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INTERNATIONAL STANDARD

Nuclear power plants - Instrumentation and control systems important to safety - Detection of leakage in coolant systems

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Nuclear power plants - Instrumentation and control systems important to safety - Detection of leakage in coolant systems

FOREWORD

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IEC 61250 has been prepared by subcommittee 45A: Instrumentation, control and electrical power systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

This second edition cancels and replaces the first edition published in 1994. This edition constitutes a technical revision.

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

a) to take into account new advances in leakage detection technology, and to renew general design requirements for leakage detection systems;
b) to align the document with the new revisions of reference standards and documents;

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The text of this International Standard is based on the following documents:

Draft	Report on voting
45A/1633/CDV	45A/1649/RVC

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

The language used for the development of this International Standard 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

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INTRODUCTION

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

This document specifically focuses on detection of leakage from the reactor coolant and associated systems (RCAS). Detection of leakage from the RCAS into the reactor containment of a nuclear power plant is required, in support of the concepts of "leak before break" or “break preclusion”, and early detection of developing deviation from normal operation. Applicable international recommendations for RCAS leakage detection are provided in IAEA Safety Standards Series No. SSG-56.

Leakage detection from pressurized systems is necessary because small leaks can develop into larger leaks or ruptures.

During reactor operation:

– detection of leakage from non-isolable portions of cooling systems is important to allow early identification of minor flaws before they can develop into a pipe break or component rupture in pressurized fluid circuits that could result in a loss of coolant; and

– early detection of leakage from isolable portions permits actions to limit the consequences of leakage on heat removal from nuclear fuel.

Leakage detection systems may be chosen and designed based on the consequences of leakage for safety of the plant. Consequences depend on:

– the time to detect leakage and to take countermeasures (automatic or human actions);

– the possibility of isolating the fluid portion and the potential propagation of a pipe break, regarding pressure within the fluid circuit;

– the consequences of a pipe break on reactivity, heat removal from the core and the load on circuits and structure ensuring confinement; and

– the impact on the availability of systems important to safety.

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The leakage detection system serves to facilitate the detection of small leaks and to meet physiological requirements for personnel within the containment whilst avoiding spurious leakage alarms.

It is intended that this document be used by operators of NPPs (utilities), systems evaluators and by licensors.

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

IEC 61250 is the third level IEC SC 45A document covering the specific issue of leakage detection in reactor coolant systems.

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 document

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

To ensure that the document will continue to be relevant in future years, the emphasis has been placed on issues of principle, rather than specific technologies.

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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 IEC SC 45A standard series comprises a consistent set of documents organised in a hierarchy of four levels. The top-level documents of the IEC SC 45A standard series are IEC 61513 and IEC 63046, covering respectively general requirements for instrumentation and control (I&C) systems and general requirements for electrical power systems of NPPs. 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 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).

IEC 61513 and IEC 63046 refer directly to second-level IEC SC 45A standards for general requirements for specific topics, such as categorization of functions and classification of systems (IEC 61226), qualification (IEC/IEEE 60780-323), separation (IEC 60709), control room design (IEC 60964), electromagnetic compatibility (IEC 62003), human factors engineering (IEC 63351), programmable digital item and hardware aspects for programmable digital systems (in particular IEC/IEEE 60880 and IEC 62566) and management of ageing (IEC 62342). For cybersecurity, IEC 62645 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 a third level, standards relate 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 of the IEC SC 45A standard series comprises Technical Reports, which are not normative.

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The IEC SC 45A standards series consistently implement the safety and cybersecurity principles and terminology within relevant IAEA safety standards and relevant documents of the IAEA nuclear security series (NSS). In particular, these include the IAEA requirements SSR-2/1 (Rev.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, the implementing guide IAEA Nuclear Security Series No. 42-G and technical guidance IAEA Nuclear Security Series No. 17-T for computer security at nuclear facilities.

NOTE IEC TR 63400 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.

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