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**Nuclear power plants – Instrumentation and control important to safety –
Electrical equipment condition monitoring methods –
Part 4: Oxidation induction techniques**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**NUCLEAR POWER PLANTS – INSTRUMENTATION AND CONTROL
IMPORTANT TO SAFETY – ELECTRICAL EQUIPMENT
CONDITION MONITORING METHODS –****Part 4: Oxidation induction techniques**

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 document(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.

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC/IEEE 62582-4:2011. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC/IEEE 62582-4 was prepared by subcommittee 45A: Instrumentation, control and electrical power systems of nuclear facilities, of IEC technical committee 45: Nuclear instrumentation, in cooperation with Nuclear Power Engineering Committee of the IEEE, 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) Consideration of publication of IEC/IEEE 60780-323;
- b) An example added in Annex B and update;
- c) Annex C added.

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

Draft	Report on voting
45A/1435/FDIS	45A/1445/RVD

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/standardsdev/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

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INTRODUCTION

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

This part of IEC/IEEE 62582 specifically focuses on oxidation induction methods for condition monitoring for the management of ageing of electrical equipment installed in nuclear power plants. The methods are primarily suited to samples taken from materials that are polyolefin-based, but they can also be used for some materials based on ethylene-propylene polymers and for some ethylene vinyl acetate materials.

This part 4 of IEC/IEEE 62582 is the fourth part of the IEC/IEEE 62582 series. ~~It contains detailed descriptions of condition monitoring based on oxidation induction measurements.~~

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.

~~Historically, IEEE Std 323-2003 introduced~~ IEC/IEEE 60780-323 includes the concept and role that condition based qualification could be used in equipment qualification as an adjunct to qualified life. In equipment qualification, the condition of the equipment for which acceptable performance was demonstrated is the qualified condition. The qualified condition is the condition of equipment, prior to the start of a design basis event, for which the equipment was demonstrated to meet the design requirements for the specified service conditions.

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) JNES-SS-0903, 2009 and IAEA-TECDOC-1825:2017.

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

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

IEC/IEEE 62582-4 is the third level IEC SC 45A document tackling the specific issue of application and performance of oxidation induction measurements in the management of ageing of electrical instrument and control equipment in nuclear power plants.

IEC/IEEE 62582-4 is to be read in association with IEC/IEEE 62582-1, which provides background and guidelines for the application of methods for condition monitoring of electrical equipment important to safety of nuclear power plants.

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 document establishes no additional functional requirements for safety systems.

d) Description of the structure of the IEC SC45A 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 categorisation 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 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.~~

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 NSS17 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).

At level 2, regarding nuclear security, IEC 62645 is the entry document for the IEC/SC 45A security standards. It 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 level 2, IEC 60964 is the entry document for the IEC/SC 45A control rooms standards, IEC 63351 is the entry document for the human factors engineering standards and IEC 62342 is the entry document for the ageing management standards.

NOTE 1 It is assumed that for the design of I&C systems in NPPs that implement conventional safety functions (e.g. to address worker safety, asset protection, chemical hazards, process energy hazards) international or national standards would be applied.

NOTE 2 IEC TR 64000 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.

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

Part 4: Oxidation induction techniques

1 ~~Scope and object~~

This part of IEC/IEEE 62582 specifies methods for condition monitoring of organic and polymeric materials in instrumentation and control systems using oxidation induction techniques in the detail necessary to produce accurate and reproducible measurements. It includes the requirements for sample preparation, the measurement system and conditions, and the reporting of the measurement results.

The different parts of IEC/IEEE 62582 are measurement standards, primarily for use in the management of ageing in initial qualification and after installation. IEC/IEEE 62582-1 includes requirements for the application of the other parts of the IEC/IEEE 62582 series and some elements which are common to all methods. Information on the role of condition monitoring in the qualification of equipment important to safety is found in ~~IEEE Std 323~~ IEC/IEEE 60780-323.

2 Normative references

There are no normative references in this document.



