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Petitions Requesting Safeguards for Glass Fronts of Gas Vented Fireplaces

Comment On: CPSC-2011-0028-0001

Petitions Requesting Safeguards for Glass Fronts of Gas Vented Fireplaces

Document: CPSC-2011-0028-0027

Comment from William S. Lerner

Submitter Information

Name: William Lerner

Address: United States,

General Comment

See Attached

Attachments

Comment from William S. Lerner

Heggs, Angela

From: Stevenson, Todd
Sent: Wednesday, August 10, 2011 11:10 AM
To: Heggs, Angela
Subject: FW: Glass Ceramic Standard is 1,328 f, not "500 f" as everyone states. Please see attachments from the Z.21.88 Standard.
Attachments: Glass Ceramic Standard, 1,328 F..pdf; ANSI_Z_21_88-2009-CSA_2_33-2009.pdf

Todd Stevenson
Director, The Secretariat
(Office of the Secretary)
Office of the General Counsel
US Consumer Product Safety Commission
(301) 504-6836, Fax (301) 504-0127

From: William S. Lerner [mailto:wslerner@gmail.com]
Sent: Wednesday, August 10, 2011 10:29 AM
To: Jordan, Ronald
Cc: Ayers, Scott; Inkster, Sandra; Stevenson, Todd; Tenenbaum, Inez
Subject: Glass Ceramic Standard is 1,328 f, not "500 f" as everyone states. Please see attachments from the Z.21.88 Standard.

They fooled you!!!!

For heat producing glass fronted gas fireplaces, the majority of these units have glass ceramic front panel. According to one supplier, non-glass ceramic panels are small percentage. The exact statistics and numbers are unknown. However a quick scan of Manufacturers offerings shows the glass ceramic fronts. So, the true standard for these units is 1328 f, not 500f.

Napolean

GD36 Direct Vent Gas Fireplace

- A multitude of designer choices offering 40,000 different looks to match any decor
- No electricity required to light or operate - millivolt system ensures reliable use
- Advanced burner technology produces the most realistic, beautiful YELLOW DANCING FLAME®
- 50% flame/heat adjustment for maximum comfort and efficiency
- Available in clean burning, convenient natural gas or propane
- PHAZER® log set with glowing charcoal ember bed for a natural wood burning look
- Clear, unobstructed view of the fire using heat resistant ceramic glass that radiates heat back into the room
- Convenient hinged door assembly provides easy access for cleaning
- Equipped with 100% SAFE GUARD™ safety shut off feature for your peace of mind
- Turn on and off at the flick of a switch
- Concealed, easy to use controls
- Backed by the President's Limited Lifetime Warranty

Regency

Innovative design and high-efficiency create the perfect fireplace insert. The L390E Traditional Regency Gas Insert offers a timeless charm that combines modern style with a rustic appeal. The High Definition Fire (HDF) provides one of the most realistic flame packages as each piece of wood was molded from a real wood log. In addition, the one piece HDF ceramic burner was also molded from a real wood fire; each ember on the burner is the exact replica of the actual fire.

www.regency-fire.com

Standard Features Optional Features

- Natural Gas
 - Flush front with Ceramic safety glass
 - Clean Front 390 sq. in. Viewing area
 - 6 pc. Ceramic Log Set molded from real wood
 - Ceramic burner with built-in glowing ember bed
 - Electronic Ignition with SureFire™ switch
 - Proflame GTM Remote (L390E only)
 - Proflame GTMF Remote (L390EB only)
 - Variable Speed Blower (L390EB only)
 - 6-tube heat exchanger for maximized efficiencies
 - 30° angled flue (for versatile installations)
 - Easy Access Controls
 - Low profile faceplates in two sizes
 - Customizable backing plate
 - Full Screen Doors
 - Brick Panels
 - Variable Speed Blower (L390E only)
 - Programmable Wall Thermostat
 - Regency Flex Venting
 - Propane Conversion kit
- options

Majestic:

Product Details for the Majestic LX32DVN

Natural Gas Direct Vent Fireplace with Ceramic Glass and Leafier Burner

The Lexington Fireplace Series, like all Majestic appliances, is built to stand the test of time. We understand that durability and performance are important criteria when selecting a fireplace for your home. While we deliver these features on every product we produce, we also know that more often than any other product, a fireplace is the focal point of a room. A fireplace adds value, comfort and beauty to any setting. Our designers and craftsmen have meticulously scrutinized every detail to ensure that you receive the finest fireplace built today.

- Flush face design
- Ceramic glass with large viewing area –710 square inches (LX32) –802 square inches (LX36)
- Featuring the exclusive Leafier Burn System™ with a realistic detailed dual burner log set, a beautiful glow with five distinct flame areas and a large ember bed
- Optional decorative fronts and fire screen doors available in several different finishes
- Fireplace interior offers a beautiful, richly colored ceramic Brick pattern Battery operated pilot igniter
- Quick glass release
- Operator friendly deluxe control panel with color illustrated decal including Off/Pilot/On knob, Hi/Lo knob, blower control, optional remote receiver and an easily accessible shut off valve
- Variable flame control
- Up to 80% efficient
- Standard heat activated blower with variable speed control
- Built in adjustable flue restrictor
- Convertible top or rear flue outlet
- CSA design certified
- Exclusive Leafier Burn System™ – combines all of the elements of a natural wood fire to produce flames so realistic, you'll forget it's not real wood.
- Realistic Logs – starting with hand carved samples that are perfectly proportioned to fit the stove size and viewing area and then color enhanced to match real wood.
- Yellow Flames – bright yellow flames appear almost translucent in color. Log glow – as log surfaces heat up they produce a bright reddish orange glow, similar to wood in the secondary stages of combustion.
- Ember Bed – a large area of burning ember replicates the look of wood in the final stages of combustion.
- Primary Combustion Zone – primary combustion of fuel load.
- Leafier Burn – gas and oxygen are precisely metered and strategically distributed to provide optimum flame presentation.

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Table VII**Maximum Temperature For Glass**

Material	Maximum Temperature	
	°F	(°C)
Tempered (Soda-Lime) Glass & Toughened $3.25 \times 10^{-6}/^{\circ}\text{K}$ Expansion Borosilicate Glass	500	(260)
Annealed Borosilicate Glass with $3.25 \times 10^{-6}/^{\circ}\text{K}$ Expansion	446	(230)
Ceramic Glass	1328	(720*)
Other Glass Materials	**	**

* Use lower of 1328°F (720°C) or the manufacturer's maximum absolute temperature.

** Absolute temperature as specified by the material supplier for normal service conditions.

Table VIII**Maximum Flame Spreader Temperatures***

Metal	Maximum Temperature Rise Above Room Temperature,	
	°F	(°C)
Gray Cast Iron	930	(516.5)
Chrome Alloy Cast Iron, 0.5 to 1.0 percent Cr, 0.2 to 0.5 percent Cu or Ni	1230	(683.5)
Ductile (Nodular Cast Iron	1230	(683.5)
Chrome Alloy Steel, 5 percent Cr, 0.45 to 0.65 percent Mo, 1.0 percent Si	1280	(711)
AISI Type 430	1325	(736)
AISI Type 442	1550	(861)
AISI Type 446	1640	(911)
AISI Type 39C0	1730	(961)

* The maximum usage temperature of steel not shown shall be 90 percent of scaling temperature for the material. (Temperatures shown have been determined on this basis, temperatures of Chrome Alloy and Ductile Cast Iron are limited on the basis of excessive decarbonization above temperatures shown.)

Preface

This publication represents a basic standard for safe operation, substantial and durable construction, and acceptable performance of vented gas fireplace heaters. It is the result of years of experience in the manufacture, testing, installation, maintenance, inspection and research on vented gas fireplace 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 vented gas fireplace 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 Chairman of the Z21/83 Committee, CSA America Inc., 8501 East Pleasant Valley Road, Cleveland, Ohio 44131, or the Chairman of CSA Technical Committee on Gas Appliances and Related Accessories, CSA, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

Safe and satisfactory operation of vented gas fireplace 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 level. 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.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute, Inc., require that action be taken to reaffirm, revise or withdraw this standard no later than five (5) years from the date of approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, Inc., 25 West 43rd Street, Fourth Floor, New York, N.Y. 10036, (212) 642-4900.

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 The Development Of The Standard For Vented Gas Fireplace 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 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 step toward harmonization with international standards. Joint subcommittees were established to facilitate the standards harmonization process between the United States and Canada.

At its October 19-20, 1995 meeting, the Z21/CGA Joint Subcommittee on Standards for Vented Gas-Fired Warm Air Heaters formed a working group to prepare a draft bi-national standard for Vented Gas Fireplace Heaters. During its October 22-23, 1996 meeting the joint subcommittee approval to send the draft standard for public review and comment.

The first draft harmonized standard was based on current coverage from the American National Standard/Canadian Gas Association Standard for Vented Gas Fireplace, Z21.50-1996 - CGA 2.22-M96, and the American National Standard/CSA Standard for Vented Gas-Fired Space Heating Equipment, Z21.86-1998 - CSA 2.32-M98.

Following reconsideration and modification of the proposed draft standard, in light of comments received, the joint vented heater subcommittee at its March 10-11, 1997 meeting, recommended the proposed draft standard to Accredited Standards Committee Z21/83 and the (Interim CSA) Standards Steering Committee for approval.

The proposed draft of the harmonized standard for vented gas-fireplace heaters, as modified by the joint subcommittee, was approved by the Z21/83 Committee by letter ballot dated August 19, 1997, and by the CGA Standards Steering Committee by letter ballot dated January 5, 1998.

The first edition of the American National Standard/CSA Standard for Vented Gas Fireplace Heaters was approved by the Canadian Interprovincial Gas Advisory Council on February 26, 1998, and by the American National Standards Institute, Inc., on March 31, 1998.

The second edition of the American National Standard/CSA Standard for Vented Gas Fireplace Heaters was approved by the Canadian Interprovincial Gas Advisory Council on June 1, 2000, and by the American National Standards Institute, Inc., on October 20, 1999.

The third edition of the harmonized American National Standard/CSA Standard for Vented Gas Fireplace Heaters was approved by the Canadian Interprovincial Gas Advisory Council on March 18, 2002 and by the American National Standards Institute, Inc., on April 11, 2002.

The fourth edition of the harmonized American National Standard/CSA Standard for Vented Gas Fireplace Heaters, was approved by the Canadian Interprovincial Gas Advisory Council on December 2, 2005 and by the American National Standards Institute, Inc., on October 19, 2005.

Following the procedures outlined above further revisions to this standard were made in line with industry developments.

This, the fifth edition of the harmonized American National Standard/CSA Standard for Vented Gas Fireplace Heaters, was approved by the Interprovincial Gas Advisory Council on December 29, 2009 and by the American National Standards Institute, Inc., on March 26, 2009.

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

ANSI Z21.88-1998 • CSA 2.33-M98
ANSI Z21.88a-1998 • CSA 2.33a-M98
ANSI Z21.88b-1999 • CSA 2.33b-M99

ANSI Z21.88-2005 • CSA 2.33-2005
ANSI Z21.88a-2007 • CSA 2.33a-2007
ANSI Z21.88b-2008 • CSA 2.33b-2008

ANSI Z21.88-2000 • CSA 2.33-2000
ANSI Z21.88a-2000 • CSA 2.33a-2000
ANSI Z21.88b-2001 • CSA 2.33b-2001

ANSI Z21.88-2002 • CSA 2.33-2002
ANSI Z21.88a-2003 • CSA 2.33a-2003
ANSI Z21.88b-2003 • CSA 2.33b-2003

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

ANSI Z21.88-2009 • CSA 2.33-2009

NOTE: *This edition of Z21.88 • CSA 2.33 incorporates changes to the 2005 edition and addenda thereto. Changes, other than editorial, are denoted by a vertical line in the margin.*

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American National Standard/CSA Standard For Vented Gas Fireplace Heaters

Part 1: Construction

1.1 Scope

1.1.1

This standard applies to newly produced vented gas fireplace heaters (see Part IV, Definitions), hereinafter referred to as appliance(s), constructed entirely of new, unused parts and materials, and having input ratings up to and including 400,000 Btu/hr (117 228 W).

- a. For use with natural gas;
- b. For use with liquified petroleum (propane);
- c. Direct vent appliances for manufactured home (USA only) or mobile home OEM installation convertible for use with natural gas and propane when provision is made for simple conversion from one gas to the other (see 1.2.4-a and -b);
- d. Direct vent appliances for manufactured home (USA only) or mobile home aftermarket installation for use with natural gas only or liquified petroleum (propane) gases only (see 1.2.4-b.);
- e. Direct vent appliances for recreational vehicle installation for use with liquified petroleum (propane) gases only (see 1.2.4-c);
- f. Direct vent appliances for recreational vehicle installation only convertible for use with natural gas and liquified petroleum (propane) gases when provision is made for the simple conversion from one gas to the other (see 1.2.4-c); and
- g. For direct vent appliances for manufactured home (USA only) or mobile home OEM installation for use with liquified petroleum (propane) gases only (see 1.2.4-a).

The construction of vented gas fireplace heaters and vented gas fireplace heaters with cooling units for use with the above-mentioned gases is covered under Part I, Construction.

The performance of vented gas fireplace heaters and vented gas fireplace heaters with cooling units for use with the above-mentioned gases is covered under Part II, Performance.

1.1.2

Exhibit A.1, Automatic Intermittent Pilot Ignition Systems for Field Installation and Exhibit A.2, Recommended Procedure for Safety Inspection of the Existing Appliance Installation as a Preliminary Step to Field Installing the Automatic Intermittent Pilot Ignition System, includes provisions for newly produced (optional) automatic intermittent pilot ignition systems (see Part IV, Definitions), constructed entirely of new, unused parts and materials, to be adapted in the field to an appliance equipped with an existing continuous pilot burner and which has been examined and tested for compliance with this Standard when installed on the appliance.

1.1.3

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

1.1.4

Appliances covered by this standard, except for those installed in recreational vehicles, are those whose efficiencies are regulated in the United States by the Energy Policy and Conservation Act of 1975 and the National Energy Conservation Policy Act of 1978* or covered in Canada by Exhibit B, Items Unique to Canada.

1.1.5

Exhibit B, Items Unique to Canada, contains provisions that are unique to Canada.

1.1.6

Exhibit C, Items Unique to the United States, contains provisions that are unique to the United States.

1.1.7

This standard also applies to appliances with draft hoods which are factory equipped with automatic vent damper devices (See Part IV, Definitions), hereinafter referred to as vent damper devices.

1.1.8

Special construction provisions applicable to vented gas fireplace heaters designed for use with an optional design-certified conversion kit are outlined under Exhibit D, (Optional) Provisions for Listed Gas Appliance Conversion Kits.

1.1.9

Exhibit E, List of Reference Standards, contains a list of standards specifically referenced in this standard, and sources from which they may be obtained.

1.2 General Construction And Assembly

1.2.1 The construction of an appliance, 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.

All specifications as to construction set forth herein may be satisfied by the construction actually prescribed or such other construction as will provide at least equivalent performance.

1.2.2

Asbestos shall not be used in the construction of an appliance unless it is contained, protected or combined in a binder material in a manner which will not permit asbestos fibers to become airborne under normal conditions of appliance use.

1.2.3

Every part of the appliance shall be designed to be secure against displacement and constructed to maintain a fixed relationship between essential parts under normal and reasonable conditions of handling and usage. Simulated logs are a functional part of the burner.

* At the time of this printing, the above acts regulate the thermal efficiency (heating capacity) of vented appliances. For information, contact the U.S. Department of Energy, Conservation and Solar Applications, Consumer Products Efficiency Branch, 20 Massachusetts Avenue, N.W., Washington, DC 20545.

Component parts not secured shall be designed so that the method of assembly is apparent during installation, or removal and replacement for cleaning and other servicing. Functional performance of the appliance shall not be adversely affected by parts intended to be randomly applied (i.e. coal pieces or embers).

When submitting an appliance for test, the manufacturer may furnish a list of manufacturing tolerances applicable thereto and may have the appliance tested for compliance to this standard in both extremes of tolerances specified.

1.2.4

Special construction provisions applicable to direct vent gas fireplace heaters for manufactured home (USA only) or mobile home or recreational vehicle installation are specified in:

- a. For manufactured home (USA only) or mobile home OEM installation - 1.1.1-c and -g, 1.8.12, 1.8.17, 1.10.5, 1.18.4, 1.34.1, 1.35.2-r, 1.35.7-f, 1.35.7-h and 1.35.7-i;
- b. For manufactured home (USA only) or mobile home aftermarket installation - 1.1.1-c and -d, 1.8.12, 1.10.5, 1.18.4, 1.34.1, 1.35.2-r, -s and -t; and
- c. For recreational vehicle installation - 1.1.1-e, and -f, 1.3.1, 1.8.12, 1.8.17, 1.10.5, 1.18.4, 1.21.2, 1.34.1, 1.35.2-r, 1.35.7-f, 1.35.7-g, 1.35.7-h and 1.35.10.

1.2.5

A direct vent gas fireplace heater shall be provided with a venting system, certified and listed for use with the appliance, as part of the appliance at the time of installation. Venting systems shall be provided with means for secure attachment to the appliance or wall structure as specified in 2.33, Vent and Vent/Air Intake Terminal Assemblies.

1.2.6

An appliance equipped with safety screens and guards to protect clothing or flammable materials from contacting parts of the appliance which could easily cause ignition (see 2.26, Evaluation of Clothing Ignition Potential) shall have such equipment mechanically attached to the appliance by the manufacturer.

1.2.7

Exposed edges which may come in contact with the operator's hand during normal adjustment or usage shall be smooth.

1.2.8

Joints of surfaces enclosing combustion products shall not depend primarily on cement for tightness and shall be of durable and rigid construction, such as welded, brazed, machined and bolted, tongue-and-groove, slip, lap, or screw joint.

1.2.9

When tap bolts are used to attach air shutters, manifold supports, or other parts which must be removed for normal servicing or replacement, they shall be made of corrosion-resistant material, or if steel, have a corrosion-resistant coating.

1.2.10

Bolts, nuts, screws (except sheet-metal screws) and other threaded parts used in the general assembly of the appliance 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*.

1.2.11

For direct vent and power vented appliances, any flue gas passageway having a flue gas temperature lower than 250°F (121°C), shall be constructed of a corrosion-resistant material or have a corrosion-resistant finish to resist corrosion by condensate.

Steels with coatings, such as paint suitable for the temperature and conditions to which exposed, and cast iron are considered corrosion resistant.

1.2.12

Optional fans for use with gas fireplace heaters shall be provided with the appliance submitted for test. The junction box, complete wiring harness and wiring clips (when necessary) shall be provided as a part of the fan assembly, together with complete wiring diagrams.

1.2.13

Warm air circulating fireplace heaters, with or without integral or booster fans, shall not use filters.

1.2.14

The construction shall be substantial to the extent that the appliance will not be damaged when a weight of 300 lb (140 kg) is applied uniformly, without impact, to any surface on which a person might be expected to sit when the appliance is installed in accordance with the manufacturer's instructions.

1.2.15

A free standing appliance shall be constructed so that it cannot be tipped by any reasonable pressure or pull. Appliances which are provided with means (including necessary screws, bolts, or both) and instructions for attaching them to the floor and wall shall be tested with these means in place.

Method of Test

An appliance weighing not more than 100 lb (45 kg) shall be tipped in any direction at an angle of 15 degrees from the vertical and shall not tip over when released.

An appliance weighing more than 100 lb (45 kg) shall not tip over when a horizontal pull in any direction, equal to $\frac{1}{10}$ the appliance weight, is applied at the center of the top of the appliance.

1.2.16

Means for inspection of the vent connection to the appliance at the time of installation shall be provided and shall be specified in the installation instructions.

1.2.17

Fastening means, used for securing parts that may need servicing, shall be of a reusable type.

1.2.18

When it is possible for any incandescent matter to fall on any flammable material beneath the appliance, a screen, shield or other means shall be provided as a part of the appliance to protect such material. If a screen is used, the openings shall not be greater than $\frac{5}{64}$ in (1.98 mm).

1.2.19

When a unit is equipped with a relief device that requires manual reset, it shall be interlocked to shut off the gas supply to the appliance. A relief device shall be of the re-usable type. Replacement is not considered acceptable.

1.2.20

Parts of the appliance that are intended to be installed into combustible construction shall be suitable for zero ("0") clearance to combustible construction. This may be accomplished by use of spacers provided as an integral part of the equipment by the manufacturer.

1.2.21

Combustion chamber pressure relief devices (see Part IV, Definitions) shall be factory assembled and shall have reproducible relief characteristics. A combustion chamber pressure relief device shall be designed such that it is unsusceptible to user adjustment or misalignment. The combustion chamber pressure relief device shall be positioned so that the discharge is not directed toward the user when igniting pilot or operating controls. In its inactivated position, the combustion chamber pressure relief device shall continue to provide a reliable seal for the products of combustion. (See also 2.5, Appliance and Burner Durability Test).

1.2.22

A vented gas fireplace heater with cooling units shall have the refrigeration coil located down stream of the heating section, unless the heating section is specifically for installation down stream of the coil (See 1.33, Heating Elements Located Down Stream From Refrigeration Coils, and 2.38, Heating Elements Located Down-Stream from Refrigeration Coils), or the coil shall be located parallel to the heating section. In those cases where the coil is located parallel to the heating sections, dampers or other means used to control air flow shall be adequate to prevent chilled air from entering the heating sections. If the dampers are manually operated, means shall be provided to prevent operation of either unit, unless the damper is in the full heat or cool position. Adequate means shall be provided for disposal of condensate and to prevent dripping condensate on the heating element.

1.2.23

Appliances for manufactured (mobile) home OEM installation shall be provided with the means to be secured in place to avoid displacement.

1.3 Accessibility

1.3.1

Controls, pilot and main burners, fans and electrical components shall be accessible for servicing and replacement.

1.3.2

All clauses concerning accessibility and visual checks shall be performed with the appliance installed as it would be in service in accordance with the manufacturer's instructions at the specified minimum service clearances.

1.3.3

It shall be possible to oil the motor, blower or fan bearing, which require that lubricant be added, without dismantling or removing any portion of the venting system.

1.3.4

On other than direct vent designs, it is permissible to disconnect the venting system for removal of the blower assembly.

1.3.5

Flue baffles shall be removable for cleaning or shall be designed so they cannot be dislodged or distorted during cleaning. Flue baffles which are removable for cleaning shall be constructed so they cannot be installed in other than the correct position.

1.3.6

The flue gas passageways through an appliance shall be accessible for cleaning. This may be accomplished by appliance disassembly or heating element removal.

1.4 Thickness Of Materials

1.4.1

Materials used in the construction of appliances shall have strength, durability, resistance to corrosion and other physical properties equivalent to:

Heating elements, vent tubes and radiation shields exposed to combustion products as shown in Table I, Minimum Thickness of Sheet Metal and Materials.

Inner liners, air intakes within the exterior casings, and radiation shields not exposed to combustion products and recessed portion of casings.....	0.0152 in (0.386 mm)* thick low carbon steel
Exterior casings.....	0.0254 in (0.645 mm)** thick low carbon steel
Air in takes exterior to casing.....	0.0152 in (0.386 mm)* thick with a zinc or cadmium coating equivalent to that specified in 1.4.2-b.

1.4.2

Casings and vent caps employing ferrous materials subject to outdoor atmosphere shall be protected against corrosion by one of the following coatings or by other metallic or non-metallic coatings which have been shown to give equivalent protection.

a. Less than 0.0508 in (1.291 mm) thick:

1. Hot-dipped mill galvanized sheet steel conforming with the coating designation G90 specified in Standard Specification for General Requirements for *Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process ASTM A924/A924M*, with not less than 40 percent of the zinc on either side. The weight of zinc coating may be determined by any suitable method. However, in case of question, the weight of coating shall be established in accordance with *Methods of Test for Weight of Coating on Zinc-Coating (Galvanized) Iron or Steel Articles, ASTM A90*;
2. A zinc coating, other than that provided on hot-dipped mill galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00061 in (0.01550 mm) on each surface, with a minimum thickness of 0.00054 in (0.01372 mm). The thickness of the coating shall be established in accordance with *Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section, ASTM B487*; *Method for Measurement of Coating Thicknesses by the Magnetic Method; Non-magnetic Coatings on Magnetic Basis Metals, ASTM B499*; or *Method for Measuring the Thickness of Metallic Coatings by the Coulometric Method, ASTM B504*;

* This corresponds to No. 26 U.S. Standard gage sheet steel with all applicable minus tolerances included.

** This corresponds to No. 22 U.S. standard gage sheet steel with all applicable minus tolerances included.

3. A cadmium coating not less than 0.001 in (0.0254 mm) thick on both surfaces. Thickness of coating shall be established in accordance with *ASTM B487*, *ASTM B499* or *ASTM B504*.
 4. A zinc coating conforming with 1.4.2-b1 or -b2 with one coat of outdoor paint as specified in 1.4.2-b3; or
 5. A cadmium coating not less than 0.00075 in (0.01905 mm) thick on both surfaces with one coat of outdoor paint on both surfaces, or not less than 0.005 in (0.0127 mm) thick on both surfaces with two coats of outdoor paint on both surfaces. The thickness of the cadmium coating shall be established in accordance with *ASTM B487*, *ASTM B499* or *ASTM B504*, and the paint shall be as specified in 1.4.2-b3.
- b. At least 0.0508 in (1.291 mm) thick:
1. Hot-dipped mill galvanized sheet steel conforming with the coating designation G60 or A60 specified in *ASTM A924/A924M*, with not less than 40 percent of the zinc on either side. The weight of zinc coating may be determined by any suitable method. However, in case of question, the weight of coating shall be established in accordance with *ASTM A90/A90M*. A hot-dipped mill galvanized A60 (alloyed) coating or an annealed zinc coating which is bent or similarly formed after annealing shall be additionally painted in the bent or formed area if the bending or forming process damages the zinc coating, except on the inside surfaces of a cabinet or enclosure not exposed to water when tested in accordance with 2.33.3. (This shall also apply to annealed coatings complying with 1.4.2-a2 and -b2.
 2. A zinc coating, other than that provided on hot-dipped mill galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00041 in (0.01042 mm) on each surface, with a minimum thickness of 0.00034 in (0.00864 mm). The thickness of the coating shall be established in accordance with *ASTM B487*, *ASTM B499*, *ASTM B504*.
 3. Two coats of organic finish of the epoxy or alkyd-resin type or other outdoor paint on both surfaces. The suitability of the paint may be determined by consideration if its composition or by corrosion tests if these are considered necessary.

Non-ferrous outside portions of casings and vent caps may be employed without special corrosion protection. The thickness of the materials is to be judged on the basis of its strength and rigidity.

1.4.3

Materials shall be of such composition that they will not disintegrate to the extent that particles will separate and drop upon the burner and affect combustion.

1.4.4

The body finish of the appliance shall not show deterioration after conduct of the following Method of Test.

Method of Test

Before any other performance tests are conducted under this provision, the appliance shall be adjusted at the manufacturer's specified input rating and operated for one (1) hour at increased test pressure. At the conclusion of this period, the body finish of the appliance shall show no deterioration. Discoloration alone is not to be considered deterioration.

1.4.5

Gaskets shall be suitable for the temperature to which exposed.

1.4.6

Gaskets of access panels or doors shall have sufficient durability to withstand expected usage.

1.5 Evaluation Of Combustion/Venting Side Sealing Materials

1.5.1

The certification organization shall make appropriate investigation of the resilient material that is used as a sealant in the combustion/venting side of the appliance. Such an investigation shall consider, at least, temperature rating and compatibility with the products of combustion. Such material shall be suitable for the application and otherwise fit for purpose.

1.5.2

A factor of safety on sealant material temperature rating [when expressed °F (°C)] of at least the following shall be required:

- a. 1.5 for silicone and flourosilicone based sealants when used to seal a viewing glass front;
- b. 1.2 for silicone and flourosilicone based sealants when used to seal joints other than a viewing glass front; and
- c. 1.2 for any other sealant material.

1.5.3

A sound engineered solution that provides for equivalent long term safe performance may be acceptable at the discretion of the certification organization.

1.5.4

Sealing materials that must be field-applied shall be supplied by the appliance manufacturer in the appliance packaging. The Instructions shall provide adequate direction with respect to proper application of the packaged sealing material.

1.6 Glass Fronts

1.6.1

Glass fronts shall have heat resistant properties suitable for the application as specified in 2.14.1.

1.6.2

Glass fronts shall be of such strength to withstand tests for impact and thermal shock without cracking or breaking (see 2.14.2 and 2.14.3).

1.6.3

Glass fronts shall not be rigidly mounted. Allowance for differential expansion and distortion shall be provided for the type of glass used.

1.6.4

Where the glass front is mounted in a frame, $\frac{1}{8}$ in (3 mm) total edge clearance shall be provided or the use of heat-resistant resilient mountings providing at least such clearance, shall be considered as meeting this requirement.

1.6.5

All installations for direct vent appliances that require glass front removal for servicing or cleaning shall have the glass front mounted in a metal frame or equivalent means to protect the glass during servicing, and the frame shall be securely attached to the appliance. The glass front shall be retained in the frame used to seal the combustion space from the living space, such that the frame and glass front may only be removed as a single assembly.

1.6.6

The design of the frame on direct vent units shall be such that there are no exposed glass edges, metal parts do not come in contact with the glass front, removal and replacement shall be repeatable and not subject to error by the user. The glass front frame assembly shall be secured to the appliance by:

- a. Using bolts, or machine screws, through holes in the frame for direct mounting to the appliance; or
- b. A latching, or fastening mechanism that is part of the appliance or frame.

1.6.7

Ceramic type glass shall be resistant to attack from sulphur compounds in fuel gas and from other sources.

1.7 Combustion Air And Ventilation

1.7.1

Cabinet compartments housing gas piping and controls shall be adequately ventilated.

1.7.2

When air for combustion is drawn through removable panels, such panels shall be designed so as to prevent their being attached in an improper position or being interchanged with other panels on the same unit in a manner that may interfere with its performance.

