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Group**

**CSA/ANSI Z21.1-2018 • CSA 1.1-2018**  
**National Standard of Canada**



# Household cooking gas appliances



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# Contents

Interprovincial Gas Advisory Council (IGAC)	4
Canadian Technical Committee on Gas Appliances and Related Accessories	6
Z21/83 Technical Committee on Performance and Installation of Gas Burning Appliances and Related Accessories	9
Z21/CSA Joint Technical Subcommittee on Standards for Domestic Gas Ranges	12
Preface	15
<b>1 Scope</b>	20
<b>2 Reference publications</b>	22
<b>3 Definitions</b>	25
<b>4 Construction</b>	37
4.1 General construction and assembly	37
4.2 Appliance structure	42
4.3 Bases, legs, casters, and frames	43
4.4 Glass/ceramic panels	44
4.4.1 Electrical enclosures	44
4.4.2 Oven doors	45
4.4.3 Top surface cooking sections	45
4.5 Stability tests	46
4.6 Gas supply lines	48
4.7 Manual valves and other energy controlling devices	51
4.8 Gas appliance pressure regulators	55
4.9 Automatic valves	56
4.10 Thermostats	57
4.11 Orifices and orifice fittings	58
4.12 Main burner and pilot input ratings	58
4.13 Burners	59
4.14 Top surface cooking section burner lighters	61
4.15 Automatic gas ignition systems	62
4.16 Pilot gas filters	64
4.17 Top surface sections, surface cooking section covers, and utensil supports	65
4.18 Drip trays	65
4.19 Oven and broiler linings and oven bottoms	66
4.20 Oven racks, rack supports and broiler pans	66
4.21 Thermal insulation	68
4.22 Venting and combustion air supply	68
4.23 Fan and limit controls	69
4.24 Flue collars	69
4.25 Flue deflectors	70
4.26 Electrical equipment and wiring	70

4.27	Electronic controls	82
4.28	Instructions	86
4.29	Marking	97
4.30	Flammability	105

**5 Performance 108**

5.1	General	108
5.2	Test gases	113
5.3	Test pressures and burner adjustments	114
5.4	Combustion*	115
5.5	Burner and pilot operating characteristics	121
5.6	Top surface cooking section burner lighters	127
5.7	Ignition systems	130
5.8	Piloted ignition systems	136
5.9	Direct ignition systems	139
5.10	Proved igniter systems	142
5.11	Manual gas valves	144
5.12	Gas appliance pressure regulators	145
5.13	Automatic valves	145
5.14	Broiler temperature	145
5.15	Broiler operation	145
5.16	Evaluation of clothing ignition potential	146
5.17	Evaluation of burn hazard potential of exterior surfaces	150
5.18	Temperatures of handles, knobs, and touchpads	155
5.19	Wall, floor, and enclosure temperatures	156
5.20	Abnormal operation stalled-fan test	161
5.21	Flue gas temperature	162
5.22	Draft hoods	162
5.23	Exhaust hood outlet air temperature	164
5.24	Oven flue discharge temperatures	164
5.25	Performance of appliances provided with pyrolytic self-cleaning oven or self-cleaning broiler features	165
5.26	Performance of an appliance incorporating a microwave cooking section	172
5.27	Marking material adhesion and legibility	172
5.28	Safety circuit analysis	173
5.29	Performance of appliances intended to be utilized with ventilation systems that direct air in a downward direction	174
5.30	Sponge washing test	174
5.31	Nichrome wire test	177

**6 Manufacturing and production tests 181**


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Annex A (normative) — Items unique to Canada	183
Annex B (normative) — (Optional) Provisions for listed gas appliance conversion kits	191
Annex C (informative) — Pertinent references to ANSI Y14.15	194
Annex D (informative) — Wire color designations	195
Annex E (informative) — Recommended wire color usage	196

Annex F (informative) — Preferred graphic symbols of commonly used items, extracted from standard  
ANSI/IEEE 315, Graphic symbols for electrical and electronics diagrams, and  
abbreviations for these items 197

Annex G (informative) — Table of conversion factors 199

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<b>T. Martelle</b>	Solaronics Inc., Rochester, Michigan, USA	<i>Non-voting</i>
<b>P. McConnell</b>	Dometic Corporation, LaGrange, Indiana, USA	
<b>R. Myers</b>	Channel Products, Inc., Chesterland, Ohio, USA	
<b>J. Nanni</b>	Consumers Union, Yonkers, New York, USA	
<b>R. Noles</b>	Viking Range LLC, Greenwood, Mississippi, USA	<i>Non-voting</i>
<b>M. Pablo</b>	Orkli, S. Coop, Ordizia-Gipuzkoa, Spain	
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<b>C. Pieper</b>	Alto-Shaam Inc., Menomonee Falls, Wisconsin, USA	<i>Alternate</i>
<b>W.M. Pryor</b>	Electrolux Home Products Inc., Springfield, Tennessee, USA	
<b>M. Sanz</b>	Enbridge Gas Distribution, Toronto, Ontario, Canada	
<b>T.A. Smith</b>	Brown Stove Works, Inc., Cleveland, Tennessee, USA	
<b>F.A. Stanonik</b>	Air-Conditioning, Heating, and Refrigeration Institute, Arlington, Virginia, USA	<i>Alternate</i>
<b>C. Suchovsky</b>	Gas Consultants, Inc., Walton Hills, Ohio, USA	
<b>M.B. Williams</b>	Association of Home Appliance Manufacturers (AHAM), Washington, DC, USA	<i>Alternate</i>
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# Preface

This is the second edition of CSA/ANSI Z21.1 • CSA 1.1, *Household cooking gas appliances*. It supersedes the previous edition published in 2016.

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

This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

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

**Notes:**

- 1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
- 2) *This Standard contains SI (Metric) corresponding to the yard/pound quantities, the purpose being to allow the standard to be used in SI (Metric) units. (IEEE/ASTM SI 10, American National Standard for Metric Practice, or ISO 80000-1:2009, Quantities and units — Part 1: General, are used as a guide in making metric conversion from yard/pound quantities.) If a value for a measurement and a corresponding value in other units are stated, the first stated value is to be regarded as the requirement. The given corresponding value may be approximate. If a value for a measurement and a corresponding value in other units are both specified as a quoted marking requirement, the first stated unit, or both shall be provided.*
- 3) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
- 4) *This Standard was developed by consensus, which is defined by CSA Policy governing standardization — Code of good practice for standardization as “substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity.” It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
- 5) *This Standard is subject to review at least every five years; suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to [inquiries@csagroup.org](mailto:inquiries@csagroup.org) and include “Proposal for change” in the subject line:
  - a) Standard designation (number)
  - b) relevant clause, table, and/or figure number;
  - c) wording of the proposed change; and
  - d) rationale for the change.*
- 6) *To submit a request for interpretation of this Standard, please send the following information to [inquiries@csagroup.org](mailto:inquiries@csagroup.org) and include “Request for interpretation” in the subject line:
  - a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;
  - b) provide an explanation of circumstances surrounding the actual field condition; and*

- c) where possible, phrase the request in such a way that a specific “yes” or “no” answer will address the issue.

*Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are available on the Current Standards Activities page at [standardsactivities.csa.ca](http://standardsactivities.csa.ca).*

## History of the development of the Standard for Household cooking gas appliances

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

The first definite step toward the preparation of gas range specifications appears to have been taken by The Philadelphia Gas Works Company in 1903, after several years' observation had indicated the desirability of preparing general specifications, which would enable manufacturers to build their ranges to meet certain specific requirements.

In Volume 4 of the 1909 Proceedings of the American Gas Institute there is a report of the Committee on Utilization of Gas Appliances, which includes the specifications in use by two large purchasers of gas ranges. In the 1912 proceedings: (1) specifications for gas ranges were submitted for approval which had been prepared jointly by the Committee of the American Gas Institute and a similar Committee of the National Commercial Gas Association, and (2) recommendation was made that a standing committee be appointed to continue the standardization and simplification of gas appliance specifications.

These specifications were revised several times between 1914 and 1918. In June 1918, the American Gas Institute and the National Commercial Gas Association amalgamated to form the American Gas Association. During 1919, a Committee on Standardization of Gas Appliances was formed by the American Gas Association to carry out revisions of existing gas appliance specifications.

In 1925, the Subcommittee on Approval Requirements for Domestic Gas Ranges was formed for the purpose of revising existing standards of the American Gas Association and placing them in a form adaptable to industry's needs and readily capable of enforcement by the newly created Testing Laboratories of the American Gas Association. The first American Gas Association Approval Requirements for Gas Ranges were released to the gas industry in 1926. Revised editions were published in 1928 and 1930.

In September 1930, the American Gas Association Approval Requirements Committee became Sectional Committee Z21 of the American Standards Association. Consequently, the Subcommittee on Approval Requirements for Domestic Gas Ranges became a subcommittee of the Z21 Committee.

During 1930 and 1931, general revision and enlargement of the standards were undertaken by the subcommittee and the Z21 Committee. The resulting standard, the most comprehensive ever issued for gas ranges, was submitted to the American Standards Association for adoption and accepted in 1932.

Revisions to this standard reflecting the latest developments and improvements were approved by the subcommittee during 1932. This draft standard was adopted by the Z21 Committee at its May 1933 meeting and approved as American Standard by the American Standards Association in 1933. Following this procedure, seven subsequent editions of this standard were approved by the American Standards Association from 1935 to 1955.

Up to this point, the domestic gas range standard (Z21.1) covered both free-standing and built-in cooking units; however, in view of the rapid development of built-in units (formerly classified as recessed range sections) as well as other considerations as to the testing of these types of units, it was deemed advisable to have a separate standard devoted to each type of appliance. Consequently, the standard was divided into two volumes: the fourteenth edition, Volume I, Free-Standing Units (Z21.1.1), and the first edition, Volume II, Built-In Domestic Cooking Units (Z21.1.2), which were approved as American Standard by the American Standards Association in 1956. New editions of Z21.1.1 and Z21.1.2 were approved in 1959.

As a result of the use of domestic gas ranges by the trailer coach and mobile home industry, the standards were modified to cover the special construction and performance features deemed necessary for ranges for installation in such vehicles. These revisions were included in first addenda to the standards approved as American Standards in 1960. Subsequent editions of both standards were approved in 1961 and 1964.

Continued progress in the development of domestic gas ranges prompted further revision of the standards. In the first addenda (Z21.1.1a-1965 and Z21.1.2a-1965) issued to the seventeenth edition of Z21.1.1 and the fourth edition of Z21.1.2, provisions covering outdoor gas broilers were incorporated.

In August 1966, the American Standards Association was reconstituted as the United States of America Standards Institute. As a result, the eighteenth edition of Z21.1.1 and the fifth edition of Z21.1.2 were approved as USA Standards by the United States of America Standards Institute in 1967.

In October 1969, the United States of America Standards Institute was renamed the American National Standards Institute, Inc.

As a result of continued progress and development of domestic cooking equipment designs plus the increasing similarity of some designs of free-standing and built-in ranges, the subcommittee concluded that reorganization and expansion of the domestic gas range standards was needed to adequately cover various types of cooking equipment. Accordingly, three draft standards were distributed for review and comment during September 1970: coverage for outdoor broilers contained in the existing standards, plus added coverage for outdoor top cooking units, was combined into a draft standard for outdoor cooking gas appliances; coverage for appliances for use with liquefied petroleum gases and for installation in travel trailers, as contained in the existing standards, was combined into a separate draft standard for recreational vehicle cooking appliances; and the remainder of Z21.1.1 and Z21.1.2 was combined into a draft standard for household cooking gas appliances.

The nineteenth edition of the former domestic gas range standards, Z21.1.1 and Z21.1.2, retitled and redesignated the American National Standard for *Household Cooking Gas Appliances*, Z21.1, was approved as American National Standard in 1972.

Further revisions in line with developments in gas utilization, including transfer of the remaining coverage for appliances for recreational vehicle installation to American National Standard for *Recreational Vehicle Cooking Gas Appliances*, Z21.57, were incorporated in the twentieth edition of the household cooking gas appliance standard, which was approved as American National Standard by the American National Standards Institute, Inc., in 1974.

The twenty-first, twenty-second, twenty-third, twenty-fourth, twenty-fifth, twenty-sixth, twenty-seventh, twenty-eighth, and twenty-ninth editions of the household cooking gas appliance standards were approved as American National Standards by the American National Standards Institute, Inc., in 1978, 1982, 1987, 1990, 1993, 1996, 2000, 2005, and 2010 respectively.

Harmonization efforts to harmonize the American national Standard for *Household Cooking Gas Appliances*, ANSI Z21.1 with the *Standard for Domestic Gas Ranges*, CAN1.1 began in 2005. A working group was formed in 2006 to combine both documents.

While harmonization efforts were ongoing, further revisions to Z21.1, were developed in line with industry developments. The twenty-ninth edition of the household cooking gas appliance standard, was approved as an American National Standard by the American National Standards Institute, Inc. on November 17, 2010.

The harmonized Standard for *Household Cooking Gas Appliances* ANSI Z21.1 • CSA 1.1 was approved as an American national Standard by the American National Standards Institute, Inc. on January 6, 2016 and by the Interprovincial Gas Advisory Council on January 18, 2016.

This, the second edition of the harmonized Standard for *Household Cooking Gas Appliances*, CSA/ANSI Z21.1 • CSA 1.1, was approved as an American National Standard by the American National Standards Institute, Inc. on November 29, 2018 and by the Interprovincial Gas Advisory Council on October 30, 2018.

The following identifies the designation and year of the second edition of the harmonized Standard:

ANSI Z21.1-2016 • CSA 1.1-2016

CSA/ANSI Z21.1-2018 • CSA 1.1-2018

# CSA/ANSI Z21.1-2018 • CSA 1.1-2018

## Household cooking gas appliances

### 1 Scope

#### 1.1

This Standard applies to newly produced household cooking gas appliances (see Clause 3, Definitions), hereinafter referred to as units or appliances, constructed entirely of new, unused parts and materials. These appliances may be floor supported or built-in.

#### 1.2

This Standard applies to household cooking gas appliances:

- a) for use with natural gas;
- b) for use with manufactured gas;
- c) for use with mixed gas;
- d) for use with propane gas;
- e) for use with LP gas-air mixtures;
- f) for use with either natural, manufactured, or mixed gas and convertible for use with propane gas (see Clause 3, Definitions);
- g) for manufactured (mobile) home installation for use with propane gas only (see Clause 4.1.29);
- h) for manufactured (mobile) home installation for use with either natural, manufactured, or mixed gas and convertible for use with propane gas (see Clause 4.1.29 and Clause 3, Definitions);
- i) for recreational park trailer installation for use with natural, manufactured, or mixed gases and convertible for use with propane gas (see Clause 4.1.29 and Clause 3, Definitions); and
- j) provided with pyrolytic self-cleaning oven features or self-cleaning broiler features, or both (see Clause 4.1.30).

The construction of floor-supported units and built-in units for use with the above-mentioned gases is covered under Clause 4, Construction.

The performance of floor-supported units and built-in units for use with the above-mentioned gases is covered under Clause 5, Performance.

#### 1.3

The electrical sections of this Standard are unique to the United States and cover all electrical equipment, wiring, and accessories built-in or supplied for use with an appliance. This Standard covers only appliances having current limitations of 20 amperes and whose electrical equipment, wiring, and accessories are installed in accordance with the *National Electrical Code*, NFPA 70.

For Canada, the electrical portions of the electrical equipment, wiring, and accessories built-in or supplied for use with an appliance are covered under the Standard for *Electrical Components of Fuel Burning Equipment*, CAN C22.2 No. 3.

This Standard covers:

- a) appliances that use only gas for cooking and that are designed for connection to nominal 120-volt electrical supplies; or

- b) appliances that also use electrical energy for cooking and that are designed for connection to either nominal 120-volt or 240-volt electrical supplies.

#### **1.4**

Outdoor cooking gas appliances are covered in the Standard for *Outdoor Cooking Gas Appliances*, ANSI Z21.58 • CSA 1.6.

#### **1.5**

Compact cooking gas appliances (See Clause 3, Definitions) for installation in recreational vehicles, including recreational park trailers, are covered in the Standard for *Recreational Vehicle Cooking Gas Appliances*, ANSI Z21.57 or the Standard for *Propane Fired Cooking Appliances for Recreational Vehicles*, CAN1.1.16.

#### **1.6**

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

#### **1.7**

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

#### **1.8**

Annex A contains Items Unique to Canada.

#### **1.9**

Clause 2 contains a list of standards specifically referenced in this Standard and sources from which these reference standards may be obtained.

It is the responsibility of the user of this Standard to determine which referenced standard applies based on the requirements of the authority having jurisdiction at the location of the installation.

#### **1.10**

Special construction provisions applicable to an appliance designed for use with an optional listed conversion kit are outlined under Annex B (Optional) Provisions for listed gas appliance conversion kits.

#### **1.11**

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

#### **1.12**

In this Standard, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; "should" is used to express a recommendation or that

which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

## △ 2 Reference publications

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

### **CSA Group**

CAN1-6.6-M78 (R2016)

*Gas Appliance Thermostats*

CSA C22.2 No. 0.15-15

*Adhesive Labels*

CAN/CSA C22.2 No. 0.17-00 (R2013)

*Evaluation of Properties of Polymeric Materials*

CSA C22.2 No. 0.3-09 (R2014)

*Test Methods for Electrical Wires and Cables*

CSA C22.2 No. 3-1988 (R2014)

*Electrical Features of Fuel-Burning Equipment*

CSA C22.2 No. 24-15

*Temperature-Indicating and -Regulating Equipment*

CAN/CSA C22.2 No. 150-16

*Microwave Ovens*

CSA C22.2 No. 197-M1983 (R2013)

*PVC Insulating Tape*

CAN/CSA-C22.2 No. 198.1-06 (R2015)/UL 224-2006

*Extruded Insulating Tubing*

CAN/CSA-C22.2 No. 198.3-05 (R2014)/UL 1441-2005

*Coated Electrical Sleeving*

ANSI Z21.15-2009 • CSA 9.1-2009 (R2014)

*Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves*

ANSI Z21.18-2007 • CSA 6.3-2007 (R2016)  
*Gas Appliance Pressure Regulators*

ANSI Z21.20-2014/CAN/CSA-C22.2 No. 60730-2-5-14  
*Automatic Electrical Controls for Household and Similar Use — Part 2-5: Particular Requirements for Automatic Electrical Burner Control Systems*

ANSI Z21.21-2015 • CSA 6.5-2015  
*Automatic Valves for Gas Appliances*

ANSI Z21.23-2010 (R2015)  
*Gas Appliance Thermostats*

ANSI Z21.24-2015 • CSA 6.10-R2015  
*Connectors for Gas Appliances*

ANSI Z21.35-2005 • CSA 6.8-2005 (R2015)  
*Pilot Gas Filters*

ANSI Z21.41-2014 • CSA 6.9-2014  
*Quick-Disconnect Devices for Use with Gas Fuel Appliances*

ANSI Z21.57-2010  
*Recreational Vehicle Cooking Gas Appliances*

ANSI Z21.58-2018 • CSA 1.6-2018  
*Outdoor Cooking Gas Appliances*

ANSI Z21.69-2015 • CSA 6.16-2015  
*Connectors for Moveable Gas Appliances*

ANSI Z21.78-2010 • CSA 6.20-2010 (R2015)  
*Combination Gas Controls for Gas Appliances*

ANSI Z21.86-2016 • CSA 2.32-2016  
*Vented Gas-Fired Space Heating Appliances*

ANSI Z21.92-2001 (R2016) • CSA 6.29-2001 (R2016)  
*Manually Operated Electric Gas Ignition Systems and Components*

**ANSI (American National Standards Institute, Inc.)**  
ANSI A119.5-2009  
*Recreational Park Trailers (no longer available)*

ANSI Y14.15-1973  
*Electrical and Electronics Diagrams (no longer available)*

ANSI Z97.1-2015  
*For Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test*

**ASME International**

ASME B1.20.1-2013

*Pipe Threads, General Purpose (Inch)*

ASME B18.6.3-2013

*Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)*

ASME B36.10M-2015

*Welded and Seamless Wrought Steel Pipe***Department of Housing and Urban Development**

Title 24 CFR, Part 3280

*Manufactured Home Construction and Safety Standard***Department of the Navy**

MIL-STD-1629A

*Procedures for Performing a Failure Mode, Effects and Critical Analysis***GRI (Gas Research Institute)**

GRI-96/0270-1996

*Topical Report: Critique of ANSI Z21.1 Standard for CO Emissions from Gas-Fired Ovens and Ranges***IEC (International Electrotechnical Committee)**

IEC 60695-2-11:2014

*Fire Hazard Testing — Part 2-11: Glowing/Hot-wire Based Test Methods — Glow-wire Flammability Test Method for End-products (GWEPT)*

IEC 60695-2-13:2010

*Fire Hazard Testing — Part 2-13: Glowing/Hot-wire Based Test Methods — Glow-wire Ignition Temperature (GWIT) Test Method for Materials*

IEC 60695-11-10:2013

*Fire Hazard Testing — Part 11-10: Test Flames — 50 W Horizontal and Vertical Flame Test Methods***IEEE (Institute of Electrical and Electronic Engineers)**

ANSI/IEEE 315 -1975 (R1993)

*Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Class Designation Letters)***NEMA (National Electrical Manufacturers Association)**

ANSI/NEMA WD6-2016

*Wiring Devices — Dimensional Requirements***NFPA (National Fire Protection Association)**

ANSI Z223.1/NFPA 54-2018

*National Fuel Gas Code*

NFPA 70-2017

*National Electrical Code*

ANSI A225.1/NFPA 501A-2013

*Fire Safety Criteria for Manufactured Home Installations, Sites and Communities*

**UL (Underwriters Laboratories Inc.)**

UL 62-2014

*Flexible Cord and Cables*

UL 94-2013

*Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 101-2017

*Leakage Current for Appliances*

UL 507-2017

*Electric Fans*

UL 510-2017

*Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape*

UL 858-2014

*Household Electric Ranges*

UL 873-2007

*Temperature-Indicating and -Regulating Equipment*

UL 923-2013

*Microwave Cooking Appliances*

UL 969-2017

*Marking and Labeling Systems*

UL 1581-2001

*Reference Standard for Electrical Wires, Cables, and Flexible Cords*

UL 1694-2002

*Standard for Tests for Flammability of Small Polymeric Component Materials*

### 3 Definitions

The following definitions shall apply in this Standard:

**Air curtain ventilation system** — a ventilation system that pulls intake air from above the cooking surface or from a remote location and re-directs the air down onto the cooktop surface.

**Air shutter** — an adjustable device for varying the size of the primary air inlet(s).

#### **Appliance**

**Convertible** — a household cooking gas appliance designed by the manufacturer to be changed in service from use with either natural, manufactured, or mixed gas to use with propane gas and vice versa, which may incorporate a convertible type gas appliance pressure regulator, alternate

orifice(s) or double coaxial orifice(s), or other parts supplied by the manufacturer for conversion of the appliance.

**Dedicated** — a household cooking gas appliance supplied from the factory for use with one gas only.

**Universal** — a household cooking gas appliance designed by the manufacturer to be changed in service from use with either natural, manufactured, or mixed gas to use with propane gas, and vice versa, by incorporating a convertible type gas appliance pressure regulator and double coaxial orifice(s) for the main burners.

**Automatic gas ignition system** — a system designed to ignite and re-ignite an appliance burner(s). Such systems are to:

- a) automatically ignite gas at the main burner, or gas at the pilot burner, so the pilot can ignite the main burner;
- b) prove the presence of either the ignition source, the main burner flame, or both; and
- c) automatically act to shut off the gas supply to the main burner or to the pilot burner and the main burner, when the supervised flame or ignition source is not proved.

**Automatic gas ignition system timings —**

**Flame failure re-ignition time** — the period of time between loss of the supervised ignition source or the supervised main burner flame and attainment of the capability of the ignition means to ignite gas. During this time period, the main burner gas supply is not shut off.

**Flame failure response time** — the period of time between loss of the supervised ignition source or the supervised main burner flame and the action to shut off the gas supply.

**Ignition activation period** — the period of time between energizing the main gas valve and deactivation of the ignition means during a trial for ignition period.

**Igniter failure response time** — the period of time between the loss of the supervised proved igniter and the action to shut off the gas supply.

**Igniter proving time** — the period of time between energizing the igniter and achieving the proved igniter characteristic, which allows gas to flow.

**Lockout time** — the period of time between energizing the system and lockout, if proof of the supervised ignition source or the supervised main burner flame is not established.

**Multitry system** — an ignition system that allows for more than one trial for ignition period during the ignition sequence.

**Pilot flame-establishing period** — the period of time between initiation of pilot gas flow and proof of the supervised pilot flame.

**Purge time** — the period of time intended to allow for the dissipation of any unburned gas or residual products of combustion.

**Pre-purge time** — the purge time that occurs at the beginning of an appliance operating cycle prior to initiating ignition.

**Inter-purge time** — the purge time that takes place between the end of a trial for ignition period and reactivation of the ignition means on a multitry system.

**Post-purge time** — the purge time that occurs at the end of an appliance burner operating cycle.

**Recycle time** — the period of time between shut-off of the gas supply following loss of the supervised ignition source or the supervised main burner flame and reactivation of the ignition source.

**Trial for ignition period** — the period of time between energizing and de-energizing the gas valve, if proof of the supervised flame is not established.

**Valve sequence period** — the sum of all trial for ignition periods, prior to lockout, if proof of the supervised ignition source, or the supervised main burner flame, is not established.

**Baffle** — an object placed in an appliance to change the direction of or retard the flow of air, gas-air mixtures, or flue gases.

**Base** — the lowest supporting frame or structure of the appliance, exclusive of legs.

**BTU** — abbreviation for British Thermal Unit. The quantity of heat required to raise the temperature of 1 pound of water 1°F.

**Burner** — a device for the final conveyance of the gas, or a mixture of gas and air, to the combustion zone.

**Infrared burner** — a burner that utilizes heat energy to raise to an elevated temperature the radiating surface of the burner, which in turn emits energy in the form of infrared radiation. The radiating surface is commonly either a porous refractory material or a high temperature-resistant wire screen.

**Injection burner** — a burner employing the energy of a jet of gas to inject air for combustion into the burner and mix it with the gas.

**Atmospheric injection burner** — a burner in which the air at atmospheric pressure is injected into the burner by a jet of gas.

**Open top burner** — an open burner used in conjunction with a utensil support intended for use with typical cooking utensil.

**Power burner** — a burner in which either gas or air or both are supplied at pressures exceeding for gas, the line pressure, and for air, atmospheric pressure; this added pressure being applied at the burner.

**Premixing burner** — a power burner in which all or nearly all of the air for combustion is mixed with the gas as primary air.

**Pressure burner** — a burner that is supplied with a gas-air mixture under pressure (usually from 0.5 to 14 inches water column and occasionally higher).

**Yellow-flame burner** — a burner in which secondary air only is depended on for the combustion of the gas.

**Wok burner** — a dedicated burner, or a grate or wok holder, that is designed to be used with a round bottom wok.

**Burner head** — that portion of a burner, beyond the outlet end of the mixer tube, which contains the ports.

**Bypass for top burner thermostat** — a top burner thermostat is considered bypassed when the thermostatic valve is closed and gas taken from ahead of the valve acts to:

- a) maintain a minimum safe flow to the main burner ports; or
- b) maintain a sub-burner when one purpose of the sub-burner is for means of re-igniting the main burner gas when the thermostatic valve reopens.

**Circuit** —

**High-tension ignition** — an ignition circuit involving a potential of more than 600 volts supplied by a step-up transformer or by a suitable combination of devices that will increase line voltage to over 600 volts.

**Line-voltage** — a circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

**Low-voltage** — a circuit involving a potential of not more than 30 volts supplied by a transformer suitable for an NEC Class 2 circuit or by a suitable combination of a transformer and a fixed impedance which, as a unit, complies with all performance provisions for a transformer for an NEC Class 2 circuit.

**Thermoelectric** — a circuit that receives its electrical energy by a conversion of heat to electricity by means of a thermocouple or thermopile.

**Combustion** — the rapid oxidation of fuel gases accompanied by the production of heat or heat and light.

**Combustion chamber** — the portion of an appliance within which combustion occurs.

**Combustion products** — constituents resulting from the combustion of a fuel gas with the oxygen of the air, including the inert, but excluding excess air.

**Compact cooking gas appliance** — a gas cooking appliance:

- a) whose outer casing encloses a volume not in excess of 6 ft<sup>3</sup> (0.17 m<sup>3</sup>);
- b) whose weight is not in excess of 80 lb (36.3 kg); and
- c) that is designed to be recessed into or placed upon and attached to the construction of a recreational vehicle or recreational park trailer.

For the determination of volume, back guards, vent extensions, handles, etc., may be removed.

For the determination of weight, other easily removable parts such as conventional top burners, oven racks, etc., may also be removed.

**Control function** —

**Class A** — control functions that are not relied upon for the safety of the application. (The control functionality is not investigated for fault tolerance; i.e., no Failure Mode and Effect Analysis (FMEA) is required).

**Class B** — control functions that are intended to prevent an unsafe state of the appliance. (The functionality of the control is investigated for single order failure fault tolerance; i.e., a single component fault FMEA is required).

**Class C** — control functions that are intended to prevent special or catastrophic hazards such as explosion. [The functionality of the control is investigated for second order failure fault tolerance; i.e., multiple component faults (subsequent faults are applied until the effect on the equipment is evident) FMEA is required].

**Controls** — devices, which may be manual, semi-automatic, or automatic, designed to regulate the gas, air, water, or electrical supplies to a gas appliance.

**Control, Type 1 action** — the actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence has not been declared and tested. This type of action is normally designated to electro-mechanical controls.

**Control, Type 2 action** — the actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence have been declared and tested. This type of action is normally designated to electro-mechanical controls.

**Cooking functions —**

**Baking** — to cook food by a combination of radiated, convected, and conducted heat.

**Broiling** — to cook food by exposure to radiant heat.

**Top surface cooking** — to cook food by heat conducted through a container or griddle.

**Top surface grilling** — to cook food by heat through a cooking grid.

**Cooking grid** — the surface upon which the food to be broiled is placed.

**Cooking sections/units —**

**Broiler** — a unit, or section of a unit, that cooks primarily by radiated heat and may be combined with a rotisserie. Broilers are further classified as:

**Enclosed broiler** — a broiler in which the source of heat is above the surface on which cooking is done.

**Grill (open top broiler)** — a broiler in which the source of heat is below the cooking grid.

**Built-in broiler unit** — a unit that may have an open top or be enclosed, may be a separate broiler, or may be combined with a rotisserie.

**Built-in oven** — a unit consisting of one or more ovens designed to be mounted in a wall or cabinet.

**Combination unit** — a unit that performs two or more cooking functions.

**Convertible griddle** — a top surface cooking burner(s) designed to be equipped with either an aeration bowl and a utensil support, or a griddle.

**Drop-in unit** — a built-in unit consisting of an oven compartment and top surface compartment and top surface cooking section, supported by the horizontal surface cabinetry.

**Griddle** — (See **Top or surface unit**.)

**Open top broiler unit** — a stand-alone appliance consisting of an open top broiler(s).

**Oven** — a compartment in which baking or broiling may be performed.

**Room heater unit** — a cooking appliance having a gas oven and top section, and a separate room heater section designed for gas fuel.

**Slide-in unit** — a floor supported unit designed to appear built-in and be installed between two base cabinets.

**Top broiler units** — (See **Top or surface unit**.)

**Top or surface unit** — a unit for installation in or on a counter top. It may have top burners, a griddle, a deep well cooker, top broiler unit, or any combination thereof.

**Top surface cooking section** — a section of a household cooking gas appliance consisting of any combination of top burner(s), griddle, convertible griddle, and open top broiler.

**Warming oven** — a compartment in which the temperature is limited so that the baking function cannot be performed.

**Cubic foot of gas** — the amount of gas that would occupy 1 cubic foot at Standard Temperature and Pressure conditions (STP), which is a temperature of 60°F and under a pressure equivalent to that of 30 inches mercury column.

**Draft hood** — a device built into an appliance, or made a part of the vent connector from an appliance, that is designed to:

- a) provide for the ready escape of the products of combustion in the event of no draft, backdraft, or stoppage beyond the draft hood;
- b) prevent a backdraft from entering the appliance; and
- c) neutralize the effect of stack action of the chimney or gas vent upon the operation of the appliance.

**Effective area, cooking grid** — the horizontal portion of the cooking grid capable of supporting food for cooking.

**Electrical connection** — the physical interface between two points in a circuit such as spade terminals, pin terminals, micro switch contacts, relay contacts, timer contacts, crimped connections, and connections that are welded or soldered.

#### **Electrical diagrams** —

**Connection** — a diagram that shows the connections of an installation or its component devices or parts. It may cover internal or external connections, or both, and contains such detail as is needed to make or trace connections that are involved. The Connection Diagram usually shows general physical arrangement of the component devices or parts.

**Schematic** — a diagram that shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The Schematic Diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component device or parts.

**Ladder form of schematic** — a diagram drawn in the form of a vertical ladder. The outer vertical lines represent the electrical supply conductors. The horizontal steps represent each individual circuit with all component devices.

**Electrical enclosure** — a case enclosing electrical equipment and wiring, which is designed expressly to prevent:

- a) a person from accidentally contacting uninsulated live parts;
- b) burning or molten materials from contacting adjacent combustible materials or falling onto combustible materials;
- c) conductive or combustible materials from dropping onto uninsulated live parts; and
- d) mechanical abuse of electrical equipment not designed or approved to withstand the normal use without such additional enclosure.

**Electronic control** — a device that incorporates two or more electronic components (such as printed circuit boards, transistors, and microprocessors) and that causes the intended output of the appliance energy source(s) (e.g., heating elements, gas burners, moving parts, airflow) to vary.

**Excess air** — air that passes through the combustion chamber and the appliance flues in excess of that which is required for complete combustion.

**Flame cylinder** — a projection of a vertical cylinder having a diameter of 20 mm and a height of 50 mm.

**Flue** — the general term for the passages and conduits through which flue gases pass from the combustion chamber to the outer air.

**Appliance flue** — the flue passages within an appliance.

**Chimney flue** — a conduit for conveying the flue gases delivered into it by a vent connector, to the outer air.

**Flue collar** — a projection or recess provided to accommodate the vent pipe.

**Flue gases** — products of combustion and excess air.

**Gas control circuit** — the system of components that controls the flow of gas to a pilot or main burner(s).

**Grate** — (See **Utensil support**.)

**Grate, radiant support** — the assembly within or upon which refractory radiant material is supported.

**Heating surface** — all surfaces that transmit heat from flames or flue gases to the medium to be heated.

**Heating value (gross or higher heating value)** — the number of British Thermal Units produced by the combustion at constant pressure of 1 cubic foot of gas measured at 60°F and 30 inches of mercury column when the products of combustion are cooled to the initial temperature of the gas and air, when the water vapor formed during combustion is condensed, and when all the necessary corrections have been applied.

**Household cooking gas appliance** — a gas appliance for food preparation incorporating one or more cooking function(s).

**Built-in unit** — a cooking appliance designed to be recessed into, placed upon, or attached to the construction of a building other than the floor. It may incorporate one or more cooking function(s). (See **Cooking functions**.)

**Floor-supported unit** — a cooking appliance for installation directly on the floor without requiring supporting cabinetry or structure. It may provide one or more cooking function(s). (See **Cooking functions**.)

**Type of appliance** — household cooking gas appliances are also classified as to the type(s) of gas(es) for which they are designed and equipped. (See definitions for **Appliance**.)

**Igniter** — a device that utilizes electrical energy to ignite gas at a pilot burner or main burner.

**Igniter, proved** — an igniter that is proven to be capable of ignition prior to initiating gas flow.

**Ignition device** — a device for igniting gas at a burner. It may be a pilot or an igniter.

**Ignition device, direct** — an igniter utilized to ignite gas at a main burner.

**Ignition source** —

**Continuous** — an ignition source that, once placed in operation, is intended to remain ignited or energized continuously until manually interrupted.

**Intermittent** — an ignition source that is automatically ignited or energized when an appliance is called on to operate and that remains continuously ignited or energized during each period of main burner operation. The ignition source is automatically extinguished or de-energized when each main burner operating cycle is completed.

**Intermittent/continuous** — an ignition source that is ignited or energized upon appliance user initiation of the operational cycle and that remains continuously ignited or energized during the appliance use cycle. The ignition source is extinguished or de-energized when the appliance use cycle is completed.

**Intermittent/interrupted** — an ignition source that is ignited or energized upon appliance user initiation of the operational cycle and that is extinguished or de-energized after the appliance use cycle has been initiated.

**Interrupted** — an ignition source that is automatically ignited or energized when an appliance is called on to operate and is automatically extinguished or de-energized during the trial for ignition period.

**Manually activated intermittent/continuous** — an ignition pilot that is manually ignited upon appliance user initiation of the operational cycle and that remains continuously ignited during the appliance use cycle. The ignition pilot is extinguished when manually interrupted at the completion of the appliance use cycle. For the purposes of this Standard, this system may be considered automatic if the ignition pilot is observable.

**IID** — (See **Intermittent ignition system**.)

**Indirect oven thermostat system** — a control system employing a pilot and two or more integrated automatic devices to maintain an oven temperature as selected by the operator. That portion of the system responsive to oven temperature causes operation of another portion of the system to turn on or shut off the gas supply to the oven burner.

**Input rating** — the gas-burning capacity of an appliance in Btu per hour as specified by the manufacturer. Appliance input ratings are based on sea level operation and need not be changed for operations up to 2000 ft elevation. For operation at elevations above 2000 ft, input ratings should be reduced at the rate of 4 percent for each 1000 ft above sea level.

**Intermittent ignition system** — a system in which the ignition source is automatically shut off when the appliance is in an off or standby condition.

**Lockout** — the automatic action to end an ignition sequence. Re-initiating another ignition sequence requires a manual operation.

**LP gas-air mixtures** — propane gas distributed at relatively low pressures and normal atmospheric temperatures, which have been diluted with air to produce desired heating value and utilization characteristics.

**Main burner** — a main burner is any burner other than a pilot burner.

**Manifold** — the conduit of an appliance which supplies gas to the individual burners.

**Manufactured home** — a structure, transportable in one or more sections, that in the travelling mode, is 8 body feet or more in width, 40 body feet or more in length, or, when erected on site, is 320 or more square feet, and that is built on a permanent chassis and designed to be used as a dwelling with or without permanent foundation when connected to the required utilities, and that includes the plumbing, heating, air-conditioning, and electrical systems contained therein.

**Mobile industrial or commercial structure** — a structure intended as a dwelling unit, towable on its own chassis, and for use without a permanent foundation. Such structures are built specifically for commercial or industrial use such as construction offices, bunk houses, wash houses, kitchen and dining units, libraries, TV units, industrial display units, laboratory units, and medical clinics.

**Maximum individual load capacity** — the maximum capacity or flow at which the regulator will control pilot line pressure within acceptable limits.

**Maximum regulation capacity** — the high limit of flow below which are found acceptable regulating characteristics.

**Mechanical off position** — the position of a manually operated actuating mechanism of a controlling valve or device for use during normal operation of the appliance, that prevents gas flow to the main burner(s) or energization of the heating element(s) under its supervision. The actuating mechanism is to necessitate not less than two separate manual operations to turn on and only one operation to turn off.

**Mixer** — the combination of mixer head, mixer throat, and mixer tube.

**Mixer head** — that portion of an injection type burner, usually enlarged, into which primary air flows to mix with the gas stream.

**Mixer throat** — that portion of the mixer which has the smallest cross-sectional area and which lies between the mixer head and the mixer tube.

**Mixer tube** — that portion of the mixer which lies between the throat and the burner head.

**Mixer face** — the air inlet end of the mixer head.

**Mobile home** — (See **Manufactured home**.)

**Multiple temperature self-clean cycle** — a self-clean cycle that varies the oven set temperature during the course of the self-clean cycle.

**Non-displaceable valve member (rotor)** — a valve member that cannot be moved from its seat by a force applied to the handle, or a force applied by a plane surface to any exterior portion of the valve.

**Normal butane (n-Butane), technical grade** — a propane gas composed of a minimum of 95 percent n-butane ( $C_4H_{10}$ ), which may contain other impurities such as isobutane, butylenes, and propane not in excess of 5 percent.

**Normal inlet test pressures** — those pressures specified for testing purposes at which adjustment of burner ratings and primary air adjustments are made.

**Open top broiler section** — an open top broiler that is incorporated as a section of a household cooking gas appliance.

**Operating control** — a control intended to start, regulate, or operate the appliance during normal operation. Examples are a thermostat or temperature controller. Electronic controls where the specifications of the functions have not been declared or relied upon from a safety perspective are considered Class A control functions. Electronic controls where the specifications of the functions have been declared or relied upon from a safety perspective are considered Class B control functions

**Orifice** — an opening through which the flow of gas being discharged is limited.

**Orifice fitting** — a device containing an orifice.

**Orifice hood** — a removable cap containing an orifice, which permits adjustment of the flow of gas by changing its position with respect to a fixed needle or other device.

**Orifice spud** — a removable plug containing an orifice.

**Pilot** — a gas flame(s) utilized to ignite the gas at a main burner(s).

**Pilot shut-off device** — a device that is capable of shutting off the pilot gas and that is not intended for frequent usage. It may also be capable of adjusting pilot gas flow.

**Port, burner** — any opening in a burner head through which gas or a gas-air mixture is discharged for ignition.

**Primary air** — the air introduced into a burner, which mixes with the gas before it reaches the port(s).

**Primary air inlet** — the opening(s) through which primary air is admitted into a burner.

**Propane** — a liquefied petroleum gas that is classified as either “commercial propane” or “Special-Duty” propane in accordance with ASTM D1835, *Standard Specification for Liquefied Petroleum (LP) Gases*. Special-Duty propane is equivalent to Propane HD-5.

**Propane HD-5** — propane that complies with the same requirements as “Special-Duty” propane, as defined by ASTM D1835, *Standard Specification for Liquefied Petroleum (LP) Gases*.

**Protective control** — a control intended to prevent the risk of electric shock, fire, or injury to persons, typically during abnormal operation of the appliance. An example is a temperature limiting control (thermal cut-out). An electro-mechanical protective control will always provide type 2 action. An

electronic protective control can have Class B or C control functions based on the severity of the hazard if the function fails to operate as intended.

**Raceways** — any channel for holding wires, cables, or bus bars, which is designed expressly and used solely for this purpose. Raceways may be of metal or insulating material and include metal conduit, flexible metal conduit, and wireways.

**Recreational park trailer** — a trailer type unit that is primarily designed to provide temporary living quarters for recreational, camping, or seasonal use that meets the following criteria:

- a) built on a single chassis mounted on wheels;
- b) having a gross trailer area not exceeding 400 ft<sup>2</sup> (37.15 m<sup>2</sup>) in the set-up mode; and
- c) certified by the manufacturer as complying with ANSI A119.5, *Park Trailers*, CSA Z240 RV Series, *Recreational Vehicles*, or CSA Z241 Series, *Park Model Trailers*.

**Regulator, gas appliance pressure** — a device, either adjustable, nonadjustable, or convertible for controlling a selected outlet gas pressure.

**Adjustable** —

**Spring type, limited adjustment** — a regulator in which the regulating force acting upon the diaphragm is derived principally from a spring, the loading of which is adjustable over a range of not more than  $\pm 15$  percent of the outlet pressure at the midpoint of the adjustment range.

**Spring type, standard adjustment** — a regulator in which the regulating force acting upon the diaphragm is derived principally from a spring, the loading of which is adjustable. The adjustment means is to be concealed.

**Convertible** — a regulator for conversion between gases having different heating values, whose adjustment means can be positioned from one predetermined outlet pressure setting for one gas to another predetermined outlet pressure setting for the other gas with no intermediate pressure settings and without addition, deletion, or substitution of parts.

**Nonadjustable** —

**Spring type, nonadjustable** — a regulator in which the regulating force acting upon the diaphragm is derived principally from a spring, the loading of which is not adjustable.

**Weight type** — a regulator in which the regulating force acting upon the diaphragm is derived from a weight or combination of weights.

**Safety extra low voltage (SELV)** — nominal voltage for use in a SELV system between conductors and between conductors and earth, not exceeding 30 V<sub>RMS</sub> between conductors, the no-load voltage of the circuit not exceeding 42.4Vpk and 60 Vdc, respectively, and when obtained from higher voltage is provided by a safety isolating transformer as defined by UL/EN 60730-1 standard, Class 2 transformer as defined by CSA C22.2 No. 24-15, or a converter with separate windings.

**Secondary air** — the air externally supplied to the flame at the point of combustion.

**Software** —

**Class A** — for controls with programmable components, the software is not investigated for fault tolerance; i.e., no software investigation is required.

**Class B** — for controls with programmable components, the software associated with the functionality is investigated for single order failure fault tolerance.

**Class C** — for controls with programmable components, the software associated with the functionality is investigated for multiple order failure fault tolerance.

**Specific gravity** — as applied to gas, the ratio of the weight of a given volume to that of the same volume of air, both measured at the same temperature and pressure.

**Thermostat** —

**Electric switch type** — a device that senses changes in temperature and controls electrically, by means of separate components, the flow of gas to the burner(s) to maintain selected temperatures.

**Integral gas valve type** — an automatic device actuated by temperature changes designed to control the gas supply to the burner(s), in order to maintain temperatures between predetermined limits, and in which the thermal actuating element is an integral part of the device.

**Graduating thermostat** — a thermostat in which the motion of the valve is approximately in direct proportion to the effective motion of the thermal element induced by temperature change.

**Snap-acting thermostat** — a thermostat in which the thermostatic valve travels instantly from the closed to an open position, and vice versa.

**Tools, special** — those tools that are not available on the open retail market.

**Top burner** — burner used in conjunction with a utensil support intended for use with typical cooking utensils.

**Top surface cooking section** — a section of a household cooking gas appliance consisting of any combination of top burner(s), griddle, convertible griddle, and open top broiler.

**Unsafe operation** — for the purposes of evaluating the effects of field miswiring, a condition which results in any of the following:

- a) bypassing a safety control or safety function;
- b) an unsafe change in the ignition system timings;
- c) a change in the ignition system sequence;
- d) the unsupervised flow of gas to the main burner(s); and
- e) for appliances that require shut-off of the pilot burner gas, the unsupervised flow of gas to the pilot burner(s).

**Utensil support (grate)** — a device to support a typical cooking utensil above a top burner.

**Valve** —

**Gas burner** — a manually operated valve that controls the gas supply to a burner.

**Gas burner, selector type** — a manually operated valve controlling the gas supply to oven and broiler burners that are in the same compartment, constructed so gas cannot be admitted to both burners at the same time.

**High-low** — a valve that provides a full “ON” flow and a reproducible low flow at a position indicated by a click, detent, or stop.

**Latching type** — a manual gas valve that requires at least two separate actions or movements to turn on the valve, as for example, pushing in on the valve handle to “unlatch” the valve before the valve handle can be rotated to turn on the gas.

**Vent connector** — the conduit connecting an appliance with the chimney or gas vent.

**Vent limiter** — a means that limits the flow of gas or air from the atmospheric diaphragm chamber of a gas appliance pressure regulator to the atmosphere. This may be either a limiting orifice or a limiting device.

**Vent outlet grill opening** — any area of the appliance designed to provide dispersion of the flue products from the flue outlet to the surrounding atmosphere.

## 4 Construction

### 4.1 General construction and assembly

#### 4.1.1

Appliances having sections that use electrical energy for cooking shall comply with the applicable provisions of the Standard for *Household Electric Ranges*, UL 858 and/or the Standard for *Household Cooking Appliances*, CSA C22.2 No. 61 as appropriate based on submission.

#### 4.1.2

A microwave cooking appliance incorporated in a household cooking gas appliance shall comply with the applicable provisions of the Standard for *Microwave Cooking Appliances*, UL 923 and/or the Standard for *Microwave Ovens*, CSA C22.2 No. 150 as appropriate based on submission.

#### 4.1.3

An exhaust hood incorporated in an appliance shall comply with the applicable provisions of the Standard for *Electric Fans*, UL 507 and/or the Standard for *Fans and Ventilators*, CSA C22.2 No. 113 as appropriate based on submission.

Ventilation systems with provisions to direct air in a downward direction (Air Curtain Ventilation System), although not supplied with the range or cook top, are a part of the listing of the range or cook top as outlined in Clauses 4.28.17 and 5.29. Performance of appliances intended to be utilized with ventilation systems that direct air in a downward direction.

#### 4.1.4

A gas-fired room heater incorporated in a household cooking gas appliance shall be of the vented type and is to comply with the applicable construction provisions of the Standard for *Vented Gas-Fired Space Heating Appliances*, ANSI Z21.86 • CSA 2.32.

#### 4.1.5

A household cooking gas appliance incorporating a functional section other than that covered by this Standard shall comply with the applicable standards covering that function.

**4.1.6**

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

**4.1.7**

The construction of all parts, whether specifically covered by the various sections of this Standard or not, shall be in accordance with reasonable concepts of safety, substantiality, and durability.

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.

**4.1.8**

Asbestos shall not be used in construction of an appliance.

**4.1.9**

The general construction and assembly shall be of a neat and workmanlike character with parts well fitted and bolts or other fasteners drawn up tightly to give rigidity. Exposed edges that might be brought in contact with the hand during usage or adjustment of the appliance shall be smooth.

**4.1.10**

Materials used in the construction of an appliance shall be suitable for temperatures to which they will be exposed in use. (Also see Clause 4.1.7.)

**4.1.11**

Every part of the appliance shall be of such construction as to be secure against displacement, distortion, warping, or other damage and shall be supported to maintain a fixed relationship between essential parts under normal and reasonable conditions of handling and usage. Such parts not permanently secured shall be designed so they cannot be incorrectly assembled and cannot be improperly located or misaligned in removing or replacing during cleaning or other servicing.

**4.1.12**

The cooking grid, the burner(s), heat distribution plate, or flame spreader, and the radiant support grate of an open top broiler section or unit shall not show evidence of corrosion or distortion when exposed to elevated temperatures in accordance with the following Method of Test.

**Method of Test**

For the purpose of this test, 75 percent of the effective area of the cooking grid shall be covered with insulating firebrick measuring approximately  $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$  in ( $229 \times 114 \times 63.5$  mm) and weighing approximately  $2\frac{1}{2}$  lb (1.1 kg) per brick, with the  $9 \times 4\frac{1}{2}$  in ( $229 \times 114$  mm) side down. The uncovered area shall comprise a space of about equal width around the perimeter of the uncovered area.

The burner(s) shall be adjusted with the test gas providing the highest specified input rating (see Clause 5.1.2) and then placed in operation under the appropriate test condition in Table 1, Gas pressure and input conditions for use in the various performance tests. The appliance shall be operated continuously for a period of 8 hours, after which time the burner(s) shall be turned off and the

appliance allowed to cool to room temperature. This cycle of operation shall be continued for a total operating time of 96 hours.

After 96 hours of operation, the specified parts shall be inspected and shall comply with the following specifications:

- a) there shall be no evidence of flaking, spalling, or corrosion of parts;
- b) there shall be no leakage, fusion, deformation, or loosening of burner parts sufficient to cause malfunctioning of the burner(s); and
- c) any sagging, distortion, or warping of the cooking grid, heat distribution plate, or flame spreader, and the radiant support grate shall not exceed 1/2 in (12.7 mm).

**Table 1**

**Gas pressure and input conditions for use in the various performance tests**

(See Clauses 4.1.7, 4.12.4, 4.13.5, 4.22.2, 4.22.7, 4.26.25, 4.26.26, 4.26.28, 5.2, 5.3.4, 5.4.1, 5.4.2, 5.4.3, 5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.5.5, 5.5.6, 5.5.7, 5.5.8, 5.5.9, 5.5.10, 5.5.11, 5.5.12, 5.5.13, 5.5.14, 5.5.15, 5.6.2, 5.6.3, 5.7, 5.7.4, 5.7.8, 5.7.9, 5.8.1, 5.8.4, 5.8.5, 5.9.3, 5.10.4, 5.10.6, 5.15, 5.17.1, 5.17.2, 5.19, 5.20, 5.22.1, 5.22.2, 5.22.4, 5.22.5, 5.22.6, 5.25.1, 5.25.2, 5.25.3, 5.25.4, 5.25.5, 5.25.6, and 5.25.11.)

<b>Test condition</b>	<b>Inlet test</b>	<b>Manifold</b>	<b>Input rate *3</b>	<b>Test gases *4</b>
	<b>Pressure *1</b>	<b>Pressure *2</b>		
1	Normal	Normal	100%	All
2	Reduced	Resultant	Resultant	All
3a	Increased as necessary	(Approx. increase 25%) Resultant	112% *5	A, B, C, F, G, H
3b	Increased as necessary	(Approx. increase 18%)	109% *5	E
3c*6	Normal	Resultant	Resultant	D
4	Normal		100% *7	A
5	Normal	Normal 4.0 in wc (995 Pa) 3.0 in wc (747 Pa)	100% *7	B

**Notes:**

- 1) See Table 14, Inlet test pressures
- 2) See Clause 5.3.2.
- 3) See Clause 4.9, Automatic Valves.
- 4) See Table 13, Characteristics of test gases
- 5) See Clause 5.3.3.
- 6) See Clause 5.2 e).
- 7) Reorifice main burners to obtain full rate at the indicated manifold pressure.

#### 4.1.13

All components requiring adjustment during or after installation shall be accessible for adjustment from the front of the appliance when installed in accordance with the minimum clearances specified by the manufacturer.

An appliance equipped with casters may be designed so servicing can be accomplished when the appliance is removed from its installed position. [See Clause 4.28.1 b) vi).] Gas-air adjustments, if provided, must be capable of being made with the appliance in its installed position.

If operation of the appliance is necessary to make such adjustments, making the adjustment shall be possible without exposing electrically live parts operating at more than 30 volts or disturbing wiring. Means shall be provided for changing fuses and lamps without exposing electrically live parts operating at more than 30 volts except screw shells or clips of lamp holders and fuse holders. Partial disassembly for this purpose is permissible provided wiring is not exposed in such a manner as to be damaged or have strain applied to connections during the servicing.

#### **4.1.14**

Electrical devices or electrically actuated controls, or both, that control the gas supply shall be removable without breaking permanent wiring connections.

#### **4.1.15**

A lens, shield, or shade employed as a guard for an oven lamp shall not be supported by the lamp and shall be made of material that will not be adversely affected by temperatures encountered during normal oven operation.

#### **4.1.16**

A lamp in an oven or broiler, if provided, shall be so installed that it cannot be contacted by an oven or broiler rack during or after proper installation of the rack.

#### **4.1.17**

If an oven or broiler lamp extends into the cavity more than 3-1/2 in (88.9 mm) from the rear wall of the cavity, it shall be guarded against contact by a utensil.

#### **4.1.18**

Pilot burner adjustment means, double coaxial orifices used on main burners in convertible or universal appliances and main burner primary air adjustment means shall be capable of being adjusted from the front of the appliance.

#### **4.1.19**

Valves or orifice fittings equipped with double coaxial orifices shall employ the same burners for use with the two gases for which the appliance is marked [see Clause 4.29.4 a) ii).]

