SLOVENSKI STANDARD
SIST EN 17666:2023

01-februar-2023

Vzdrževanje - Vzdrževalni inženiring - Zahteve

Maintenance - Maintenance engineering - Requirements

Instandhaltung - Instandhaltungsengineering - Anforderungen

Maintenance - Ingénierie de maintenance - Exigences

Ta slovenski standard je istoveten z: **EN 17666:2022**

ICS:

03.080.10	Vzdrževalne storitve. Upravljanje objektov	Maintenance services. Facilities management

SIST EN 17666:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 17666

November 2022

ICS 03.080.10

English Version

Maintenance - Maintenance engineering - Requirements

Maintenance - Ingénierie de maintenance - Exigences

Instandhaltung - Instandhaltungsengineering - Anforderungen

This European Standard was approved by CEN on 16 October 2022.

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Ref. No. EN 17666:2022 E

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European foreword

This document (EN 17666:2022) has been prepared by Technical Committee CEN/TC 319 “Maintenance”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2022, and conflicting national standards shall be withdrawn at the latest by May 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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0 Introduction

0.1 Scope and benefits of maintenance engineering

Maintenance engineering is a discipline applying competencies, methods, techniques and tools to develop and support maintenance in order to ensure that an item is able to perform its required functions in a safe, sustainable and cost-effective manner throughout the life cycle.

The prime aim of maintenance engineering is to contribute to the achievement of overall stakeholder requirements through optimized and cost-effective maintenance as part of physical asset management.

The benefits of the contributions from maintenance engineering include, but are not limited to:

— achievement of dependability goals by influencing design;

— risk analysis related to maintenance;

— application of sustainability principles;

— achieved required integrity and safety level;

— achieved required performance and technical condition;

— improved life extension decisions;

— improved maintenance support performance;

— reduced environmental footprint by saving energy and raw materials consumption;

— improved competitiveness and output value.

0.2 Use of this document

This document is generic and provides guidance on the methodology to achieve maintenance engineering aims.

The intended users of this document are personnel involved in design, procurement, construction, commissioning, operation, improvement, maintenance and disposal/transition or decommissioning of physical assets. No specific structure or size of organization is assumed so that maintenance engineering effort should be tailored to suit specific applications and organisational requirements.

This document is based on the maintenance terminology as defined in EN 13306 Maintenance — Maintenance terminology. Adjustments and additional terminology used, are found in Clause 3.

Clause 5 of this document describes maintenance engineering discipline and its objectives.

Clause 6 of this document describes maintenance engineering activities during the life cycle stages. Activities are used to express the application of knowledge, skills and tools in maintenance engineering. The following life cycle stages and substages are used, see 6.1:

1) concept stage with the following substages: feasibility and concept baseline;

2) development stage with the following substages: preliminary design and detailed design;

3) realization stage with the following substages: build and implementation / commissioning;

4) utilization stage with the following substage: operation and maintenance;

5) disposal/transition stage with the following substage: reuse, recycling or disposal.

NOTE These life cycle stages are harmonized as far as possible and based on what are used in EN 16646 [7] and IEC 60300 series [see Bibliography]. Disposal and transition are used instead of retirement used in IEC 60300 series. See an overview in Annex D.

While maintenance engineering has the most impact when applied during the concept stage and design of a physical item, this document is applicable to maintenance engineering in all life cycle stages, and for different scenarios, for example:

— manufacturer producing one equipment and then maintaining it;

— transfer of property at commissioning to a buyer who will be in charge of maintenance;

— transfer of property at commissioning followed by a warranty period. The seller is responsible during the warranty and the buyer thereafter;

— maintenance service (sub) contract by the seller to the buyer or to a third party.

Clause 7 of this document describes maintenance engineering and digitalization.

The document also includes informative Annexes A to D with additional guidance.

Processes are defined as set of interrelated or interacting activities that use inputs to deliver an intended result (3.24). In the context of this document, the term “maintenance engineering activities” is used to express the application of knowledge, skills and tools to support the processes given in EN 17007 [10]. While EN 17007 describes the processes, this document FprEN 17666 follows the life cycle stages.

