

Quality vocabulary —

Part 3: Availability, reliability and maintainability terms —

Section 3.1 Guide to concepts and related definitions

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Committees responsible for this British Standard

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- Association for Consumer Research (ACRE)
- Association of Consulting Engineers
- British Gas plc
- British Railways Board
- British Telecommunications plc
- Cable and Wireless plc
- Civil Aviation Authority
- Cranfield Information Technology Institute
- Cranfield Institute of Technology
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electricity Supply Industry in United Kingdom
- Electronic Components Industry Federation
- Engineering Equipment and Materials Users' Association
- GAMBICA (BEAMA Ltd.)
- Institute of Quality Assurance
- Institution of Electrical Engineers
- Institution of Plant Engineers
- Ministry of Defence
- National Computing Centre Ltd.
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Foreword

This Part of BS 4778 has been prepared under the direction of the Quality, Management and Statistics Standards Policy Committee. Together with BS 4778-2:1991 it revises and extends the terms defined in BS 4778-2:1979 and contains terms and definitions for availability, reliability and maintainability.

This Part of BS 4778 is issued in two Sections as follows.

This Section contains definitions of terms not included in Section 3.2 which the UK considers important in this field of application, and also the concepts of many of the terms contained in Section 3.2 to which direct reference is made.

Section 3.2 is identical with IEC 50(191), International electrotechnical vocabulary, Chapter 191, Dependability and quality of service, published by the International Electrotechnical Commission (IEC). Section 3.2 contains an extensive vocabulary of availability, reliability and maintainability terms in the preparation of which the UK has taken an active role.

NOTE It has been decided to reproduce as a dual-numbered British Standard, the four language revisions of the definitions and the seven language translations of the terms.

BS 4778 will be published in three Parts as follows.

- *Part 1: International terms;*
- *Part 2: Guide to quality concepts and related definitions;*
- *Part 3: Availability, reliability and maintainability terms.*

Previous editions of BS 4778 were arranged in a conceptual format which provided additional explanation and perspective for the major terms defined, as well as the formal definitions themselves. Many users found this conceptual approach helpful and this has been retained in BS 4778-2 and in Section 3.1. BS 4778-1 and Section 3.2 do not include concepts.

The relationship between BS 4778-3, some other British Standard glossaries, IEC 50(191) and ISO 8402 is listed.

International standard	British Standard
	BS 4778 Quality vocabulary
ISO 8402 Quality vocabulary	Part 1:1987 International terms (Identical)
Not applicable	Part 2:1991 Quality concepts and related definitions
Not applicable	Part 3: Availability, reliability and maintainability terms
	Section 3.1:1991 Guide to concepts and related definitions
IEC Publication 50: International electrotechnical vocabulary	
Chapter 191 Dependability and quality of service	Section 3.2:1991 Glossary of international terms (Identical)
	BS 4727 ¹⁾ Glossary of electrotechnical, power, telecommunications, electronic lighting and colour terms
Other Chapters of IEC 50	Parts 1 to 5 (Mostly technically equivalent)

¹⁾ Published under the direction of the Electrotechnical Standards Policy Committee.

Attention is drawn to definitions of terms used in closely related fields given in BS 2846, BS 3811, BS 4727 and BS 5532.

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 22, 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 Scope

This Part of BS 4778 gives guidance on concepts and defines terms used in the disciplines of availability, reliability and maintainability (ARM). Its object is to assist understanding and communication in these fields.

NOTE 1 The acronym ARM is used in this document to avoid making the text cumbersome; its use has no other significance and other acronyms such as RAM or R and M could equally serve the purpose.

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

2 Arrangement

This Part of BS 4778 is subdivided into the following two Sections.

- a) This Section explains concepts underlying several major subject areas and also provides definitions of some additional national terms not included among the internationally accepted terms in Section 3.2. It also includes supplementary vocabularies for some topics, e.g. human reliability, not covered by Section 3.2.
- b) Section 3.2 contains the internationally agreed definitions of terms listed in IEC 50(191).

3 Terms which merit special note

3.1 Defect

Care should be taken in the use of this term. In the United Kingdom the term is frequently used for a product or service that is found to be unfit for its intended usage. Some national and international glossaries relate defect to a condition that renders an item unsafe or incapable of meeting functional or other customer expectation.

The IEC concept of a defect relates to all conditions that can give rise to losses and product liability. Legislation varies widely from one authority to another.

It appears likely that the definition of defect will remain under review for some considerable time and caution should be exercised in the use of this term.

The term should not be used as a general term and it would be prudent to avoid its use altogether if possible.

3.2 Item

Differing definitions of and associated notes on the term “item” appear in BS 4778-3.2 and BS 5532-1. This is mainly due to translation problems at the international level, but it is hoped that the differences can be resolved in future editions. The notes accompanying the definition of item in **191-01-01** of BS 4778-3.2:1991 explain this problem succinctly and allow the French version to use the term “entité” while the English version uses the term “item”. This concept is extended to derived compound terms.

4 References

Appendix A lists ordinary English words adopted as “terms” in quality and reliability activities with their everyday meaning.

Section 2. Hazard, risk and safety

5 Relationship of terms

The purpose of this section is to provide an understanding of the relation between hazard, risk and safety and ARM terms.

6 Hazard

6.1 Concept

A general concept of a hazard as applied, for example, to an industrial process, or a commercial organization, is the potential for adverse consequences of some primary event, sequence of events or combination of circumstances.

Hazards can be classified according to the severity of their potential effects, either in terms of safety, economics or other consequences. Different industries use different classifications. Such classifications alone are purely subjective and usually require qualification and quantification, by definition of the precise form of the hazard and a quantified evaluation of the consequences.

