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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Nuclear power plants – Control rooms – Application of visual display units (VDUs)

Centrales nucléaires de puissance – Salles de commande – Utilisation des unités de visualisation

IEC 61772:2009

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

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CONTENTS

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NUCLEAR POWER PLANTS – CONTROL ROOMS – APPLICATION OF VISUAL DISPLAY UNITS (VDUs)

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 61772 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 1995 and constitutes a technical revision.

The main technical changes with respect to the previous edition are as follows:

– Expand the previous text to cover the use of Large Screen Displays (LSDs), to provide improved recommendations on the use of colour, and to improve the coverage of back-fit or upgrade applications.
– Provide references to relevant normative standards.
– Harmonise terminology according to SC 45A guidance.
– Cover experience of VDU systems design and use.
– Present examples of good practice, including methods of access to displays of current interest.

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

FDIS	Report on voting
45A/728/FDIS	45A/740/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 organisation of this Standard

During the work to create a standard for the design of control rooms of nuclear power plants, it became obvious that the volume of such a standard would become very large. Therefore the standard was split into one main standard (IEC 60964 with an annex) and some supplementary standards. This standard is one of the supplementary standards.

It is intended that the Standard be used by operators of NPPs (utilities), designers, systems evaluators and by licensors.

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

IEC 61772 is the third level IEC SC 45A document tackling the generic issue of use of VDUs in NPPs Main Control Room.

IEC 61772 is to be read in conjunction with IEC 60964 which is the appropriate IEC SC 45A document which provides general requirements concerning the design of Nuclear Power Plants main control rooms. IEC 61227, IEC 61771, IEC 62241 and IEC 61839 should also be read with this standard.

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 this Standard

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

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 – APPLICATION OF VISUAL DISPLAY UNITS (VDUs)

1 Scope and object

This International Standard supplements IEC 60964. It presents design requirements for the application of VDUs in main control rooms of nuclear power plants.

For the main control room of a nuclear power plant, IEC 60964 includes general requirements for layout, user needs and verification and validation methods and these aspects are not repeated in this standard. IEC 61227, IEC 61771, IEC 62241 and IEC 61839 should also be read with this standard.

This standard assists the designer in specifying VDU applications (including displays on individual workstations and larger displays for group-working or distant viewing) together with or instead of conventional (panel) displays by:

– stating principles to take advantage of VDU capability;
– giving examples of good practice and guiding the designer to avoid deficiencies of design.

This standard contains:

a) requirements for information needs:
   – according to information goals e.g. operation, maintenance, protection,
   – allowing for the necessary amount of space, e.g. location, arrangement,
   – using a hierarchy and/or relationships,
   – avoiding unnecessary information,
   – ensuring that information is relevant,
b) requirements for good presentation such as:
   – clear and flicker-free display with suitable updating frequency,
   – enough display space and an optimal arrangement,
   – adequate format and symbol sizes,
   – pictorial, symbolic display in addition to alpha-numeric capacity,
   – standardized, common symbols and names,
   – arrangements oriented to human factor needs, e.g. population stereotypes,
   – use of grouping and coding methods,
   – use of consistent flow directions,
   – appropriate abstraction levels according to the needs of the different presumed users,
c) methods for easy and quick access to the specific information of current interest:
   – by simple selection of single formats or format-sets according to information goals,
   – by using different kinds of menus (icons of neighbouring information) or other access techniques (last display, selection on screen, etc.) by soft keys on or off the VDU screens or cursors,
   – by using programmed presentation (triggered by any binary signal, such as an alarm),
d) design criteria to obtain appropriate reliability of all functions necessary to achieve the specified information goals.

This standard is intended for application to the design of new main control rooms in nuclear power plants designed to IEC 60964 and where this is initiated after the publication of this standard. If it is to be applied to existing control rooms or control areas designs, care should be taken as some assumptions made (such as automation level) may not apply.

Where a deviation from this standard is necessary in a back-fitting application the reasons should be documented.

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 60964:2009, *Nuclear power plants – Control rooms - Design*

IEC 61226:2005, *Nuclear power plants – Instrumentation and control systems important to safety – Classification of instrumentation and control functions*

IEC 61227:2008, *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 61839:2000, *Nuclear power plants – Design of control rooms – Functional analysis and assignment*

IEC 62241:2004, *Nuclear power plants – Main control room – Alarm functions and presentation*

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

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

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in IEC 60964 apply as well as the following:

3.1
associated information
additional, or helpful information complementary to the main display content of a single format or a format-set. The existence of this additional capability of display may be indicated by certain icons (navigation targets, as integrated parts of the displayed information) and their selection will lead to the display of single formats or pictorial menus or, where suitable, alpha-numeric menus

3.2
Large Screen Display (LSD)
any form of larger display intended for group viewing, shared tasks, monitoring at a distance, etc.