

BS EN 13306:2010



BSI Standards Publication

Maintenance — Maintenance terminology

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee DS/1, Dependability and terotechnology.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Maintenance - Terminologie de la maintenance

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 13306:2010) 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of an identical text or by endorsement, at the latest by February 2011, and conflicting national standards shall be withdrawn at the latest by February 2011.

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This document supersedes EN 13306:2001.

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Introduction

The purpose of this European Standard is to define the generic terms used for all types of maintenance and maintenance management irrespective of the type of item considered. Maintenance of software only is not covered in this standard. However, maintenance of items and systems containing software is considered.

It is the responsibility of any maintenance management to define its maintenance strategy according to the following main objectives:

- to ensure the availability of the item to function as required, at optimum costs;
- to consider the safety and any other mandatory requirements associated with the item;
- to consider any impact on the environment;
- to uphold the durability of the item and/or the quality of the product or service provided considering costs where necessary.

As a part of the requirement of CEN/TC 319 it was necessary to produce a comprehensive structured generic maintenance vocabulary standard containing the main terms and their definitions.

Maintenance provides an essential contribution to the dependability of an item. Correct and formal definitions are required which will give the user of associated maintenance standards a fuller understanding of the maintenance terms used. These terms may be of particular importance in the formulation of maintenance contracts.

The terms contained in this standard indicate that maintenance is not confined to the technical actions alone but includes other activities such as planning, documentation handling, etc.

The standard IEC 60050-191 has been used as a basis for the preparation of this standard but some terms have been modified. Not all terms specified in IEC 60050-191 are included in this European Standard. Readers are referred to this IEC standard for further definitions.

1 Scope

This European Standard specifies generic terms and definitions for the technical, administrative and managerial areas of maintenance. It may not be applicable to terms which are used for the maintenance of software only.

2 Fundamental terms

2.1

maintenance

combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function

NOTE See also the definitions of improvement and modification.

2.2

maintenance management

all activities of the management that determine the maintenance objectives, strategies and responsibilities, and implementation of them by such means as maintenance planning, maintenance control, and the improvement of maintenance activities and economics

2.3

maintenance objective

target assigned and accepted for the maintenance activities

NOTE These targets may include for example availability, cost reduction, product quality, environment preservation, safety, asset value preservation.

2.4

maintenance strategy

management method used in order to achieve the maintenance objectives

NOTE Examples could be outsourcing of maintenance, allocation of resources, etc.

2.5

maintenance plan

structured and documented set of tasks that include the activities, procedures, resources and the time scale required to carry out maintenance

2.6

required function

function, combination of functions, or a total combination of functions of an item which are considered necessary to provide a given service

NOTE 1 To provide a given service may also include asset value preservation.

NOTE 2 The given service may be expressed or implied and may in some cases be below the original design specifications.

2.7

dependability

ability to perform as and when required

NOTE 1 Dependability characteristics include availability and its influencing factors (reliability, recoverability, maintainability, maintenance support performance) and, in some cases, durability, economics, integrity, safety, security and conditions of use.

NOTE 2 Dependability is used descriptively as an umbrella term for the time-related quality characteristics of a product or service.

2.8

maintenance supportability **maintenance support performance**

ability of a maintenance organization to have the correct maintenance support at the necessary place to perform the required maintenance activity when required

2.9

operation

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

NOTE Maintenance actions carried out by operators are not included in operation.

3 Item related terms

3.1

item

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

NOTE 1 A number of items e.g. a population of items, or a sample, may itself be considered as an item.

NOTE 2 An item may consist of hardware, software or both.

NOTE 3 Software consists of programs, procedures, rules, documentation and data of an information processing system.

3.2

asset (physical)

item formally accountable

3.3

repairable item

item which may be restored under given conditions, and after a failure to a state in which it can perform a required function

NOTE The given conditions may be economical, ecological, technical and/or others.

3.4

consumable item

item or material which is expendable, may be regularly replaced and generally is not item specific

NOTE Generally, consumable items are relatively low cost compared to the item itself.

3.5

spare part

item intended to replace a corresponding item in order to retain or maintain the original required function of the item

NOTE 1 The original item may be subsequently repaired.

NOTE 2 In English, any item that is dedicated and/or exchangeable for a specific item is often referred to as replacement item.

3.6

insurance spare part

spare part which is not normally needed during the useful life of the item but whose unavailability would involve an unacceptable downtime due to its provisioning

NOTE If the spare part is expensive then for accountancy purposes such a part may be considered as a capital asset.

3.7

indenture level

level of sub-division within an item hierarchy

NOTE 1 Examples of indenture levels are: system, subsystem and component.