0.3 Related standards

This document is part of a group of European maintenance standards published by CEN/TC 319 *Maintenance* giving requirements and guidance on maintenance, see the committee site on https://standards.cencenelec.eu/dyn/www/f?p=CEN:105::RESET and Bibliography [2] to [7] and [9] to [12].

In addition, there are a number of standards published in CEN, ISO and IEC which address maintenance as part of asset management and dependability view.

The asset management standards in the ISO 55000 series [59 to 61] address the overall requirements for assets, decision criteria, strategic asset management plan (SAMP) and asset management plan. EN 17485 [12] and EN 16646 [7] create a bridge between these ISO standards and the EN maintenance standards which determine the requirements for maintenance engineering.

The IEC dependability standards (principally the IEC 60300 series) address the management and technical activities to produce and / or sustain a dependable item, which is one where there is justified confidence that it will operate as desired and satisfy agreed stakeholder needs and expectations.

1 Scope

This document specifies the maintenance engineering discipline throughout the entire life cycle.

This document gives guidance on how maintenance engineering can contribute to the assurance of required dependability to achieve a sustainable balance between performance, risk and costs.

This document refers to standards that further describe detailed methods and techniques.

This document does not give guidance on how to set up systems and infrastructure for maintenance engineering nor does it include guidance on software maintenance.

NOTE 1 For software components of an item, the maintenance activities are covered in ISO/IEC/IEEE 14764 [54].

NOTE 2 The overall maintenance process is covered by EN 17007 [10].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 13306, *Maintenance — Maintenance terminology*

3 Terms and definitions

For the purposes of this document the terms and definitions given in EN 13306 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp/

3.1
maintenance
combination of all technical, administrative and managerial actions during the *life cycle* (3.10) of an *item* (3.13) intended to retain it in, or restore it to, a state in which it can perform the *required function* (3.8)

Note 1 to entry: Technical maintenance actions include observation and analyses of the item state (e.g. inspection, monitoring, testing, diagnosis, prognosis, etc.) and active maintenance actions (e.g. repair, refurbishment).

Note 2 to entry: See also the definitions of improvement and modification in EN 13306.

[SOURCE: EN 13306:2017, 2.1]

3.2
maintenance engineering
engineering discipline applying *competencies* (3.14), methods, techniques and tools to develop and support *maintenance* (3.1) in order to assure that an *item* (3.13) is able to perform its *required functions* (3.8) in a safe, sustainable and *cost-effective* (3.9) manner throughout the *life cycle* (3.10)

3.3
maintenance management
all activities of the management that determine the *maintenance* (3.1) requirements, objectives, strategies and responsibilities, and implementation of them by such means as maintenance planning, maintenance control, and the improvement of maintenance activities and economics

[SOURCE: EN 13306:2017, 2.2]

3.4
maintenance plan
structured and documented set of tasks that include the activities, procedures, resources and the time scale required to carry out *maintenance* (3.1)

[SOURCE: EN 13306:2017, 2.5]

3.5
maintenance strategy
management method used in order to achieve the maintenance objectives

EXAMPLE Outsourcing of maintenance, allocation of resources, etc.

[SOURCE: EN 13306:2017, 2.4]

3.6
failure management policy
maintenance activities, operational changes, design modifications or other actions in order to mitigate the consequences of failure

[SOURCE: EN 60300-3-11:2009, 3.1.6]

3.7
operation
combination of all technical, administrative and managerial actions, other than maintenance actions, that results in the item being in use

Note 1 to entry: Maintenance actions carried out by operators are not included in operation.

Note 2 to entry: In this document, operational and operations are used as synonyms.

[SOURCE: EN 13306:2017, 2.9, modified – Note 2 to entry have been added.]

3.8
required function
function, combination of functions, or a total combination of functions of an item which are considered necessary to fulfil a given requirement

Note 1 to entry: “Necessary to fulfil a given requirement” may also include asset value preservation.

Note 2 to entry: The given requirement may be expressed or implied and may in some cases be below the original design specifications.

Note 3 to entry: The required function, by implication, also covers what the item shall not do.

[SOURCE: EN 13306:2017, 2.6]

3.9
cost-effective
balance of cost, *risk* (3.26), opportunity and performance taking into account stakeholder objectives

Note 1 to entry: Performance covers quality, short and long term.

