

Reliability of constructed or manufactured products, systems, equipments and components —

**Part 4: Guide to specification clauses
relating to the achievement and
development of reliability in new and
existing items**

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Foreword

This Part of BS 5760 has been prepared under the direction of the Quality, Management and Statistics Standards Committee.

Although only five Parts of this standard have been prepared at present, further Parts are envisaged in order to give greater emphasis to certain aspects of reliability and to take account of new developments. The first five Parts may be summarized as follows.

Part 0: Introductory guide to reliability. This Part is aimed at directors of companies looking for overall advantages, engineers not trained in quality and reliability to show them how reliability can help in their technical decision making, and at middle management not specialized in engineering to demonstrate how reliability should be dovetailed in with other disciplines to give them the best result.

Part 1: Guide to reliability and maintainability programme management. This Part discusses the essential features of a comprehensive reliability and maintainability programme for the planning, organization, direction and control of resources to produce systems, equipments and components which will be reliable and maintainable. This guide is concerned mainly with what has to be done, and why, when and how it has to be done, but it cannot be specific about who should do it and where, because organizations and projects vary widely. Recommendations are given for the drafting of specifications for reliability and maintainability achievement.

The main considerations for the assessment of reliability are reviewed and this is followed by details of the means by which reliability data are transmitted from the point of collection and recording to the point of storage and/or usage.

Part 2: Guide to the assessment of reliability. This Part recommends general procedures for the assessment of reliability and contains guidance, for the reliability practitioner, on the quantitative and statistical aspects of reliability, such as reliability modelling, the provision of data, and the concepts of redundancy and simulation.

Part 3: Guide to reliability practices: examples. This Part contains authentic practical examples illustrating the principles established in BS 5760-1 and BS 5760-2.

Part 4: Guide to specification clauses relating to the achievement and development of reliability in new and existing items. This Part provides guidance on the form and content of clauses concerned with the achievement of the reliability of products in the various types of specifications that cover the definition, use and maintenance of manufactured and constructed products. Information is also given on specifications related to the management of reliability programmes.

NOTE This British Standard makes numerous cross-references to BS 4778 "Glossary of terms used in quality assurance (including reliability and maintainability terms)". The glossary contains definitions relating to reliability concepts applicable to the guide and it is essential that these definitions and concepts be fully understood if this guide is to be interpreted correctly. For this reason it is recommended that BS 4778 be read in conjunction with BS 5760.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1.1 Scope

This Part of BS 5760 provides guidance on the subject and content of clauses, concerned with the achievement of the reliability of products, in the various types of specifications that cover the definition, use and maintenance of manufactured and constructed products. Information is also given on specifications related to the management of reliability programmes.

Section 2 considers the diverse kinds of reliability specification needed to cater for different kinds of purchaser and supplier, different activities and phases of the design/production process, different kinds of product and different markets. It also considers the development of existing products.

Section 3 is concerned with the characteristics of reliability clauses; what clauses are needed in a general reliability specification; and with writing reliability clauses for such a specification.

Section 4 gives guidance on the reliability clauses that need to be included in particular types of specification.

Section 5 gives guidance on the clauses relating to reliability programme management and procedures.

NOTE 1 More detailed guidance for engineering products is given in the *Guide to Reliability Specifications* published by and available from the Engineering Equipment and Materials Users' Association (EEMUA).

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

1.2 Definitions

For the purposes of this British Standard, the definitions given in BS 4778 apply together with the following.

NOTE 1 The general concept of specification is defined in clause 6 of BS 4778:1979, together with twelve types of specification.

Attention is drawn in particular to the terms relating to reliability characteristics in clause 31 of BS 4778:1979.

NOTE 2 In the context of this guide, the broader meaning of reliability includes availability and maintainability, and their interdependence. (See BS 5760-1).