1.7.3

All openings in perforated or expanded metal panels, provided over combustion air, circulating air, draft hood relief openings or vent outlet openings, shall be of such size that they will permit entrance of a $\frac{1}{8}$ in (3 mm) diameter rod. Combustion air openings which do not permit entrance of a $\frac{1}{8}$ in (3 mm) diameter rod shall be permitted provided the appliance complies with 2.4, Combustion, when these openings are 90 percent blocked.

1.7.4

The construction of the appliance shall be such that when installed in accordance with the manufacturer's instructions, the combustion air supply will be in the same pressure zone as the draft hood relief opening on an appliance equipped with a draft hood, or as the vent outlet on an appliance not equipped with a draft hood.

1.7.5 On an appliance provided with an induced draft, the appliance design shall be such as to prevent gas flow to the main burner(s), or to the main burner(s) and pilot burner(s) when an interrupted or intermittent pilot ignition system(s) is used, in the event the blower providing the draft becomes inoperative.

A properly applied centrifugal or sail switch, temperature sensing device, or equivalent device, complies with the intent of this provision. If a centrifugal switch is used, the blower shall be secured to the shaft on which the centrifugal switch is located, by keying, or by at least two screws, one of which shall be on a flattened shaft, or the equivalent.

1.7.6

The design of the appliance shall be such that the air heated by circulation over the heating surfaces will not be discharged directly into the walls, floor, or ceiling.

1.8 Main Burners

1.8.1

Bodies of burners (including mixer head, mixer tube and burner head) shall be of substantial and durable construction. They shall be constructed of either:

- a. Materials having melting points above 1450°F (788°C); or
- b. Materials having melting points of from 1000°F to 1450°F (538°C to 788°C).

The design and materials used in -b above shall comply with 2.15, Main Burner and Flame Spreader Temperatures.

1.8.2

The burner shall be gastight and of durable construction.

1.8.3

Burner ports shall be accurately made.

1.8.4

Ports shall be clear and free of burrs inside the burner.

1.8.5

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

1.8.6

Gauzes shall not be used in burner construction.

1.8.7

Sheet-metal burner parts shall be AISI C1010 steel at least 0.0304 in (0.722 mm)* thick or of metal having equivalent or superior strength and durability.

1.8.8

On direct vent designs, burners shall be constructed of a corrosion-resistant material or have a corrosion-resistant finish to resist corrosion by condensate. Steels with coatings, such as paint suitable to the temperature to which exposed, and cast iron are considered corrosion resistant.

1.8.9

Ribbon burners shall be constructed so the ribbon assembly is securely fixed in position.

1.8.10

Burners shall be mounted so that they will not move out of their proper operating position.

1.8.11

Provisions shall be made to permit satisfactory observation of main burner flames and the ignition means during adjustment and under operating conditions.

* This corresponds to No. 20 U.S. Standard gage sheet with all applicable minus tolerances included.

1.8.12

Appliances for manufactured home (USA only) or mobile home installation or recreational vehicle installation convertible for use with natural gas and liquefied petroleum (propane) gases shall be provided with burner(s) designed to operate satisfactorily with test gases A and/or E when the appliance is shipped from the factory. In the event burner(s) designs differ for each test gas, this burner(s) will be properly identified including identification as to which burner(s) is in place on the appliance as shipped. This marking is to be located on the outside front of the appliance. This marking may be on a Class VI marking and may be combined in 1.10.5.

The marking is to be worded as follows:

“THIS APPLIANCE IS EQUIPPED FOR NATURAL (LP/PROPANE) GAS. This appliance is equipped with main burner(s) designed for operation with natural (LP/propane) gas.”

“Main burner(s) necessary for LP/propane (or natural) conversion are provided ____.”*

(*Location to be determined by manufacturer.)

When a change of main burner(s) is not required to convert from one gas to the other, the above label need not be provided.

1.8.13

Means shall be provided to prevent misalignment of orifices or orifice holders and burner mixer tubes.

1.8.14

Burners shall be easily removable, without the use of special tools, for repair and cleaning.

1.8.15

The construction shall be such that the burner cannot be installed in the appliance in other than the correct position.

1.8.16

If a burner tray is used the means for fastening shall be readily accessible and shall be designed so that one person can perform the removal and replacement unassisted.

1.8.17

Burners of direct vent appliances for manufactured home (USA only) or mobile home OEM installation or recreational vehicle installation shall be fastened in place and arranged so they may be readily removed for servicing.

1.9 Primary Air Adjustment Means

1.9.1

It is recommended that air shutters, when used, be of such design that they can be adjusted to have not more than two primary air openings, each approximating a circle near point of closure or shall be of such design and construction as can be demonstrated to provide equally effective protection against stoppage by lint and dust.

1.9.2

Means shall be provided to fix air shutters securely in any desired position. Such means shall be conveniently accessible for adjustment with the burner(s) in place and the appliance in operation and shall be located so as not to interfere with adjustment of orifice caps when used.

1.9.3

Primary air adjustment means, when provided, shall not change position by the action of gravity when the means for locking the adjustment is loosened sufficiently to permit adjustment.

1.9.4

Sheet-metal air shutters and locking screws shall be constructed of corrosion-resistant material or have a corrosion-resistant finish.

1.9.5 Sheet-metal air shutters shall not be less than 0.0254 in (0.645 mm) thick. sheet-metal air shutters less than 0.0508 in (1.291 mm) thick shall have the outer edge turned at 90 degrees (1.57 rad) or be otherwise properly reinforced.

1.10 Orifice Spuds And Orifice Fittings

1.10.1

Threaded hexagon head or equivalent fixed orifice spuds shall be provided for the main burners and shall be readily accessible after burner and mixer tubes have been removed.

1.10.2

Main burner orifice spuds shall be threaded to their holders at least 3¹/₂ full threads.

1.10.3

Main burner orifice spuds and orifice spud holders shall be constructed of metal having a melting point of not less than 1450°F (788°C).

1.10.4

Readily removable fixed orifice spuds shall be provided, independent of the operation of the pilot gas valve, for limiting the amount of gas consumed by the pilot.

When a separate gas pressure regulator is installed in the pilot line, the outlet pressure specified by the manufacturer shall be employed in determining the maximum rating of the pilot.

1.10.5

When a direct vent appliance is designed for OEM installation in manufactured homes (USA only) or mobile homes or recreational vehicles and is convertible for use with natural gas and liquified petroleum (propane) gases it shall be provided with orifices for both natural gas and liquified petroleum (propane) gases which shall be properly identified. One set of orifices shall be in place (in the main and pilot burners) when the appliance is shipped from the factory.

Proper identification as to which orifices are in place on the appliance as shipped shall be provided on the outside front of the appliance, including reference to the location of the conversion instructions. This marking may be a tear-off type label worded as follows:

“THIS APPLIANCE IS EQUIPPED FOR NATURAL (OR PROPANE) GAS.

This appliance is equipped with orifices sized for operation with natural (or propane) gas.

For conversion to propane (or natural) gas see instructions provided with the appliance.

Orifices and instructions necessary for propane (or natural) conversion are provided

_____.”

When a change of orifice spuds is not required to convert from one gas to another, the above label need not be provided.

(* Location to be determined by manufacturer.)

1.11 Automatic Ignition Systems

1.11.1

Automatic gas ignition systems (see Part IV, Definitions) and components shall comply with the applicable provisions of the *Standard for Automatic Gas Ignition Systems and Components, ANSI Z21.20* or *CAN1-6.4*, or *Combination Gas Controls for Gas Appliances, ANSI Z21.78 • CSA 6.20*, or the *Standard for Combustion Safety Control and Solid-State Igniters for Gas and Oil Burning Equipment, CSA C22.2 No. 199*.

1.11.2

If a piezo-electric spark device is used for pilot burner ignition, it shall comply with the *Standard for Manually-Operated Piezo-Electric Spark Gas Ignition Systems and Components, ANSI Z21.77 • CGA 6.23*.

1.11.3

Each appliance shall be equipped with an automatic gas ignition system(s). This system(s) shall be designed to function in one of the following manners:

- a. Provide for ignition of main burner gas by means of proved pilot. If the presence of the pilot is not proved, provide for automatic shut-off of pilot and main burner gas.
- b. Provide for ignition of main burner gas using a direct ignition system, which only supervises the main burner(s) flame.

If the presence of the main burner flame is not proved, provide for automatic shut off 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 re-ignition of main burner gas by re-energizing the direct ignition device as stipulated in 2.9.6 and 2.10.6.

The application of this type of direct ignition systems is limited to appliances having input ratings up to and including 400,000 Btu/hr (117 228 W) per combustion chamber under control of the ignition system.

- c. Provide for ignition of main burner gas using a direct ignition system incorporating a proved igniter which provide that the igniter is capable of ignition prior to initiation of main burner gas flow. The proved igniter system shall function in one of the following manners:
 1. For systems that do not supervise main burner flame during an operating cycle, the igniter shall remain proved during the entire burner operating cycle. If the igniter does not remain proved, provide for automatic shutoff of main burner gas.
 2. For systems that do supervise main burner flame during an operating cycle and de-energize the igniter, provide for automatic shutoff of main burner gas in the event of main burner flame outage.

1.11.4

In addition to the automatic gas ignition system functions specified in 1.11.3, 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 shut-off of the gas to the main burner(s) and pilot burner(s).

1.11.5

An automatic ignition device shall be placed so as to be easily seen or, if concealed in normal operation, shall be capable of being reached by the simple removal of an access cover without the use of tools.

1.11.6

A manually lighted pilot burner shall be located so as to be capable of being lighted without burning the hand. If a pilot burner ignition device or lighter rod is necessary for safe and convenient pilot 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 appliance.

1.11.7

When a manually lighted pilot is provided, the design of the control shall be such that main burner gas flow cannot occur while the pilot is being lighted. The interruption of main burner gas flow shall not depend on the operation of a manual valve which is not mechanically interlocked with the pilot gas control, or a separate switch. After the pilot has been established and the safety shut-off device remains in a position that would permit main burner gas flow, an additional manual operation of the control shall be necessary to permit main burner gas flow.

1.11.8

Pilot burners 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.

1.11.9

Automatic ignition devices shall be positively positioned with respect to the main burner ports.

1.11.10

When an automatic relight pilot system is used, the system shall 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.

1.11.11

Automatic ignition and safety shut-off devices shall be installed so that the operation of these devices and main burner ignition will not be affected by falling scale, dirt or carbon during normal operation.

1.11.12

Automatic ignition devices, safety shut-off device assemblies and bleed assemblies, when used, shall be made secure against accidental displacement. Such assemblies shall be constructed and installed so that they may be removed without the use of special tools or requiring tool manipulation within the burner compartment. Automatic ignition and safety shut-off device assemblies which are easily removed with main burners and controls as a unit are considered as complying with this provision.

1.11.13

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

1.11.14

Bunsen type pilot burners shall be constructed so that ignition of main burner gas occurs in a normal manner even though the pilot is burning at the orifice. A pilot burner that cannot be made to flash back under any conditions of test shall be considered acceptable.

1.11.15

Tips of aerated pilot burners shall be made from AISI 416 steel or material having at least equivalent heat and corrosion resistant characteristics. Nickel alloys of greater than 1.0 percent nickel, because of catalytic cracking effect, are not acceptable.

1.11.16

The design of electronic ignition modules for direct vent fireplace heaters shall be such as to ensure that the main gas valve does not open without supervised flame under any conditions including moisture and component fault. (See 2.9.13.)

1.11.17

Pilot burner assemblies shall be constructed so it is impossible to direct the pilot in other than the correct direction.

1.12 Flame Spreaders

1.12.1

When metal is used in the construction of a flame spreader or its support, the metal shall be in accordance with that specified in 2.15.2.

1.12.2

Flame spreaders and their supports shall be constructed so they cannot be incorrectly fitted together. When it is necessary to remove the flame spreader for service or assembly, it shall not be threaded to its support unless the support is readily removable.

1.12.3

Flame spreader supports shall be constructed so the flame spreader cannot be supported at other than the correct distance above the burner.

1.13 Appliance Main Gas Valves

- a. An appliance main gas valve, when provided, shall comply with the applicable provisions of the *Standard for Manually Operated Gas Valves for Appliances, Appliance Connector Valves, and Hose End Valves, ANSI Z21.15 • CGA 9.1*, or *Combination Gas Controls for Gas Appliances, ANSI Z21.78 • CSA 6.20*.
- b. A heater shall have either:
 1. An appliance main gas valve provided in an accessible location for turning on or shutting off the gas supply to the main burner(s); or
 2. An accessible switch integral to the gas control for manually interrupting the ungrounded leg of the electrical power to both automatic valves, provided that the heater does not have a continuous pilot ignition system and that it has two automatic valves in series controlling main burner gas flow.
- c. An appliance main gas valve means for turning on and shutting off the gas supply to the pilot burner shall be provided on continuous pilot ignition systems and shall be located so as to be accessible.

1.13.1

When the valve is exposed to view, lever or tee handles shall be at 90 degrees (1.57 rad) to the line of flow when in the "off" position and parallel when in the "on" position. If this cannot be accomplished, or if the valve handle or knob only is exposed to view, the "on" and "off" positions or directions of rotation to open and close shall be clearly indicated by a Class IIIB marking.

1.13.2

Removable handles shall be constructed so that they cannot be attached so as to confuse the "on" and "off" positions.

1.13.3

Gas valves shall be located or constructed so that they will not be subject to accidental change of setting.

1.13.4

Construction shall not require the use of a special tool or device for shut-off of the gas to the pilot burner(s).

1.13.5

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

1.13.6

Adjustment screws for regulating the gas admitted to the pilot shall be concealed, protected or enclosed.

1.13.7

The pilot gas take-off shall be upstream of the main burner manual shutoff valve. Devices in which the design of the control system is such that gas cannot be admitted to the main burner while the pilot is being lighted and until the safety shutoff device will remain in its normal open position shall be exempt from this provision.

1.14 Gas Supply Lines

The following construction provisions apply to the gas supply lines used within an appliance.

1.14.1

Steel pipe employed as gas supply lines on an appliance shall comply dimensional with the *Standard for Welded and Seamless Wrought Steel Pipe, ANSI/ASME B36.10M*.

1.14.2

Piping tapped for gas valves, pilots or other branch supply lines shall provide a continuous run of not less than 3½ taper pipe threads in accordance with the *Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1*.

1.14.3

Series 300 stainless steel corrugated tubing used as part of a manifold assembly shall not be exposed to temperatures in excess of 900°F (482°C) when the appliance is operated as specified in 2.22.1. The tubing shall demonstrate compliance with the Tubing Structure, Bending Test, and Bursting Test requirements specified in the *Standard for Metal Connectors, Z21.24 • CSA 6.10*.

1.14.4

Ends of piping and tubing shall be carefully reamed and cleaned to remove obstructions and burrs. Bent supply piping shall have the bends smoothly made without appreciable reduction in the cross sectional area and shall reveal no imperfections occasioned by the bending process.

1.14.5

When steel pipe is used for pilot burner manifolds, its nominal size shall not be less than $\frac{1}{4}$ in. When used for individual pilot lines, its nominal size shall not be less than $\frac{1}{8}$ in.

1.14.6

Semi-rigid tubing constructed of aluminum shall not be acceptable for use where the tubing passes through insulation of other than neutral reaction, unless the tubing is adequately protected from the insulation. Such tubing shall not be exposed to condensate.

1.14.7

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

1.14.8

Aluminum tubing used for a pilot gas supply line(s) shall be Type 1100 or Type 3003 with temper either O (fully annealed) or F (as extruded).

1.14.9

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

1.14.10

Tubing and fittings used as gas conduit 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 appliance is operated as specified in 2.23.1, Free Standing Attached or Recessed Appliances.

1.14.11

Gas supply piping to which connections are made for burners, pilots, lighters or other branch supply lines, shall be readily removable, yet rigidly supported to prevent turning or lateral displacement while making connection to the building piping or during the ordinary handling of the appliance.

1.14.12

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

1.14.13

Unions in gas lines shall be of the ground-joint type.

1.14.14

A test gage connection shall be furnished downstream from the last main line gas control for measuring gas pressure at the burner. The connection shall be a minimum $\frac{1}{8}$ in NPT plug or cap with cleanly cut taper pipe threads in accordance with the *Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1*. If the plug is of the slotted type it shall also incorporate square or hex flats, or;

When the pressure tap is provided as part of the control this pressure test gage connection shall be:

- a. A tapping sealed by a $\frac{1}{8}$ in NPT plug or cap with cleanly cut taper pipe threads in accordance with the *Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1*. If the plug is of the slotted type, it shall also incorporate square or hex flats; or
- b. A hose fitting with a minimum length of 0.355 in (9.02 mm) and a 0.355 in (9.02 mm) maximum/0.335 in (8.05 mm) minimum outside diameter and which incorporates a sealing means. The construction of the hose fitting shall incorporate an internal restriction not greater than 0.0394 in (1.0 mm) in diameter.

1.14.15

Connections for pilot gas supply lines shall be located so that pilot lines of semi-rigid tubing and the pilot valves will not be unnecessarily exposed to damage hazards.

1.14.16

Sizes of gas connections to the inlet of appliances, except those for use with propane, shall in no case be less than $\frac{3}{8}$ in standard pipe size or equivalent semi-rigid tubing size.

1.14.17

Where the use of bushings cannot be avoided, only those of the face or recessed type shall be used. Nesting of bushings is prohibited.

1.15 Bleeds And Vents

1.15.1

The gas appliance pressure regulator shall be equipped with either a vent line or a vent limiter.

1.15.2

A diaphragm type automatic valve incorporating an external bleed shall be equipped with a bleed line.

1.15.3

When there is a continuous pilot:

- a. A bleed line from a diaphragm type automatic valve and, when furnished, a vent line from the regulator, shall vent into the combustion chamber. A common bleed line and vent line shall not be used; and
- b. A bleed line or vent line shall terminate in a suitable burner tip constructed of metal having a melting point of not less than 1450°F (788°C). The tip shall be secured in a fixed position relative to the pilot burner and located so the escaping gas shall be readily ignited by the pilot and the heat liberated thereby shall not adversely affect the normal operation of the automatic gas ignition system.

1.15.4

When there is no continuous pilot:

- a. A vent line, when furnished, from the regulator shall be vented according to the manufacturer's instructions but not into the combustion chamber, except on an appliance where all combustion air is supplied by mechanical means and which is equipped with a combination control incorporating an integral vent limiter and two automatic valves, one of which is upstream of the regulator diaphragm; and
- b. A bleed line from a diaphragm type automatic valve shall be vented in such a manner as to provide for burning of the bleed gas during normal operation. In the event of diaphragm rupture, the bleed shall not permit the escape of more than 1.0 ft³/hr (7.87 cm³/s) of 0.6 specific gravity gas at 7.0 in wc (1.74 kPa) pressure for natural, and 0.5 ft³/hr (3.93 cm³/s) of 1.53 specific gravity gas at 11.0 in wc (2.74 kPa) pressure for liquefied petroleum (propane) gases.

1.15.5

When a vent line is provided for a gas pressure regulator, a No. 40 mesh brass, aluminum or stainless steel wire screen, sufficient in size to provide free area equal to the area of the escapement orifice, shall be installed in and made part of the connecting fitting for installation at the regulator vent tapping. The

fitting when tightened against the screen, shall provide no opening larger than the mesh of the screen specified. This provision is only applicable to gas pressure regulators having escapement orifices larger than 0.0165 in (0.4191 mm) in diameter.

1.15.6

When gas flow controls are not furnished assembled on the appliance, they shall be furnished pre-assembled and ready for assembly on the appliance. (See 1.35.7-c.)

1.15.7

(See 1.11.12, Automatic Ignition Systems.)

1.16 Thermostats

(See Exhibit B, Items Unique to Canada, B.5.)

1.16.1

The control system supplied with the appliance may be capable of control by a comfort thermostat.

1.16.2

Nonelectric thermostats, when provided, shall be accessible for servicing or replacement and shall comply with the applicable construction provisions of the *Standard for Gas Appliance Thermostats, ANSI Z21.23* or *CAN1-6.6*.

1.17 Automatic Valves

1.17.1

Automatic valves, shall comply with the applicable provisions of the *Standard for Automatic Valves for Gas Appliances, ANSI Z21.21 • CSA 6.5*.

1.17.2

Combination gas controls, when provided, shall comply with the applicable construction provisions of the *Standard for Combination Gas Controls for Gas Appliances, ANSI Z21.78 • CSA 6.20*.

1.17.3

Electrically operated automatic valves shall be of a type that will close upon current failure.

1.17.4

When an automatic valve is used with a gas supply line of semi-rigid tubing, the automatic valve shall be adequately supported.

1.17.5

On an appliance with a circulating air fan, all gas to the main burner(s) shall pass through at least two valves in series which may or may not be in a single control body. (This requirement does not apply to appliances equipped with optional fan assemblies.) These valves shall be either:

- a. At least two automatic valves (see Part IV, Definitions), all of which serve as both operating valves and safety shut-off valves (See Part IV, Definitions), or
- b. At least one automatic valve and one safety shut-off valve. The automatic valve shall serve as an operating valve and a safety shut-off valve. The safety shut-off valve shall serve only as a safety shut-off valve, control any pilot gas as well as main burner gas, comply with 1.11.7, and be controlled

only by the automatic gas ignition system and a secondary temperature limit control (see 1.21.4). An appliance equipped as specified in this paragraph shall comply with 2.22.4, Duct Discharge Temperature.

1.17.6

Reverse-acting gas-actuated controls shall be arranged so the escapement gas bleeds off only momentarily and there is no continuous bleed during the normal "off" period. Off periods resulting from the operation of controls such as a limit control or safety shutoff device are not considered to be normal "off" periods.

1.18 Gas Appliance Pressure Regulators

1.18.1

A gas appliance pressure regulator shall be provided with each appliance.

1.18.2

Gas appliance pressure regulators, including the vent limiter when the regulator is so equipped, shall comply with the applicable provisions of the *Standard on Gas Appliance Pressure Regulators, ANSI Z21.18 - CSA 6.3* or the *Standard for Combination Gas Controls for Gas Appliances, ANSI Z21.78 • CSA 6.20*. (See also 1.15.2).

1.18.3

When a single gas appliance pressure regulator is used to control the pressure of both the 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 pressure regulator model number:

- a. \textcircled{P} 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. \textcircled{P} or $\textcircled{\nabla}$ for an appliance having a pilot gas flow rate of 0.50 ft³/hr (3.93 cm³/s) or greater.

1.18.4

Gas appliance pressure regulators shall be of either the limited adjustment or non-adjustable type. (See Part IV, Definitions.) The outlet pressure shall approximate that specified by the manufacturer.

A direct vent gas fireplace for manufactured home (USA only) or mobile home installation or recreational vehicle installation convertible for use with natural gas and liquefied petroleum (propane) gases shall be provided with a convertible gas appliance pressure regulator. (See Part IV, Definitions.)

1.18.5

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 appliance is subjected to the tests specified under 2.23, Wall, Floor and Ceiling Temperatures. (See 2.18.2.)

1.19 Adjustment Of Minimum Input Rating

When controls are designed for two or more rates, the adjustment means, when provided, shall be readily accessible and leak proof. Printed instructions shall be supplied with each appliance clearly outlining the adjustment procedure to determine a low-flow rate setting equal to or greater 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 no lower than the manufacturer's specified minimum input rating.

1.20 Pilot Gas Filters

1.20.1

Pilot gas filters, when used, shall conform to the *Standard for Pilot Gas Filters, Z21.35 • CGA 6.8*.

1.20.2

Manufacturer's specified capacities of pilot gas filters shall not be less than the rated capacities of the burners with which they are used.

1.20.3

A pilot gas filter when used shall be installed at the point of pilot gas take-off from the main gas supply line. When the pilot valve is combined with another control and does not constitute the pilot flow adjustment means, the gas filter may be installed in the pilot line take-off from the combination control.

1.21 Fan And Limit Controls

This section applies to vented gas fireplace heaters constructed with integral circulating air fans (non-optional).

1.21.1

Fan controls and limit controls shall be listed by a nationally recognized testing agency.

1.21.2

A primary temperature limit control, to limit the discharge air temperature, shall be provided with each appliance equipped with a circulating air blower (non-optional) and each appliance for recreational vehicle installation.

1.21.3

If an auxiliary temperature limit control is used to provide protection from excessive temperatures under reversed air flow conditions or blower or motor failure in a down-flow appliance, it may be of the manual reset type.

1.21.4

A secondary temperature limit control, when provided as specified under 1.17.5-b, shall be of the single use type, manual reset type, or automatic reset type wired to a manual reset control system and have a temperature sensing element separate from that of the primary temperature limit control.

1.21.5

The temperature limit control(s), when provided, shall be supplied and installed by the manufacturer.

1.22 Joints In Heating Surfaces

1.22.1

Joints in heating surfaces (surfaces located above the burner port level and serving as a direct means of heat exchange between the combustion products and circulating air) shall be either welded, brazed, threaded, lock-seamed, machined and bolted, have a rigid pressed joint, a machined slip joint, or be of rigid flanged construction tightly bolted together enclosing gaskets.

1.22.2

Welded joints shall be substantially a continuous weld.

1.22.3

When a lock-seam joint is not continuous as in corners of similar locations, it shall be made gastight by brazing, welding or other acceptable means. Examples of acceptable lockseam joints are shown in Figure 1, Types of Lock Seams Considered Acceptable for Heating Elements.

1.22.4

A slip joint shall neither be constructed entirely of sheet-metal nor depend upon friction of the joint itself for strength, except that slip joints of sheet-metal construction may be employed as a means of connecting a draft hood to a heating surface or to a vent, if constructed so as to be gastight. The joint shall be considered gastight when no leakage is observed during the test procedure specified in 2.28.6, or when a direct vent design complies with the test specified in 2.34, Joints In Direct Vent Systems. Such joints shall be constructed so that making and breaking the connection in normal usage shall not alter the effectiveness of the joint.

Heating elements and flue gas passageways located on the negative pressure side of the circulating air blower shall employ welded joints or equivalent as determined by the certifying agency.

1.23 Appliance Openings

Openings shall be provided which will permit inspection of the heating element. These openings shall be accessible when the appliance is installed in service, and shall be of such size that smoke or reflected light may be observed inside the casing to indicate the presence or absence of leaks in the heating element resulting from a smoke or light test.

1.24 Direct Vent/Air Intake Pipes

The design of a direct vent appliance shall be such that the flue gases from all burners are carried out of the appliance through a single flue outlet.

1.24.1

Pipe size for direct vent/air-intake pipes shall be determined by the manufacturer, and construction shall be in accordance with reasonable concepts of safety, substantiality and durability. Component parts shall be secured against distortion, warpage, or other damage and supported to maintain a fixed relationship between essential parts under normal and reasonable conditions of handling and usage so as to provide continued compliance with this standard.

1.24.2

The direct vent/air intake pipes shall be supplied as part of the direct vent system.

1.24.3

Material and gauge specifications for direct vent/air intake pipes shall be in accordance with 1.4, Thickness of Materials.

1.24.4

Lock-seam joints are acceptable for the longitudinal joints in direct vent/air intake pipes.

1.24.5

If a telescoping slip-fit connection is used in the vent-air intake pipes the minimum overlap shall be 1¹/₄ in (31.8 mm).

1.24.6

If a slip-fit connection is used at the junction of the vent pipe with the appliance or vent terminal, the minimum overlap shall be 1¹/₄ in (31.8 mm).

1.24.7

If a slip-fit connection is used at the junction of the air-intake pipe with the appliance or air intake terminal, the minimum overlap shall be 1/2 in (12.7 mm).

1.24.8

Provision shall be made to provide a firm support of the vent piping. Direct vent/air intake pipes shall have a 1 in (25.4 mm) minimum lip for attachment of vent piping of 5 in (127 mm) diameter or less and 1 1/4 in (31.8 mm) minimum lip for vent piping of 6 in (152 mm) diameter or larger.

1.24.9

Construction at the outer ends of the direct vent/air intake pipes shall be such as to provide a firm connection to the direct vent/air intake terminals and the pipes shall be fully engaged with the collar and secured with a minimum of 2 screws at opposite sides or by an equivalent mechanical means.

1.24.10

If vent kits are available with direct vent gas fireplace heaters for use with various ranges of wall or ceiling thickness, complete information covering maximum and minimum vent configurations and part numbers of vent kits shall be shown. The instructions shall specify the minimum overlap of the vent and combustion air tubes, when telescopic joints are used.

Corrugated aluminum vent pipes for co-axial and co-linear systems are acceptable for direct vent fireplace heaters under the following conditions:

- a. The minimum bend radius for safe installation of the corrugated aluminum vent assembly will be specified in the manufacturer's installation manual;
- b. The corrugated pipes meet the puncture and impact requirements of 2.33.4, Puncture Test for Venting System, and 2.33.6, Impact Test for Vent System;
- c. During installation the vent and air intake pipes are also secured to the appliance and terminal by mechanical means, and with gaskets or sealants suitable for the temperature to which they are exposed;
- d. The vent pipe shall have no joint components fabricated by the installer between the appliance and the vent terminal; and
- e. In addition to the above the following will apply to co-axial systems:
 1. The co-axial vent pipe is surrounded by another pipe and separated from that pipe by spacers. The spacers shall be of a design that will ensure that the vent pipe is not damaged or punctured during transit and installation. The vent pipe, spacers and outer pipe shall be delivered assembled by the manufacturer; or
 2. The vent pipe is surrounded by insulation or a sleeve and retainer to ensure that the vent pipe is not damaged or punctured during transit and installation. The vent pipe, insulation, sleeve and retainer shall be delivered assembled by the manufacturer; or
 3. Where the vent and intake pipes are co-axial, the design and separation of spacers shall ensure that the pipes remain separated and are not deformed when the assembly is bent into a 90 degree bend at the minimum bend radius specified in the manufacturer's installation manual.

1.24.11

Where the direct vent/air intake pipe of a direct vent fireplace heater passes through a combustible wall or ceiling, the assembly shall provide for zero ("0") clearance installation by use of a continuous sleeve or spacers from one side of the surface to the other side. All parts needed to accomplish this shall be provided by the manufacturer. Manufacturer's installation instructions shall detail the method of installation.

