

American National Standard/
CSA Standard for
**Gas-Fired Construction
Heaters**

AMERICAN NATIONAL STANDARD
ANSI Z83.7-2011

CSA STANDARD
CSA 2.14-2011

Second Edition - 2011
This Standard is based on the Standard for
Gas-Fired Constuction Heaters

ANSI Z83.7a-2000 • CSA 2.14a-2000
Addenda ANSI Z83.7a-2007 • CSA 2.14a-2007 and
ANSI Z83.7b-2009 • CSA 2.14b-2009

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10036***

Preface

This publication represents a basic standard for safe operation, substantial and durable construction, and acceptable performance of gas-fired construction heaters. It is the result of years of experience in the manufacture, testing, installation, maintenance, inspection and research on gas-fired construction heaters designed for utilization of gas. There are risks of injury to persons inherent in appliances that, if completely eliminated, would defeat the utility of the appliance. The provisions in this standard are intended to help reduce such risks while retaining the normal operation of the appliance.

Nothing in this standard is to be considered in any way as indicating a measure of quality beyond compliance with the provisions it contains. It is designed to allow compliance of gas-fired construction heaters, the safety construction and performance of which may exceed the various provisions specified herein. In its preparation, recognition has been given to possibilities of improvement through ingenuity of design. As progress takes place, revisions may become necessary. When they are believed desirable, recommendations or suggestions should be forwarded to the CSA America, 8501 East Pleasant Valley Road, Cleveland, Ohio 44131, or the Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

Safe and satisfactory operation of gas-fired construction heaters depends to a great extent upon its proper installation, use and maintenance. It should be installed, as applicable, in accordance with the *National Fuel Gas Code, ANSI Z223.1/NFPA 54*; the *Natural Gas and Propane Installation Code, CSA B149.1*.

Users of this American National Standard/CSA Standard are advised that the devices, products and activities within its scope may be subject to regulation at the Federal, Territorial, Provincial, state or local levels. Users are strongly urged to investigate this possibility through appropriate channels. In the event of a conflict with this standard, the Federal, Territorial, Provincial, state or local regulation should be followed.

THIS STANDARD IS INTENDED TO BE USED BY THE MANUFACTURING SECTOR AND BY THOSE APPLYING THE EQUIPMENT AND BY THOSE RESPONSIBLE FOR ITS PROPER INSTALLATION. IT IS THE RESPONSIBILITY OF THESE USERS TO DETERMINE THAT IN EACH CASE THIS STANDARD IS SUITABLE FOR AND APPLICABLE TO THE SPECIFIC USE THEY INTEND.

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EFFECTIVE DATE: An organization using this standard for product evaluation as a part of its certification program will normally establish the date by which all products certified by that organization should comply with this standard.

History Of Development Of The Standard For Gas Gas-Fired Construction Heaters

(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 equipment.

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.

A Z83/CGA joint Subcommittee on Standards for Gas-Fired Construction Heaters was established, based on memberships of the Z83 Subcommittee on Standards for Gas-Fired Construction Heaters and the CGA Committee on Gas-Fired Construction Heaters..

To facilitate the reporting structure of joint subcommittees, a CSA Technical Committee on Gas Burning Appliances and Related Accessories was established to parallel the Z21/Z83 Technical Committee on Performance and Installation of Gas Burning Appliances and Related Accessories.

The first edition of the harmonized Z83/CSA Standard for Construction Heaters was approved by the Interprovincial Gas Advisory Council on May 23, 2000, and by the American National Standards Institute, Inc. on October 24, 2000.

The previous editions of the construction heater standard, and addenda thereto, approved by the Interprovincial Gas Advisory Council and American National Standards Institute, Inc. are as follows:

Z83.7-1994
Z83.7a-1981
Z83.7b-1984

Z83.7-1987
Z83.7a-1989
Z83.7b-1989

Z83.7-1990
Z83.7a-1991
Z83.7ba-1993

Z83.7-2000 • CSA 2.14-2000
Z83.7a-2007 • CSA 2.14a-2007
Z83.7b-2009 • CSA 2.14b-2009

The following identifies the designation and year of this edition of the standard:

ANSI Z83.7-2011 • CSA 2.14-2011

NOTE: *This edition of Z83.7 • CSA 2.14 incorporates changes to the 2000 edition and addenda thereto. Changes, other than editorial, are denoted by a vertical line in the margin.*

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NOTE

This standard contains SI (Metric) equivalents 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 Metric Practice Guide, CAN/CSA Z234.1 are used as a guide in making metric conversion from yard/pound quantities.) If a value for a measurement and an equivalent value in other units, the first stated is to be regarded as the requirement. The given equivalent value may be approximate. If a value for a measurement and an equivalent value in other units, are both specified as a quoted marking requirement, the first stated unit, or both shall be provided.

American National Standard/ CSA Standard For Gas-Fired Construction Heaters

Part I: Construction

1.1 Scope

1.1.1

This standard applies to newly produced direct fired construction heaters, hereinafter referred to as heaters or appliances, constructed entirely of new, unused parts and materials and primarily intended for temporary use in heating buildings or structures under construction, alteration or repair. All the products of combustion generated by the heater are released into the area being heated. The requirements of this standard cover heaters with rated inputs up to and including 10,000,000 Btu/h (2930 kW).

1.1.2

This standard applies to self-contained heaters with or without integral means for air circulation and not intended for connection to ducts. It shall also apply to forced draft, fan equipped, heaters connected to duct systems supplied by the manufacturer.

1.1.3

This standard does not apply to heaters employing a flameless catalytic combustion process or heaters for use with liquid phase fuel gases.

1.1.4

If a value for measurement as given in this standard is followed by an equivalent value in other units, the first state value is to be regarded as the specification.

1.1.5

The standard applies to heaters using the following fuels:

- a. Natural gas; and
- b. Propane.

1.1.6

Accessories.

All accessories intended for use with appliances certified to the standard shall be tested to this standard on the appliance on which they may be used.

1.1.7

Exhibit A, Items Unique to Canada, contains items unique to the Canada.

1.1.8

Exhibit B, Items Unique to the United States, contains items unique to the U.S.

