



# *Maintenance related IEC dependability standards*

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## ***Outline of talk***

- ***Standardisation bodies***
- ***TC56 work***
- ***Maintenance-related standards***
- ***Use of international standards***
- ***Information sources***



- ***International standardisation bodies***
  - ***ISO – International Standards Organisation***
  - ***IEC – International Electrotechnical Commission***
- ***European (an example)***
  - ***CEN – European Committee for Standardisation***
- ***National***
  - ***Standards Australia***
  - ***Swedish Standards Institute***
  - ***British Standards Institution***



### ***Different responsibilities:***

- ***ISO has responsibility for developing quality related standards***
- ***IEC has responsibility for developing dependability standards***



### ***History of TC56***

***Its history can be traced back to 1965, when the Reliability and Maintainability Committee was formed.***

***In 1990, after contacts with ISO, it was decided that the IEC/TC56 should be responsible for standardization in the field of dependability, in any appropriate technological area, including those normally considered as outside the scope of IEC.***





### ***The scope of TC56 today***

***“To prepare international standards in the field of dependability, in all appropriate technological areas, including those not normally dealt with by IEC Technical Committees. ...***

***The standards provide systematic methods and tools for the dependability assessment and management of equipment services and systems throughout their life cycle.”***



### ***The concept of Dependability***

***The term “dependability” (IEV 191-02-03) is a collective term, used to describe***

***availability performance***

***and its constituent factors***

***reliability performance***

***maintainability performance and***

***maintenance support performance.***



### ***TC56 – a horizontal technical committee***

***Within the work of ISO and IEC, TC 56 is classified as a horizontal Technical Committee. This means that it should exclusively treat fundamental principles, concepts, terminology or technical characteristics that are relevant to a number of other horizontal or product Technical Committees.***

***The other committee type, product Technical Committee, has a scope, covering a specific product or group of related products.***



### ***Horizontal Technical Committee Standards vs. Product Technical Committee Standards***

***The IEC Dependability standards are examples of horizontal technical committee standards, mostly containing guidelines and tools, using the word “should”.***

***Some of the ISO Condition Monitoring standards are of a normative type, similar to product technical committee standards, using the word “shall” much more than the word “should”.***



### ***TC56 – member countries***

***Today TC 56 has 33 member countries, 23 so-called P-members, and 10 so-called O-members.***

***P-members are supposed to participate actively in the work, to vote on all questions formally submitted for voting within the technical committee or subcommittee, and to participate in meetings.***

***O-members are allowed to follow the work as observers and have the right to submit comments and to attend meetings.***



### ***TC56 – Working Groups 1-4***

***WG 1. Dependability terminology***

***WG 2. Dependability techniques***

***WG 3. Dependability management***

***WG 4. System aspects of dependability***

***These groups constitute the four Maintenance Teams and they are responsible for the establishing and managing of Project Teams.***





## ***TC56 – Liaisons***

***The Committee has liaisons with several other IEC and ISO committees, e.g.***

***ISO/TC 108/SC 5 “Mechanical vibration and shock – Condition monitoring and diagnostics of machines”***

***ISO/TC 176 “Quality management and quality assurance”.***



## ***Stages in the life of an IEC standard***

### ***Project stages***

- Preliminary (PWI, Preliminary Work Item)***
- Proposal (NP, New Work Item Proposal)***
- Preparatory (WD, Working Drafts)***
- Committee (CD, Committee Drafts)***
- Enquiry (CDV, Committee Draft for Vote)***
- Approval (FDIS, Final Draft Int’l Standard))***
- Publication (IEC Standard)***

***Maintenance stage (From CD to IEC Standard)***

***Withdrawal stage***

### ***Standards at four levels***

***The top level documents (60300-1) deal with dependability management system and dependability programs.***

***The second level documents (60300-2) give guidance on various program elements and tasks.***

***The third level documents (60300-3) are so-called application guides.***

***The fourth level documents describe different tools, such as procedures and statistical techniques.***

### ***IEC standards related to maintenance management***

- ***Life cycle costing (60300-3-3)***
- ***Maintainability (60300-3-10)***
- ***Reliability centred maintenance (60300-3-11)***
- ***Integrated logistic support (60300-3-12)***
- ***Maintenance and maintenance support (60300-3-14)***

