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Standards Related to Reliability

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Additional information is available at the end of the chapter

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1. IEC — International Electrotechnical Commission (<http://iec.ch>)

Due to big importance, reliability issues are covered by many standards, which provide well-tested procedures and design values. The standards are the result of cooperation of many experts from various countries and contribute worldwide to the high level of quality, reliability, and safety of products and services and to the reduction of failures and accidents. Standards also facilitate legal disputes related to the compensation of various damages. In some cases, the use of standards is compulsory, but sometimes it is a matter of agreement between the supplier and the customer. However, competition among many manufacturers leads to high emphasis on quality and reliability so that the use of pertinent standards gradually becomes the norm. Generally, standards offer safe rules and values, though somewhat conservative, so that they are also updated from time to time, with respect to new information or methods.

There are many associations for standardization around the world. The names of many of them as well as the numbers and titles of numerous individual standards can be found, for example, at the website of IHS Global (<http://global.ihs.com>) and can be purchased here. They can also be found (and bought) via various standardization bodies given below. In this chapter, several institutions will be listed, whose standards for reliability are used internationally. Then, some of these standards will be named as examples.

The technical commission TC 56 “Dependability” of this organization for standardization prepares the international standards related to reliability. An overview of all valid IEC standards can be found via the above web site.

2. ISO — International Commission for Standardisation (<http://www.iso.org>)

This commission prepares and approves the standards for quality and many other subjects.

Reliability and quality standards can also be found under BS (British Standards), DIN (Deutsches Institut für Normung), ASME (American Society of Mechanical Engineers), NBS (National Bureau of Standards, USA), JSA (Japanese Standards Association), KSA (Korean Standards Association), GOST (Gosudarstvennye Standarty — Russian state standards), and various others. Standards for civil engineering constructions can be found, for example, under EN (Euronorms, i.e. European standards or Eurocodes; see <http://www.eurocodes-online.com>).

Standards for military applications, but not only for them, can be found via <http://www.dstan.mod.uk> (United Kingdom defence standards), <http://nso.nato.int/nso> (NATO Standardization Office), and <http://www.defense.gov> (DoD or U.S. Department of Defense) or via websites such as <http://quicksearch.dla.mil>, <https://assist.dla.mil>, or <http://everyspec.com>. The access to some of them is open only for authorized people.

A selection of some international standards related to reliability follows.

IEC/ISO 31010. Risk management. Risk assessment techniques.

IEC 60050-191. International electrotechnical vocabulary. Part 191: Dependability and quality of service.

IEC 60050-192. International electrotechnical vocabulary. Part 192: Dependability.

IEC 60300-1. Dependability management. Part 1: Guidance for management and application.

IEC 60300-3-1. Dependability management. Part 3-1: Application guide: Analysis techniques for dependability — Guide on methodology.

IEC 60300-3-2. Dependability management. Part 3-2: Application guide: Collection of dependability data from the field.

IEC 60300-3-3. Dependability management. Part 3-3: Application guide: Life cycle costing.

IEC 60300-3-4. Dependability management. Part 3-4: Application guide: Guide to the specification of dependability requirements.

IEC 60300-3-5. Dependability management. Part 3-5: Application guide: Reliability test conditions and statistical test principles.

IEC 60300-3-6. Dependability management. Part 3: Application guide Section 6: Software aspects of dependability.

IEC 60300-3-10. Dependability management. Part 3-10: Application guide: Maintainability.

IEC 60300-3-11. Dependability management. Part 3-11: Application guide: Reliability centred maintenance.

IEC 60300-3-12. Dependability management. Part 3-12: Application guide: Integrated logistic support.

IEC 60300-3-14. Dependability management. Part 3-14: Application guide: Maintenance and maintenance support.

IEC 60300-3-15. Dependability management. Part 3-15: Application guide: Engineering of system dependability.

IEC 60300-3-16. Dependability management. Part 3-16: Application guide: Guidelines for specification of maintenance support services.

IEC 60319. Presentation and specification of reliability data for electronic components.

IEC 60605-2. Equipment reliability testing. Part 2: Design test cycles.

IEC 60605-4. Equipment reliability testing. Part 4: Statistical procedures for exponential distribution: Point estimates, confidence interval, prediction intervals, and tolerance intervals.

IEC 60605-6. Equipment reliability testing. Part 6: Tests for the validity and estimation of the constant failure rate and constant failure intensity.

IEC 60706-2. Maintainability of equipment. Part 2: Maintainability requirements and studies during the design and development phase.

IEC 60706-3. Maintainability of equipment. Part 3: Verification and collection, analysis, and presentation of data.

IEC 60706-5. Maintainability of equipment. Part 5: Testability and diagnostic testing.

IEC 60812. Analysis techniques for system reliability. Procedure for failure mode and effects analysis (FMEA).

IEC 61014. Programmes for reliability growth.

IEC 61025. Fault tree analysis (FTA).

IEC 61070. Compliance test procedures for steady-state availability.

IEC 61078. Analysis techniques for dependability. Reliability block diagram and Boolean methods.