1.1.9

Exhibit C contains a list of standards specifically referenced in this standard, and sources from which these reference standards may be obtained.

1.1.10

All references to psi through this standard are to be considered gauge pressure unless otherwise specified.

1.2

General Construction

1.2.1

The construction of a heater, whether specifically covered in this standard or not, shall be in accordance with reasonable concepts of safety, substantiality and durability. Component parts shall be well fitted and not show signs of becoming warped, bent, broken or otherwise damaged during the initial test installation or during any of the tests specified so as to prevent compliance with this standard.

1.2.2

Asbestos shall not be used in the construction of a heater.

1.2.3

Every part of the heater shall be secure against displacement and shall be constructed so as to maintain a fixed relationship between essential parts under normal and reasonable conditions of handling and usage. Parts not permanently secured shall be designed so they cannot be incorrectly assembled and cannot be improperly located or misaligned in removing or replacing during cleaning or other servicing.

1.2.4

All components shall be suitable for the temperatures to which exposed. In those instances where component temperature suitability is not determined under the other provisions of this standard or by established compliance with a nationally recognized standard pertaining to the specific component, the testing agency at its discretion may rely upon the recommendations of the component manufacturer as submitted by the heater manufacturer.

1.2.5

Stability.

It shall be noted that mechanical means such as screws, bolts, or other such devices and the instructions for attachment of the heater are not acceptable means of providing stability for the heater.

1.2.6

Heaters not equipped with a tip-over shutoff device shall not tip over when set in any normal operating position on a surface inclined 25 degrees (0.44 rad) from a horizontal plane.

1.2.7

Heaters equipped with a tip-over shutoff device shall not tip over when set in any normal operating position on a surface inclined 15 degrees (0.26 rad) from a horizontal plane.

The tipover shutoff device shall function to cause complete shutoff of all gas to the heater within 5 seconds after the heater is fully tipped over from any direction on a level surface. A manual reset function shall be required to restart the heater.

1.2.8

Special construction provisions applicable to heaters for outdoor use are outlined under 1.4.3, 1.4.4, 1.8.3-b, 1.20.10 and in the tables in the back of the standard.

1.2.9

Special provisions for heaters intended for use with ductwork are outlined under 1.16.3, 1.19.1-20, 1.20.14, 2.1.6, and 2.8.2.

All ducts shall be supplied by the manufacturer. The materials of the duct shall be suitable for the temperatures to which they are exposed.

1.2.10

The pressure rating of automatic safety shutoff valves and all other gas components shall be not less than the maximum pressure to which the system is protected.

1.2.11

A means to test gas tightness of automatic safety shutoff valves shall be provided.

1.3 Assembly

1.3.1

The construction and assembly of a heater shall be of a neat and workmanlike character with parts well fitted and bolts or other fasteners drawn up to give rigidity. Any exposed edges of the heater which might be brought in contact with the hand during normal usage or adjustment shall be smooth.

1.3.2

Bolts, nuts, screws and other threaded fasteners, except sheet-metal screws, used in the general assembly of the heater shall have threads conforming to the *Standard for Unified Inch Screw Threads (UN and UNR Thread Form)*, ANSI/ASME B1.1, or the *Standard for Metric Screw Threads -M Profile*, ANSI/ASME B1.13M.

1.3.3

In submitting the heater for test, the manufacturer may furnish a list of manufacturing tolerances applicable thereto and may have the heater tested for compliance with this standard in both extremes of tolerances specified.

1.4 Accessibility

1.4.1

All controls shall be accessible for normal servicing and functional adjustment in position and shall be replaceable during normal servicing. Manifold assemblies which permit removal of control(s) intact shall be considered as complying with this provision. Removal of an access panel or door to secure access to a control compartment shall be considered acceptable.

1.4.2

Provision shall be made to permit ready observation of the igniter or pilot and a major portion of the flames of each burner under operating conditions.

1.4.3

Access doors or panels of heaters for outdoor use shall be constructed such that with the doors or panels in place, no water will accumulate within the heater or heater enclosure during the conduct of 2.13.1.

1.4.4

Access doors or panels of heaters for outdoor use shall require the use of a tool to open.

1.5 Main Burners

1.5.1

Bodies of burners (including mixer head, mixer tubes and burner plenum) shall be of substantial and durable construction. They shall be constructed of materials having a melting point above 1000°F (538°C). If materials having a melting point below 1450°F (788°C) are used, the design of the burner shall be such that no part of the burner having a melting point below 1450°F (788°C) will attain a temperature above 875°F (468°C) and the burner will not deteriorate during any of the tests specified in Part II.

1.5.2

Ports shall be machined or otherwise accurately made.

1.5.3

Joints, when used in the pressure zone or in the burner head of a burner assembly, shall be gas tight and shall not depend for mechanical strength nor primarily for tightness on cement or other sealing material, except where such joints may be considered part of the port area. Joints shall be securely bolted, screwed, machined, welded, brazed or of equivalent construction.

1.5.4

Bolt holes shall not intersect gas-ways unless adequate provision is made to provide permanent gas tightness.

1.5.5

Burners or burner and support assemblies shall be removable and essentially self-locating, and shall be secured so that they will not twist, slide, or drop out of position in normal use. Burners which are bolted or locked into position shall be provided with securing means that are accessible and constructed of a corrosion-resistant material.

1.6 Combustion Air Control

1.6.1

Primary air openings shall be fixed and non adjustable.

1.6.2

Heaters utilizing forced or induced draft, or both, for supplying combustion air shall be provided with means for automatically shutting off the gas supply to the burner(s) in the event of failure of the fan(s), unless the heater will comply with this standard without the fan(s) in operation.

1.6.3

Heaters utilizing forced or induced draft, and having an input over 400,000 BTU/h (117 kW) shall provide a purge period of at least six complete air changes of the combustion chamber and integral ductwork prior to trial for ignition.

1.7 Orifices And Orifice Fittings

1.7.1

A fixed orifice(s) shall be provided for the main burner(s) and shall be readily accessible.

1.7.2

Main burner orifices and orifice holders shall be made of material melting at not less than 1450°F (788°C).