***[Guideline for the specification of maintenance support services (60300-3-16, tent.)]***





***IEC 60300-3-3, Edition 2, 2004-07***

***“Life cycle costing” provides an introduction to the concept of life cycle costing, with special reference to costs associated with the product’s dependability.***

***The document describes the value of life cycle costing and outlines general approaches. It also covers common life cycle cost elements and guidance for performing a life cycle cost analysis.***  
***(59 pages, English)***



***IEC 60300-3-10, Edition 1, 2001-01***

***“Maintainability” is an application guide for maintainability, to be used in the implementation of a maintainability program for the life cycle phases initiation, development and in-service of a product.***

***It gives guidance on how maintenance aspects are considered in design and modification work in order to achieve the appropriate maintainability.***

***(67 pages, bilingual)***



### ***IEC 60300-3-11, Edition 1, 1999-03***

***“Reliability centred maintenance” provides guidelines for the use of reliability centred maintenance (RCM) analysis techniques in the development of preventive maintenance programs for an equipment or a structure.***

***The present version of the standard is based largely on the procedures in MSG-3. However, it is applicable not only to aircrafts but to a variety of items. (107 pages, bilingual)***



### ***IEC 60300-3-11***

***The standard is subject to revision, and a Committee Draft (56/1087/CD) was circulated in December 2005, with closing date for comments March 2006.***





***IEC 60300-3-12, Edition 1, 2001-12***

***“Integrated logistic support” describes the process of the management method ILS, by which the logistic support services required by a customer can be brought together in a structured way. These logistic support services include maintenance, manpower, training, spares, documentation, packaging, handling, storage, transportation, support resources and disposal. The standard provides guidance on minimum activities necessary for an effective ILS implementation.***  
***(93 pages, bilingual)***

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***IEC 60300-3-14, Edition 1, 2004-03***

***“Maintenance and maintenance support” describes a framework for maintenance and maintenance support and also minimal common practices. It further describes related management, processes and methodologies. The approach is more general than the one used in integrated logistic support (ILS) and is applicable also to cases where maintenance and maintenance support have to be adapted to specific conditions during the various life phases of a system. (43 pages, English)***

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## From IEC 60300-3-14," Maintenance and maintenance support"

### 4.2 Description of maintenance

#### 4.2.1 General

Maintenance is the combination of all technical and administrative actions, including supervisory actions, intended to retain an item in, or restore it to, a state in which it can perform a required function.

#### 4.2.2 Maintenance policy and concept

A maintenance policy defines the general approach for the provision of maintenance and maintenance support based on the objectives and policies of owners, users and customers (see 5.3). It influences the decisions made on maintenance activities and resources during the complete life cycle of an item.

The maintenance concept is the specific maintenance approach developed for items using the different levels of maintenance based on the indenture levels. It makes use of maintenance support resources within the framework of the maintenance policy and is performed by a maintenance echelon.



#### 4.2.3 Indenture levels

Items may be subdivided into a hierarchy (for example, facility, system, assembly, equipment and component) or indenture levels against which maintenance tasks are prescribed. The set of maintenance tasks to be carried out at a specified indenture level are referred to as the level of maintenance. The level of maintenance can be broken down into units of work or elementary maintenance activities. A sequence of elementary maintenance activities carried out for a given purpose becomes the actual maintenance task.

#### 4.2.4 Maintenance echelons

Organizational units where maintenance is carried out are referred to as the lines of maintenance or maintenance echelons. These can be internal groups such as field mechanics and personnel in repair shops or they can be external such as personnel in manufacturer overhaul facilities.



#### 4.2.5 Preventive and corrective maintenance

Preventive maintenance may be carried out at regular intervals or according to prescribed criteria to reduce the probability of failure or degradation in order to retain the functioning of an item or to detect a hidden fault. This can be condition based and achieved by monitoring its condition until failure is imminent, or by functional checks to detect failure of hidden functions, and then performing maintenance. It can also be predetermined, based on a fixed interval (such as calendar time, operating hours, number of cycles) consisting of regular refurbishment or replacement of an item or its components.