NOTE 2 From the maintenance perspective, the indenture level depends on the complexity of the item's construction, the accessibility to sub-items, skill level of maintenance personnel, test equipment facilities, safety considerations, etc.

4 Properties of items

4.1

availability

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

NOTE 1 This ability depends on the combined aspects of the reliability, maintainability and recoverability of the item and the maintenance supportability.

NOTE 2 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 3 Availability may be quantified using appropriate measures or indicators and is then referred to as availability performance.

4.2

reliability

ability of an item to perform a required function under given conditions for a given time interval

NOTE 1 It is assumed that the item is in a state to performed as required at the beginning of the time interval.

NOTE 2 Reliability may be quantified as a probability or performance indicators by using appropriate measures and is then referred to as reliability performance.

NOTE 3 In some cases a given number of unit of use can be considered instead of a given time interval (number of cycles, number of running hours, number of kilometres, etc.).

4.3

intrinsic reliability

inherent reliability

reliability of an item determined by design and manufacture

4.4

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, when maintenance is performed under given conditions and using stated procedures and resources

NOTE Maintainability may be quantified using appropriate measures or indicators and is then referred to as maintainability performance.

4.5

intrinsic maintainability

inherent maintainability

maintainability of an item determined by the original design

4.6

conformity

fulfilment of a requirement

4.7

durability

ability of an item to perform a required function under given conditions of use and maintenance, until a limiting state is reached

NOTE 1 A limiting state of an item may be characterized by the end of the useful life.

NOTE 2 The limiting state may be redefined by changes in conditions of use.

4.8

redundancy

in an item, existence of more than one means for performing a required function when needed

4.9

active redundancy

redundancy wherein more than one means for performing a required function are operating simultaneously

4.10

standby redundancy

redundancy wherein an alternative means for performing the particular function is only activated when the active means is unavailable

NOTE Standby redundancy is often referred to as passive redundancy

4.11

useful life

time interval from a given instant until the instant when a limiting state is reached

NOTE The limiting state may be a function of failure rate, maintenance support requirement, physical condition, economics, age, obsolescence, changes in the user's requirements or other relevant factors.

4.12

mean failure rate

number of failures of an item in a given time interval divided by the time interval

NOTE In some cases unit of time can be replaced by units of use.

4.13

life cycle

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

4.14

obsolescence (for maintenance purposes)

inability of an item to be maintained due to the unavailability on the market of the necessary resources at acceptable technical and/or economic conditions

NOTE 1 The necessary resources can be:

- one (or more) sub-item needed to restore the item;

- tools or monitoring or testing devices;
- documentary resources;
- skills;
- etc.

NOTE 2 The unavailability of the resources can be due to:

- technological development;
- market situation;
- absence of supplier;
- regulations.

5 Failures and events

5.1

failure

termination of the ability of an item to perform a required function

NOTE 1 After failure the item has a fault, which may be complete or partial.

NOTE 2 "Failure" is an event, as distinguished from "fault", which is a state.

NOTE 3 The concept as defined does not apply to items consisting of software only.

5.2

failure mode

manner in which the inability of an item to perform a required function occurs

NOTE 1 The use of the term "fault mode" is deprecated.

NOTE 2 A failure mode may be defined by the function lost or the state transition that occurred.

5.3

failure cause

circumstances during specification, design, manufacture, installation, use or maintenance that result in failure

5.4

wear-out-failure

failure whose probability of occurrence increases with the operating time or the number of operations of the item and the associated applied stresses

NOTE Wear-out is a physical phenomenon which results in a loss, deformation or change of material.

5.5

ageing failure

failure whose probability of occurrence increases with the passage of calendar time

NOTE 1 This time is independent of the operating time of the item.

NOTE 2 Ageing is a physical phenomenon which involves a modification of the physical and/or chemical characteristics of the material.

5.6

degradation

detrimental change in physical condition, with time, use or external cause

NOTE 1 Degradation may lead to a failure.

NOTE 2 In a system context, degradation may also be caused by failures within the system. (See "degraded state".)

5.7

common cause failures

failures of several items resulting from the same direct cause and where these failures are not consequences of each other

NOTE Common cause failures may reduce the effect of system redundancy.

5.8

primary failure

failure of an item not caused either directly or indirectly by a failure or a fault of another item

5.9

secondary failure

failure of an item caused either directly or indirectly by a failure or a fault of another item

5.10

sudden failure

failure that could not be anticipated by prior examination or monitoring

5.11

hidden failure

failure which is not detected during normal operation

5.12

failure mechanism

physical, chemical or other processes which may lead or have led to failure

5.13

severity (of a failure or a fault)

potential or actual detrimental consequences of a failure or a fault

NOTE The severity of a failure may be related to safety, availability, costs, quality, environment, etc.

