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Nuclear facilities - Instrumentation, control and electrical power systems important to safety - Structure of the IEC SC 45A standards series

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Nuclear facilities – Instrumentation, control and electrical power systems important to safety - Structure of the IEC SC 45A standards series

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC TR 63400:2021. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC TR 63400 has been prepared by subcommittee 45A: Instrumentation, control and electrical power systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
45A/1597/DTR	45A/1622/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

This second edition cancels and replaces the first edition published in 2021. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) This edition reflects changes made to the IEC SC45A portfolio of publications between 2021 and 2025, including the publication of revised standards in addition to new publications including in the field of artificial intelligence applications for nuclear facilities.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

INTRODUCTION

a) Technical background, main issues and organisation of this document

The IEC SC 45A series of standards include the same common description in their Introduction, item d), outlining the overall structure of the series and its relationship with other standards bodies and standards (e.g. specific IAEA safety guides and IEC 61508).

The structure of the IEC SC 45A series at the time of drafting this document can be described as a "pyramid" extending down from two top-level documents (at level 1) to other documents (at levels 2, 3 and 4).

With the gradual extension of the IEC SC 45A scope to address electrical power systems, cybersecurity and human factors engineering, and ongoing development of new standards, it had become apparent that the common description could no longer, on its own, adequately fulfil this objective without becoming overly extensive.

This document is therefore intended to augment the common description that is included in the Introduction, item d), of all IEC SC 45A documents.

~~It was agreed at the IEC SC 45A meeting held in Paris in April 2019 that this Technical Report should be primarily for the benefit of the users of the IEC SC 45A standards (including first time users) rather than for the expert members of IEC SC 45A and its working groups.~~

A revision of this document ~~should~~ can be considered after each IEC SC 45A meeting and, if judged necessary, a revision then undertaken subject to the availability of the appropriate resources.

In this Edition 2, the list of IEC SC 45A published documents and approved projects and the list of IAEA documents of particular relevance to the IEC SC 45A technical scope have been updated. However, no significant changes have been made to either the basic objective or structure of the edition 1.

This document is organized as follows:

– Clause 5 outlines the scope of the IEC SC 45A standards series;
– Clause 6 describes the basic structure of the IEC SC 45A standards series, with particular reference to a hierarchy of levels and subdivision into a set of broad topic areas;
– Clause 7 presents the structure of the IEC SC 45A standards series in diagrammatic form;
– Clause 8 introduces and points to three annexes that include:
– the full set of IEC SC 45A standards in tabular form and numerical order,
– other (i.e. non-IEC SC 45A) documents of particular relevance to IEC SC 45A, and
– the IEC SC 45A standards in tabular form for each broad topic area.

NOTE 1 In this edition, the documents under the responsibility of IEC SC 45A, as listed in the annexes, and their status correspond to the situation that applied on 1 May ~~2021~~ 2025. For documents developed by other committees cited for their relevance to IEC SC 45A, this document in most cases reflects the status of the situation that applied on 1 May 2024.

b) Situation of this document in the structure of the IEC SC 45A standards series

This document is a fourth level IEC SC 45A document.

Item d) of this Introduction describes the structure of the IEC SC 45A standards series in general terms.

This document augments that description to enable users of individual IEC SC 45A standards to obtain a more comprehensive understanding of the overall structure of the series and its relationship with other standards bodies and standards. The publication of this document and its subsequent editions should also enable minor changes in the structure to be described without the need for amending the common description that is included in the Introduction, item d), of all IEC SC 45A documents.

c) Recommendations and limitations regarding the application of this document

It is important to note that a Technical Report is entirely informative in nature. It gathers data collected from different origins and it establishes no requirements.

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

The IEC SC 45A standards series comprises a consistent set of documents organised in a hierarchy of four levels. The top-level documents of the IEC SC 45A standards series are IEC 61513 and IEC 63046, covering general requirements for instrumentation and control (I&C) systems, and general requirements for electrical power systems of NPPs, respectively. IEC 61513 and IEC 63046 adopt an overall system life-cycle framework and constitute, along with the relevant second-level standards, the nuclear implementation of the basic safety series IEC 61508.