Corrective maintenance restores the functions of an item after failure has occurred or performance fails to meet stated limits. Some failures are acceptable if the consequences of failure (such as production loss, safety, environmental impact, failure cost) are tolerable compared to the cost of preventive maintenance. This results in a planned run-to-failure approach to maintenance.



If failure consequences are severe, root cause analysis should be performed to prevent reoccurrence.

Preventive maintenance is normally scheduled while corrective maintenance is usually unscheduled. It is not unusual to defer corrective maintenance for a later convenient time when redundancy preserves function.

Different approaches are taken to maintenance tasks, depending on product criticality and selected maintenance concept.





## *IEC 60300-3-16 (tent), Work in progress*

**“Guideline for the specification of maintenance support services” is supposed to “Describe a framework for the specification of services related to the maintenance support of products, systems and equipment that are carried out during the operation and maintenance phase. Outline, in a generic manner, the development of agreements for maintenance support services as well as guidelines for the management and monitoring of these agreements by both the company and the service provider.”**

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**(56/1047/NP, 24 pages, English)**  
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***On the use of international standards***

***The compliance to the IEC dependability standards is voluntary, they are not laws, and the benefits from using them have to be identified.***

***Possible use:***

- ***as a basis for contracts,***
- ***for evaluation of providers of service,***
- ***for risk and insurance management,***
- ***for decisions regarding contract compliance, and***
- ***for related litigation and prosecution***



***Is there anything in the ISO/IEC standards for an EAMBoK?***

***The standards represent a wealth of knowledge, compiled by experts within the project groups, commented upon by members of the working groups and by the corresponding national committees of the participating member states, P-states as well as O-states.***



***Is there anything in the ISO/IEC standards for an EAMBoK?***

***The toolbox principle:***

- ***management system, programs***
- ***guidance on program elements/tasks***
- ***application guides***
- ***tools***

***(Similar to the approach using core values, methodologies, and tools. [Akersten, ICOMS 2002])***



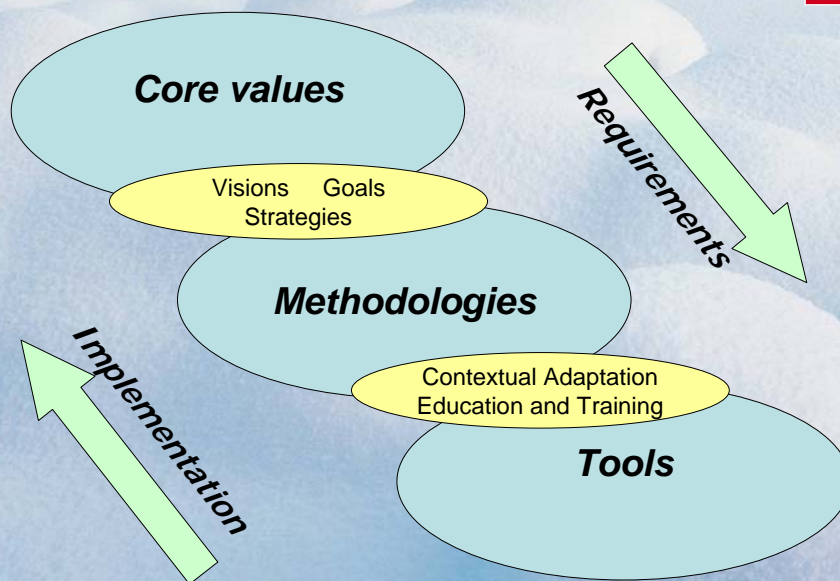
### ***Standards at four levels***

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### ***Reported benefits of international standards***

- ***They are used world-wide***
- ***They can be used by companies and organizations, regardless of size***
- ***They provide a common language for description of processes***
- ***They provide checklists of the main issues to be covered***
- ***They provide a framework, facilitating performance measurement and improvement work***
- ***They facilitate education and training within its subject area***
- ***They reduce technical barriers to trade by harmonizing of national standards***



### ***International standardisation work***

***The homepage of Standards Australia describes the value of participating with the use of the headings Value to you, Value to your business and Value to the nation.***