5.14

criticality (of a failure or a fault)

numerical index of the severity of a failure or a fault combined with the probability or frequency of its occurrence

NOTE The numerical index in this context may be defined, for example, as an area in the frequency of failure occurrence - severity matrix diagram (see Annex E).

5.15

failure criteria

pre-defined conditions to be accepted as conclusive evidence of failure

EXAMPLE A defined limiting state of wear, crack propagation, performance degradation, leakage, emission, etc. beyond which it is deemed to be unsafe or uneconomic to continue operation.

6 Faults and states

6.1

fault

state of an item characterized by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources

NOTE A fault usually results from a failure, but in some circumstances it may be a pre-existing fault.

6.2

fault masking

condition in which a fault exists in a sub-item of an item but cannot be recognized because of a fault of the item or because of another fault of that sub-item or of another sub-item

NOTE Fault masking may conceal a progressive loss of redundancy.

6.3

latent fault

existing fault that has not become apparent

6.4

partial fault

fault characterized by the fact that an item can only perform some but not all of the required functions

NOTE In some cases it may be possible to use the item with reduced performance.

6.5

up state

state of an item characterized by the fact that it can perform a required function, assuming that the external resources, if required, are provided

6.6

degraded state

state in which the ability to provide the required function is reduced, but within defined limits of acceptability

NOTE A degraded state may be the result of faults at lower indenture levels.

6.7

down state

state of an item characterized either by a fault, or by a possible inability to perform a required function during preventive maintenance

NOTE 1 This state is related to availability performance.

NOTE 2 A down state is sometimes referred to as an internal disabled state.

6.8

disabled state

outage

state of an item characterised by its inability to perform a required function, for any reason

NOTE A disabled state may be either an up or down state.

6.9

external disabled state

subset of the disabled state when the item is in an up state, but lacks required external resources or is disabled due to planned actions other than maintenance

6.10

operating state

state when an item is performing as required

6.11

idle state

state of an item which is in an up state and non-operating, during non-required time

6.12

standby state

state of an item which is in an up state and non operating during the required time

6.13

hazardous state

state of an item assessed as likely to result in an injury to persons, significant material damage or other unacceptable consequences

6.14

shutdown

outage scheduled in advance, for maintenance or other purposes

NOTE Shutdown may also be called "planned outage".

6.15

software fault

bug

condition of a software item that may prevent it from performing as required

7 Maintenance types

7.1

preventive maintenance

maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item

7.2

predetermined maintenance

preventive maintenance carried out in accordance with established intervals of time or number of units of use but without previous condition investigation

NOTE Intervals of times or number of unit of use may be established from knowledge of the failure mechanisms of the item.

7.3

condition based maintenance

preventive maintenance which include a combination of condition monitoring and/or inspection and/or testing, analysis and the ensuing maintenance actions

NOTE The condition monitoring and/or inspection and/or testing may be scheduled, on request or continuous.

7.4

predictive maintenance

condition based maintenance carried out following a forecast derived from repeated analysis or known characteristics and evaluation of the significant parameters of the degradation of the item

7.5

corrective maintenance

maintenance carried out after fault recognition and intended to put an item into a state in which it can perform a required function

7.6

deferred corrective maintenance

corrective maintenance which is not immediately carried out after a fault detection but is delayed in accordance with given rules

7.7

immediate corrective maintenance

corrective maintenance that is carried out without delay after a fault has been detected to avoid unacceptable consequences

7.8

scheduled maintenance

maintenance carried out in accordance with an established time schedule or established number of units of use

NOTE Corrective deferred maintenance may also be scheduled.

7.9

remote maintenance

maintenance of an item carried out without physical access by the personnel to the item

7.10

on line maintenance

maintenance carried out on the item whilst it is operating and without impact on its performance

NOTE In this type of maintenance it is important that all the safety procedures are followed.

7.11

on site maintenance

maintenance carried out at the location where the item is normally located

7.12

operator maintenance

maintenance actions carried out by an operator

NOTE Such maintenance actions should be clearly defined.

7.13

maintenance level

level of maintenance

maintenance task categorisation by complexity

NOTE 1 These tasks are divided into levels of increasing complexity.

EXAMPLES

Level 1 is characterized by simple actions carried out with minimal training.

Level 2 is characterized by basic actions which should be carried out by qualified personnel using detailed procedures.

Level 3 is characterized by complex actions carried out by qualified technical personnel using detailed procedures.

Level 4 is characterized by actions which imply the know-how of a technique or a technology and carried out by specialized technical personnel.

Level 5 is characterized by actions which imply a knowledge held by the manufacturer or a specialized company with industrial logistic support equipment.

NOTE 2 The maintenance level may be related to the indenture level.

