

Nuclear power plants – Control rooms - Design

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NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 60964:2010 sisaldab Euroopa standardi EN 60964:2010 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 30.04.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

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This standard is ratified with the order of Estonian Centre for Standardisation dated 30.04.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

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**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.

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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.

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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with the EN have to be withdrawn (dow) 2013-03-01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	-	-

<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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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*

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 – Main control room – Application of visual display units (VDU)*

IEC 61839, *Nuclear power plants – Design of control rooms – Functional analysis and assignments*

IEC 62241, *Nuclear power plants – Main control room – Alarm functions and presentation*

ISO 11064 (all parts), *Ergonomic design of control centres*

IAEA NS-G-1.3, *Instrumentation and control systems important to safety in Nuclear Power Plants, 2002*

IAEA NS-G-1.9, *Design of the reactor coolant system and associated systems 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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. For other terms, refer to the general terminology defined in IEC 61513 and in the IAEA NUSS programme, such as Safety Guide NS-G-1.3.

3.1

alarms

an item of diagnostic, prognostic, or guidance information, which is used to alert the operator and to draw his or her attention to a process or system deviation.

NOTE Specific information provided by alarms includes the existence of an anomaly for which corrective action might be needed, the cause and potential consequences of the anomaly, the overall plant status, corrective action to the anomaly, and feedback of corrective actions.

Two types of deviation may be recognised:

- Unplanned - Undesirable process deviations and equipment faults;
- Planned - Deviations in process conditions or equipment status that are the expected response to but could be indicative of undesirable plant conditions.

[IEC 62241]

3.2

auxiliary control (operating) systems

operating systems that are installed outside the control room such as local-to-plant control points and local-to-plant shutdown systems

3.3

control room staff

a group of plant personnel stationed in the control room, who are responsible for achieving the plant operational goals by controlling the plant through the human-machine interface.