1.2.1

designer

the person that establishes the form of (designs) a product or service including architects, engineers and naval architects

1.2.2

storage specification

the document that describes in detail the principal conditions under which a product should be kept while waiting transport or use

1.2.3

transport specification

the document that describes in detail the conditions to be observed in moving or conveying the product

1.2.4

reliability specification

the document that describes in detail the reliability requirements with which the product or service has to comply

1.2.5

reliability development testing

experimentation conducted under simulated operational environments to improve the reliability of a design or progressively identify failure modes in order to eliminate them by design action

1.2.6

reliability demonstration testing

experimentation conducted on pre-production items to show, with an agreed degree of confidence, that the required level of reliability has been attained

1.2.7

reliability acceptance testing

experimentation conducted on production items or samples thereof to provide assurance that the reliability achieved in demonstration testing is being maintained during production

1.2.8

stress screening

testing, by means of any production or manufacturing process that applies physical climatic stresses or forces (or combinations thereof) to a product, to establish whether that product attains or fails to attain predetermined limits and to eliminate faulty, abnormal or marginal parts and manufacturing faults

1.2.9

maintenance¹⁾

the combinations of all technical and corresponding administrative actions intended to retain an item in, or restore it to, a state in which it can perform its required function

NOTE In hardware this usually means restoring an item to its original condition, but in software it always means changing the item from its original condition (to correct mistakes).

¹⁾ Definition repeated from BS 5760-1.

Section 2. The need for reliability specifications

2.1 Diversity of requirements

2.1.1 Originator and user requirements

A specification is a means of communicating in writing the requirements or intentions of one party to another in relation to a product or service, a material, a procedure or a test. A specification may be written by the product supplier, the user, the designer, the constructor or by the manufacturer. Before embarking on the writing of a specification the originator should ascertain whether an appropriate British Standard exists. Authors of British Standard specifications should always consider whether clauses covering the reliability and maintainability of the subject are desirable. A specification may define general characteristics or it may be specific to the reliability and maintainability features of a product, such as life duration at various performance levels, conditions of use, installation, acceptance/rejection criteria and definitions of failure.

The specification may be applicable only to certain phases in the life of a product, such as the design, development, production, storage, operating or maintenance phases, or it may apply to the whole life.

Reliability requirements can be stated in a series of specifications, each of which derives from the preceding stage, as shown in Figure 1. This method can be very effective because only the relevant clauses appear in each document, and the reliability requirements do not have to be sought elsewhere. There is, however, a risk that this technique may result in reliability clauses that do not clearly define the standards required. The alternative is to prepare a single reliability specification to cover all aspects of the reliability requirements. The preparation of a separate reliability specification in its simplest form has the advantage of providing a check list that can be used to ensure that no important features are omitted in the preparation of any other specification.

In either case all the series of specifications (see Figure 1) should be considered, although they may not all apply to a particular item or project.

The risk of omission can be minimized by having good liaison and review procedures to examine each specification before it is published to ensure that it is:

- a) concise and precise;
- b) adequate or complete; and
- c) unambiguous, particularly as regards acceptance/rejection criteria corresponding to the desired functions and reliability of the product in question.

2.1.2 Purchaser and supplier requirements

The function of a specification is to provide a basis of understanding between two parties so that both agree on the criteria to be met. It is a detailed statement of a set of requirements to be satisfied by a product in service, including where appropriate, the procedures for checking compliance with the requirements. The two parties are usually the purchaser and the supplier although specifications may be used in other connections as described in subsequent subclauses. The purchaser may be the user of the product, or a procurement agency or a prime contractor.

The supplier may be the vendor offering the product for sale, or a manufacturer, a subcontractor, a fabricator or a distributor.

Reliability clauses in specifications between a purchaser and a supplier can vary considerably. They may define the test programme to meet the purchaser's requirements or they may define the complete management of a contract: setting requirements for design studies, for consideration of the operating environment, for life testing and for in-service maintenance. Because of the through-life factor in reliability it is essential that the supplier is fully informed of the purchaser's requirements for use.

A specification consists essentially of two parts, the first defines requirements, the second defines the means by which compliance with requirements can be demonstrated.

2.1.3 Marketing, design, manufacturing and construction requirements

2.1.3.1 Marketing requirements. Those concerned with the marketing function of a business undertaking are responsible for formulating the market requirements for the reliability of the item under consideration. In order to fulfil this responsibility they should seek technical advice from reliability personnel. They should decide whether reliability is to be a major selling feature, taking into account what is known of the reliability of competitors' products. Timing is usually a major factor in marketing programmes. Time constraints may conflict with the proper consideration of the reliability element which should be included in the design brief or target specification.

When claims of high reliability and low costs of ownership are made in marketing, they should be substantiated by establishing valid source data. Therefore, marketing requirements may demand the accumulation or development of reliability data.