INTERNATIONAL STANDARD

ISO 18229

First edition
2018-02

Essential technical requirements for mechanical components and metallic structures foreseen for Generation IV nuclear reactors

Exigences techniques essentielles pour les composants mécaniques et les structures métalliques prévus pour les réacteurs nucléaires de la quatrième génération

Reference number
ISO 18229:2018(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents 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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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

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Introduction

GEN IV reactors' objectives are to meet reinforced requirements (compared to GEN II to III reactors) concerning safety and reliability and linked with design and fabrication of equipment:

— to excel in safety and reliability;

— to eliminate the need for offsite emergency response;

— to have a very low likelihood and degree of reactor core damage.

This is supported with the use of codes or standards with a proven history of supporting public safety.

The purpose of this document is not to replace these codes or standards but to identify the essential technical requirements which need to be addressed by the design and fabrication codes in order to allow to meet such safety requirements at the expected level for the GEN IV reactors.

It enables these standards to co-exist, providing an approach that can accommodate technical innovations, existing national frameworks and market needs.

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Essential technical requirements for mechanical components and metallic structures foreseen for Generation IV nuclear reactors

1 Scope

This document defines the essential technical requirements that are addressed in the process of design and construction of Generation IV (GEN IV) nuclear reactors. It does not address operation, maintenance and in-service inspection of reactors.

Six reactor concepts are considered for GEN IV: the sodium fast reactor, the lead fast reactor, the gas fast reactor, the very high temperature reactor, the supercritical water reactor and the molten salt reactor.

Annex A details the main characteristics for the different concepts.

The scope of application of this document is limited to mechanical components related to nuclear safety and to the prevention of the release of radioactive materials

— that are considered to be important in terms of nuclear safety and operability,

— that play a role in ensuring leaktightness, partitioning, guiding, securing and supporting, and

— that contain and/or are in contact with fluids (such as vessels, pumps, valves, pipes, bellows, box structures, heat exchangers, handling and driving mechanisms).

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/IEC 17050-1, *Conformity assessment — Supplier's declaration of conformity — Part 1: General requirements*

3 Terms and definitions

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

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

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

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

3.1
certification
third-party attestation related to products, processes, systems or persons

[SOURCE: ISO 17000:2004, 5.5 modified — notes deleted]

3.2
component
part of equipment which can be considered as an individual item

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3.3
conformity
fulfilment of specified requirements

3.4
contractor
supplier (3.16) in a contractual situation

3.5
designer
organization or individual that performs design of *components* (3.2) in compliance with a number of requirements, such as customer's needs, nuclear safety rules, national and international standards, good engineering practices

3.6
equipment specification
document used to specify technical and quality assurance requirements of the equipment

Note 1 to entry: The equipment specification specifies in particular:

— scope;

— scope of supplies (such as description, safety classification, quality grade, seismicity);

— reference documents, together with details of their conditions of application, where necessary.

Note 2 to entry: The equipment specification and a set of supplementary reports (operating conditions report, limiting conditions definition report, interface reports, loading definition reports) contain all data required to check the design rules according to the specified criteria level. All these data are designated by the general term equipment specification.

Note 3 to entry: The equipment specification also addresses the design activities.

3.7
examination
activity carried out by qualified personnel using qualified procedures to assess that given products, processes or services fulfil *conformity* (3.3)

3.8
inspector
person in charge of verifying the compliance of the documentation issued by a *supplier* (3.16) against the technical attachments to the order

Note 1 to entry: The inspector is also the person in charge of verifying the correctness of certain fabrication phases to which he or she is called to attend.

Note 2 to entry: The inspector can or cannot be a member of the supplier's staff.

3.9
manufacturer
legal entity responsible for final design, manufacturing, engineering, and for the construction of any *component* (3.2) of the nuclear reactor

Note 1 to entry: Beyond the scope of mechanical components and metallic structures, different entities are usually responsible for the functions of manufacturing, engineering and design. Sometimes, one entity could be responsible for more than one of the mentioned functions (e.g. design and engineering).

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3.10
operating organization
legal entity having been duly authorized to implement and execute the operation of the nuclear installation

Note 1 to entry: In the subject field, the concept is usually designated by the term “Operator” beginning with capital letter.

3.11
prime contractor
legal entity granted that receives a major contract from the owner for providing a full provision of either the nuclear island and/or the balance of plant

3.12
qualification
proof of suitability of an individual, product, process, procedure or service to fulfil specified requirements

3.13
regulation
rules promulgated by a regulatory body in accordance with legal statutes or directives

3.14
standard
code
document established and approved by a standard issuing body that provides for common and repeated use, mandatory requirements, guidelines or characteristics for activities or their results

Note 1 to entry: A code or standard can be approved by a safety authority, depending on the *regulations* (3.13) in a given country.

3.15
subcontractor
any *contractor* (3.4), except for a *prime contractor* (3.11), providing supplies and/or services through a contract passed with other project contractor or eventually the project management for specific items

Note 1 to entry: Some of these subcontractors will be explicitly named as tubes *manufacturer* (3.9), plates manufacturer (rolling mill), forgings manufacturer (forging mill), pumps manufacturer, valves manufacturer.

3.16
supplier
individual and legal entity (steelmaker, forging mill, pipemaker, foundry, etc.) responsible for the fabrication of products or parts on behalf of the *manufacturer* (3.9) or one *subcontractor* (3.15)

3.17
surveillance agent
person not subordinated to the *supplier* (3.16) concerned, commissioned to ensure that the *component* (3.2) is constructed and inspected in compliance with the documents attached to the orders placed with the supplier, with the present code and with the documents drawn up in application of the latter

3.18
testing
activity carried out to determine, by specific procedures, that one or more characteristic of a product, process or service fulfil *conformity* (3.3)

3.19
inspection body
organization that performs inspections on any granted-by-contract service or supply as provided for by *standards* (3.14) and is independent of the *manufacturer* (3.9), contracting party, owner or *operating organization* (3.10)

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