

Reliability of systems, equipment and components —

Part 15: Guide to the application of Markov techniques

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee QMS/23, Reliability and maintainability of systems, upon which the following bodies were represented:

- AEA Technology
- Association of Consulting Engineers
- Association of Project Managers
- British Gas plc
- British Railways Board
- British Telecommunications plc
- City University
- Civil Aviation Authority
- Consumers' Association
- Cranfield Institute of Technology
- Department of Trade and Industry (Standards Policy Unit)
- Design Council
- Electricity Association
- Electronic Components Industry Federation
- FEI (The Federation of the Electronics Industry)
- Federation of Small Businesses
- GAMBICA (BEAMA Ltd.)
- Institute of Quality Assurance
- Institute of Risk Management
- Institution of Electrical Engineers
- Institution of Mechanical Engineers
- Institution of Plant Engineers
- Mercury Communications Limited
- Ministry of Defence
- National Computing Centre Ltd.
- Railway Industry Association of Great Britain
- Royal Institution of Chartered Surveyors
- Safety and Reliability Society
- Society of British Aerospace Companies Limited
- Society of Environmental Engineers
- Society of Motor Manufacturers and Traders Limited
- University of Technology, Loughborough

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National foreword

This Part of BS 5760 has been prepared by Technical Committee QMS/23. It is identical with IEC 1165:1995, *Application of Markov Techniques*, published by the International Electrotechnical Commission (IEC).

This Part provides guidance on the application of Markov techniques to dependability analysis. Further information, including advice on the application, benefits and limitations of Markov techniques, is given in BS 5760-2.11.

BS 5760 provides comprehensive guidance on many aspects of reliability management. Fifteen Parts of this standard have been published and these may be summarized as follows:

Part 0: Introductory guide to reliability. This Part provides guidance for senior management and non-specialists on the importance of reliability and explains how measures to achieve reliability should be integrated with other aspects of project management.

Part 1: Guide to reliability and maintainability programme management. This Part discusses the essential features of a comprehensive reliability and maintainability programme to produce reliable and maintainable products.

Part 2: Guide to the assessment of reliability. This Part explains the purpose and problems of assessing reliability. A range of available assessment techniques is reviewed and the principal advantages and limitations are outlined. Sections are included on the assessment of software reliability, human reliability and one-shot devices. The extension of these techniques to the assessment of availability and to the assessment of reliability of services is considered. This use of a range of statistical distributions to analyse reliability data is described.

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

Part 4: Guide to specification clauses relating to the achievement and development of reliability in new and existing items. This Part provides detailed guidance on the specification of reliability.

Part 5: Guide to failure modes, effects, and criticality analysis (FMEA and FMECA). This Part gives guidance on the application of these techniques.

Part 6: Guide to programmes for reliability growth. This Part describes procedures for exposing and removing weaknesses in hardware and software items in order to achieve acceptable reliability in a product. It explains basic concepts, management and test procedures and describes techniques for analysis and correction of failures.

Part 7: Guide to fault tree analysis. This Part gives guidance on the application of fault tree analysis. This technique may be used to identify factors affecting the reliability, performance and safety characteristics of a system.

Part 9: Guide to the block diagram technique. This Part describes the use of the block diagram technique for modelling and evaluating the reliability of both elementary and more complex systems. The extension of the method to calculate availability is also outlined.

Part 10: Guide to reliability of testing.

Section 10.1 General requirements. This Section provides guidance on general principles, procedures and considerations for reliability testing in the laboratory and in the field.

Section 10.2 Design of test cycles. This Section provides a general procedure for design of test cycles, where no applicable preferred test cycles can be found.

Section 10.3 Compliance test procedures for steady-state availability. This Section provides guidance on techniques for testing the availability performance of frequently maintained items under defined conditions.

Section 10.5 Compliance test plans for success ratio. This Section gives procedures for preparing and applying compliance test plans for success ratio or failure ratio. Plans are provided for three main types of test.

NOTE 1 Further Sections of Part 10 based on other Parts of IEC 605 and related IEC standards are planned.

Part 11: Guide to the collection of reliability, maintainability, availability and maintenance support data from the field. This Part provides guidance for the collection of data relating to reliability, maintainability, availability and maintenance support performance of items operating in the field. It deals in general terms with the practical aspects of data collection and presentation and briefly explores the related topics of data analysis and presentation of results.

Part 12: Guide to the presentation of reliability, maintainability and availability predictions. This Part gives guidance on the presentation of quantitative predictions of reliability, maintainability and availability. The items to be included when presenting prediction information are listed and explained with the object of facilitating comparisons between projects and reports.

Part 13: Guide to preferred test conditions for equipment reliability testing.

Section 13.1 Indoor portable equipment: low degree of simulation.

Section 13.2 Equipment for stationary use in weather protected locations: high degree of simulation.

Section 13.3 Equipment for stationary use in partially weather protected locations: low degree of simulation.

Section 13.4 Equipment for portable and non-stationary use: low degree of simulation.

Part 14: Guide to formal design review. This Part provides guidelines for planning and conducting design reviews. Much of the guidance given is widely applicable and relevant to the general conduct of design reviews but it also includes details of the specific contributions to be made by various specialists.

Part 15: Guide to the application of Markov techniques. This Part provides guidance on the application of Markov techniques to dependability analysis. Further information, including advice on the application, benefits and limitations of Markov techniques, is given in BS 5760-2.11.

Further Parts of BS 5760 are envisaged in order to provide guidance on other techniques of reliability management. At present one further Part is in the process of being drafted, and this is as follows:

Part 8: Guide to the assessment or reliability of systems containing software.

This Part will provide guidance on the assessment of reliability of systems containing software. (This is currently published as DD 198:1991).

Whilst mainly addressing system and equipment level reliability, many of the techniques described in the Parts of BS 5760 may also be applied at the component level. Further guidance on component reliability is given in CECC 00804.

Guidance on specific aspects of maintainability is provided in the various Parts of BS 6548 *Maintainability of equipment*.

NOTE 2 This Part of BS 5760 makes reference to BS 4778 *Quality vocabulary*, and in particular to BS 4778-3.1, which contains definitions relating to reliability concepts applicable to this Part of BS 5760. It is essential that these definitions and concepts should be fully understood if this guide is to be interpreted correctly. For this reason it is recommended that BS 4778 should be read in conjunction with BS 5760.

NOTE 3 BS 4778-3.2 deprecates the use of the terms “failure modes and effects analysis” and “failure modes, effects and criticality analysis”. It favours the use of “fault modes and effects analysis” and “fault modes, effects and criticality analysis”, and these terms are used throughout BS 5760-2. However, the older terms have been retained in BS 5760-5 in order to align it with the current version of IEC 812.

Cross-references

Publication referred to	Corresponding British Standard
IEC 50(191):1990	BS 4778 <i>Quality vocabulary</i> Part 3. <i>Availability, reliability and maintainability terms</i> . Section 3.2:1991 <i>Glossary of international terms</i> (Identical)
IEC 1078:1991	BS 5760-9:1992 <i>Guide to the block diagram technique</i> . (Identical)

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to vi, 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.