1.8 Ignition Means (Systems)

1.8.1

Automatic gas ignition systems (see Part IV, Definitions) and components shall comply with the applicable construction provisions of the *Standard for Automatic Gas Ignition Systems and Components, ANSI Z21.20, CAN1 6.4, Combustion Safety Controls and Solid-State Igniters for Gas and Oil-Burning Equipment, CSA C22.2 No. 199*, or other nationally recognized standards covering such components.

1.8.2

If a piezo-electric spark device is used, it shall comply with the *Standard for Manually-Operated Piezo-Electric Spark Gas Ignition Systems and Components, ANSI Z21.77 • CSA 6.23* or equivalent. It shall be limited to

- a. Ignition of a pilot burner, with an input of 50,000 Btu/hr (15 kW) or less; or
- b. Direct ignition of a main burner, with an input of 50,000 Btu/hr (15 kW) or less.

1.8.3

Every heater and each combustion chamber of a heater shall be equipped with an ignition system designed to function in one of the following manners:

- a. Provide for manual (direct) lighting of main burner gas for appliances having inputs of 50,000 Btu/hr (14654 W) or less.
- b. Provide for ignition of main burner gas by means of a proved ignitor or pilot. If the presence of the ignition source is not proved, provide for automatic shutoff of:
 1. The pilot burner gas:
 - (a) On an appliance for use indoors, except an appliance for use only with a gas having a specific gravity less than 1.0 and equipped with an ignition system not requiring manual lighting and which complies with 2.6.15; and
 - (b) On an appliance for outdoor installation, except an appliance equipped with an ignition system not requiring manual lighting and which complies with 2.6.15.
 2. The main burner gas.
- c. Provide for ignition of main burner gas by means of a direct ignition device. If the presence of the main burner flame is not proved, provide for automatic shutoff of main burner gas.

In the event of main burner flame outage during an operating cycle, provide for automatic shutoff of main burner gas without re-energizing the direct ignition device or provide for prompt and safe reignition of main burner gas by re-energizing the direct ignition device as stipulated in 2.7.5.

1.8.4

In addition to the automatic gas ignition system functions specified in 1.8.3-b, a system having an interrupted ignition source shall provide for supervision of the main burner flame only following the main burner flame-establishing period. If the presence of the main burner flame is not proved within the flame-establishing period, the system shall provide for automatic shutoff of main burner gas.

1.8.5

Pilot burners shall be of substantial and durable construction. They shall be of materials having a melting point above 1450°F (788°C). Alloys of greater than 1.0 percent nickel content are not acceptable because of catalytic cracking effect.

1.8.6

An ignition device shall be located so as to be easily seen.

1.8.7

Pilot burner shall be placed so their flames may be directly observed with the main burner(s) off and, unless other means are available for checking operation, shall be observable with the main burner(s) on.

1.8.8

A manually lighted burner shall be capable of being lighted without burning the hand. If a pilot burner ignition device or lighter rod is necessary for safe and convenient ignition, it shall be provided. If a lighter rod is used, it shall not exceed 12 in (305 mm) in length, and means shall be provided for permanently attaching it to the heater.

1.8.9

When a manually lighted pilot is provided, the design of the control system shall be such that main burner gas flow cannot occur while the pilot is being lighted in accordance with the manufacturer's lighting instructions (see 1.20.3). The interruption of main burner gas flow shall not depend on the operation of a manual valve nor on a separate switch. After the pilot has been established and the safety shutoff device remains in a position that would permit main burner gas flow, an additional manual operation of a control shall be necessary to permit main burner gas flow.

1.8.10

When an automatic relight pilot system is used, it shall be of the type that will act to re-establish the ignition means in 0.8 second or less, or a mechanical or electrical interlocking means shall be provided to prevent the flow of gas to the main burner(s) when the automatic relight pilot system is energized.

1.8.11

Automatic gas ignition system components shall be installed so the operation of these components and main burner ignition will not be affected by falling scale and dirt during normal operation.

1.8.12

An automatic ignition device shall be positively positioned with respect to the main burner port(s). Such devices shall be secure against accidental displacement, incorrect assembly and reversible mounting.

1.8.13

Automatic gas ignition system components, and bleed assemblies when used, shall be made secure against accidental displacement. Except as noted below, pilot burner and igniter assemblies shall be constructed and installed so they may be removed without the use of special tools and without removing main burners, controls or accessories, or breaking or disturbing any gas connection other than that of the pilot supply, bleed supply or manifold unions. Automatic gas ignition system components which are easily removed with main burners and controls as a unit are considered as complying with this provision.

1.8.14

When the pilot gas supply line is taken from a horizontal line, the connection shall be made on the side, top or, if means are provided to prevent condensate from entering the pilot line, the bottom of the horizontal line. When a pilot gas supply line is taken from a vertical line, the connection shall be above the main burner supply line.

1.8.15

Pilot burner primary air openings and gas orifices shall be easily accessible for servicing.

1.8.16

Ample clearance shall be provided for removal and replacement of pilot burners without damage to pilot gas tubing.

1.8.17

Electric make-and-break contacts shall not be placed within a combustion chamber unless shielded against deterioration from heat and flue gases.

1.8.18

When ignition system wiring extends into a combustion chamber, it shall be protected against abrasion. When it is necessary to disconnect leads to remove components, the leads shall be of sufficient length to reach a convenient disconnect point.

1.8.19

Slotted ports connecting ignition and thermal element ports shall be milled or otherwise accurately formed.

1.8.20

The application of a pilot igniter shall be such that its operation will not produce a proved pilot effect at the flame sensor if the pilot is not established.

1.8.21

If the position of the pilot igniter is adjustable with respect to the pilot burner, a locking means shall be provided for maintaining such adjustment.

1.8.22

Pilot igniter shall not interfere with the adjustment of the pilot.

1.9 Primary Safety Control (Flame Safeguard)

The input during trial for ignition shall not exceed the maximum rated input for the burner or the heater.

1.9.1

The pilot or main burner flame, or both, shall be supervised by a primary safety control.

