

CSA/ANSI Z21.10.1:19 • CSA 4.1:19 National Standard of Canada American National Standard



# Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less







Standards Council of Canada Conseil canadien des normes

**REVISED SEPTEMBER**: 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 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 negroes 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.

#### 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 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.



# **Revision History**

# CSA/ANSI Z21.10.1:19 • CSA 4.1:19, Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less

Errata — September 2020	Revision symbol (in margin)
Figures <u>2-A</u> and <u>2-B</u>	ΔΔ

Administrative update — September 2020
Revision History page: "Revision from previous edition" updated

Revision from previous edition	Revision symbol (in margin)
Clauses <u>3</u> , <u>4.1.24</u> , <u>4.2.11</u> , <u>4.28</u> , <u>4.33.2</u> , <u>4.34.3</u> , <u>4.34.26</u> , <u>5.15.1</u> , <u>5.15.2</u> , <u>5.17</u> , <u>8.3</u> , and <u>8.6</u>	Δ

# Standards Update Service

# *CSA/ANSI Z21.10.1:19* • *CSA* 4.1:19 *November 2019*

**Title:** Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less

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

- go to store.csagroup.org
- click on Product Updates

The List ID that you will need to register for updates to this publication is 2426305.

If you require assistance, please e-mail techsupport@csagroup.org or call 416-747-2233.

Visit CSA Group's policy on privacy at <u>www.csagroup.org/legal</u> 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-forprofit, 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 <u>www.scc.ca</u>.

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 wellbeing, 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 <u>www.scc.ca</u>.

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"

### **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.

### 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.

For further information on CSA Group services, write to CSA Group 178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3 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 Z21.10.1:19 • CSA 4.1:19 Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less



<sup>®</sup>A trademark of the Canadian Standards Association and CSA America Standards Inc., operating as "CSA Group"



Interprovincial Gas Advisory Council





American National Standards Institute, Inc.

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 <u>store.csagroup.org</u> or call toll-free 1-800-463-6727 or 416-747-4044.

ICS 97.100.20; 91.140.65 ISBN 978-1-4883-1533-6

© 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.

# 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

- **1 Scope** 21
- **2** Reference publications 22
- 3 Definitions 27
- 4 Construction 38
- 4.1 General construction and assembly 38
- 4.2 Materials 44
- 4.3 Combustion air supply 48
- 4.4 Heat pipe heat exchangers 48
- 4.5 Water heater openings 49
- 4.6 Burners 49
- 4.7 Flame spreaders 51
- 4.8 Primary air adjustment means 51
- 4.9 Main burner orifices and orifice fittings 52
- 4.10 Automatic gas ignition systems 53
- 4.11 Pilot gas filters 56
- 4.12 Gas and water connections 56
- 4.13 Opening for relief valves 58
- 4.14 Dip tubes 59
- 4.15 Manually operated gas valves 59
- 4.16 Gas appliance pressure regulators 60
- 4.17 Adjustment of minimum input rating 61
- 4.18 Thermostats 61
- 4.19 Automatic valves 61
- 4.20 Bleeds and vents 62
- 4.21 Automatic gas shutoff systems 62
- 4.22 Relief valves 63
- 4.23 Automatic flammable vapor sensor systems and components 64
- 4.24 Condensate disposal 64
- 4.25 Flue collars 64
- 4.26 Flue pipe extensions 64
- 4.27 Draft hoods *65*
- 4.28 Non-metallic vent and air intake connection strength test 66
- 4.29 Automatic vent damper devices 66

November 2019

© 2019 CSA America Standards Inc./ © 2019 Canadian Standards Association 5

83

136

141

159

167

4.30 Automatic flue damper devices 67 4.31 Electrical equipment and wiring 69 4.32 Vent and air-intake pipes of direct vent systems 4.33 Instructions 84 4.34 Marking 97 Performance 110 5.1 General 110 5.2 Test gases 115 5.3 Test pressures and burner adjustments 117 5.4 Combustion 117 5.5 Burner and pilot operating characteristics 120 5.6 Category determination 122 5.7 Piloted ignition systems 126 5.8 Proved igniter systems 131 5.9 Direct ignition systems 133 5.10 Heat roll out safety shutoff means 135 5.11 Heat required to supply daily guota of hot water 5.12 Gas appliance pressure regulators 138 5.13 Storage heater temperature limits 138 5.14 Temperature limiting systems 140 5.15 Evaluation of burn hazard potential of exterior surfaces Wall, floor, and ceiling temperatures 5.16 145 5.17 Non-metallic vent material temperatures 147 5.18 Flue gas temperature 148 5.19 Temperature of manually operated parts 149 5.20 Burner and flame spreader temperatures 149 5.21 Flue collars 151 5.22 Draft hoods 151 5.23 Automatic vent damper devices 155 5.24 Automatic flue damper devices 155 5.25 Draft tests for water heaters equipped with power burners 5.26 Wind test 161 5.27 Safety circuit analysis 164 5.28 Capacities of storage vessels 164 5.29 Hydrostatic test 165 5.30 Heat pipe heat exchanger pressure 166 5.31 Burner durability 167 5.32 Venting systems for Category II, III, or IV water heaters 5.33 Condensate disposal system(s) 168 5.34 Rain tests 169 5.35 Direct vent systems 171 5.36 Marking material adhesion and legibility 178 5.37 Flammable vapors ignition resistance 179 5.38 Resistance to lint, dust and oil accumulation 188 5.39 Corrugated metal tubing 192 5.40 Condensate disposal system(s) 195

#### 6 Manufacturing and production tests 195

November 2019

© 2019 CSA America Standards Inc./ © 2019 Canadian Standards Association

#### 7 Items unique to the United States 197

- 7.1 High altitude 197
- 7.2 Marking material adhesion and legibility 197
- 7.3 General construction 197

### 8 Items unique to Canada 197

- 8.1 High altitude 197
- 8.2 Storage vessels 197
- 8.3 Outdoor installation 198
- 8.3.1 Components for low temperature operation *198*
- 8.3.2 Rating plate marking for outdoor heaters 198
- 8.4 Draft hoods 198
- 8.5 Pilot burners and safety shut-off devices 198
- 8.6 French translations for quoted instructions and markings 198

Annex A (normative) — Outline of lighting instructions for appliances equipped with continuous pilots 217	
Annex B (normative) — Outline of operating instructions for appliances equipped with intermittent pilot or interrupted pilot systems 220	
Annex C (normative) — Outline of operating instructions for appliances equipped with direct ignition systems 223	
Annex D (normative) — Flammable vapors label 226	
Annex E (normative) — Scald hazard label 228	
Annex F (normative) — Optional provisions for listed gas appliance conversion kits 229	
Annex G (informative) — Pertinent references to ANSI Y14.15 232	
Annex H (informative) — Wire color designations 233	
Annex I (informative) — Recommended wire color usage 234	
Annex J (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 235	
Annex K (informative) — Sample failure modes and effects analysis for component miswiring* 237	
Annex L (informative) — Table of conversion factors 238	
Annex M (informative) — Lint, dust, and oil test equipment and procedures	
(see Clause 5.38) 241	