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INTERNATIONAL STANDARD

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**Nuclear power plants – Instrumentation and control important to safety –
Electrical equipment condition monitoring methods –
Part 4: Oxidation induction techniques**

**Centrales nucléaires de puissance – Instrumentation et contrôle-commande
importants pour la sûreté – Méthodes de surveillance de l'état des matériels
électriques –
Partie 4: Techniques d'induction à l'oxydation**

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Part 4: Oxidation induction techniques

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 document(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.

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IEC/IEEE 62582-4 is to be read in association with IEC/IEEE 62582-1, which provides background and guidelines for the application of methods for condition monitoring of electrical equipment important to safety of nuclear power plants.

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 document establishes no additional functional requirements for safety systems.

d) Description of the structure of the IEC SC45A 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 NSS17 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).

At level 2, regarding nuclear security, IEC 62645 is the entry document for the IEC/SC 45A security standards. It 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 level 2, IEC 60964 is the entry document for the IEC/SC 45A control rooms standards, IEC 63351 is the entry document for the human factors engineering standards and IEC 62342 is the entry document for the ageing management standards.

NOTE 1 It is assumed that for the design of I&C systems in NPPs that implement conventional safety functions (e.g. to address worker safety, asset protection, chemical hazards, process energy hazards) international or national standards would be applied.

NOTE 2 IEC TR 64000 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.

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

Part 4: Oxidation induction techniques

1 Scope

This part of IEC/IEEE 62582 specifies methods for condition monitoring of organic and polymeric materials in instrumentation and control systems using oxidation induction techniques in the detail necessary to produce accurate and reproducible measurements. It includes the requirements for sample preparation, the measurement system and conditions, and the reporting of the measurement results.

The different parts of IEC/IEEE 62582 are measurement standards, primarily for use in the management of ageing in initial qualification and after installation. IEC/IEEE 62582-1 includes requirements for the application of the other parts of the IEC/IEEE 62582 series and some elements which are common to all methods. Information on the role of condition monitoring in the qualification of equipment important to safety is found in IEC/IEEE 60780-323.

2 Normative references

There are no normative references in this document.

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

CENTRALES NUCLÉAIRES DE PUISSANCE – INSTRUMENTATION ET CONTRÔLE-COMMANDE IMPORTANTS POUR LA SÛRETÉ – MÉTHODES DE SURVEILLANCE DE L'ÉTAT DES MATÉRIELS ÉLECTRIQUES –

Partie 4: Techniques d'induction à l'oxydation

AVANT-PROPOS

- 1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux.

Les normes de l'IEEE sont élaborées par les Sociétés de l'IEEE, ainsi que par les Comités de coordination des normes du Conseil de normalisation de l'IEEE Standards Association (IEEE-SA). Ces normes sont l'aboutissement d'un consensus, soumis à l'approbation de l'Institut national américain de normalisation, qui rassemble des bénévoles représentant divers points de vue et intérêts. Les participants bénévoles ne sont pas nécessairement membres de l'IEEE et leur intervention n'est pas rétribuée. Si l'IEEE administre le déroulement de cette procédure et définit les règles destinées à favoriser l'équité du consensus, l'IEEE lui-même n'évalue pas, ne teste pas et ne vérifie pas l'exactitude de toute information contenue dans ses normes. L'utilisation de normes de l'IEEE est entièrement volontaire. *Les documents de l'IEEE sont disponibles à des fins d'utilisation, à condition d'être assortis d'avis importants et de clauses de non-responsabilité (voir <http://standards.ieee.org/ipr/disclaimers.html> pour de plus amples informations).*

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- 2) Les décisions officielles de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études. Une fois le consensus établi entre les Sociétés de l'IEEE et les Comités de coordination des normes, les décisions officielles de l'IEEE relatives aux questions techniques sont déterminées en fonction du vote exprimé par un groupe à la composition équilibrée, composé de parties intéressées qui manifestent leur intérêt pour la révision des normes proposées. L'approbation finale de la norme de l'IEEE est soumise au Conseil de normalisation de l'IEEE Standards Association (IEEE-SA).
- 3) Les Publications IEC/IEEE se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC/Sociétés de l'IEEE. Tous les efforts raisonnables sont entrepris afin de s'assurer de l'exactitude du contenu technique des Publications IEC/IEEE; l'IEC ou l'IEEE ne peuvent pas être tenus responsables de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
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L'IEC/IEEE 62582-4 a été établie par le sous-comité 45A: Systèmes d'instrumentation, de contrôle-commande et d'alimentation électrique des installations nucléaires, du comité d'études 45 de l'IEC: Instrumentation nucléaire, en coopération avec le "Nuclear Power Engineering Committee" de l'IEEE, selon l'accord double logo IEC/IEEE. Il s'agit d'une Norme internationale.