1.25 Venting (Other Than Direct Vent Types)

1.25.1

The design of an appliance shall be such that the flue gases from all burners are carried out of the appliance through a single flue outlet.

1.25.2

An appliance equipped with a draft hood shall be equipped with a vent safety shutoff system designed to shut off main burner gas in the event the appliance venting system is blocked. The operation of this system shall not allow automatic recycling of the main burner. (See 2.30, Vent Safety Shutoff Systems.)

The blocked vent shutoff device shall comply with a nationally recognized standard.

1.25.3

Sensors of a vent safety shutoff system shall be positively located with respect to the appliance and secured to their mounting means.

1.26 Flue Collars And Flue Outlets (Other Than Direct Vent Types)

1.26.1

A flue collar shall be provided at the flue gas outlet.

1.26.2

When a detachable draft hood (see Part IV, Definitions) is provided, the flue collar shall be designed to provide escape of the flue gases when the outlet of the collar is covered with a flat object and such outlet is essential to proper functioning and safe operation of the appliance. Any extension between the flue collar and draft hood shall comply with 1.4.1 and shall be permanently attached to the appliance and permit the secure fastening of a draft hood.

1.26.3

When an appliance is equipped with an outside casing, the flue collar shall extend beyond the casing a sufficient distance to permit the secure fastening of a draft hood or vent pipe thereto. Any extension between the flue collar and draft hood shall be of the same material and of equal thickness to that used in the surfaces exposed to flue gases and shall be permanently attached to the appliance and permit the secure fastening of a draft hood.

1.26.4

The outlet of a flue collar shall be of such size as to accommodate a vent pipe or draft hood of integral inch diameter, except when a built-in draft hood is provided or screwed pipe connections are to be made.

1.26.5

Provisions shall be made to fasten the draft hood and vent pipe securely to the flue collar.

1.26.6

When the draft hood outlet or vent pipe is extended through a blower compartment of a fan-type heater, the construction shall comply with one of the following:

- a. An extension shall be provided from the draft hood outlet or vent pipe through the blower compartment for a sufficient distance outside the casing to enable fastening of the vent connector. This extension shall be constructed of a corrosion-resistant material or have a corrosion-resistant finish to resist corrosion by condensate (see 1.4.2).
- b. A sleeve shall be provided through the blower compartment through which the vent connector can be connected to the draft hood outlet or vent pipe when the appliance is installed. This sleeve shall be constructed of corrosion-resistant finish to resist corrosion by condensate (see 1.4.2).
- c. The extension through the blower compartment shall provide separation of the circulating air and flue gases equivalent to that provided by the construction specified in "-a" and "-b" above.

This provision is not applicable when the vent connector passes through a ventilated section which is separated from the blower compartment by a reasonably tight partition.

1.27 Draft Hoods

1.27.1

Appliances shall have draft hoods as standard equipment, except when equipped with direct vent systems.

1.27.2

Detachable draft hoods, when provided, shall comply with the applicable provisions of the *Standard for Draft Hoods, ANSI Z21.12, or CAN1-6.2.*

1.27.3

A draft hood shall be located and constructed so that when the appliance is installed in a normal manner it will not be rendered inoperative.

1.27.4

All parts of the draft hood shall be constructed of a corrosion-resistant material or of a material having a corrosion-resistant finish.

1.27.5

All parts of the draft hood shall be constructed of a material not less than 0.0304 in (0.772 mm)* thick.

1.27.6

If spacers are required to ensure clearance for proper operation of a draft relief opening, the spacers must be provided as part of this appliance.

1.27.7

Where draft relief is dependent upon openings in a trim panel assembly, this assembly must be supplied by the manufacturer as part of the appliance.

1.27.8

Detachable draft hoods shall be designed so removal and replacement in normal usage will not permanently deform any part nor alter the relative position of any part with respect to another.

* This corresponds to No. 20 U.S. Standard gage sheet steel with all applicable minus tolerances included.

1.27.9

Joints used in the construction of draft hoods shall not depend primarily on solder for strength or tightness.

1.27.10

Draft hoods shall be constructed of such material that there will be no melting, softening or distortion of any part as a result of the tests specified herein.

1.27.11

The flue connection shall be of such size as to accommodate vent pipe of integral inch diameter or other commercially available vent pipe.

1.27.12

A draft hood shall be located so that the relief opening is accessible for checking vent operation.

1.27.13

The design of the appliance shall be such that no portion of the flue gases issuing from the draft hood relief openings in the event of a blocked flue or down-draft, will be discharged into walls, floors or ceiling. Openings in the jacket top or sides through which the flue connection extends shall be sufficiently close fitting to prevent occurrence of such a condition.

1.28 Automatic Vent Damper Devices

[See Exhibit B, Items Unique To Canada, B.3]

Automatic vent damper devices shall comply with the applicable provisions of the *Standard for Vent Damper Devices, ANSI Z21.66 • CGA 6.14*.

1.29 Manually Operated Vent Dampers

1.29.1

Manually operated vent dampers shall assume a fully open position when any locking mechanism is released and shall not be adjustable between fully open and fully closed.

1.29.2

A manually operated vent damper shall be so constructed that breakage of a part will result in the vent damper remaining in the fully open position.

1.29.3

Appliances incorporating a manually operated vent damper shall be equipped with a device which will shut off all gas to the main burner when the main burner is operated with the manually operated vent damper closed, as specified in the following Method of Test.

Method of Test

A section of vent pipe 4 ft (1.22 m) long shall be attached to, and vertically above, the outlet of a draft hood having a vertical outlet, or a 90 degree (1.57 rad) elbow and 5 ft (1.52 m) of vertical vent pipe shall be attached to, and vertically above, the outlet of a draft hood having a horizontal outlet.

With all parts of the appliance at room temperature and the damper closed, the pilot and main burner(s) shall be placed in operation. The gas to the main burner(s) shall be shut off before the main burner operation has exceeded 10 minutes.

An appliance which cannot be placed in operation with the vent damper in the closed position shall be considered to comply with this provision.

1.30 Electrical Equipment And Wiring

See Exhibit B, Items Unique to the Canada and Exhibit C, Items Unique to the United States.

The leads or terminals of an individual control in the gas control circuit, that are provided for making electrical connections and which are intended to be disconnected in order to replace or service the control, shall be identified by a number(s), letter(s), symbol(s) or combination thereof, in a color which contrasts with the background. This provision does not apply when:

- a. The control incorporates means which will physically prevent miswiring; or
- b. The control incorporates only two terminals or leads, the interchange of which does not change the operation of the control.

1.31 Motors And Blowers

1.31.1

Motor, blower or fan bearing shall either be (a) permanently lubricated or (b) provided with accessible means for lubrication. (See 1.3.3, 1.34.1-c3 and 1.34.9.)

1.31.2

Bearings of motors, blowers or fans shall be of a type suitable for the temperatures to which subjected in normal operation.

1.31.3

On belt-driven blowers or fans, means for adjusting the belt tension shall be provided and shall be readily accessible. (See 1.3.4.)

1.31.4

With direct-driven fans, the whole fan and motor assembly should be removable as a unit.

1.32 Cooling Section Of Vented Gas Fireplace Heaters With Cooling Units

When an electrically driven compression type refrigeration unit is combined with an appliance in a common casing, all refrigerants and refrigerant-containing parts shall comply with the *Safety Standard for Heating and Cooling Equipment, ANSI/UL 1995, CSA C22.2, No. 236, Heating and Cooling Equipment*, or the *Safety Standard for Room Air Conditioners, ANSI/UL 484, CSA C22.2 No. 117, Room Air Conditioners*, whichever is applicable, and with the *Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15, CSA B51, Boilers and Pressure Vessel Code*.

1.33 Heating Elements Located Downstream From Refrigeration Coils

1.33.1

The heating element(s), burner(s), and burner enclosure(s) shall be constructed of a corrosion-resistant material, or have a corrosion-resistant finish to resist corrosion by condensate. Stainless steel, ceramic-coated steel or an aluminum-coated steel in which the bond between the steel and the aluminum is an iron-aluminum alloy are considered to be corrosion resistant.

1.33.2

The electrical equipment and wiring shall be suitably protected from condensate.

1.33.3

Adequate means shall be provided for the collection and disposal of condensate.

1.34 Instructions

(Also See Exhibit B, Items Unique To Canada.)

1.34.1

Each appliance shall be accompanied by clear, concise printed instructions and diagrams adequate for proper field assembly, installation, maintenance, safe use and operation.

The front cover or, in the absence of a cover, the first page shall bear the following statements. They shall be boxed as shown:

<p>WARNING: If the information in these instructions are not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.</p>
<p>— Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.</p>
<p>— WHAT TO DO IF YOU SMELL GAS</p> <ul style="list-style-type: none">• Do not try to light any appliance.• Do not touch any electrical switch; do not use any phone in your building.• Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.• If you cannot reach your gas supplier, call the fire department.
<p>— Installation and service must be performed by a qualified installer, service agency or the gas supplier.</p>

For a direct vent gas appliance for recreational vehicle installation:

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

— Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

— WHAT TO DO IF YOU SMELL GAS

- Evacuate all persons from the vehicle.
- Shut off the gas supply at the gas container or source.
- Do not touch any electrical switch or use any phone or radio in the vehicle.
- Do not start the vehicle's engine or electric generator.
- Contact the nearest gas supplier or qualified service technician for repairs.
- If you cannot reach your gas supplier, or qualified technician, contact the nearest fire department.
- Do not turn on the gas supply until the gas leak(s) has been repaired.

— Installation and service must be performed by a qualified installer, service agency or the gas supplier.

For a direct vent convertible appliance installed as an OEM installation in a manufactured home (USA only) or mobile home (see 1.1.1-c):

This appliance may be installed as an OEM installation in a manufactured home (USA only) or mobile home and must be installed in accordance with the manufacturer's instructions and the *Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280*, in the United States, or the Standard for Installation in *Mobile Homes, CAN/CSA Z240 MH*, in Canada.

This appliance is only for use with the type(s) of gas indicated on the rating plate. A conversion kit is supplied with the appliance.

For a direct vent gas appliance installed as an aftermarket installation in a manufactured home (USA only) or mobile home for use with natural gas only or liquefied petroleum (propane) gases only (see 1.1.1-d):

This appliance may be installed in an aftermarket, permanently located, manufactured home (USA only) or mobile home, where not prohibited by local codes.

This appliance is only for use with the type of gas indicated on the rating plate. This appliance is not convertible for use with other gases, unless a certified kit is used.

For a direct vent convertible appliance installed as an aftermarket installation in a manufactured home (USA only) or mobile home (see 1.1.1-c):

This appliance may be installed in an aftermarket, permanently located, manufactured home (USA only) or mobile home, where not prohibited by local codes.

This appliance is only for use with the types of gas indicated on the rating plate. A conversion kit is supplied with the appliance.

For a direct vent gas appliance installed as an OEM installation in a manufactured home (USA only) or mobile home for use with liquefied petroleum (propane) gas only (see 1.1.1-g):

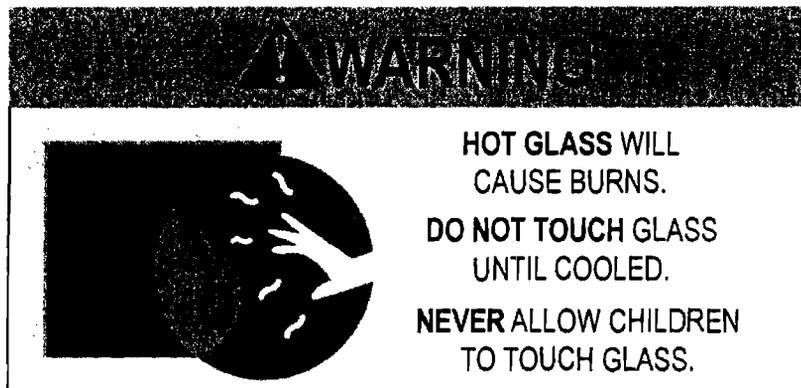
This appliance may be installed in an OEM installation in a manufactured home (USA only) or mobile home and must be installed in accordance with the manufacturer's instructions and the *Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280*, in the United States, or the *Standard for Installation in Mobile Homes, CAN/CSA Z240 MH Series*, in Canada.

This appliance is only for use with the type of gas indicated on the rating plate. This appliance is not convertible for use with other gases, unless a certified kit is used.

INSTALLER: Leave this manual with the appliance.
CONSUMER: Retain this manual for future reference.

The letters used for the boxed statements above 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 specifications.

For a glass fronted gas appliance where the temperature of the glass outside surface exceeds 95°F (53°C) above room temperature when measured in accordance with 2.14.1, Glass Fronts, the following graphic warning and statement shall be shown.



The Warning letter-type shall be a sans-serif font with a minimum letter height of the following:

The symbol and word, "  WARNING," shall be boldfaced type having a minimum uppercase letter height of 0.498 in (12.65 mm)**; and

The words, as shown above, in the boxed statement 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).* Lower case letters shall be compatible with the uppercase letter size specifications.

These instructions shall include:

- a. Assembly instructions for field installed parts and components, including all controls and accessories (when applicable).
- b. Installation instructions specifying:
 1. That the installation must conform with, as applicable:
 - (a) The installation must conform with local codes or, in the absence of local codes, with the *National Fuel Gas Code, ANSI Z223.1/NFPA 54*, or the *Natural Gas and Propane Installation Code, CSA B149.1*.
 - (b) For appliances for recreational vehicle installation, the *Standard for Recreational Vehicles, ANSI A119.2*, or *Standard for Gas Equipped Recreational Vehicles and Mobile Housing, CSA Z240.4*.

* This letter height and line spacing measurements correspond to 12-point type.

** This letter height corresponds to 36-point type.

- (c) A manufactured home (USA only) or mobile home OEM installation must conform with the *Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280*, or, when such a standard is not applicable, the *Standard for Manufactured Home Installations, ANSI/NCSBCS A225.1*, or *Standard for Gas Equipped Recreational Vehicles and Mobile Housing, CSA Z240.4*.
- 2. The manufacturer's, distributors, jobbers or dealers name, as it appears on the appliance rating plate, and address and appliance model or series number.
- 3. The appliance and its appliance main gas valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi (3.5 kPa).

The appliance must be isolated from the gas supply piping system by closing its equipment shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi (3.5 kPa).

- 4. Directions to provide a means to measure the pressure immediately upstream of the gas supply connection to the appliance, unless such means are provided on the appliance.
- 5. Provisions for adequate combustion and ventilation air.
- 6. Minimum clearances from spacers, standoffs or surfaces to combustible construction and combustible trim and mantles, as verified by test. (See 2.23, Wall, Floor and Ceiling Temperatures.)

In addition to the minimum clearances the installation instructions shall define the left and right side and front of the appliance. For those clearances where a second side wall is specified, accessibility for purposes of servicing shall also be addressed.

The installation instructions for an appliance for installation on combustible flooring shall specify that when the appliance is installed directly on carpeting, tile or other combustible material other than wood flooring, the appliance shall be installed on a metal or wood panel extending the full width and depth of the appliance.

The installation instructions for an appliance for installation at a specified minimum distance above combustible flooring shall specify that the specified clearance shall be maintained from the top surface of carpeting, tile, etc.

- 7. Adequate clearances around air openings into the combustion chamber.
- 8. Adequate accessibility clearances for servicing and proper operation.
- 9. If applicable, clearances from any projection(s), such as shelves, window sills, fireplace mantles, above the appliance (see 1.35.10, Electrical Diagrams).
- 10. Proper vent installation, i.e. manufacturer's specified vent type, maximum horizontal and minimum vertical vent pipe length.
- 11. A statement to the effect that a gas appliance must not be connected to a chimney flue serving a separate solid-fuel burning appliance.
- 12. The minimum inlet gas supply pressure for the purpose of input adjustment.
- 13. The maximum inlet gas supply pressure.

14. Complete electrical diagrams and fan or blower installation instructions when a fan or blower is provided as optional equipment.
 15. The draft hood be installed so as to be in the same atmospheric pressure zone as the combustion air inlet to the appliance and shall be located so that the relief opening is accessible for checking vent operation.
 16. The appliance, when installed, must be electrically grounded in accordance with local codes or, in the absence of local codes, with the *National Electrical Code, ANSI/NFPA 70*, or the *Canadian Electrical Code, CSA C22.1*.
 17. The intent of the warning statement specified in Exhibit C, Items Unique to the United States, C.2-f, if a flexible service cord is provided to connect the appliance to a line-voltage electrical supply.
 18. Clearances from the vent cap of direct vent units to intersecting walls, overhangs or eaves, window openings, air intakes, aboveground, grade or deck shall be specified and illustrated as per Figure 3, Vent Terminal Clearances.
 19. Proper vent installation and for direct vent appliances for use with various ranges of wall thickness, complete information covering maximum and minimum vent configurations and part numbers of vent kits, if several vent kits are available.
 20. If manufacturers venting instructions for B vented appliances differ from the venting tables in the *National Fuel Gas Code, Z223.1/NFPA 54*, or the *Natural Gas and Propane Installation Code, B149.1*, then detailed instructions regarding the venting configuration shall be provided.
 21. The methods and parts to be employed to connect the optional warm air duct system to the exterior of the fire chamber of a circulating warm air type fireplace.
 22. Any limitations with respect to installation and use of the optional warm air duct systems such as minimum or maximum height of air intakes or outlets above the floor, minimum cross-sectional area and maximum length, allowable grille locations, proximity to combustibles, and framing details for the air ducts where they penetrate adjacent walls or floors.
- c. Maintenance instructions (including recommended frequency guidelines) suggesting:
1. For direct vent designs, proper reassembly and resealing of the vent-air intake system.
 2. Information covering the cleaning of the appliance, including the burner(s).
 3. Lubrication of moving parts (when applicable) and the type and amount of lubricant to be used.
 4. Periodic examination of venting systems by a qualified agency.
 5. Periodic visual check of pilot and burner flames, with pictorial sketches or drawings.
 6. The appliance area be kept clear and free from combustible materials, gasoline and other flammable vapors and liquids.
 7. The flow of combustion and ventilation air not be obstructed.
- d. Lighting/operating instructions as specified in 1.35.3 through 1.35.5 including sketches or diagrams. See 1.35.5-e, for type size.

- e. The following statement: "Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water."
- f. Electrical diagrams in the form(s) specified in 1.35.10, Electrical Diagrams.
- g. The following statements:
 - "Caution: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation."
 - "Verify proper operation after servicing."
- h. A list of replacement parts and the source from which such parts are available.
- i. Identification of the testing agency.

1.34.2

The printed instructions accompanying the appliance shall also include the following minimum information presented in a readily obvious and prominent manner, such as by being underlined, encircled, or printed in larger or different color type:

- a. "Due to high temperatures, the appliance should be located out of traffic and away from furniture and draperies."
- b. "Children and adults should be alerted to the hazards of high surface temperature and should stay away to avoid burns or clothing ignition."
- c. "Young children should be carefully supervised when they are in the same room as the appliance. Toddlers, young children and others may be susceptible to accidental contact burns. A physical barrier is recommended if there are at risk individuals in the house. To restrict access to a fireplace or stove, install an adjustable safety gate to keep toddlers, young children and other at risk individuals out of the room and away from hot surfaces."
- d. "Clothing or other flammable material should not be placed on or near the appliance."
- e. "Any safety screen or guard removed for servicing an appliance must be replaced prior to operating the appliance" (see 1.2.6).
- f. "Installation and repair should be done by a qualified service person. The appliance should be inspected before use and at least annually by a professional service person. More frequent cleaning may be required due to excessive lint from carpeting, bedding material, et cetera. It is imperative that control compartments, burners and circulating air passageways of the appliance be kept clean."
- g. The instructions for an appliance optionally for use with glass doors (or equivalent) shall state that only doors certified with the appliance shall be used. The instructions for an appliance not intended for use with glass doors (or equivalent) shall emphasize that the appliance is not for use with glass doors.

1.34.3

Where the appliance incorporates glass components, the instructions shall include:

- a. Directions and information adequate for attaining a proper and safe installation of the glass component or assembly. The instructions shall not require the cutting of glass or metal;

- b. Complete details for the removal of broken or damaged components;
- c. The manufacturer's part number(s) for replacement glazing components shall indicate that the glazing/frame assembly shall only be replaced as a complete unit as supplied by the manufacturer;
- d. Complete instructions on the reinstallation of the components including where applicable, the use of gasket, cushioning devices and other accessories, and the need to maintain edge clearances;
- e. A warning against the use of substitute materials;
- f. A warning regarding abuse of glass doors such as striking or slamming shut;
- g. A caution against operating with broken glass;
- h. Directions for cleaning glass;
- i. A warning against using abrasive cleaners; and
- j. A warning against cleaning when hot.

1.34.4

Where the appliance incorporates a trim panel assembly which forms part of the draft hood relief mechanism, the instructions shall include the following:

- a. "Only trim kit(s) supplied by the manufacturer shall be used in the installation of this appliance."
- b. "Draft relief openings must not be covered or blocked."

1.34.5

For an appliance designed for installation in a solid-fuel burning fireplace the following instructions shall be included:

- a. A pictorial diagram in at least two views or a single exploded view depicting proper positioning of field assembled parts. The following statement must be included with the pictorial diagram:

"WARNING: Failure to position the parts in accordance with these diagrams or failure to use only parts specifically approved with this appliance may result in property damage or personal injury."
- b. A statement that the installer must mechanically attach the marking supplied with the gas fireplace insert to the inside of the firebox of the fireplace into which the gas fireplace insert is installed (see 1.35.7-j).
- c. A statement that cutting any sheet-metal parts of the fireplace, in which the gas fireplace insert is to be installed, is prohibited.
- d. The statement: "If the factory-built fireplace has no gas access hole(s) provided, an access hole of 1.5 in (37.5 mm) or less may be drilled through the lower sides or bottom of the firebox in a proper workmanship like manner. This access hole must be plugged with non-combustible insulation after the gas supply line has been installed."
- e. A statement that the fireplace flue damper can be fully blocked open or removed for installation of the gas fireplace insert.

- f. A statement that the fireplace and fireplace chimney must be clean and in good working order and constructed of non-combustible materials.
- g. A statement that chimney cleanouts fit properly.
- h. A statement that refractory, glass doors, screen rails, screen mesh and log grates can be removed from the fireplace before installing the gas fireplace insert.
- i. A statement that smoke shelves, shields and baffles may be removed if attached by mechanical fasteners.
- j. Information concerning the minimum size fireplace into which the gas fireplace size.
- k. A statement that trim panels or surrounds shall not seal ventilation openings in the fireplace.
- l. Instructions shall include directions on making a tight connection between the gas fireplace insert flue collar and fireplace chimney.

1.34.6

The printed instructions accompanying the appliance shall also include the following minimum information presented in a readily obvious and prominent manner; such as by being underlined, encircled or printed in larger or different color type:

For appliances equipped with glass fronts (see 1.6, Glass Fronts) the following statement:

“WARNING: Do not operate appliance with the glass front removed, cracked or broken. Replacement of the glass should be done by a licensed or qualified service person.” (See 1.35.23.)

1.34.7

Installation instructions accompanying a direct vent appliance or other appliance that can utilize a side wall vent system shall include a diagram as shown in Figure 3, Vent Terminal Clearances, or equivalent, indicating vent terminal clearances A to M. The clearances marked on the diagram shall be stated separately for U.S. and Canadian installations and shall not be less than those specified in the current *ANSI Z223.1/NFPA 54, National Fuel Gas Code*, or *CSA B149.1, Natural Gas and Propane Installation Code*. For clearances not specified in *ANSI Z223.1/NFPA 54* or *CSA B149.1*, one of the following shall be indicated:

- a. A minimum clearance value determined by testing in accordance with section 2.23, Wall, Floor and Ceiling Temperatures, or;
- b. A reference to the following footnote:

“Clearances are in accordance with local installation codes and the requirements of the gas supplier.”

1.34.8

The manufacturer’s instructions for an appliance equipped with a vent damper device shall also include the following, as applicable:

- a. Location and method of installation, without modification of either the draft hood or the vent damper device.
- b. A statement to the effect that the venting system be so arranged that only the appliance is served by the vent damper device supplied with the appliance.

- c. Instructions that a minimum clearance of 6 in (152 mm) between the vent damper device and combustible construction be maintained and that there be provisions for access for service of the vent damper device.
- d. Method of the proper interconnection of the wiring harness.
- e. Instructions and illustrations indicating the manner in which field installed mechanical connections shall be made and routed, and the materials to be used.
- f. A statement that the damper position indicating means be in a visible location following installation.
- g. The statement, "Damper must be in open position when appliance main burner(s) is operating."
- h. If the vent damper device is thermally actuated, a description of how the damper operates.

1.34.9

Instructions on Class V marking for lubrication of motor, blower or fan bearings, which require that lubricant be added, shall be provided on the fan or blower housing or on surfaces adjacent to the means of access. (See Exhibit C, Items Unique to the United States, C.3, Motors and Blowers).

1.34.10

Also see 1.2.15, 1.2.16, 1.7.4, 1.15.4, 1.35.3, 1.35.4, 1.35.5, 2.1.6, 2.1.7 and 2.8.3.

1.35 Marking (Also see Exhibit B, Items Unique to Canada)

1.35.1

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 under 2.39, 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 enamelled surface.

Class IIA-1. Permanent Plate

Shall be made of metal having a minimum thickness of 0.012 in (0.30 mm), shall be securely attached by mechanical means and shall comply with 2.39, Marking Material Adhesion and Legibility.

Class IIA-2. Permanent Plate

Shall be made of metal having a thickness of 0.006 in to 0.012 in (0.15 mm to 0.30 mm), shall have mechanical attachment means at all corners with a maximum spacing of 6 in (152 mm) between mechanical fasteners and shall comply with 2.39, Marking Material Adhesion and Legibility.

Class IIA-3. Permanent Plate

Shall be made of metal having a thickness less than 0.006 in (0.15 mm). Such plates shall be attached by means of non-water-soluble adhesive which will comply with 2.39, Marking Material Adhesion and Legibility. These materials shall not be located on surfaces having temperatures exceeding 300°F (149°C) as determined during conduct of 2.23, Wall, Floor and Ceiling Temperatures.

Class IIA-4. Permanent Plate

Shall be made of pressure-sensitive metal foil requiring no solvent or activator, provided such plates comply with 2.39, Marking Material Adhesion and Legibility. These materials shall not be located on surfaces having temperatures exceeding 300°F (149°C) as determined during conduct of 2.23, Wall, Floor and Ceiling Temperatures.

Class IIIA-1. Permanent Label

Shall be made of material not adversely affected by water, shall be attached by means of non-water-soluble adhesive and shall comply with 2.39, Marking Material Adhesion and Legibility. These materials shall not be located on surfaces having temperatures exceeding 300°F (149°C) as determined during conduct of 2.23, Wall, Floor and Ceiling Temperatures.

Class IIIA-2. Permanent Label

Shall be made of material not adversely affected by water, shall be attached by means of non-water-soluble adhesive and shall comply with 2.39, Marking Material Adhesion and Legibility. These materials shall not be located on surfaces having temperatures exceeding 175°F (79.5°C) as determined during conduct of 2.23, Wall, Floor and Ceiling 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 conduct of 2.23, Wall, Floor and Ceiling Temperatures.

Class IIIC. Waterproof Label

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

Class IV. Non-waterproof Label

Shall be made of material which may be soluble in water, and may use water-soluble 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

1.35.2

RATING PLATE(S). Each appliance shall bear a plate, or a combination of plates in proximity, of Class IIIA marking material located so as to be easily read when the appliance is in a normally installed position. A rating plate(s) applied to the inner surface of a control compartment door is considered acceptable. The following information shall appear on the plate(s):

- a. Type of appliance: "Vented Gas Fireplace Heater"
- b. On an appliance suitable for use only with a vent damper device:

"For use only with automatic vent damper device Part No. _____. Follow installation instructions."

- c. On an appliance suitable for use with or without a vent damper device:
 "May be used with automatic vent damper device Part No. _____. Follow installation instructions."
- d. On an appliance where the trim panel assembly forms part of the draft hood relief mechanism:
 "For use only with trim kit(s) Part No(s). _____. Follow installation instructions."
- e. The manufacturer's or distributor's name and location.
- f. The manufacturer's or distributor's model designation of the appliance.
- g. A distinctive number which will identify an individual appliance.
- h. The manufacturer's normal hourly Btu input rating and manifold pressure in inches water column.
- i. The manufacturer's minimum hourly Btu input rating for an appliance having a multi-rate or automatic modulating control.
- j. Type of gas for which equipped: Natural or Liquefied Petroleum (Propane)
- k. Minimum permissible gas supply pressure for purpose of input adjustment.
- l. The statement: "Vented Gas Fireplace Heater - Not for Use with Solid Fuel." The size of the lettering used for this marking shall be Vogue boldfaced upper case type, or equivalent, having a minimum letter height of 0.100 in (2.54 mm).* The minimum vertical spacing between lines of type shall be 0.066 in (1.67 mm).**
- m. On all vented gas fireplace heaters:
 "This vented gas fireplace heater is not for use with air filters."
- n. Identification of this standard by indicating either the edition of the standard, or the most recent effective addenda thereto, with one of the following markings:
 "ANS Z21.88-(year) • CSA 2.33-(year), Vented Gas Fireplace Heater;"
 "ANS Z21.88a-(year) • CSA 2.33a-(year), Vented Gas Fireplace Heater;" or
 "ANS Z21.88b-(year) • CSA 2.33b-(year), Vented Gas Fireplace Heater."
- o. Electrical rating-voltage, frequency (Hz) and total input in amperes. If the total input of all components is less than 12 amperes, the input marking may optionally be shown as "less than _____* amperes."

(* This amperage rating shall be equal to or greater than the total input in amperes).

On an appliance with a cooling unit which includes an electrically driven compressor air conditioning component, this marking shall include the voltage, frequency, phase, full load amperes and horsepower of each motor, except hermetic motors shall include locked rotor amperes instead of horsepower rating.

* This letter height measurement corresponds to 10 point type.