7.14

maintenance outsourcing

contracting out of all or part of the maintenance activities of an organisation for a stated period of time

NOTE In the case of complete outsourcing of all maintenance activities this is referred to as "complete maintenance outsourcing".

8 Maintenance activities

8.1

inspection

examination for conformity by measuring, observing, or testing the relevant characteristics of an item

8.2

condition monitoring

activity, performed either manually or automatically, intended to measure at predetermined intervals the characteristics and parameters of the actual state of an item

NOTE 1 Monitoring is distinguished from inspection in that it is used to evaluate any changes in the parameters of the item with time.

NOTE 2 Monitoring may be continuous, over time interval or after a given number of operations.

NOTE 3 Monitoring is usually carried out in the operating state.

8.3

compliance test

test used to show whether or not a characteristic or a property of an item complies with the stated requirements

8.4

function check-out

action taken after maintenance actions to verify that the item is able to perform as required

NOTE Function check is usually carried out after down state.

8.5

routine maintenance

regular or repeated simple preventive maintenance activities

NOTE Routine maintenance may include for example cleaning, tightening of connections, replacement of connectors, checking liquid level, lubrication, etc.

8.6

overhaul

comprehensive set of preventive maintenance actions carried out, in order to maintain the required level of performance of an item

NOTE 1 Overhaul may be performed at prescribed intervals of time or number of operations.

NOTE 2 Overhaul may require a complete or partial dismantling of the item.

8.7

fault diagnosis

actions taken for fault recognition, fault localization and identification of causes

8.8

fault localisation

actions taken to identify the faulty item at the appropriate indenture level

NOTE These actions may include black-box testing (a means of testing in which tests cases are chosen using only the functional specifications of the item).

8.9

restoration

event at which the ability to perform as required is re-established, after a failure

8.10

repair

physical action taken to restore the required function of a faulty item

NOTE Repair also include fault localisation and function checkout.

8.11

temporary repair

physical action taken to allow a faulty item to perform its required function for a limited time interval and until a repair is carried out

8.12

improvement

combination of all technical, administrative and managerial actions, intended to ameliorate the reliability and/or the maintainability and/or the safety of an item, without changing the original function

NOTE An improvement may also be introduced to prevent misuse in operation and to avoid failures.

8.13

modification

combination of all technical, administrative and managerial actions intended to change one or more functions of an item

NOTE 1 Modification is not a maintenance action, but has to do with changing the required function of an item to a new required function. The changes may have an influence on the dependability characteristics.

NOTE 2 Modification may involve the maintenance organisation.

NOTE 3 The change of an item where a different version is replacing the original item without changing the function or ameliorating the dependability of the item is called a replacement and is not a modification.

8.14

rebuilding

action following the dismantling of an item and the repair or replacement of those sub-items, that are approaching the end of their useful life and/or should be regularly replaced

NOTE 1 Rebuilding differs from overhaul in that the actions may include modifications and/or improvements.

NOTE 2 The objective of rebuilding is normally to provide an item with an extended useful life

8.15

maintenance task preparation

supplying of all of the necessary information and identifying the required resources to enable the maintenance task to be carried out

NOTE The preparation may include description of how to perform the work, reference to valid instructions and/or documentation, required permits, spare part, skill, tools, etc.

8.16

maintenance schedule

plan produced in advance detailing when a specific maintenance task should be carried out

9 Time related terms

9.1

up time

time interval throughout which an item is in an up state

9.2

down time

time interval throughout which an item is in a down state

9.3

operating time

time interval throughout which an item is in operating state

9.4

required time

time interval throughout which the item is required to be in an up state

9.5

standby time

time interval throughout which an item is in a standby state

9.6

idle time

time interval throughout which an item is in an idle state

9.7

maintenance time

time interval when maintenance is carried out on an item including technical and logistic delays

NOTE Maintenance may be carried out while the item is functioning.

9.8

preventive maintenance time

part of maintenance time when preventive maintenance is carried out on an item, including logistic delays

9.9

corrective maintenance time

part of the maintenance time when active corrective maintenance is carried out on an item, including logistic delays

9.10

active maintenance time

part of the maintenance time when active maintenance is carried out on an item, excluding logistic delays

NOTE An active maintenance action may be carried out while the item is functioning.

9.11

repair time

part of active corrective maintenance time when repair is carried out on an item

9.12

active preventive maintenance task time

time interval when an active preventive maintenance task is carried out

NOTE All technical delays are excluded from active preventive maintenance task time.

9.13

logistic delay

accumulated time when maintenance cannot be carried out due to the need to acquire maintenance resources, excluding any administrative delay

NOTE Logistic delays can be due to, for example, travelling to installations, pending arrival of spare parts, specialists, test equipment and information and unsuitable environmental conditions.

