



« Nuclear energy, nuclear technologies, and radiological protection »

ISO/TC 85

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**ISO/NWIP/12749-5**  
**“Nuclear energy, nuclear technologies, and radiological protection – Vocabulary – Part 5 : Reactors” - Preliminary Draft**

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NEW WORK ITEM PROPOSAL	
Closing date for voting <b>2014-11-06</b>	Reference number (to be given by the Secretariat)
Date of circulation <b>2014-08-06</b>	<b>ISO/TC 85 / SC 1 N</b>
Secretariat <b>AFNOR</b>	<input checked="" type="checkbox"/> <b>Proposal for new PC</b>

A proposal for a new work item within the scope of an existing committee shall be submitted to the secretariat of that committee with a copy to the Central Secretariat and, in the case of a subcommittee, a copy to the secretariat of the parent technical committee. Proposals not within the scope of an existing committee shall be submitted to the secretariat of the ISO Technical Management Board.

The proposer of a new work item may be a member body of ISO, the secretariat itself, another technical committee or subcommittee, or organization in liaison, the Technical Management Board or one of the advisory groups, or the Secretary-General.

The proposal will be circulated to the P-members of the technical committee or subcommittee for voting, and to the O-members for information.

**IMPORTANT NOTE: Proposals without adequate justification risk rejection or referral to originator.**

Guidelines for proposing and justifying a new work item are contained in [Annex C of the ISO/IEC Directives, Part 1](#).

The proposer has considered the guidance given in the [Annex C](#) during the preparation of the NWIP.

**Proposal** (to be completed by the proposer)

<p><b>Title of the proposed deliverable.</b> (in the case of an amendment, revision or a new part of an existing document, show the reference number and current title)</p>	
English title	Nuclear energy, nuclear technologies and radiological protection - Vocabulary - Part 5: Reactors
French title (if available)	Energie nucléaire, technologies nucléaires et radio-protection - Vocabulaire - Partie 5 : Réacteurs nucléaires
<p><b>Scope of the proposed deliverable.</b></p> <p>The scope of this project encompasses the collection of terms, definitions, examples and notes corresponding to the subsubject field Reactors.</p> <p>As there is a huge number of concepts to be defined in the Reactors subsubject field, this is the fifth part of the vocabulary, dealing with the data elaborated by ISO/SC6.</p> <p>This document will provide terms and definitions for reactor technology concepts, covering all reactor types according to the most relevant reactor classifications (according to purpose and application, generated power capacity, dominant neutron energy-spectra, operation mode and associated fuel-cycle); covering the main stages of a typical nuclear project, from site studies and nuclear/ conventional regulations, through conceptual engineering and all main areas of basic design, definitions on design basis and compliance with nuclear safety philosophy principles, limiting processes to reactor/ plant operation time and safe design lifetime; safety analyses and evaluations; typical and mandatory documentation; nuclear licensing procedure; procurement and manufacturing, construction and erection, equipment and system testing; personnel training; reactor/ plant start-up. Special projects : reactor/ plant capacity optimization and enhancements; fuel and fuel-cycle optimization, power up-rating, major refurbishment, plant life extension, decontamination activities and plant decommissioning.</p> <p>Specific consideration of present PWR, BWR and HWR Nuclear Power Plants features; relevant safety aspects and fuel-cycles under G-III and G-IV concepts. Similar consideration of research, irradiation and production reactors; as well as demonstration, prototype, special-purpose and accelerator-driven sub-critical plant concepts.</p> <p>The whole nuclear safety area deserves a major attention, covering from the main design safety approaches, like defence-in depth, the definition of the natural and the man-induced external events and the man-induced covered, either within the design-basis or as parts of deterministic and probabilistic safety assessments (including here accident simulations and the three level PSA assessments). Severe accidents are also covered from their progression simulations, including behaviors of reactor vessel, radiation shielding structures and containment structure and isolation system. Main specific safety features of research and production reactors are also included.</p> <p>Plant, configuration and quality managements, licensee personnel training, interactions with the regulator and specialized external services, are also covered.</p> <p>Terminological data are taken from ISO standards developed by TC85/SC6 and other technically validated documents issued by international organizations.</p>	

**Purpose and justification of the proposal\***

Taking into account that the market of reactor technology is an extremely broad, heterogeneous and multi-disciplinary one, because it comprises equipment designed, built and operated for a wide range of applications and requirements, and for different kinds of nuclear reactors, unambiguous communication of reactors concepts is crucial because of the relevant implications that may arise from misunderstandings with regard to equipment and materials involved in the standards dealing with this subsubject field within the nuclear energy activities.

