



CSA/ANSI Z21.10.3:19 • CSA 4.3:19  
National Standard of Canada  
American National Standard



# Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous



Standards Council of Canada  
Conseil canadien des normes

This is a preview. [Click here to purchase the full publication.](#)

# Legal Notice for Standards

Canadian Standards Association and CSA America Standards Inc. (operating as “CSA Group”) develop standards through a consensus standards development process approved by the Standards Council of Canada and the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA Group administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

## Disclaimer and exclusion of liability

This is a draft document for the purpose of comment, review, and approval only. This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document’s fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party’s intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document’s compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA Group is a private not-for-profit company that publishes voluntary standards and related documents. CSA Group has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

## Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group’s and/or others’ intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

## Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

## Assignment of copyright

A user who provides a comment to CSA Group in relation to this document agrees that the entire copyright in the comment is hereby assigned to CSA Group and waives all associated moral rights, such that CSA Group is the exclusive owner of such comment and may use such comment as it sees fit. The user, being the sole owner of the copyright or having the authority to assign the copyright on behalf of his or her employer, confirms his or her ability to assign the copyright in a comment provided to CSA Group.

## Authorized use of this document

This document is being provided by CSA Group for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in print or paper form may be distributed only to persons who are authorized by CSA Group to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and may not permit others to

- alter this document in any way or remove this Legal Notice from the attached draft standard;
- sell this document without authorization from CSA Group; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents hereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.

This is a preview. [Click here to purchase the full publication.](#)

# Revision History

CSA/ANSI Z21.10.3:19 • CSA 4.3:19, Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous

| Revision from previous edition  | Revision symbol (in margin) |
|---|-----------------------------|
| Clauses <a href="#">3</a> , <a href="#">4.1.25</a> , <a href="#">4.2.9</a> , <a href="#">4.2.11</a> , <a href="#">4.9.1</a> , <a href="#">4.9.2</a> , <a href="#">4.26</a> , <a href="#">4.31.2</a> , <a href="#">4.32.3</a> , <a href="#">4.32.37</a> , <a href="#">5.5</a> , <a href="#">5.9.1</a> , <a href="#">5.17</a> , <a href="#">5.18</a> , <a href="#">5.33</a> , and <a href="#">8.4</a><br>Tables <a href="#">3</a> , <a href="#">2-A</a> , and <a href="#">2-B</a> | Δ                           |

# ***Standards Update Service***

## ***CSA/ANSI Z21.10.3:19 • CSA 4.3:19 November 2019***

**Title:** *Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous*

To register for e-mail notification about any updates to this publication

- go to [store.csagroup.org](http://store.csagroup.org)
- click on **Product Updates**

The **List ID** that you will need to register for updates to this publication is **2426327**.

If you require assistance, please e-mail [techsupport@csagroup.org](mailto:techsupport@csagroup.org) or call 416-747-2233.

Visit CSA Group's policy on privacy at [www.csagroup.org/legal](http://www.csagroup.org/legal) to find out how we protect your personal information.

**Canadian Standards Association (operating as “CSA Group”)**, under whose auspices this National Standard has been produced, was chartered in 1919 and accredited by the Standards Council of Canada to the National Standards system in 1973. It is a not-for-profit, nonstatutory, voluntary membership association engaged in standards development and certification activities.

CSA Group standards reflect a national consensus of producers and users — including manufacturers, consumers, retailers, unions and professional organizations, and governmental agencies. The standards are used widely by industry and commerce and often adopted by municipal, provincial, and federal governments in their regulations, particularly in the fields of health, safety, building and construction, and the environment.

Individuals, companies, and associations across Canada indicate their support for CSA Group’s standards development by volunteering their time and skills to Committee work and supporting CSA Group’s objectives through sustaining memberships. The more than 7000 committee volunteers and the 2000 sustaining memberships together form CSA Group’s total membership from which its Directors are chosen. Sustaining memberships represent a major source of income for CSA Group’s standards development activities.

CSA Group offers certification and testing services in support of and as an extension to its standards development activities. To ensure the integrity of its certification process, CSA Group regularly and continually audits and inspects products that bear the CSA Group Mark.