9.14

technical delay

accumulated time necessary to perform auxiliary technical actions associated with, but not part of, the maintenance action

EXAMPLE Rendering the equipment safe, and setting up test equipment.

9.15

operating time to failure

accumulated operating times of an item, from the instant it is first into use, until failure or, from the instant of restoration until next failure

NOTE 1 Operating time between failures is a special case of operating time to failure.

NOTE 2 Time to failure is often used instead of operating time to failure.

9.16

time between failures

time duration between two consecutive failures of an item

NOTE Time between failures may include non operating time after restoration.

9.17

operating time between failures

total time duration of operating time between two consecutive failures of an item

9.18

external disabled time

time interval throughout which an item is in an external disabled state

9.19

time to restoration

time interval for which an item is in a down state due to a failure

NOTE Down time for other reasons, e.g. for preventive maintenance, is excluded.

9.20

wear-out failure period

period in the life of an item when the instantaneous failure intensity for a repairable item, or the instantaneous failure rate for a non-repairable item, increases significantly with time

9.21

constant failure period

period in the life when the instantaneous failure intensity for a repairable item, or the instantaneous failure rate for a non-repairable item, is approximately constant

9.22

early failure period

time interval in early life when the instantaneous failure intensity for a repairable item, or the instantaneous failure rate for a non-repairable item, is significantly higher than that of the subsequent period

10 Maintenance support and tools

10.1

maintenance support

provision of resources, services and management necessary to carry out maintenance

NOTE The provision may include, for example, personnel, test equipment, workrooms, spare parts, documentation, tools, etc.

10.2

line of maintenance

maintenance echelon

position in an organization where specified levels of maintenance are to be carried out on an item

NOTE 1 Examples of line of maintenance are: field (first line maintenance), workshop (second line maintenance) and manufacturer (third line maintenance).

NOTE 2 The lines of maintenance are characterized by the skill required of the personnel, the facilities available, the location, the complexity of the maintenance task, etc.

10.3

failure analysis

logical and systematic examination of item failure modes and causes before or after a failure to identify the consequences of failure as well as the probability of its occurrence

NOTE Failure analysis is generally performed to improve dependability

10.4

item register

record of individually identified items

NOTE 1 Additional information such as location may also be stored on the item register.

NOTE 2 The level of individual items to be registered should be specified.

10.5

maintenance record

part of maintenance documentation which contains the history of all maintenance related data for an item

NOTE The history may contain records of all failures, faults, costs, item availability, up time and any other relevant data.

11 Economic and technical factors

11.1

life cycle cost

all of the costs generated during the life cycle of the item

NOTE For a user or an owner of an item, the total life cycle cost may include only those costs pertaining to acquisition, operation, maintenance and disposal.

11.2

mean operating time between failures

MTBF

average of the operating times between failures

NOTE 1 In the field of reliability, mean operating time between failures is defined as the mathematical expectation of the operating time between failures.

NOTE 2 This term is applied to repairable items.

11.3

mean time between failures

average of the times between failures

NOTE In the field of reliability, mean time between failures is defined as the mathematical expectation of the time between failures.

11.4

mean repair time

MRT

average of the repair times

NOTE In the field of reliability, mean repair time is defined as the mathematical expectation of the repair time.

11.5

mean time to restoration

MTTR

average of the times to restoration

Annex A (informative)