*\*The reason for requiring justification statements with approval or disapproval votes is primarily to collect input on market or stakeholder needs, and on market relevance of the proposal, to benefit the development of the proposed ISO standard(s). Any NSB vote in relation to a proposal for new work may result in significant commitments of resources by all parties (NSBs, committee leaders and delegates/experts) or may have significant implications for ISO's relevance in the global community. It is especially important that NSBs consider and express why they vote the way they do. In addition, it is felt that it would be useful for ISO and its committees to have documentation as to why the NSBs feel a proposal has market need and market relevance. Therefore, please ensure that your justifying statements with your approval or disapproval vote convey the reason(s) why your national consensus does or does not support the market need and/or global relevance of the proposal.*

**If a draft is attached to this proposal,:**

Please select from one of the following options (note that if no option is selected, the default will be the first option):

- Draft document will be registered as new project in the committee's work programme (stage 20.00)
- Draft document can be registered as a Working Draft (WD – stage 20.20)
- Draft document can be registered as a Committee Draft (CD – stage 30.00)
- Draft document can be registered as a Draft International Standard (DIS – stage 40.00)

**Is this a Management Systems Standard (MSS)?**

- Yes  No

NOTE: if Yes, the NWIP along with the Justification study (see Annex SL of the Consolidated ISO Supplement) must be sent to the MSS Task Force secretariat ([tmb@iso.org](mailto:tmb@iso.org)) for approval before the NWIP ballot can be launched.

**Indication(s) of the preferred type or types of deliverable(s) to be produced under the proposal.**

- International Standard  Technical Specification  Publicly Available Specification  Technical Report

**Proposed development track**  1 (24 months)  2 (36 months - default)  3 (48 months)

**Known patented items (see ISO/IEC Directives, Part 1 for important guidance)**


- Yes  No **If "Yes", provide full information as annex**

**A statement from the proposer as to how the proposed work may relate to or impact on existing work, especially existing ISO and IEC deliverables. The proposer should explain how the work differs from apparently similar work, or explain how duplication and conflict will be minimized.**

**A listing of relevant existing documents at the international, regional and national levels.**

**A simple and concise statement identifying and describing relevant affected stakeholder categories (including small and medium sized enterprises) and how they will each benefit from or be impacted by the proposed deliverable(s)**

**New work item proposal**

<p><b>Liaisons:</b>  <b>A listing of relevant external international organizations or internal parties (other ISO and/or IEC committees) to be engaged as liaisons in the development of the deliverable(s).</b>          IAEA          WNA          NEA</p>	<p><b>Joint/parallel work:</b>  <b>Possible joint/parallel work with:</b>  <input type="checkbox"/> IEC (please specify committee ID)  <input type="checkbox"/> CEN (please specify committee ID)  <input type="checkbox"/> Other (please specify)</p>
<p><b>A listing of relevant countries which are not already P-members of the committee.</b></p>	
<p><b>Preparatory work</b> (at a minimum an outline should be included with the proposal)  <input checked="" type="checkbox"/> A draft is attached      <input type="checkbox"/> An outline is attached      <input type="checkbox"/> An existing document to serve as initial basis          The proposer or the proposer's organization is prepared to undertake the preparatory work required    <input type="checkbox"/> Yes    <input type="checkbox"/> No</p>	
<p><b>Proposed Project Leader</b> (name and e-mail address)          Carolina Popp          carolinapopp@gmail.com</p>	<p><b>Name of the Proposer</b>          (include contact information)          IRAM - Instituto Argentino de Normalización y          Certificación - Ing. Osvaldo D. Petroni - Standardization          Director          Email: opetroni@iram.org.ar</p> 
<p><b>Supplementary information relating to the proposal</b>  <input checked="" type="checkbox"/> This proposal relates to a new ISO document;  <input type="checkbox"/> This proposal relates to the adoption as an active project of an item currently registered as a Preliminary Work Item;  <input type="checkbox"/> This proposal relates to the re-establishment of a cancelled project as an active project.          Other:</p>	

**Annex(es) are included with this proposal** (give details)

- ISO/PD 12749-5 - Nuclear energy, nuclear technologies, and radiological protection - Vocabulary - Part 5: Reactors





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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO TC/85 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/PRELIMINARY DRAFT was prepared by Technical Committee ISO/TC85, *Nuclear Energy*.