** This line spacing measurement corresponds to 2 point leading.

- p. Symbol of the organization making the tests for compliance with this standard.
- q. Where applicable (see 1.34.2-g), the statement: "FOR USE WITH GLASS DOORS CERTIFIED WITH THE APPLIANCE ONLY" or "NOT FOR USE WITH GLASS DOORS."
- r. On a direct vent gas appliance designed for installation in a manufactured home (USA only) or mobile home or recreational vehicle installation, convertible for use with natural gas and liquified petroleum (propane) (see 1.1.1-c), this marking shall be as follows:

"For natural gas when equipped with No. _____ drill size orifice."

"For propane when equipped with No. _____ drill size orifice."

(Each orifice shall be clearly identified with regard to the gas for which it will be used, and the orifice size shall be indicated on the spud or hood. Also see 1.10.5.)

- s. A direct vent gas appliance for manufactured home (USA only) or mobile home aftermarket installation for use with natural gas only or liquified petroleum (propane) gases only (see 1.1.1-d) shall be marked:

"This appliance is only for use with the type of gas indicated on the rating plate and may be installed in an aftermarket, permanently located, manufactured home (USA only) or mobile home, where not prohibited by local codes. See owner's manual for details. This appliance is not convertible for use with other gases, unless a certified kit is used."
- t. A direct vent gas appliance for manufactured home (USA only) or mobile home aftermarket installation convertible for use with natural gas and liquified petroleum (propane) gases (see 1.1.1-c) shall be marked:

"This appliance is only for use with the type(s) of gas indicated on the rating plate and may be installed in an aftermarket, permanently located, manufactured home (USA only) or mobile home, where not prohibited by local codes. See owner's manual for details. This appliance is supplied with a conversion kit."

1.35.3

INSTRUCTIONS TO PUT THE FIREPLACE HEATER IN OPERATION. Each appliance shall bear a single label or a series of adjacent labels of Class IIIB marking with letters on a contrasting background, located on or adjacent to the controlling device or in an equally conspicuous position where the instructions can be easily read by the operator during the lighting/operating and shutdown procedures.

Where a series of labels is used, they shall:

- a. Be capable of being reviewed simultaneously (in the same plane) in the sequence as shown in Exhibit F, Outline of Lighting Instructions for Appliances Equipped with Continuous Pilot; Exhibit G, Outline of Operating Instructions for Appliances with Intermittent Pilot or Interrupted Pilot Systems; or Exhibit H, Outline of Operating Instructions for Appliances with Direct Ignition Systems, as applicable; and
- b. Not be separated from each other by more than one inch.

The label(s) may be on the interior of a removable panel which provides access to the gas controls.

A separate means may be provided for mounting the lighting/operating instructions label(s). This means shall be permanently attached to the appliance in a manner such that, when lighting the appliance the lighting/operating instructions can be easily read without detachment from the appliance.

If the above label(s) is not visible on the appliance when all panels are in place, a Class IIIA marking shall be affixed on the exterior of the appliance in a location where it can be easily read when the appliance is installed at the minimum clearances for which the appliance is to be listed. This marking shall indicate where the lighting/operating instructions are to be found.

On an appliance of such design that space does not permit proper location of these instructions, they may be furnished on a metal tag attached to the appliance or combined with the information on the rating plate.

1.35.4

The lighting/operating instructions label(s) specified in 1.35.3 shall contain at least the following:

- a. For an appliance equipped with a continuous (piloted) ignition system, as outlined in Exhibit F, Outline of Lighting Instructions for Appliances Equipped with Continuous Pilot;
- b. For an appliance equipped with an intermittent pilot or interrupted pilot ignition system, as outlined in Exhibit G, Outline of Operating Instructions for Appliances Equipped with Intermittent Pilot or Interrupted Pilot Systems;
- c. For an appliance equipped with a direct ignition system, as outlined in Exhibit H, Outline of Operating Instructions for Appliances Equipped with Direct Ignition Systems.

The statements in quotes in the above referenced Exhibits shall be worded as shown in the applicable Exhibit.

1.35.5

The physical specifications of the lighting/operating instructions label(s) specified in 1.35.3 shall be as follows:

- a. Each of the three sections shall be boxed by a red border, the top dimensions being a minimum $\frac{1}{4}$ in (6.4 mm) solid red line.

The solid red line shall be broken to show the title of these three sections on a white background as shown in Exhibit Figures F, G, or H, as applicable.

- b. The titles of each section shall be black boldfaced type having a minimum letter height of 0.100 in (2.54 mm)* and located within the top border line.
- c. The word "WARNING" shall be black boldfaced type having a minimum letter height of 0.100 in (2.54 mm).*
- d. The text of the label(s) shall be black boldfaced letters on a white background having a minimum uppercase letter height of 0.080 in (2.03 mm)** with a minimum vertical spacing between lines of type of 0.038 in (0.96 mm).*** Lowercase letters shall be compatible with the uppercase letter size specification.

* This letter height measurement corresponds to 10 point type.

** This letter height measurement corresponds to 8 point type.

*** This line spacing measurement corresponds to 10 point-type spacing

- e. Unless the type sizes used for -b, -c and -d above are at least 0.140 in (3.65 mm), 0.120 in (3.05 mm) and 0.100 in (2.54 mm), respectively, the instructions specified in 1.34.1-d shall be shown in these larger type sizes.

If the appliance does not provide a surface area adequate to affix the prescribed label, which is accessible and visible after installation, the label size may be reduced in proportion to available surface area.

The maximum reduction permitted shall be:

1. Reduce 1/4 in (6.4 mm) solid red line to 1/8 in (3.2 mm);
2. Reduce 0.100 in (2.54 mm) letter height measurement to 0.080 in (2.03 mm);
3. Reduce 0.080 in (2.03 mm) letter height measurement to 0.060 in (1.5 mm); and
4. Reduce 0.038 in (0.96 mm) line spacing measurement to 0.024 in (0.61 mm).

Note: The allowable reduced sizing is 64 percent of prescribed sizing.

1.35.6

INSTRUCTION PLATE. Each appliance shall bear a Class IIIB marking with letters on a contrasting background, located adjacent to the controlling device or in an equally conspicuous position where the instructions can be easily read. These instructions shall include the following in a form which can be easily understood.

- a. **CAUTION:** Hot while in operation. Do not touch. Severe burns may result. Keep children, clothing, furniture, gasoline and other liquids having flammable vapors away.

or

CAUTION: Hot while in operation. Do not touch. Severe burns may result. Keep children, clothing and furniture away.

CAUTION: Keep gasoline and other liquids having flammable vapors away.

- b. The statement, "Keep burner and control compartment clean. See installation and operating instructions accompanying appliance."

On an appliance of such design that space does not permit proper location of these instructions, they may be furnished on a metal tag attached to the appliance.

The word "CAUTION" shall be in letters having a minimum height of 0.240 in (6.09 mm).* The remainder of the wording shall be in letters having a minimum height of 0.120 in (3.04 mm) with a minimum vertical spacing between lines of 0.046 in (1.16 mm).** Letters are to be on a contrasting background.

* This letter height measurement corresponds to 24 point type.

** These line height and line spacing measurements correspond to 12 point type.

1.35.7

INSTALLATION MARKING. Each appliance shall bear:

- a. A marking on Class III marking material located on a surface which will be visible at the time of installation stating: "This appliance must be installed in accordance with local codes, if any; if none, follow the *National Fuel Gas Code, ANSI Z223.1/NFPA 54, or Natural Gas and Propane Installation Code, CSA B149.1.*"
- b. A label of Class III marking material located so as to be easily read when the appliance is in a normally installed position, which includes the following information:

"WARNING: Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to the owner's information manual provided with this appliance. For assistance or additional information consult a qualified installer, service agency or the gas supplier."
- c. When gas flow controls are not furnished assembled on the appliance, a Class VI marking on the control sub-assembly shall indicate assembly to the appliance.
- d. A marking on Class III marking material located on an exterior surface adjacent to the flue collar stating:
 1. For a direct vent or power vent system: "This appliance must be properly connected to a venting system in accordance with the manufacturer's installation instructions." or
 2. For a gravity vent appliance:

"This appliance must be properly connected to a venting system in accordance with the manufacturer's installation instructions. This appliance is equipped with a vent safety shutoff system."

"WARNING: Operation of this appliance when not connected to a properly installed and maintained venting system or tampering with the blocked vent shutoff system can result in carbon monoxide (CO) poisoning and possible death."

"This appliance needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air."
- e. A prominent Class V marking provided in a location visible at the time of installation, specifying the suitable vent or vents, such as B or BW type.
- f. For a direct vent gas fireplace heater for an OEM manufactured home (USA only) or mobile home installation, "This appliance must be installed in accordance with the *Standard for Manufactured Housing, CAN/CSA Z240 MH*, in Canada; or with the *Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280*, in the United States; or when such a standard is not applicable, the *Standard for Manufactured Home Installations Standard, ANSI/NCSBCS A225.1/NFPA 501A.*"
- g. For a direct vent gas fireplace heater for recreational vehicle installation, "This appliance must be installed in accordance with the Standard *CAN/CSA Z240 RV, Recreational Vehicles*, in Canada, or with *ANSI A119.2/NFPA 501C, Standard for Recreational Vehicles*, in the United States."

- h. A direct vent gas appliance for manufactured home (USA only) or mobile home OEM installation or recreational vehicle installation shall be marked with a Class IIIC marking either "for OEM installation in a manufactured home (USA only) or mobile home only," "for installation in a recreational vehicle only," or "for OEM installation in a manufactured home (USA only) or mobile home or recreational vehicle only."
- i. In cases where sections of the venting system of direct vent gas appliances for manufactured home (USA only) or mobile home OEM installation have been removed or not installed for transporting the manufactured home (USA only) or mobile home, a Class V marking shall be attached and shall state:

"Sections of the venting system have not been installed. WARNING - Do not operate the appliance until all sections have been assembled and installed in accordance with the manufacturer's instructions."
- j. For a gas fireplace insert, a Class IIA-1 marking to be supplied with the gas fireplace insert and attached to the fireplace in which the gas fireplace insert is to be installed stating: "WARNING. This fireplace has been converted for use with a gas fireplace insert only and cannot be used for burning wood or solid fuels unless all original parts have been replaced, and the fireplace re-approved by the authority having jurisdiction."
- k. For a gas fireplace insert, a Class IV marking stating the minimum size fireplace into which the gas fireplace insert can be installed: i.e. height and width of front opening, depth and minimum chimney flue size.
- l. For a gas fireplace insert, a Class IV marking, visible at the time of installation stating: "WARNING: Failure to install this appliance per the manufacturer's instructions or failure to use only parts specifically approved with this appliance may result in property damage or personal injury."

1.35.8

For appliances having a fast-acting thermocouple, a Class IIIC WARNING label shall be attached to the fast-acting thermocouple adjacent to the valve connection stating:

"WARNING: Fire or explosion hazard. Can cause property damage, severe injury or death.

This is a fast-acting thermocouple. Replace it only with another fast-acting thermocouple specified by the appliance manufacturer. Refer to the manual for the part number."*

1.35.9

An appliance equipped with a single use or manual reset type temperature limit control shall have the following applicable information on the rating plate or a separate plate of Class IIIA marking material attached to the appliance in a location convenient to the user:

- a. For a single use type temperature limit control, complete instructions for replacement of the control.
- b. For a manual reset type limit control, instructions on the use of the reset button.

* *Black bold-faced type with a minimum letter height of 0.1 inch.*

1.35.10

ELECTRICAL DIAGRAMS.

See Exhibit C, Items Unique to the United States.

An appliance for use on a direct-current electrical wiring system shall bear a Class III marking adjacent to the point of connection of the electrical service, which reads:

"THIS CONNECTION IS FOR LOW-VOLTAGE BATTERY OR DIRECT CURRENT ONLY. DO NOT CONNECT TO 120 OR 240 VOLTS AC."

1.35.11

An appliance found suitable with an optional fan or blower shall bear a marking to the effect that: "(Part No. _____) fan or blower assembly may be used." This marking may be on the rating plate or on a separate Class IIIB marking adjacent to the rating plate.

1.35.12

An optional fan or blower assembly provided with a vented fireplace heater shall bear a Class IIIB marking showing the appliance manufacturer's name and the fan or blower assembly part number.

1.35.13

CLEARANCE MARKING. Each appliance shall bear a marking on Class III marking material, located as specified in 1.35.2, stating the minimum clearances from spacers/standoffs or surfaces to combustible construction for all appliance and vent surfaces. The marking for clearances shall indicate that the left and right sides are determined when facing the front of the appliance. For an appliance equipped with an external draft hood, the marking shall specify the minimum clearance in integral inches between the draft hood and the nearest combustible construction.

An appliance which requires clearances from any type of construction for serviceability or proper operation shall bear a marking on Class III marking material, located on the surface(s) requiring such clearance, indicating the minimum distance required.

In addition, each appliance for installation recessed within combustible construction shall bear a Class V marking specifying the depth to which it may be recessed.

For an appliance with specified clearances from projections above the appliance, the marking shall indicate the minimum vertical clearance from the projection and the maximum horizontal extension of the projection over the appliance. (See Figure 2, Test Room Configuration).

1.35.14

For an appliance equipped for use only at altitudes 0-2000 ft (0-610 m), the rating plate or a plate of Class IIIA marking material attached adjacent thereto shall state:

"This appliance equipped only for altitudes 0-2000 ft (0-610 m)."

1.35.15

The carton containing an automatic intermittent pilot ignition system for field installation shall be marked with at least the following:

- a. The manufacturer's name and address;
- b. The manufacturer's model number or other designation;

- c. The appliance manufacturer's name and the model number for which the automatic intermittent pilot ignition system is for use on as follows:

"FOR USE WITH (Manufacturer) (Model No.) ONLY."

- d. The type of gas for which equipped;
- e. The rated supply voltage;
- f. The symbol of the organization making the tests for compliance with this standard; and
- g. A statement that the system must be installed by a qualified installing agency.

1.35.16

See Exhibit D, (Optional) Provisions for Listed Gas Appliance Conversion Kits.

1.35.17

An appliance found suitable with an optional register to be supplied in kit form shall bear a marking to the effect that: "(Part No. _____) register kit may be used." This marking may be on the rating plate or on a separate Class IIIB marking adjacent to the rating plate.

1.35.18

An optional register kit provided for an appliance shall bear a Class IIIB marking showing the manufacturer's name and the part number.

1.35.19

The direction of rotation of belt-driven fans used on appliances shall be clearly indicated on Class V marking.

1.35.20

An appliance with a cooling unit which includes an electrically driven compressor air conditioning component shall have a Class IIIA marking showing the type and amount of refrigerant used (designated according to the *Standard for Number Designation of Refrigerants, ANSI/ASHRAE 34*) and the test pressure for the high and low pressure sides as determined in 2.29, Draft Tests for Appliances Not Equipped with Draft Hoods, but in no case lower than indicated in Table 28.1 of the *Standard for Heating and Cooling Equipment, ANSI/UL 1995* or to the *Canadian Mechanical Refrigeration Code, CSA B52*.

1.35.21

Each direct vent fireplace heater shall bear a marking on Class III marking material stating the necessity for proper resealing or reinstallation of the vent-air intake system. This marking shall be located on an exterior surface and shall be visible at the time of installation or servicing of the appliance.

1.35.22

Where the trim panel assembly forms part of the draft hood relief mechanism, the trim assembly shall bear a Class IIIB marking in a conspicuous location, visible at the time of installation, indicating the following (see 1.35.2-d):

"Trim Kit Part No. _____. This trim assembly is a component part of the draft hood. Follow installation instructions."

1.35.23

A direct vent fireplace heater equipped with a glass front shall bear a label on Class IIIA marking located adjacent to the controlling device or in an equally conspicuous position where the instructions can be easily read, on which shall appear the following:

“CAUTION: Do not operate the appliance with glass removed, cracked or broken. Replacement of the panel(s) should be done by a licensed or qualified service person.”

The word “CAUTION” shall be in letters having a minimum height of 0.240 in (6.09 mm).* The remainder of the wording shall be in letters having a minimum height of 0.120 in (2.04 mm) with a minimum vertical spacing between lines of 0.046 in (1.16 mm).** Letters are to be on a contrasting background.

1.35.24

A vent damper device which is not an integral part of the draft hood shall bear a plate of Class II marking material on which shall appear the following:

- a. The appliance manufacturer’s part number of the vent damper device.
- b. A distinctive number which will identify each individual vent damper device or a separate date code marking.

If a separate date code marking is used, it shall consist of at least four consecutive digits determined as follows:

1. The first and second digits shall indicate the calendar year in which the device is manufactured (e.g. 09 for 2009).
2. The third and fourth digits shall indicate the week in which the device was manufactured (e.g. 03 for the third week of the year). For purpose of this marking, a week shall begin at 0001 hours on Sunday and end at 2400 hours on Saturday. A date code may be used for more than one week; however, it shall not be used for more than four consecutive weeks, nor for more than two weeks into the next calendar year.

Additional numbers, letters or symbols may follow the four digit number specified in “-b1” and “-b2,”above. If additional numbers are used, they must be separated from the date code.

- c. The inlet, outlet or direction of vent gas flow.
- d. On mechanically actuated vent damper devices, type and range of motive power which will permit normal functioning of the vent damper device.

1.35.25

Also see 1.2.12; 1.13.2; 1.16, Thermostats; 1.17, Automatic Valves; 1.18.3; Exhibit C, Items Unique to the United States - C.1 (prefatory note); C.1.4; C.2.1 and Exhibit D, (Optional) Provisions For Listed Gas Appliance Conversion Kits.

* This letter height measurement corresponds to 24 point type.

** This letter height and line spacing corresponds to 12 point type.

Part II Performance

2.1 General

2.1.1

This standard applies to newly-produced vented gas fireplace heaters constructed entirely of new, unused parts and materials:

- a. For use with natural gas;
- b. For use with liquified petroleum (propane);
- c. Direct vent gas appliances for manufactured home (USA only) or mobile home OEM installation or aftermarket installation, convertible for use with natural gas and liquefied petroleum (propane) gases when provision is made for the simple conversion from one gas to another;
- d. Direct vent gas appliances for manufactured home (USA only) or mobile aftermarket installation for use with natural gas only or liquified petroleum (propane) gases only;
- e. Direct vent gas appliances for recreational vehicle installation for use with propane gases only;
- f. Direct vent gas appliances for recreational vehicle installation only convertible for use with natural gas and liquified petroleum (propane) gases when provision is made for the simple conversion from one gas to the other; and
- g. Direct vent gas appliances for manufactured home (USA only) or mobile home OEM installation for use with liquified petroleum (propane) gases only.

2.1.2

An appliance submitted for examination under this standard shall be tested with the type(s) of gas selected by the manufacturer.

2.1.3

During tests for compliance with this standard, unless otherwise specified herein, an appliance with operable doors shall be conducted with doors fully opened and fully closed. If the appliance requires the doors to only be closed, the appliance must incorporate a means to prevent operation with the doors open.

2.1.4

With the exception of 1.29.3, 2.28.1, 2.29, Draft Tests for Appliances Not Equipped with Draft Hoods; and 2.30, Vent Safety Shut-Off System, all tests for compliance with this standard shall be conducted with the blocked flue switch rendered inoperative.

2.1.5

When a thermocouple is specified for the measurement of air, flue or vent gas temperatures, a thermocouple or an equivalent temperature measuring device complying with the current *ANSI/ASME PTC 19.3, Performance Test Codes, Supplement on Instruments and Apparatus, Part 3, Temperature Measurement*, shall be used.

2.1.6

These appliances take many forms, so for their testing, principles must be established for the guidance of the testing agency in determining compliance with basic standards for safe operation and acceptable performance, without restricting their design to preconceived forms. These appliances may be free

standing, or attached to, or recessed, or partially recessed in the combustible construction of a building. With this in mind, the principles stated in this section are to be used by the testing agency in interpreting the performance provisions of Part II.

In applying these principles, the floor-to-ceiling height shall be considered as 8 ft (2.44 m). Beyond this consideration, the testing agency shall be guided by the manufacturer's printed installation instructions in designing a test structure and in conducting tests so as to duplicate as closely as possible the anticipated conditions of installation and use.

2.1.7

The appliance, if designed for other than free standing installation, unless otherwise specified herein, shall be installed in a test structure with the minimum clearances to ceiling, floor, side wall(s) and draft hood specified by the manufacturer. This test structure shall be constructed so as to simulate the normal installation and venting of the appliance generally in accordance with the manufacturer's printed instructions. Otherwise the side wall(s) and ceiling shall extend 3 ft (914 mm) beyond the test structure. Portions of the appliance normally in contact with or recessed into combustible material when installed in accordance with the manufacturer's instructions shall be in firm contact with or enclosed in wood panels, unless otherwise specified herein. The test structure shall be fabricated from nominal 1 in pine boards or $\frac{3}{4}$ in (19 mm) plywood with the inner surface painted dull black.

For test purposes, the manufacturer shall supply with the appliance the vent material and accessories necessary to complete the installation. If optional methods of venting are indicated in the manufacturer's installation instructions, the vent configuration which is deemed by the testing agency to impose the most severe operation conditions shall be employed.

2.1.8

During tests for compliance with this standard, unless otherwise specified herein, the appliance shall not be connected to a vent pipe but shall depend for venting of the flue gases solely on the provisions incorporated in the appliance. (See 1.2.5.)

2.1.9

When an appliance with a vent damper device is submitted for examination, the manufacturer shall specify whether the appliance is for use only with the vent damper device or for use both with and without the vent damper device.

If the appliance is for use only with the vent damper device, the device shall be in place for all tests specified herein.

If the appliance is for use both with and without the vent damper device, the tests specified in 2.28.2 through 2.28.6 shall be conducted both with and without the vent damper device in place. The tests specified in 2.4, Combustion; 2.24, Flue Gas Temperatures and 2.28.1 shall be conducted without the vent damper device in place. All other tests specified herein shall be conducted with the vent damper device in place.

All appliance performance tests for which an electrically operated or mechanically actuated vent damper device is specified to be in place shall be conducted with the damper open to the minimum degree that would permit the automatic valve of the appliance to open.

2.1.10

Appliances having controls providing multi-rate control of the input rating or automatic controls which permit the main burner gas to be turned on at a reduced rate shall also be tested at the minimum input rating under 2.4.2-a, 2.6.1 through 2.6.7, 2.8.1, 2.9.3 through 2.9.5, 2.28.6, 2.30 - Test Condition B, Vent Safety Shutoff Systems, and 2.35-a, Allowable Vent Pipe, Heating Element and Load-Bearing Flue Gas Baffle Temperatures.

Appliances having modulating controls which act to reduce the input rating after ignition of the main burner(s) shall also be tested at the minimum input rating under 2.4.2-a, 2.6.1, 2.6.2, 2.6.5, 2.6.6, 2.6.7, 2.28.6, 2.30-Test Condition B, and 2.35-a.

Tests at minimum input rating shall be conducted at normal inlet test pressure only.

2.1.11

An appliance incorporating multiple burners which can operate individually or in combination with other burners, at maximum or minimum input rates, shall comply with the tests specified in 2.4, Combustion; 2.6, Burner Operating Characteristics; and 2.8, Pilot Operating Characteristics, when operated individually or in combination with other burners at all possible input rate combinations.

2.1.12

Vent limiters, when provided on gas appliance pressure regulators, shall be in place during all performance tests.

2.1.13

Room temperature, when specified, shall be determined by means of four No. 24 AWG (0.21 mm²) iron-constantan bead-type thermocouples, the junctions of which are shielded from radiation. These thermocouple junctions shall be located so that room air temperature can be measured at points approximately 24 in (610 mm) away from the approximate mid-points of each of the four sides of the appliance or test enclosure. The thermocouple leads shall be connected to a temperature indicating device, and room temperature shall be the average of the four individual temperature readings.

2.1.14

All performance tests shall be conducted with all non-positively secured parts, other than the loose burner material, in the position deemed most critical by the testing agency.

2.1.15

Special performance provisions applicable to vented gas fireplace heaters for manufactured home (USA only) or mobile home installation are specified in 2.1.1-c, -d and -g and 2.2-d.

2.1.16

Special performance provisions applicable to vented gas fireplace heaters for recreational vehicle installation are specified in 2.1.1-e and -f, 2.2-d and 2.25.4.

2.2 Test Gases

In conducting the performance tests specified herein, gases with characteristics approximately as shown in Table IV, Characteristics of Test Gases, shall be used:

- a. An appliance for use with natural gas shall have the tests specified herein conducted with Test Gas A. Additional tests shall be conducted with Test Gas G at normal inlet test pressure with no change whatever in the natural gas adjustments, and shall comprise those tests specified in 2.6.1-a, 2.8.1, 2.8.2 and 2.9.3 or 2.10.4. Under conditions of these tests, yellow-tipped flames are considered acceptable. Resonance encountered during conduct of burner operating characteristics tests with Test Gas G is not to be considered cause for rejection. Compliance with these supplemental tests does not imply that the appliance has been examined under this standard for use with butane air mixtures.
- b. An appliance for use with propane shall have the tests specified herein conducted with Test Gas E. The tests specified in 2.6 Burner Operating Characteristics, 2.8 Pilot Operating Characteristics, and 2.9.3, 2.9.4, 2.9.5, 2.9.9, 2.9.10 and 2.9.11 (or 2.10.4 through 2.10.7) shall also be conducted with Test Gas D with no change whatever in burner equipment.

- c. When use with more than one type of gas is desired, the tests specified in 2.23, Wall, Floor and Ceiling Temperatures; through 2.29, Draft Tests for Appliances Not Equipped with Draft Hoods and 2.36, Automatic Vent Damper Devices, need be conducted with only one test gas provided there are no changes in the appliance or input rating for different gases which, in the opinion of the testing agency, would affect the results of these tests.
- d. An appliance for manufactured home (USA only) or mobile home or recreational vehicle installation convertible for use with natural gas and liquefied petroleum (propane) gases shall be tested as specified in 2.2-a and -b. Conversion from one gas to the other shall be made in accordance with the manufacturer's instructions.

2.3 Test Pressure And Burner Adjustments

2.3.1

Unless otherwise stated, each test specified herein shall consist of a series of three tests: one at normal test pressure, one at reduced test pressure and one at increased test pressure, as shown in Table V, Inlet Test Pressures.

When a manifold pressure at increased test pressure is not greater than the manifold pressure at normal test pressure, the tests at increased test pressure need not be conducted. However, tests at normal test pressure shall be conducted whenever tests at increased test pressure are specified.

2.3.2

The test pressures stated in 2.3.1 shall be the pressures immediately ahead of all controls. The manifold pressure shall be that specified by the manufacturer (see 1.18.5) unless otherwise specified herein.

2.3.3

Unless otherwise specified herein, tests at increased input rate shall be conducted with the gas appliance pressure regulator adjusted to provide an increase in the test rate of 12 percent for appliances for use with natural gas, and 9 percent for appliances for use with propane. When the regulator outlet pressure cannot be readily adjusted to obtain this increase in input rate, the regulator may be removed or blocked in the open position, or the inlet test pressure may be increased as necessary (also see 2.3.4).

2.3.4

Burners shall be adjusted to their Btu input ratings at normal inlet test pressure, unless otherwise specified herein. After the appliance has been operated for 15 minutes, starting with all parts of the appliance at room temperature, the burner adjustments shall be within 0 to + 5 percent of the manufacturer's specified hourly Btu input rating. When primary air control is provided, it shall be set to the manufacturer's specified opening and neither burner ratings nor primary air adjustments shall be changed during a series of tests on any one test gas, unless otherwise specified. All carbon deposits formed during any of the tests specified herein shall not be removed during the remainder of the tests and shall not interfere with the compliance to the requirements of this standard.

2.3.5

The minimum input rating for test purposes, on appliances provided with controls which will reduce the input rating by automatic means, shall be 87 percent of the minimum input rating specified by the manufacturer.

2.4 Combustion

2.4.1

Carbon deposits formed during the combustion process shall not affect the performance of the appliance.

Method of Test

The primary air adjustment on a burner, when supplied, shall be closed to the minimum setting obtainable. The appliance shall be assembled as described in the installation instructions with any non-positively located components placed in the position deemed most critical by the testing agency. Any loose burner material will be evenly distributed over the burner ports as per manufacturer's instructions.

The appliance shall be operated for 24 hours at normal inlet test pressure. Any carbon deposits that are developed shall not be removed during the remainder of the testing.

2.4.2

An appliance shall not produce a concentration of carbon monoxide in excess of:

- a. During normal operations (Test Condition A) 0.02 percent for gravity vent and 0.04 percent for direct vent and power vent appliances in an air-free sample of the flue gases obtained.

A normal test condition is defined as installed per manufacturer's instructions except that the primary air shutter, if provided, shall be closed to the minimum setting obtainable and with all non-positively located components placed in the position deemed most critical by the testing agency. Any loose burner material will be evenly distributed over the burner ports as per manufacturer's instructions.

- b. During abnormal operations (Test Condition B) 0.04 percent in an air-free sample of the flue gases.

An abnormal test condition is defined as a normal test condition with:

1. Reduced inlet test pressure (see 2.3.1);
2. Increased input rate (see 2.3.3); or
3. 50 percent of the loose burner material, when supplied, evenly removed.

Method of Test

Test Condition A

With all parts of the appliance at room temperature, the pilot(s) shall be placed in operation and allowed to operate until equilibrium temperatures are attained, at which time the main burner(s) shall be placed in operation. The appliance shall then be operated for 15 minutes at the normal inlet test pressure, at which time a sample of the flue gases shall be secured.

On an appliance provided with an induced draft, an additional combustion sample shall be taken at normal inlet test pressure and the supply voltage reduced to 85 percent of the appliance rating plate voltage.

The samples secured shall be analyzed for carbon monoxide and carbon dioxide, when appropriate.

Test Condition B

Immediately following Test Condition A, i.e. upon securing the sample at normal inlet test pressure, the reduced inlet test pressure (see 2.3.1) shall be applied. Following a purge period of at least 2 minutes, another sample of the flue gases shall be secured.

The gas appliance pressure regulator shall then be adjusted to provide the increased input rate (see 2.3.3). Following a purge period of at least 2 minutes, another sample of the flue gases shall be secured.

The gas appliance pressure regulator shall be adjusted to normal inlet test pressure and 50 percent of the loose burner material, when supplied, shall be evenly removed. Following a purge period of at least 2 minutes, another sample of the flue gases shall be secured.

