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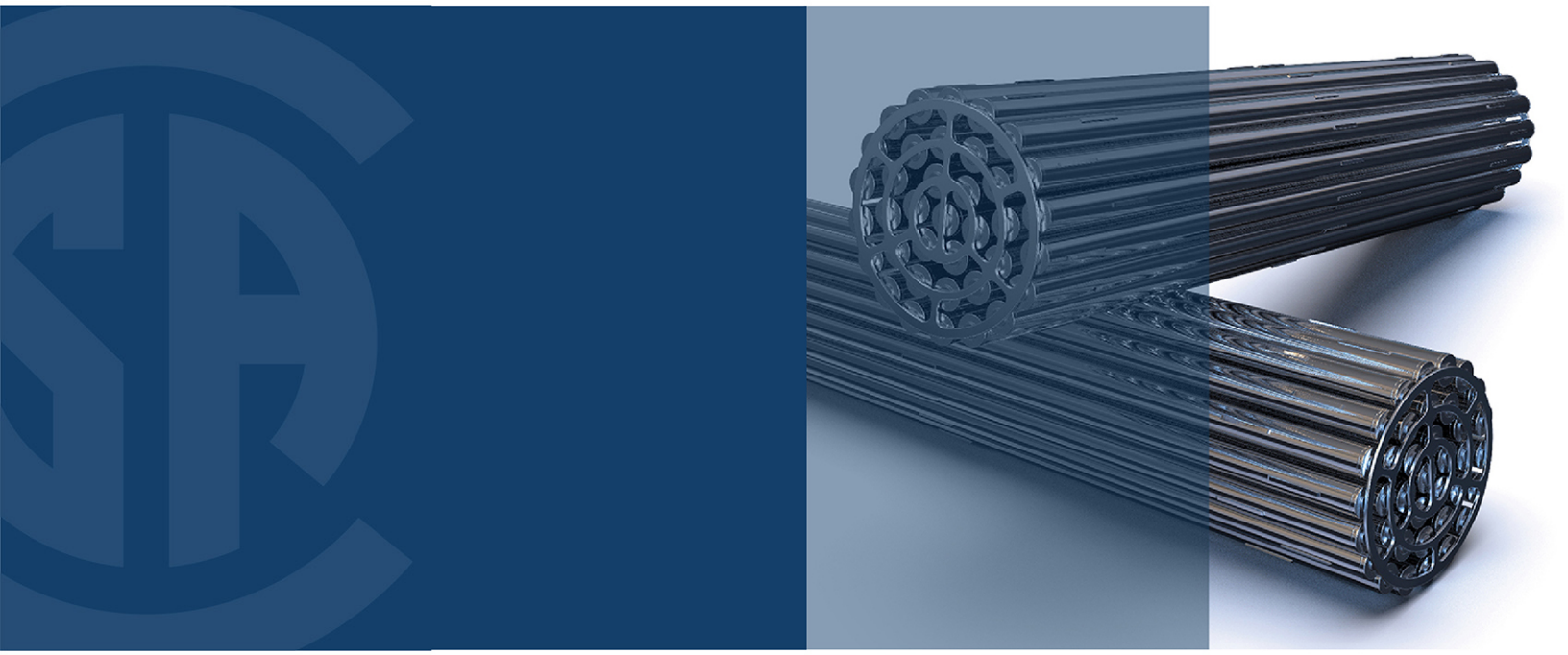
CSA N287.4:19

Construction, fabrication, and installation requirements for concrete containment structures for nuclear power plants



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CSA N287.4:19
September 2019

Title: *Construction, fabrication, and installation requirements for concrete containment structures for nuclear power plants*

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CSA N287.4:19

Construction, fabrication, and installation requirements for concrete containment structures for nuclear power plants

Published in September 2019 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3

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or call toll-free 1-800-463-6727 or 416-747-4044.

ISBN 978-1-4883-2247-1

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Preface

This is the fifth edition of CSA N287.4, *Construction, fabrication, and installation requirements for concrete containment structures for nuclear power plants*. It supersedes the previous editions published in 2009, 1992, 1983, and 1977 under the title *Construction, fabrication, and installation requirements for concrete containment structures for CANDU nuclear power plants*. It reflects Canadian regulatory requirements, operating experience of the Canadian nuclear industry, and international practices. This Standard was originally written for CANDU® reactors but can be used for other concrete containment structures as applicable. The title has been changed to reflect this.

Note: *CANDU (CANada Deuterium Uranium) is a registered trademark of Atomic Energy of Canada Limited (AECL).*

The significant changes to this edition include the following:

- clarification of terminology used and modification of definitions to align with other CSA nuclear standards;
- additional requirements on personnel qualifications and responsibilities;
- additional requirements on concrete quality testing;
- additional requirements on prequalification tests;
- clarification of requirements on concrete temperature during hydration;
- clarification of requirements on curing of concrete;
- clarification of requirements on sheaths, grout, and grouting operation for the pre-stressing system;
- clarification of requirements on metallic parts;
- clarification of requirements on anchorage systems; and
- addition of requirements for grouted embedments.