Le présent document est publié en tant que norme IEC/IEEE double logo.

Cette deuxième édition annule et remplace la première édition, parue en 2011. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) Prise en considération de la publication de l'IEC/IEEE 60780-323;
- b) Ajout d'un exemple dans l'Annexe B et mise à jour;
- c) Ajout de l'Annexe C.

Le texte de cette Norme internationale est issu des documents suivants de l'IEC:

Projet	Rapport de vote
45A/1435/FDIS	45A/1445/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La version française de cette norme n'a pas été soumise au vote.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé conformément aux règles données dans les Directives ISO/IEC, Partie 2, disponibles à l'adresse www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Une liste de toutes les parties de la série IEC/IEEE 62582, publiées sous le titre général *Centrales nucléaires de puissance – Instrumentation et contrôle-commande importants pour la sûreté – Méthodes de surveillance de l'état des matériels électriques*, se trouve sur le site web de l'IEC.

Le comité d'études de l'IEC et le comité d'études de l'IEEE ont décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

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INTRODUCTION

a) Contexte technique, questions importantes et structure de la présente norme

La présente partie de l'IEC/IEEE 62582 s'intéresse plus particulièrement aux méthodes d'induction à l'oxydation utilisées dans le cadre de la surveillance de l'état pour la gestion du vieillissement des matériels électriques installés dans les centrales nucléaires de puissance. Ces méthodes sont principalement adaptées pour les échantillons prélevés sur des matériaux de la famille des polyoléfinés, mais elles peuvent aussi être utilisées pour certains matériaux de la famille des polymères éthylène-propylène et pour certains matériaux acétate de vinyle éthylène.

La présente partie (4) de l'IEC/IEEE 62582 est la quatrième partie de la série IEC/IEEE 62582.

La série IEC/IEEE 62582 est publiée en double logo, ce qui la rend applicable pour la gestion du vieillissement des matériels électriques qualifiés tant dans le cadre des normes IEEE que dans celui des normes IEC.

La norme IEC/IEEE 60780-323 couvre le concept et le rôle complémentaire que peut jouer la qualification reposant sur l'état du matériel dans le cadre de la qualification des matériels au niveau de la durée de vie qualifiée. Dans le cadre de la qualification du matériel, l'état du matériel pour lequel des performances acceptables ont été prouvées correspond à l'état qualifié. L'état qualifié est l'état du matériel qui prévaut au début d'un événement de dimensionnement, pour lequel il a été démontré que le matériel satisfaisait aux exigences de conception pour les conditions de service spécifiées.

Des recherches importantes ont été réalisées sur les techniques de surveillance de l'état des matériels et l'utilisation de ces techniques dans le cadre de la qualification desdits matériels, comme cela est indiqué dans les documents NUREG/CR-6704, Vol. 2 (BNL-NUREG-52610), JNES-SS-0903, 2009 et AIEA TECDOC-1825:2017.

L'objectif du présent document est d'être utilisé par les laboratoires d'essai, les exploitants de centrales nucléaires de puissance, les évaluateurs de systèmes et les régulateurs.

b) Position de la présente norme dans la structure de la série de normes du SC 45A de l'IEC

L'IEC/IEEE 62582-4 est le document du SC 45A de l'IEC de troisième niveau qui traite du problème particulier de l'application et des performances des mesurages réalisés par induction à l'oxydation dans le cadre de la gestion du vieillissement des matériels électriques et des matériels de commande utilisés dans les centrales nucléaires de puissance.