In addition to its head office and laboratory complex in Toronto, CSA Group has regional branch offices in major centres across Canada and inspection and testing agencies in eight countries. Since 1919, CSA Group has developed the necessary expertise to meet its corporate mission: CSA Group is an independent service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards, certification and related services to meet national and international needs.

For further information on CSA Group services, write to  
CSA Group  
178 Rexdale Boulevard  
Toronto, Ontario, M9W 1R3  
Canada

A National Standard of Canada is a standard developed by a Standards Council of Canada (SCC) accredited Standards Development Organization, in compliance with requirements and guidance set out by SCC. More information on National Standards of Canada can be found at [www.scc.ca](http://www.scc.ca).

SCC is a Crown corporation within the portfolio of Innovation, Science and Economic Development (ISED) Canada. With the goal of enhancing Canada's economic competitiveness and social well-being, SCC leads and facilitates the development and use of national and international standards. SCC also coordinates Canadian participation in standards development, and identifies strategies to advance Canadian standardization efforts.

Accreditation services are provided by SCC to various customers, including product certifiers, testing laboratories, and standards development organizations. A list of SCC programs and accredited bodies is publicly available at [www.scc.ca](http://www.scc.ca).

Standards Council of Canada  
600-55 Metcalfe Street  
Ottawa, Ontario, K1P 6L5  
Canada



**Standards Council of Canada**  
**Conseil canadien des normes**

Cette Norme Nationale du Canada n'est disponible qu'en anglais.

*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 to judge its suitability for their particular purpose.*

*®A trademark of the Canadian Standards Association, operating as “CSA Group”*

This is a preview. [Click here to purchase the full publication.](#)

## CSA Group

The Canadian Standards Association (operating as "CSA Group"), under whose auspices this National Standard has been produced, was chartered in 1919 and accredited by the Standards Council of Canada to the National Standards system in 1973. It is a not-for-profit, nonstatutory, voluntary membership association engaged in standards development and certification activities.

CSA Group standards reflect a national consensus of producers and users including manufacturers, consumers, retailers, unions and professional organizations, and governmental agencies. The standards are used widely by industry and commerce and often adopted by municipal, provincial, and federal governments in their regulations, particularly in the fields of health, safety, building and construction, and the environment.

Individuals, companies, and associations across Canada indicate their support for CSA Group's standards development by volunteering their time and skills to Committee work and supporting CSA Groups objectives through sustaining memberships. The more than 7000 committee volunteers and the 2000 sustaining memberships together form CSA Group's total membership from which its Directors are chosen. Sustaining memberships represent a major source of income for CSA Groups standards development activities.

CSA Group offers certification and testing services in support of and as an extension to its standards development activities. To ensure the integrity of its certification process, CSA Group regularly and continually audits and inspects products that bear the CSA Group Mark.

In addition to its head office and laboratory complex in Toronto, CSA Group has regional branch offices in major centres across Canada and inspection and testing agencies in eight countries. Since 1919, CSA Group has developed the necessary expertise to meet its corporate mission: CSA Group is an independent service organization whose mission is to provide an open and effective forum for activities facilitating the exchange of goods and services through the use of standards, certification and related services to meet national and international needs.

For further information on CSA Group services, write to  
CSA Group  
178 Rexdale Boulevard, Toronto, Ontario,  
Canada M9W 1R3

## American National Standards Institute

The American National Standards Institute (ANSI), Inc. is the nationally recognized coordinator of voluntary standards development in the United States through which voluntary organizations, representing virtually every technical discipline and every facet of trade and commerce, organized labor and consumer interests, establish and improve the some 10,000 national consensus standards currently approved as American National Standards.

ANSI provides that the interests of the public may have appropriate participation and representation in standardization activity, and cooperates with departments and agencies of U.S. Federal, state and local governments in achieving compatibility between government codes and standards and the voluntary standards of industry and commerce.

ANSI represents the interests of the United States in international nontreaty organizations such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). The Institute maintains close ties with regional organizations such as the Pacific Area Standards Congress (PASC) and the Pan American Standards Commission (COPANT). As such, ANSI coordinates the activities involved in the U.S. participation in these groups.

ANSI approval of standards is intended to verify that the principles of openness and due process have been followed in the approval procedure and that a consensus of those directly and materially affected by the standards has been achieved. ANSI coordination is intended to assist the voluntary system to ensure that national standards needs are identified and met with a set of standards that are without conflict or unnecessary duplication in their requirements.