Maintenance – Overall view

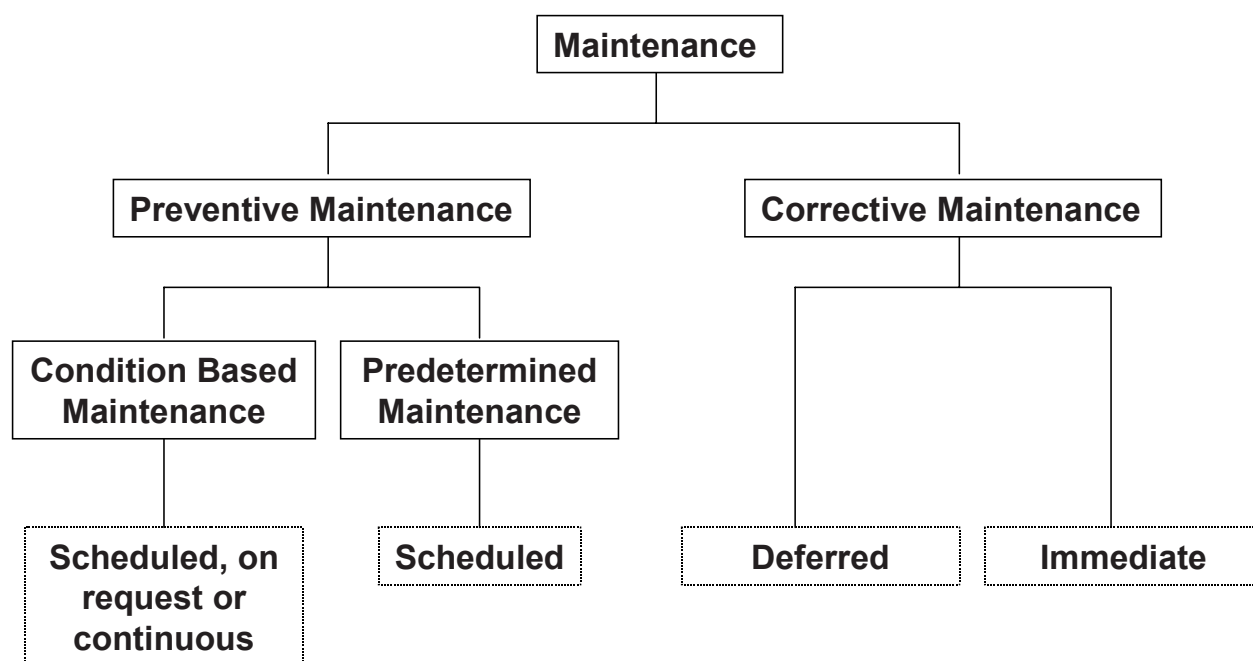


Figure A.1

Annex B (informative)

States of an item

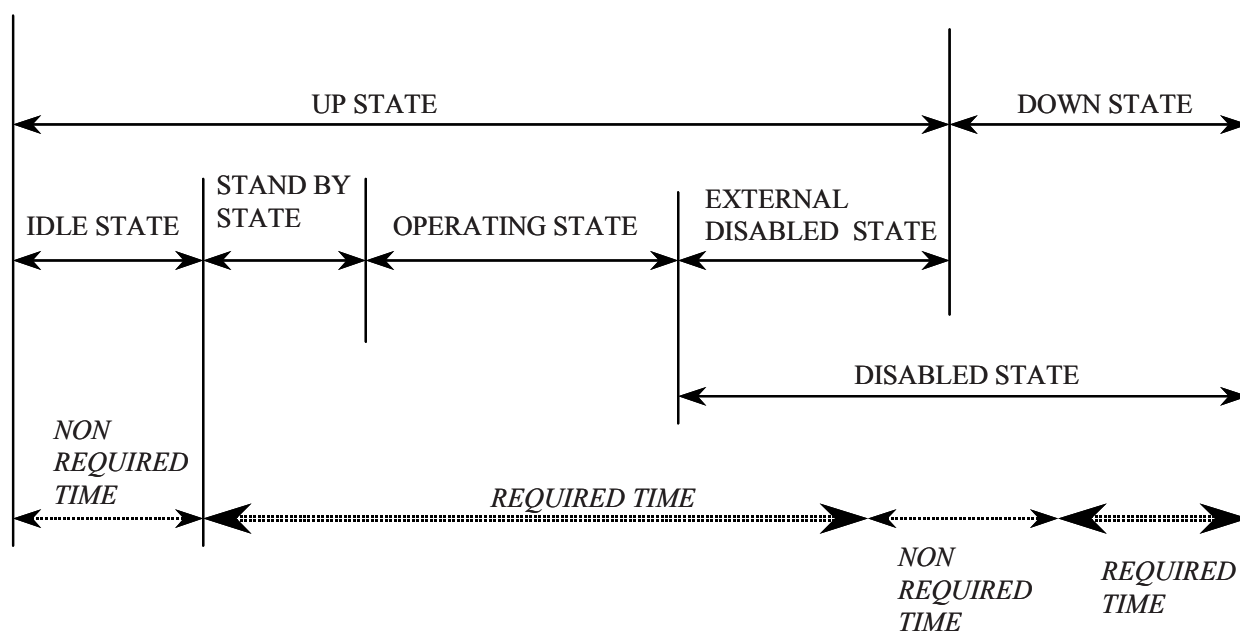


Figure B.1

Annex C (informative)