~~IEC 61513 provides general requirements for instrumentation and control (I&C) systems and equipment that are used to perform functions important to safety in nuclear power plants (NPPs). IEC 63046 provides general requirements for electrical power systems of NPPs; it covers power supply systems including the supply systems of the I&C systems.~~

~~IEC 61513 and IEC 63046 are to be considered in conjunction and at the same level. IEC 61513 and IEC 63046 structure the IEC SC 45A standard series and shape a complete framework establishing general requirements for instrumentation, control and electrical power systems for nuclear power plants.~~

IEC 61513 and IEC 63046 refer directly to other IEC SC 45A standards for general requirements for specific topics, such as categorization of functions and classification of systems, qualification, separation, defence against common cause failure, control room design, electromagnetic compatibility, human factors engineering, cybersecurity, ~~software~~ programmable digital item and hardware aspects for programmable digital systems, coordination of safety and ~~security~~ cybersecurity requirements and management of ageing. ~~The standards referenced directly at this second level should be considered together with IEC 61513 and IEC 63046 as a consistent document set.~~

At a third level, IEC SC 45A standards not directly referenced by IEC 61513 or by IEC 63046 are standards related to specific requirements for specific equipment, technical methods, or activities. Usually, these documents refer to second-level documents for general requirements and can be used on their own.

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

The IEC SC 45A standards series consistently implements and details the safety and security principles and basic aspects provided in the relevant IAEA safety standards and in the relevant documents of the IAEA nuclear security series (NSS). In particular this includes the IAEA requirements SSR-2/1, establishing safety requirements related to the design of nuclear power plants (NPPs), the IAEA safety guide SSG-30 dealing with the safety classification of structures, systems and components in NPPs, the IAEA safety guide SSG-39 dealing with the design of instrumentation and control systems for NPPs, the IAEA safety guide SSG-34 dealing with the design of electrical power systems for NPPs, the IAEA safety guide SSG-51 dealing with human factors engineering in the design of NPPs, and the implementing guide ~~NSS17~~ NSS42-G for

computer security at nuclear facilities. The safety and security terminology and definitions used by the SC 45A standards are consistent with those used by the IAEA.

~~IEC 61513 and IEC 63046 have adopted a presentation format similar to the basic safety publication IEC 61508 with an overall life-cycle framework and a system life-cycle framework. Regarding nuclear safety, IEC 61513 and IEC 63046 provide the interpretation of the general requirements of IEC 61508-1, IEC 61508-2 and IEC 61508-4, for the nuclear application sector. In this framework IEC 60880, IEC 62138 and IEC 62566 correspond to IEC 61508-3 for the nuclear application sector.~~

IEC 61513 and IEC 63046 refer to ISO 9001 as well as to IAEA GSR part 2 and IAEA GS-G-3.1 and IAEA GS-G-3.5 for topics related to quality assurance (QA).

At level 2, regarding nuclear security, IEC 62645 is the entry document for the IEC/SC 45A security standards. It builds upon the valid high-level principles and main concepts of the generic security standards, in particular ISO/IEC 27001 and ISO/IEC 27002; it adapts them and completes them to fit the nuclear context and coordinates with the IEC 62443 series. At level 2, IEC 60964 is the entry document for the IEC/SC 45A control rooms standards, IEC 63351 ~~(currently in preparation)~~ is ~~intended as~~ the entry document for the human factors engineering standards and IEC 62342 is the entry document for the ageing management standards.

~~NOTE 1 It is assumed that for the design of I&C systems in NPPs that implement conventional safety functions (e.g. to address worker safety, asset protection, chemical hazards, process energy hazards) international or national standards would be applied.~~

NOTE 2 This document provides a more comprehensive description of the overall structure of the IEC SC 45A standards series and of its relationship with other standards bodies and standards.

1 Scope

The IEC SC 45A series of standards includes a general description in the Introduction, item d) of each part, outlining the overall structure of the series and its relationship with other standards bodies and standards (e.g. specific IAEA safety guides and IEC 61508).

This document is intended to augment that description to enable users of individual IEC SC 45A International Standards to obtain a more comprehensive understanding of the overall structure of the series and its relationship with other standards bodies and standards.