#### **4.1.20**

The centers of knobs or buttons located on the backguard of an appliance, excluding single-purpose, time-of-day set knobs of clocks, shall be at least 6 in (152 mm) above the plane of the utensil support surface.

#### **4.1.21**

Clearance shall be provided to afford manipulation of tools when connecting the appliance to house piping.

On a floor-supported unit, this shall be possible with the appliance installed at its minimum clearances.

On a built-in unit, it shall be possible to perform this manipulation and make the necessary electrical supply connections at the appliance from the front of the installed appliance.

#### **4.1.22**

On a built-in unit, all controls (see Clause 4.8.5 for gas appliance pressure regulators), the gas manifold, gas supply tubing or piping to burners, electrical bases, and the flue collar shall be located within the confines of the appliance. Gas supply tubing or piping to burners of a built-in oven or broiler need not comply with this provision if protected by rigid spacers.

#### **4.1.23**

If an appliance is designed to have an exterior surface applied using materials supplied by the installer, the appliance shall be self-sufficient without the applied material and shall be sufficiently rigid to be secure against displacement, distortion, warping, or other damage when such material is applied following either the manufacturer's instructions or normal installation practices. Such an appliance shall be designed so operating parts of the appliance can be serviced and removed and replaced without disturbing the applied exterior surface.

#### **4.1.24**

Backguard or radiation shields supplied with a built-in unit shall be part of, and attached, to the appliance structure. Such parts, if removable, shall be designed to preclude their being attached in other than the correct manner.

Spacers on a built-in unit shall be non-removable and of such strength and bearing surface as to maintain required clearance from building materials.

#### **4.1.25**

On a floor-supported unit for installation with zero clearance to adjacent combustible construction, spacing means for holding finished side panels away from such combustible construction are not permitted.

#### **4.1.26**

An oven or enclosed broiler or a combination oven and enclosed broiler unit shall be equipped with an extreme top cover to protect controls from damage and to prevent material from contacting the flue collar or flue gas carrying conduits.

#### **4.1.27**

Sheet-iron or steel parts, if unfinished, shall be at least 0.0195\* in (0.495 mm) thick. Sheet-metal parts fabricated from corrosion-resistant metals or alloys, or sheet-steel or iron parts finished in porcelain enamel or otherwise finished to equal the durability and strength of 0.0195\* in (0.495 mm) thick sheet steel, need not comply with this provision if the structures into which they are incorporated comply with Clause 4.2, Appliance Structure. Ornamental trimmings and finishing strips need not comply with this provision.

\* This corresponds to No. 24 U.S. Standard gauge sheet steel with the minus tolerances included.

#### **4.1.28**

Tap bolts shall be of corrosion-resistant material or, if of steel, shall have a metallic, corrosion-resistant coating.

**4.1.29**

Special constructional provisions applicable to appliances for manufactured (mobile) home installation are specified in Clauses 1.2 g), h), and i), 4.2.6 and 4.28.1 a) ii), 4.29.4 d), and 4.29.4 e).

**4.1.30**

Special constructional provisions applicable to appliances provided with pyrolytic self-cleaning oven or broiler features are specified in Clauses 1.2 j), 4.6.13, 4.26.25, 4.28.12, and 4.29.12.

**4.2 Appliance structure****4.2.1**

Base frames, front frames, and top frames, or their equivalent, when subjected to a load of 300 lb (136 kg) applied for a period of 5 minutes, shall not show:

- a) breakage or permanent damage to any part; or
- b) a maximum permanent deformation in excess of 0.02 in (0.51 mm).

**Method of Test**

Removable utensil supports shall be removed during this test.

If the cooking top is not a structural member, it shall be removed and the load applied to the top structural or frame members.

Application of the load shall be made over a width of approximately 4 in (102 mm) and a depth approximately that of the cooking top. The load shall be placed as close as possible to the center of the top of the appliance and shall not be applied closer than 1 in (25.4 mm) to the front and back of the appliance.

**4.2.2**

Collars around burner or valve stem or other similar openings, on an appliance designed to have an exterior surface applied using materials supplied by the installer, shall be of sufficient height to accommodate the surfacing material contemplated by the manufacturer, assuming normal procedures for applying such material. If the contemplated surfacing material is ceramic tile, collars shall be at least 1-1/8 in (28.6 mm) in height.

Such collars shall be designed so they will support aeration bowls, valve stem cover plates, and other components, which are intended to rest on them, and shall prevent such members from resting upon the surface intended to be applied by the installer.

**4.2.3**

Drop doors, when fully open, shall remain in position.

**4.2.4**

A broiler drawer, when subjected to a load of 50 lb (22.7 kg) uniformly applied for a period of 5 minutes without impact along a strip 4 in (102 mm) wide and the full width of the drawer equidistant from the face of the appliance and outer edge of the drawer when fully open, shall not show:

- a) breakage or permanent damage to any part; or
- b) deflection, during application of the load, from its normal position in excess of 0.5 in (12.7 mm) at a point 6 in (152 mm) from the face of the appliance.

**4.2.5**

Means shall be provided to obtain a proper fit between oven and broiler doors and the body of the appliance.

**4.2.6**

If the appliance is for manufactured (mobile) home installation, means for permanent attachment of the appliance to the vehicle shall be available from the manufacturer.

**4.3 Bases, legs, casters, and frames****4.3.1**

The bottoms of built-in appliances and bottoms of bases and legs of floor-supported appliances shall have no sharp edges in contact with the floor.

**4.3.2**

The base of a built-in oven, broiler, or combination oven and broiler unit shall not be permanently deformed or damaged by moving the assembled appliance on its base along a smooth plywood surface endwise and sidewise in any direction.

**4.3.3**

Band iron, angle iron, or other structural shapes used in the construction of bases and frames shall have joints securely riveted or welded together, or to the body sides.

**4.3.4**

Cast bases and frames, when not cast in one piece, shall have joints securely fastened to be comparable to a one-piece construction.

**4.3.5**

For floor-supported appliances employing casters, adjustable means to level the appliance shall be provided.

**4.3.6**

Detachable legs and casters that are not interchangeable shall be identified by a Class VI marking with reference to proper location, unless the shape and dimensions are such as to preclude wrong assembly. (See Clause 4.29.5.)

**4.3.7**

Construction of appliances that are designed to be used both with and without bases, legs or casters shall be such that the combustion will not be affected when the legs or casters are detached or the base is removed and the appliance is set directly on the floor.

**4.3.8**

Bases, legs, casters, and frames shall be substantial and rigid to the extent that they will not be permanently deformed or damaged by moving the assembled appliance, without a load, 3 ft (914 mm) along a smooth concrete floor endwise or sidewise by pressure exerted in a normal manner against the end or side, respectively, sufficient to cause the appliance to move freely with all bases, legs, casters, or frames remaining in contact with the floor.

### 4.3.9

The total area of contact between the base or legs of a floor-supported unit and the floor shall be large enough to provide at least 1 in<sup>2</sup> (6.5 cm<sup>2</sup>) of contact for each 50 lb (22.7 kg) of appliance weight.

**Exception:** When casters are employed on two or more legs (see Clause 4.29.5), installation instructions must specify for installation on 1/8 in (2 mm) thick commercial grade vinyl composition floor finishing materials or equivalent. [See Clause 4.28.1 a) vii].

### 4.3.10

Casters may be of swivel or rigid type construction and shall have a minimum total rated capacity of the weight of the appliance plus maximum anticipated load (as determined by the appliance manufacturer). Individual caster loads shall be determined by dividing the gross weight by the number of casters on the appliance.

### 4.3.11

Caster wheels and treads shall be of a material that can withstand exposure to oils, grease, water, cleaning compounds, and elevated temperatures of a least 150°F (65.5 °C).

### 4.3.12

On an appliance equipped with casters, means accessible from the front of the appliance shall be provided to prevent movement of the appliance under normal use.

## 4.4 Glass/ceramic panels

### 4.4.1 Electrical enclosures

Glass covering the front surface of a control panel, the front or an exposed bottom surface of a background, and constituting a part of the electrical enclosure shall:

- a) be reliably secured so that it cannot be readily displaced; and
- b) not be utilized for the support of any component.

**Exception:** Can only be utilized for the support of an electrical component containing low voltage (See Clause 3, Definitions).

In addition, glass having a dimension, including diagonal, more than 12 in (305 mm) shall:

- a) be of a non-shattering or tempered type that complies with the requirements in the Standard for *Glazing Material Used in Buildings Safety Performance Specifications and Methods of Test*, ANSI Z97.1 Class A; or
- b) withstand an impact test, without cracking or breaking to the extent that pieces are released or dropped from their normal position, when subjected to the following Method of Test.

In addition, glass having a dimension, including diagonal, less than 12 in (305 mm) and thickness less than 1/8 in (2.92 mm) shall withstand an impact test without cracking to the extent that pieces are released or dropped from their normal position when subjected to the following Method of Test.

### Method of Test

An impact shall be applied to the panel by allowing a solid steel sphere, 2 in (50.8 mm) in diameter and weighing 1.18 lb (535 g), to fall through a vertical distance of 25-1/2 in (648 mm). The fall through the vertical distance may be accomplished through pendulum action as well as a vertical drop. The test shall be conducted with the glass at room temperature.

#### 4.4.2 Oven doors

An inner or outer glass panel in an oven door shall:

- a) be reliably secured so that it cannot be readily displaced; and,
- b) not be utilized for the support of any component.

**Exception:** *Can only be utilized for the support of non-safety circuit electrical components containing low voltage (See Clause 3, Definitions).*

In addition, glass having any dimension, including diagonal, more than 18 in (457 mm) shall:

- a) be of a non-shattering or tempered type that complies with the requirements in the Standard for *Glazing Material Used in Buildings Safety Performance Specifications and Methods of Test*, ANSI Z97.1 Class A; or
- b) withstand an impact test, without cracking or breaking to the extent that pieces are released or dropped from their normal position, when subjected to the following Method of Test.

In addition, glass having a dimension, including diagonal, less than 18 in (457 mm) and thickness less than (1/8 in) 2.92 mm shall withstand an impact test without cracking to the extent that pieces are released or dropped from their normal position when subjected to the following Method of Test.

#### Method of Test

An impact shall be applied to the panel by allowing a solid steel sphere, 2 in (50.8 mm) in diameter and weighing 1.18 lb (535 g), to fall through a vertical distance of 25-1/2 in (648 mm). The fall through the vertical distance may be accomplished through pendulum action as well as a vertical drop. The test shall be conducted with the glass at room temperature.

#### 4.4.3 Top surface cooking sections

##### Test Condition A

The utensil support (cooking) surface of a glass/ceramic-top appliance shall withstand a thermal shock without cracking or breaking when subjected to the following Method of Test.

##### Method of Test

The largest surface unit shall be operated for 1/2 hour at its maximum heat setting. After 1/2 hour, 500 cm<sup>3</sup> of water at room temperature shall be poured over the hottest area of the utensil support (cooking) surface.

##### Test Condition B

Each glass/ceramic panel of a glass/ceramic-top appliance that constitutes a part of the electrical enclosure shall withstand impact tests without cracking, breaking, or exposing live parts, when subjected to the following Method of Test. Breaking or cracking of the panel is acceptable if the leakage current does not exceed 5.0 milliamperes, when measured as specified in the following Method of Test.

##### Method of Test

With regard to Test Condition B, each glass/ceramic panel shall be subjected to the impact produced by dropping a steel sphere, 2 in (50.8 mm) in diameter and weighing 1.18 lb (535 g), through a distance of 20-1/4 in (514 mm). The test shall be conducted with the panel at room temperature.

Each glass/ceramic panel shall be subjected to 10 impacts produced by dropping a 3.96 lb (1.8 kg) weight through a vertical distance of 6 in (152 mm). The weight shall be shaped as a cooking utensil, have a diameter of 4-1/4 to 5 1/8 in (108 to 130 mm) and have a corner radius of 3/8 in (9.5 mm). The 10 impacts shall be equally distributed over the panel. The weight shall be dropped so that it strikes the panel as flatly as possible. The test shall be conducted with the panel at room temperature.

To determine whether a broken or cracked panel is acceptable, a test using the following steps shall be performed.

- Step 1. A solution of 500 cm<sup>3</sup> of water containing 1/4 gram of ordinary table salt shall be poured over the broken or cracked area of the panel.
- Step 2. A layer of metallic foil shall then be placed over the panel.
- Step 3. The foil shall be covered with a 1 in (25.4 mm) thick layer of 1 lb/ft<sup>3</sup> (16 kg/m<sup>3</sup>) glass fiber insulation.
- Step 4. A 10 in (254 mm) diameter pan filled with a sufficient amount of water to make it weigh 10 lb (4.54 kg) shall then be placed directly on the insulation over the broken or cracked area.
- Step 5. The leakage current between the metallic foil and live parts of the appliance shall then be measured.

The appliance frame shall be isolated from the leakage current test circuit and the appliance shall not be connected to the power supply. The test potential for the leakage current circuit shall be the potential that normally exists between the appliance and electrical ground.

## 4.5 Stability tests

### 4.5.1

#### Door loading

A floor-supported, built-in or drop-in appliance shall be installed on a level surface in accordance with the manufacturer's installation instructions with the following exceptions:

- a) the gas and electric supply shall not be connected;
- b) the broiler pan shall be removed;
- c) a floor-supported unit shall not be secured to any adjacent structure;
- d) a floor-supported unit with adjustable feet shall be level with the feet adjusted at the most unfavorable position; and
- e) an appliance with plug-in modules shall be tested with the combination modules that will result in the most unfavorable condition. Any optional accessories (e.g., rotating spit or backguard) shall be removed or placed in the most severe normal operating position, whichever is deemed most critical for the test.

The appliance shall be subjected for 5 minutes to a static test load, as specified in Table 2, Door loading.

For a swing door, the test load shall be uniformly applied without impact along the top edge of the fully open door midway between the vertical edges. For the purposes of this test, the "FULLY OPEN" position of a swing door shall be the position at which the door is perpendicular to the face of the appliance to which the door is attached.

For a drop door, the test load shall be uniformly applied without impact across the full width of the door, along a line equidistant from the front frame and the outer edge of the door when fully open.

For an appliance with two or more doors, the above test shall be conducted on one door at a time.

In the event the broiler door is hinged to the broiler drawer, the entire assembly shall be inserted into the appliance as far as the open door will permit or until the inner edge of the door, in the fully open position, coincides with the plane of the face of the appliance.

The application of the static load shall not show:

- a) breakage or permanent damage of any part thereof;
- b) deflection, measured at a point 6 in (152 mm) from the rear edge of the door, of more than 0.5 in (12.7 mm) from its normal position; or
- c) the appliance to break contact with the floor or surrounding structure.

**Table 2**  
**Door loading**  
(See Clause 4.5.1.)

Distance of door from floor when appliance normally installed	Static test load, pounds, (kg)
Within 36 in (914 mm)	75 (34.0)
More than 36 in (914 mm)	50 (22.7)

#### 4.5.2

##### Abnormal use

A floor-supported, built-in or drop-in appliance equipped with top burners and with a door or drawer located within 36 in (914 mm) from the floor when fully open shall be subjected to the following Method of Test.

##### Method of Test

This test shall be applied separately to each oven, broiler, and storage cabinet or drawer if any part of the door or drawer is located within 36 in (914 mm) from the floor.

An appliance with removable components shall be tested with the items removed except one module and/or surface unit drop bowl (the most unfavorable one) shall remain in order to support the test pan described below. Any optional accessories (e.g., rotating spit, backguard or similar) shall be removed or placed in the most severe normal operating position, whichever is deemed most critical for the test.

The appliance shall be installed in accordance with the manufacturer's installation instructions and without being connected to the gas supply or electric power. The appliance installation shall use any mounting brackets provided for securing the appliance to a wall, floor, or cabinet structure. A floor mounted appliance with adjustable feet shall be level with the adjustable feet set at their most unfavorable position.

An aluminum pan 9 in (229 mm) in diameter at the rim, having a flat bottom, vertical sides 4 in (102 mm) high, and containing a 4.6 lb (2.09 kg) weight uniformly placed inside, shall be centered on the utensil support (cooking) surface nearest the front edge of the appliance.

The test load shall be applied to the door or drawer as outlined in Clause 4.5.1. Starting with a 75 lb (34 kg) test load, a gradually increasing load shall be applied at a loading rate not to exceed 20 lb (9 kg) per minute until a maximum load of 250 lb (113 kg) has been attained or until the door or drawer (including hinges) deforms to the extent that the test weight can no longer be supported, breaks away, or similar. If the maximum load can be applied, it is to remain on the door or drawer for 5 minutes.

The application of the above forces shall not cause the appliance to tip to the extent that the test pan slides off the top surface cooking section. Sliding of the pan on the utensil supporting surface or onto the top surface cooking section shall be acceptable.

### 4.5.3

If mounting hardware for securing the appliance to the wall, floor, or cabinet structure is necessary to comply with the Method of Test under Clause 4.5.2, the appliance shall comply with the following:

- a) A fastening means shall be provided to secure the appliance to one of the constructions specified in Clause 4.5.4. A second fastening means shall also be provided to secure the appliance to a second construction specified in Clause 4.5.4. (Only one means of securing the appliance is intended. In the event the first fastening means is not suitable for a specific installation, the second fastening means shall be available using the same device or a separate device). All hardware, including fastening devices, screws, wall anchors, and similar, required to secure the appliance in accordance with the manufacturer's installation instructions to two or more of the constructions specified in Clause 4.5.4, shall be provided with the appliance including instructions in the same package. The package shall be located where it will be apparent to the installer.
- b) Only common tools shall be required to install the hardware and appliance in accordance with the manufacturer's installation instructions.
- c) No tools shall be required to remove and replace a floor-supported appliance from a securing device for operations such as servicing and cleaning. No tools, or at most, common tools shall be required to remove and replace the other types of appliances noted in Clauses 4.5.1 or 4.5.2 for similar operations.
- d) Clear and explicit instructions shall be provided with the appliance detailing the intended method of installation. Instructions for securing the appliance shall also be included to address installations when the enclosed hardware cannot be utilized. The instructions shall also warn the installer and user that a risk of tip-over may result if the appliance is not installed in accordance with the manufacturer's installation instructions. (See Clauses 4.28.2, 4.29.8, 4.29.9, and 4.29.10.)
- e) The user's manual shall contain instructions regarding the intended method of appliance removal and replacement, and shall also warn the user of possible risks that may result from abnormal usage, including excessive loading of the oven door and of the risk of tip-over, should the appliance not be reinstalled in accordance with the manufacturer's installation instructions.

### 4.5.4

If mounting to a wall, floor, cabinet, or countertop is required to comply with the Method of Test under Clause 4.5.2, the mounting surface shall be fixed to prevent movement and shall be constructed as follows:

- a) Wall — 3/8 in (9.5 mm) trade size plasterboard (dry wall) on nominal 2 × 4 in (1-5/8 × 3-5/8 in) (41 × 92 mm) wood studs placed 16 in (406 mm) on center on a 2 × 4 sole plate.
- b) Floor — A single thickness of 3/8 in (9.5 mm) thick plywood on nominal 2 × 4 in (1-5/8 × 3-5/8 in) (41 × 92 mm) wood studs placed 16 in (406 mm) on center.
- c) Cabinet or Countertop — A single thickness of 3/8 in plywood for the cabinets. The side cabinets to be  $6 \pm 1/4$  in ( $152 \pm 6.4$  mm) wide, 36 in (914 mm) high, and the same depth as the top surface cooking section of the appliance, except that they shall extend not less than 1 in (25.4 mm) beyond the junction of the door and the body of the oven. The base cabinet for an appliance, not floor supported, shall be the same depth as the side cabinets and a width sufficient to support the appliance.

## 4.6 Gas supply lines

### 4.6.1

Steel pipe employed as gas conduit on the appliance shall comply with the Standard for *Welded and Seamless Wrought Steel Pipe* ASME B36.10M.

**4.6.2**

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

**4.6.3**

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 Clause 5.19, Wall, floor, and enclosure temperatures. The tubing shall demonstrate compliance with the Tubing Structure, Bending Test, and Burst Test requirements specified in the Standard for *Connectors for Gas Appliances*, ANSI Z21.24 • CSA 6.10.

**4.6.4**

The gas supply system of the appliance shall terminate in a standard taper pipe thread in accordance with the Standard for *Pipe Threads, General Purpose (Inch)*, ASME B1.20.1.

**4.6.5**

Aluminum semi-rigid tubing shall not be acceptable for use where it may contact insulating material of other than neutral reaction.

**4.6.6**

Ends of pipe and tubing shall be carefully reamed to remove obstructions or burrs.

**4.6.7**

Supply piping and tubing shall have any bends smoothly made without any appreciable reduction in the cross-sectional area, shall reveal no imperfections occasioned by the bending process, shall be annealed if necessary to remove internal stresses, and shall be thoroughly cleaned inside to remove loose particles.

**4.6.8**

Gas supply piping and tubing shall be within the confines of the appliance, shall be supported, and shall be removable. (Also see Clause 4.1.22.)

**4.6.9**

Gas supply piping to which connections are made for burners, pilots, lighters, or other branch supply lines shall be supported to prevent turning or displacement in making connections to the building piping or during the handling of the appliance.

**4.6.10**

Joint compounds and gas line gaskets shall be resistant to the action of propane gas.

**4.6.11**

Copper semi-rigid tubing or tubing with internal copper surfaces shall be internally tinned or equivalently treated to resist corrosion by sulfur compounds.

**4.6.12**

Aluminum semi-rigid tubing employed as gas conduit shall have a wall thickness in accordance with Table 3, Minimum acceptable wall thickness for aluminum semi-rigid tubing.

**Table 3**  
**Minimum acceptable wall thickness for aluminum semi-rigid tubing**  
(See Clause 4.6.12.)

<b>Outside diameter</b>		<b>Minimum acceptable wall thickness</b>	
<b>Inch</b>	<b>(mm)</b>	<b>Inch</b>	<b>(mm)</b>
1/8	(2.0)	0.020	(0.51)
3/16	(4.8)	0.025	(0.64)
1/4	(6.4)	0.029	(0.74)
5/16	(7.9)	0.029	(0.74)
3/8	(9.5)	0.032	(0.81)
7/16	(11.1)	0.032	(0.81)
1/2	(12.7)	0.038	(0.97)
9/16	(14.3)	0.038	(0.97)
5/8	(15.9)	0.038	(0.97)
3/4	(19.1)	0.045	(1.14)
7/8	(22.2)	0.045	(1.14)

#### 4.6.13

Tubing and fittings used as gas conduits shall be capable of withstanding a temperature of 1000°F (538 °C) without melting.

Tubing and fittings used as gas conduits shall not be exposed to temperatures in excess of those specified in Table 4, Maximum tubing and fitting temperatures, when the appliance is operated as specified in Clause 5.19, Wall, floor, and enclosure temperatures, or Clause 5.25.7, whichever is applicable.

**Table 4**  
**Maximum tubing and fitting temperatures**  
(See Clause 4.6.13.)

<b>Material</b>	<b>Maximum allowable temperature, °F (°C)</b>	
Aluminum	700	(371)
Tinned Copper	350	(177)
Steel (AISI Type C1010)	800	(427)
AISI Type 300 Stainless Steel	700	(371)
AISI Type 410 Stainless Steel	1000	(538)
AISI Type 430 Stainless Steel	1240	(671)
AISI Type 446 Stainless Steel	1600	(871)

**4.6.14**

A 1/8 in NPT plugged tapping accessible for test gauge connection shall be furnished for measuring the manifold pressure under flow, unless some other accessible means for such connection, such as an orifice hood on a multiple burner appliance, is incorporated in the appliance. This tapping shall be at the outlet of, or downstream from, the gas pressure regulator. The plug used shall not be of the slotted head type.

**4.6.15**

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

**4.7 Manual valves and other energy controlling devices****4.7.1**

Manual gas valves and pilot shut-off devices shall comply with the applicable construction provisions of the Standard for *Manually Operated Gas Valves for Appliances, Appliance Connector Valves, and Hose End Valves*, ANSI Z21.15 • CSA 9.1, or *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20, as applicable.

**4.7.2**

The gas flow to each main burner or the energy flow to each heating element shall be under the control of a device having a mechanical off position (see Clause 3, Definitions).

**4.7.3**

Any manual gas valve or energy controlling device intended for use during normal operation and that has an off position to shut off the gas to a main burner or the energy flow to a heating element shall necessitate not less than two separate manual operations to turn on and shall necessitate only one manual operation to turn off.

Programmable timing devices controlling an Oven or Broiler section need not comply with this provision [see Clause 4.28.1 a) xi)]. (Also see Clauses 4.10.3 and 4.10.6.)

When an electronic control with a touch-type user interface is used to meet the two-step ON requirement, two operations that consist of touching two different touch pads but not the same touch pad twice meets the intent of the requirement. A non-valid or a single input shall be cancelled within 30 seconds.

**4.7.4**

An oven or broiler section provided with an indirect control system, other than an electric system incorporating a normally closed valve in the main gas supply line, shall be designed so the thermostat and main burner gas supply line are under the supervision of a manual shut-off means, either integral with the thermostat or as a selector valve in the case of a single-cavity dual-burner unit. An electric control system shall include a manual shut-off means to the system gas supply, or the system gas supply shall pass through two automatic valves, both of which close when the oven or broiler is turned off.

**4.7.5**

A manual valve(s) or a pilot shut-off device shall be provided in the pilot gas supply line for turning on and shutting off the gas supply to all continuous pilots and shall be located so as to be accessible for adjustment.

**4.7.6**

Each top surface cooking section burner control shall be clearly identified with the burner it serves. The identification shall be by symbol or orientation, and shall not be by wording alone. The identification shall be visible and interpretable at a distance of 3 ft (914 mm) in front of the control when viewed from a height of 5 ft (1.52 m). Markings on user interchangeable parts shall not be considered acceptable.

**4.7.7**

The oven and broiler burner valve handles shall be readily distinguishable from the top surface cooking section burner valve handles and each other, unless properly identified.

**4.7.8**

When interlocking means are provided between dampers and gas valve plugs, they shall be positive in their action and shall show no tendency to displace plugs under any conditions of operation.

**4.7.9**

Gas valves of the high-low type embodying a single jet orifice shall not have an "OFF" position between the "FULL ON" and "LOW" positions.

**4.7.10**

All gas valves controlling top burners on the appliance shall have the same degree of valve handle rotation at which ignition takes place. Griddle, convertible griddle, open-top broiler, and thermostatically controlled burners need not comply with this provision.

**4.7.11**

A manual valve intended for use during normal operation of the appliance shall have a non-displaceable valve member (rotor).

**4.7.12**

All valve handles controlling burners (except pilots) shall rotate in a clockwise direction to close. This provision does not apply to selector type valves for ovens, broilers and top burner valves incorporating multiple outlets.

**4.7.13**

Gas valve handles and thermostat dials shall be designed so they can be attached in the correct position only and shall not be subject to accidental displacement.

**4.7.14**

Each top surface cooking section burner control shall have markings to clearly and unmistakably indicate the "OFF" position, the "LIGHT" position, and the "FULL ON" or heat level position. These markings shall be visible and interpretable from a height of 5 ft (1.52 m) above the floor, and

- a) for a range, no closer than the forward projection of the appliance; or

- b) for a counter-mounted unit, no closer than the forward projection of the counter when the appliance is installed per manufacturer's instructions.

The markings of the "OFF" position of the valve shall be clearly and unmistakably indicated by using with the word "off" or "OFF" or an open circle (O) at least 3 mm in diameter.

#### 4.7.15

Control handle covers, if used, shall be designed so they cannot cover the control handle when the control is in other than the "OFF" position.

#### 4.7.16

There shall be a visible indication that a top surface cooking section burner control is in other than the "OFF" position.

#### Method of Test

A pan of the appropriate size, as specified in Table 5, Pan Dimensions, shall be placed on each top burner utensil support. A top surface cooking section burner control shall be adjusted from the "OFF" position through all operating positions available to the user.

An indication that the control is in any position, other than the "OFF" position, shall be visible from any point on a line 10 ft (3.05 m) from the front of the appliance and within the projected width of the appliance, when viewed from a height of 5 ft (1.52 m).

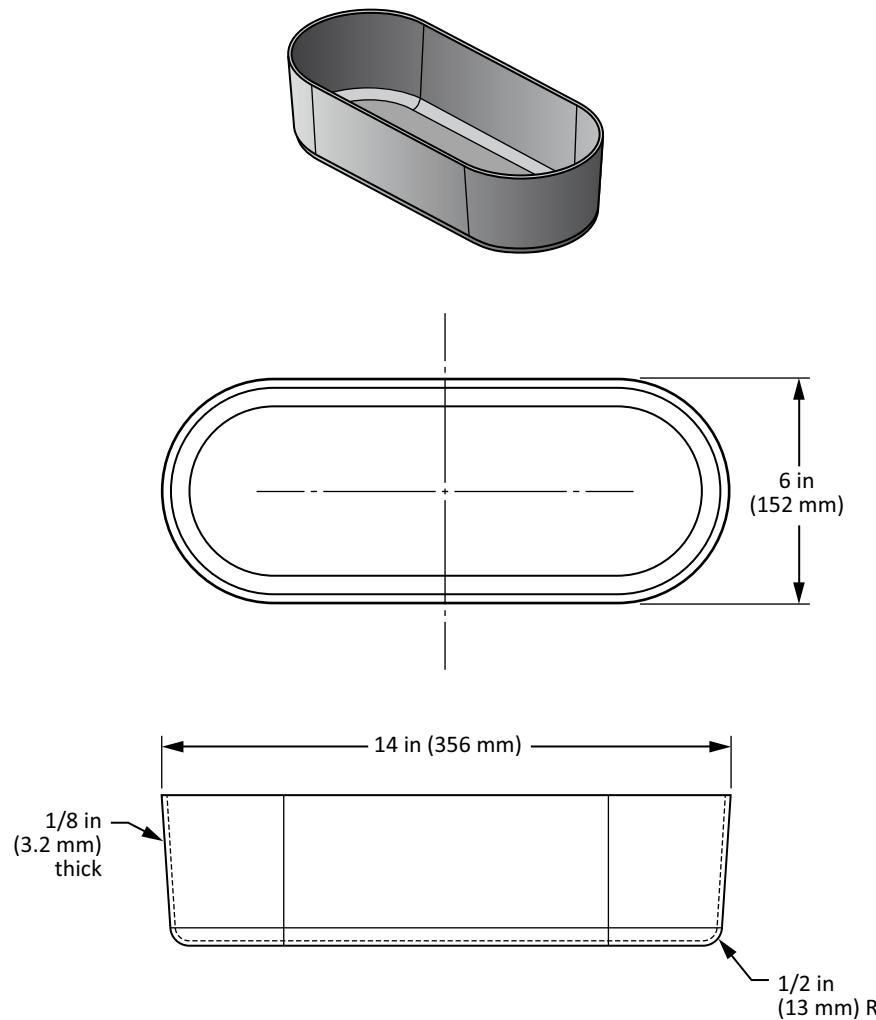
This procedure shall be repeated with each top surface cooking section burner control.

**Table 5**  
**Pan dimensions**  
(See Clause 4.7.16.)

Pan dimensions, inches (mm)	Rated burner input, Btu/h (W)		
	9000 (2 638) or less	9001–14,999 (2 638–4 395)	15,000 (4 396) or more
Outside diameter — top	7 (178)	9 (229)	12 (305)
Projected outside diameter — bottom	6-1/2 (165)	8-1/2 (216)	11-3/4 (298)
Height	3-1/2 (88.9)	4 (102)	6-1/2 Min. (165)

Burners that are elongated in shape or intended for use with elongated pans shall be tested with an elongated pan with a maximum length 2 in (50.8 mm) longer than the maximum length of the burner cap but not less than 14 in (355.6 mm) and a nominal width of 6 in (152.4 mm). These dimensions shall be measured from the top of the pan. The projected bottom dimensions shall be no more than 1/2 in (12.7 mm) smaller than the top dimensions. At the junction of the bottom and sides of the pan, the radius shall not be more than 1/2 in (12.7 mm). The height of the pan shall be identical to the pan heights for round pans noted in the table. The pan shall approximate the shape shown in Figure 1, Test pan for elongated burner.

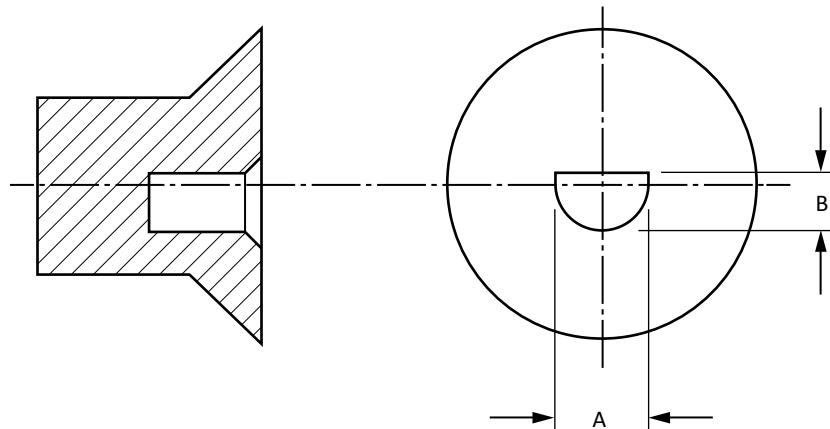
**Figure 1**  
**Test pan for elongated burner**  
(See Clause 4.7.16.)



#### 4.7.17

Removable knobs shall be constructed such that installation shall be possible in only one orientation. A D-shaped valve stem, as depicted in Figure 2, would comply with this requirement.

**Figure 2**  
**Recommended dimensions for D-shaped handle cavity for valve stems of 11/32 in (8.7 mm) diameter**  
(See Clause 4.7.17.)



A =  $0.348 \pm 0.002$  in ( $8.84 \pm 0.05$  mm)

B =  $0.240 \pm 0.002$  in ( $6.10 \pm 0.05$  mm)

#### 4.7.18

Adjustment retention screws provided on high-low valves of the trailer port type shall have slotted heads for operation by a screwdriver that conform to the Standard for *Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)*, ASME B18.6.3, except that indented hex head type machine screws shall not be acceptable for this application.

### 4.8 Gas appliance pressure regulators

#### 4.8.1

Gas appliance pressure regulators, including vent limiters, shall comply with the applicable construction provisions of the Standard for *Gas Appliance Pressure Regulators*, ANSI Z21.18 • CSA 6.3, or *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20, as applicable.

#### 4.8.2

A gas appliance regulator shall be provided with each appliance.

An appliance provided with fixed orifices shall be provided with either an adjustable or a nonadjustable gas appliance pressure regulator. An appliance provided with double coaxial orifices shall be provided with a convertible gas appliance pressure regulator.

The regulator outlet pressure (normal manifold pressure) shall be nominally either 4, 5, or 6 in wc (995 Pa, 1.24, or 1.49 kPa), as specified by the manufacturer, for natural, manufactured, and mixed gases or LP gas-air mixtures. The regulator outlet pressure for propane gas shall approximate that specified by the manufacturer.

#### 4.8.3

When a single gas appliance pressure regulator controls the pressure of both pilot and main burner gas, it shall be of the type suitable for pilot and main burner load application as designated by the symbol  adjacent to the model number.

#### 4.8.4

A gas appliance pressure regulator shall be equipped with a vent limiter and shall be rated as follows:

- a) the lower limit of the range of regulation capacity and the range of variable load capacity (see Clause 3, Definitions) shall not be greater than the minimum flow rating of the smallest individual burner;
- b) the upper limit of the range of individual load capacity shall not be less than the largest individual burner rating; and
- c) the upper limit of the range of regulation capacity shall not be less than the manufacturer's total hourly input rating at normal inlet test pressure.

#### 4.8.5

The gas appliance pressure regulator provided on an appliance for use with either natural, manufactured, or mixed gas and convertible for use with propane gas shall control the pressure of the propane gas as well as either the natural, manufactured, or mixed gas that will pass through it. It shall be constructed so that by use of a tool-operated device, it can be set to a previously adjusted operating pressure for either gas without the necessity of measuring the pressure.

#### 4.8.6

The gas appliance pressure regulator shall be installed in such a location that it will not attain a temperature in excess of that specified by the regulator manufacturer when the appliance is subjected to the tests specified in Clause 5.19, Wall, floor, and enclosure temperatures, or Clause 5.25.7, as applicable, and in such a manner that pressure adjustments may be made from the front of the appliance when the appliance is in the normally installed position. The gas appliance pressure regulator shall be:

- a) installed as specified above and within the confines of the appliance body;
- b) installed exterior to the appliance body; or
- c) supplied separately, with complete instructions for installing the regulator, which shall specify that the regulator must be installed where it will be accessible for adjustment.

#### 4.8.7

A gas appliance regulator shall be removable from the appliance without disconnecting any gas supply lines within the appliance other than those connected directly to the regulator body.

#### 4.8.7.1

The adjustment means of a gas appliance pressure regulator of the standard adjustable spring type shall be concealed.

### 4.9 Automatic valves

#### 4.9.1

Automatic valves shall comply with the applicable construction provisions of the Standard for *Automatic Valves for Gas Appliances*, ANSI Z21.21 • CSA 6.5, or *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20, as applicable.

**4.9.2**

Automatic valves controlling the gas supply to the main burner(s), pilot burner(s), or both, shall be of the normally closed type, except that clock-controlled valves may be of either the normally open or normally closed type.

**4.9.3**

Automatic valves for oven and broiler burners shall not be provided with means for manual operation.

**4.9.4**

Automatic valves shall be installed only in the operating position for which they were designed.

**4.9.5**

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

## **4.10 Thermostats**

**4.10.1**

Thermostats shall comply with the applicable construction provisions of either

- a) the Standard for *Gas Appliance Thermostats*, ANSI Z21.23; or
- b) if the thermostat is part of a combination control, it shall comply with the applicable provisions of the Standard for *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20.

**4.10.2**

Each oven shall be equipped with a thermostat.

**4.10.3**

Thermostats or devices incorporating thermostats shall have a mechanical “OFF” position independent of the thermal sensing means.

**4.10.4**

A graduating-type oven thermostat shall be bypassed to permit a minimum safe gas flow with the thermostatic valve closed.

**4.10.5**

A graduating-type top burner thermostat shall be bypassed (see Clause 3, Definitions) to permit a minimum safe gas flow with the thermostatic valve closed.

**4.10.6**

In the design of a valve handle, thermostat or devices incorporating thermostats, the marking of the OFF position of the valve shall be clearly and unmistakable indicated by using either the word “off” or “OFF” or an open circle (O) at least 3 mm in diameter. These markings shall allow interpretation at a distance of 3 ft (914 mm) in front of the appliance when viewed from a height of 5 ft (1.52 m) above the floor.

**4.10.7**

Dials of thermostatically controlled burners shall be marked in degrees Fahrenheit or Celsius.

**4.10.8**

An indirect oven thermostat incorporating more than one gas supply tube shall be constructed so tubing cannot be interchanged.

**4.10.9**

Electronic controls that function as thermostats shall be designed so that a single component failure shall not result in a gas burner or electric heating element remaining energized when the cooking cycle is turned off manually or automatically (such as a timed cycle).

**4.11 Orifices and orifice fittings****4.11.1**

Main burners of dedicated appliances shall be provided with fixed orifices. [See Clause 4.29.4 a) i).]

**4.11.2**

Main burners of universal appliances shall be provided with double coaxial orifices with the fixed orifice in the needle sized for propane gas and the orifice in the hood sized for the other gas at the burner rating and manifold pressure specified by the manufacturer (see Clause 5.3.2).

**4.11.3**

Main burners for convertible appliances shall be provided with fixed orifices or a combination of fixed orifices and double coaxial orifices. When double coaxial orifices are used, the fixed orifice in the needle shall be sized for propane gas and the orifice in the hood sized for the other gas at the burner rating and manifold pressure specified by the manufacturer (see Clause 5.3.2). When fixed orifices are used, one set of orifices shall be in place when the appliance is shipped from the factory.

**4.11.4**

Orifice hoods and needles of double coaxial orifices shall be constructed so neither the orifice hood nor the needle will be damaged or grooved when the hood is turned down tightly against the needle. The needle containing the inner orifice shall not project beyond the outer edge of the orifice hood in any position of the hood.

**4.11.5**

Orifice fittings shall be secured to prevent misalignment with the burner mixers.

**4.11.6**

Orifice hoods, spuds, and orifice fittings shall be constructed of metal having a melting point not less than 800°F (427 °C).

**4.11.7**

Double tube pilot assemblies employed with indirect oven thermostats shall be constructed so neither gas supply tubing nor pilot orifices are interchangeable.

**4.12 Main burner and pilot input ratings****4.12.1**

Main burner gas input ratings and manifold pressures shall be specified by the manufacturer.

#### **4.12.2**

A continuous pilot used on the top surface cooking section shall be rated at not more than 175 Btu/hr (51 W). This input rating may be limited by a fixed orifice(s) or adjustment means.

A continuous pilot used on oven or broiler burners shall be rated at not more than 250 Btu/hr (73 W). This input may be limited by a fixed orifice(s) or adjustment means.

#### **4.12.3**

The combined input rating of a continuous and an intermittent pilot assembly shall not be more than 800 Btu/hr (234 W). This input rating may be limited by a fixed orifice(s) or adjustment means.

#### **4.12.4**

Means shall be provided to limit the gas flow of the combined oven or enclosed broiler pilot assembly(s) in one cavity to not more than 0.8 ft<sup>3</sup>/hr (6.29 cm<sup>3</sup>/sec.) of Test Gas E when tested under Test Condition 1 in Table 1, Gas Pressure And Input Conditions For Use In The Various Component Parts.

### **4.13 Burners**

#### **4.13.1**

Burners shall be removable and may be secured to their supports by corrosion-resistant fasteners.

#### **4.13.2**

Burners and burner supports shall be designed to prevent incorrect assembly, and their construction shall be such that burners cannot be installed in other than their correct position.

#### **4.13.3**

Burner assemblies (including air shutters) shall be made of materials having minimum melting points as follows:

- a) Top and griddle burners: 950°F (510 °C); and
- b) Oven and broiler burners: 1450°F (788 °C).

#### **Method of Test**

The melting point for three samples of each type material employed for each type burner shall be determined. The melting temperature of the material for each of the three melting point determinations shall not be less than the applicable temperature specified above.

#### **4.13.4**

Burners having multiple mixer tubes shall be constructed such that, in the event of an obstructed orifice, fuel from any mixer tube shall not be capable of exiting through another mixer tube.

#### **4.13.5**

Top and griddle burners shall be constructed in such a manner as to show no deformation or loosening of parts as determined by the following Method of Test.

#### **Method of Test**

This test shall be conducted on the burner having the maximum input rating and on each size and design of burner differing from the maximum input burner. When tests are required on more than one burner, the tests may be conducted separately or concurrently, at the option of the manufacturer.

The burner shall be adjusted with the test gas providing the highest specified input rating (see Clause 5.1.2 under the appropriate test condition in Table 1, Gas pressure and input conditions for use in the various performance tests. Two standard No. 1, 9 in × 4-1/2 in × 2-1/2 in or 229 mm × 114 mm × 63.5 mm fireclay bricks weighing approximately 7 lb (3.2 kg), arranged side by side to form a square of 9 in (229 mm), shall be centered over the burner. The gas supply shall then be turned on and the burner placed in operation.

The burner shall be operated "FULL ON" for 60 minutes and "OFF" for 30 minutes for a total of 100 cycles. During periods when gas is shut off, the burner shall be allowed to cool in a normal manner without removing the fireclay bricks from the burner grate. Following each 20 cycles, after the burner has cooled, the burner shall be removed and immersed in a water-bath for 1 hour. The initial temperature of the water shall be  $140 \pm 5^{\circ}\text{F}$  ( $60 \pm 3^{\circ}\text{C}$ ). The burner shall then be removed, drained, and air-dried for a minimum of 8 hours. If no leakage, deformation, or loosening of parts sufficient to cause malfunctioning of the burner occurs during the test, the burner shall be considered as complying with this provision. The water bath portion of this test shall only be applied to those portions of the burners designed to be removed for cleaning.

#### **4.13.6**

An open top broiler section equipped with an integral exhaust system shall be tested as follows:

- a) with the exhaust system both on and off:
  - i) if the open top broiler can be operated with or without the exhaust system; or
  - ii) if the absence of the air stream would not be apparent to the user; or
- b) with the exhaust system on, if the open top broiler can be operated only with the exhaust system operating and the absence of the air stream would be apparent to the user.

#### **4.13.7**

Burner ports shall be machined or formed in an accurate manner.

#### **4.13.8**

Fasteners shall not penetrate gasways unless provision is made to provide gas-tightness.

#### **4.13.9**

Fasteners used in burner construction shall be constructed of corrosion-resistant material or have a corrosion-resistant finish. Fasteners, if removable, shall be reusable.

#### **4.13.10**

Top burners shall be centered, within 1/8 in (2 mm), with respect to aeration bowl openings.

#### **4.13.11**

Burner supports shall be of rigid construction and shall be securely held in place. They shall hold the burners permanently rigid so they lie level, cannot be easily tilted, and are secured against side-to-side or front-to-back displacement.

#### **4.13.12**

Supports for top surface cooking section burners shall be such that they will keep the burners fixed rigidly at a uniform distance below the utensil support (cooking) surface.

**4.13.13**

When air shutters are used, openings between air shutters and burners or around the orifice hoods or holders shall be reduced to a practical minimum.

**4.13.14**

Means shall be provided to hold air shutters securely in any adjusted position. This shall not preclude use of friction fits, such as by springs, except where the air shutter also serves as a means for supporting or aligning the burner venturi.

**4.13.15**

An air shutter shall be constructed of corrosion-resistant material or have a corrosion-resistant finish and shall be of sufficient strength not to be deformed during adjustment or during any test specified in this Standard.

**4.13.16**

Means shall be provided for observing oven and broiler burner flames for service adjustment purposes.

**4.13.17**

Organic finishes are not considered acceptable for use on steel mixer tubes, unless it can be demonstrated that they approach the qualities of vitreous enamel.

**4.13.18**

The ports of pilot and main burners for open top broiler sections and units shall be protected from falling particles and grease drippings. If the broiler is equipped with a fully premixed infrared burner, compliance with Clause 5.30 meets the intent of this Clause.

**4.14 Top surface cooking section burner lighters****4.14.1**

Any top surface cooking section burner, when the flames can be readily observed by the operator, shall be lighted from a continuous pilot or an electric ignition system.

Electric ignition systems shall be activated by the process of establishing gas flow to the burner with the valve in the light position. Once activated, the electric ignition system, unless of the flame-proving type, shall remain in operation for at least 8.0 seconds with the valve in the light position. If a manual operation is needed to maintain the valve in the light position, such manual operation is permissible.

**4.14.2**

Electric ignition systems used to ignite gas at top surface cooking section burners shall comply with the applicable construction provisions of the Standard for *Automatic Gas Ignition Systems and Components*, ANSI Z21.20 • CSA C22.2 No. 199, the Standard for *Automatic Electrical Controls For Household And Similar Use — Part 2-5: Particular Requirements For Automatic Electrical Burner Control Systems*, ANSI Z21.20/CAN/CSA-C22.2 No. 60730-2-5, or the Standard for *Manually Operated Electric Gas Ignition Systems and Components*, ANSI Z21.92 • CSA 6.29, as applicable.

**4.14.3**

Lighter assemblies shall be designed and supported so a permanently fixed relationship will be maintained between essential parts, such as pilot tip, igniters, lighter tube, and burner ignition port,

under normal and reasonable conditions of handling and usage. Such design and support shall prevent misalignment or the rendering of the lighter inoperative by normal handling of the appliance.

#### **4.14.4**

Lighter assemblies shall be such that parts not permanently secured cannot be incorrectly assembled and cannot be improperly located or misaligned in removing and replacing during cleaning or other servicing.

#### **4.14.5**

Pilot gas flow adjustment means shall be constructed so as not to be susceptible to accidental displacement during cleaning or other normal operations or due to vibration.

A needle adjustment valve with a simple lock nut, or with a coiled spring arranged so its torque may affect the setting of the needle, shall not be considered acceptable.

#### **4.14.6**

A pilot burner assembly shall be accessible from the front of the appliance for adjustment and for ignition of the pilot(s).

#### **4.14.7**

Pilot burners shall be equipped with durable burner ports. Alloys having a catalytic cracking effect, such as those having greater than 1.0 percent nickel content, shall not be acceptable.

#### **4.14.8**

Flames of multiple pilot burners controlled by a single adjustment means shall be substantially uniform in size.

#### **4.14.9**

Pilot gas flow adjustment screws shall be provided with screwdriver slots at least 3/64 in (1.2 mm) wide and 1/16 in (1.6 mm) deep.

#### **4.14.10**

Pilot burners and pilot burner tips shall be rigidly supported to prevent any possibility of dislodgement.

### **4.15 Automatic gas ignition systems**

#### **4.15.1**

Automatic gas ignition systems shall comply with the applicable construction provisions of the Standard for *Automatic Gas Ignition Systems and Components*, ANSI Z21.20 • CSA C22.2 No. 199, the Standard for *Automatic Electrical Controls For Household And Similar Use — Part 2-5: Particular Requirements For Automatic Electrical Burner Control Systems*, ANSI Z21.20/CAN/CSA-C22.2 No. 60730-2-5, or the Standard for *Manually Operated Electric Gas Ignition Systems and Components*, ANSI Z21.92 • CSA 6.29.

#### **4.15.2**

A main burner(s) located in an oven, an enclosed broiler compartment or a warming oven, or in a location where the flames cannot be readily observed by the operator, shall be equipped with an

automatic ignition system (see Clause 3, Definitions). This system shall be designed to function in one of the following manners:

- a) Provide for ignition of main burners by means of a proved pilot.  
If the presence of the pilot is not proved, provide for automatic shut-off of main burner gas.
- b) Provide for ignition of main burner gas using a direct ignition system that only supervises the main burner(s) flame.  
If the presence of the main burner flame is not proved, provide for shut-off of main burner gas.  
In the event of main burner flame outage during an operating cycle, provide for automatic shut-off 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.
- c) Provide for ignition of main burner gas using a direct ignition system incorporating a proved igniter that proves that the igniter is capable of ignition prior to initiation of main burner gas flow.

For systems that supervise main burner flame during an operating cycle and de-energize the igniter, provide for automatic shut-off of main burner gas in the event of main burner flame outage or provide for prompt and safe re-ignition of main burner gas by re-energizing the proved igniter.

#### **4.15.3**

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

#### **4.15.4**

The main burner(s) shall not depend upon a runner arm for ignition from the pilot when a continuous pilot is maintaining the safety shut-off device in its open position.

#### **4.15.5**

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

#### **4.15.6**

An ignition device shall be designed and installed so the relative position of the device and main burner will be maintained.

#### **4.15.7**

An ignition device shall be removable. If the device is secured to the main burner, corrosion-resistant fasteners shall be used.

#### **4.15.8**

Manual reset means incorporated in a safety shut-off device shall be accessible from the front of the appliance, and clearance shall be provided so the hand and arm used in resetting the device need not contact other portions of the appliance.

#### **4.15.9**

When a pilot burner is provided, the design of the control system shall be such that main burner gas flow can occur only after the pilot has been ignited and proved. For electrical systems for which the manufacturer supplies instructions for manual pilot ignition during a power failure, either a period of at

least 8.0 seconds shall elapse between ignition of the pilot and supply of gas to the main burner(s), or an additional manual operation of the control device shall be necessary to allow main burner gas flow.

#### **4.15.10**

A pilot igniter shall have the sole function of igniting pilot burner gas.

#### **4.15.11**

A pilot igniter shall light the pilot without requiring any manual operation other than turning on a gas valve. If a manual operation is needed to maintain the valve in the light position, such manual operation is permissible on a manually ignited intermittent/continuous system.

#### **4.15.12**

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

#### **4.15.13**

A pilot that is normally lighted by a pilot igniter shall be accessible for manual ignition and adjustment from the front of the appliance.

#### **4.15.14**

In the event a pilot igniter fails to function, construction shall be such as to permit operation of the main burner(s) after manual ignition of the pilot(s). Operation of the main burner(s) under such conditions shall not nullify the control afforded by safety shut-off devices.

#### **4.15.15**

Automatic means for igniting pilot gas shall be designed and located so as to eliminate the collection of carbon or other materials, or the dislocation, distortion, or burning of parts as the result of normal conditions of heating or vibration of parts.

#### **4.15.16**

An oven incorporating a manually activated intermittent/continuous burner control shall have the pilot or main burner operation confirmed directly or indirectly from a height of 4 ft (1.21 m) and from a distance 2 ft (610 mm) from the most projection of the appliance. The opening of the oven door or broiler drawer is acceptable for this purpose.

### **4.16 Pilot gas filters**

#### **4.16.1**

Pilot gas filters complying with the Standard for *Pilot Gas Filters*, ANSI Z21.35 • CSA 6.8, or *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20, shall be provided for all continuous gas pilots.

#### **4.16.2**

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

**4.16.3**

A pilot gas filter shall be installed on the upstream side of and as close to the accessories that it is intended to protect as is practical. It shall be easily replaceable in service.

**4.17 Top surface sections, surface cooking section covers, and utensil supports****4.17.1**

A removable surface cooking section incorporating aeration bowls as integral parts shall be designed so as to prevent incorrect placement of the burner openings with respect to the burners.

**4.17.2**

Utensil supports shall be designed so either they cannot be firmly placed in other than the proper position, or, if improper or inverted placement is possible, combustion will be unimpaired when operating in that manner.

**4.17.3**

Individual utensil supports shall be firmly supported and positioned to prevent rocking in their supports and any shifting or lateral movement in excess of 1/8 in (2 mm).

**4.17.4**

The bottom of a built-in top unit shall be closed to protect combustible construction from direct radiation of the burner flames, the dropping of incandescent particles and spill-overs, and to prevent interference from items stored in cabinets below the appliance.

**4.17.5**

A cover attached to a top surface cooking section shall be provided with suitable means to prevent accidental closure, such as a counterbalance or a manually released catch arrangement.

**4.17.6**

The sensing element of a thermostatically controlled top burner, when subjected to a weight of 0.75 lb (0.34 kg), shall be depressed to a plane level with the top of the utensil support.

**4.18 Drip trays****4.18.1**

In the absence of aeration plates or burner bowls serving the added purpose of collecting spill-overs, separate drip trays shall be provided for top and griddle burners.

**4.18.2**

Suitable drip trays shall be provided for built-in open top broilers.

**4.18.3**

Drip trays shall not be bolted or locked in place and shall be easily removable. The simple opening of a service door or drawer or the removal of a panel not permanently fastened in place shall be acceptable.

**4.18.4**

A drip tray shall be constructed of corrosion-resistant material or have a corrosion-resistant finish.

**4.18.5**

A drip tray shall have the four sides raised, the corners made tight, and the edges smooth.

**4.19 Oven and broiler linings and oven bottoms****4.19.1**

A sheet-steel lining immediately over a broiler burner shall be at least 0.0304 in (0.772 mm) thick. When the space above such a lining constitutes a flue for the flue gases from the broiler burner, the top of such flue, if of sheet-steel, shall be at least 0.0254 in (0.645 mm) thick.