- *Part 1: Nuclear energy: General terminology*

- *Part 2: Radiological protection*

- *Part 3: Nuclear fuels cycle*

- *Part 4: Dosimetry for radiation processing*

- *Part 5: Nuclear reactors*

## Introduction

This document will provide terms and definitions for reactors technology concepts dealing with analysis and measurements in support of safe operation of nuclear power plants and research reactors, with decay heat calculations in support of reactor safety, with the safe and efficient operation of research reactors and with services from research reactors. Terminological data are taken from ISO standards developed by TC85/SC6 and other technically validated documents issued by international organizations.

Unambiguous communication of nuclear energy concepts is crucial taking into account the relevant implications that may arise from misunderstandings with regard to equipment and materials involved in the standards dealing with any subject regarding nuclear energy activities. The market of reactor technology is a heterogeneous one because it comprises equipment designed, built and operated for a wide range of applications and requirements and for different kinds of nuclear reactors including the nuclear fuel cycle.

In view of the foregoing, a large number of people are involved having different levels of scientific and technical knowledge, thus, it can be widely divergent understandings and assumptions about concepts. The result is poor communication that might lead into an increase of the risk of accidents and duplication of efforts as different groups are going to define concepts according to their perspectives.

Conceptual arrangement of terms and definitions is based on concepts systems that show corresponding relationships among nuclear energy concepts. Such arrangement provides users with a structured view of the nuclear energy sector and will facilitate common understanding of all related concepts. Besides, concepts systems and conceptual arrangement of terminological data will be helpful to any kind of user because it will promote clear, accurate and useful communication.

# Nuclear energy, nuclear technologies, and radiological protection – Vocabulary – Part 5: Nuclear reactors

## 1 Scope

This International Standard encompasses the collection of terms, definitions, examples and notes corresponding to the sub subject field reactors. It provides terms and definitions for reactor technology concepts to facilitate communication and promote common understanding. Terminological data are taken from ISO standards developed by ISO/TC85/SC6 and other technically validated documents issued by international organizations.

