

Nuclear power plants — Instrumentation and control systems important to safety — Requirements for electrical supplies

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National foreword

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INTERNATIONAL STANDARD

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**Nuclear power plants –
Instrumentation and control systems
important to safety –
Requirements for electrical supplies**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS –
INSTRUMENTATION AND CONTROL SYSTEMS
IMPORTANT TO SAFETY –
REQUIREMENTS FOR ELECTRICAL SUPPLIES****FOREWORD**

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International Standard IEC 61225 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 1993. This edition constitutes a technical revision.

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

- a) general update of all the references in Clause 2 and throughout the text of this standard;
- b) addition of references to IEC 62138, IEC 61513, and IEC 60880;

- c) addition of software programme design, categorization, verification, and validation requirements;
- d) addition of the recommendation to avoid parallel connection of batteries from more than one division;
- e) addition of the requirement that, when batteries are connected in parallel under abnormal operating conditions, they shall be properly protected with isolation devices to avoid any failure that may impair more than one division;
- f) editorial changes throughout the standard to improve comprehension and clarity;
- g) correction of minor errors in Figures 1, 4, and 5;
- h) addition of more typical performance characteristics to the examples in Annex A for reference purposes, adherence to these values being at the discretion of the users.

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

FDIS	Report on voting
45A/595/FDIS	45A/602/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.

0 Introduction

0.1 Technical background, main issues and organization of the standard

The 1993 issue of IEC 61225 was developed for specifying the requirements relevant to the design of electrical supplies of nuclear power plants. Considering the experience gathered worldwide on this subject, in 2003 the working group A2 recommended a revision to this standard so that this revision, IEC 61225 Ed. 2 (2005), be consistently integrated into the SC 45A standard series.

This standard is applicable to the design of electrical supplies of new nuclear power plants, whose design work is initiated after the publication of this standard. It also serves as a reference for upgrading and modernizing existing nuclear power plants.

0.2 Situation of the current standard in the structure of the SC 45A standard series

IEC 61225 is the third-level document specifically tackling the particular topic of requirements for electrical supplies.

For more details on the structure of the SC 45A standard series, see Clause 0.4.

0.3 Recommendations and limitations regarding the application of this standard

This standard is to be applied in conjunction with IEC 61513, IEC 61226, IEC 60709, IEC 60880 and IEC 62138.

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

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

IEC 61513 refers directly to other 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, SC 45A standards not directly referenced by IEC 61513 are standards related to specific equipment, technical methods or 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 SC 45A standard series corresponds to the technical reports which are not normative.

IEC 61513 has adopted a presentation format similar to that of 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 facilitates 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 for topics related to quality assurance.

The SC 45A standards series consistently implements and details the principles and basic safety aspects provided in the IAEA Code on the safety of nuclear power plants and in the IAEA safety series, in particular NS-R-1 and the Safety Guide NS-G-1.3. The terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL SYSTEMS IMPORTANT TO SAFETY – REQUIREMENTS FOR ELECTRICAL SUPPLIES

1 Scope

This International Standard specifies the performance and the functional characteristics of the electrical supply systems required for the instrumentation and control (I&C) systems important to safety of a nuclear power plant. Guidance is also given on the possible use of these supplies for other I&C systems.

These supplies should be fed from primary sources of suitable redundancy and reliability, so that the safety and functional objectives of the I&C system can be adequately achieved.

This standard defines the methods of application of IAEA Safety Guide NS-G-1.3.

The specific design requirements for the components of the I&C power supply system are covered by IEC standards and standards listed in the references and are otherwise outside the scope of this standard.

The scope of the I&C power supply system covered by this standard does not apply to supplies to certain equipment within an I&C system, which may need specific and special quality or reliability of power supplies, such as closer tolerances of frequency or voltage or of interruption time for loss of supply shorter than the period required by the normal tolerances of IEC standards relevant to power plants.

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 60038:2002, *IEC standard voltages*

IEC 60146-2:1999, *Semiconductor converters – Part 2: Self-commutated semiconductor converters including direct d.c. converters*

IEC 60686:1980, *Stabilized power supplies, a.c. output*

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

IEC 60780:1998, *Nuclear power plants – Electrical equipment of the safety system – Qualification*

IEC 60880, *Software for computers in the safety of nuclear power plants*

IEC 60980:1989, *Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations*

IEC 61000-4, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques*

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

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

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

IAEA Safety Guide NS-G-1.3: *Instrumentation and control systems important to safety in nuclear power plants*

3 Definitions

For the purposes of this document, the following definitions apply. Other terms not defined below are defined in IAEA Safety Guide NS-G-1.3.

3.1

item important to safety

item that is part of a safety group and/or whose malfunction or failure could lead to radiation exposure of the site personnel or members of the public

[Derived from IAEA Safety Guide NS-G-1.3]

3.2

safety system

system important to safety, provided to ensure the safe shutdown of the reactor or residual heat removal from the core, or to limit the consequences of anticipated operational occurrences and design basis accidents

[IAEA Safety Guide NS-G-1.3]

3.3

safety-related I&C system

I&C system important to safety which is not part of a safety system

[IAEA Safety Guide NS-G-1.3]

3.4

safety system support features

collection of equipment that provides services such as cooling, lubrication and energy supply required by the protection system and the safety actuation systems

[IAEA Safety Guide NS-G-1.3]