



# SLOVENSKI STANDARD

## SIST EN 60706-2:2007

01-januar-2007

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**Vzdrževalnost opreme - 2. del: Zahteve za vzdrževalnost in študije vzdrževalnosti v fazi snovanja in razvoja (IEC 60706-2:2006)**

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

Instandhaltbarkeit von Geräten -- Teil 2: Instandhaltbarkeitsanforderungen und Studien in der Entwicklungsphase

Maintenabilité de matériel -- Partie 2: Exigences et études de maintenabilité pendant la phase de conception et de développement

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**Ta slovenski standard je istoveten z: EN 60706-2:2006**

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**ICS:**

03.100.40	Raziskave in razvoj	Research and development
21.020	Značilnosti in načrtovanje strojev, aparatov, opreme	Characteristics and design of machines, apparatus, equipment

**SIST EN 60706-2:2007**

**en**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 60706-2**

June 2006

ICS 03.120.01; 21.020

English version

**Maintainability of equipment**  
**Part 2: Maintainability requirements and studies**  
**during the design and development phase**  
(IEC 60706-2:2006)

Maintenabilité de matériel  
Partie 2 : Exigences et études de  
maintenabilité pendant la phase de  
conception et de développement  
(CEI 60706-2:2006)

Instandhaltbarkeit von Geräten  
Teil 2: Instandhaltbarkeitsanforderungen  
und Studien in der Entwicklungsphase  
(IEC 60706-2:2006)

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This European Standard was approved by CENELEC on 2006-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 56/1090/FDIS, future edition 2 of IEC 60706-2, prepared by IEC TC 56, Dependability, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60706-2 on 2006-05-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2007-02-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-05-01

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 60706-2:2006 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60300-1	NOTE Harmonized as EN 60300-1:2003 (not modified).
IEC 60300-2	NOTE Harmonized as EN 60300-2:2004 (not modified).
IEC 60300-3	NOTE Harmonized in 60300-3 series (not modified).

<https://standards.iteh.ai/catalog/standards/sist/ca4b022f-e943-4f55-a420-4175691255a/sist-en-60706-2-2007>

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-191	1990	International Electrotechnical Vocabulary (IEV) Chapter 191: Dependability and quality of service	-	-
IEC 60300-3-1	- <sup>1)</sup>	Dependability management Part 3-1: Application guide - Analysis techniques for dependability - Guide on methodology	EN 60300-3-1	2004 <sup>2)</sup>
IEC 60300-3-3	- <sup>1)</sup>	Dependability management Part 3-3: Application guide - Life cycle costing	EN 60300-3-3	2004 <sup>2)</sup>
IEC 60300-3-10	2001	Dependability management Part 3-10: Application guide - Maintainability	-	-
IEC 60300-3-11	- <sup>1)</sup>	Dependability management Part 3-11: Application guide - Reliability centred maintenance	-	-
IEC 60300-3-12	- <sup>1)</sup>	Dependability management Part 3-12: Application guide - Integrated logistic support	EN 60300-3-12	2004 <sup>2)</sup>
IEC 60300-3-14	- <sup>1)</sup>	Dependability management Part 3-14: Application guide - Maintenance and maintenance support	EN 60300-3-14	2004 <sup>2)</sup>
IEC 60706-3	- <sup>1)</sup>	Maintainability of equipment Part 3: Verification and collection, analysis and presentation of data	-	-
IEC 60706-5	- <sup>1)</sup>	Guide on maintainability of equipment Part 5 - Section 4: Diagnostic testing	-	-
IEC 60812	- <sup>1)</sup>	Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)	EN 60812	2006 <sup>2)</sup>
IEC 61025	- <sup>1)</sup>	Fault tree analysis (FTA)	HD 617 S1	1992 <sup>2)</sup>
IEC 61160	- <sup>1)</sup>	Design review	EN 61160	2005 <sup>2)</sup>

<sup>1)</sup> Undated reference.

<sup>2)</sup> Valid edition at date of issue.