**4.19.2**

All parts of linings for ovens, broilers, deep well cookers, or other heated compartments exposed to flue gases shall be constructed of a corrosion-resistant metal or have a corrosion-resistant finish. Painted or japanned finishes shall not be acceptable.

**4.19.3**

Linings shall be constructed, reinforced, or braced so the size and shape of flue passages will not be appreciably altered by alternate heating and cooling of the oven or broiler, or both, simulating normal usage in service, or as the result of the tests specified in this Standard.

**4.19.4**

The oven bottom shall be constructed and reinforced where necessary to prevent warpage. The upper sheet shall be constructed of corrosion-resistant metal or have a corrosion-resistant finish. The oven bottom may employ an observation window for the purpose of viewing the pilot burner. Painted or japanned finishes shall not be acceptable.

**4.19.5**

The extreme bottom of an appliance incorporating an oven or broiler shall protect combustible construction or storage compartments below the appliance from direct radiation of the burner flames and the dropping of incandescent particles and spill-overs, and shall prevent interference from stored items. Compliance with this provision shall be determined with the broiler drawer and storage drawer in both the closed position and withdrawn to the fully open position.

**4.20 Oven racks, rack supports and broiler pans****4.20.1**

Each baking oven of an appliance shall be equipped with one or more racks of sufficient strength to sustain, without becoming dislodged, the loads shown in Table 6, Oven rack loading, when distributed over 2/3 the area of the rack.

**Table 6**  
**Oven rack loading**  
(See Clause 4.20.1.)

Width of rack, inches (mm)		Load, pounds (kg)
Up to 14	(Up to 356)	15 (6.8)
1 to 18	(356 to 457)	20 (9.1)
18 and over	(457 and over)	25 (11.3)

#### 4.20.2

At least one rack position for each full 3-1/2 in (88.9 mm) of oven height shall be provided.

#### 4.20.3

Oven racks and broiler pans shall be supported in a horizontal plane and shall not bind against the rack supports or linings when the oven and broiler are either hot or cold.

#### 4.20.4

If removable oven rack supports are used, they shall be rigidly held in place and shall be supported and constructed so as to prevent racks from binding.

#### 4.20.5

Rack supports shall be constructed so they will prevent racks from tilting when partially withdrawn. Effective stops shall be provided for all drawers and racks.

#### 4.20.6

With the broiler pan in its lowest position, the minimum vertical clearance between the top surface of the broiler pan rack and the broiler burner ports or the bottom of any projection below the burner ports shall not be less than 3 1/2 in (88.9 mm). A 2-1/2 in (63.5 mm) clearance is permissible on a built-in unit whose outer casing, exclusive of backguards, vent extensions, handles, etc., encloses a volume not in excess of 6 ft<sup>3</sup> (0.17 m<sup>3</sup>) and whose weight is not in excess of 80 lb (36.3 kg).

#### 4.20.7

An enclosed broiler shall be provided with at least three rack positions located so as to permit effective utilization of the broiler. A built-in unit whose outer casing, exclusive of backguards, vent extensions, handles, etc., encloses a volume not in excess of 6 ft<sup>3</sup> (0.17 m<sup>3</sup>) and whose weight is not in excess of 80 lb (36.3 kg) need have only two rack positions. Open top broiler sections or units need not comply with this provision.

#### 4.20.8

A rack provided to support a broiler pan, when subjected to a load of 15 lb (6.8 kg) uniformly applied for a period of 5 minutes without impact along a strip 4 in (102 mm) wide and the full width of the rack equidistant from the face of the appliance and the outer edge of the rack when extended as far as the stops will permit, shall not show:

- a) breakage or permanent damage to any part thereof; or

- b) deflection, during application of the load, from its normal position in excess of 0.5 in (12.7 mm) at a point 6 in (152 mm) from the face of the front frame of the compartment.

## 4.21 Thermal insulation

### 4.21.1

Thermal insulation material shall be installed and enclosed so as to maintain integrity of insulation.

### 4.21.2

Electrically conductive thermal insulation shall be spaced from electrically live parts in accordance with the spacing provisions in Clause 4.26, Electrical Equipment and Wiring (U.S. only). For Canadian provisions, see the Standard for *Electrical Features of Fuel-Burning Equipment*, CSA C22.2 No. 3.

## 4.22 Venting and combustion air supply

### 4.22.1

When a flue collar is provided for a cooking section, it shall serve as an effective vent for all oven and enclosed broiler sections.

### 4.22.2

When both a flue collar and flue deflector are provided, the flue collar opening shall effectively vent the flue gases.

This provision shall be deemed met when no smoke (slight wisps of smoke may be permitted) can be observed escaping from the flue deflector outlet(s) of the appliance, following introduction of a fuming material such as titanium tetrachloride ahead of the outlet(s) after all sections of the appliance have been in operation for 15 minutes under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, and with an 8 ft (2.44 m) stack attached vertically to the flue collar.

### 4.22.3

On a floor-supported unit for installation at zero clearance at the back, a concealed flue shall have a built-in type draft hood that shall comply with the applicable provisions of Clause 5.22, Draft hoods. A built-in unit having a flue collar outlet shall be provided with a built-in type draft hood that shall comply with the applicable provisions of Clause 5.22, Draft hoods.

### 4.22.4

A built-in unit shall be constructed so air for combustion is supplied from spaces exterior to the cabinet, partition, or wall in which it may be installed, either through fixed openings in the appliance structure or through ducts that are integral parts of and attached to the appliance structure.

### 4.22.5

When air for combustion is supplied through a removable grille, duct, or fitting, such grille, duct, or fitting shall be an integral part of the appliance and shall be designed so as to prevent its being attached in an improper position. The minimum dimension of any air opening in the grill shall be 1/8 in (2 mm).

#### **4.22.6**

The construction of a built-in open top broiler section or unit shall provide a fixed minimum venting area.

#### **4.22.7**

A flue system beyond the oven and broiler outlets shall be constructed so no leakage of flue gases will occur at any joint in the flue system when the oven and broiler are in operation.

#### **Method of Test**

The oven and broiler burners shall be placed in operation under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. The broiler burner valve and the oven thermostat shall be set to the full open position. The burners shall be operated for a period of 15 minutes.

At the end of the 15 minute period, 1 cm<sup>3</sup> of titanium tetrachloride, or other suitable fuming material, shall be atomized in 10 seconds in the oven and broiler compartments. This provision shall be deemed met when no smoke (slight wisps of smoke may be permitted) can be observed escaping from either the oven or broiler flue system or at their points of attachment with the splash panels or flue deflectors.

#### **4.22.8**

In the event a blower motor becomes inoperative when used on a built-in oven having provision for front flue discharge of flue products below the 36 in (914 mm) level, the appliance design shall comply with Clause 5.17, Evaluation of burn hazard potential of exterior surfaces, and Clause 5.24, Oven flue discharge temperatures.

A properly applied centrifugal, pressure operated or sail switch, thermal switch, or equivalent device, meets 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 means of keying, two set screws with at least one on a flattened shaft, a locking type set screw on a flattened shaft, or the equivalent.

### **4.23 Fan and limit controls**

#### **4.23.1**

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

#### **4.23.2**

If an auxiliary temperature limit control is used to provide protection from excessive temperatures under blower and motor failure, it may be of the manual reset type.

#### **4.23.3**

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

### **4.24 Flue collars**

#### **4.24.1**

A flue collar, when provided on a floor-supported unit, shall be on the top or rear of the appliance. Provisions shall be made for supporting a draft hood or vent pipe on the flue collar.

#### **4.24.2**

A flue collar, when provided, on a built-in unit, shall be located within the body of the appliance. The outlet collar shall be at least 1-1/4 in (31.8 mm) high. The appliance shall be provided with access openings through which the connection between the draft hood outlet and vent can be visually inspected from the front of the appliance. Means for the mechanical attachment of the vent pipe to the flue collar shall be provided. A single screw, or the equivalent, is acceptable for this purpose. The construction shall be such that the attachment means is accessible when the appliance is installed as specified in the manufacturer's installation instructions.

#### **4.24.3**

The outside circumference of flue collars, whether circular or elliptical, shall be of such length as to accept a vent pipe of integral inch diameter. It is suggested that the circumference of a pipe 4 in (102 mm) in diameter be the minimum size.

### **4.25 Flue deflectors**

#### **4.25.1**

Flue deflector outlet openings shall be located and designed so the direction of flue gas discharge will not be vertical.

#### **4.25.2**

The total free area of the flue deflector vent shall be adequate to pass all the flue gases discharged through the oven vent opening(s).

#### **4.25.3**

The minimum opening of any outlet or of any flue passageway in a flue deflector shall be at least 1/4 in (6.4 mm) on the smallest dimension and have an area not less than 1/4 in<sup>2</sup> (161 mm<sup>2</sup>).

#### **4.25.4**

The design of the outlet openings of a flue deflector or their position with respect to the top surface cooking sections shall be such as to prevent closure or restriction of such openings by utensils placed on the top surface cooking sections.

#### **4.25.5**

Outlet grilles, flue deflectors, or outlet fittings of flue deflectors shall be constructed so they cannot be installed in other than the correct position.

### **4.26 Electrical equipment and wiring**

This clause is unique to the United States only. In Canada, provisions regarding electrical equipment and wiring can be found in the Standard for *Electrical Features of Fuel-Burning Equipment*, CSA C22.2 No. 3.

#### **4.26.1**

Electrical equipment, wiring, and accessories built in or supplied for use with an appliance shall be submitted with the appliance.

#### 4.26.2

Electrical equipment and wiring supplied on an appliance shall be of approved types or shall be investigated as an integral part of the appliance for construction and performance equivalent to approved types. Electrical equipment and wiring shall be judged with respect to its suitability for the particular application.

Electrical equipment and wiring listed or certified by a nationally recognized testing agency qualified to certify or list electrical equipment or wiring shall be deemed to be an approved type.

#### 4.26.3

On a domestic gas cooking appliance, the leads or terminals of an individual control, in the gas control circuit, which 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), or combination thereof, in a color that contrasts with the background. This provision does not apply when:

- a) the control incorporates means that 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.

#### 4.26.4

Appliances shall not be provided with electrical convenience outlets.

#### 4.26.5

The cord provided to connect an appliance to a nominal 120-volt electrical supply shall consist of a three conductor grounding type flexible cord of one of the types shown in Table 7, Maximum allowable rise above room temperature for various component parts, or its equivalent, and a suitable approved attachment plug cap of the parallel blade type, constructed in accordance with the applicable Standard for *Wiring Devices-Dimensional Requirements*, NEMA WD6.

An appliance for connection to a nominal 240-volt electrical supply shall be provided with provisions for the connection of the appliance to the power supply as outlined in the Standard for *Household Electric Ranges*, UL 858.

The current-carrying capacity of the supply cord shall not be less than the rating of the appliance (see Clause 4.26.24). Strain relief shall be provided between the flexible cord and the wiring terminals of each of the devices to which it is connected.

On a floor-supported unit, the supply cord shall be of such length that when properly engaged with the primary disconnect specified in Clause 4.26.8, it can be extended at least 4 ft (1.22 m) beyond the back of the appliance.

On a built-in unit, the supply cord shall be protected or otherwise arranged so that during installation and servicing, pinching between the appliance and supporting cabinet can be avoided. The cord shall not extend more than 4 ft (1.22 m) beyond the back of the appliance when properly engaged with the primary disconnect specified in Clause 4.26.8.

**Table 7**  
**Maximum allowable rise above room temperature for various component parts (\*1)**  
(See Clauses 4.26.5 and 5.20.)

Part (*3)	Maximum allowable rise above room temperature (*2) °F (°C)
<b>Insulated wire, type</b>	
RF, FF, RW, RU	63 (35)
RH, RFH, FFH	90 (50)
TF, TFF, TW	63 (35)
CF, TA	117 (65)
AF (*4), SFF	225 (125)
SF	315 (175)
GTF (CSA)	180 (100)
<b>Appliance wiring material</b>	
Thermoplastic 80C	99 (55)
Thermoplastic 90C	117 (65)
Thermoplastic 105C	144 (80)
Thermoplastic 125C	180 (100)
<b>Flexible cord for use as supply cords or internal wiring (*5)</b>	
SJ, SJO, SJT	63 (35)
S, SO, ST	63 (35)
SRD, SRDT	63 (35)
SP-2, SPT-2, SP-3, SPT-3 (*6)	63 (35)
HPD	63 (35)
HS, HSJ, HPN (*7)	117 (65)
CFPD	117 (65)
AVPO, AVPD	153 (85)
AFPD, AFSJ (*8)	225 (125)
<b>Electrical insulating material (*9)</b>	
Class A	144 (80)
Class B	180 (100)
Class C	Unspecified

(Continued)

**Table 7 (Continued)**

<b>Part (*3)</b>	<b>Maximum allowable rise above room temperature (*2) °F (°C)</b>
Class H	As determined by test
Fiber	117 (65)
Phenolic composition	225 (125)
<b>Windings of relays, solenoids, and other coils (*10) (*11)</b>	
<b>Class A insulation</b>	
Thermocouple method	117 (65)
Resistance method	153 (85)
<b>Class B insulation</b>	
Thermocouple method	153 (85)
Resistance method	171 (95)
<b>Coil windings of d.c. universal, and integral horsepower a.c. motors (*10) (*11)</b>	
<b>Thermocouple method</b>	
<b>Class A insulation</b>	
Open motors	117 (65)
Totally enclosed motors	126 (70)
<b>Class B insulation</b>	
Open motors	153 (85)
Totally enclosed motors	162 (90)
<b>Resistance method</b>	
<b>Class A insulation</b>	
Open motors	135 (75)
Totally enclosed motors	144 (80)
<b>Class B insulation</b>	
Open motors	171 (95)
Totally enclosed motors	180 (100)
<b>Coil windings of fractional horsepower a.c. motors (*10) (*11)</b>	
<b>Thermocouple or resistance method</b>	
<b>Class A insulation</b>	

*(Continued)*

**Table 7 (Concluded)**

<b>Part (*3)</b>	<b>Maximum allowable rise above room temperature (*2) °F (°C)</b>
Open motors	135 (75)
Totally enclosed motors	144 (80)
<b>Class B insulation</b>	
Open motors	171 (95)
Totally enclosed motors	180 (100)
Class 2 transformer enclosure	108 (60)
Power and ignition transformer enclosure	117 (65)
Capacitors electrolytic types (*12)	72 (40)
Capacitors other types (*13)	117 (65)
Sealing compound	Maximum temperature 27 (15) Less than melting point
Diaphragms	73 (40.5)
Filters	90 (50)

**Notes:**

- 1) For microwave cooking appliance components not covered in this table, see the Standard for Microwave Cooking Appliances, UL 923.
- 2) The values shown are based on a room temperature of 77°F (25 °C).
- 3) Parts other than those listed may be used providing the application and temperature limitation are in accordance with the National Electrical Code, NFPA 70.
- 4) This wire is satisfactory if temperatures are such as to require the use of this type of wire and other approved wire is not readily available.
- 5) Flexible cords, other than those listed, may be used providing the application is in accordance with the National Electrical Code, NFPA 70, and the temperature limitation is in accordance with the Standard for Flexible Cord and Fixture Wire, UL 62.
- 6) These flexible cords are suitable for a 90°F (50 °C) temperature rise when specially approved and marked.
- 7) Use if temperature requirements will not allow one of the above types of flexible cords. Do not use to gain higher current capacity.
- 8) Temperature rise of 225°F (125 °C) applies only to impregnated asbestos insulation if cord is employed within an appliance; cotton and rayon braids are limited to a 117°F (65 °C) temperature rise.
- 9) The classes of material used for electrical insulation referred to include materials as follows:
  - Class A = Class A insulation system is one which by experience or accepted test can be shown to have suitable thermal endurance when operating at the limiting Class A temperature specified in the temperature rise standard for the device under consideration. Typical materials used in Class A systems include cotton, paper, cellulose, acetate films, enamel coated wire, and similar organic materials impregnated with suitable substances.
  - Class B = A Class B insulation system is one which by experience or accepted test can be shown to have suitable thermal endurance when operating at the limiting Class B temperature specified in the temperature rise standard for the device under consideration. Typical materials used in a Class B system include mica, glass fiber, asbestos, and other materials, not necessarily inorganic, with compatible bonding substances having suitable thermal stability.
  - Class C = Inorganic materials such as pure mica, quartz, porcelain, etc.

**Class H** = A Class H insulation system is one which by experience or accepted test can be shown to have suitable thermal endurance when operating at the limiting Class H temperature specified in the temperature rise standard for the device under consideration. Typical materials used in Class H systems include mica, glass fiber, asbestos, silicone elastomer, and other materials, not necessarily inorganic, with compatible bonding substances, such as silicone resins, having suitable thermal stability.

- 10) At a point on the surface of an insulated coil where the temperature is affected by an external source of heat, the temperature rise measured by means of a thermocouple may be 9°F (5 °C) (for fractional horsepower a.c. motors) and 27°F (15 °C) (for d.c., Universal, and integral horsepower a.c. motors) more than the indicated maximum, provided that the temperature rise of the coil, as measured by the resistance method, is not more than that specified in the table.
- 11) For a thermocouple measured temperature on the coil of a fractional horsepower a.c. motor (other than a Universal motor), the thermocouple is to be applied to the conducting material or it is to be separated from that material by not more than the integrally applied insulation of the conductor itself. For a thermocouple-measured temperature of a coil of any other motor, the thermocouple is to be mounted as described above or it may be separated from the conductor by not more than the integrally applied insulation of the conductor itself and the conventional coil wrap normally encountered. Ordinarily, temperatures are to be measured by means of thermocouples, except that motor coil temperatures may be determined by the resistance method if the coil is inaccessible for mounting thermocouples.
- 12) For an electrolytic capacitor that is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure may not be more than 117°F (65 °C).
- 13) These limitations do not apply to capacitors that are recognized as being suitable for service at higher temperatures.

#### 4.26.6

A junction box provided for connection of an appliance to the electrical supply shall be located on a part of the assembly that does not require movement for normal servicing and adjustment.

The box shall have provisions for strain relieving the field wiring entering the box.

This box shall be located so the temperature of the conductors within the box, or surfaces of the box likely to be in contact with conductors, will not exceed 63°F (35 °C) rise when the appliance is tested as specified in Clause 4.26.26. During conduct of this test, all unused electrical connection openings shall be closed.

The size of a junction box in which field-installed conductors are to be connected by splicing shall not be less than that indicated in Table 8. A conductor passing through the box is counted as one conductor, and each conductor terminating in the box is also counted as one conductor.

Steel used in the fabrication of a junction box shall not be less than 0.031 in (0.79 mm) thick [0.035 in (0.89 mm) thick if zinc coated]. Nonferrous metal shall not be less than 0.045 in (1.14 mm) thick at points where conduit or metal-sheathed cable is to be connected.

**Table 8**  
**Junction box size**  
(See Clause 4.26.6.)

<b>Conductor,</b>		<b>Free space per conductor,</b>	
<b>AWG</b>	<b>(mm<sup>2</sup>)</b>	<b>in<sup>3</sup></b>	<b>(cm<sup>3</sup>)</b>
18, 16	(0.82, 1.3)	1.5	(24.6)
14	(2.1)	2	(32.8)
12	(3.3)	2.25	(36.9)
10	(5.3)	2.5	(41.0)
8	(8.4)	3	(49.2)

#### 4.26.7

Appliance wiring terminating in a junction box shall have at least 4 in (102 mm) free length available for making connections and strain relief sufficient to comply with the Method of Test of Clause 4.26.10.

#### 4.26.8

When employed, all disconnects shall be polarized. There shall be sufficient free length of wire attached to the movable parts of the disconnect to permit connection and disconnection. The arrangement of the disconnect with respect to internal wiring shall be such as to prevent strain from being transmitted to internal wiring terminals and connections during disconnection.

#### 4.26.9

All wiring other than the supply cord, electrically live parts, and electrical equipment whose approval anticipates an additional enclosure, shall be located within the confines of the appliance structure, an enclosure, or a raceway in a manner to:

- a) provide protection for wiring and electrical equipment against strain and physical abuse which may, in the course of normal handling during and after installation, damage insulation or disrupt splices or terminal connections;
- b) provide protection for wiring and electrical equipment from damage during normal cleaning and normal usage of the appliance;
- c) prevent contact with combustible material;
- d) prevent burning or molten wiring material from falling on combustible material; and
- e) prevent exposure of uninsulated live parts to possible contact by the user. Such parts shall be guarded or positioned so they cannot be contacted by a 1/4 in (6.4 mm) diameter rod, 4 in (102 mm) long, held in the hand. For the purpose of this test, all valve handles, utensil supports, loose aeration bowls, griddles, and conventional top burners shall be removed. Access panels normally opened by the customer for cleaning purposes, such as hinge-type top panels, shall be open. Snap-on type top panels shall be removed. Clips of fluorescent lamp sockets, ignition coils, or ignition electrodes need not comply; however, ignition coils or ignition electrodes shall be guarded to prevent accidental contact.

**4.26.10**

Strain relief between wiring and the device(s) to which it connects shall be provided whenever the conditions of normal servicing of the appliance create the likelihood of placing a strain on wiring junctions.

**Method of Test**

A pull of 35 lb (156 N) shall be applied to the wiring for a period of 1 minute without damage to the connection. If screw-type terminals are used, the screws shall be loosened before applying the force. This test need not be conducted if the assembly is an approved type.

**4.26.11**

The general construction and assembly of electrical equipment and wiring shall be of a neat and workmanlike character. The wiring shall be properly located and supported. Electrical wiring shall be protected against damage from movable parts and from utensils placed in a storage drawer or compartment.

**4.26.12**

High-tension leads shall be fabricated from cable recognized as acceptable for the purpose and conforming to a nationally recognized standard. Such leads shall be provided at each end with brass loops, eyes, or other equivalent means to facilitate positive connection. The leads may be integrally joined to the transformer windings, provided proper strain relief is furnished.

**4.26.13**

Wireways shall be smooth and entirely free from sharp edges, burrs, fins, etc., that may cause abrasion of the insulation on wiring. In order to prevent abrasion of the insulation, openings in metal walls through which insulated wires not in wireways pass shall be provided with smoothly rounded bushings or an acceptable metal grommet, or shall have smooth well-rounded surfaces as formed by rolling or extruding the metal around the opening. Bushings shall be phenolic, porcelain, hard fiber, or other suitable material having a smoothly rounded surface.

**4.26.14**

The wiring shall not pass through appliance flues even when enclosed in raceways. Wiring shall be located so as not to be in the direct path of spill-overs.

**4.26.15**

Conductors shall be spliced or joined so as to be mechanically secure without solder and, unless made with an approved splicing device, shall then be soldered with a fusible metal or alloy, brazed, or welded. Provision shall be made to prevent mechanical strain on splicing devices. All joints and the free ends of conductors shall be covered with an insulation equal to that on the conductors.

**4.26.16**

The spacing between uninsulated live-metal parts of opposite polarity, and between such parts and dead-metal parts, shall not be less than 1/4 in (6.4 mm) over surfaces or through air.

An insulating lining or barrier of fiber or similar material not less than 1/32 in (0.8 mm) thick may be employed in conjunction with an air spacing of not less than 1/16 in (1.6 mm), where spacings otherwise would be insufficient. Insulating material less than 1/32 in (0.8 mm) thick may be employed if, upon investigation, it is found to be suitable for the particular application.

Uninsulated live-metal parts shall be secured so they will be prevented from turning or shifting by means other than friction between surfaces, if such motion may result in a reduction of spacings below the minimum required.

#### **4.26.17**

The appliance shall be constructed so the enclosure, frame, and similar noncurrent-carrying metal parts are electrically continuous to the point of connection of the equipment grounding means. This provision shall be deemed met when the electrical resistance between the point of connection of the equipment grounding means and any noncurrent-carrying metal part is not more than 0.1 ohm.

#### **Method of Test**

The electrical resistance between the point of connection of the equipment grounding means and each noncurrent-carrying metal part shall be determined by either a Wheatstone bridge or by measuring the potential drop between the two points when an alternating current of 20 amperes, derived from a power supply of not more than 12 volts, is passed between the two points and dividing the measured potential drop by the current. The electrical resistance shall not be more than 0.1 ohm. (Insulating resistant finishes may be scraped from the enclosure test points.)

#### **4.26.18**

A lamp holder, fuse holder, receptacle, or similar device provided as a part of the appliance shall be mounted securely and shall be prevented from turning by means other than friction between surfaces.

#### **4.26.19**

A transformer suitable for an NEC Class 2 circuit (see the *National Electrical Code*, NFPA 70) shall be employed with control and ignition systems operating at less than line voltage.

#### **4.26.20**

Materials used for electrical construction shall be suitable for their particular application:

- a) in determining the acceptability of an electrical insulating material, consideration shall be given to its mechanical strength, dielectric strength, heat-resistant properties, the degree to which it is enclosed or protected, and any other features having a bearing on the fire and accident hazards involved;
- b) lamp holders having paper liners shall not be employed;
- c) lamp holders having aluminum screw shells shall not be installed in ovens; and
- d) switches controlling lamp holders shall be suitable for use with tungsten filament lamps.

#### **4.26.21**

The internal wiring shall consist of insulated conductors of adequate size and type(s) that are appropriate for the particular application when considered with respect to:

- a) the temperature and voltage to which the wiring is likely to be subjected;
- b) its exposure to oil, water, or grease; and
- c) other conditions of service to which it is likely to be subjected.

#### **4.26.22**

Switches shall have current and voltage ratings not less than those of the circuits they control.

**4.26.23**

Single-pole switches, including those of safety controls and protective devices, shall not be wired in neutral or grounded lines.

Screw shells of lamp holders shall be wired in neutral or grounded lines.

**Exceptions:**

- a) A door-operated, single-pole switch controlling an oven lamp receptacle may be connected in the grounded conductor.
- b) A single-pole switch may be connected in the grounded conductor
  - i) if it is in the same circuit and controls the same lamp receptacle as a door-operated switch; or
  - ii) if it controls a hood motor and is operated by the hood visor.

**4.26.24**

The current input to an appliance shall not be more than 110 percent of its marked rating, when measured with the appliance in operation under full load conditions at rated voltage.

**4.26.25**

Electrical equipment, including clock and rotisserie motors, and wiring shall have insulation suitable for the temperature to which they are exposed and for the service to which they are subjected. (See Table 7, Maximum allowable rise above room temperature for various component parts.)

**Method of Test**

The appliance shall be operated as specified in Clause 5.19, Wall, floor, and enclosure temperature or Clause 5.25.7, whichever is applicable, under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. At the conclusion of the operating period specified, temperatures of electrical components and wiring shall be determined for each component at points subjected to maximum temperatures. Temperatures shall be determined by means of bead-type thermocouples not larger than 24 AWG (0.20 mm<sup>2</sup>) placed in good thermal contact with the material. Observed temperatures shall not be in excess of those shown in Table 7, Maximum allowable rise above room temperature for various component parts.

With reference to electrical windings with Class A insulation, the temperature rise observed by means of thermocouples on the surface of a coil, where affected by an external source of heat, may be 27°F (15 °C) higher than indicated in Table 7, Maximum allowable rise above room temperature for various component parts, provided the temperature rise by the resistance method is not more than 135°F (75 °C).

The resistance measurement shall be obtained using a suitable impedance bridge and attendant circuits. The windings shall be at room temperature at the start of the test. The temperature rise of a winding shall be calculated as follows:

$$\Delta t = \frac{R}{r} (k + t_1) - (k + t_2)$$

where

$\Delta t$  = temperature rise, °F (°C)

$R$  = resistance of winding at end of test, ohms

$r$  = resistance of winding at beginning of test, ohms

$t_1$  = room temperature at beginning of test, °F (°C)

$t_2$  = room temperature at end of test, °F (°C)

$k$  = 390 for copper for U.S. customary units (234.5 for metric units)

#### 4.26.26

The leakage current measured on an appliance tested as specified in the following Method of Test shall not exceed 0.5 milliampere.

#### Method of Test

When connected to a supply circuit of rated voltage and frequency, the appliance shall be operated under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, as specified in Clause 5.19, Wall, floor, and enclosure temperatures, or Clause 5.25.7, whichever is applicable.

Prior to and at the conclusion of the operating period specified, with continued application of rated voltage and frequency, leakage current between each of the supply terminals and all noncurrent-carrying metal parts (ungrounded) which might become energized shall be measured using the instrumentation and appropriate test procedures specified in the Standard for *Leakage Current for Appliances*, UL 101. The leakage current shall not exceed 0.5 milliampere.

#### 4.26.27

Electrical equipment of cooking appliances shall not be adversely affected by moisture spills in the area of the horizontal cooking surface.

#### Method of Test

a) Controls mounted on the horizontal cooking surface

This test applies to controls such as gas valves, switches, or electronic controls that are mounted in a surface that is more than 45 degrees from vertical, and that is mounted in or adjacent to a cooking surface. The appliance shall be electrically energized with all controls in the off position. A solution of 500 cm<sup>3</sup> of water containing 0.25 grams of ordinary table salt shall be poured at random over knobs and controls. All sections shall then be operated for a period of 5 minutes.

b) Vents, slots, or openings

This test applies to vents, slots, or openings on or near the horizontal cooking surface. The appliance shall be electrically energized with all controls in the OFF position. A solution of 500 cubic centimeters of water containing 0.25 grams of ordinary table salt shall be poured down any series of openings (vent, slot, gap, groove, crevice, or similar openings) that could receive water from a spill at a steady rate while steadily moving back and forth along the length of the opening. All sections shall then be operated for a period of 5 minutes.

At the end of the 5 minute period, the appliance shall be tested for compliance with Clause 4.26.28 a). Additionally, there shall be no evidence of arcing, short-circuiting, insulation breakdown, or unintended operation.

#### 4.26.28

Adequate dielectric shall be interposed between ungrounded current-carrying parts and those external surfaces that can be contacted.

#### Method of Test

When connected to a supply circuit of rated voltage and frequency, the appliance shall be operated under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance

tests, as specified in Clause 5.19, Wall, floor, and enclosure temperatures or Clause 5.25.7, whichever is applicable. At the conclusion of the operating period specified, the applicable dielectric test(s) specified below shall be conducted.

If the appliance employs a component(s), such as a solid state device, that can be damaged by the dielectric potential(s) specified in the provision, the point of connection of this component(s) to the chassis ground shall be disconnected for the purpose of this test in order to eliminate the likelihood of component damage while still retaining representative dielectric stress of the circuit.

During conduct of the dielectric withstand tests, a 500 volt-ampere or larger transformer, having an essentially sinusoidal output voltage that can be varied, shall be used. The applied potential shall be increased gradually from zero until the required test voltage is reached and shall be held at that value for 1 minute. The use of a 500 volt-ampere or larger transformer is not necessary if the high potential testing equipment used maintains the specified high potential voltage at the appliance during the test.

- a) An appliance shall be capable of withstanding, for 1 minute without breakdown, the application of a 60 hertz potential between high-voltage live parts and dead-metal parts, and between live parts of high- and low-voltage circuits. The test potential shall be 1000 volts.
- b) A low-voltage circuit shall be capable of withstanding, for 1 minute without breakdown, the application of a 60 cycle alternating potential of 500 volts applied between uninsulated low-voltage live-metal parts of opposite polarity (with contacts, if any, closed), and between uninsulated low-voltage live-metal parts and the enclosure and grounded dead-metal parts.

The dielectric withstand test between low-voltage parts of opposite polarity need not be conducted on the complete assembly if the components have been separately subjected to this test condition.

The arrangement of the test circuit shall be such that if the dielectric material breaks down a positive signal will be obtained, rather than depending upon a visual inspection of the material.

#### 4.26.29

Electrical motors, such as provided for clocks and rotisseries, shall be designed for continuous duty and shall be provided with overcurrent protection in accordance with the *National Electrical Code*, NFPA 70 and shall be protected with temperature or current-sensitive devices or temperature and current-sensitive devices that will prevent motor winding temperatures from exceeding those specified in Table 9, Maximum allowable motor winding temperatures, °F (°C). If the impedance of the motor windings is sufficient to prevent winding temperatures in open motors or enclosure temperatures on totally enclosed motors of over 302°F (150 °C) with the rotor locked, no additional motor protection is required, but the motor shall be marked that it is impedance protected. The marking provision shall not apply to clock or timer motors. The above tests may be conducted using the resistance method for determining temperature rise, at the option of the manufacturer submitting the equipment.

**Table 9**  
**Maximum allowable motor winding temperatures, °F (°C)**  
(See Clause 4.26.29.)

<b>Motor condition</b>	<b>Class A insulation</b>	<b>Class B insulation</b>
1. Locked rotor, during first hour of operation.	392 (200)	437 (225)
2. Maximum temperature, locked rotor, after first hour of operation.	347 (175)	392 (200)
3. Average temperature, locked rotor, after first hour of operation.	302 (150)	347 (175)
4. Motor operating at any load.	284 (140)	329 (165)

## 4.27 Electronic controls

### 4.27.1

Electronic controls shall be certified to:

- a) UL 60730-1, *Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements*;
- b) CAN/CSA E60730-1, *Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements*; or
- c) CSA C22.2 No. 24-15, *Temperature-Indicating and -Regulating Equipment*, if the electronic control is classified as a thermostat.

### 4.27.2

Electronic controls that are also classified as a thermostat shall also comply with:

- a) UL 60730-2-9, *Particular Requirements for Temperature Sensing Controls*;
- b) CAN/CSA E60730-2-9, *Particular Requirements for Temperature Sensing Controls*; or
- c) CSA C22.2 No. 24-15, *Temperature-Indicating and -Regulating Equipment*.

Circuits that transmit or receive signals (analog or digital), transform or convert electricity to supply other circuits (e.g., power supply), or switch an electrical load (e.g., electronic relay) are subject to the requirements of Clause 4.27 when they are integrated (physically or functionally) with an electronic control.

### 4.27.3

Electronic controls that comply with the following are excluded from these requirements and do not need to be further investigated.

- a) The control is located in a single Class 2 circuit or SELV, Limited Power (less than 15 watt) circuit;
- b) The control does not perform and does not influence the performance of required functionality (see Table 11, Control functions);
- c) The control does not serve to complete the enclosure of the appliance; and
- d) The control does not contain lithium batteries.

The investigation of an electronic control is defined by declaration of control type, action type, and function class. See Table 10 for declaration guidance.

**Table 10**  
**Declaration guidance relating to UL or CAN/CSA-60730-1**  
(See Clause 4.27.3.)

Declaration	Purpose	Available options	Explanation
Control type	Declaration is used to define the severity level of the environmental stress testing.	Operating control	Control functions during the normal use of the appliance. Example: a temperature-regulating thermostat.
		Protective control	Control functions during abnormal conditions of the appliance. Example: a temperature-limiting control or thermal-link (thermal cutoff).
Action type	a) Define the severity level of the environmental stress testing; and b) Define calibration tolerances associated with performance.	Type 1	No calibration tolerances are specified.
		Type 2	Calibration tolerances are specified
Function and software class	Declaration is used to define the level of hardware and/or fault tolerance (FMEA).	Class A	Fault tolerance not examined.
		Class B	Single order fault tolerance. Software investigation required.
		Class C	Second order fault tolerance; associated with control functionality where the severity of the hazard is extreme.

Safety critical functions have been considered with respect to the control type, action type, and function and software class. All control declarations associated with control functionality shall be as noted in Table 11, Control functions.

**Table 11**  
**Control functions**  
(See Clause 4.27.3.)

<b>Function title</b>	<b>ANSI requirement</b>	<b>ANSI section</b>	<b>Safety function classification</b>		
			<b>Function class/ action type</b>	<b>Control type</b>	<b>SW class</b>
Burner 2-Step ON	Two separate manual operations are required to turn on the gas to a main burner or the energy flow to a heating element.	4.7.3	B/2 <b>Note:</b> Only 1 step needs to be hardware single fault tolerant.	Operating	B
Burner 2-Step ON timing	Single input cancelled after 30 seconds.	4.7.3	A/1	Operating	A
Burner 1-Step OFF	Only one manual operation to turn off.	4.7.3	B/2	Operating	B
Redundancy in switching	Electronic controls that function as thermostats shall be designed so that a single component failure shall not result in unintended gas flow to a burner.	4.10.10	B/2	Operating	A
Vent/cooling fan failure — thermostatic	An auxiliary temperature limit control is used to provide protection from excessive temperatures under blower and motor failure or it may be of the manual reset type.	4.23 and 5.20	B/2	Operating	B
Vent/cooling fan failure — nonthermostatic	A control that functions in a manner that indicates loss of fan operation/rotation to de-energize loads during the Abnormal Operation Stalled Fan Test shall function as intended.	4.23 and 5.20	B/2	Operating	B
Self-clean door lock — locks	Doors providing access to self-cleaning ovens or self-cleaning broilers shall have means that will lock the doors at cleaning	5.25.10	B/2	Operating	B

(Continued)

**Table 11 (Concluded)**

<b>Function title</b>	<b>ANSI requirement</b>	<b>ANSI section</b>	<b>Safety function classification</b>		
			<b>Function class/ action type</b>	<b>Control type</b>	<b>SW class</b>
	cycle temperatures in excess of 675°F.				
Self-clean temperature regulating	The calibration temperature of the device shall not vary more than $\pm 10$ percent of the calibration temperature.	5.25.10	B/2	Operating	B
Electronically assisted relay; relay used in an operating circuit.			A/1	Operating	A
Electronically assisted relay; relay used in a protective circuit.			B/2	Protective	B

Electronic controls shall be evaluated in accordance with the unique required parameters/conditions for controls as specified in Table 12, Unique parameters/conditions for controls.

**Table 12**  
**Unique parameters/conditions for controls**  
(See Clause 4.27.3.)

Purpose	Control type	Control requirement
Environmental stress, transportation condition	Type 2, Class B or C control functions	Min. temp. = $-40^{\circ}\text{C}$ Max. temp. = $70^{\circ}\text{C}$ or max ambient whichever is higher.
Number of endurance test cycles	Table 11 (ANSI Z21.23) Temp. selecting mechanism	<p>Manual action:</p> <ul style="list-style-type: none"> <li>– Mechanical cancel touch pad — 100,000 cycles;</li> <li>– Mechanical gas oven start touch pad — 100,000 cycles;</li> <li>– Mechanical top surface cooking burner select start pad — 100,000 cycles;</li> <li>– Mechanical rotary adjustment mechanism such as a potentiometer or encoder — 6,000 cycles</li> </ul> <p><b>Note:</b> Mechanical touch circuits are tactile switches, membrane switches, etc., with moving mechanical parts. The failure mode of such switches that complete 100,000 cycles does not need to be considered.</p> <ul style="list-style-type: none"> <li>– Electronic manual adjustments such as capacitive touch mechanisms — N/A (endurance testing is not needed)</li> </ul> <p>Automatic action:</p> <p>Mechanical Switches:</p> <ul style="list-style-type: none"> <li>– Primary heating load relays (oven and cooktop) — 100,000 cycles;</li> <li>– Redundant relays (when carry only) — 6,000 cycles</li> <li>– Non-heating element relays (such as convection fan, cooling fan, oven light, door lock solenoid/motor, etc.) — 6,000 cycles</li> </ul> <p>Electronic Switches:</p> <ul style="list-style-type: none"> <li>– Triacs, FETs, etc. — N/A (endurance testing is not needed).</li> </ul>

## 4.28 Instructions

### 4.28.1

Each appliance shall be accompanied by clear, concise printed instructions and diagrams, stated in terms clearly understandable to the consumer, adequate for proper field assembly, installation, maintenance, safe use, and operation. Instructions for testing the appliance for leaks shall be included.

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

The instructions shall be marked with directions to the installer to leave them with the appliance and to the consumer to retain them for future reference.

The front cover or the first page shall bear the following boxed warning. It shall be boxed as shown:

**WARNING: If the information in these instructions 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**
  - **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.**
- **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**

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 specification.

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

These instructions shall include:

- a) For all appliances:
  - i) A statement that 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, in Canada, the *Natural Gas and Propane Installation Code*, CSA B149.1.
  - ii) A statement that the installation of appliances designed for manufactured (mobile) home installation must conform with the *Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280* [formerly the *Federal Standard for Mobile Home Construction and Safety, Title 24, HUD (Part 280)*] or with local codes where applicable.
  - iii) A statement that the installation of appliances designed for recreational park trailers must conform with state or other codes or, in the absence of such codes, with the *Standard for Recreational Park Trailers*, ANSI A119.5.
  - iv) If an external electrical source is utilized, a statement that 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*, NFPA 70 or the *Canadian Electric Code*, CSA C22.1-02.
  - v) A statement that:
    - 1) The appliance and its individual shut-off 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).

- 2) The appliance must be isolated from the gas supply piping system by closing its individual manual shut-off 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).
- vi) Directions for the proper assembly of field-installed parts and accessories supplied with the appliance.
- vii) A statement to the installer that appliances equipped with casters on two (2) or more legs are for installation on 1/8 in (2 mm) thick commercial grade vinyl composition floor finishing materials or equivalent. (See Clause 4.3.9.)
- viii) A statement of the maximum gas supply pressure in accordance with the inlet pressure rating of the gas appliance pressure regulator supplied.
- ix) A statement of the gas supply pressure for checking the regulator setting. [The pressure stated shall be at least 1 in wc (249 Pa) above the manufacturer's specified manifold pressure.]
- x) A description of proper vent installation, if applicable, and the specific type of gas vent to be used, including a statement that the vent pipe must be mechanically fastened to the flue collar and instructions for accomplishing this attachment.
- xi) Advice to the user on the safe use of the appliance including lighting instructions and control operation, with pictorial representations. This shall include instructions to reset all controls to the "OFF" position after using a programmable timing operation. For an appliance having a continuous pilot(s) in the oven, broiler, or combination oven-broiler, these instructions shall include a statement that the pilot(s) must be lighted with the control dial in the "OFF" position (or pilot position, if provided).
- xii) Advice to the user on the safe use of the appliance in the event of prolonged power failure.
  - 1) For an appliance without a continuous pilot(s), for which manual ignition of pilot gas may be desired, detailed instructions for safely lighting the pilot(s).
  - 2) For an appliance that is not capable of being safely placed in operation in the event of power failure, instructions informing the user that no attempt should be made to operate the appliance during power failure.
- xiii) Maintenance instructions (including recommended frequency guidelines) suggesting:
  - 1) Keeping appliance area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
  - 2) Not obstructing the flow of combustion and ventilation air.
  - 3) Visually checking pilot(s) and burner flames, with pictorial representation.
  - 4) Cleaning appliance, including special oven surfaces, with recommended cleaning agents, if necessary.
  - 5) Lubricating moving parts, when applicable, including type and amount of lubricant.
- xiv) A statement that the maximum depth of cabinets installed above top surface cooking sections be 13 in (330 mm) or a greater depth specified by the manufacturers as tested by the certification agency.
- xv) Information for obtaining replacement parts and where they are obtainable.
- xvi) A statement that "Leak testing of the appliance shall be conducted according to the manufacturer's instructions."
- xvii) The cover or first page of the manual shall bear the following instruction:

**⚠ WARNING:****Never Operate the Top Surface Cooking Section of this Appliance Unattended**

- Failure to follow this warning statement could result in fire, explosion, or burn hazard that could cause property damage, personal injury, or death.
- If a fire should occur, keep away from the appliance and immediately call your fire department.

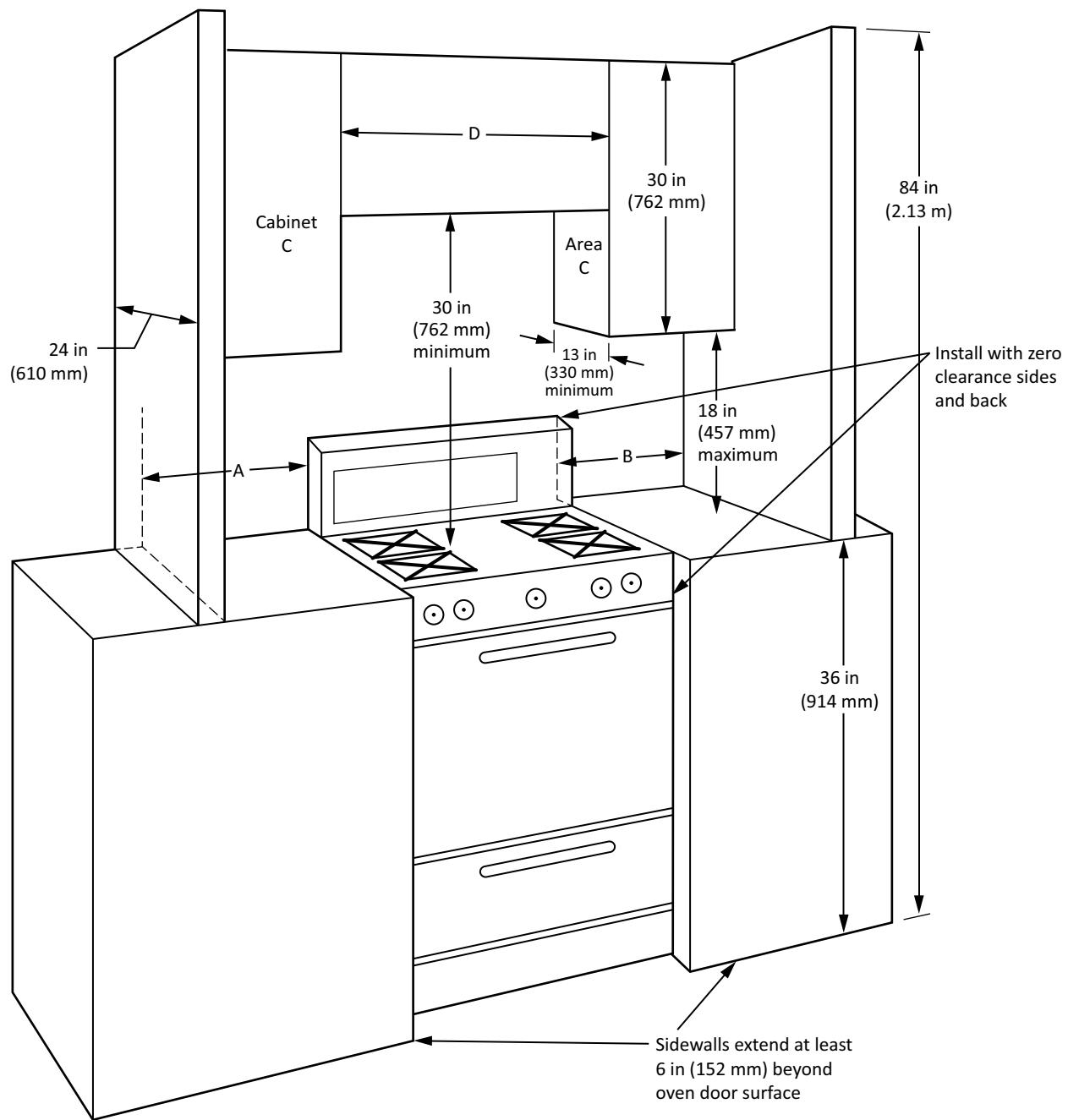
**DO NOT ATTEMPT TO EXTINGUISH AN OIL/GREASE FIRE WITH WATER.**

This warning shall be in boldface type. The word WARNING shall have a letter height of at least 3/16 in (4.8 mm) and the rest of the wording a letter height of at least 1/8 in (3.2 mm). If larger than minimum height letters are used, the WARNING word shall be 50 percent larger than the other words.

- b) For floor-supported units:
- i) Diagrams detailing:
    - 1) For all appliances, except those incorporating room heaters, zero clearance between adjacent combustible construction below the countertop surface and the back and sides of the appliance.
    - 2) For an appliance incorporating a room heater, minimum clearance to adjacent combustible construction below the countertop surface and the back and sides of the appliance as established by performance tests (see Clause 5.1.14).
    - 3) For all appliances, the minimum horizontal clearance in integral inches between the appliance and combustible construction extending from the countertop surface to 18 in (457 mm) or a lesser height specified by the manufacturer as tested by the certification agency above the level of the cooking surface (dimensions "A" and "B" in Figure 3, Test structure for floor-supported units not having elevated cooking sections and Figure 4, Test structure for floor-supported units having elevated cooking sections).
    - 4) For an appliance without an elevated section, the minimum clearance in integral inches between the countertop surface and combustible construction 18 in (457 mm) or a lesser height specified by the manufacturer as tested by the certification agency above the appliance and the minimum distance in integral inches between overhead cabinets installed on either side of the appliance (dimension "D" in Figure 3, Test structure for floor-supported units not having elevated cooking sections, but not less than the nominal width of the appliance.)
    - 5) For an appliance having an elevated cooking section, zero clearance between adjacent combustible construction and:
      - A) the back of the appliance; and
      - B) the sides and top of the elevated section for 13 in (330 mm) or a greater depth specified by the manufacturer as tested by the certification agency from the rear wall.
  - ii) A statement that a manual valve be installed in an accessible location in the gas piping external to the appliance for the purpose of turning on or shutting off gas to the appliance.
  - iii) Directions that any opening in the wall behind the appliance and in the floor under the appliance shall be sealed.

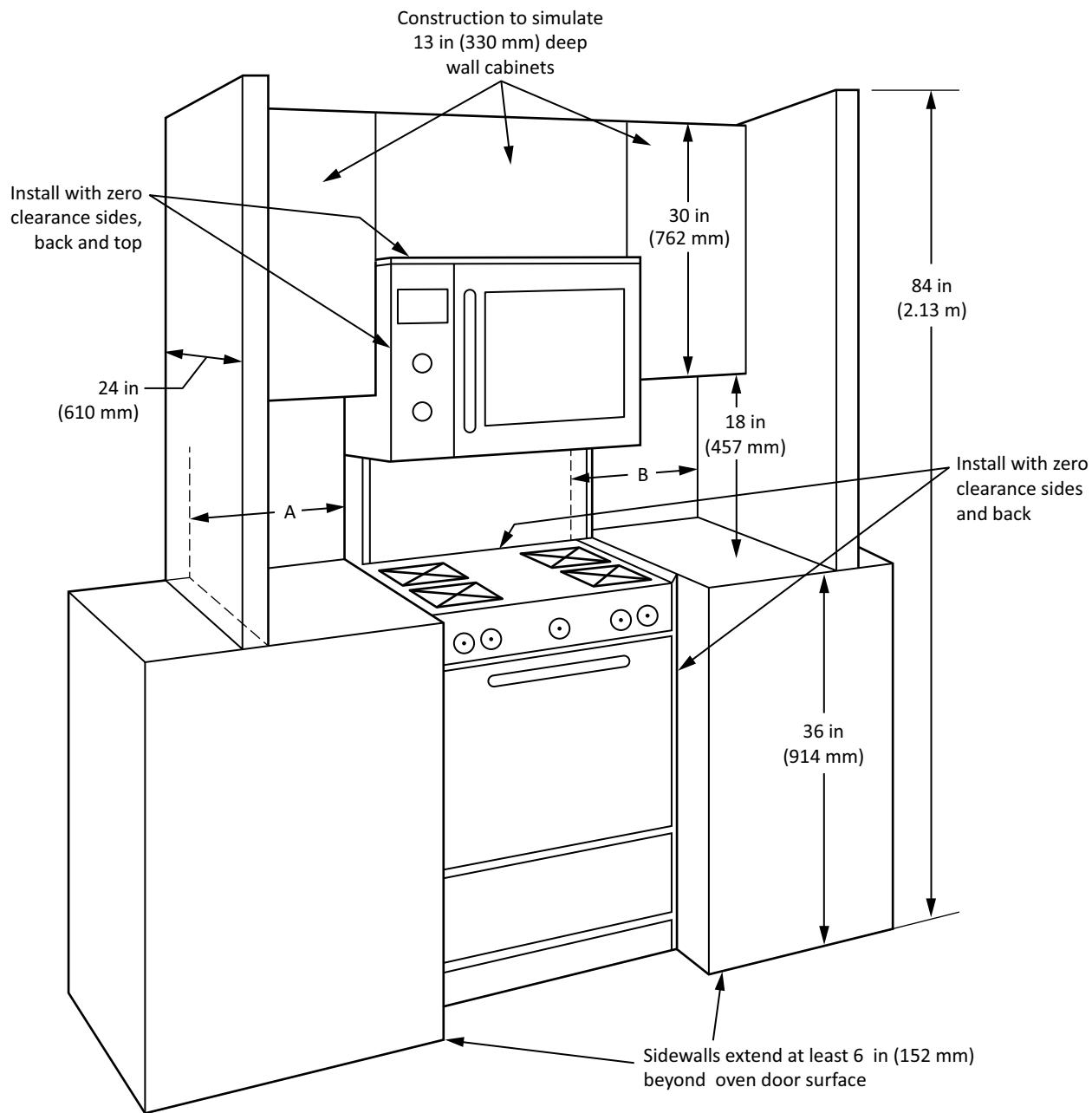
- iv) For an open top broiler section or unit incorporating an integral exhaust system, the instructions shall state that a noncombustible material is to be installed on the underside of a cabinet located above the broiler section or unit in accordance with local codes, or in the absence of local codes, with the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 or, in Canada, the *Natural Gas and Propane Installation Codes*, CSA B149.1.
  - v) For an appliance equipped with casters, the instructions shall state:
    - 1) that the installation shall be made with a connector that complies with the Standard for *Connectors for Movable Gas Appliances*, ANSI Z21.69 • CSA 6.16, and a quick-disconnect device that complies with the Standard for *Quick-Disconnect Devices for Use With Gas Fuel*, ANSI Z21.41 • CSA 6.9;
    - 2) that adequate means shall be provided to limit the movement of the appliance without depending on the connector and the quick-disconnect device or its associated piping to limit the appliance movement;
    - 3) where the restraining means shall be attached to the appliance; and
    - 4) that if disconnection of the restraint is necessary, ensure the restraint is reconnected after the appliance has been returned to its original installed position.
  - vi) For appliances that may be installed according to Clause 4.1.13, the manufacturer shall provide information as to the method of gaining access for servicing.
- c) For built-in units:
- i) Diagrams detailing:
    - 1) For all appliances, clearances between adjacent combustible construction and the back of the appliance (dimension "D" in Figure 3, Test structure for built-in top surface cooking units and open top broiler units).
    - 2) For a top unit, the minimum horizontal clearance in integral inches between the appliance and combustible construction extending from the cooking surface to 18 in (457 mm) or a lesser height specified by the manufacturer as tested by the certification agency above the cooking surface (dimensions "A" and "B" in Figure 3, Test structure for built-in top surface cooking units and open top broiler units).
    - 3) For a top unit, the minimum distance between the front edge of the counter and the cutout opening.  
If the manufacturer's installation instructions permits island installation of a top unit, the installation instructions shall address the minimum distances between the rear and side edges of the counter and the cutout opening in addition to the front distance.
    - 4) For a top unit, the minimum spacing between individual top sections.
    - 5) For an oven or broiler unit, the minimum distance between the floor and bottom of the cutout opening.
  - ii) A statement that a manual valve be installed in an accessible location in the gas line external to the appliance for the purpose of turning on or shutting off gas to the appliance.
  - iii) Directions that the recess in which an oven or broiler unit is installed shall be constructed so as to provide a complete closure around the recessed portion of the appliance, except for the vent thimble for a vented appliance, and that any openings around gas and electric service outlets shall be closed at the time of installation, except when the construction of the appliance provides the necessary closure.
  - iv) For an open top broiler section or unit incorporating an integral exhaust system, the instructions shall state that a noncombustible material is to be installed on the underside of a cabinet located above the broiler section or unit in accordance with local codes, or in the absence of local codes, with the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 or, in Canada, the *Natural Gas and Propane Installation Codes*, CSA B149.1.

