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

Part 0: Introductory guide to reliability

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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 BS 5760 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, at engineers not trained in quality and reliability to show how reliability can help them 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.

Satisfactory reliability has traditionally been achieved by the use of codes of practice or methods of working that have been shown by experience to give good results for established products. However, with the increase in pace of change and performance expectations it is no longer sufficient to consider reliability in purely qualitative terms when its achievement often demands the specification of quantitative acceptance/rejection criteria also. Accordingly the onus is on all parties (i.e. the designer, supplier, purchaser or any other responsible authority) to ensure that quantitative requirements for performance in service are specified whenever appropriate.

NOTE BS 4778 "Glossary of terms used in quality assurance (including reliability and maintainability terms)" contains definitions relating to reliability concepts applicable to this guide and it is essential that those definitions and concepts are fully understood if this introductory guide is to be interpreted correctly.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 14, 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.

0 Introduction

No matter what a company or undertaking designs, constructs, manufactures, processes or purchases, the **achieved reliability** usually has a vital effect upon the life-cycle efficiency, profits and market share.

Market share is normally determined by quality, and in particular the *reliability*, relative to price and delivery. The achievement of *reliability* in products requires a sincere and sustained commitment and understanding by top management. Committed organizations have found that public image, market share, profitability, customer loyalty and internal relations can all be improved. The results may not be immediate and there may be some outlay to be made before the benefits begin, but experience has shown that the returns on investment and effort are well worthwhile. The earliest returns are usually seen in a marked reduction in scrap and rework and their attendant savings.

The need to satisfy competing constraints, including stricter health and safety requirements, the advent of new materials and pressure to reduce life-cycle costs has made people realize that *reliability* can and should be expressed in quantitative terms if it is to be given its proper weight. For example, an item or product may be required to achieve at least a certain useful life, not to exceed a certain failure rate or to have an extremely high availability. Quantitative statements relating to *reliability* should then be made which may be accompanied by stipulations that certain codes of practice are followed.

A standardized systematic approach is essential to ensure that statements are adequate, precise, consistent and unambiguous in all communications concerning *reliability*.

1 Scope

This Part of BS 5760 provides guidance on the basic concepts of *reliability* that are applicable to any business supplying or purchasing products, services, plant or structures.

2 Definitions

For the purposes of this Part of BS 5760 the definitions given in BS 4778 apply, together with the following.

2.1 quality

the totality of features and characteristics of a product, process or service that bear on its ability to satisfy stated or implied needs

2.2 reliability

the ability of an item to perform a required function under stated conditions for a stated period of time

NOTE In building and construction, reliability is often called durability (see CP 3: Chapter IX:1950).

2.3 durability

the ability of an item to perform its required function under stated conditions of use and under stated conditions of preventive or corrective maintenance until a limiting state is reached.

2.4 maintainability

the ability of an item, under stated conditions of use, to be retained in, or restored to, a state in which it can perform its required functions, when maintenance is performed under stated conditions and using prescribed procedures and resources

2.5 availability

the ability of an item (under combined aspects of its *reliability*, maintainability and maintenance support) to perform its required function at a stated instant of time or over a stated period of time

NOTE In a building, the people concerned with the building are interested in durability of the structure; the people concerned with the heating and ventilating equipment are interested in availability; the people concerned with the lifts are interested in *reliability*.

3 What is reliability?

A subjective idea of what is meant by *reliability* is “long periods of adequate performance without failure in service or use”. However, a more formal definition may be taken from BS 4778: “Reliability is the ability of an item to perform a required function under stated conditions for a stated period of time”. Less formally this can be split into qualitative and quantitative aspects as follows.

Qualitatively: freedom from operational failure in service or use on a comparative scale (see *reliability* (1) on Figure 1).

Quantitatively: the probability that an item will operate in a prescribed fashion for a prescribed time under prescribed conditions without suffering any event predefined as a failure (see *reliability* (2) on Figure 1).