1.9.2

Flame supervision shall be provided for pilot operation and shall be in accordance with one of the following types:

- a. Continuous Pilot. A manually lighted constant-burning pilot. Supervision is of the pilot flame.
- b. Intermittent Pilot. An electric-ignited pilot which is automatically lighted each time there is a call for heat. It burns during the entire period that the main burner(s) is firing. Supervision is of the pilot flame.
- c. Interrupted Pilot. An electric-ignited pilot which is automatically lighted each time there is a call for heat. Supervision is of the pilot flame during the main burner flame-establishing period. After the main burner valve is open, supervision is of the main burner flame and the pilot is automatically shut off.

1.9.3

When pilots are used, the primary safety control shall be arranged so the main gas safety shutoff valve(s) will shut off gas to the main burner(s) until the pilot has been proven.

1.9.4

Pilot supervision shall be only at the point where the pilot will effectively ignite the gas at the main burners even when the gas supply to the pilot is reduced so the flame is just sufficient to prove the pilot.

1.9.5

With an intermittent or interrupted pilot, the pilot flame-establishing period for proving the pilot shall not exceed the timing specified in Table I, Maximum Ignition System Timings. If the pilot is proven, the main gas safety shutoff valve is energized. The pilot is not proven within the specified period, the pilot gas shall be automatically shut off and the primary safety control shall assume a lockout position and require a manual restart.

1.9.6

With an interrupted pilot or electronic burner control, the main burner flame-establishing period for proving the main burner flame shall not exceed the timing specified in Table I, Maximum Ignition System Timings. If the main burner flame is not proven within the specified period, the main burner safety shutoff valve shall be de-energized and the primary safety control shall assume a lockout position and require a manual restart.

1.9.7

Except with electronic burner control which act to re-establish the ignition means in 0.8 seconds or less on loss of main burner flame, the primary safety control shall de-energize all safety shutoff valves, or automatic valves utilized as safety shutoff valves, within the flame failure response time specified in Table I, Maximum Ignition System Timings, after accidental outage of the supervised flame and shall assume a lockout position and require a manual restart. The valve closing time for such valves shall not exceed that specified in Table I.

With an electronic burner control which act to re-establish the ignition means in 0.8 second or less on loss of main burner flame, the primary safety control shall permit only one trial for reignition. Such trial shall not exceed the main burner flame-establishing period specified in Table I, Maximum Ignition System Timings. If the main burner flame is not proven within this period, the primary safety control shall immediately de-energize all safety shutoff valves, or automatic valves, utilized as safety shutoff valves, shall assume a lockout position and require a manual restart. The valve closing time for such valves shall not exceed the specified in Table I.

The secondary voltage of the ignition transformer shall not be less than 6000 volts.

The trial for ignition shall not exceed five seconds and the flame safe guard system shall deenergize the automatic safety shut off valves within this period if burner flame is not established.

Electronic burner controls shall be of the interrupted type only.

Spark gap shall be in accordance with manufacturers specification and be located in the air/gas stream.

1.9.8

A burner circuit shall be arranged to prevent feedback by a motor, capacitor or similar device from energizing a gas valve or ignition device after a control functions to shut off the burner.

1.9.9

Multiport burners with more than 3 ft (1 m) of flame travel from the source of ignition shall have a main burner flame safeguard sensing the flame as far as possible from the source of ignition and shall be shielded from the source of ignition to assure ignition of the burner grid.

1.10 Manual Gas Valves

1.10.1

Manual gas valve(s) for shutting off the gas to the main burner, and to the pilot burner if a pilot burner is used, shall be furnished as part of a heater for use with natural gas. A heater for use with propane only may be furnished with a manual valve at the option of the manufacturer.

1.10.2

Lubricants used on valves shall be resistant to the action of natural gas and propane.

1.10.3

Manual gas valves on appliances intended for operation at inlet pressures not exceeding $\frac{1}{2}$ psi (3.5 kPa) shall comply with the construction provisions of the *Standard for Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves, ANSI Z21.15 • CGA 9.1*.

Manual gas valves on appliances intended for operation at inlet pressures exceeding $\frac{1}{2}$ psi (3.5 kPa) shall be suitable for the gas and pressure to which they will be exposed. Valve bodies, casings and parts intended to maintain gastightness to the atmosphere when the valve is in either the open or closed position shall be made of material having a melting point of not less than 800°F (427°C) melting point requirement. These valves shall also comply with sections 2.11, Manual Gas Valves through 2.16, Stability.

1.10.4

All manual valves shall clearly indicate the open and closed positions and shall be provided with rigid stops secured to the valve.

1.10.5

The manual valve actuating handle shall be parallel to the gas supply line in the open position and at right angles to the gas supply line in the closed position.

1.10.6

Heaters having inputs over 400,000 Btu/hr (117 kW) shall be equipped with the following:

- a. A manual main burner test firing valve. The purpose of this valve is for checking the safe operation of the main burner safety shut off valves; and
- b. Where a pilot burner is used, a manual shutoff valve shall be provided. The valve shall be located in the pilot gas piping upstream from all pilot controls.

1.11 Heater Gas Piping

The following construction provisions apply to the gas supply lines used within a heater.

1.11.1

Iron or steel pipe employed as gas conduit within heaters shall comply dimensionally with the *Standard for Welded and Seamless Wrought Steel Pipe, ANSI/ASME B36.10M*.

1.11.2

Tapped holes for gas valves, pilots or other branch supply lines shall carry not less than $3\frac{1}{2}$ taper pipe threads in accordance with the *Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1*.

1.11.3

Pilot gas line connections shall be made to the proper port of a combination gas control valve if so equipped or, either on the side or top of the supply line in such a manner that there will be no likelihood of stoppage of the pilot line due to collection of dust, dirt or condensate.

1.11.4

Formed supply piping shall have all bends smoothly made without any appreciable reduction in the cross-sectional area, shall reveal no imperfections occasioned by the forming process, and shall be annealed if necessary to remove internal stresses.

1.11.5

Nonferrous semi-rigid tubing employed as gas conduit shall have a wall-thickness in accordance with Table II, Minimum Acceptable Wall Thickness for Nonferrous Tubing.

1.11.6

Aluminum piping or tubing shall not be used.

1.11.7

Copper tubing, or tubing with internal copper surfaces, when used for conveying natural gas, shall be internally tinned or equivalently treated to resist corrosion by sulphur compounds.