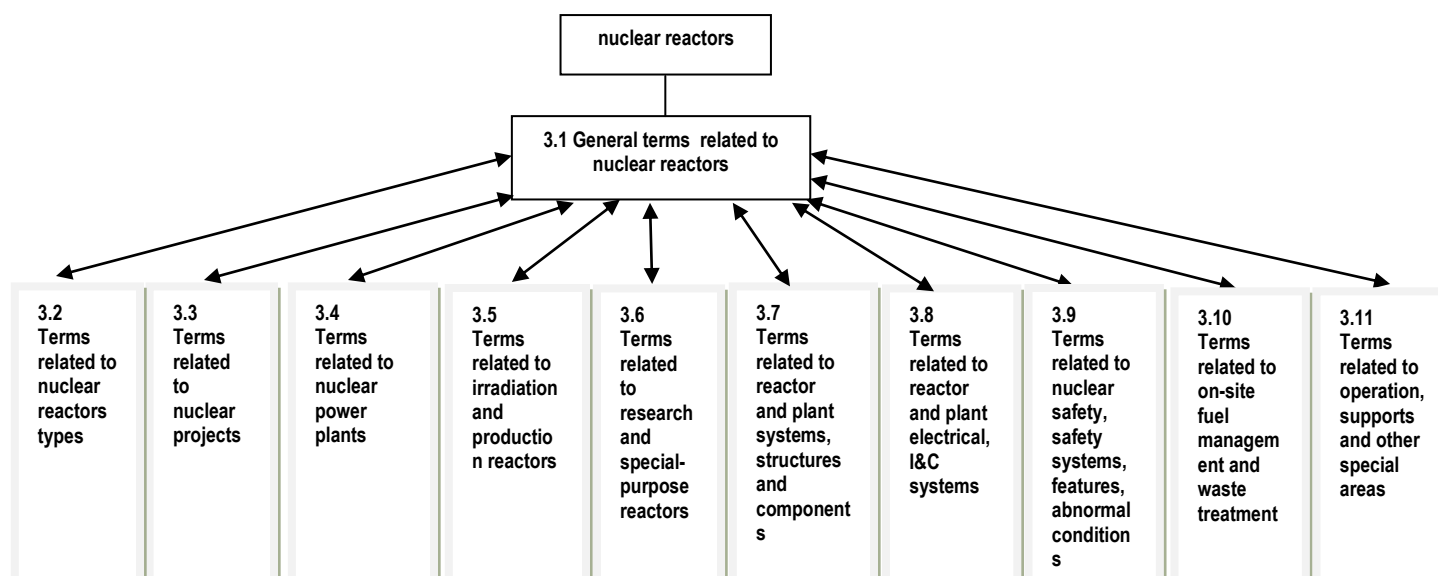
## 2 Structure of the vocabulary

The terminology entries are presented in the conceptual order of the English preferred terms. Both a systematic index and an alphabetical index are included at the end of the standard. The structure of each entry is in accordance with ISO 10241-1:2011, *Terminological entries in standards -- Part 1: General requirements and examples of presentation*.

All the terms included in this standard deal exclusively with nuclear reactor technology. When selecting terms and definitions, special care has been taken to include the terms that need to be defined, that is to say, either because the definitions are essential to the correct understanding of the corresponding concepts or because some specific ambiguities need to be addressed.

The notes appended to certain definitions offer clarification or examples to facilitate understanding of the concepts described. In certain cases, miscellaneous information is also included, for example, the units in which a quantity is normally measured, recommended parameter values, references, etc.

According to the title, the vocabulary deals with concepts belonging to the general **nuclear energy** subject field within which concepts in the **nuclear reactors** sub subject field are taken into account.



### **3 Terms and definitions**

*Following is a non-exhaustive list of concepts (stated in the ISO standards developed by the ISO/TC85/SC6) that may be included in the standard. Corresponding headings have to be analyzed and rearranged by WG1 experts so as to make it possible concept systems modeling.*

#### **3.1 General terms related to nuclear reactors**

**controlled chain reaction**

**nuclear reactor**

**nuclear power unit**

nuclear steam-supply System, its associated turbine generator and auxiliaries

[SOURCE: ISO 6527:1982, 2.1]

**building type**

**controlled zone**

**main reactor component**

**main reactor function**

**reactor / plant system**

#### **3.2 Terms related to nuclear reactor types**

(main reactor classification)

**dominant neutron energy**

**power level**

### 3.3 Terms related to nuclear projects

(basic reactor)

(plant design)

(specialized technology)

(plant sitting)

(site selection)

(mandatory documentation)

#### **system**

integral part of a nuclear power unit comprising electrical, electronic, or mechanical components (or combinations of them) that may be operated as a separate entity to perform a particular process function

[SOURCE: ISO 6527:1982, 2.2]

#### **line/train**

part of a system which by itself can perform the type of process function

NOTE . One line on its own may or may not meet full system capacity.

[SOURCE: ISO 6527:1982, 2.3]

#### **sub-system**

part of a system which participates in the operation of the latter (for example, electric power supply, controls, mechanical devices, etc.)

[SOURCE: ISO 6527:1982, 2.4]

#### **component**

element of a sub-system, having its own defined performance characteristics and forming a whole that can be removed from the process and replaced with a spare

[SOURCE: ISO 6527:1982, 2.5]

#### **failure (of a component)**

termination of the ability of a component to perform any one of its designed functions

[SOURCE: ISO 6527:1982, 2.6]

**failure (of a system)**

termination of the ability of a system to perform any one of its designed functions. Failure of a line within a system may occur in such a way that the system retains its ability to perform all its required functions; in this case the system has not failed

[SOURCE: ISO 6527:1982, 2.7]

**failure mode**

effect by which the failure is observed

[SOURCE: ISO 6527:1982, 2.8]

**failure rate**

number of failures per unit time in a given time interval. The failure rate may be specified for different failure modes

[SOURCE: ISO 6527:1982, 2.9]

**failure probability on demand**

failure probability expressed as a number of failures per number of type of actions requested (i.e. start, stop, open, close etc.).