Responsibility of approving American standards rests with the  
American National Standards Institute, Inc.  
25 West 43rd Street, Fourth floor  
New York, NY 10036

*National Standard of Canada  
American National Standard*

*CSA/ANSI Z21.10.3:19 • CSA 4.3:19  
Gas-fired water heaters, volume III,  
storage water heaters with input  
ratings above 75,000 Btu per hour,  
circulating and instantaneous*



*American National  
Standards Institute, Inc.*



*®A trademark of the Canadian Standards Association and  
CSA America Standards Inc., operating as "CSA Group"*

**IGAC**

*Interprovincial  
Gas Advisory Council*



*Approved on September 23, 2019 by ANSI  
Approved on October 9, 2019 by IGAC  
Effective in Canada May 1, 2021  
Published in November 2019 by CSA Group  
A not-for-profit private sector organization  
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3*

*To purchase standards and related publications, visit our Online Store at [store.csagroup.org](https://store.csagroup.org)  
or call toll-free 1-800-463-6727 or 416-747-4044.*

*ICS 97.100.20; 91.140.65  
ISBN 978-1-4883-1547-3*

*© 2019 Canadian Standards Association  
All rights reserved. No part of this publication may be reproduced in any form whatsoever  
without the prior permission of the publisher.*

[This is a preview. Click here to purchase the full publication.](#)

# Contents

|  |           |
|--|-----------|
| Interprovincial Gas Advisory Council   | 4         |
| Canadian Technical Committee on Gas Appliances and Related Accessories                                       | 6         |
| Z21/83 Technical Committee on Performance and Installation of Gas Burning Appliances and Related Accessories | 9         |
| Joint Technical Subcommittee on Gas-Fired Water Heaters  | 12        |
| Preface  | 18        |
| <b>1 Scope</b>   | <b>21</b> |
| <b>2 Reference publications</b>  | <b>23</b> |
| <b>3 Definitions</b>   | <b>27</b> |
| <b>4 Construction</b>  | <b>38</b> |
| 4.1 General construction   | 38        |
| 4.2 Materials  | 44        |
| 4.3 Combustion air supply  | 47        |
| 4.4 Water heater openings  | 48        |
| 4.5 Burners  | 48        |
| 4.6 Flame spreaders  | 50        |
| 4.7 Primary air adjustment means   | 50        |
| 4.8 Main burner orifices and orifice fittings  | 51        |
| 4.9 Automatic gas ignition systems   | 52        |
| 4.10 Pilot gas filters   | 56        |
| 4.11 Gas connections   | 57        |
| 4.12 Opening for relief valve  | 59        |
| 4.13 Dip tubes   | 59        |
| 4.14 Manually operated gas valves  | 60        |
| 4.15 Gas appliance pressure regulators and gas pressure switches   | 61        |
| 4.16 Adjustment of minimum input rating  | 62        |
| 4.17 Thermostats   | 62        |
| 4.18 Automatic valves and safety shutoff valves  | 62        |
| 4.19 Bleeds and vents  | 63        |
| 4.20 Automatic gas shutoff systems   | 63        |
| 4.21 Relief valves   | 64        |
| 4.22 Condensate disposal   | 65        |
| 4.23 Flue collars  | 66        |
| 4.24 Flue pipe extensions  | 66        |
| 4.25 Draft hoods   | 66        |
| 4.26 Non-metallic vent and air intake connection strength test   | 67        |
| 4.27 Automatic vent damper devices   | 68        |
| 4.28 Automatic flue damper devices   | 68        |
| 4.29 Electrical equipment and wiring   | 70        |