**Figure 3**  
**Test structure for floor-supported units not having elevated cooking sections**  
(See Clause 4.28.1.)

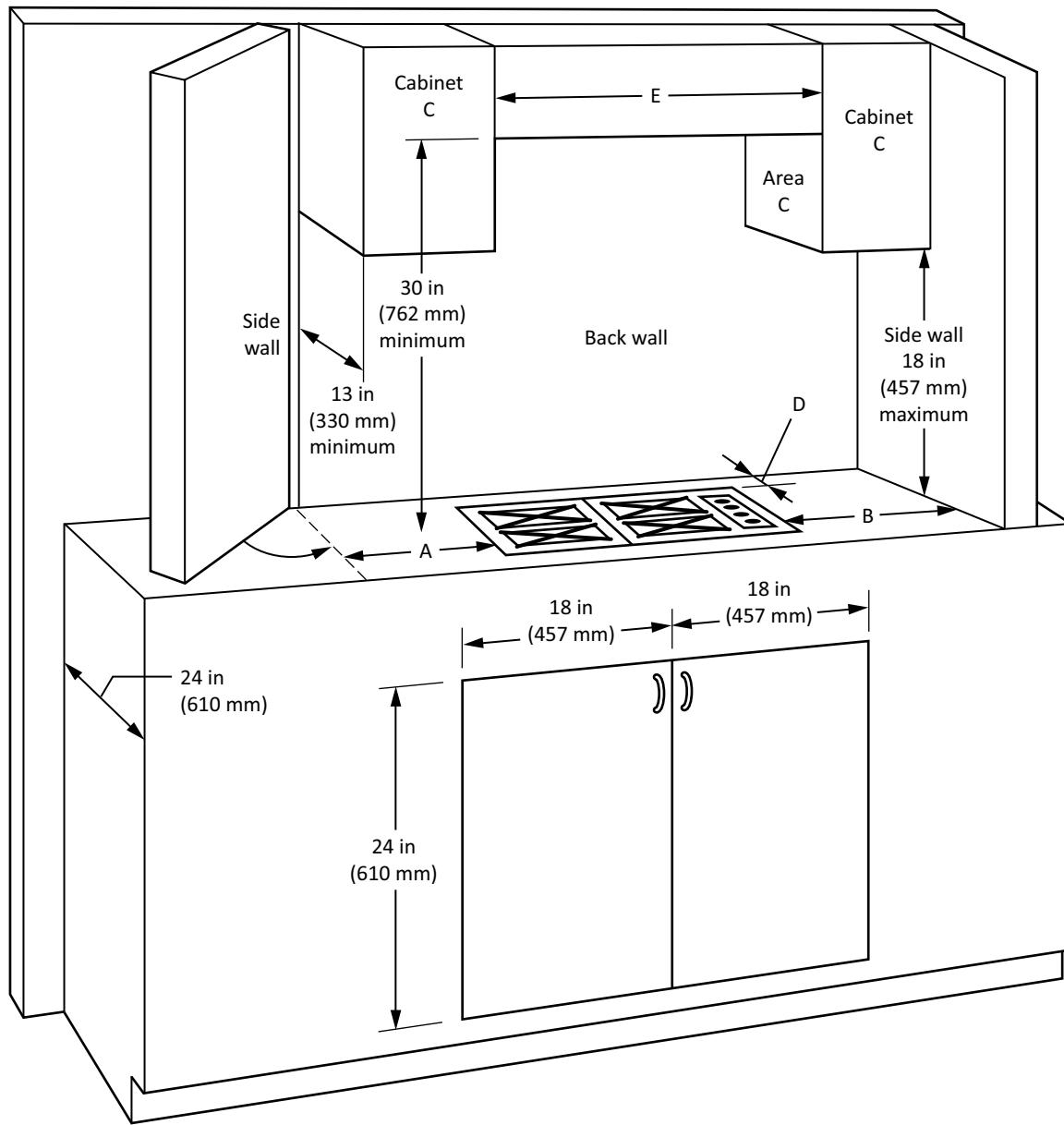


Dimensions "A," "B" and "D" specified by manufacturer.  
("D" not less than nominal width of appliance)

**Figure 4**  
**Test structure for floor-supported units having elevated cooking sections**  
(See Clauses 4.28.1 and 5.19.)



**Figure 5**  
**Test structure for built-in top surface cooking units and open top broiler units**  
(See Clauses 4.28.1, 5.1.6, 5.5.6, and 5.19.)



Dimensions "A," "B," "D" and "E" specified by manufacturer.

("E" not less than nominal width of appliance)

**Note:** Manufacturer's specified cutout location and dimensions shall be used for installation of the appliance.

#### 4.28.2

With reference to Clause 4.5.3 d), the user instructions for an appliance employing devices intended to

reduce the risk of tipping the appliance shall include the word “WARNING” and the following or its equivalent:

- a) “A child or adult can tip the range and be killed.”
- b) “Install the anti-tip device to the structure and/or the range. Verify the anti-tip device has been properly installed and engaged [state how for the two or more possible locations].”
- c) “Engage the range to the anti-tip device by [state how for the two or more possible locations]. Ensure the anti-tip device is re-engaged when the range is moved [state how for the two or more possible locations].”
- d) “Re-engage the anti-tip device if the range is moved. Do not operate the range without the anti-tip device in place and engaged.”
- e) “See installation instructions for details.”
- f) “Failure to do so can result in death or serious burns to children or adults.”

Instructions shall be included specifying how to check installation of the anti-tip device. The warning shall be on the front cover or the first page of the instructions and in the section of the installation instructions describing the installation of the anti-tip device.

#### **4.28.3**

Operating instructions for an appliance with a top burner(s) shall include a warning to the user to the effect that top burner flame size should be adjusted so it does not extend beyond the edge of the cooking utensil. The instructions shall state that this instruction is based on safety considerations.

#### **4.28.4**

The instructions shall warn the user of possible hazards or injuries that may result from the misuse of appliance doors or drawers such as stepping, leaning, or sitting on the doors or drawers.

#### **4.28.5**

Instructions shall be provided for the proper removal and replacement of the appliance for servicing or cleaning.

#### **4.28.6**

Operating instructions for an appliance equipped with adjustable low setting high-low valves shall include instructions on how to adjust the low setting.

#### **4.28.7**

The instructions shall warn of the potential hazards associated with storage cabinet areas above appliances.

#### **4.28.8**

Operating instructions for the appliance shall include a warning to the user to the effect that the appliance shall not be used for space heating. The instructions shall state that this instruction is based on safety considerations as shown below:

**⚠️ WARNING**

**NEVER use this appliance as a space heater to heat or warm the room. Doing so may result in carbon monoxide poisoning and overheating of the oven.**

The instructions shall also warn of the potential hazards associated with using an oven for storage space.

**4.28.9**

For an open top broiler unit or an appliance equipped with an open top broiler section, the instructions shall include a statement to the effect that cooking utensils should not be used on the open top broiler unit or section.

**4.28.10**

When an appliance, equipped with a top surface cooking section cover not intended to be closed during appliance operation, is capable of operation with the cover in place, the instructions shall include the following statement:

“Top cover must be open when main burner is in operation.”

**4.28.11**

All cord connected appliances shall include instructions relative to location of the wall receptacle and a warning to the user to disconnect the electrical supply before servicing the appliance.

**4.28.12**

Operating instructions for an appliance provided with self-cleaning oven or self-cleaning broiler features shall include a warning to the user pointing out the importance of removing broiler trays and other utensils and wiping off all excessive spillage before initiating the cleaning cycle.

**4.28.13**

A universal or convertible type appliance for use with either natural, manufactured, or mixed gas and convertible for use with propane gas shall be provided with adequate instructions for converting from one gas to the other.

If replacement of fixed orifices is required, instructions for installing these orifices shall be included. The instructions shall contain a statement:

“Save the orifices removed from the appliance for future use.”

The instructions shall also contain information required to convert the appliance back to the original gas.

**4.28.14**

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

#### 4.28.15

When a flexible service cord of the grounding type is provided to connect the appliance to a line-voltage electrical supply, the instructions shall also include the intent of the warning statement specified in Clause 4.29.14.

#### 4.28.16

Operating instructions for the appliance shall include a warning to the user of the hazards regarding the use of aluminum foil in ovens during oven operation. The instructions shall state that this instruction is based on safety considerations, as shown below:

 **WARNING**

**NEVER cover any slots, holes or passages in the oven bottom or cover an entire rack with materials such as aluminum foil. Doing so blocks airflow through the oven and may cause carbon monoxide poisoning. Aluminum foil linings may also trap heat, causing a fire hazard.**

#### 4.28.17

For gas cooking appliances that have been tested under Clause 5.29, Performance of appliances intended to be utilized with ventilation systems that direct air in a downward direction, the manufacturer shall detail the brands and model numbers of those ventilation systems found acceptable. A warning statement shall be also made that using models or brands that direct air in a downward direction other than the ones specified may lead to improper operation of the gas appliance and may result in personal injury or property damage. Ventilating systems that direct the air upwards do not have any restriction.

Instructions that if the model number ventilation hood is no longer available the owner should contact the appliance manufacture for acceptable replacement ventilation system model numbers.

For gas cooking appliances not tested under Clause 5.29, Performance of appliances intended to be utilized with ventilation systems that direct air in a downward direction, and not intended for use in conjunction with a ventilation system with provisions to direct air in a downward direction, instructions shall include a statement that the appliance should not be installed with a ventilation system that blows air downward toward the appliance. The instructions shall also include that this type of ventilation system may cause ignition and combustion problems with the gas cooking appliance resulting in personal injury or unintended operation.

#### 4.28.18

A statement that an air curtain or other overhead range hood, which operates by blowing a downward airflow onto a range, shall not be used in conjunction with a gas range unless the hood and range have been designed and tested in accordance with the Standard for *Domestic Gas Ranges*, ANSI Z21.1 • CSA 1.1, and listed by an independent testing laboratory for combination use. The installation instructions for both the gas range and air curtain range hood shall include statements that the air curtain or overhead range hood is permitted to be used in conjunction with a gas range, and the gas range and air curtain range hood have been designed and tested in accordance with the Standard for

*Domestic Gas Ranges, ANSI Z21.1 • CSA 1.1 and listed by an independent testing laboratory for combination use.*

#### **4.28.19**

Also see Clauses [4.1.23](#), [4.8.6 c\)](#), [4.24.2](#), [4.29.3 d\)](#), [4.29.15](#), and [4.29.16](#).

### **4.29 Marking**

#### **4.29.1**

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 Clause [5.27](#), Marking material adhesion and legibility. The designation of any class of marking shall not preclude the use of marking of a lower number class.

##### **Class I. Integral Marking**

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

##### **Class IIA-1. Permanent Plate**

Shall be made of metal having a minimum thickness of 0.012 in (0.30 mm) and shall be securely attached by mechanical means.

##### **Class IIA-2. Permanent Plate**

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

##### **Class IIA-3. Permanent Plate**

Shall be made of metal having a thickness less than 0.006 in (0.15 mm), shall be attached by means of nonwater-soluble adhesive, and shall comply with Clause [5.27](#), 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 Clause [5.19](#), Wall, floor, and enclosure temperatures.

##### **Class IIA-4. Permanent Plate**

Shall be made of pressure-sensitive metal foil requiring no solvent or activator and shall comply with Clause [5.27](#), 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 Clause [5.19](#), Wall, floor, and enclosure temperatures.

##### **Class IIIA-1. Permanent Label**

Shall be made of material not adversely affected by water, shall be attached by means of nonwater-soluble adhesive, and shall comply with Clause [5.27](#), 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 Clause [5.19](#), Wall, floor, and enclosure temperatures.

##### **Class IIIA-2. Permanent Label**

Shall be made of material not adversely affected by water, shall be attached by means of nonwater-soluble adhesive, and shall comply with Clause [5.27](#), 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 Clause [5.19](#), Wall, floor, and enclosure 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 Clause 5.19, Wall, floor, and enclosure temperatures.

**Class IV. Semi-Permanent Label**

Shall be made of material that 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****4.29.2****Name plate(s)**

Each appliance shall bear a plate, or a combination of adjacent plates, of Class IIIA-1 marking material attached to a permanent part of the appliance that is not exposed to the accumulation of spillage. The plate(s) shall be visible by either opening a door or a drawer, lifting the top, or removing one or more of the parts normally removable by the user without the use of tools.

**4.29.3**

The following information shall be permanently recorded on the name plate(s):

- a) Manufacturer's or dealer's name and address (city and province or state).
- b) Model number of the appliance.
- c) A distinctive number that will identify an individual appliance.
- d) Information on the need for venting, as follows:
  - i) "Vented unit. See installation instructions."
  - ii) "May be vented. If vented, see installation instructions."
- e) If the appliance utilizes any electrical equipment, the voltage, frequency, and current input.
- f) Identification of this Standard by indicating the edition of the standard, with the following marking:  
"CSA/ANSI Z21.1 XXXX-(year) • CSA 1.1 XXXX-(year) Household Cooking Appl.;"
- g) The symbol of the organization making the tests for compliance with this Standard.

**4.29.4**

The following information also shall be permanently recorded on the name plate(s):

- a) Gases for which equipped:
  - i) A dedicated type appliance shall be marked for only the type of gas for which equipped, as follows: Nat., Mfd., Mix., Propane, or \_\_\_\_ Btu/Cubic foot LP gas-air mixture (the heating value for the LP gas-air mixture shall be indicated).
  - ii) A convertible or universal type appliance shall be marked for only the two types of gases for which equipped, as follows: Nat-Propane, Mfd-Propane, Mix-Propane.  
The appliance shall also be marked to the effect that:  
"The gas appliance pressure regulator must be set for the gas with which the appliance is used." (See Clause 4.28.13.)
    - 1) A universal type appliance shall also be marked: "This appliance can be used with Propane gas and \_\_\_\_ gas. (Only the gas for which the appliance is equipped shall be identified.) It is shipped from the factory adjusted for use with \_\_\_\_ gas: DOUBLE COAXIAL ORIFICE HOODS MUST BE SCREWED TIGHT WHEN PROPANE GAS IS USED."

- 2) A convertible type appliance provided with a combination of fixed orifices and double coaxial orifices shall also be marked: "This appliance can be used with Propane gas and \_\_\_\_ gas. (Only the gas for which the appliance is equipped shall be identified.) It is shipped from the factory adjusted for use with gas: DOUBLE COAXIAL ORIFICE HOODS MUST BE SCREWED TIGHT WHEN PROPANE GAS IS USED. (oven, broiler, top) \_\_\_\_ burners are equipped with fixed orifices, located \_\_\_\_\_. Follow the instructions packaged with the orifices for gas conversion." (Each fixed 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.) (See Clause 4.28.13.)
  - 3) A convertible type appliance provided with fixed orifices shall also be marked: "This appliance can be used with Propane gas and \_\_\_\_ gas. (Only the gas for which the appliance is equipped shall be identified.) It is shipped from the factory adjusted for use with \_\_\_\_ gas: Conversion orifices are located \_\_\_\_\_. Follow the instructions packaged with the orifices for gas conversion." (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.) (See Clause 4.28.13.)
- iii) A convertible appliance equipped with dual outlet burner valves requiring orifice spud substitution shall display a marking outlining the correct selection of the orifices for the gas with which the appliance is to be used when installed.
  - iv) The appliance shall be marked with the manufacturer's normal hourly Btu input rating for each main burner for each gas for which the appliance is equipped.
  - v) The appliance shall be marked with the manufacturer's manifold pressure in inches water column for each gas for which the appliance is equipped.
- b) The appliance shall have a marking stating a maximum depth of 13 in (330 mm) or a greater depth specified by the manufacturer as tested by the certification agency for the overhead cabinets.
- c) Clearances from adjacent combustible construction as follows:
- i) Each appliance shall be clearly marked with the minimum horizontal clearances in integral inches or millimeters between the appliance and combustible construction extending from the countertop surface to 18 in (457 mm) or a lesser height specified by the manufacturer as tested by the certification agency above the level of the cooking surface.
  - ii) A floor-supported unit, except one incorporating a room heater, shall be clearly marked that it is for zero clearance between adjacent combustible construction below the countertop surface and the back and sides of the appliance.  
A floor-supported unit incorporating a room heater shall be clearly marked with the minimum clearance to adjacent combustible construction below the countertop surface and the back and sides of the appliance as established by performance tests (see Clause 5.1.14).
  - iii) An appliance not having an elevated cooking section shall be clearly marked with:
    - 1) the minimum vertical clearance between the countertop surface and combustible construction above the appliance; and
    - 2) the minimum horizontal distance in integral inches between overhead cabinets installed to either side of the appliance (not less than the nominal width of the appliance), or the statement, "not less than the nominal width of the appliance."
  - iv) An appliance having an elevated cooking section shall be clearly marked that it is for zero clearance between adjacent combustible construction and
    - 1) the back of the appliance; and
    - 2) for 13 in (330 mm) or a greater depth specified by the manufacturer as tested by the certification agency from the rear wall on the sides and top of the elevated section
  - v) A built-in top unit shall have a marking stating:

"Minimum horizontal distance(s) from sides and back of appliance to adjacent vertical combustible walls extending above the top panel, \_\_\_\_ in from side walls, \_\_\_\_ in from rear wall. Minimum horizontal distance from front edge of counter to front side of appliance, \_\_\_\_ in."

These distances shall be from the outermost edge of the top panel or any trim strip supplied with the appliance.

- vi) A two-burner built-in top unit shall have a marking specifying the minimum acceptable spacing between similar adjacent top units.
- vii) A built-in oven or broiler unit shall be clearly marked with the minimum distance from the floor to the bottom of the cutout opening.
- viii) If vented, the appliance shall be clearly marked with the minimum clearances from the vent.
- d) Marking appliance for manufactured (mobile) homes or recreational park trailers.
  - i) An appliance for manufactured (mobile) home or recreational park trailer installation only shall be marked: "For installation in a manufactured (mobile) home or recreational park trailer only."
  - ii) An appliance for household installation as well as for manufactured (mobile) home or recreational park trailer installation should be marked: "Also for installation in a manufactured (mobile) home or recreational park trailer."
  - iii) Any of the following may be substituted for the term "manufactured home (mobile home)" in i) and ii) above:
    - 1) Mfd. home (mobile home);
    - 2) Manufactured (mobile) home;
    - 3) Mfd. (mobile) home;
    - 4) Manufactured home; or
    - 5) Mfd. home.
- e) Marking appliances for manufactured (mobile) homes and recreational vehicles:  
An appliance complying with the Standard for *Recreational Vehicle Cooking Gas Appliances*, ANSI Z21.57 or the Standard for *Propane Fired Cooking Appliances for Recreational Vehicles*, CAN 1.1.16, as well as with the provisions of this Standard may be marked: "Also for installation in a recreational vehicle." This marking may be combined with that specified under Clause 4.29.4 d) ii).

#### 4.29.5

When an appliance is designed so that the legs, casters, or base can be removed for shipping, the appliance shall bear a Class IV marking to the effect that the appliance is for use only with the specific legs, casters, or base specified by the manufacturer, as applicable.

#### 4.29.6

An appliance designed as specified in Clause 4.1.13 shall have a Class IV marking in a conspicuous exterior location in black letters on a yellow background, stating:

"NOTICE: In order to be able to service this appliance, it must be installed with the casters supplied, a connector complying with the Standard for *Connectors For Movable Gas Appliances*, ANSI Z21.69 • CSA 6.16, and a quick-disconnect device complying with the Standard for *Quick-Disconnect Devices For Use With Gas Fuels*, ANSI Z21.41 • CSA 6.9. It must also be installed with restraining means to guard against transmission of strain to the connector, as specified in the appliance manufacturer's instructions."

The word "NOTICE" shall be in letters having a minimum uppercase letter height of 0.360 in (9.14 mm).\* The remainder of the notice shall be in letters having a minimum uppercase letter height of 0.180 in (4.57 mm)† with a minimum vertical spacing between lines of 0.069 in (1.75 mm). Lowercase letters shall be compatible with uppercase letter size specifications.

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

† This letter height corresponds to 18-point type.

#### 4.29.7

An appliance that can be caster-mounted shall have a Class IV marking in a conspicuous exterior location in black letters on a yellow background, stating:

"NOTICE: When the appliance is installed with casters, it must be installed with the casters supplied, a connector complying with the Standard for *Connectors for Movable Gas Appliances*, ANSI Z21.69 • CSA 6.16 and a quick-disconnect device complying with the Standard for *Quick Disconnect Devices For Use With Gas Fuels*, ANSI Z21.41 • CSA 6.9. It must also be installed with restraining means to guard against transmission of strain to the connector, as specified in the appliance manufacturer's instructions."

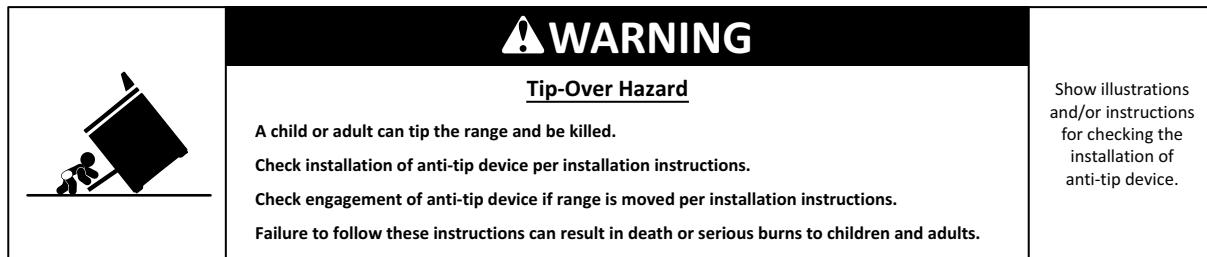
The word "NOTICE" shall be in letters having a minimum uppercase letter height of 0.360 in (9.14 mm).\* The remainder of the notice shall be in letters having a minimum uppercase letter height of 0.180 in (4.57 mm)† with a minimum vertical spacing between lines of 0.069 in (1.75 mm). Lowercase letters shall be compatible with uppercase letter size specifications.

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

† This letter height corresponds to 18-point type.

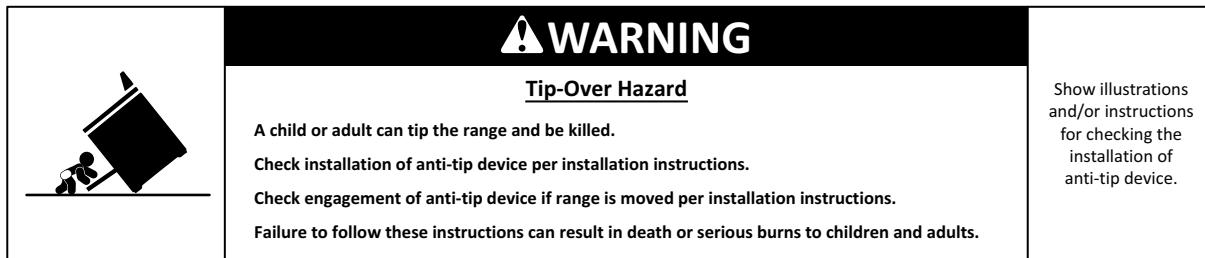
#### 4.29.8

An appliance employing devices to reduce the risk of tipping of the appliance shall be marked with a Class IV marking as shown below, and the marking shall be readily visible during installation of the appliance (see Clause 4.28.2). An equivalent marking may be used provided the word "WARNING" appears on the marking.



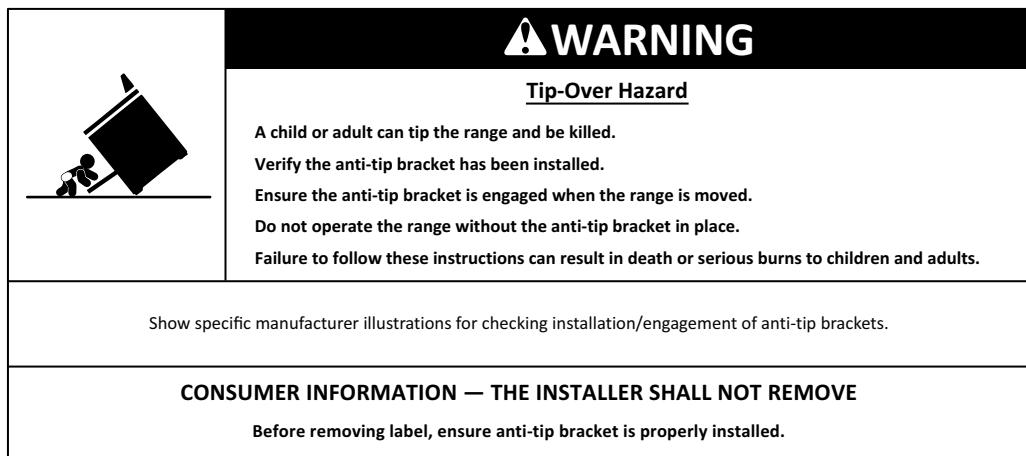
#### 4.29.9

An appliance employing devices to reduce the risk of tipping of the appliance shall be marked with a Class II or Class III marking with the text and illustration as shown below. An equivalent marking may be used provided the word "WARNING" appears on the marking. The marking may be visible after opening an oven door.



#### 4.29.10

An appliance employing devices to reduce the risk of tipping of the appliance shall be marked with a Class IV marking with an area of at least 36 in<sup>2</sup> (0.02 m<sup>2</sup>). The label shall state that the appliance should not be operated without the anti-tip device installed and include information and illustration as shown below. An equivalent marking may be used provided the word "WARNING" appears on the marking. The marking shall state "CONSUMER INFORMATION — THE INSTALLER SHALL NOT REMOVE" and "Before removing marking, ensure anti-tip device is properly installed." The marking shall be visible after the appliance is installed with any doors closed.



#### 4.29.11

##### Separate gas appliance pressure regulator

When a gas appliance pressure regulator is supplied separately:

- the appliance shall be marked: "For use with a gas pressure regulator"; and
- the appliance shall also bear a marking on Class VI marking material in an obvious location stating, "The regulator supplied must be used with this appliance."

#### 4.29.12

##### Self-cleaning

An appliance provided with self-cleaning oven or self-cleaning broiler features shall have a permanent marking stating that the broiler tray and utensils must be removed from the compartment and excessive spillage wiped off before initiating the cleaning cycle.

This marking shall be in sharp contrast to its background.

The marking shall be applied in a location that will be clearly evident to the user when initiating the cleaning cycle.

When applied to the inside of the oven door, it shall have a permanency equivalent to a marking baked into an enameled surface. When applied to the outside of the oven door or adjacent to the point of actuation of the cleaning cycle, a Class III A-2 marking shall be used.

#### 4.29.13

#### Electrical diagrams

Except when electrical equipment is limited to a light(s) and clock motor(s), electrical diagrams of all circuits within the appliance shall be attached to the appliance on Class IV marking material or in a marked envelope. Some means of color, letter, or number coding shall be used in the diagram so as to identify each circuit and the actual wiring shall be colored or marked as shown in the diagram.

- a) Electrical diagrams shall conform to the Standard for *Electrical and Electronics Diagrams*, ANSI Y14.15. See Annex C for reference to pertinent provisions of ANSI Y14.15. The wire color designations specified under 15-3.11 of ANSI Y14.15 are shown in Annex D.
- b) It is recommended that the usage of wire colors be as shown in Annex E.
- c) Unidentified graphical symbols used for electrical diagrams shall conform to the Standard for *Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Class Designation Letters)*, ANSI/IEEE 315. See Annex F for preferred symbols of commonly used items, as extracted from the above standard. Abbreviations for identified items shall be as shown in Annex F.
- d) The electrical diagram specified in Clause 4.29.13 a) shall be a schematic diagram of the ladder form (see Clause 3, Definitions, Electrical Diagrams). When necessary for clarification, a cycle chart or printed sequence of switching action shall accompany the schematic diagram.
- e) It is recommended that a connection diagram (see Clause 3, Definitions, Electrical Diagrams) also be provided, in addition to the schematic diagram, to aid in locating components for field service.
- f) The electrical diagram shall include 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.”

#### 4.29.14

An appliance provided with a flexible service cord of the grounding type for connection to a line-voltage electrical supply shall bear a Class VI marking attached to the plug end of the cord, which includes the following information, as applicable:

#### WARNING

#### Electrical Grounding Instructions

This appliance is equipped with a (three-prong) (four-prong) grounding plug for your protection against shock hazard and should be plugged directly into a properly grounded receptacle. Do not cut or remove the grounding prong from this plug.

## 4.29.15

### Vent connection

When the appliance is provided with a flue collar, it shall be provided with a Class IV marking in a location conspicuous prior to installation, clearly indicating the specific type of Type B Gas Vent (such as B-0, B-1 or B-1/2) with which the appliance is to be used. Stenciling this marking directly on the appliance is considered acceptable. (The manufacturer's instructions shall state the specific type of Type B Gas Vent to be used, together with the listed clearances from combustible construction.)

## 4.29.16

### Front flue discharge

A built-in oven with provisions for front discharge of flue gases shall comply with Clause 5.24, Oven flue discharge temperatures. Otherwise, it shall have a Class IV marking stating, "Do not install beneath work counters. The flue discharge shall not be located below the 36 in (914 mm) level when the oven is installed in accordance with the manufacturer's instructions."

## 4.29.17

### Field applied exterior surface

An appliance having an exterior surface applied using materials supplied by the installer shall have the surface upon which the finish material is to be superimposed stenciled with a statement in Class V marking that only material that the manufacturer specifies should be applied.

## 4.29.18

### Open top broiler unit markings

In addition to other applicable specified markings, a built-in open top broiler unit shall bear the following markings on the rating plate or on a separate Class II plate adjacent to the rating plate, unless otherwise specified:

- a) When the appliance does not incorporate an integral exhaust system, the statement, "To be used in conjunction with a suitable vent hood only."
- b) If the appliance complies with Clause 5.19, Wall, floor, and enclosure temperatures, the statement, "For Installation in Other Than Noncombustible Locations." Otherwise, the statement, "For Use Only In Noncombustible Locations."
- c) If the appliance is for installation in other than noncombustible locations, the statements:
  - i) "Minimum horizontal distance(s) from center of grid area to adjacent vertical combustible walls extending above the top panel in (mm) from side walls, in (mm) from rear wall."
  - ii) "Minimum vertical distance from top of broiler grid to overhead unprotected combustible surfaces 36 in (975 mm)."
- d) A statement to the effect that cooking utensils should not be used on an open top broiler unit.

## 4.29.19

A Class VI marking shall include the following information:

A statement that an air curtain or other overhead range hood, which operates by blowing a downward airflow onto a range, shall not be used in conjunction with a gas range unless the hood and range have been designed, tested and listed by an independent testing laboratory for combination use. The marking should also direct the purchaser/installer to review the installation instructions to determine if their range is acceptable for use with such a ventilation system and what are the acceptable manufacturer(s) and model number(s) of such products.

## 4.29.20

### Open top broiler section markings

In addition to other applicable specified markings, an open top broiler section shall bear the following markings on the rating plate or on a separate Class II plate adjacent to the rating plate, unless otherwise specified:

- a) When the appliance does not incorporate an integral exhaust system, the statement, "To be used in conjunction with a suitable vent hood only."
- b) A statement to the effect that cooking utensils shall not be used on an open top broiler section.

## 4.29.21

Also see Clauses 4.7.6, 4.7.7, 4.7.14, 4.10.7, and 4.26.29.

## 4.30 Flammability

### 4.30.1

All electrical connections where the total circuit load is greater than 60 W during normal operation shall:

- a) comply with Clauses 4.30.2, 4.30.3, and 4.30.4; or
- b) be evaluated as specified in Clause 5.31, Nichrome wire test.

**Note:** A risk of fire is considered to exist at any two points in a circuit where a power of more than 15 watts can be delivered into an external resistor connected between the two points within 5 seconds. To deliver 15 watts at a connector, the circuit must have a nominal load of 60 watts or more. This is based on the maximum power transfer theorem that shows an electrical connection can only dissipate 1/4 of the power of the load when the resistance of the connection is equal to the resistance of the load.

Electrical connections are not required to comply with this provision when all mating parts of the electrical connection are provided within a component (e.g., contacts within a switch or relay, connections within a motor, etc.) that complies with the relevant component standard. Electrical connections that are mated to the component from the appliance are required to comply with this provision.

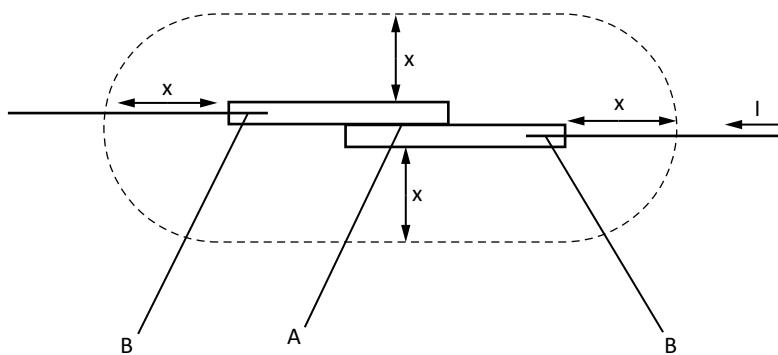
This provision shall not apply to welded or soldered connections.

### 4.30.2

With reference to Clause 4.30.1, components such as wire, tubing, sleeving, or tape that are located within 0.12 in (3 mm) of an electrical connection, as shown in Figure 6, Definition of "within 3 mm of an electrical connection", shall have a flammability classification as follows:

- a) VW-1 for wire evaluated in accordance with the *Reference Standard for Electrical Wires, Cables, and Flexible Cords*, UL 1581, or CSA C22.2 No. 0.3;
- b) VW-1 for tubing and sleeving evaluated in accordance with the *Standard for Extruded Insulating Tubing*, CAN/CSA-C22.2 No. 198.1/UL 224, or the *Standard for Coated Electrical Sleeving*, CAN/CSA-C22.2 No. 198.3/UL 1441;
- c) evaluated in accordance with the *Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape*, UL 510, or the *Standard for PVC Insulating Tape*, CSA C22.2 No. 197 for flame-retardant insulating tape.

**Figure 6**  
**Definition of “within 3 mm of an electrical connection”**



“Within 3 mm of an electrical connection” means falling within the dotted boundary formed by the cylinder with hemispherical ends, as shown in the above drawing.

- A — Terminal connection zone
- B — Wire crimp connection zone
- I — Current through the connection
- X — Distance from the connection

#### 4.30.3

With reference to Clause 4.30.1, polymeric materials located within 0.12 in (3 mm) of an electrical connection as shown in Figure 6, Definition of “within 3 mm of an electrical connection”, shall have a flammability classification as follows:

- a) a minimum V-0 or VTM-0, in accordance with the Standard for *Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*, UL 94, or the Standard for *Evaluation of Properties of Polymeric Materials*, CAN/CSA-C22.2 No. 0.17;
- b) a minimum SC-0 or SCTC-0, in accordance with Standard for *Tests for Flammability of Small Polymeric Component Materials*, UL 1694;
- c) a minimum glow wire ignition temperature (GWIT) of 1427°F (775 °C) according to *Fire Hazard Testing — Part 2-13: Glowing/Hot-wire Based Test Methods — Glow-wire Ignition Temperature (GWIT) Test Method for Materials*, IEC 60695-2-13; or
- d) the material withstands glow-wire test (GWT) according to *Fire Hazard Testing — Part 2-11: Glowing/Hot-wire Based Test Methods — Glow-wire Flammability Test Method for End-products (GWEPT)*, IEC 60695-2-11 with a minimum test severity of 1382°F (750 °C), and during the test flames persist for no longer than 2 seconds.

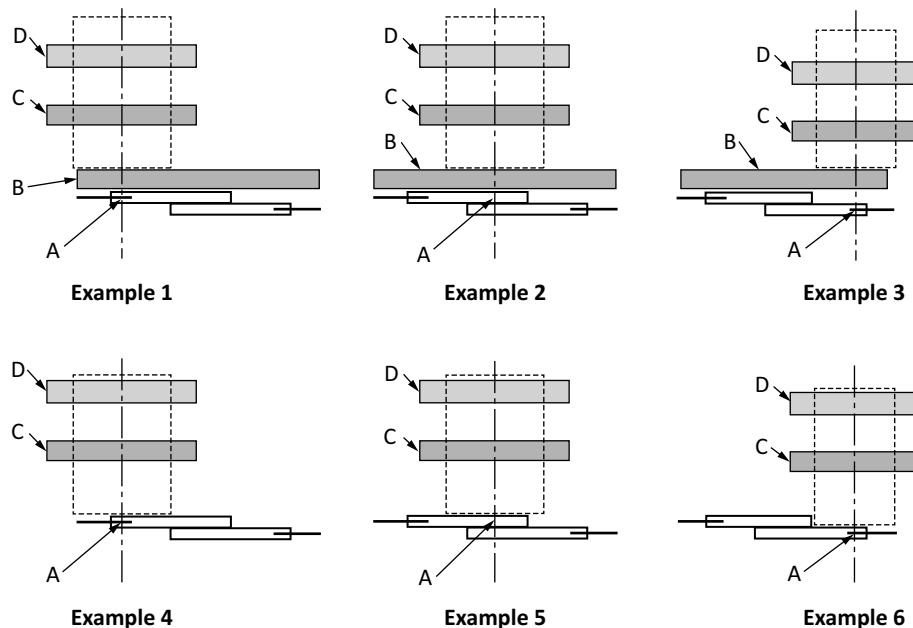
#### 4.30.4

With reference to Clause 4.30.1, all non-metallic combustible materials located within the envelope of a vertical flame cylinder having a diameter of 0.79 in (20 mm) and a height of 1.97 in (50 mm), placed above the center of the connection zone and on top of the non-metallic parts that are supporting current-carrying electrical connections as shown in Figure 7, Placement of flame cylinder, shall have a flammability classification as follows:

- a) a minimum of V-0, VTM-0, or HF-1, in accordance with the Standard for *Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*, UL 94, or the Standard for *Evaluation of Properties of Polymeric Materials*, CAN/CSA-C22.2 No. 0.17, and *Fire Hazard Testing — Part 11-10: Test Flames — 50 W Horizontal and Vertical Flame Test Methods*, IEC 60695-11-10;

- b) a minimum of SC-0 or SCTC-0, in accordance with the Standard for *Tests for Flammability of Small Polymeric Component Materials*, UL 1694; or
- c) a minimum VW-1 for wire, tubing, sleeving, and tape in accordance with Clause 4.30.2.

**Figure 7**  
**Placement of flame cylinder**



- A — Center of connection zone
- B — Non-metallic material supporting current carrying connection
- C — Metallic or non-metallic material
- D — Metallic or non-metallic material

#### 4.30.5

With reference to Clause 4.30.4 and Figure 7, Placement of the flame cylinder, the flame cylinder shall be placed above the center of each connection zone and on top of any non-metallic combustible parts that are supporting current-carrying connections as shown in Examples 1–3 of Figure 7. In the case of uninsulated connections, the flame cylinder shall be placed above the center of each connection zone and directly on top of current-carrying conductors as shown in Examples 4–6 of Figure 7. The flame cylinder shall project through all metallic and non-metallic material. If "C" is intended to act as a barrier to "D", or if the flame cylinder extends beyond the outer enclosure of the appliance, then the adequacy of the barrier shall be demonstrated by testing as described in Abnormal Operation — Nichrome Wire Test, Clause 5.31.

## 5 Performance

### 5.1 General

#### 5.1.1

This Standard applies to household cooking gas appliances:

- a) for use with natural gas;
- b) for use with manufactured gas;
- c) for use with mixed gas;
- d) for use with propane gas;
- e) for use with LP gas-air mixtures;
- f) for use with either natural, manufactured, or mixed gas and convertible for use with propane gas (see Clause 3, Definitions);
- g) for manufactured (mobile) home installation for use with propane gas only (see Clause 5.1.17);
- h) for manufactured (mobile) home installation for use with either natural, manufactured, or mixed gas and convertible for use with propane gas (see Clause 5.1.17 and Clause 3, Definitions); and
- i) provided with pyrolytic self-cleaning oven features or self-cleaning broiler features, or both (see Clause 5.1.16).

#### 5.1.2

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

#### 5.1.3

The vent limiter on a gas appliance pressure regulator shall be in place during all performance tests.

#### 5.1.4

Unless otherwise specified herein, an appliance tested for compliance with this Standard shall not be connected to a flue pipe but shall depend for venting of the flue gases solely on the provisions incorporated within it.

#### 5.1.5

Unless otherwise specified herein, a floor-supported unit for installation with zero clearance shall be tested for compliance with this Standard with the back of the appliance placed against a suitable test wall (as near as appliance construction will permit) and with the base of the appliance sealed to the floor for a vertical distance of 1/2 in (12.7 mm) at the front and sides but not at the rear. Leg levelers, when provided, shall be removed.

#### 5.1.6

During all tests for compliance with this Standard, each built-in top surface cooking unit or open top broiler unit intended to be installed in a counter-height cabinet shall be installed in a base cabinet of an enclosure also comprising back and side walls and simulated wall-hung cabinetry as shown in Figure 5, Test structure for built-in top surface cooking units and Open Top Broiler Units. Two-burner top units shall be tested in pairs with spacing between the units as specified by the manufacturer. The walls and cabinetry shall be constructed of studding covered on both sides with nominal 1 inch-thick wooden boards or 3/4 in (19.1 mm) plywood. All surfaces facing the appliance shall be finished in dull black. The base cabinets shall be provided with tight-fitting doors. These doors shall remain closed during all tests except as otherwise specified herein. Openings shall be provided in the cabinet only for those flues and

combustion air supply ducts designed to extend to the cabinet exterior that are integral parts of the appliance. All joints of the cabinet shall be sealed.

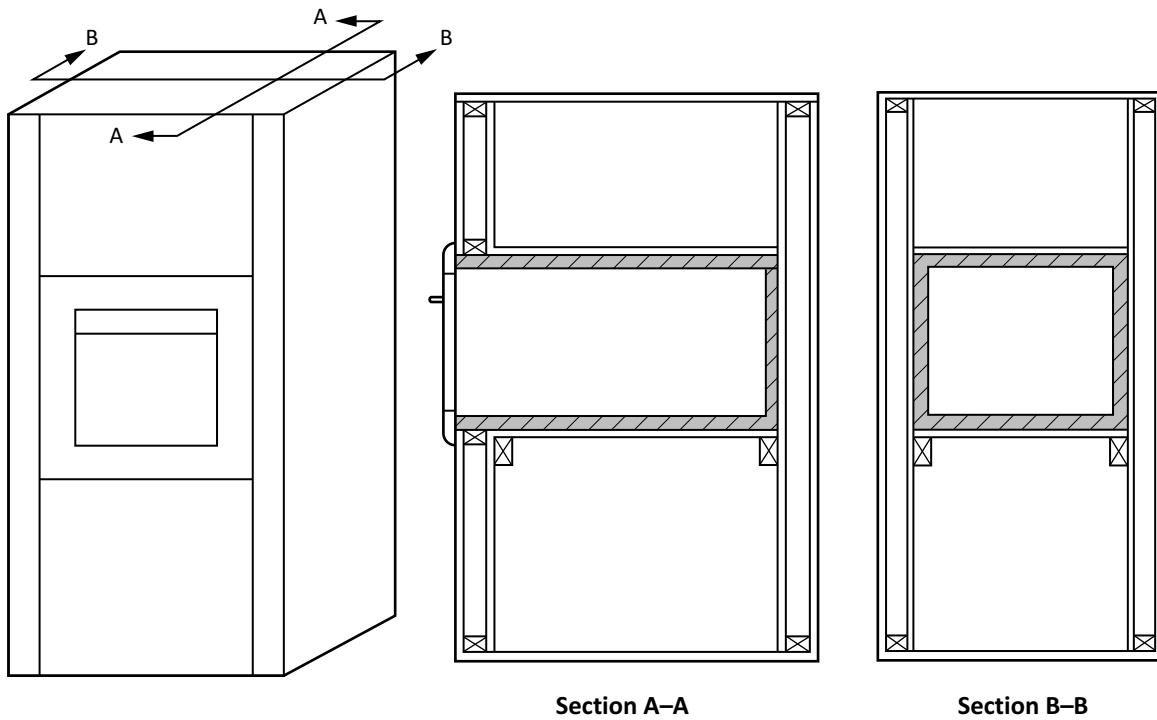
The horizontal distances from the back walls and side walls (dimensions "D," "A", and "B") and the minimum distance between the cabinets centered above the appliance (dimension "E", but not less than the nominal width of the appliance) shall be as specified by the manufacturer.

### 5.1.7

During all tests for compliance with this Standard, each built-in oven unit, enclosed broiler unit, or combination oven and broiler unit shall be installed in an enclosure constructed in accordance with Figure 8, Test enclosure for testing built-in oven and enclosed broiler units. The back, side, and front walls of this enclosure shall be constructed of studding covered on both sides with nominal 1 inch-thick wooden boards or 3/4 in (19.1 mm) plywood. The back and side walls shall extend 1 ft (305 mm) above the appliance and shall be dimensioned so their interior faces will be in contact with the rear and side surfaces of the appliance. The front wall shall extend from the floor to the bottom of the appliance and from the top of the appliance to a height of 1 ft (305 mm) above the appliance.

The bottom and top of the appliance shall be covered with nominal 1 inch-thick wooden boards or 3/4 in plywood. All surfaces facing the appliance shall be finished in dull black. The enclosure shall be provided with a floor and a ceiling constructed of nominal 1 inch-thick wooden boards or 3/4 in (19.1 mm) plywood. All joints shall be sealed.

**Figure 8**  
**Test enclosure for testing built-in oven and enclosed broiler units**  
(See Clauses 5.1.7 and 5.19.)



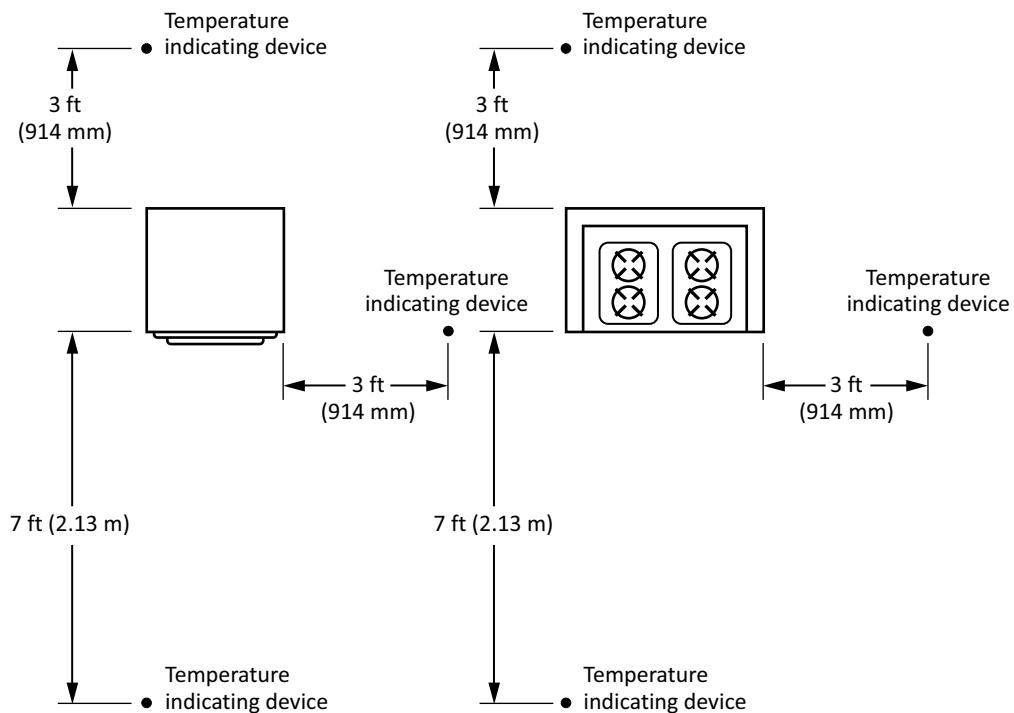
### 5.1.8

If the appliance is designed to have an exterior surface applied using materials supplied by the installer, the appliance shall be tested with the exterior surface applied according to the manufacturer's installation instructions.

### 5.1.9

Room temperature, when specified, shall be determined by any suitable means accurate to within  $\pm 1^{\circ}\text{F}$  ( $\pm 0.5^{\circ}\text{C}$ ) and located 5 ft (1.52 m) above floor level, and positioned with respect to the appliance under test as shown in Figure 9, Location of temperature indicating devices for determination of ambient room temperature during test for wall, floor, and enclosure temperatures. The observed room temperatures shall be the average of the temperatures indicated by the temperature indicating devices.

**Figure 9**  
**Location of temperature indicating devices for determination of ambient room temperature during test for wall, floor, and enclosure temperatures**  
(See Clause 5.1.9.)

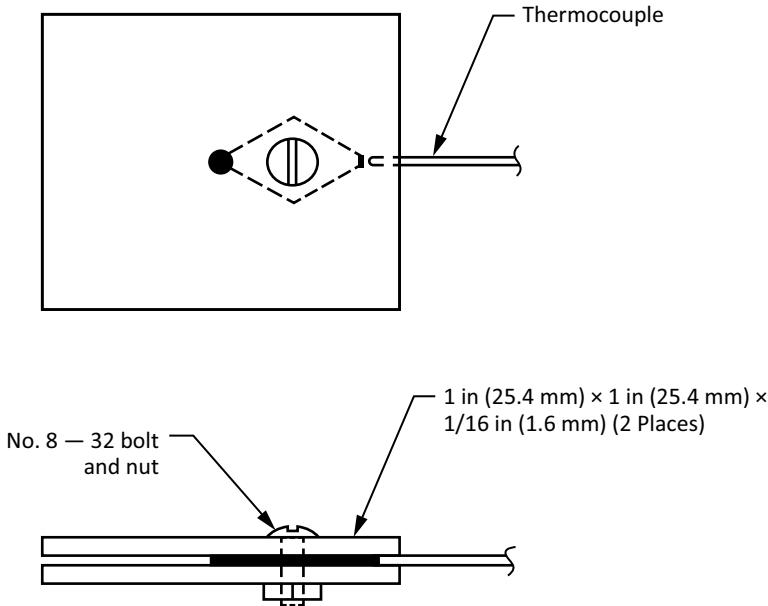


**Note:** Temperature indicating devices are located 5 ft (1.52 m) above room floor level.

### 5.1.10

Oven temperature shall be measured by a temperature indicating or recording device and a single shielded 24 AWG (0.20 mm<sup>2</sup>) bead type thermocouple located in the center of the oven. The thermocouple shall be shielded by clamping the tip in the center of two 1 in (25.4 mm) squares of 1/16 in (1.6 mm) thick aluminum fastened together with a suitable No. 8 bolt and nut. [See Figure 10, Shielded thermocouple between two 1 in (25.4 mm) squares of 1/16 in (1.6 mm) aluminum.]

**Figure 10**  
**Shielded thermocouple between two 1 in (25.4 mm)**  
**squares of 1/16 in (1.6 mm) aluminum**  
(See Clause 5.1.10.)



### 5.1.11

Broiler temperatures shall be determined by means of an indicating potentiometer and nine parallel connected 24 AWG (0.20 mm<sup>2</sup>) iron-constantan thermocouples, the junctions of which are copper plates 1 in (25.4 mm) in diameter and 1/32 in (0.8 mm) thick, to which the thermocouple wires are silver-soldered 1/2 in (12.7 mm) apart. Each disc shall be located at the center of the top surface of a board constructed of Lytherm 1401,\* or equivalent, 2-1/2 in (63.5 mm) in diameter and 1/2 in (12.7 mm) thick. The surfaces of the copper discs and Lytherm 1401 boards shall be finished in dull black.

The Lytherm 1401 boards or equivalent, bearing the thermocouples shall be located on rectangular broiler racks in the following manner: one in each corner with its outer edges coinciding with the edges of the rack, one in the center of the rack, and four on the diagonals through the center of the rack located respectively midway between the center board and each of the four corner boards. When the corner of a rack is cut away to permit access to the broiler pan, the board ordinarily placed on this corner shall occupy the same position as it would if the rack were not cut away.

In the case of round broiler racks, the Lytherm 1401 boards or equivalent, shall be placed as described above, on a square that is circumscribed by the outer circumference of the rack, two sides of which are parallel to the front of the appliance.

The Lytherm 1401 boards or equivalent, shall be placed on the broiler rack and the broiler rack placed in the top rack position. If this places the copper discs less than 2 in (50.8 mm) below the burner ports, the Lytherm 1401 boards or equivalent, shall be positioned and supported so the upper surfaces of the copper discs will be a vertical distance of 2 in (50.8 mm) below the burner ports. For infrared type burners, the distance from the burner ports to the copper discs may be greater than 2 in (50.8 mm) as

specified by the manufacturer. When radiant surfaces are interposed between burner ports and broiler racks, the distance from the copper discs shall be measured from a plane through such surfaces.

\* Lytherm 1401 may be obtained from Lydall, Inc., Technical Division, P.O. Box 1713, Chestnut Hill Road, Rochester, NH 03867.

### **5.1.12**

An exhaust hood incorporated in the appliance shall comply with the applicable provisions of the Standard for *Electric Fans*, UL 507, and/or the Standard for *Fans and Ventilators*, CSA C22.2 No. 113 as appropriate based on submission.

### **5.1.13**

During tests for compliance with this Standard, an appliance incorporating an exhaust hood shall have tests conducted to determine that the operation of the exhaust hood does not interfere with the operation of the appliance. Tests shall also be conducted to determine that operation of the appliance, with the exhaust hood under both operating and inoperative conditions, does not adversely affect the exhaust hood.

### **5.1.14**

A room heater incorporated in a floor-supported unit shall comply with the performance provisions of the Standard for *Vented Gas-Fired Space Heating Appliances*, ANSI Z21.86 • CSA 2.32.

### **5.1.15**

When a room heater is incorporated in a floor-supported unit, the room heater burner(s) shall be adjusted as specified in Clause 5.3.5 and the room heater shall be operated, whenever operation of the oven burner is specified, during conduct of the tests specified in Clauses 5.4, Combustion, 5.5.6, 5.5.8, 5.5.9, 5.5.12, 5.7.2, 5.11.2, 5.19, Wall, floor, and enclosure temperatures, 5.24, Oven flue gas temperature, and 5.22, Draft hoods.

### **5.1.16**

Special performance provisions applicable to appliances provided with pyrolytic self-cleaning oven or self-cleaning broiler features are specified in Clause 5.25, Performance of appliances provided with pyrolytic self-cleaning oven or self-cleaning broiler features.

