ANSI Z21.47-2016 • CSA 2.3-2016

CSA Group

# Gas-fired central furnaces

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# ***Gas-fired central furnaces***

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# Preface

This is the seventh edition of ANSI Z21.47 • CSA 2.3, *Gas-fired central furnaces*. It supersedes the previous editions published in 2012, 2006, 2003, 2001, 1998, and 1993.

This Standard was prepared by the Z21/CSA Joint Technical Subcommittee on Standards for Gas-Fired Central Furnaces, under the jurisdiction of the Z21/83 Technical Committee on Performance and Installation of Gas Burning Appliances and Related Accessories, the Canadian Technical Committee on Gas Appliances and Related Accessories, and the Strategic Steering Committee on Standards for Fuel Burning Equipment, and had been formally approved by the Technical Committees, American National Standards Institute, and the Interprovincial Gas Advisory Council.

Interpretations: The Strategic Steering Committee on Standards for Fuel Burning Equipment has provided the following direction for the interpretation of standards under its jurisdiction: "The literal text shall be used in judging compliance of products with the safety requirements of this Standard. When the literal text cannot be applied to the product, such as for new materials or construction, and when a relevant committee interpretation has not already been published, CSA Group's procedures for interpretation shall be followed to determine the intended safety principle."

**Notes:**

**1)** *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*

**2)** *This Standard contains SI (Metric) corresponding to the yard/pound quantities, the purpose being to allow the standard to be used in SI (Metric) units. (Standard for use of the International System of Units (SI): The Modern Metric System, IEEE/ASTM SI 10 or ISO 80000-1:2009 Quantities and units– Part 1: General is used as a guide in making metric conversion from yard/pound quantities.) If a value for a measurement and a corresponding value in other units are stated, the first stated value is to be regarded as the requirement. The given corresponding value may be approximate. If a value for a measurement and a corresponding value in other units are both specified as a quoted marking requirement, the first stated unit, or both shall be provided.*

**3)** *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.*

**4)** *This publication 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 publication.*

**5)** *This Standard is subject to review at least every five years; 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.*

**6)** *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.*

# History of the development of the Standard for Gas-fired central furnaces

**Note:** *This history is informative and is not part of the standard.*

With the onset of the Free Trade agreement between the United States and Canada on January 2, 1988, significant attention was given to the harmonization of the United States and Canadian safety standards addressing gas-fired equipment for residential, commercial, and industrial applications. It was believed that the elimination of the differences between the standards would remove potential trade barriers and provide an atmosphere in which North American manufacturers could market more freely in the United States and Canada. The harmonization of these standards was also seen as a preliminary step toward harmonization with international standards, which was to become a necessity as Europe moved toward its goal to form an economic United States of Europe (EC) by early 1990's.

A Z21/CGA joint working group on harmonizing central furnace standards was established. On May 4, 1989, the joint working group reviewed an initial comparison of the construction sections of the Standard for *Gas-Fired Central Furnaces (Except Direct Vent Central Furnaces)*, ANSI Z21.47-1987, and the National Standard of Canada, CAN/CGA-2.3-M86. It was agreed that a consultant should be used to draft a complete unitary standard to address gas-fired central furnaces, including direct vent central furnaces. As a result, several drafts, based on the current Standards for *Gas-Fired Central Furnaces (Except Direct Vent Central Furnaces)* (ANSI Z21.47-1990 and Z21.47a-1990, ANSI Z21.64-1990, and CAN/CGA 2.3-M86) were subsequently developed by the consultant and reviewed by the joint working group between 1989 and 1991.

A joint Z21/CGA Joint Subcommittee on Standards for Gas-Fired Central Furnaces was then established, based on memberships of the Z21 Subcommittee on Standards for Gas-Fired Central Furnaces and the CGA 2.3-2.9 Committee on Standards for Central Furnaces, Duct Furnaces, and Unit Heaters. Membership encompasses representatives from the U.S. and Canadian manufacturing industry, gas suppliers (natural and LP), regulatory authorities and general interest with the intent that each country is equally represented.