1.11.8

Nonferrous semi-rigid tubing shall comply with:

- a. The *Specification for Seamless Brass Tube, ASTM B135*;
- b. Type K or L coverage in the *Specification for Seamless Copper Water Tube, ASTM B88*; and
- c. The *Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service, ASTM B280*.

1.11.9

Tubing and fittings used as gas piping shall be capable of withstanding a temperature of 1000°F (538°C) without melting. Tubing and fittings used as gas conduit shall not be exposed to temperatures in excess of those specified in Table III, Maximum Tubing and Fitting Temperatures when the heater is operated as specified in 2.13, Wall, Floor, Ceiling, and Electrical Equipment and Wiring Temperatures.

1.11.10

Gas pipe, tubing, and fittings shall be rigidly supported.

1.11.11

Compounds used on threaded joints of gas piping shall be resistant to the action of natural gas and propane.

1.11.12

Unions in gas piping on heaters shall be of the ground joint type or a flanged joint including a gasket resistant to the action of propane and suitable for the temperature to which it is exposed.

1.11.13

The gas piping of integral heater-container units shall not support the heater. (Also see 1.12.1).

1.11.14

Test openings shall be furnished downstream of the gas pressure regulator for measuring gas pressure. The test openings shall use an NPT plugged tapping, accessible for test gauge connection. The test opening shall be closed by a gauge, metal plug, or cap. If a plug is used it may not be of the slotted head type.

1.11.15

Heater having inputs over 400,000 BTU/h (117 kW) shall be equipped with:

- a. A test opening immediately upstream of the manual main burner test firing valve to test the operation of the main burner safety shut off valve(s);
- b. A test opening shall be provided downstream of the pilot automatic safety shut off valve, where used, to test the operation of the pilot automatic safety shut off valve; and
- c. If the maximum rated input of the pilot is in excess of 400,000 Btu/h (117 kW) each pilot shall be equipped with a pilot test firing valve.

1.12 Gas Hose Assemblies (Connectors)

1.12.1

Each heater shall be supplied with a gas hose assembly (consisting of a hose and end fittings). The hose assemblies for integral heater-container units (appliances specifically designed for attachment to the propane gas container or to a supporting stand which also holds the container) may be as short as practicable or may be eliminated if gas piping covered by 1.11, Heater Gas Piping, makes provision for direct connection to the container shutoff valve and does not support the heater. The length of the gas hose assembly shall be as described in Exhibit A, Items Unique to Canada, and Exhibit B, Items Unique to the United States.

1.12.2

The gas hose assembly (consisting of a hose and end fittings) shall either:

- a. Comply with the *Standard for Pigtails and Flexible Hose Connectors for LP Gas, ANSI/UL 569*, with the exception of the 5 ft (60 in (1.52 m)) length limitation, or the *Standard for Elastomeric Composite Hose and Hose Couplings for Conducting Propane and Natural Gas, CAN/CGA-8.1*, or the *Standard for Thermoplastic Hose and Hose Couplings for Conducting Propane and Natural Gas, CAN1-8.3*; or
- b. As an alternative to compliance with ANSI/UL 569, the gas hose assembly may comply with the following Methods of Test.
 1. Withstand an internal pressure of 700 psi (4.82 MPa) without leakage.

Method of Test

Three new test samples, each 2 ft (610 mm) long, shall be provided for an assembly to be tested under this provision. Each sample is to be connected to a source of air, nitrogen, or carbon dioxide gas which will provide a 700 psi (4.82 MPa) test pressure. The outlet of the free end fitting is to be closed and the entire sample immersed in water. A suitable pressure gauge shall be installed in the pressure supply piping between a positive shutoff valve and the hose assembly connector sample. Each sample shall contain a 700 psi (4.82 MPa) test pressure for 5 minutes with no evidence of leakage. (During pressurization, safety precautions shall be taken for hose assembly rupture.)

2. Withstand a pulling force without damage to the hose assembly or shall be listed by a nationally recognized testing agency as a LPgas/propane hose assembly with a rated working pressure of at least 350 psi (2.41 MPa).

Method of Test

Three new test samples, each 1 ft (305 mm) long, shall be provided for a hose assembly to be tested under this provision. The connecting fitting on each end of each sample is to be made up tightly with a corresponding companion part so both end fittings, fitting joints and hose are subjected to the pulling force. The pulling force shall be 400 lb (1.78 kN) for hose assemblies having nominal inside diameters of $\frac{5}{8}$ in or less and 750 lb (3.34 kN) for larger hose assemblies. The mechanical pulling means shall extend the sample at a rate of $\frac{1}{2}$ in (12.7 mm) per minute until the applicable pulling force is reached and shall then maintain this force for 1 minute. Each hose assembly shall not rupture or show other evidence of failure.

3. Withstand a 1750 psi (12.07 MPa) hydrostatic pressure without rupture or permanent distortion or shall be listed by a nationally recognized testing agency as a LP-Gas/propane hose assembly with a rated working pressure of at least 350 psi (2.41 MPa).

Method of Test

The 3 test samples used for the test in “-a” above shall be used for a hose assembly to be tested under this provision. Each sample is to be connected to a source of hydrostatic pressure which will provide a 1750 psi (12.07 MPa) test pressure, and the outlet of the free end fitting is to be closed. A suitable pressure gauge shall be installed in the pressure supply piping between a positive shutoff valve and the connector sample. Each sample shall contain a 1750 psi (12.07 MPa) test pressure for 1 minute without rupturing or showing evidence of permanent distortion.

4. End fittings shall be consistent with the service for which the gas hose assembly (connector) is designed and shall be of corrosion resistant metal or of steel provided with a protective coating having corrosion resistant qualities equivalent to those of the coatings specified.

Cadmium plating shall be not less than 0.0003 in (0.008 mm) thick, and zinc plating shall be not less than 0.0005 in (0.013 mm) thick. On parts where threads constitute the major portion of the area, the cadmium or zinc plating shall be not less than 0.00015 in (0.0038 mm) thick.

Fittings made of drawn brass or machined from brass rod containing more than 15 percent zinc shall comply with the following Method of Test.

