

Maintainability of equipment —

Part 2: Guide to maintainability studies during the design phase

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Quality, Management and Statistics Standards Policy Committee (QMS/-) to Technical Committee QMS/23, upon which the following bodies were represented:

- Association for Consumer Research (ACRE)
- Association of Consulting Engineers
- British Gas plc
- British Railways Board
- Cable and Wireless plc
- City University
- Civil Aviation Authority
- Cranfield Information Technology Institute
- Cranfield Institute of Technology
- Design Council
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electricity Industry in United Kingdom
- Electronic Components Industry Federation
- Engineering Equipment and Materials Users' Association
- GAMBICA (BEAMA Ltd.)
- Institute of Petroleum
- Institute of Quality Assurance
- Institution of Electrical Engineers
- Institution of Plant Engineers
- Ministry of Defence
- National Computing Centre Ltd.
- Railway Industry Association of Great Britain
- Safety and Reliability Society
- Society of British Aerospace Companies Limited
- Society of Motor Manufacturers and Traders Limited
- United Kingdom Atomic Energy Authority
- University of Technology, Loughborough

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National foreword

This Part of BS 6548 has been prepared under the direction of the Quality, Management and Statistics Standards Policy Committee. It is identical with IEC 706-2:1990 “*Guide on maintainability of equipment. Part 2.5: Maintainability studies during the design phase*”, published by the International Electrotechnical Commission (IEC).

Two Parts of this standard have been published and these may be summarized as follows.

Part 1: Guide to specifying and contracting for maintainability. This Part introduces the concept of maintainability and provides guidance on the definition of maintainability requirements and on the programmes needed to achieve them.

Part 2: Guide to maintainability studies during the design phase. This Part provides guidance on studies which should be carried out during the design phase and on the relationship of these studies to maintainability and maintenance support tasks. The purpose of the studies is to assist design decision making, to predict the quantitative maintainability characteristics of an item and to help in the evaluation of alternative design options.

Further Parts are envisaged in order to provide guidance on other techniques of maintainability management. At present four further Parts are in the process of being drafted, and these are as follows.

Part 3: Guide to the verification of maintainability and to the collection, analysis and presentation of maintainability data. This Part will provide guidance on the various aspects of verification necessary to ensure that specified maintainability requirements have been met and will advise suitable procedures and test methods. Guidance will also be provided on the collection, analysis and presentation of maintainability data.

Part 4: Guide to maintenance and maintenance support planning. This Part will provide guidance on the tasks for planning maintenance and maintenance support that should be performed during the system acquisition phase in order that availability objectives are met in the operational phase. The interrelationships with reliability and maintainability programmes will also be described.

Part 5: Guide to diagnostic testing. This Part will provide guidance on the consideration of testability characteristics during the design and development of equipment. It will assist in determining effective test procedures as an integral part of operation and maintenance.

Part 6: Guide to statistical methods for maintainability evaluation. This Part will provide guidance on statistical methods for use when allocating maintainability requirements to the various parts of a system, and when carrying out maintainability demonstrations and evaluations.

Guidance on many studies closely related to maintainability is also contained in the various Parts of BS 5760 “*Reliability of systems, equipment and components*”. Many terms used in this standard are defined in BS 4778 “*Quality vocabulary*” — Part 3 “*Availability, reliability and maintainability terms*”.

Cross-references

International standard	Corresponding British Standard
IEC 812:1985 ^a	BS 5760 Reliability of systems, equipment and components
	Part 5:1991 Guide to failure modes, effects and criticality analysis (FMEA and FMECA) (Technically equivalent)

^a IEC 812:1985 is not listed as a normative reference but is quoted in the text.

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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.

Introduction

This guide on maintainability is intended to make recommendations for the standardization of maintainability practices and to stimulate ideas in the maintainability field. This guide will assist users in defining maintainability requirements and associated programmes. Suppliers will gain an understanding of the requirements for achieving and verifying maintainability objectives.

This guide contains Section 5 of the guide. Final publication of the complete series, which will comprise nine sections, is expected to take several years, but since each section is able to make a contribution to the needs of other IEC Technical Committees, it has been decided to issue each section as it is approved for publication.

1 Scope

This guide outlines maintainability studies in the preliminary and detailed design phases and their relationships to other maintainability and maintenance support tasks, which are described in other sections of the guide.

The selected maintainability and design studies are described in this section. Maintainability considerations in design reviews are also included.

2 Objectives

The objectives of maintainability studies are:

- to guide design decisions;
- to predict the quantitative maintainability characteristics of the item;
- to identify any changes to the item design or the requirements, or both, which are necessary to meet operational requirements within the given constraints.

Maintainability studies should be developed and integrated with the design process to meet the stated system operational requirements. To ensure that these requirements are met, maintainability studies should be carried out during all phases of design, and their results should provide inputs to design decision-making.

3 Maintainability studies in the design process

3.1 General

Maintainability studies form a part of the maintainability programme intended to ensure that the delivered item meets its maintainability requirements. They should be planned and performed by the supplier, even if they are not contractually specified.

Maintainability analysis, an integral part of maintainability studies, is a process which translates operational requirements into detailed qualitative and quantitative maintainability requirements and design criteria. It provides inputs to the design process by means of documentation under the following headings:

- specific maintainability requirements to be met in the design;
- design guidelines and check-lists to ensure that the required maintainability features are included in the design;
- a summary of basic maintenance functions and support requirements.

Maintainability analyses are involved in iterative design trade-off studies, a number of which may be required before the optimum design is selected. They should also be used to evaluate the extent of achievement of the maintainability design requirements.

In order to provide optimum results, analyses should be based on a maintenance concept established in parallel with the design optimization. They should accord with the operational concept of the item and the maintenance constraints (interrelationships between levels of maintenance, lines of maintenance and maintenance conditions) in the user's organization. The operational concept results in mission definition, operational deployment, life-cycle, utilization and operational environment. The elements of the maintenance concept will be described in Section 8 of the guide.