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INTERNATIONAL STANDARD

Nuclear power plants – Instrumentation and control important to safety – Electrical equipment condition monitoring methods – Part 1: General

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INTERNATIONAL STANDARD

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL IMPORTANT TO SAFETY – ELECTRICAL EQUIPMENT CONDITION MONITORING METHODS –

Part 1: General

FOREWORD

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IEC/IEEE 62582-1 was prepared by subcommittee 45A: Instrumentation and control of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation, in cooperation with Nuclear Power Engineering Committee of the IEEE Power & Energy Society[1], under the IEC/IEEE Dual Logo Agreement between IEC and IEEE. It is an International Standard.

This document is published as an IEC/IEEE Dual Logo standard.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

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

a) Integration of experience from the work with IAEA-TECDOC-1825:2017 “Benchmark analysis for condition monitoring test techniques of low voltage cables in nuclear power plants. Final results of a Coordinated Research Project”.
b) Referral to IEC/IEEE 60780-323 instead of IEC 60780 and IEEE 323.

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

Draft	Report on voting
45A/1510/CDV	45A/1537/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 the rules given in the ISO/IEC Directives, Part 2, 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/.

A list of all parts of IEC/IEEE 62582 series, under the general title *Nuclear power plants – Instrumentation and control important to safety – Electrical equipment condition monitoring methods*, can be found on the IEC website.

The IEC Technical Committee and IEEE Technical Committee have 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.

[1] A list of IEEE participants can be found at the following URL: http://standards.ieee.org/downloads/62582-1/62582-1-2011/62582-1-2011_wg-participants.pdf.

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INTRODUCTION

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

This part of this IEC/IEEE 62582 series focuses on methods for condition monitoring for management of ageing of electrical equipment installed in nuclear power plants and for application of the concept of qualified condition.

IEC/IEEE 6258-1 is the first part of the IEC/IEEE 62582 series of standards, containing background and guidelines for the application of methods for condition monitoring of electrical equipment important to safety of nuclear power plants. The detailed descriptions of the methods are given in the other parts, one part for each method. This document also includes some elements which are common to all methods.

IEC/IEEE 62582 series is issued with a joint logo which makes it applicable to the management of ageing of electrical equipment qualified to IEEE as well as IEC Standards.

Condition monitoring is a developing field and more methods will be added to the IEC/IEEE 62582 series when they are considered widely applied and a good reproducibility of the condition monitoring method can be demonstrated.

IEC/IEEE 60780-323 defined condition-based qualification which is an adjunct to type testing. The qualified condition is established by condition indicator(s) prior to the start of accident conditions for which the equipment was demonstrated to meet the design requirements for the specified service conditions. IEC/IEEE 60780-323 defined condition indicator.

Significant research has been performed on condition monitoring techniques and the use of these techniques in equipment qualification as noted in NUREG/CR-6704, Vol. 2 (BNL -NUREG-52610) [1],[2] JNES-SS-0903, 2009 [2] and IAEA-TECDOC-1825:2017 [3].

It is intended that this IEC/IEEE document be used by operators of nuclear power plants, systems evaluators and by licensors.

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

IEC/IEEE 62582-1 is the third level IEC SC 45A document tackling the issue of application of condition monitoring in equipment qualification and management of ageing of electrical I&C equipment in nuclear power plants.

IEC/IEEE 62582-1 is to be read in association with IEC/IEEE 60780-323, which provides general requirements for qualification of I&C systems and equipment that are used to perform functions important to safety in NPPs and nuclear facilities.

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.

This document discusses the general measurement technique for current condition monitoring methods and is not meant to cover any specific technologies.

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[2] Numbers in square brackets refer to the Bibliography.

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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 hierarchy of four levels. The top-level documents of the IEC SC 45A standard series are IEC 61513 and IEC 63046.

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 and hardware aspects for programmable digital systems, coordination of safety and security 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, which make reference to second-level documents for general requirements, 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.

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 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).

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