Times

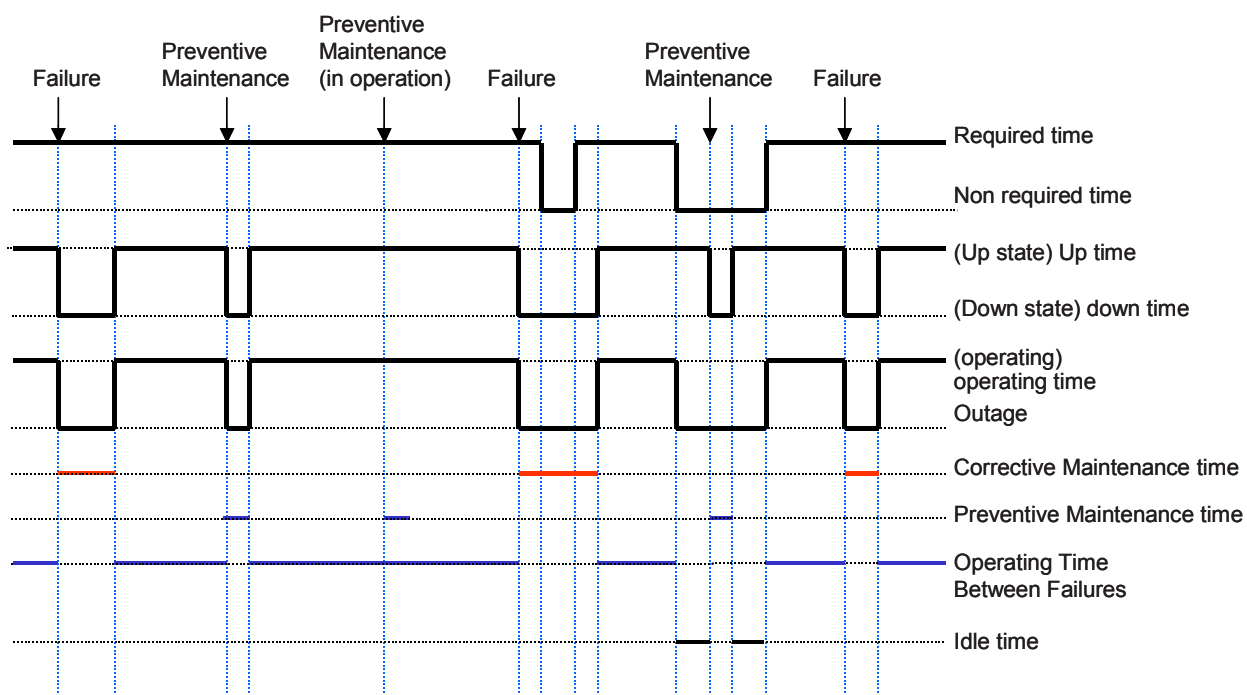


Figure C.1

Annex D (informative)

Maintenance times

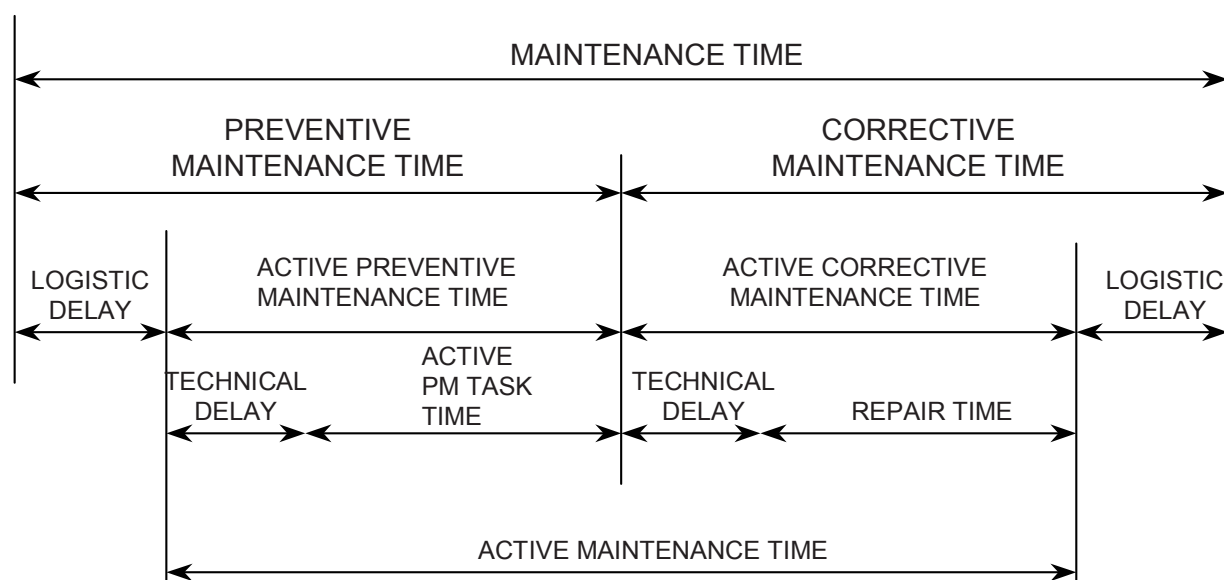


Figure D.1

Annex E (informative)