The first meeting of the Z21/CGA Joint Central Furnace Subcommittee was held on July 10-12, 1992. At that meeting a third draft of a harmonized central furnace standard was considered and modified. A fourth draft was subsequently adopted for industry review during November 1991.

With the formation of joint subcommittees, a Canadian Gas Association Standards Steering Committee on Gas Burning Appliances and Related Accessories was established to parallel Accredited Standards Committees Z21 and Z83. Also, to support the formation of joint subcommittees, operating procedures, in accordance with American National Standards Institute procedures, for joint subcommittees were developed and subsequently approved by ANSI on April 1, 1993.

Following reconsideration and modification of the proposed draft standard for gas-fired central furnaces in light of comments received, the joint central furnace subcommittee, at its February 11-13, 1992 meeting, recommended the proposed fourth draft to the Z21 Committee and the CGA Standards Steering Committee for approval.

The Z21 Committee, at its April 9, 1992 meeting, approved the proposed fourth draft of the harmonized standard for central furnaces, as modified by the joint subcommittee. The CGA Standards Steering Committee concurred with the actions of the Z21 Committee but further modified the standard to better address bilingual instructions and markings and other issues unique to one country. The additional modifications by the CGA Committee were subsequently adopted by the Z21 Committee by letter ballot dated June 16, 1992.

  

The first edition of the harmonized Standard for *Gas-Fired Central Furnaces* , ANSI Z21.47/CGA 2.3 incorporated coverage from the Standard for *Direct Vent Central Furnaces*, ANSI Z21.64, coverage for recreational vehicle central furnaces, and central furnaces for outdoor installation. The first edition of the harmonized standard was approved by the Standards Advisory Committee and the Standards Council of Canada on March 31, 1993, and by the American National Standards Institute, Inc., on May 26, 1993.

At their respective meetings on April 10 and April 11, 1996, and by letter ballot dated May 16, 1996, members of the Z21 Accredited Standards Committee and the Z83 Accredited Standards Committee unanimously approved the merger of the two committees. By letter ballot dated October 8, 1996, the members of the Z21 Committee and the Z83 Committee unanimously approved the title and procedures of the new committee as Accredited Standards Committee Z21/83 on Performance and Installation of Gas-Burning Appliances and Related Accessories.

The Z21/83 Committee, at its April 17, 1997 meeting, approved proposed revisions to the harmonized central furnace standard. The Canadian Standards Steering Committee concurred with the actions of the Z21/83 Committee and approved the proposed revisions to the harmonized central furnace standard. The second edition of the harmonized central furnace standard was approved by the Interprovincial Gas Advisory Council on December 21, 1998, and the American National Standards Institute, Inc. on June 9, 1998.

The third edition of the harmonized central furnace standard was approved by the Interprovincial Gas Advisory Council on September 4, 2001, and the American National Standards Institute, Inc. on September 27, 2000.

The fourth edition of the harmonized central furnace standard was approved by the Interprovincial Gas Advisory Council on August 28, 2003, and the American National Standards Institute, Inc. on September 17, 2003.

The fifth edition of the harmonized central furnace standard was approved by the Interprovincial Gas Advisory Council on December 1, 2006, and the American National Standards Institute, Inc. on July 27, 2006.

The sixth edition of the harmonized central furnace standard was approved by the Interprovincial Gas Advisory Council on March 22, 2012, and the American National Standards Institute, Inc. on March 27, 2012.

This, the seventh edition of the central furnace standard was distributed for industry review during October 2012, June 2014, December 2014, and May 2015; approved by the Z21/83 Technical Committee on Performance and Installation of Gas Burning Appliances and Related Accessories on March 6, 2016, March 25, 2016, and July 11, 2016; the CSA Technical Committee on Gas Appliances and Related Accessories on March 6, 2016, March 25, 2016, and July 11, 2016; by the American National Standards Institute, Inc. on October 28. 2016; and by the Interprovincial Gas Advisory Council on August 22, 2016.