[SOURCE: ISO 6527:1982, 2.10]

**reliability**

ability of a component or a system expressed as the probability to perform a required function under stated conditions for a stated period of time

[SOURCE: ISO 6527:1982, 2.11]

**operating time**

total time during which components or systems are performing their designed functions

[SOURCE: ISO 6527:1982, 2.12]

**availability time**

total time during which components or systems are capable of performing their designed functions

[SOURCE: ISO 6527:1982, 2.13]

**unavailability time**

total time during which components or systems are incapable of performing their designed functions

[SOURCE: ISO 6527:1982, 2.14]

**mean time between failure (MTBF)**

arithmetic average of calendar times between failures of components or a system

NOTE . MTBF is the reciprocal of failure rate when an exponential failure distribution can be assumed.

[SOURCE: ISO 6527:1982, 2.15]

**mean time to failure (MTTF)**

average time to failure of a new item or a repaired item assumed as new

[SOURCE: ISO 6527:1982, 2.16]

**mean time to repair (MTTR)**

arithmetic average of times required to perform a repair activity on the actual item

[SOURCE: ISO 6527:1982, 2.17]

**preventive maintenance**

activity performed on a system or component in order to reduce the probability of failures due to known wear-out failure modes

[SOURCE: ISO 6527:1982, 2.18]

**corrective maintenance**

activity performed on a system or component in order to eliminate the causes of failures that happened or were revealed by scheduled tests

[SOURCE: ISO 6527:1982, 2.19]

**downtime**

the period of time during which an is not in a condition to perform its required function

[SOURCE: ISO 8107:1993, 3.2]

**undetected failure time**

the time that elapses between the moment when the component fails and the moment when the faulty component is identified

[SOURCE: ISO 8107:1993, 3.2.1]

**undetected fault time**

the time that elapses between the moment when an item fails and the moment when the system malfunction is detected

NOTE 1. Of course this time cannot be determined precisely. It can be estimated, however, on the basis of inspection and testing intervals.

[SOURCE: ISO 8107:1993, 3.2.1.1]

**fault diagnosis time**

the time that elapses between the moment when a system malfunction is detected and the moment when the fault is identified in a certain item of equipment by control room indications, technical deductions, testing, etc.

[SOURCE: ISO 8107:1993, 3.2.1.2]

**administrative delay time**

the period of time following identification of faulty equipment until that time at which any maintenance operations can feasibly commence

[SOURCE: ISO 8107:1993, 3.2.2]

**organization time**

that part of the administrative delay time during which the work is being organized and the maintenance cannot yet be carried out

[SOURCE: ISO 8107:1993, 3.2.2.1]

**preparation time**

inactive time due to administration and organization procedures; it includes the time for decision making, document processing, authorizations

[SOURCE: ISO 8107:1993, 3.2.2.1.1]

**maintenance organization time**

the period of time needed for preparing the crew (including providing drawings, tools, instructions, etc.). The time spent training or practising for the actual maintenance procedure is also included

[SOURCE: ISO 8107:1993, 3.2.2.1.2]

**programmed delay time**

delay dependent on the plant maintenance schedule

[SOURCE: ISO 8107:1993, 3.2.2.2]

**external logistic delay**

the part of the administrative delay time during which the maintenance cannot be carried out because of external logistic delays (e.g. outside maintenance contractor's delays)

[SOURCE: ISO 8107:1993, 3.2.2.3]

**time for outside personnel to arrive**

the period of time spent waiting for outside maintenance contractors and/or inspectors to arrive

[SOURCE: ISO 8107:1993, 3.2.2.3.1]

**delivery time**

the period of time needed to deliver the faulty/new item, or part thereof, from the plant to the manufacturer's and back again



[SOURCE: ISO 8107:1993, 3.2.2.3.2]

**new design time**

the period of time needed to design a new type of equipment and to manufacture it

[SOURCE: ISO 8107:1993, 3.2.2.3.3]

**actual maintenance time**

the period of time during which maintenance work is carried out on an item (time including delays inherent in maintenance operations)

[SOURCE: ISO 8107:1993, 3.2.3]

**in situ preparation time**

the part of the maintenance time during which no active work is carried out on the item

[SOURCE: ISO 8107:1993, 3.2.3.1]

**isolating time**

the period of time needed to isolate the faulty equipment from the line

[SOURCE: ISO 8107:1993, 3.2.3.1.1]