|          |   |            |
|----------|---|------------|
| 4.30     | Vent and air intake pipes of direct vent systems          | 84         |
| 4.31     | Instructions  | 85         |
| 4.32     | Marking   | 97         |
| <b>5</b> | <b>Performance</b>  | <b>109</b> |
| 5.1      | General   | 109        |
| 5.2      | Test gases  | 115        |
| 5.3      | Test pressures and burner adjustments                     | 117        |
| 5.4      | Combustion  | 117        |
| 5.5      | Category determination                                    | 119        |
| 5.6      | Burner and pilot operating characteristics                | 123        |
| 5.7      | Piloted ignition systems                                  | 126        |
| 5.8      | Proved igniter systems                                    | 130        |
| 5.9      | Direct ignition systems                                   | 132        |
| 5.10     | Efficiency  | 134        |
| 5.11     | Gas appliance pressure regulators                         | 134        |
| 5.12     | Automatic valves and safety shutoff valves                | 134        |
| 5.13     | Temperature control                                       | 135        |
| 5.14     | Storage heater temperature limits                         | 135        |
| 5.15     | Temperature limiting devices                              | 137        |
| 5.16     | Evaluation of burn hazard potential of exterior surfaces  | 139        |
| 5.17     | Wall, floor, and ceiling temperatures                     | 142        |
| 5.18     | Non-metallic vent material temperatures                   | 143        |
| 5.19     | Flue gas temperature                                      | 145        |
| 5.20     | Temperature of manually operated parts                    | 146        |
| 5.21     | Burner and flame spreader temperatures                    | 147        |
| 5.22     | Draft hoods   | 148        |
| 5.23     | Draft tests for water heaters equipped with power burners | 152        |
| 5.24     | Automatic vent damper devices                             | 154        |
| 5.25     | Automatic flue damper devices                             | 154        |
| 5.26     | Wind test   | 158        |
| 5.27     | Safety circuit analysis                                   | 160        |
| 5.28     | Capacities of storage vessels                             | 161        |
| 5.29     | Capacities of tube type water heaters                     | 161        |
| 5.30     | Hydrostatic test  | 161        |
| 5.31     | Burner durability   | 162        |
| 5.32     | Venting systems for Category II, III, or IV water heaters | 163        |
| 5.33     | Condensate disposal system(s)                             | 163        |
| 5.34     | Rain tests  | 164        |
| 5.35     | Direct vent systems                                       | 166        |
| 5.36     | Marking material adhesion and legibility                  | 173        |
| <b>6</b> | <b>Manufacturing and production tests</b>                 | <b>174</b> |
| <b>7</b> | <b>Items unique to the United States</b>                  | <b>175</b> |
| 7.1      | High altitude   | 175        |
| 7.2      | Thermal efficiency  | 175        |
| 7.3      | Temperature and pressure relief valves                    | 175        |
| 7.4      | Marking material adhesion and legibility                  | 175        |

|          |  |            |
|----------|--|------------|
| 7.5      | General construction and assembly                        | 176        |
| <b>8</b> | <b>Items unique to Canada</b>                            | <b>176</b> |
| 8.1      | High altitude  | 176        |
| 8.2      | Relief valves  | 176        |
| 8.3      | Storage vessels  | 176        |
| 8.4      | Outdoor installation                                     | 176        |
| 8.4.1    | Components for low temperature operation                 | 176        |
| 8.4.2    | Rating plate marking for outdoor heaters                 | 177        |
| 8.5      | Draft hoods  | 177        |
| 8.6      | Pilot burners and safety shutoff devices                 | 177        |
| 8.7      | Thermal efficiency                                       | 177        |
| 8.8      | French translations for quoted instructions and markings | 177        |

---

|                       |   |     |
|-----------------------|---|-----|
| Annex A (normative)   | — Outline of lighting instructions for appliances equipped with continuous pilots   | 195 |
| Annex B (normative)   | — Outline of operating instructions for appliances equipped with intermittent pilot or interrupted pilot systems  | 198 |
| Annex C (normative)   | — Outline of operating instructions for appliances equipped with direct ignition systems  | 201 |
| Annex D (normative)   | — Optional Clauses for listed gas appliance conversion kits   | 204 |
| Annex E (normative)   | — Efficiency test procedures  | 207 |
| Annex F (informative) | — Pertinent references to ANSI Y14.15   | 212 |
| Annex G (informative) | — Wire color designations   | 213 |
| Annex H (informative) | — Recommended wire color usage  | 214 |
| Annex I (informative) | — Preferred graphic symbols of commonly used items, extracted from standard ANSI/IEEE 315, graphic symbols for electrical and electronics diagrams, and abbreviations for these items | 215 |
| Annex J (informative) | — Sample failure modes and effects analysis for component miswiring*  | 217 |
| Annex K (informative) | — Table of conversion factors   | 218 |
| Annex L (informative) | — Legibility and design of safety information in water heater markings and manuals  | 221 |