The samples secured shall be analyzed for carbon monoxide and, when appropriate, carbon dioxide.

2.4.3

An appliance for use with natural gas shall comply with 2.4.2 when re-adjusted (re-orificed if necessary) to obtain the manufacturer's specified input rating and operated with Test Gas A at a 4.0 in wc (1.00 kPa).

When the manifold pressure at the 4.0 in wc (1.00 kPa) adjustment is not less than that obtained at normal test pressure during conduct of the combustion tests outlined in 2.4.2, this test need not be conducted.

2.5 Appliance And Burner Durability Test

The test shall be conducted using natural gas only, unless the appliance is for use with propane gas only.

Burner adjustments shall be made in accordance with provisions of 2.3, Test Pressures and Burner Adjustments and 2.23, Wall, Floor and Ceiling Temperatures. Where primary air adjustment means are provided, they shall be set at the minimum air position.

At the end of the test, the appliance shall comply with the following;

- a. 2.4, Combustion;
- b. 2.6, Burner Operating Characteristics;
- c. There shall be no accumulation of carbon likely to affect the safe operation of the appliance;
- d. There shall be no signs of leakage of combustion products from the combustion chamber, glass front seals, flue connections, etc.;
- e. There shall be no corrosion, breakdown or distortion in any part of the appliance likely to affect its safety;
- f. There shall be no seizure of screws, or other changes likely to cause undue difficulty in subsequent maintenance; and
- g. For direct vent appliances only, 2.34, Joints In Direct Vent Systems.

Method of Test

Install the unit as per 2.23, Wall, Floor and Ceiling Temperatures. Direct vent fireplace heaters shall have the maximum horizontal vent with the minimum vertical rise. The main burner shall be successively lighted and extinguished for 4 cycles of 23 hours ON and 1 hour OFF. During the first 3 cycles the primary air adjustment on a burner, when supplied, shall be set at a manufacturer's recommended setting and during the last cycle, the primary air shutter shall be closed. Any carbon deposits that are developed shall not be removed during the duration of the performance testing. The glass front shall be removed and re-installed at the end of each of these 4 cycles.

2.6 Burner Operating Characteristics

When the gas appliance pressure regulator is equipped with a removable vent limiter, the tests specified under this section shall be conducted both with and without the vent limiter in place. When the gas appliance pressure regulator is equipped with a non-removable vent limiter, the tests specified under this section shall be conducted both with and without the regulator adjustment concealing cap in place.

2.6.1

Burner flames shall not flash back:

- a. When turned on and off at the burner adjustment and test pressures specified by 2.3, Test Pressure and Burner Adjustments;
- b. When turned on and off at the 4.0 in wc (1.00 kPa) adjustment pressure with Test Gas A as specified in 2.4.2 when use with natural gas is desired (when the regulator outlet pressure at the 4.0 in wc (100 kPa) adjustment pressure is not less than that obtained at normal test pressure, this test need not be applied); and
- c. When the gas valve is adjusted to deliver 15 percent the normal input rating.

These tests shall be conducted with the burner(s) both hot and cold.

2.6.2

Burner flames shall continually burn at all ports and/or all portions of a pan burner.

Method of Test

After burner adjustment the gas shall be shut off and the appliance allowed to cool to approximately room temperature.

The gas shall then be ignited at one point under the conditions of test specified in 2.6.1-a and -b, and the flame travel and burning of gas at all burner ports or portions of a pan burner be noted.

2.6.3

The arrangement of main burners and ignition devices shall be such that the gas from any burner or combination of burners will be effectively ignited within 4 seconds without delayed ignition, flash back or damage to the appliance under the conditions specified in 2.6.1-a and -b.

2.6.4

When ignition is made in a normal manner under the adjustment conditions specified in 2.6.1-a and -b, flames shall not flash outside the combustion space.

2.6.5

There shall be no back pressure at the burner mixer face under the test conditions specified in 2.6.1-a, -b and -c.

Method of Test

A flame shall be played on the mixer face in such a manner that any gas expelled from the mixer head would be ignited.

2.6.6

Burners and pilots shall ignite, operate and extinguish without undue noise under the adjustment conditions specified in 2.6.1.

2.6.7

For appliances other than ones using direct vent systems, burner flames shall not flash back nor become permanently extinguished when the front and side of the appliance are subjected to a draft equivalent to a wind velocity of 3 mph (1.34 m/s).

Method of Test

This test shall be conducted at normal inlet test pressure.

A draft shall be directed to strike the appliance successively from the front and side, or vice versa, by means of a blower, the output of which passes through a 12 in (305 mm) length of 5 in (127 mm) diameter sheet-metal pipe in the outlet end of which is fastened a sheet-metal orifice disc with a 3 in (76.2 mm) diameter opening.

The point on the axis of the air stream 6 ft (1.83 m) from the orifice of the blower duct shall coincide with the midpoint of the plane of the burner surface containing the ports. When two or more burners are employed, the mid-point of the one nearest the front or side of the appliance shall be used. The appliance shall then be removed and the blower regulated to produce a wind velocity of 3 mph (1.34 m/s) as measured by the average of the readings taken with an anemometer at the midpoint of four 6 in (152 mm) squares forming a plane area 1 ft (305 mm) square at 90 degrees (1.57 rad) to the axis of the air stream and 6 ft (1.83 m) from the orifice. The appliance shall then be replaced in the identical position it initially occupied.

The same procedure shall be repeated for such locations of the blower around the appliance as may be necessary to determine satisfactory compliance with this provision.

Determinations shall be made at each position. Tests shall be of 2 minutes duration.

2.6.8

An appliance provided with an induced draft shall also comply with the following tests when operated with the supply voltage adjusted to 85 percent and 110 percent of the rated voltage of the appliance. Unless otherwise specified, normal and reduced test pressures at the burner adjustment specified in 2.3.3, shall be used.

- a. Burners shall effectively ignite within 4 seconds without delayed ignition or flash back.
- b. Burners shall extinguish without flash back.
- c. There shall be no back pressure at the burner mixer face.
- d. There shall be no back pressure at the mixer face when an automatic control device for reduction of gas flow to a low rate operates in a normal manner at normal test pressure.

2.7 Loose Burner Materials

Loose burner materials, such as rock wool or glowing embers when provided shall not adversely affect the performance of the heater.

The loose burner material, when provided, shall be applied to the burner and/or flame areas according to the manufacturer's instructions. Under this condition the heater must comply with all performance tests.

2.8 Pilot Operating Characteristics

When the gas appliance pressure regulator is equipped with a removable vent limiter, the tests specified in this section shall be conducted both with and without the vent limiter in place. When the gas appliance pressure regulator is equipped with a non-removable vent limiter, the tests specified in this section shall be conducted both with and without the regulator adjustment concealing cap in place.

2.8.1

Pilot(s) shall ignite the gas at the main burner(s) without delay.

2.8.2

A continually burning pilot(s) shall not be extinguished when the gas to the main burner(s) is turned on or off in a normal manner, either manually or by means of automatic devices.

2.8.3

The pilot(s) shall show no carbon deposits during any test specified in the performance provisions when adjusted according to the manufacturer's printed instructions.

2.8.4

A bunsen type pilot burner shall be constructed so that ignition of the main burner gas occurs in a normal manner, even though the pilot flame is burning at the orifice. A pilot burner that cannot be made to flash back under any conditions of test shall be considered as complying with this provision.

2.8.5

The pilot(s) of an appliance of other than a direct vent type, shall be protected against drafts.

Method of Test

The pilot(s) shall be operated at normal inlet test pressure for a period of 15 minutes.

For pilot burners and safety shut-off device assemblies, a 3 mph (5 Km/h) wind shall be directed horizontally against the front and sides of the appliance, both on a plane with, and below, the pilot burner(s) by means of a fan or blower. For manually operated pilot burners, a 10 mph (16 Km/h) wind shall be applied as specified above.

The pilot(s) shall not be unstable due to lifting or flashback, nor be extinguished during a period of 1 minute.

2.8.6

Remotely controlled systems employing automatic electric ignition shall be designed so as to prevent turning on of the main gas supply in the event of failure of ignition of the pilot burner(s). Such systems shall meet the applicable provisions specified herein for pilot burners and safety shut-off devices.

2.9 Pilot Burners And Safety Shut-Off Devices

2.9.1

Pilot burner(s) and safety shut-off devices shall comply with the applicable provisions of the *Standard for Automatic Gas Ignition Systems and Components, ANSI Z21.20* or *CAN1-6.4*, or the *Standard for Combination Gas Controls for Gas Appliances, ANSI Z21.78 - CSA 6.20*.

2.9.2

If a piezo-electric spark device is used for pilot burner ignition it shall comply with the *Standard for Manually-Operated Piezo-Electric Spark Gas Ignition Systems and Components, ANSI Z21.77 - CSA 2.23*.

2.9.3

The pilot(s) shall effect ignition of gas at the main burner(s) immediately after gas reaches the main burner port(s) and shall not become extinguished and remain extinguished when the gas to the main burner(s) or, pan burner media surface is turned on or off in a normal manner, except for designed turn-off of intermittent or interrupted pilots.

Method of Test

This test shall be conducted at all inlet test pressures specified in 2.3.1 for each type of gas selected. When natural gas is selected this shall include the 4.0 in wc (995 Pa) inlet test pressure adjustment with Test Gas A specified in 2.4.3. This latter test need not be applied when the manifold pressure at the 4.0 in wc (995 Pa) inlet test pressure adjustment is not less than that specified by the manufacturer for natural gas.

The pilot(s), main burner(s) and automatic igniter(s) shall be adjusted according to the manufacturer's instructions and the gas turned off at the main burner(s).

Gas shall be admitted to the main burner(s) by turning on fully, in a continuous movement, any manual means provided for controlling main burner gas flow. The period of time between the instant gas is admitted to the main burner(s) and ignition of the gas shall be recorded. Before timing the ignition, it shall be determined that all gas piping is filled with gas.

At least 25 successive ignition tests shall be conducted with the main burner gas flow maintained for 30 seconds and interrupted for 30 seconds for each cycle. Failure to effect ignition immediately after gas reaches the main burner port(s) or pan burner media surface in any one instance, or continued extinction of the pilot, shall be considered as non-compliance with this provision.

This test shall then be repeated using any automatic means provided for controlling main burner gas flow.

2.9.4

The pilot(s) shall effect ignition of the gas at the main burner(s) under the conditions specified in the following tests. For purposes of this test, the control manufacturer's specified maximum flame failure response time for the automatic gas ignition system shall be used.

The test shall be conducted from a cold start, and 30 seconds after the appliance has been shut off after 15 minutes of operation. A pilot which becomes extinguished after having completed main burner ignition is considered as complying with this provision.

The following tests shall be conducted at normal inlet test pressure:

a. Single-Flame Pilot Burners

(Pilot burners which produce a single flame with substantially uniform contour under turndown conditions).

The pilot shall effect ignition of the gas within 4 seconds from the time gas is admitted to the main burner(s), without excessive flame flashback or damage to the appliance, when the pilot gas supply is reduced to an amount just sufficient to keep the valve of the safety shut-off device open, or just above the point of flame extinction, whichever represents the higher pilot gas rate. A flame can be considered as being equivalent to a substantially uniform contour flame if its deviation from uniform contour is occasioned by a flame baffle(s) or channel(s).

- b. Multi-flame Pilot Burners. Pilot Burners where flame contour is substantially different under turndown conditions, when compared to full flame conditions, i.e. lack of continuous flame.

The pilot shall effect ignition of the gas within 4 seconds from the time gas is admitted to the main burner(s), without excessive flame flashback or damage to the appliance, when all the pilot burner ports, except those for heating the thermal element, are blocked and the pilot gas supply is reduced to an amount just sufficient to keep the valve of the safety shut-off device open, or just above the point of flame extinction, whichever represents the higher pilot gas rate.

The above test shall also be conducted under sufficient conditions of increased pilot burner input rating to determine that main burner ignition will take place within 4 seconds from the time gas is admitted to the main burner(s) with the pilot burner input at any level from the turndown condition described above, up to and including that providing normal flow through the unblocked port(s) based on the manufacturer's specified normal input rating for the pilot burner. An approximately normal actuating flame can be obtained by removing the block from the ignition port(s). With this block removed, the gas issuing from the ignition port(s) shall either not ignite or the flame shall be baffled in such a manner as to provide ignition from only the actuating flame.

- c. Pilot Burner and Thermal Element Assemblies Which Supply Electrical Energy for an Automatic Control System

When the thermal element is the only source of electric power for operation of the automatic valve, the tests under -a and -b above shall be conducted with the pilot adjusted to the minimum size (pull-in milli-voltage) required to open the automatic valve. This test condition shall be based on the performance of the system when only the thermal element and automatic valve are present. Under these conditions, the pilot shall effect ignition of the gas within 4 seconds from the time gas is admitted to the main burner(s) without excessive flame flashback or damage to the appliance. Any system components which may be changed or added shall be excluded during this test.

When a multi-flame pilot burner is provided, the tests specified in -b above at increased pilot input ratings shall also be conducted.

- d. Recycling Pilot Burners

In the case of a pilot burner which operates every time the main burner(s) is turned on or off, either manually or by automatic controls, the ignition flame(s) shall provide ignition of the gas within 4 seconds from the time gas is admitted to the main burner(s), without excessive flame flashback or damage to the appliance, when the gas supply to the ignition flame is just sufficient to allow main burner gas to flow.

2.9.5

An appliance equipped with controls permitting ignition at less than full rate shall comply with the provisions of 2.9.4, with the main burner gas input at full rate and at minimum turn-on rate.

2.9.6

The time from initiation of pilot gas flow to proof of the ignition source shall not exceed 5 minutes, except that those systems which operate every time the main gas burner(s) with which they are used is turned on or off, the time shall not exceed 1.5 minutes.

In the case of those systems requiring a manual operation to assume the "on" position, the time required for application of the manual operation shall not exceed 1.5 minutes, and this time plus the time from initiation of gas flow to proof of the ignition source shall not exceed 5 minutes.

For purposes of this test, the control manufacturer's specified maximum flame-establishing period for the automatic gas ignition system shall be used.

Method of Test

This test shall be conducted at normal inlet test pressure. With the device at room temperature, the gas at the pilot burner shall be ignited and the time required for the device to turn on the main gas supply noted.

2.9.7

When an interrupted ignition source is provided, the time required for the main burner flame to be proved from the initiation of main gas flow shall not exceed 90 seconds when the appliance is operated at normal inlet test pressure.

For purposes of this test, the control manufacturer's specified maximum main burner flame-establishing period for the automatic gas ignition system shall be used.

2.9.8

The time required for the automatic gas ignition system to shut off the gas supply following loss of supervised flame shall not exceed 3 minutes and shall not exceed 30 seconds for a direct vent fireplace heater. For purposes of this test, the control manufacturer's specified maximum flame failure response time for the automatic gas ignition system shall be used.

Method of Test

The appliance shall be operated for 15 minutes at normal test pressure. All gas shall then be turned off and the gas flow to a continuous or intermittent pilot immediately re-established but not ignited. The combined flame failure response time and valve closing time shall not exceed 3 minutes and shall not exceed 30 seconds for a direct vent fireplace heater. An interrupted pilot having a separate sensing device from that for the main burner flame shall also be tested by turning off all gas after the pilot has been proved but before the main burner gas is ignited. The gas flow to the interrupted pilot shall be immediately re-established but not ignited. The combined flame failure response time and valve closing time shall not exceed 3 minutes, and shall not exceed 30 seconds for a direct vent fireplace heater.

2.9.9

When the pilot burner flame acts both as the actuating medium of the safety shut-off device and as the means for igniting the gas at the main burner(s), the construction shall be such that in the event the pilot flame flashes back and burns at the orifice, the device will operate either to shut off the main gas supply in accordance with the test specified by 2.9.8, or provide effective ignition of the gas at the main burner(s). A pilot that cannot be made to flash back under any condition of test shall be considered as complying with this provision.

2.9.10

Any type of pilot equipped with an automatic igniter shall not cause excessive flame flashback or damage to the appliance.

Control systems providing multiple ignition recycles shall not be permitted on appliances not equipped with a draft hood or an induced draft.

For purposes of this test, the control manufacturer's specified maximum flame failure response time in combination with the control manufacturer's specified minimum recycle time for the automatic gas ignition system shall be used.

Method of Test

The pilot igniter shall be rendered inoperative.

The appliance shall be installed as specified in 2.1.6 and instrumented with a sampling tube(s) to measure the gas-air ratio at various points in the appliance. This sampling tube(s) shall be connected to a gas-air analyzer coupled to a single-point recording device in order to produce a constant trace of the gas/air ratio at the sample point for sufficient time to allow a complete evaluation of the system. The gas/air ratio trace shall be developed with the appliance both hot and cold, and with all test gases for which the appliance is tested. Supplemental natural gas tests with Test Gas G need not be conducted.

Unburned gas shall be allowed to flow into the appliance for a time equivalent to the control manufacturer's specified maximum flame failure response time. Immediately following shut off of the gas supply, an ignition cycle shall be initiated at normal rated voltage and continued until the pilot igniter would be energized, as determined by the control manufacturer's specified minimum recycle time.

An appliance with a control system providing multiple ignition recycles shall have an extended gas/air ratio trace. Unburned pilot gas shall be allowed to flow for the control manufacturer's maximum flame establishing period followed by the minimum recycle time. These recycles shall be continued until the gas/air ratio stabilizes.

If the gas/air ratio at the time at which the pilot igniter would be energized is below the lower explosive limit, the appliance shall be considered as complying with this provision. If this ratio is above the lower explosive limit, sufficient ignition tests shall be conducted between the time of energization of the ignition means and when the atmosphere within the appliance returns to below the lower explosive limit to determine that the pilot igniter does not cause excessive flame flashback or damage to the appliance.

For the purpose of this test, flame flashback shall be considered excessive if a single layer of cheesecloth draped 12 in (300 mm) in front of the appliance is ignited. The cheesecloth shall be as specified in 2.13.1.

An appliance with a control system not providing complete gas shut off but having a purge period of 5 minutes or longer shall be tested as specified above, except the purge time shall be 4½ minutes. Pilot gas shall be allowed to flow during the purge period.

An appliance equipped with a draft hood, a control system providing a purge period of 5 minutes or longer and a pilot burner with an input rate of 3000 Btu/hr (879 W) or less shall be considered as complying with this provision.

An appliance where combustion air is supplied by mechanical means and the control system provides a purge period of a minimum of four (4) air changes of the combustion chamber and appliance flue shall be considered as complying with this provision.

2.9.11

Flames shall travel freely to all pilot burner ports when the gas is ignited at any one port.

Method of Test

This test shall be applied only to those pilot burners in which separate ports are used for heating the thermal element of the safety shut-off device and for igniting gas at the main burner(s).

The pilot burner shall be adjusted according to the manufacturer's instructions and the gas at the pilot burner ignited. The flames shall then be extinguished by means other than interrupting the gas supply and gas from the ports which serve to heat the thermal element of the safety shut-off device immediately reignited. The flames shall travel freely to all other ports on the pilot burner.

2.9.12

The temperatures developed on an automatic gas ignition system component shall not exceed those for which the component is designed.

Method of Test

Thermocouples shall be peened into or brazed to the following points which are applicable to the device provided:

- a. Pilot burner tip;
- b. Pilot burner orifice fittings;
- c. Electric igniter;
- d. Flame sensor;
- e. Spark electrode;
- f. Surfaces of the hot and cold junction of thermoelectric types;
- g. Valve body;
- h. Electric switch;
- i. Spark generator;
- j. Contact mechanism
- k. Magnetic assembly; and
- l. Electronic module.

The pilot(s) and main burner(s) shall be operated at normal inlet test pressure until equilibrium pilot temperatures have been attained.

Temperatures attained at the points listed above shall be recorded and shall not be in excess of those for which the components have been found suitable.

2.9.13

Moisture applied to electronic ignition modules of the appliance shall not cause the main gas valve to open without supervised flame, as determined by the following test method. Electronic ignition modules complying with the provisions of the *Standard for Automatic Gas Ignition Systems and Components, ANSI Z21.20* or *CAN1-6.4*, shall be considered as complying with this provision.

Method of Test

The electronic ignition module shall be electrically connected to the entire system but shall be positioned outside the appliance to permit wetting of the module from all directions. Sealing boots (if any) which can be left out of place by any installer service person shall be left disengaged. A manometer shall be connected to indicate gas valve opening. The flame sensor wire is to be disconnected from the module.

With the module board components oriented upwards and gas and power supply ON, direct water spray at the module for a period of 60 seconds. The water spray is to be produced from a Steinen 45 degree solid spray pattern 1.75 gallon per hour oil burner nozzle with water supply pressure at 40 psi (275 kPa). The nozzle is to be located 12 in (305 mm) above the center of the control with spray directed down. After the one minute spray period, the control set-up is to be observed for an additional 4 minutes. Opening of the gas valve within this time period constitutes a failure. The test is to be repeated with the module oriented as in the installation on the appliance. For the repeat test the spray again is directed from a distance of 12 in (305 mm) at the center of the control.

2.10 Direct Ignition Systems

2.10.1

A direct ignition system shall provide a valve sequence period of not more than 60 seconds for units other than a direct vent fireplace heater. For direct vent fireplace heaters, the valve sequence period shall not exceed 11 seconds for natural gas and 7 seconds for propane. For non-power vent, direct vent fireplace heaters, only one trial for ignition is permitted. Subsequent trials shall:

- a. Require manual reset; and
- b. Not occur in less than 5 minute intervals following lockout.

For test purposes, the control manufacturer's specified maximum trial for ignition period or valve sequence period, as applicable, for the ignition system shall be used.

2.10.2

For systems which incorporate an ignition activation period (See Part IV, Definitions), the period of time between deactivation of the ignition means and the maximum lockout time shall not exceed 4 seconds.

2.10.3

On an appliance with an input rating of 400,000 Btu/hr (117,228 W) or less and where all air for combustion is supplied by mechanical means, the ignition system may incorporate an automatic restart if the ignition means is reactivated after a pre-purge time sufficient to provide a minimum of 4 air changes of the combustion chamber and appliance flue. For systems which incorporate an automatic restart, the minimum automatic restart time shall not be less than 1 hour.

On all other appliances equipped with a direct ignition system, an automatic restart is not permitted.

2.10.4

The ignition system shall effect ignition of the gas at the main burner(s) immediately after gas reaches the main burner port(s) or pan burner media surface when operated at the appliance rating plate voltage.

Method of Test

While maintaining the appliance rating plate voltage to the appliance, the ignition system shall be placed in operation and ignition observed.

The procedure described above shall be repeated 25 times, and in each instance ignition shall occur immediately after gas reaches the main burner port(s) or pan burner media surface.

2.10.5

Under the conditions of voltage variation specified in the following Method of Test, the direct ignition system shall either (1) ignite main burner gas within 4 seconds after gas reaches the main burner port(s) or loose burner material surface, or (2) at voltages to the igniter of less than 85 percent of the appliance rating plate voltage, lock out within the control manufacturer's specified maximum lockout time. For purposes of this test, the control manufacturer's specified maximum lockout time for the ignition system shall be used.

Method of Test

The following voltages shall be used during conduct of this test:

a. Undervoltage

1. The voltage to the appliance shall be adjusted to 85 percent of the appliance rating plate voltage.
2. The ignition source circuit shall be separated from the other circuits of the ignition system and the appliance and the voltage to this circuit adjusted to 70 percent of the appliance rating plate voltage. The voltage to the remaining circuits shall be adjusted to 85 percent of the appliance rating plate voltage. If separation of the circuits is not possible, the energy content to the ignition source shall be measured at 70 percent of the appliance rating plate voltage, and this energy level shall be used to conduct this test.

b. Overvoltage

The voltage to the appliance shall be adjusted to 110 percent of the appliance rating plate voltage.

Under the conditions of both undervoltage and overvoltage as specified in "-a1," "-a2" and "-b" above, ignition cycles shall be repeated 25 times.

In each case the direct ignition system shall either:

1. Ignite main burner gas within 4 seconds after gas reaches the main burner port(s) or loose burner material surface; or
2. At voltages to the igniter of less than 85 percent of the appliance rating plate voltage, lock out within the control manufacturer's specified maximum lockout time.

2.10.6

With the appliance at equilibrium temperatures while operating at normal inlet test pressure, the time required for the main burner gas supply to be shut off in the event of flame outage during an operation cycle shall not exceed 60 seconds, and shall not exceed 30 seconds for a direct vent fireplace heater.

If the ignition system incorporates flame failure re-ignition it shall be capable of reestablishing ignition in not more than 0.8 second following flame outage, and it shall re-ignite the main burner gas without flame flashback or damage to the appliance. On an appliance where all air for combustion is supplied by mechanical means, the ignition means may be reactivated after a purge period (recycle time) sufficient to provide a minimum of 4 air changes to the combustion chamber and flue gas passageways. For purposes of this test, the control manufacturer's specified maximum flame failure response time shall be used.

If the ignition means is reactivated, the control manufacturer's specified maximum flame failure reignition time or minimum recycle time for the automatic gas ignition system shall be used.

2.10.7

The construction of the appliance and the arrangement of the ignition system shall be such that in the event of a delay in ignition of the main burner gas, such as might be caused by foreign debris or electrical shorting of the ignition means, the appliance will vent itself without excessive flame flashback or damage.

For the purpose of this test, flame flashback shall be considered excessive if a single layer of cheesecloth draped 12 in (300 mm) in front of the appliance is ignited. The cheesecloth shall be as specified in 2.13.1.

For purposes of this test, the control manufacturer's specified maximum trial for ignition period for the automatic gas ignition system shall be used. For systems which deactivate the ignition means prior to the end of the trial for ignition period, the test shall be conducted using the control manufacturer's specified maximum ignition activation period timing.

Method of Test

The igniter shall be rendered inoperative.

With the appliance installed as specified in 2.1.6 and at room temperature, the appliance shall be placed in operation at normal inlet test pressure with the ignition means temporarily circumvented for varying intervals of time up to the control manufacturer's specified maximum trial for ignition period or maximum specified ignition activation period, whichever is shorter.

For multi-try systems, attempts to ignite shall be made for varying intervals of time for each trial for ignition period throughout the total operating sequence up to lockout.

The resulting ignition in each trial shall be observed for excessive flame flashback or damage to the appliance.

2.10.8

Temperatures developed on automatic gas ignition system components shall not exceed those for which the components are designed when tested as specified in 2.9.12.

2.11 Proved Igniter Systems

This section is applicable to a proved igniter system that provides for ignition of the main burner gas.

2.11.1

Proved igniter systems shall comply with the applicable performance provisions of the *Standard for Automatic Gas Ignition Systems and Components, ANSI Z21.20* or *CAN1-6.4*.

2.11.2

The proved igniter system shall effect ignition of the gas at the main burner(s) when tested in accordance with the Method of Test specified in 2.13.3

2.11.3

Under the conditions of voltage variation specified in the following Method of Test, the proved igniter system shall ignite main burner gas within 4 seconds after gas reaches the main burner port(s).

Method of Test

The following voltages shall be used during conduct of this test.

a. Undervoltage.

The voltage to the appliance shall be adjusted to 85 percent of the appliance rating plate voltage.

b. Overvoltage.

The voltage to the appliance shall be adjusted to 110 percent of the appliance rating plate voltage.

Under the conditions specified in “-a” and “-b” above, ignition cycles shall be repeated 25 times. In each case, the proved igniter system shall ignite main burner gas within 4 seconds after gas reaches the main burner port(s).

2.11.4

The proved igniter system shall effect ignition of the gas at the main burner(s) under the following conditions:

- a. The test shall be conducted at normal inlet test pressure and with the appliance both hot and cold; and
- b. The proved igniter system shall be placed in operation with the igniter-proving characteristic reduced to the minimum value specified by the control manufacturer. Under these conditions the proved igniter system shall effect ignition of the gas within 4 seconds after gas reaches the main burner port(s) without damage to the appliance or excessive flame flashback. While maintaining these conditions, the ignition cycle shall be repeated a total of 25 times.

2.11.5

For proved igniter systems which incorporate an interrupted ignition source together with main burner flame proving the time required for the system to shut off the main burner gas supply following loss of the supervised main burner flame shall not exceed the flame failure response time and valve closing time specified in Table VI, Maximum Safety Control Timings.

For purposes of this test, the control manufacturer’s specified maximum flame failure response time for the proved igniter system shall be used.

Method of Test

The appliance shall be operated for a period of 30 minutes at normal inlet pressure. All gas shall then be turned off and the gas flow immediately reestablished, but not ignited. The time for the main burner gas to be shut off shall be recorded and shall not exceed that specified in Table VI.

2.11.6

A proved igniter system which incorporates an interrupted ignition source together with main burner flame proving shall not cause excessive flame flashback damage to the appliance.

For purposes of this test, the control manufacturer’s specified maximum flame failure response time in combination with the control manufacturer’s specified minimum recycle time for the proved igniter system shall be used.

Method of Test

The appliance shall be instrumented with a sampling tube(s) to measure the gas-air ratio at various points in the appliance. This sampling tube(s) shall be connected to a gas-air analyzer coupled to a single point recording device in order to produce a constant trace of the gas-air ratio at the sample point for sufficient time to allow a complete evaluation of the system. The gas-air ratio trace shall be developed with the appliance both hot and cold and with all test gases for which the appliance is tested. Supplemental natural gas test with test Gas G need not be conducted.

Unburned gas shall be allowed to flow into the appliance for the control manufacturer’s maximum specified flame failure response time plus the valve closing time. Immediately following shut off of the gas supply, an ignition cycle shall be initiated at normal rated voltage and continued until the igniter would be energized, as determined by the control manufacturer’s specified minimum recycle time.

If the gas-air ratio at the time at which the igniter would be energized is below the lower explosive limit, the appliance shall be considered as complying with this provision. If this ratio is above the lower explosive limit, sufficient ignition tests shall be conducted between the time of energization of the proved igniter and when the atmosphere within the appliance returns to below the lower explosive limit, to determine that the igniter does not cause excessive flame flashback or damage to the appliance.

An appliance with a control system providing a purge period of 5 minutes or longer shall be considered as complying with this provision.