Method of Test

Any plating on the devices shall be removed prior to this test. The specimen shall be degreased in a suitable alkaline degreasing solution or organic solvent and, if necessary, totally immersed in an aqueous solution of sulphuric acid (15 percent by volume) or nitric acid (40 percent by volume) until all oxides are completely removed from its surface, or pickled in such solutions as may be prescribed in the specification for the material being tested. The specimen shall be removed from the pickling solution and washed immediately in running water.

The specimen shall then be drained free of excess water and then continuously exposed in a set position for ten days to a moist ammonia-air mixture maintained in a glass chamber approximately 12 by 12 by 12 in having a glass cover.

Approximately 600 ml of aqueous ammonia having a specific gravity of 0.94 is to be maintained at the bottom of the glass chamber below the samples. The samples are to be positioned $1\frac{1}{2}$ inches above the aqueous ammonia solution and supported by an inert tray. The moist ammonia air mixture in the chamber is to be maintained at atmospheric pressure with the temperature constant at $95^{\circ}\text{F} \pm 2^{\circ}\text{F}$.

At the end of 10 days, the samples are to be removed from the glass chamber and inspected for cracks and/or delamination under 25 X magnification.

Specimens shall not show evidence of cracks or flaws.

1.12.3

The hose component of the gas hose assembly (see 1.12.2) shall comply with the *Safety Standard for LP-Gas Hose, UL 21*.

1.12.4

End fittings shall be faced or otherwise finished externally to provide an adequate hexagonal or octagonal wrench grip.

1.12.5

The gas hose assembly shall terminate in a tapered pipe thread in accordance with the *Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1*, or a flared fitting in accordance with the *Standard for Automotive Tube Fittings, ANSI/SAE J512*.

For threaded pipe connections, the length to shoulder shall not be less than shown in Table IV, Minimum Length to Shoulder.

1.12.6

Union seats shall not depend upon gaskets for gas tightness. Listed quick-disconnect devices are exempt from this provision.

1.13 Automatic Valves And Safety Shutoff Valves

1.13.1

A safety shutoff valve(s) shall be provided to shut off the main burner gas and, if a pilot burner is used, the pilot gas.

1.13.2

Automatic and safety shutoff valves shall comply with the *Standard for Automatic Valves for Gas Appliances, ANSI Z21.21 • CSA 6.5*, or other nationally recognized standards covering such devices.

Heaters having inputs over 400,000 Btu/hr (117 kW) shall be equipped with two main burner automatic safety shut off valves installed in series and wired in parallel.

1.13.3

Diaphragm type valves shall incorporate an internal bleed.

1.13.4

Automatic valves and safety shutoff valves shall assume the closed position upon failure of their power supply (electrical or mechanical) and shall not incorporate a manually set device which could prevent such closure. (Also see 1.9.7)

1.13.5

A means for manually opening a main gas safety shutoff valve shall be permitted only on heaters with manually lighted main burners in accordance with 1.8.3-a. Such means shall not cause the valve to remain open when the manual opening force is removed.

1.13.6

A means for manually opening a main gas automatic valve shall not be provided.

1.14 Gas Pressure Regulators

1.14.1

Heaters for use with natural gas shall be equipped with a gas appliance pressure regulator that will satisfactorily limit the main burner gas supply pressure.

1.14.2

Heaters for use with propane shall be supplied with a gas pressure regulator(s) located at the container which will satisfactorily reduce container pressure. This pressure regulator(s) shall comply with the *Standard for Pressure Regulating Valves for LP-Gas, ANSI/UL 144*. The inlet of the pressure regulator shall be fitted for attachment to:

- a. Connection No. 510 as specified in the *Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections, ANSI/CGA-V1*.

The nipple of the 510 connection fitting shall be listed and shall embody a captive soft lip or O-ring so as to provide an elastomer seal in addition to a metal-to-metal seal, and the nut shall be capable of accepting a wrench; or

- b. A listed or approved combination propane gas cylinder valve and quick-disconnect assembly that (1) will not permit gas flow until the mating halves of the quick-disconnect assembly are connected; (2) is configured as shown in Figures 1, Male Half Quick Disconnect and 2, Female Half Quick Disconnect; and (3) is interchangeable with all other such assemblies.

The connecting fitting shall incorporate an excess flow check valve complying with the *Standard for Valves for Anhydrous Ammonia and LP-Gas (Other Than Safety Relief), UL 125*, to minimize gas flow in the event of regulator breakage.

A gas appliance pressure regulator for use with propane may be provided at the heater in addition to the gas pressure regulator(s) supplied for use at a container.

1.14.3

Gas appliance pressure regulators, including vent limiters when so equipped, shall comply with the applicable construction provisions of the *Standard for Gas Appliance Pressure Regulators, ANSI Z21.18 • CSA 6.3*, or other nationally recognized standards covering such devices.

When a single regulator complying with the Z21.18 • CSA 6.3 standard is used to control the pressure of both pilot and main burner gas, it shall be of the type suitable for pilot and main burner load application as designated by the following symbol adjacent to the regulator model number:

- a.  for an appliance having a pilot gas flow rate less than 0.50 but not less than 0.15 ft³/hr (less than 3.93 but not less than 1.18 cm³/s); or
- b.  or  for an appliance having a pilot gas flow rate of 0.50 ft³/hr (3.93 cm³/s) or greater.

1.14.4

A gas appliance pressure regulator provided on a heater shall be of the adjustable, nonadjustable, or multi-stage type (see Part IV, Definitions). The outlet pressure shall approximate that specified by the manufacturer (see 1.20.2-d and 1.20.2-e).

1.14.5

The gas appliance pressure regulator shall be an assembled part of the manifold and located so as not to attain a temperature in excess of that specified by the regulator manufacturer when the heater is subjected to the tests specified in 2.13, Wall, Floor, Ceiling, and Electrical Equipment and Wiring Temperatures.

