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CSA B51:19
National Standard of Canada

Boiler, pressure vessel, and pressure piping code

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Preface

This is the nineteenth edition of CSA B51, *Boiler, pressure vessel, and pressure piping code*. It supersedes the previous editions published in 2014, 2009, 2003, 1997, 1995, 1991, 1986, 1981, 1975, 1972, 1969, 1965, 1960, 1957, 1955, 1951, 1945, and 1939.

In keeping with CSA Group's goal of harmonizing its standards with those of other countries to the greatest extent possible, CSA's Technical Committee on Boilers and Pressure Vessels and its Subcommittees have, in the course of developing this Standard, worked closely with the National Board of Boiler and Pressure Vessel Inspectors in the United States and with the American Society of Mechanical Engineers (ASME) committees responsible for producing the *National Board Inspection Code* and ASME's *Boiler and Pressure Vessel Code.*

There are three parts to this Standard:

a) Part 1 contains requirements for boilers, pressure vessels, pressure piping, and fittings. It is intended mainly to fulfill two objectives: first, to promote safe design, construction, installation, operation, inspection, testing, and repair practices; and second, to facilitate adoption of uniform requirements by Canadian jurisdictions.

b) Part 2 contains requirements for high-pressure cylinders for the on-board storage of natural gas, blends of natural gas and hydrogen (hydrogen blends), and hydrogen as fuels for automotive vehicles. It has been harmonized with International Organization for Standardization (ISO) Standard 11439:2013, *Gas cylinders — High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles.* In addition, the CSA Subcommittee responsible for developing Part 2 has consulted with the American National Standards Institute (ANSI) committees responsible for developing CSA/ANSI NGV 2-2016, *Compressed natural gas vehicle fuel containers,* and CSA/ANSI HGV 2-2014, *Compressed hydrogen gas vehicle fuel containers.* The members of these two committees are dedicated to harmonizing their standards as far as circumstances allow.

c) Part 3 contains requirements for compressed natural gas and hydrogen refuelling station pressure piping systems and ground storage vessels. These requirements have been allotted a separate part of the Standard to emphasize the differences between them and the requirements in Part 1, thereby facilitating their application.

This Standard has undergone substantial technical and editorial revisions since the previous edition in 2014. Significant changes to Part 1 include the following:

- addition of the following definitions in Clause 3:
  - "high-energy steam (HES) piping systems"; and
  - "mechanical joint";
- addition of Clause 4.3.5 on Canadian Registration Numbers (CRNs);
- revision of Clause 4.6 on manufacturer's data reports, including a revised Clause 4.6.1 and a new Clause 4.6.6;
- revision of Clause 4.8.2 on fabrication inspection;
- deletion of Clause 4.15.1 on general requirements for piping;
- revision of Clause 5.1.1 on nameplate stamping;
- addition of Clause 6.3.4.7 on boiler installation clearances;
- addition of Clause 6.3.6 on boiler loadings;
- revision of Clause 6.6 on thermal fluid heaters and piping;
- addition of Clause 7.1.5 on the use of Part 5 of Section VIII, Division 2, of the ASME Code;
- addition of Clause 7.8 on pressure vessels designed and constructed using cold-stretch technology;
- revision of Clause 8 on piping and fittings, including the addition of Clauses 8.6 and 8.7;

- addition of Clause 12.1.1 on general requirements for pressure relief devices;
- revision of Clause 12.2.2 on the installation of pressure relief devices;
- revision of Clause 12.5.3 on periodic visual inspection of pressure relief devices;
- revision of Clause 12.7 on servicing of reclosing pressure relief devices, including the addition of Clauses 12.7.2.2 on ANSI/UL 132 pressure relief valves (PRVs) and 12.7.3.2 on testing after servicing is complete;
- addition of Clause 12.11 on CSA B149 series propane service pressure relief valves (PRVs);
- addition of Clause 13.4 on high-energy steam (HES) piping systems;
- revision of Table 5 on maximum in-service testing and service intervals;
- revision of Annex C on guidelines for safety valve, relief valve, and safety relief valve repair organizations;
- revision of Annex D sample forms;
- revision of Annex G on automotive propane vessel standards;
- revision of Annex I on historical boilers;
- revision of Annex J on requirements regarding the use of finite element analysis (FEA) to support a pressure equipment design submission, including Clause J.3 on special design equipment and Clause J.6.3 on turn angles;
- addition of Annex K on requirements for pressure vessels designed and constructed using cold-stretch technology; and
- addition of Annex L on condition assessments for high-energy steam (HES) piping systems.