EN 60706-2:2006

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<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61649	1997	Goodness-of-fit tests, confidence intervals and lower confidence limits for Weibull distributed data	-	-

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NORME  
INTERNATIONALE  
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CEI  
IEC

60706-2

Deuxième édition  
Second edition  
2006-03

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**Maintenabilité de matériel –**

**Partie 2:**

**Exigences et études de maintenabilité  
pendant la phase de conception et  
de développement**

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**Maintainability of equipment –**

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**Part 2:**

**Maintainability requirements and studies  
during the design and development phase**

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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

CODE PRIX  
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XA

*Pour prix, voir catalogue en vigueur  
For price, see current catalogue*

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## MAINTAINABILITY OF EQUIPMENT –

**Part 2: Maintainability requirements and studies  
during the design and development phase**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60706-2 has been prepared by IEC technical committee 56: Dependability.

This second edition cancels and replaces the first edition, published in 1990, and constitutes a technical revision.

The major technical changes with regard to the first edition concern the inclusion of the original Section Two from IEC 60706-1:1982 entitled: Maintainability requirements in specifications and contracts, as well as the original mathematical Annex A from IEC 60706-6:1994, entitled Maintainability allocation.

The text of this standard is based on the following documents:

FDIS	Report on voting
56/1090/FDIS	56/1101/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 60706 consists of the following parts, under the general title *Maintainability of equipment*:

NOTE Each part outlines the application of specific techniques to implement a maintainability programme.

Part 1: Introduction, requirements and maintainability programme

Part 2: Maintainability requirements and studies during the design and development phase

Part 3: Verification and collection, analysis and presentation of data

Part 4: Guide to maintenance and maintenance support planning

Part 5: Diagnostic testing

Part 6: Statistical methods in maintainability evaluation

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed; [SIST EN 60706-2:2007](https://standards.iteh.ai/catalog/standards/sist/ca4b022f-e943-4f55-a420-a173c69f253a/sist-en-60706-2-2007)
- withdrawn; [https://standards.iteh.ai/catalog/standards/sist/ca4b022f-e943-4f55-a420-](https://standards.iteh.ai/catalog/standards/sist/ca4b022f-e943-4f55-a420-a173c69f253a/sist-en-60706-2-2007)
- replaced by a revised edition, or [a173c69f253a/sist-en-60706-2-2007](https://standards.iteh.ai/catalog/standards/sist/ca4b022f-e943-4f55-a420-a173c69f253a/sist-en-60706-2-2007)
- amended.

## INTRODUCTION

Maintainability is a characteristic that defines the ease with which an item can be maintained and supported during its period of use. Maintainability has to be built into an item during the design and development phase and it is therefore important that maintainability requirements be established as part of the initial specification.

The IEC 60706 series of standards is intended to give guidance on how a designer should best incorporate high standards of maintainability into a product so that the cost of maintenance is reduced to an acceptable level. It is also important to ensure that the necessary maintenance can be undertaken to keep the product in a safe condition and that it can be operated to its required performance.

This International Standard gives an introduction to the concept of maintainability, and guidance as to how maintainability can be incorporated into specifications and contracts and how maintainability should be considered as part of the design process. It forms part of a hierarchy of standards on dependability as described below.

IEC 60300-1 and IEC 60300-2 are the IEC top-level standards that provide guidance on how to incorporate dependability, including reliability, availability and maintainability, into manufactured products. IEC 60300-3-10 is the top-level standard on maintainability, serving as an application guide and which forms part of the IEC 60300-3 series of standards. It can be used to implement a maintainability programme covering the initiation, development and in-service phases of a product, which form part of the tasks described in IEC 60300-2. It also provides guidance on how the maintenance aspects of the tasks should be considered in order to achieve optimum maintainability.