**time to gain access**

the period of time spent gaining access to the faulty item (once the crew is ready)

[SOURCE: ISO 8107:1993, 3.2.3.1.2]

**decontamination time**

the period of time spent on decontamination in order to allow the repair work to be carried out

[SOURCE: ISO 8107:1993, 3.2.3.1.3]

**shielding time**

the period of time spent shielding the faulty item area in order to allow the repair work to be carried out

[SOURCE: ISO 8107:1993, 3.2.3.1.4]

**active maintenance [repair] time**

the part of the maintenance time during which active work is carried out on the item

[SOURCE: ISO 8107:1993, 3.2.3.2]

**fault location time**

the period of time spent identifying the fault in the equipment

[SOURCE: ISO 8107:1993, 3.2.3.2.1]

**dismantling time**

the period of time during which the equipment, or part thereof, is being dismantled for repairs or replacement

[SOURCE: ISO 8107:1993, 3.2.3.2.2]

**repair time at the plant workshop**

the period of time spent repairing the item in the plant workshop

[SOURCE: ISO 8107:1993, 3.2.3.2.3]

**repair time at the manufacturer**

the period of time spent by the manufacturer repairing the items of his own factory

[SOURCE: ISO 8107:1993, 3.2.3.2.4]

**in situ repair time**

the period of time spent repairing the item in situ

[SOURCE: ISO 8107:1993, 3.2.3.2.5]

**reassembly time**

the period of time needed to reassemble the item in its original position

[SOURCE: ISO 8107:1993, 3.2.3.2.6]

**calibration and testing time**

the period of time needed for calibrating and testing the item

[SOURCE: ISO 8107:1993, 3.2.3.2.7]

**inherent technical delay**

delayed pending delivery of new or repaired item, tools, decontamination of parts, etc

[SOURCE: ISO 8107:1993, 3.2.3.2.8]

**post-repair time**

[SOURCE: ISO 8107:1993, 3.2.3.3]

**clean-up time**

the period of time spent removing extraneous material not required for operation

[SOURCE: ISO 8107:1993, 3.2.3.3.1]

**closure time**

the period of time needed for the maintenance crew to withdraw properly from the area in which the faulty item is situated

[SOURCE: ISO 8107:1993, 3.2.3.3.2]

**approval time**

the period of the time needed for the administrative handling of regulatory documents authorizing the restart

[SOURCE: ISO 8107:1993, 3.2.3.3.3]

**time to return to on-line operation**

the period of time needed to link the equipment up to the unit, including testing at system level

[SOURCE: ISO 8107:1993, 3.2.3.3.4]

**fuel assembly**

component containing a fissile material and forming a unit in charging and discharging a reactor

[SOURCE: ISO 10979:1994, 3.1]

**lifetime (of a fuel assembly)**

period of time starting at the time of assembling of the fuel assembly in the fabricator's facility and ending when the assembly is destroyed as an entity

[SOURCE: ISO 10979:1994, 3.2]

## Annex A (Informative)

### Methodology used in the development of the vocabulary

#### A.1 General

The specific character of the reactors concepts contained in this standard requires the use of

- clear technical descriptions, and
- a coherent and harmonized vocabulary that is easily understandable by all potential users.

Concepts are not independent of one another, and an analysis of the relationships between concepts within the fields of energy efficiency and renewable energy sources and the arrangement of them into concept systems is a prerequisite of a coherent vocabulary. Such an analysis was used in the development of the vocabulary specified in this International Standard. Since the concept diagrams employed during the development process may be helpful in an informative sense, they are reproduced in A.3.

#### A.2 Concept relationships and their graphical representation

##### A.2.1 General

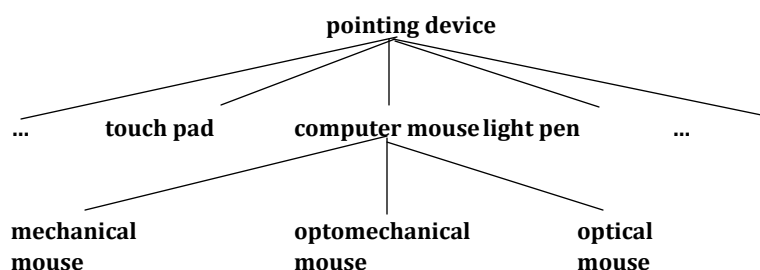
In terminology work, the relationships between concepts are based on the three primary forms of concept relationships indicated in this annex: the hierarchical generic (A.2.2), and partitive (A.2.3) and the non hierarchical associative (A.2.4).

