to have a separate reference to their fibre content on the label. Interlinings and pads need not be identified as long as they constitute less than 30% by weight of the finished garment. It is usual, however, to identify the fibre content of the filling in quilted and similar articles. When clothing is sold in more than one piece such as a suit,

Table 11.1 Some generic names for man-made fibres [4]

Generic name	Attribute
Cupro	Cellulose fibre from cuprammonium process
Modal	High wet modulus cellulose fibre
Viscose	Cellulose fibre from viscose process
Acetate	Cellulose acetate
Triacetate	Cellulose triacetate
Acrylic	Polyacrylonitrile
Elastane	Elastomeric polyurethane
Elastodiene	Rubber
Modacrylic	Fibre containing between 35% and 85% of polyacrylonitrile
Polyamide or nylon	Contains amide linkages joined to aliphatic units
Polyester	Ester of a diol and terephthalic acid
Polyethylene	
Polypropylene	

one label is sufficient for the whole ensemble. Entries in mail order catalogues must also give the fibre content in their description of textile products. The names used on the label for the fibres must be the appropriate generic names as shown in Table 11.1, not the manufacturers' proprietary ones, though these can be added for example 'Tactel polyamide'. Silk may not be used as a descriptive word for the properties of other fibres that are not from silkworms.

The terms that can be used for wool have restricted meanings: phrases such as 'fleece wool' and 'virgin wool' may only be used if the wool has not been reclaimed. '100%', 'pure' or 'all' wool may only be used when the product is wholly of wool. The regulations concerning wool allow for inadvertent adulteration providing it does not exceed 2% of the weight of the product. In the case of products that have passed through a carding stage, up to 5% impurities are allowed. Purely decorative effects such as metallic yarns are permitted at a level of up to 7% in 'all wool' structures if they are visible and distinct.

11.6.2 Flammability labels

The Nightwear (Safety) Regulations 1985 require that children's nightwear comprising nightdresses and dressing gowns must pass a flame retardancy test laid down in BS 5722. Because of this it does not have to carry a warning label except when a flame retardant chemical has been used. In that case there must be a label stating 'Do not wash at more than 50°C. Check suitability of washing agent'.

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Cotton wash
(No bar)

A wash tub without a bar indicates that normal (maximum) washing conditions may be used at the appropriate temperature.



Synthetics wash
(Single bar)

A single bar beneath the wash tub indicates reduced (medium) washing conditions at the appropriate temperature.



Wool wash
(Broken bar)

A broken bar beneath the wash tub indicates much reduced (minimum) washing conditions, and is designed specifically for machine washable wool products



Hand wash only

Do not machine wash

The number in the wash tub shows the most effective wash temperature.



Chlorine bleach may be used



May be tumble dried.



with high heat setting



with low heat setting



Cool iron - Acrylic, Nylon, Polyester



Warm iron - Polyester mixtures, Wool



Hot iron - Cotton, Linen, Viscose



May be dry cleaned. Other letters and / or a bar beneath the circle will indicate the required process to the dry cleaner.



A cross through any symbol means DO NOT

11.1 Fabric care symbols.

Babies' garments (under three months) do not have to pass BS 5722 but they must carry a label showing whether or not they meet the flammability standard.

If the garment does not pass the relevant test the label must show 'Keep away from fire'. If the garment does pass the test the label must show 'Low flammability to BS 5722'.

11.6.3 Origin markings

It is no longer necessary to label textile products with their country of origin, however, if such a label is used it must be truthful. There is a special case that if a product uses a UK trademark and/or has a UK headquarters address and the garment is made outside the UK then the country of origin must be stated.

Origin means the country in which the goods were manufactured or produced. That is the country in which the components last underwent a substantial change, for example the making up of a garment. However, the addition of minor trimmings or badges does not count as a substantial change. The markings must specify *one* country. Legends such as 'foreign', 'imported', 'made in South Korea and/or Taiwan' are unacceptable.

11.6.4 Care labelling

In the UK, labelling of garments with care instructions is not compulsory but it is a desirable feature. However, once a garment is so labelled it is a legal requirement that the article is fit for the cleansing or finishing method recommended without any adverse effects such as colour loss or shrinkage.

Care labelling is governed in the UK by the Home Laundering Consultative Council (HLCC) which is working towards a reliance on symbols rather than words for a description of the processes in preparation for eventual international harmonisation of labelling. The symbols shown in Fig. 11.1 are: a washtub with temperature for washing, a triangle for chlorine bleaching, an iron with dots in for temperature of ironing, a circle for dry cleaning and a square with a circle inside to represent tumble drying. In all cases a cross through the symbol indicates 'do not'.

References

1. Ross J E, 'Total quality Management', Kogan Page, 1994.
2. Ford J, 'Labelling: getting the message home', *Textile Month*, 1988 Feb. 32.
3. Bryan R, 'Textile law', *Text Horizons*, 1995 15 32.
4. ISO 2076 Generic names for man-made fibres.