IEC 61123. Reliability testing. Compliance test plans for success ratio.

IEC 61124. Reliability testing. Compliance tests for constant failure rate and constant failure intensity.

IEC 61160. Design review.

IEC 61163-1. Reliability stress screening. Part 1: Repairable assemblies manufactured in lots.

IEC 61163-2. Reliability stress screening. Part 2: Electronic components.

IEC 61164. Reliability growth — Statistical test and estimation methods.

IEC 61165. Application of Markov techniques.

IEC 61649. Weibull analysis.

IEC 61650. Reliability data analysis techniques: Procedures for comparison of two constant failure rates and two constant failure (event) intensities.

IEC 61703. Mathematical expressions for reliability, availability, maintainability, and maintenance support terms.

IEC 61709. Electric components: Reliability. Reference conditions for failure rates and stress models for conversion.

IEC 61710. Power law model: Goodness-of-fit tests and estimation methods.

IEC 61882. Hazard and operability studies (HAZOP studies): Application guide.

IEC 62198. Managing risk in projects: Application guidelines.

ISO 61713. Software dependability through the software life-cycle processes: Application guide.

ISO 9000. Quality management.

This is a group of standards that addresses various aspects of quality management. It provides guidance and tools for companies and organizations that want to ensure that their products and services consistently meet the customer's requirements and that quality is permanently improved.

The updated version ISO 9001:2008 – Quality Management Systems has several parts: Principles, Vocabulary, Requirements, etc. This standard sets out the criteria for a quality management system and is the only standard in this family that can be certified to. It can be used by any organization regardless of its field of activity. ISO 9001:2008 is implemented by more than 1 million companies and organizations in more than 170 countries.

There are also branch-related groups of standards based on internationally recognized standard ISO 9001. For example, standards AS/EN 9100, AS/EN 9110, and AS/EN 9120 are devoted to quality management systems with specific requirements on aviation, space, and defense industries. They are published by the International Aerospace Quality Group (IAQG). Especially, the AS/EN 9120 focuses on product safety and reliability and addresses critical product performance, conformity to specifications, and airworthiness.

ISO 2394. General principles on reliability for structures.

ISO 12491. Statistical methods for quality control of building materials and components.

ISO 13822. Bases for design of structures: Assessment of existing structures.

ISO/IEC Guide 51. Safety aspects: Guidelines for their inclusion in standards.

ISO-IEC Guide 73. Risk management: Vocabulary.

CAN/CSA – Q634-91. Risk Analysis Requirements and Guidelines.

EN 1990. Eurocode: Basis of structural design.

EN 50126. Railway applications. The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS). This is a group of the standards of the CENELEC (European Committee for Electrotechnical Standardization) for the reliability and safety in rail

industry in Europe and other countries. It has several parts: EN 50126-1: Part 1: Generic RAMS process, EN 50126-2: Part 2: Systems approach to safety, EN 50126-3: Guide to application of EN 50126-1 for rolling stock RAM, EN 50126-4: Functional safety: Electrical/electronic/programmable electronic systems, and EN 50126-5: Functional safety: Software.

The standards for reliability and quality in the railway industry can also be found under the International Railway Industry Standard (IRIS). Those for road vehicles industry can be found, for example, under SAE (Society of Automotive Engineers) or VDI (Verein Deutscher Ingenieure).

As said above, the standards are updated from time to time, and some can even lose its validity, be withdrawn, or replaced by others. Thus, when looking for a certain standard, one must make sure whether it is valid or if it has undergone some changes.

3. MIL-HDBK and MIL-STD

Various volumes of Military Handbook (MIL-HDBK) or Military Standards (MIL-STD), issued by the U.S. Department of Defense (DoD), deal with reliability (among other things) and are worldwide recognized and become international standards of their own. Some titles follow. However, the reader must always check whether the pertinent issue is valid. Nevertheless, even “cancelled” issues can contain useful information.

MIL-HDBK-189. Military Handbook: Reliability growth management.

MIL-HDBK-217. Military Handbook: Reliability prediction of electronic equipment. It contains failure rate models for numerous components, usually more conservative than in other standards.

MIL-HDBK-338B. Military Handbook: Electronic reliability design handbook.

MIL-HDBK-344. Military Handbook: Environmental stress screening of electronic equipment.

MIL-HDBK-472. Military Standardization Handbook: Maintainability prediction.

MIL-STD-105E. Military Standard: Sampling procedures and tables for inspection by attributes. This standard was officially cancelled in 1995. A similar topic is dealt with in MIL-STD-1916: DoD preferred methods for acceptance of product.

MIL-HDBK-781D. Military Handbook: Reliability test methods, plans, and environments for engineering development, qualification, and production.

MIL-STD-785B. Military Standard: Reliability program for systems and equipment development and production.

MIL-STD-1629A. Military Standard: Procedures for performing a failure mode, effects, and criticality analysis.

MIL-STD-2074. Military Standard: Failure classification for reliability testing.

MIL-STD-2155. Military Standard: Failure reporting, analysis, and corrective action system (FRACAS).]

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