***I recognize the values Personal satisfaction, Networking opportunity (national as well as international), Knowledge gain, Familiarity with standards, and Recognition for your organization.***



## ***International standardisation work***

***A final quote from Valter Loll, convenor of TC56 WG2:***

***“If you want to stay updated you have to participate in the standardization work or receive information from someone who does.”***



## ***Information sources***

- ***IEC SMB/2936/R (2004). TC 56 Dependability: Strategic Policy Statement. Genève: IEC.***
- ***IEV (International Electrotechnical Vocabulary) <http://std.iec.ch/iec60050>***
- ***Dunn, S. (2005). The maintenance dictionary: a plea for common maintenance terminology. In: Proceedings of ICOMS 2005, Hobart, Tasmania.***
- ***Hitchcock, L. (2005). Evolving international standards for machine condition monitoring. In: Proceedings of ICOMS 2005, Hobart, Tasmania.***
- ***Jamieson, D. (2005). Upcoming international standards on tribology-based machine condition monitoring. In: Proceedings of ICOMS 2005, Hobart, Tasmania.***
- ***Standards Australia, <http://www.standards.org.au>***
- ***Loll, V. (2001). International standards for reliability, Quality and Reliability Engineering International, 7, 362.***





### General guidelines

- IEC 60300-3-1, Ed.2 (2003). *Dependability management - Part 1: Dependability management systems.*
- IEC 60300-3-2, Ed.2 (2004). *Dependability management - Part 2: Guidelines for dependability management*
- IEC 60300-3-1, Ed.2 (2003). *Dependability management - Part 3-1: Application guide - Analysis techniques for dependability - Guide on methodology*

### Maintenance management, application guides

- IEC 60300-3-3, Ed.2 (2005). *Dependability management - Part 3-3: Application guide - Life cycle costing*
- IEC 60300-3-10, Ed.1 (2001). *Dependability management - Part 3-10: Application guide – Maintainability*
- IEC 60300-3-11, Ed.1 (1999). *Dependability management -- Part 3-11: Application guide -- Reliability centred maintenance*
- IEC 60300-3-12, Ed.1 (2001). *Dependability management - Part 3-12: Application guide - Integrated logistic support*
- IEC 60300-3-14, Ed.1 (2004). *Dependability management - Part 3-14: Application guide - Maintenance and maintenance support*



### Maintainability, a number of tools

- IIEC 60706-1, Ed.1 (1982). *Guide on maintainability of equipment. Part 1 - Sections One, Two and Three. Introduction, requirements and maintainability programme*
- IEC 60706-2, Ed.1 (1990). *Guide on maintainability of equipment. Part 2 - Section Five: Maintainability studies during the design phase*
- IEC 60706-3, Ed.1 (1987). *Guide on maintainability of equipment. Part 3 - Sections Six and Seven. Verification and collection, analysis and presentation of data*
- IEC 60706-4, Ed.1 (1992). *Guide on maintainability of equipment. Part 4 - Section 8: Maintenance and maintenance support planning*
- IEC 60706-5, Ed.1 (1994). *Guide on maintainability of equipment. Part 5: Section 4: Diagnostic testing*
- IEC 60706-6, Ed.1 (1994). *Guide on maintainability of equipment. Part 6: Section 9: Statistical methods in maintainability evaluation*



Maintenance-related ongoing IEC standardisation work (2006-01)

IEC 60300-3-1, Ed.2 (2003). *Dependability management - Part 1: Dependability management systems.*

IEC 60300-3-11, Ed. 2. *Dependability management - Part 3-11: Application guide - Reliability centred maintenance*

IEC 60300-3-15, Ed. 1. *Dependability management - Part 3-15: Guidance to engineering of system dependability*

IEC 60300-3-16, Ed. 1. *Dependability management - Part 3-16: Application guide - Guideline for the specification of maintenance support services*

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

IEC 60706-3, Ed. 2. *Maintainability of equipment - Part 3: Verification and collection, analysis and presentation of data*

IEC 60706-5, Ed. 2. *Maintainability of equipment - Part 5: Testability and diagnostic testing*

IEC 62402, Ed. 1. *Obsolescence management - Application guide*