2.11.7

For a proved igniter system which incorporates an intermittent ignition source, the time required for the gas supply to the main burner to be shut off following failure of the supervised proved igniter shall not exceed that specified in Table VI, Maximum Safety Control Timings.

Method of Test

The appliance shall be operated for a period of 30 minutes at normal inlet pressure. The proved igniter shall then be disabled. The time required for the proved igniter system to shut off the main burner gas supply shall not exceed the igniter failure response time and valve closing time specified in Table VI.

For purposes of this test, the control manufacturer's specified maximum igniter failure response time shall be used.

2.12 Combustion Chamber Relief For Gravity Vented Gas Fireplace Heaters.

The construction of a gravity vented gas fireplace heater equipped with nonmetallic panel(s) in the visible face of the heat exchanger shall be such that, should sufficient gas accumulate before ignition so as to cause an excessive internal force when ignition takes place, such force will be relieved without damage to the appliance.

Method of Test

This test shall be started when the appliance is cold. The gas shall be turned on and allowed to flow before ignition for varying intervals of time up to 10 seconds.

Appliances equipped with piezo ignition systems shall then be operated until equilibrium. The gas shall be turned on and allowed to flow before ignition for varying intervals of time from 10 seconds up to the control manufacturers maximum flame failure response time.

The appliance may be surrounded by a metal box or screen to prevent accidents to observers.

2.13 Delayed Ignition And Integrity Tests For Direct Vent Gas Fireplace Heaters

A natural gas-fired direct vent fireplace heaters shall comply with 2.13.1, 2.13.2, and 2.13.3. A natural gas-fired direct vent fireplace heater complying with Appendix G, Delayed Ignition Test Using a Stoichiometric Gas/Air Mix for Natural Gas Direct Vent Fireplace Heaters, shall be deemed to comply with 2.13.1, 2.13.2, and 2.13.3. A propane fired direct vent fireplace heater shall comply with 2.13.4.

2.13.1

Provision for Slow Accumulation of Gas for Natural Gas Units

When the flue outlet is lower than the highest pass of the heat exchanger and there is possibility of entrapment of gas, a direct vent gas fireplace heater shall be tested to determine that slow gas leakage through the control assembly will not result in an accumulation of gas which could cause glass breakage, expulsion of glass or debris into the living space, excessive flame flashback, or damage to the appliance.

For the purpose of testing, damage to the appliance is defined as a condition which renders the appliance unsafe to operate and still capable of operation. If following the delayed ignition test, the appliance is not capable of operation, the appliance shall be reset in accordance with the manufacturer's instructions, and tested to assure it provides safe operation. Safe operation is defined as complying with the combustion tests of 2.4, Combustion, and the leakage tests of 2.34, Joints In Direct Vent Systems.

Method of Test

This test shall be conducted in a draft free environment.

The test shall be performed with the following vent conditions taken from the manufacturer's installation instructions:

- a. Minimum vertical rise and minimum horizontal run;
- b. Maximum horizontal run at required minimum vertical rise; and
- c. Minimum vertical rise at maximum horizontal run.

Each test is to be conducted with the maximum number of elbows (if allowed) and restrictor discs (if required) as given in the manufacturer's installation instructions. These instructions must be in compliance with Appendix B, Wire Color Designations, of the applicable Installation Code.

The gas fireplace and venting shall be tested with a sampling probe to measure the gas-air ratio at various points in the appliance and vent. This sampling probe shall be connected to a gas-air analyzer coupled to a chart-type recording instrument in order to produce a constant trace of the gas-air ratio at the sample point for sufficient time to allow a complete evaluation of the system. The gas-air ratio trace shall be developed with the appliance at ambient temperature and with all test gases for which the appliance is tested.

An amount of unburnt gas, V , equal to 10 percent of the combustion chamber volume shall be evenly introduced through the gas control system into the combustion chamber at a rate of $[0.2 \times (V)]$ per minute over a period of 5 minutes. The gas-air ratio shall be monitored for the next 30 minutes. If the gas-air ratio during this period is less than the lower explosive limit, the appliance shall be considered as complying with this provision. If the gas-air ratio is equal to or above the lower explosive limit the appliance shall be purged and the test equipment removed and gas be re-introduced at the same rate. At the end of this 5 minute gas introduction period, ignition tests shall be conducted using the normal ignition sequence to main burner full on position. If the gas-air ratio at the pilot level is found to exceed the upper explosive limit, the monitoring period may be extended until an upper explosive limit is reached at which time the normal ignition sequence will be initiated. The purpose of this test is to determine that ignition does not cause glass breakage, expulsion of glass into the living space, excessive flame flash-out, or damage to the appliance. Resetting of a relief device is considered acceptable. Replacement is not considered acceptable.

For the purpose of calculation the combustion chamber volume shall consist of the firebox chamber including the heat exchanger up to the vent connection.

For the purpose of this test, flame flashback shall be considered excessive if a single layer of cheesecloth draped 12 in (300 mm) in front of the appliance is ignited. The cheesecloth shall be dry and shall conform to the Canadian Government Specifications Board Specification 4-GP, Cloth: Cotton, Cheesecloth, for Type 2 cheesecloth. (Commercial Designation 32 x 28). For type 2, the woven fabric count (yarns per inch) is not less than 30 in the warp and not less than 26 in the weft and the weight is not less than 1.0 oz/yd² (34 g/m²) and not more than 1.4 oz/yd² (48 g/m²).

Care must be taken by persons conducting this test to prevent personal injury or damage to equipment other than the test appliance.

2.13.2

Provisions for Appliance Integrity Test for Accumulation of Gas for Natural Gas Units

A direct vent gas fireplace heater shall be tested to determine that the integrity of the unit will not be affected by an accumulation of gas which when ignited could cause glass breakage, expulsion of glass or debris into the living space, excessive flame flashback or damage to the appliance.

For the purpose of testing, damage to the appliance is defined as a condition which renders the appliance unsafe to operate and still capable of operation. If following the delayed ignition test, the appliance is not capable of operation, the appliance shall be reset in accordance with the manufacturer's instructions, and tested to assure it provides safe operation. Safe operation is defined as complying with the combustion tests of 2.4, Combustion, and the leakage tests of 2.34, Joints in Direct Vent Systems.

Method of Test

A sample probe located at the appliance flue outlet shall be connected to a gas/air analyzer. Provisions shall be made to supply gas through the main burner with the ignition means temporarily circumvented, and to control the main burner independently from the normal ignition and pilot burner control system.

The test shall be performed with the following vent conditions taken from the manufacturer's installation instructions:

- a. Maximum horizontal vent run at minimum vent rise; and
- b. Minimum required vent rise at maximum horizontal vent run.

Each test is to be conducted with the maximum number of elbows (if allowed) and restrictor discs (if required) as given in the manufacturer's installation instructions.

With the above provisions in place, the time (T) at which the gas mixture attains equilibrium, with main burner gas supplied at rated manifold pressure, shall be recorded. If the gas mixture attains equilibrium at less than 11 percent gas mixture, the vent outlet at the vent terminal shall be partially blocked until equilibrium at 11 percent gas mixture is attained and the corresponding time (T) recorded. The unburnt gas shall be purged from the appliance and the instrumentation sample probe(s) removed with no change to the appliance. Priming of the pilot gas system shall be proved. With the appliance at room temperature, a series of ignition tests shall be conducted with ignition times ranging from 0.0T to T.

The ignition test shall be conducted by taking time "T" divided by ten to get the test increments, starting at 0.0 "T" and continuing in those increments. In order to reduce the number of tests, if the manufacturer declares the worst case timing, the number of tests may be reduced, providing this is verified by the lab. In each test, gas shall be permitted to flow through the main burner gas valve and burner without being ignited until each of the above ignition times is reached. At ignition time, the main burner gas valve shall remain open while concurrently turning on pilot gas and energizing spark ignition (if equipped). Main burner gas shall be turned off 10 seconds after ignition time, but ignition means and pilot gas shall remain

on until explosion occurs, or until the gas/air mixture falls below the lower explosive limit. The resulting ignition shall not result in glass breakage, excessive flame flashout or damage. Resetting of a relief device is considered acceptable. Replacement is not considered acceptable.

For the purpose of this test, flame flashout shall be considered excessive if a single layer of cheesecloth draped 12 in (300 mm) in front of the appliance is ignited. The cheesecloth shall be as specified in 2.13.1.

Care must be taken by persons conducting this test to prevent personal injury or damage to equipment other than the test appliance.

2.13.3

Blocked Flue Delayed Ignition of Accumulated Gas for Natural Gas Units

A direct vent gas fireplace heater with a glass front shall withstand a delayed ignition without any permanent deformation, glass breakage or damage which will not allow it to perform properly.

For the purpose of testing, damage to the appliance is defined as a condition which renders the appliance unsafe to operate and still capable of operation. If following the delayed ignition test, the appliance is not capable of operation, the appliance shall be reset in accordance with the manufacturer's instructions, and tested to assure it provides safe operation. Safe operation is defined as complying with the combustion tests of 2.4, Combustion and the leakage tests of 2.34, Joints In Direct Vent Systems.

Method of Test

The combustion air intake and vent outlet shall be blocked except for a $\frac{1}{8}$ in diameter opening in the vent outlet.

The test shall be conducted by opening the main burner gas valve without any ignition source when the appliance is at room temperature and igniting the gas at the pilot location a certain interval after opening the main valve. The time interval between opening the valve and igniting the gas shall be the time required to reach the lower explosive limit for the first trial. The time intervals between successive trials shall be determined in the following manner. Measure and record the time to reach the upper explosive limit. The difference between the time to reach the upper explosive mixture and the lower explosive mixture will be divided by 5 to give the time interval for successive trials. The appliance and any vents or air intakes shall be thoroughly ventilated between trials.

The test shall be conducted with the manufacturer's minimum and maximum vent lengths.

The resulting ignition shall not result in glass breakage, damage, or permanent distortion. Resetting of a relief device is considered acceptable. Replacement is not considered acceptable.

Care must be taken by persons conducting this test to prevent personal injury or damage to equipment other than the test appliance.

2.13.4

Provisions for Appliance Integrity Test for Accumulation of Gas for Propane Units

A direct vent gas fireplace heater shall be tested to determine that the integrity of the unit will not be affected by an accumulation of gas which when ignited could cause glass breakage, expulsion of glass or debris into the living space, excessive flame flashout or damage to the appliance.

For the purpose of testing, damage is defined as an appliance condition which renders the appliance unsafe to operate and still capable of operation. Safe operation is defined as complying with the combustion tests of 2.4, Combustion, and the leakage tests of 2.34, Joints In Direct Vent Systems.

Method of Test

A sample probe located at the appliance flue outlet shall be connected to a gas/air analyzer. Provisions shall be made to supply gas through the main burner with the ignition means temporarily circumvented, and to control the main burner independently from the normal ignition and pilot burner control system.

The test shall be performed with the following vent conditions taken from the manufacturer's installation instructions:

- a. Maximum horizontal vent run at minimum vent rise; and
- b. Minimum required vent rise at maximum horizontal vent run.

Each test is to be conducted with the maximum number of elbows (if allowed) and restrictor discs (if required) as given in the manufacturer's installation instructions.

With the above provisions in place, and the appliance at room temperature, gas shall be permitted to flow through the main burner gas valve and burner without being ignited until ignition time (T) is reached. At ignition time, the main burner gas valve shall remain open while concurrently turning on pilot gas and energizing spark ignition. Ignition and all gas shall be turned off ten seconds after ignition time. Tests are to be conducted with T = 5 seconds and then repeated with T increased in 5 second increments until the upper explosion limit is exceeded. The appliance is to be purged and cooled between each test. The resulting ignitions shall not result in glass breakage, expulsion of debris into the living space, excessive flame flashback or damage. Resetting of a relief device is considered acceptable. Replacement is not considered acceptable.

For the purpose of this test, flame flashback shall be considered excessive if a single layer of cheesecloth draped 12 in (300 mm) in front of the appliance is ignited. The cheesecloth shall be as specified in 2.13.1.

Care must be taken by persons conducting this test to prevent personal injury or damage to equipment other than the test appliance.

2.14 Glass Fronts

2.14.1

The temperature at any point on the inside of a glass viewing surface shall not exceed the maximum specified in Table VII, Maximum Temperatures for Glass.

In addition, the maximum thermal-mechanical stress on a fully tempered soda-lime glass viewing surface, when used on a direct vent appliance, shall not exceed 10,000 psi. This is the minimum allowable surface compression stress required to qualify glass as fully tempered in accordance with *ASTM C1048*.

The infrared radiation thermometer specified in the Method of Test outlined below shall have a spectral response of 8-14 microns, adjustable emissivity and close-focus optics [spot diameter of 0.5 in (1.27 cm) or less].

Method of Test

Room temperature for the following test should be set at 75°F (24°C) ± 5°F (± 3°C).

- a. A non-direct vent appliance shall be set up and operated in accordance with the Method of Test in 2.23, Wall, Floor and Ceiling Temperatures. When equilibrium conditions are attained, the exterior of the glass surface shall be scanned using an infrared radiation thermometer. The highest temperature

reading shall be recorded, and the interior glass surface temperature calculated using the equations outlined in Appendix I, Glass Temperature Calculations, or using the Glass Safety Program.* The calculated interior temperature shall not exceed the limits specified in Table VII.

- b. A direct vent appliance shall be set up with the minimum vertical vent length, and corresponding maximum horizontal vent length and maximum number of elbows as specified by the manufacturer (see Figure 18, Arrow A). An additional test shall also be conducted at the maximum horizontal vent length and maximum number of elbows and corresponding minimum vertical vent length as specified by the manufacturer (see Figure 18, Arrow B).
 1. A direct vent appliance, using other than tempered soda-lime glass, shall be operated in accordance with the Method of Test in 2.23. When equilibrium conditions are attained, the exterior of the glass surface shall be scanned using an infrared radiation thermometer. The highest temperature reading shall be recorded, and the interior glass surface temperature calculated using the equations outlined in Appendix I or using the Glass Safety Program.* The calculated interior temperature shall not exceed the limits specified in Table VII.
 2. A direct vent appliance, using tempered soda-lime glass, shall be operated in accordance with the Method of Test in 2.23. When equilibrium conditions are attained, temperatures on the exterior of the glass surface shall be measured using an infrared radiation thermometer at the points specified for the glass surface as outlined in the Glass Safety Program.*

Temperatures on the outer edges of the glass surface shall also be measured using 10 Type-K beaded thermocouples, attached with high temperature adhesive, and located at the points specified for the glass surface as outlined in the Glass Safety Program.

The temperature measurements shall be entered into the Glass Safety Program in accordance with its specific location on the glass surface. The program output shall not yield a maximum interior temperature in excess of 500°F (260°C) as outlined in Table VII. The program output shall not yield stress in excess of 10,000 psi.

2.14.2

The glass material when mounted as intended shall withstand without breaking, the following impact test.

Method of Test

An impact is to be applied to the center of the panel by means of a 1.2 lb, 2 in diameter (535 gram, 50.8 mm diameter) steel sphere swung through a pendulum arc from a horizontal distance of 13.2 in (300 mm). The suspension point of the ball is to be 39.6 in (1000 mm) above and 1 in (25 mm) in front of the point of impact. (See Figure 4, Glass Impact Test).

The test shall be conducted in the cold condition after completion of the firing tests.

When glass components are mounted in doors hinged such that they may close or open by gravity, they shall resist without breakage the effects of full, unrestrained opening or closure from their extreme closed or open positions.

* Windows 95 Application. The "Glass Safety Program" may be purchased from the Gas Technology Institute (GTI).

2.14.3

Thermal Shock

Glass material, other than ceramic, shall withstand a thermal shock without cracking or breaking, when subjected to the following Method of Test.

This test shall be conducted either a the completion of prior specified performance tests or after the appliance is operated at normal input for two hours, cooled down to ambient room temperature and then operated for an additional two hours.

Method of Test

- a. A wet cloth, fully saturated with water at room temperature, shall be wiped across the hot surface of the glass; and
- b. Three misted water sprays, projected across the surface of the glass from a household cleaning bottle with a gun type nozzle, shall be applied after the glass is dried and again attains the maximum temperature under the heated condition.

The glass shall be subjected to the above Method of Test 100 times and shall show no evidence of cracking or breaking and shall comply with 2.35, Allowable Vent Pipe, Heating Element and Load-Bearing Flue Gas Baffle Temperatures.

2.15 Main Burner And Flame Spreader Temperatures

2.15.1

The design and materials used in the construction 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 sag, distort, melt, exhibit appreciable corrosion or damage to any protective coating sufficient to expose the base metal, or show leakage of gas during any of the tests specified herein or when the burner is operated with flame burning within the mixer tube or burner head.

Method of Test

The following test need only be conducted when parts of the burner have a melting point of from 1000°F to 1450°F (538°C to 788°C).

The test shall be conducted at the increased inlet test pressure.

Thermocouples shall be suitably attached to all probable high temperature points of material having a melting point of from 1000°F to 1450°F (538°C to 788°C).

- a. During conduct of 2.23, Wall, Floor and Ceiling Temperatures, the temperatures indicated by the thermocouples shall be recorded and shall not exceed 875°F (468°C).
- b. The gas to the burner shall be ignited in such a manner that it will burn within the mixer tube or burner head and shall continue to burn there for 30 minutes. If the flame cannot be maintained within the mixer tube or burner head, the gas rate to the burner shall be reduced by pressure reduction to a point where it can be so maintained.

A burner design in which a gas flame within these burner parts cannot be maintained due to appliance design or because the appliance control system, which includes all safety devices, acts to shut off the main burner gas supply to the burner, is deemed to comply with this provision.

At the end of this test, as well as at the conclusion of all performance tests specified herein, the burner shall be carefully examined for evidence of sagging, distortion, melting, appreciable corrosion, damage to protective coating sufficient to expose the base metal, or leakage of gas.

2.15.2

Metal used in the construction of a flame spreader and its support shall be suitable for the temperature rise developed during the following Method of Test and in accordance with Table IX, Maximum Flame Spreader Temperatures.

Method of Test

This test shall be conducted at normal inlet test pressure using appropriate equipment, as specified by the manufacturer, with test gases as follows:

Burner and Flame Spreader for use with _____	Test Gas
Natural Gas	A
Manufactured Gas	B
Mixed Gas	C
Natural, Manufactured and Mixed Gases	B
Natural and Mixed Gases	C
Liquefied Petroleum Gases	E
LP Gas-Air Mixtures	H

Thermocouple shall be peened into the metal at the outer edges and at other probable high temperature points on the flame spreader and its support. The appliance shall be placed in operation and the burner(s) adjusted to give a hard, stable flame. When equilibrium conditions are attained, the temperature as indicated by the thermocouples shall be recorded.

The burner(s) shall then be adjusted to give a soft flame and continued in operation until equilibrium conditions are attained. Temperatures as indicated by the thermocouples shall be compared with the previously recorded temperatures.

The temperature rise developed on any part of the flame spreader and its support during either test condition shall not be in excess of the permitted for the metal employed as specified in Table VIII, Maximum Flame Spreader Temperatures.

2.16 Nonload-Bearing Flue Gas Baffle Temperatures

Metal used in the construction of nonload-bearing flue gas baffles shall be suitable for the temperature rise developed during the following Method of Test and in accordance with Table XI, Maximum Heating Element and Nonload-Bearing Flue Gas Baffle Temperatures.

Method of Test

This test shall be conducted at normal inlet test pressure.

Thermocouples shall be suitably attached to the baffles at probable high temperature points. The appliance shall be placed in operation and the burner(s) adjusted to give a hard flame. When equilibrium conditions are attained, the temperature as indicated by the thermocouples shall be recorded.

The burner(s) shall then be adjusted to give a soft flame and continued in operation until equilibrium conditions are attained. Temperatures as indicated by the thermocouples shall be recorded.

The temperature rise developed on any part of the baffles during eight test conditions shall not be in excess of that permitted for the metal employed as specified in Table XI, Maximum Heating Element and Nonload-Bearing Flue Gas Baffle Temperatures.

2.17 Appliance Main Gas Valves

Temperatures of appliance main gas valve bodies shall not exceed those for which the valves are designed.

Method of Test

This test shall be conducted as specified in 2.25.2 concurrently with the test specified in 2.22, Temperature at Discharge Air Opening.

2.18 Gas Appliance Pressure Regulators

2.18.1

The manufacturer's specified hourly Btu rating of the appliance shall be within the range of regulation capacity (see Part IV, Definitions) of the regulator as determined under 1.18.2.

2.18.2

Temperatures of pressure regulator bodies shall not exceed those for which the pressure regulators are designed.

Method of Test

This test shall be conducted as specified in 2.25.2 concurrently with the test specified in 2.22, Temperature at Discharge Air Opening.

2.19 Automatic Valves

Temperatures of automatic gas valve bodies shall not exceed those for which the valves are designed.

Method of Test

This test shall be conducted as specified in 2.25.2 concurrently with the test specified in 2.22, Temperature at Discharge Air Opening.

2.20 Safety Circuit Analysis

The manufacturer shall supply "Failure Modes and Effects Analysis" (FMEA) for each individual control. A typical analysis is shown in Appendix H, Sample Failure Modes and Effects Analysis for Component Miswiring. This FMEA shall be evaluated to determine that:

1. The failure to connect an individual lead or terminal in the gas control circuit shall not result in an unsafe operation.

2. The interchange of lead or terminal connections on an individual control in the gas control circuit, that are physically interchangeable* without alteration, shall not result in an unsafe operation.

Control wiring bases which are not intended to be disconnected to replace the control need not comply.

Method of Test

Sufficient tests shall be conducted on each individual control, one at a time, to verify the completeness and accuracy of the control miswiring FMEA provided by the manufacturer.

2.21 Manifold And Control Assembly Capacity

The manifold and control assembly shall have sufficient flow capacity to provide the manufacturer's normal hourly Btu input rating and manifold pressure when supplied with the gas pressure designated as the minimum permissible for the purpose of input adjustment.

Method of Test

The appliance shall be equipped with the manifold and gas control assembly having the lowest flow capacity for the applicable gas. The appliance shall be adjusted and operated as specified in 2.3.4. The inlet test pressure shall then be reduced so as to maintain the minimum permissible gas supply pressure for the purpose of input adjustment at the upstream pressure tapping specified in 1.34.1-b4. With no additional change other than minor adjustment of the gas appliance pressure regulator outlet pressure setting, the manufacturer's normal hourly Btu input rating and manifold pressure shall be maintained. The manifold pressure shall be measured at the downstream tapping specified in 1.14.14.

2.22 Temperature At Discharge Air Opening

2.22.1

A primary temperature limit control, when provided, shall act to shut off the gas supply to the main burner(s) when or before the average temperature of the discharged air reaches 250°F (121°C).

Method of Test

Five bead-type No. 24 AWG (0.20 mm²) thermocouples shall be placed in each warm air outlet, in a plane 1 in (25.4 mm) from the grille(s). These thermocouples shall be located along diagonals drawn between opposite corners of each grille as follows: one at the intersection of the diagonals, and two on each diagonal, located ²/₃ of the distance from the center to the grille corners. (In case of other than rectangular grilles, the five thermocouples shall be located at the discretion of the testing agency in such a manner as to determine the average outlet temperature.)

The appliance shall be placed in operation and a preliminary test conducted to determine the degree of blocking of the cold air inlet required to produce the air temperature that will cause the primary temperature limit control to function. The cold air inlet blockage shall then be relieved slightly and the appliance operated until substantial equilibrium outlet air temperatures have been attained.

* For example, 1/4 inch quick-connects and screw terminals are not to be considered interchangeable with each other.

The cold air inlet shall then be gradually blocked over a period of 10 minutes until the effective area is reduced to 5 percent of its original area. The appliance shall then be operated until the primary temperature limit control acts to shut off the gas supply to the main burner(s). The average outlet air temperature at this instant shall not exceed 250°F (121°C).

2.22.2

A room heater equipped with a temperature limit control(s) shall be capable of continuous operation without the limit control(s) functioning to shut off the gas supply when operated at normal inlet test pressure at the normal hourly Btu input rating of the appliance.

2.22.3

On a room heater not equipped with a temperature limit control, the average discharge air temperature shall not exceed 280°F (155.5°C) above room temperature.

Method of Test

The average discharge air temperature shall be measured after 1 hour of appliance operation in an open room at normal inlet test pressure and with a vent pipe attached as specified in 2.27.1.

A test device, as shown in Figure 5, Typical Device for Measuring Discharge Air Temperatures, shall be used to determine the average outlet air temperature. When two adjacent sides of the discharge air opening are 12 in (305 mm) or greater, the test device shall have 12 in (305 mm) sides. When both dimensions are less than 12 in (305 mm), the device shall be the size of the discharge air opening. When one side of the discharge air opening is 12 in (305 mm) or more and the other side is less than 12 in (305 mm), the smaller side of the test device shall equal the smaller dimension of the discharge air opening, and the other side of the test device shall not be longer than the larger dimension of the discharge air opening and in addition, shall not be longer than a size which would provide an area of 144 in² (0.09 m²) for the device. The test device shall be contoured to fit the discharge air opening. Five parallel connected bead-type No. 24 AWG (0.20 mm²) thermocouples shall be positioned on the thermocouple support wires as shown in Figure 5, and a distance of 1 in (25.4 mm) between the thermocouples and the discharge air opening shall be maintained.

When a discharge air opening exceeds an area of 144 in² (0.09 m²) as described above, the test device shall be located over that section of the discharge air opening which will result in the highest average discharge air temperature.

2.22.4

Duct Discharge Temperature.

- a. When tested at normal test pressure, heating ducts shall not discharge air at an average temperature in excess of 130°F (72.2°C) above the inlet air temperature.

When air circulating fireplace heaters equipped with booster fans shall not discharge air at an average temperature in excess of 130°F (72.2°C) above the inlet air temperature with the fan in operation. With the fan off, the average outlet air temperature shall not exceed 180°F (100°C) above the inlet air temperature.

Method of Test

This test shall be conducted at normal test pressure.

Warm air circulating fireplace heaters shall be installed with thermocouples located in warm air ducts and return air openings as prescribed in 2.22.3. The fireplace heater shall be operated until equilibrium temperature is established. The average outlet air temperature shall not exceed 130°F (72.2°C) above the inlet air temperatures.

Warm air circulating fireplace heaters equipped with booster fans shall be installed with thermocouples located in the warm air ducts and return air openings as prescribed in 2.22.3. The fireplace heater shall be operated until equilibrium conditions are obtained with the fan in operation. The average outlet air temperature shall not exceed 130°F (72.2°C) above the inlet air temperature. The fan shall then be shut off and the appliance continued in operation until a consistent outlet air temperature is obtained. The average outlet air temperature shall not exceed 180°F (100°C) above the inlet air temperature.

- b. The primary temperature limit control shall act to shut off the gas supply to the main burner(s) when or before the average temperature of the discharge air reaches 250°F (121°C).

Method of Test

Five bead-type No. 24 AWG (0.20 mm²) thermocouples shall be placed in each discharge air opening, in a plane 1 in (25.4 mm) from the grille(s). These thermocouples shall be located along diagonals drawn between opposite corners of each grill as follows: one at the intersection of the diagonals, and two on each diagonal, located $\frac{2}{3}$ of the distance from the center to the grille corners. (In case of other than rectangular grilles, the five thermocouples shall be located at the discretion of the testing agency in such a manner as to determine the average outlet temperatures.)

The appliance shall be placed in operation and a preliminary test conducted to determine the degree of blocking of the cold air inlet required to produce the air flow that will cause the primary temperature limit control to function. The cold air inlet blockage shall then be relieved slightly and the appliance operated until substantial equilibrium outlet air temperatures have been attained.

The cold air inlet shall then be gradually blocked over a period of 1 minute until the effective area is reduced to 5 percent of its original area. The appliance shall then be operated until the primary temperature limit control acts to shut off the gas supply to the main burner(s). The average discharge air temperature at this instant shall not exceed 250°F (121°C).

2.22.5

The primary temperature limit control shall act to shut off the gas supply to the main burner(s) when or before the average temperature of the discharge air reaches 250°F (121°C).

Method of Test

Five bead-type No. 24 AWG (0.20 mm²) thermocouples shall be placed in each discharge air opening, in a plane 1 in (25.4 mm) from the grille(s). These thermocouples shall be located along diagonals drawn between opposite corners of each grille as follows: one at the intersection of the diagonals, and two on each diagonal, located $\frac{2}{3}$ of the distance from the center to the grille corners. (In the case of other than rectangular grilles, the five thermocouples shall be located at the discretion of the testing agency, in such a manner as to obtain substantially an average discharge air temperature.)

The appliance shall be placed in operation and a preliminary test conducted to determine the degree of blocking of the cold air inlet required to produce the discharge air temperature that will cause the primary limit control to function. The cold air inlet blockage shall then be relieved slightly and the appliance operated until substantially equilibrium discharge air temperatures have been attained.

The cold air inlet shall then be gradually blocked over a period of 10 minutes until the effective area is reduced to 5 percent of its original area. The appliance shall then be operated until the primary temperature limit control acts to shut off the gas supply to the main burner(s). The average discharge air temperature at this instant shall not exceed 250°F (121°C).

2.23 Wall, Floor And Ceiling Temperatures

For test purposes, gas fireplace inserts shall be installed in a non-combustible enclosure that corresponds to the minimum size fireplace specified in the manufacturer's installation instructions. (See Figure 2, Test Room Configuration.)

2.23.1

Free Standing, Attached or Recessed Appliances.

When the appliance is installed at the minimum clearances specified by the manufacturer in integral inches, within the limitations shown in Figure 2, Test Room Configuration, or as stated in 2.1.6 for recessed appliances, the maximum temperature rise above ambient temperature shall not exceed:

- a. 117°F (65°C) on exposed surfaces of the test structure within 18 in (457 mm) of the appliance; and
- b. 90°F (50°C) on unexposed surfaces of the test structure, such as beneath the appliance or within a stud space of a Zero ("0") Clearance installation or the wall behind a wall mount unit, and the enclosure of the venting system.