The CSA N-Series Standards provide an interlinked set of requirements for the management of nuclear facilities and activities. CSA N286 provides overall direction to management to develop and implement sound management practices and controls, while the other CSA Group nuclear Standards provide technical requirements and guidance that support the management system. This Standard works in harmony with CSA N286 and does not duplicate the generic requirements of CSA N286; however, it might provide more specific direction for those requirements.

This Standard provides requirements for construction, fabrication, and installation of concrete containment structures. This Standard is part of the CSA N287 series of Standards, which provides the requirements for concrete containment structures for nuclear power plants. These Standards were initiated in response to the recognition by the utilities and industries concerned with nuclear power plant structures in Canada of a need for consistent standards for the design, construction, and testing of concrete containment structures for nuclear power plants.

The CSA N287 series of Standards consists of eight Standards. The objectives of each Standard are summarized as follows:

- CSA N287.1, *General requirements for concrete containment structures for nuclear power plants*, specifies general requirements for the design, construction, testing, commissioning, and in-service examination and testing of concrete containment structures for nuclear power plants and is directed to the owners, designers, manufacturers, fabricators, and constructors;
- CSA N287.2, *Material requirements for concrete containment structures for nuclear power plants*, specifies requirements for materials used for concrete containment structures;
- CSA N287.3, *Design requirements for concrete containment structures for nuclear power plants*, specifies requirements for the design of concrete containment structures;

- CSA N287.4, *Construction, fabrication, and installation requirements for concrete containment structures for nuclear power plants*, specifies construction, fabrication, and installation requirements for concrete containment structures for nuclear power plants;
- CSA N287.5, *Examination and testing requirements for concrete containment structures for nuclear power plants*, specifies examination and testing requirements that apply to the work of any organization participating in the construction, fabrication, or installation of concrete containment structures for nuclear power plants;
- CSA N287.6, *Pre-operational proof and leakage rate testing requirements for concrete containment structures for nuclear power plants*, specifies requirements for proof by demonstration, before first criticality, that the design and construction of a concrete containment structure are satisfactory with respect to quality and performance as demonstrated by achieving the specified requirements of CSA N287.6, including the commissioning leakage rate target;
- CSA N287.7, *In-service examination and testing requirements for concrete containment structures for nuclear power plants*, specifies uniform requirements whereby, through systematic and periodic examination, the structural and leak-tight integrity of concrete containment structures can be assessed as demonstrated by achieving the specified requirements of CSA N287.7, including the operational leakage rate target; and
- CSA N287.8, *Aging management for concrete containment structures for nuclear power plants,* provides aging management requirements for concrete containment structures for nuclear power plants and is directed to the owners/operators, designers, manufacturers, fabricators, and constructors.

Users of this Standard are reminded that the design, manufacture, construction, commissioning, operation, and decommissioning of nuclear facilities in Canada are subject to the provisions of the *Nuclear Safety and Control Act* and its Regulations. Requirements additional to those specified in this Standard could be imposed by the Canadian Nuclear Safety Commission.

This Standard was prepared by the Subcommittee on Construction, Fabrication, and Installation Requirements for Concrete Containment Structures for Nuclear Power Plants, under the jurisdiction of the Technical Committee on Concrete Containment and Safety-Related Structures for Nuclear Power Plants and the Strategic Steering Committee on Nuclear Standards, and has been formally approved by the Technical Committee.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
3) *This Standard was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include "Request for interpretation" in the subject line:*
   a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
   b) *provide an explanation of circumstances surrounding the actual field condition; and*
   c) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*

   Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are available on the* Current Standards Activities *page at* ***standardsactivities.csa.ca***.

5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line:*
   a) *Standard designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

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Construction, fabrication, and installation requirements for concrete containment structures for nuclear power plants

1 Scope

1.1
This Standard provides requirements for the construction, fabrication, and installation of concrete containment structures that include, but are not limited to, the following structural and non-structural elements:

a) concrete;
b) reinforcement (pre-stressed and non-pre-stressed);
c) steel (e.g., liner, embedded parts, anchors);
d) non-metallic liners and coating systems;
e) joint sealants; and
f) elements necessary to support containment structure (e.g., foundations).

1.2
This Standard provides personnel qualification requirements for work performed as it pertains to the construction, fabrication, and installation of concrete containment structures for nuclear power plants, in accordance with this Standard.

1.3
This Standard may be applied, as appropriate, to nuclear facilities under the jurisdiction of the *Nuclear Safety and Control Act*.

1.4
This Standard is used in concert with the following standards, as applicable:

a) CSA N287.1, which outlines general requirements for concrete containment structures for nuclear power plants; and
b) CSA N287.8, which outlines aging management requirements for concrete containment structures for nuclear power plants.

1.5
In this Standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the Standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.