The manufacturer shall specify both the maximum and minimum temperatures for the self-cleaning operation.

### **5.1.17**

Special performance provisions applicable to appliances for manufactured (mobile) home installation are specified in Clauses 5.1.1 g) and h) and 5.2 e) and h).

### **5.1.18**

Tests specified under Clauses 5.5, Burner and pilot operating characteristics, 5.6, Top surface cooking section burner Llighters, and 5.7, Ignition systems, shall be conducted at the pilot location tolerances specified by the manufacturer.

## 5.2 Test gases

In conducting the performance tests specified herein, gases with characteristics approximately as shown in Table 13, Characteristics of test gases, shall be used.

- a) An appliance for use with natural gas shall have tests specified herein conducted with Test Gas A. Additional tests for these appliances shall be conducted with Test Gas G under the test conditions prescribed for Test Gas A in Table 1, Gas pressure and input conditions for use in the various performance tests, with no change whatever in the natural gas adjustments, and shall comprise those tests specified in Clauses 5.5.1-a, 5.6, Top surface cooking section burner lighters, 5.7.2, 5.7.4, 5.7.6, and 5.7.9. Compliance with these supplemental tests does not imply that the appliance has been examined under this Standard for use with LP gas-air mixtures.
- b) An appliance for use with manufactured gas shall have the tests specified herein conducted with Test Gas B.
- c) An appliance for use with mixed gas shall have the tests specified herein conducted with Test Gas C.
- d) An appliance for use with natural, manufactured, and mixed gases shall be tested with Test Gases A and G, as specified in Clause 5.2 a), and Test Gas B. Test Gas C shall also be used as a test gas only:
  - i) when the appliance is equipped with different burners for natural and manufactured gas; or
  - ii) when a third burner is supplied specifically for use with mixed gas. In the former case, the burner equipment employed for the mixed gas tests shall be that specified by the manufacturer.
- e) An appliance for use with propane gas or an appliance for manufactured (mobile) home installation for use with propane gas only shall have the tests specified herein conducted with Test Gas E. The tests specified in Clauses 5.5, Burner and pilot operating characteristics (except 5.5.14), 5.6, Top surface cooking section burner lighters, 5.7.2, 5.7.3, 5.7.4, 5.7.5, 5.7.8, 5.7.9, and 5.7.12 shall also be conducted with Test Gas D with the gas appliance pressure regulator in place and functioning and with no change whatever in burner equipment. When Test Condition 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, is specified for those tests listed above, tests with Test Gas E shall be conducted under Test Condition 3b and tests with Test Gas D shall be conducted under Test Condition 3c.
- f) An appliance for use with LP gas-air mixtures shall be tested with Test Gas H. The tests specified in Clauses 5.4.1, 5.5, Burner and pilot operating characteristics, 5.6, Top surface cooking section burner lighters, 5.7.2, 5.7.3, 5.7.4, 5.7.5, 5.7.7, 5.7.9, and 5.7.12 shall also be conducted with Test Gas F without change in the appliance except for main burner and pilot orifices and air shutter adjustment.
- g) An appliance for use with either natural, manufactured, or mixed gas convertible for use with propane gas shall be tested with Test Gases A and G, B, or C as specified in Clause 5.2 a), b), or c) and Test Gases D and E as specified in Clause 5.2 e).
- h) An appliance for manufactured (mobile) home installation for use with natural, manufactured, or mixed gas convertible for use with propane gas shall be tested with Test Gases A and G, B, or C as specified in Clause 5.2 a), b), or c) and Test Gases D and E as specified in Clause 5.2 e).
- i) When use with more than one type of gas is desired, the tests specified in Clauses 5.11, Manual gas valves, through 5.26, Performance of an appliance incorporating a microwave cooking section, need be conducted with only one test gas provided there are no changes in the appliance or input ratings for the different gases, which, in the opinion of the testing agency, would affect the results of these tests.

**Table 13**  
**Characteristics of test gases**  
(See Clause 5.2.)

	<b>Heating value</b>		<b>Specific gravity</b>
	<b>Btu/ft<sup>3</sup></b>	<b>MJ/m<sup>3</sup></b>	<b>Air = 1.0</b>
Gas A (Natural)	1075	40.1	0.65
Gas B (Manufactured)	535	19.9	0.38
Gas C (Mixed)	800	29.8	0.50
Gas D (n-Butane)	3200	119.2	2.00
Gas E (Propane HD-5)	2500	93.1	1.55
Gas F (Propane – Air)	700	26.1	1.16
Gas G (Butane-Air)	1400	52.2	1.42
Gas H (Propane-Air)	1400	52.2	1.30

### 5.3 Test pressures and burner adjustments

#### 5.3.1

During the conduct of all tests specified in this Standard, the inlet test pressures applied to the appliance immediately ahead of all controls shall be those specified in Table 14, Inlet test pressures.

**Table 14**  
**Inlet test pressures**  
(See Clause 5.3.1.)

	<b>Inlet test pressure — inches water column (kPa)</b>		
<b>Test gas</b>	<b>Reduced</b>	<b>Normal</b>	<b>Increased</b>
A	3.5 (0.87)	7.0 (1.74)	10.5 (2.61)
B	3.0 (0.75)	6.0 (1.49)	9.0 (2.24)
C	3.0 (0.75)	6.0 (1.49)	9.0 (2.24)
D	8.0 (1.99)	11.0 (2.74)	13.0 (3.23)
E	8.0 (1.99)	11.0 (2.74)	13.0 (3.23)
F	3.0 (0.75)	6.0 (1.49)	9.0 (2.24)
G	3.5 (0.87)	7.0 (1.74)	10.5 (2.61)
H	3.0 (0.75)	6.0 (1.49)	9.0 (2.24)

### 5.3.2

With all burners in operation, the outlet pressure (normal manifold pressure) of the gas appliance pressure regulator specified in Clause 4.8.2 shall be nominally either 4, 5, or 6 in wc (995 Pa, 1.24 or 1.49 kPa), as specified by the manufacturer, for natural, manufactured, and mixed gases or LP gas-air mixtures, and shall approximate that specified by the manufacturer for propane gas [see Clause 4.29.4 a) v)]. The adjustment shall not be changed during any of the tests unless otherwise specified herein.

### 5.3.3

In conducting the tests specified in this Standard, whenever tests at the increased input rate are specified, the tests shall be conducted with the gas appliance pressure regulator adjusted to provide an increase in the input rate specified by the manufacturer of 12 percent for an appliance for use with natural, manufactured, and mixed gases or LP gas-air mixtures, and 9 percent for an appliance for use with propane gas. 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.

### 5.3.4

The manifold pressure, inlet test pressure, and input rate test conditions specified in each of the various performance tests contained in this Standard shall be those shown in Table 1, Gas pressure and input conditions for use in the various performance tests.

### 5.3.5

Individual burners shall be adjusted to their Btu rating at normal inlet test pressure unless otherwise specified herein. When operated for 5 minutes, starting with all parts of the appliance at room temperature, the burner adjustments shall be within  $\pm 5$  percent of the capacities specified in Clause 4.12, Main burner and pilot input ratings. The combined rate of all burners, capable of simultaneous operation, shall be within  $\pm 15$  percent. Neither the burner rating nor primary air adjustment shall be changed during a series of tests with any one test gas.

### 5.3.6

Electrical cooking sections used in combination with gas cooking appliances shall be operated, when specified herein, at the appliance rating plate voltage.

## 5.4 Combustion\*

\* For additional information on the specified 800 ppm CO allowable, please refer to Gas Research Institute (GRI) Topical Report, GRI-96/0270, "Critique of ANSI Z21.1 Standard for CO Emissions from Gas-Fired Ovens and Ranges."

### 5.4.1

An appliance shall not produce a concentration of carbon monoxide in excess of 0.08 percent in an air-free sample of the flue gases when the appliance is tested in a room having approximately a normal oxygen supply.

During combustion tests of a built-in unit, all cracks related to installation (other than designed air openings) shall be sealed.

For ranges or cook tops intended for use in conjunction with a ventilation system with provisions to direct air in a downward direction: Combustion testing shall be performed on any enclosed compartment (oven or broiler), specialty top section burners that operate automatically such as

thermostatically controlled griddles, open top broilers, or any other burner hidden from view of the operator. After the burners have been in operation for 5 minutes under Test Conditions 2 and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, samples of the flue gases shall be procured and analyzed for carbon monoxide and carbon dioxide. During these tests, no test pots shall be placed on the open top burners and no 75 percent coverage plate shall be used over the open top broiler.

For ranges incorporating a pyrolytic self-clean feature and intended for use in conjunction with a ventilation system with provisions to direct air in a downward direction, an additional series of tests as noted above shall be conducted with the oven operating at the manufacturer's specified self-clean temperature.

## Method of Test

Burners shall be adjusted as specified in Clause 5.3.5. Thermostats shall be set at their maximum temperature setting.

- a) Open top burner combustion — For top burners, a flat-bottom test pot as shown in Figure 11, Top burner test pot, containing 5 lb of water (2.3 kg) ( $\pm 1$  percent) at approximately room temperature shall be placed over each top burner. Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pot defined for Clause 5.16, Evaluation of clothing ignition potential, containing 5 lb of water (2.3 kg) ( $\pm 1$  percent) at approximately room temperature. A means shall be used with a mechanism to evacuate the steam vapor from the collection hood.

A suitably designed hood shall then be placed on the cooking top. After the top burners have been in operation for 5 minutes under Test Conditions 2 and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, samples of the flue gases shall be secured from the hood vent and analyzed for carbon monoxide and carbon dioxide.

A combustion hood, provided with adjustable legs, shall be placed on the cooking top so it covers the test pots placed over all of the top burners. When there are six top burners or two pairs of burners on a divided top unit, more than one combustion hood may be used. With the edge of the combustion hood(s) located at least 5 in (127 mm) above the cooking surface, the flames shall be observed. The hood(s) shall then be lowered in small increments, preferably 1/2 in (12.7 mm), while constant observation of the flames is maintained. As soon as any noticeable change in the character of the flames occurs, the hood shall be raised 1/2 in (12.7 mm). With the hood at this height, a sample of the flue gases shall be secured from the outlet of the hood and analyzed for carbon dioxide. The outlet area of the hood may be gradually reduced to obtain as high a carbon dioxide percentage as possible without altering the flame characteristics. On designs where a noticeable change in the character of flames is not evident when the hood position is lowered, the position of the hood shall be at the discretion of the testing agency.

- b) Griddle plate combustion-Open top burners — An additional test under Test Condition 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, shall be conducted on open top burners. During this test, other burners shall not be in operation. On appliances for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only. On appliances for use with LP-gas, this test need be conducted with Test Gas E only. [See Clause 5.2 e.]

Two adjacent open top burners shall be covered as symmetrically as possible with cast-iron griddle plates 9-1/2 in (241 mm) in diameter having the bottom recessed 3/16 in (4.8 mm) with approximately a 1/8 in (2 mm) wide lip. (See Figure 12, Griddle plate used in combustion test.) This test does not apply to single elongated burners.

When a burner having an input rating of 12,000 Btu/hr (3 517 W) or more is provided, it shall be one of those covered by the griddle plates. A 7-1/2 in (191 mm) diameter (bottom) water-filled test pot shall be placed on each of the griddle plates and over each of the remaining top burners.

After the open top burners have been in operation for 5 minutes, a sample of the flue gases shall be secured from the hood vent and analyzed for carbon monoxide and carbon dioxide, and when more than one hood is used, an averaging sample from the hood vents shall be secured and analyzed.

Additional tests shall be conducted when deemed necessary with the plates covering other combinations of any two adjacent burners.

If the manufacturer specifies a specific griddle plate as part of the design to cover one or more open top burner(s), the test shall be repeated with this griddle plate installed per the manufacturer's instructions. A 7-1/2 in (191 mm) diameter (bottom) water-filled test pot shall be placed on this griddle plate and over each of the remaining top burners.

Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pot defined for Clause 5.16, Evaluation of clothing ignition potential, containing 5 lb of water (2.3 kg) ( $\pm 1$  percent) at approximately room temperature. A means shall be used with a mechanism to evacuate the steam vapor from the collection hood. At the option of the manufacturer, if the elongated burner is 5.5 in or less, the standard 7.5 in test pot may be used for the combustion test.

- c) Wok burner construction. Wok burner(s) shall be tested with the maximum size wok pan(s) possible to be installed or the manufacturer's specified maximum size wok pan(s). The wok pan(s) shall be filled to 80 percent capacity with water at approximately room temperature. A suitably designed combustion hood shall then be placed on the top section surface over the wok(s) burner and if applicable adjacent burner.

After the wok burner(s) have been in operation for 5 minutes under Test Conditions 2 and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, samples of the flue gases shall be secured from the hood and analyzed for carbon monoxide and carbon dioxide.

- d) When the construction of the utensil supports is such that they can be positioned so as to cause the burner flames to impinge on the utensil support bars, the top burner tests shall be conducted with the utensil supports in that position.
- e) Griddle burner combustion. A griddle burner section shall be tested with the manufacturer's griddle installed in accordance with the manufacturer's instructions. The top burner test pot described in Figure 11, Top burner test top, containing 5 lb (2.3 kg) of water shall be placed on the griddle.

Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pot defined for Clause 5.16, Evaluation of clothing ignition potential, containing 5 lb of water (2.3 kg) ( $\pm 1$  percent) at approximately room temperature. A means shall be used with a mechanism to evacuate the steam vapor from the collection hood.

A suitably designed hood shall be placed over the griddle in such a manner as to collect all of the griddle burner(s) flue gases. After the griddle burner has been in operation for 5 minutes under Test Conditions 2 and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, samples of the flue gases shall be secured from the hood vent and analyzed for carbon monoxide and carbon dioxide. If a griddle section can be operated with or without the manufacturer's griddle installed, testing shall be conducted under both conditions.

- f) When an appliance is supplied with a top surface cooking section cover(s) and the burner(s) is capable of operating with the cover(s) closed, an additional test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, with the cover in place. On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only. A suitably designed test

hood of sufficient size shall be used to collect the flue gases. After the burner(s) has been in operation for 15 minutes, a sample of the flue gases shall be secured from the hood vent and analyzed for carbon monoxide and carbon dioxide. During this test, other burner(s) shall not be in operation.

- g) Open top broiler test. An open top broiler section or unit shall be tested with 75 percent of the effective grid area covered with a flat sheet-metal plate. This plate shall be shaped and positioned so the uncovered area is a space of equal width around the perimeter of the broiler grid. During each test, a suitably designed test hood of sufficient size to collect the flue gases shall be placed over the broiler section or unit. With the appliance operating under Test Conditions 2 and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, samples of the flue gases shall be secured from the hood vent and analyzed for carbon monoxide and carbon dioxide after the burner(s) has been in operation for 5 minutes.
- h) An additional test shall be conducted on an open top broiler unit and an open top broiler section when operating under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only. During the test for open top broiler sections, no other burners shall be in operation.

The open top broiler unit shall be covered with a flat sheet-metal plate of a size that will cover the unit to the outer edges.

An open top broiler section shall be covered with a flat sheet-metal plate of the largest size that can be positioned without extending over adjacent cooking sections or controls and be within the confines of the appliance.

For either of the above tests, a suitably designed test hood of sufficient size to collect the flue gases shall be placed on the top surface section. After the burner has been in operation for 15 minutes, a sample of the flue gases shall be secured from the hood vent and analyzed for carbon monoxide and carbon dioxide.

- i) Oven or enclosed broiler test. An oven or enclosed broiler unit shall be operated for 5 minutes under Test Conditions 2 and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, after which samples of the flue gases shall be secured from the flue outlet and analyzed for carbon monoxide and carbon dioxide.

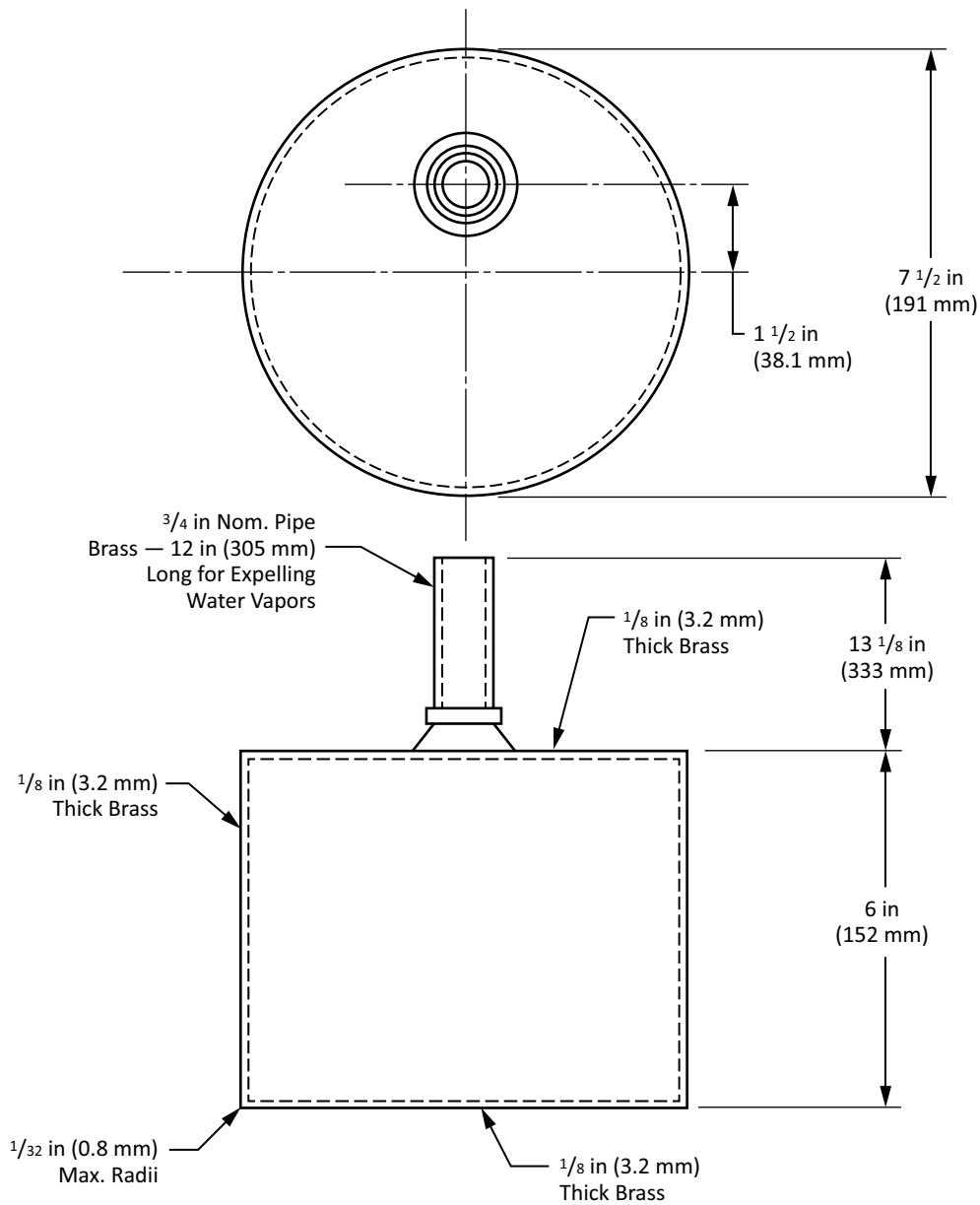
When the flue gases from two oven or broiler burners, assembled within the same unit, are vented through separate flues, they shall be tested separately.

- j) An appliance having a flue collar outlet, and which incorporates a built-in or permanently attached draft diverting device, shall comply with Clause 5.23, Exhaust hood outlet air temperature.
- k) All sections of a floor-supported unit having a flue collar outlet, which does not incorporate a built-in or permanently attached draft diverting device, shall be operated for 15 minutes under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, with the flue collar outlet blocked. On an appliance for use with natural, manufactured, and mixed gases or natural and mixed gases, this test need only be conducted with Test Gas A. A sample of the flue gases shall be secured from each section designed to vent through the flue collar and analyzed for carbon monoxide and carbon dioxide.
- l) An oven or enclosed broiler in a built-in oven, with provision for front discharge of fan assisted flue products below the 36 in (914 mm) level, shall be tested as follows to simulate flue outlet blockage, while operating under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests.

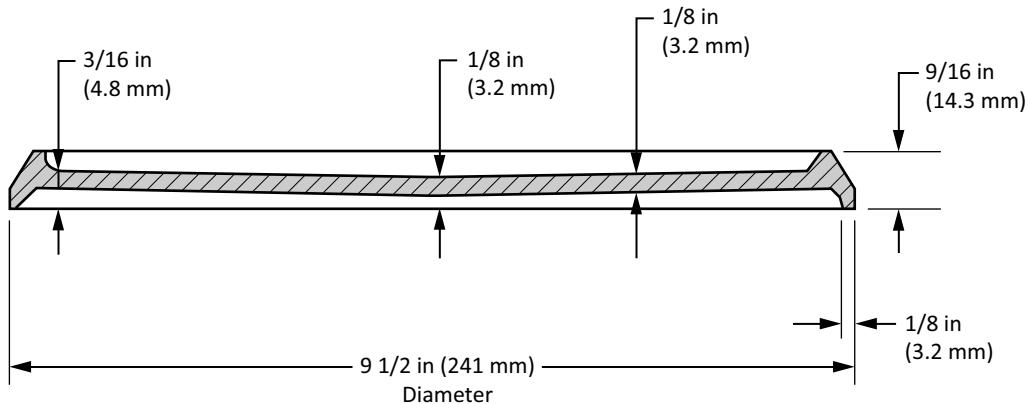
The area of the vent outlet grill opening (see Clause 3, Definitions) shall be gradually and uniformly reduced starting at the outermost periphery of the vent outlet grill opening, until the smallest area at which the appliance will continue to operate, as intended, is attained. The unit shall be cooled to room temperature. Then the oven shall be operated in the previously

- determined condition for 5 minutes, after which samples of flue gases shall be secured from the flue outlet and analyzed for carbon monoxide and carbon dioxide.
- m) Interference combustion test. Following the conduct of the tests specified in Clause 5.4.1 a) – l), as applicable, an additional test shall be conducted with all sections of the appliance capable of simultaneous operation. For the purpose of this test, each section of the appliance shall be operated under Test Condition 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, and under the conditions specified in Clause 5.4.1 a) – l) for each appliance section. A suitably designed test hood of sufficient size to collect flue products from all cooking section(s) capable of simultaneous operation shall be placed over the test unit. After the unit has been in operation for 15 minutes, samples of the flue gases shall be secured from the hood vent and analyzed for carbon monoxide and carbon dioxide.

**Figure 11**  
**Top burner test pot**  
(See Clause 5.4.1.)



**Figure 12**  
**Griddle plate used in combustion test**  
(See Clause 5.4.1.)



#### 5.4.2

An appliance for use with natural gas shall comply with Clause 5.4.1, with the exception of "b)", "h)", "j)", "k)", and "m)" when adjusted and operated with Test Gas A at 4.0 in wc (995 Pa) manifold pressure. This test shall be applied only if the appliance has a normal manifold pressure in excess of 4.0 in wc (995 Pa).

#### Method of Test

The gas rate to each burner shall be adjusted to operate under Test Condition 4 in Table 1, Gas pressure and input conditions for use in the various performance tests. The appliance shall then be tested as specified in Clause 5.4.1 and samples of flue gases secured and analyzed in the manner prescribed in Clause 5.4.1.

#### 5.4.3

An appliance for use with manufactured gas shall comply with Clause 5.4.1, with the exception of b), g), i), and j) when adjusted and operated with Test Gas B at 3.0 in wc (747 Pa) manifold pressure.

#### Method of Test

The gas rate to each burner shall be adjusted to operate under Test Condition 5 in Table 1, Gas pressure and input conditions for use in the various performance tests. The appliance shall then be tested as specified in Clause 5.4.1 and samples of flue gases secured and analyzed in the manner prescribed in Clause 5.4.1.

### 5.5 Burner and pilot operating characteristics

An appliance incorporating a separate wok burner(s) or in combination with open top burners shall have all applicable tests in this clause conducted with and without the wok pan(s) in place. The wok pan(s) shall be the maximum size possible to be installed or manufacturer's maximum specified size wok pan(s). For the applicable tests with wok pan(s), the wok pan(s) shall be filled to 80 percent capacity with water at approximate room temperature.

Unless otherwise specified, the top burner test pot shall be the test pot shown in Figure 11, Top burner test pot, of the combustion test. This pot shall be filled with 5 lb (2.3 kg) of water unless otherwise specified.

A thermostatically controlled top burner shall be tested with the aluminum test pan described in Clause 4.5.2.

**Note:** Placement of the test pot on the griddle is only necessary for the purposes of preventing heat damage to the griddle plate during conduction of the test.

The following sections of Clause 5.5, Burner and pilot operating characteristics shall be tested with the air curtain ventilation system in operation: Clauses 5.5.1 to 5.5.3 and Clause 5.5.8. Additionally, the operation of the air curtain ventilation system shall not extinguish any burners or pilot burners. Some blowing of open top burners with or without pots in place is permitted.

### 5.5.1

Pilots and burner flames shall not flash back:

- a) upon immediate ignition under Test Conditions 1, 2, and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests;
- b) after 2 to 20 seconds delayed ignition under Test Condition 1 in Table 1 for burners not equipped with automatic ignition systems;
- c) at a gas rate 1/5 of the full supply or at the manufacturer's simmer condition (whichever is lower) under Test Condition 1 in Table 1 for other than infrared burners;
- d) at the lowest gas rate necessary to maintain a stable flame for infrared burners; and
- e) during any of the other tests specified in this Standard.

Pilots shall be exempt from item c) above.

### Method of Test

Pilot and main burners shall be allowed to cool to approximately room temperature after the tests for flashback specified above shall be applied. Tests on top and griddle burners shall be conducted with the test pots in place.

Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pots in place at approximately room temperature.

### 5.5.2

The oven burner(s) flames shall not burn through openings in the oven bottom when tested in accordance with the following Method of Test.

### Method of Test

The appliance shall be operated under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. The appliance shall be placed in operation from a cold start and operated for 15 minutes. The oven burner(s) flames shall not burn through openings in the oven bottom upon burner ignition or at any time during the 15 minute operating period.

After 15 minutes, the oven burner(s) shall be extinguished and re-ignited. Under this hot start condition, the oven burner(s) flames shall not burn through openings in the oven bottom upon burner ignition.

### 5.5.3

Pilot and main burners shall operate without depositing carbon during any tests specified in this Standard, and also when operated for 1 hour under Test Condition 3 in Table 1, Gas pressure and input conditions for use in the various performance tests. These observations shall be made with the test pots over the top and griddle burners.

Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pot in place at approximately room temperature.

An additional test as above shall be conducted on the pilots without the main burners in operation.

#### 5.5.4

Burners shall not expel gas through air openings in mixer faces under Test Condition 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, nor at a pressure only high enough to support combustion at the ports.

#### 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.

#### 5.5.5

When operated under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, pilots and main burner flames of all appliances, except built-in top units, shall not be extinguished by “snapping” open or quickly closing any door or drawer when tested in accordance with the following Method of Test. Built-in top units are covered in Clause 5.5.6.

#### Method of Test

These tests shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, these tests need be conducted with Test Gas A only.

The oven burner(s) shall be tested at rated input and, if a bypass is provided, at a rate sufficient to maintain the manufacturer’s specified minimum oven temperature. Top and griddle burners, separate broiler burners, and other auxiliary burners shall be tested at rated input and with the gas valve turned to the position providing 1/5 of the rated input. A conventional top or griddle burner having gas flow controlled by a high-low valve shall be tested when adjusted to the low setting in accordance with the manufacturer’s instructions (see Clause 4.28.6).

Top surface cooking sections shall have the test pot placed over each top and griddle burner.

During tests on pilots, the top surface cooking section, and the oven or broiler burners shall not be in operation and the test shall be conducted with and without the test pots over the top and griddle burners.

Tests for stability of bypass flames of a thermostatically-controlled oven shall be conducted with the bypass rate adjusted according to the manufacturer’s instructions. The thermostat shall be set to 500°F (260 °C). The oven temperature shall be brought to approximately 500°F (260 °C), after which the thermostat shall be set at the manufacturer’s lowest indicated setting.

Tests for stability of bypass flames of a thermostatically-controlled top burner shall be conducted with the bypass gas rate adjusted according to the manufacturer’s instructions. The 9 in (229 mm) aluminum pan referenced in Clause 4.5.2 containing approximately 5 lb (2.3 kg) of water shall be placed over the burner. The dial shall be adjusted to the maximum temperature setting and after the water has been boiling for 5 minutes, the thermostat shall be set at the lowest marked temperature setting and the test prescribed above conducted.

The oven door, separate broiler door, and broiler drawer, if used, shall be manually snapped open and quickly closed five times to determine compliance with this provision.

Pilots on a top surface cooking section having a top surface cooking section cover integrally attached to the appliance body shall also be tested by lifting the cover to a position such that the outer edge is 4 in (102 mm) above the utensil support surface. From this position, the cover shall be allowed to close by the force of gravity at least twice for each possible combination of open and closed positions of every other compartment or cabinet door. Pilots on a top surface cooking section having a cover not integrally attached to the appliance shall be subjected to an equivalent test.

During the above tests, the flames of top surface cooking section, oven, broiler, and pilot burners, and bypass flames of thermostatically-controlled oven and top burners, shall not flash back, be extinguished or otherwise affected by the opening and closing of doors and drawers, and pilot(s) shall not be extinguished by the opening and closing of top covers.

Following completion of the above tests, the bypass flames of thermostatically controlled oven burners shall be extinguished by means other than turning off the gas supply. Re-ignition of the bypass gas shall take place from the oven pilot.

Designs with automatic ignition systems equipped with a flame failure re-ignition timing shall be considered as complying with this requirement provided the burner flame is re-ignited within 4 seconds following being extinguished.

Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pot in place at approximately room temperature.

### 5.5.6

When operated under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, pilots and main burner flames of built-in top units shall not be extinguished by “snapping” open or quickly closing any door when tested in accordance with the following Method of Test.

#### Method of Test

These tests shall be conducted in accordance with the tests specified for top surface cooking section burners in Clause 5.5.5, except that four  $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{32}$  in ( $12.7 \times 12.7 \times 0.8$  mm) thick shims shall be placed under the supporting flanges at or adjacent to the cover of the built-in top unit. The  $\frac{1}{32}$  in (0.8 mm) thick shims shall be in place for this test only.

Top surface cooking sections shall have the test pot placed over each top and griddle burner.

During tests on pilots, the top surface cooking section and the oven or broiler burners shall not be in operation and the test shall be conducted with and without test pots over the top and griddle burners.

The doors of the cabinet described in Figure 5, Test structure for built-in top surface cooking units and open top broiler units, shall be snapped open and quickly closed five times to determine compliance with this provision.

For snapping cabinet doors open, a 15 lb (6.8 kg) weight attached to the edges of the doors by means of wires extending over a pulley shall be used. The pulley shall be attached to a frame resting on the floor and the top of the pulley shall be at a height approximately the same as the points where the wires are attached to the doors. This door opening mechanism shall be arranged so the weight will have a free

fall of not less than 20 in (508 mm) before it exerts a force to open the cabinet doors, and it shall continue to fall not less than an additional 6 in (152 mm). During this test, a friction catch adjusted to a releasing force of not less than 3 lb (13.3 N) nor more than 5 lb (22.2 N) shall be provided on each cabinet door. Both cabinet doors shall be snapped open simultaneously from the tightly closed position.

Designs with automatic ignition systems equipped with a flame failure re-ignition timing, shall be considered as complying with this requirement provided the burner flame is re-ignited within 4 seconds following being extinguished.

### 5.5.7

An appliance having a flue collar outlet shall show no signs of smothering any burner flames when the flue collar outlet is completely blocked.

Compliance with this provision shall be determined with all sections of the appliance venting through the secondary vent openings operating from a cold start under Test Condition 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, with the flue collar outlet blocked.

On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only.

### 5.5.8

On an appliance assembled with multiple sections, the burner flames of any section shall not be extinguished nor exhibit signs of smothering as the result of simultaneous operation of the other sections when tested in accordance with the following Method of Test.

#### **Method of Test**

This test shall be conducted under Test Condition 3 in Table 1, Gas pressure and input conditions for use in the various performance tests. Each thermostat shall be set at its full open position. With all parts of the appliance at room temperature, the gas supply to the oven burner shall be turned on, ignited, and the door closed. Immediately thereafter, gas to other ovens, separate broilers, or auxiliary burners shall be turned on, ignited, and the doors closed. Electrical cooking sections shall also be placed in operation. Top surface cooking sections shall have the test pots placed over each top and griddle burner. Simultaneous operation shall be continued for 15 minutes, observing the burner flames at intervals by cracking open the door to the section being observed. Burner flames shall not be extinguished nor show signs of smothering.

### 5.5.9

There shall be no objectionable lifting, floating, or blowing of top burners when the burners are operated individually or simultaneously with either the test pots or no test pots in place. If oven and broiler burners are incorporated as part of the appliance, their operation shall also not cause top surface cooking section burner flames to show objectionable lifting, floating, or blowing, or be otherwise adversely affected when tested in accordance with the following Method of Test.

#### **Method of Test**

This test shall be conducted under Test Conditions 1, 2, and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests. On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only.

The gas to oven burners and separate broiler burners shall be turned on and ignited, after which the gas to top surface cooking section burners shall be turned on and ignited and observation made of the top surface cooking section burner flames. This test shall be conducted for a 15 minute period without test pots placed over the top and griddle burners.

### 5.5.10

Top surface cooking section burner pilots shall not become extinguished as a result of concussion when tested as specified in the following Method of Test.

#### Method of Test

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only.

The top surface cooking section burner pilots shall be placed in operation. The 9 in (229 mm) aluminum pan referenced in Clause 4.5.2 containing 5 lb (2.3 kg) of weight, shall be dropped from a distance of 2 in (50.8 mm) onto the utensil supports directly over each top burner. The pilot(s) shall not become extinguished

### 5.5.11

Pilots and bypass flames of thermostatically-controlled top burners shall not be extinguished, or shall re-ignite in accordance with Clause 5.6.2, after having been subjected to a wind with a velocity of 3 mph (1.34 m/s) directed from the front, sides, and intermediate points at an angle 30 degrees (0.52 rad) down from the horizontal and also from the horizontal when tested in accordance with the following Method of Test.

#### Method of Test

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only.

The bypass rate on the burner shall be obtained as described in Clause 5.5.5. This test shall be conducted with the 9 in (229 mm) aluminum pan referenced in Clause 4.5.2 in place.

The wind shall be produced by a blower that delivers air through a 12 in (305 mm) length of 5 in (127 mm) diameter sheet-metal pipe having a sheet-metal orifice plate with a 3 in (76.2 mm) diameter orifice fastened to its outlet end. The blower shall be adjusted before each test to produce a wind velocity of 3 mph (1.34 m/s) from a distance of 6 ft (1.83 m), as measured by the average of 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 a 90 degree (1.57 rad) angle to the axis of the air stream 6 ft (1.83 m) from the orifice.

The blower shall be placed above the top surface cooking section in such a position that its axis, when directed at the thermostatically controlled top burner, forms an angle of 30 degrees (0.52 rad) with the plane of the top surface cooking section. The point on the axis of the air stream 6 ft (1.83 m) from the orifice shall coincide with the plane of the cooking top immediately above the midpoint of the burner. This procedure shall be repeated for such locations of the blower around the top surface cooking section as may be necessary to determine compliance with this provision. In each subsequent determination, the position of the blower relative to the thermostatically-controlled top burner shall be maintained.

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

### **5.5.12**

Stability of pilots shall be unaffected by the operation of any combination of burners under Test Conditions 1, 2, and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests.

Top surface cooking sections shall have the test pot placed over each top and griddle burner.

### **5.5.13**

Burners shall ignite, operate, and extinguish without undue noise under Test Conditions 1, 2, and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests.

Top surface cooking sections shall have the test pot placed over each top and griddle burner.

### **5.5.14**

A top surface cooking section burner having gas flow controlled by a high-low valve shall, under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, be capable of maintaining a stable flame on the ports to which gas is flowing when adjusted to the low setting in accordance with the manufacturer's instructions (see Clause 4.28.6).

Top surface cooking sections shall have the test pot placed over each top and griddle burner.

### **5.5.15**

Pilots shall be capable of satisfactory operation under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, when rated as specified in Clauses 4.12.2 or 4.12.3, as applicable.

## **5.6 Top surface cooking section burner lighters**

An appliance incorporating a separate wok burner(s) or in combination with open top burners shall have all applicable tests in this clause conducted with and without the wok pan(s) in place. The wok pan(s) shall be the maximum size possible to be installed or manufacturer's maximum specified wok pan(s). For the applicable tests with wok pan(s), the wok pan(s) shall be filled to 80 percent capacity with water at approximate room temperature.

Clauses 5.6.2 and 5.6.3 shall be conducted with the air curtain ventilation system in operation if the range or cooktop being tested is intended for use in conjunction with a ventilation system with provisions to direct air in a downward direction.

### **5.6.1**

Electrical ignition systems used to ignite gas at top surface cooking section burners shall comply with the applicable performance provisions of the Standard for *Automatic Gas Ignition Systems and Components*, ANSI Z21.20 • CSA C22.2 No. 199, the Standard for *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*, ANSI Z21.20/CAN/CSA-C22.2 No. 60730-2-5, or the Standard for *Manually Operated Gas Ignition Systems and Components*, ANSI Z21.92 • CSA 6.29.

## 5.6.2

Ignition of gas at the top surface cooking section burners shall occur within 4 seconds after gas is available at the burner ports.

### Method of Test

The following tests shall be conducted under Test Conditions 1, 2, and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, unless otherwise specified. An appliance for use with natural gas shall also comply with these provisions under the test conditions specified in Clause 5.5.2. An appliance for use with manufactured gas shall also comply with these provisions under the test condition specified in Clause 5.4.3.

On an appliance for use with natural gas, the additional tests with Test Gas G shall be conducted using only Test Condition 1 for Test Gas A in Table 1, Gas pressure and input conditions for use in the various performance tests.

Each appliance shall be tested as installed in its test enclosure specified in Clause 5.19, Wall, floor, and enclosure temperatures. In addition, a floor-supported unit shall also be tested with the appliance standing clear of all walls.

Burners and pilots shall be adjusted in accordance with Clause 4.9, Automatic valves. For each test, it shall be determined that all gas piping is filled with gas.

Top surface cooking section burners or top surface cooking section burner assemblies shall not be covered with utensils. Time shall be allowed between successive tests for parts to attain their proper temperatures so conditions of operation will be the same as those prevailing during previous tests under each condition.

When more than one igniter is supplied, this provision shall be met whether these igniters are operated simultaneously or successively.

Tests shall be conducted under the following conditions:

- a) all sections incorporated as part of the appliance at room temperature;
- b) top surface cooking section at room temperature but with other sections, if incorporated as part of the appliance, at operating temperature;
- c) all sections incorporated as part of the appliance at operating temperature; and
- d) electrically operated top surface cooking section burner lighters (igniters) shall be tested as specified in a), b), and c) at both 85 and 110 percent of the appliance rating plate voltage.

At least 5 successive ignition tests shall be conducted on each top surface cooking section burner or top surface cooking section burner assembly controlled by a single valve handle.

If there are no concealed burners incorporated as a part of the appliance, operating temperature shall be considered attained at the end of 1/2 hour of operation at normal inlet test pressure of all burners of the appliance. Tests shall be conducted with any combination of top surface cooking section burners in operation.

If concealed burners are incorporated as parts of the appliance, operating temperatures shall be considered attained at the end of 1 hour of operation at normal inlet test pressure of all sections except separate broilers or griddles. Burners not thermostatically controlled, except those noted above, shall be operated at their normal input rating, and thermostats of thermostatically controlled oven and broiler burners shall be adjusted to 400°F (204.5 °C). When a separate broiler or griddle is provided as part of the appliance, the gas supply to such compartment burners shall be ignited 30 minutes before the end of the 1-hour period and the burners allowed to operate at full manufacturer's rating until the

temperature of the broiler or griddle surface reaches 600°F (315.5 °C). Oven temperatures shall be measured as prescribed in Clause 5.1.10. All other temperatures shall be measured as prescribed in Clause 5.1.11. These temperatures shall then be maintained constant for the balance of the 1-hour period.

Tests shall be conducted with oven and broiler doors closed and with any combination of top surface cooking section burners in operation. At the discretion of the testing agency, these tests may be repeated with the oven and broiler doors 1/4 in (6.4 mm) open and fully open.

Prior to testing, each burner or burner assembly shall be checked for the time required for gas to reach the burner ports after the valve is turned on. This may be done with a lighted match held at the ignition ports of the burner and measuring the time interval between opening the valve and ignition of the gas at the ports. The time interval required for gas to reach the burner shall be added to the ignition time limit specified during test on each burner.

The gas valve controlling the burner or burner assembly to be tested shall be turned from its closed position to the position to obtain the rated input specified in Clause 4.9, Automatic valves, and left in this position until ignition occurs. As soon as ignition has occurred on all ports to which gas is being admitted, the valve shall be turned to the closed position and, as soon as all burner flames are extinguished, shall again be turned to its rated input position. Ignition and ignition after extinction shall occur within 4 seconds at all ports of the burner or burner assembly through which gas flows. This time shall be determined from the instant gas is available at the ports. This ignition and ignition after extinction cycle shall not be repeated until the system has regained normalcy.

When an appliance is equipped with valves that require different degrees of rotation to obtain their rated input, the above test shall be repeated with the valve controlling each burner or burner assembly rotated from its closed position to the position corresponding to the degree of rotation required by the valve having the least rotation to obtain its rated input.

The gas from a burner that is designed for ignition from an ignition means shall ignite with the valve controlling that burner in the full "ON" position, unless there is a light position used in conjunction with an electric ignition system, in which case the light position shall be used.

The gas from a burner that is designed for ignition from another burner of the same burner assembly shall ignite before the flames of the burner from which ignition occurs become extinguished.

### 5.6.3

Ignition of gas at a thermostatically controlled "ON" and "OFF" type burner shall occur within 4 seconds after a flow rate of 500 Btu/hr (147 W) is available at the burner ports.

### Method of Test

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. On an appliance for use with natural, manufactured, and mixed gases, or natural and mixed gases, this test need be conducted with Test Gas A only.

A flowmeter shall be connected to the appliance manifold. A standard utensil, containing approximately 1 lb (0.45 kg) of water, shall be placed on the burner. The thermostat dial shall be set a point above the 212°F (100 °C) dial marking. After the water has come to a boil, the thermostat dial shall be set at the 200°F (93.5 °C) dial marking so that flow to the main burner is shut off. The flowmeter reading shall then be recorded as the pilot flow rate. When gas again starts to flow through the main burner section, the flowmeter shall be observed continuously. The gas at the main burner shall ignite within 4 seconds

after flow into the main burner section reaches 500 Btu/hr (147 W). Five determinations shall be made and the average taken as the ignition time.

## 5.7 Ignition systems

Clause 5.7 applies to all types of ignition systems. Additional requirements are included in Clauses 5.8, Piloted Ignition Systems, 5.9, Direct ignition systems, and 5.10, Proved igniter systems, for specific ignition system types.

The following tests shall be conducted on oven, broiler, combination oven-broiler, or other burners in enclosed compartments under Test Conditions 1, 2, and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests, unless otherwise specified. An appliance for use with natural gas shall also comply with these provisions under the test condition specified in Clause 5.4.2. An appliance for use with manufactured gas shall also comply with these provisions under the test conditions specified in Clause 5.4.3.

On an appliance for use with natural gas, the additional tests with Test Gas G shall be conducted using only Test Condition 1 for Test Gas A in Table 1, Gas pressure and input conditions for use in the various performance tests.

For an electric ignition system, unless otherwise specified, tests shall be conducted at 85 and 110 percent of the appliance rating plate voltage.

Each appliance shall be tested as installed in its test enclosure specified in Clause 5.19, Wall, floor, and enclosure temperatures. In addition, a floor-supported unit shall also be tested with the appliance standing clear of all walls.

Prior to testing, the time required for gas to reach the burner ports after the valve has been turned on or the gas controlling device has opened shall be determined. This may be done with a lighted match held at the ignition ports of the burner and measuring the time interval between opening the valve and ignition of the gas at the ports. For testing purposes, this time interval for each burner shall be added to the ignition time limits specified.

When more than one ignition device is supplied, the following provisions shall be met whether these igniters are operated simultaneously or successively.

If the range or cook top being tested is intended for use in conjunction with a ventilation system with provisions to direct air in a downward direction, the following sub-clauses of Clause 5.7, Ignition systems, shall be tested with the air curtain ventilation system in operation: Clauses 5.7.2, 5.7.3, 5.7.4, 5.7.5, and 5.7.7.

### 5.7.1

Automatic gas ignition systems shall comply with the applicable performance provisions of the Standard for *Automatic Gas Ignition Systems and Components*, ANSI Z21.20 • CSA C22.2 No. 199, the Standard for *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*, ANSI Z21.20/CAN/CSA-C22.2 No. 60730-2-5, or the Standard for *Manually Operated Gas Ignition Systems and Components*, ANSI Z21.92 • CSA 6.29.

### 5.7.2

Ignition of the gas at the burner shall occur within 4 seconds after gas is available at the burner ports.

## Method of Test

At least ten successive ignition tests shall be conducted on each burner, five with the appliance at room temperature and five at operating temperature.

For tests at room temperature, time shall be allowed between successive tests for parts to attain their proper temperature so the conditions of operation will be the same as those prevailing during previous tests. If a thermostat is provided to control the burner under test, it shall be set at its maximum temperature setting.

For tests at operating temperature, all sections of the appliance shall be operated for 15 minutes at normal inlet test pressure with thermostatically controlled oven and broiler burners adjusted to maintain 400°F (204.5 °C) as prescribed in Clause 5.1.10. To initiate an ignition trial on a thermostatically controlled burner, the thermostat shall be reset to its maximum temperature setting. Tests shall be conducted with oven and broiler doors open and closed, and with any combination of other burners in operation.

### 5.7.3

For an ignition system that is designed to allow for burner re-ignition when the main burner gas supply has been momentarily interrupted, re-ignition shall occur within 4 seconds after gas is available at the burner ports.

## Method of Test

The manual gas valve controlling the burner or burner assembly to be tested shall be turned from its closed position to the open position to obtain the rated input specified by the manufacturer and left in this position until ignition occurs. If the appliance is not constructed with a manual valve that controls gas flow to the individual burner under test, then one shall be installed in the gas supply line to the appliance. The gas valve shall be turned off as soon as ignition has occurred, except that a burner served by a pilot equipped with a pilot igniter shall be allowed to remain in operation for 10 minutes, after which the valve shall be turned off. Immediately after all burner flames have been extinguished, the valve shall again be turned to its rated input position. Ignition shall be effected within 4 seconds after gas is available at the burner ports without objectionable noise or concussion.

### 5.7.4

An automatic ignition device used in connection with a thermostatically controlled oven burner provided with a bypass shall provide complete ignition of the gas at such burner within 30 seconds after gas is admitted to it when the oven burner is operated at its thermostatically maintained bypass rate.

## Method of Test

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests.

The pilot shall be adjusted so the gas supply is just sufficient to maintain the safety shut-off device in the open position. Bypass rates shall be adjusted to give a minimum stable flame.

The oven temperature shall be brought to approximately 500°F (260 °C), after which the thermostat dial shall be set at the lowest thermostat set point such that the gas flow to the burner(s) is at the bypass flow condition. The oven burner valve shall be turned off and immediately turned on and left in this position until ignition occurs. This test shall be repeated five times. The maximum period between the time that gas is admitted to the burner and the ignition of the gas at the burner shall be recorded.

### 5.7.5

A pilot igniter or direct ignition system shall provide for ignition of gas at the pilot burner or main burner, respectively, under all conditions of test. This provision shall apply under both room temperature and equilibrium operating temperature conditions, with the supply voltage to the appliance at 85 and 110 percent of the appliance rating plate voltage. During these tests, igniter coils or spark gaps shall show no signs of excessive deterioration or wear.

#### Method of Test

Two series of ignition tests shall be conducted. For each test, it shall be determined that all gas piping is filled with gas.

For the first series of tests, the supply voltage shall be maintained at 85 percent of the appliance rating plate voltage, an ignition cycle initiated, and the pilot gas ignition observed. Upon ignition, the pilot or main burner shall be immediately extinguished to prevent the components from becoming heated. This test shall be repeated 25 times, after which the supply voltage shall be increased to 110 percent of the appliance rating plate voltage and the test repeated 25 additional times.

For the second series of tests, the entire appliance shall be placed in operation.

- a) When an igniter or direct ignition system is used in conjunction with an oven burner, the oven thermostat shall be set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as measured by an indicating or recording potentiometer, and thermocouples installed according to the method prescribed in Clause 5.1.10, the thermostat shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- b) When an igniter or direct ignition system is used in conjunction with a separate broiler burner, the broiler burner valve shall be turned to the full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- c) When an igniter or direct ignition system is used in conjunction with a combination oven and broiler burner, the test conditions shall be those prescribed in b) above.
- d) When an igniter or direct ignition system is used in conjunction with a top section burner(s), the burner(s) shall be operated at rated input for a period of 15 minutes. For this test, a utensil shall be placed over the top burner.

At the end of the prescribed heat-up period, the appliance shall be shut off and the tests specified above repeated, except that the main burner shall be allowed to operate 1 minute between each successive trial.

Failure of the igniter or direct ignition system to ignite the pilot gas or main burner gas in any one trial in either of the above series of tests shall be considered as noncompliance with this provision.

- e) When an ignition system is used in conjunction with top section burners that is either of the 1) cycling thermostatically controlled type, or 2) cycled on a timing process to maintain a low input heat level/mode (or simulated simmer mode), the ignition system shall demonstrate reliable ignition of the gas at the lowest user setting in the pulsing or thermostatically controlled mode. The test shall be conducted with test pots as shown in Figure 11, Top burner test pot. No less than 25 ignitions shall take place automatically under this mode of test with the flame setting at the lowest size that the system can be utilized at. Any other top burners, oven cavity burners, or built-in exhaust system that can operate at the same time shall be in operation if that operation impacts the ignition of the burner under test.

At the end of the prescribed heat-up period, the appliance shall be shut off and the tests specified above repeated except for "e)" above, except that the main burner shall be allowed to operate 1 minute between each successive trial.

Failure of the igniter or direct ignition system to ignite the pilot gas or main burner gas in any one trial in either of the above series of tests shall be considered as noncompliance with this provision.

### 5.7.6

Time for the gas to be admitted to the burner after the valve has been turned on shall not exceed 90 seconds. For electric ignition systems, tests shall be conducted at the appliance rating plate voltage.

### 5.7.7

Time for ignition to be proved after the pilot has been ignited shall not exceed 90 seconds. For purposes of this test, the manufacturer's specified maximum flame-establishing period for the ignition system shall be used. For igniters, these time limits shall be determined at the appliance rating plate voltage.

### 5.7.8

The time required to shut off the gas supply to a burner following loss of the supervised flame shall not exceed 90 seconds when the following test is conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance 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.

### Method of Test

The gas to the pilot of the burner being tested shall be ignited.

If the ignition means is reactivated, it shall be re-energized in not more than 0.8 seconds following flame outage, and the ignition means shall re-ignite the main burner gas without flame flashback or damage to the appliance. If the ignition means is reactivated, the control manufacturer's specified maximum flame failure re-ignition time or minimum recycle time for the automatic gas ignition system shall be used.

On an appliance where all air for combustion is supplied by mechanical means, the ignition means may be reactivated after a purge period sufficient to provide a minimum of four air changes of the combustion chamber and flue passages.

- a) An oven burner shall be tested with the oven thermostat set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as measured by an indicating or recording potentiometer and thermocouples installed according to Clause 5.1.10, the thermostat shall be set to maintain this temperature. The burner shall then be operated for 1 hour and the test started.
- b) A separate broiler burner shall be tested with the broiler burner valve turned to its full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes and the test started.
- c) A combination oven and broiler burner shall be tested as prescribed in b) above. After the applicable time periods prescribed above have elapsed, gas to the appliance shall be shut off and the time required to shut off the gas supply to the burner(s) noted.

### 5.7.9

The pilot shall effect ignition of the gas at the main burner when the gas supply to the pilot is reduced to a point where the flame is just sufficient to keep the gas supply from being shut off, or just above the point of flame extinction, whichever represents the higher pilot gas rate. A pilot that becomes extinguished after having completed main burner gas ignition is considered as complying with this provision. If the pilot is extinguished by the main burner gas flow without igniting it, additional tests shall be made at successively greater pilot inputs until acceptable ignition is accomplished without the creation of an unsafe condition at any input.

This test shall be repeated (1) on the pilot(s) serving the burner(s) in a single-duty oven with the compartment temperature maintained at 400°F (204.5 °C) according to the method prescribed in Clause 5.1.10, and (2) on the pilot(s) serving the burner(s) for a separate broiler or a combination oven-broiler unit with the compartment temperature maintained at 500°F (260 °C) according to the method prescribed in Clause 5.1.11.

- a) Single-Flame Pilot Burners (Pilot burners that 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 when the pilot gas supply is reduced to an amount just sufficient to keep the gas from being shut off, 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) Multiflame Pilot Burners (Pilot burners that produce a flame(s) with substantial variation in 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 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 gas from being shut off, or just above the point of flame extinction, whichever represents the higher pilot gas rate.

- c) Recycling Pilot Burners

In the case of a pilot that operates every time the main gas is turned on or off, either manually or by automatic controls, the ignition flame shall provide ignition of the gas within 4 seconds from the time gas is admitted to the main burner when the gas supply to the pilot burner is just sufficient to keep the gas from being shut off.

### Method of Test

Tests shall be conducted under Test Conditions 2 and 3 in Table 1, Gas pressure and input conditions for use in the various performance tests. An appliance for use with natural gas shall also have this test conducted under the test conditions specified in Clause 5.4.2. An appliance for use with manufactured gas shall also have this test conducted under the test conditions specified in Clause 5.4.3.

In conducting the tests at elevated compartment temperatures, the temperature in a single-duty oven or a combination oven-broiler shall be determined by an indicating potentiometer and 5 parallel-connected thermocouples located as specified in Clause 5.1.10. The thermostat shall be set to maintain a temperature of 400°F (204.5 °C) in a single-duty oven or 500°F (260 °C) in a combination oven-broiler. For a separate broiler, the compartment temperature shall be determined as specified in Clause 5.1.11, and shall be kept constant at 500°F (260 °C).

### 5.7.10

The temperatures developed on automatic gas ignition system components shall not exceed those for which the components are designed.

#### Method of Test

This test shall be conducted at the manufacturer's specified appliance rating plate voltage.

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 fitting;
- c) electric igniter;
- d) flame sensor;
- e) surfaces of the hot and cold junction of thermoelectric types;
- f) valve body;
- g) electric switch;
- h) contact mechanism; and
- i) magnetic assembly.

The pilot and main burner(s) shall be operated as specified in Clause 5.19, Wall, floor, and enclosure temperatures, and temperatures shall be recorded in conjunction with the wall, floor, and enclosure temperature recordings specified in Clause 5.19.