3.10
life cycle
series of stages through which an item goes, from its conception to disposal

Note 1 to entry: The stages identified will vary with the application. Reuse and recycle follows disposal.

[SOURCE: EN 13306:2017, 4.18, modified — List of examples of life cycle stages is omitted because EN 17666 defines the stages given in Clause 6.]

3.11
life cycle cost
sum of the costs generated during the *life cycle* (3.10) of the *item* (3.13)

[SOURCE: EN 13306:2017, 11.1, modified — Note 1 to entry is omitted because EN 17666 defines the stages given in Clause 6.]

3.12
physical asset
item (3.13) that has potential or actual value to an organization

Note 1 to entry: Examples of physical assets are components, machines, plants, buildings, infrastructures, etc.

[SOURCE: EN 13306:2017, 3.2]

3.13
item
part, component, device, subsystem, functional unit, equipment or system that can be individually described and considered

[SOURCE: EN 13306:2017, modified — Notes 1, 2 and 3 to entry are omitted]

3.14
competence
proven ability to use knowledge, *skills* (3.15), and personal, social and/or methodological abilities, in work or study situations and in professional and personal development

Note 1 to entry: Competence is described in the terms of responsibility and autonomy.

[SOURCE: EN 15628:2014, 3.1]

3.15
skills
ability to apply knowledge and use know-how to complete tasks and resolve problems

Note 1 to entry: Skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, tools and instruments).

[SOURCE: EN 15628:2014, 3.6]

3.16
dependability
ability to perform as and when required

Note 1 to entry: Dependability includes *availability* (3.20), safety, security, durability, economics and their influencing factors (reliability, *maintainability* (3.19), *supportability* (3.17), conditions of use and operators influence).

Note 2 to entry: Dependability is used as a collective term for the time-related quality characteristics of an item.

[SOURCE: EN 13306:2017, 2.7, modified — In Note 1 to entry "maintenance support performance" is replaced by "supportability"]

3.17
supportability
ability to be supported to sustain the required availability with a defined operational profile and given logistic and maintenance resources

Note 1 to entry: Supportability of an item results from the inherent maintainability, combined with factors external to the item that affect the relative ease of providing the required maintenance and logistic support.

[SOURCE: IEC 60050-192:2015, 192-01-31]

3.18
integrated logistic support
ILS
management process to determine and coordinate the provision of all materials and resources required to meet the needs for operation and maintenance

Note 1 to entry: ILS is a process to determine the optimal maintenance support. ILS integrates logistic support analysis and the development of resources, see Annex A.

[SOURCE: IEC 60050-192:2015, 192-01-30, modified — Note 1 to entry added]

3.19
maintainability
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* (3.8), when *maintenance* (3.1) is performed under given conditions and using stated procedures and resources

Note 1 to entry: Maintainability may be quantified using appropriate measures or indicators and is then referred to as maintainability performance.

[SOURCE: EN 13306:2017, 4.5]

3.20
availability
ability of an item to be in a state to perform as and when required, under given conditions, assuming that the necessary external resources are provided

Note 1 to entry: Required external resources, other than maintenance resources, do not affect the availability of the item although the item may not be available from the user's viewpoint.

Note 2 to entry: This ability depends on the combined aspects of the reliability, maintainability of the item, the maintenance supportability and the maintenance actions carried out on the item.

Note 3 to entry: Availability may be quantified using appropriate measures or indicators and is then referred to as availability performance (see EN 13306:2017, 4.9).

Note 4 to entry: There are several types of availability, for example: *achieved availability* (3.21), *operational availability* (3.22) and *inherent availability* (3.23).

[SOURCE: EN 13306:2017, 4.7, modified — Note 4 to entry added]

3.21
achieved availability
probability than an item when used under stated conditions in an ideal support environment will operate satisfactorily at any point in time

3.22
operational availability
availability (3.20) experienced under actual conditions of operation and maintenance

Note 1 to entry: Operational availability is determined considering down time due to failures and associated delays, but excluding external causes.

[SOURCE: IEC 60050-192:2015, 192-08-03]

3.23
inherent availability
availability (3.20) provided by the design under ideal conditions of operation and maintenance

Note 1 to entry: Delays associated with maintenance, such as logistic and administrative delays, are excluded.

[SOURCE: IEC 60050-192:2015, 192-08-02]