Method of Test

The appliance shall be installed with the minimum clearances specified by the manufacturer (See Figure 2, Test Room Configuration) from each side of a partial enclosure and formed by an adjoining side and rear wall and a ceiling each constructed of nominal 3/4 in plywood set at 90 degree (1.57 rad) angles and finished in dull black. If the clearance from a second side wall is specified by the manufacturer at a distance less than 18 in (457 mm), then a second side wall shall be included as a part of the test enclosure.

The walls of the test enclosure shall be 7 ft 6 in (2.29 m) high and extend to more than 24 in (610 mm) beyond the front of the appliance. The ceiling clearance shall be specified by the manufacturer but shall be no greater than 7 ft 6 in (2.29 m) minus the height of the appliance. The manufacturer shall specify the right and left sides and the front of the appliance. The front of the appliance shall face the open end of the enclosure.

If clearances from projections above the appliance are specified by the manufacturer, (see 1.35.13, Clearance Marking), the test enclosure shall also include such projections, as shown in Figure 2c and as specified by the manufacturer. The projection shall extend the full length of the rear test wall.

The floor shall be constructed of nominal 3/4 in plywood superimposed by a second sheet of 3/4 in plywood finished in dull black. It shall rest on a frame of nominal 2 x 4 studs spaced 16 in (406 mm) apart (on centers). (See Figure 2, Test Room Configuration.)

For an appliance for installation on carpeting, the test installation flooring shall be constructed of wood and shall be built up one inch under and/or around the base of the appliance so as to simulate installation on carpeting with one-inch pile.

When the design of the appliance is such as to clearly indicate it is not intended to be installed in a conventional manner, the test structure shall be such as to simulate the intended installation and venting of the appliance at the discretion of the testing agency and in accordance with the manufacturer's printed instructions.

Wall, floor and ceiling temperatures may be determined by means of a temperature indicating device and No. 24 AWG (0.20 mm²) iron-constantan bead-type thermocouples. The thermocouples shall be made by contact welding with the free ends clipped off beyond the junctions. The junctions and $\frac{3}{8}$ in (9.5 mm) of the lead shall be exposed on the test surface, the remainder of the lead extending through the wall, floor or ceiling surface. Thermocouples shall be secured to the wall, floor and ceiling surfaces facing the appliance by staples over the insulated portions of the leads. The junctions shall be held in thermal contact with the surfaces by radiation transparent adhesive tape finished in dull black.

On wall and ceiling surfaces, thermocouples shall be spaced at intervals of not more than 6 in (152 mm). Thermocouples shall also be placed on the inside combustible surface 1 in (25.4 mm) away from the annulus provided for the vent connector of an appliance having a horizontal flue outlet. Thermocouples on the floor shall be spaced at intervals of not more than 3 in (76.2 mm) under the appliance and within 3 ft (914 mm) of it.

Additional thermocouples shall be placed at any other points deemed necessary by the testing agency.

The appliance shall be installed in the partial enclosure with the manufacturer's specified clearances between the appliance jacket and the side and rear test walls. If any relief opening faces a rear or side wall, these clearances shall provide at least a 2 in (50.8 mm) clearance between the relief opening and the test wall.

If the appliance has a ventilating opening(s), the register(s), if provided, shall be set in the position resulting in the most severe temperature condition.

A direct vent appliance shall be tested with the direct vent system supplied by the manufacturer.

A non-direct vent appliance shall be tested using either a galvanized single-wall vent connector or a listed Type B vent connector, at the option of the manufacturer, and with due consideration to the requested clearance listings. When a single-wall vent connector is used, it shall have a clearance of 6 in (152 mm) between its surface and the walls and ceiling of the test enclosure. Where the vent connector pierces the enclosure, an opening having a diameter 4 in (102 mm) larger than the diameter of the vent connector shall be provided and the vent connector centered in the opening. The 2 in (50.8 mm) annulus thus formed shall be sealed on the outer surface. (See Figure 6, Method of Sealing Annulus). If a Type B vent connector is used, the clearance from its surface to the walls and ceiling of the enclosure shall be in accordance with its listing. At its point of passage through the enclosure, the annulus shall be sealed as specified for a single-wall vent connector. These clearances shall be maintained whether the vent connector is inside or outside of the test enclosure.

The appliance shall be placed in operation at normal inlet test pressure with the limit control (if provided) bypassed. Any fan shall be allowed to operate in a normal manner. The vent outlet on a non-direct vent appliance shall be progressively blocked as specified in 2.24, Flue Gas Temperatures. The appliance shall be continued in operation until equilibrium conditions are attained, at which time the temperatures as indicated by all the thermocouples shall be recorded and compared with room temperature.

On a non-direct vent appliance, the above test shall then be repeated with the vent completely blocked and the limit control bypass removed. The limit control shall be adjusted to its maximum temperature setting and minimum differential. The appliance shall be allowed to cycle on the limit control.

2.23.2

(Optional) For an Appliance Equipped with Warm Air Duct Systems.

Additional testing will be conducted to determine that various conditions of blocking the outlets of the duct system or reverse flow shall not cause the test structure to exceed the limits specified in the following Method of Test.

Method of Test

After equilibrium has been reached with ducts open, the outlet(s) shall be partially blocked in small increments to determine what amount of blocking may increase any combustible surface temperatures.

A slight reverse flow shall then be artificially created in the duct(s) to simulate natural reverse flow from pressure differentials in different rooms. If any increase in any surface temperature is noted, the flow shall be adjusted to cause the highest temperature increase. After equilibrium has been reached, no surface temperature on wall, floor and ceiling shall exceed 117°F (65°C) above room temperature.

2.23.3

Circulating Air Type Appliances with Optional Warm Air Duct Systems.

The warm air outlet air temperature of a circulating air type appliance is to be determined with parallel connected bead-type thermocouples, not heavier than No. 24 AWG (0.20 mm²) located 1 in (25 mm) from the outer face of the warm air grille or register. A minimum of six thermocouples are to be used, spaced a maximum of 2 in (50 mm) apart with the inner thermocouples evenly spaced between the outer thermocouples.

Method of Test

Optional warm air duct systems shall be enclosed within a structure representative of the most severe field installation described in the manufacturer's installation instructions.

Thermocouples are to be installed on the enclosure adjacent to the hot air outlet. Warm air ducts, where provided, shall be installed with their outlets in the closest approach to the ceiling, as permitted by the manufacturer's installation instructions.

2.23.4

For an appliance equipped with a fan(s), the temperatures of any portion of the test structure shall not exceed the limits specified in the following Method of Test.

Method of Test

The appliance shall be installed as specified in 2.23.1. Following compliance with 2.23.1, an appliance having a fan shall be tested with the fan rendered inoperative. The limit control, if provided, shall be adjusted to its maximum temperature setting and minimum differential.

The appliance shall then be placed in operation at normal inlet test pressure. The flue outlet on a non-direct vent appliance shall be completely blocked. The appliance shall be continued in operation until equilibrium conditions are attained, at which time the temperatures as indicated by all the thermocouples shall be recorded and compared with room temperature.

If a limit control(s) is provided and the appliance cycles on the limit control during this test, the appliance shall be allowed to cycle until equilibrium or receding temperatures are attained. During the test, the temperatures of the walls, floor and ceiling surfaces shall not exceed 175°F (97°C) above room

temperature for the first shut-off cycle effected by operation of the limit control. On the sixth and subsequent shut-off cycles effected by operation of the limit control, the temperatures on the wall, floor and ceiling surfaces shall not exceed those temperatures specified in 2.23.1.

2.23.5

The temperatures attained by electrical conductors, controls and other components shall not exceed the limits specified when determined in accordance with the following Method of Test.

Method of Test

- a. The appliance shall be installed and operated as specified in 2.23.1 until equilibrium temperatures are attained. Temperatures of controls and wiring shall be determined for each electrical component at points subject to maximum temperatures, at the discretion of the testing agency. Temperatures shall be determined by means of bead-type thermocouples not larger than No. 24 AWG (0.20 mm²) placed in good thermal contact with the material. Temperatures attained by electrical conductors, controls and other components shall not exceed those shown in operating condition A of the *Standard for Electrical Features of Fuel Burning Equipment, CSA C22.2 No. 3*, or Column 1 of Table C-I, Maximum Allowable Rise above Room Temperature for Various Component Parts.
- b. Following compliance with (a) above, the test shall be repeated under test conditions specified in 2.23.2. During the first shut-off cycle effected by operation of the limit control temperatures attained by electrical conductors, controls and other components shall not exceed the limits specified in operating condition B of the *Standard for Electrical Features of Fuel Burning Equipment, CSA C22.2 No. 3*, or in Column 2 of Table C-I, Maximum Allowable Rise above Room Temperature for Various Component Parts. Filters shall not attain a temperature in excess of 175°F (97°C) above room temperature during the first shut-off cycle. Upon the sixth and subsequent shut-off cycles effected by operation of the limit control, the observed temperatures of electrical conductors, controls and other components shall not exceed those specified in operating condition A of the *Standard for Electrical Features of Fuel Burning Equipment, CSA C22.2 No. 3*, or as specified in Table C-I, Maximum Allowable Rise above Room Temperature for Various Component Parts, and temperatures of filters shall not exceed 117°F (65°C) above room temperature.

2.23.6

Fan Type and Direct Vent Appliances with Safety Shut Off Valve and Secondary Temperature Limit Control.

The temperatures of the combustible wall, floor and ceiling surfaces specified in 2.23.1 shall not exceed 350°F (194°C) under the test conditions specified in the following Method of Test.

Method of Test

This test applies only to a fan type direct vent gas fireplace heater equipped with a safety shut off valve and secondary temperature limit control as specified in 1.17.5-b.

The test shall be conducted following the test specified in 2.23.5-b with no changes other than bypassing the primary temperature limit control and, if provided, the auxiliary temperature limit control specified in 2.23.4. Under these test conditions, starting the appliance at room temperature, the secondary temperature limit control shall act to close the safety shut-off valve within 10 minutes after the main burner(s) is placed in operation and wall, floor and ceiling temperatures shall not exceed 350°F (194°C) during conduct of this test.

2.23.7

Outside Building Wall Temperature for Side-Wall-Vented Appliances.

The temperatures on the building wall surface adjacent to the vent termination as outlined in the manufacturer's installation instructions (see 1.34.1-b20) shall not exceed 90°F (50°C) above ambient for all types of combustible materials when measured by means of bead-type thermocouples as specified in the method of test. The vent termination and any special heat shields, if used, must be installed in accordance with the manufacturer's instructions.

Method of Test

The appliance shall be installed with its shortest vent configuration in order to obtain maximum flue gas temperatures at the vent termination outlet.

Exterior walls must be of $\frac{3}{4}$ in plywood and finished in dull black. Wall configurations and distances must be in accordance with the manufacturer's instructions and must include overhangs and perpendicular corner type installations. For test purposes, a 4 ft (1.2 m) depth shall be provided for overhangs.

A grid of bead-type thermocouples must be installed onto the exterior, black wall surface at a distance of no more than 3 in (75 mm) apart. The grid must also extend to the perpendicular wall. (See Figure 2, Test Room Configuration.)

The appliance must be fired until equilibrium temperatures have been reached, after which time the temperatures on the exterior wall surface must be recorded.

2.24 Flue Gas Temperatures

2.24.1

The average temperature of the flue gases from a gravity vented gas fireplace heater shall not exceed 480°F (266.6°C) above room temperature when the test vent is restricted to provide a condition of maximum flue gas temperature.

Method of Test

This test shall be conducted at normal test pressure. The draft hood shall be in place. Appliances having a vertically discharging draft hood outlet shall have attached to and vertically above the outlet sufficient uninsulated flue pipe, the same size as the draft hood outlet, to extend not less than 5 ft (1.53 m) nor more than 5 ft 6 in (1.67 m) above the highest point of the draft hood relief opening(s). Appliances having a horizontally discharging draft hood outlet shall have attached an uninsulated 90 degree elbow, the same size as the draft hood outlet, and sufficient vertical uninsulated flue pipe so that the outlet is not less than 5 ft (1.53 m) nor more than 5 ft 6 in (1.67 m) above the highest point of the draft hood relief opening(s).

Two lines, intersecting at right angles, shall be established in the horizontal plane of measurement which shall be located 4 ft 6 in (1.37 m) above the highest point of the draft hood relief opening(s). They shall be oriented so that they will divide the cross-sectional area of the flue pipe into quadrants. One temperature measurement shall be taken at the intersection of the two lines. Eight temperature measurements shall be taken, in two sets of four along each line, at points $\frac{1}{3}$ and $\frac{2}{3}$ of the distance from the intersection to the periphery. The temperatures shall be determined with a bead-type thermocouple not larger than No. 24 AWG (0.21 mm²) successively placed at the specified positions. The flue gas temperature shall be the average of these nine individual readings.

The appliance shall be operated until equilibrium conditions are attained, as indicated by temperature changes in the flue gas or not more than $\pm 5^{\circ}\text{F}$ ($\pm 3^{\circ}\text{C}$) between readings 15 minutes apart when the flue gas thermocouple is located in the center position of the flue. The gas meter, gas temperature, gas pressure and barometer shall be read and a heating value determination made.

The outlet of the test flue shall then be progressively blocked and the flue gas temperature continuously observed until a new condition of equilibrium is reached at which the flue gas temperature is at its maximum. The temperature shall be determined and recorded.

2.24.2

For gas fireplace heaters having a direct venting system, a power venting system or an unconventional venting system supplied with the appliance by the manufacturer, the flue gas temperature may be deemed met if the flue gas temperature and construction of the appliance are such as to preclude any fire hazard as determined by the testing agency, when the appliance is installed in accordance with the manufacturer's printed instructions.

2.25 Surface Temperatures

2.25.1

Guards and surfaces of the top, front and sides of an appliance which can be contacted by the accessibility probe shown in Figure 7, Accessibility Probe for Heated Surfaces, shall not have temperatures exceeding the following:

- a. 140°F (78°C) above room temperature on any surface up to and including 18 in (457 mm) above the bottom of the appliance; and
- b. 180°F (100°C) above room temperature on any surface above 18 in (457 mm) from the bottom of the appliance.

Discharge air openings, parts directly exposed to radiation from flames or glowing surfaces through front openings, and parts within 2 in (50.8 mm) of these openings, are exempt from this provision.

Method of Test

The appliance shall be operated for 1 hour in an open room at normal inlet test pressure with the vent pipe configuration specified in 2.26.6. At the end of this time the temperatures of the appliance surfaces and guards, if used, shall be determined by means of one of the temperature-measuring probes shown in Figures 9 or 9A, Temperature-Measuring and Accessibility Probe.

2.25.2

The temperatures of all parts which the operator is normally expected to handle in normal operation of the appliance shall not exceed room temperature by more than 40°F (22.2°C) for metallic parts or 60°F (33.3°C) for non-metallic parts.

Method of Test

Temperatures of handled parts shall be measured by means of No. 24 AWG (0.21 mm^2) iron-constantan thermocouples in firm contact (such as by cementing or tapping) with the surfaces of these parts. Temperatures shall be taken on all portions of handled parts that are grasped during normal use.

This test shall be conducted concurrently with the test specified in 2.23, Wall, Floor and Ceiling Temperatures, whichever is applicable. The appliance shall be operated at normal test pressure for a period of 1 hour. At the end of this time, the surface temperatures of handled parts shall not exceed room temperature by more than 40°F (22.2°C) for metallic parts nor 60°F (33.3°C) for non-metallic parts.

2.25.3

Where the outside surface temperature of the vent terminal assembly exceeds 180°F (100°C) above room temperature the marking shall state that when the vent terminal is accessible a certified guard shall be installed. The outside surface temperature of the guard shall not exceed 180°F (100°C) above room temperature.

Method of Test

The appliance shall be operated for 1 hour in an open room at normal test pressure and normal input rate. At the end of this time the outside surface temperatures of the vent terminal assembly or guard, if used, shall be determined by means of the probes shown in Figures 9 and 9A, Temperature Measuring and Accessibility Probe. Where an opening in the vent terminal assembly or guard exceeds $\frac{3}{4}$ in in diameter (i.e. will allow a $\frac{3}{4}$ in diameter rod to pass through the opening) The surface temperature shall be measured at surfaces that can be contacted by the probe shown in Figure 7, Accessibility Probe for Heated Surfaces.

2.25.4

Vented gas fireplace heaters for Recreational Vehicle Installation.

a. Surface Temperature of Fan Type Appliances Under Normal Operating Conditions.

The average temperature of the surfaces within the discharge air opening shall not exceed 140°F (60°C) above room temperature when tested as specified in the following Method of Test.

Method of Test

The appliance shall be installed as specified in 2.23, Wall, Floor and Ceiling Temperatures. Sixteen bead-type No. 24 AWG (0.20 mm²) iron-constantan thermocouples shall be welded or brazed on the metal casing surface closest to the intersection of 4 vertical and 4 horizontal lines which divide the vertical front discharge air surface of the appliance into 25 equal areas. The appliance shall be operated at normal inlet test pressure and at normal voltage until the vertical front discharge air surface has reached equilibrium conditions (average temperature change of less than 1 degree in 5 minutes). The 8 thermocouples indicating the highest temperature shall be connected in parallel, and the resultant temperature recorded shall not exceed 140°F (60°C) above room temperature.

b. Surface Temperature of Gravity Type Appliances Under Normal Operating Conditions.

The average temperature of the surfaces within the discharge air opening shall not exceed 210°F (99°C) above room temperature when tested as specified in the following Method of Test.

Method of Test

The appliance shall be tested as specified in 2.25.4-a, and the resultant temperature recorded shall not exceed 210°F (99°C) above room temperature.

c. Discharge Air and Surface Temperature Under Abnormal Blockage Condition.

The spot temperature of the discharge air and the metal casing surface temperature of unblocked portions of an appliance for recreational vehicle installation shall not exceed 280°F (138°C) above room temperature, and the spot temperature on the cotton sheet blanket covering the blocked portion of the appliance shall not exceed 240°F (115.5°C) above room temperature when determined as specified in the following Method of Test.

Method of Test

Bead-type No. 24 AWG (0.20 mm²) iron-constantan thermocouples for individual temperature determinations shall be placed in the center of the discharge air openings in the same plane as the surface of the surrounding jacket. Thermocouples shall be spaced 3 in (76.2 mm) apart in a horizontal row to measure spot discharge air temperatures. The thermocouple arrangement shall be located in the discharge air openings so as to measure those areas where it is deemed the highest temperatures will occur. Thermocouples shall also be welded or brazed on the metal casing surfaces adjacent to the discharge air openings and arranged in the manner prescribed above. Additional thermocouples may be installed at the discretion of the testing agency. The appliance shall be placed in operation at normal inlet test pressure and operated until equilibrium discharge air temperatures are attained.

The entire length of the inlet and discharge air openings shall then be progressively blocked from bottom to top until the temperature limit control(s) acts to shut off the main burner gas supply. If the limit control(s) is not of the manual reset type, the appliance shall be allowed to cycle on the limit control until the surface and cotton sheet blanket temperatures do not increase for three successive burner cycles.

Progressive blockage shall be obtained by placing a 100 percent cotton sheet blanket* folded in 4 layers directly over the circulating air openings of the appliance in increments of not less than 1 in (25.4 mm). No. 24 AWG (0.20 mm²) iron-constantan bead-type thermocouples shall be sewn with cotton thread to the surface of the blanket in the areas of highest temperature. The thermocouple beads shall be located on the side facing the appliance and ³/₄ in (19 mm) apart with 1 in (25.4 mm) of the lead wires exposed to the heat source.

This test procedure shall then be repeated, except that the entire length of the inlet and discharge air openings shall be progressively blocked (1) from top to bottom, and (2) from each side toward the opposite side. In the event all thermocouples are covered by this blockage, the unblocked portion of the discharge air openings shall be probed with a bead-type No. 24 AWG (0.20 mm²) iron-constantan thermocouple to determine the maximum spot discharge air temperature.

When usual appliance designs or control applications are involved, blockage tests other than those described above may be applied at the discretion of the testing agency.

Any discharge air or metal casing surface temperature in excess of 280°F (138°C) above room temperature or any cloth temperature in excess of 240°F (115.5°C) above room temperature is considered as not complying with this provision.

2.26 Evaluation Of Clothing Ignition Potential

An appliance shall be designed so that it will not readily ignite clothing or flammable materials brought in contact with the appliance.

* The density of the cotton sheet blanket shall be 1.9 ft²/oz (6.2 m²/kg).

Method of Test

Safety screens and guards provided as a part of the appliance by the manufacturer in 1.2.6, shall be in place during this test.

One hundred percent white cotton terry cloth test material with a pile weave on both sides, approximately 8 oz/yd² (270 g/m²) and pre-conditioned at 30 percent relative humidity, or less, at 75°F (23.9°C) for at least 24 hours, shall be used. Test samples shall consist of a single layer of the test material, 6 in (152 mm) wide, and equal in length to the height of the appliance.

A test sample shall be draped on a probe as shown in Figure 8, Probe for Evaluation of Clothing Ignition Potential. The appliance shall then be operated for 1 hour in an open room at normal test pressure at the end of which time the probe, with its handle maintained in a horizontal position at all times and its axis at any vertical height with respect to the appliance, advanced toward the appliance from any direction, including from above, until the frame of the probe contacts or presses the cloth test material against any surface or guard. The probe shall then be maintained in that position for 30 seconds. No flaming of the test material shall occur.

A previously unused test sample shall be used for each evaluation.

2.27 Venting

When use with one gas is desired, these tests shall be conducted with the appropriate gas as specified in 2.2, Test Gases.

When use with more than one gas is desired, and if the appliance input ratings are not identical for the different gases, these tests shall be conducted at the specified input ratings for the individual gases. The number of tests conducted shall be at the discretion of the testing agency.

When use with more than one gas is desired, and if the appliance input rating is identical for both gases, these tests shall be conducted with Test Gas E.

2.27.1

There shall be no leakage of flue gases. Negligible leakage of flue gases through joints which must be provided for expansion of heated parts shall be considered acceptable under this provision. The actuation of a blocked flue switch during this test shall be considered non-compliance with this test.

Method of Test

The appliance shall be operated for at least 15 minutes at normal inlet test pressure.

The vent pipe shall be at the manufacturer's specified minimum height and maximum horizontal length.

A fuming or smoking material shall be injected into the primary or secondary air supply in an amount sufficient to produce a dense smoke at the flue outlet.

Smoke shall not escape from any part of the appliance. Intermittent or negligible smoke through apertures provided for thermal expansion of parts shall not be considered as non-compliance with this provision.

2.27.2

When the appliance includes mechanical draft devices, the design and construction shall be such that during the time of failure of the mechanical draft until the gas supply is shut off, it will not extinguish the

main burner flames nor cause them to flash back, lift, float, burn outside the appliance, nor produce a concentration of carbon monoxide in excess of 0.04 percent in an air-free sample when the appliance is tested in an atmosphere having a normal oxygen supply.

Method of Test

The appliance shall be operated for a period of 15 minutes at normal inlet test pressure with mechanical draft. The fan or blower shall be stopped and the appliance allowed to operate for a period of 15 minutes with a natural draft and the effect noted. A sample of the flue gases shall also be secured from the appliance flue at a point preceding its outlet and analyzed for carbon monoxide. When this method of sampling is not practical nor productive of samples representing the most severe conditions prevailing, the procedure to be followed shall be determined by the testing agency.

2.28 Draft Hoods

A draft hood shall comply with the following provisions when attached to the appliance in a normal position.

Appliances having a recessed draft relief system (see Part IV, Definitions) shall comply with these provisions when installed in an enclosure having the minimum dimensions specified in the manufacturer's installation instructions (see 2.1.7) and with trim panels in place. If trim panels incorporate relief openings, these provisions shall be repeated with all panel variations. If the appliance incorporates a circulating air blower (either standard or optional), the appliance shall comply with these provisions with the blower off and with the blower operating at both maximum and minimum speed levels.

When use with one gas is desired, these tests shall be conducted with the appropriate gas as specified in 2.2, Test Gases.

When use with more than one gas is desired, and the appliance input ratings are not identical for the different gases, these tests shall be conducted at the specified input ratings for the individual gases. The number of tests conducted shall be at the discretion of the testing agency.

When use with more than one gas is desired, and the appliance input rating is identical for the various gases, these tests shall be conducted with Test Gas E.

2.28.1

With the outlet of the test vent blocked, the main burner flame shall not extinguish, shall remain stable without lifting or floating, and the concentration of carbon monoxide in a sample of the flue gases shall not exceed 0.04 percent in an air-free sample when the appliance is tested in an atmosphere having a normal oxygen supply.

Method of Test

This test shall be conducted at normal inlet test pressure. After adjustment, and operating the appliance for 30 minutes, the outlet of the test vent shall be blocked and the appliance operated for at least 15 minutes. A sample of the flue gases shall be secured and analyzed as specified in 2.4.2-a.

2.28.2

Total downdraft pressures ranging from zero (0) to 0.05 in wc (12 Pa), imposed at the outlet of the appliance, shall not extinguish the main burner flames nor cause them to flash back, lift, float, or burn outside the appliance, nor produce a concentration of carbon monoxide in a sample of the flue gases in excess of 0.04 percent in an air-free sample when the appliance is tested in an atmosphere having a normal oxygen supply.

Method of Test

A straight section of vent pipe of suitable diameter and of a length equal to 10 pipe diameters shall be attached directly to the outlet of the draft hood and connected to the outlet of a blower. The total draft pressure shall be measured with a pitot tube* and a differential gage which may be read directly to 0.005 in wc (1.24 Pa) pressure. The pitot tube shall be inserted in the straight section of vent pipe at a point midway between its ends so (1) the head of the tube is coincident with the axis of the vent pipe, and (2) the impact opening of the pitot tube faces the flow stream.

The appliance shall be operated for approximately 15 minutes at normal inlet test pressure.

The draft in the vent pipe shall be varied from the minimum total pressure to the maximum value specified above, and the effect on the main burner flames noted. Samples of the flue gases shall also be secured from the appliance at a point determined by the testing agency and analyzed for carbon monoxide. The point selected for sampling shall be productive of samples representing the most severe condition prevailing.

2.28.3

Downdrafts imposed as specified in 2.28.2 shall not extinguish the pilot nor cause it to lift or flash back when operated separately from the main burner(s).

2.28.4

A chimney action consisting of static up-draft and velocity updraft numerically totalling between 0.06 and 0.07 in wc (15 and 17 Pa) pressure, applied at the outlet of the appliance, shall not extinguish the main burner flames, nor cause them to flash back, lift or float.

Method of Test

A straight length of vent pipe of suitable diameter and of a length at least equal to 10 pipe diameters shall be attached directly to the outlet of the draft hood and connected to the inlet of a blower. The pressure and velocity heads shall be measured with a pitot tube (See 2.28.2) and a differential gage which may be read directly to 0.005 in wc (1.24 Pa) pressure. The pitot tube shall be inserted in the straight section of vent pipe at a point midway between its ends, so that (1) the head of the tube is coincident with the axis of the vent pipe, and (2) the impact opening of the pitot tube faces the flow stream.

The appliance shall be operated for at least 15 minutes at normal inlet test pressure. An updraft shall be imposed at the outlet of the draft hood so the numerical sum of the pressure head and velocity head will be between 0.06 and 0.07 in wc (15 and 17 Pa) pressure. Under this condition, the main burner flames shall not be extinguished nor flash back, lift or float.

2.28.5

Updrafts imposed as specified in 2.28.4 shall not extinguish the pilot nor cause it to lift or flash back when operated separately from the main burner(s).

2.28.6 Flue gases shall not issue from the relief opening(s) of a draft hood when the appliance is connected to a vent of the minimum specified height and maximum specified horizontal length.

* The pitot tube shall be of a recognized standard type or one calibrated by comparison with standard type under conditions of air and flue gas flow comparable to those prevailing under draft conditions specified herein.

Method of Test

a. Free Standing Appliances.

For the purpose of this test, uninsulated vent pipe the same size as the outlet of the draft hood shall be used. Elbows shall be 90 degrees (1.57 rad), four piece, sheet-metal elbows. The vent pipe shall have a reasonably smooth inner contour. At the discretion of the testing agency, Type B vent may be used if the design of the appliance and the manufacturer's installation instructions so indicate.

When the flue gases are vented horizontally, the maximum horizontal distance specified by the manufacturer, an elbow and a sufficient length of vertical vent pipe shall be attached to provide the minimum height specified by the manufacturer measured from the highest point of the flue gas outlet to the top of the vertical vent pipe, or 12 ft (3.66 m) above the floor, whichever is less.

When the flue gases are vented vertically, an elbow, a maximum specified section of vent pipe extending horizontally, a second elbow and sufficient vertical vent pipe shall be attached to the flue gas outlet to provide the minimum height specified by the manufacturer measured from the flue gas outlet to the top of the vertical vent pipe, or 12 ft (3.66 m) above the floor, whichever is less.

The horizontal run of vent pipe shall be pitched upward $\frac{1}{4}$ in to the foot (21 mm to the meter).

The appliance shall be operated for 15 minutes at normal inlet test pressure. A fuming or smoking material shall be introduced ahead of the relief opening(s) so as to form a dense smoke. A beam of light shall be directed across the relief opening(s). This provision shall be deemed met when no smoke can be observed escaping from the relief opening(s).

b. Attached or Recessed Appliances.

The test specified in "-a" above shall be conducted with the appliance installed in the test structure as specified in 2.1.7 and using the type of vent specified in the manufacturer's installation instructions.

2.29 Draft Tests For Appliances Not Equipped With Draft Hoods

The construction of an appliance operating under forced or induced draft shall be such that its performance is not impaired by chimney drafts or chimney stoppage. This provision shall be deemed met when the appliance complies with the conditions specified in 2.29.1 and 2.29.2.

When use with one gas is desired, these tests shall be conducted with the appropriate gas as specified in 2.2, Test Gases.

When use with more than one gas is desired, and the appliance input ratings are not identical for the different gases, these tests shall be conducted at the specified input ratings for the individual gases. The number of tests conducted shall be at the discretion of the testing agency.

When use with more than one gas is desired, and the appliance input rating is identical for the various gases, these tests shall be conducted with Test Gas E.

