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Nuclear power plants - Control rooms - Design (IEC 60964:2009 (EQV))

I.S. EN 60964:2010

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EUROPEAN STANDARD
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EN 60964

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English version

**Nuclear power plants -
Control rooms -
Design
(IEC 60964:2009)**

Centrales nucléaires de puissance -
Salles de commande -
Conception
(CEI 60964:2009)

Kernkraftwerke -
Warten -
Auslegung
(IEC 60964:2009)

This European Standard was approved by CENELEC on 2010-03-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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CENELEC

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

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of the International Standard IEC 60964:2009, prepared by SC 45A, Instrumentation and control of nuclear facilities, of IEC TC 45, Nuclear instrumentation, was submitted to the CENELEC formal vote for acceptance as a European Standard and was approved by CENELEC as EN 60964 on 2010-03-01.

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

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2011-03-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2013-03-01

Annex ZA has been added by CENELEC.

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 European Standard.”

Endorsement notice

The text of the International Standard IEC 60964:2009 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60709	-	Nuclear power plants - Instrumentation and control systems important to safety - Separation	EN 60709	-
IEC 60780	-	Nuclear power plants - Electrical equipment of the safety system - Qualification	-	-
IEC 60960	-	Functional design criteria for a safety parameter display system for nuclear power stations	-	-
IEC 60965	-	Nuclear power plants - Control rooms - Supplementary control points for reactor shutdown without access to the main control room	-	-
IEC 60980	-	Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations	-	-
IEC 61225	-	Nuclear power plants - Instrumentation and control systems important to safety - Requirements for electrical supplies	-	-
IEC 61226	-	Nuclear power plants - Instrumentation and control important to safety - Classification of instrumentation and control functions	EN 61226	-
IEC 61227	-	Nuclear power plants - Control rooms - Operator controls	-	-
IEC 61513	-	Nuclear power plants - Instrumentation and control for systems important to safety - General requirements for systems	-	-
IEC 61771	-	Nuclear power plants - Main control-room - Verification and validation of design	-	-
IEC 61772	-	Nuclear power plants - Control rooms - Application of visual display units (VDUs)	-	-
IEC 61839	-	Nuclear power plants - Design of control rooms - Functional analysis and assignment	-	-
IEC 62241	-	Nuclear power plants - Main control room - Alarm functions and presentation	-	-

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<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 11064	Series	Ergonomic design of control centres	-	-
IAEA NS-G-1.3	-	Instrumentation and control systems important to safety in nuclear power plants	-	-
IAEA NS-G-1.9	-	Design of the reactor coolant systems and associated system in nuclear power plants	-	-
IAEA NS-G-1.11	-	Protection against internal hazards other than fires and explosions in the design of nuclear power plants : safety guide	-	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

NUCLEAR POWER PLANTS – CONTROL ROOMS – DESIGN

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 60964 has been prepared by subcommittee 45A: Instrumentation and control of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation.

This second edition cancels and replaces the first edition published in 1989.

The revision of the standard is intended to accomplish the following:

- to take into account the fact that software engineering techniques advanced significantly in the intervening years;
- to align the Standard with the new revisions of IAEA documents NS-R-1 and NS-G-1.3, which includes as far as possible adaptation of the definitions;
- to replace, where relevant, the previous requirements in the standard, where these are now given by references to Standards published since the first edition, especially IEC 60709, IEC 60780, IEC 60980, IEC 61225, IEC 61226, IEC 61227, IEC 61513, IEC 61771, IEC 61772, IEC 61839, IEC 62241 and ISO 11064;
- to review the existing requirements and to update the terminology and definitions.

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

FDIS	Report on voting
45A/724/FDIS	45A/731/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 maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

a) Technical background, main issues and organization of the standard

IEC 60964:1989 was developed to supply requirements relevant to the design of the main control room of NPPs. The first edition of IEC 60964 has been used extensively within the nuclear industry. It was however recognized that recent technical developments especially those which are based on software technology should be incorporated. It was also recognized that the relationships with derivative standards (i.e. IEC 61227, IEC 61771, IEC 61772, IEC 61839, and IEC 62241) should be clarified and conditioned.

This IEC standard specifically focuses on the functional designing of the main control room of NPPs. It is intended that the Standard be used by NPP vendors, utilities, and by licensors.

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

IEC 60964 is the second level IEC SC 45A document tackling the generic issue of control room design.

IEC 60964 is to be read in association with the derivative standards mentioned above which are the appropriate IEC SC 45A documents which provide guidance on operator controls, verification and validations of design, application of visual display units, functional analysis and assignment, and alarm functions and presentation.

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

This standard is intended for application to new control rooms whose conceptual design is initiated after the publication of this standard. The recommendations of the standard may be used for refits, upgrades and modifications.

The primary purpose of this standard is to provide functional design requirements to be used in the design of the main control room of a nuclear power plant to meet operational and safety requirements.

This standard also provides functional interface requirements which relate to control room staffing, operating procedures and the training programme which are, together with the human-machine interface, constituents of the control room system.

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.

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 50-C-QA (now replaced by IAEA GS-R-3) for topics related to quality assurance (QA).

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.

NUCLEAR POWER PLANTS – CONTROL ROOMS – DESIGN

1 Scope and object

This International Standard establishes requirements for the human-machine interface in the main control rooms of nuclear power plants. The standard also establishes requirements for the selection of functions, design consideration and organization of the human-machine interface and procedures which shall be used systematically to verify and validate the functional design. These requirements reflect the application of human factors engineering principles as they apply to the human-machine interface during normal and abnormal plant conditions. This standard does not cover special purpose or normally unattended control points, such as those provided for shutdown operations from outside the main control room or for radioactive waste handling, or emergency response facilities. Detailed equipment design is outside the scope of this standard.

The primary purpose of this standard is to provide functional design requirements to be used in the design of the main control room of a nuclear power plant to meet operational and safety requirements. This standard also provides functional interface requirements which relate to control room staffing, operating procedures, and the training programmes which, together with the human-machine interface, constitute the control room system.

This standard is intended for application to new control rooms whose conceptual design is initiated after the publication of this standard. If it is desired to apply it to an existing control room, special caution must be exercised so that the design basis is kept consistent.

2 Normative references

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

IEC 60709, *Nuclear power plants – Instrumentation and control systems important to safety – Separation*

IEC 60780, *Nuclear power plants – Electrical equipment of the safety system – Qualification*

IEC 60960, *Functional design criteria for a safety parameter display system for nuclear power stations*

IEC 60965, *Supplementary control points for reactor shutdown without access to the main control room*

IEC 60980, *Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations*

IEC 61225, *Nuclear power plants – Instrumentation and control systems important for safety – Requirements for electrical supplies*

IEC 61226, *Nuclear power plants – Instrumentation and control important to safety – Classification of instrumentation and control functions*

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