

Nuclear power plants — Instrumentation and control important to safety — Resistance temperature detectors

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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INTRODUCTION

a) Technical background, main issues and organisation of the standard

This standard describes the requirements for the design, material selection, procurement, construction, and testing of resistance temperature detectors (RTDs) being used in nuclear power plants (NPPs). These RTDs may be used in both the nuclear safety I&C systems and/or in the non-safety-related instrumentation systems.

When the project was proposed in October 2002 during the SC 45A meeting held in Beijing, China, there was no other known IEC standard currently available on this subject.

b) Situation of the current standard in the structure of the SC 45A standard series

IEC 62397 is not directly referenced by IEC 61513 and is the third-level SC 45A document tackling the issue of RTDs.

For more details on the structure of the SC 45A series of standards, see item d) of this introduction.

c) Recommendations and limitations regarding the application of this standard

There is no particular recommendation or limitation regarding the application of this standard.

d) Description of the structure of the 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 45A standard series corresponds to 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 50-C/SG-Q) for topics related to quality assurance (QA).

The IEC SC 45A series of standards 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 NPPs, and safety guide NS-G-1.3 dealing with instrumentation and control systems important to safety in NPPs. The terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL IMPORTANT TO SAFETY – RESISTANCE TEMPERATURE DETECTORS

1 Scope

This International Standard describes the requirements for resistance temperature detectors (RTDs) suitable for nuclear power plant (NPP) services. The requirements of RTDs include design, materials, manufacturing, testing, calibration, procurement, and inspection. In nuclear application, both “direct-immersion” and “thermowell-mounted” RTD are commonly used; however, this standard does not exclude any other design of RTD which may be required for certain special applications in various types of reactors.

RTDs can be supplied in different internal constructions, which depend on the manufacture, qualifications, and applications. For RTD being used in an NPP, the design and structure of the RTD should consider the environmental conditions in which the detector is being used under normal operating and under design basis accident conditions, as well as the qualification tests specified by the user¹. The use of a flexible mineral-insulated (MI) cable between the RTD and the connector is commonly adopted, and the user may also adopt any other construction. A variation of this design may include a rigid exterior sheath over the MI cable between the RTD and the connector, these being welded to each other.

The scope of this standard does not cover the design, material selection, and construction of the thermowell, the guide tube, the extension cable, and the temperature transmitter or bridge which may be associated with the RTD.

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

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

IEC 61224, *Nuclear reactors – Response time in resistance temperature detectors (RTD) – In situ measurements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

¹ The user corresponds to the party or the company that uses the RTD in a NPP for measuring the temperature in a safety or a non-safety system. The term user may also refer to the purchaser or the buyer, or the operator of the RTD.