1.15 Adjustment Of Minimum Input Rating

1.15.1

When controls are designed for two or more rates, the adjustment means, when provided, shall be readily accessible and leakproof. Printed instructions shall be supplied with each heater clearly outlining the adjustment procedure to provide a low-flow rate setting not less than the manufacturer's specified minimum input rating as shown on the rating plate. Nonadjustable types shall be set by the manufacturer so the low-flow condition is not lower than the manufacturer's specified minimum input rating.

1.15.2

On power burners, the control shall be constructed so no adjustment of the rate of gas flow is permitted, unless the burner system is such that adjustment of the valve will not adversely affect the proportion of air and gas supplies to the burner.

1.16 Limit Controls

1.16.1

Limit controls shall be listed as complying with the *Standard for Limit Controls, UL 353 and CSA C22.2 No. 24, Temperature-Indicating and -Regulating Equipment*.

1.16.2

Fan equipped heaters shall be provided with an integral high temperature limit control which will cause safety shutdown of the heater in the event of fan failure unless the heater will comply with this standard without the fan in operation. Safety shutdown as the result of fan failure shall afford compliance with 2.13.2 and prevent any over temperature damage to the heater.

1.16.3

Heaters for use with ducts shall be provided with limit controls that will prevent the outlet air temperature from exceeding 350°F (194.5°C) above room temperature when tested in accordance with 2.8.2.

1.17 Electrical Equipment And Wiring

Information relating to electrical requirements appears in Exhibit A, Items Unique to Canada, and Exhibit B, Items Unique to the United States.

1.18 Motors

Information relating to electrical requirements appears in Exhibit A, Items Unique to Canada, and Exhibit B, Items Unique to the United States.

1.19 Instructions

1.19.1

Each heater shall be accompanied by clear, concise printed instructions and diagrams, stated in terms clearly understandable to the operator, adequate for proper field assembly, maintenance, safe use and operation.

The safety-related items included in the instructions shall be prominently displayed and shall precede the instructions concerning the functional use of the heater.

The instructions shall be marked with directions to the operator to retain them for future reference.

The instructions shall be reviewed by the testing agency for comprehensibility, accuracy and compatibility with results of test.

Either the front cover or the first page of the instructions shall bear the following boxed warnings. The letters used for the boxed warning shall be boldfaced type having a minimum uppercase letter height of 0.120 in (3.05 mm). The minimum vertical spacing between lines of type shall be 0.046 in (1.17 mm).^{*} Lowercase letters shall be compatible with the uppercase letter size specification.



GENERAL HAZARD WARNING:

FAILURE TO COMPLY WITH THE PRECAUTIONS AND INSTRUCTIONS PROVIDED WITH THIS HEATER, CAN RESULT IN DEATH, SERIOUS BODILY INJURY AND PROPERTY LOSS OR DAMAGE FROM HAZARDS OF FIRE, EXPLOSION, BURN, ASPHYXIATION, CARBON MONOXIDE POISONING, AND / OR ELECTRICAL SHOCK.

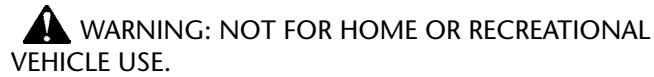
ONLY PERSONS WHO CAN UNDERSTAND AND FOLLOW THE INSTRUCTIONS SHOULD USE OR SERVICE THIS HEATER.

IF YOU NEED ASSISTANCE OR HEATER INFORMATION SUCH AS AN INSTRUCTIONS MANUAL, LABEL, ETC. CONTACT THE MANUFACTURER.



WARNING: FIRE, BURN, INHALATION, AND EXPLOSION HAZARD. KEEP SOLID COMBUSTIBLES, SUCH AS BUILDING MATERIALS, PAPER, OR CARDBOARD, A SAFE DISTANCE AWAY FROM THE HEATER AS RECOMMENDED BY THE INSTRUCTIONS. NEVER USE THE HEATER IN SPACES WHICH DO OR MAY CONTAIN VOLATILE OR AIRBORNE COMBUSTIBLES, OR PRODUCTS SUCH AS GASOLINE, SOLVENTS, PAINT THINNER, DUST PARTICLES OR UNKNOWN CHEMICALS.

^{*} This letter height and line spacing correspond to 12-point type.



The above boxed warning regarding home and recreational vehicle use shall be followed by information similar to that shown below:

The heater is designed and approved for use as a construction heater in accordance with Standard ANSI Z83.7 • CSA 2.14. CHECK WITH YOUR LOCAL FIRE SAFETY AUTHORITY IF YOU HAVE QUESTIONS ABOUT APPLICATIONS.

Other standards govern the use of fuel gases and heat producing products in specific applications. Your local authority can advise you about these.

The instructions shall include:

1. The manufacturer's name and address, appliance model type or series number, the certifying agency, and the date of issue, or equivalent, to relate the heater with its instructions;
2. A statement that the intended use is the temporary heating of buildings or structures under construction, alteration or repair;
3. A statement stressing the need for adequate ventilation;
4. Information on maintaining proper clearances from combustible material showing the specific minimum clearances from such material;
5. Directions for proper assembly and for assembly of field-installed parts and accessories supplied with the heater, including duct work if applicable , and proper procedure for gas leak testing;
6. Directions for leveling the heater;
7. Lighting and shutdown instructions including operation of all controls and accessories and any adjustment means of minimum input rating;
8. For indoor heaters, a statement that the heater be installed such that it is not directly exposed to water spray, rain and/or dripping water;
9. The minimum inlet gas supply pressure for the purpose of input adjustment;
10. The maximum inlet gas supply pressure;
11. Complete electrical diagrams and fan or blower installation instructions when a fan or blower is available as optional equipment;
12. For a heater not provided with a supply cord, a statement that the electrical grounding of the appliance shall be in compliance with the *National Electrical Code*, *ANSI/NFPA 70*, or *CSA C22.1*, *Canadian Electrical Code, Part I*;
13. The intent of the warning statement specified in 1.20.12;
14. Maintenance instructions (including recommended frequency guidelines) suggesting:
 - (a) Periodic cleaning of any filters (when supplied);