2.29.1

With the flue outlet blocked to any degree up to and including complete closure, the concentration of carbon monoxide in a sample of the flue gases shall not exceed 40 ppm, or if the sample is over 40 ppm,

0.06 percent in an air-free sample when the appliance is tested in an atmosphere having a normal oxygen supply. Should outage occur, raw gas shall not be forced into the combustion chamber on reopening the flue outlet.

Method of Test

The appliance shall be operated for at least 45 minutes at normal inlet test pressure. When the appliance incorporates a control to automatically shut off the main gas supply under blocked flue conditions, the area of the flue outlet shall be gradually decreased to the lowest point at which the control will remain in its open position. A sample of the flue gases shall then be secured and analyzed as specified in 2.4.2.

In the event of outage, the blocked condition shall be maintained for 3 minutes to allow for operation of safety devices, and then removed and observation made.

2.29.2

The appliance shall comply with 2.28.6.

Method of Test

The Method of Test specified in 2.28.6 shall apply except that the straight length of vent pipe shall be attached directly to the flue outlet and the updraft shall be imposed at the flue outlet of the appliance.

2.30 Vent Safety Shutoff Systems

This test applies only to appliances equipped with draft hoods.

When tested as outlined in the following Method of Test, main burner gas to the appliance shall shut off if the appliance is called upon to operate when the vent to which it is connected is totally blocked. On appliances having a recessed draft relief system, main burner gas to the appliance shall also shut off if the appliance is not connected to a vent.

Method of Test

These tests shall be conducted at normal inlet test pressure and input rating. Tests Condition B shall also be conducted at minimum input rate, if applicable.

When use with one gas is specified, these tests shall be conducted with the appropriate gas as specified in section 2.2, Test Gases.

When use with more than one gas is specified, and the appliance input rates are not identical for different gases, these tests shall be conducted at the specified input rates for the individual gases. The number of tests conducted shall be at the discretion of the testing agency.

When use with more than one gas is specified, and the appliance input rate is identical for the various gases, these tests shall be conducted in accordance with the following:

- a. If the gases specified by the manufacturer include natural gas, use Test Gas A;
- b. If the gases specified by the manufacturer do not include natural gas but include liquefied petroleum gases, use Test Gas E; and
- c. If the gases specified by the manufacturer include neither natural gases nor liquefied petroleum gases, the test gas used shall be at the discretion of the testing agency.

Test Condition A

This test shall be conducted with the appliance installed at the manufacturer's specified minimum clearances. Appliances having a recessed draft relief system (see Part IV, Definitions) shall comply with this provision when installed in an enclosure having the minimum dimensions specified in the manufacturer's installation instructions (see 2.1.6) and with trim panels in place. If trim panels incorporate relief openings, this condition shall be repeated with all panel variations. If the appliance incorporates a circulating air blower (either standard or optional), the appliance shall comply with this provision with the blower off and with the blower operating at maximum speed.

The pilot and main burner(s) shall be operated for a sufficient period of time at normal input rate and maximum outlet air temperature (limit control shut off) to determine that the appliance shall operate continuously using the applicable vent pipe configurations specified in 2.28, Draft Hoods.

Test Condition B

This test shall be conducted with the appliance installed in a draft-free open room, using the applicable vent pipe configurations specified in 2.28, Draft Hoods. Appliances having a recessed draft relief system (see Part IV, Definitions) shall comply with this provision when installed in a draft-free open room, outside the enclosure and with trim panels in place. If trim panels incorporate relief openings, this condition shall be repeated with all panel variations. If the appliance incorporates a circulating air blower (either standard or optional), the appliance shall comply with this provision with the blower off and with the blower operating at maximum speed unless the blower is incapable of operating at the minimum burner input rate.

With the appliance adjusted as specified in Test Condition A, it shall be operated until equilibrium conditions are attained. The outlet of the vent pipe shall be totally blocked and the time for the gas to the main burner(s) to be shut off by the blocked vent shut-off system shall not exceed 10 minutes. The appliance shall also comply with this provision when operated at minimum input rate, but the time to shut off the gas to the main burner(s) shall not exceed the time as calculated by the following formula or 30 minutes, whichever is less:

$$T_m = -\frac{1}{N} \cdot \ln \left[1 - \frac{R}{R_m} \cdot (1 - e^{-NT}) \right]$$

where:

- T_m = Maximum shutdown time at minimum input rate, hours [or 0.5 hr. (30 minutes) whichever is less]
- N = Number of room air changes per hour (0.35 tight house)
- R = Manufacturer's specified maximum input rate, Btu/hr
- e = Napierian logarithmic base (2.7183)
- T = Maximum shutdown time at maximum input rate, hours (0.167 hr = 10 minutes)
- R_m = Manufacturer's specified minimum input rate, Btu/hr

Test Condition C

This test shall be conducted on recessed appliances having a recessed draft relief system, with the appliance installed in a draft-free open room, outside the enclosure and with trim panels in place. If trim panels incorporate relief openings, this condition shall be repeated with all panel variations. If the appliance incorporates a circulating air blower (either standard or optional), the appliance shall comply with this provision with blower off and with the blower operating at maximum speed.

The pilot and main burner(s) shall be placed in operation from a cold start (room temperature) at normal input rate with no vent pipe connected to the draft hood outlet. The vent safety shutoff system shall cause the gas to the main burner(s) to be shut off before main burner operation has exceeded 10 minutes.

A recessed appliance which cannot be placed in operation without a vent pipe connected to the draft hood outlet shall be deemed to comply with this test condition.

2.31 Wind Tests (Side Wall Termination)

This section covers tests to be applied to gravity direct vented and power vented (including direct vented) appliances, intended to be vented through sidewalls. Tests shall be conducted with the various configurations specified in the manufacturer's installation instructions (see 1.34.1-b20) at the discretion of the testing laboratory. Unless otherwise specified, testing shall be conducted at normal test pressure, at the manufacturer's specified normal maximum input rating and minimum input rating (if applicable).

2.31.1

For gravity direct vent, side wall vented appliances, the gas at the pilot burner(s) and main burner(s) shall be capable of being ignited when the vent/air intake terminal is exposed to a wind having a nominal velocity of 2.5, 5, 10 and 40 mph (4 km/h, 8 km/h, 16 km/h and 64 km/h).

Pilot flame(s) shall ignite and remain stable without flashback or lift and any flame supervision device shall continue to function normally. The pilot(s) and main burner(s) shall not become extinguished, and the gas from the main burner(s) shall ignite from the pilot(s) without excessive delay. Ignition of the main burner(s) shall be smooth and flame shall carry over to all ports or jets.

Method of Test

- a. The test shall be conducted at normal test pressure and the vent configurations used for the test shall be set up in accordance with the manufacturer's instructions to provide for:
 1. The least resistance to the egress of combustion products; and
 2. The highest resistance to egress of combustion products.
- b. The appliance shall be installed in the test wall structure as specified in 2.1, General. Deflector walls shall be installed against the test wall structure in order that the wind from the wind apparatus will not affect that section of the appliance normally located within the room.

Wind directions from the wind apparatus shall include:

1. 90 degrees to the test wall surface;
2. 45 degrees to the test wall surface in both vertical and horizontal planes; and
3. Parallel to the test wall in vertical up, vertical down, and one horizontal direction.

Where the manufacturer's installation instructions permit the terminal center line to be closer than 3 ft (914.4 mm) to an overhang, an external corner, or an inside corner, each such configuration (see 1.34.1-b22) shall be simulated and tested in addition to the above tests for a plain wall.

A draft produced by a blower having sufficient capacity to develop a 0.01 and 0.04 in wc (2.5 and 10 Pa) static pressure (nominal 5 and 10 mph (2.24 m/s and 4.47 m/s) wind velocity) shall be directed against the outside surface of the test structure on which the vent-air intake terminal is attached. The blower shall be located so that the wind is directed perpendicular to the surface of the wall structure. Static pressure shall be measured by means of static pressure taps encompassing the area of the vent terminal. The static pressure at these points shall indicate uniform pressure distribution. At the discretion of the testing agency, additional tests shall be conducted with the same fan setting as determined above, with the draft directed from the wind directions above.

With the appliance subjected to the above wind conditions, the gas at the pilot(s) and main burner(s) shall be capable of being ignited.

2.31.2

The main burner(s) and pilot(s) shall not become extinguished, and the gas at the main burner(s) shall ignite from the pilot(s) without excessive delay, when the vent/air intake terminal is exposed to a wind having a nominal velocity of 2.5, 5, 10, 20 and 40 mph (4 km/h, 8 km/h, 16 km/h, 32 km/h and 64 km/h).

Method of Test

The test shall be conducted at normal test pressure and with the vent configurations specified in 2.33.1.

The test method as specified in 2.33.1 shall be applied except the blower shall be capable of producing a static pressure on the surface of the test wall of 0.01, 0.04, 0.16 and 0.66 in wc (2.5, 10, 41 and 164 Pa), and the pilot(s) shall be ignited before the appliance is subjected to the wind. While operating under the above wind conditions, the pilot(s) and main burner(s) when operating simultaneously, shall not become extinguished during a 1 minute period. The most critical wind test condition as deemed by the testing agency shall be repeated for a period of 10 minutes.

The main burner valve shall then be shut off. After a period of at least 30 seconds the main burner valve shall be turned on and the main burner gas shall ignite from the pilot without excessive delay. An automatically controlled appliance shall also comply with this test when the burner(s) is turned on and off by the automatic controls.

2.31.3

For power vented, sidewall vented appliances the gas at the pilot burner(s) shall be capable of being ignited when the vent/air intake terminal is exposed to a wind having a nominal velocity of 10 mph (16 km/h). Pilot flame(s) shall ignite and remain stable without flashback or lift and any flame supervision device shall continue to function normally.

Method of Test

The test shall be conducted at normal test pressure and at both the minimum and maximum vent lengths as specified by the manufacturer's installation instructions.

The test method as specified in 2.31.1 shall be applied.

With the appliance subjected to the above wind conditions, the gas at the pilot(s) shall be capable of being ignited.

2.31.4

For power vented appliances, the pilot(s) and main burner(s) shall not become extinguished, and the gas from the main burner(s) shall ignite from the pilot(s) without excessive delay, and the intermittent and interrupted ignition systems shall ignite when the vent/air intake terminal is exposed to a wind having a nominal velocity of 31 mph (50 km/h). Ignition of the main burner(s) shall be smooth and flame shall carry over to all ports or jets.

Method of Test

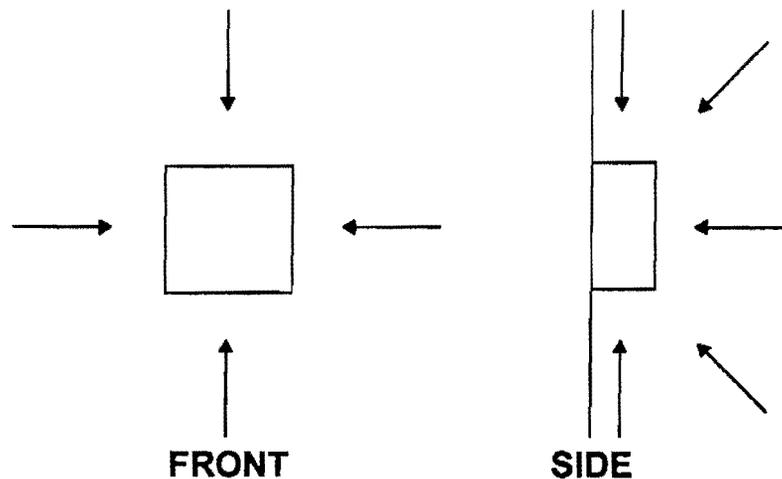
- a. The manually ignited pilot(s), if provided, shall be ignited before the appliance is subjected to the wind. While operating under the above wind conditions, the pilot(s) when operating alone, and the pilot(s) and main burner(s) when operating simultaneously, shall not become extinguished during a 10 minute period. Burner operation with the main burner(s) ignited shall be stable and shall not exhibit any lifting, floating, flashback or flue reversal.

The main burner valve shall then be shut off. After a period of at least 30 seconds, the main burner valve shall be turned on. An intermittent or interrupted ignition system, if provided, shall ignite, and the main burner gas shall ignite from the automatic ignition device(s) without excessive delay. An automatically controlled appliance shall also comply with this test when the burner(s) is turned on and off by the automatic controls.

- b. For wind directed perpendicularly to the wall, the following test method shall apply.

The test method specified in 2.31.4a shall be applied at the maximum vent length specified.

DIAGRAM



2.32 Wind Test (Vertical Termination)

This section covers tests to be applied to gravity direct vented and power vented (including direct vented) appliances intended to be vented through roofs. Tests shall be conducted with the various configurations specified in the manufacturer's installation instructions (see 1.34.1-b19) at the discretion of the testing laboratory. Unless otherwise specified, testing shall be conducted at normal test pressure, at the manufacturer's specified normal maximum input rating and minimum input rating (if applicable).

The test shall be conducted at the minimum vent length as specified by the manufacturer's installation instructions.

The appliance is to be installed as shown in Figure 23, Test Roof with Terminal Located. Wind directions from the wind apparatus shall include the following orientations:

- a. Forty-five degrees above horizontal, at the horizontal and 45 degrees below the horizontal, with the wind directed at a point centered between the air intake ports and exhaust ports; and
- b. Where the face of the vent/air intake terminal exposed to the wind varies when rotated around its vertical axis through 360 degrees, each face shall be rotated to be exposed directly to the above wind conditions.

2.32.1

For gravity vented direct vent appliances, intended to terminate vertically, the gas at the pilot burner(s) and main burner(s) shall be capable of being ignited when the vent/air intake terminal is exposed to a wind having a nominal velocity of 2.5, 5, 10 and 40 mph (4 km/h, 8 km/h, 16 km/h and 64 km/h).

Pilot flame(s) shall ignite and remain stable without flashback or lift, and any flame supervision device shall continue to function normally. The pilot(s) and main burner(s) shall not become extinguished and the gas from the main burner(s) shall ignite from the pilot(s) without excessive delay. Ignition of the main burner(s) shall be smooth and flame shall carry over to all ports or jets.

Method of Test

Using the blower as specified in 2.31.1 the appliance shall be subjected to the above wind conditions and the gas at the pilot(s) and main burner(s) shall be capable of being ignited.

Burner operation with the main burner(s) ignited shall be stable during a 1-minute period and shall not exhibit any lifting, floating, flashback or flue reversal at any of the above wind speeds and directions. The most critical wind condition as deemed by the testing agency shall be repeated for a period of 10 minutes.

The main burner valve shall then be shut off. After a period of at least 30 seconds the main burner valve shall be turned on and the burner gas shall ignite from the pilot without excessive delay. An intermittent or interrupted ignition system, if provided, shall ignite, and the main burner gas shall ignite from the automatic ignition device(s) without excessive delay. An automatically controlled appliance shall also comply with this test when the burner(s) is turned on and off by the automatic controls.

2.32.2

For power vented appliances, intended to terminate vertically, the gas at the pilot burner(s) shall be capable of being ignited when the vent/air intake terminal is exposed to a wind having a nominal velocity of 10 mph (16 km/h). Pilot flame(s) shall ignite and remain stable without flashback or lift and any flame supervision device shall continue to function normally.

Method of Test

Using the blower as specified in 2.31.1 the appliance shall be subjected to the above wind conditions and the gas at the pilot(s) shall be capable of being ignited.

2.32.3

For power vented appliances intended to terminate vertically, the pilot(s) and main burner(s) shall not become extinguished, and the gas from the main burner(s) shall ignite from the pilot(s) without excessive delay, and intermittent and interrupted ignition systems shall ignite when the vent/air intake terminal is exposed to a wind having a nominal velocity of 31 mph (50 km/h). Ignition of the main burner(s) shall be smooth and flame shall carry over to all ports or jets.

Method of Test

The manually ignited pilot(s), if provided, shall be ignited before the appliance is subjected to the wind. While operating under the above wind conditions, the pilot(s) when operating alone, and the pilot(s) and main burner(s) when operating simultaneously, shall not become extinguished during a 10 minutes period. Burner operation with the main burner(s) ignited shall be stable and shall not exhibit any lifting, floating, flashback or flue reversal.

The main burner valve shall then be shut off. After a period of at least 30 seconds, the main burner valve shall be turned on. An intermittent or interrupted ignition system, if provided, shall ignite, and the main burner gas shall ignite from the automatic ignition device(s) without excessive delay. An automatically controlled appliance shall also comply with this test when the burner(s) is turned on and off by the automatic controls.

2.33 Vent And Vent/Air Intake Terminal Assemblies

2.33.1

A vent/air intake terminal assemblies shall be sufficiently rigid in construction and supported so that it will withstand a load of 150 lb (68.1 kg) without extensive damage or alteration of its position with respect to the appliance. Following application of this load, the appliance shall comply with the combustion test specified in the Method of Test.

Method of Test

A vertical suspension load of 150 lb (68.1 kg) shall be evenly distributed, without impact, over the vent/air intake terminal.

The load shall then be removed and shall not have caused substantial distortion of any part of the vent/air intake terminal or alteration of its position relative to the appliance so that the appliance would not operate satisfactorily.

The appliance shall then be operated at normal test pressure until equilibrium conditions are attained, at which time a sample of the flue gases shall then be secured and analyzed as outlined in 2.4.1. The concentration of carbon monoxide based on an air-free sample, shall not exceed 0.04 percent.

2.33.2

The vent/air intake terminal for horizontal installations shall be sufficiently rigid in construction so as not to become damaged to the extent that it would be unsafe for use when subjected to impact in accordance with the following Method of Test. Following impact of the vent/air intake terminal, the appliance shall comply with the combustion test outlined in the Method of Test.

Method of Test

The impact shall be produced by a pendulum consisting of a cloth bag filled with sand to a weight of 25 lb (11.3 kg) suspended from a steel cable or rope. The bag shall be formed from a flat section of burlap, canvas or suitable material. A suitable plastic liner may be used to prevent sand loss. All sides and corners of the cloth shall be drawn up as tightly as possible around the sand and the excess material tied as close as possible at the top of the bag. The bag shall have an at-rest position not more than 1 in (25.4 mm) from the edge of the bag to the nearest edge of the vent/air intake terminal. The point of impact shall be opposite the center of gravity of the bag. The distance of swing [angle 45 degrees (0.79 rad)] shall be measured as the angle [see Figure 10, Arrangement of Sandbag and Vent Terminal for Impact Test, Side Views A and B) between the pendulum arm with the bag at its at-rest position and the pendulum arm at its elevated position. The length of the pendulum is that distance measured from the point of rotation to the center of gravity of the bag.

On a horizontal vent/air intake terminal, one impact shall be made at each of the following points, as shown in Figure 13, Impact Test for Vent/Air Intake Piping:

- a. The center of the vertical front surface of the vent/air intake terminal;
- b. The leading edge on the left side of the vent/air intake terminal, pendulum rotated left, at an angle of 45 degrees (0.79 rad) from the point described in "-a;" and
- c. The leading edge on the right side of the vent/air intake terminal, pendulum rotated right, at an angle of 45 degrees (0.79 rad) from the point described in "-a."

Following each impact, the appliance shall be operated at normal inlet test pressure until equilibrium conditions are attained at which time a sample of the flue gases shall then be secured and analyzed as specified in 2.4.1. In each case, the concentration of carbon monoxide, based on an air-free sample of the flue gases, shall not exceed 0.04 percent.

At the option of the manufacturer, the vent or vent/air intake terminal may be replaced following each impact and combustion test.

2.33.3

Vent/air intake terminals shall be constructed so that no water will accumulate in the appliance when subjected to a simulated rainstorm and insulation utilized in the vent system shall remain dry.

Method of Test

The vent or vent/air intake terminal shall be secured to a suitable watertight container and placed on the test platform of the rain test apparatus described in Figure 11, Arrangement of Spray Heads and Associated Piping for Simulated Rainstorm Test and Figure 12, Spray Head Assembly and Details of Construction in the position with respect to the showerheads deemed most critical by the testing agency.

The rain test apparatus shall then be placed in operation and each spray head adjusted by means of the control valve to operate at 5 psi (34.5 kPa). The spray head unit shall be adjusted to varying elevations and horizontal distances from the test platform to determine the most critical location. The exposure at the position deemed most critical by the testing agency shall be maintained throughout the test.

After adjustment of the spray head unit, the rain test apparatus shall be operated for a period of 30 minutes.

The above test procedure shall be repeated with the terminal located in any other position(s) with respect to the shower heads deemed necessary by the testing agency.

In vent systems having insulated vent pipes, the insulation shall be deemed to have met the requirement of remaining dry, if after the test the weight of the first 12 in (25.4 mm) of insulation nearest the terminal does not absorb more than 1 oz (28.3 gm) of water.

2.33.4

Puncture Test for Venting System

Direct vent gas fireplace heaters shall have their Vent System resist Puncture under the following Method of Test.

Method of Test

The test apparatus similar to that illustrated in Figure 14, Puncture Test for Vent System, shall be utilized to provide for a free fall of a plunger onto the surface of a sample of the Vent System.

The plunger is to consist of a $\frac{3}{8}$ in (9.5 mm) diameter steel rod having a steel head, $\frac{9}{16}$ inch (14.3 mm) diameter, attached to the impact end. The length of the plunger assembly is to be sufficient to provide a mass of 2 lb (0.9 kg.). The surfaces of the rod and head are to be smooth. The impact end of the rod is to be formed as shown in Figure 14, Puncture Test for Vent System.

Guides arranged to allow for a practically frictionless fall of the plunger are to be provided. A means for measuring the height of fall is to be provided.

Pieces, 24 in (600 mm) long, are to be taken from duct sections that have been subjected to the temperature tests in 2.33.5, and identical samples from duct sections that have not been subjected to the temperature tests. The samples are to be provided with a firm support below and throughout their length and width. At least three areas of each sample are to receive the impact of the plunger at the impact points shown in Figure 14, Puncture Test for Vent Systems.

To conform to the requirements for resistance to puncture, the samples are to prevent the complete penetration of the wall of the sample of the plunger head falling through a distance of 20 in (508 mm) as measured to the top surface of the sample.

2.33.5

Temperature Test for Vent System

- a. Materials for ducts and connectors, including any tapes, fabrics, cements, or other materials to be used in assembly during installation, shall be resistant to the effects of the temperatures to which they are exposed in the following tests.
- b. Three samples, of 8 in (200 mm) length, representing typical wall areas of the assembled product are to be prepared. Each sample is to include joining materials employed in the installation of the vent system.
- c. The samples are to be placed in a closed vessel in which an atmosphere saturated with water vapor is maintained at room temperature for a period of 48 hours. The samples are then to be removed and immediately placed in a refrigerated compartment and maintained at a temperature of 18°F (-8°C) for a period of 24 hours.
- d. The samples are then to be examined visually for indications of deterioration in wall structure, exterior casing or interior linings. Structural material is not to become deformed or show delamination; tapes, casings and lining are to remain securely in place; and joints are not to open up or show evidence of separation.

- e. Also to conform to the requirements of 2.33.5-a, the exterior and interior surfaces of samples of duct sections and connectors are to be simultaneously exposed to air maintained at not less than 126°F (52°C) on the exterior and not less than 266°F (130°C) on the interior. Any practical arrangement using samples of duct sections or duct connectors may be employed. The test arrangement is to provide means for maintaining air at the specified test temperatures in moving contact with the two surfaces of the test samples.
- f. At least two representative samples are to be selected and prepared for this test. If the product is of uniform grade, thickness, and cross section, such as square or round, the samples are to be selected from the smaller sizes. Square or round sections, varying in grade and thickness with size, may also require samples in other size ranges. Rectangular sections are to be selected on the basis of grade, thickness, and size. In selecting samples of duct sections shapes which will be most vulnerable to damage under the conditions of the puncture test are to be chosen. (See 2.33.4.)
- g. Each sample is to be 36 in (900 mm) long and is to be made up from two sections of duct, providing for a joint between sections located 24 in (600 mm) from one end or a single piece of connector. At least one end of each sample is to be attached to a metal collar in accordance with the manufacturer's instructions.
- h. The conditions of test are to be maintained for a period of 60 days. The samples are then to be examined visually for indications of deterioration in wall structure, exterior casings or interior linings, tapes, fabrics, cements, etc. Structural material is not to become deformed or show delamination; tapes, casings, and linings are to remain securely in place; and joints are not to open up or show evidence of separation.

2.33.6

Impact Test for Vent System

Sections of the Venting System shall resist damage as a result of the impact created in the following Method of Test.

Method of Test

Test samples, 8 ft (2400 mm) long, are to be made up to provide for a circumferential joint at the center of the sample. In making up a sample of flexible duct, the material is to be extended to its normal length. If the joint is reinforced to the extent that the section may be less vulnerable to the test than a section without the joint, additional samples of sections without the joint are to be tested; except that if the longest section obtainable from the material under test is less than 8 ft (2400 mm), additional pieces may be joined thereto to provide a sample 8 ft (2400 mm) long, in which case the longest piece is to be in the middle of the test section. Any adhesives or cements are to be allowed to cure for a period of at least 24 hours. Samples are not to be exposed to relative humidity greater than 70 percent during the 24 hour period prior to the test.

The sample is to be placed upon a firm, flat surface, such as a concrete floor, for the test. (See Figure 15, Impact Test for Vent System).

The impact is to be that of a canvas bag containing sand and having a mass of 20 lb (9 kg.). The bag is to be formed of 8 oz (225 g) duck, drawn tightly around the sand and tied with a cord. The bag is to be raised above the top of the duct and allowed a free fall of 10 in (254 mm) so as to strike the top of the duct on its longitudinal axis.

An impact is to be made at the longitudinal center of the test sample and another at a point halfway between the center and one end of the test sample.

Following the above test, the inner and outer surfaces of the sample shall not be ruptured, broken, torn, ripped, collapsed, or separated; joints and seams shall remain intact and not be fractured; and there shall be no evidence of other damage to the sample which would cause it to be unusable. Collapse is defined as any reduction in either external or internal cross-sectional area in excess of 20 percent.

2.33.7

Impact Test for Vent/Air Intake Piping

The vent/air intake piping shall be sufficiently rigid in construction so as not to open up, break apart, nor become damaged to the extent that it would be unsafe for use when subjected to impact in accordance with the following Method of Test. Following impact of the vent/air intake piping, the appliance shall comply with the combustion test outlined in the Method of Test.

Method of Test

The impact shall be produced by a pendulum consisting of a cloth bag filled with sand to a weight of 20 lb (9.1 kg) suspended from a steel cable or rope. The bag shall be formed from a flat section of burlap, canvas or suitable material. A suitable plastic liner may be used to prevent sand loss. All sides and corners of the cloth shall be drawn up as tightly as possible around the sand and the excess material tied as close as possible at the top of the bag. The bag shall have an at-rest position not more than one inch measured from the edge of the bag to the nearest edge of the vent-air intake piping. The point of impact shall be opposite and on the same horizontal plane as the center of gravity of the bag at rest. The distance of swing is to be that required to raise the center of gravity of the bag to an elevation of 9 in (229 mm) above the center of gravity of the bag at its resting position. (See Figure 13, Impact Test for Vent/Air Intake Piping.)

The three impacts are to be made successively at the following points:

- a. At the level of a joint;
- b. At the level halfway above the first joint tested and the next joint; and
- c. At the same level as in "-b," and rotated around the axis of the chimney by 90 degrees from the impact of "-b."

Following each impact, the appliance shall be operated at normal test pressure until equilibrium conditions are attained at which time a sample of the flue gases shall then be secured and analyzed as outlined in 2.4.1. In each case, the concentration of carbon monoxide based on an air-free sample, shall not exceed 0.04 percent.

If the vent and air intake piping are not coaxial, the impact shall be repeated on both the vent and air inlet pipe.

At the option of the manufacturer, the vent or the vent-air intake piping may be replaced following each impact and combustion test.

2.33.8

Pull Test for Vent/Air Intake Systems

Sections of the venting system and vent terminal assembly shall not break, disassemble, or become damaged to the extent that they are unacceptable for further use when subject to the following Method of Test.

Method of Test

Representative vent pipe samples and vent terminal assemblies of two or more companion parts are to be joined together in accordance with the manufacturer's installation instructions. If cemented joints are included in an assembly, the cement is to be allowed to dry for 24 hours before the test is conducted. Three representative assemblies are to be tested for each vent size.

A longitudinal force is to be applied to each vent and vent terminal assembly. The force is to be exerted on each assembly in a direction tending to pull the assembly apart. A longitudinal force of 100 lb (445 N) is to be applied to the vent gas conduit and then, if provided, to the air inlet piping. The force is to be sustained for 5 minutes.

After each test, the vent assembly shall be examined for any breakage, disassemble, or damage.

2.33.9

Load Test for Vent/Air Intake Elbows

A support for an elbow shall not break, disassemble, or become damaged to the extent that it would be unacceptable for further use when subjected to a load equivalent to four times the weight of the longest venting system section between adjacent supports, but not less than 10 pounds-mass (4.5 kg), when the venting system is assembled and supported as described in the installation instructions.

Method of Test

Representative elbows are to be tested using an elbow vent and, if provided, air intake section having the greatest angle from the vertical specified by the manufacturer and installed directly on the vent and air intake section as illustrated by Figure 19, Load Test for Vent Elbows. A vertical load, equivalent to four times the weight of the longest supported section of the system that is intended to be attached to the elbow, or a load of 10 pounds-mass (4.5 kg), whichever is greater, is to be applied through the center of gravity of the section. The load is to be sustained for 5 minutes.

2.33.10

Vent/Air Intake Joint Load Test

A joint of a vent offset shall not loosen, break, or disassemble when subjected to a load equivalent to four times the weight of the maximum length between the supports applied as described below, but not less than 10 pounds-mass (4.5 kg).

Method of Test

The maximum inclined length of vent, and if provided, air intake pipe between supports is to be assembled and installed on supports as shown by Figure 20, Vent Joint Load Test. A vertical load, equal to four times the weight of the length between supports, or 10 pounds-mass (4.5 kg), whichever is greater, is to be applied at the joint located centrally between the supports. The load is to be sustained for 5 minutes.

2.33.11

Vertical Support Load

An assembly intended to support a vertical venting system shall not be damaged, nor shall the security of its attachment to the building structure be impaired when tested as described below.