
Jedrske elektrarne - Instrumenti in krmilje, pomembni za varnost - Razvoj HDL-programiranih integriranih vezij za sisteme, ki izvajajo funkcije kategorije A (IEC 62566:2012)

Nuclear power plants - Instrumentation and control important to safety - Development of HDL-programmed integrated circuits for systems performing category A functions

Kernkraftwerke – Leittechnik für Systeme mit sicherheitstechnischer Bedeutung – Entwicklung HDL-programmierter integrierter Schaltkreise für Systeme, die Funktionen der Kategorie A ausführen

Centrales nucléaires de puissance - Instrumentation et contrôle-commande importants pour la sûreté - Développement des circuits intégrés programmés en HDL pour les systèmes réalisant des fonctions de catégorie A

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Nuclear power plants - Instrumentation and control important to safety - Development of HDL-programmed integrated circuits for systems performing category A functions
(IEC 62566:2012)

Centrales nucléaires de puissance - Instrumentation et contrôle-commande importants pour la sûreté - Développement des circuits intégrés programmés en HDL pour les systèmes réalisant des fonctions de catégorie A
(CEI 62566:2012)

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(IEC 62566:2012)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (EN 62566:2014) consists of the text of IEC 62566:2012 prepared by SC 45A "Instrumentation, control and electrical systems of nuclear facilities" of IEC/TC 45 "Nuclear instrumentation".

The following dates are fixed:

- latest date by which this document has to be implemented (dop) 2015-08-04
at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting (dow) 2017-08-04
with this document have to be withdrawn

As stated in the nuclear safety directive 2009/71/EURATOM, Chapter 1, Article 2, item 2, Member States are not prevented from taking more stringent safety measures in the subject-matter covered by the Directive, in compliance with Community law. In a similar manner, this European standard does not prevent Member States from taking more stringent nuclear safety measures in the subject-matter covered by this standard.

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The text of the International Standard IEC 62566:2012 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

NOTE 1 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60671	-	Nuclear power plants - Instrumentation and control systems important to safety - Surveillance testing	EN 60671	-
IEC 60880	2006	Nuclear power plants - Instrumentation and control systems important to safety - Software aspects for computer-based systems performing category A functions	EN 60880	2009
IEC 60987	2007	Nuclear power plants - Instrumentation and control important to safety - Hardware design requirements for computer-based systems	EN 60987	2009
IEC 61513	2011	Nuclear power plants - Instrumentation and control important to safety - General requirement for systems	EN 61513	2013
IEC 62138	-	Nuclear power plants - Instrumentation and control important for safety - Software aspects for computer-based systems performing category B or C functions	EN 62138	-
IEC 62340	-	Nuclear power plants - Instrumentation and control systems important to safety - Requirements for coping with common cause failure (CCF)	EN 62340	-
IAEA guide NS-G-1.3	2002	Instrumentation and control systems important to safety in nuclear power plants	-	-

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**Nuclear power plants – Instrumentation and control important to safety –
Development of HDL-programmed integrated circuits for systems performing
category A functions**

**Centrales nucléaires de puissance – Instrumentation et contrôle-commande
importants pour la sûreté – Développement des circuits intégrés programmés
en HDL pour les systèmes réalisant des fonctions de catégorie A**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS –
INSTRUMENTATION AND CONTROL IMPORTANT TO SAFETY –
DEVELOPMENT OF HDL-PROGRAMMED INTEGRATED CIRCUITS
FOR SYSTEMS PERFORMING CATEGORY A FUNCTIONS**

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 62566 has been prepared by subcommittee 45A: Instrumentation and control of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation.

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

FDIS	Report on voting
45A/859/FDIS	45A/865/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.

The committee has decided that the contents of this publication will remain unchanged until the stability 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,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

a) Technical background, main issues and organisation of the Standard

The electronic systems of class 1 (according to IEC 61513) used in Nuclear Power Plants (NPP) which are required in emergency situations, need to be fully validated and qualified before being used in operation.

In traditional systems that are computer-based, a separation can be drawn between the hardware and software portions. The hardware is mainly designed with standardised components having pre-defined electronic functions such as microprocessors, timers or network controllers, whereas software is used to coordinate the different parts of the hardware and to implement the application functions.

Nowadays, I&C designers may build application functions directly in one integrated circuit using devices such as FPGAs or similar technologies. The function of such an integrated circuit is not defined by the supplier of the physical component or micro-electronic technology but by the I&C designer.

The specific integrated circuits addressed by this Standard are:

- 1) based on pre-developed micro-electronic resources,
- 2) developed within an I&C project,
- 3) developed with Hardware Description Languages (HDL) and related tools used to implement the requirements in a proper assembly of the pre-developed micro-electronic resources.