- (b) Lubrication of moving parts (when applicable) and the type and amount of lubricant to be used;
 - (c) That the appliance area be kept clear and free from combustible materials, gasoline and other flammable vapours and liquids;
 - (d) That the flow of combustion and ventilation air not be obstructed; and
 - (e) Cleaning heater, including special surfaces, with recommended cleaning agents, if necessary;
15. Wiring diagrams in the form(s) specified in 1.20.11;
 16. A statement that the heater should be inspected before each use, and at least annually by a qualified service person;
 17. A statement that the hose assembly shall be visually inspected prior to each use of the heater. If it is evident there is excessive abrasion or wear, or the hose is cut, it must be replaced prior to the heater being put into operation. The replacement hose assembly shall be that specified by the manufacturer;
 18. An easily understandable parts list, including information for obtaining replacement parts and where they are obtainable;

For a heater for connection to natural gas, a statement that the installation shall conform with local codes or, in the absence of local codes, with the *National Fuel Gas Code ANSI Z223.1/NFPA 54* and the *Natural Gas and Propane Installation Code, CSA B149.1*; and

19. For a heater for connection to a propane supply cylinder:
 - (a) A statement that the installation must conform with local codes or, in the absence of local codes, with the *Standard for the Storage and Handling of Liquefied Petroleum Gases, ANSI/NFPA 58* and the *Natural Gas and Propane Installation Code, CSA B149.1*;
 - (b) A statement that the heater, other than a heater with an integral propane gas container, must be located at least: (i) 6 ft. (1.83 m) in the U.S.; or (ii) 10 ft. (3 m) in Canada, from any propane gas container;
 - (c) A statement that blower or radiant type heaters shall not be directed toward any propane-gas container within 20 ft (6 m);
 - (d) Information on the size and capacity of the cylinder(s) to be used;
 - (e) A statement specifying that the cylinder supply system be arranged to provide for vapor withdrawal from the operating cylinder;
 - (f) How to connect and disconnect the propane cylinder(s) and the proper procedure for leak checking the connections;
 - (g) A statement which specifies that the gas be turned off at the propane supply cylinder(s) when the heater is not in use; and

- (h) A statement that when the heater is to be stored indoors, the connection between the propane supply cylinder(s) and the heater must be disconnected and the cylinders removed from the heater and stored in accordance with *Standard for the Storage and Handling of Liquefied Petroleum Gases, ANSI/NFPA 58* and *Natural Gas and Propane Installation Code, CSA B149.1*.

1.19.2

See also 1.15.1

1.20 Marking

1.20.1

Marking material shall be identified by class number and shall meet the following specifications. All metal marking materials shall be rustproof. All markings shall be suitable for application to surfaces upon which applied and shall demonstrate suitable legibility as specified in 2.15, Marking Material Adhesion and Legibility. The designation of any class of marking shall not preclude the use of marking of a lower number class.

Class I. Integral Marking

Marking that is embossed, cast, stamped or otherwise formed in the part. This includes markings baked into an enameled surface.

Class IIA1. Permanent Plate

Shall be made of metal having a minimum thickness of 0.012 in (0.305 mm) and shall be securely attached by mechanical means.

Class IIA2. Permanent Plate

Shall be made of metal having a thickness of 0.006 in (0.152 mm) to 0.012 in (0.305 mm) and shall have mechanical attachment means at all corners with a maximum spacing of 6 in (152 mm) between mechanical fasteners.

Class IIA3. Permanent Plate

Shall be made of metal having a thickness less than 0.006 in (0.152 mm). Such plates shall be attached by means of nonwater-soluble adhesive which will comply with 2.15, Marking Material Adhesion and Legibility. These materials shall not be located on surfaces having temperatures exceeding 300°F (149°C) as determined during the conduct of 2.13, Wall, Floor, Ceiling, and Electrical Equipment and Wiring Temperatures.

Class IIA4. Permanent Plate

Shall be made of pressure-sensitive metal foil requiring no solvent or activator, provided such plates comply with 2.15, Marking Material Adhesion and Legibility. These materials shall not be located on surfaces having temperatures exceeding 300°F (149°C) as determined during the conduct of 2.13, Wall, Floor, Ceiling, and Electrical Equipment and Wiring Temperatures.

Class IIIA1. Permanent Label

Shall be made of material not adversely affected by water, shall be attached by means of nonwater-soluble adhesive and shall comply with 2.15, Marking Material Adhesion and Legibility. These materials shall not be located on surfaces having temperatures exceeding 300°F (149°C) as determined during the conduct of 2.13, Wall, Floor, Ceiling, and Electrical Equipment and Wiring Temperatures.

Class IIIA2. Permanent Label

Shall be made of material not adversely affected by water, shall be attached by means of nonwater-soluble adhesive and shall comply with 2.15, Marking Material Adhesion and Legibility or shall be otherwise permanently attached. These materials shall not be located on surfaces having temperatures exceeding 175°F (79.5°C) as determined during the conduct of 2.13, Wall, Floor, Ceiling, and Electrical Equipment and Wiring Temperatures.

Class IIIB. Waterproof Marking

Shall be printed directly on the part with waterproof marking not adversely affected by a temperature of 175°F (79.5°C). This marking shall not be used on surfaces having temperatures exceeding 175°F (79.5°C) as determined during the conduct of 2.13, Wall, Floor, Ceiling, and Electrical Equipment and Wiring Temperatures.

Class IIIC. Waterproof Label

Shall be made of material not soluble in water, and may use watersoluble adhesives for attachment means.

Class IV. SemiPermanent Label

Shall be made of material which may be soluble in water, and may use watersoluble adhesive for attachment means.

Class V. Printed Marking

Marking shall be clear and prominent and may be applied directly by any printing means.

Class VI. Attached Tags

1.20.2

Rating Plate. Heaters shall bear a rating plate of Class IIIA marking material located where it can be easily read when the appliance is in a normal operating position, on which shall appear the following:

- a. The manufacturer's or distributor's name and location;
- b. The manufacturer's or distributor's model designation of the heater;
- c. A distinctive number which will identify an individual appliance or production lot;
- d. The manufacturer's maximum BTU/h (W) input rating and manifold pressure in appropriate units;
- e. The manufacturer's normal BTU/h (W) input rating and manifold pressure in appropriate units;
- f. The manufacturer's minimum BTU/h (W) input rating for heaters having multirate or modulating controls;