##### A.2.2 Generic relation

Subordinate concepts within the hierarchy inherit all the characteristics of the superordinate concept and contain descriptions of these characteristics which distinguish them from the superordinate (parent) and coordinate (sibling) concepts, e.g. the relation of mechanical mouse, optomechanical mouse and optical mouse to computer mouse.

Generic relations are depicted by a fan or tree diagram without arrows (see Figure A.1).

Example from ISO 704:2009 (5.5.2.2.1)



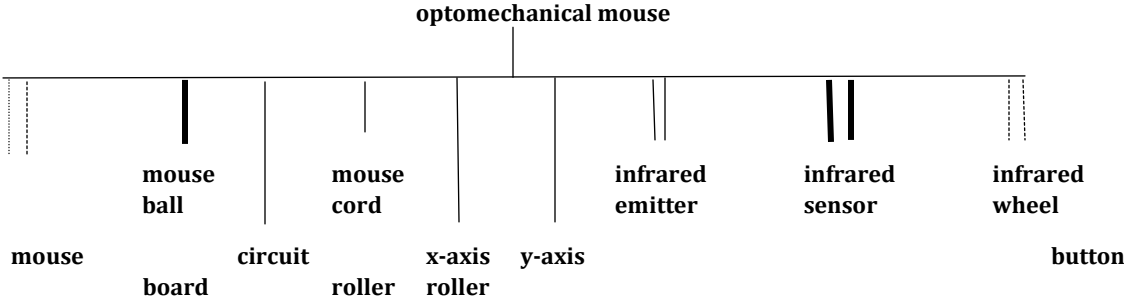
**Figure A.1 — Graphical representation of a generic relation**

##### A.2.3 Partitive relation

Subordinate concepts within the hierarchy form constituent parts of the superordinate concept, e.g. mouse button, mouse cord, infrared emitter and mouse wheel may be defined as

parts of the concept optomechanical mouse. In comparison, it is inappropriate to define red cord (one possible characteristic of mouse cord) as part of an optomechanical mouse. Partitive relations are depicted by a rake without arrows (see Figure A.2). Singular parts are depicted by one line, multiple parts by double lines.

Example from ISO 704:2009 (5.5.2.3.1)



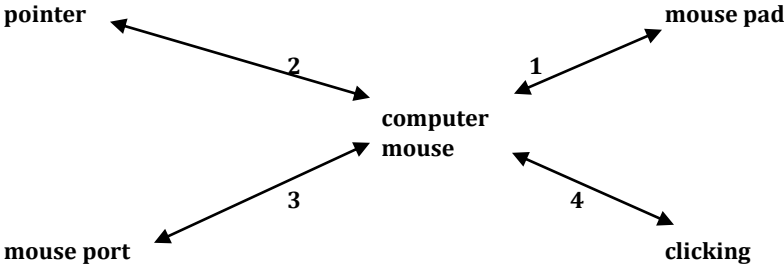
**Figure A.2 — Graphical representation of a partitive relation**

**A.2.4 Associative relation**

Associative relations cannot provide the economies in description that are present in generic and partitive relations but are helpful in identifying the nature of the relationship between one concept and another within a concept system, e.g. cause and effect, activity and location, activity and result, tool and function, material and product. Besides, associative relations are the most commonly encountered in terminology practical work, as they correspond to the concepts relations established in the real world.

Associative relations are depicted by a line with arrowheads at each end (see Figure A.3).

Example from ISO 704:2009 (5.6.2)



**Figure A.3 — Graphical representation of an associative relation**

### **A.3 Concept diagrams**

Figures A.4.1 to A.4... show the concept diagrams on which the thematic groups of the reactors vocabulary are based.

## **Concept diagrams**

(To be drafted)

Notations in following diagrams show the position of each concept according to generic, partitive and associative relationships.

### **Figure A.4**

#### **3.1 General terms related to nuclear reactors**

## Bibliography

[1] INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. "Terminology work — Principles and methods". ISO 704:2009. ISO, Geneva, 2009. 65 p.

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