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BSI Standards Publication

Nuclear facilities – Equipment important to safety – Seismic qualification

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National foreword

This British Standard is the UK implementation of EN IEC/IEEE 60980-344:2021. It is identical to IEC/IEEE 60980-344:2020. It supersedes BS IEC/IEEE 60980-344:2020, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NCE/8, Instrumentation, Control & Electrical Systems of Nuclear Facilities.

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

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Amendments/corrigenda issued since publication

Date	Text affected
31 May 2021	This corrigendum renumbers BS IEC/IEEE 60980-344:2020 as BS EN IEC/IEEE 60980-344:2021

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EUROPÄISCHE NORM

April 2021

ICS 27.120.10; 27.120.20

English Version

**Nuclear facilities - Equipment important to safety - Seismic
qualification
(IEC/IEEE 60980-344:2020)**

Installations nucléaires - Equipements importants pour la
sûreté - Qualification sismique
(IEC/IEEE 60980-344:2020)

Kerntechnische Anlagen - Gerät mit sicherheitstechnischer
Bedeutung - Seismische Qualifizierung
(IEC/IEEE 60980-344:2020)

This European Standard was approved by CENELEC on 2021-04-19. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

The text of document 45A/1323/FDIS, future edition 1 of IEC/IEEE 60980-344, prepared by SC 45A "Instrumentation, control and electrical power systems of nuclear facilities" of IEC/TC 45 "Nuclear instrumentation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC/IEEE 60980-344:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2022-01-19 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2024-04-19 document have to be withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

As stated in the nuclear safety directive 2009/71/EURATOM, Chapter 1, Article 2, item 2, Member States are not prevented from taking more stringent safety measures in the subject-matter covered by the Directive, in compliance with Community law.

In a similar manner, this European standard does not prevent Member States from taking more stringent nuclear safety and/or security measures in the subject-matter covered by this standard.

Endorsement notice

The text of the International Standard IEC/IEEE 60980-344:2020 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068-3-3	NOTE	Harmonized as EN IEC 60068-3-3
IEC 60068-2-81	NOTE	Harmonized as EN 60068-2-81
IEC 60068-2-47	NOTE	Harmonized as EN 60068-2-47
IEC 60068-2-57	NOTE	Harmonized as EN 60068-2-57

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(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests Test Fc: Vibration (sinusoidal)	-EN 60068-2-6	-
IEC/IEEE 60780-323	-	Nuclear facilities - Electrical equipment important to safety - Qualification	EN 60780-323	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

NUCLEAR FACILITIES – EQUIPMENT IMPORTANT TO SAFETY – SEISMIC QUALIFICATION

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.

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- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
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International Standard IEC/IEEE 60980-344 has been 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.

It is published as an IEC/IEEE dual logo standard.

This new edition cancels and replaces the first edition of IEC 60980, published in 1989, and constitutes a technical revision. It also supersedes IEEE Std 344TM-2013.

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

FDIS	Report on voting
45A/1323/FDIS	45A/1334/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.

International standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this publication will remain unchanged until the stability 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.

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INTRODUCTION

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

This standard is applicable to electrical equipment important to safety and its interfaces that are necessary to perform a safety function, or whose failure could adversely affect the safety functions of other equipment.

Electrical equipment in nuclear facilities shall meet its safety function requirements throughout its installed life. This is accomplished by a thorough programme of quality assurance, design control, quality control, qualification, production, transportation, storage, installation, maintenance, periodic testing, and surveillance. This IEC/IEEE standard specifically focuses on seismic qualification. This standard shall be used in conjunction with IEC/IEEE 60780-323.

Other aspects, relating to quality assurance, reliability, selection and use of electronic devices, design and modification of digital systems including Verification and Validation (V&V) activities are not part of this standard.

Industry research in the area of equipment qualification and decades of its application have greatly benefited this standard. Future activities of the working group to update this standard will consider the following:

- Experience and knowledge gained by using condition monitoring techniques,
- Knowledge gained on ageing mechanisms and kinetics,
- Improvement in the use of methods (test and analysis) described throughout the standard,
- Improvement of computation tools and modalities of use.

It is intended that the Standard be used by operators of NPPs (utilities), systems evaluators, equipment manufacturers, test facilities, qualification laboratories and by licensors.