Significant changes to Part 2 include the following:

- revision of Clause 6.3.2.3 on tensile tests for steel excluding than stainless steel;
- revision of Clause 6.3.6 on plastic liners;
- revision of Clause 7.3.1 on general requirements for manufacturing and production tests;
- revision of Clause 7.4.1 on material tests;
- deletion of Clause 8.6.8 on high-temperature creep test;
- deletion of Clause 10.7.4 on boss torque test;
- revision of Clause 14.13 on ambient temperature pressure-cycling test;
- revision of Clause 14.14 on extreme-temperature pressure-cycling test;
- revision of Clause 14.16 on penetration test;
- revision of Clause 14.17 on flaw tolerance test;
- deletion of Clause 14.18 on high-temperature creep test;
- revision of renumbered Clause 14.18 on accelerated stress rupture test;
- revision of Clause 14.19 on drop test;
- revision of Clause 14.21.4 on pressure cycle and pressure hold; and
- deletion of Clause 14.24 on boss torque test.

The users of this Standard should note that it is a recommendatory document only and does not have the force of law except where it has been officially adopted by a Canadian jurisdiction. Users should also note that adoption does not necessarily mean that the Standard has been adopted unchanged. For example, a jurisdiction may decide to make an informative annex normative.

In addition, owners and users of cylinders designed to the requirements of Part 2 should note that the safe operation of such cylinders requires, first, compliance with the service conditions specified by the manufacturer, and second, use of the cylinders only during the service life specified by the manufacturer. Each cylinder is marked with an expiry date, and owners and users are responsible for ensuring that a cylinder is not used after that date.

The Technical Committee intends to meet periodically to review this Standard and, if necessary, to revise it to meet changing conditions and maintain uniformity of practice throughout Canada.

The Technical Committee supports the use of the *National Board Inspection Code*. It is the responsibility of users of this Standard to be aware that applicable local regulations can take precedence over the requirements of that Code.

This Standard was prepared by the Technical Committee on Boilers and Pressure Vessels, under the jurisdiction of the Strategic Steering Committee on Mechanical Industrial Equipment Safety, and has been formally approved by the Technical Committee.

This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

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.*

National Standard of Canada

B51-19, Part 1

General requirements for boilers, pressure vessels, and pressure piping

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B51-19, Part 1
General requirements for boilers, pressure vessels, and pressure piping

1 Scope

1.1

Except as indicated in Clause 1.2, Part 1 of this Standard applies to all boilers, pressure vessels, pressure piping, and fittings, as provided for by the Act (as defined in Clause 3) and identified in Part 1 of this Standard.

Notes:

1) *It is possible that the size limitations specified in provincial or territorial statutes or regulations will differ from those specified in Part 1 of this Standard. The applicable regulatory authority should be consulted.*
2) *The pressures specified in Part 1 of this Standard are gauge pressures above atmospheric pressure.*
3) *This Standard applies to all boilers, pressure vessels, pressure piping, and fittings installed subsequent to its adoption.*

1.2

Requirements for compressed natural gas cylinders and refuelling station pressure piping systems and containers are covered in Parts 2 and 3 of this Standard.

1.3

This Standard does not apply to

a) pressure-retaining components in hydraulic elevators;
b) pressure-containment devices for gas-filled switchgear and controlgear; and
c) pressure vessels for the transportation of dangerous goods regulated by Transport Canada.

1.4

Where a clause in Part 1 of this Standard is at variance with a code or standard referenced in Part 1 of this Standard, the requirements of Part 1 of this Standard govern.

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.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.