6.2 Terms

6.2.1 hazard

A situation that could occur during the lifetime of a product, system or plant that has the potential for human injury, damage to property, damage to the environment, or economic loss.

6.2.2 major hazard

A large scale hazard which may have severe consequences.

6.2.3 hazard analysis

The identification of hazards and the consequences of the credible accident sequences of each hazard.

7 Risk

7.1 Concept

A general concept of risk is the chance, in quantitative terms, of a defined hazard occurring. It therefore combines a probabilistic measure of the occurrence of the primary event(s) with a measure of the consequences of that/those event(s). Criteria for acceptability of some predicted risk or measured risk can be set voluntarily by the organization responsible and/or subjected to the hazard, or be set mandatorily by some regulatory organization.

7.2 Terms

7.2.1 risk

A combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

7.2.2 risk criteria

A qualitative and quantitative statement of the acceptable standard of risk with which the assessed risk needs to be compared.

7.2.3 risk assessment

The integrated analysis of the risks inherent in a product, system or plant and their significance in an appropriate context.

7.2.4 risk quantification

The estimation of a given risk by a statistical and/or analytical modelling process.

NOTE This may be done by such logic tree modelling methods as are employed in hazard analysis, or by statistical inferences from historical accident data derived from past circumstances similar to those of the product or system or planned operation of facilities, i.e. by developing probabilities of future accidents from files of historical reports of such accidents.

7.2.5 risk evaluation

The appraisal of the significance of a given quantitative (or, when acceptable, qualitative) measure of risk.

7.2.6 individual risk

The frequency at which an individual may be expected to sustain a given level of harm from the realization of specified hazards.

7.2.7 societal risk

The relationship between frequency of occurrence and the number of people in a given population suffering from a specified level of harm from the realization of specified hazards.

8 Risk management

8.1 Concept

The overall subject area concerned with hazard identification, risk analysis, risk criteria and risk acceptability, is generally known as risk management (see 8.2.1) or loss prevention (see 9.2.2). This includes the various techniques that have been developed for the assessment and control of risk. These techniques include the probabilistic assessment of reliability for the quantification of the chance of a hazard occurring.

8.2 Term

8.2.1 risk management

The process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probability of occurrence.

NOTE A compromise is made considering increased cost, schedule requirements and effectiveness of redesign or retraining, installation of warning and safety devices and procedural changes. Risk management is also concerned with the mitigation of those risks deriving from unavoidable hazards through the optimum specification of warning and safety devices and risk control procedures, such as contingency plans and emergency actions.

9 Economic risk

9.1 Concept

Economic risks are related to financial losses that represent the commercial consequences of a hazard. These consequences can include the loss of capital investment in a process plant or other commercial venture, together with the loss of the product of that process or venture. For example, the risk could be the damage caused by a fire in a production plant and the loss of expected future production in that plant. The loss can be either partial or total, temporary or permanent.

9.2 Terms

9.2.1 *economic risk*

The risk of financial loss associated with a product, system or plant due to potential hazards causing loss of production, damage or other financial consequence.

NOTE Risks to human safety can also have economic consequences.

9.2.2 *loss prevention*

A systematic approach to preventing hazardous events or minimizing their effects.

NOTE The activities may be associated with financial loss or safety issues. They are a form of risk management, but are not necessarily quantitative.

9.2.3 *capital cost*

The total cost to the owner of acquiring an item and bringing it to the condition where it is capable of performing its intended function.

9.2.4 *operating cost*

The total cost to the owner of the operation, maintenance and modification of a system or plant.

9.2.5 *maintenance cost*

The total cost of retaining an item in, or restoring it to, a state in which it can perform its required function.

9.2.6 *life-cycle cost*

The total cost of ownership of an item taking into account all the costs of acquisition, personnel training, operation, maintenance, modification and disposal.

NOTE Consideration of life-cycle cost may be important in making decisions on new or changed requirements and as a control mechanism in service, for existing and future items.

10 Hazard and risk to the environment

10.1 Concept

The concepts of hazard and risk can also apply to the environment, either locally, nationally or worldwide. They include the consequences of some hazardous events that do not directly cause personnel harm or cause economic loss associated with the particular industrial plant, but do more generally affect the environment. The consequence of an event can therefore directly affect anything outside the boundary of the plant and only indirectly affect human safety or the economics of the plant at the source of the event. For example, atmospheric pollution affecting vegetation.

NOTE Risks affecting the environment should not be confused with risks caused by environmental effects, either natural or man-made.

10.2 Terms

10.2.1 *environmental hazard*

An event, or continuing process, which, if realized, will lead to circumstances having the potential to degrade, directly or indirectly, the quality of the environment in the short or longer term.

10.2.2 *environmental risk*

A measure of potential threats to the environment which combines the probability that events will cause or lead to degradation of the environment and the severity of that degradation.

11 Safety

11.1 Concept

Safety relates to the freedom from risks that are harmful to a person, or group of persons, either local to the hazard, nationally or even worldwide. It is implied that for the consequences of an event to be defined as a hazard, i.e. a potential for causing harm, there is some risk to the human population and therefore safety could not be guaranteed, even if the risk is accepted when judged against some criterion of acceptability.

11.2 Terms

11.2.1 *safety*

The freedom from unacceptable risks of personal harm.

NOTE Safety is defined in the context of risk of personal harm. It is traceable quantitatively in decision-making on acceptable risks.

11.2.2 *safety management*

The application of organizational and management principles in order to achieve optimum safety with high confidence. This encompasses planning, organizing, controlling, coordinating all contributory development and operational activities.