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

IEC 61513 and IEC 63046 are first level IEC SC 45A documents that give guidance applicable to Instrumentation and Control (I&C) system and electrical power systems (at system level). They are completed by guidance relative to functional classification (IEC 61226).

These documents are supplemented by second level IEC SC 45A documents. Second level IEC SC 45A documents give guidance on hardware design (IEC 60987), software (IEC 60880 and IEC 62138), selection and use of HDL programmed integrated circuits (IEC 62566), requirements in order to reduce the possibility and limit the impact of common cause failure of category A functions (IEC 62340), qualification (IEC/IEEE 60780-323, IEC/IEEE 60980-344 and IEC 62003), control room design (IEC 62342) and cybersecurity (IEC 62645).

IEC/IEEE 60980-344 is a second level IEC SC 45A document which focuses on seismic qualification of electrical equipment important to safety.

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

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c) Recommendations and limitations regarding the application of this standard

This dual logo standard applies to all electrical equipment important to safety in accordance with IAEA terminology. If using IEEE standards, this standard applies to systems, structures, and components classified as safety or safety-related. If using the IEC 61226 and IEC 61513 classification guidance, this standard applies to all Class 1, 2 and 3 equipment. This document shall only be applied in accordance with the single selected classification scheme, either IEC or IEEE.

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 documents of the IEC SC 45A standard series are IEC 61513 and IEC 63046. IEC 61513 provides general requirements for I&C systems and equipment that are used to perform functions important to safety in 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 systems for nuclear power plants.

IEC 61513 and IEC 63046 refer directly to other IEC SC 45A standards for general topics related to categorization of functions and classification of systems, qualification, separation, defence against common cause failure, control room design, electromagnetic compatibility, 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 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.

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 and the implementing guide NSS 17 for computer security at nuclear facilities. The safety and security terminology and definitions used by SC 45A standards are consistent with those used by the IAEA.

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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 as well as to IAEA GS-R 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 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/SC 45A domain was extended in 2013 to cover electrical systems. In 2014 and 2015 discussions were held in IEC/SC 45A to decide how and where general requirements for the design of electrical systems were to be considered. IEC/SC 45A experts recommended that an independent standard be developed at the same level as IEC 61513 to establish general requirements for electrical systems. Project IEC 63046 is now launched to cover this objective. When IEC 63046 is published, this Note 2 of the introduction of IEC/SC 45A standards will be suppressed.

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NUCLEAR FACILITIES – EQUIPMENT IMPORTANT TO SAFETY – SEISMIC QUALIFICATION

1 Scope

This International Standard describes methods for establishing seismic qualification procedures that will yield quantitative data to demonstrate that the equipment can meet its performance requirements. This document is applicable to electrical, mechanical, instrumentation and control equipment/components that are used in nuclear facilities. This document provides methods and documentation requirements for seismic qualification of equipment to verify the equipment's ability to perform its specified performance requirements during and/or after specified seismic demands. This document does not specify seismic demand or performance requirements. Other aspects, relating to quality assurance, selection of equipment, and design and modification of systems, are not part of this document. As seismic qualification is only a part of equipment qualification, this document is used in conjunction with IEC/IEEE 60780-323.

The seismic qualification demonstrates equipment's ability to perform its safety function(s) during and/or after the time it is subjected to the forces resulting from at least one safe shutdown earthquake (SSE/S2). This ability is demonstrated by taking into account, prior to the SSE/S2, the ageing of equipment and the postulated occurrences of a given number of lower intensity operating basis earthquake (OBE/S1). Ageing phenomena to be considered, if specified in the design specification, are those which could increase the vulnerability of equipment to vibrations caused by an SSE/S2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC/IEEE 60780-323, *Nuclear facilities – Electrical equipment important to safety – Qualification*^{1,2}

IEEE Std 382™, *IEEE Standard for Qualification of Safety-Related Actuators for Nuclear Power Generating Stations*

3 Terms and definitions

The terminology and definitions used in this document are consistent with IAEA Safety Glossary³.

¹ IEEE publications are available from The Institute of Electrical and Electronics Engineers (<http://standards.ieee.org/>).

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³ IAEA safety glossary is available at <https://www.iaea.org/publications/11098/iaea-safety-glossary-2018-edition>