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

### 5.7.11

On an ignition system in which main burner gas flow is initiated prior to proof of the ignition source, a maximum trial for ignition period of 15 seconds shall be provided. For multityr systems, the maximum valve sequence period shall not exceed 60 seconds. For test purposes, the control manufacturer's specified maximum trial for ignition period and maximum valve sequence period for the ignition system shall be used. An ignition system having a proved ignition source need not be provided with a lockout feature.

### 5.7.12

On an appliance equipped with an ignition system in which main burner gas flow is initiated prior to proof of the ignition source, 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 undue noise, excessive flame flashback, or damage. For purposes of this test, the control manufacturer's specified maximum trial for ignition period for the automatic gas ignition system shall be used.

#### Method of Test

With the appliance at room temperature, the appliance shall be placed into operation at normal inlet test pressure with the ignition means temporarily circumvented for varying intervals of time up to the control manufacturer's maximum specified trial for ignition period.

For multityr systems, attempts to ignite shall be made for varying intervals of time for each trial for ignition period.

For systems that incorporate multiple ignition sources, repeat the test with each ignition source activated.

### 5.7.13

With the appliance at equilibrium temperature 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 operating cycle shall not exceed 90 seconds.

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

If the ignition means is reactivated, it shall be re-energized in not more than 0.8 seconds following flame outage and the ignition means shall re-ignite the main burner gas without undue noise, excessive flame flashback, or damage to the appliance.

For purposes of this test, the control manufacturer's specified maximum flame failure re-ignition time or minimum recycle time for the automatic gas ignition system shall be used.

On an appliance where all air for combustion is supplied by mechanical means, the ignition means may be reactivated after a purge period sufficient to provide a minimum of four air changes to the combustion chamber and flue passages.

## 5.8 Piloted ignition systems

### 5.8.1

An automatic ignition device pilot used in connection with a thermostatically controlled oven burner provided with a bypass shall provide complete ignition of the gas at such burner within 30 seconds after gas is admitted to it when the oven burner is operated at its thermostatically maintained bypass rate.

#### Method of Test

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input rate conditions for use in the various performance tests.

The pilot shall be adjusted so the gas supply is just sufficient to maintain the safety shut-off device in the open position. Bypass rates shall be adjusted to give a minimum stable flame. The thermostat shall be calibrated as specified in Clause 5.1.10, and the dial then set at the 500°F (260 °C) position.

The oven temperature shall be brought to approximately 500°F (260 °C), after which the thermostat dial shall be set at 300°F (149 °C). The oven burner shall be turned off and immediately turned on and left in this position until ignition occurs. This test shall be repeated five times. The maximum period between the time that gas is admitted to the burner and the ignition of the gas at the burner shall be recorded.

### 5.8.2

A pilot igniter system shall provide for ignition of gas at the pilot burner, under all conditions of test. This provision shall apply under both room temperature and equilibrium operating temperature conditions, with the supply voltage to the appliance at 85 and 110 percent of the appliance rating plate voltage. During these tests, igniter coils or spark gaps shall show no sign of excessive deterioration or wear.

## Method of Test

Two series of ignition tests shall be conducted. For each test, it shall be determined that all gas piping is filled with gas.

For the first series of tests, the supply voltage shall be maintained at 85 percent of the appliance rating plate voltage, an ignition cycle initiated and the pilot gas ignition observed. Upon ignition, the pilot shall be immediately extinguished to prevent components from being heated. This test shall be repeated 25 times, after which the supply voltage shall be increased to 110 percent of the appliance rating plate voltage and the test repeated 25 additional times.

- a) When the pilot igniter is used in conjunction with an oven burner, the oven thermostat shall be set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as measured by a temperature indicating or recording device, and thermocouples installed according to the method described in Clause 5.1.10, the thermostat shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- b) When the pilot igniter is used in conjunction with a separate broiler burner, the broiler burner shall be turned to the full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- c) When the pilot igniter is used in conjunction with a combination oven and broiler burner, the test conditions shall be those prescribed in b) above.
- d) When the pilot igniter is used in conjunction with a top section burner(s), the burner shall be operated at rated input for a period of 15 minutes. For this test, a utensil shall be placed over the top burner.

At the end of the prescribed heat-up period, the appliance shall be shut off and the test specified above repeated, except that the main burner shall be allowed to operate for 1 minute between each successive trial.

Failure of the pilot igniter to ignite the pilot gas or main burner gas in any one trial in either of the above series of tests shall be considered as noncompliance with this provision.

### 5.8.3

Time for ignition to be proved after a pilot has been ignited shall not exceed 90 seconds. For purposes of this test, the manufacturer's specified maximum pilot flame-establishing period shall be used. These time limits shall be determined at the appliance rating plate voltage.

### 5.8.4

The time required to shut off the gas supply to a burner following loss of the supervised pilot flame shall not exceed 90 seconds when the following test is conducted under Test Condition 1 of Table 1, Gas pressure and Input rate conditions for use in the various performance 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.

## Method of Test

The gas to the pilot of the burner being tested shall be ignited.

If the ignition means is reactivated, it shall be re-energized in not more than 0.8 seconds following flame outage, and the ignition means shall re-ignite the main burner gas without flame flashback or damage to the appliance. If the ignition means is reactivated, the control manufacturer's specified maximum flame failure re-ignition time or minimum recycle time for the automatic ignition system shall be used.

On an appliance where all air for combustion is supplied by mechanical means, the ignition means may be reactivated after a purge period sufficient to provide a minimum of four air changes of the combustion chamber and flue passages.

- a) An oven burner shall be tested with the oven thermostat set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as measured by a temperature indicating or recording device and thermocouples installed according to Clause 5.1.10. The thermostat shall be set to maintain this temperature. The burner shall then be operated for 1 hour and the test started.
- b) A separate broiler burner shall be tested with the broiler burner valve turned on to its full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes and the test started.
- c) A combination oven and broiler burner shall be tested as prescribed in b) above. After the applicable time periods described above have elapsed, gas to the appliance shall be shut off and the time required to shut off the gas supply to the burner(s) noted.

### 5.8.5

A pilot shall effect ignition of the gas at the main burner when the gas supply to the pilot is reduced to a point where the flame is just sufficient to keep the gas supply from being shut off, or just above the point of flame extinction, whichever represents the higher pilot gas rate. A pilot that becomes extinguished after having completed main burner gas ignition is considered as complying with this provision. If the pilot is extinguished by the main burner gas flow without igniting it, additional tests shall be made at successively greater pilot inputs until acceptable ignition is accomplished without the creation of an unsafe condition at any input rate.

This test shall be repeated (1) on the pilot(s) serving the burner(s) in a single-duty oven with the compartment temperature maintained at 400°F (204.5 °C) according to the method prescribed in Clause 5.1.10, and (2) on the pilot(s) serving the burner(s) for a separate broiler or combination oven-broiler unit with the compartment temperature maintained at 500°F (260 °C) according to the method prescribed in Clause 5.1.11.

- a) Single-Flame Pilot Burners (Pilot burners that 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 when the pilot gas supply is reduced to an amount just sufficient to keep the gas from being shut off, or just above the point of flame extinction, whichever represents the higher pilot 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) Multiflame Pilot Burners (Pilot burners that produce flame(s) with substantial variation in contour under turndown conditions.)

The pilot shall effect ignition of gas within 4 seconds from the time gas is admitted to the main burner and 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 gas from being shut off, or just above a point of flame extinction, whichever represents the higher pilot gas rate.

- c) Recycling Pilot Burners

In the case of a pilot that operates every time the main gas is turned on or off, either manually or by automatic controls, the ignition flame shall provide ignition of the gas within 4 seconds from the time gas is admitted to the main burner when the gas supply to the pilot burner is just sufficient to keep the gas from being shut off.

## Method of Test

Tests shall be conducted under Test Conditions 2 and 3 in Table 1, Gas pressure and input rate conditions for use in the various performance tests. An appliance for use with natural gas shall also have this test conducted under test conditions specified in Clause 5.4.2. An appliance for use with manufactured gas shall also have this test conducted under the test conditions specified in Clause 5.4.3.

In conducting the tests at elevated compartment temperatures, the temperature in a single-duty oven or a combination oven-broiler shall be determined by a temperature indicating device and five parallel connected thermocouples located as specified in Clause 5.1.10. The thermostat shall be set to maintain a temperature of 400°F (204.5 °C) in a single-duty oven or 500°F (260 °C) in a combination oven-broiler. For a separate broiler, the compartment temperature shall be determined as specified in Clause 5.1.11, and shall be kept constant at 500°F (260 °C).

### 5.8.6

On an appliance equipped with a manually activated intermittent/continuous ignition system, 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, the appliance will vent itself without undue noise, excessive flame flashback, or damage to the appliance. For purpose of this test, the maximum flame failure response time for the system shall be used.

## Method of Test

This test shall be conducted with the appliance at both room temperature and equilibrium operating temperature conditions with all test gases for which the appliance is tested. Supplemental natural gas test with Test Gas G need not be conducted.

Unburned main burner and pilot gas shall be allowed to flow into the appliance for varying intervals of time up to and including the maximum flame failure response time for the system. Manual activation of the igniter shall be initiated at normal rated voltage at the end of each interval for a sufficient period of time to determine if the gas will be ignited.

If ignition occurs, it shall not cause undue noise, excessive flame flashback, or damage to the appliance. If ignition occurs during testing at the room temperature condition, the appliance shall be returned to the room temperature condition prior to the conduct of further testing at other time intervals.

## 5.9 Direct ignition systems

This clause is applicable only to direct ignition systems for which only main burner flame supervision is provided. [See Clause 4.15.2 b.)]

### 5.9.1

An ignition system in which main burner gas flow is initiated without proof of the ignition source must be provided with a lockout feature.

### 5.9.2

A direct ignition system shall provide for ignition of gas at the main burner under all conditions of test. This provision shall apply under both room temperature and equilibrium operating temperature conditions, with the supply voltage to the appliance at 85 and 110 percent of the appliance rating plate voltage. During these tests, igniter coils or spark gaps shall show no sign of excessive deterioration or wear.

## Method of Test

Two series of ignition tests shall be conducted. For each test, it shall be determined that all gas piping is filled with gas.

For the first series of tests, the supply voltage shall be maintained at 85 percent of the appliance rating plate voltage, an ignition cycle initiated, and the pilot gas ignition observed. Upon ignition, the pilot or main burner shall be immediately extinguished to prevent components from being heated. This test shall be repeated 25 times, after which the supply voltage shall be increased to 110 percent of the appliance rating plate voltage and the test repeated 25 additional times.

For the second series of tests, the entire appliance shall be placed in operation.

- a) When a direct ignition system is used in conjunction with an oven burner, the oven thermostat shall be set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as measured by a temperature indicating or recording device, and thermocouples installed according to the method described in Clause 5.1.10, the thermostat shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- b) When a direct ignition system is used in conjunction with a separate broiler burner, the broiler burner shall be turned to the full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- c) When a direct ignition system is used in conjunction with a combination oven and broiler burner, the test conditions shall be those prescribed in b) above.
- d) When a direct ignition system is used in conjunction with a top section burner(s), the burner shall be operated at rated input for a period of 15 minutes. For this test, a utensil shall be placed over the top burner.

At the end of the prescribed heat-up period, the appliance shall be shut off and the test specified above repeated, except that the main burner shall be allowed to operate 1 minute between each successive trial.

Failure of the direct ignition system to ignite main burner gas in any one trial in either of the above series of tests shall be considered as noncompliance with this provision.

### 5.9.3

The time required to shut off the gas supply to a burner following loss of the supervised flame shall not exceed 90 seconds when the following test is conducted under Test Condition 1 of Table 1, Gas pressure and input conditions for use in the various performance 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.

## Method of Test

If the ignition means is reactivated, it shall be re-energized in not more than 0.8 second following flame outage, and the ignition means shall re-ignite the main burner gas without flame flashback or damage to the appliance. If the ignition means is reactivated, the control manufacturer's specified maximum flame failure re-ignition time or minimum recycle time for the automatic ignition system shall be used.

On an appliance where all air for combustion is supplied by mechanical means, the ignition means may be reactivated after a purge period sufficient to provide a minimum of four air changes of the combustion chamber and flue passages.

- a) An oven burner shall be tested with the oven thermostat set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as

- measured by a temperature indicating or recording device and thermocouples installed according to Clause 5.1.10. The thermostat shall be set to maintain this temperature. The burner shall then be operated for 1 hour and the test started.
- b) A separate broiler burner shall be tested with the broiler burner valve turned on to its full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes and the test started.
  - c) A combination oven and broiler burner shall be tested as prescribed in b) above.  
After the applicable time periods described above have elapsed, gas to the appliance shall be shut off and the time required to shut off the gas supply to the burner(s) noted.

#### 5.9.4

On an ignition system in which the main burner gas flow is initiated prior to proof of the ignition source, a maximum trial for ignition period of 15 seconds shall be provided. For multity systems, the maximum valve sequence period shall not exceed 60 seconds. For test purposes, the control manufacturer's specified maximum trial for ignition period and maximum valve sequence period for the ignition system shall be used.

#### 5.9.5

For systems that incorporate an ignition activation period (see Clause 3, Definitions), the period of time between deactivation of the ignition means and the maximum trial for ignition period shall not exceed 4 seconds.

#### 5.9.6

On an appliance equipped with an ignition system in which main burner gas flow is initiated prior to proof of the ignition source, 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 undue noise, excessive flame flashback, or damage. For purposes of this test, the control manufacturer's specified maximum trial for ignition period for the automatic ignition system shall be used. For systems that 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

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

For multity systems, attempts to ignite shall be made for varying intervals of time for each trial for ignition period and any time the ignition means is activated throughout the total operating sequence up to lockout. Prior to each ignition attempt, the appliance shall be returned to room temperature condition.

The resulting ignition for each time interval shall be observed for undue noise, excessive flame flashback, or damage to the appliance.

For systems that incorporate multiple ignition sources, repeat the test with each ignition source activated.

## 5.10 Proved igniter systems

This clause is applicable only to a direct ignition system that incorporates a proved igniter.

### 5.10.1

An ignition system having a proved ignition source need not be provided with a lockout feature.

### 5.10.2

A proved igniter system shall provide for ignition of gas at the main burner under all conditions of test. This provision shall apply under both room temperature and equilibrium operating temperature conditions, with the supply voltage to the appliance at 85 and 110 percent of the appliance rating plate voltage.

#### Method of Test

Two series of ignition tests shall be conducted. For each test, it shall be determined that all gas piping is filled with gas.

For the first series of tests, the supply voltage shall be maintained at 85 percent of the appliance rating plate voltage, an ignition cycle initiated and the pilot gas ignition observed. Upon ignition, the main burner shall be immediately extinguished to prevent components from being heated. This test shall be repeated 25 times, after which the supply voltage shall be increased to 110 percent of the appliance rating plate voltage and the test repeated 25 additional times.

For the second series of tests, the entire appliance shall be placed in operation.

- a) When a proved igniter system is used in conjunction with an oven burner, the oven thermostat shall be set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as measured by a temperature indicating or recording device, and thermocouples installed according to the method described in Clause 5.1.10, the thermostat shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- b) When a proved igniter system is used in conjunction with a separate broiler burner, the broiler burner shall be turned to the full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes.
- c) When a proved igniter system is used in conjunction with a combination oven and broiler burner, the test conditions shall be those prescribed in b) above.
- d) When a proved igniter system is used in conjunction with a top section burner(s), the burner shall be operated at rated input for a period of 15 minutes. For this test, a utensil shall be placed over the top burner.

At the end of the prescribed heat-up period, the appliance shall be shut off and the test specified above repeated, except that the main burner shall be allowed to operate 1 minute between each successive trial.

Failure of the proved igniter or direct ignition system to ignite the pilot gas or main burner gas in any one trial in either of the above series of tests shall be considered as non-compliance with this provision.

### 5.10.3

For proved igniter systems, the igniter proving time shall not exceed 90 seconds at the appliance rating plate voltage. For purposes of this test, the control manufacturer's specified maximum igniter proving time shall be used.

### 5.10.4

For proved igniter systems that incorporate an intermittent-interrupted ignition source or an interrupted ignition source together with main burner flame proving, the time required to shut off the gas supply to a burner following loss of the supervised flame shall not exceed 90 seconds when the following test is conducted under Test Condition 1 of Table 1, Gas pressure and input conditions for use in the various performance tests. 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

- a) An oven burner shall be tested with the oven thermostat set at the full open position of the thermostat dial. After the temperature at the center of the oven has reached 475°F (246 °C), as measured by a temperature indicating or recording device and thermocouples as prescribed in Clause 5.1.10. The thermostat shall be set to maintain this temperature. The burner shall then be operated for 1 hour and the test started.
- b) A separate broiler burner shall be tested with the broiler burner valve turned on to its full open position. After the broiler temperature has reached 600°F (315.5 °C), as measured according to the method prescribed in Clause 5.1.11, the broiler valve shall be set to maintain this temperature. The burner shall then be operated for 15 minutes and the test started.
- c) A combination oven and broiler burner shall be tested as prescribed in b) above.

After the applicable time periods described above have elapsed, gas to the appliance shall be shut off and the time required to shut off the gas supply to the burner(s) noted.

### 5.10.5

A proved igniter system that incorporates an intermittent-interrupted ignition source or an interrupted ignition source together with main burner flame proving shall not cause undue noise, excessive flame flashback, or 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

This test shall be conducted as outlined in Clause 5.10.4 a), b), and c).

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 chart-type 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 at both room temperature and equilibrium operating temperature conditions 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 undue noise, excessive flame flashback, or damage to the appliance.

On an appliance where all air for combustion is supplied by mechanical means, and the ignition means may be reactivated after a purge period sufficient to provide a minimum of four air changes of the combustion chamber and flue passages shall be considered as complying with this provision.

### 5.10.6

For a proved igniter system that 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 90 seconds when the following test is conducted under Test Condition 1 of Table 1, Gas pressure and input conditions for use in the various performance tests. For purposes of this test, the control manufacturer's specified maximum igniter failure response time of the proved igniter system shall be used.

#### Method of Test

This test shall be conducted as outlined in Clause 5.10.4 a), b), and c).

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 90 seconds.

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

### 5.10.7

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 at both room temperature and equilibrium operating temperature conditions.
- 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.

## 5.11 Manual gas valves

### 5.11.1

Manual gas valves and pilot shut-off devices shall comply with the applicable performance provisions of the Standard for *Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves*, ANSI Z21.15 • CSA 9.1, or *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20, as applicable. Burner and pilot valves and pilot shut-off devices shall be suitable for operation at a temperature of at least 300°F (149 °C).

### 5.11.2

The temperature of the body of any burner valve or pilot valve or pilot shut-off device shall not exceed that for which it is designed.

## Method of Test

The temperature of the control body shall be measured by means of a temperature indicating or recording device and a 24 AWG (0.20 mm<sup>2</sup>) bead-type thermocouple, the junction of which is embedded or peened in the central part of the control body at a depth equal to half the thickness of the body.

The appliance shall be operated as specified in Clause 5.19, Wall, floor, and enclosure temperatures, and the temperature of the control body recorded in conjunction with the wall, floor, and enclosure temperature recordings specified in Clause 5.19. The temperature shall not exceed that for which the control has been found suitable.

## 5.12 Gas appliance pressure regulators

Gas appliance pressure regulators shall comply with the applicable performance provisions for regulators equipped with vent limiters and regulators for main burner and pilot load application of the Standard for *Gas Appliance Pressure Regulators*, ANSI Z21.18 • CSA 6.3, or *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20. Gas appliance pressure regulators shall have a maximum regulation capacity (see Clause 3, Definitions), as determined under that standard, at least equal to the manufacturer's total hourly Btu input rating for the appliance.

## 5.13 Automatic valves

Automatic valves, controlling the gas supply to main burners, pilot burners, or both, shall comply with the applicable performance provisions of the Standard for *Automatic Valves for Gas Appliances*, ANSI Z21.21 • CSA 6.5 or *Combination Gas Controls for Gas Appliances*, ANSI Z21.78 • CSA 6.20.

## 5.14 Broiler temperature

The maximum temperature on the inner surface of the drip tray of an open top broiler section or unit shall not exceed 300°F (149 °C).

## Method of Test

This test shall be conducted in conjunction with Clause 5.19, Wall, floor, and enclosure temperatures. During the test period, temperatures on the inner surface of the drip tray shall be determined.

## 5.15 Broiler operation

### 5.15.1

An enclosed broiler shall perform the following broiling operation without the safety shut-off device shutting off the main gas supply and without the pilot or main burner flames extinguishing. Open top broiler units or sections need not comply with this provision.

## Method of Test

A thermostat, when provided, shall be set at its maximum open position.

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests.

With the broiler at room temperature, the gas shall be turned on and ignited and the door closed. The broiler shall be operated for 15 minutes.

Six meat cakes made from freshly ground commercial hamburger, each weighing 0.3 lb (0.14 kg) and having a thickness of 3/8 in (9.5 mm) and a diameter of approximately 4 in (102 mm), shall then be immediately placed uniformly on the broiler rack, or broiler pan when no rack is provided, so the distance between the top surface of the meat and the burner ports is 2 in (50.8 mm). If the outer casing of the appliance, exclusive of backguards, vent extensions, handles, etc., encloses a volume not in excess of 6 ft<sup>3</sup> (0.17 m<sup>3</sup>), and the weight of the appliance is not in excess of 80 lb (36.3 kg), the number of meat cakes shall be reduced in accordance with the size of the broiler pan, and the broiler pan shall be placed in the rack position, which most nearly provides a 2 in (50.8 mm) clearance between the burner ports and the top surface of the meat. At least one meat cake shall be placed under the pilot burner. When this cannot be done due to location of the pilot, a cake shall be placed as close to the pilot as possible. The cakes shall be broiled for 5 minutes on each side.

During this 10 minute broiling operation, neither the pilot nor burner flames shall be extinguished and the safety shut-off device shall not operate to shut off the main gas supply. Thermostatic cycling of the burner(s) shall not constitute a failure.

Following the broiling operation, the gas to the burner shall be turned off and the pilot observed for an additional 2 minutes with the oven and broiler doors closed. During this period, the pilot shall not be extinguished and the safety shut-off device shall not operate to shut off the main gas supply.

### 5.15.2

Open top broilers equipped with fully premixed infrared burners shall comply with the following Method of Test. The main burner shall re-light and, after 15 minutes of additional operation, shall re-light and, after 15 minutes of additional operation, shall demonstrate normal burner operation. Compliance may be achieved by pyrolytic self-cleaning of the burner.

#### Method of Test

This test shall be conducted at normal test pressure. With the broiler at room temperature, the gas shall be turned on, ignited, and the cover closed. The broiler shall be operated for 15 minutes. Meat cakes made from freshly ground 80 percent lean/20 percent fat hamburger meat weighing 0.3 lb (0.14 kg) with a diameter of 4 in (102 mm) and a thickness of approximately 3/4 in (9.5 mm) shall be immediately placed on the broiler rack directly over the main burner in a manner that will represent a normal cooking load without crowding. The meat cakes shall be placed in a method to completely cover the burner. The meat cakes shall be positioned uniformly, with no more than 1/2 in space between each cake. The broiler rack shall be placed in the lowest rack position for this test. The cakes shall be broiled for 5 minutes on each side. After broiling the meat cakes on both sides, the main burners shall be manually extinguished and the meat cakes left on the broiler rack for 5 minutes. The cakes shall then be removed and an attempt to re-light the open top broiler burner shall be made.

### 5.16 Evaluation of clothing ignition potential

No ignition of clothing shall occur under any of the tests in this clause.

One hundred percent white cotton terry cloth test material with a pile weave on both sides, nominal 9 oz/yd<sup>2</sup>(+/- 1 oz) (0.27 kg/m<sup>2</sup>), shall be used.

Test samples shall be preconditioned at 30 percent relative humidity, or less, at 75°F (24 °C) for at least 24 hours before conduct of any test.

All tests shall be conducted at normal inlet test pressure on a test gas for which the maximum input, for the burner being tested, has been specified.

If the range or cook top being tested is intended for use in conjunction with a ventilation system with provisions to direct air in a downward direction, Clause 5.16.2 shall be conducted with the air curtain ventilation system in operation. Attention shall be made during the test so that the test person does not influence the air direction.

### 5.16.1

#### Backing or leaning on appliance

This test shall be conducted on appliances with top surface cooking section burners, including wok burner(s).

Guards packaged with the appliance shall be installed in accordance with the manufacturer's installation instructions.

#### Method of Test

Gas to all top surface cooking section burners shall be ignited and the burners operated at maximum input for at least 10 minutes. No utensils shall be in place during conduct of this test.

A sample of the test material, 16 in (406 mm) long and 4 in (102 mm) wide, shall be folded to cover a three-sided U-shaped frame, 8 in (203 mm) long and 4 in (102 mm) wide. The folded edge shall be at the 4 in (102 mm) wide open end of the frame.

The frame shall be placed in a vertical position, the 4 in (102 mm) width parallel to the front and well outside the forward projection of the appliance, and the folded edge at the bottom at the same height as the utensil support surface, with the center line of the test fixture on the projected center line of each front burner. The frame shall then be moved, towards the heat source, to a distance 4 in (102 mm) past the maximum forward projection of the appliance. [The maximum forward projection excludes valve handles and knobs but includes guards, oven door handles, manifold covers, and shields, so long as they span the projected width of the utensil support surface and are no more than 6 in (152 mm) above or below the horizontal plane of the utensil support surface.] For built-in units, the distance shall be measured from the front edge of the counter or guard, when installed in accordance with the manufacturer's installation instructions.

The frame shall be held in this position for 30 seconds. No flaming of the test material shall occur.

The test agency shall review the manufacturer's installation instructions with regard to installation in islands as to the minimum distance from the cutout to the counter edge at the rear and side(s). The inputs of rear burners shall also be reviewed as to their impact in this evaluation. Tests shall be performed at the minimum distances to the side(s) and to prove the safety of the island installation.

### △ 5.16.2

#### Reaching for controls or performing cooking operations

This test shall be conducted on appliances with top surface cooking section burners and wok burner(s).

#### Method of Test

An uncovered pan of the appropriate size as shown in Table 5, Pan dimensions, shall be 3/4 filled with water and centered on each top surface cooking section burner utensil support. Each pan shall have a flat bottom, a radius of not more than 1/2 in (12.7 mm) at the juncture of the bottom and sides, and a straight side taper and no external lip. The wok pan(s) shall be the minimum size possible to be installed or the manufacturer's minimum specified wok pan(s). Wok pan(s) shall be filled to 80 percent capacity with water at approximately room temperature.

All surface cooking section top burners shall be ignited and operated simultaneously at maximum input for at least 10 minutes.

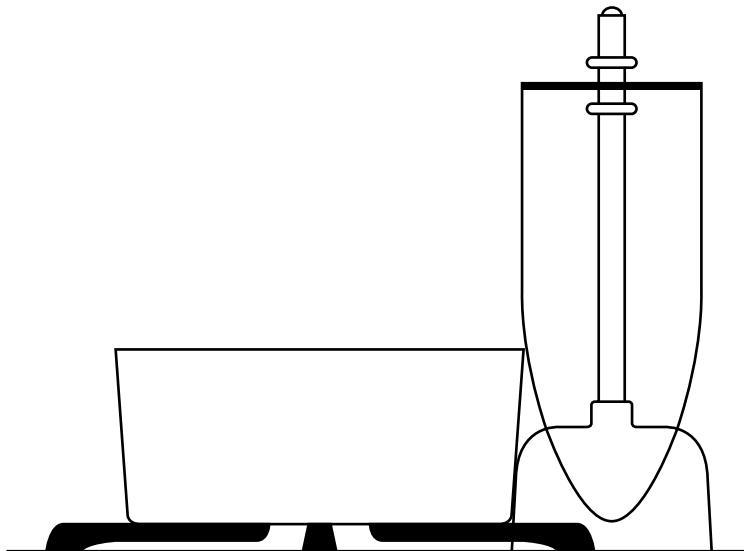
The 4 in (102 mm) wide free ends of a sample of the test material, 22 in (559 mm) long and 4 in (102 mm) wide, shall be fastened to a 4 in (102 mm) long and 3 in (76.2 mm) wide horizontal support so a loop, at least 9-1/2 in (241 mm) long, is formed.

The loop shall be positioned so its bottom curve coincides with the horizontal plane of the utensil support surface and one side is just touching the top edge of the pan over the burner being tested (see Figure 13, Arrangement of test apparatus simulating reaching for controls or performing cooking operations and Figure 14, Arrangement of test apparatus simulating both reaching for controls or performing cooking operations and oven usage). The loop shall be allowed to remain in this position for 30 seconds. No flaming of the test material shall occur.

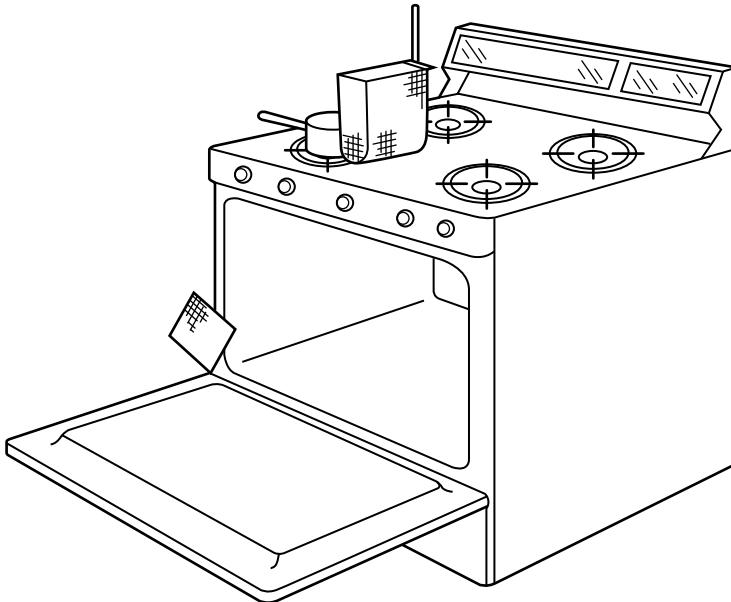
This test shall be conducted on each top surface cooking section burner.

Additional tests, as outlined above, may be conducted with other burner-test material orientations. If the specified test pans are spaced 3-1/2 in (88.9 mm) apart, or less, tests shall not be conducted with the loop between adjacent pans.

**Figure 13**  
**Arrangement of test apparatus simulating reaching for**  
**controls or performing cooking operations**  
(See Clause 5.16.2.)



**Figure 14**  
**Arrangement of test apparatus simulating both reaching for controls or performing cooking operations and oven usage**  
(See Clauses 5.16.2 and 5.16.4.)



### 5.16.3

#### Reaching for touch pads, knobs, or handles controlling top surface cooking section burners

This test shall be conducted on appliances having top surface cooking section burners and/or wok burner(s) controlled by knobs, touch pads, or handles mounted to the side of the burners or between the left and right burners.

#### Method of Test

To determine the position of the knobs between left and right burners, a line shall be drawn between the forward tangents of the edge of the right burner cap and the left burner cap. If the centerline of the grasping portion of the knob is behind that line, the following test shall be performed on that burner control knob.

Gas to all top surface cooking section burners shall be ignited and the burners operated at maximum input for at least 10 minutes. No utensils shall be in place during conduct of this test.

A U-shaped frame as specified in Clause 5.16.1 shall be covered with the test material and placed in a vertical position over the centerline of any touch pad, knob, or handle, parallel to the nearest heat source, with the folded edge of the test material at the same height as the utensil support surface. The frame shall then be moved toward the heat source to a distance 4 in (102 mm) from the centerline of the knob, touch pad, or handle.

The frame shall be held in this position for 30 seconds. No flaming of the test material shall occur. Additional tests, as specified above, may be conducted between other knobs, touch pads, or handles and heat sources.

## 5.16.4

### Oven usage

The test specified in a) shall be conducted on appliances with ovens.

The test specified in b) shall be conducted on appliances with ovens where the oven bottom is 36 in (914 mm) or less above the floor when installed in accordance with the manufacturer's installation instructions.

### Method of Test

#### a) Reaching into Oven.

One oven rack shall be installed in the lowest rack position.

The gas to the oven burner(s) shall be ignited, the thermostat set to 400°F (204.5 °C) and the oven allowed to operate with its door open for at least 10 minutes.

A 6 in by 6 in (152 mm by 152 mm) simulated pot holder, consisting of six layers of test material, shall be folded diagonally in half so there are no exposed cut edges and used to grasp the oven rack at the front center, within the fold. The oven rack shall be pulled to the full out position and then returned to its normal position. No flaming of the test material shall occur.

This test shall be repeated with the simulated pot holder folded in half so as to form a rectangle.

#### b) Standing Beside Open Oven Door.

The oven racks shall be removed. The gas to the oven burner(s) shall be ignited, the thermostat set to 400°F (204.5 °C) and the oven allowed to operate with its door open for at least 10 minutes.

One corner of a 6 in by 6 in (152 mm by 152 mm) simulated pot holder, as described in a), shall be attached to the uppermost edge of the side of the open oven door closest to the oven cavity (see Figure 14, Arrangement of test apparatus simulating both reaching for controls or performing cooking operations and oven usage). The free edge of the material shall be moved in any direction from the point of attachment and allowed to dwell at any location for 30 seconds. No flaming of the test material shall occur.

## 5.17 Evaluation of burn hazard potential of exterior surfaces

### 5.17.1

The temperatures of exterior surfaces of the appliance, when tested as specified in the following Method of Test, shall not exceed the temperatures listed in Table 15, Maximum surface temperature, °F (°C).

### Method of Test

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. Room temperature shall be within the range of 68–86°F (20–30 °C). The maximum temperatures specified are based on a 77°F (25 °C) room temperature. When the room temperature is other than 77°F (25 °C) the allowable temperatures shall be increased or decreased 1 degree for each 1 degree of room temperature greater or less than 77°F (25 °C).

A floor-supported appliance shall be installed with a vertical back wall, extending at least 1 ft (305 mm) above and 1 ft (305 mm) on either side of the appliance, and with no side walls. A built-in appliance shall be installed in an enclosure constructed in accordance with the manufacturer's installation instructions. Surfaces to be measured shall be cleaned to remove surface dirt and oil before tests are begun.

With the appliance at room temperature, the gas shall be turned on and ignited. The thermostat shall be set to maintain an oven temperature, when measured in accordance with the method prescribed in Clause 5.1.10 of  $475 \pm 5^{\circ}\text{F}$  ( $246 \pm 3^{\circ}\text{C}$ ) or, on a continuous cleaning oven, the design operating temperature specified by the manufacturer if in excess of  $475^{\circ}\text{F}$  ( $246^{\circ}\text{C}$ ). This temperature shall be increased or decreased 1 degree for each degree of room temperature greater or less than  $77^{\circ}\text{F}$  ( $25^{\circ}\text{C}$ ). The oven door shall then be closed. When an appliance incorporates more than one oven, the test shall be conducted with all ovens in operation. Broilers shall not be operated during conduct of these tests.

Burn hazard potential shall be determined on all specified exterior surfaces 1 hour after the specified oven temperature has first been attained or, on a continuous cleaning oven, at the manufacturer's specified cleaning time, whichever is longer.

Burn hazard potential shall be determined for all surfaces that can be fully contacted by the flat tip of the test probe surface having a diameter of at least  $11/16$  in (17.5 mm). Burn hazard potential shall also be determined for any surfaces adjacent to or surrounding a knob or control, as defined in Figure 15, Surfaces surrounding a knob or control and subject to contact, that may be subject to contact during operation of the knob or control.

Burn hazard potential shall not be determined for:

- a) the horizontal surface of the top surface cooking section containing the top surface cooking section burners and surfaces facing the top surface cooking section, such as backguards of the appliance, vertical top section extensions, the underside of an upper oven, and the surfaces between the underside of the upper oven and the top surface cooking section, unless portions of these surfaces are adjacent to or surround knobs or controls and are subject to contact as defined in Figure 15, Surfaces surrounding a knob or control and subject to contact;
- b) the front edge of the top surface, providing this edge is protected from accidental contact by handles, knobs, guards, etc.;
- c) surfaces higher than 5 ft (1.52 m) above the floor; and
- d) flue deflectors, vent openings and surfaces within 1 in (25.4 mm) of such deflectors or openings. Surface temperatures shall be measured using the probe illustrated in Figure 16, Temperature-measuring and accessibility probe. For each measurement, the probe shall be at the ambient temperature, and then shall be heated for 15 seconds to approximately the temperature of the surface under consideration. The probe is then to be applied to the surface under consideration with a 5 lb (22 N) force for 10 seconds. The probe shall be moved from the pre-heat position to the surface as quickly as possible, and shall be applied so the tip will fully contact the surface. The tip is considered to be the disc and the flat surface of the cork surrounding the disc. The surface temperatures obtained shall not exceed those specified in Table 15, Maximum surface temperature,  $^{\circ}\text{F}$  ( $^{\circ}\text{C}$ ).

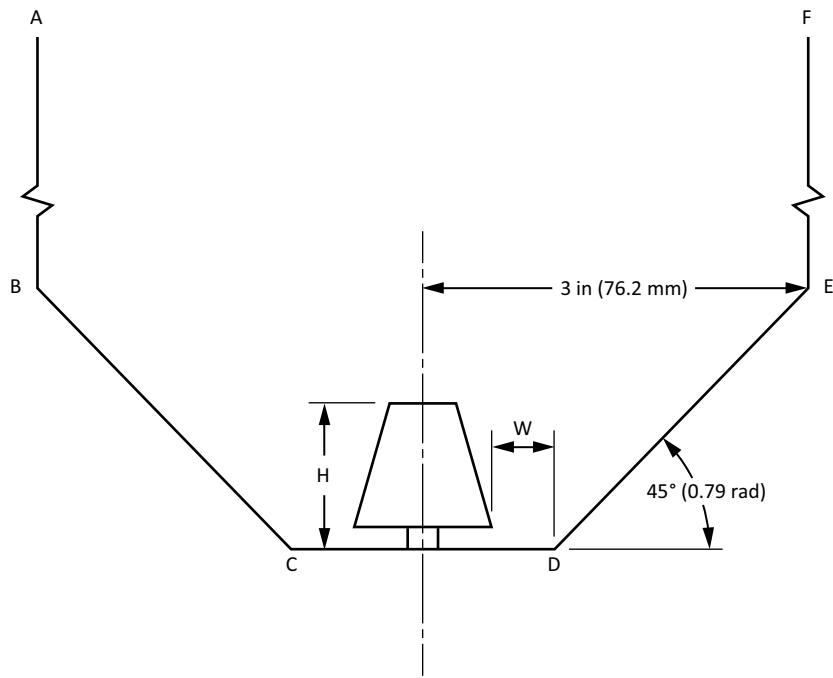
**Table 15**  
**Maximum surface temperature, °F (°C)\***  
(See Clauses 5.17.1 and 5.17.2.)

	Height above floor, feet (m)			
	Over 3 (0.9) to 5			
	3 (0.9) or less	(1.52) or less		
Bare or painted metal	152 (66.5)	182 (83.5)		
Porcelain enamel	160 (71)	190 (88)		
Glass	172 (78)	202 (94.5)		
Plastic†	182 (83.5)	212 (100)		

\* Temperatures are based on a 77°F (25 °C) room temperature. When the room temperature is other than 77°F (25 °C), the temperatures shall be increased or decreased 1 degree for each degree of room temperature greater or less than 77°F (25 °C).

† Includes plastic with a metal plating not more than 0.005 in (0.13 mm) thick and metal with a plastic or vinyl covering not less than 0.005 in (0.13 mm) thick.

**Figure 15**  
**Surfaces surrounding a knob or control and subject to contact**  
(See Clause 5.17.1.)

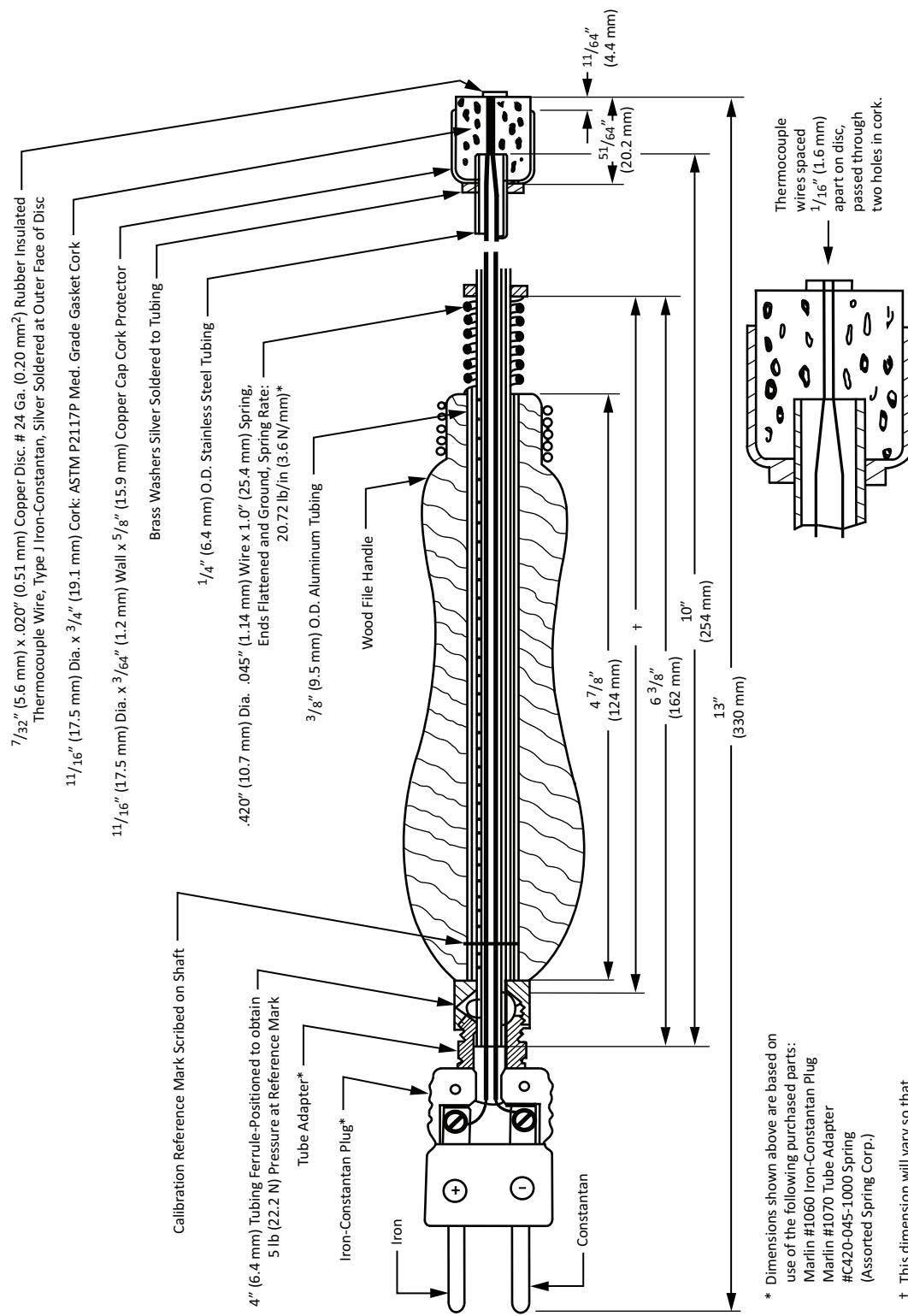


Lines AB, BC, CD, DE, and EF define the limits of a zone surrounding a control or knob. Any surface within the above-defined zone is considered subject to contact.

W = 1/2 in (12.7 mm), measured from extremity of knob, not including a skirt (if any).

If H, knob height plus shaft extension, is less than 1 in (25.4 mm), or skirt (not shown) less than 1/4 in (6.4 mm) is provided at the base of the knob, surface CD is likely to be contacted. The portion of surface CD covered by the base of the knob is not considered to be subject to contact.

**Figure 16**  
**Temperature-measuring and accessibility probe**  
(See Clause 5.17.1.)



## 5.17.2

Temperatures on unbroken surfaces of top panels, other than utensil support areas, immediately above pilot burners, shall not exceed the applicable temperatures listed in Table 15, Maximum surface temperature, °F (°C), when tested as specified in the following Method of Test.

### Method of Test

The input to each top surface cooking section pilot burner shall be adjusted according to Clause 4.9, Automatic valves. The pilots shall be ignited and operated for 1 hour under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. Burn hazard potential shall be determined with the probe as described in Clause 5.17.1. The maximum contact temperature on unbroken top surface areas, other than utensil support areas, immediately above the pilot burners shall not exceed the temperature limit specified in Table 15, Maximum surface temperature, °F (°C), for 3 ft (914 mm) or less above the floor based on a room temperature of 77°F (25 °C). Where the room temperature is other than 77°F (25 °C), the allowable temperature shall be increased or decreased 1 degree for each 1 degree of room temperature greater or less than 77°F (25 °C).

## 5.18 Temperatures of handles, knobs, and touchpads

The temperatures on door handles, valve handles, thermostat knobs, and any other knobs, touch pads, or handles employed during normal cooking operations shall not exceed those specified in Table 16, Maximum handle and knob temperatures, °F (°C).

### Method of Test

- a) The appliance shall be operated as specified in Clause 5.17.1. Temperatures of handles, knobs, and touch pads shall be measured by means of 24 AWG (0.20 mm<sup>2</sup>) iron-constantan thermocouples in firm contact (such as by cementing or taping) with the handle, knob, or touch pad surfaces. Temperatures shall be measured on all portions of handles and knobs that are grasped, or in the case of touch pads, touched during normal use and shall not exceed the temperatures specified in Column A of Table 16, Maximum handle and knob temperatures, °F (°C).

The temperatures of knobs skirts 1 in (25.4 mm) or more from the end of knob shall not exceed the temperatures specified in Column B of Table 16, Maximum handle and knob temperatures, °F (°C).

- b) When handles, knobs, and touch pads are located so as to be affected more by operation of top surface cooking section burners than by operation of oven burners, an additional test with only the top surface cooking section, including wok burners (if applicable), in operation shall be made to determine handle, knob, and touch pad temperatures.

Top surface cooking sections shall be tested with a 7-1/2 ± 1/4 in (191 ± 6.4 mm) diameter pan placed over each top surface cooking section burner. This pan shall be straight-sided, flat-bottomed, at least 4 in (102 mm) high, and contain a minimum of 2 qt (1.89 L) of water. If the manufacturer's operating instructions specify the use of special cooking pans or utensils that are provided with each appliance and that are intended for primary use on the appliance, they shall be used for the test in place of the pans specified above.

Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pot defined for Clause 5.16, Evaluation of clothing ignition potential, containing 5 lb of water (2.3 kg) (± 1 percent) at approximately room temperature.

The wok pan(s) shall be the maximum size possible to be installed or the manufacturer's maximum specified wok pan(s). Wok pan(s) shall be filled to 80 percent capacity with water at approximately room temperature.

All top burners and/or wok burner(s) shall be adjusted to 50 percent of the manufacturer's specified input ratings and operated for 1 hour. After 1/2 hour, the gas to the griddle burners shall

be ignited and the burners operated at full input rating until the temperature of the griddle surface, determined in accordance with Clause 5.19 c) iii), reaches 400°F (204.5 °C) as measured in Clause 5.19, Wall, floor, and enclosure temperatures, c) iii) or the temperature resulting from the maximum setting of the control, whichever is lower. This temperature shall then be maintained constant for the remainder of the 1-hour test period. The operating temperature of the griddle surface shall be increased or decreased 1 degree for each degree of room temperature greater or less than 77°F (25 °C).

Temperatures of handles, knobs, and touch pads shall be determined as described in a) above and shall not exceed the temperatures specified in Table 16, Maximum handle and knob temperatures, °F (°C).

**Table 16**  
**Maximum handle and knob temperatures, °F (°C)\***  
**(as measured by thermocouples)**  
(See Clause 5.18.)

	<b>Column A</b>		<b>Column B</b>	
Bare or painted metal	131	(55)	152	(66.5)
Porcelain Enamel	139	(59)	160	(71)
Glass	149	(65)	172	(78)
Wood or Plastic†	167	(75)	182	(83.5)

\* Maximum allowable temperatures are based on a 77°F (25 °C) room temperature. When the room temperature is other than 77°F (25 °C), the allowable temperatures for handles and knobs shall be increased or decreased 1 degree for each degree of room temperature greater or less than 77°F (25 °C).

† Includes plastic with a metal plating not more than 0.005 in (0.13 mm) thick and metal with a plastic or vinyl covering not less than 0.005 in (0.13 mm) thick.

### 5.19 Wall, floor, and enclosure temperatures

Open top broiler units for installation in noncombustible locations only shall be so marked and need not comply with this provision. [See Clause 4.29.18 b.]

The temperature of 1) any wall, enclosure, or counter surface adjacent to or in contact with an appliance, 2) any exposed surface of cabinets installed above the top surface cooking section of an appliance, 3) the burner box surface of a built-in top or open top broiler unit or section that extends into a cabinet space, 4) the outside surface of an integral exhaust system of an open top broiler section or unit, and 5) where the vent connector of an integral exhaust system of an open top broiler section or unit pierces the enclosure shall not be more than 117°F (65 °C) in excess of room temperature as determined in Clause 5.19 f).

The temperature on the floor beneath a floor-supported unit shall not be more than 90°F (50 °C) in excess of room temperature as determined in Clause 5.19 f).

The temperature on the inside surface of a storage compartment shall not be more than 124°F (69 °C) in excess of room temperature as determined in Clause 5.19 f).

The temperature at any point on a surface located directly above a storage compartment shall not be more than 232°F (129 °C) in excess of room temperature of 70°F (21 °C) as determined in Clause 5.19 f).

## Method of Test

a) Test Enclosure.

The appliance shall be installed in an instrumented test structure applicable to the type of appliance, as listed below.

Vertical walls of the test enclosure and simulated cabinets shall be constructed of either nominal 1 in thick wooden boards or 3/4 in plywood. All vertical walls and all surfaces facing the appliance shall be finished in dull black. The base cabinets shall extend at least 6 in (152 mm) beyond the oven door. The appliance shall be installed with zero clearance (as near as construction will permit) to adjacent rear wall surfaces and side base cabinets. Spacing means to hold side base cabinets away from side panels of an appliance are not permitted. The floor shall be constructed of nominal 1 inch tongue-and-groove oak flooring finished with clear varnish.

- i) A floor-supported unit not incorporating an elevated oven or broiler shall be installed in a test enclosure as shown in Figure 3, Test structure for floor-supported units not having elevated cooking sections, with spacings and dimensions as specified.

A floor-supported unit shall be installed in the test enclosure with side wall clearances in integral inches, as specified by the manufacturer, and back wall clearances of 2 in (50.8 mm) from a projecting flue box, but not less than 6 in (152 mm) from the body of the appliance. The back wall clearance for a bungalow type unit utilizing fuels other than gas shall be as specified by the manufacturer.

- ii) A floor-supported unit incorporating an elevated oven or broiler shall be installed in a test enclosure as shown in Figure 4, Test structure for floor-supported units having elevated cooking sections, with spacings and dimensions as specified.
- iii) A built-in top unit, open top broiler unit, or combination thereof, shall be installed in an enclosure as described in Clause 5.1.6 and shown in Figure 5, Test structure for built-in top surface cooking units and open top broiler units.
- iv) A built-in oven, enclosed broiler unit, or combination oven and enclosed broiler unit shall be installed in a test enclosure as described in Clause 5.1.7 and shown in Figure 8, Test enclosure for testing built-in oven and enclosed broiler units.

When an oven, broiler, or combination oven and broiler is provided with a flue collar, a 4 ft high (1.22 m) listed Type B gas vent of the type specified by the manufacturer (see Clause 4.28.1 a) x) shall be attached to the flue collar. At the points where the vent pierces the panel directly above the top of the appliance and the top panel of the enclosure, an opening shall be cut that will form an annulus around the vent in accordance with its listing. The annuli thus formed shall be sealed on their top surfaces (see Figure 17, Method of sealing annuli around vent during wall and enclosure temperature tests).

An appliance differing from the types described in a) i) through a) iv) above shall be installed in the test structure most nearly applicable and modified as deemed necessary by the testing agency.

b) Instrumentation.

Test enclosure temperatures shall be determined by means of a temperature indicating device and 24 AWG (0.20 mm<sup>2</sup>) copper-constantan thermocouples or beaded 24 AWG (0.20 mm<sup>2</sup>) iron-constantan thermocouples. The junctions of copper-constantan thermocouples shall be copper discs 11/32 in (8.7 mm) in diameter and 0.022 in (0.559 mm) thick, to which the thermocouple wires are silver-soldered 1/8 in (2 mm) apart. The discs shall be embedded so their surfaces are flush with the surrounding surfaces. The junctions of beaded iron-constantan thermocouples shall be constructed so as to touch the plane of the test surface as shown in Figure 18, Method of mounting thermocouples. The surfaces of either the copper discs or masking tape, as applicable, except those in the floor, shall be finished in dull black.

Thermocouples shall be placed at 3 in (76.2 mm) intervals over the entire surfaces of the back and side walls, the interior surfaces of enclosures, the undersurfaces of the center section and each end section (designated as "Cabinet C" in Figure 3, Test structure for floor-supported units not having elevated cooking sections), the surfaces of the end sections adjacent to the appliance (designated as "Area C"), and on the surfaces directly above the front of an elevated oven section, a built-in oven or broiler, or a combination oven and broiler unit. Thermocouples embedded in the floor shall be 6 in (152 mm) apart.

A floor-supported unit shall be located so the vertical plane of the oven door surface intersects one vertical row of thermocouples on each of the lower side walls. Each lower side wall shall also have two additional vertical rows of thermocouples located at 1 in (25.4 mm) intervals on both sides of the row of thermocouples intersected by the vertical plane of the oven door surface. The center line of the top horizontal row of thermocouples on each lower side wall shall be 1/4 in (6.4 mm) below the countertop surface

An enclosure for a built-in unit shall have additional thermocouples embedded in counter or wall surfaces, at intervals of 2 in (50.8 mm) on center lines 1/2 in (12.7 mm) from the edge of the recess accommodating the appliance, and in other enclosed surfaces deemed necessary by the testing agency. For a vented built-in oven, broiler, or combination oven and broiler installed as described in Clause 5.19 a) iv) and Figure 8, Test enclosure for testing built-in oven and enclosed broiler units, additional thermocouples, as shown in Figure 17, Method of sealing annuli around vent during wall and enclosure temperature tests, shall be located on the bottom of the combustible surface, centered 1/4 in (6.4 mm) away from the annuli around the vent.

c) Temperature Determination.

Room temperature shall be determined as specified in Clause 5.1.9.

Temperatures of operating sections of the appliance shall be determined as indicated below:

- i) The oven temperature shall be determined as specified in Clause 5.1.10.
- ii) The broiler temperature shall be determined as specified in Clause 5.1.11.
- iii) The griddle temperature shall be determined by means of a temperature indicating device and a single 24 AWG (0.20 mm<sup>2</sup>) iron-constantan bead-type thermocouple with the bead peened into the top surface of the griddle at its center.
- iv) On a built-in top or oven top broiler unit, the temperatures on burner box surfaces that extend into the cabinet space shall be determined as specified in Clause 5.17.1.

d) Electrical Equipment.