Previous editions of the central furnace standard, and addenda thereto, approved by the American National Standards Institute or its predecessor organizations are as follows:

Z21.13–1934

Z21.13–1936

Z21.13–1938

  

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| Z21.13–1940 | Z21.13a-1940 | |
| Z21.13–1943 | | |
| Z21.13–1945 | Z21.13a-1950 | Z21.13b-1950 |
| Z21.13.2–1951 | Z21.13.2a-1952 | Z21.13.2b-1954 |
| Z21.13.2–1955 | | |
| Z21.13.2–1956 | Z21.13.2a–1957 | |
| Z21.13.2–1958 | Z21.13.2a-1959 | Z21.13.2b-1960 |
| Z21.13.2–1960 | | |
| Z21.13.2–1961 | Z21.13.2a-1962 | Z21.13.2b-1963 |
| Z21.47–1964 | Z21.47a-1965 | Z21.47b-1967 |
| Z21.47–1968 | Z21.47a-1969 | |
| Z21.47–1971 | Z21.47a-1972 | |
| Z21.47–1973 | Z21.47a-1974 | Z21.47b-1975 |
| Z21.47–1978 | Z21.47a-1980 | Z21.47b-1982 |
| Z21.47–1983 | Z21.47a-1985 | Z21.47b-1986 |
| Z21.47–1987 | Z21.47a-1988 | Z21.47b-1989 |

Previous editions of the harmonized central furnace standard, and addenda thereto, approved by the Interprovincial Gas Advisory Council and the American National Standards Institute are as follows:

| | | |
|---|---|---|
| ANSI Z21.47-1993 • CAN/CGA 2.3-M93 | ANSI Z21.47a-1995 • CGA 2.3a-M95 | ANSI Z21.47b-1997 • CGA 2.3b-M97 |
| ANSI Z21.47-1998 • CSA 2.3-M98 | ANSI Z21.47a-1999 • CSA 2.3a-M99 | ANSI Z21.47b-2000 • CSA 2.3b-M00 |
| ANSI Z21.47-2001 • CSA 2.3-2001 | ANSI Z21.47a-2001 • CSA 2.3a-2001 | ANSI Z21.47b-2002 • CSA 2.3b-2002 |
| ANSI Z21.47-2003 • CSA 2.3-2003 | ANSI Z21.47a-2004 • CSA 2.3a-2004 | ANSI Z21.47b-2006 • CSA 2.3b-2006 |
| ANSI Z21.47-2006 • CSA 2.3-2006 | ANSI Z21.47a-2007 • CSA 2.3a-2007 | ANSI Z21.47b-2008 • CSA 2.3b-2008 |
| ANSI Z21.47-2012 • CSA 2.3-2012 | | |

**Note:** *This edition of ANSI Z21.47 • CSA 2.3 incorporates changes to the 2012 edition of the standard. Changes, other than editorial, are denoted by a Δ in the margin.*

# ANSI Z21.47-2016 • CSA 2.3-2016
# Gas-fired central furnaces

## 1 Scope

Δ **1.1**

This Standard applies to automatically operating gas-fired central furnaces (see Clause 3, Definitions), hereinafter referred to as furnaces, for installation in residential, commercial, and industrial structures including furnaces for direct vent, recreational vehicle, outdoor, and manufactured (mobile) homes. These furnaces may include a cooling unit. All units are to be constructed entirely of new, unused parts and materials.

**1.2**

In Canada, this Standard applies to gas-fired central furnaces having inputs up to and including 400,000 Btu/hr (117 228 W).

**1.3**

This Standard applies to Category I, Category II, Category III, and Category IV Central Furnaces. See Clause 3, Definitions.

**1.4**

This Standard applies to furnaces of the types defined in Clause 3, Definitions, which are designed to supply heated air through ducts to spaces remote from or adjacent to the furnace location. Location and use of such furnaces with respect to the spaces being heated necessitates automatic operation of the appliance.

**1.5**

This Standard covers the thermal efficiency, Clause 5.40, Thermal efficiency, and related markings of only those furnaces whose efficiencies are not regulated in the U.S.A. by the Energy Policy Act and Conservation Act of 1975 and the National Energy Conservation Policy of 1978* or not covered in Canada by Clause 13, Items unique to Canada, when connected to single phase electrical supply.

