BS ISO 4917-3:2024

BSI Standards Publication

Design of nuclear power plants against seismic events

Part 3: Civil structures

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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 committee manager.

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Phone: +41 22 749 01 11
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 6, *Reactor technology*.

A list of all parts in the ISO 4917 series can be found on the ISO website.

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Introduction

In accordance with IAEA Safety Standards Series No. SSR-2/1 protective measures against seismic events are required, provided earthquakes is taken into consideration.

Earthquakes belong to the group of design basis events that requires taking preventive plant engineering measures against damage and which are relevant with respect to radiological effects on the environment.

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Design of nuclear power plants against seismic events —

Part 3:
Civil structures

1 Scope

This document applies to civil structures of nuclear power plants with water cooled reactors in order to achieve the safety objectives given in ISO 4917-1. For other nuclear facilities the applicability of the document needs to be checked in advance, before it might be applied correspondingly.

This document specifies the requirements for civil structures for the verification of their load-bearing capacity in case of a seismic event. Additionally, requirements are specified pertaining to the verification of the serviceability of civil structures as far as necessary for maintaining their safety-related function in case of a seismic event (e.g. deformation and crack-width limitations).

This document will be applied under the presumption that the geology and tectonics of the plant site have been investigated with special emphasis on the existence of active geological faults and lasting geological ground displacements, and that the site has been deemed suitable for a nuclear installation.

To achieve these goals, this document deals with the requirements specific to the seismic design of civil structures above and beyond their conventional design. The basic requirements of these precautionary measures are dealt with in ISO 4917-1.

This document does not apply to cranes, to detachment devices for lifting equipment nor to the supporting and mounting constructions of components.

This document is independent of national standards. Recommendations, given in Annex A, are mainly based on the KTA Design-Philosophy and European standards. Alternatively other equivalent standards or regulations can be used in case the general requirements given in this document can be met.

NOTE The term civil structures as used in this document comprise buildings and structural members made of reinforced concrete, pre-stressed concrete, steel, as well as steel composite structures and masonry. Among others, these include the containment, crane runways, platforms, fastening constructions and canals.

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.

ISO 4917-1:2024, *Design of nuclear power plants against seismic events— Part 1: Principles*

ISO 4917-4:2024, *Design of nuclear power plants against seismic events — Part 4: Components*

IAEA Safety Standards Series No, SSG-67, *Seismic Design for Nuclear Installations*, INTERNATIONAL ATOMIC ENERGY AGENCY VIENNA (2021)

3 Terms and definitions

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

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ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
structural member damping
damping of a structural member (e.g. plate, beam) including bordering influences and effects from secondary elements (screeds, floor coverings, etc.)

Note 1 to entry: For equal load levels, structural element damping is larger than material damping.

3.2
geometric non-linearity
non-linear relationship between force and path values caused by equilibrium and kinematic considerations for the deformed system

3.3
homogenous soil
rock
soil or rock with a near constant shear-wave velocity throughout its stratum thickness and a ratio of a stratum thickness-to-foundation-radius larger than 4

Note 1 to entry: In case of squared foundations, the radius of an area equivalent circle applies.

3.4
soil-structure interaction
interaction relationship between local soil or rock conditions and the vibration behaviour of the building via its foundation

Note 1 to entry: This interaction comprises the kinematic interaction and the interaction due to the inertial forces of the structure.

3.5
impedance functions
complex frequency dependent foundation stiffness values in the subsoil; their real and imaginary parts characterize stiffness and damping

3.6
interaction
<kinematic> interaction of the foundation with the subsoil, whereby the foundation is assumed as being massless and rigid

3.7
material damping
damping caused by internal micro-plastic deformations

Note 1 to entry: The material damping is measured in the laboratory excluding bordering influences and the like; it is dependent on the load level.

3.8
material non-linearity
non-linear relationship between stresses and strains caused by a non-linear material behaviour

3.9
radiation damping
damping due to energy being radiated into an adjacent medium, e.g. from one structural member to a bordering member or from foundation to the subsoil

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