All electrical equipment provided, such as lamps, rotisserie motor, and clock, shall be operated throughout the test periods prescribed. The rotor of a rotisserie motor of the impedance-protected type shall be locked. A compartment or section that uses electrical energy for cooking shall be operated in the manner and for the time period specified in the Standard for *Household Electrical Ranges*, UL 858 and/or the Standard for *Household Cooking Appliances*, CSA C22.2 No. 61 as appropriate based on submission. A microwave cooking section shall be operated in the manner and for the time period specified in the Standard for *Microwave Cooking Appliances*, UL 923 and/or the Standard for *Microwave Ovens*, CSA C22.2 No. 150 as appropriate based on submission. The gas-fired sections of the appliances shall be operated for the time specified in Table 17, Test conditions for wall, floor, and enclosure temperature tests.

e) Test Period.

The appliance shall be placed in operation under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, and continued in operation under the specified conditions of time, burner input, burner loading, and compartment temperature as listed in Table 17, Test conditions for wall, floor, and enclosure temperature tests, and under any further special conditions specified in the notes to Table 17, Test conditions for wall, floor, and enclosure temperature tests. [Also see Clause 5.19 d.)] When different operating times are specified for

different sections, the section shall be turned on in a sequence that allows the various tests to be run concurrently and ended simultaneously.

Cabinet doors shall be closed during the tests.

After the appliance has been operating under the test conditions and for the length of time specified in Table 17, Test conditions for wall, floor, and enclosure temperature tests, all applicable enclosure temperatures shall be determined and recorded. The ambient room temperature shall be determined and recorded.

f) Maximum Permissible Temperature.

The maximum permissible temperature shall be determined by the following formula:

$$\text{Tmp} = (\text{Ort} \pm \text{CF}) + \text{Trp}$$

where

$\text{Tmp}$  = maximum permissible wall, enclosure or burner box surface temperature, °F (°C)

$\text{Ort}$  = observed room temperature, °F (°C)

$\text{CF}$  = correction factor for variation in actual observed room temperature from 77°F (25 °C) room [plus 1°F (0.5 °C) for every 5°F (3 °C) observed room temperature above 77°F (25 °C), or minus 1°F (0.5 °C) for every 5°F (3 °C) observed room temperature below 77°F (25 °C), and]

$\text{Trp}$  = temperature rise permissible [117°F (65 °C), 90°F (50 °C), 124°F (69 °C) or 232°F (129 °C), as applicable].

**Table 17**  
**Test conditions for wall, floor, and enclosure temperature tests**  
(See Clause 5.19.)

<b>Appliance section or compartment</b>		<b>Time</b>	<b>Burner input</b>	<b>Compartment temperature</b>	<b>See Notes</b>
Top		1 hour	80%	—	1, 8, 9
Griddle		1/2 hour	Full on then adjust	Not over 600°F (315.5 °C)	2
Thermostatically controlled ovens Including Combination Oven — low broilers	Floor-supported Built-in Elevated	1 hour 2 hours 2 hours	—	475°F (246 °C)	3, 4, 5
Non-thermostatically controlled compartment		2 hours	—	475°F (246 °C)	5, 6

(Continued)

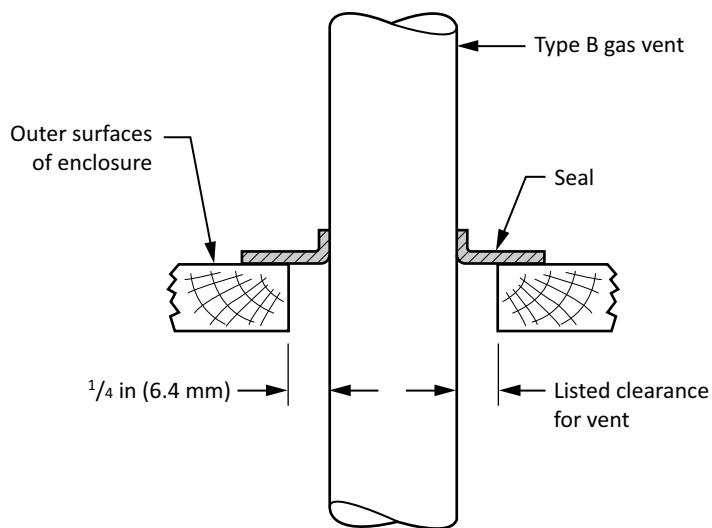
**Table 17 (Concluded)**

<b>Appliance section or compartment</b>	<b>Time</b>	<b>Burner input</b>	<b>Compartment temperature</b>	<b>See Notes</b>
Separate controlled broiler	1 hour	—	600°F (315.5 °C)	4, 5
Open top broiler	1 hour	100%	—	7

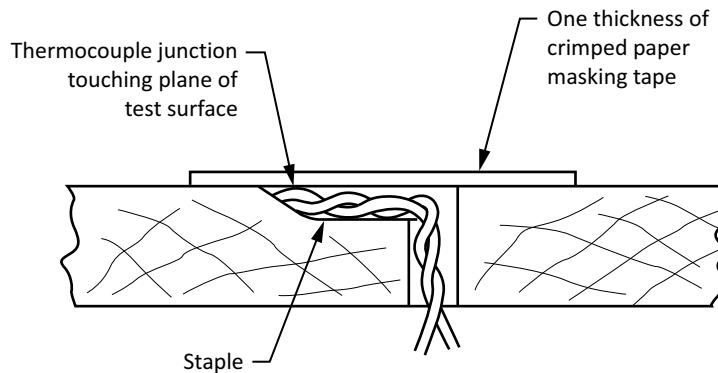
**Notes:**

- 1) For top burners a flat-bottom utensil as shown in Figure 11 Top burner test pot, shall be placed over each top burner. Burners that are elongated in shape or intended for use with elongated pans shall be tested with the test pot defined in Clause 5.16 Evaluation of clothing ignition potential.
- 2) The gas supply to the griddle shall be ignited 30 minutes before the end of the test period and the burner(s) operated at full input rating on nonthermostatically-controlled griddles until the temperature of the griddle surface reaches 600°F (315.5 °C), at which point it shall be maintained constant for the remainder of the test period. Griddles equipped with thermostats shall be operated at 600°F (315.5 °C). If 600°F (315.5 °C) is not attainable, the thermostat should be set at its maximum setting. Surface temperatures shall be determined as specified in Clause 5.19 e).
- 3) The thermostat shall be set at the full open position of the dial. After the temperature at the center of the oven has reached 475°F (246 °C), the thermostat shall be set to maintain this temperature and the test started. For combination oven-low broilers utilizing the same burner, the broiler pan(s) shall be removed.
- 4) When a locking device prevents operation of a separate oven and broiler burners at the same time, two separate tests shall be conducted; one with the oven burner and all other burners capable of being operated at the same time in use, and one with the broiler and all other burners capable of being operated at the same time in use.
- 5) During specified operating periods on an appliance provided with a flue collar, the outlet of the 4 ft (1.22 m) high gas vent shall be progressively blocked and the flue gas temperature continuously observed until a condition of equilibrium is attained, at which the flue gas temperature is at its maximum. Thermocouples, as described in Clause 5.21, Flue gas temperature, shall be used in determining the flue gas temperature. The appliance shall then be operated under this condition for the remainder of the specified operating period, at which time the enclosure temperatures shall be recorded. If the blockage of the vent in the preceding determination was less than complete, the outlet of the vent shall be completely blocked and an additional test conducted with the appliance operated under this condition for the specified operating period, after which the enclosure temperatures shall again be recorded.
- 6) The gas supply to the oven burner shall be regulated by means of the burner valve to maintain the oven temperature specified.
- 7) An open top broiler section or unit shall be tested with a sheet-metal plate having the same aspect ratio and an area equal to 75 percent of the grid area, centrally positioned on the grid so the uncovered area is a space of equal width around the perimeter of the panel.
- 8) A wok burner or wok burners shall be tested with the maximum size wok pan(s) possible to be installed or the manufacturer's specified maximum size wok pan(s). The wok pan(s) shall be filled to 80 percent capacity with water at approximately room temperature.
- 9) When the design of the top section prevents the placement of the 7-1/2 in (191 mm) diameter (bottom) water-filled test pot uniformly, tests are to be conducted in accordance with the manufacturer's instructions. If there are no manufacturer's instructions, the tests shall be conducted at the discretion of the testing agency.

**Figure 17**  
**Method of sealing annuli around vent during wall and enclosure temperature tests**  
(See Clause 5.19.)



**Figure 18**  
**Method of mounting thermocouple**  
(See Clause 5.19.)



## 5.20 Abnormal operation stalled-fan test

The temperature of various component parts on appliances equipped with cooling fans the malfunction of which would not be apparent to the user shall not exceed those listed in Table 7, Maximum allowable rise above room temperature for various component parts, when tested as specified in the following Method of Test.

### Method of Test

The appliance shall be operated as specified in Clause 5.19, Wall, floor, and enclosure temperatures, or Clause 5.25.7, whichever is applicable, except that the cooling fan shall be stalled or de-energized when stabilized temperatures are obtained. During the pyrolytic self-cleaning cycle, top burners shall not be operated. The test shall be continued after the fan has been stalled or de-energized, and the maximum temperatures shall be recorded.

If, after the fan has been stalled or de-energized, the operation is interrupted by the operation of a temperature-limiting device, the maximum temperatures shall be recorded at that time. It may be necessary to restart the test from ambient temperature with the fan stalled or de-energized to determine whether the temperature limits are exceeded before the temperature-limiting device operates.

**Exception:** An oven need not comply with this requirement if the oven burner is controlled so it can be operated only when the air stream is present.

## 5.21 Flue gas temperature

The average temperature of the flue gases from an oven, broiler, or combination oven and broiler designed to be connected to a venting system shall not exceed 480°F (266.5 °C) above room temperature.

### Method of Test

A 4 ft (1.22 m) length of vertical vent pipe of the proper size to accommodate the flue outlet shall be attached to the flue outlet. The flue gas temperature shall be measured by a temperature indicating or recording device and nine thermocouples placed in a plane perpendicular to the axis of the flue outlet in the vent pipe at a point 6 in (152 mm) above the outlet from the draft hood. One of the thermocouple junctions shall be placed in the center of the vent pipe and the other eight placed 90 degrees (1.57 rad) apart at points 1/3 and 2/3 the distance from the center to the periphery of the vent pipe.

With the appliance adjusted to operate under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, the main burner gas shall be ignited and the thermostat set to its wide open position. Flue gas temperatures shall be recorded over the period of time necessary for the temperature indicating device reading to become constant as indicated by a change of not more than 5°F (3 °C) for three consecutive readings 5 minutes apart.

For an appliance not equipped with a thermostat, flue gas temperature shall be recorded during the period of time necessary for the temperature indicating device reading to become constant with the main burner gas valve set at its full open position.

The maximum recorded flue gas temperature shall not be in excess of 480°F (266.5 °C) above room temperature.

## 5.22 Draft hoods

A draft hood provided as an integral part of an appliance shall comply with the following provisions when attached to the appliance in a normal position. The thermostat(s) shall be set at the fully open position and oven and other doors shall be closed at the beginning of the following tests.

When use with one gas is desired, these tests shall be conducted with the appropriate gas as specified in Clause 5.2, 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 in accordance with the following:

- a) if the gases selected include propane gas or LP gas-air mixtures, use Test Gas E or H;

- b) if the gases selected are natural and mixed, or natural, manufactured, and mixed, use Test Gas A; and
- c) if the gases selected are mixed and manufactured, use Test Gas C.

### 5.22.1

With the outlet of the draft hood blocked, the concentration of carbon monoxide shall not exceed 0.08 percent in an air-free sample of flue gases when the appliance is tested in a room having approximately a normal oxygen supply.

#### Method of Test

The appliance shall be operated approximately 15 minutes under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. The outlet of the draft hood shall be blocked and a sample of the flue gases secured and analyzed as specified in Clause 5.4.1.

### 5.22.2

Total downdraft pressures ranging from zero to 0.05 in wc (12 Pa), imposed at the outlet of the draft hood, shall not extinguish the main burner flames nor cause them to flash back, lift, float, burn outside the appliance, or produce carbon monoxide in excess of that specified in Clause 5.4.1.

#### Method of Test

The appliance shall be operated for approximately 15 minutes under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. Vent pipe of suitable diameter shall be attached to the outlet of the draft hood and connected to a blower. The draft in the vent pipe shall be varied from the minimum total pressure available to the maximum value specified above, and a sample of the flue gases shall be secured and analyzed as specified in Clause 5.4.1.

### 5.22.3

Downdrafts imposed as specified in Clause 5.25.2 shall not extinguish the pilot(s) nor cause it to flash back when operated separately from the main burner(s).

### 5.22.4

A chimney action, consisting of static updraft and velocity updraft numerically totaling between 0.06 and 0.07 in wc pressure (15 and 17 Pa), applied to the outlet of the draft hood, shall not cause a fractional increase in the volume of flue gases greater than twice the numerical sum of the pressure head and five times the velocity head, expressed as inches water column (Pa).

#### Method of Test

The appliance shall be operated for at least 15 minutes under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. An updraft shall be imposed at the outlet of the draft hood such that the numerical sum of the pressure head and velocity head are between 0.06 and 0.07 in wc (15 and 17 Pa). Under this condition, a sample of the flue gases shall be secured ahead of the draft hood. The ratio of the carbon dioxide concentration for normal operation as determined in Clause 5.4.1 to that for updraft as determined above shall not be more than  $1 + 2(h_p + 5h_v)$ , where "hp" is the pressure head and "hv" is the velocity head.

### 5.22.5

With updrafts imposed as specified in Clause 5.25.4, the concentration of carbon monoxide shall not exceed 0.08 percent in an air-free sample of the flue gases when the appliance is tested in a room having approximately a normal oxygen supply.

#### Method of Test

The appliance shall be operated approximately 15 minutes under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests. With the updraft imposed, a sample of the flue gases shall be secured and analyzed as specified in Clause 5.4.1.

### 5.22.6

Flue gases shall not issue from the relief opening(s) of a draft hood.

#### Method of Test

The appliance shall be operated for at least 15 minutes under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, with a 4 ft (1.22 m) stack when a vertical draft hood is employed, and an elbow and 5 ft (1.52 m) of stack when a horizontal draft hood is employed. A fuming material such as titanium tetrachloride shall be introduced ahead of the draft hood 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).

### 5.23 Exhaust hood outlet air temperature

On an appliance equipped with an exhaust hood, the average temperature of exhaust hood outlet air shall not exceed 250°F (121 °C).

#### Method of Test

The appliance shall be installed and operated as specified in Clause 5.19, Wall, floor, and enclosure temperatures, or Clause 5.25.7, whichever is applicable. At the conclusion of the applicable test, the exhaust hood shall be turned on and the appliance continued in operation. After 15 minutes, the exhaust hood outlet air temperature shall be measured, and the average shall not exceed 250°F (121 °C).

### 5.24 Oven flue discharge temperatures

On a built-in oven with provision for front discharge of flue gases below the 36 in (914 mm) level, the average temperature of the flue gases discharging from the flue opening shall not exceed 130°F (54.5 °C) above room temperature.

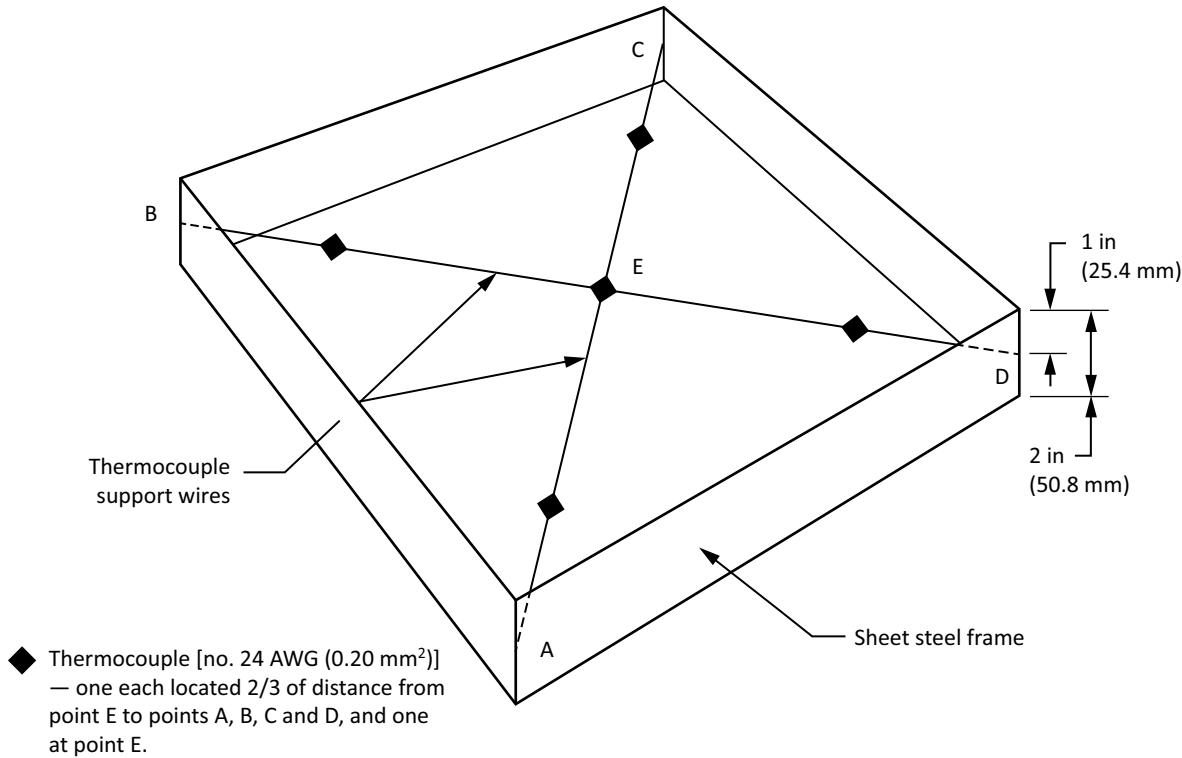
#### Method of Test

The appliance shall be installed as specified in Clauses 5.17.1 or 5.25.5, whichever is applicable. The appliance shall be operated as specified in Clauses 5.17.1 or 5.25.5. After 15 minutes of operation, the air inlet shall be gradually decreased to the lowest point at which the appliance will continue to operate.

At the conclusion of the applicable test, the temperature of the flue gases discharging from the flue opening shall be measured and the average shall not exceed 130°F (54.5 °C) above room temperature. Flue gas temperature shall be measured by means of five parallel connected bead type 24 AWG (0.20 mm<sup>2</sup>) iron-constantan thermocouples placed in a plane 1 in (25.4 mm) from the flue opening.

These thermocouples shall be located along diagonals drawn between opposite corners of the flue opening as follows: one at the intersection of the diagonals and one on each diagonal located 2/3 of the distance from the center to the flue opening corners (see Figure 19, Typical device for measuring oven flue discharge temperatures). The frame shown in Figure 19 should approximate the size and shape of the flue opening. In the case of other flue opening configurations, the five thermocouples shall be located at the discretion of the testing agency in such a manner as to determine the average flue gas temperature.

**Figure 19**  
**Typical device for measuring oven flue discharge temperatures**  
(See Clause 5.24.)



## 5.25 Performance of appliances provided with pyrolytic self-cleaning oven or self-cleaning broiler features

### 5.25.1

#### Combustion at cleaning temperatures

When operating at cleaning temperatures, an appliance provided with self-cleaning oven or self-cleaning broiler features shall not produce carbon monoxide in excess of 0.08 percent in an air-free sample of the flue gases when the appliance is tested in a room having approximately a normal oxygen supply.

#### Method of Test

Prior to conducting this test, the appliance shall be adjusted so the manufacturer's specified maximum cleaning temperature will be obtained.

These tests shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, without a soil load, prior to the conduct of any cleaning tests and repeated after the conduct of all cleaning tests. A sample of the flue gases shall be secured from the flue outlet and analyzed for carbon monoxide and carbon dioxide after the oven or broiler has reached the manufacturer's specified maximum cleaning temperature.

Additional flue gas samples shall also be obtained from other appliance sections capable of operation during a cleaning cycle 5 minutes after each of these sections has been turned on. These additional tests shall be conducted with oven or broiler operating at the manufacturer's specified maximum cleaning temperature.

The combustion tests on top surface cooking sections shall be conducted using the test pots and equipment specified in Clause 5.4.1 a).

### 5.25.2

#### **Burner and pilot operating characteristics of appliances provided with self-cleaning features**

Burner and pilot operating characteristics of an appliance provided with self-cleaning oven or self-cleaning broiler features shall not be adversely affected by operation at cleaning temperatures.

#### **Method of Test**

Prior to conducting these tests, the appliance shall be adjusted so the manufacturer's specified maximum cleaning temperature will be obtained.

The tests specified in Clauses 5.5.7, 5.5.11, and 5.5.12 shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, without a soil load in the oven after the oven or broiler has reached the manufacturer's specified maximum cleaning temperature.

In the event the appliance is designed so that any burner or combination of burners is not capable of being used during the cleaning cycle, this burner(s) shall not be subject to these tests.

These tests shall be conducted prior to the conduct of any cleaning tests and repeated after the conduct of all cleaning tests.

In addition, the appliance shall comply with Clause 5.5, Burner and pilot operating characteristics, following the conduct of all cleaning tests.

### 5.25.3

#### **Ignition on appliances provided with self-cleaning features**

Ignition on appliances provided with self-cleaning oven or self-cleaning broiler features shall not be adversely affected by operation at cleaning temperatures.

#### **Method of Test**

Prior to conducting these tests, the appliance shall be adjusted so the manufacturer's specified maximum cleaning temperature will be obtained.

The tests specified in Clauses 5.6.2 b), 5.6.2 c), 5.7.2, 5.7.3, 5.7.6, and 5.7.7 shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests,

without a soil load after the oven or broiler has reached the manufacturer's specified maximum cleaning temperature.

In the event the appliance is designed so that any burner or combination of burners is not capable of being used during the cleaning cycle, this burner(s) shall not be subject to these tests.

These tests shall be conducted prior to the conduct of any cleaning tests and repeated after the conduct of all cleaning tests.

In addition, the appliance shall comply with the above provisions following the conduct of all cleaning tests.

#### 5.25.4

### Pilot burners and safety shut-off devices of appliances provided with self-cleaning features

Pilot burner and safety shut-off device operation shall not be adversely affected by operation at cleaning temperatures.

#### Method of Test

Prior to conducting these tests, the appliance shall be adjusted so the manufacturer's specified maximum cleaning temperature will be obtained.

The tests specified in Clauses 5.6.2 b), 5.6.2 c), 5.7.2, 5.7.3, 5.7.6, and 5.7.7 shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, without a soil load after the oven or broiler has reached the manufacturer's specified maximum cleaning temperature.

#### 5.25.5

### Evaluation of burn hazard potential of exterior surfaces of appliances provided with self-cleaning ovens

The contact temperatures of the exterior surfaces of an appliance provided with self-cleaning oven features shall not exceed those specified in Clause 5.17.1 when the appliance is operated in the self-cleaning cycle.

#### Method of Test

Prior to conducting this test, the appliance shall be adjusted so the manufacturer's design operating temperature will be obtained.

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, using the test procedure specified in Clause 5.17.1, except that the oven(s) temperature shall be the manufacturer's design operating temperature. If the appliance includes two ovens, a non-self-cleaning oven shall remain inoperative during the test. Two self-cleaning ovens shall be operated simultaneously, if the controls permit such operation. If the controls do not permit simultaneous operation of the two self-cleaning ovens, individual tests shall be conducted on each oven.

The appliance shall be operated through the longest cleaning cycle attainable by using the control system or until all contact temperatures of the exterior surfaces to be measured are constant, whichever results in the shorter operating time. Points of expected maximum contact temperature shall be monitored throughout the heating and cooling periods of the self-cleaning cycle.

Burn hazard potential shall be determined on all surfaces specified in Clause 5.17.1, except that temperatures shall not be taken on front vertical surfaces between the top of the oven door and the top surface. If no top surface is provided, this surface is considered to extend 6 in (152 mm) above the top edge of the oven door(s).

### 5.25.6

#### **Temperatures of handles, knobs, and touch pads of appliances provided with self-cleaning ovens**

The temperatures on door handles, valve handles, thermostat knobs, touch pads, and any other knobs, handles, or touch pads employed during normal cooking operations of an appliance provided with self-cleaning oven features shall not exceed those specified in Clause 5.18, Temperatures of handles, knobs, and touchpads.

#### **Method of Test**

Prior to conducting this test, the appliance shall be adjusted so the manufacturer's design operating temperature will be obtained.

This test shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests, using the test procedure specified in Clause 5.18 a), except that the oven temperature shall be the manufacturer's design operating temperature. If the appliance includes two ovens, a non-self-cleaning oven shall remain inoperative during the test. Two self-cleaning ovens shall be operated simultaneously, if the controls permit such operation. If the controls do not permit simultaneous operation of the two self-cleaning ovens, individual tests shall be conducted on each oven.

The appliance shall be operated through the longest cleaning cycle attainable by using the control system or until all the external temperatures being measured are constant, whichever results in the shorter operating time.

### 5.25.7

#### **Wall, floor, enclosure, control, supply tubing, temperatures of appliance provided with self-cleaning features**

The temperature of any exposed or concealed wall, cabinet, or enclosure surface in contact with or adjacent to an appliance having self-cleaning oven or self-cleaning broiler features shall not be more than 117°F (65 °C) in excess of a room temperature and the temperature on the floor shall not be more than 90°F (50 °C) in excess of room temperature. Room temperature shall be determined per Clause 5.19 f).

Tubing and fittings used as gas conduits shall not be exposed to temperatures in excess of those specified in Clause 4.6.13.

Controls shall not be exposed to temperatures in excess of those for which they have been certified.

#### **Method of Test**

The appliance shall be installed as specified in Clause 5.19, Wall, floor, and enclosure temperatures. Prior to conducting these tests, the appliance shall be adjusted so the manufacturer's specified maximum cleaning temperature will be obtained.

The control system shall be set for the cleaning cycle and the timer, if provided, set to obtain the maximum cleaning cycle. The temperature of walls, floor, enclosures, controls, and supply tubing, shall be recorded during the first cleaning cycle. At the end of burner operation of the cleaning cycle, a second cleaning cycle shall be started unless the control system is such as to prevent immediate start of a second cleaning cycle. In this case, the second cleaning cycle shall be started as soon as the control system will permit.

Unless provisions are incorporated that will prevent use of top surface cooking section burners during the cleaning cycle, operation of top surface cooking section burners, if provided, shall be as specified in Clause 5.19, Wall, Floor, and Enclosure Temperatures, except that the turn-on time for these burners shall be 1 hour for top burners and 30 minutes for griddle burners before the end of the burner operation of the second cleaning cycle. In the event the burner operating time of the cleaning cycle is less than 1 hour, top burners shall be placed in operation at the start of the second cleaning cycle. The temperature of walls, floor, enclosures, controls, and supply tubing shall be recorded during the second cleaning cycle.

In the event that the system uses multiple temperature settings for the self-clean cycle, the unit and enclosure are to be cooled and the test shall be repeated for an additional two cycles. During the second cycle, the top burners shall be placed in operation one hour prior to the time corresponding to the peak enclosure temperatures found in the first clean cycle. Griddles shall be turned on 30 minutes prior to the time. The top burners shall be left in operation for 1 hour, griddle burners for 30 minutes. The temperature of walls, floor, enclosures, controls, and supply tubing shall be recorded during the operation of the top burners for the second cleaning cycle.

If the oven burner(s) continue in operation past the end of the top burner portion of the test of multiple temperature cycles, the top burners shall be turned off and temperatures of walls, floors, enclosures, controls, and supply tubing shall continue to be recorded to the end of the full self-clean cycle of oven burner operation. The highest temperature obtained shall be recorded.

## 5.25.8

### Flue gas temperatures of self-cleaning ovens or self-cleaning broilers

Flue temperatures of a self-cleaning oven or self-cleaning broiler designed to be connected to a venting system shall comply with Clause 5.21, Flue gas temperature, when the oven or broiler is operating during the cleaning cycle.

The Method of Test specified in Clause 5.21, Flue gas temperature, shall apply. Any other sections of the appliance that use the same venting system and can be operated during the cleaning cycle shall be in operation.

Flue gases issuing from the flue deflectors of self-cleaning ovens or self-cleaning broilers shall not constitute a fire hazard.

#### Method of Test

The oven shall be operated for a complete cleaning cycle and, at the time of maximum flue gas temperature, an 8 1/2 by 11 in (216 by 279 mm) piece of 20 lb (9.1 kg) bond paper supported on a suitable flat frame shall be placed in that area of the flue deflector outlet having maximum flue gas temperatures. The paper shall neither char nor ignite within a period of 10 seconds.

### 5.25.9

#### **Temperature limiting means for self-cleaning ovens or self-cleaning broilers**

A self-cleaning oven or self-cleaning broiler shall be provided with means to limit the oven or broiler cavity temperature to the manufacturer's specified maximum cleaning temperature. This may be accomplished either by the operating thermostat or by a separate control.

#### **Method of Test**

The cleaning cycle shall be started and, after the cavity has attained an equilibrium temperature, the input rate shall be increased by an increase in manifold pressure or other convenient means. The limiting means shall then operate to control the temperature at or below the manufacturer's specified maximum cleaning temperature.

Temperature readings shall be obtained by the method specified in Clause [5.1.10](#).

### 5.25.10

#### **Locking means of self-cleaning ovens or self-cleaning broilers**

Doors providing access to self-cleaning ovens or self-cleaning broilers, or to other compartments involved in the self-cleaning operation, shall have means that will lock the doors at cleaning cycle temperatures in excess of 675°F (357 °C) as prescribed in Clause [5.1.10](#).

The locking means shall be interlocked with the self-cleaning cycling operation. The locking means shall not interfere with normal oven and broiler cooking operations.

Portions of door lock mechanisms that are temperature actuated shall withstand 100,000 cycles of thermal operation without mechanical or electrical failure. The calibration temperature of the device, after continued operation, shall not vary more than  $\pm 10$  percent of the calibration temperature before the continued operation test.

Portions of door lock mechanisms that are manually or electrically actuated prior to placing the appliance in a cleaning cycle shall withstand 3000 cycles of operation without mechanical or electrical failure.

### 5.25.11

#### **Vapor combustion or flashback during the cleaning cycle**

Any burning of combustible vapors during the self-cleaning cycle shall be contained within the oven or broiler cavity or flueway and be safely vented and shall not cause damage to the appliance under the conditions of test specified below.

#### **Method of Test**

A grid of five parallel-connected iron-constantan thermocouples shall be located in the oven. Oven temperature shall be specified as measured in Clause [5.1.10](#).

Prior to conducting this test, the appliance shall be adjusted so the manufacturer's specified maximum cleaning temperature will be obtained.

Spark electrodes shall be located within the oven or separate broiler cavity in the following approximate locations: one so it is centered in the compartment 1-1/2 in (38.1 mm) above the bottom rack when the rack is in the lowest position, one 4 in (102 mm) above the oven bottom in the area where the flue gases enter the oven, one centered in the compartment oven, and one 1 in (25.4 mm) in front of the

center of the flue outlet. These spark electrodes shall be wired in series and connected to a suitable spark transformer.

An additional spark electrode shall be located at the flue outlet.

These tests shall be conducted under Test Condition 1 in Table 1, Gas pressure and input conditions for use in the various performance tests.

A 2-1/2 oz (0.07 kg) test load, consisting of a mixture of 2/3 beef gravy and 1/3 hydrogenated vegetable oil by weight, shall be applied to all interior self-cleaning compartment surfaces (excluding burners, radiants, and racks).

The appliance shall be placed in operation and the load baked on at a temperature of 550°F (288 °C) for 1-1/2 hours as determined in Clause 5.1.10. This procedure shall be repeated two additional times, cooling between loadings. After a total of 7 1/2 oz (0.21 kg) are baked onto the compartment surfaces and the appliance is cooled to room temperature, the cleaning cycle shall be started.

The spark electrodes at the vent outlet and inside the compartment shall be energized at 10°F (5.5 °C) increments of compartment temperature until the temperatures reach equilibrium and at 2-minute intervals during the remaining portion of the cleaning cycle.

There shall be no burning of combustible vapors outside the appliance or any visible damage to the appliance.

## 5.25.12

### Window impact tests

The window assembly of an oven door shall be subjected to three impact tests as specified in the following Method of Test. A new door assembly shall be utilized for each test.

#### Method of Test

##### Impact Test A

An impact shall be applied to the inside glass panel of the window assembly with the oven door mounted on the oven in accordance with the manufacturer's installation instructions and with the door in the open position.

The panel shall be subjected to a single impact produced by a smooth, solid steel sphere, 3-1/4 in (82.6 mm) in diameter and weighing 5 lb (2.3 kg). The sphere shall be allowed to fall or to swing as a pendulum through a vertical distance of 5 ft (1.52 m) to produce the required impact.

In the event that one panel remains intact after the impact test, the test as specified in Clause 5.25.7 shall be repeated to determine whether the effects of heat will cause the panel to break. If the panel breaks or the airflow in the oven is changed as a result of conducting the test specified in Clause 5.25.7, the tests specified in Clauses 5.25.1 and 5.25.11 shall be repeated to determine whether a risk of fire or explosion exists.

In the event that all panels break as a result of the impact, the tests in Clauses 5.25.1 and 5.25.11 shall be repeated to determine whether a risk of fire or explosion exists.

### Impact Test B

An impact shall be applied to the outside glass panel of the window assembly with the oven door mounted on the oven in accordance with the manufacturer's installation instructions and with the door in the closed position.

The panel shall be subjected to a single impact produced by a smooth, solid steel sphere, 2 in (50.8 mm) in diameter and weighing 1.18 lb (535 g). The sphere shall be allowed to fall or swing as a pendulum through a vertical distance of 25-7/16 in (646 mm). Following impact, the panel is to remain intact.

### Impact Test C

An impact shall be applied to the outside glass panel of the oven door assembly as specified in Impact Test B, except the sphere is to fall or swing as a pendulum through a vertical distance of 51 in (1.29 m) before impact. Cracking or breaking of the panel as a result of the impact is acceptable if the airflow in the oven does not change. If the airflow in the oven is changed, the tests specified in Clauses 5.25.1 and 5.25.11 shall be repeated to determine whether a risk of fire or explosion exists.

## 5.26 Performance of an appliance incorporating a microwave cooking section

Microwave Cooking Section Separate from Oven of Household Cooking Appliance

- a) The microwave cooking section shall be loaded and operated according to
  - i) The Standard for *Microwave Cooking Appliances*, UL 923; and/or
  - ii) CAN/CSA C22.2 No. 150, *Microwave Ovens (Excluding Industrial Applications)* as appropriate based on submission without any gas burners in operation. The power density of microwave radiation emission from the microwave cooking section shall not exceed 1 mw/cm<sup>2</sup> at any point 5 cm or more away from the external surface of the section with only the designated primary interlock in the circuit (all other door interlocks bypassed). The emission shall not exceed 5 mw/cm<sup>2</sup> with only the designated secondary interlock in the circuit (all other door interlocks bypassed).
- b) If the microwave cooking section is located below the top surface cooking section of the appliance, no tests other than those specified in a) above, Clause 4.26.25 and Clause 5.19, Wall, floor, and enclosure temperatures, or Clause 5.25.7 need be conducted.
- c) If the microwave cooking section is located above the top surface cooking section, the radiation emission shall be measured at the start of the test specified in Clause 5.19, Wall, floor, and enclosure temperatures, or Clause 5.25.7 and subsequently at 15-minute intervals during the test and shall comply with a) above.

## 5.27 Marking material adhesion and legibility

Marking material recognized as complying with the Standard for *Adhesive Labels*, CSA C22.2 No. 0.15, or the Standard for *Marking and Labeling Systems*, UL 969, are exempt from this test.

The adhesive quality of Class IIA-3, IIA-4, IIIA-1, and IIIA-2 marking materials and the legibility of all Class II and III marking materials (see Clause 4.29.1) shall not be adversely affected when the marking materials are exposed to heat and moisture as specified in the following Method of Test.

### Method of Test

- a) Adhesive type marking materials shall be applied to a sample test panel having the particular type of finish used on the appliance in production. A sample metal panel of this finish shall be cleaned with a solvent and dried. Half of the panel shall be wiped with a clean cloth lightly oiled with SAE-30 medium machine oil. Two samples of marking material shall be applied to the panel, one on the dry area and one on the oiled area. Test samples shall be applied with firm pressure, unless the

manufacturer's application instructions specify otherwise. Each sample shall be allowed to set for 24 hours at room temperature.

Each sample of marking material shall exhibit:

- i) good adhesion and no curling at edges;
  - ii) no illegible or defaced printing when rubbed with thumb or finger pressure; and
  - iii) good adhesion when a dull metal blade (such as the back of a pocketknife blade) is held at 90 degrees (1.57 rad) to the applied marking and scraped across the edges of the marking.
- b) Non-adhesive type marking materials shall exhibit no illegible or defaced printing when rubbed with thumb or finger pressure. Two samples of marking material shall be tested.
- c) Samples of both adhesive and non-adhesive type marking materials shall then be placed in an oven for a period of two weeks with the oven temperature maintained at:
- i) 350°F (176.5 °C) for Class IIA-1, IIA-2, IIA-3, IIA-4, and IIIA-1 marking materials; or
  - ii) 250°F (121 °C) for Class IIIA-2 and IIIB marking materials.

Following the oven test, adhesion and legibility of the samples shall be checked again as specified in a) or b) above.

Samples shall then be immersed in water for a period of 24 hours, after which adhesion and legibility shall be rechecked as specified in a) or b) above.

Good adhesion and legibility qualities shall be obtained under all of the above test conditions.

Final acceptance of marking materials shall be based on the suitability of the marking material to the appliance.

## 5.28 Safety circuit analysis

On a domestic cooking gas appliance, the manufacturer shall supply "Failure Modes and Effects Analysis" (FMEA) for each individual gas control with electrical leads that are intended to be disconnected in order to replace or service the control. A typical analysis is shown in Figure 20, Samples failure modes and effects analysis for component miswiring.

This FMEA shall be evaluated to determine that:

- a) the failure to connect an individual lead or terminal in the gas control circuit shall not result in an unsafe operation; and
- b) 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 that are not intended to be disconnected to replace the control need not comply.

*\* For example, 1/4 in quick connects, 3/16 in quick-connects, and screw terminals are not to be considered interchangeable with each other.*

## 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.

**Figure 20**  
**Samples failure modes and effects analysis for component miswiring\***  
(See Clause 5.28.)

MODEL NO.		REFERENCES: Mode	
		Mode Description:	
SUBMITTED BY: DATE:			
ELECTRICAL COMPONENT	WIRING MODE	EFFECT AND CONSEQUENCES	FAILURE CONTROL ACTIONS
Limit, L1	Lead H1 disconnected	Main valve circuit open	No main burner gas. Safe condition
Limit, L1	Lead H1, H2 interchanged	None	Normal operation.
Ignition control	Lead disconnected from Terminal 7	Pilot igniter disabled	No pilot ignition. No main burner gas. Pilot gas locks out after 15 seconds.

\* For reference only, background information on FMEA can be found in "Procedures for Performing a Failure Mode, Effects and Critical Analysis", MIL-STD-1629A4, dated November 24, 1980.

## 5.29 Performance of appliances intended to be utilized with ventilation systems that direct air in a downward direction

This clause pertains to gas ranges or cook tops intended to be utilized with ventilation systems incorporating a downward directed supply of air that affects the operation of the gas burners of the range. The range manufacturer shall supply a sample of each ventilation system for testing that they want approved for use with their range. These products are not necessarily sold or supplied with the appliance but are detailed in the manufacturer's installation instructions as deemed acceptable for use with their product (see Clause 4.28.17).

The tests outlined in Clause 5.4, Combustion, Clause 5.5, Burner and pilot operating characteristics, Clause 5.6, Top surface cooking section burner lighters, Clause 5.7, Ignition Systems, and Clause 5.16, Evaluation of Clothing Ignition Potential shall be conducted with ventilation systems that incorporate provisions to direct air in a downward direction. The ventilation system shall be installed in accordance with the manufacturer's instructions at the minimum height above the cooktop surface. If the ventilation system has variable speed settings for the makeup air, the tests shall be run at the maximum speed setting.

## 5.30 Sponge washing test

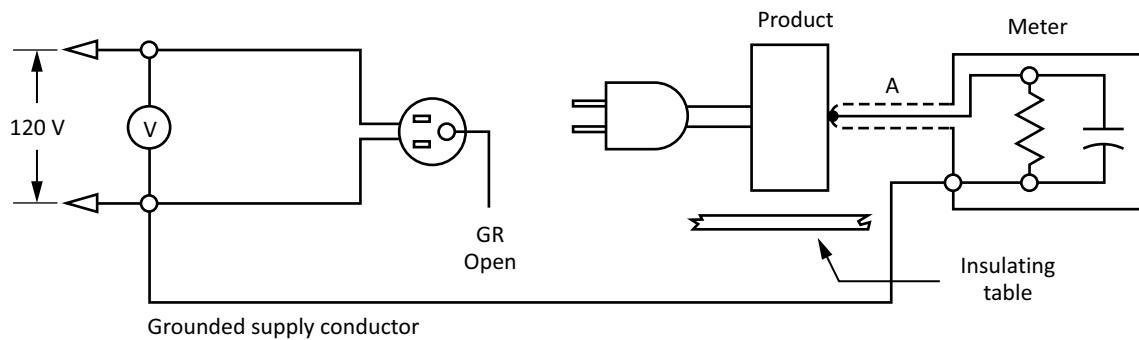
Electrical equipment including switches, latches, controls, and control panels shall not be adversely affected by washing the product with a wet sponge.

### Method of Test

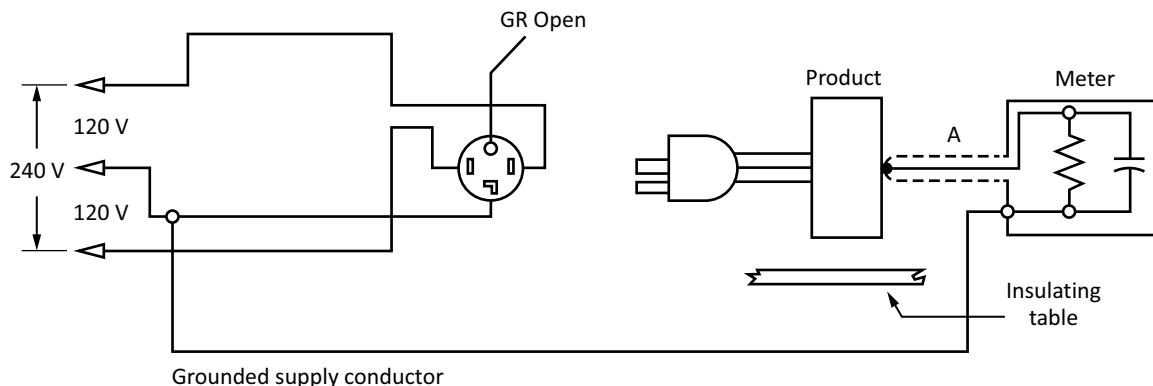
The appliance shall be isolated from ground with the normal grounding means disconnected and shall be connected to line voltage so the component to be tested is in the ungrounded side of the supply. Control knobs, guards, panels, etc., located in the area to be cleaned that are removable without the use of tools, shall be removed. The test shall be conducted at a temperature of  $77 \pm 9^{\circ}\text{F}$  ( $25 \pm 5^{\circ}\text{C}$ ). The appliance shall not be connected to a gas supply.

The measurement circuit for leakage current shall be as shown in Figure 21, Wet cleaning test setup. The meter used for measurement of leakage current shall have the same characteristics as the meter used in current leakage test per Clause 4.26.26. The meter shall be connected between a metal backing on a cellulose sponge and the grounded conductor of the power supply.

**Figure 21**  
**Wet cleaning test setup**  
(See Clause 5.30.)



Appliance intended for connection to 120 V power supply  
A — Sponge with metal backing

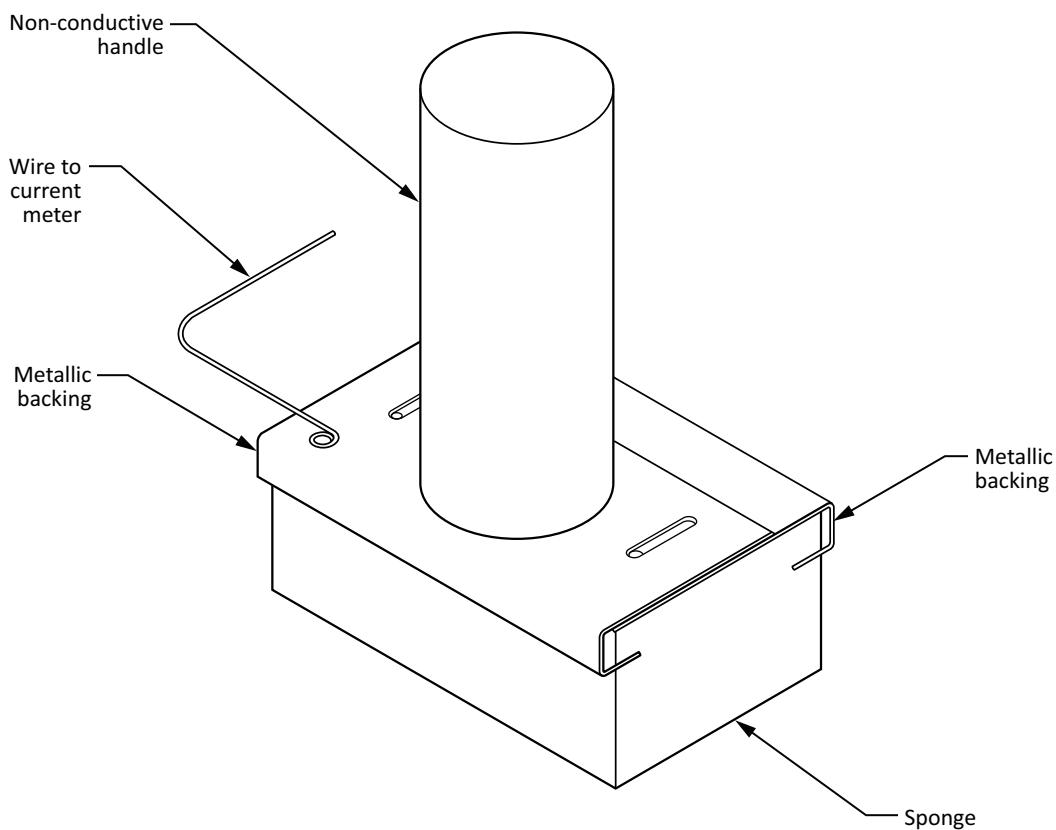


Appliance intended for connection to a 3-wire, grounded  
neutral power supply, as illustrated above  
A — Sponge with metal backing

**Note:** If the product contains a conductor that connects neutral and ground, it must be removed.

The sponge shall be approximately 1-5/8 by 3 by 5 in (41.3 by 76.2 by 127.0 mm), capable of retaining from 2.6–3.5 oz (75–100 g) of solution, and shall have a corrosion-resistant metal backing on one of the 3 by 5 in (76.2 by 127.0 mm) faces as shown in Figure 22.

**Figure 22**  
**Sponge in metal housing with insulated handle**  
(See Clause 5.30.)



The sponge shall be saturated in a solution consisting of 2 tsp (10 mL) of sodium bicarbonate and 0.2 oz (4.5 g) of chip soap or liquid hand soap, in 1 qt (0.95 L) of water at approximately 77°F (25 °C). After saturation, the sponge shall be weighed to establish that between 75 and 100 grams have been absorbed. The saturated sponge shall be wiped six times with a pressure of 2–3 lb (8.9–13.4 N) applied to the metal-backed side, over the control panel or other area being tested. The sponge shall be wiped directly over low-profile switches (such as rocker switches). If removal of knobs has left exposed control shafts, the sponge shall be wiped so that the side of the sponge contacts the shafts. The direction of wiping shall be such that liquid is forced into or above electrical components. The sponge shall be re-saturated in the test cleaning solution after the third wipe. During the test, the technician is to be properly insulated.

The test shall be conducted with manually operable switch contacts, integral to the appliance, in the open and closed positions. An equal number of wipes shall be applied at each position of the switch or control for a total of six wipes (three wipes at each position for 2-position switch; two wipes at each position for 3-position switch). A variable position switch shall be tested with two wipes each at off, high, and low settings. The product shall be observed for 5 minutes following the final wipe for compliance with Item b) below.

The appliance shall comply with the following:

- a) Leakage current through the sponge shall not exceed 0.5 mA for appliances rated 120 V or less, and 5 mA for appliances rated greater than 120 V. This requirement applies equally to electromechanical, electronic, membrane, capacitance, and mechanical switches.
- b) There shall be no evidence of arcing, short-circuiting, or insulation breakdown nor shall there be unintended operation or change of power level of burners or heating elements. In the case of touch-type controls, activation of keys, including power level settings, is acceptable provided that burners or heating elements do not turn on from the OFF position.

## 5.31 Nichrome wire test

### 5.31.1

If required per Clause 4.30.1, an electrical connection shall be tested as specified in this provision. Each connection shall be evaluated using one connector sample. Multiple connections may be evaluated within the same appliance if connections are located such that the test results of one individual connection do not affect the results of the other connections. As a result of the test, there shall be no evidence of ignition of the cheesecloth referenced in Clause 5.31 as indicated by broken threads of the cheesecloth. Browning of the cheesecloth is acceptable provided that all individual threads are unbroken.

**Note:** *Cheesecloth fibers may become brittle after exposed to heat. Care must be taken to prevent breakage of fibers during inspection. Fibers broken during inspection are not considered as a non-compliance.*

The test shall be considered inconclusive and then repeated if there is evidence of:

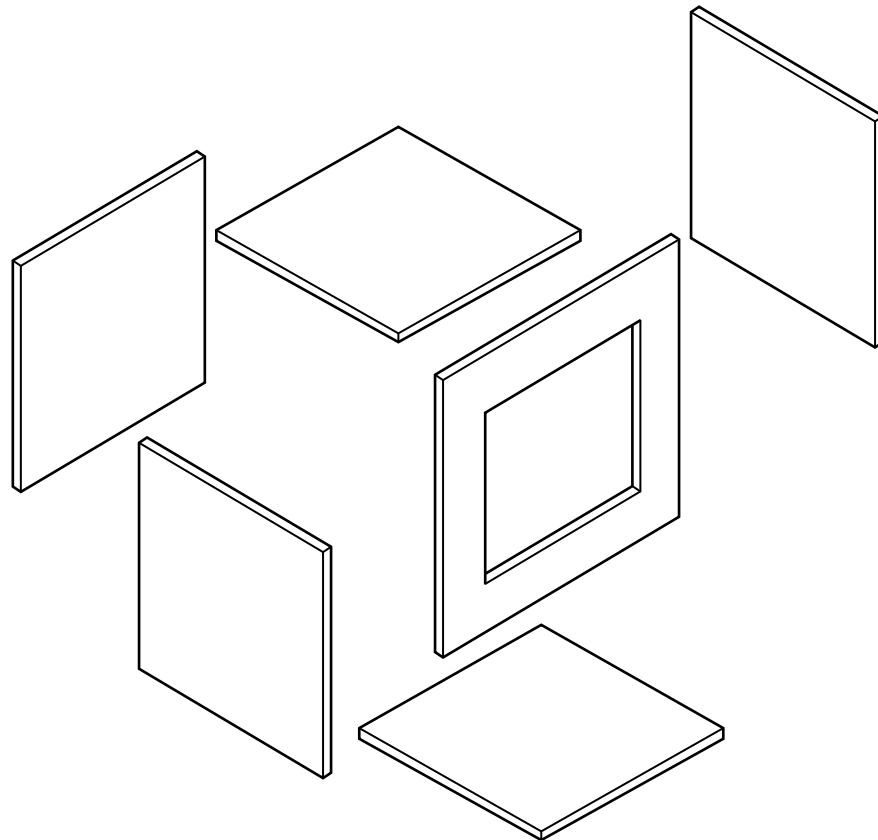
- a) fracture or shorting of the nichrome wire prior to completion of the test; or
- b) a shift in the position of the nichrome wire sufficient to alter the severity of the test.

### Method of Test

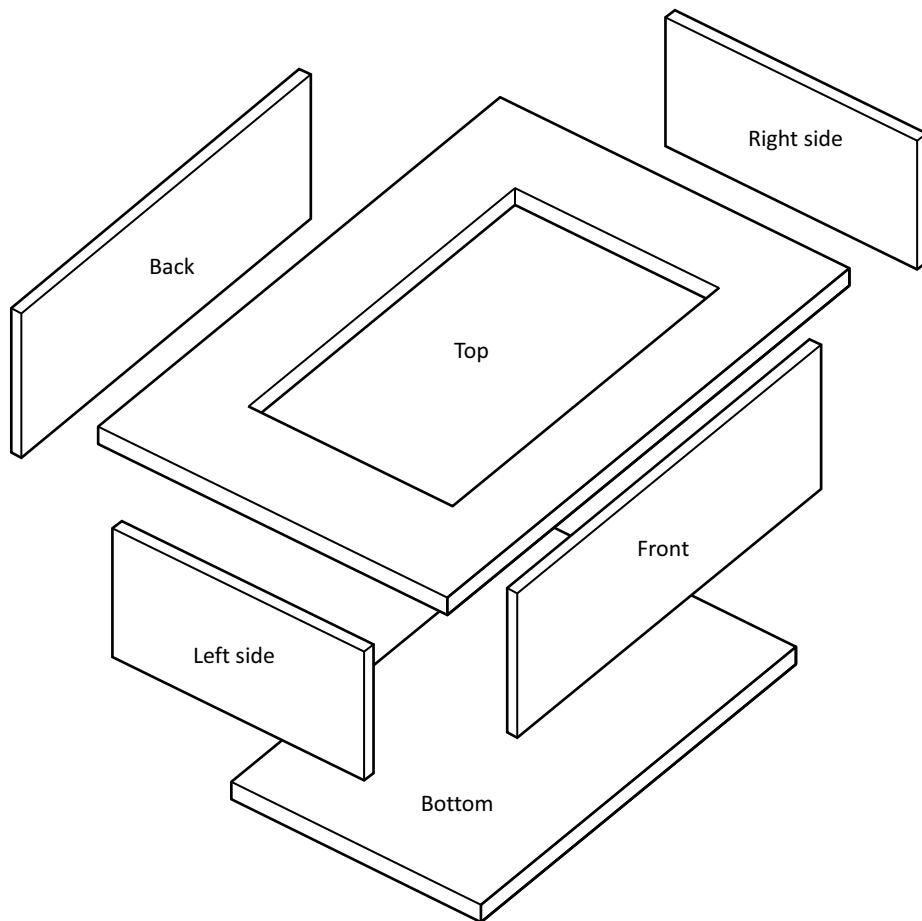
The test location shall have sufficient fresh air to sustain the flame. This test shall be conducted at an elevation of less than 2,000 ft (610 m) above sea level. A floor-supported appliance shall be supported on a non-combustible and non-conductive surface. The top, sides, front, and back of the appliance shall be completely covered by single-layer cheesecloth panels. A mechanical means, such as small pieces of metal foil adhesive tape, shall be used to secure the cheesecloth panels so there are no gaps between the panels. A single layer of cheesecloth, slightly larger than the appliance bottom surface, shall cover the supporting surface. If agreeable to those concerned, cheesecloth may be placed only in the area of the anticipated breach.