Therefore these circuits are named “HDL-Programmed Devices”, (HPD). The HDL statements which describe a HPD can include the instantiation of Pre-Developed Blocks (PDB) which are typically provided as libraries, macros, or Intellectual Property cores.

HPDs can be effective solutions to implement functions required by an I&C project. However, the verification and validation may be limited by issues such as high number of internal paths and limited observability, if the HPD has not been developed with verifiability in mind.

In order to achieve the reliability required for safety I&C systems, the development of HPDs shall comply with strict process and technical requirements such as those provided by this Standard, including the specification of requirements, the selection of blank integrated circuits and PDBs, the design and implementation, the verification, and the procedures for operation and maintenance.

It is intended that this Standard be used by hardware designers, operators of NPPs (utilities), and by regulators. Regulatory bodies will find guidance to assess important aspects such as design, implementation, verification and validation of HPDs.

b) Situation of the current Standard in the structure of the IEC SC 45A Standard series

IEC 61513 is a first level IEC SC 45A document and gives guidance applicable to I&C at system level. It is supplemented by guidance at hardware level (IEC 60987) and software level (IEC 60880 and IEC 62138). IEC 62340 gives requirements in order to reduce and overcome the possibility of common cause failure of category A functions.

IEC 62566 is a second level IEC SC 45A document which focuses on the activities when HPDs are developed. It complements IEC 60987 which deals with the generic issues of hardware design of computer based systems. It refers to IEC 60880 when issues identical to that of software development are addressed.

For more details on the structure of the IEC SC 45A Standard series, see item d) of this introduction.

c) Recommendations and limitations regarding the application of the Standard

It is important to note that this Standard establishes no additional functional requirements for safety systems.

Aspects for which special requirements and recommendations have been produced are:

- 1) an approach to specify the requirements of, to design, to implement and to verify “HDL-Programmed Devices” (HPD, 3.7), and to handle the corresponding aspects of system integration and validation;
- 2) an approach to analyse and select the blank integrated circuits, micro-electronic technologies and Pre-Developed Blocks (PDB, 3.11) used to develop HPDs;
- 3) procedures for the modification and configuration control of HPDs;
- 4) requirements for selection and use of software tools used to develop HPDs.

It is recognized that digital technology is continuing to develop at a rapid pace and that it is not possible for a Standard such as this one to include references to all modern design technologies and techniques.

To ensure that the Standard will continue to be relevant in future years the emphasis has been placed on issues of principle, rather than specific technologies. If new techniques are developed then it should be possible to assess the suitability of such techniques by applying the safety principles contained within this Standard.

d) Description of the structure of the IEC SC 45A Standard series and relationships with other IEC documents and other bodies documents (IAEA, ISO)

The top-level document of the IEC SC 45A Standard series is IEC 61513. It provides general requirements for I&C systems and equipment that are used to perform functions important to safety in NPPs. IEC 61513 structures the IEC SC 45A Standard series.

IEC 61513 refers directly to other IEC SC 45A Standards for general topics related to categorization of functions and classification of systems, qualification, separation of systems, defence against common cause failure, software aspects of computer-based systems, hardware aspects of computer-based systems, and control room design. The Standards referenced directly at this second level should be considered together with IEC 61513 as a consistent document set.

At a third level, IEC SC 45A Standards not directly referenced by IEC 61513 are Standards related to specific equipment, technical methods, or specific activities. Usually these documents, which make reference to second-level documents for general topics, can be used on their own.

A fourth level extending the IEC SC 45 Standard series, corresponds to the Technical Reports which are not normative.

IEC 61513 has adopted a presentation format similar to the basic safety publication IEC 61508 with an overall safety life-cycle framework and a system life-cycle framework and provides an interpretation of the general requirements of IEC 61508-1, IEC 61508-2 and IEC 61508-4, for the nuclear application sector. Compliance with IEC 61513 will facilitate consistency with the requirements of IEC 61508 as they have been interpreted for the nuclear industry. In this framework IEC 60880 and IEC 62138 correspond to IEC 61508-3 for the nuclear application sector.

IEC 61513 refers to ISO as well as to IAEA GS-R-3 and IAEA GS-G-3.1 for topics related to quality assurance.

The IEC SC 45A Standards series consistently implements and details the principles and basic safety aspects provided in the IAEA code on the safety of NPPs and in the IAEA safety series, in particular the Requirements NS-R-1, establishing safety requirements related to the design of Nuclear Power Plants, and the Safety Guide NS-G-1.3 dealing with instrumentation and control systems important to safety in Nuclear Power Plants. The terminology and definitions used by SC 45A Standards are consistent with those used by the IAEA.

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