La norme IEC/IEEE 62582-4 doit être lue avec l'IEC/IEEE 62582-1, qui fournit les éléments de contexte et des lignes directrices pour l'application des méthodes de surveillance de l'état des matériels électriques importants pour la sûreté des centrales nucléaires de puissance.

Pour de plus amples informations sur la collection de normes du SC 45A de l'IEC, voir l'article d) de la présente introduction.

c) Recommandations et limites relatives à l'application de la présente norme

Il est important de noter que le présent document n'établit pas d'exigence fonctionnelle supplémentaire pour les systèmes de sûreté.

d) Description de la structure de la série de normes du SC 45A de l'IEC et relations avec d'autres documents de l'IEC, et d'autres organisations (AIEA, ISO)

La série de normes du SC 45A de l'IEC comprend une hiérarchie de quatre niveaux. Les documents de niveau supérieur de la série de normes du SC 45A de l'IEC sont les normes IEC 61513 et IEC 63046.

L'IEC 61513 fournit des exigences générales relatives aux systèmes et matériels d'instrumentation et de contrôle-commande (I&C) utilisés pour accomplir les fonctions importantes pour la sûreté des centrales nucléaires de puissance (NPPs – *Nuclear power plants*). L'IEC 63046 fournit des exigences générales relatives aux systèmes d'alimentation électrique des NPP; elle couvre les systèmes d'alimentation électrique jusqu'à et y compris les alimentations des systèmes d'instrumentation et de contrôle-commande.

L'IEC 61513 et l'IEC 63046 doivent être étudiées ensemble et au même niveau. L'IEC 61513 et l'IEC 63046 structurent la série de normes du SC 45A de l'IEC et forment un cadre complet qui établit les exigences générales relatives aux systèmes et matériels d'instrumentation et de contrôle-commande, ainsi qu'aux systèmes d'alimentation électriques des centrales nucléaires de puissance.

L'IEC 61513 et l'IEC 63046 font directement référence aux autres normes du SC 45A de l'IEC pour les exigences générales relatives à des sujets particuliers, tels que la catégorisation des fonctions et le classement des systèmes, la qualification, la séparation des systèmes, la protection contre la défaillance de cause commune, la conception des salles de commande, la compatibilité électromagnétique, l'ergonomie, la cybersécurité, les aspects logiciels et matériels relatifs aux systèmes numériques programmables, la coordination des exigences de sûreté et de sécurité et la gestion du vieillissement. Il convient de considérer les normes référencées directement à ce deuxième niveau, ainsi que l'IEC 61513 et l'IEC 63046, comme un ensemble cohérent de documents.

Au troisième niveau, les normes du SC 45A de l'IEC, qui ne sont pas référencées directement par l'IEC 61513 ou l'IEC 63046, sont liées à des exigences spécifiques relatives à des matériels particuliers, ainsi qu'à des méthodes techniques ou à des activités spécifiques. Généralement, ces documents, qui font référence aux documents de deuxième niveau pour les exigences générales, peuvent être utilisés seuls.

Un quatrième niveau qui est une extension de la série de normes du SC 45A de l'IEC correspond aux rapports techniques qui ne sont pas des documents normatifs.

La série de normes du SC 45A de l'IEC met en œuvre et détaille de manière cohérente les principes de sûreté et de sécurité, ainsi que les aspects fondamentaux fournis dans les normes de sûreté pertinentes de l'AIEA et dans les documents pertinents de la série sur la sécurité nucléaire (NSS – *nuclear security series*) de l'AIEA. Cette disposition inclut plus particulièrement les exigences SSR-2/1 de l'AIEA qui établissent les exigences de sûreté relatives à la conception des centrales nucléaires de puissance, le guide de sûreté SSG-30 de l'AIEA qui traite du classement de sûreté des structures, systèmes et composants des centrales nucléaires de puissance, le guide de sûreté SSG-39 de l'AIEA qui traite de la conception de l'instrumentation et du contrôle-commande des centrales nucléaires de puissance, le guide de sûreté SSG-34 de l'AIEA qui traite de la conception des systèmes d'alimentation électrique des centrales nucléaires de puissance, le guide de sûreté SSG-51 de l'AIEA qui traite de l'ergonomie dans la conception des centrales nucléaires de puissance et le guide de mise en œuvre NSS17 relatif à la sécurité informatique des installations nucléaires. La terminologie et les définitions utilisées pour la sûreté et la sécurité dans les normes produites par le SC 45A sont conformes à celles utilisées par l'AIEA.