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## MAINTAINABILITY OF EQUIPMENT –

### Part 2: Maintainability requirements and studies during the design and development phase

#### 1 Scope

This part of IEC 60706 examines the maintainability requirements and related design and use parameter, and discusses some activities necessary to achieve the required maintainability characteristics and their relationship to planning of maintenance. It describes the general approach in reaching these objectives and shows how maintainability characteristics should be specified in a requirements document or contract.

It is not intended to be a complete guide on how to specify or to contract for maintainability. Its purpose is to define the range of considerations when maintainability characteristics are included as requirements for the development or the acquisition of an item.

The standard goes on to describe maintainability studies in the preliminary and detailed design phases and their relationships to other maintainability and maintenance support tasks, described in associated standards. Maintainability considerations in design reviews are also included.

It is intended that customers acquiring items of equipment will find this standard useful in assisting them to define their maintainability objectives and associated maintainability programmes.

[SIST EN 60706-2:2007](https://standards.iteh.ai/catalog/standards/sist/ca4b022f-e943-4f55-a420-a173c69f253a/sist-en-60706-2-2007)

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#### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050(191):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 191: Dependability and quality of service*

IEC 60300-3-1, *Dependability management – Part 3-1: Application guide – Analysis techniques for dependability – Guide on methodology*

IEC 60300-3-3, *Dependability management – Part 3-3: Application guide – Life cycle costing*

IEC 60300-3-10:2001, *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 60706-3, *Guide on maintainability of equipment – Part 3: Sections Six and Seven – Verification and collection, analysis and presentation of data*<sup>1</sup>

IEC 60706-5, *Guide on maintainability of equipment – Part 5 – Section 4: Diagnostic testing*

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

IEC 61025, *Fault tree analysis (FTA)*

IEC 61160, *Design review*

IEC 61649, *Goodness-of-fit tests, confidence intervals and lower confidence limits for Weibull distributed data*

### 3 Terms, definitions and acronyms

For the purposes of this document, the terms and definitions given in IEC 60050(191) apply, together with the following:

#### 3.1 Terms and definitions

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##### 3.1.1

##### **maintainability** (performance)

ability of an item under given conditions of use, to be retained in, or restored to, a state in which it can perform a required function, when maintenance is performed under given conditions and using stated procedures and resources

NOTE The term "maintainability" is also used as a measure of maintainability performance (see 191-13-01).

[IEV 191-02-07:1990]

##### 3.1.2

##### **maintainability**

probability that a given maintenance action, for an item under given conditions of use, can be carried out within a stated time interval, when the maintenance is performed under stated conditions and using stated procedures and resources

NOTE The term "maintainability" is also used to denote the maintainability performance quantified by this probability (see 191-02-07:1990).

[IEV 191-13-01:1990]

<sup>1</sup> A second edition is due to be published shortly under the revised title "*Maintainability of equipment – Part 3: Verification and collection, analysis and presentation of data*".

**3.1.3****maintenance**

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

[IEV 191-07-01:1990]

**3.1.4****maintenance concept**

interrelationship between the maintenance echelons, the indenture levels and the levels of maintenance to be applied for the maintenance of an item

**3.1.5****maintenance policy**

general approach to the provision of maintenance and maintenance support based on the objectives and policies of owners, users and customers

**3.2 Acronyms**

BITE built-in test equipment

FMEA failure modes and effects analysis

FTA fault tree analysis

ILS integrated logistic support

LCC life cycle cost

LRU line replaceable unit

LSA logistic support analysis

MART mean active repair time

MTTR mean time to repair (or restoration or recovery)

RCM reliability centred maintenance

SSI software significant item

**4 General approach**

An important portion of the cost of using an item is the total resources spent on those tasks necessary to retain an item in, or restore it to, a satisfactory condition. This total effort is related to the number of these tasks, their complexity and duration.

The design of an item shall ensure three things, namely:

- a) that it achieves the performance required of it;
- b) that it is reliable;
- c) that it is maintainable.

The second and third of these characteristics directly affect the maintenance effort which shall be expended on an item in that the achieved reliability reflects the frequency of unscheduled maintenance and the maintainability reflects the effort necessary to undertake all maintenance.