Criticality matrix

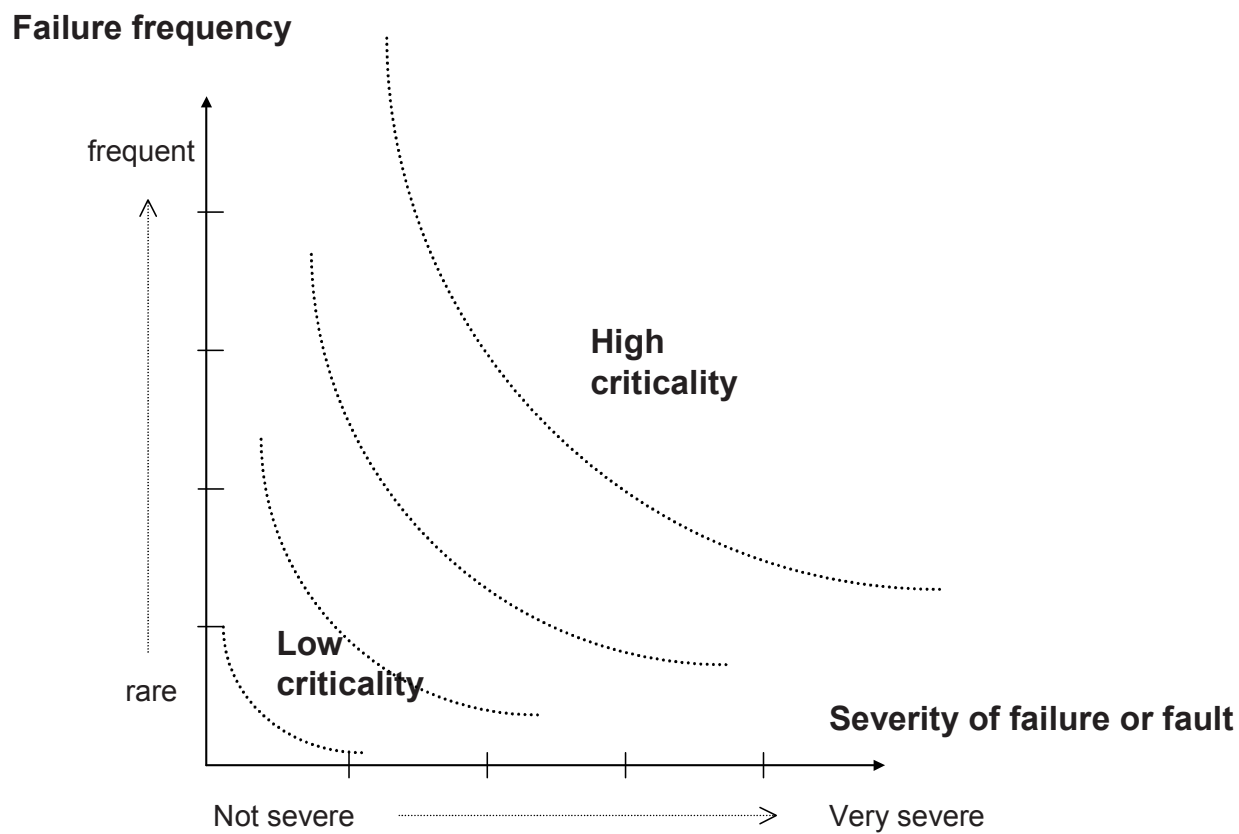


Figure E.1

Annex F (informative)

Identification of significant technical changes between this standard and the previous edition (EN 13306:2001)

New clauses and annexes in the current edition	Modified clauses and annexes in the current edition
2.9 Operation 3.6 Insurance spare part 4.3 Intrinsic (inherent) Reliability 4.5 Intrinsic (inherent) Maintainability 4.12 Mean failure rate 4.14 Obsolescence (for maintenance purposes) 5.2 Failure mode 5.11 Hidden failure 5.13 Severity 5.14 Criticality 5.15 Failure criteria 6.15 Software fault 7.13 Maintenance level 7.14 Maintenance outsourcing 8.9 Restoration 8.15 Maintenance task preparation 8.16 Maintenance schedule 9.12 Active preventive maintenance task time 9.14 Technical delay 9.15 Operating time to failure 9.22 Early failure period 11.5 Mean time to restoration Annex D Maintenance Times Annex E Criticality matrix	Clause 2 to Clause 11 and Annexes A to C have been reviewed and updated.
Deleted clauses of 2001 edition	
3.4 Repaired item 4.10 Rate of occurrence of failure 6.5 Fault mode 6.6 Actual state 9.13 Time to failure 10.4 Fault analysis 10.5 Maintenance documentation 11.2 Maintenance effectiveness 11.3 Maintenance support efficiency	

Bibliography

- [1] IEC 60050-191, *International Electrotechnical Vocabulary. Chapter 191: Dependability and quality of service*

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