2 Normative references

~~The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60515, *Nuclear power plants – Instrumentation important to safety – Radiation detectors – Characteristics and test methods*~~

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

~~IEC 60737, *Nuclear power plants – Instrumentation important to safety – Temperature sensors (in-core and primary coolant circuit) – Characteristics and test methods*~~

~~IEC 60772, *Nuclear power plants – Instrumentation systems important to safety – Electrical penetration assemblies in containment structures*~~

~~IEC 60880, *Nuclear power plants – Instrumentation and control systems important to safety Software aspects for computer-based systems performing category A functions*~~

~~IEC 60964, *Nuclear power plants – Control rooms – Design*~~

~~IEC 60965, *Nuclear power plants – Control rooms – Supplementary control room for reactor shutdown without access to the main control room*~~

~~IEC 60987, *Nuclear power plants – Instrumentation and control important to safety – Hardware requirements*~~

~~IEC 60988, *Nuclear power plants – Instrumentation important to safety – Acoustic monitoring systems for detection of loose parts: characteristics, design criteria and operational procedures*~~

~~IEC 61031, *Nuclear facilities – Instrumentation and control systems – Design, location and application criteria for installed area gamma radiation dose rate monitoring equipment for use during normal operation and anticipated operational occurrences*~~

~~IEC 61225, *Nuclear power plants – Instrumentation, control and electrical power systems – Requirements for static uninterruptible DC and AC power supply systems*~~

~~IEC 61226, *Nuclear power plants – Instrumentation, control and electrical power systems important to safety – Categorization of functions and classification of systems*~~

~~IEC 61250, *Nuclear reactors – Instrumentation and control systems important for safety – Detection of leakage in coolant systems*~~

~~IEC 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*~~

~~IEC 61508-2, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*~~

~~IEC 61508-3, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements*~~

~~IEC 61508-4, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 4: Definitions and abbreviations*~~

~~IEC 61508-7, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 7: Overview of techniques and measures*~~

~~IEC 61513, *Nuclear power plants – Instrumentation and control important to safety – General requirements for systems*~~

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

~~IEC 62138, *Nuclear power plants – Instrumentation and control systems important to safety – Software aspects for computer-based systems performing category B or C functions*~~

~~IEC 62340, *Nuclear power plants – Instrumentation and control systems important to safety – Requirements for coping with common cause failure (CCF)*~~

~~IEC 62342, *Nuclear power plants – Instrumentation and control systems important to safety – Management of ageing*~~

~~IEC 62465, *Nuclear power plants – Instrumentation and control important to safety – Management of ageing of electrical cabling systems*~~

~~IEC 62566, *Nuclear power plants – Instrumentation and control important to safety – Development of HDL-programmed integrated circuits for systems performing category A functions*~~

~~IEC 62645, *Nuclear power plants – Instrumentation, control and electrical power systems – Cybersecurity requirements*~~

~~IEC 62671, *Nuclear power plants – Instrumentation and control important to safety – Selection and use of industrial digital devices of limited functionality*~~

~~IEC 62705, *Nuclear power plants – Instrumentation and control important to safety – Radiation monitoring systems (RMS): Characteristics and lifecycle*~~

~~IEC 62808, *Nuclear power plants – Instrumentation and control systems important to safety – Design and qualification of isolation devices*~~

~~IEC 62855, *Nuclear power plants – Electrical power systems – Electrical power systems analysis*~~

~~IEC 62859, *Nuclear power plants – Instrumentation and control systems – Requirements for coordinating safety and cybersecurity*~~

~~IEC 63046, *Nuclear power plants – Electrical power system – General requirements*~~

~~IEC 63272, *Nuclear facilities – Electrical power systems – AC interruptible power supply systems* (in preparation)~~

~~IEC 63298, *Nuclear power plants – Electrical power systems – Coordination and interaction with electric grid* (in preparation)~~

~~IEC 63351, *Nuclear facilities – Human Factors Engineering – Application to the design of Human Machine Interfaces* (in preparation)~~

~~IEC/IEEE 60780-323, *Nuclear facilities – Electrical equipment important to safety – Qualification*~~

~~IEC/IEEE 60980-344, *Nuclear facilities – Equipment important to safety – Seismic qualification*~~

~~IAEA Safety Glossary, 2018 Edition, IAEA, Vienna, 2019~~

~~IAEA Nuclear Security Series Glossary, Version 1.3, November 2015~~

There are no normative references in this document.