A built-in oven or a built-in top or surface unit shall be placed in an enclosure constructed of nominal 3/8 in thick minimum plywood, calcium silicate board, or cement board as shown in Figure 23, Enclosure panels for built-in oven, or Figure 24, Enclosure for built-in top or surface unit. The enclosure shall be firmly assembled so that the sides, back, and top will provide as close a fit as the construction of the product will permit — a sliding fit. The surfaces of the test enclosure shall be completely covered with two layers of cheesecloth secured as tightly as practicable to the enclosure surface. A single layer of cheesecloth shall be held in close contact with the exposed surfaces of the appliance.

**Figure 23**  
**Enclosure panels for built-in oven**  
(See Clause 5.31.1.)



**Figure 24**  
**Enclosure for built-in top or surface unit**  
(See Clause 5.31.1.)



All labels applied by the manufacturer shall be applied to the intended surfaces of the test appliance. Printing on the labels is not required. The manufacturer shall place the wiring diagram in the test appliance as intended.

During this test, the appliance shall be de-energized unless equipped with a protective control or device. The connection under evaluation shall be electrically isolated from the appliance circuitry. If the appliance is energized during the test, a duplicate connection that is electrically isolated from live parts shall be evaluated. Thermocouples shall be placed around the connector (but not in direct contact) such that when ignition occurs, an increase in temperature can be detected. When appropriate, windows made of glass or other clear non-combustible material may be used in the appliance to allow viewing of the connector being tested. Windows shall be sealed to prevent extraneous drafts or air leaks. Windows shall be located in areas not likely to be involved in or influence flame propagation. Video cameras may be employed to assist in verification of ignition. A constant current power supply shall be used, and the current shall be monitored for evidence of shorting or resistance wire breaks.

An appliance control or device employed to provide protection from risk of fire shall be evaluated as protective control and may be used to de-energize the nichrome wire if found to actuate during the test.

Nichrome wire (80% Nickel, 20% Chrome, 22 AWG), in accordance with ASTM B344, shall be applied to a connector or switching contact such that the adjacent non-metallic combustible materials will be ignited during the test.

In the application of the nichrome wire to the part under test, the nichrome wire may be inserted into the part, or the wire may be externally wrapped around the part under test. The intent is to achieve complete combustion of the part under test and/or adjacent materials.

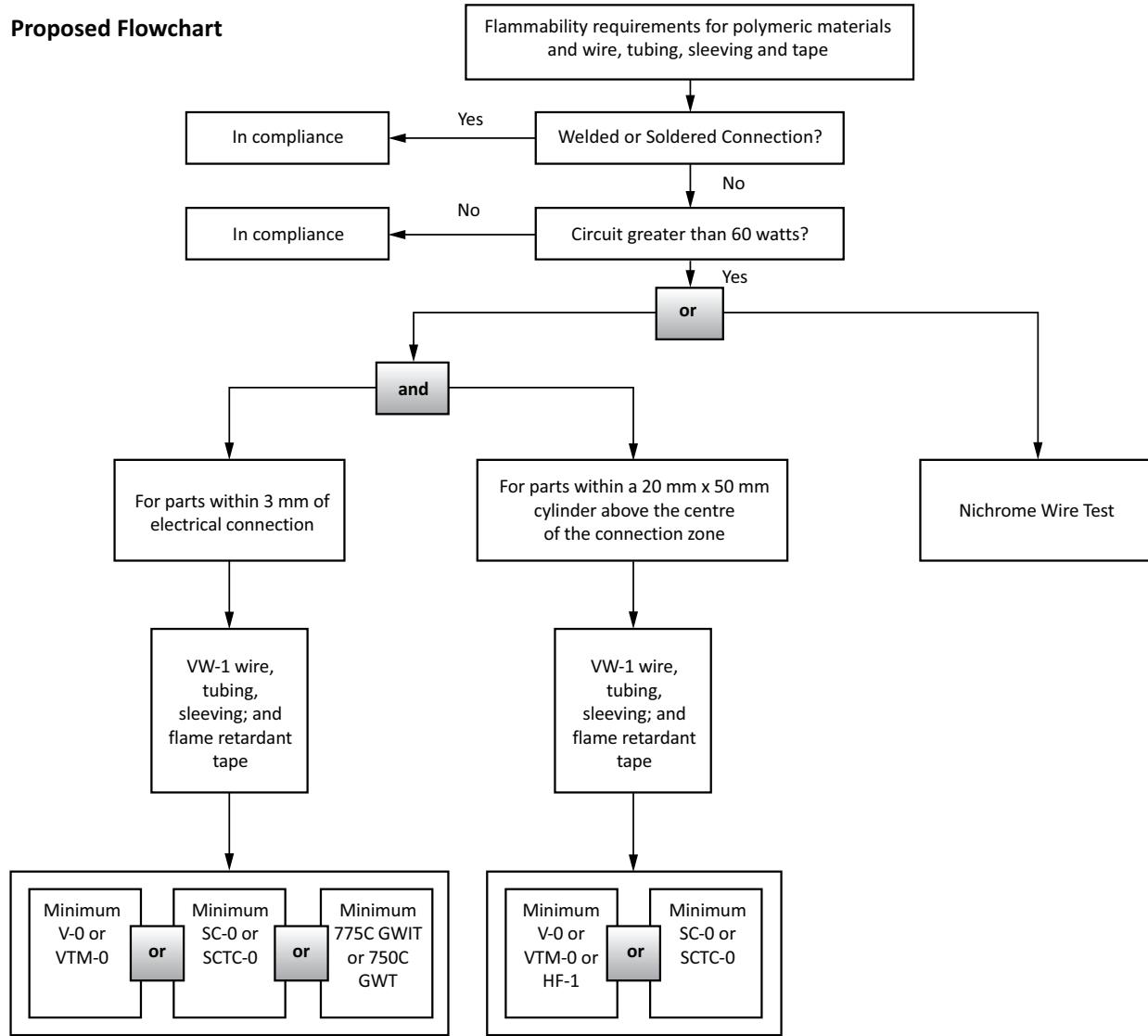
- a) A single strand of nichrome wire with a minimum length of 4.0 in (100 mm) shall be formed into a coil with a diameter and length that approximates the connection under evaluation. The coil shall be inserted in place of the connection under evaluation. In the case of a multi-pin connector, a single terminal pin shall be removed from the connector such that the coil can be inserted in the worst case location (typically the lowest position). If worst case position is not obvious, then multiple positions shall be evaluated.
- b) When externally wrapping a connector or uninsulated terminal, use minimum 2.0 in (50 mm) of nichrome wire to achieve a minimum of three evenly spaced wraps along the length of the connector or uninsulated terminal.
- c) Uninsulated terminals shall be wrapped with a non-flammable tape or sleeve prior to wrapping with nichrome wire to prevent shorting out portions of the nichrome wire.
- d) In the case of switching devices, a coil of nichrome wire shall be placed inside the device in the position of the contacts and appropriately supported to prevent movement during the test.

Insulated wire leads shall be used to supply power to the nichrome wire and shall be supported and strain-relieved to prevent the nichrome wire from shifting during testing.

**Note:** With reference to a) and d), the preferred method of wrapping a coil is wrapping nichrome wire around the threads of a No. 6-18 wood screw with a root diameter of 0.094 in (2.4 mm) and a thread per inch (25.4 mm) count of 18.

The nichrome wire shall be energized such that current in the circuit is immediately increased to 11 ampere and held constant for the duration of the test. If no ignition is detected within 20 minutes, the current shall be removed from the nichrome wire. If ignition is detected, as evidenced from the thermocouples, the current shall be held constant until burning of the non-metallic combustible material ceases naturally or there is ignition of the cheesecloth. If ignition of the cheesecloth occurs, the fire shall be extinguished as soon as possible. If the nichrome wire fractures prematurely, the test shall be repeated.

**Figure 25**  
**Flowchart**  
(See Clause 5.31.1.)

**Proposed Flowchart**

## 6 Manufacturing and production tests

The following manufacturing and production tests are intended to provide the means for certifying agencies to uniformly apply minimum quality control standards to all household cooking appliances.

### 6.1

The manufacturer shall check the components and the assemblies of each appliance in the following manner:

- Inspect raw materials, to the extent that they may affect the final product, and purchased components using a sampling plan found mutually acceptable to the manufacturer and the certifying agency.

- b) Verify that the igniter is hot enough to ignite gas prior to main burner gas flow.
- c) Test fire each burner and manifold and control assembly for proper burner and gas valve operation and verify the gas-tightness of the manifold and control assembly. This test shall be conducted on completely assembled appliances when practical.
- d) Test each appliance to determine that electrical components function properly. This test shall be conducted on completely assembled appliances when practical. When not practical, subassemblies shall be tested.
- e) Conduct dielectric withstand tests on each factory-assembled appliance incorporating high-voltage electrical circuits. If the appliance employs solid-state components that can be damaged by the dielectric potential, the test may be conducted before these components are electrically connected. The tests shall consist of the application of the 60 hertz potential between high-voltage current-carrying parts and the casing, frame, and similar noncurrent-carrying parts of the appliance with any switch contacts closed. The potential shall be in accordance with the dielectric withstand test specified in Clause 4.26.28 applied for 1 minute, or a potential of 120 percent of that value applied for 1 second.

## 6.2

Using a sampling plan found mutually agreeable to the manufacturer and the certifying agency, completely assembled appliances shall be tested to determine satisfactory operation with respect to:

- a) burner operating characteristics;
- b) ignition systems and safety shut-off devices;
- c) combustion;
- d) burn hazard potential and handle temperatures; and
- e) dielectric withstand with solid-state components connected [if not tested under Clause 6.1 d)].

Under this sampling plan, the frequency of conducting the tests specified in a) through h) above need not be the same.

The manufacturer's test method(s) shall be capable of relating back to the test(s) specified in the standard.

The results of these tests shall be recorded and maintained by the manufacturer for review by the certifying agency.

## Annex A (normative)

### Items unique to Canada

**Note:** This Annex is a mandatory part of this Standard.

#### A.1 French installation and marking provisions

All markings and instructions required by this Standard shall be provided in a form that is easily understood in both the English and French languages.

##### A.1.1

The following French translation for only the quoted text required under the instructions and marking provisions.

	English	French
4.28.1	<p><b>WARNING:</b> If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.</p> <ul style="list-style-type: none"> <li>— Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.</li> <li>— <b>WHAT TO DO IF YOU SMELL GAS</b> <ul style="list-style-type: none"> <li>• Do not try to light any appliance.</li> <li>• Do not touch any electrical switch.</li> <li>• Do not use any phone in your building.</li> <li>• Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.</li> <li>• If you cannot reach your gas supplier, call the fire department.</li> </ul> </li> <li>— Installation and service must be performed by a qualified installer, service agency or the gas supplier.</li> </ul>	<p><b>AVERTISSEMENT :</b> Le non-respect à la lettre de ces instructions peut causer un incendie ou une explosion, qui pourrait entraîner des dommages matériels, des blessures ou la mort</p> <ul style="list-style-type: none"> <li>— Ne pas entreposer ou utiliser d'essence ou tout autre liquide ou gaz inflammable à proximité de cet appareil ou de tout autre appareil.</li> <li>— <b>EN PRÉSENCE D'UNE ODEUR DE GAZ :</b> <ul style="list-style-type: none"> <li>• Ne tenter d'allumer aucun appareil ;</li> <li>• Ne toucher à aucun commutateur électrique ;</li> <li>• N'utiliser aucun téléphone dans l'immeuble ;</li> <li>• Appeler immédiatement le fournisseur de gaz à partir d'un téléphone situé à l'extérieur de l'immeuble ; Suivre les instructions du fournisseur de gaz ;</li> <li>• S'il est impossible de joindre le fournisseur de gaz, appeler le service des incendies.</li> </ul> </li> <li>— L'installation et la réparation doivent être effectuées par un installateur ou une agence de réparation ayant les qualifications requises ou par le fournisseur de gaz.</li> </ul>
4.28.1 a) xvii)	<p><b>⚠ WARNING:</b></p> <p>Never Operate the Top Surface Cooking Section of this Appliance Unattended</p> <ul style="list-style-type: none"> <li>• Failure to follow this warning statement could result in fire, explosion, or burn hazard that could cause property damage, personal injury, or death.</li> <li>• If a fire should occur, keep away from the appliance and immediately call your fire department.</li> </ul> <p><b>DO NOT ATTEMPT TO EXTINGUISH AN OIL/GREASE FIRE WITH WATER.</b></p>	<p><b>⚠ ATTENTION :</b></p> <p>Ne faites jamais fonctionner la surface de cuisson, sur le dessus de cet appareil, sans surveillance</p> <ul style="list-style-type: none"> <li>• Le non-respect de cette mise en garde pourrait entraîner un incendie, une explosion ou un risque de brûlure et ainsi causer des dommages matériels, des blessures ou la mort.</li> <li>• Si l'appareil prend feu, tenez-vous à l'écart et appelez immédiatement votre service des incendies.</li> </ul> <p><b>NE TENTEZ JAMAIS D'ÉTEINDRE UN FEU DE GRAISSE OU D'HUILE EN L'ASPERGEANT D'EAU.</b></p>
4.28.1 a) xiv)	Leak testing of the appliance shall be conducted according to the manufacturer's instructions	L'essai d'étanchéité de l'appareil électroménager doit être exécuté conformément aux directives du fabricant.
4.28.2	WARNING	AVERTISSEMENT

	<b>English</b>	<b>French</b>
<b>4.28.2 a)</b>	"A child or adult can tip the range and be killed."	« Une personne, enfant ou adulte, peut faire basculer la cuisinière et subir des blessures mortelles. »
<b>4.28.2 b)</b>	"Install the anti-tip device to the structure and/or the range. Verify the anti-tip device has been properly installed and engaged [state how for the two or more possible locations]."	« Installer le dispositif antibasculement sur la structure ou sur la cuisinière (ou sur les deux). Vérifier si le dispositif antibasculement est installé et engagé convenablement [préciser de quelle façon pour les deux endroits possibles ou plus]. »
<b>4.28.2 c)</b>	"Engage the range to the anti-tip device by [state how for the two or more possible locations]. Ensure the anti-tip device is re-engaged when the range is moved [state how for the two or more possible locations]."	« Engager la cuisinière dans le dispositif antibasculement en [préciser de quelle façon pour les deux endroits possibles ou plus]. S'assurer que le dispositif antibasculement est engagé de nouveau après un déplacement de la cuisinière [préciser de quelle façon pour les deux endroits possibles ou plus]. »
<b>4.28.2 d)</b>	"Re-engage the anti-tip device if the range is moved. Do not operate the range without the anti-tip device in place and engaged."	« Engager de nouveau le dispositif antibasculement si la cuisinière est déplacée. Ne pas utiliser la cuisinière lorsque le dispositif antibasculement n'est pas installé et engagé. »
<b>4.28.2 e)</b>	"See installation instructions for details."	« Voir les directives d'installation pour obtenir de plus amples renseignements. »
<b>4.28.2 f)</b>	"Failure to do so can result in death or serious burns to children or adults."	« Toute omission de le faire expose les enfants et les adultes à un risque de décès ou de brûlures graves. »
<b>4.28.8</b>	<p><b>⚠ WARNING</b></p> <p>NEVER use this appliance as a space heater to heat or warm the room. Doing so may result in carbon monoxide poisoning and overheating of the oven.</p>	<p><b>⚠ AVERTISSEMENT</b></p> <p>Ne JAMAIS utiliser cet appareil électroménager en guise de chauffefermette. Le fait de chauffer une pièce ainsi peut entraîner un empoisonnement au monoxyde de carbone ou une surchauffe du four.</p>
<b>4.28.10</b>	"Top cover must be open when main burner is in operation."	« Le couvercle du dessus doit être ouvert lorsque le brûleur principal est utilisé. »
<b>4.28.13</b>	"Save the orifices removed from the appliance for future use."	« Conserver les orifices retirés de l'appareil en vue d'une utilisation ultérieure. »
<b>4.28.16</b>	<p><b>⚠ WARNING</b></p> <p>NEVER cover any slots, holes or passages in the oven bottom or cover an entire rack with materials such as aluminum foil. Doing so blocks airflow through the oven and may cause carbon monoxide poisoning. Aluminum foil linings may also trap heat, causing a fire hazard.</p>	<p><b>⚠ AVERTISSEMENT</b></p> <p>Ne JAMAIS recouvrir une fente, un trou ou une conduite dans le fond du four ni recouvrir entièrement une grille d'un matériau comme du papier d'aluminium. Un tel revêtement bloque la circulation d'air dans le four, ce qui peut entraîner un empoisonnement au monoxyde de carbone. De plus, le papier d'aluminium peut emprisonner la chaleur, ce qui risque de provoquer un incendie.</p>

	<b>English</b>	<b>French</b>
<b>4.29.3 d) i)</b>	"Vented unit. See installation instructions."	« Unité à évacuation d'air. Voir les directives d'installation. »
<b>4.29.3 d) ii)</b>	"May be vented. If vented, see installation instructions."	« Unité pouvant fonctionner à évacuation d'air. Le cas échéant, voir les directives d'installation. »
<b>4.29.3 f)</b>	"ANS Z21.1 • CSA 1.1-(year) Household Cooking Appl."	« Appareil électroménager de cuisson conforme à la norme ANSI Z21.1 • CSA 1.1-(année). »
<b>4.29.4 a) ii)</b>	"The gas appliance pressure regulator must be set for the gas with which the appliance is used."	« Le régulateur de pression d'un appareil au gaz doit être réglé en fonction du gaz utilisé avec l'appareil. »
<b>4.29.4 a) ii) 1)</b>	"This appliance can be used with Propane gas and ____ gas. (Only the gas for which the appliance is equipped shall be identified.) It is shipped from the factory adjusted for use with ____ gas: DOUBLE COAXIAL ORIFICE HOODS MUST BE SCREWED TIGHT WHEN PROPANE GAS IS USED."	« Cet appareil électroménager peut être utilisé avec du gaz propane et du gaz _____. (Seul le gaz pour lequel l'appareil est conçu doit être indiqué.) Il est réglé en usine pour être utilisé avec du gaz _____ : LES COUVERCLES D'ORIFICE COAXIAL DOUBLE DOIVENT ÊTRE VISSÉS SERRÉS POUR UNE UTILISATION AVEC DU GAZ PROPANE. »
<b>4.29.4 a) ii) 2)</b>	"This appliance can be used with Propane gas and ____ gas. (Only the gas for which the appliance is equipped shall be identified.) It is shipped from the factory adjusted for use with ____ gas: DOUBLE COAXIAL ORIFICE HOODS MUST BE SCREWED TIGHT WHEN PROPANE GAS IS USED. (Oven, broiler, top) ____ burners are equipped with fixed orifices, located _____. Follow the instructions packaged with the orifices for gas conversion."	« Cet appareil électroménager peut être utilisé avec du gaz propane et du gaz _____. (Seul le gaz pour lequel l'appareil est conçu doit être indiqué.) Il est réglé en usine pour être utilisé avec du gaz _____ : LES COUVERCLES D'ORIFICE COAXIAL DOUBLE DOIVENT ÊTRE VISSÉS SERRÉS POUR UNE UTILISATION AVEC DU GAZ PROPANE. Les brûleurs du (four, grilloir et dessus) _____ sont munis d'orifices fixes, situés _____. Suivre les directives fournies dans l'emballage des brûleurs à propos de la conversion du gaz. »
<b>4.29.4 a) ii) 3)</b>	"This appliance can be used with Propane gas and ____ gas. (Only the gas for which the appliance is equipped shall be identified.) It is shipped from the factory adjusted for use with ____ gas: Conversion orifices are located _____. Follow the instructions packaged with the orifices for gas conversion."	« Cet appareil électroménager peut être utilisé avec du gaz propane et du gaz _____. (Seul le gaz pour lequel l'appareil est conçu doit être indiqué.) Il est réglé en usine pour être utilisé avec du gaz _____ : Les orifices de conversion se trouvent _____. Suivre les directives fournies dans l'emballage des brûleurs à propos de la conversion du gaz. »
<b>4.29.4 c) iii) 2)</b>	"Not less than the nominal width of the appliance."	« Au moins la largeur nominale de l'appareil électroménager. »
<b>4.29.4 c) v)</b>	"Minimum horizontal distance(s) from sides and back of appliance to adjacent vertical combustible walls extending above the top panel, ____ in from side walls, ____ in from rear wall. Minimum	« Distance horizontale minimale entre les côtés et le dos de l'appareil et toute paroi verticale adjacente combustible plus haute que le panneau supérieur : ____ po des côtés et ____ po de l'arrière. Distance horizontale minimale entre le bord du

	<b>English</b>	<b>French</b>
	horizontal distance from front edge of counter to front side of appliance, ____ in.”	comptoir et le devant de l'appareil : ____ po. »
<b>4.29.4 d) i)</b>	“For installation in a manufactured (mobile) home or recreational park trailer only.”	« Installation dans une maison préfabriquée (mobile) ou dans un parc de véhicules récréatifs seulement. »
<b>4.29.4 d) ii)</b>	“Also for installation in a manufactured (mobile) home or recreational park trailer.”	« Convient également à une installation dans une maison préfabriquée (mobile) ou dans un parc de véhicules récréatifs. »
<b>4.29.4 e)</b>	“Also for installation in a recreational vehicle.”	« Convient également à une installation dans un véhicule récréatif. »
<b>4.29.6</b>	“NOTICE: In order to be able to service this appliance, it must be installed with the casters supplied, a connector complying with the Standard for <i>Connectors For Movable Gas Appliances</i> , ANSI Z21.69 • CSA 6.16, and a quick-disconnect device complying with the Standard for <i>Quick-Disconnect Devices For Use With Gas Fuels</i> , ANSI Z21.41 • CSA 6.9. It must also be installed with restraining means to guard against transmission of strain to the connector, as specified in the appliance manufacturer's instructions.”	« AVIS : Pour être en mesure d'entretenir cet appareil, il faut l'installer sur les roulettes fournies et utiliser un raccord conforme à la norme ANSI Z21.69 • CSA 6.16 visant les raccords pour appareils au gaz mobiles (Standard for <i>Connectors For Movable Gas Appliances</i> ) ainsi qu'un dispositif de débranchement rapide conforme à la norme ANSI Z21.41 • CSA 6.9 visant les dispositifs de débranchement rapide pour appareils au gaz (Standard for <i>Quick-Disconnect Devices For Use With Gas Fuels</i> ). Des dispositifs de retenue doivent également être installés pour éviter que le raccord soit soumis à une contrainte, comme il est indiqué dans les directives du fabricant de l'appareil. »
<b>4.29.7</b>	“NOTICE: When the appliance is installed with casters, it must be installed with the casters supplied, a connector complying with ANSI Z21.69 • CSA 6.16 and a quick-disconnect device complying with ANSI Z21.41 • CSA 6.9. It must also be installed with restraining means to guard against transmission of strain to the connector, as specified in the appliance manufacturer's instructions.”	« AVIS : Lorsque l'appareil est installé sur des roulettes, on doit utiliser les roulettes fournies, un raccord conforme à la norme ANSI Z21.69 • CSA 6.16 et un dispositif de débranchement rapide conforme à la norme ANSI Z21.41 • CSA 6.9. Des dispositifs de retenue doivent également être installés pour éviter que le raccord soit soumis à une contrainte, comme il est indiqué dans les directives du fabricant de l'appareil. »
<b>4.29.8</b>	“WARNING”	« AVERTISSEMENT »
<b>4.29.8</b>	WARNING A child or adult can tip the range and be killed. Check installation of anti-tip device per installation instructions. Check engagement of anti-tip device if range is moved per installation instructions.	AVERTISSEMENT Une personne, enfant ou adulte, peut faire basculer la cuisinière et subir des blessures mortelles. Vérifier si le dispositif antibasculement a été installé conformément aux directives d'installation. Si l'appareil est déplacé, vérifier l'engagement du dispositif

	<b>English</b>	<b>French</b>
	<p>Failure to follow these instructions can result in death or serious burns to children or adults.</p> <p>Show illustrations and/or instructions for checking the installation of anti-tip device.</p>	<p>antibasculement, conformément aux directives d'installation.</p> <p>Le non-respect de ces directives expose enfants et adultes à un risque de décès ou de brûlures graves.</p> <p>Montrer les illustrations ou les directives concernant la vérification de l'installation du dispositif antibasculement.</p>
<b>4.29.9</b>	<b>“WARNING”</b>	<b>« AVERTISSEMENT »</b>
<b>4.29.9</b>	<p><b>WARNING</b></p> <p>A child or adult can tip the range and be killed.</p> <p>Check installation of anti-tip device per installation instructions.</p> <p>Check engagement of anti-tip device if range is moved per installation instructions.</p> <p>Failure to follow these instructions can result in death or serious burns to children or adults.</p> <p>Show illustrations and/or instructions for checking the installation of anti-tip device.</p>	<p><b>AVERTISSEMENT</b></p> <p>Une personne, enfant ou adulte, peut faire basculer la cuisinière et subir des blessures mortelles.</p> <p>Vérifier si le dispositif antibasculement a été installé conformément aux directives d'installation.</p> <p>Si l'appareil est déplacé, vérifier l'engagement du dispositif antibasculement, conformément aux directives d'installation.</p> <p>Le non-respect de ces directives expose enfants et adultes à un risque de décès ou de brûlures graves.</p> <p>Montrer les illustrations ou les directives concernant la vérification de l'installation du dispositif antibasculement.</p>
<b>4.29.10</b>	<b>“WARNING”</b>	<b>« AVERTISSEMENT »</b>
<b>4.29.10</b>	<b>“CONSUMER INFORMATION — THE INSTALLER SHALL NOT REMOVE”</b>	<b>« INFORMATION À L'INTENTION DU CONSOMMATEUR NE DEVANT PAS ÊTRE ENLEVÉE PAR L'INSTALLATEUR. »</b>
<b>4.29.10</b>	<b>“Before removing marking, ensure anti-tip device is properly installed.”</b>	<b>« Avant d'enlever les marques, s'assurer que le dispositif antibasculement est installé convenablement. »</b>
<b>4.29.10</b>	<p><b>Warning</b></p> <p><b>Tip-Over Hazard</b></p> <p>A child or adult can tip the range and be killed.</p> <p>Verify the anti-tip bracket has been installed.</p> <p>Ensure the anti-tip bracket is engaged when the range is moved.</p> <p>Do not operate the range without the anti-tip bracket in place.</p> <p>Failure to follow these instructions can result in death or serious burns to children and adults.</p>	<p>Avertissement</p> <p>Risque de basculement</p> <p>Une personne, enfant ou adulte, peut faire basculer la cuisinière et subir des blessures mortelles.</p> <p>Vérifier si le support antibasculement a été installé.</p> <p>S'assurer que le support antibasculement est engagé lorsque la cuisinière est déplacée.</p> <p>Ne pas utiliser la cuisinière si le support antibasculement n'est pas installé.</p>

	<b>English</b>	<b>French</b>
	Show specific manufacturer illustrations for checking installation engagement of anti-tip brackets. <b>CONSUMER INFORMATION – THE INSTALLER SHALL NOT REMOVE</b> Before removing label, ensure anti-tip bracket is properly installed.	Le non-respect de ces directives expose enfants et adultes à un risque de décès ou de brûlures graves. Montrer les illustrations du fabricant concernant la vérification de l'engagement des supports antibasculement. <b>INFORMATION À L'INTENTION DU CONSOMMATEUR NE DEVANT PAS ÊTRE ENLEVÉE PAR L'INSTALLATEUR.</b> Avant d'enlever l'étiquette, s'assurer que le support antibasculement est installé convenablement.
<b>4.29.11 a)</b>	“For use with a gas pressure regulator;”	« Pour utilisation avec un régulateur de pression du gaz. »
<b>4.29.11 b)</b>	“The regulator supplied must be used with this appliance.”	« Le régulateur fourni doit être utilisé avec cet appareil. »
<b>4.29.13 f)</b>	“Caution: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.”	« Attention : Étiqueter tous les fils avant de les débrancher pour effectuer l'entretien des régulateurs. Une erreur de câblage peut entraîner une utilisation inappropriée ou dangereuse. »
<b>4.29.13 f)</b>	“Verify proper operation after servicing.”	« S'assurer du bon fonctionnement de l'appareil après l'entretien. »
<b>4.29.14</b>	<b>WARNING</b> Electrical Grounding Instructions This appliance is equipped with a (three-prong) (four-prong) grounding plug for your protection against shock hazard and should be plugged directly into a properly grounded receptacle. Do not cut or remove the grounding prong from this plug.	Avertissement Mise à la terre Cet appareil est pourvu d'une fiche à trois broches dont une mise à la terre assurant une protection contre les chocs électriques. La prise dans laquelle elle est branchée doit être correctement mise à la terre. Ne pas couper ni enlever la broche de mise à la terre de la fiche.
<b>4.29.16</b>	“Do not install beneath work counters. The flue discharge shall not be located below the 36 in (914 mm) level when the oven is installed in accordance with the manufacturer's instructions.”	« Ne pas installer sous un plan de travail. L'échappement de gaz de combustion ne doit pas se trouver sous la limite de 914 mm (36 po) lorsque le four est installé conformément aux directives du fabricant. »
<b>4.29.18 a)</b>	“To be used in conjunction with a suitable vent hood only.”	« À utiliser exclusivement avec une hotte à évacuation appropriée. »
<b>4.29.18 b)</b>	“For Installation in Other Than Noncombustible Locations.”	« Pour installation ailleurs que dans un endroit non combustible. »
<b>4.29.18 b)</b>	“For Use Only In Noncombustible Locations.”	« Pour installation dans un endroit non combustible seulement. »

	<b>English</b>	<b>French</b>
<b>4.29.18 c) i)</b>	“Minimum horizontal distance(s) from center of grid area to adjacent vertical combustible walls extending above the top panel ____ in (mm) from side walls, ____ in (mm) from rear wall.”	« Distance horizontale minimale entre le centre de la section de la grille et toute paroi verticale adjacente combustible plus haute que le panneau supérieur : ____ po des côtés et ____ po de l’arrière. »
<b>4.29.18 c) ii)</b>	“Minimum vertical distance from top of broiler grid to overhead unprotected combustible surfaces 36 in (975 mm).”	« Distance verticale minimale entre le dessus de la grille de rôtissage et toute surface combustible non protégée : 975 mm (36 po). »
<b>4.29.20 a)</b>	“To be used in conjunction with a suitable vent hood only.”	« À utiliser exclusivement avec une hotte à évacuation appropriée. »
<b>B.3 b)</b>	“WARNING” “This conversion kit shall be installed by a qualified service agency in accordance with the manufacturer’s instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, explosion or production of carbon monoxide may result causing property damage, personal injury or loss of life. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer’s instructions supplied with the kit.”	« AVERTISSEMENT » « Cet ensemble de conversion doit être installé par un organisme de service qualifié, conformément aux directives du fabricant ainsi qu’à tous les codes applicables et à toutes les exigences des autorités compétentes. Si les directives ne sont pas suivies à la lettre, un incendie, une explosion ou une émission de monoxyde de carbone pourrait se produire et entraîner des dommages matériels et des blessures graves ou mortelles. L’organisme de service qualifié est responsable de l’installation appropriée de cet ensemble de conversion. L’installation n’est pas considérée adéquate et complète tant que le fonctionnement de l’appareil converti n’a pas été vérifié, conformément aux directives du fabricant fournies avec l’ensemble de conversion. »
<b>B.4 f)</b>	“Caution: Before proceeding with the conversion, shut off the gas supply to the appliance prior to disconnecting the electrical power.”	« Attention : Avant de procéder à la conversion, fermer d’abord la source d’alimentation en gaz de l’appareil, puis débrancher le cordon d’alimentation en électricité. »
<b>B.5 d)</b>	“This appliance was converted on day-month-year to gas with Kit No. by (name and address of organization making this conversion), which accepts the responsibility that this conversion has been properly made.”	« Cet appareil a été converti le _____ (jour-mois-année) au gaz avec l’ensemble numéro par (nom et adresse de l’organisme qui a effectué la conversion), qui assume la responsabilité de l’exécution adéquate de la conversion. »
<b>B.5 e)</b>	“This control has been converted for use with gas.”	« Ce régulateur a été converti pour être utilisé avec du gaz _____. »

## A.2 Units of measurement

Units of measurement required on printed instructions and markings shall include the SI (Metric) values as a minimum.

## A.3 Electrical equipment and wiring

Electrical equipment and wiring supplied on the system shall comply with applicable clauses of the Standard for *Electrical Features of Fuel-Burning Equipment*, CSA C22.2 No. 3.

## A.4 Instructions

The installation instructions shall specify the type of vent that will meet the Provincial installation requirements or, in their absence, CSA B149 Installation code shall prevail. The lighting instructions shall include a 5-minute waiting period.

## *Annex B (normative)*

### **(Optional) Provisions for listed gas appliance conversion kits**

**Note:** This Annex is a mandatory part of this Standard.

#### **B.1**

The following provisions are for use by manufacturers who wish to make available field conversion kits, when provision is made for the simple conversion of an appliance from one approved gas to the other.

Listing of conversion kits is permitted provided they meet the following criteria.

#### **B.2 Types of conversion kits to be listed**

##### **B.2.1**

Gas appliance conversion kits listed under these provisions may include, but are not limited to, the following:

- a) main burner orifices and pilot burner orifices;
- b) new gas controls or kits for pressure regulators;
- c) primary air shutters, spoiler screws;
- d) ignition control(s);
- e) main burner(s); and
- f) rating plates, labels, instruction.

Conversion kits shall be listed only for appliances having listing for use with both natural and propane gas.

##### **B.2.2**

Conversions are not permitted that require:

- a) modifications to baffles; or
- b) use of any component that has not been tested and listed as part of the appliance.

#### **B.3 Control modifications**

Conversions that require modifications to a control at the time of conversion are permitted with a listed conversion kit only if, at the time the conversion kit is submitted to the testing agency for purposes of listing, a letter from the control manufacturer agreeing with the specified control modifications accompanies the submittal.

#### **B.4 Instructions**

Each conversion kit shall be accompanied by clear, concise printed instructions and diagrams, stated in terms clearly understandable, adequate for the proper field assembly, installation, service, and safe use of the conversion kit.

- a) Instructions that the conversion kit shall be installed by a qualified service agency.
- b) The following boxed warning in bold-faced type:

**"WARNING"**

**"This conversion kit shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, explosion or production of carbon monoxide may result causing property damage, personal injury or loss of life. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in the manufacturer's instructions supplied with the kit."**

The warning shall be in letters having a minimum uppercase letter height of 0.120 in (3.05 mm) with a minimum vertical spacing between lines of 0.046 in (1.17 mm).\* Lowercase letters shall be compatible with uppercase letter size specification.

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

- c) Appliance model number or series of models acceptable for use with the kit.
- d) Complete parts list identifying all components provided in the kit.
- e) Identification of the gas to which the appliance is to be converted.
- f) Step-by-step instructions for converting the appliance. If necessary, these instructions shall provide illustrations of the pilot assembly, the manifold, or the manifold and main burner assembly. Instructions shall state: "Caution. The gas supply shall be shut off prior to disconnecting the electrical power, before proceeding with the conversion."
- g) Illustrations indicating the proper relationship of the igniter to the main burner with instructions to verify this relationship prior to completing the conversion.
- h) Procedures for proper leak testing of the converted appliance prior to placing it into operation.
- i) Manifold pressure of the converted appliance with instructions for checking and properly adjusting this gas pressure.
- j) Minimum (at least 1 in which above the manufacturer's specified manifold pressure) and maximum inlet gas pressures with the instructions for checking the gas pressure.
- k) The required input rating of the converted appliance.
- l) Details on adjustment for proper pilot and main burner flame appearance, including written instructions and pictorial illustrations.
- m) Instructions for placing all markings provided in the kit in the appropriate location on the converted appliance.
- n) Instructions for checking out the normal operating sequence of the ignition system.
- o) The instructions are to address de-rating at altitudes above 2000 ft (610 m).

## B.5 Marking

Each conversion kit shall be provided with the following markings:

- a) All components provided with the kit must be marked or color-coded so as to make them visibly distinguishable from the components they are replacing. This marking or color coding shall be identified in the instructions provided with the kit.

- b) All orifices provided with the kit must be permanently marked to indicate the orifice size. The orifice size shall be specified in the instructions accompanying the kit.
- c) A conversion plate on Class IIIA marking material, with explicit instructions to affix the conversion plate as close as possible to the existing rating plate. This plate shall include the following information or reference the information on the existing rating plate:
  - i) appliance model number or series of models;
  - ii) the gas to which the appliance has been converted;
  - iii) minimum and maximum inlet gas pressures of the converted appliance;
  - iv) manifold pressure;
  - v) input rating of each main burner; and
  - vi) identification of the conversion kit by part, model or equivalent number.
- d) The following Class IIIA marking, with explicit instructions to affix the label as close as possible to the conversion plate on the appliance:

"This appliance was converted on \_\_\_\_\_ day-month-year to \_\_\_\_\_ gas with Kit No. \_\_\_\_\_ by \_\_\_\_\_ (name and address of organization making this conversion), which accepts the responsibility that this conversion has been properly made."
- e) If the entire control is not replaced when the appliance is converted, a separate Class IIIA marking shall be affixed on or near the gas control(s) stating:

"This control has been converted for use with \_\_\_\_\_ gas."
- f) The following information marked on the exterior of the kit:
  - i) identification of the conversion kit by part number;
  - ii) appliance model number or series of models acceptable for use with the kit; and
  - iii) identification of the gas to which the appliance is to be converted.

## *Annex C (informative)*

### **Pertinent references to ANSI Y14.15**

**Note:** This Annex is not a mandatory part of this Standard.

The following sections of ANSI Y14.15 are pertinent to wiring diagrams for gas appliances accessories.

15-2.2	Schematic Diagrams
15-2.3	Connection Diagrams
15-2.4	Interconnection Diagrams
15-3.6.1	Representation of Contacts
15-3.7	Abbreviations
15-3.11	Wire Colors
15-9.2.5	Circuit Arrangements
15-10.3.1	Views-Conn. Diagrams
15-10.3.2	Wiring Views
15-10.3.3	Device Representation

## Annex D (informative) Wire color designations

**Note:** This Annex is not a mandatory part of this Standard.

Wire color	Designation specified in 15-3.11 of ANSI Y14.15
Black	BK
Brown	BR
Red	R
Orange	O
Yellow	Y
Green	G
Blue	BL
Violet (Purple)	V (PR)
Gray (Slate)	GY (S)
White	W

## *Annex E (informative)*

### **Recommended wire color usage**

**Note:** This informative Annex has been written in mandatory language to facilitate adoption by anyone wishing to do so.

#### **Line voltage conductors**

<b>Single phase</b>			<b>Three phase</b>		<b>Three phase/Single phase</b>		
	120v	240v	*120v/240v	208v		208v/120v*	240v/208v*
	208v	480v		240v		240v/277v*	
	277v			480v		(Alternative)	(Alternative)
L <sub>1</sub> (Hot)	Black	Black	Black	Black	Black	Black	Black
L <sub>2</sub> (Neutral)	White	—	White	—	—	White	White
L <sub>3</sub> (Hot)	—	Red	Red	Black	Red	Black	Red
	—	—	—	Black	Blue	Black	Blue

The equipment grounding conductor shall be Green, Green with Yellow stripe(s), or bare.

\* 120v, 208v, 277v circuits — use Black & White

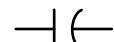
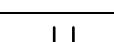
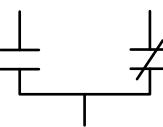
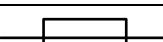
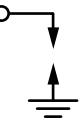
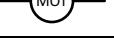
#### **Line Voltage Component Leads**

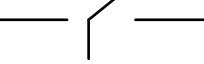
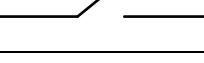
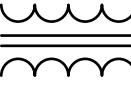
Capacitors		Brown
Single Phase Multi-Speed Motors	Common (208v, 240v, 480v)	Purple
	Common (120v, 277v) (Neutral)	White
	High Speed	Black
	Low Speed	Red
	Medium Speed	Blue

## Annex F (informative)

### Preferred graphic symbols of commonly used items, extracted from standard ANSI/IEEE 315, Graphic symbols for electrical and electronics diagrams, and abbreviations for these items

**Note:** This Annex is not a mandatory part of this Standard.

Item description	Abbreviation	Symbol	IEEE standard 315 section reference
Capacitor (*Closest To Grnd)	CAP		2.2.1
Coil, Relay	R		4.5
Contact, Normally Closed	N.C.		4.3.1
Contact, Normally Open	N.O.		4.3.2
Contact, Transfer Single Pole Double Throw	S.P.D.T.		4.3.3
Crossing of Paths (Conductors not Connected)	—		3.1.5
Fuse, General	FUSE		9.1.1
Ground (Direct Circuit Return to Earth)	GND		3.9.1
Igniter; Glow Bar, Glow Coil, Hot Wire	IGN		—
Igniter, Spark, Grounded	IGN		—
Igniter, Spark, Ungrounded	IGN		—
Junction of Paths (Conductor or Cable)	—		3.1.6.3
Link, Fusible	FL		2.12.3
Motor, General	MOT		13.1.3

Item description	Abbreviation	Symbol	IEEE standard 315 section reference
Resistor, Adjustable	RES		2.1.3
Resistor, Heating	RES		2.1.8
Resistor, Variable	RES		2.1.4
Switch, Double Throw General	S.P.D.T.		4.6.2
Switch, Normal Closed Time Delay Opening	N.C.SW		4.16.2
Switch, Normally Open Time Delay Closing	N.O.SW		4.16.1
Switch, Pressure or Vacuum Actuated (Closes on Rising Pressure)	N.O.SW		4.19.1
Switch, Single Throw General	N.O.SW		4.6.1
Switch, Temperature Actuated (Closes on Rising Temperature)	N.O.SW		4.20.1
Switch, Temperature Actuated (Opens on Rising Temperature)	N.C.SW		4.20.2
Transformer, Magnetic Core Non-saturating	TRAN.		6.4.2.1

## Annex G (informative)

### Table of conversion factors

**Note:** This Annex is not a mandatory part of this Standard.

**Table G**  
**Table of conversion factors**

Quantity	U. S. unit		Multiplying factor		SI units*	
	Name	Symbol	U.S. to SI	SI to U.S.	Symbol	Name
TORQUE	ounce-force-inch pound-force-inch pound-force-foot	ozf-in lbf-in lbf-ft	$7.061 \times 10^{-3}$ $1.129 \times 10^{-1}$ 1.355	141.62 8.85 $7.38 \times 10^{-1}$	N•m N•m N•m	newton-meter newton-meter newton-meter
LENGTH	inch inch foot	in in ft	$2.540 \times 10^{-2}$ $2.540 \times 10$ $3.048 \times 10^{-1}$	39.37 $39.37 \times 10^{-3}$ 3.281	m mm m	meter millimeter meter
AREA	square inch square inch square foot	in <sup>2</sup> in <sup>2</sup> ft <sup>2</sup>	$6.452 \times 10^{-4}$ $6.452 \times 10^2$ $9.290 \times 10^{-2}$	1550 $1550 \times 10^{-6}$ 10.76	m <sup>2</sup> mm <sup>2</sup> m <sup>2</sup>	square meter square millimeter square meter
VOLUME	cubic inch cubic foot cubic foot gallon gallon	in <sup>3</sup> ft <sup>3</sup> ft <sup>3</sup> gal gal	$1.639 \times 10^{-5}$ $2.832 \times 10^{-2}$ $2.832 \times 10$ $3.785 \times 10^{-3}$ 3.785	61.02 × 10 <sup>3</sup> 35.31 $35.31 \times 10^{-3}$ 264.1 $264.1 \times 10^{-3}$	m <sup>3</sup> m <sup>3</sup> l m <sup>3</sup> l	cubic meter cubic meter liter cubic meter liter
VELOCITY	foot/second foot/minute mile/hour mile/hour	ft/s ft/min m/hr m/hr	$3.048 \times 10^{-1}$ $5.080 \times 10^{-3}$ $4.470 \times 10^{-1}$ 1.609	3.281 196.8 2.236 $6.214 \times 10^{-1}$	m/s m/s m/s k/hr	meter/second meter/second meter/second kilometer/hour
ACCELERATION	foot/second <sup>2</sup>	ft/s <sup>2</sup>	$3.048 \times 10^{-1}$	3.281	m/s <sup>2</sup>	meter/second <sup>2</sup>
FREQUENCY	cycle/second	c/s	1	1	Hz	hertz
MASS	ounce ounce pound grain	oz oz lb gr	$2.835 \times 10^{-2}$ $2.835 \times 10$ $4.536 \times 10^{-1}$ $6.480 \times 10^{-5}$	35.27 $35.27 \times 10^{-3}$ 2.204 $15.43 \times 10^{-3}$	kg g kg kg	kilogram gram kilogram kilogram
MASS PER UNIT AREA	pound/foot <sup>2</sup>	lb/ft <sup>2</sup>	4.882	$2.048 \times 10^{-1}$	kg/m <sup>2</sup>	kilogram/meter <sup>2</sup>
MASS PER UNIT VOLUME	pound/foot <sup>3</sup>	lb/ft <sup>3</sup>	$1.602 \times 10$	$6.243 \times 10^{-2}$	kg/m <sup>3</sup>	kilogram/meter <sup>3</sup>
SPECIFIC VOLUME	foot <sup>3</sup> /pound	ft <sup>3</sup> /lb	$6.243 \times 10^{-2}$	$1.602 \times 10$	m <sup>3</sup> /kg	meter <sup>3</sup> /kilogram
MASS FLOW RATE	pound/hour pound/foot <sup>2</sup> hour pound/inch <sup>2</sup> hour	lb/hr lb/ft <sup>2</sup> hr lb/in <sup>2</sup> hr	$1.260 \times 10^{-4}$ $1.356 \times 10^{-3}$ $1.953 \times 10^{-1}$	$7.936 \times 10^3$ $7.374 \times 10^2$ 5.120	kg/s kg/m <sup>2</sup> s kg/m <sup>2</sup> s	kilogram/second kilogram/ meter <sup>2</sup> second kilogram/ meter <sup>2</sup> second
VOLUME FLOW RATE	foot <sup>3</sup> /second foot <sup>3</sup> /second foot <sup>3</sup> /minute foot <sup>3</sup> /minute gallon/minute gallon/minute gallon/hour gallon/hour	ft <sup>3</sup> /s ft <sup>3</sup> /s ft <sup>3</sup> /min. ft <sup>3</sup> /min. gal/min. gal/min. gal/hr gal/hr	$2.832 \times 10^{-2}$ $2.832 \times 10$ $4.719 \times 10^{-4}$ $4.719 \times 10^{-1}$ $6.309 \times 10^{-5}$ $6.309 \times 10^{-2}$ $1.052 \times 10^{-6}$ $1.052 \times 10^{-3}$	35.31 $35.31 \times 10^{-3}$ $2.119 \times 10^{-3}$ $2.119 \times 10$ $1.585 \times 10^4$ $1.585 \times 10$ $9.505 \times 10^5$ $9.505 \times 10^2$	m <sup>3</sup> /s l/s m <sup>3</sup> /s l/s m <sup>3</sup> /s l/s m <sup>3</sup> /s l/s	meter <sup>3</sup> /second liter/second meter <sup>3</sup> /second liter/second meter <sup>3</sup> /second liter/second meter <sup>3</sup> /second liter/second

(Continued)

**Table G (Concluded)**

Quantity	U. S. unit		Multiplying factor		SI units*	
	Name	Symbol	U.S. to SI	SI to U.S.	Symbol	Name
PRESSURE	pound force/inch <sup>2</sup> pound force/foot <sup>2</sup>  atmosphere  pounds/square inch <sup>‡</sup> pounds/square inch inch water column	lbf/in <sup>2</sup> lbf/ft <sup>2</sup>  inch H <sub>2</sub> O (4 °C) inch Hg (0 °C)  atm (std) psi  psi iwc	$6.895 \times 10^3$ $4.788 \times 10$ $2.491 \times 10^2$ $3.386 \times 10^3$ $1.013 \times 10^5$ $2.768 \times 10$ $6.895 \times 10$ $2.491$	$1.450 \times 10^{-4}$ $2.088 \times 10^{-2}$ $4.014 \times 10^{-3}$ $2.953 \times 10^{-4}$ $9.871 \times 10^{-6}$ $3.613 \times 10^{-2}$ $1.450 \times 10^{-2}$ $4.015 \times 10^{-1}$	Pa Pa Pa Pa Pa Pa iwc mb mb	pascal pascal pascal pascal pascal pascal inch water column millibar millibar
ENERGY, WORK, QUANTITY OF HEAT	horsepower hour horsepower hour kilowatt hour kilowatt hour	Btu Btu hphr hphr kwhr kwhr	$1.055 \times 10^3$ 1.055 $2.685 \times 10^6$ 2.685 $3.6 \times 10^6$ 3.6	$9.478 \times 10^{-4}$ $9.478 \times 10^{-1}$ $3.724 \times 10^{-7}$ $3.724 \times 10^{-1}$ $2.777 \times 10^{-7}$ $2.777 \times 10^{-1}$	J kJ J MJ J MJ	joule kilojoule joule megajoule joule megajoule
POWER, HEAT FLOW RATE	Btu/hr Btu/hr hp hp ton refrigeration (12,000 Btu/hr) ton refrigeration (12,000 Btu/hr) Btu/hour Btu/hr Btu/hourfoot <sup>2</sup> Btu/hrft <sup>2</sup>	$2.931 \times 10^{-1}$ $2.931 \times 10^{-4}$ $7.457 \times 10^2$ $7.457 \times 10^{-1}$ $3.516 \times 10^3$ 3.516 $2.929 \times 10^{-4}$ 3.155	$3.412$ $3.412 \times 10^3$ $1.341 \times 10^{-3}$ 1.341 $2.844 \times 10^{-4}$ $2.844 \times 10^{-1}$ $3.414 \times 10^3$ $3.1695 \times 10^{-1}$	W kW W kW W kW kW W/m <sup>2</sup>	watt kilowatt watt kilowatt watt kilowatt kilowatt watt/meter <sup>2</sup>	
HEAT CAPACITY SPECIFIC HEAT CAPACITY	Btu/degree F Btu/ pounddegree F Btu/ pounddegree F	Btu/°F Btu/lb°F Btu/lb°F	$1.899 \times 10^3$ $4.187 \times 10^3$ 4.187	$5.265 \times 10^{-4}$ $2.388 \times 10^{-2}$ $2.388 \times 10^{-5}$	J/°C J/kg•°C kJ/kg•°C	joule/degree Celsius joule/kg•degree Celsius kilojoule/ kg•degree Celsius
LATENT HEAT	Btu/pound Btu/pound	Btu/lb Btu/lb	$2.326 \times 10^3$ 2.326	$4.299 \times 10^{-4}$ $4.299 \times 10^{-1}$	J/kg kJ/kg	joule/kilogram kilojoule/kilogram
VOLUME AT STD. CONDITION <sup>†</sup>	ft <sup>3</sup> (60°F, 30 inches Hg, sat) " " " " " " " "		.9826 .02784 .02832 .02639 .02655	1.0177 35.92 35.31 37.89 37.66	ft <sup>3</sup> (60°F, 30 inches Hg, dry) m <sup>3</sup> (15 °C, 760 mm Hg, dry) m <sup>3</sup> (15 °C, 760 mm Hg, sat) m <sup>3</sup> (0 °C, 760 mm Hg, dry) m <sup>3</sup> (0 °C, 760 mm Hg, sat)	
HEATING VALUE	Btu/cubic foot	Btu/ft <sup>3</sup>	$3.752 \times 10^{-2}$	$2.684 \times 10$	MJ/m <sup>3</sup>	megajoule/meter <sup>3</sup>

\* SI Units (International System of Units) have been adopted by the International Gas Union for use within the gas industry. Where the same quantities have been defined by ISO (International Standards Organization), they are identical to the SI Units.

† Standard cubic foot (SCF) measured @ 60°F and 30 inches Hg, Saturated. (U.S. Conditions) Standard cubic meter (m<sup>3</sup>) measured @ 15 °C and 760 mm Hg, dry. (SI Conditions)

Normal cubic meter (m<sup>3</sup>) measured @ 0 °C and 760 mm Hg, dry.

‡ U.S. unit to U.S. unit.

## Temperature scales and conversions

The unit of temperature in the International System of Units (SI) is the kelvin (K), but it is generally accepted practice to express temperature differences in terms of degrees Celsius ( $^{\circ}\text{C}$ ) because the degree intervals are identical. The term “centigrade” was abandoned in 1948 by the General Conference on Weights and Measures but in fact is still in common use. The accepted abbreviation for centigrade is also  $^{\circ}\text{C}$  and for all practical purposes the degree intervals of centigrade, Celsius and kelvin, are identical.

Many temperature measurements are still made in terms of degrees Fahrenheit ( $^{\circ}\text{F}$ ). Although a formal definition of the Fahrenheit scale does not exist, it is based on:

- The freezing (ice) point of water =  $32^{\circ}\text{F}$
- The boiling point of water under standard pressure conditions =  $212^{\circ}\text{F}$
- The formula for absolute temperature,  $5/9 (^{\circ}\text{F}-32) = ^{\circ}\text{C}$
- The formula for “temperature rise,”  $5/9^{\circ}\text{F} = ^{\circ}\text{C}$

$^{\circ}\text{C}$	$^{\circ}\text{F}$	$^{\circ}\text{C}$	$^{\circ}\text{F}$	$^{\circ}\text{C}$	$^{\circ}\text{F}$
-40	-40.0	25	77.0	70	158.0
-20	-4.0	30	86.0	80	176.0
0	32.0	35	95.0	90	194.0
10	50.0	40	104.0	100	212.0
15	59.0	50	122.0	110	230.0
20	68.0	60	140.0	120	248.0

## Multiples and submultiples of basic units

Factor by which the unit is multiplied		Prefix	Symbol
1 000 000 000 000	= $10^{12}$	tera	T
1 000 000 000	= $10^9$	giga	G
1 000 000	= $10^6$	mega	M
1 000	= $10^3$	kilo	k
100	= $10^2$	hecto	h
10	= $10^1$	deka	da
0.1	= $10^{-1}$	deci	d
0.01	= $10^{-2}$	centi	c
0.001	= $10^{-3}$	milli	m
0.000 001	= $10^{-6}$	micro	$\mu$
0.000 000 001	= $10^{-9}$	nano	n
0.000 000 000 001	= $10^{-12}$	pico	p