** At the time of printing, Federal energy acts in the U.S.A. regulate the efficiency (heating capacity) of furnaces having input ratings less than 225,000 Btu/hr (65 941 W).*

**1.6**

A furnace of a type not specifically defined in this Standard may be subjected to such examination and tests as deemed necessary by the testing agency to determine compliance with the intent of this Standard.

**1.7**

This Standard also applies to a furnace that is factory equipped with both a draft hood and an automatic vent damper device (see Clause 3, Definitions), hereinafter referred to as vent damper device.

  

Δ **1.8**

Unless otherwise indicated on its rating plate, a furnace is to be for installation indoors in accordance with its markings and the manufacturer's installation instructions. When specified additional or alternate provisions are met, a furnace may be for manufactured (mobile) home installation or for use outdoors.

Δ **1.9**

A furnace for manufactured (mobile) home installation is to be designed so when installed in accordance with the manufacturer's installation instructions supplied with the furnace, it provides complete separation of its combustion system from the living space of the manufactured (mobile) home.

The complete separation of the furnace combustion system from the living space of the manufactured (mobile) home is accomplished by the furnace being designed and installed so (1) all air supplied for combustion, (2) the combustion system of the furnace, and (3) all products of combustion are completely isolated from the living space. Doors, panels, and any other access openings of the structure serving an enclosure required for such isolation are to communicate only to the outdoors. A furnace that by its inherent design provides such complete separation is referred to as a direct vent central furnace (see Clause 3, Definitions).

Δ **1.10**

A furnace is for use with one or more of the gases specified in Clause 5.1.1. A furnace for manufactured (mobile) home installation is to be convertible for use with natural gas and propane gas.

**1.11**

Special construction provisions applicable to Category II, III, or IV furnaces are outlined under Clauses 1.12,4.1.25, 4.13, Condensate disposal, Clauses 4.14.16 through 4.14.18, 4.23.6(d), 4.23.6(h), 4.26.3(b)(iv), and Clause 4.26.6(f).

Δ **1.12**

A furnace for indoor installation designed to vent the flue gases horizontally through an outside wall is to be specified as Category III or IV, except Category I furnaces utilizing a listed mechanical venter applied externally to the venting system.

**1.13**

Special construction provisions applicable to a furnace for manufactured (mobile) home installation are outlined under Clauses 1.8, 1.9, 1.10, 4.1.24, 4.5.5, 4.10.18, 4.23.3(d), 4.23.9, 4.26.3(b)(vi), 4.26.13(a) and Clause 4.26.13(d), and Clause 6.

Δ **1.14**

Special construction provisions applicable to a furnace convertible for use with natural gas and propane gas are outlined under Clauses 1.10, 4.7.5, 4.11.5(d), 4.26.3(b)(vii), and Clause 4.26.5(a).

**1.15**

If a value for measurement as given in this Standard is followed by an equivalent value in other units, the first stated value is to be regarded as the specification, except as noted in Clauses 4.22.1 and 4.26.1(b).

  

Δ **1.16**

All references to “psi” throughout this Standard are to be considered gauge pressures, unless otherwise specified.

**1.17**

Special construction provisions applicable to a furnace designed for use with an optional listed conversion kit are outlined under Annex H, Provisions for listed gas appliances conversion kits (optional).

**1.18**

Clause 2, Reference publications, contains a list of standards specifically referenced in this Standard and sources from which they may be obtained.

Clause 2, Reference publications, includes both U.S. and Canadian reference standards where applicable. It is the responsibility of the user of this Standard to determine which referenced standard applies based on the requirements of the authority having jurisdiction at the location of the installation. However, a furnace for use in a particular country only should comply with the applicable referenced standard for that country.

**1.19**

Clause 4.17, Electrical equipment and wiring, is unique to the Standard for *Gas-Fired Central Furnaces*, ANSI Z21.47. The Canadian electrical equipment and wiring provisions are contained in the Standard for *Electrical Features of Fuel-Burning Equipment*, CAN/CSA-C22.2, No. 3.

**1.20**

Special construction provisions applicable to furnaces designed to operate at altitudes over 2000 ft (610 m) are outlined in Annex K, Provisions for listed high altitude conversion kits (optional).

**1.21**

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.

# 2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

  