L'IEC 61513 et l'IEC 63046 ont adopté une présentation similaire à celle de la publication fondamentale de sécurité IEC 61508, avec un cadre de cycle de vie global et un cadre de cycle de vie du système. En ce qui concerne la sûreté nucléaire, l'IEC 61513 et l'IEC 63046 interprètent les exigences générales des normes IEC 61508-1, IEC 61508-2 et IEC 61508-4, pour le secteur des applications nucléaires. Dans ce cadre, l'IEC 60880, l'IEC 62138 et l'IEC 62566 correspondent à l'IEC 61508-3 pour le secteur des applications nucléaires.

L'IEC 61513 et l'IEC 63046 font référence à l'ISO 9001, ainsi qu'aux documents AIEA GSR partie 2, AIEA GS-G-3.1 et AIEA GS-G-3.5 pour les sujets liés à l'assurance qualité (AQ).

Au niveau 2, concernant la sécurité nucléaire, l'IEC 62645 constitue le document chapeau pour les normes de sécurité produites par le SC 45A de l'IEC. Cette norme s'appuie sur les principes de haut niveau et les principaux concepts valides des normes de sécurité génériques, notamment l'ISO/IEC 27001 et l'ISO/IEC 27002, qu'elle adapte et complète pour répondre au contexte nucléaire et les coordonne avec la série IEC 62443. Au niveau 2, l'IEC 60964 constitue le document chapeau pour les normes du SC 45A de l'IEC portant sur les salles de commande, l'IEC 63351 constitue le document chapeau pour les normes portant sur l'ergonomie et l'IEC 62342 constitue le document chapeau pour les normes portant sur la gestion du vieillissement.

NOTE 1 Par hypothèse, des normes nationales ou internationales sont appliquées pour la conception des systèmes d'instrumentation et de contrôle-commande dans les centrales nucléaires de puissance qui mettent en œuvre des fonctions de sûreté conventionnelles (par exemple, pour assurer la sécurité des travailleurs et la protection des biens, répondre aux dangers chimiques et aux dangers liés à l'énergie procédé).

NOTE 2 L'IEC TR 64000 fournit une description plus complète de la structure globale de la série de normes produites par le SC 45A de l'IEC et de sa relation avec d'autres organismes de normalisation et d'autres normes.

CENTRALES NUCLÉAIRES DE PUISSANCE – INSTRUMENTATION ET CONTRÔLE-COMMANDE IMPORTANTS POUR LA SÛRETÉ – MÉTHODES DE SURVEILLANCE DE L'ÉTAT DES MATÉRIELS ÉLECTRIQUES –

Partie 4: Techniques d'induction à l'oxydation

1 Domaine d'application

La présente partie de l'IEC/IEEE 62582 établit des méthodes de surveillance de l'état des matériaux organiques et polymères présents dans les systèmes d'instrumentation et de contrôle-commande, par l'utilisation des techniques d'induction à l'oxydation selon un processus détaillé nécessaire pour obtenir des mesurages reproductibles et exacts. La présente partie comprend les exigences relatives à la préparation d'échantillons, au système et aux conditions de mesure, ainsi qu'au compte-rendu des résultats de mesure.

Les différentes parties de l'IEC/IEEE 62582 sont des normes de mesure, principalement destinées à être utilisées pour la gestion du vieillissement dans le cadre de la qualification initiale et après installation. L'IEC/IEEE 62582-1 comprend des exigences pour l'application des autres parties de la série IEC/IEEE 62582 et certains éléments communs à toutes les méthodes. L'IEC/IEEE 60780-323 fournit des informations concernant le rôle de la surveillance de l'état dans la qualification des matériels importants pour la sûreté.

2 Références normatives

Le présent document ne contient aucune référence normative.